Final report to the CCT on key comparison CCT-K8 – Comparison of local realisations of dew-point temperature of humid gas in the range 30 °C to 95 °C

Final Report

December 2024

Co-authors:

J. G. Gallegos², H. Mitter¹, H. Abe⁷, S. Bell⁸, R. Benyon², P. Carroll⁸, B. I. Choi⁴, R. Deschermeier⁹, V. Ebert⁹, V. Fernicola³, L. Wang⁶, C. Meyer⁵, D. Smorgon³, T. Vicente²

Extracts from this report may be reproduced provided they are not taken out of context and the source is appropriately acknowledged.

¹E+E Elektronik (BEV/E+E), Engerwitzdorf, Austria.

² Instituto Nacional de Técnica Aeroespacial (INTA), Madrid, Spain.

³ Istituto Nazionale di Ricerca Metrologica (INRIM), Turin, Italy.

⁴ Korea Research Institute of Standards and Science (KRISS), Daejeon, R. of Korea.

⁵ National Institute for Standards and Technology (NIST), Gaithersburg, USA.

⁶ National Metrology Centre, Agency for Science, Technology and Research (NMC, A*STAR), Singapore.

⁷ National Metrology Institute of Japan (NMIJ), Tsukuba, Japan.

⁸ National Physical Laboratory (NPL), Teddington, United Kingdom.

⁹ Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany.

CONTENT

1	INT	FRODUCTION	4
2	OR	GANIZATION	4
	2.1	PARTICIPANTS	5
	2.2	COMPARISON SCHEME	6
	2.3	COMPARISON SCHEDULE	7
3	COI	MPARISON METHOD	9
	3.1	TRAVELLING STANDARDS	9
	3.2	REPORTING	9
	3.3	IMPARTIALITY	10
4	PEF	RFORMANCE OF THE TRAVELLING STANDARDS	11
	4.1	CHARACTERIZATION AND CHOICE OF TRANSFER STANDARDS	11
	4.2	PROBLEMS WITH THE TRANSFER STANDARDS	12
	4.3	STABILITY STUDY	13
5	LOC	CAL DEW POINT TEMPERATURE SCALES	17
	5.1	BEV/E+E	17
	5.2	INRiM	17
	5.3	INTA	18
	5.4	KRISS	19
	5.5	NIST	19
	5.6	NMC, A*STAR	20
	5.7	NMIJ	20
	5.8	NPL	21
	5.9	PTB	21
6	ME	EASUREMENT RESULTS	22
	6.1	ANALYSIS OF RESULTS	22
7	BIL	ATERAL EQUIVALENCE	24
	7.1	ANALYSIS METHOD	24
	7.2	RESULTS	26
8	KEY	Y COMPARISON REFERENCE VALUE	31
	8.1	CALCULATION METHOD	31
	8.2	CONSISTENCY TEST AND DISCUSSION	32
	8.3	RESULTS	33
9	COI	NCLUSIONS	43
10	ACI	KNOWLEDGEMENTS	45

11	REFERENCES	46
12	ANNEXES	48
	12.1 ANALYSIS METHOD	48
	12.1.1 FUNCTION B _{i,j} AND UNCERTAINTY	48
	12.1.2 CONSISTENCY TESTS FOR LINKAGE	50
	12.1.3 UNCERTAINTY OF Dij	51
	12.2 ANALYSIS METHOD OF KCRV	52
	12.3 SUMMARY TABLE OF ALL PARTICIPANTS	54
	12.4 ABBREVIATIONS	58
	12.5 DETAILS OF PARTICIPATING INSTITUTES	59
	12.6 RESULTS REPORTED BY ALL PARTICIPANTS	61
	12.7 UNCERTAINTY BUDGET REPORTED BY ALL PARTICIPANTS	106
	12.8 IEC 60751 RELATIONSHIP	124
	12.9 TECHNICAL PROTOCOL	125

1 INTRODUCTION

Under the Mutual Recognition Arrangement (MRA) [MRA99] the metrological equivalence of national measurement standards will be determined by a set of key comparisons chosen and organized by the Consultative Committees of the CIPM working closely with the Regional Metrology Organizations (RMOs).

At the 24th Meeting of the CCT in May 2008, it was agreed to organize a CCT Comparison in dew point temperature (high range) as a follow-up of the existing CCT-K6 frost/dew-point temperature comparison, as proposed by CCT-WG6, now known as WG-Hu.

The completed registration form for the proposed CCT-Kx high range dew-point key comparison was submitted on 26/09/2008 and registered in the KCDB database on 29/09/2008.

The technical protocol [TPR16] was drawn up by the coordinator (INTA) in consultation with all participants and it was based on the protocol developed by CCT-WG6 to be consistent between CCT-K8 and the corresponding RMO.T-K8s. The CCT-K8 protocol was approved by K8 participants in November 2016, with agreed minor changes.

Technical operations to be followed during measurement of the travelling standards were described in the technical protocol, which follows the guidelines established by the BIPM [Quin99, CIPM16], is based on current best practice in the use of dew/frost-point hygrometers and takes account of the experience collected from the CCT-K6 [Bel15], EURAMET.T-K6 [Hei08], EURAMET.T-K8 [Des23] and APMP.T-K8 [Abe21].

Once the measurement phase had finished in November 2017, there was a significant delay until starting to write draft. This was mainly due to the need to approve a mathematical and statistical consistency analysis method aligned with corresponding RMO K8 comparison, together time limitations due to changes in staff responsibilities at INTA.

2 ORGANIZATION

The main target of this comparison was to obtain the degree of equivalence (DoE) between realizations of local scales of dew point temperature of humid gas (air), in the range from 30 °C to 95 °C, among the participating national metrology institutes (NMI). To fully meet this objective, this comparison was designed to provide the following information for each nominal value of dew point:

- Estimates of bilateral equivalence between every pair of participants.
- A key comparison reference value (KCRV).
- Estimates of equivalence of each participant to the KCRV.

According to the approved technical protocol [TPR16], the comparison was carried out by means of circulation of a pair of travelling transfer standards. Each transfer standard was used to independently measure dew-point temperature of a sample of humid gas produced using the same measuring process and the own standard generator system of each participant.

Measurements were done at seven dew-point temperature nominal values of 30 °C, 50 °C, 65 °C, 80 °C, 85 °C, 90 °C and 95 °C in rising order. For those laboratories whose scope did not cover the whole range of this comparison, they were allowed to limit the highest nominal dew-point temperature to that within their scope. The small interval steps of 5 °C between the top four values is mainly caused by constraints of the CMC review protocol [CCT24] in this range.

2.1 PARTICIPANTS

Ten participants were divided into two groups. Each group to form a comparison loop. To link the loops to each other, the loops have besides the two Pilots one common participant who measures also both travelling standards.

INTA is the coordinator of the comparison and the Pilot for both loops, taking main responsibility for running the comparison. NIST is Assistant Pilot. The third, common participant is BEV/E+E who also covers the full range of the comparison, complementing the capability of NIST.

By their declared intention to participate in this key comparison, the laboratories accepted the general instructions and the technical protocol written down in the technical protocol and committed themselves to follow strictly the procedures of the protocol as well as the version of the "Guidelines for Key Comparisons" in effect at the time of the initiation of the Key Comparison.

Once the protocol and list of participants had been approved, no change to the protocol or list of participants could be made without prior agreement of all participants.

Table 2.1.1 List of ten participants (C = Coordinator, P = Pilot, L = Linking laboratory). More details about mailing and electronic addresses are given in Section 12.5.

RMO	NMI	COUNTRY	ROLE
АРМР	Korea Research Institute of Standards and Science (KRISS)	KR	
	National Metrology Centre (NMC, A*STAR)	SG	
	National Metrology Institute of Japan (NMIJ), AIST	JP	
COOMET			
EURAMET	Instituto Nacional de Técnica Aeroespacial (INTA)	ES	C, P
	Istituto Nazionale di Ricerca Metrologica (INRiM)	IT	
	National Physical Laboratory (NPL)	GB	
	Physikalisch-Technische Bundesanstalt (PTB)	DE	
	E+E Elektronik Ges.m.b.H. (BEV/E+E)	AT	L
SIM	National Institute for Standards and Technology (NIST)	US	P

2.2 COMPARISON SCHEME

The key comparison is a comparison of the measurand "realization of local scale of dew-point temperature" at the participating NMIs.

The comparison was made by calibration of travelling standards purchased by Centro Español de Metrología (CEM) and deposited at INTA as part of the Spanish humidity national metrology infrastructure. The travelling standards measured dew point temperature of a sample of moist gas produced by a participant's standard humidity generator.

The travelling standards are used as comparators of measured dew point temperatures realized by means of the humidity generator systems used by each participant, described in Section 5.

The comparison was carried out in two parallel loops with separate travelling standards. Measurements started in the Pilot and Assistant Pilot laboratories. The other participants in the loop then performed comparison measurements at the dew point temperatures required. The last participant returned the travelling standard to the Pilot to carry out final measurements to monitor drift.

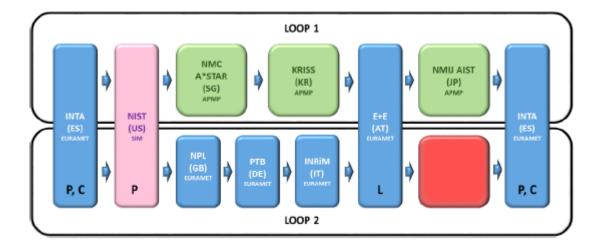


Fig. 2.2.a Original circulation scheme of travelling standards.

However, the original circulation scheme depicted in the above figure was slightly modified after BEV/E+E, adding another data set of INTA for both standards. The reason why this was done was because the ATA Carnets had to come back to Spain to solve some formal issues regarding the absence of some signatures or stamps at customs. So meanwhile INTA took advantage to perform another measurement set to check the performance of the travelling standards.

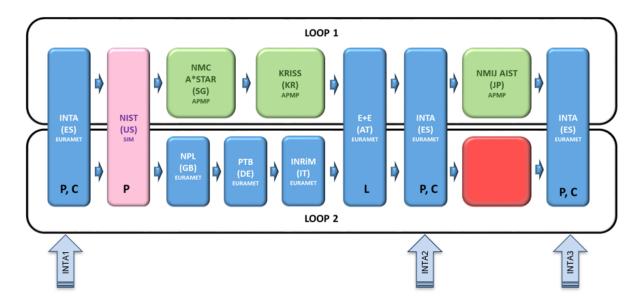


Fig. 2.2.b Final circulation scheme of travelling standards actually carried on after including "INTA 2" measurement set.

2.3 COMPARISON SCHEDULE

The provisional time schedule for this comparison was defined in Appendix B of Technical Protocol [TPR16]. Allowing between 4 and 6 weeks per set of measurements (including shipping) for each participant. It was estimated that comparison would have a duration of approximately 10 months.

However, because of the problems of completing the ATA Carnets and the need to increase their period of validity for one more year, in case there was a delay in the intercomparison after the measurement set performed by BEV/E+E laboratory, new Carnets were obtained and the schedule updated.

The following figures, show the comparison between the estimated and actual time schedule, and the cumulative final delay during the measurement phase of the comparison.

Year			2	0	1	6	2 0 1 7																							
Month		()	1	٧	ı	D		J		F	ſ	M	,	4	ı	М	,	J	,	J	1	٩	Ş	S	(С	١	7	D
Spain	ES				Χ																									
United States of America	US						Х																							
Singapore	SG									Х																				
Republic of Korea	KR													Х																
Austria	АТ															Х														
Spain	ES																					Χ								
Japan	JP																										Χ		П	
Spain	ES																													

Fig. 2.3.a Final time schedule for the comparison in Loop 1. Each column is equivalent to two weeks. Legend used is as follows: = measurement, X = measurement / transportation, = at time; = before estimation, = delay

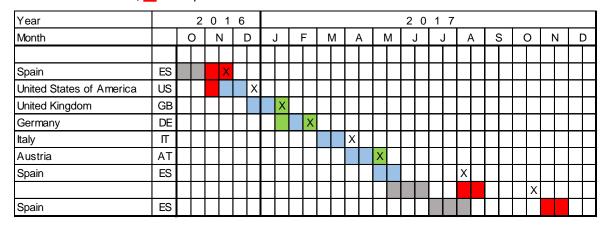


Fig. 2.3.b Final time schedule for the comparison in Loop 2. Each column is equivalent to two weeks. Legend used is the next: = measurement, X = measurement / transportation, = at time; = before estimation, = delay

As can be seen in the above figures, there was a delay in both loops after the second measurement set performed by INTA. This was not due to technical or metrological issues, but it was the required to solve the formal issue problems previously mentioned in both ATA carnets, as well as manage the shipment to the last participants in both loops simultaneously.

3 COMPARISON METHOD

3.1 TRAVELLING STANDARDS

Centro Español de Metrología (CEM), the Spanish NMI, supplied one travelling standard per loop for the key comparison which were state-of-the-art, commercially available chilled-mirror type of dew point hygrometers when the comparison was approved. The two travelling standards were new and of the same model and their main features can be seen in the following table:

Table 3.1.1 Details of travelling standards

Model	MBW 373 HX
Size (in packing case)	75 x 55 x 58 cm
Weight (in packing case)	40 kg
Manufacturer:	MBW Calibration AG
Owner:	Centro Español de Metrología (CEM)
Electrical supply:	230 V / 50 Hz
Electrical connection:	Instrument socket IEC/EN 60320-2-2 (socket C14/plug C13) The instrument is supplied with a Schuko (Continental Europe) plug Standard CEE 7/VII
Power consumption:	300 W
Tube connectors:	Swagelok® 6 mm
Accessories:	Endoscope, 4-wire cable for resistance measurements (3 m), heated flexible hose with 6 mm Swagelok® connectors, pressure measurement insert, condensation trap, flowmeter, operating manual
Approximate value for insurance and	40.000 EUR
customs declaration:	
Serial r	numbers of the instruments are:
<u>Loop 1</u> : 08-1215	<u>Loop 2</u> : 08-1216

Both travelling standards were supplied with theirs shipping containers, which were sufficiently robust to ensure safe transportation. In addition, each standard was shipped together with an ATA Carnet and all equipment included in the packing list, which had been described in the technical protocol together with packing and unpacking instructions.

3.2 REPORTING

Each laboratory summarized and reported:

- Seven dew point temperature values, except for those participants whose range does not cover some of the higher nominal values.
- each nominal dew point was reproduced 4 times forming a new condensate layer each time.
 Measured values by the participants had to be within 0.5 °C of the comparison nominal values.

each participant measured one travelling standard, except three laboratories (NIST, BEV/E+E and INTA – see Fig. 2.2.b) who measured both standards simultaneously, resulting in thirteen individual transfer standard results.

Participants reported:

- applied dew point from the participant standard generator.
- measured values (both travelling standards simultaneously where applicable).
- difference (measured dew point applied dew point) for the travelling standards.
- uncertainties associated with these (including short-term standard deviation of travelling standards).
- Difference values (results compared and analyzed in this comparison).

Supporting information was reported, including pressure, temperature and flow rates of sample gas supplied to the hygrometers, and other relevant background information. All measurements were made at nominally (just above) atmospheric pressure and at flow rates after the condensation traps according to the approved version of Protocol.

The dew point values obtained from standard hygrometers were determined based on their measured resistance of the mirror PRT, which was likewise reported for each measured condition of the instrument. This resistance value was converted to a nominal temperature indication by using the nominal PRT resistance-temperature characteristic in the international standard IEC 60751:2008 [IEC08], defined in Annex 12.8.

3.3 IMPARTIALITY

The impartiality of the comparison was ensured by the pilots conserving the confidentiality of the data during the whole intercomparison, that includes no exchange of results between partners. This essential premise was fulfilled for both instruments, during the measurement period and circulation of standards, and during any decisions that had to be taken by the pilots. Any limited data shared during the comparison for the purpose of discussing concerns about the instruments (See Section 4.2) was strictly in coded terms, not absolute values.

Most participants have taken part in their corresponding RMO comparisons, such as: EURAMET.T-K8 whose measurement period was from August 2008 to June 2011; and APMP.T-K8 from January 2012 to December 2015. The following laboratories involved in this situation were: BEV/E+E, INRIM, INTA, PTB and NPL; and KRISS, NMC, A*STAR and NMIJ, respectively. However, there is not a period

overlapping with this key comparison and even a time frame long enough to suggest that this affected the blindness of CCT-K8.

4 PERFORMANCE OF THE TRAVELLING STANDARDS

This section details the choice of the travelling standards and the characterization performed before running the comparison. In addition, the problems that appeared during the comparison and their possible influence on the results, are listed.

Finally, a detailed analysis of the performance of the standards during the comparison is included, putting the focus mainly in the standards drift, as one of the best suitability indicators in their choice.

4.1 CHARACTERIZATION AND CHOICE OF TRANSFER STANDARDS

One of the most important decisions to guarantee the success of any comparison is a correct choice of travelling standards. For this comparison two dew point hygrometers based on chilled mirror technology were chosen because they were representative of the state of the art of instruments commonly used by the NMIs worldwide (see Section 3.1).

The main influence quantities that affect the performance of temperature sensors incorporated in the dew point hygrometer are considerable heat flux and conduction effects within an assembly with reduced dimensions and a compact configuration. Hence, these factors need to be considered to mitigate their consequences through careful design and material selection [Ben12a].

An experimental investigation was performed to characterize and choose the most appropriate platinum resistance thermometers (PRT) embedded behind the polished surface on which condensate forms. The work involved evaluating the performance of several probes with two different encapsulation materials (glass and ceramic) to determine their behavior after hysteresis and aging tests. The PRT's were subjected to thermal treatments, consisting of cycles at temperatures between 0 °C and 150 °C, simulating the performance that the travelling standards would have during the entire intercomparison. Differences of relative stability of probes at 50 °C between the first measurement and those collected after each cycle, was the parameter used to assess their drift behavior [Ben12a].

It was concluded that the most suitable solution was to use PRT probes with ceramic encapsulation of a design that had previously demonstrated excellent results for over two decades [Ben12b]. The manufacturer had switched from ceramic to glass encapsulated probes, because in the low-temperature range hygrometers some these sensors were damaged due to the condensation of ambient water on the porous ceramic of the sensors and subsequent breakage after freezing due to expansion. However, this disadvantage should not be a problem because this comparison is focused

on the high dew-point temperature range [Ben12a]. The final set of ceramic encapsulated sensors was also measured at NIST, and the most stable sensors were chosen for the PRT to be measured by the participants and the next best were destined for use as the control sensor used for the digital display.

4.2 PROBLEMS WITH THE TRANSFER STANDARDS

As explained in the previous section, both travelling standards represented the state of the art when the comparison started and incorporated selected sensors after several tests, to guarantee the best steady and reliable behavior. Nevertheless, there were some minor problems throughout the measurement phase of the comparison. The following table details the problems encountered and the adopted solution

Table 4.2.1 List of problems and complications that appeared on travelling standards throughout the whole intercomparison together with solutions adopted.

LOOP	REPORTED BY	FAILURE REPROTED	SOLUTION
1	KRISS	Flow meter digital measurement was failing and reading 1.6 L/min (internal limit)	Flowmeter replaced during second measurement set at INTA.
1	KRISS	Endoscope has some internal condensation; a minor problem but should be fixed.	Endoscope replaced during second measurement set at INTA.
1	BEV/E+E	Photodiode did not come back to 4 V after finishing measurement and turning "mirror control" off. It stayed at 6.5 V.	Detector assembly substituted.
1	BEV/E+E	"Block temperature" goes only up to 103 °C with oscillations of about 0.5 °C instead of 115 °C.	Excess temperature switch was bypassed by soldering a circuit bridge on the board of heating box.
1 & 2	INTA	ATA Carnets: both sent to INTA to correct formal customs issues.	Absence of some stamps and dates corrected.
1	NMIJ	Rotameter Glass tube was broken.	NMIJ used its own rotameter for checking the flow after vapor trap.

The repairs and those interruptions provoked by formal issues relating to international transport, already explained in Section 2.3, caused a 3-month delay on the original comparison schedule (see Fig. 2.3.a and Fig. 2.3.b). However, no significant effect on the long-term features and performances of either instrument was observed, fact verified by means of the stability study carried described in the following section.

4.3 STABILITY STUDY

One of the lessons learned from CCT-K6 was that stability must be one of the issues related to the instruments of greatest concern, mainly in those intercomparisons with long duration and several interventions made to diagnose and repair problems in the travelling standards [Bel15].

Stability of the transfer standards is one of the main components of the uncertainty budget of DoE, KCRV and all NMI differences with respect to these, is a key point to ensure validity of all the comparison parameters between participants.

Hence, it was decided that each travelling standard circulated within only one loop and only linking laboratories measured both instruments. This way, the comparison time was halved compared to the method that all instruments were measured by all participants, as was done in CCT-K6, decreasing risks and consequences from a possible drift.

On the other hand, the performance of the transfer standards during the comparison was monitored on receipt of the instruments, because every participant had to report to the Pilot the first measurement at a nominal dew point temperature of 30 °C within 48 h of it being measured, to check the correct performance of the transfer standard(s) [TPR16].

In addition, drift of both instruments throughout the entire comparison measurement phase was assessed by means of the pilots and link laboratories at the beginning, intermediate and end of the comparison (see Fig. 2.2.b). Regarding that matter, Fig. 4.3.a shows differences between both travelling standards (s/n. 08-1215 and 08-1216) for those laboratories that measured both transfer standards simultaneously. The figure depicts the arithmetic mean of differences of the n repeated measurements of each participant measured at each nominal dewpoint, Δt_d^{lab} ; together with its corresponding expanded uncertainty, denoted as $U(\Delta t_d^{lab})$, which was obtained by multiplying by a coverage factor k=2, providing a coverage probability higher than 95 %.

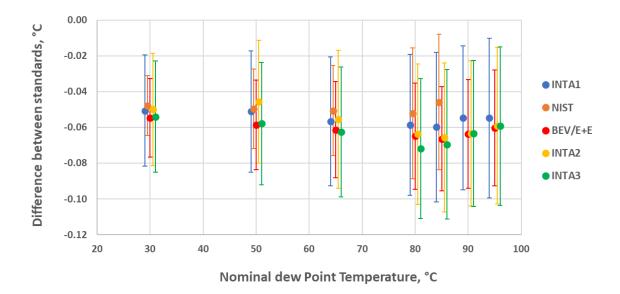
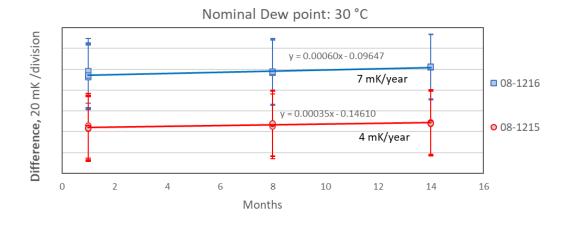


Fig. 4.3.a Difference betweeen both travelling standards measured by all linking laboratories together with their corresponding expanded uncertainty obtained by multiplying by a coverage factor k = 2. The three measurement sets performed by INTA were included and denoted by its name followed by a number chronologically chosen. At every nominal dew point data set from each participant has been scattered in 0.50 °C for easy viewing.

As can be seen in the previous figure, the highest differences among the five measurement sets performed by three different participants thought the whole comparison, were practically in all cases less than 20 mK. Considering that the lowest uncertainties reported by these participants were the same order, it seems reasonable to assume that the relative behaviour between both travelling standards did not show any remarkable drift effects or at least could not be recognized according to the measurement capabilities demonstrated by the participants.

To be able to confirm this assumption another study was carried out but, in this case, only those measurement sets performed by INTA were considered because they covered the entire comparison period: beginning, intermediate and end. Potential drift effects coming from transfer standards were evaluated by means of the slope obtained from the linear fit of the differences measured over time, for each hygrometer and at seven nominal dew-point temperatures. The following figures show examples at the extremes of the range:



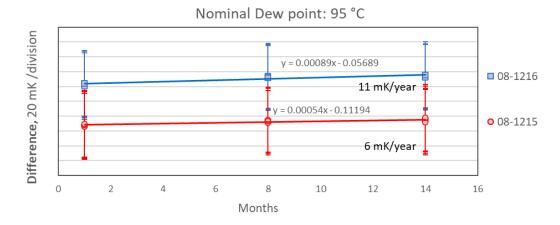


Fig. 4.3.b Drift study performed from differences together with their corresponding expanded uncertainty obtained by multiplying by a coverage factor k = 2, collected on three measurement sets of INTA that cover the whole comparison time, allowing the analysis of the drift behaviour of both travelling standards. Two examples at lowest (30 °C) and highest (95 °C) nominal dew-point temperatures are shown.

From the slopes obtained for the fourteen months that the comparison lasted, it is easy to quantify the annual drift of each standard. All slopes obtained from the previous figures are summarized in the following table, for each nominal dew-point temperature. The first conclusion that can be reached is that there is not a clear trend in the drift behaviour as a function of the dew-point temperature in either standard and that the highest drift occurred at the highest nominal dew-point temperature.

Table 4.3.1 Summary table of the drift behaviour shown by the two travelling standards at all nominal dew point temperatures. A colour shading is used as an aid to detect potential drift trends as a function of nominal dew point generated. Lighter shading for lower drift and darker for higher drift.

Nominal DP	Loop 1 08-1215	Loop 2 08-1216
℃	mK/year	mK/year
30	4.2	7.2
50	3.4	9.1
65	1.7	7.0
80	-6.2	5.8
85	-4.0	4.9
90	-3.5	4.8
95	6.5	10.7
MAX	6.5	10.7
MIN	-6.2	4.8

Using maximum and minimum values of the table, both instruments had a drift within -7 mK/year and 11 mK/year. These variations are of the order of the reproducibility of the instruments and, consistent with the reproducibility in setting the flow rate after the condensation trap according to the measurement instructions described in the protocol [TPR16]. On the other hand, the expanded uncertainties declared by INTA for a confidence level higher than 95 % were between 30 mK and 45 mK, which were in any cases more than three times the variation shown by both instruments.

The uncertainty component due to the stability was considered and calculated as follows:

$$u_{stab(i,j)} = \sqrt{u_{stab,loop1}^2 + u_{stab,loop2}^2}$$
 Eq. 4.3.a

where $u_{stab,loopi}^2=\frac{|\delta_{stab,max}|}{\sqrt{12}}$, where $|\delta_{stab,max}|$ is the maximum value of the magnitude obtained in each loop from Table 4.3.1.

The table below lists the uncertainty due to the drift in the worst case in both loops, which does not mean that the same behavior was exhibited at all nominal dew point temperatures but was considered as the most representative value of this uncertainty component.

Table 4.3.2 Summary table of the standard uncertainties due to drift for the worst case in both loops for k = 1.

	in <i>mK</i>
u _{stab} =	3.6
u _{stab.loop 1} =	1.9
u _{stab.loop2} =	3.1

Thus, according to Table 4.3.1, it can be assumed that both travelling standards did not exhibit significant drift during the comparison period and therefore this effect was considered negligible and, no corrections were performed in this sense throughout the entire data analysis, and the uncertainties showed in Table 4.3.2. were used.

5 LOCAL DEW POINT TEMPERATURE SCALES

A brief description of the humidity generation system used by the participants is summarized below according to the information reported. These systems are still currently used to maintain the local dew-point temperature scales at the date of issue of this report, unless otherwise stated.

5.1 BEV/E+E

The BEV/E+E standard humidity generator is based on the two-pressure generator of the Physikalisch-Technische Bundesanstalt (PTB), with a number of design improvements that lead to an extended range and improved stability and flexibility. In this design, the first level of saturation is provided by a downward helix, followed by two condensers stacked horizontally (as opposed to the vertical position of the original PTB design). This has several advantages for condensate level adjustment within the condensers and also for defining a vertical bath gradient to ensure that the final point of saturation is located in the lower condenser, where little heat transfer is required and the immersion conditions are optimum for temperature measurement and control. The measurement of saturator pressure has also been optimized to avoid the well-known problems associated with humid air in contact with precision pressure sensors. The generator can be operated in the two-pressure mode over the range of dew/frost-point temperatures from –80 °C to +90 °C, and from –60 °C to 95 °C in the single-pressure mode.

The measurements of temperature, pressure, and electrical quantities are traceable to the SI via the Austrian National Standards maintained at BEV. The standard humidity generator used by BEV/E+E is described extensively in [Mit06].

5.2 INRIM

The comparison was made between the 1-P recirculating-type INRIM-01 generator and the transfer standard model MBW 373 HX.

The INRIM-01 primary humidity standard operates according to the principle of a single-pressure, recirculating-type, generator. It covers the dew/frost point temperature range from -25 °C to 95 °C.

The total pressure is kept constant to better than 0.05% at any value between 1000 hPa and 1200 hPa, typically at 1050 hPa, by means of an electronic pressure controller. The pressure controller keeps the pressure stable and constant even when a small gas flow, in the range between 0,5 l/min and 4 l/min in normal conditions, is drawn from the generator to feed dew-point hygrometers under calibration and vented to the ambient. The small flow vented through the dew-point hygrometers is replaced by the same amount of dry gas coming from a pressurized nitrogen/air gas source.

The reference dew-point is established within an isothermal saturator as sole function of its temperature which is measured at the saturator outlet by means of a pair of calibrated PRTs traceable to ITS-90 immersed in the liquid and in the gas flow, respectively. Neglecting any possible difference between the evaporation and condensation temperatures, which for pure water (demineralized water) is below 0.001 °C in both liquid and solid phases, the dew point temperature is the parameter describing the saturation of a gas stream over water and the frost point temperature that for the saturation over ice.

The hygrometer under calibration was connected to the generator outlet by means of a 1.5-m length, 6-mm o.d., heated flexible hose held at a temperature at least 10 °C higher than dew-point temperature. The applied condition to the hygrometer under calibration was estimated from the generated dew point temperature in the saturator after applying a correction to compensate for the pressure drop between the saturator outlet and the hygrometer point of measurement as indicated in the protocol. The correction was experimentally determined during the comparison by means of a calibrated differential pressure gauge and never exceeded 100 Pa.

The mirror PRT of the transfer standard hygrometer was measured by means of a calibrated temperature bridge, model Corradi RP7000, operating with a DC-reversed and pulsed current of 1 mA (with duty-cycle 20 %). The resulting self-heating effect was more than ten times lower than that produced by a DC current of equal magnitude.

All the instrumentation for the measurement of the electrical quantities is calibrated at INRIM which guarantees the traceability of the measurements to the SI.

5.3 INTA

The INTA high range humidity generator is based on the main components supplied by BEV/E+E, consisting of a temperature-stabilized pressure unit, a temperature regulation unit, a pre-saturator, a pressure regulation system, a temperature-stabilized expansion unit, and the main saturator (condenser) [B&M08]. The main saturator in placed in a temperature-controlled bath. The humid gas from the generator was supplied to the transfer standards via 4 mm inner diameter electropolished stainless steel tubes.

The saturator temperature is measured with two Rosemount 162CE standard platinum resistance thermometers calibrated at INTA at ITS-90 fixed points from the triple point of water to the freezing point of indium, an ASL F700A AC resistance bridge, with a measurement frequency of 75 Hz, calibrated in-house using an inductive voltage divider calibrated by PTB, and Tinsley Wilkins standard resistors calibrated by the INTA electricity laboratory. Absolute pressure measurements are performed with

Ruska 6230 digital pressure gauges and Paroscientific series 6000 pressure transducers, calibrated by the INTA Pressure and Mass Laboratory using Ruska 2465 pressure balances. Auxiliary flow and differential pressure measurements to establish the required conditions in the transfer standards have been made with instruments calibrated by the INTA Flow and Pressure and Mass laboratories, respectively.

All measurements have metrological traceability to the SI via regular calibration of reference standards at Centro Español de Metrología (temperature, DC resistance, pressure).

5.4 KRISS

The KRISS Two-pressure High Dew-point Generator (HDPG) was used to provide the reference dew-point temperature. The humid gas from the generator was supplied to the transfer standards via electropolished stainless steel heated tubes. Saturation temperature was measured using a Hart Scientific model 5686 Standard Platinum Resistance Thermometer. Saturation pressure and pressure at the chilled mirror hygrometer were monitored with Paroscientific model 745 pressure transducers. The mirror PRT of the transfer standard was measured using an ASL model F700 AC Resistance bridge at a current of 1 mA and frequency of 90 Hz.

Measurement traceability to the SI is obtained via by pressure, temperature and electrical standards maintained at KRISS.

5.5 NIST

The NIST Hybrid Humidity Generator (HHG) was used to provide the reference dew-point temperature. This generator produces humidified air with water amount fractions (water mole fractions) ranging from 1.0×10^{-7} to 0.57 using calibration gas flows up to 150 standard liters per minute. At ambient pressure these amount fractions correspond to dew/frost points ranging from -90 °C to +85 °C. The HHG may be used to calibrate instruments measuring water amount fraction, such as cavity ring-down hygrometers. It may also be used to calibrate chilled-mirror hygrometers measuring dew/frost-point temperature when an additional pressure measurement is made at the inlet of the hygrometer.

The HHG combines the two-pressure and divided-flow humidity generation methods (hence the name "hybrid"). The centerpiece of the HHG is a heat exchanger/saturator that is immersed in a temperature-controlled bath stable to within 1 mK. For dew/frost-point temperatures that are above –10.3 °C, the two-pressure method is employed. For frost points at or below –10.3 °C, the water-

vapor/air mixture is produced by mixing metered streams of moist air produced by the two-pressure method with purified, dry air.

The generator and its use in the calibration of hygrometers is documented extensively in [Mey21]. The dewpoint standards generated by the HHG are traceable to the International System of Units (SI) through NIST pressure and temperature standards.

5.6 NMC, A*STAR

Measurements were made using two systems. A Thunder Scientific Model 2500 two-pressure humidity generator was used for dew-point temperature in the range from 30 °C to 65 °C. Saturation pressure, chamber pressure, and pressure drop from the generator to the transfer standard dew-point meter were measured using pressure standards traceable to the SI via NMC's national standards. The saturation temperature was measured with a Standard Platinum Resistance Thermometer traceable to ITS-90 via NMC's national standards. Air was the carrying gas. The transfer dew point meter sampled the air from a small chamber made of stainless tube, connected to the generator's chamber inlet.

A Weiss climatic chamber model WK340 was used as humidity source for dew-point temperatures from 80 °C to 90 °, using an RH Systems dew-point meter model 373LHX calibrated by NPL as the reference standard. Air was the carrying gas and was sampled directly from the chamber.

In both systems, the provided stainless steel heat hose was used for the connection between the transfer hygrometer and the generator/chamber. The transfer standard PRT resistance was measured with a Fluke Model 1529 DC bridge, using a sensing current of 1 mA.

5.7 NMIJ

The primary humidity standard for the high-humidity range at the NMIJ is realized with a two-pressure (2-P) generator developed by the NMIJ. The main components of the NMIJ 2-P generator are a pressure regulator, a pre-saturator, a heat-exchanger, a main saturator, an expansion valve (EV) and a manifold. Pressurized gas (air) at a pressure of Pu is introduced into the pre-saturator and is humidified by bubbling it through water. After passing through a heat-exchanger, final saturation of the gas is achieved by flowing it over the surface of water in the main saturator kept at a temperature of Ts and a pressure of Ps. After this, the gas flows into the manifold through the EV and its pressure is reduced from Ps to Pt. The manifold has multiple outlet ports to connect hygrometers to the 2-P generator. The dew point of the gas at the outlet, Td, is given by:

$$\frac{e_{s}(T_{d})f(P_{t},T_{d})}{P_{t}} = \frac{e_{s}(T_{s})f(P_{s},T_{s})}{P_{s}}$$
 Eq. 5.7.a

where $e_s(T)$ is the saturation vapor pressure of water at temperature T; f(P,T) is the water vapor enhancement factor at pressure P and temperature T, which corrects for the non-ideal behavior of the

humid gas. By measuring T_s , P_s , and Pt, we can accurately determine T_d by using Eq. 5.7.a with an iterative method, and by controlling T_s and P_u , we can achieve stable generation of humid gas with a target dew point T_d . T_s and P_s can be controlled in the ranges of 5 °C to 98 °C and 100 kPa to 600 kPa, respectively. The range of T_d that can be generated is -10 °C to 95 °C. The measurement results of T_s , P_s , and P_t are traceable to the International System of Units (SI) through the NMIJ primary measurement standards.

5.8 NPL

The NPL measurements were carried out against the NPL Standard Humidity Generator (SHG2), in terms of dew-point temperature. The "generated dew point" was determined from measurements made using a PRT immersed at a point in the generator where the gas has reached complete saturation and therefore a measurement of air temperature is equal to that of dewpoint temperature. Traceability of measurement was provided by calibration of this thermometer to the International Temperature Scale of 1990 (ITS90) through NPL Temperature Standards.

Air of a known dewpoint temperature, at a pressure of 105.0 kPa, was supplied to the test hygrometer inlet. A 1.2 m length of 4 mm internal diameter PTFE tubing was used to connect the moist air to the transfer standard hygrometer. The moist air was then vented to atmosphere, through a cold trap and then a rotameter with a needle valve assembly for flow control.

5.9 PTB

PTB's humidity generator is a two-pressure generator with a range from -25 °C frost point temperature up to +80 °C dew point temperature. The generator is supplied by oil and dust free, compressed air up to 15 bar. The pressure is precisely regulated by a pressure regulator. The gas stream passes a heated pre-saturator in which the air is saturated with water with respect to temperature and pressure in the pre-saturator. Afterwards the air is fed to the main saturator which is a specially designed metal block immersed in a thermostatic bath. The temperature in the bath is slightly below the temperature of the pre-saturator. Therefore, water condenses along the horizontally arranged fins of the saturator. At the end of the saturator the gas stream is saturated with respect to the temperature and pressure in the saturator. After the saturator block the gas stream is expanded via a needle valve to atmospheric pressure. The temperature is measured within the bath in direct vicinity of the saturator with two Tinsley SPRT PT-25. Each of the two relevant pressure values (saturator and point-of-use) is measured using an MKS Baratron® pressure transmitter. Both, temperature and pressure measurements, are directly traceable to the national standards of Germany. The generated moist air stream is directed to the transfer standard via a heated line and 6 mm

Swagelok® tubing. The resistance value of the second PRT of the mirror of the transfer standard is read using an ASL F17 resistance bridge.

The vapor pressures and enhancement factors used in the calculation of the reference dew-point temperature are given in [Gre76, Son90, Har98].

6 MEASUREMENT RESULTS

Dew-point temperatures reported, and used along all this report were calculated values from the measured resistance output, by means of the international standard IEC 60751:2008 [IEC08], described in Section 12.8 and previously selected by all participants.

The evaluation is based on that of EURAMET.T-K6 [Hei08] and CCT-K6 [Bel15]. Measurement results reported by all participating laboratories were annexed in Section 12.6, as well as the uncertainty budget in Section 12.7.

6.1 ANALYSIS OF RESULTS

Each participating laboratory reported both dew-point temperature generated (laboratory reference), $t_{d,i}^{ref}$, and dew-point temperature measured by the transfer standard, $t_{d,i}^{hyg}$, for each nominal dew-point temperature, t_d . This was repeated four times for each nominal dew point generated. Thus, difference between them for each point i, $\Delta t_{d,i}^{lab}$ is given by:

$$\Delta t_{d,i}^{lab} = t_{d,i}^{hyg} - t_{d,i}^{ref}$$
 Eq. 6.1.a

This way, four values for each nominal dew point temperature, together with a single value obtained from the mean of these, was reported by the participants using the approved template (Section 12.6).

The method of analysis used comprises three main steps:

- 1. Determination of the linking path between loops
 - a. Function $B_{i,i}$ (Section 12.1.1)
 - b. Consistency test of $B_{i,j}$ (Section 12.1.2)
- 2. Bilateral equivalence, *DoE* (Section 7.1)
- 3. Key Comparison Reference Values, KCRV (Section 12.2)
 - a. Consistency test inter-laboratory (Section 8.2)

Details on the analysis is given in the section indicated for each step.

In the following two figures, the differences reported from every participant with their corresponding measurement uncertainty are depicted:

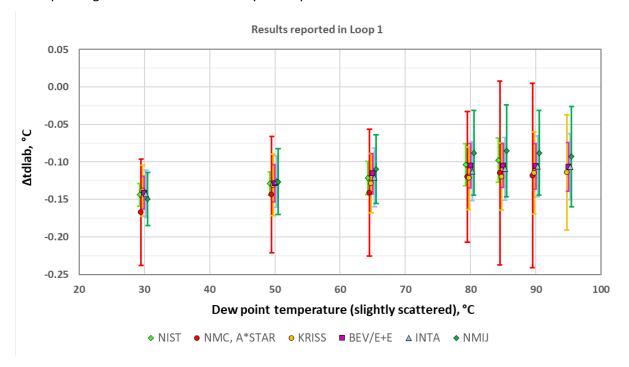


Fig. 6.1.a Results reported for each participant in Loop 1, together with their expanded uncertainty for a coverage factor k = 2. At every nominal dew point data set from each participant has been scattered in 0.25 °C for easy viewing.

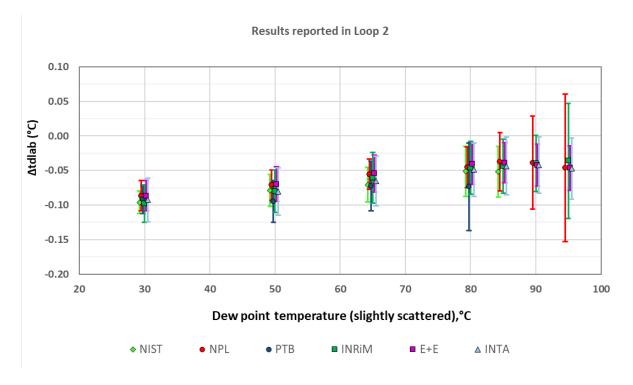


Fig. 6.1.b Results reported for each participant in Loop 2, together with their expanded uncertainty for a coverage factor k = 2. At every nominal dew point data set from each participant has been scattered in 0.25 °C for easy viewing.

7 BILATERAL EQUIVALENCE

7.1 ANALYSIS METHOD

The bilateral equivalence, D_{ij} , of laboratory i and j, also known as Degrees of Equivalence (DoE) were initially obtained from:

$$D_{ij} = \Delta t_d^i - \Delta t_d^j + \delta_{stab} = \Delta t_{d,loop(i)}^i + B_{i,j} - \Delta t_{d,loop(j)}^j + \delta_{stab}$$
 Eq. 7.1.a

The subscripts loop(i) and loop(j) mark the loop of laboratory i and j, respectively. The stability term, δ_{stab} , was considered zero because drift effects of both travelling standards were neglected (see section 4.3), but their contribution due to stability of the transfer standards, as summarized in Table 4.3.2, were considered in the uncertainty budget.

The discrete function B_{ij} was used to calculate the linkage between both loops and was obtained from each link-laboratory given that they could measure simultaneously both standards in parallel four times, so for each link-laboratory and each artefact there were four single measurements at all nominal dew points. Calculation of function B is detailed in annexes in Section 12.1.1. according to the following definition of the function B:

$$B_{i,j} = result. loop. j - result. loop. i$$
 Eq. 7.1.b

This means that a positive $B_{i,j}$ gives larger results in loop 2 than in loop 1 at a given nominal dew point temperature. On the other hand, it is meet that $B_{i,j} = -B_{j,i}$, which means that the way to calculate the difference between a participant of loop 1 and another from loop 2 is just the opposite than calculating the difference between the same participant of loop 2 regarding to the other same participant from loop 1. In addition, as can be seen in Eq. 12.1.a, according to the parameter's own definition B_{ij} , when laboratory i and j participated in the same loop $B_{i,j}$ is equal to zero.

However, as will be explained in Section 8, the key comparison reference value (KCRV) calculation method used, had to simplify the intercomparison scheme to a single loop, denominated virtual loop, in which a supposed virtual transfer standard was measured by all participants.

The way to create this virtual loop was from the function B to generate a virtual transfer standard with an intermediate behaviour between both hygrometers that circulated in loop 1 and 2. In this sense, the correction factor C_{loop} was used and defined according to the following equations:

$$C_{loop.1} = C_1 = \frac{B_{i,j}}{2}$$
 Eq. 7.1.c

$$C_{loop.2} = C_2 = \frac{B_{j,i}}{2} = -\frac{B_{i,j}}{2}$$
 Eq. 7.1.d

The uncertainty of this factor is determined by the following general expression:

$$u\left(\frac{x}{2}\right) = \frac{\partial\left(\frac{x}{2}\right)}{\partial x} \cdot u(x) = \frac{1}{2}u(x)$$
 Eq. 7.1.e

Thus, being consistent with such model, the uncertainty of the correction factor $C_{loop(i)}$ was given as follows:

$$u(C_{loop}) = \frac{1}{2}u(B_{i,j}) = \frac{1}{2}u(B_{j,i})$$
 Eq. 7.1.f

Finally, the bilateral equivalence of different participants can be directly calculated using the harmonized laboratory results, $\Delta t_d^{(i)\prime}$, according to next equation:

$$D_{ij} = \Delta t_d^{(i)'} - \Delta t_d^{(j)'} + \delta_{stab.loop.v}$$
 Eq. 7.1.g

where: $\Delta t_d^{(i)'}$ is the harmonized result of laboratory i in the virtual loop with only one virtual transfer standard and is calculated as follows:

$$\Delta t_d^{(i)'} = \Delta t_d^{(i)} + C_{loop(i)}$$
 Eq. 7.1.h

 $\delta_{stab.loop.v}$ is the stability of the virtual loop calculated as the average of the stability of the two real loops, both considered negligible (see section 4.3):

$$\delta_{stab.loop.v} = \frac{1}{2} \cdot \left(\delta_{stab.loop.1} + \delta_{stab.loop.2} \right) = 0$$
 Eq. 7.1.i

The uncertainty associated to the bilateral equivalence considering this virtual loop is fully explained in Section 12.1.3 of the annexes.

7.2 RESULTS

As was previously mentioned, an essential condition to be met by linking laboratories in the loop difference calculation is that both artefacts should be measured in parallel and simultaneously with a symmetrical setup. All measurements that fulfil this condition are considered statistically independent. In other words, loop difference and related uncertainty are not a property of the applied reference but a property of the travelling standards.

Therefore, it was considered the most appropriate to include the three INTA measurements, not only as a broad data pool as possible and reasonable, but INTA had data from the beginning until the end of the comparison, which confers an extra added value to this study.

The calculated values of function $B_{i,j}$ and the corresponding uncertainties are shown in the table below:

Table 7.2.1 Calculated values of $B_{i,j}$ and the related uncertainties (k = 1) used when $loop(i) \neq loop(j)$ and for each nominal dew-point temperatures.

			Nominal Dew Point in °C														
	30	30 50 65 80 85 90 95															
$B_{i,j}$	0.0517	0.0574	0.0601	0.0643	0.0658	0.0627	0.0598										
$u\left(B_{i,j}\right)\left(k=1\right)$	0.0020	0.0023	0.0016	0.0024	0.0024	0.0029	0.0012										

The bilateral degrees of equivalence (DoE) for each nominal dew point temperature are shown in Table 7.2.2 to Table 7.2.8, together with related expanded uncertainties, $U(D_{ij})$, given by multiplying by two the $u(D_{ij})$.

Table 7.2.2 Degree of equivalence (DoE) between the participants of CCT-K8 at dew-point temperature 30 °C. DoE is expressed as (D_{ij}, U_{ij}) , where i is the row and j the column laboratory.

DoE	INF	RiM	NI	ST	NI	VIIJ	KR	ISS	NMC, A	A*STAR	IN	TA	BEV	/E+E	N	PL	P	ГВ
DP = 30 °C	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)
DP = 30 C	in °c	in °c	in °c	in ℃	in °c	in °c	in °c	in °c	in ℃	in ℃	in °c	in °c	in °c	in °c	in ℃	in°c	in ℃	in °c
INRIM	-	-	-0.006	0.032	0.000	0.045	-0.011	0.044	0.018	0.077	-0.005	0.042	-0.008	0.035	-0.011	0.035	-0.006	0.034
NIST	0.006	0.032	-	-	0.006	0.039	-0.005	0.038	0.024	0.073	0.001	0.036	-0.003	0.028	-0.006	0.028	0.000	0.027
NMIJ	0.000	0.045	-0.006	0.039	-	-	-0.011	0.049	0.018	0.080	-0.005	0.047	-0.008	0.042	-0.011	0.042	-0.006	0.041
KRISS	0.011	0.044	0.005	0.038	0.011	0.049	-	-	0.029	0.079	0.006	0.046	0.003	0.041	0.000	0.041	0.005	0.040
NMC, A*STAR	-0.018	0.077	-0.024	0.073	-0.018	0.080	-0.029	0.079	ı	1	-0.023	0.078	-0.026	0.075	-0.029	0.075	-0.024	0.074
INTA	0.005	0.042	-0.001	0.036	0.005	0.047	-0.006	0.046	0.023	0.078	-	-	-0.003	0.038	-0.006	0.038	-0.001	0.038
BEV/E+E	0.008	0.035	0.003	0.028	0.008	0.042	-0.003	0.041	0.026	0.075	0.003	0.038	-	-	-0.003	0.031	0.002	0.030
NPL	0.011	0.035	0.006	0.028	0.011	0.042	0.000	0.041	0.029	0.075	0.006	0.038	0.003	0.031	-	-	0.005	0.030
РТВ	0.006	0.034	0.000	0.027	0.006	0.041	-0.005	0.040	0.024	0.074	0.001	0.038	-0.002	0.030	-0.005	0.030	-	-

Table 7.2.3 Degree of equivalence (DoE) between the participants of CCT-K8 at dew-point temperature 50 °C. DoE is expressed as (D_{ij}, U_{ij}) , where i is the row and j the column laboratory.

DoE	INF	RiM	NI	ST	NI	VIIJ	KR	ISS	NMC, A	*STAR	IN	TA	BEV	/E+E	N	PL	P.	ТВ
DP = 50 °C	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)
DP = 50 C	in ℃	in °c	in °c	in ℃	in °c	in °c	in ℃	in °c	in ℃	in ℃	in °c	in °c	in °c	in °c	in ℃	in°c	in °c	in °c
INRiM	-	-	-0.009	0.039	-0.011	0.054	-0.007	0.052	0.006	0.084	0.000	0.047	-0.009	0.042	-0.009	0.039	0.015	0.044
NIST	0.009	0.039	•	-	-0.002	0.050	0.002	0.047	0.015	0.081	0.009	0.041	0.000	0.035	0.000	0.031	0.024	0.038
NMIJ	0.011	0.054	0.002	0.050	-	-	0.004	0.060	0.017	0.090	0.012	0.056	0.002	0.052	0.002	0.049	0.026	0.054
KRISS	0.007	0.052	-0.002	0.047	-0.004	0.060	-	-	0.013	0.088	0.007	0.054	-0.002	0.049	-0.002	0.047	0.022	0.051
NMC, A*STAR	-0.006	0.084	-0.015	0.081	-0.017	0.090	-0.013	0.088	-	-	-0.006	0.085	-0.015	0.083	-0.015	0.081	0.009	0.084
INTA	0.000	0.047	-0.009	0.041	-0.012	0.056	-0.007	0.054	0.006	0.085	-	-	-0.009	0.044	-0.009	0.041	0.014	0.046
BEV/E+E	0.009	0.042	0.000	0.035	-0.002	0.052	0.002	0.049	0.015	0.083	0.009	0.044	-	-	0.000	0.035	0.024	0.041
NPL	0.009	0.039	0.000	0.031	-0.002	0.049	0.002	0.047	0.015	0.081	0.009	0.041	0.000	0.035	-	-	0.024	0.038
PTB	-0.015	0.044	-0.024	0.038	-0.026	0.054	-0.022	0.051	-0.009	0.084	-0.014	0.046	-0.024	0.041	-0.024	0.038	-	-

Table 7.2.4 Degree of equivalence (DoE) between the participants of CCT-K8 at dew-point temperature 65 °C. DoE is expressed as (D_{ij}, U_{ij}) , where i is the row and j the column laboratory.

DoE	INF	RiM	NI	ST	NI	ΛIJ	KR	ISS	NMC, A	A*STAR	IN	TA	BEV	/E+E	N	PL	P.	ТВ
DP = 65 °C	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	$U_{ij}(k=2)$
DP = 65 C	in ℃	in °c	in ℃	in ℃	in °c	in °c	in °c	in °c	in ℃	in ℃	in °c	in °c	in °c	in °c	in ℃	in°c	in °c	in °c
INRiM	-	-	0.001	0.046	-0.011	0.061	0.008	0.054	0.021	0.094	0.005	0.052	-0.005	0.046	-0.005	0.043	0.012	0.052
NIST	-0.001	0.046	-	-	-0.012	0.054	0.007	0.047	0.020	0.090	0.004	0.045	-0.006	0.038	-0.006	0.035	0.011	0.045
NMIJ	0.011	0.061	0.012	0.054	-	-	0.019	0.062	0.031	0.098	0.016	0.060	0.006	0.055	0.006	0.053	0.023	0.060
KRISS	-0.008	0.054	-0.007	0.047	-0.019	0.062	-	-	0.013	0.094	-0.003	0.054	-0.013	0.048	-0.013	0.045	0.004	0.053
NMC, A*STAR	-0.021	0.094	-0.020	0.090	-0.031	0.098	-0.013	0.094	-	1	-0.016	0.093	-0.025	0.090	-0.026	0.089	-0.008	0.093
INTA	-0.005	0.052	-0.004	0.045	-0.016	0.060	0.003	0.054	0.016	0.093	-	-	-0.010	0.046	-0.010	0.043	0.007	0.051
BEV/E+E	0.005	0.046	0.006	0.038	-0.006	0.055	0.013	0.048	0.025	0.090	0.010	0.046	-	-	0.000	0.035	0.017	0.045
NPL	0.005	0.043	0.006	0.035	-0.006	0.053	0.013	0.045	0.026	0.089	0.010	0.043	0.000	0.035	1	-	0.017	0.042
PTB	-0.012	0.052	-0.011	0.045	-0.023	0.060	-0.004	0.053	0.008	0.093	-0.007	0.051	-0.017	0.045	-0.017	0.042	-	-

Table 7.2.5 Degree of equivalence (DoE) between the participants of CCT-K8 at dew-point temperature 80 °C. DoE is expressed as (D_{ij}, U_{ij}) , where i is the row and j the column laboratory.

DoE	INF	RiM	NIST		NI	ΛIJ	KR	ISS	NMC, A	A*STAR	IN	TA	BEV	/E+E	NPL		P	ТВ
DP = 80 °C	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)
DP = 80 C	in ℃	in °c	in °c	in ℃	in ℃	in °c	in °c	in °c	in ℃	in ℃	in °c	in °c	in °c	in °c	in ℃	in °c	in °c	in °c
INRIM	1	-	-0.007	0.058	-0.022	0.070	0.011	0.058	0.009	0.096	0.003	0.055	-0.005	0.051	-0.001	0.050	0.028	0.075
NIST	0.007	0.058	-	-	-0.016	0.071	0.018	0.059	0.016	0.097	0.010	0.057	0.002	0.053	0.006	0.052	0.034	0.076
NMIJ	0.022	0.070	0.016	0.071	-	-	0.034	0.071	0.032	0.105	0.025	0.069	0.017	0.066	0.022	0.065	0.050	0.085
KRISS	-0.011	0.058	-0.018	0.059	-0.034	0.071	-	-	-0.002	0.097	-0.008	0.057	-0.016	0.053	-0.012	0.052	0.016	0.076
NMC, A*STAR	-0.009	0.096	-0.016	0.097	-0.032	0.105	0.002	0.097	ı	-	-0.006	0.096	-0.014	0.093	-0.010	0.093	0.018	0.108
INTA	-0.003	0.055	-0.010	0.057	-0.025	0.069	0.008	0.057	0.006	0.096	-	-	-0.008	0.050	-0.004	0.049	0.025	0.074
BEV/E+E	0.005	0.051	-0.002	0.053	-0.017	0.066	0.016	0.053	0.014	0.093	0.008	0.050	-	-	0.004	0.044	0.033	0.071
NPL	0.001	0.050	-0.006	0.052	-0.022	0.065	0.012	0.052	0.010	0.093	0.004	0.049	-0.004	0.044	-	-	0.028	0.070
PTB	-0.028	0.075	-0.034	0.076	-0.050	0.085	-0.016	0.076	-0.018	0.108	-0.025	0.074	-0.033	0.071	-0.028	0.070	-	-

Table 7.2.6 Degree of equivalence (DoE) between the participants of CCT-K8 at dew-point temperature 85 °C. DoE is expressed as (D_{ij}, U_{ij}) , where i is the row and j the column laboratory.

DoE	INF	RiM	NI	ST	NI	VIIJ	KR	ISS	NMC, A	A*STAR	IN	TA	BEV	/E+E	N	PL	P.	ТВ
DP = 85 °C	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)
DP = 85 C	in °c	in °c	in °c	in ℃	in °c	in °c	in °c	in °c	in ℃	in ℃	in °c	in °c	in °c	in °c	in ℃	in °c	in °c	in °c
INRiM	-	-	-0.012	0.058	-0.024	0.074	0.010	0.060	0.005	0.130	0.000	0.058	-0.004	0.050	-0.006	0.059	-	-
NIST	0.012	0.058	-	-	-0.013	0.074	0.022	0.060	0.017	0.130	0.012	0.058	0.007	0.050	0.006	0.059	-	-
NMIJ	0.024	0.074	0.013	0.074	-	-	0.034	0.076	0.030	0.138	0.024	0.075	0.020	0.068	0.018	0.075	-	-
KRISS	-0.010	0.060	-0.022	0.060	-0.034	0.076	-	-	-0.005	0.131	-0.010	0.061	-0.014	0.053	-0.016	0.061	-	-
NMC, A*STAR	-0.005	0.130	-0.017	0.130	-0.030	0.138	0.005	0.131	ı	=	-0.005	0.131	-0.010	0.127	-0.011	0.131	-	-
INTA	0.000	0.058	-0.012	0.058	-0.024	0.075	0.010	0.061	0.005	0.131	-	-	-0.004	0.051	-0.006	0.060	-	-
BEV/E+E	0.004	0.050	-0.007	0.050	-0.020	0.068	0.014	0.053	0.010	0.127	0.004	0.051	-	=	-0.002	0.051	-	-
NPL	0.006	0.059	-0.006	0.059	-0.018	0.075	0.016	0.061	0.011	0.131	0.006	0.060	0.002	0.051	-	-	-	-
РТВ	-	-	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-

Table 7.2.7 Degree of equivalence (DoE) between the participants of CCT-K8 at dew-point temperature 90 °C. DoE is expressed as (D_{ij}, U_{ij}) , where i is the row and j the column laboratory.

DoE	INF	RiM	NIST		NI	VIIJ	KR	ISS	NMC, A	A*STAR	IN	TA	BEV	/E+E	N	PL	P.	ТВ
DP = 90 °C	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)
DP = 90 C	in ℃	in °c	in ℃	in ℃	in °c	in °c	in °c	in °c	in ℃	in ℃	in °c	in °c	in °c	in °c	in ℃	in °c	in °c	in °c
INRiM	-	-	-	-	-0.015	0.070	0.012	0.069	0.015	0.130	0.003	0.059	0.003	0.052	-0.001	0.079	-	-
NIST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NMIJ	0.015	0.070	-	-	-	-	0.027	0.079	0.030	0.136	0.017	0.070	0.018	0.064	0.013	0.088	-	-
KRISS	-0.012	0.069	-	-	-0.027	0.079	-	-	0.003	0.135	-0.010	0.069	-0.009	0.063	-0.013	0.087	-	-
NMC, A*STAR	-0.015	0.130	-	-	-0.030	0.136	-0.003	0.135	-	-	-0.013	0.130	-0.012	0.127	-0.017	0.141	-	-
INTA	-0.003	0.059	-	-	-0.017	0.070	0.010	0.069	0.013	0.130	-	-	0.001	0.052	-0.004	0.079	-	-
BEV/E+E	-0.003	0.052	-	-	-0.018	0.064	0.009	0.063	0.012	0.127	-0.001	0.052	-	-	-0.004	0.074	-	-
NPL	0.001	0.079	-	-	-0.013	0.088	0.013	0.087	0.017	0.141	0.004	0.079	0.004	0.074	-	-	-	-
PTB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 7.2.8 Degree of equivalence (DoE) between the participants of CCT-K8 at dew-point temperature 95 °C. DoE is expressed as (D_{ij}, U_{ij}) , where i is the row and j the column laboratory.

DoE	INF	RiM	NIST		NMIJ		KR	ISS	NMC,	A*STAR	IN	TA	BEV	/E+E	N	PL	P.	ТВ
DP = 95 °C	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)	D _{ij}	U _{ij} (k = 2)
DP = 95 C	in ℃	in °c	in °c	in ℃	in °c	in °c	in °c	in °c	in ℃	in ℃	in °c	in °c	in °C	in °c	in ℃	in °c	in °c	in °c
INRIM	-	-	-	-	-0.003	0.099	0.018	0.106	-	-	0.011	0.086	0.011	0.081	0.010	0.129	-	-
NIST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NMIJ	0.003	0.099	-	-	-	-	0.021	0.102	-	-	0.014	0.081	0.014	0.075	0.013	0.126	-	-
KRISS	-0.018	0.106	-	-	-0.021	0.102	-	-	-	-	-0.007	0.089	-0.007	0.084	-0.008	0.132	-	-
NMC, A*STAR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INTA	-0.011	0.086	-	-	-0.014	0.081	0.007	0.089	-	-	-	-	0.000	0.056	-0.001	0.116	-	-
BEV/E+E	-0.011	0.081	-	-	-0.014	0.075	0.007	0.084	-	-	0.000	0.056	-	-	0.000	0.112	-	-
NPL	-0.010	0.129	-	-	-0.013	0.126	0.008	0.132	-	-	0.001	0.116	0.000	0.112	-	-	-	-
РТВ	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-

Finally, in view of the results obtained in all DoE data tables (Table 7.2.2 to Table 7.2.8), which represent the entire data group analysed, it can be concluded that all participants exhibited very strong cross-correlation among themselves in all cases studied. This assessment is founded on which the resulting DoE were lower than the related uncertainties by a factor of at least of 2 times in the worst case, except between NMIJ and PTB at 80 °C nominal dew point temperature.

8 KEY COMPARISON REFERENCE VALUE

In this comparison, as well as in its equivalents RMOs, a reference value is calculated for each nominal dew point temperature. The availability of reference values is essential to the use of comparison results for review of CMC claims by NMIs and DIs worldwide.

The key comparison reference value reported is the reference value resulting from the measurements taken in this CIPM key comparison, accompanied by its measurement uncertainty.

Only primary realizations were considered to obtain the final KCRV. For this reason, the data set of NMC, A*STAR laboratory at 80 °C, 85 °C and 90 °C dew point temperatures were excluded from the KCRV calculation, because its standard has metrological traceability to SI via NPL humidity standards.

On the other hand, the KCRV calculation method only considered one data set of INTA, specifically the second, or intermediate measurement, in such way that first and third measurement set of INTA are only used to carry out the travelling standards drift study and the different paths between loops for setting robust bilateral equivalences among all participants. And finally, the three link laboratories were treated as normal participants, considering only one measurement set in one loop, i.e., NIST and BEV/E+E in loop 1, and INTA in loop 2; in this way, the contribution of these three laboratories to the KCRVs was not enhanced.

8.1 CALCULATION METHOD

Calculation of the KCRV was based on the procedure developed by M. Cox [Cox02], specially applied according to H. Mitter's comments and recommendations [Mit21] during detailed discussions with the pilot, assistant pilot and coordinator of EURAMET-T.K8 [Des23].

The CCT-K8 was performed with two transfer standards circulating in two loops, with one artefact per loop and, as already mentioned before, this would lead to a set of data for each loop and finally in two loop reference values (not KCRVs). However, a single KCRV must be obtained, for each nominal dew point for the key comparison [CIPM21]. For this matter, the results of all participants had to be harmonized to one single result of KCRV. Such harmonization of two loops was carried out through a virtual artefact equidistant of the two loop-results by normalizing the results of both loops by half the loop difference $B_{i,j}$, applying the correction factor C_{loop} .

Participation of every NMI was usually expressed as the difference between the measurement results for each participant and the KCRV, once the harmonization results previously explained in Section 7.1, were applied for each nominal dew point temperature evaluated according to the following expression:

$$\Delta t_{KCRV}^{(i)'} = \Delta t_d^{(i)'} - \Delta t_d^{KCRV}$$
 Eq. 8.1.a

The calculation method of the KCRV for the harmonized virtual loop, the linking uncertainties, and the difference between the participants and the KCRV together with the associated uncertainty, is given in detail in Section 12.2 of the annexes.

8.2 CONSISTENCY TEST AND DISCUSSION

The inter-laboratory consistency results were evaluated according to the chi-squared test to the difference of participant with the KCRV. The same criterion defined in CCT-K6 [Bel15] was used, making differentiation between those laboratories which contribute or not to the KCRV and similarly to the uncertainty of the laboratory difference to the KCRV.

The following inequations give the discrepancy criterion, where special attention to the signs of the different terms must be paid, according to H. Mitter's proposal [Mit21].

- If laboratory contributes to KCRV, there is a correlation between $\Delta t_d^{lab'}$ and Δt_d^{KCRV} :

$$\left|\Delta t_d^{lab'} - \Delta t_d^{KCRV}\right| > 2 \cdot \sqrt{u^2 \left(\Delta t_d^{lab'}\right) - u^2 \left(\Delta t_d^{KCRV}\right) + u^2_{stab.loop.v(lab)}}$$
 Eq. 8.2.a

- If laboratory does not contribute to KCRV which means that there is no correlation between $\Delta t_d^{lab'}$ and Δt_d^{KCRV} :

$$\left|\Delta t_d^{lab'} - \Delta t_d^{\textit{KCRV}}\right| > 2 \cdot \sqrt{u^2 \left(\Delta t_d^{lab'}\right) + u^2 \left(\Delta t_d^{\textit{KCRV}}\right) + u^2_{\textit{stab.loop.v(lab)}}}$$
 Eq. 8.2.b

The following figure shows the results of all participants for each nominal dew-point temperature in relation to the criterion used to identify possible outliers.

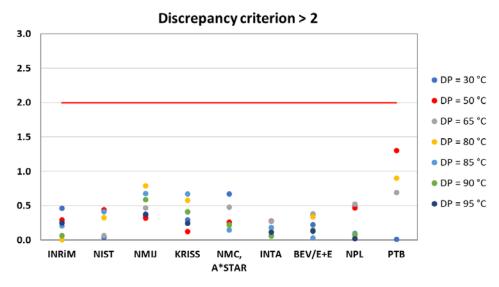


Fig. 8.2.a Results of evaluation of outliers criterion for the calculation of the KCRV taking into account only independent measurements.

As can be seen in the above figure, absolutely all participants and for every nominal dew point temperature which they measured, meet with the inter-laboratory consistency test applied. This is the

most graphic example not only for the excellent results shown by all participants, but also about the great performance of both travelling standards which were previously chosen according to a thorough characterization of standards before launching this intercomparison.

8.3 RESULTS

The KCRV results of all laboratories together with their associated uncertainties are given in Table 8.3.2 and depicted in the following figures.

Table 8.3.1 Summary table of the KCRV obtained with their corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

		Nominal DP in °C													
	30 50 65 80 85 90 9														
KCRV	-0.118	-0.104	-0.091	-0.078	-0.073	-0.073	-0.075								
<i>U</i> (KCRV) (<i>k</i> = 2)	k = 2) 0.009 0.011 0.012 0.014 0.016 0.018 0.02														

Table 8.3.2 Summary table of the difference between the harmonized participant result, $\Delta t_d^{lab'}$, minus the calculated KCRVs for each nominal dew point temperature, Δt_d^{KCRV} , in Celsius degrees. Every difference value comes together with its expanded uncertainty of the partly correlated weighted mean at a coverage probability of 95 %.

	DP =	: 30 °C	DP :	= 50 °C	DP :	= 65 °C	DP =	= 80 °C	DP =	= 85 °C	DP =	= 90 °C	DP =	95 ℃
KCRV	Δt _d ^{lab'} - Δt _d ^{KCRV}	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$ $k = 2$	$\Delta t_d^{\;lab'}$ - $\Delta t_d^{\;KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$ $k = 2$	$\Delta t_d^{\;lab'}$ - $\Delta t_d^{\;KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$ $k = 2$	$\Delta t_d^{\;lab'}$ - $\Delta t_d^{\;KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$ $k = 2$	$\Delta t_d^{\;lab'}$ - $\Delta t_d^{\;KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$ $k = 2$	$\Delta t_d^{\;lab'}$ - $\Delta t_d^{\;KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$ $k = 2$	Δt _d lab' - Δt _d KCRV	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$ $k = 2$
	in °C	in °C	in °C	in °C	in °C	in °C	in °C	in °C	in °C	in °C	in °C	in °C	in °C	in °C
	-0.118	0.009	-0.104	0.011	-0.091	0.012	-0.078	0.014	-0.073	0.016	-0.073	0.018	-0.075	0.022
INRiM	-0.006	0.026	-0.004	0.030	0.000	0.036	0.000	0.037	-0.004	0.038	0.001	0.038	0.009	0.070
NIST	0.000	0.015	0.005	0.020	-0.001	0.024	0.007	0.040	0.008	0.038	-	-	-	-
NMIJ	-0.006	0.035	0.007	0.043	0.011	0.046	0.022	0.056	0.020	0.060	0.016	0.054	0.012	0.064
KRISS	0.005	0.033	0.002	0.040	-0.008	0.038	-0.011	0.040	-0.014	0.042	-0.011	0.052	-0.009	0.074
NMC, A*STAR	-0.024	0.071	-0.010	0.077	-0.020	0.085	-0.010	0.089	-0.009	0.12	-0.014	0.12	-	-
INTA	-0.001	0.030	-0.005	0.033	-0.005	0.035	-0.003	0.036	-0.004	0.039	-0.001	0.038	-0.002	0.039
BEV/E+E	0.002	0.021	0.005	0.025	0.005	0.025	0.005	0.029	0.000	0.025	-0.002	0.025	-0.002	0.026
NPL	0.005	0.021	0.005	0.020	0.005	0.020	0.000	0.027	0.002	0.040	0.002	0.065	-0.001	0.10
РТВ	0.000	0.019	-0.019	0.029	-0.012	0.035	-0.028	0.062	-	-	-	-	-	-

Blue data are those values traceable to another NMI participant in the CCT-K8, that to say not independent, and therefore not taken into account to calculate the KCRV at those nominal dew-point temperatures.

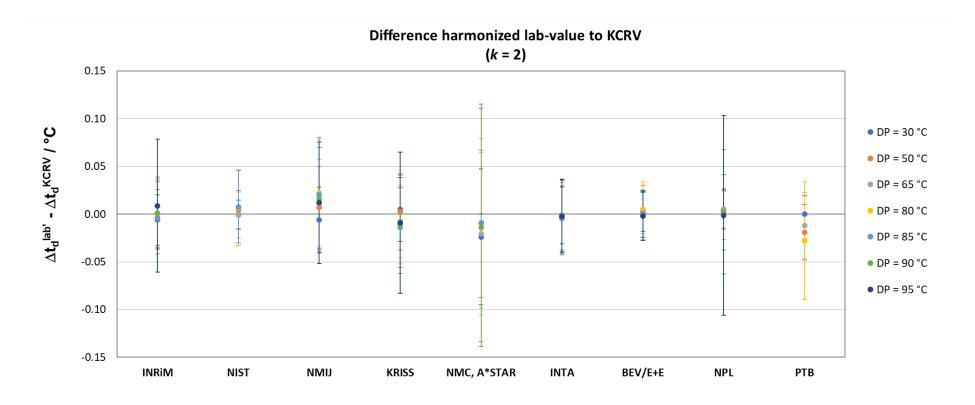


Fig. 8.3.a The harmonized laboratory result, $\Delta t_d^{lab'}$, minus the calculated KCRV for each nominal dew point temperature, in degrees Celsius. Error bars show the expanded uncertainty for a coverage probability of 95 %.

The figure above is divided into different graphs for each nominal dew point evaluated:

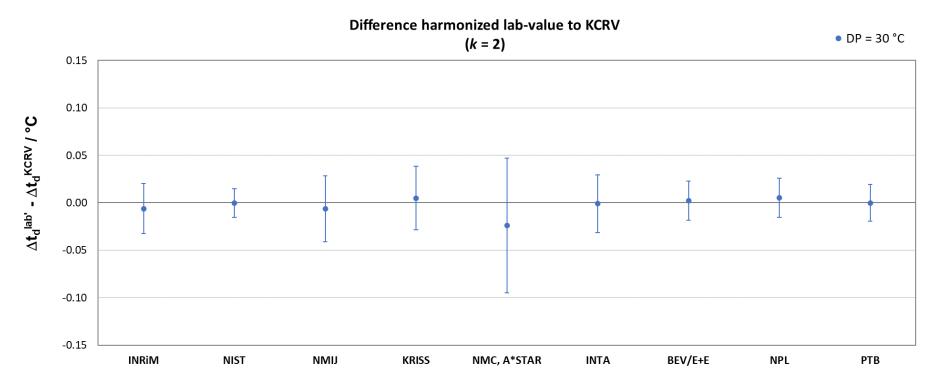


Fig. 8.3.b The harmonized laboratory result, $\Delta t d^{lab'}$, minus the calculated KCRVs at the nominal dew point temperature **30 °C**, in Celsius degrees. Error bars show the expanded uncertainty for a coverage probability of 95 %.

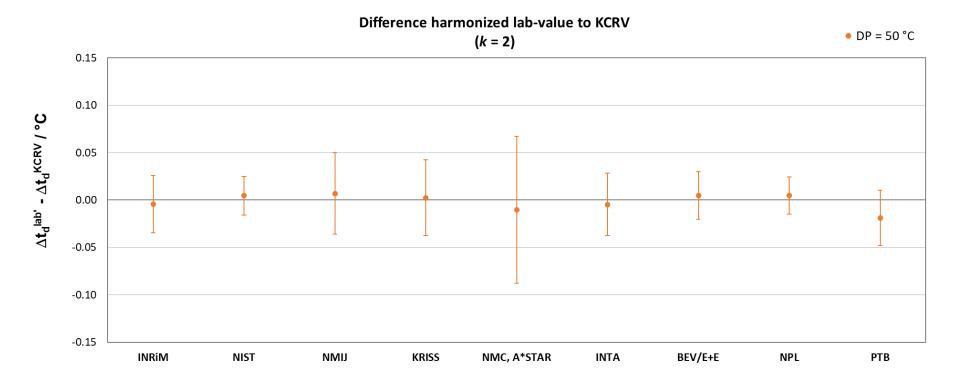


Fig. 8.3.c The harmonized laboratory result, $\Delta t_d^{lab'}$, minus the calculated KCRVs at the nominal dew point temperature **50 °C**, in Celsius degrees. Error bars show the expanded uncertainty for a coverage probability of 95 %.

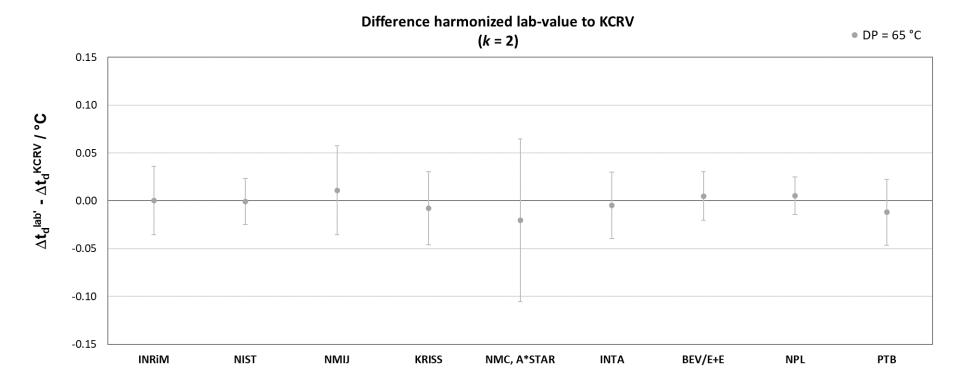


Fig. 8.3.d The harmonized laboratory result, $\Delta t_d^{lab'}$, minus the calculated KCRVs at the nominal dew point temperature 65 °C, in Celsius degrees. Error bars show the expanded uncertainty for a coverage probability of 95 %.

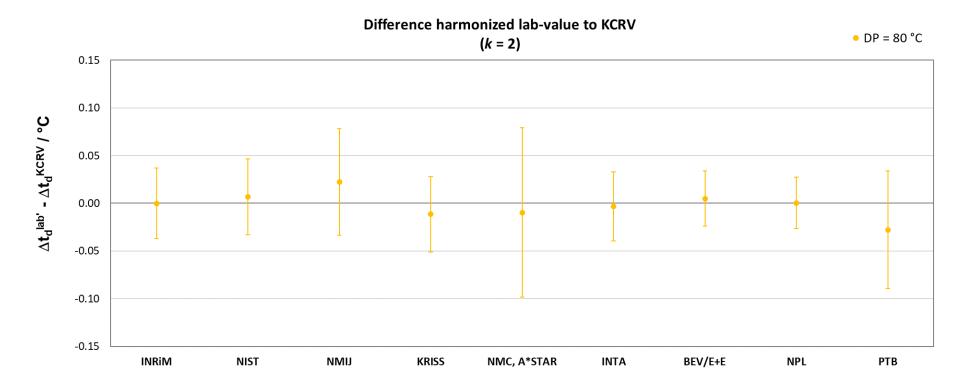


Fig. 8.3.e The harmonized laboratory result, $\Delta t_d^{lab'}$, minus the calculated KCRVs at the nominal dew point temperature **80 °C**, in Celsius degrees. Error bars show the expanded uncertainty for a coverage probability of 95 %.

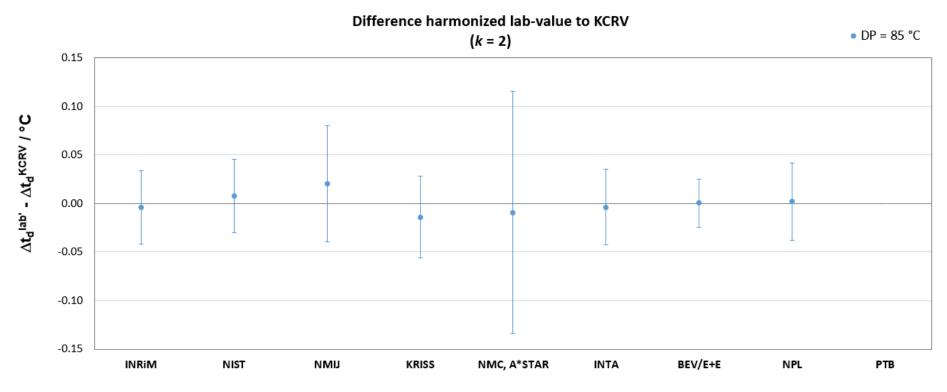


Fig. 8.3.f The harmonized laboratory result, $\Delta t d^{lab'}$, minus the calculated KCRVs at the nominal dew point temperature 85 °C, in Celsius degrees. Error bars show the expanded uncertainty for a coverage probability of 95 %.

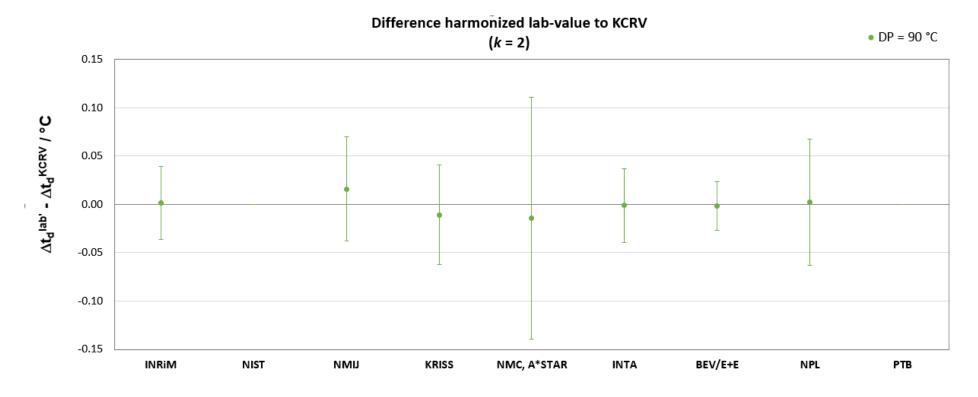


Fig. 8.3.g The harmonized laboratory result, $\Delta t_d^{lab'}$, minus the calculated KCRVs at the nominal dew point temperature **90 °C**, in Celsius degrees. Error bars show the expanded uncertainty for a coverage probability of 95 %.

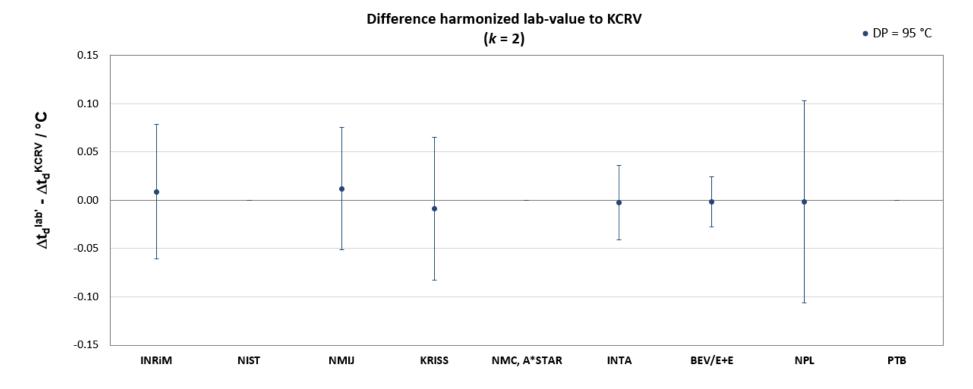


Fig. 8.3.h The harmonized laboratory result, $\Delta t d^{lab'}$, minus the calculated KCRVs at the nominal dew point temperature 95 °C, in Celsius degrees. Error bars show the expanded uncertainty for a coverage probability of 95 %.

9 CONCLUSIONS

A successful key comparison of local realizations of dew-point temperature of humid gas in the range 30 °C to 95 °C of 9 participating NMIs in four RMOs has been performed.

The results show excellent agreement between the realized scales with no detected outliers. The performance of the travelling standards was excellent and can be attributed to the intensive preconditioning and selection of the platinum resistance thermometers, prior to their integration into the measuring head assembly, that led to insignificant drift.

The resulting expanded uncertainty assigned to the KCRV values ranges from 9 mK to 22 mK for dew-point temperatures from 30 °C to 95 °C. This can be considered state of the art and is adequate for comparing the primary realizations of the participant NMIs with reported expanded uncertainties from 17 mK to 110 mK for dew-point temperatures from 30 °C to 95 °C.

Despite the excellent results, the delay in completing the analysis and presenting the different versions of the Draft A of the final report, was exceptionally long compared with the excellent measurement phase, carried out in record time. The delay in the preparation step of Draft A was mainly due to the selection and development of the most suitable method for analyzing DoEs and KCRV, which could also serve as a reference for future key comparisons of humidity measurement. In close collaboration with PTB and BEV/E+E, the framework of the development of the analysis method covering a wide range of possible ways for achieving an aggregated laboratory result were studied. This includes different mean calculations (arithmetic and weighted), considering correlations (no, fully, complete), and simpler approaches. Based on the study for the given data set it could be stated that the differences between arithmetic and weighted mean are negligible, whereas neglecting the influence of correlation without using an approximation for the repeatability, in some cases, can lead to unrealistic small uncertainties and a significant number of potential outliers. The importance of consideration of correlation is discussed extensively in Draft B of EURAMET.T-K8 [Des23]. In the CCT-K8 comparison reported, the quality of the results with no outliers, whatever the consistency test applied, did not justify, in the opinion of some participants, the applicability of intralaboratory consistency tests on the supplied data set (four measurements) and it was agreed to use the aggregate result of the four measurements supplied by the participants as reported in the approved template, without further treatment. For the interlaboratory consistency tests, in determining the DoE and KCRV, the same methodology used in EURAMET.T-K8 was applied, based on the modified Birge Ratio [Bod14] and weighted mean. It is emphasized that no correction due to Birge ratio >1 had to be applied in this comparison, due to the excellent results of the participants.

A lot of discussions were held by participants which led to five versions and inevitably increasing the delay in obtaining the final report. During the discussion the conclusion was drawn that a simpler approach compared to the evaluation of EURAMET.T-K8 is sufficient since the data quality in CCT-K8 is much more homogenous than in EURAMET.T-K8. Therefore, NMIs should not be discouraged to pilot future comparisons, since methods are available for a lot of kinds of data quality.

As a result, the following lessons were learned, that could be beneficial for future humidity key comparisons:

- 1. The careful selection and annealing of the PRTs integrated into the chilled mirror transfer standards can lead to an excellent long-term stability during the comparison.
- 2. Having two loops, although requiring a slightly more complex analysis, ensures that the measurement phase of the comparison can be completed within one year with a suitable number of participants representing all RMOs.
- 3. In this and previous dew-point key comparisons, the definition of the four repeated or reproduced reference conditions and measurements has been ambiguous, and the uniformity of execution of this by participants has been unclear. In future comparisons, it would be advisable to ensure greater clarity and consistent action for multiple repeated or reproduced values.
- 4. The methodology of analysis and treatment of supplied data should be included in the protocol approved by the participants prior to any data processing. This involves an adequate mathematical and statistical knowledge from the pilot and co-pilot that, in the case of INTA, had to be acquired during the development of the comparison itself. Changes and modifications may always be required later depending on the particular needs of the intercomparison, but having adequate foresight helps to avoid possible tedious discussions that greatly increase the intercomparisons closure.
- 5. The linking method designed to establish a single KCRV using a virtual transfer standard defined on the simultaneous measurements of both transfer standards by the pilot, co-pilot and one other laboratory, mitigated the envisaged complexity of the analysis of two loops, as the comparison is analyzed as a single loop.

10 ACKNOWLEDGEMENTS

This comparison would not have been possible without the generous collaboration of MBW Calibration of Switzerland, and in particular, of Mr. Daniel Mutter. Support was provided in record time, even on site. He arranged for up to three batches of PRTs to be supplied, specially assembled for calibration and then finally integrating the selected probes in the measurement heads and provided information and technical assistance during measurements at the most inconvenient hours.

Equally important has been the support of Dr. Helmut Mitter, of BEV/E+E whose excellent knowledge of statistics enabled the different analysis scenarios to be performed, establishing the DoE and KCRV, with robust statistical methods. We also wish to thank Dr. Volker Ebert for hosting at PTB our colleague Dr. Jaime Garcia Gallegos during his period as a research student at INTA, and Dr. Regina Deschermeier who liaised in the analysis of the EURAMET.T-K8, providing useful knowledge [Des23] for the analysis of this comparison.

Special thanks to Sarah Beardmore from the NPL for her invaluable assistance in conducting the measurements for the aforementioned laboratory.

11 REFERENCES

- [Abe21] H. Abe et al (2021). Final report on APMP comparison in humidity APMP.T–K8: Dew point temperature +30 °C to +95 °C. *Metrologia* **58**. Tech. Suppl., 03002.
- [Bel15] S. Bell *et al.* (2015). Final report on CCT-K6: Comparison of local realisations of dewpoint temperature scales in the range –50 °C to +20, Draft. *Metrologia*. **52.** Tech. Suppl., 03005.
- [Ben12a] R. Benyon, N. Böse, H. Mitter, D. Mutter, T. Vicente. (2012). An investigation of the relation between contact thermometry and dew-point temperature realization. *Int. Journal of Thermophysics.* **33**, issue 8-9, pp 1741-1757.
- [Ben12b] R. Benyon, T. Vicente, P. Hernández, L. De Rivas, F. Conde. (2012). An Evaluation of the Long-Term Stability and Temperature Coefficient of Dew-Point Hygrometers. *Int. Journal of Thermophysics.* **33**, issue 8-9, pp 1758-1770.
- [Bod14] O. Bodnar. (2014). On the adjustment of inconsistent data using the Birge ratio. *Metrologia*51 (2014) 516-521.
- [B&M08] R. Benyon & H. Mitter, Int. J. Thermophys. (2008) **29**:1623–1631.
- [CCT24] Review Protocol for Humidity CMC's.

 https://www.bipm.org/en/committees/cc/cct/publications (Last accessed 20/05/2024)
- [Cox02] M. Cox. (2002). The evaluation of key comparison data. *Metrologia*. **39**, p. 589-595.
- [CIPM16] CIPM MRA-D-05. (March 2016). Measurement comparisons in the CIPM MRA.
- [CIPM21] CIPM MRA-G-11 Measurement comparisons in the CIPM MRA
- [Des23] R. Deschermeier. (2023). EURAMET.T-K8 (EURAMET Project No. P 717) Draft B.
- [Gre76] L. Greenspan. (1976). Functional Equations for the Enhancement Factors for CO₂ -Free Moist Air. *Journal of research of the National Bureau of Standards A. Physics and Chemistry.* **Vol. 80A**, 1, p. 41.
- [Har98] B. Hardy. (1998). ITS-90 formulations for vapour pressure, frostpoint temperature, dewpoint temperature and enhancement factors in the range –100°C to 100°C. *Third International Symposium on Humidity and Moisture*, Papers and Abstracts of the Conference, National Physical Laboratory, UK). ISBN 0 946754 241 p. 214–221.
- [Hei08] M. Heinonen. (2008). Comparison of the realization of local dew/frost-point temperature scales in the range of -50 °C to +20 °C. EURAMET.T-K6.

- [IEC08] International Electrotechnical Commission. (2008). IEC 60751:2008. Industrial platinum resistance thermometers and platinum temperature sensors.
- [Mey21] C.W. Meyer, T. Herman, and W.W. Miller, "Calibration of Hygrometers with the Hybrid Humidity Generator", NIST SP 250-83r1, DOI:10.6028/NIST.SP.250-83r1.
- [Mit06] H. Mitter. (2006). The BEV/E+E Elektronik standard humidity generator in Proceedings of the 5th International Symposium on Humidity and Moisture ISHM 2006 (INMETRO, Brazil, 2006), ISBN 978-85-86920-04-2.
- [Mit21] Private conversations between INTA and H. Mitter as an expert in the calculation of uncertainty budget and excellence values in intercomparison processes.
- [MRA99] Mutual Recognition Arrangement. (1999). BIPM.
- [Quin99] T.J. Quinn. (1999). Guidelines for key comparisons carried out by Consultative Committees. Appendix F to the MRA, BIPM, Paris.
- [Son90] D. Sonntag. (1990). Important new values of the physical constants of 1986, vapour pressure formulations based on the ITS-90, and psychrometer formulae. *Z Meteorol* **70**: 340–344.
- [TPR16] Technical protocol CCT-K8. (2016). Comparison of realizations of local scales of dewpoint temperature of humid gas. Dew-point Temperature +30 °C to +95 °C. Submitted on 26/11/2016.

12 ANNEXES

12.1 ANALYSIS METHOD

12.1.1 FUNCTION $B_{i,j}$ AND UNCERTAINTY

Function B, used in the linkage between loops, was calculated as follows:

$$B_{ij} = \begin{cases} \frac{\sum_{k=1}^{n} {P_k(i,j) / u^2[P_k(i,j)]}}{\sum_{k=1}^{n} {1 / u^2P_k(i,j)}} & for loop(i) \neq loop(j) \\ 0 & for loop(i) = loop(j) \end{cases}$$
Eq. 12.1.a

where: P_k is an aggregated loop difference for each potential link laboratory, k, calculated by weighted mean:

$$P_k(i,j) = \mu_{wm}(P_{s,i,k}) = \frac{\sum_i \frac{P_{s,i,k}}{u^2(P_{s,i,k})}}{\sum_i \frac{1}{u^2(P_{s,i,k})}}$$
Eq. 12.1.b

$$u(P_k(i,j)) = \left(\sum_i \frac{1}{u^2(P_{s,i,k})}\right)^{-1/2}$$
 Eq. 12.1.c

where: $P_{s,i,k}$ is the loop difference for each single measurement i of n=4 for each link laboratory k:

$$P_{s,i,k} = \Delta t_{d,L2,i}^{lab} - \Delta t_{d,L1,i}^{lab}$$
 Eq. 12.1.d

 $\Delta t_{d,L1,i}^{lab}$ and $\Delta t_{d,L2,i}^{lab}$ are the single i measurements of dew point difference at each nominal dew point temperature and calculated according to Eq.6.1.a for loop 1 and 2, respectively.

It can be said that P_k describes the potential routes of linking, and the function B_{ij} is the weighted mean of all these possible routes of linking.

One of the main advantages of this intercomparison was that all link-laboratories could measure both hygrometers simultaneously, making it possible to calculate the differences between loops for each single measurement together with the corresponding uncertainty. This scenario allowed correlation effects to be quantified, and not having to be simplified and thus, usually overestimated without a statistical basis, so the uncertainty reached for the linkages will be the minimum possible.

The uncertainty calculation of $\Delta t_{d,Li,i}^{lab}$ is given by:

$$u^2 \left(\Delta t_{d,l1,i}^{lab} \right) = u^2 \left(\Delta t_{d,l1,i}^{ref} \right) + u^2 \left(\Delta t_{d,l1,i}^{instab} \right) + \ u^2 \left(\Delta t_{d,l1,i}^{res} \right) = \left(u_{corr,L1,i} \right)^2 + \left(u_{stat,L1.i} \right)^2 \ \text{Eq. 12.1.e}$$

As it has been explained above, the correlated uncertainty because of the refence of nominal dew point temperatures was the same in both loops as measurements were taking simultaneously. For this reason, following simplification was assumed:

$$u_{corr,i} = u_{corr,L1,i} = u_{corr,L2,i}$$
 Eq. 12.1.f

On the other hand, the uncertainty of $P_{s.i.k}$ is given as follows:

$$u^{2}(P_{s,i,k}) = u^{2}(\Delta t_{d,L1,i}^{lab}) + u^{2}(\Delta t_{d,L2,i}^{lab}) - 2 \cdot u(\Delta t_{d,L1,i}^{lab}) \cdot u(\Delta t_{d,L2,i}^{lab}) \cdot corr_{L1,L2}$$
 Eq. 12.1.g

where the correlation coefficient, $corr_{L1,L2}$, was calculated as follows:

$$corr_{L1,L2,i} = \frac{u_{corr,L1,i} \cdot u_{corr,L2,i}}{u(\Delta t_{d,L1,i}^{lab}) \cdot u(\Delta t_{d,L2,j}^{lab})} = \frac{u_{corr,i}^2}{u(\Delta t_{d,L1,i}^{lab}) \cdot u(\Delta t_{d,L2,j}^{lab})}$$
Eq. 12.1.h

The final expression used to obtain the uncertainty of $P_{s,i,k}$ is the result of combining the last two equations:

$$u^{2}(P_{s,i,k}) = u^{2}(\Delta t_{d,L1,i}^{lab}) + u^{2}(\Delta t_{d,L2,i}^{lab}) - 2 \cdot u_{corr,i}^{2}$$
 Eq. 12.1.i

For CCT-K8, there were a total of five possible paths for the linkage, namely: three sets of four measurements of INTA and one set of four measurements coming from NIST and BEV/E+E. Every set of linkages provides four differences between loops, $P_{s,i,k}$, which were statistical independent. The weighted mean for the four single loop differences, P_k , was calculated using Eq.12.1.b and the corresponding uncertainty $u(P_k)$ using the Eq.12.1.d which was corrected according the following equation, triggered by the modified Birge ratio exceeding one:

$$u_{BM}(P_k(i,j)) = \sigma_{BM,P_k} \cdot u(P_k(i,j))$$
 Eq. 12.1.j

Coming up next the five aggregated loop differences at each nominal dew point, P_k , were used to calculate the initial discrete function B by means of a weighted mean value without correlation:

$$B(i,j) = \frac{\sum_{k} {P_{k}(i,j) / u_{BM}^{2}[P_{k}(i,j)]}}{\sum_{k} (u_{BM}^{-2}[P_{k}(i,j)])}$$
Eq. 12.1.k

where, u_{BM} , is the uncertainty associated to the function $B_{i,j}$, calculated as is shown as follows and corrected by the modified Birge ration in those cases in which exceeded one:

$$u(B_{i,j}) = \left(\sum_{k} \frac{1}{u_{BM}^2[P_k(i,j)]}\right)^{-1/2}$$
 Eq. 12.1.I

$$u_{BM}(B_{i,j}) = \sigma_{BM,B} \cdot u(B_{i,j})$$
 Eq. 12.1.m

12.1.2 CONSISTENCY TESTS FOR LINKAGE

In this section, auxiliary results for the diverse consistency tests performed are shown and evaluated. Firstly, the consistency survey on the aggregated loop difference for each link laboratory, P_k , calculated from every single loop difference, $P_{s,i,k}$, was summarized for both methods evaluated.

Table 12.1.1 Consistency test of the aggregated loop difference for each link laboratory, P_k , calculated by weighted mean of all loop differences, $P_{s,l,k}$, for each single measurement i of n = 4.

			Nominal D	ew Point T	emperatur	2	
	30 °C	50 °C	65 °C	80 °C	85 °C	90 °C	95 °C
_	_		Chi	-squared te	st, χ²		
INTA1	0.76	0.20	0.18	0.56	0.07	0.10	0.31
NIST	0.37	0.17	0.58	0.51	0.16		
BEV/E+E	2.86	0.80	0.83	0.05	0.57	0.92	1.39
INTA2	0.74	0.23	3.11	0.65	1.73	1.74	0.28
INTA3	0.46	0.53	1.72	0.13	0.08	0.88	0.07
_			Modified	d Birge Rati	o, σ_{BM,P_k}		
INTA1	0.87	0.44	0.43	0.75	0.27	0.32	0.56
NIST	0.61	0.41	0.76	0.71	0.40		
BEV/E+E	1.69	0.89	0.91	0.22	0.76	0.96	1.18
INTA2	0.86	0.48	1.76	0.81	1.32	1.32	0.53
INTA3	0.68	0.73	1.31	0.36	0.28	0.94	0.26

On the other hand, it can be seen that uncertainties of function $B_{i,j}$, shown in Table 7.2.1, are reached after performing a second calculation of modified Birge ratios, $\sigma_{BM,B}$, by applying again Eq. 12.1.m. This decision was taken after checking that in the first step not all values of σ_{BM,P_k} , were less than one and, therefore did not meet the criteria of modified Birge ratio in this point of the analysis. Applying that second step was decided because this would only derive in an increase of the related uncertainties of $B_{i,j}$, but never the $B_{i,j}$ values themselves, acting only on the final assigned uncertainties of the bilateral equivalences, $u(B_{i,j})$, but did not change the degrees of equivalences (DoE).

Table 12.1.2 Consistency test results for the first step of function $B_{i,j}$ in every nominal dew point temperature and using both methods: Chi-squared test and modified Birge ratio.

		Nominal Dew Point Temperature in °C											
	30 °C 50 °C 65 °C 80 °C 85 °C 90 °C 95 °C												
		First step consistency test											
.2	38.12	102.69	36.96	50.99	36.376	26.73	1.86						
χ²	failed	failed	failed	failed	failed	failed	pass						
_	4.37	7.17	4.30	5.05	4.26	5.17	1.36						
σ вм	failed	failed	failed	failed	failed	failed	failed						

As can be seen at a glance, a second calculation of modified Birge ratio for function $B_{i,j}$ was necessary because in all nominal dew points exceeded the limit. As curiosity, because its use is not recommended either in this case, here it can be checked again that chi-squared criterion is less restrictive than Birge ratio method, since in 95 °C Chi-squared criterion was fulfilled. In the following table is showed the increasing uncertainty of function $B_{i,j}$ for applying this second modified Birge ratio step.

Table 12.1.3 Calculated values of $u(B_{i,j})$ for k = 1 applying only one or two modified Birge ratio steps.

		Nominal Dew Point in °C									
	30	50	65	80	85	90	95				
1st step	0.0005	0.0003	0.0004	0.0005	0.0006	0.0006	0.0009				
2nd step	0.0020	0.0023	0.0016	0.0024	0.0024	0.0029	0.0012				

12.1.3 UNCERTAINTY OF Dij

From the equation to describe the bilateral equivalence of different participants in the virtual loop (Eq. 7.1.g), the corresponding uncertainties are as follows:

$$u^{2}(D_{ij}) = u^{2}\left(\Delta t_{d}^{(i)'} - \Delta t_{d}^{(j)'}\right) = u^{2}\left(\Delta t_{d}^{(i)'}\right) + u^{2}\left(\Delta t_{d}^{(j)'}\right) - 2 \cdot corr_{i,j} \cdot u\left(\Delta t_{d}^{(i)'}\right) \cdot u\left(\Delta t_{d}^{(j)'}\right) \quad \text{Eq. 12.1.n}$$

Considering the method of harmonization of results of laboratory expressed by the Eq. 7.1.h and the general expression above, the following expression is obtained:

$$u^{2}(D_{ij}) = u^{2}\left(\Delta t_{d}^{(i)}\right) + u^{2}\left(C_{loop(i)}\right) + u^{2}\left(\Delta t_{d}^{(j)}\right) + u^{2}\left(C_{loop(j)}\right) - 2 \cdot corr_{i,j} \cdot u\left(\Delta t_{d}^{(i)'}\right) \cdot u\left(\Delta t_{d}^{(j)'}\right)$$
 Eq. 12.1.0

At a nominal dew point temperature, $u(C_{loop(i)})$ is equal for all harmonized lab values which also means that $u(C_{loop(i)}) = u(C_{loop(j)})$ which also leads to correlations between $u(\Delta t_d^{(i)'})$ and $u(\Delta t_d^{(j)'})$ that were taken into account here below.

$$u^2\big(D_{ij}\big) = u^2\left(\Delta t_d^{(i)}\right) + u^2\big(C_{loop(i)}\big) + u^2\left(\Delta t_d^{(j)}\right) + u^2\big(C_{loop(j)}\big) - 2 \cdot corr_{i,j} \cdot u\left(\Delta t_d^{(i)'}\right) \cdot u\left(\Delta t_d^{(j)'}\right) \qquad \text{Eq. 12.1.p}$$

where the correlation coefficient, $corr_{i,j}$, is calculated according to the same which also leads to correlations between methods developed in Eq. 12.1.h:

$$corr_{i,j} = \frac{u^2(C_{loop(i)})}{u(\Delta t_d^{(i)'}) \cdot u(\Delta t_d^{(j)'})}$$
Eq. 12.1.q

Correlation factors applied to each participant were summarized in the following table:

			Nomina	al Dew Poi	nt in °C		
	30	50	65	80	85	90	95
INRiM	7.38E-05	7.38E-05	3.41E-05	7.34E-05	7.00E-05	9.91E-05	1.02E-05
NIST	1.20E-04	1.20E-04	4.84E-05	6.89E-05	7.00E-05	-	-
NMIJ	5.71E-05	5.71E-05	2.66E-05	5.04E-05	4.60E-05	7.28E-05	1.11E-05
KRISS	5.91E-05	5.91E-05	3.22E-05	6.92E-05	6.40E-05	7.55E-05	9.69E-06
NMC, A*STAR	2.83E-05	2.83E-05	1.48E-05	3.30E-05	2.30E-05	3.34E-05	-
INTA	6.48E-05	6.48E-05	3.50E-05	7.49E-05	6.80E-05	9.86E-05	1.68E-05
BEV/E+E	9.27E-05	9.27E-05	4.63E-05	9.09E-05	9.79E-05	1.35E-04	2.19E-05
NPL	9.27E-05	9.27E-05	5.71E-05	9.63E-05	6.73E-05	6.12E-05	6.98E-06
PTR	9 80F-05	9 80F-05	3 52F-05	4 58F-05	-	-	_

Table 12.1.4 Correlation factors, $corr_{i,j}$, obtained for each participant at every nominal dew point temperature.

Combining the two previous equations it also meets that:

$$u^{2}(D_{ij}) = u^{2}\left(\Delta t_{d}^{(i)'} - \Delta t_{d}^{(j)'}\right) = u^{2}\left(\Delta t_{d}^{(i)'}\right) + u^{2}\left(\Delta t_{d}^{(j)'}\right) - 2 \cdot u^{2}(C_{loop(i)})$$
 Eq. 12.1.r

The term $2 \cdot u^2(C_{loop(i)})$ also can be simplified as:

$$2 \cdot u^2(C_{loop(i)}) = 2 \cdot \left(\frac{u(B_{j,i})}{2}\right)^2 = \frac{u^2(B_{j,i})}{2}$$
 Eq. 12.1.s

Thus, the final equation that gives the uncertainty of D_{ij} considering correlation is:

$$u^{2}(D_{ij}) = u^{2}(\Delta t_{d}^{(i)'}) + u^{2}(\Delta t_{d}^{(j)'}) - \frac{u^{2}(B_{j,i})}{2} + u^{2}_{stab.loop}$$
 Eq. 12.1.t

12.2 ANALYSIS METHOD OF KCRV

The KCRV was calculated from the harmonized laboratory results of the single virtual loop as weighted mean of all labs, considering only one set of measurements for each participant. Thus, the expression which gives the KCRV is:

$$\Delta t_{d}^{KCRV} = \frac{\sum_{i} \frac{\Delta t_{d}^{(i)'}}{u^{2}(\Delta t_{d}^{(i)'})}}{\sum_{i} \frac{1}{u^{2}(\Delta t_{d}^{(i)'})}} + \delta_{stab.loop} = \frac{\sum_{i} \frac{\Delta t_{d}^{(i)} + C_{loop(i)}}{u^{2}(\Delta t_{d}^{(i)}) + u^{2}(C_{loop(i)})}}{\sum_{i} \frac{1}{u^{2}(\Delta t_{d}^{(i)}) + u^{2}(C_{loop(i)})}} + \delta_{stab.loop}$$
 Eq. 12.2.a

where for the particular case of this intercomparison, $\delta_{stab.loop}$ was neglected as has already been justified.

On the other hand, the uncertainty of the KCRV is calculated as:

$$u^{2}(\Delta t_{d}^{KCRV}) = \left[\sum_{i} \frac{1}{u^{2}(\Delta t_{d}^{(i)}) + u^{2}(C_{loop(i)})}\right]^{-1} + u^{2}_{stab.loop}$$
 Eq. 12.2.b

According to the Eq. 8.1.a, the difference between harmonized laboratory result, $\Delta t_d^{lab\prime}$, and KCRV is calculated, including the stability term, as follows:

$$\Delta_{KCRV}^{lab} = \Delta t_d^{lab'} - \Delta t_d^{KCRV}$$
 Eq. 12.2.c

$$\Delta_{KCRV}^{lab} = \Delta t_d^{lab'} - \frac{\sum_i \frac{\Delta t_d^{(i)'}}{u^2 \left(\Delta t_d^{(i)'}\right)}}{\sum_i \frac{1}{u^2 \left(\Delta t_d^{(i)'}\right)}} - \delta_{stab.loop} = \Delta t_d^{lab'} - \frac{\sum_i \frac{\Delta t_d^{(i)} + C_{loop(i)}}{u^2 \left(\Delta t_d^{(i)}\right) + u^2 \left(C_{loop(i)}\right)}}{\sum_i \frac{1}{u^2 \left(\Delta t_d^{(i)'}\right)}} - \delta_{stab.loop} \quad \text{Eq. 12.2.c}$$

And the uncertainty the difference between the harmonized laboratory results, $u(\Delta t_d^{lab'})$, and KCRV is given by:

$$u(\Delta_{KCRV}^{lab}) = u(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$$
 Eq. 12.2.e

- If laboratory contributes to KCRV, there is a correlation between $\Delta t_d^{lab\prime}$ and Δt_d^{KCRV} :

$$u^{2}(\Delta_{KCRV}^{lab}) = u^{2}(\Delta t_{d}^{lab}) - u^{2}(\Delta t_{d}^{KCRV}) + u^{2}_{stab.loop}$$
 Eq. 12.2.f

$$u^{2}(\Delta_{KCRV}^{lab}) = u^{2}(\Delta t_{d}^{lab'}) - \left[\sum_{i} \frac{1}{u^{2}(\Delta t_{d}^{(i)}) + u^{2}(C_{loop(i)})}\right]^{-1} + u^{2}_{stab.loop}$$
 Eq. 12.2.g

If laboratory does not contribute to KCRV which means that there is no correlation between $\Delta t_d^{lab'}$ and Δt_d^{KCRV} :

$$u^2(\Delta_{KCRV}^{lab}) = u^2(\Delta t_d^{lab}) + u^2(\Delta t_d^{KCRV}) + u^2_{stab.loop}$$
 Eq. 12.2.h

$$u^{2}(\Delta_{KCRV}^{lab}) = u^{2}(\Delta t_{d}^{lab'}) + \left[\sum_{i} \frac{1}{u^{2}(\Delta t_{d}^{(i)}) + u^{2}(C_{loop(i)})}\right]^{-1} + u^{2}_{stab.loop}$$
 Eq. 12.2.i

where the uncertainty of the stability of the virtual loop, $u_{stab.loop}$, is obtained by:

$$u_{stab.loop} = \frac{1}{2} \cdot \left[u_{stab.loop.1}^2 + u_{stab.loop.2}^2 \right]^{1/2}$$
 Eq. 12.2.j

12.3 SUMMARY TABLE OF ALL PARTICIPANTS

The following tables summarize the individual results of each participant. The header reproduced below shows the symbols used in the Humidity CMC Review Protocol [CCT24] between brackets.

Nominal Dew		oorted esults		esults in al loop	Drift virtual transfer standard	I KCRV		Difference with KCRV		
Point, °C	$\Delta t_{\sf d}$	u(∆t _d)	Δt _d ^{lab.} [V _{NMI, RC}]	u(Δt _d ^{lab.}) [u _{NMI, RC}]	u _{stab.loop} [u _{RC}]	$\Delta t_{ m d}^{ m KCRV}$ $[V_{ m RCRV}]$	$u(\Delta t_{\rm d}^{\rm KCRV})$ $[u_{\rm RCRV}]$	$\Delta t_{\rm d}^{\rm lab.} - \Delta t_{\rm d}^{\rm KCRV} \ [V_{\rm NMI,RC} - V_{\rm RCRV}]$	$U(\Delta t_{\rm d}^{\rm lab.} - \Delta t_{\rm d}^{\rm KCRV})$	

Table 12.3.1 Summary of the most important value obtained by **INRIM** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

	Nominal Reported Results		Lab. Results in virtual loop		Drift virtual KCRV transfer standard		CRV	Difference with KCRV		
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t d lab')	u _{stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$	
30	-0.098	0.014	-0.124	0.014	0.0018	-0.118	0.009	-0.006	0.026	
50	-0.080	0.016	-0.109	0.016	0.0018	-0.104	0.011	-0.004	0.030	
65	-0.061	0.019	-0.091	0.019	0.0018	-0.091	0.012	0.000	0.036	
80	-0.046	0.020	-0.078	0.020	0.0018	-0.078	0.014	0.000	0.037	
85	-0.044	0.020	-0.077	0.020	0.0018	-0.073	0.016	-0.004	0.038	
90	-0.040	0.021	-0.071	0.021	0.0018	-0.073	0.018	0.001	0.038	
95	-0.036	0.037	-0.066	0.037	0.0018	-0.075	0.022	0.009	0.070	

Table 12.3.2 Summary of the most important value obtained by **NIST** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

Nominal Dew	Reported	l Results		esults in al loop	Drift virtual transfer standard	K	KCRV Difference with KC			
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t _d ^{lab'})	u _{stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$	
30	-0.144	0.008	-0.118	0.008	0.0018	-0.118	0.009	0.000	0.015	
50	-0.129	0.011	-0.100	0.011	0.0018	-0.104	0.011	0.005	0.020	
65	-0.121	0.013	-0.091	0.013	0.0018	-0.091	0.012	-0.001	0.024	
80	-0.104	0.021	-0.071	0.021	0.0018	-0.078	0.014	0.007	0.040	
85	-0.098	0.020	-0.065	0.020	0.0018	-0.073	0.016	0.008	0.038	

Table 12.3.3 Summary of the most important value obtained by **NMIJ** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

Nominal Dew	Reported Results		Reported Results Lab. Results in virtual loop		Drift virtual transfer standard KCRV			Difference	Difference with KCRV		
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t _d ^{lab'})	u _{stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$		
30	-0.150	0.018	-0.124	0.018	0.0018	-0.118	0.009	-0.006	0.035		
50	-0.126	0.022	-0.098	0.022	0.0018	-0.104	0.011	0.007	0.043		
65	-0.110	0.024	-0.080	0.024	0.0018	-0.091	0.012	0.011	0.046		
80	-0.088	0.029	-0.056	0.029	0.0018	-0.078	0.014	0.022	0.056		
85	-0.085	0.031	-0.052	0.031	0.0018	-0.073	0.016	0.020	0.060		
90	-0.088	0.028	-0.057	0.028	0.0018	-0.073	0.018	0.016	0.054		
95	-0.093	0.034	-0.063	0.034	0.0018	-0.075	0.022	0.012	0.064		

Table 12.3.4 Summary of the most important value obtained by **KRISS** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

Nominal Dew	Reported	Reported Results		Lab. Results in Drift v		K	CRV	Difference	e with KCRV
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t _d ^{lab'})	U _{stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$
30	-0.139	0.017	-0.113	0.017	0.0018	-0.118	0.009	0.005	0.033
50	-0.131	0.021	-0.102	0.021	0.0018	-0.104	0.011	0.002	0.040
65	-0.128	0.020	-0.098	0.020	0.0018	-0.091	0.012	-0.008	0.038
80	-0.122	0.021	-0.089	0.021	0.0018	-0.078	0.014	-0.011	0.040
85	-0.120	0.022	-0.087	0.022	0.0018	-0.073	0.016	-0.014	0.042
90	-0.115	0.027	-0.083	0.027	0.0018	-0.073	0.018	-0.011	0.052
95	-0.114	0.039	-0.084	0.039	0.0018	-0.075	0.022	-0.009	0.074

Table 12.3.5 Summary of the most important value obtained by **NMC**, **A*STAR** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

Nominal Dew	Reported Results		Reported Results Lab. Results in virtual loop t		Drift virtual transfer standard	KCRV			Difference with KCRV		
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t _d ^{lab'})	U _{stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$		
30	-0.167	0.036	-0.142	0.036	0.0018	-0.118	0.009	-0.024	0.071		
50	-0.143	0.039	-0.115	0.039	0.0018	-0.104	0.011	-0.010	0.077		
65	-0.141	0.043	-0.111	0.043	0.0018	-0.091	0.012	-0.020	0.085		
80	-0.120	0.044	-0.088	0.044	0.0018	-0.078	0.014	-0.010	0.089		
85	-0.115	0.062	-0.082	0.062	0.0018	-0.073	0.016	-0.009	0.12		
90	-0.118	0.062	-0.087	0.062	0.0018	-0.073	0.018	-0.014	0.12		

Table 12.3.6 Summary of the most important value obtained by **INTA** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

Nominal Dew	al Reported Results			esults in al loop	Drift virtual transfer standard	K	CRV	Difference	e with KCRV
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t _d ^{lab'})	U _{Stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$
30	-0.093	0.016	-0.119	0.016	0.0018	-0.118	0.009	-0.001	0.030
50	-0.080	0.017	-0.109	0.017	0.0018	-0.104	0.011	-0.005	0.033
65	-0.065	0.018	-0.095	0.018	0.0018	-0.091	0.012	-0.005	0.035
80	-0.049	0.019	-0.081	0.019	0.0018	-0.078	0.014	-0.003	0.036
85	-0.043	0.021	-0.076	0.021	0.0018	-0.073	0.016	-0.004	0.039
90	-0.043	0.021	-0.074	0.021	0.0018	-0.073	0.018	-0.001	0.038
95	-0.047	0.022	-0.077	0.022	0.0018	-0.075	0.022	-0.002	0.039

Table 12.3.7 Summary of the most important value obtained by **BEV/E+E** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (*k* = 2) for a probability higher that 95 %.

Nominal Dew	•		Reported Results Lab. Results in virtual loop tr		Drift virtual transfer standard	KCRV			Difference with KCRV		
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t _d ^{lab'})	u _{stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$		
30	-0.141	0.011	-0.115	0.011	0.0018	-0.118	0.009	0.002	0.021		
50	-0.129	0.013	-0.100	0.013	0.0018	-0.104	0.011	0.005	0.025		
65	-0.116	0.014	-0.086	0.014	0.0018	-0.091	0.012	0.005	0.025		
80	-0.105	0.016	-0.073	0.016	0.0018	-0.078	0.014	0.005	0.029		
85	-0.105	0.015	-0.072	0.015	0.0018	-0.073	0.016	0.000	0.025		
90	-0.106	0.015	-0.075	0.015	0.0018	-0.073	0.018	-0.002	0.025		
95	-0.107	0.017	-0.077	0.017	0.0018	-0.075	0.022	-0.002	0.026		

Table 12.3.8 Summary of the most important value obtained by **NPL** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

Nominal Dew	Reported	d Results		esults in al loop	Drift virtual transfer standard	K	CRV	Difference	e with KCRV
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t _d ^{lab'})	U _{Stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$
30	-0.087	0.011	-0.112	0.011	0.0018	-0.118	0.009	0.005	0.021
50	-0.071	0.011	-0.100	0.011	0.0018	-0.104	0.011	0.005	0.020
65	-0.055	0.011	-0.085	0.011	0.0018	-0.091	0.012	0.005	0.020
80	-0.045	0.015	-0.078	0.015	0.0018	-0.078	0.014	0.000	0.027
85	-0.038	0.021	-0.071	0.021	0.0018	-0.073	0.016	0.002	0.040
90	-0.039	0.034	-0.070	0.034	0.0018	-0.073	0.018	0.002	0.065
95	-0.046	0.053	-0.076	0.053	0.0018	-0.075	0.022	-0.001	0.10

Table 12.3.9 Summary of the most important value obtained by **PTB** in the CCT-K8 including: the weighted mean values and their corresponding mean in the virtual loop together with their standard uncertainties; the uncertainty of the stability of the virtual loop; the KCRVs and theirs uncertainties; and the differences with the KCRV and the corresponding expanded uncertainty using a coverage factor (k = 2) for a probability higher that 95 %.

Nominal Dew	Reported	l Results		esults in al loop	Drift virtual transfer standard	K	CRV	Difference	e with KCRV
Point, °C	∆t _d	u (∆t _d)	Δt d lab'	u (∆t _d ^{lab'})	U _{stab.loop}	Δt d KCRV	u (∆t _d ^{KCRV})	$\Delta t_d^{\ lab'}$ - $\Delta t_d^{\ KCRV}$	$U(\Delta t_d^{lab'} - \Delta t_d^{KCRV})$
30	-0.092	0.010	-0.118	0.010	0.0018	-0.118	0.009	0.000	0.019
50	-0.095	0.015	-0.124	0.015	0.0018	-0.104	0.011	-0.019	0.029
65	-0.073	0.018	-0.103	0.018	0.0018	-0.091	0.012	-0.012	0.035
80	-0.074	0.032	-0.106	0.032	0.0018	-0.078	0.014	-0.028	0.062

12.4 ABBREVIATIONS

BEV Bundesamt für Eich- und Vermessungswesen (Federal Office of Metrology and

Surveying)

CCT Consultative Committee on Thermometry

CEM Centro Español de Metrología

CIPM Comité International des Poids et Mesures

DI Designated Institutes

DoE Degree of Equivalence

INRiM Istituto Nazionale di Ricerca Metrologica

INTA Instituto Nacional de Técnica Aeroespacial

ITS-90 International Temperature Scale

KRISS Korea Research Institute of Standards and Science

LRV Loop Reference Value

MBW Calibration Ltd.

NIST National Institute of Standards and Technology

NMC, A*STAR National Metrology Centre

NMI National Metrology Institute

NMIJ National Metrology Institute of Japan

NPL National Physical Laboratory

PTB Physikalisch-Technische Bundesanstalt

PRT Platinum Resistance Thermometer

KCRV Key Comparison Reference Value

12.5 DETAILS OF PARTICIPATING INSTITUTES

E+E Elektronik (BEV/E+E) Austria

Address: Langwiesen 7, A-4209 Engerwitzdorf, Austria

Contact: Dr Helmut Mitter; Mr. Patrick Raab

Phone: +43 7235 605 320 Fax: +43 7235 605 383

E-mail: helmut.mitter@epluse.com; patrick.raab@epluse.com;

Instituto Nacional de Técnica Aeroespacial (INTA)

Spain

Address: Centro de Metrologia y Calibración, Ctra. a Ajalvir, km. 4

28850 Torrejon de Ardoz

Contact: Dr Robert Benyon; Dr. Jaime G. Gallegos

Phone: +34 915 201 711 Fax: +34 915 201 645

E-mail: benyonpr@inta.es; garciagaj@inta.es

Istituto Nazionale di Ricerca Metrologica (INRiM) Italy

Address: Strada delle Cacce, 73, I-10135 – Torino Contact: Dr Vito Fernicola; Dr. Denis Smorgon

Phone: +39 011 3977 337 Fax: +39 011 3977 347

E-mail: v.fernicola@inrim.it; d.smorgon@inrim.it

Korea Research Institute of Standards and Science (KRISS) R. of Korea

Address: 267 Gajeong-Ro Yuseong-Gu Daejeon 305-340

Contact: Dr. Byung Il Choi; Dr. Sang Wook Lee

Phone: +82 428685275 Fax: +82 428685290

Email: cbi@kriss.re.kr; sangwook@kriss.re.kr

National Institute for Standards and Technology (NIST)

United States of America

Address: Bldg. 221, Rm. B131. 100 Bureau Dr.

Gaithersburg, MD 20899

Contact; Dr. Christopher Meyer

Phone: +1 301 975 4825 Fax: +1 301 548 0206

E-mail: christopher.meyer@nist.gov

National Metrology Centre (NMC, A*STAR) Singapore

Address: Cleantech Three, 8 Cleantech Loop

Singapore 637145

Contact Dr. Wang Li Phone: 65 9876 8362

Email: wang li@nmc.a-star.edu.sg

National Metrology Institute of Japan (NMIJ), AIST

Address: AIST Tsukuba Central 3,

Tsukuba 305-8563

Contact: Dr Hisashi Abe
Phone +81 29 861 6845
Fax: +81 29 861 4068
Email: abe.h@aist.go.jp

National Physical Laboratory (NPL)

United Kingdom

Germany

Japan

Address: Hampton Road, Teddington, Middlesex, TW11 0LW

Contact: Dr Stephanie Bell

Mr. Paul Carroll Phone: +44 20 8943 6402

Fax: +44 20 8943 6306
Email: Stephanie.Bell@npl.co.uk; paul.carroll@npl.co.uk

Physikalisch-Technische Bundesanstalt (PTB)

Address: Bundesallee 100, D-38116 Braunschweig

Contact: Dr.-Ing. Regina Deschermeier

Phone: +49 531 592 3410 Fax: +49 531 592 69 3410

E-mail: regina.deschermeier@ptb.de

12.6 RESULTS REPORTED BY ALL PARTICIPANTS

Following are showed the results reported by participants pasted from the Excel template used in this comparison.

REPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8 Nominal value: 30 °C Lab name BEV/E+E Elektronik - each participant submits one spreadsheet summary per nominal dew-point measured in the comparison; labeled "data t*C", where "t" should be replace ROBERT: Type serial number: 08-1215 or 08-1216 Results -lvarometer Applied Resistance (meas do output applied dp) dew-poin Check in °C in ohm 29.815 -0.142 29.816 -0.141 29.816 -0.141 29.816 -0.141Uncertainties (in °C) 08-1215 Hygromete Meas 1 leas 4 Meas 3 Standard uncertainty of applied condition 0.0109 0.0110 0.0110 0.0109 Std uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) 0.0007 0.0005 0.0010 Std uncert due to long-term drift of travelling standard [if needed] Std uncert due to resolution of travelling standard [if needed] Std uncert due to non-linearity of travelling standard [if needed] Covariance between applied and measured values of dew/frost-point temperature [if needed] 0.010906 0.010989 0.01099 0.010923 Combination of these standard uncertainties in quadrature Effective degrees of freedom of uncertainty estimates: In most cases the effective number of degrees of freedom will be large. If significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background

-0.141

0.0109

Fig. 12.6.a Results reported by BEV/E+E in Loop 1

Aggregation of results

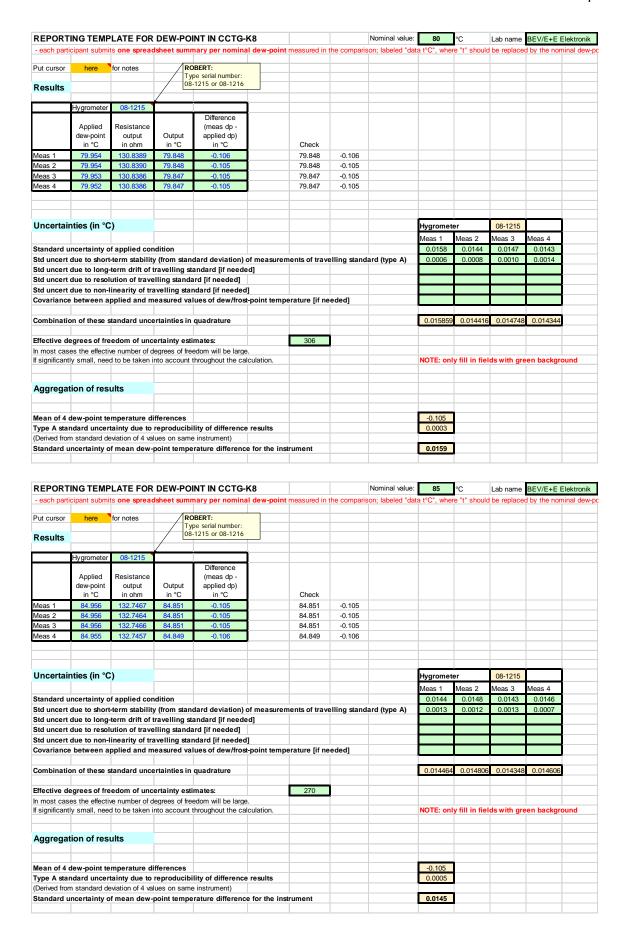
Mean of 4 dew-point temperature differences

Type A standard uncertainty due to reproducibility of difference results (Derived from standard deviation of 4 values on same instrument)

Standard uncertainty of mean dew-point temperature difference for the instrument

REPORT	ING TEMP	LATE FOR	DEW-P	OINT IN CCTG-K8			Nominal value:	50	°C	Lab name	BEV/E+E	Elektronil
each parti	cipant submit	s one spread	dsheet su	mmary per nominal dew	/-point measured in	the compari	ison; labeled "dat	a t°C", whe	re "t" should	be replace	d by the no	minal de
Put cursor	here	for notes		ROBERT:								
at outou	11010	101 110100		Type serial number:								
Results				08-1215 or 08-1216								
	Hygrometer	08-1215										
	Applied dew-point	Resistance output	Output	Difference (meas dp - applied dp)								
	in °C	in ohm	in °C	in °C	Check							
Meas 1	49.954	119.3301	49.826		49.826	-0.129						
Meas 2	49.954	119.3298	49.825		49.825	-0.129						
Meas 3	49.954	119.3302	49.826		49.826	-0.128						
Meas 4	49.954	119.3300	49.826		49.826	-0.128						
Uncertair	nties (in °C)						Hygromet	er	08-1215		
		<i>'</i>						Meas 1	Meas 2	Meas 3	Meas 4	1
Standard II	ncertainty o	f applied cor	ndition					0.0134	0.0121	0.0122	0.0123	
				andard deviation) of me	asurements of trav	elling stand	dard (type A)	0.0005	0.0005	0.0004	0.0005	1
				standard [if needed]	usurements or truv	July Starte	aura (type A)	0.0000	0.0000	0.0004	0.0000	
				ndard [if needed]								
				standard [if needed]								1
				values of dew/frost-poin	t temperature [if ne	eded]						
Combinatio	on of these s	tandard unce	ertainties	in quadrature				0.013417	0.012068	0.012177	0.012277	1
Effective de	egrees of fre	edom of unc	ertainty e	estimates:	324							
In most case	es the effective	e number of d	legrees of	freedom will be large.								
If significantl	ly small, need	d to be taken i	into accou	nt throughout the calculation	on.			NOTE: onl	y fill in fiel	ds with gre	en backgi	round
Aggraga	tion of resi	ulto										
Aggregat	ion or resi	uits										
	dew-point te	mperature di	ifferences	S				-0.129				
Mean of 4 o			reproduc	ibility of difference resu	Its			0.0005				
	ndard uncer	amity due to	.ор.ошио	,								
Type A star				ame instrument)								

REPORT	TING TEMP	LATE FOR	DEW-F	OINT IN CCTG-K8			Nominal value:	65	°C	Lab name	BEV/E+E E	Elektronik
- each part	ticipant submi	ts one spread	Isheet su	mmary per nominal de	w-point measured in	the compar	ison; labeled "dat	a t°C", whe	re "t" should	be replace	d by the nom	ninal dew
out cursor	here	for notes		ROBERT:								
				Type serial number:								
Results				08-1215 or 08-1216								
			/									
	Hygrometer	08-1215										
				Difference								
	Applied	Resistance		(meas dp -								
	dew-point	output	Output	applied dp)								
	in °C	in ohm	in °C	in °C	Check							
Meas 1	64.950	125.0967	64.835	-0.115	64.835	-0.115						
Meas 2	64.949	125.0959	64.833	-0.116	64.833	-0.116						
Meas 3	64.948	125.0957	64.832	-0.116	64.832	-0.116						
Meas 4	64.947	125.0952	64.831	-0.116	64.831	-0.116						
Uncertai	inties (in °C	;)						Hygromet	er	08-1215		
								Meas 1	Meas 2	Meas 3	Meas 4	
Standard (uncertainty o	of applied cor	dition					0.0136	0.0131	0.0138	0.0130	
				andard deviation) of m	easurements of trav	elling stand	dard (type A)	0.0007	0.0005	0.0007	0.0006	
Std uncert	t due to long	term drift of t	ravelling	standard [if needed]								
Std uncert	due to resol	ution of trave	lling sta	ndard [if needed]								
Std uncert	due to non-	linearity of tra	velling	standard [if needed]								
				values of dew/frost-poi	int temperature [if ne	eded]						
Combinati	ion of these s	standard unce	ertainties	in quadrature				0.013658	0.013107	0.013775	0.013054	
- ##	1				205							
	•	edom of unc			305							
				freedom will be large. int throughout the calcula	tion			NOTE: on	ly fill in fie	de with an	en backgro	nund
ii sigriiiicari	illy Small, nee	u to be taken i	TILO ACCOL	int throughout the calcula	ition.			NOTE. OII	y iiii iii iie	us with gir	backgre	Juliu
Aggraga	tion of res	ulte										
-ggrega	Lion or res	uito										
Maan a/ 4	daw males s							0.110				
		mperature di			lta			-0.116				
			•	cibility of difference res	suits		-	0.0005				
				ame instrument)								
Standard i	uncertainty o	of mean dew-	point ten	perature difference for	r the instrument			0.0137	J			



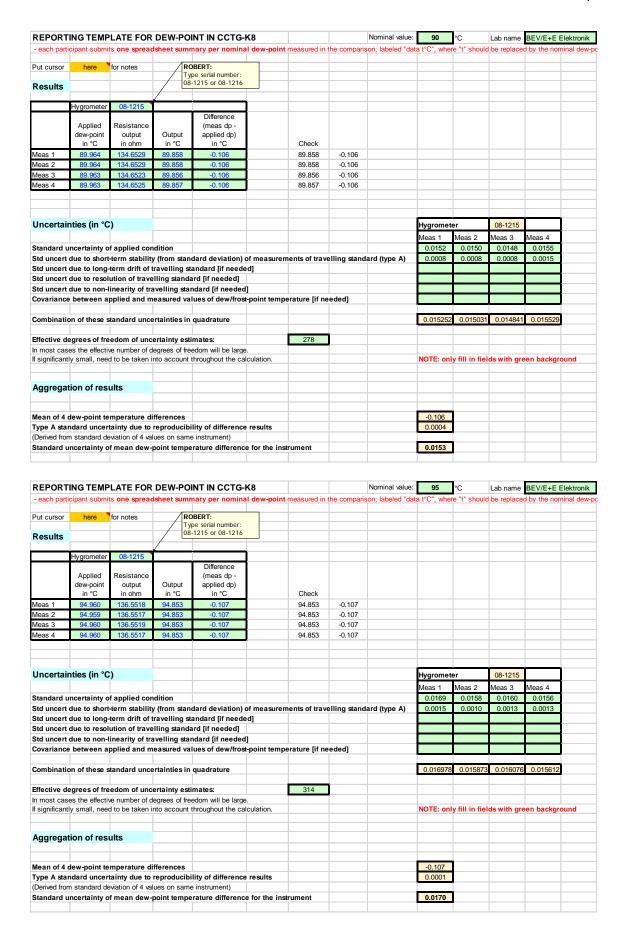


Fig. 12.6.b Results reported by BEV/E+E in Loop 2

				OINT IN CCTG-K				Nominal value:	30	°C		BEV/E+E E	
- each parti	icipant submi	ts one spread	dsheet su	mmary per nominal	dew-point	measured in	the compari	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal dew
Put cursor	here	for notes		ROBERT:									
rut cuisoi	Here	ioi rioles		Type serial number:									
Results				08-1215 or 08-1216									
ittosuits					_	-							
	Hygrometer	08-1216	ř										
	r iy gramatar	00 1210		Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Output										
	in °C	in ohm	in °C	in °C		Check							
Meas 1	29.957	111.6219	29.868	-0.089		29.868	-0.089						
Meas 2	29.956	111.6227	29.870	-0.086		29.870	-0.086						
Meas 3	29.957	111.6229	29.871	-0.086		29.871	-0.086						
Meas 4	29.957	111.6231	29.871	-0.086		29.871	-0.086						
Uncertaiı	nties (in °C	;)							Hygromete	er	08-1216		
		'							Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	incertainty o	f applied cor	ndition						0.0109	0.0110	0.0110	0.0109	
				andard deviation) o	f measuren	nents of trave	elling stand	lard (type A)	0.0006	0.0006	0.0007	0.0007	
				standard [if needed			Jiming Guarre	.a. a (type 7 ty	0.0000	0.0000	0.0007	0.0007	
				ndard [if needed]	-,								
				standard [if needed]									
				values of dew/frost-		erature [if ne	ededl						
Combination	on of these s	standard unce	ertainties	in quadrature					0.01091	0.01098	0.010997	0.010901	
				i i									
Effective de	egrees of fre	edom of unc	ertainty	estimates:		351							
In most cas	es the effecti	ve number of d	legrees of	freedom will be large.									
If significant	ly small, nee	d to be taken i	nto accou	nt throughout the calc	culation.				NOTE: onl	y fill in fiel	ds with gre	en backgro	ound
Aggregat	tion of res	ults											
333		_											
Mean of 4	dew-noint te	mperature di	ifference	3					-0.087				
	-	-		ibility of difference	results				0.0014				
		•		ame instrument)	i Courto				0.0014				
`					for the inc	trument			0.0110				
Standard u	incertainty o	n mean déw-	point ten	perature difference	ior the ins	trument			0.0110				

REPORT	ING TEMP	LATE FOR	DEW-F	OINT IN CCTG-I	48			Nominal value:	50	°C	Lab name	BEV/E+E I	Elektronik
- each part	icipant submi	ts one spread	dsheet su	mmary per nomina	I dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	ninal dew
Put cursor	here	for notes		ROBERT:									
at outou	11010	ioi notoc		Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1216											
				Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Output										
	in °C	in ohm	in °C	in °C		Check							
Meas 1	49.954	119.3527	49.885			49.885	-0.070						
Meas 2	49.954	119.3525	49.884			49.884	-0.070						
Meas 3	49.954	119.3528	49.885			49.885	-0.069						
Meas 4	49.954	119.3524	49.884	-0.070		49.884	-0.070						
Uncertai	nties (in °C	;)							Hygromete	er	08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ι	uncertainty of	of applied cor	ndition						0.0134	0.0121	0.0122	0.0123	
Std uncert	due to short	t-term stability	y (from s	andard deviation) o	of measurem	nents of trave	elling stand	lard (type A)	0.0006	0.0004	0.0005	0.0005	
Std uncert	due to long	term drift of	travelling	standard [if neede	d]								
Std uncert	due to resol	lution of trave	elling sta	ndard [if needed]									
Std uncert	due to non-	linearity of tra	avelling	standard [if needed									
Covariance	e between a	pplied and m	easured	values of dew/frost	-point tempe	erature [if ne	eded]						
Combination	on of these s	standard unce	ertainties	in quadrature					0.013421	0.012068	0.012179	0.012277	
						221							
		edom of unc				324							
				freedom will be large					NOTE: and	. 611 15 651	ala milita ann		
ii signilicani	ily small, nee	d to be taken i	nio accoi	nt throughout the cal	cuiation.				NOTE: ON	y mii in nei	as with gre	en backgr	ouna
Aggrega	tion of res	ults											
Moan of 4	dow-noint to	emperature di	ifference						-0.070				
	•	•		ibility of difference	results				0.0003				
				ame instrument)					0.0000				
				perature difference	for the inc	rument			0.0134				
Jianuai a	ancertainty C	n mean dew-	pomit ten	iperature umerence	ioi uie inst	unient			0.0134				

REPORT	ING TEMP	LATE FOR	DEW-F	POINT IN CCTG-K8			Nominal value:	65	°C	Lab name	BEV/E+E E	lektroni
- each part	icipant submi	ts one spread	Isheet su	ımmary per nominal d	ew-point measured in	the compar	ison; labeled "dat	a t°C", wher	e "t" should			
Put cursor	here	for notes	/	ROBERT:								
out cursor	nere	ior notes		Type serial number:								
Results				08-1215 or 08-1216								
resuits					•							
	Hygrometer	08-1216	Ý.									
				Difference								
	Applied	Resistance		(meas dp -								
	dew-point	output	Outpu	t applied dp)								
	in °C	in ohm	in °C	in °C	Check							
Meas 1	64.950	125.1199	64.89	6 -0.055	64.896	-0.055						
Meas 2	64.949	125.1194	64.89	4 -0.055	64.894	-0.055						
Meas 3	64.948	125.1193	64.89	4 -0.054	64.894	-0.054						
Meas 4	64.947	125.1189	64.893	3 -0.055	64.893	-0.055						
Uncertai	nties (in °C	.)						Hygromet		08-1216		
								Meas 1	Meas 2	Meas 3	Meas 4	
		f applied con						0.0136	0.0131	0.0138	0.0130	
				tandard deviation) of r	neasurements of trav	elling stan	dard (type A)	0.0008	0.0006	0.0008	0.0006	
				g standard [if needed]								
				ndard [if needed]								
		-		standard [if needed]								
Covariance	e between a	pplied and m	easured	values of dew/frost-po	int temperature [if ne	eeded]						
Combinati	on of these s	standard unce	rtainties	s in quadrature				0.013662	0.013113	0.013779	0.013051	
Effective d	earees of fre	edom of unc	ertainty	estimates:	305	1						
	_			f freedom will be large.		•						
				unt throughout the calcul	ation.			NOTE: onl	y fill in fiel	ds with gre	en backgro	und
Aggraga	l tion of res	ulte										
-ggrega	lon or res	uito							-			
		mperature di						-0.054				
Гуре A sta	ndard uncer	tainty due to	reprodu	cibility of difference re	sults			0.0002				
Derived from	m standard de	eviation of 4 val	ues on s	ame instrument)								
Standard I	incertainty o	f mean dew-	noint ter	nperature difference for	r the instrument			0.0137				

				POINT IN CCTG-K				Nominal value:	80	°C		BEV/E+E E	
- each part	icipant submi	ts one spread	Isheet su	mmary per nominal	dew-point	measured in	the compari	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal dev
Put cursor	here	for notes		ROBERT:									
				Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1216											
				Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Output										
	in °C	in ohm	in °C	in °C		Check							
Meas 1	79.954	130.8637	79.913			79.913	-0.041						
Meas 2	79.954	130.8638	79.914			79.914	-0.040						
Meas 3	79.953	130.8634	79.912			79.912	-0.040						
Meas 4	79.952	130.8633	79.912	2 -0.040		79.912	-0.040						
Uncertair	nties (in °C								Hugromot		08-1216		
Uncertail	inies (iii C	,							Hygromete				
									Meas 1	Meas 2	Meas 3	Meas 4	
		f applied cor			_				0.0158	0.0144	0.0147	0.0143	
				andard deviation) o		nents of trave	elling stand	lard (type A)	0.0007	0.0009	0.0010	0.0013	
				standard [if needed	1]								
				ndard [if needed]									
				standard [if needed]									
Covariance	e between a	pplied and m	easured	values of dew/frost-	point temp	erature [if ne	ededj						
O I: I 1						-			0.045000	0.044400	0.04.47.40	0.044000	
Combinatio	on of these s	tandard unce	ertainties	in quadrature		-			0.015862	0.014422	0.014746	0.014336	
		edom of unc				306							
				freedom will be large.		306							
				int throughout the calc	ulation.				NOTE: onl	v fill in fiel	ds with ar	een backgro	ound
,,													
Aggrega	tion of res	ults											
Moan of 4	dew-point te	mperature di	ifference	S					-0.040				
weam or 4		tainty due to	reproduc	ibility of difference	results				0.0003				
	ndard uncer												
Type A sta				ame instrument)									

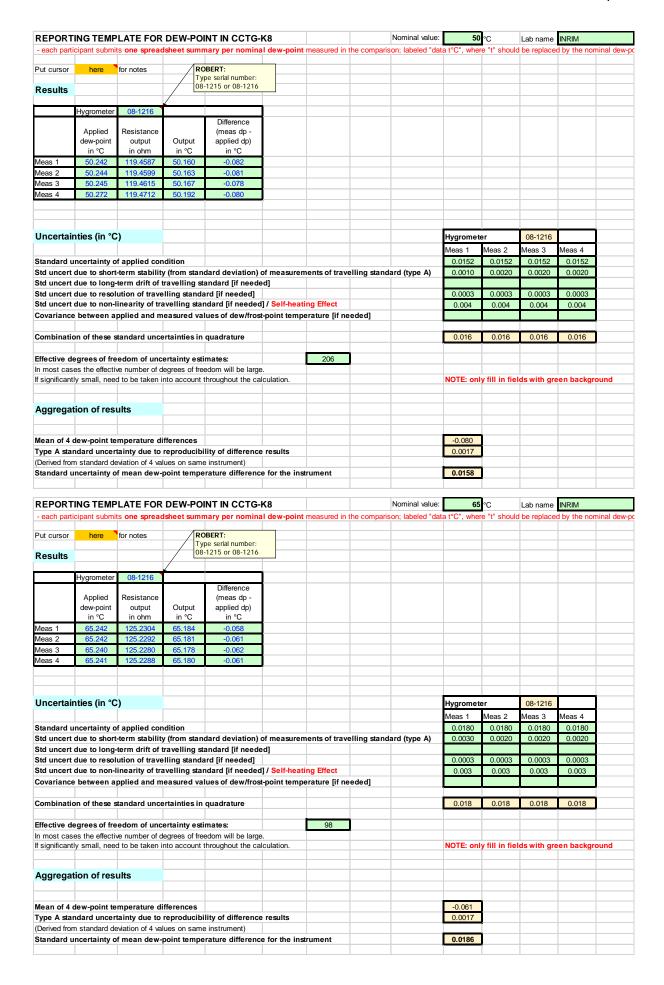
REPORT	ING TEMP	LATE FOR	DEW-	POINT IN CCTG-K	8		Nominal value:	85	°C	Lab name	BEV/E+E E	lektror
each part	icipant submi	ts one spread	Isheet s	ummary per nominal	dew-point measured in	the compari	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nomi	inal de
out cursor	here	for notes		ROBERT:								
ut cuisoi	Here	ioi riotes		Type serial number:								
Results				08-1215 or 08-1216								
resuits					_							
	Hygrometer	08-1216										
				Difference								
	Applied	Resistance		(meas dp -								
	dew-point	output	Outpu	ut applied dp)								
	in °C	in ohm	in °C	in °C	Check							
Meas 1	84.956	132.7721	84.91	8 -0.038	84.918	-0.038						
Meas 2	84.956	132.7719	84.91	8 -0.038	84.918	-0.038						
Meas 3	84.956	132.7717	84.91		84.917	-0.039						
Meas 4	84.955	132.7708	84.91	5 -0.040	84.915	-0.040						
Uncertai	nties (in °C	;)						Hygromete	er	08-1216		
								Meas 1	Meas 2	Meas 3	Meas 4	
Standard ı	incertainty o	f applied cor	dition					0.0144	0.0148	0.0143	0.0146	
Std uncert	due to short	-term stability	y (from s	standard deviation) of	measurements of trav	elling stand	dard (type A)	0.0010	0.0010	0.0010	0.0008	
Std uncert	due to long-	term drift of	ravellin	g standard [if needed]							
Std uncert	due to resol	ution of trave	lling sta	indard [if needed]								
Std uncert	due to non-l	inearity of tra	evelling	standard [if needed]								
Covariance	e between a	pplied and m	easured	l values of dew/frost-p	oint temperature [if n	eeded]						
combinati	on of these s	tandard unce	ertaintie	s in quadrature				0.014442	0.014794	0.014324	0.014613	
Effective d	egrees of fre	edom of unc	ertainty	estimates:	270	1						
n most cas	es the effective	ve number of d	legrees o	f freedom will be large.								
fsignificant	ly small, nee	d to be taken i	nto acco	unt throughout the calcu	ulation.			NOTE: onl	y fill in fiel	ds with gre	en backgro	und
Aggrega	tion of res	ults										
lean of 4	dew-point te	mperature di	ifference	es				-0.039				
ype A sta	ndard uncer	tainty due to	reprodu	cibility of difference r	esults			0.0008				
Derived from	n standard de	eviation of 4 va	lues on s	same instrument)								
				mperature difference				0.0145				

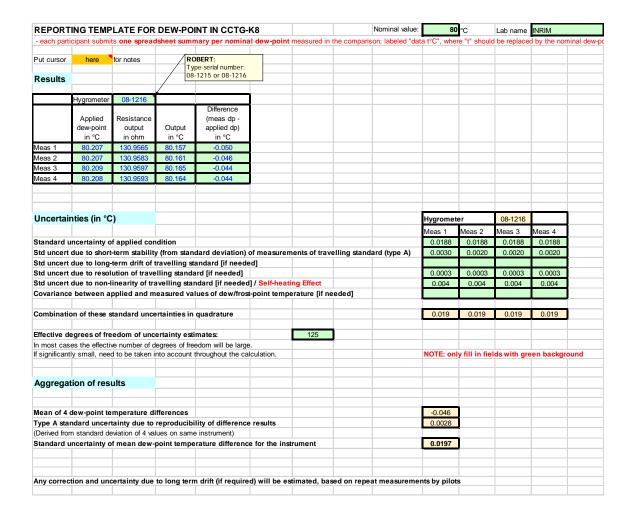
				POINT IN CCTG-K			Nominal value:	90	°C		BEV/E+E	
- each parti	cipant submi	ts one spread	isheet su	mmary per nominal	dew-point measured in	the compari	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	minal dew
Put cursor	here	for notes	/	ROBERT:								
at cuisoi	Here	ioi riotes		Type serial number:								
Results				08-1215 or 08-1216								
riocuito												
	Hygrometer	08-1216										
				Difference								
	Applied	Resistance		(meas dp -								
	dew-point	output	Outpu									
	in °C	in ohm	in °C	in °C	Check							
Meas 1	89.964	134.6769	89.92		89.921	-0.042						
Meas 2	89.964	134.6771	89.92		89.922	-0.042						
Meas 3	89.963	134.6768	89.92		89.921	-0.042						
Meas 4	89.963	134.6765	89.920	-0.043	89.920	-0.043						
Uncertair	nties (in °C	;)						Hygromet	er	08-1216		
								Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	ncertainty o	f applied cor	dition					0.0152	0.0150	0.0148	0.0155	ĺ
Std uncert	due to short	term stabilit	y (from s	andard deviation) of	measurements of trav	elling stand	dard (type A)	0.0009	0.0010	0.0008	0.0010	
Std uncert	due to long-	term drift of	travelling	standard [if needed]							
Std uncert	due to resol	ution of trave	lling sta	ndard [if needed]								
Std uncert	due to non-	inearity of tra	avelling	standard [if needed]								
Covariance	between a	pplied and m	easured	values of dew/frost-p	oint temperature [if n	eeded]						
Combination	on of these s	tandard unce	ertainties	in quadrature				0.015255	0.01504	0.014839	0.015486	<u> </u>
		edom of unc			278							
				freedom will be large.								
If significant	ly small, nee	d to be taken i	nto accoi	int throughout the calc	ulation.			NOTE: onl	y fill in fie	ds with gre	en backgr	ound
Aggregat	tion of res	ults										
	•	mperature di						-0.042				
				cibility of difference i	esults			0.0004				
				ame instrument)								
Ctandard	incertainty of	f mean dew-	point ten	perature difference	for the instrument			0.0153				

REPORT	ING TEMP	LATE FOR	DEW-F	POINT IN CCTG-K	8			Nominal value:	95	°C	Lab name	BEV/E+E	Elektronik
- each parti	cipant submit	s one sprea d	isheet su	ımmary per nominal	dew-point r	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal dev
out cursor	here	for notes		ROBERT:	_								
out cursor	nere	ior notes		Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1215											
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C			Check							
Meas 1	94.960	136.5741	94.912	2 -0.048		94.912	-0.048						
Meas 2	94.959	136.5748	94.913	3 -0.046		94.913	-0.046						
Meas 3	94.960	136.5752	94.91	5 -0.045		94.915	-0.045						
Meas 4	94.960	136.5749	94.91	4 -0.046		94.914	-0.046						
Uncertair	nties (in °C	\							Hygromet		08-1215		
Oncertail	ities (iii O	,							Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	ncertainty of	applied cor	dition						0.0169	0.0158	0.0160	0.0156	
				tandard deviation) of	measurem	ents of trave	elling stand	lard (type A)	0.0011	0.0015	0.0011	0.0015	
				g standard [if needed				(3,511.4)					
				ndard [if needed]	•								
Std uncert	due to non-li	nearity of tra	avelling	standard [if needed]									
Covariance	between a	plied and m	easured	values of dew/frost-	point tempe	rature [if ne	eded]						
Combinatio	on of these s	andard unce	ertainties	s in quadrature					0.016948	0.015913	0.016065	0.015628	
Effective de	agrees of fre	edom of unc	ertainty	estimates:		314							
	-			f freedom will be large.		014							
				unt throughout the calc	ulation.				NOTE: onl	y fill in fiel	ds with gre	en backgro	ound
Aggregat	ion of resu	ılts											
Mean of 4	lew-noint te	mperature di	ifference						-0.046				
	•	•		cibility of difference	results				0.0012				
Tvpe A star			- F 344	,									
		viation of 4 va	lues on s	ame instrument)									

Fig. 12.6.c Results reported by INRiM in Loop 2

				POINT IN CCTG-				Nominal value:	30		Lab name		
- each part	icipant submi	s one spread	dsheet su	ımmary per nomina	I dew-point	t measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal dev
Put cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1216	Ž										
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C	Difference (meas dp - applied dp) in °C									
Meas 1	30.287	111.7455	30.187										
Meas 2	30.288	111.7465	30.190	-0.098									
Meas 3	30.287	111.7463	30.189	-0.098									
Meas 4	30.286	111.7464	30.190	-0.096									
Uncertai	nties (in °C	i)							Hygromete	er	08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ı	incertainty o	f applied cor	ndition						0.0136	0.0136	0.0136	0.0136	
Std uncert	due to short	term stabilit	y (from s	tandard deviation)	of measure	ments of trave	elling stand	ard (type A)	0.0010	0.0010	0.0020	0.0010	
Std uncert	due to long-	term drift of	travelling	g standard [if neede	d]								
				ndard [if needed]					0.0003	0.0003	0.0003	0.0003	
				standard [if needed					0.001	0.001	0.001	0.001	
Covariance	e between a	pplied and m	easured	values of dew/frost	-point temp	erature [if ne	eded]						
Combinati	on of these s	tandard unce	ertainties	in quadrature					0.014	0.014	0.014	0.014	
Effective d	egrees of fre	edom of unc	ertainty	estimates:		147							
				freedom will be large									
If significant	ly small, need	d to be taken i	into accou	unt throughout the cal	culation.				NOTE: onl	y fill in fiel	ds with gre	en backgr	ound
Aggrega	tion of res	ults											
Mean of 4	dew-point te	mperature di	ifference	S					-0.098				
Type A sta	ndard uncer	tainty due to	reproduc	cibility of difference	results				0.0017				
	m standard de	viation of 4 va	lues on sa	ame instrument)									
				perature difference					0.0137				





REPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8								Nominal value:	85	_	Lab name		
- each parti	icipant submi	ts one spread	dsheet su	ımmary per nomina	I dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	ninal dev
Put cursor	here	for notes	/	ROBERT:									
ut cuisoi	TICIC	ioi riotes		Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1216	Ť										
	73			Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Outpu	-1117									
	in °C	in ohm	in °C										
Meas 1	85.187	132.8577	85.143										
Meas 2	85.197	132.8621	85.154										
Meas 3	85.193	132.8599	85.149										
Meas 4	85.193	132.8603	85.149	-0.044									
Uncertaiı	nties (in °C	;)							Hygrometer		08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	incertainty o	f applied con	dition						0.0193	0.0193	0.0193	0.0193	
				tandard deviation)	of measuren	nents of trav	elling stand	ard (type A)	0.0040	0.0030	0.0040	0.0030	
Std uncert	due to long-	term drift of t	travelling	g standard [if neede	ed]								
Std uncert	due to resol	ution of trave	lling sta	ndard [if needed]					0.0003	0.0003	0.0003	0.0003	
Std uncert	due to non-l	inearity of tra	avelling	standard [if needed] / Self-heati	ing Effect			0.005	0.005	0.005	0.005	
Covariance	e between a	pplied and m	easured	values of dew/frost	-point tempe	erature [if ne	eded]						
Combination	on of these s	tandard unce	ertainties	in quadrature					0.020	0.020	0.020	0.020	
Effective de	egrees of fre	edom of unc	ertainty	estimates:		121							
				freedom will be large									
If significant	ly small, nee	d to be taken i	nto accou	unt throughout the cal	culation.				NOTE: onl	y fill in fiel	ds with gre	en backgr	ound
Aggrega	tion of res	ults											
		mperature di							-0.044				
				cibility of difference	results				0.0005				
,				ame instrument)									
Standard u	ıncertaintv o	f mean dew-	point ten	nperature difference	e for the inst	trument			0.0203				

REPORT	ING TEMP	LATE FOR	DEW-PC	INT IN CCTG-F	₹8			Nominal value:	90	°C	Lab name	INRIM	
each part	icipant submit	s one spread	lsheet sum	mary per nomina	I dew-point	measured in	the comparis	on; labeled "dat	a t°C", whe	e "t" should	be replace	d by the nom	inal de
out cursor	here	for notes	T	OBERT: /pe serial number:									
Results			<u> </u>	3-1215 or 08-1216									
			/										
	Hygrometer	08-1216		D:#									
	Applied	Resistance		Difference (meas dp -									
	dew-point	output	Output	applied dp)									
	in °C	in ohm	in °C	in °C									
Meas 1	90.173	134.7569	90.131	-0.042									
Meas 2	90.175	134.7573	90.132	-0.043									
Meas 3	90.173	134.7579	90.134	-0.039									
Meas 4	90.175	134.7599	90.139	-0.036									
Uncertainties (in °C)								Hygrometer		08-1216			
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ι	incertainty o	f applied cor	dition						0.0199	0.0199	0.0199	0.0199	
Std uncert	due to short	term stabilit	y (from star	dard deviation) o	of measuren	nents of trave	elling stand	ard (type A)	0.0020	0.0030	0.0020	0.0050	
Std uncert	due to long-	term drift of	travelling s	tandard [if neede	d]								
				ard [if needed]					0.0003	0.0003	0.0003	0.0003	
				ndard [if needed]					0.005	0.005	0.005	0.005	
Covariance	e between a	pplied and m	easured va	lues of dew/frost	-point temp	erature [if ne	eded]						
Combination	on of these s	tandard unce	ertainties ir	quadrature					0.021	0.021	0.021	0.021	
						170							
	-	edom of unc		edom will be large.		172							
				throughout the cal					NOTE: onl	v fill in fie	ds with are	en backgro	und
orgour.	, , , , , , , , , , , , ,	a to bo takom	nto docodin	Lineagnear the ear	outuro						l gr	l la cing	
Aggrega	tion of res	ults											
Mean of 4 dew-point temperature differences Type A standard uncertainty due to reproducibility of difference results							-0.040	ł					
					results				0.0032				
		viation of 4 va											
Standard u	ıncertainty o	f mean dew-	point temp	erature difference	for the ins	trument			0.0208				

				POINT IN CCTG-F				Nominal value:		°C	Lab name		
- each parti	cipant submi	ts one spread	dsheet su	mmary per nomina	I dew-poin	t measured in	the compari	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal de
Put cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1216											
	Applied dew-point in °C	Resistance output in ohm	Output in °C	Difference (meas dp - applied dp) in °C									
Meas 1	95.164	136.6567	95.129	-0.035									
Meas 2	95.161	136.6551	95.125	-0.036									
Meas 3	95.167	136.6575	95.131	-0.036									
Meas 4	95.145	136.6481	95.107	-0.038									
Uncertair	nties (in °C	;)							Hygromet	er	08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	ncertainty o	f applied cor	ndition						0.0345	0.0345	0.0345	0.0345	
Std uncert	due to short	term stabilit	y (from sl	andard deviation) o	of measure	ments of trav	elling stand	lard (type A)	0.0110	0.0130	0.0330	0.0280	
				standard [if neede	d]								
				ndard [if needed]					0.0003	0.0003	0.0003	0.0003	
				standard [if needed]					0.005	0.005	0.005	0.005	
Covariance	between a	pplied and m	easured	values of dew/frost-	-point temp	perature [if no	eeded]						
									0.000	0.007	0.040	0.045	
Combinatio	on of these s	tandard unce	ertainties	in quadrature					0.037	0.037	0.048	0.045	
Effective de	earees of fre	edom of unc	ertainty e	estimates:		61							
				freedom will be large.									
If significant	ly small, nee	d to be taken i	into accou	int throughout the cal	culation.				NOTE: onl	y fill in fie	ds with gre	en backgro	ound
Aggregat	tion of res	ults											
Maan at 4 .			·						-0.036				
		mperature di		s cibility of difference	rogulte				0.0013				
			•	ame instrument)	reauits				0.0013				
				perature difference	for the in-	etrument			0.0365				
Canaara u	criamity C	can uew-	Ponni ten	iporature umerence	, ioi uie III:	JU AIIICIIL	-	-	0.0303		-		

Fig. 12.6.d Results reported by INTA2 in Loop 1

Pygrometer 08-1215 or 08-1216 Applied Resistance dewpoint output in "C					POINT IN CCTG			4ba aa	Nominal value:	30	°C	Lab name	INTA2	ine!
Application (Mesistance Computer Control Contr	each part	ıcıpant submi	is one spread	asneet su	mmary per nomin	ar dew-poin	t measured in	tne comparis	son; labeled "dat	a t°C", whei	e "t" should	pe replace	by the nom	iinal c
Apparenter (06-316) Apparente	it cursor	here	for notes		ROBERT:									
Applied Pesistance Applied Appli		11010	101 110100											
Applied Process of County	esults				08-1215 or 08-1216									
Applied Applied Company Resistance County (miss dp.) spelling by s														
Applied Presistance (upper Output Seption (pt) (upper Seption (pt) spellod (pt) spellod (pt) (upper Seption (pt) spellod (pt) (upper Seption (pt) (pt) (upper Seption (pt) (pt) (upper Seption (pt) (pt) (pt) (upper Seption (pt) (pt) (pt) (pt) (pt) (pt) (pt) (pt)		Hygrometer	08-1215											
size port of anyta and community of the community of applied condition of applied condition. **Description** **Community** of the community of applied condition of the community of applied condition of applied condition of the community of applied condition of applied condition. **Description** **Description					Difference									
mort in 1°C in order in 1°C in °C in														
need 1 30,000 111,000 20,000 40 101,000 100,000 40 100,000 40 101,000														
20,000 111,000 20,000 0														
necrtainties (in °C) Associated a sociation of the set and and uncertainties in quadrature during standard uncertainty of the producibility of differences and 4 show point temperature difference and 4 show poi														
nectainties (in °C) anidate uncertainty of applied condition during the total to be better many and anidate deviation) of measurements of travelling standard (type A) during the total to the observer mathiff to rewalling standard (fire needed) during the total total control total total control total control total total control total total control control control						4								
ncertainties (in *C) andard uncertainty of applied condition durant due to study the condition durant due to study the condition durant due to study the condition durant due to the study that the condition of a welling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant due to non-linearity of travelling standard (if readed) durant														
anderd uncertainty of applied condition of uncerd due to a bord-term stability (from standard deviation) of measurements of travelling standard (type A) of uncerd due to the contract of travelling standard (type A) of uncerd due to resolution of travelling standard (freeded] of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) ordinarios of these standard uncertainty set of the contraction of uncertainty set of the contraction of the contraction of the contraction of uncertainty set of the contraction of th	eas 4	30.032	111.6304	29.890	-0.142									
anderd uncertainty of applied condition of uncerd due to a bord-term stability (from standard deviation) of measurements of travelling standard (type A) of uncerd due to the contract of travelling standard (type A) of uncerd due to resolution of travelling standard (freeded] of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) ordinarios of these standard uncertainty set of the contraction of uncertainty set of the contraction of the contraction of the contraction of uncertainty set of the contraction of th														
anderd uncertainty of applied condition of uncerd due to a bord-term stability (from standard deviation) of measurements of travelling standard (type A) of uncerd due to the contract of travelling standard (type A) of uncerd due to resolution of travelling standard (freeded] of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) ordinarios of these standard uncertainty set of the contraction of uncertainty set of the contraction of the contraction of the contraction of uncertainty set of the contraction of th														
anderd uncertainty of applied condition of uncerd due to a bord-term stability (from standard deviation) of measurements of travelling standard (type A) of uncerd due to the contract of travelling standard (type A) of uncerd due to resolution of travelling standard (freeded] of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) of uncerd due to resolution of travelling standard (freeded) ordinarios of these standard uncertainty set of the contraction of uncertainty set of the contraction of the contraction of the contraction of uncertainty set of the contraction of th	Incortai	ntios (in °C	٠,							Lhumamas		00.4045		
andard uncertainty of applied condition of uncert due to long-term stability (from standard deviation) of measurements of travelling standard (type A) of uncert due to long-term drift of travelling standard (if needed) of uncert due to long-term drift of travelling standard (if needed) of uncert due to non-linearity of travelling standard (if needed) of uncert due to non-linearity of travelling standard (if needed) of uncert due to non-linearity of travelling standard (if needed) of uncert due to non-linearity of travelling standard (if needed) ombination of these standard uncertainties in quadrature ombination of these standard uncertainties in quadrature for needed of the standard uncertainties in quadrature for needed of the standard uncertainties of the standard in uncertainties of the standard uncertainties of the standard uncertainty due to reproducibility of difference results enter to account throughout the calculation. PEPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8 Nomined value So C Lab name NTA2 EPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8 Nomined value For noise Paymometre (861216) Applied Resistance (meeded) of the standard uncertainty of applied condition uncertainties (in "C) Nomined value Phyprometre (861216) Applied Resistance (meeded) of the standard uncertainty of applied condition uncertainty of applied condition uncertainty of applied condition uncertainty of applied condition uncertainties (in "C) Note of travelling standard (if needed) of uncert due to inclinearity of travelling standard (if needed) uncert due to inclinearity of travelling standard (if needed) uncert due to inclinearity of travelling standard (if needed) uncert due to inclinearity of travelling standard (if needed) uncert due to inclinearity of travelling standard (if needed) uncert due to inclinearity of travelling standard (if needed) uncert due	nicertai	illes (iii C	,											
durcert due to other-term stability (from standard deviation) of measurements of travelling standard (fight ended) durcert due to resolution of travelling standard (fight ended) durcert due to resolution of travelling standard (fight ended) durcert due to resolution of travelling standard (fight ended) durcert due to resolution of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard fight ended of durcert and to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (fight ended) durcert due to non-inearity of travelling standard (f														
d uncert due to long-term drift of travelling standard [if needed] uncert due to non-linearity of travelling standard [if needed] uncert due to non-linearity of travelling standard [if needed] uncert due to non-linearity of travelling standard [if needed] uncertainties in quadrature 0.01556d 0.01566d 0.01566														
d uncert due to real-ulation of travelling standard [if needed] warrance between applied and measured values of dew/frost-point temperature [if needed] mibination of these standard uncertainties in quadrature factive degrees of freedom of uncertainty estimates: most cases the effective number of degrees of freedom will be large. most cases the effective number of degrees of freedom will be large. most cases the effective number of degrees of freedom will be large. most cases the effective number of degrees of freedom will be large. most cases the effective number of degrees of freedom will be large. most cases the effective number of degrees of freedom will be large. most cases the effective number of degrees of freedom will be large. most cases the effective number of degrees of freedom will be large. most cases the effective number of degrees of freedom will be large. most cases the effective number of degree of freedom will be large. most cases the effective number of degree of freedom will be large. most cases the effective number of degree of freedom will be large. most cases the effective number of degree of freedom will be large. most cases the effective number of degree of freedom will be large. per A standard uncertainty of mean dew-point temperature difference for the instrument and and uncertainty of mean dew-point temperature difference for the instrument each participant is units one spreadohest asummary per nominal dew-point measured in the comparison; labeled "data TC", where "should be replaced by the normal will be replaced by an in "C" in ohm in "C" i							ments of trav	elling stand	ard (type A)	0.0016	0.0025	0.0040	0.0016	
d uncert due to non-linearity of travelling standard [if needed] worklance between applied and measured values of dewitos-point temperature [if needed] worklance between applied and measured values of dewitos-point temperature [if needed] worklance of the provided of the provided in the provided of						ed]								
miniation of these standard uncertainties in quadrature Continued to the standard uncertainties of development with the large.														
mobination of these standard uncertainties in quadrature lective degrees of freedom of uncertainty estimates lead of 4 dew-point temperature differences ger A standard uncertainty due to reproducibility of difference results lead of 4 dew-point temperature differences on same instrumenty lead of 4 dew-point temperature difference for the instrument lead of 4 dew-point develor of 4 selects on same instrumenty lead of 4 dew-point develor of 4 selects on same instrumenty lead of 4 dew-point develor of 4 selects on same instrumenty lead of 4 dew-point develor of 4 selects on same instrumenty lead of 4 develor of 4 selects on same instrumenty lead of 4 develor of 4 selects on same instrumenty lead of 4 develor of 4 selects on same instrumenty lead of 4 develor of 4 selects on same instrumenty lead of 4 develor of 4 selects of 4 selects on same instrumenty lead of 4 develor of 4 selects of 4 sel													\blacksquare	
tective degrees of freedom of uncertainty estimates: most cases the effective number of degrees of freedom will be large. ggregation of results and of 4 dew-point temperature differences per A sandard uncertainty due to reproducibility of difference results enclosed deskinot of values or same instrument) andard uncertainty of mean dew-point temperature difference for the Instrument D.0155 EPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8 Nominal value: BO C Lab name INTA2 Lab name INTA2 Lab name INTA2 Lab name INTA2 Both of the Comparison, labeled data In Country Instrument of the comparison, labeled data In Country Instrument of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison	ovariance	e petween a	ppiled and m	ieasured	values of dew/fros	st-point temp	perature [if ne	eaeaj					ш	
tective degrees of freedom of uncertainty estimates: most cases the effective number of degrees of freedom will be large. ggregation of results and of 4 dew-point temperature differences per A sandard uncertainty due to reproducibility of difference results enclosed deskinot of values or same instrument) andard uncertainty of mean dew-point temperature difference for the Instrument D.0155 EPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8 Nominal value: BO C Lab name INTA2 Lab name INTA2 Lab name INTA2 Lab name INTA2 Both of the Comparison, labeled data In Country Instrument of the comparison, labeled data In Country Instrument of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison, labeled data Inc., where "I should be replaced by the nominal of the comparison			4a m.d1							0.04550	0.04500	0.04500-	0.045550	
most cases the effective number of degrees of freedom will be large, significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background gregorial or the standard uncertainty of the calculation. NOTE: only fill in fields with green background gregorial or the calculation. NOTE: only fill in fields with green background gregorial or the calculation. NOTE: only fill in fields with green background gregorial or the calculation. NOTE: only fill in fields with green background green and a standard uncertainty of mean dew-point temperature difference for the Instrument and and uncertainty of mean dew-point interpretation of the standard uncertainty of mean dew-point interpretation of the standard uncertainty of mean dew-point interpretation of the standard uncertainty of the comparison; labeled death of a visual or the comparison; labeled death or the comparison of the comparison; labeled death or the comparison; label	ompinati	on of these s	tangard unce	ertainties	in quadrature					0.015564	U.U15682	U.U15987	0.015572	
most cases the effective number of degrees of freedom will be large, significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background gregorial or the standard uncertainty of the calculation. NOTE: only fill in fields with green background gregorial or the calculation. NOTE: only fill in fields with green background gregorial or the calculation. NOTE: only fill in fields with green background gregorial or the calculation. NOTE: only fill in fields with green background green and a standard uncertainty of mean dew-point temperature difference for the Instrument and and uncertainty of mean dew-point interpretation of the standard uncertainty of mean dew-point interpretation of the standard uncertainty of mean dew-point interpretation of the standard uncertainty of the comparison; labeled death of a visual or the comparison; labeled death or the comparison of the comparison; labeled death or the comparison; label	foother-	0000000011	odom of	orte!= ···	natimata a		0.5							
ggregation of results and of 4 dew-point temperature differences pe A standard uncertainty due to reproducibility of difference results pe A standard uncertainty due to reproducibility of difference results 0.0015 EPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8 Sech participant submits one spreadsheet summary per nominal dew-point measured in the comparison, labeled "data t"C", where "t" should be replaced by the nominal of the comparison of the second of the se		-				•	85				-			
ggregation of results and of 4 dew-point temperature differences pe A standard uncertainty due to reproducibility of difference results control of dewich of 4 standard deviation of 4 subset on same instrument) andard uncertainty of mean dew-point temperature difference for the instrument Control of the comparison, labeled data of 4 dew-point submits one spreadsheet summary per nominal dew-point measured in the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of current of the comparison, labeled data in C., where 1' should be replaced by the nominal of the comparison, labeled data in C., where 1' should be replaced by the nominal of the comparison, labeled data in C., where 1' should be replaced by the nominal of the comparison of the comparison of the comparison of the comparison of the current of the comparison of the comparison of the current of the c										NOTE: onl	v fill in fiel	lds with are	en hackgro	und
and of 4 dew-point temperature differences pp A standard uncertainty due to reproducibility of difference results pp A standard uncertainty of the temperature difference for the instrument 0.0155	o.granicai li	, Jirian, 1166	o be idkell l	accol	unougnout trie Ci	arounditori.				IL. UIII	, ne	with gre	.c.i backyi0	unu
and of 4 dew-point temperature differences pp A standard uncertainty due to reproducibility of difference results pp A standard uncertainty of the temperature difference for the instrument 0.0155														
and of 4 dew-point temperature differences pp A standard uncertainty due to reproducibility of difference results pp A standard uncertainty of the temperature difference for the instrument 0.0155	aareaa	tion of res	ults											
pe A standard uncertainty due to reproducibility of difference results eined from standard desistion of 4 subsets on same instrument) Doubte D	33 - 3													
pe A standard uncertainty due to reproducibility of difference results eined from standard desistion of 4 subsets on same instrument) Doubte D														
pe A standard uncertainty due to reproducibility of difference results eined from standard desistion of 4 subsets on same instrument) Doubte D	ean of 4	dew-point te	mperature di	ifference	s					-0.143				
ented from standard deviation of 4 values on same instrument) andard uncertainty of mean dew-point temperature difference for the instrument D.0156 C Lab name INTA2 ROBERT:	ype A sta	ndard uncer	tainty due to	reproduc	cibility of difference	e results				0.0015				
andard uncertainty of mean dew-point temperature difference for the instrument EPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8 Nominal value: 50	 		-											
EPORTING TEMPLATE FOR DEW-POINT IN CCTG-K8 Nominal value: 50 °C Lab name INTA2 ROBERT: Type serial number: (08-1215 or 08-1216) Phygrometer Applied Resistance (meas do labeled of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison, labeled of data "C", where "t" should be replaced by the nominal of the comparison			wiation of 4 val	lues on saul	ame instrument)									
type serial number: 08:1215 or 08-1216 Applied Resistance developint output in "C i	andard u	incertainty o	f mean dew-	point tem	nperature differen		strument		Nominal value:		00	Labrana	INITAO	
type serial number: 08:1215 or 08-1216 Applied Resistance developint output in "C i	tandard (Incertainty o	f mean dew- LATE FOR	point ten	POINT IN CCTG	-K8		the comparis		50				inal o
Phygrometer 08-1215	tandard u	ING TEMP	f mean dew- LATE FOR	point ten	POINT IN CCTG	-K8		the comparis		50				inal o
Applied Resistance dew-point in "C in ohrm in "C	REPORT	ING TEMP	f mean dew- LATE FOR	point ten	POINT IN CCTG	-K8		the comparis		50				inal c
Applied Resistance dew-point in 'C' in o'm in 'C' in 'C' in 'C' applied dp) in 'C' in	REPORT each part	ING TEMP	f mean dew- LATE FOR	point ten	POINT IN CCTG mmary per nomin ROBERT: Type serial number:	-K8 al dew-poin		the comparis		50				inal c
Applied Resistance dew-point in 'C' in o'm in 'C' in 'C' in 'C' applied dp) in 'C' in	REPORT each part ut cursor	ING TEMP	f mean dew- LATE FOR	point ten	POINT IN CCTG mmary per nomin ROBERT: Type serial number:	-K8 al dew-poin		the comparis		50				inal c
dew-point in °C in	tandard (TING TEMP	f mean dew- LATE FOR ts one spread for notes	point ten	POINT IN CCTG mmary per nomin ROBERT: Type serial number:	-K8 al dew-poin		the comparis		50				inal c
in °C in ohm in °C	REPORT each part	TING TEMP	f mean dew- LATE FOR ts one spread for notes	point ten	POINT IN CCTG Immary per nomin ROBERT: Type serial number: 08-1216 or 08-1216	-K8 al dew-poin		the comparis		50				inal c
eas 1 49.983 119.3422 49.857 -0.126 eas 2 49.979 119.3405 49.853 -0.126 eas 3 49.981 119.3405 49.858 -0.125 eas 4 49.986 119.3425 49.858 -0.127 ncertainties (in °C) Hygrometer Meas 1 Meas 2 Meas 3 Meas 4 andard uncertainty of applied condition du concert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) du uncert due to long-term drift of travelling standard [if needed] du uncert due to non-linearity of travelling standard [if needed] du uncert due to non-linearity of travelling standard [if needed] du uncert due to non-linearity of travelling standard [if needed] ed uncert due to non-linearity of travelling standard [if needed] for a control of these standard uncertainties in quadrature ombination of these standard uncertainty estimates: great of 4 dew-point temperature differences great of 4 dew-point tem	REPORT each part	ING TEMP icipant submi here	LATE FOR sone spread for notes	point ten	POINT IN CCTG Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216	-K8 al dew-poin		the comparis		50				inal c
eas 2 49.979 119.3405 49.853 -0.126 eas 3 49.981 119.3417 49.856 -0.125 eas 4 49.986 119.3425 49.858 -0.127 Hygrometer	REPORT each part ut cursor	TING TEMP icipant submi here Hygrometer Applied	LATE FOR ts one spread for notes 08-1215 Resistance	point terr	POINT IN CCTG Immary per nomin ROBERT: Type seral number: 08-1215 or 08-1216 Difference (meas dp -	-K8 al dew-poin		the comparis		50				inal c
eas 3	REPORT each part	ING TEMP icipant submi here Hygrometer Applied dew-point	LATE FOR Sone spread for notes 08-1215 Resistance output in ohm	DEW-F	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp)	-K8 al dew-poin		the comparis		50				inal c
ncertainties (in °C) Hygrometer 08-1215 Meas 1 Meas 2 Meas 3 Meas 4 0.0169 0.0169 0.0169 0.0169 0.0069 0.0018 0.0034 0.0025 0.0027 d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] povariance between applied and measured values of dew/frost-point temperature [if needed] pombination of these standard uncertainties in quadrature most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results -0.126 -0.126 -0.0011 envel dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results envel of the way of the standard deviation of 4 values on same instrument)	REPORT each part ut cursor Results	TING TEMP icipant submi here Hygrometer Applied dew-point in °C 49.983	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422	Output in °C	POINT IN CCTG Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126	-K8 al dew-poin		the comparis		50				tinal c
ncertainties (in °C) Hygrometer 08-1215 Meas 1 Meas 2 Meas 3 Meas 4 0.0169 0.0169 0.0169 0.0169 0.0069 0.0018 0.0034 0.0025 0.0027 d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] povariance between applied and measured values of dew/frost-point temperature [if needed] pombination of these standard uncertainties in quadrature most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results -0.126 -0.126 -0.0011 envel dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results envel of the way of the standard deviation of 4 values on same instrument)	REPORT each part ut cursor Results	TING TEMP icipant submi here Hygrometer Applied dew-point in °C 49.983	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422	Output in °C	POINT IN CCTG Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126	-K8 al dew-poin		the comparis		50				inal c
meas 1 Meas 2 Meas 3 Meas 4 andard uncertainty of applied condition d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to long-term difference [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed]	eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 49.981	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417	Output in °C 49.857 49.853	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.126 -0.125	-K8 al dew-poin		the comparis		50				iinal c
meas 1 Meas 2 Meas 3 Meas 4 andard uncertainty of applied condition d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to long-term difference [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed]	EPORT each part ut cursor esults eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 49.981	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417	Output in °C 49.857 49.853	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.126 -0.125	-K8 al dew-poin		the comparis		50				iinal c
meas 1 Meas 2 Meas 3 Meas 4 andard uncertainty of applied condition d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to long-term difference [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed]	EPORT each part ut cursor esults eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 49.981	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417	Output in °C 49.857 49.853	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.126 -0.125	-K8 al dew-poin		the comparis		50				iinal c
meas 1 Meas 2 Meas 3 Meas 4 andard uncertainty of applied condition d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to long-term difference [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed]	EPORT each part ut cursor esults eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 49.981	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417	Output in °C 49.857 49.853	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.126 -0.125	-K8 al dew-poin		the comparis		50				inal c
andard uncertainty of applied condition d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] downtraince between applied and measured values of dew/frost-point temperature [if needed] combination of these standard uncertainties in quadrature 0.017041 0.017288 0.017126 0.017157 fective degrees of freedom of uncertainty estimates: 92 most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results ean of 4 dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results enveloped from standard deviation of 4 values on same instrument)	REPORT each part ut cursor Results	Hygrometer Applied dew-point in °C 49.983 49.981	f mean dew- LATE FOR S one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417	Output in °C 49.857 49.853	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.126 -0.125	-K8 al dew-poin		the comparis		50 a t°C", when	e "t" should	be replaced		inal (
d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to resolutes 92 most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results 92 pe A standard uncertainty due to reproducibility of difference results 90 0.017041 0.017288 0.017126 0.017126 0.017127 0.017128 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017127 0.017127 0.017128 0.017126 0.	eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 49.983 49.981	f mean dew- LATE FOR S one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417	Output in °C 49.857 49.853	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.126 -0.125	-K8 al dew-poin		the comparis		50 a t°C", when	e "t" should	be replaced		inal c
d uncert due to short-term stability (from standard deviation) of measurements of travelling standard (type A) d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] d uncert due to resolutes 92 most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results 92 pe A standard uncertainty due to reproducibility of difference results 90 0.017041 0.017288 0.017126 0.017126 0.017127 0.017128 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017126 0.017127 0.017127 0.017128 0.017126 0.	REPORT each part ut cursor Results	Hygrometer Applied dew-point in °C 49.983 49.981	f mean dew- LATE FOR S one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417	Output in °C 49.857 49.853	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.126 -0.125	-K8 al dew-poin		the comparis		50 a t°C", when	e "t" should	d be replaced to the replaced	d by the nom	inal c
d uncert due to long-term drift of travelling standard [if needed] d uncert due to resolution of travelling standard [if needed] d uncert due to non-linearity of travelling standard [if needed] ovariance between applied and measured values of dew/frost-point temperature [if needed] ombination of these standard uncertainties in quadrature 0.017041 0.017288 0.017126 0.017157	REPORT each part ut cursor results leas 1 leas 2 leas 3 leas 4	Hygrometer Applied dew-point in °C 49.983 49.979 49.986	Mean dew- LATE FOR Is one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425	Output in °C 49.85549.8556	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.126 -0.125	-K8 al dew-poin		the comparis		50 a t°C", when	e "t" should	08-1215 Meas 3	by the nom	inal c
d uncert due to non-linearity of travelling standard [if needed] povariance between applied and measured values of dew/frost-point temperature [if needed] pombination of these standard uncertainties in quadrature 0.017041 0.017288 0.017126 0.017157	EPORT each part ut cursor eesults eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 uncertainty o	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425	Output in °C 49.855 49.856	Difference (meas dp - applied dp) in °C 7 -0.126 -0.125 -0.127	-K8 al dew-poin	t measured in		son; labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0169	e "t" should	08-1215 Meas 3 0.0169	Meas 4	inal c
provided from standard deviation of 4 values on same instrument) Output Output	REPORT each part ut cursor Results leas 1 leas 2 leas 3 leas 4	Hygrometer Applied dew-point in °C 49.981 49.986	f mean dew- LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425	Output in °C 49.856 49.856	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 3 -0.126 3 -0.125 3 -0.127	-K8 al dew-poin	t measured in		son; labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0169	e "t" should	08-1215 Meas 3 0.0169	Meas 4	ninal c
pombination of these standard uncertainties in quadrature 0.017041 0.017288 0.017126 0.017157	REPORT each part ut cursor results leas 1 leas 2 leas 3 leas 4 lincertai tandard utd uncert tid uncert tid uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 nties (in °C uncertainty of due to short due to long-due to resol due to resol	Mean dew- LATE FOR Sone spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425	Output in °C 49.855 49.856 49.856 output in °C 19.856 and ition stravelling elling star	Difference (meas dp - applied dp) in °C 7 - 0.126 3 -0.127	K8 al dew-poin of measure	t measured in		son; labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0169	e "t" should	08-1215 Meas 3 0.0169	Meas 4	tinal c
fective degrees of freedom of uncertainty estimates: most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results ean of 4 dew-point temperature differences rpe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 Incertai tandard tat uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C uncertainty of due to short due to long-due to resol due to non-l	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 f applied corterm stability term drift of trution of trave inearity of tra	Output in °C 49.855 49.856 49.856 andition y (from stravelling state)	Difference (meas dp - applied dp) in °C 7 -0.126 3 -0.127	K8 al dew-poin of measurer ed j	ments of trav	elling stand	son; labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0169	e "t" should	08-1215 Meas 3 0.0169	Meas 4	tinal c
fective degrees of freedom of uncertainty estimates: most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results ean of 4 dew-point temperature differences rpe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	EPORT each part ut cursor esults eas 1 eas 2 eas 3 eas 4 Incertai duncert du uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C uncertainty of due to short due to long-due to resol due to non-l	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 f applied corterm stability term drift of trution of trave inearity of tra	Output in °C 49.855 49.856 49.856 andition y (from stravelling state)	Difference (meas dp - applied dp) in °C 7 -0.126 3 -0.127	K8 al dew-poin of measurer ed j	ments of trav	elling stand	son; labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0169	e "t" should	08-1215 Meas 3 0.0169	Meas 4	tinal c
most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results ean of 4 dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 Incertai tandard tand	Hygrometer Applied dew-point in °C 49.983 49.976 49.986 Inties (in °C due to short due to long-due to resol due to non-le between a	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 f applied corterm stability term drift of ution of trave inearity of trapplied and model.	Output in °C 49.857 49.855 49.856 49.858 indition y (from statravelling statavelling statavellin	Difference (meas dp - applied dp) in °C 7 - 0.126 3 -0.127 4 andard [if needed] standard [if needed] standard [if needed] standard [if needed] values of dew/froe	K8 al dew-poin of measurer ed j	ments of trav	elling stand	son; labeled "dat	50 a t°C", when Hygromet Meas 1 0.0169 0.0018	e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	tinal c
most cases the effective number of degrees of freedom will be large. significantly small, need to be taken into account throughout the calculation. NOTE: only fill in fields with green background ggregation of results ean of 4 dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 Incertai tandard tand	Hygrometer Applied dew-point in °C 49.983 49.976 49.986 Inties (in °C due to short due to long-due to resol due to non-le between a	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 f applied corterm stability term drift of ution of trave inearity of trapplied and model.	Output in °C 49.857 49.855 49.856 49.858 indition y (from statravelling statavelling statavellin	Difference (meas dp - applied dp) in °C 7 - 0.126 3 -0.127 4 andard [if needed] standard [if needed] standard [if needed] standard [if needed] values of dew/froe	K8 al dew-poin of measurer ed j	ments of trav	elling stand	son; labeled "dat	50 a t°C", when Hygromet Meas 1 0.0169 0.0018	e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	inal c
ggregation of results ean of 4 dew-point temperature differences pe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	REPORT each part ut cursor Results leas 1 leas 2 leas 3 leas 4 lincertai tandard ut tid uncert	Hygrometer Applied dew-point in °C 49.986 Applied 49.986 Applied to son-due to long-due to resol due to non-de between a	f mean dew- LATE FOR Is one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425	Output in °C 49.852 49.855 49.855 49.856 adition by (from statravelling statavelling statavellin	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 3 -0.126 3 -0.125 3 -0.127 andard deviation) g standard [if needed] standard [if needed] standard [if needed] standard [if needed]	K8 al dew-poin of measurer ed j	ments of trav	elling stand	son; labeled "dat	50 a t°C", when Hygromet Meas 1 0.0169 0.0018	e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	inal c
ggregation of results ean of 4 dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 Incertai tandard u td uncert tovarianac ombinati	Hygrometer Applied dew-point in °C 49.981 49.981 49.986 Inties (in °C uncertainty of due to short due to long-due to resol due to non-de between a on of these segrees of free	f mean dew- LATE FOR Is one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 If applied core term stability term drift of fution of trave inearity of trapplied and mandard unce edom of unceedom	Output in °C 49.856 49.856 49.856 elling staravelling sta	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp- applied dp) in °C -0.126 3 -0.126 3 -0.125 3 -0.127 anndard deviation) g standard [if needed ndard [if needed values of dew/fro: i. in quadrature	of measure ed]	ments of trav	elling stand	son; labeled "dat	50 a t°C", when Hygromet Meas 1 0.0169 0.0018	e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	inal c
ean of 4 dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	EEPORT each part ut cursor eesults leas 1 leas 2 leas 3 leas 4 lincertai tuncert tid uncert tid unc	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C due to short due to short due to short due to non-de between a con of these segrees of frees the effectives the effectives the effectives and the conditional control of the segrees of the effectives the effective t	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 or term stability term drift of oution of trave inearity of trave polied and mean dandard unce the number of deep n	Output in °C 49.857 49.855 49.856 49.856 indition by (from stravelling staravelling starave	Difference (meas dp - applied dp in °C 7 - 0.126 3 -0.127 4 -0.127	K8 al dew-poin of measurer ed] d1 st-point temp	ments of trav	elling stand	son; labeled "dat	50 a t°C", when Hygromete Meas 1 0.0169 0.0018	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	
ean of 4 dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 Incertai tandard tand	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C due to short due to short due to short due to non-de between a con of these segrees of frees the effectives the effectives the effectives and the conditional control of the segrees of the effectives the effective t	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 or term stability term drift of oution of trave inearity of trave polied and mean dandard unce the number of deep n	Output in °C 49.857 49.855 49.856 49.856 indition by (from stravelling staravelling starave	Difference (meas dp - applied dp in °C 7 - 0.126 3 -0.127 4 -0.127	K8 al dew-poin of measurer ed] d1 st-point temp	ments of trav	elling stand	son; labeled "dat	Hygromet Meas 1 0.0169 0.0017041	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	
ean of 4 dew-point temperature differences ppe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 Incertai tandard tand	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C due to short due to short due to short due to non-de between a con of these segrees of frees the effectives the effectives the effectives and the conditional control of the segrees of the effectives the effective t	f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 or term stability term drift of oution of trave inearity of trave polied and mean dandard unce the number of deep n	Output in °C 49.857 49.855 49.856 49.856 indition by (from stravelling staravelling starave	Difference (meas dp - applied dp in °C 7 - 0.126 3 -0.127 4 -0.127	K8 al dew-poin of measurer ed] d1 st-point temp	ments of trav	elling stand	son; labeled "dat	Hygromet Meas 1 0.0169 0.0017041	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	
re A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 Incertai tandard tand	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C due to short due to long-due to resol due to non-le between a le between a le between a le segrees of frees the effectity small, need	f mean dew- ILATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 In applied correterm stability term drift of ution of trave inearity of travelinearity of tr	Output in °C 49.857 49.855 49.856 49.856 indition by (from stravelling staravelling starave	Difference (meas dp - applied dp in °C 7 - 0.126 3 -0.127 4 -0.127	K8 al dew-poin of measurer ed] d1 st-point temp	ments of trav	elling stand	son; labeled "dat	Hygromet Meas 1 0.0169 0.0017041	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	
pe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 Incertai duncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C due to short due to long-due to resol due to non-le between a le between a le between a le segrees of frees the effectity small, need	f mean dew- ILATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 In applied correterm stability term drift of ution of trave inearity of travelinearity of tr	Output in °C 49.857 49.855 49.856 49.856 indition by (from stravelling staravelling starave	Difference (meas dp - applied dp in °C 7 - 0.126 3 -0.127 4 -0.127	K8 al dew-poin of measurer ed] d1 st-point temp	ments of trav	elling stand	son; labeled "dat	Hygromet Meas 1 0.0169 0.0017041	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	
pe A standard uncertainty due to reproducibility of difference results erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 ncertai andard u duncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C due to short due to long-due to resol due to non-le between a le between a le between a le segrees of frees the effectity small, need	f mean dew- ILATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 In applied correterm stability term drift of ution of trave inearity of travelinearity of tr	Output in °C 49.857 49.855 49.856 49.856 indition by (from stravelling staravelling starave	Difference (meas dp - applied dp in °C 7 - 0.126 3 -0.127 4 -0.127	K8 al dew-poin of measurer ed] d1 st-point temp	ments of trav	elling stand	son; labeled "dat	Hygromet Meas 1 0.0169 0.0017041	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	
erived from standard deviation of 4 values on same instrument)	eas 1 eas 2 eas 3 eas 4 ncertai andard t d uncert guriance ombinati fective d most cas significant	Hygrometer Applied dew-point in °C 49.983 49.986 A9.986	f mean dew- LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 of applied correterm stability term drift of fution of trave inearity of trav	Output in °C 49.857 49.855 49.856 49.856 ertainties ertainties	Difference (meas dp - applied dp) in °C - 0.126 - 0.125 - 0.127 - 0.12	K8 al dew-poin of measurer ed] d1 st-point temp	ments of trav	elling stand	son; labeled "dat	Hygromet Meas 1 0.0169 0.0017041	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	
	EPORT each part to cursor esults eas 1 eas 2 eas 3 eas 4 ncertai andard to duncert duncert duncert duncert duncert duncert duncert guncert g	Hygrometer Applied dew-point in °C 49.983 49.979 49.986 Inties (in °C 49.986 Applied dew-point of the second due to hondure to long due to nondure to hondure to ho	f mean dew- ILATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 In applied correcterm stability term drift of in ution of trave inearity of tra poplied and m tandard unce edom of unce e number of d to be taken i	Output in °C 49.857 49.855 49.856 49.856 into account in account i	Difference (meas dp - applied dp) in °C 7 - 0.126 3 - 0.127 4 - 0.	K8 al dew-poin of measure: ed] d] st-point temp	ments of trav	elling stand	son; labeled "dat	Hygromete Meas 1 0.0169 0.0017041	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	
andard uncertainty of mean dew-point temperature difference for the instrument 0.0171	EPORT each part to cursor esuits ass 2 eass 3 eass 4 andard to duncert douncert do	Hygrometer Applied dew-point in °C 49.986 Applied 49.979 49.981 49.986 Inties (in °C uncertainty of due to short due to long-due to monde between a on of these segrees of frees the effectity small, need dew-point tendard uncer and and uncertainty of the segrees of frees the effectity small, need the formal of the segrees of frees the effectity small of the segrees of frees the effective the segrees of frees t	f mean dew- LATE FOR Is one spread for notes 08-1215 Resistance output in ohm 119.3422 119.3405 119.3417 119.3425 in ohm tandard unce output in of trave in a control of trave in a control of the control of	Output in °C 49.855 49.855 49.856 49.856 interactions are all in general interactions are all in general interactions are all inte	POINT IN CCTG mmary per nomin ROBERT: Type serial number: (08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.126 -0.126 -0.125 -0.127 andard deviation) g standard [if needed]	K8 al dew-poin of measure: ed] d] st-point temp	ments of trav	elling stand	son; labeled "dat	Hygromete Meas 1 0.0169 0.0017041	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0169 0.0025	Meas 4 0.0169 0.0027	

				POINT IN CCTG-I				Nominal value:	65	°C	Lab name		
- each part	icipant submi	s one spread	isheet su	ımmary per nomina	I dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nom	ninal dev
out cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1215											
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C										
Meas 1	64.992	125.1125	64.876	-0.116									
Meas 2	65.020	125.1212	64.899	-0.121									
Meas 3	64.999	125.1129	64.877	7 -0.122									
Meas 4	65.007	125.1152	64.883	3 -0.124									
Uncertai	nties (in °C	:)							Hygromete	r	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ι	incertainty o	f applied cor	dition						0.0180	0.0180	0.0180	0.0180	
Std uncert	due to short	term stabilit	y (from s	tandard deviation) d	of measuren	nents of trave	elling stand	lard (type A)	0.0142	0.0008	0.0006	0.0007	
Std uncert	due to long-	term drift of	travelling	g standard [if neede	ed]								
Std uncert	due to resol	ution of trave	lling sta	ndard [if needed]									
Std uncert	due to non-l	inearity of tra	evelling	standard [if needed]								
Covariance	e between a	pplied and m	easured	values of dew/frost	t-point temp	erature [if ne	eded]						
Combinati	on of these s	tandard unce	ertainties	in quadrature					0.022963	0.018026	0.018019	0.018023	
Effective d	egrees of fre	edom of unc	ertainty	estimates:		90							
In most cas	es the effective	e number of d	legrees of	freedom will be large).								
If significant	tly small, nee	d to be taken i	nto accou	unt throughout the cal	lculation.				NOTE: onl	y fill in fiel	ds with gre	een backgro	ound
Aggrega	tion of res	ults											
	dew-point te	mperature di	ifference	s					-0.121				
Mean of 4		•		cibility of difference	rogulte				0.0032				
	ndard uncer	unity due to			results								
Type A sta				ame instrument)	results								

REPORT	ING TEMP	LATE FOR	DEW-I	POINT IN CCTG-K	8			Nominal value:	80	°C	Lab name	INTA2	
- each parti	icipant submi	ts one spread	lsheet su	ummary per nominal	dew-poin	t measured in	the compari	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nom	inal d
Put cursor	here	for notes		ROBERT:									
ut cuisoi	Here	ioi riotes		Type serial number:									
Results				08-1215 or 08-1216									
			/										
	Hygrometer	08-1215											
	Amelical	Desistance		Difference									
	Applied	Resistance	0	(meas dp -									
	dew-point in °C	output in ohm	Outpu in °C										
Meas 1	80.007	130.8558	79.89										
Meas 2	79.997	130.8529	79.88										
Meas 3	79.993	130.8511	79.88										
Meas 4	79.975	130.8441	79.86										
Uncertaiı	nties (in °C	;)							Hygromete	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	incertainty o	f applied con	dition						0.0193	0.0193	0.0193	0.0193	
Std uncert	due to short	-term stability	(from s	tandard deviation) of	measure	ments of trav	elling stand	dard (type A)	0.0017	0.0062	0.0015	0.0016	
Std uncert	due to long-	term drift of t	ravellin	g standard [if needed]								
Std uncert	due to resol	ution of trave	lling sta	indard [if needed]									
		-		standard [if needed]									
Covariance	e between a	pplied and m	easured	I values of dew/frost-p	oint temp	erature [if ne	eded]						
Combinatio	on of these s	tandard unce	rtaintie	s in quadrature					0.019368	0.020271	0.019357	0.019362	
Effective de	egrees of fre	edom of unce	ertainty	estimates:		87							
n most cas	es the effecti	ve number of de	egrees o	f freedom will be large.									
lf significant	ly small, nee	d to be taken in	nto acco	unt throughout the calc	ulation.				NOTE: onl	y fill in fiel	ds with gre	en backgro	und
_													
Aggregat	tion of res	ults											
	-	mperature di							-0.113				
• •		•	_	cibility of difference r	esults				0.0010				
				ame instrument)									
Standard u	incertainty o	r mean dew-p	ooint ter	nperature difference	tor the ins	strument			0.0194				

REPORT	ING TEMP	LATE FOR	DEW-F	POINT IN CCTG-K8			Nominal value:	85	°C	Lab name	INTA2	
each parti	cipant submi	ts one spread	Isheet su	mmary per nominal de	w-point measured in	the comparis	son; labeled "dat	a t°C", whei	e "t" should	be replace	d by the nor	minal de
Put cursor	here	for notes		ROBERT: Type serial number:								
Results				08-1215 or 08-1216								
	Hygrometer	08-1215										
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C	Difference (meas dp - applied dp) in °C								
Meas 1	84.951	132.7431	84.842	-0.109								
Meas 2	84.913	132.7282	84.803	3 -0.110								
Meas 3	84.928	132.7344	84.819	-0.109								
Meas 4	84.934	132.7367	84.825	-0.109								
Uncertair	nties (in °C	;)						Hygromet	er	08-1215		
								Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	ncertainty o	f applied con	dition					0.0207	0.0207	0.0207	0.0207	
Std uncert	due to short	-term stability	(from s	andard deviation) of m	easurements of trav	elling stand	lard (type A)	0.0018	0.0032	0.0026	0.0017	
				standard [if needed]								
				ndard [if needed]								
				standard [if needed]								
Covariance	between a	pplied and m	easured	values of dew/frost-po	nt temperature [if n	eeded]						<u>. </u>
Combinatio	on of these s	tandard unce	rtainties	in quadrature				0.02078	0.020954	0.020872	0.020776	
Effective d	arreas of fre	edom of unc	ortainty :	actimates	99	1						
				freedom will be large.	99	-						
				int throughout the calcula	tion.			NOTE: onl	y fill in fiel	ds with gre	en backgr	ound
Aggregat	tion of res	ults										
Mean of 4	dew-noint te	mperature di	fference	9				-0.109				
	•	•		cibility of difference re	sults			0.0004				
			_	ame instrument)								
`				perature difference fo	r the instrument			0.0208				

REPORT	ING TEMP	LATE FOR	DEW-F	POINT IN CCTG-K	8			Nominal value:	90	°C	Lab name	INTA2	
- each part	icipant submi	ts one spread	isheet su	ımmary per nominal	dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nomi	nal d
Put cursor	h	f		ROBERT:									
out cursor	here	for notes	-/	Type serial number:									
Results				08-1215 or 08-1216									
Nesulis													
	Hygrometer	08-1215											
				Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Outpu										
	in °C	in ohm	in °C										
Meas 1	89.966	134.6534	89.859										
Meas 2	89.951	134.6478	89.84										
Meas 3	89.967	134.6539	89.86										
Meas 4	89.973	134.6568	89.86	8 -0.105									
Uncertail	nties (in °C	.)							Hygromete		08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ι	incertainty o	of applied con	dition						0.0200	0.0200	0.0200	0.0200	
Std uncert	due to short	term stability	y (from s	tandard deviation) of	measuren	nents of trave	elling stand	lard (type A)	0.0050	0.0022	0.0021	0.0032	
Std uncert	due to long-	term drift of t	travelling	g standard [if needed]								
Std uncert	due to resol	ution of trave	lling sta	ndard [if needed]									
				standard [if needed]									
Covariance	e between a	pplied and m	easured	values of dew/frost-	point temp	erature [if ne	eded]						
Combinatio	on of these s	tandard unce	rtainties	s in quadrature					0.020577	0.020082	0.020069	0.02021	
Jonibinati	on or these t	auridura direc	, turring	3 III quadrature					0.020077	0.020002	0.020003	0.02021	
Effective d	egrees of fre	edom of unc	ertainty	estimates:		105							
n most cas	es the effecti	ve number of d	legrees of	f freedom will be large.									
f significant	ly small, nee	d to be taken i	nto acco	unt throughout the calc	ulation.				NOTE: onl	y fill in fiel	ds with gre	en backgrou	und
Δαατρασ	tion of res	ulte											
ggi cga		uno											
Mean of 4	•	mperature di							-0.106				
	ndard uncer	tainty due to	reprodu	cibility of difference	results				0.0005				
Type A sta												1	
•	m standard de	eviation of 4 val	lues on s	ame instrument)					0.0206				

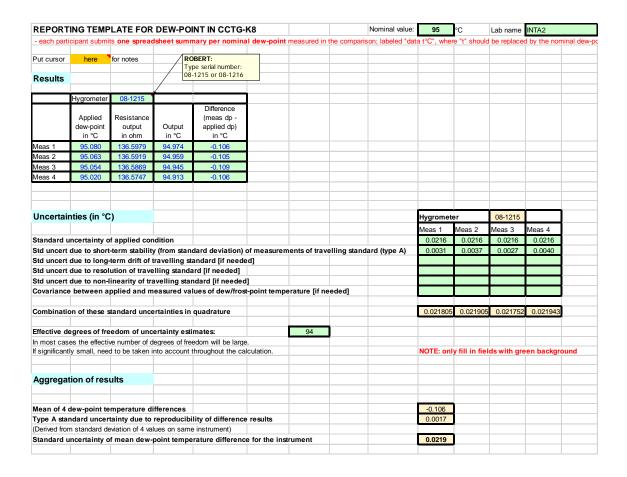
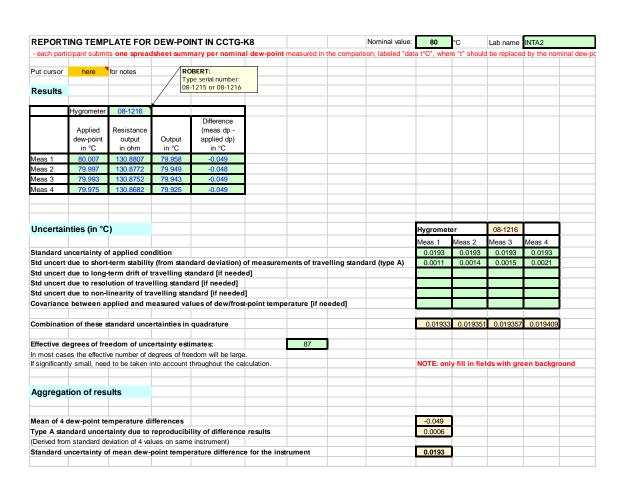


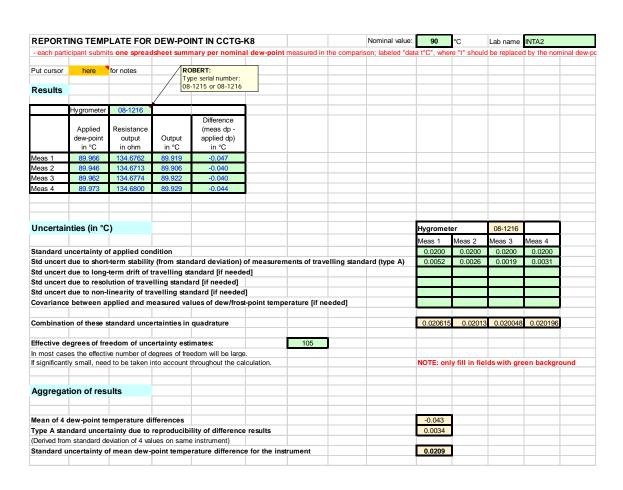
Fig. 12.6.e Results reported by INTA2 in Loop 2

			Automotive Communication		and a second		Oracle and the second	and the base of the state of	- 100"	and the second	Lab name	INTA2	
each part	icipant submit	s one spread	dsheet su	mmary per nomina	a dew-point	measured in	tne comparis	on; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	ninal d
t cursor	here	for notes	1	ROBERT:									
it cuisoi	Here	ioi riotes		Type serial number:									
esults				08-1215 or 08-1216									
			/										
	Hygrometer	08-1216											
				Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Output										
	in °C	in ohm	in °C	in °C									
eas 1	30.033	111.6495	29.940	_									
eas 2	29.978	111.6283	29.885										
eas 3	30.040	111.6526	29.948										
eas 4	30.032	111.6496	29.940	-0.092									
											_		
ncertai	nties (in °C)							Hygromete	er	08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
andard ι	ıncertainty o	f applied cor	ndition						0.0155	0.0155	0.0155	0.0155	
d uncert	due to short	term stabilit	y (from sta	andard deviation)	of measuren	nents of trav	elling standa	ard (type A)	0.0018	0.0021	0.0038	0.0016	
d uncert	due to long-	term drift of	travelling	standard [if neede	ed]								
				dard [if needed]									
td uncert	due to non-l	inearity of tra	avelling s	tandard [if needed	i]								
				values of dew/fros	-	erature [if ne	eded]						
					·								
ombinatio	on of these s	tandard unce	ertainties	in quadrature					0.015585	0.015623	0.015948	0.01557	
fective d	egrees of fre	edom of unc	ertainty e	stimates:		85							
				freedom will be large	Э.								
significant	ly small, need	d to be taken i	into accou	nt throughout the ca	lculation.				NOTE: onl	y fill in fie	lds with gre	en backgr	ound
ggrega	tion of resi	ults											
		mperature d							-0.093	l			
		-		ibility of difference	results				0.0004				
	m standard de	viation of 4 va	lues on sa	me instrument)									
EPORT	ING TEMP	LATE FOR	DEW-P	perature difference	К8			Nominal value:	0.0156 50	°C	Lab name		
EPORT	ING TEMP	LATE FOR	DEW-P		К8				50	-			ninal d
REPORT each part	ING TEMP	LATE FOR	DEW-P	OINT IN CCTG- mmary per nomina ROBERT:	К8				50	-			ninal d
REPORT each part	ING TEMP	LATE FOR	DEW-P	OINT IN CCTG- mmary per nomina ROBERT: Type serial number:	К8				50	-			ninal d
REPORT each parti ut cursor	ING TEMP	LATE FOR	DEW-P	OINT IN CCTG- mmary per nomina ROBERT:	К8				50	-			ninal d
REPORT each parti ut cursor	ING TEMP	LATE FOR	DEW-P	OINT IN CCTG- mmary per nomina ROBERT: Type serial number:	К8				50	-			ninal d
REPORT	ING TEMP	LATE FOR	DEW-P	OINT IN CCTG- mmary per nomin: ROBERT: Type serial number: 08-1215 or 08-1216	К8				50	-			ninal d
REPORT each parti ut cursor	ING TEMP icipant submit	LATE FOR sone spread for notes	DEW-P	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216	К8				50	-			ninal d
REPORT each parti ut cursor	TING TEMP icipant submit here Hygrometer Applied	LATE FOR ts one spread for notes 08-1216 Resistance	DEW-P	OINT IN CCTG- mmary per nomina ROBERT: Type serial number: 08-1215 or 08-1216	K8				50	-			ninal d
EPORT each parti	ING TEMP icipant submit here Hygrometer Applied dew-point	LATE FOR s one spread for notes 08-1216 Resistance output	DEW-Pdsheet sui	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp)	K8				50	-			ninal d
EPORT each parti ut cursor esults	here Hygrometer Applied dew-point in °C	LATE FOR s one spread for notes 08-1216 Resistance output in ohm	Output in °C	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C	K8				50	-			ninal d
REPORT each part ut cursor Results	Hygrometer Applied dew-point in °C 49.983	to notes Os-1216 Resistance output in ohm 119.3595	Output in °C	OINT IN CCTG- mmary per nomina ROBERT: 17 ype serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081	K8				50	-			ninal d
each partiut cursor esults eas 1 eas 2	Hygrometer Applied dew-point in °C 49.983 49.979	tate For some spread for notes 08-1216 Resistance output in ohm 119,3595 119,3580	Output in °C 49.902	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081	K8				50	-			ninal d
eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 49.93 49.979 49.981	LATE FOR s one spread for notes 08-1216 Resistance output in ohm 119.3595 119.3580 119.3592	Output in °C 49.902 49.898 49.902	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079	К8				50	-			ninal d
eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 49.983 49.979	tate For some spread for notes 08-1216 Resistance output in ohm 119,3595 119,3580	Output in °C 49.902	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079	К8				50	-			ninal d
EPORT each part ut cursor esults eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 49.93 49.979 49.981	LATE FOR s one spread for notes 08-1216 Resistance output in ohm 119.3595 119.3580 119.3592	Output in °C 49.902 49.898 49.902	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079	К8				50	-			ninal d
EPORT each part at cursor esults eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 49.93 49.979 49.981	LATE FOR s one spread for notes 08-1216 Resistance output in ohm 119.3595 119.3580 119.3592	Output in °C 49.902 49.898 49.902	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079	К8				50	-			ninal d
each partiut cursor esults eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 49.981 49.996	08-1216 Resistance output in ohm 119.3595 119.3590 119.3590 119.3606	Output in °C 49.902 49.898 49.902	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079	К8				50 a t°C", wher	e "t" should	be replace		ninal d
each partiut cursor esults eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 49.93 49.979 49.981	08-1216 Resistance output in ohm 119.3595 119.3590 119.3590 119.3606	Output in °C 49.902 49.898 49.902	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079	К8				50 a t°C", wher	e "t" should	08-1216	d by the nor	ninal d
each partiut cursor esults eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 49.981 49.996	08-1216 Resistance output in ohm 119.3595 119.3590 119.3590 119.3606	Output in °C 49.902 49.898 49.902	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079	К8				50 a t°C", where	e "t" should	08-1216 Meas 3	d by the nor	ninal d
each partiut cursor cesults leas 1 leas 2 leas 3 leas 4	Hygrometer Applied dew-point in °C 49.981 49.986 Applied of the second	URATE FOR Its one spread for notes 08-1216 Resistance output in ohm 119,3595 119,3590 119,3592 119,3606	Output in °C 49.902 49.898 49.905	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081	K8 al dew-point	measured in	the comparis	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169	e "t" should	08-1216 Meas 3 0.0169	d by the nor Meas 4 0.0169	minal d
eas 1 eas 2 eas 3 eas 4 Incertain	Hygrometer Applied dew-point in "C 49.983 49.996 49.986 anties (in "C uncertainty of due to short	Description of the property of	Output in °C 49.902 49.905 49.905	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081	K8 al dew-point	measured in	the comparis	on; labeled "dat	50 a t°C", where	e "t" should	08-1216 Meas 3	d by the nor	ninal d
eas 1 eas 2 eas 3 eas 4 ncertail	Hygrometer Applied dew-point in °C 49.981 49.986 httes (in °C uncertainty o due to short due to long-	Description of applied correcterm stabiliterm drift of	Output in °C 49.902 49.905 49.905	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.081 -0.081 standard deviation) standard [if needd	K8 al dew-point	measured in	the comparis	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169	e "t" should	08-1216 Meas 3 0.0169	d by the nor Meas 4 0.0169	ninal d
EPORT each part at cursor esults eas 1 eas 2 eas 3 eas 4 ncertain andard u d uncert d uncert d uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 htties (in °C uncertainty of due to short due to long-due to resol	O8-1216 Resistance output in ohm 119.3595 119.3590 119.3606 If applied corterm stabilitierm drift of ution of trave	Output in °C 49.902 49.898 49.905 49.905	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C - 0.081 - 0.079 - 0.081 andard deviation) standard [if needed]	K8 al dew-point	measured in	the comparis	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169	e "t" should	08-1216 Meas 3 0.0169	d by the nor Meas 4 0.0169	ninal d
each parties toursor esults eas 1 eas 2 eas 3 eas 4 ncertain andard u d uncert d uncert d uncert d uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C due to short due to long-due to non-ldue to non-l	Description of traves inearity of tra	Output in °C 49.902 49.898 49.905	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed] tandard [if needed]	K8 al dew-point of measuren d]	measured in	elling standa	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169	e "t" should	08-1216 Meas 3 0.0169	d by the nor Meas 4 0.0169	ninal d
EPORT each part ut cursor esults eas 1 eas 2 eas 3 eas 4 ncertail d uncert d uncert d uncert d uncert d uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C due to short due to long-due to non-ldue to non-l	Description of traves inearity of tra	Output in °C 49.902 49.898 49.905	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C - 0.081 - 0.079 - 0.081 andard deviation) standard [if needed]	K8 al dew-point of measuren d]	measured in	elling standa	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169	e "t" should	08-1216 Meas 3 0.0169	d by the nor Meas 4 0.0169	ninal d
eas 1 eas 2 eas 3 eas 4 ncertail andard u d uncert d uncert d uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 due to short due to long-due to resol due to non-le between a	Description of trave inearity of traveline and meaning to the second content of the seco	Output in °C 49.902 49.905 49.905 elling star avelling saeasured	OINT IN CCTG- mmary per nomina ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.081 -0.081 andard deviation) standard [if needed] tandard [if needed] tandard [if needed] values of dew/fros	K8 al dew-point of measuren d]	measured in	elling standa	on; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	minal d
eas 1 eas 2 eas 3 eas 4 ncertail andard u d uncert d uncert d uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 due to short due to long-due to resol due to non-le between a	Description of trave inearity of traveline and meaning to the second content of the seco	Output in °C 49.902 49.905 49.905 elling star avelling saeasured	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed] tandard [if needed]	K8 al dew-point of measuren d]	measured in	elling standa	on; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should	08-1216 Meas 3 0.0169	Meas 4 0.0169 0.0025	ninal d
each particular cursor esults eas 1 eas 2 eas 3 eas 4 incertain duncert id uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C due to short due to long-due to resol due to resol due to non-la between al	Description of traves in earity of traveline and ard unce	Output in °C 49.902 49.898 49.905 49.905	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed] tandard [if needed] tandard [if needed values of dew/fros in quadrature	K8 al dew-point of measuren d]	measured in	elling standa	on; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	minal d
each particular cursor esults eas 1 eas 2 eas 3 eas 4 incertain duncert id uncert	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C due to short due to long-due to resol due to resol due to non-la between al	Description of trave inearity of traveline and meaning to the second content of the seco	Output in °C 49.902 49.898 49.905 49.905	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed] tandard [if needed] tandard [if needed values of dew/fros in quadrature	K8 al dew-point of measuren d]	measured in	elling standa	on; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	ininal d
eas 1 eas 2 eas 3 eas 4 Incertain duncert duncert duncert duncert duncert combination fective de	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C uncertainty or due to long-due to resol due to non-le between all on of these segrees of frees the effective set the effet the effective set the effective set the effective set the effec	DRATE FOR IS one spread for notes 08-1216 Resistance output in ohm 119.3595 119.3590 119.3590 119.3590 119.3590 in applied conterm stabiliterm drift of ution of trave inearity of travelinearity of travelinear	Output in °C 49.902 49.898 49.905 49.905 elling star aveiling star aveil	OINT IN CCTG- mmary per nomina ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed]	K8 al dew-point of measuren ed] l] t-point tempe	measured in	elling standa	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
eas 1 eas 2 eas 3 eas 4 Incertain duncert duncert duncert duncert duncert combination fective de	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C uncertainty or due to long-due to resol due to non-le between all on of these segrees of frees the effective set the effet the effective set the effective set the effective set the effec	DRATE FOR IS one spread for notes 08-1216 Resistance output in ohm 119.3595 119.3590 119.3590 119.3590 119.3590 in applied conterm stabiliterm drift of ution of trave inearity of travelinearity of travelinear	Output in °C 49.902 49.898 49.905 49.905 elling star aveiling star aveil	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.079 -0.081 -0.079 -0.081 in andard [if needed]	K8 al dew-point of measuren ed] l] t-point tempe	measured in	elling standa	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
eas 1 eas 2 eas 3 eas 4 Incertain duncert duncert duncert duncert duncert combination fective de	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C uncertainty or due to long-due to resol due to non-le between all on of these segrees of frees the effective set the effet the effective set the effective set the effective set the effec	DRATE FOR IS one spread for notes 08-1216 Resistance output in ohm 119.3595 119.3590 119.3590 119.3590 119.3590 in applied conterm stabiliterm drift of ution of trave inearity of travelinearity of travelinear	Output in °C 49.902 49.898 49.905 49.905 elling star aveiling star aveil	OINT IN CCTG- mmary per nomina ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed]	K8 al dew-point of measuren ed] l] t-point tempe	measured in	elling standa	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
eas 1 eas 2 eas 3 eas 4 Incertail tandard tad uncert tid uncert ti	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C incertainty of due to hond-due to short due to long-due to resol due to non-de between all on of these segrees of frees the effectively small, need	Resistance output in ohm 119.3595 119.3590 119.3	Output in °C 49.902 49.898 49.905 49.905 elling star aveiling star aveil	OINT IN CCTG- mmary per nomina ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed]	K8 al dew-point of measuren ed] l] t-point tempe	measured in	elling standa	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
eas 1 eas 2 eas 3 eas 4 Incertail tandard tad uncert tid uncert ti	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C uncertainty or due to long-due to resol due to non-le between all on of these segrees of frees the effective set the effet the effective set the effective set the effective set the effec	Resistance output in ohm 119.3595 119.3590 119.3	Output in °C 49.902 49.898 49.905 49.905 elling star aveiling star aveil	OINT IN CCTG- mmary per nomina ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed]	K8 al dew-point of measuren ed] l] t-point tempe	measured in	elling standa	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
eas 1 eas 2 eas 3 eas 4 Incertail tandard tad uncert tid uncert ti	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Inties (in °C incertainty of due to hond-due to short due to long-due to resol due to non-de between all on of these segrees of frees the effectively small, need	Resistance output in ohm 119.3595 119.3590 119.3	Output in °C 49.902 49.898 49.905 49.905 elling star aveiling star aveil	OINT IN CCTG- mmary per nomina ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed]	K8 al dew-point of measuren ed] l] t-point tempe	measured in	elling standa	on; labeled "dat	50 a 1°C", where Hygromete Meas 1 0.0169 0.0024	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
eas 1 eas 2 eas 3 eas 4 Incertain andard uncert id uncer	Hygrometer Applied dew-point in "C 49.983 49.981 49.986 Inties (in "C increasing the point in "C increasing the "C increasing the point in "C increasing the "C increasing the "C increasing the "C increasing th	ILATE FOR is one spread for notes 08-1216 Resistance output in ohm 119.3595 119.3580 119.3592 119.3606 If applied conterm stabilitier drift of ution of trave inearity of trapplied and managed in the specific of to be taken in the specific of the taken in the specific of the specific	Output in °C 49.902 49.905 49.905 dition by (from statravelling star avelling star ave	OINT IN CCTG- mmary per nomine ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.089 -0.081 -0.081 in output -0.081 -0.08	K8 al dew-point of measuren ed] l] t-point tempe	measured in	elling standa	on; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0169 0.0024 NOTE: onl	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
each particular partic	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Applied dew-point in °C 49.983 49.979 49.986 Applied dew-point in °C 49.983 49.979 49.986 Applied dew-point in °C 49.983 49.979 49.986	Resistance output in ohm 119,3595 119,3590 119,3590 119,3696 119,3	Output in °C 49.902 49.898 49.902 49.898 as a vertainties be retainty e degrees of into account ifferences iff	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed dard [if needed] tandard [if needed] tan	K8 al dew-point of measuren ed] i] t-point temp	measured in	elling standa	on; labeled "dat	Hygromete Meas 1 0.0169 0.0024 0.017118	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
EPORT T toursor sesults assas 1 assas 2 assas 3 assas 4 certain d uncert d uncert d uncert d uncert d uncert d uncert wariance mbination assassignificant assassignificant d uncert d uncer	Hygrometer Applied dew-point in °C 49.983 49.979 49.981 49.986 Applied dew-point in °C 49.986	DEATE FOR IS one spread for notes fo	Output in °C 49.902 49.898 49.905 49.905 ertainties ertainty e degrees of into accountifferences reproduc	OINT IN CCTG- mmary per nomine ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed] tandard [if needed]	K8 al dew-point of measuren ed] i] t-point temp	measured in	elling standa	on; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0169 0.0024 NOTE: onl	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	
each partiut cursor esults eas 1 eas 2 eas 3 eas 4 ncertail d uncert d uncert d uncert d uncert d uncert combination fective demost cassignificant ggregat ean of 4 ppe A stale	Hygrometer Applied dew-point in °C 49.981 49.996 A9.996 A9	ILATE FOR is one spread for notes O8-1216 Resistance output in ohm 119,3595 119,3590 119,3592 119,3606 The policy of the control of trave inearity of trapplied and material in the control of the the con	Output in °C 49.902 49.898 49.905 49.905 ertainties ertainties ertainty e degrees of into accoulures on sa	OINT IN CCTG- mmary per nomins ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.081 -0.081 -0.079 -0.081 andard deviation) standard [if needed dard [if needed] tandard [if needed] tan	of measuren of measuren d] t-point temp	measured in measur	elling standa	on; labeled "dat	Hygromete Meas 1 0.0169 0.0024 0.017118	e "t" should e "t" should e "t" should o .0169 o .0033	08-1216 Meas 3 0.0169 0.0030	Meas 4 0.0169 0.0025	

REPORT	ING TEMP	LATE FOR	DEW-F	POINT IN CCTG-K8			Nominal value:	65	°C	Lab name	INTA2	
each parti	icipant submi	ts one spread	Isheet su	mmary per nominal de	w-point measured in	the compari	son; labeled "dat	a t°C", whei	e "t" should	be replace	d by the nor	minal de
Put cursor	here	for notes		ROBERT: Type serial number:								
Results				08-1215 or 08-1216								
	Hygrometer	08-1216										
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C	Difference (meas dp - applied dp) in °C								
Meas 1	64.992	125.1310	64.924	-0.068								
Meas 2	65.020	125.1430	64.956	-0.064								
Meas 3	64.999	125.1348	64.934	-0.065								
Meas 4	65.007	125.1380	64.943	-0.064								
Uncertair	nties (in °C	;)						Hygromet	er	08-1216		
								Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	incertainty o	f applied con	dition					0.0180	0.0180	0.0180	0.0180	
Std uncert	due to short	-term stability	(from s	andard deviation) of m	easurements of trav	elling stand	lard (type A)	0.0011	0.0007	0.0008	0.0010]
				standard [if needed]								
				ndard [if needed]								
				standard [if needed]								
Covariance	e between a	pplied and m	easured	values of dew/frost-po	nt temperature [if n	eeded]						<u>. </u>
Combinatio	on of these s	tandard unce	rtainties	in quadrature				0.018041	0.018023	0.018026	0.018035	1
Effective de	naroos of fra	edom of unc	ortainty	actimates:	90	1						
				freedom will be large.	- 30	-			-			
				int throughout the calcula	tion.			NOTE: onl	y fill in fiel	ds with gre	en backgr	ound
Aggregat	tion of res	ults										
Mean of 4	dew-point te	mperature di	fference	s				-0.065				
	•	•		cibility of difference res	ults			0.0018				
			_	ame instrument)								
`				perature difference fo	the instrument			0.0181				



REPORT	ING TEMP	LATE FOR	DEW-PC	DINT IN CCTG-I	48			Nominal value:	85	°C	Lab name	INTA2	
- each parti	cipant submi	s one spread	dsheet sum	mary per nomina	I dew-point	measured in	the comparis	on; labeled "dat	a t°C", whe	re "t" should	be replace	d by the non	ninal dev
out cursor	here	for notes	T	OBERT: ype serial number:									
Results			0:	8 <mark>-1215 or 08-1216</mark>									
	Hygrometer	08-1216	*										
	Applied dew-point in °C	Resistance output in ohm	Output in °C	Difference (meas dp - applied dp) in °C									
Meas 1	84.951	132.7687	84.909	-0.042									
Meas 2	84.913	132.7542	84.871	-0.041									
Meas 3	84.928	132.7588	84.883	-0.045									
Meas 4	84.934	132.7609	84.889	-0.045									
Uncertair	nties (in °C	;)							Hygromet	er	08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	ncertainty o	f applied cor	ndition						0.0207	0.0207	0.0207	0.0207	
Std uncert	due to short	term stabilit	y (from stai	ndard deviation) o	of measurem	ents of trav	elling stand	ard (type A)	0.0018	0.0024	0.0037	0.0020	
Std uncert	due to long-	term drift of	travelling s	tandard [if neede	d]								
Std uncert	due to resol	ution of trave	elling stand	lard [if needed]									
				indard [if needed]									
Covariance	between a	pplied and m	easured va	alues of dew/frost	-point tempe	rature [if ne	eded]						
Combinatio	on of these s	tandard unce	ertainties ir	n quadrature					0.020783	0.020839	0.021029	0.020799	
Effective de	earees of fre	edom of unc	ertainty es	timates		99							
	•			eedom will be large		- 00							
				throughout the cal					NOTE: onl	y fill in fiel	ds with gre	een backgr	ound
Aggregat	tion of res	ults											
Mean of 4 o	dew-point te	mperature d	ifferences						-0.043				
Type A star	ndard uncer	tainty due to	reproducit	ility of difference	results				0.0022				
		viction of 4 vn	luca on com	o inetrument)									
(Derived fron	n standard de	viation of 4 va	iues on san	ie instrument)									



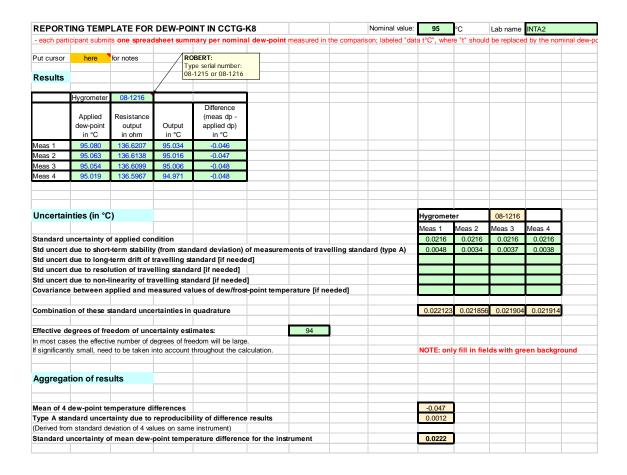


Fig. 12.6.f Results reported by KRISS in Loop 1

REPORT								Nominal value:	30	°C	Lab name	KRISS
each parti	icipant submit	s one sprea	dsheet su	mmary per nomin	al dew-poin	t measured in	the comparis	son; labeled "dat	a t°C", whe	re "t" should	be replace	d by the nomin
ut cursor	here	for notes		ROBERT:								
ut cuisoi	TICIC	ioi riotes		Type serial number:								
esults				08-1215 or 08-1216								
			/									
	Hygrometer	08-1215										
				Difference								
	Applied	Resistance	0	(meas dp -								
	dew-point in °C	output	Output									
1000 1	30.111	in ohm 111.6605	in °C 29.968	in °C 3 -0.143								
Meas 1 Meas 2	30.111	111.6685	29.989			_						
Meas 3	30.128	111.6696	29.992									
Meas 4	30.128	111.6703	29.993									
1003 4	00.120	111.0700	20.000	0.104	-							
Jncertair	nties (in °C	:)							Hygromet	er	08-1215	
	`								Meas 1	Meas 2	Meas 3	Meas 4
Standard 11	Incertainty o	f applied cor	ndition						0.0166	0.0166	0.0166	0.0166
				andard deviation)	of measure	ments of trav	elling stand	lard (type A)	0.0007	0.0004	0.0012	0.0006
				standard [if need			Janes Grand	Lata (type 7ty	0.0001	0.0001	0.0012	0.0000
				ndard [if needed]								
				standard [if needed	d]	1						
				values of dew/fros		perature [if ne	eeded]					
,,,,,								İ				
ombinatio	on of these s	tandard unc	ertainties	in quadrature					0.016614	0.016606	0.01664	0.016611
ffective de	egrees of fre	edom of und	ertainty e	estimates:		468						
				freedom will be larg	e.							
significant	ly small, need	d to be taken	into accou	int throughout the ca	alculation.				NOTE: onl	y fill in fie	lds with gre	en backgrou
	tion -f	ulto				-						
aggregat	tion of res	uitS				-						
						+						
lean of 4	dew-point to	mperature d	ifference	8		+			-0.139			
						1			0.0040	1		
Vno A cto	ndard uncor			hility of difference	o roculte							
		-		cibility of difference	e results				0.0040			
Derived from	m standard de	viation of 4 va	lues on sa	ame instrument)		strument						
Derived from	m standard de uncertainty o	eviation of 4 va f mean dew-	lues on sa point tem	-	ce for the in	strument		Nominal value:	0.0171	°C	Lab name	KRISS
Derived from Standard u REPORT - each parti	m standard de uncertainty o	eviation of 4 variation of 4 variation of 4 variation dew-	lues on sa point tem	eme instrument) nperature difference POINT IN CCTG- mmary per nomin	ce for the in		the comparis		0.0171			
Derived from Standard u REPORT - each parti	m standard de incertainty o	eviation of 4 va f mean dew-	lues on sa point tem	POINT IN CCTG- mmary per nomin	ce for the in		the comparis		0.0171			
Derived from Standard un REPORT - each parti	m standard de uncertainty o	eviation of 4 variation of 4 variation of 4 variation dew-	point tem	eme instrument) nperature difference POINT IN CCTG- mmary per nomin	ce for the in		the comparis		0.0171			
Derived from Standard u REPORT - each parti	m standard de uncertainty o	eviation of 4 variation of 4 variation of 4 variation dew-	point tem	POINT IN CCTG- immary per nomin ROBERT: Type serial number:	ce for the in		the comparis		0.0171			
Derived from Standard u	m standard de uncertainty o	rivation of 4 va f mean dew- LATE FOR is one spread for notes	point tem	POINT IN CCTG- immary per nomin ROBERT: Type serial number:	ce for the in		the comparis		0.0171			
Derived from Standard u REPORT - each parti	m standard de uncertainty o	eviation of 4 variation of 4 variation of 4 variation dew-	point tem	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216	ce for the in		the comparis		0.0171			
Derived from Standard u REPORT - each parti	m standard de uncertainty o	rivation of 4 va f mean dew- LATE FOR is one spread for notes	point tem	POINT IN CCTG- immary per nomin ROBERT: Type serial number:	ce for the in		the comparis		0.0171			
Derived from Standard u REPORT - each parti	ING TEMP icipant submit here	LATE FOR ts one spread for notes	point tem	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp -	ce for the in		the comparis		0.0171			
Derived from Standard under Standard under Standard under Standard under Standard under Standard under Standard und under Standard und under Standard und und under Standard und und under Standard und und und und und und	Hygrometer Applied dew-point in °C	LATE FOR Is one spread for notes 08-1215 Resistance output in ohm	DEW-Pdsheet su	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C	ce for the in		the compari		0.0171			
Derived from transfer of the control	m standard de incertainty o	LATE FOR is one spread for notes 08-1215 Resistance output in ohm 119.3878	Output in °C	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143	ce for the in		the comparis		0.0171			
Derived from transfer of the control	Hygrometer Applied dew-point in °C	LATE FOR Is one spread for notes 08-1215 Resistance output in ohm	DEW-Pdsheet su	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143	ce for the in		the comparis		0.0171			
REPORT - each parti Put cursor Results Meas 1 Meas 2 Meas 3	m standard de incertainty of incerta	LATE FOR is one spread for notes 08-1215 Resistance output in ohm 119.3878 119.4017	Output in °C 49.976 50.012	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132	ce for the in		the comparis		0.0171			
REPORT each parti Put cursor Results	m standard de incertainty of standard de incertainty of standard s	LATE FOR is one spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028	Output in °C 49.976	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132	ce for the in		the comparis		0.0171			
REPORT each parti ut cursor Results	m standard de incertainty of incerta	LATE FOR is one spread for notes 08-1215 Resistance output in ohm 119.3878 119.4017	Output in °C 49.976 50.012	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132	ce for the in		the comparis		0.0171			
REPORT each parti ut cursor Results	m standard de incertainty of incerta	LATE FOR is one spread for notes 08-1215 Resistance output in ohm 119.3878 119.4017	Output in °C 49.976 50.012	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132	ce for the in		the comparis		0.0171			
REPORT each parti ut cursor Results	m standard de incertainty of standard de incertainty of standard de incertainty of standard s	LATE FOR some spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4017 119.4130	Output in °C 49.976 50.012	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132	ce for the in		the comparis		0.0171 50 a t°C", whe	re "t" should	be replace	
REPORT each parti ut cursor Results	m standard de incertainty of incerta	LATE FOR some spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4017 119.4130	Output in °C 49.976 50.012	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132	ce for the in		the comparis		0.0171 50 a t°C", whee	te "t" should	d be replace	d by the nomin
REPORT each parti Put cursor Results Aleas 1 Aleas 2 Aleas 3 Aleas 4	m standard de incertainty of incerta	LATE FOR URANGE STATE OF THE S	Output in °C 49.976 50.015 50.041	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132	ce for the in		the comparis		0.0171 50 a t°C", whee	e "t" should	08-1215 Meas 3	d by the nomin
REPORT each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain	m standard de incertainty of incerta	LATE FOR some spread for notes 08-1215 Resistance output in ohm 119.3378 119.4028 119.4017 119.4130	Output in °C 49.976 50.012 50.041	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.125 -0.123 -0.123	K8 al dew-poin	it measured in		son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174	er Meas 2 0.0174	08-1215 Meas 3 0.0174	Meas 4
REPORT - each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert	m standard de incertainty of incerta	LATE FOR some spread for notes 08-1215 Resistance output in ohm 119.3478 119.4428 119.44130	Output in °C 50.011 50.011 10.	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.123 andard deviation)	K8 al dew-poin	it measured in		son; labeled "dat	0.0171 50 a t°C", whee	e "t" should	08-1215 Meas 3	d by the nomin
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertain ttandard u tt	m standard de incertainty of due to short due to long-	URATE FOR SOME STATE OF THE STA	Output in °C 49.976 50.012 50.041	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.132 -0.123	K8 al dew-poin	it measured in		son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174	er Meas 2 0.0174	08-1215 Meas 3 0.0174	Meas 4
REPORT each particular cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Jincertain Maturitation uncert Maturicert	m standard de incertainty of due to long-due to resol due to resol	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3378 119.4017 119.4130 f applied conderm stability term drift of ution of trave	Output in °C 49.976 50.015 50.041	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 -0.125 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure	it measured in		son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174	er Meas 2 0.0174	08-1215 Meas 3 0.0174	Meas 4
REPORT each particular cursor Results leas 1 leas 2 leas 3 leas 4 Jincertain tandard uncert tid u	m standard de uncertainty of the properties of t	LATE FOR some spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4130	Output in °C 50.012 50.041 odition y (from st travelling slugger subsequently subse	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in "C 3 -0.143 5 -0.125 2 -0.132 -0.123 andard deviation) g standard [if needed] dard [if needed] standard [if needed]	K8 al dew-poin of measure	nt measured in	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174	er Meas 2 0.0174	08-1215 Meas 3 0.0174	Meas 4
REPORT each particular cursor Results leas 1 leas 2 leas 3 leas 4 Jincertain tandard uncert tid u	m standard de uncertainty of the properties of t	LATE FOR some spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4130	Output in °C 50.012 50.041 odition y (from st travelling slugger subsequently subse	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 -0.125 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure	nt measured in	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174	er Meas 2 0.0174	08-1215 Meas 3 0.0174	Meas 4
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertain tandard ut tandard uncert	m standard de incertainty of incerta	Use of the control of	Output in °C 49.976 50.012 50.041 output in solution y (from st travelling star avelling sa easured	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: (08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.132 -0.123 andard deviation) g standard [if needed] standard [if needed] standard [if needed] standard [if needed]	K8 al dew-poin of measure	nt measured in	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti tut cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Jincertail did uncert	m standard de incertainty of incerta	Use of the control of	Output in °C 49.976 50.012 50.041 output in solution y (from st travelling star avelling sa easured	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in "C 3 -0.143 5 -0.125 2 -0.132 -0.123 andard deviation) g standard [if needed] dard [if needed] standard [if needed]	K8 al dew-poin of measure	nt measured in	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4
REPORT each parti tut cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Jincertain Standard u	m standard de uncertainty ou survey of the se son of these s	URATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4130 119.4130 119.4130 119.4130 119.4130 119.4130 119.4130 119.4130	Output in °C South of the substitution of the	prevalues of dew/fros	K8 al dew-poin of measure	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti tut cursor Results Meas 1 feas 2 feas 3 feas 4 Jincertair standard u std uncert std uncert std uncert std uncert std uncert combinatio	Hygrometer Applied dew-point in °C So.119 So.119 So.119 Applied dew-point dew-point in °C So.119 So.119 So.119 so.144 So.164 Inties (in °C	LATE FOR some spread for notes 08-1215 Resistance output in ohm 119.3478 119.4430 f applied conterm stabiliteterm drift of utiliteterm drift of utilitete	Output in °C 50.012 50.041 Output in °C 50.015 50.012 50.041 output in °C 60.012 60.012 60.013 contravelling star avelling star ave	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure ed]	nt measured in	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert	m standard de incertainty of incerta	URATE FOR SOME STATE OF THE STA	Output in °C 49.976 50.012 50.011 50.011 starvelling s	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure ed] 11]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert	m standard de incertainty or incerta	URATE FOR SOME STATE OF THE STA	Output in °C 49.976 50.012 50.011 50.011 starvelling s	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C 3 -0.143 5 -0.125 2 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure ed] 11]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert	m standard de incertainty or incerta	URATE FOR SOME STATE OF THE STA	Output in °C 49.976 50.012 50.011 50.011 starvelling s	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure ed] 11]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert Std uncert Std uncert Covariances Combinatio	m standard de incertainty of incerta	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4017 119.4130 f applied conterm stabiliterm drift of ution of travet in one for notes in output in ohe management of conterms that in output in ohe management of conterms that in output in output in ohe management of conterms that in output in out	Output in °C 49.976 50.012 50.011 50.011 starvelling s	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure ed] 11]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert Std uncert Std uncert Covariances Combinatio	m standard de incertainty or incerta	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4017 119.4130 f applied conterm stabiliterm drift of ution of travet in one for notes in output in ohe management of conterms that in output in ohe management of conterms that in output in output in ohe management of conterms that in output in out	Output in °C 49.976 50.012 50.011 50.011 starvelling s	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure ed] 11]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert Std uncert Std uncert Covariances Combinatio	m standard de incertainty of incerta	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4017 119.4130 f applied conterm stabiliterm drift of ution of travet in one for notes in output in ohe management of conterms that in output in ohe management of conterms that in output in output in ohe management of conterms that in output in out	Output in °C 49.976 50.012 50.011 50.011 starvelling s	POINT IN CCTG- mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.132 -0.123 andard deviation) g standard [if needed]	K8 al dew-poin of measure ed] 11]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u	m standard de uncertainty of the properties of the standard de uncertainty of the properties of the pr	URATE FOR SOME STATE OF THE STA	Output in °C 49.976 50.015 50.015 50.041 output in °C 49.976 49.976 control of the stravelling staravelling	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.123 andard deviation) g standard [if needed] standard [if needed values of dew/fros in quadrature estimates: freedom will be larg int throughout the ca	K8 al dew-poin of measure ed] 11]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each parti fut cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Juncertain did uncert	Hygrometer Applied dew-point in °C So.119 So.139 So.144 So.164 Thies (in °C Incertainty of the total of the	LATE FOR sone spread for notes 08-1215 Resistance output in 19-3378 119-4028 119-4017 119-4130 f applied conterm stabilit term drift of tution of trave inearity of tropplied and management of d to be taken ults	Output in °C 49.976 50.012 50.014 in output in °C 49.976 in	Difference (meas dp - applied dp) in °C - 0.125 - 0.123 - 0.12	of measure ed]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059 0.018374	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029
REPORT each particular cursor Results leas 1 leas 2 leas 3 leas 4 Jincertain tandard uncert tid u	m standard de incertainty of due to short due to long-due to short due to resolute to non-label between all on of these street effectively small, need dew-point tendard uncertainty of incertainty of in	LATE FOR some spread for notes 08-1215 Resistance output in ohm 119.3878 119.4028 119.4017 119.4130	Output in °C South of the substitution of the	POINT IN CCTG- Immary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.143 -0.125 -0.123 andard deviation) g standard [if needed] standard [if needed values of dew/fros in quadrature estimates: freedom will be larg int throughout the ca	of measure ed]	ments of trav	elling stand	son; labeled "dat	0.0171 50 a t°C", whee Hygromet Meas 1 0.0174 0.0059	er Meas 2 0.0174 0.0027	08-1215 Meas 3 0.0174 0.0021	Meas 4 0.0174 0.0029

				POINT IN CCTG-P				Nominal value:	65	°C	Lab name		
each part	icipant submi	ts one spread	isheet su	ımmary per nominal	dew-point	measured in	the compari	son; labeled "dat	a t°C", whe	e "t" should	be replace	d by the nom	inal de
Put cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1215											
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C										
Meas 1	65.180	125.1793	65.050	-0.130									
Meas 2	65.160	125.1714	65.030										
Meas 3	65.141	125.1639	65.010										
Meas 4	65.217	125.1958	65.093	-0.124									
Uncertai	nties (in °C	:)							Hygromet	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
		f applied cor							0.0182	0.0182	0.0182	0.0182	
				tandard deviation) o		nents of trav	elling stand	lard (type A)	0.0042	0.0028	0.0036	0.0058	
				g standard [if neede	d]								
				ndard [if needed]									
				standard [if needed] values of dew/frost-		oroturo lif ne	odod1						
Covariance	e between a	ppilea ana m	easurea	values of dew/frost-	point temp	erature (ii ne	eaeaj						
Combinati	on of these s	standard unce	ertainties	in quadrature					0.018677	0.018409	0.018557	0.019114	
Effective d	egrees of fre	edom of unc	ertainty	estimates:		346							
				freedom will be large.									
If significant	tly small, nee	d to be taken i	nto accou	unt throughout the calc	ulation.				NOTE: on	y fill in fiel	ds with gre	en backgro	und
Aggrega	tion of res	ults											
	•	mperature di				-			-0.128				
				cibility of difference	results				0.0063		** STDEV	x 2	
`				ame instrument)					0.010=				
Standard ι	uncertainty o	f mean dew-	point ten	nperature difference	for the ins	trument			0.0197	I			

REPOR1	TING TEMP	LATE FOR	DEW-F	POINT IN CCTG-F	∢ 8			Nominal value:	80	°C	Lab name	KRISS	
 each part 	ticipant submi	ts one spread	dsheet su	ımmary per nomina	I dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nomi	inal dew
	h a m	f	ļ ,	ROBERT:									
Put cursor	here	for notes		Type serial number:									
Results				08-1215 or 08-1216									
results													
	Hygrometer	08-1215	<u> </u>										
	r iy gronnotor	00 1210		Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Outpu	t applied dp)									
	in °C	in ohm	in °C	in °C									
Meas 1	80.171	130.9162	80.05	-0.120									
Meas 2	80.152	130.9069	80.02	-0.125									
Meas 3	80.153	130.9073	80.028	-0.125									
Meas 4	80.162	130.9142	80.04	-0.116									
Uncertai	inties (in °C	;)							Hygromete	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard (uncertainty o	f applied cor	ndition						0.0200	0.0200	0.0200	0.0200	
Std uncert	due to short	-term stability	y (from s	tandard deviation) c	of measurem	ents of trave	elling stand	lard (type A)	0.0041	0.0036	0.0043	0.0028	
Std uncert	due to long-	term drift of	travelling	g standard [if neede	d]								
Std uncert	due to resol	ution of trave	elling sta	ndard [if needed]									
				standard [if needed]									
Covarianc	e between a	pplied and m	easured	values of dew/frost	-point tempe	erature [if ne	eded]						
Combinati	on of these s	tandard unce	ertainties	in quadrature					0.020422	0.020319	0.020463	0.020194	
	-	edom of unc				322							
				freedom will be large ant throughout the cal					NOTE: onl	v fill in fiel	de with are	en backgro	und
ii sigiiiiicari	try Siriali, riee	a to be taken i	nto acco	ant throughout the can	culation.				NOTE. OII	y iiii iii iiei	us with gre	en backgro	unu
	tion of roc	ults											
Aggrega													
Aggrega	luon or res							1					
		mperature di	ifference	s					-0.122				
Mean of 4	dew-point te	mperature di		s cibility of difference	results				-0.122 0.0044				
Type A sta	dew-point te	tainty due to	reprodu		results								

				POINT IN CCTG-I				Nominal value:	85	°C	Lab name		
- each part	icipant submi	ts one spread	dsheet su	ımmary per nomina	l dew-point	measured in	the comparis	on; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal dev
Put cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1215											
	Applied dew-point in °C	Resistance output in ohm	Output in °C										
Meas 1	85.115	132.8023	84.997	7 -0.117									
Meas 2	85.126	132.8051	85.005	-0.121									
Meas 3	85.106	132.7988	84.988	-0.118									
Meas 4	85.107	132.7974	84.984	4 -0.122									
Uncertai	nties (in °C	;)							Hygromete	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ı	uncertainty o	f applied cor	ndition						0.0211	0.0211	0.0211	0.0211	
				tandard deviation) o		nents of trave	elling stand	ard (type A)	0.0049	0.0050	0.0047	0.0049	
				g standard [if neede	d]								
				ndard [if needed]									
				standard [if needed]									
Covarianc	e between a	pplied and m	easured	values of dew/frost	-point temp	erature [if ne	eded]						
Cambinasi	44			s in quadrature					0.021655	0.021675	0.021625	0.021663	
Combinati	on or these s	standard unce	ertainties	in quadrature					0.021000	0.021675	0.021625	0.021003	
Effective d	learnes of fre	edom of unc	ertainty (estimates		310							
				freedom will be large		0.0							
				unt throughout the cal					NOTE: onl	y fill in fiel	ds with gre	een backgro	ound
Aggrega	tion of res	ults											
Mean of 4	dew-point te	mperature di	ifference	s					-0.120				
Type A sta	ndard uncer	tainty due to	reproduc	cibility of difference	results				0.0048		** STDEV	x 2	
(Derived fro	m standard de	eviation of 4 va	lues on sa	ame instrument)									
Standard I	uncertainty o	f mean dew-	point ten	nperature difference	for the ins	trument			0.0222				

REPORT	ING TEMP	LATE FOR	DEW-I	POINT IN CCTG-F	(8			Nominal value:	90	°C	Lab name	KRISS	
- each part	icipant submi	ts one spread	Isheet su	ımmary per nomina	dew-point	measured in	the comparis	son; labeled "dat	a t°C", when	e "t" should	be replace	d by the nomi	nal de
				ROBERT:	_								
out cursor	here	for notes		Type serial number:									
Results				08-1215 or 08-1216									
Nesulis													
	Hygrometer	08-1215											
	riygiometer	00 1210		Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Outpu	t applied dp)									
	in °C	in ohm	in °C	in °C									
Meas 1	90.125	134.7106	90.01	0 -0.115									
Meas 2	90.124	134.7131	90.01	6 -0.108									
Meas 3	90.132	134.7138	90.01	8 -0.114									
Meas 4	90.128	134.7094	90.00	6 -0.122									
		_											
Uncertai	nties (in °C	;)							Hygromete	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ι	ıncertainty o	f applied con	dition						0.0214	0.0214	0.0214	0.0214	
Std uncert	due to short	-term stability	(from s	tandard deviation) o	f measuren	nents of trave	elling stand	ard (type A)	0.0021	0.0020	0.0033	0.0022	
Std uncert	due to long-	term drift of t	ravellin	g standard [if neede	d]								
Std uncert	due to resol	ution of trave	lling sta	ndard [if needed]									
				standard [if needed]									
Covariance	e between a	pplied and m	easured	values of dew/frost-	point temp	erature [if ne	eded]						
Combination	on of these s	tandard unce	rtaintie	s in quadrature					0.021499	0.021494	0.021646	0.021513	
	•	edom of unc				300							
				f freedom will be large. unt throughout the calo	vulation				NOTE: only	ı fill in fiol	do with are	en backgrou	und
i sigrillicarii	ily Siliali, fiee	I to be taken i	iilo acco	unt throughout the call	Julation.				NOTE. OII	y IIII III IIei	us with gre	en backgrot	inu
Aggrega	tion of res	ults											
		mperature di							-0.115				
				cibility of difference	results				0.0168		** STDEV	x 3	
				ame instrument)									
Standard .	incertainty o	f mean dew-	noint ter	nperature difference	for the inc	trument			0.0273				

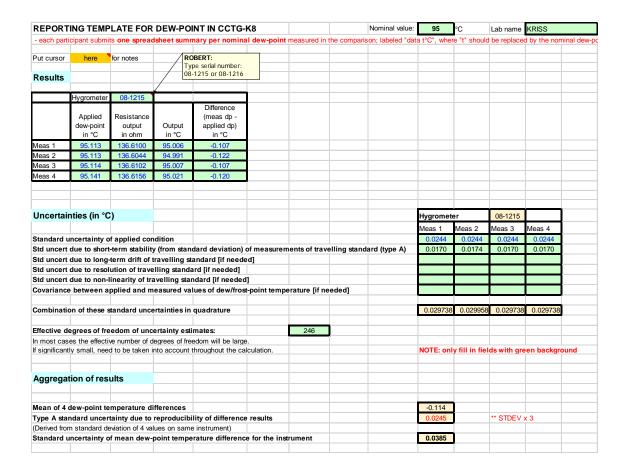


Fig. 12.6.g Results reported by NIST in Loop 1

				POINT IN CCTG-				Nominal value:	30	°C	Lab name		
- each part	icipant submi	ts one spread	dsheet su	ımmary per nomina	I dew-point	measured in	the comparis	on; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal de
Put cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1215											
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C										
Meas 1	29.998	111.6162	29.853	-0.144									
Meas 2	29.994	111.6153	29.85	1 -0.143									
Meas 3	29.988	111.6123	29.84	4 -0.145									
Meas 4	29.976	111.6079	29.832	2 -0.144									
Uncertai	nties (in °C	;)							Hygromete	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ı	incertainty o	f applied cor	ndition						0.0082	0.0082	0.0082	0.0082	
Std uncert	due to short	-term stabilit	y (from s	tandard deviation) o	of measuren	nents of trave	elling stand	ard (type A)	0.0019	0.0007	0.0007	0.0021	
				g standard [if neede	d]								
				ndard [if needed]									
				standard [if needed									
Covariance	e between a	pplied and m	easured	values of dew/frost	-point temp	erature [if ne	eded]						
Combinati	on of these s	tandard unce	ertainties	s in quadrature					0.008407	0.008228	0.008231	0.008472	
Effective d	egrees of fre	edom of unc	ertainty	estimates:		>50	i						
				freedom will be large									
lf significant	tly small, nee	d to be taken i	nto accou	unt throughout the cal	culation.				NOTE: onl	y fill in fiel	ds with gro	een backgro	ound
Aggrega	tion of res	ults											
Mean of 4	dew-point te	mperature di	ifference	s					-0.144				
Type A sta	ndard uncer	tainty due to	reprodu	cibility of difference	results				0.0007				
(Derived from	m standard de	eviation of 4 va	lues on s	ame instrument)									
									0.0084				

REPORT	ING TEMP	LATE FOR	DEW-PO	INT IN CCTG-I	K8			Nominal value:	50	°C	Lab name	NIST	
- each partic	cipant submi	ts one spread	dsheet sumi	mary per nomina	I dew-point	measured in	the compariso	on; labeled "dat	a t°C", wher	e "t" should			ninal dew-po
Put cursor	here	for notes											
Results													
results			POPERT										
	Hygrometer	08-1215	ROBERT:	al number:									
				or 08-1216									
	Applied	Resistance	0	(meas dp -									
	dew-point in °C	output in ohm	Output in °C	applied dp) in °C									
Meas 1	49.975	119.3381	49.847	-0.129									
Meas 2	49.981	119.3403	49.852	-0.128									
Meas 3	49.987	119.3422	49.857	-0.130									
Meas 4	49.969	119.3358	49.841	-0.128									
11	::												
Uncertair	nties (in °C	•)							Hygromete		08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
		f applied cor							0.0110	0.0110	0.0110	0.0110	
				dard deviation)		ents of trave	elling standa	rd (type A)	0.0019	0.0007	0.0007	0.0021	
				andard [if neede ard [if needed]	eaj								
				ard [ii needed] ndard [if needed	1								
				ndard [if needed lues of dew/frost		erature lif ne	eded1						
50.unance		rru ullu II	va		. pot tempt	(III III	- 40 41						
Combinatio	on of these s	tandard unc	ertainties in	quadrature					0.011155	0.011021	0.011023	0.011205	
Effective de	egrees of fre	edom of unc	ertainty est	imates:		>50							
				edom will be large									
If significantl	ly small, need	d to be taken	into account	throughout the cal	culation.				NOTE: onl	y fill in fiel	ds with gre	en backgr	ound
Aggregat	ion of res	ults											
/ tggi ogut													
Mean of 4 c	dew-point te	mperature d	ifferences						-0.129				
Type A star	ndard uncer	tainty due to	reproducib	ility of difference	results				0.0006				
		eviation of 4 va											
Standard u	ncertainty o	f mean dew-	-point tempe	erature difference	e for the inst	rument			0.0112				
REPORT	ING TEMP	I ATE FOR	DEW-PO	INT IN CCTG-I	KR			Nominal value:	65	°C	I ah name	NIST	
				INT IN CCTG-I		measured in		Nominal value:	65	°C	Lab name		ninal dew-no
				INT IN CCTG-I		measured in							ninal dew-po
						measured in							ninal dew-po
- each partic	cipant submi	ts one spread				measured in							ninal dew-po
- each partic	cipant submi	ts one spread				measured in							ninal dew-pc
- each partic	cipant submi	for notes	ROBERT:	mary per nomina		measured in							ninal dew-pc
- each partic	cipant submi	ts one spread	ROBERT:	nary per nomina		measured in							ninal dew-pc
- each partic	here Hygrometer	for notes 08-1215	ROBERT:	nary per nomina		measured in							ninal dew-pc
- each partic	cipant submi	for notes	ROBERT:	nary per nomina		measured in							ninal dew-po
- each partic	here Hygrometer Applied	for notes 08-1215 Resistance	ROBERT: Type seria 08-1215 0	al number: or 08-1216 (meas dp -		measured in							ninal dew-po
- each partic Put cursor Results Meas 1	here Hygrometer Applied dew-point in °C 65.014	for notes 08-1215 Resistance output in ohm 125.1176	ROBERT: Type serie 08-1215 (Output in °C 64.889	nary per nomina al number: or 08-1216 (meas dp- applied dp) in °C -0.124		measured in							ninal dew-po
- each partic Put cursor Results Meas 1 Meas 2	here Hygrometer Applied dew-point in °C 65.014 65.032	for notes 08-1215 Resistance output in ohm 125.1176 125.1254	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910	nary per nomina si number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122		measured in							ninal dew-pc
- each partic Put cursor Results Meas 1 Meas 2 Meas 3	here Hygrometer Applied dew-point in °C 65.014 65.032 65.026	08-1215 Resistance output in ohm 125.1176 125.1254 125.1244	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907	nary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119		measured in							ninal dew-pc
- each partic Put cursor Results Meas 1 Meas 2	here Hygrometer Applied dew-point in °C 65.014 65.032	for notes 08-1215 Resistance output in ohm 125.1176 125.1254	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910	nary per nomina si number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122		measured in							ninal dew-pc
- each partic Put cursor Results Meas 1 Meas 2 Meas 3	here Hygrometer Applied dew-point in °C 65.014 65.032 65.026	08-1215 Resistance output in ohm 125.1176 125.1254 125.1244	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907	nary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119		measured in							ninal dew-pc
- each partic Put cursor Results Meas 1 Meas 2 Meas 3	here Hygrometer Applied dew-point in °C 65.014 65.032 65.026	08-1215 Resistance output in ohm 125.1176 125.1254 125.1244	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907	nary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119		measured in							minal dew-pc
- each partic Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4	here Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009	08-1215 Resistance output in ohm 125.1176 125.1254 125.121171	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907	nary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119		measured in			a t°C*, wher	e "t" should			minal dew-pc
- each partic Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4	here Hygrometer Applied dew-point in °C 65.014 65.032 65.026	08-1215 Resistance output in ohm 125.1176 125.1254 125.121171	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907	nary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119		measured in			a t°C*, wher	e "t" should	be replaced	d by the nor	minal dew-pc
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009	08-1215 Resistance output in ohm 125.1176 125.1254 125.1171	ROBERT: Type seric 08-1215 c Output in °C 64.889 64.910 64.907 64.888	nary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119		measured in			a t°C*, wher	e "t" should	be replaced 08-1215 Meas 3	d by the nor	ninal dew-pc
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009	08-1215 Resistance output in ohm 125.1176 125.1254 125.121171	ROBERT: Type serie 08-1215 (Output in °C 64.889 64.910 64.907 64.888	mary per nomina Inumber: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119 -0.121	I dew-point		the compariso	on; labeled "dat	Hygromete Meas 1 0.0114	e "t" should	08-1215 Meas 3 0.0114	Meas 4	ninal dew-pc
- each partic Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009	08-1215 Resistance output in ohm 125.1176 125.1254 125.12171	ROBERT: Type seric 08-1215 Output in °C 64.889 64.910 64.907 64.888	nary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119	of measurem		the compariso	on; labeled "dat	a t°C*, wher	e "t" should e "t" should Meas 2 0.0114	be replaced 08-1215 Meas 3	d by the nor	ninal dew-pc
- each partic Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of	Hygrometer Applied dew-point or °C 65.014 65.032 65.026 65.009	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabilitierm drift of	ROBERT: Type seric 08-1215 c Output in °C 64.889 64.910 64.907 64.888	mary per nomina la number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119 -0.121	of measurem		the compariso	on; labeled "dat	Hygromete Meas 1 0.0114	e "t" should e "t" should Meas 2 0.0114	08-1215 Meas 3 0.0114	Meas 4	minal dew-pc
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u std uncert of	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied cor-term stabiliterm drift of ution of trave	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907 64.888	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119 -0.121 dard deviation) of andard [if neede	of measurem		the compariso	on; labeled "dat	Hygromete Meas 1 0.0114	e "t" should e "t" should Meas 2 0.0114	08-1215 Meas 3 0.0114	Meas 4	minal dew-pc
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabiliterm drift of ution of trave inearity of tra	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907 64.888	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.124 -0.122 -0.119 -0.121 dard deviation) a andard [if needed]	of measurem	ents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0114	e "t" should e "t" should Meas 2 0.0114	08-1215 Meas 3 0.0114	Meas 4	ninal dew-pc
Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Std uncert of Covariance	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Atties (in °C ncertainty of due to short due to long-due to resol due to non-le between a	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabilitierm drift of ution of trave inearity of trapplied and more stabilities and more stabiliti	ROBERT: Type seric 08-1215 c 08-1215 c 04.889 64.910 64.907 64.888	dard deviation) dandard [if needed] lues of dew/frost	of measurem	ents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0014 0.0060	e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114	ninal dew-pc
Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Std uncert of Covariance	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Atties (in °C ncertainty of due to short due to long-due to resol due to non-le between a	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabiliterm drift of ution of trave inearity of tra	ROBERT: Type seric 08-1215 c 08-1215 c 04.889 64.910 64.907 64.888	dard deviation) dandard [if needed] lues of dew/frost	of measurem	ents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0114	e "t" should e "t" should Meas 2 0.0114	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114	ninal dew-pc
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Std uncert of Covariance Combination	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 nties (in °C due to short due to short due to long-due to resol due to non-le between a	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 applied conterm stabilities the middle of trave inearity	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907 64.888	dard deviation) dandard [if needed quadrature	of measurem	nents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0014 0.0060	e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114	ninal dew-pc
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Std uncert of Covariance Combination Effective de	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Applied dew-point in °C control of the series (in °C control of the	ls one spread for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabiliterm drift of ution of trave inearity of trapplied and metandard uncered on the color of traveled on of uncered on of u	ROBERT: Type seria 08-1215 c Output in °C 64.889 64.910 64.907 64.888	dard deviation) and deviation dard [if needed] and ard [if needed]	of measuremed]	ents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0014 0.0060	e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114	ninal dew-pc
Meas 1 Meas 2 Meas 3 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Covariance Combinatio Effective de In most case	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Applies (in °C odue to short due to long-due to resol due to non-labetween a on of these segrees of frees the effective	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabilitierm drift of ution of trave inearity of trapplied and mutandard unce the number of content of the number of content in the number of cont	ROBERT: Type seric 08-1215 c 08-1215 c 04.889 64.910 64.907 64.888 multition by (from stan travelling standavelling standavelli	dard deviation) dandard [if needed] ues of dew/frost	of measuremed]	nents of trave	elling standa	on; labeled "dat	Hygromets Meas 1 0.0114 0.0060	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114 0.0050	
Meas 1 Meas 2 Meas 3 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Covariance Combinatio Effective de In most case	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Applies (in °C odue to short due to long-due to resol due to non-labetween a control of these segrees of frees the effective	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabilitierm drift of ution of trave inearity of trapplied and mutandard unce the number of content of the number of content in the number of cont	ROBERT: Type seric 08-1215 c 08-1215 c 04.889 64.910 64.907 64.888 multition by (from stan travelling standavelling standavelli	dard deviation) and deviation dard [if needed] and ard [if needed]	of measuremed]	nents of trave	elling standa	on; labeled "dat	Hygromets Meas 1 0.0114 0.0060	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114	
Meas 1 Meas 2 Meas 3 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Covariance Combinatio Effective de In most case	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Applies (in °C odue to short due to long-due to resol due to non-labetween a control of these segrees of frees the effective	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabilitierm drift of ution of trave inearity of trapplied and mutandard unce the number of content of the number of content in the number of cont	ROBERT: Type seric 08-1215 c 08-1215 c 04.889 64.910 64.907 64.888 multition by (from stan travelling standavelling standavelli	dard deviation) dandard [if needed] ues of dew/frost	of measuremed]	nents of trave	elling standa	on; labeled "dat	Hygromets Meas 1 0.0114 0.0060	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114 0.0050	
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Std uncert of Covariance Combination Effective de In most case If significanti	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Applies (in °C odue to short due to long-due to resol due to non-labetween a control of these segrees of frees the effective	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 applied conterm stabiliterm drift of ution of trave inearity of trapplied and metandard unce the number of content of the complete of the co	ROBERT: Type seric 08-1215 c 08-1215 c 04.889 64.910 64.907 64.888 multition by (from stan travelling standavelling standavelli	dard deviation) dandard [if needed] ues of dew/frost	of measuremed]	nents of trave	elling standa	on; labeled "dat	Hygromets Meas 1 0.0114 0.0060	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114 0.0050	
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Std uncert of Covariance Combination Effective de In most case If significanti	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Inties (in °C odue to short due to long-due to resol due to resol due to month of the se se the effectivy small, need	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 applied conterm stabiliterm drift of ution of trave inearity of trapplied and metandard unce the number of content of the complete of the co	ROBERT: Type seric 08-1215 c 08-1215 c 04.889 64.910 64.907 64.888 multition by (from stan travelling standavelling standavelli	dard deviation) dandard [if needed] ues of dew/frost	of measuremed]	nents of trave	elling standa	on; labeled "dat	Hygromets Meas 1 0.0114 0.0060	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114 0.0050	
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Std uncert of Covariance Combination Effective de In most case if significanti	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Inties (in °C description of the service of the service of the service of the service of the effective of the service of t	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 applied conterm stabilities the different drift of ution of trave inearity of traveline and mode number of content of the best of the content of the number of conte	ROBERT: Type serie 08-1215 c Output in °C 64.889 64.910 64.907 64.888	dard deviation) dandard [if needed] ues of dew/frost	of measuremed]	nents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0114 0.0060 0.012893	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114 0.0050	
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Std uncert of Covariance Combination Effective de In most case If significanti	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Inties (in °C Incertainty of due to short due to long-due to resoil due to mondate to long-due to mondate longer	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied corterm stabiliterm drift of ution of trave without of trave inearity of trapplied and meaning of the complete of the complete of the transport of the complete of the transport of the tr	ROBERT: Type seric 08-1215 c 08-1215 c 08-1215 c 64.889 64.910 64.907 64.888 deling stands everling stands ev	dard deviation) dandard [if needed] andard [if needed] dard the soft dew/frost dard will be large throughout the cal	of measuremed] 1point tempo	nents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0114 0.0060 NOTE: onl	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114 0.0050	
- each partic Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Covariance Combinatio Effective de In most case If significant! Aggregat Mean of 4 of Type A star	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Applies (in °C of the control o	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1271 f applied conterm stabilitierm drift of ution of trave inearity of travelinearity of the number of of the taken in	ROBERT: Type seric 08-1215 c 08-1215 c 08-1215 c 04.889 64.910 64.907 64.888 milition ty (from stan travelling standa avelling standa avelling standa avelling standa avelling standa in a sured va ertainties in tertainty est degrees of free into account	dard deviation) of andard [if needed] ues of dew/frost dard ture dard deviation) of andard [if needed] ues of dew/frost quadrature imates: edom will be large throughout the cal	of measuremed] 1point tempo	nents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0114 0.0060 0.012893	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114 0.0050	
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of Std uncert of Covariance Combinatio Effective de In most case If significants Aggregat Mean of 4 of Type A star (Derived from	Hygrometer Applied dew-point in °C 65.014 65.032 65.026 65.009 Applies (in °C 65.014 65.032 65.026 65.009 65.0000 65.0000 65.0000 65.	for notes 08-1215 Resistance output in ohm 125.1176 125.1254 125.1244 125.1171 f applied conterm stabiliterm drift of ution of trave inearity of the travel in the	ROBERT: Type seria 08-1215 c 08-1215	dard deviation) of andard [if needed] ues of dew/frost dard ture dard deviation) of andard [if needed] ues of dew/frost quadrature imates: edom will be large throughout the cal	of measurement of measurement of measurement temperature of measurement of mea	ents of trave	elling standa	on; labeled "dat	Hygromete Meas 1 0.0114 0.0060 NOTE: onl	e "t" should e "t" should e "t" should or Meas 2 0.0114 0.0056	08-1215 Meas 3 0.0114 0.0045	Meas 4 0.0114 0.0050	

REPORT	ING TEMP	LATE FOR	DEW-PO	INT IN CCTG-I	K8		Nominal value:	80	°C	Lab name	NIST	
						measured in	the comparison; labeled "da					ninal dew-pc
								,			.,	
Put cursor	here	for notes										
Results												
	Llugramatar	08-1215	ROBERT:									
	Hygrometer	00-1213		or 08-1216								
	Applied	Resistance	00-1213	(meas dp -								
	dew-point	output	Output	applied dp)								
	in °C	in ohm	in °C	in °C								
Meas 1	79.985	130.8527	79.885	-0.100								
Meas 2	80.064	130.8815	79.960	-0.104								
Meas 3	80.048	130.8746	79.942	-0.106								
Meas 4	80.036	130.8713	79.933	-0.103								
Uncertair	nties (in °C	· \						Hygromete	ar.	08-1215		
Oncertain	indes (iii e	, 										
								Meas 1	Meas 2	Meas 3	Meas 4	
		f applied cor		dd			- III:	0.0166	0.0166	0.0166	0.0166	
						ients of trav	elling standard (type A)	0.0126	0.0025	0.0054	0.0069	
				andard [if neede ard [if needed]	uj							
				ard (if needed) ndard [if needed	1							
				lues of dew/frost		erature lif ne	eded1					
- Jorananoe	a	rr unu II	va		tompe							
Combination	on of these s	tandard unce	ertainties in	quadrature				0.02081	0.016783	0.017454	0.017991	
								,	2.3.00			
Effective de	egrees of fre	edom of unc	ertainty est	imates:		>50						
				edom will be large								
				throughout the cal				NOTE: onl	y fill in fiel	ds with gre	en backgro	ound
_												
Aggregat	tion of res	ults										
Mean of 4	dew-noint to	mperature d	ifforonces					-0.104				
				ility of difference	regults			0.0025				
		viation of 4 va			TOGUILO			0.0020				
				erature difference	e for the inst	rument		0.0210				
REPORT	ING TEMP	LATE FOR	DEW-PO	INT IN CCTG-I	K8		Nominal value:	85	°C	Lab name	NIST	
- each parti	icipant submi	ts one spread	dsheet sumi	nary per nomina	I dew-point	measured in	the comparison; labeled "da	ta t°C", wher	e "t" should	be replaced	d by the non	ninal dew-pc
D .												
Put cursor	here	for notes										
Results												
INCOURG			_									
	Hygrometer	08-1215	ROBERT:	al number:								
	r iy gramatar	00 1210	08-1215 d	or 08-1216								
	Applied	Resistance		(meas dp -								
	dew-point	output	Output	applied dp)								
	in °C	in ohm	in °C	in °C								
Meas 1	84.501	132.5757	84.403	-0.098								
Meas 2	84.548	132.5942	84.451	-0.097					-			
Meas 3	84.555	132.5953	84.454	-0.101								
Meas 4	84.492	132.5738	84.398	-0.095								
-	-		-						-			
Uncertai	ntipe (in °C									00.4045		
Jiiocitali								Hyarome				
	lities (iii C	·)						Hygromete Moss 1		08-1215 Maga 2	Moss 4	
04			- disi					Meas 1	Meas 2	Meas 3	Meas 4	
	ıncertainty o	f applied cor		dord douis "\	of me ac	nonte ef t	olling standard (*** A)	Meas 1 0.0169	Meas 2 0.0169	Meas 3 0.0169	0.0169	
Std uncert	incertainty o	f applied cor -term stabilit	y (from stan			nents of trav	elling standard (type A)	Meas 1	Meas 2	Meas 3		
Std uncert Std uncert	incertainty o due to short due to long-	f applied cor -term stabilit term drift of	y (from stan travelling st	andard [if neede		nents of trav	elling standard (type A)	Meas 1 0.0169	Meas 2 0.0169	Meas 3 0.0169	0.0169	
Std uncert Std uncert Std uncert	uncertainty o due to short due to long- due to resol	f applied cor -term stabilit term drift of ution of trave	y (from stan travelling st elling standa	andard [if neede ard [if needed]	d]	nents of trav	elling standard (type A)	Meas 1 0.0169	Meas 2 0.0169	Meas 3 0.0169	0.0169	
Std uncert Std uncert Std uncert Std uncert	uncertainty of due to short due to long- due to resol due to non-	f applied cor -term stabilit term drift of ution of trave inearity of tra	y (from stan travelling st elling standa avelling sta	andard [if neede ard [if needed] ndard [if needed	d]]			Meas 1 0.0169	Meas 2 0.0169	Meas 3 0.0169	0.0169	
Std uncert Std uncert Std uncert Std uncert	uncertainty of due to short due to long- due to resol due to non-	f applied cor -term stabilit term drift of ution of trave inearity of tra	y (from stan travelling st elling standa avelling sta	andard [if neede ard [if needed]	d]]			Meas 1 0.0169	Meas 2 0.0169	Meas 3 0.0169	0.0169	
Std uncert Std uncert Std uncert Std uncert Covariance	uncertainty o due to short due to long- due to resol due to non-le between a	f applied cor -term stabilit -term drift of ution of trave inearity of tra pplied and m	y (from stan travelling st elling stand: avelling sta neasured va	andard [if neede ard [if needed] ndard [if needed lues of dew/frost	d]]			Meas 1 0.0169	Meas 2 0.0169	Meas 3 0.0169 0.0098	0.0169 0.0034	
Std uncert Std uncert Std uncert Std uncert Covariance	uncertainty o due to short due to long- due to resol due to non-le between a	f applied cor -term stabilit term drift of ution of trave inearity of tra	y (from stan travelling st elling stand: avelling sta neasured va	andard [if neede ard [if needed] ndard [if needed lues of dew/frost	d]]			Meas 1 0.0169 0.0109	Meas 2 0.0169 0.0082	Meas 3 0.0169 0.0098	0.0169 0.0034	
Std uncert Std uncert Std uncert Std uncert Covariance	uncertainty of due to short due to long-due to resol due to non-le between a long of these s	f applied cor -term stabilit -term drift of ution of trave inearity of tra pplied and m	y (from stan travelling st elling stand: avelling sta neasured va ertainties in	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature	d]]			Meas 1 0.0169 0.0109	Meas 2 0.0169 0.0082	Meas 3 0.0169 0.0098	0.0169 0.0034	
Std uncert Std uncert Std uncert Std uncert Covariance Combinatio	uncertainty of due to short due to long-due to resol due to non-le between a con of these segrees of fre	f applied cor- term stabilit term drift of ution of trave inearity of trapplied and m standard unce	y (from stan travelling st elling standa avelling stan neasured va ertainties in ertainty est	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature	d]] -point tempe	erature [if ne		Meas 1 0.0169 0.0109	Meas 2 0.0169 0.0082	Meas 3 0.0169 0.0098	0.0169 0.0034	
Std uncert Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective de In most cas	uncertainty of due to short due to long-due to resol due to non-le between a con of these segrees of frees the effective	f applied cor- term stabilit term drift of ution of trave inearity of tra- pplied and m standard unco- tenumber of cor-	y (from stan travelling st elling standa avelling sta neasured va ertainties in certainty est degrees of fre	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature	d]] -point tempe	erature [if ne		Meas 1 0.0169 0.0109	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034	ound
Std uncert Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective de In most cas	uncertainty of due to short due to long-due to resol due to non-le between a con of these segrees of frees the effective	f applied cor- term stabilit term drift of ution of trave inearity of tra- pplied and m standard unco- tenumber of cor-	y (from stan travelling st elling standa avelling sta neasured va ertainties in certainty est degrees of fre	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature imates: edom will be large	d]] -point tempe	erature [if ne		Meas 1 0.0169 0.0109	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	ound
Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective de In most cas If significant	due to short due to long- due to resol due to non-le between a on of these s egrees of fre tes the effectively small, need	f applied cor- term stabilit term drift of ution of trave inearity of tra- pplied and m standard unce eadom of unce we number of of d to be taken in	y (from stan travelling st elling standa avelling sta neasured va ertainties in certainty est degrees of fre	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature imates: edom will be large	d]] -point tempe	erature [if ne		Meas 1 0.0169 0.0109	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	ound
Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective de In most cas If significant	uncertainty of due to short due to long-due to resol due to non-le between a con of these segrees of frees the effective	f applied cor- term stabilit term drift of ution of trave inearity of tra- pplied and m standard unce eadom of unce we number of of d to be taken in	y (from stan travelling st elling standa avelling sta neasured va ertainties in certainty est degrees of fre	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature imates: edom will be large	d]] -point tempe	erature [if ne		Meas 1 0.0169 0.0109	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	ound
Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective de In most cas If significant	due to short due to long- due to resol due to non-le between a on of these s egrees of fre tes the effectively small, need	f applied cor- term stabilit term drift of ution of trave inearity of tra- pplied and m standard unce eadom of unce we number of of d to be taken in	y (from stan travelling st elling standa avelling sta neasured va ertainties in certainty est degrees of fre	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature imates: edom will be large	d]] -point tempe	erature [if ne		Meas 1 0.0169 0.0109	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	bund
Std uncert Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective di In most cas If significant	uncertainty of due to short due to long-due to resol due to non-le between a on of these segrees of frees the effectivity small, need	f applied cor- term stabilit term drift of ution of trave inearity of tra- pplied and m standard unce tandard unce edom of unce we number of of d to be taken i	y (from stan travelling st lling stand: avelling stan easured va ertainties in certainty est degrees of fre into account	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature imates: edom will be large	d]] -point tempe	erature [if ne		Meas 1 0.0169 0.0109 0.020125	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	ound
Std uncert Std uncert Std uncert Std uncert Std uncert Covariance Combinatic Effective de In most cas If significant Aggregat	due to short due to long-due to resol due to non-le between a con of these segrees of freues the effectively small, need tion of resolution of resolution to the segrees of	f applied cor- term stabilit term drift of ution of trave inearity of tra- pplied and m standard unce endom of unce number of of d to be taken in	y (from stan travelling sta lling standa avelling standa avelling standa avelling standa becaused va ertainties in becrtainty est degrees of fre into account	andard [if neede ard [if needed] ndard [if needed lues of dew/frost quadrature imates: edom will be large throughout the cal	d]]-point tempe culation.	erature [if ne		Meas 1 0.0169 0.0109 0.020125 NOTE: onl	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	bund
Std uncert Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective de In most cas If significant Aggregat Mean of 4 t Type A stat	due to short due to long- due to resol due to non- e between a con of these s egrees of fre ses the effectivity small, need	f applied cor- term stabilit term drift of ution of trave inearity of tra- pplied and matandard unco- tended of unco- unco	y (from stan travelling standa avelling standa avelling standa avelling standa avelling standa avelling standa easured va ertainties in ertainty est degrees of fre into account ifferences reproducibi	andard [if needed and [if needed] indard [if needed] lues of dew/frost quadrature imates: edom will be large throughout the cal	d]]-point tempe culation.	erature [if ne		Meas 1 0.0169 0.0109 0.020125	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	ound
Std uncert Std uncert Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective di In most cas If significant Aggregat Mean of 4 of Type A star (Derived fror	uncertainty of due to short due to Iong-due to resol due to non-le between a con of these segrees of frees the effectivity small, need tion of resultion of resulting the mean dew-point tendard uncermination of dew-point tendard uncermination of dew-point tendard uncermination of dew-point tendard uncermination of due to Iong the Iong to Ion	f applied cor- term stability term drift of ution of trave inearity of tra- pplied and managed and managed tandard unco- ted uncompanied and unco- ted number of of d to be taken in	y (from stan travelling standa avelling standa avelling standa avelling stan easured va ertainties in ertainties in into account ifferences reproducib ilues on sam	andard [if needed] andard [if needed] andard [if needed] lues of dew/frost quadrature imates: edom will be large throughout the cal	d] -point tempe . culation.	>50		Meas 1 0.0169 0.0109 0.020125 NOTE: onl	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	ound
Std uncert Std uncert Std uncert Std uncert Std uncert Std uncert Covariance Combinatio Effective di In most cas If significant Aggregat Mean of 4 of Type A star (Derived fror	uncertainty of due to short due to Iong-due to resol due to non-le between a con of these segrees of frees the effectivity small, need tion of resultion of resulting the mean dew-point tendard uncermination of dew-point tendard uncermination of dew-point tendard uncermination of dew-point tendard uncermination of due to Iong the Iong to Ion	f applied cor- term stability term drift of ution of trave inearity of tra- pplied and managed and managed tandard unco- ted uncompanied and unco- ted number of of d to be taken in	y (from stan travelling standa avelling standa avelling standa avelling stan easured va ertainties in ertainties in into account ifferences reproducib ilues on sam	andard [if needed and [if needed] indard [if needed] lues of dew/frost quadrature imates: edom will be large throughout the cal	d] -point tempe . culation.	>50		Meas 1 0.0169 0.0109 0.020125 NOTE: onl	Meas 2 0.0169 0.0082 0.01878	Meas 3 0.0169 0.0098 0.0098	0.0169 0.0034 0.017244	bund

Fig. 12.6.h Results reported by NIST in Loop 2

				POINT IN CCTG-I				Nominal value:	30	°C	Lab name		
- each part	icipant submi	ts one spread	dsheet su	mmary per nomina	I dew-poin	t measured in	the comparis	on; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	ninal dev
Put cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1216											
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C	Difference (meas dp - applied dp) in °C									
Meas 1	29.998	111.6351	29.902	-0.095									
Meas 2	29.994	111.6337	29.899	-0.095									
Meas 3	29.988	111.6309	29.892	-0.097									
Meas 4	29.976	111.6261	29.879	-0.097									
Uncertai	nties (in °C	5)							Hygromete	er	08-1216		
		ĺ							Meas 1	Meas 2	Meas 3	Meas 4	
Standard ı	incertainty o	f applied cor	ndition						0.0082	0.0082	0.0082	0.0082	
Std uncert	due to short	-term stabilit	y (from s	andard deviation)	of measure	ments of trave	elling standa	ard (type A)	0.0014	0.0014	0.0010	0.0018	
Std uncert	due to long-	term drift of	travelling	standard [if neede	d]								
Std uncert	due to resol	ution of trave	elling sta	ndard [if needed]									
Std uncert	due to non-l	inearity of tra	avelling	standard [if needed									
Covarianc	e between a	pplied and m	easured	values of dew/frost	-point temp	perature [if ne	eded]						
Combinati	on of these s	standard unce	ertainties	in quadrature					0.008319	0.008326	0.008264	0.008391	
		edom of unc				>50							
				freedom will be large									
lf significant	tly small, nee	d to be taken i	into accou	int throughout the cal	culation.				NOTE: onl	y fill in fiel	ds with gre	een backgr	ound
Aggrega	tion of res	ults											
Mean of 4	dew-point te	mperature d	ifference	s					-0.096				
Type A sta	ndard uncer	tainty due to	reproduc	ibility of difference	results				0.0007				
Derived from	m standard de	eviation of 4 va	lues on sa	ame instrument)									

REPORT	ING TEMP	LATE FOR	DEW-PO	INT IN CCTG	-K8			Nominal value:	50	°C	Lab name	NIST
- each part	icipant submi	ts one spreac	dsheet sumi	nary per nomin	al dew-point	measured in	the comparis	on; labeled "dat	a t°C", wher	e "t" should	be replaced	d by the n
Put cursor	here	for notes										
i ut ouisoi	11010	ioi riotos										
Results												
			ROBERT:									
	Hygrometer	08-1216		al number:								
	A 111	Desistance	08-1215	or 08-1216								
	Applied dew-point	Resistance output	Output	(meas dp - applied dp)								
	in °C	in ohm	in °C	in °C								
Meas 1	49.975	119.3570	49.896	-0.079								
Meas 2	49.981	119.3598	49.903	-0.077								
Meas 3	49.987	119.3612	49.907	-0.080								
Meas 4	49.969	119.3549	49.890	-0.079								
Uncortai	nties (in °C	•1							Llugramat		08-1216	
Uncertail	ilies (iii C	•)							Hygromet			
									Meas 1	Meas 2	Meas 3	Meas 4
		f applied con							0.0110	0.0110	0.0110	0.0110
				dard deviation) andard [if need		ients of trav	eiling standa	ara (type A)	0.0033	0.0022	0.0042	0.0016
				andard [if need ard [if needed]	eaj							
				ndard [if neede	d1							
		-		lues of dew/fro	-	erature lif ne	ededl					
OO TUITUTIO	, between a	ppiica ana in	Cubarca va	luco di ucumino	J. point temp	Jiuturo (ii iit	Jeacaj					
Combination	on of these s	standard unce	ertainties in	quadrature					0.011484	0.011225	0.011778	0.01111
				1								
Effective d	egrees of fre	edom of unc	ertainty est	imates:		>50						
				edom will be larg								
If significant	ly small, nee	d to be taken i	nto account	throughout the ca	alculation.				NOTE: onl	y fill in fiel	ds with gre	en backo
Aggrega	tion of res	ults										
, .gg, cga												
	dew-point te	mperature di	ifferences						-0.079			
Mean of 4		tainty due to	reproducib	lity of differenc	e results				0.0012			
	ndard uncer	taility due to	reproducib	inty of difference	C ICOUILO							
Type A sta		eviation of 4 val	•	•	Cicouns							

REPORT	ING TEMP	LATE FOR	DEW-PO	INT IN CCTG-	K8		1	Nominal value:	65	°C	Lab name	NIST	
- each parti	icipant submi	s one sprea	dsheet sumr	mary per nomina	al dew-point	measured in	the compariso	n; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	minal dew-po
Put cursor	here	for notes											
Results													
Nesulis			1										
	Hygrometer	08-1216	ROBERT:	al number:									
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			or 08-1216									
	Applied	Resistance		(meas dp -									
	dew-point	output	Output	applied dp)									
	in °C	in ohm	in °C	in °C									
Meas 1	65.014 65.032	125.1376 125.1461	64.942 64.964	-0.072 -0.068									
Meas 2 Meas 3	65.026	125.1431	64.956	-0.070			-						
Meas 4	65.009	125.1353	64.936	-0.073	1								
mode :	00.000	120.1000	0000	0.070									
Uncertain	nties (in °C	:)							Hygromete	er	08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	incertainty o	f applied cor	ndition						0.0114	0.0114	0.0114	0.0114	
				dard deviation)	of measurem	ents of trave	elling standa	rd (type A)	0.0041	0.0037	0.0074	0.0038	
Std uncert	due to long-	term drift of	travelling st	andard [if need	ed]								
Std uncert	due to resol	ution of trave	elling standa	ard [if needed]									
				ndard [if needed	-								
Covariance	e between a	pplied and m	neasured va	lues of dew/fros	t-point tempe	erature [if ne	eeded]						
_													
Combination	on of these s	tandard unce	ertainties in	quadrature					0.012099	0.011983	0.013591	0.012028	
	-	edom of und	-			>50							
				edom will be large throughout the ca			-		NOTE:	v 60 i = 41 ·	de with -	on back-	ound
ir significant	iy smaii, need	to be taken	into account	throughout the ca	liculation.				NOTE: On	y fili in fiei	ds with gre	en backgr	ouna
Aggregat	tion of res	ults											
33 3													
Mean of 4	dew-point te	mperature d	ifferences						-0.071				
Type A star	ndard uncer	tainty due to	reproducibi	ility of difference	eresults				0.0022				
_		viation of 4 va											
Standard u	incertainty o	f mean dew-	point tempe	erature differenc	e for the inst	rument			0.0123				
PEDORT	INC TEMP	I ATE EOR	DEW-PO	INT IN CCTG.	Kα			Nominal value	80	°C	Lab name	NICT	
				INT IN CCTG-		measured in		Nominal value:	80	°C	Lab name		ninal daw-no
				INT IN CCTG- mary per nomina		measured in							minal dew-po
						measured in							minal dew-po
- each parti	icipant submi	s one sprea				measured in							ninal dew-po
- each parti	icipant submi	s one sprea				measured in							ninal dew-pc
- each parti	here	s one spread for notes	dsheet sumr	mary per nomina		measured in							ninal dew-po
- each parti	icipant submi	s one sprea	ROBERT:	mary per nomina		measured in							ninal dew-pc
- each parti	here Hygrometer	for notes 08-1216	ROBERT:	al number: pr 08-1216		measured in							ninal dew-pc
- each parti	here Hygrometer Applied	for notes 08-1216 Resistance	ROBERT: Type serie	al number: or 08-1216 (meas dp -		measured in							ninal dew-pc
- each parti	here Hygrometer	for notes 08-1216	ROBERT:	al number: pr 08-1216		measured in							ninal dew-pc
- each parti	here Hygrometer Applied dew-point	for notes 08-1216 Resistance output	ROBERT: Type serie 08-1215 c	al number: or 08-1216 (meas dp - applied dp)		measured in							ninal dew-pc
- each parti Put cursor Results	here Hygrometer Applied dew-point in °C	for notes 08-1216 Resistance output in ohm	ROBERT: Type serie 08-1215 c Output in °C	al number: or 08-1216 (meas dp - applied dp) in °C		measured in							ninal dew-pc
- each parti Put cursor Results Meas 1	here Hygrometer Applied dew-point in °C 79.985	for notes 08-1216 Resistance output in ohm 130.8717	ROBERT: Type serie 08-1215 c Output in °C 79.934	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050		measured in							ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2	here Hygrometer Applied dew-point in °C 79.985 80.064	for notes 08-1216 Resistance output in ohm 130.8717 130.9023	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050		measured in							ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3	here Hygrometer Applied dew-point in °C 79.985 80.064 80.048	08-1216 Resistance output in ohm 130.8717 130.9923 130.8961	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050		measured in							ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3	here Hygrometer Applied dew-point in °C 79.985 80.064 80.048	08-1216 Resistance output in ohm 130.8717 130.9923 130.8961	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050		measured in							ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4	here Hygrometer Applied dew-point in °C 79.985 80.064 80.036	08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050		measured in			a t°C*, wher	e "t" should	be replaced		ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4	here Hygrometer Applied dew-point in °C 79.985 80.064 80.048	08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050		measured in			a t°C*, wher	e "t" should	be replaced	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain	here Hygrometer Applied dew-point in °C 79.985 80.064 80.036	08-1216 Resistance output in ohm 130.8717 130.9923 130.8961 130.8897	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050		measured in			a t°C*, wher	e "t" should	be replaced 08-1216 Meas 3	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain	Hygrometer Applied dew-point in °C 79.985 80.064 80.036	08-1216 Resistance output in ohm 130.8717 130.9923 130.8961 130.8897	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.050	al dew-point		the compariso	on; labeled "dat	a t°C*, wher Hygromete Meas 1 0.0166	e "t" should	08-1216 Meas 3 0.0166	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036	08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982	mary per nominal mary per nominal number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055	of measurem		the compariso	on; labeled "dat	a t°C*, wher	e "t" should	be replaced 08-1216 Meas 3	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.050 -0.055	of measurem		the compariso	on; labeled "dat	a t°C*, wher Hygromete Meas 1 0.0166	e "t" should	08-1216 Meas 3 0.0166	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Standard u Std uncert Std uncert	here Hygrometer Applied dew-point in °C 79.985 80.064 80.036 Inties (in °C	one spread for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabilite term drift of ution of trave	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) andard [if needed]	of measuremed]		the compariso	on; labeled "dat	a t°C*, wher Hygromete Meas 1 0.0166	e "t" should	08-1216 Meas 3 0.0166	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert	Hygrometer Applied dew-point in °C 79.985 80.064 80.036 nties (in °C uncertainty of due to short due to long-due to resol due to non-leaf	os-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982	mary per nomina al number: pr 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.050 -0.055	of measuremed]	ents of trave	the comparisc	on; labeled "dat	a t°C*, wher Hygromete Meas 1 0.0166	e "t" should	08-1216 Meas 3 0.0166	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert	Hygrometer Applied dew-point in °C 79.985 80.064 80.036 nties (in °C uncertainty of due to short due to long-due to resol due to non-leaf	os-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982	al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) andard [if needed]	of measuremed]	ents of trave	the comparisc	on; labeled "dat	a t°C*, wher Hygromete Meas 1 0.0166	e "t" should	08-1216 Meas 3 0.0166	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert Covariance	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-less between a se between a se	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabilit term drift of ution of trave inearity of trave inearity of trave inearity of travelinearity of travel	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 ndition y (from stan travelling standa avelling standa	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) tandard [if needed] lues of dew/fros	of measuremed]	ents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should err Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert Covariance	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-less between a se between a se	os-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 ndition y (from stan travelling standa avelling standa	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) tandard [if needed] lues of dew/fros	of measuremed]	ents of trave	the comparisc	on; labeled "dat	a t°C*, wher Hygromete Meas 1 0.0166	e "t" should	08-1216 Meas 3 0.0166	d by the nor	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertail Standard u Standard u Std uncert Std uncert Std uncert Covariance Combinatio	here Hygrometer Applied dew-point in °C 79.985 80.064 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-le between a	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of ution of trave inearity of trapplied and management and ard unce	ROBERT: Type serie 08-1215 c 08-1215 c 04-1215 c 09-1215 c 09-934 80.014 79.998 79.982 Indition y (from stan travelling standa avelling standa avelling standa avelling standa avelling standa avelling standa avelling standa	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) landard [if needed] ndard [if needed] lues of dew/fros	of measuremed]	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should err Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert Covariance Combinatio	Hygrometer Applied dew-point in °C 79.985 80.064 80.036 Inties (in °C uncertainty of due to short due to long-due to resol due to non-les between a	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of ution of trave inearity of trapplied and material and and dedom of unceedom o	ROBERT: Type serie 08-1215 c Output in °C 79-934 80.014 79.998 79.982	danumber: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.050 -0.055 dard deviation) tandard [if needed] undard [if needed]	of measuremed]	ents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should err Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	ninal dew-pc
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Covariance Combinatic Effective de	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-les between a general free sthe effective es the effective short due to free short due to non-les between a general free sthe effective short due to short due to non-les between a general free short due to short due to non-les between a general free short due to short due to non-les between a general free short due to short du	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabilitierm drift of ution of trave inearity of trave inearity of travelendand uncle edom of uncle enumber of cenumber of	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 nuition by (from stan travelling standavelling standavell	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) landard [if needed] ndard [if needed] lues of dew/fros	of measuremed]	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Covariance Combinatic Effective de	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-les between a general free sthe effective es the effective short due to free short due to non-les between a general free sthe effective short due to short due to non-les between a general free short due to short due to non-les between a general free short due to short due to non-les between a general free short due to short du	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabilitierm drift of ution of trave inearity of trave inearity of travelendand uncle edom of uncle enumber of cenumber of	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 nuition by (from stan travelling standavelling standavell	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) iandard [if needed] ard [if needed] clues of dew/frost quadrature imates: eedom will be large	of measuremed]	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertail Standard u Std uncert Std uncert Covariance Combinatic Effective de In most cas If significant	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-les between a segrees of free es the effectivity small, need	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of ution of trave ution of trave inearity of trapplied and meaning of the policy	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 nuition by (from stan travelling standavelling standavell	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) iandard [if needed] ard [if needed] clues of dew/frost quadrature imates: eedom will be large	of measuremed]	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertail Standard u Std uncert Std uncert Covariance Combinatic Effective de In most cas If significant	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-les between a general free sthe effective es the effective short due to free short due to non-les between a general free sthe effective short due to short due to non-les between a general free short due to short due to non-les between a general free short due to short due to non-les between a general free short due to short du	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of ution of trave ution of trave inearity of trapplied and meaning of the policy	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 nuition by (from stan travelling standavelling standavell	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) iandard [if needed] ard [if needed] clues of dew/frost quadrature imates: eedom will be large	of measuremed]	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertail Standard u Std uncert Std uncert Covariance Combinatic Effective de In most cas If significant	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-les between a segrees of free es the effectivity small, need	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of ution of trave ution of trave inearity of trapplied and meaning of the policy	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 nuition by (from stan travelling standavelling standavell	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) iandard [if needed] ard [if needed] clues of dew/frost quadrature imates: eedom will be large	of measuremed]	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each partit Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertail Standard u Standard u Std uncert Std uncert Std uncert Covariance Combinatio In most cas If significant	here Applied dew-point in °C 79.985 80.064 80.048 80.036 Interest (in °C Int	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabilite term drift of ution of trave inearity of travelinearity of trave	ROBERT: Type serie 08-1215 c 08-1215 c 09-1215 c 09-1215 c 09-934 80.014 79.998 79.982 Indition Travelling standary sta	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) iandard [if needed] ard [if needed] clues of dew/frost quadrature imates: eedom will be large	of measuremed]	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110 0.019887	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each particle Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Std uncert Covariance Combinatic Effective de in most cas if significant Aggregat Mean of 4 of	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to long-due to resol due to non-less the effective small, need to of residue to nor feed to the effective small, need to of residue to nor feed to nor feed to no	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of ution of trave ution of trave in and and unce number of content of to be taken in the stable of the policy of the polic	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 Indition by (from stan travelling stands avelling stand	mary per nomina al number: or 08-1216 (meas dp - applied dp) in °C -0.051 -0.050 -0.055 dard deviation) andard [if needed] andard [if needed] lues of dew/fros quadrature imates: eedom will be large throughout the ca	of measuremed] i] t-point temps e.	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each particular put cursor Results Meas 1 Meas 2 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Covariance Combinatio Effective di In most cas If significant Aggregat Mean of 4 t Type A stat	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C Incertainty of due to short due to short due to long-due to non-label to non-lab	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabilitierm drift of ution of trave inearity of the travel in t	ROBERT: Type serie 08-1215 c Output in °C 79.934 80.014 79.998 79.982 notition travelling standavelling standavel	dard deviation) and deviation)	of measuremed] i] t-point temps e.	nents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110 0.019887	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each particle Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Covariance Combinatio Effective dd In most cas If significant Aggregat Mean of 4 of Type A stan (Derived fron	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C International inter	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of ution of trave inearity of trave in	ROBERT: Type seriz 08-1215 c Output in °C 79.934 80.014 79.998 79.982 Indition by (from stant travelling standars avelling standars avell	mary per nomina al number: or 08-1216 (meas dp - applied dp) applied dp) in °C -0.051 -0.050 -0.050 -0.055 dard deviation) andard [if needed] ard [if	of measuremed] at-point tempe	ents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110 0.019887	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	
- each particular put cursor Results Meas 1 Meas 2 Meas 2 Meas 3 Meas 4 Uncertain Standard u Std uncert Std uncert Covariance Combinatio Effective dd In most cas If significant Aggregat Mean of 4 of Type A star (Derived fror	Hygrometer Applied dew-point in °C 79.985 80.064 80.048 80.036 Inties (in °C International inter	for notes 08-1216 Resistance output in ohm 130.8717 130.9023 130.8961 130.8897 f applied conterm stabiliterm drift of ution of trave inearity of trave in	ROBERT: Type seriz 08-1215 c Output in °C 79.934 80.014 79.998 79.982 Indition by (from stant travelling standars avelling standars avell	dard deviation) and deviation)	of measuremed] at-point tempe	ents of trave	the comparisc	on; labeled "dat	Hygromete Meas 1 0.0166 0.0110	e "t" should e "t" should or Meas 2 0.0166 0.0025	08-1216 Meas 3 0.0166 0.0032	Meas 4 0.0166 0.0076	

				INT IN CCTG-				Nominal value:	85	°C	Lab name		
- each part	icipant submi	ts one spread	Isheet summ	nary per nomina	I dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nom	ninal dev
out cursor	here	for notes											
Results													
iveania													
	Hygrometer	08-1216	ROBERT:	Il number:									
	riygiometer	00 1210		or 08-1216									
	Applied	Resistance		(meas dp -									
	dew-point	output	Output	applied dp)									
	in °C	in ohm	in °C	in °C									
Meas 1	84.501	132.5938	84.450	-0.050									
Meas 2	84.548	132.6121	84.498	-0.050									
Meas 3	84.555	132.6129	84.500	-0.055									
Meas 4	84.492	132.5902	84.441	-0.052									
Uncertai	nties (in °C	;)							Hygromete	er	08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ι	incertainty o	f applied con	dition						0.0169	0.0169	0.0169	0.0169	
Std uncert	due to short	-term stability	/ (from stan	dard deviation)	of measurer	nents of trave	elling stand	ard (type A)	0.0056	0.0102	0.0067	0.0057	
Std uncert	due to long-	term drift of t	ravelling st	andard [if neede	ed]								
Std uncert	due to resol	ution of trave	lling standa	ard [if needed]									
Std uncert	due to non-l	inearity of tra	velling star	ndard [if needed]								
Covariance	e between a	pplied and m	easured va	lues of dew/fros	t-point temp	erature [if ne	eded]						
Combinati	on of these s	tandard unce	rtainties in	quadrature					0.017795	0.01972	0.018195	0.017829	
Effective d	egrees of fre	edom of unc	ertainty esti	mates:		>50							
In most cas	es the effecti	ve number of d	egrees of fre	edom will be large).								
If significant	ly small, nee	d to be taken i	nto account	throughout the ca	lculation.				NOTE: onl	y fill in fiel	ds with gre	en backgro	ound
	tion of res	ults											
Aggrega													
Aggrega													
	dew-point te	mperature di	fferences						-0.052				
Mean of 4	•	•		lity of difference	results				-0.052 0.0023				
Mean of 4 Type A sta	ndard uncer	•	reproducibi	-	results								

Fig. 12.6.i Results reported by NMC, A*STAR in Loop 1

												NMC, A*ST	
each parti	icipant submit	s one spread	dsheet sum	mary per nomina	al dew-point	measured in	the comparis	on; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal o
			1-	ODEDT									
it cursor	here	for notes		OBERT: pe serial number:									
				7pe serial number: 3-1215 or 08-1216									
esults			/ 100										
			/										
	Hygrometer	08-1215											
				Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Output	applied dp)									
	in °C	in ohm	in °C	in °C									
leas 1	30.000	111.6083	29.833	-0.166									
leas 2	30.002	111.6077	29.832	-0.170									
leas 3	30.028	111.6206	29.865	-0.163									
		111.6080	-		-								-
leas 4	30.003	111.0000	29.832	-0.170									
Jncertai	nties (in °C)							Hygromete	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard :	incertainty of	f applied ser	dition						0.0352	0.0355	0.0348	0.0353	
				dead decided			. 111						
				dard deviation)		ents of trave	eiiing stand	ard (type A)	0.0052	0.0030	0.0021	0.0017	_
				tandard [if neede	ed]								
Std uncert	due to resol	ution of trave	elling stand	ard [if needed]									_
td uncert	due to non-l	inearity of tra	avelling sta	ndard [if needed	1]								
				lues of dew/fros		erature (if ne	ededl						
					,								
`ombir-c'	on of the	tandard	artaintice !	auadratur-					0.0355	0.0050	0.0349	0.0054	
omomatio	on of these s	tanuara unce	ertarrities in	quaurature	-				0.0355	0.0356	0.0349	0.0354	-
	egrees of fre		-			2319	k=2						
				edom will be large									
significant	ly small, need	d to be taken i	into account	throughout the ca	lculation.				NOTE: onl	y fill in fiel	ds with gre	en backgro	ound
Aggrega	tion of resi	ults											
.555-													
loon of 4	dow point to	mnoroturo d	ifforonooc						-0.167				
	dew-point te			1116 6 - 4122									
ype A sta	ngarg uncert	ainty due to	reproducib		recilite				0.0035				
•		-		-	o results								
	m standard de	viation of 4 va	lues on sam	e instrument)									
	m standard de	viation of 4 va	lues on sam	-		rument			0.0357				
	m standard de	viation of 4 va	lues on sam	e instrument)		rument			0.0357				
Standard u	m standard de uncertainty o	viation of 4 va f mean dew-	lues on sam point tempe	e instrument) erature differenc	e for the inst	rument			0.0357				
Standard ι	m standard de uncertainty o	viation of 4 va f mean dew-	lues on sam point tempe	e instrument)	e for the inst	rument		Nominal value:	0.0357	°C	Lab name	NMC, A*S1	ΓAR
REPORT	m standard de incertainty o	viation of 4 va f mean dew-	point tempe	e instrument) erature differenc	e for the inst		the comparis		50				
REPORT	m standard de incertainty o	viation of 4 va f mean dew-	point tempe	e instrument) erature differenc	e for the inst		the comparis		50				
REPORT	n standard de uncertainty o	triation of 4 variation of 4 variati	point tempe	e instrument) erature differenc	e for the inst		the comparis		50				
REPORT	m standard de uncertainty o ING TEMP	viation of 4 va f mean dew-	point tempe	e instrument) erature differenc	e for the inst		the comparis		50				
REPORT - each part	n standard de uncertainty o	triation of 4 variation of 4 variati	point tempe	e instrument) erature differenc	e for the inst		the comparis		50				
REPORT - each part	n standard de uncertainty o	triation of 4 variation of 4 variati	point tempe	e instrument) erature differenc	e for the inst		the comparis		50				
REPORT - each part	n standard de uncertainty o	viation of 4 va f mean dew- LATE FOR s one spread for notes	DEW-PO	e instrument) erature differenc NINT IN CCTG- mary per nomina	e for the inst		the comparis		50				
REPORT - each part	n standard de uncertainty o	triation of 4 variation of 4 variati	DEW-PO	e instrument) erature difference NINT IN CCTG- mary per nomina	e for the inst		the comparis		50				
Standard u	m standard de uncertainty o sincertainty o sincerta	LATE FOR sone spread for notes	DEW-PO	e instrument) erature differenc INT IN CCTG- mary per nomina	e for the inst		the comparis		50				
REPORT - each part	n standard de uncertainty o	viation of 4 va f mean dew- LATE FOR s one spread for notes	DEW-PO	e instrument) erature difference NINT IN CCTG- mary per nomina	e for the inst		the comparis		50				
REPORT - each part	m standard de uncertainty o sincertainty o sincerta	LATE FOR sone spread for notes	DEW-PO	e instrument) erature difference INT IN CCTG- mary per nomina al number: or 08-1216	e for the inst		the comparis		50				
REPORT - each part	rn standard de Incertainty o TING TEMP Icipant submit here Hygrometer Applied	LATE FOR sone spread for notes 08-1215 Resistance	DEW-PO dsheet sum ROBERT: Type seria 08-1215	e instrument) erature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up -	e for the inst		the comparis		50				
REPORT each parti	TING TEMP icipant submit here Hygrometer Applied dew-point	LATE FOR s one spread for notes 08-1215 Resistance output	DEW-PO dsheet sum ROBERT: Type serio 08-1215 o Output	e instrument) erature difference INT IN CCTG- mary per nomina el number: or 08-1216 (meas up- applied dp)	e for the inst		the comparis		50				
REPORT - each part Put cursor Results	Hygrometer Applied dew-point in °C 50.064	viation of 4 va f mean dew- LATE FOR is one spread for notes 08-1215 Resistance output in ohm 119.3657	ROBERT: Type serio 08-1215 Output in °C 49-918	e instrument) PINT IN CCTG- mary per nomina In number: or 08-1216 (mreas up -) applied up -) in °C -0.145	e for the inst		the comparis		50				
REPORT - each parti Put cursor Results	Hygrometer Applied dew-point in °C 50.064 50.061	LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657	ROBERT: Type serio8-1215 Output in '0' 49,918	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up- applied dp) in °C -0.145 -0.142	e for the inst		the comparis		50				
REPORT - each parti Put cursor Results Meas 1 Meas 2 Meas 3	Hygrometer Applied dew-point in °C 50.064 50.065	LATE FOR S one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677	ROBERT: Type seriols-1215 Output in °C 49.918 49.919	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	e for the inst		the comparis		50				
REPORT each particular cursor Results	Hygrometer Applied dew-point in °C 50.064 50.061	LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657	ROBERT: Type serio8-1215 Output in '0' 49,918	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up- applied dp) in °C -0.145 -0.142	e for the inst		the comparis		50				
REPORT each particular cursor Results	Hygrometer Applied dew-point in °C 50.064 50.065	LATE FOR S one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677	ROBERT: Type seriols-1215 Output in °C 49.918 49.919	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	e for the inst		the comparis		50				
REPORT each partirut cursor Results	Hygrometer Applied dew-point in °C 50.064 50.065	LATE FOR S one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677	ROBERT: Type seriols-1215 Output in °C 49.918 49.919	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	e for the inst		the comparis		50				
REPORT each particular cursor Results	Hygrometer Applied dew-point in °C 50.064 50.065	LATE FOR S one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677	ROBERT: Type seriols-1215 Output in °C 49.918 49.919	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	e for the inst		the comparis		50				
REPORT each part	Hygrometer Applied dew-point in °C 50.064 50.065 50.035	viation of 4 va f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548	ROBERT: Type seriols-1215 Output in °C 49.918 49.919	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	e for the inst		the comparis		50 a t°C", wher	e "t" should	be replace		
REPORT each part each part Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4	Hygrometer Applied dew-point in °C 50.064 50.065	viation of 4 va f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548	ROBERT: Type seriols-1215 Output in °C 49.918 49.919	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	e for the inst		the comparis		50 a t°C", when	e "t" should	be replace	d by the non	
REPORT each parti Put cursor Results Meas 1 Meas 2 Meas 3 Meas 3 Meas 4	Hygrometer Applied dew-point in °C 50.064 50.065 50.035	viation of 4 va f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548	ROBERT. Type series 08-1216 Output in °C 49.918 49.918 49.924 49.890	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	e for the inst		the comparis		50 a t°C", when	e "t" should	be replace 08-1215 Meas 3	by the non	
REPORT - each part	Hygrometer Applied dew-point in °C 50.064 50.065 50.035	viation of 4 va f mean dew- LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548	ROBERT. Type series 08-1216 Output in °C 49.918 49.918 49.924 49.890	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	e for the inst		the comparis		50 a t°C", when	e "t" should	be replace	d by the non	
REPORT - each part	Hygrometer Applied dew-point in °C 50.064 50.065 50.035	LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548	ROBERT: Type serio8-1215 Output in °C 49.918 49.919 49.924 49.890	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141	K8 al dew-point	measured in		on, labeled "dat	50 a t°C", when	e "t" should	be replace 08-1215 Meas 3	by the non	
REPORT each part each part rut cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard user Std uncert	Hygrometer Applied dew-point in °C 50.064 50.065 50.035	LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548	ROBERT: Type serios-1215 Output in °C 49.919 49.924 49.890 dittion y (from stan	e instrument) prature difference INT IN CCTG- mary per nomins al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141 -0.145	K8 al dew-point	measured in		on, labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0388	e "t" should e "t" should Meas 2 0.0385	08-1215 Meas 3 0.0385	Meas 4 0.0386	
REPORT each part each part Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Jincertail	Hygrometer Applied dew-point in °C 50.064 50.065 50.035	LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677 119.3548	ROBERT: Type serie (08-1215 e Output in °C 49.918 49.924 49.890 Addition y (from stantaravelling startavelling startav	e instrument) erature difference INT IN CCTG- mary per nomina a number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.142 -0.141 -0.145 dard deviation) tandard [if neede	K8 al dew-point	measured in		on, labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0388	e "t" should e "t" should Meas 2 0.0385	08-1215 Meas 3 0.0385	Meas 4 0.0386	
REPORT each part each part Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain Standard L Sta	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied to short due to short due to long-due to resoli due to resoli	LATE FOR sone spread for notes 08-1215 Resistance output in 119.3657 119.3657 119.3548) f applied corterm stabilit term drift of tution of trave	ROBERT: Type serion-108-1215 Output in °C 49.918 49.919 49.924 49.890 dittion y (from stant ravelling stand)	e instrument) erature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141 -0.145 dard deviation) tandard [if neede ard [if needed]	K8 al dew-point of measuremed	measured in		on, labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0388	e "t" should e "t" should Meas 2 0.0385	08-1215 Meas 3 0.0385	Meas 4 0.0386	
REPORT each particular cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertain standard used uncert stat uncert sta	Hygrometer Applied dew-point in °C 50.064 50.065 50.055 Applied dew-point in °C control of the point in °C and the point in °C	LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548) f applied corterm stabiliterm drift of tution of trave uitno not return stabiliter drift of tution of trave uitno not return stabiliter and rift of tution of trave uitno not return stabiliter and rift of tution of trave uitno not return stabiliter and rift of tution of trave uitno not return stability of traveline and return stability of traveline a	ROBERT: Type serion-108-1215 Output in °C 49-918 49-919 49-924 49-890 Indition stantravelling stales	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216	K8 al dew-point of measuremed]	measured in	elling stand	on, labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0388	e "t" should e "t" should Meas 2 0.0385	08-1215 Meas 3 0.0385	Meas 4 0.0386	
REPORT each partirut cursor Results Heas 1 Heas 2 Heas 3 Heas 4 Jincertain tandard ut	Hygrometer Applied dew-point in °C 50.064 50.065 50.055 Applied dew-point in °C control of the point in °C and the point in °C	LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548) f applied corterm stabiliterm drift of tution of trave uitno not return stabiliter drift of tution of trave uitno not return stabiliter drift of tution of trave uitno not return stabiliterm drift of tution of trave uitno not return stabiliterm drift of tution of trave uitno not return stabiliterm drift of tution of trave uitno not return stability of trave union and travel not return stability of	ROBERT: Type serion-108-1215 Output in °C 49-918 49-919 49-924 49-890 Indition stantravelling stales	e instrument) erature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141 -0.145 dard deviation) tandard [if neede ard [if needed]	K8 al dew-point of measuremed]	measured in	elling stand	on, labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0388	e "t" should e "t" should Meas 2 0.0385	08-1215 Meas 3 0.0385	Meas 4 0.0386	
REPORT each part each part ut cursor Results leas 1 leas 2 leas 3 leas 4 Juncertail tandard ut tat uncert	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied (in °C uncertainty of due to short due to long-due to resolidue to non-le between all e between all e between all e between all e control of the contro	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677 119.3548) f applied conterm stabiliterm drift of ution of trays in ordinary of the content of the co	ROBERT: Type seriols-1215 Output in °C 49.918 49.990 Addition y (from stantravelling standavelling s	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.142 -0.141 -0.145 dard deviation) tandard [if needed] undard [if needed] undard [if needed] undard [if needed] undard [if needed]	K8 al dew-point of measuremed]	measured in	elling stand	on, labeled "dat	50 a t°C", when Hygrometr Meas 1 0.0388 0.0027	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	
REPORT each part ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertail tt duncert tt duncert tt duncert tt duncert tt duncert to uncert	Hygrometer Applied dew-point in °C 50.064 50.065 50.065 50.055 Inties (in °C Incertainty of due to short due to long-due to resold due to non-leaf	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677 119.3548) f applied conterm stabiliterm drift of ution of trays in ordinary of the content of the co	ROBERT: Type seriols-1215 Output in °C 49.918 49.990 Addition y (from stantravelling standavelling s	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.142 -0.141 -0.145 dard deviation) tandard [if needed] undard [if needed] undard [if needed] undard [if needed] undard [if needed]	K8 al dew-point of measuremed]	measured in	elling stand	on, labeled "dat	50 a t°C", when Hygrometa Meas 1 0.0388	e "t" should e "t" should Meas 2 0.0385	08-1215 Meas 3 0.0385	Meas 4 0.0386	
REPORT each part each part ut cursor Results leas 1 leas 2 leas 3 leas 4 Juncertail tandard ut tat uncert	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied (in °C uncertainty of due to short due to long-due to resolidue to non-le between all e between all e between all e between all e control of the contro	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677 119.3548) f applied conterm stabiliterm drift of ution of trays in ordinary of the content of the co	ROBERT: Type seriols-1215 Output in °C 49.918 49.990 Addition y (from stantravelling standavelling s	e instrument) prature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.142 -0.141 -0.145 dard deviation) tandard [if needed] undard [if needed] undard [if needed] undard [if needed] undard [if needed]	K8 al dew-point of measuremed]	measured in	elling stand	on, labeled "dat	50 a t°C", when Hygrometr Meas 1 0.0388 0.0027	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	
REPORT each part rut cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Jincertain did uncert did uncert did uncert covariance combinatio	Hygrometer Applied dew-point in °C 50.064 50.065 50.065 50.055 Inties (in °C Incertainty of due to short due to long-due to resold due to non-le between all on of these s	LATE FOR s one spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548) f applied corterm stability term drift of tution of trave into order to the corterm stability term drift of tution of trave incertily of trapplied and motandard uncertainty of trapplied and mota	ROBERT: Type serion-108-1215 Output in °C 49-918 49-919 49-924 49-890 Indition stantravelling stalling standavelling stallers are assured varieties in extension of the control of the con	e instrument) erature difference INT IN CCTG- mary per nomina al number: or 08-1216	K8 al dew-point of measuremed]	measured in	elling stand	on, labeled "dat	50 a t°C", when Hygrometr Meas 1 0.0388 0.0027	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	
REPORT each part	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied dew-point in °C concertainty of due to short due to long-due to resold due to non-lee between all on of these segrees of free	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548) f applied corderm stabiliteterm drift of tution of trave time arity of trapplied and mutandard unce edom of unce edom of unce	ROBERT: Type serios-1215 Output in °C 49.919 49.924 49.890 Idition y (from stantravelling standavelling standavel	e instrument) erature difference INT IN CCTG- mary per nomins al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.145 -0.141 -0.145 dard deviation) tandard [if needed] ndard [if needed] ulues of dew/fros quadrature imates:	K8 al dew-point of measuremed]	measured in	elling stand	on, labeled "dat	50 a t°C", when Hygrometr Meas 1 0.0388 0.0027	e "t" should e "t" should e "t" should	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	
REPORT each part	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Anties (in °C Incertainty o due to short due to long-due to resol due to non-le between appon of these s	URATE FOR Sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548) f applied conterm stabiliterm drift of ution of tracking in ohm and	ROBERT: Type serting 1918 1919 1919 1919 1919 1919 1919 1919	e instrument) erature difference INT IN CCTG- mary per nomina a number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.145 -0.145 -0.145 in addard deviation) tandard [if needed] undard [if needed]	K8 al dew-point of measuremed] it-point temps	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (
REPORT each part	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Anties (in °C Incertainty o due to short due to long-due to resol due to non-le between appon of these s	URATE FOR Sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548) f applied conterm stabiliterm drift of ution of tracking in ohm and	ROBERT: Type serting 1918 1919 1919 1919 1919 1919 1919 1919	e instrument) erature difference INT IN CCTG- mary per nomins al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.145 -0.141 -0.145 dard deviation) tandard [if needed] ndard [if needed] ulues of dew/fros quadrature imates:	K8 al dew-point of measuremed] it-point temps	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (
REPORT each partirut cursor Results leas 1 leas 2 leas 2 leas 3 leas 4 Jncertail tandard ut tandard ut tandard uncert tat uncert	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Anties (in °C Incertainty o due to short due to long-due to resol due to non-le between appon of these s	URATE FOR Sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548) f applied conterm stabiliterm drift of ution of tracking in ohm and	ROBERT: Type serting 1918 1919 1919 1919 1919 1919 1919 1919	e instrument) erature difference INT IN CCTG- mary per nomina a number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.145 -0.145 -0.145 in addard deviation) tandard [if needed] undard [if needed]	K8 al dew-point of measuremed] it-point temps	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal
REPORT each partirut cursor Results leas 1 leas 2 leas 2 leas 3 leas 4 Jncertain tandard uncert tit duncert tit duncert tit duncert tit uncert	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied to short due to long-due to resoli due to non-le between all on of these segrees of free ses the effectivity small, need	USATE FOR SOME STREET OF THE S	ROBERT: Type serting 1918 1919 1919 1919 1919 1919 1919 1919	e instrument) erature difference INT IN CCTG- mary per nomina a number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.145 -0.145 -0.145 in addard deviation) tandard [if needed] undard [if needed]	K8 al dew-point of measuremed] it-point temps	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (
REPORT each parti ut cursor Results leas 1 leas 2 leas 2 leas 3 leas 4 Uncertain tt duncert tt duncert tt duncert tt duncert to uncert	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Anties (in °C Incertainty o due to short due to long-due to resol due to non-le between appon of these s	USATE FOR SOME STREET OF THE S	ROBERT: Type serting 1918 1919 1919 1919 1919 1919 1919 1919	e instrument) erature difference INT IN CCTG- mary per nomina a number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.145 -0.145 -0.145 in addard deviation) tandard [if needed] undard [if needed]	K8 al dew-point of measuremed] it-point temps	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (
REPORT each part	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied to short due to long-due to resoli due to non-le between all on of these segrees of free ses the effectivity small, need	USATE FOR SOME STREET OF THE S	ROBERT: Type serting 1918 1919 1919 1919 1919 1919 1919 1919	e instrument) erature difference INT IN CCTG- mary per nomina a number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.145 -0.145 -0.145 in addard deviation) tandard [if needed] undard [if needed]	K8 al dew-point of measuremed] it-point temps	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (
REPORT each parti ut cursor Results leas 1 leas 2 leas 2 leas 3 leas 4 Uncertain tt duncert tt duncert tt duncert tt duncert to uncert	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied to short due to long-due to resolidue to resolidue to non-le between all on of these segrees of frees the effectivity small, need	USATE FOR SOME STREET OF THE S	ROBERT: Type serting 1918 1919 1919 1919 1919 1919 1919 1919	e instrument) erature difference INT IN CCTG- mary per nomina a number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.145 -0.145 -0.145 in addard deviation) tandard [if needed] undard [if needed]	K8 al dew-point of measuremed] it-point temps	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertail tt duncert tt duncert tt duncert tt duncert tovariance ombination ffective de most cas significant	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Inties (in °C Incertainty of due to short due to long-due to resolute to non-interest the effectivity small, need to of rest	URATE FOR Sone Spread for notes 08-1215 Resistance output in ohm 119.3657 119.3677 119.3548) f applied coreterm stabiliterm drift of ution of trave trinpalied and manadard unce edom of unce number of cd to be taken in ults	ROBERT: Type serio 08-1215 Output in °C 49-918 49-924 49-890 dittion y (from stantravelling standavelling standave	e instrument) erature difference INT IN CCTG- mary per nomina a number: or 08-1216 (meas up- applied dp) in °C 40.145 -0.145 -0.145 -0.145 in addard deviation) tandard [if needed] undard [if needed]	K8 al dew-point of measuremed] it-point temps	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygrometr Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (
eas 1 eas 2 eas 2 eas 3 eas 4 Incertail tandard tanda	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied dew-point in °C concertainty of due to short due to long-due to resolute to non-le between all on of these segrees of free es the effectively small, need dew-point te	URATE FOR SOME SPEED OF THE STATE FOR SOME SPEED OF THE STATE FOR SOME SPEED OF THE STATE	ROBERT: Type serion-108-1215 Output in °C 49.918 49.919 49.924 49.890 Addition standard serion serion standard serion serio	e instrument) erature difference INT IN CCTG- mary per nomina al number: or 08-1216 (meas up - applied dp) in °C -0.145 -0.142 -0.141 -0.145 dard deviation) tandard [if needed] ndard [if needed] ndard [if needed] ulues of dew/fros quadrature imates: sedom will be large throughout the ca	of measuremed] Interpolation.	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (
REPORT each part ut cursor Results leas 1 leas 2 leas 3 leas 4 leas 4 leas 4 leas 4 leas 5 leas 6 leas 6 leas 7 leas 7 leas 8 leas 8 leas 9 le	Hygrometer Applied dew-point in °C So. 064 50.065 50.065 50.065 concertainty of due to short due to short due to long-due to resold due to non-le between all on of these segrees of freeses the effectively small, need to of resulting the dew-point tendard uncertified and the condition of these segrees of the dew-point tendard uncertified and the condition of the condition	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3657 119.3548) f applied corterm stability term drift of tution of trave vincerity of tropplied and manadard unce the note of the term of the tution of trave in control to be taken in the tution of trave in the tution of tution of the tution of tution of the tution of the tution of the tution of tution of the tution of the tution of tution of the tution of	ROBERT: Type serion-108-1215 Output in °C 49-918 49-919 49-924 49-890 Indition by (from stantravelling staleasured value and avelling staleasured value and avelling staleasured value and avelling staleasured value are tainties in the account ifferences reproducib	e instrument) erature difference INT IN CCTG- mary per nomina al number: or 08-1216	of measuremed] Interpolation.	measured in	elling stand	on, labeled "dat	50 a 1°C", when Hygrometr Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (
eas 1 eas 2 eas 3 eas 4 incertail tandard u dd uncert tad uncert t	Hygrometer Applied dew-point in °C 50.064 50.065 50.035 Applied dew-point in °C in °C in certainty of due to short due to long-due to long-due to resold due to resold due to resold due to resold due to month of the series the effective short due to free short due to free short due to resold due to month of the series the effective short due to free short due to free short due to resold due to month of the series the effective short due to free short due	LATE FOR sone spread for notes 08-1215 Resistance output in ohm 119.3657 119.3657 119.3548) f applied conterm stabiliterm drift of uttion of trave inearity of trave inearity of the piled and must and and unce number of d to be taken in the piled in	ROBERT: Type serios-1989 Output in °C 49.918 49.919 49.924 49.890 Idition Travelling standavelling	e instrument) erature difference INT IN CCTG- mary per nomina al number: or 08-1216	K8 al dew-point of measuremed] it-point tempe	measured in hents of trave	elling stand	on, labeled "dat	50 a 1°C", when Hygromete Meas 1 0.0388 0.0027	e "t" should e "t" should Meas 2 0.0385 0.0023	08-1215 Meas 3 0.0385 0.0022	Meas 4 0.0386 0.0020	ninal (

				INT IN CCT				Nominal value:	65	°C		NMC, A*ST	
each parti	cipant submi	ts one sprea	dsheet sumi	nary per nom	inal dew-po	oint measured i	n the compar	ison; labeled "dat	a t°C", whe	re "t" should	be replace	d by the non	ninal de
out cursor	here	for notes	ROBERT:										
Results			Type serial n 08-1215 or 0										
	Hygrometer	08-1215											
	Applied dew-point in °C	Resistance output in ohm	Output in °C	Difference (meas dp - applied dp) in °C									
Meas 1	65.070	125.1369	64.940	-0.130									
Meas 2	64.966	125.0944	64.829	-0.137									
Meas 3	64.940	125.0796	64.790	-0.149									
Meas 4	64.938	125.0793	64.790	-0.148									
Uncertair	nties (in °C	;)							Hygromet	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
		f applied cor							0.0417	0.0420	0.0421	0.0419	
Std uncert Std uncert	due to long- due to resol	term drift of ution of trave	travelling st elling standa	dard deviatio andard [if neo ard [if needeo ndard [if need	eded]	rements of tra	velling stan	dard (type A)	0.0025	0.0027	0.0024	0.0019	
						mperature [if i	needed]						
Combinatio	on of these s	tandard unc	ertainties in	quadrature					0.041808	0.042101	0.042207	0.041898	
Effective de	egrees of fre	edom of und	ertainty est	mates:		905							
In most cas	es the effecti	ve number of o	degrees of fre	edom will be la	rge.								
If significant	ly small, nee	d to be taken	into account	throughout the	calculation.				NOTE: onl	y fill in fie	lds with gre	een backgro	ound
Aggregat	tion of res	ults											
Mean of 4 of	dew-point te	mperature d	lifferences						-0.141				
Type A star	ndard uncer	tainty due to	reproducib	lity of differe	nce results				0.0093				
(Derived from	n standard de	eviation of 4 va	lues on sam	e instrument)									
			point tempe						0.0429				

REPOR1	TING TEMP	LATE FOR	DEW-PO	INT IN CCTG	-K8			Nominal value:	80	°C	Lab name	NMC, A*ST	AR
each part	icipant submi	ts one spread	dsheet sumr	nary per nomin	al dew-point	measured in t	he comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nom	ninal o
out cursor	here	for notes	ROBERT:		1								
Results			Type serial	number-									
Results			08-1215 or										
	Hygrometer	08-1215											
	riygrometer	00 1210		Difference									
	Applied	Resistance		(meas dp -									
	dew-point	output	Output	applied dp)									
	in °C	in ohm	in °C	in °C									
Meas 1	80.167	130.9140	80.045	-0.122									
Meas 2	80.240	130.9439	80.124	-0.116									
Meas 3	80.246	130.9445	80.125	-0.121									
Meas 4	80.232	130.9393	80.111	-0.121									
Uncertai	nties (in °C	;)							Hygromet	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard	uncertainty o	f applied cor	ndition						0.0429	0.0429	0.0429	0.0429	
Std uncert	due to short	-term stabilit	y (from stan	dard deviation)	of measurem	nents of trave	lling stand	lard (type A)	0.0084	0.0070	0.0043	0.0070	
Std uncert	due to long-	term drift of	travelling st	andard [if need	ed]								
Std uncert	due to resol	ution of trave	elling standa	ard [if needed]									
Std uncert	due to non-	inearity of tra	avelling star	ndard [if neede	d]								
Covarianc	e between a	pplied and m	neasured va	lues of dew/fros	st-point tempe	erature [if ne	eded]						
Combinati	on of these s	tandard unce	ertainties in	quadrature					0.043766	0.043517	0.043167	0.04352	
- ((())													
	_	edom of unc		mates: edom will be larg									
			-	throughout the ca		3003			NOTE: onl	v fill in fiel	de with ar	en backgro	und
ii sigiiiiloari	lly Siliali, fice	a to be taken i	Into account	inoughout the ot	iliculation.	3000			INOTE: OII		us with giv	or buokgre	Juliu
Angrega	tion of res	ults											
riggi egu													
	dew-point te	mperature d	ifferences						-0.120				
Mean of 4				lity of differenc	e results				0.0026				
	ndard uncer												
Гуре A sta		eviation of 4 va		•									

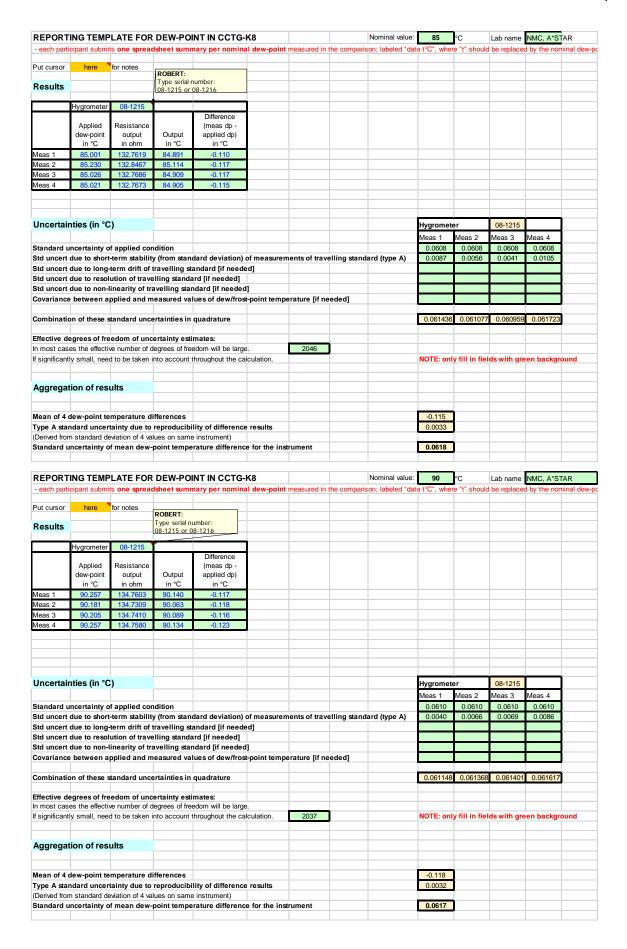
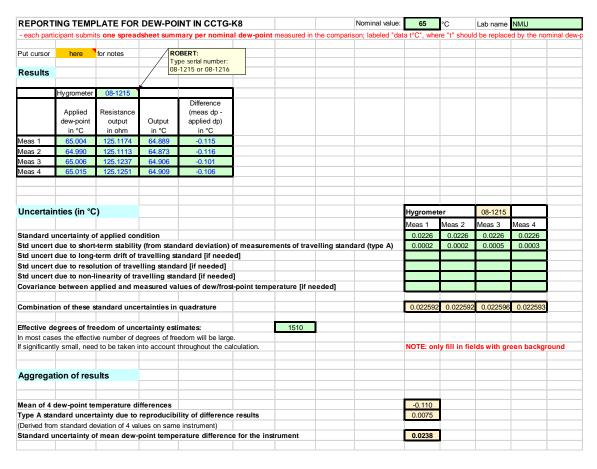
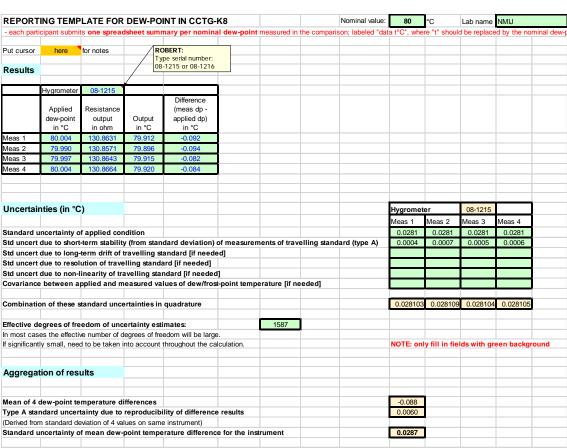


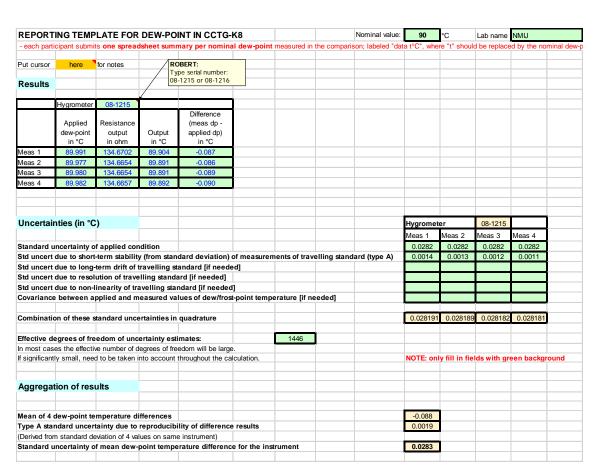
Fig. 12.6.j Results reported by NMIJ in Loop 1

EPORT									.0.0	mark of	Lab name		
each parti	icipant submit	s one sprea	dsheet su	mmary per nomii	nal dew-poin	t measured in	the comparison	on; labeled "dat	a t°C", whe	re "t" shoul	d be replace	ed by the nom	ninal
ıt cursor	here	for notes		ROBERT:									
it cuisoi	HOIC	ioi riotes		Type serial number:									
esults				08-1215 or 08-121									
			/										
	Hygrometer	08-1215		5:"									
	Applied	Resistance		Difference (meas dp -									
	dew-point	output	Output										
	in °C	in ohm	in °C	in °C									
leas 1	29.989	111.6103	29.838										
leas 2	29.997	111.6143	29.849	_									
eas 3	30.006	111.6173	29.856	_									
eas 4	29.993	111.6121	29.843	-0.150	_								
Incertaiı	nties (in °C	:)							Hygromet	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
tandard u	incertainty o	f applied cor	ndition						0.0176	0.0176	0.0176	0.0176	
td uncert	due to short-	-term stabilit	y (from st	andard deviation	of measure	ments of trav	elling standa	rd (type A)	0.0002	0.0001	0.0002	0.0002	
				standard [if need	led]								
				ndard [if needed]	الم								
				standard [if neede values of dew/fro		oraturo fit -	oodod1						
ovaniance	perween a	ppiieu and fi	easured	values of dew/fro	a-point temp	rerature (II N	eeueuj						
ombinatio	on of these s	tandard unc	ertainties	in quadrature					0.017648	0.017647	0.017648	0.017648	
fective d	egrees of fre	edom of und	ertainty e	estimates:		1069601							
				freedom will be lar									
significant	iy small, need	to be taken	nto accou	nt throughout the o	alculation.				NOTE: onl	y fill in fie	ids with gr	een backgro	ound
aareaa	tion of resu	ults											
33 3													
	dew-point te				1	-			-0.150				
	ndard uncert	tainty due to	reproduc	ibility of different	e results				0.0013				
EPORT	incertainty o	f mean dew-	point terr	eme instrument) sperature differen	ce for the ins			Nominal value:	0.0177 50	°C	Lab name		ninal
REPORT	ING TEMP	f mean dew- LATE FOR s one spream	point terr	nme instrument) perature differen POINT IN CCTG	ce for the ins				50				ninal
tandard u	ING TEMP	f mean dew-	point terr	POINT IN CCTG	ce for the ins				50				ninal
REPORT each parti	ING TEMP	f mean dew- LATE FOR s one spream	point terr	nme instrument) perature differen POINT IN CCTG	ce for the ins				50				ninal
tandard u	ING TEMP	f mean dew- LATE FOR s one spream	point terr	POINT IN CCTG mmary per nomin ROBERT: Type serial number:	ce for the ins				50				ninal
REPORT each parti	ING TEMP	f mean dew- LATE FOR s one spream	point terr	POINT IN CCTG mmary per nomin ROBERT: Type serial number:	ce for the ins				50				ninal
REPORT each parti	ING TEMP icipant submit	LATE FOR sone spread for notes	point terr	POINT IN CCTG mmary per nomin ROBERT: Type serial number 08-1215 or 08-1216 Difference	ce for the ins				50				ninal
EPORT each parti	ING TEMP icipant submit here Hygrometer Applied	LATE FOR sone spread for notes 08-1215 Resistance	DEW-F	POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp -	ce for the ins				50				ninal
EPORT each parti	ING TEMP icipant submit here Hygrometer Applied dew-point	LATE FOR sone spread for notes 08-1215 Resistance output	DEW-F	POINT IN CCTG mmary per nomin ROBERT: Type serial number 08-1215 or 08-1210 Difference (meas dp - applied dp)	ce for the ins				50				ninal
REPORT each parti ut cursor Results	ING TEMP icipant submit here Hygrometer Applied	LATE FOR sone spread for notes 08-1215 Resistance	DEW-Fdsheet su	POINT IN CCTG mmary per nomin ROBERT: Type serial number 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C	ce for the ins				50				ninal
EPORT each parti ut cursor esults	ING TEMP icipant submit here Hygrometer Applied dew-point in °C	LATE FOR sone spread for notes 08-1215 Resistance output in ohm	DEW-F	Difference (meas dp - applied d	ce for the ins				50				ninal
REPORT each partiut cursor Results	Hygrometer Applied dew-point in °C 50.011	LATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3534	Output in °C	Difference (meas dp - applied d	ce for the ins				50				ninal
eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 50.011 49.985	LATE FOR sone sprear for notes 08-1215 Resistance output in ohm 119.3534 119.3422	Output in °C 49.886	Difference (meas dp - applied dp) in °C - 0.127 - 0.127	ce for the ins				50				ninal
eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 50.011 49.985	LATE FOR is one spread for notes 08-1215 Resistance output in ohm 119.3534 119.3422 119.3478	Output in °C 49.886 49.857	Difference (meas dp - applied dp) in °C - 0.127 - 0.127	ce for the ins				50				ninal
EPORT each partiut cursor esults eas 1 eas 2 eas 3	Hygrometer Applied dew-point in °C 50.011 49.985	LATE FOR is one spread for notes 08-1215 Resistance output in ohm 119.3534 119.3422 119.3478	Output in °C 49.886 49.857	Difference (meas dp - applied dp) in °C - 0.127 - 0.127	ce for the ins				50				ninal
EPORT each particular cursor esults eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 50.011 49.985 49.999	LATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3534 119.3422 119.3428	Output in °C 49.886 49.857	Difference (meas dp - applied dp) in °C - 0.127 - 0.127	ce for the ins				50 a t°C*, whe	re "t" should	d be replace		ninal
eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 50.011 49.985	LATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3534 119.3422 119.3428	Output in °C 49.886 49.857	Difference (meas dp - applied dp) in °C - 0.127 - 0.127	ce for the ins				50 a t°C", whe	e "t" shoul	d be replace	ed by the norm	ninal
REPORT each parti ut cursor results leas 1 leas 2 leas 3 leas 4	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982	LATE FOR IS one sprear for notes 08-1215 Resistance output in ohm 119.3534 119.3412 119.3478	Output in °C 49.886 49.855	Difference (meas dp - applied dp) in °C - 0.127 - 0.127	ce for the ins				50 a t°C", whe	e "t" should	d be replaced 08-1215 Meas 3	d by the norm	ninal
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982	LATE FOR is one sprear for notes 08-1215 Resistance output in ohm 119.3534 119.3422 119.3478 119.3414	Output in °C 49.886 49.855	Difference (meas dp - applied dp) in °C - 0.124 - 0.127 - 0.127	-K8 all dew-poin	t measured in	the comparis	on; labeled "dat	50 a t°C", whee	e"t" should	08-1215 Meas 3 0.0219	Meas 4	ninal
eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982	LATE FOR to notes 08-1215 Resistance output in ohm 119.3534 119.3414 119.3414	Output in °C 49.886 49.855 49.855	Difference (meas dp - o.127 - o.127 - o.127	-K8 all dew-poin	t measured in	the comparis	on; labeled "dat	50 a t°C", whe	e "t" should	d be replaced 08-1215 Meas 3	d by the norm	ninal
eas 1 eas 2 eas 3 eas 4	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982	LATE FOR to mean dew- tornotes 08-1215 Resistance output in ohm 119.3534 119.3478 119.3414	Output in °C 49.886 49.855 49.855	me instrument) ipperature different POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.124 -0.127 -0.127 -0.127 -0.127 andard deviation	-K8 all dew-poin	t measured in	the comparis	on; labeled "dat	50 a t°C", whee	e"t" should	08-1215 Meas 3 0.0219	Meas 4	ninal
REPORT each parti ut cursor results leas 1 leas 2 leas 3 leas 4 lincertain tandard ut tandard ut tandard ut tandard ut tuncert tid uncert	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C	LATE FOR IS one sprear for notes 08-1215 Resistance output in ohm 119.3834 119.3442 119.3414	Output in °C 49.886 49.855 49.855	Difference (meas dp - o.124 - o.127 - o.127	-K8 nal dew-poin	t measured in	the comparis	on; labeled "dat	50 a t°C", whee	e"t" should	08-1215 Meas 3 0.0219	Meas 4	ninal
eas 1 eas 2 eas 3 eas 4 Incertail	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C	LATE FOR IS one spread for notes 08-1215 Resistance output in ohm 119.3534 119.3422 119.3478 119.3414	Output in °C 49.886 49.855 49.	Difference (meas dp - applied dp) in °C - 0.127 - 0.127 - 0.127 - 0.127 andard deviation is standard [if needed]	-K8 all dew-poin	t measured in	the comparis	on; labeled "dat	50 a t°C", whee	e"t" should	08-1215 Meas 3 0.0219	Meas 4	ninal
eas 1 eas 2 eas 3 eas 4 incertail	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C due to short due to long-due to resol due to non-les between as bears as between as between as between as between as between as bet	LATE FOR IS one spread for notes output in ohm 119.3634 119.3414	Output in °C 49.886 49.855 49.855 49.855 enabling star aveiling sae asured	me instrument) ipperature different POINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.124 -0.127 -0.127 -0.127 -0.127 andard deviation standard [if needed]	-K8 all dew-poin	t measured in	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should er Meas 2 0.0219 0.0002	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	ninal
eas 1 eas 2 eas 3 eas 4 incertail	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C due to short due to long-due to resol due to non-les between as bears as between as between as between as between as between as bet	LATE FOR IS one spread for notes output in ohm 119.3634 119.3414	Output in °C 49.886 49.855 49.855 49.855 enabling star aveiling sae asured	Difference (meas dp - applied dp) in °C - 0.124 - 0.127 - 0.127 - 0.127 andard [if needed] standard [if needed] standard [if needed] standard [if needed]	-K8 all dew-poin	t measured in	the comparis	on; labeled "dat	50 a t°C", whee	e"t" should	08-1215 Meas 3 0.0219	Meas 4	ninal
eas 1 eas 2 eas 3 eas 4 incertain tandard u ta	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C uncertainty of due to short due to long-due to resolidue to resolidue to non-le between applied to fine the second of these second of the second of t	In the second of	Output in °C 49.886 49.855 49.855 dition y (from statravelling statavelling statave	Difference (meas dp - applied dp) in °C - 0.127 - 0.12	-K8 all dew-poin	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should er Meas 2 0.0219 0.0002	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	ninal
eas 1 eas 2 eas 3 eas 4 Incertain tandard u td uncert to uncert	Hygrometer Applied dew-point in °C 50.011 49.985 49.993 49.982 Inties (in °C Incertainty of due to short due to long-due to resold due to non-less between all on of these segrees of fre	LATE FOR to mean dew- tor notes 08-1215 Resistance output in ohm 119.3542 119.3478 119.3414 The mean dew- term stabilit term drift of ution of trave incarity of troplied and mean dandard unce- edom of unce- edom of unce- dom of unce- do	Output in °C 49.886 49.857 49.872 49.855 indition y (from stravelling staravelling	Difference (meas dp - applied dp) in °C - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 in standard [if needed] standard [if needed values of dew/fro in quadrature estimates:	ce for the ins	t measured in	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should er Meas 2 0.0219 0.0002	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	ninal
REPORT each parti ut cursor results leas 1 leas 2 leas 3 leas 4 Incertail ttandard ut ttd uncert ttd uncert ttd uncert ttd uncert touriance ombination ffective de	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C due to short due to long-due to resoli due to non-le a between a point of these segrees of frees the effective	LATE FOR is one sprear for notes output in ohm 119.3634 119.3414 119.3414	Output in °C 49.886 49.855 49.855 49.855 enabling star aveiling star ave	me instrument) ipperature different COINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.124 -0.127 -0.127 -0.127 -0.127 -0.127 in quadrature in quadrature sestimates: freedom will be language of the content of the cont	-K8 nal dew-poin of measure led] d] st-point temp	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should be	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	
REPORT each parti ut cursor results leas 1 leas 2 leas 3 leas 4 Incertail ttandard ut ttd uncert ttd uncert ttd uncert ttd uncert touriance ombination ffective de	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C due to short due to long-due to resoli due to non-le a between a point of these segrees of frees the effective	LATE FOR is one sprear for notes output in ohm 119.3634 119.3414 119.3414	Output in °C 49.886 49.855 49.855 49.855 enabling star aveiling star ave	Difference (meas dp - applied dp) in °C - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 in standard [if needed] standard [if needed values of dew/fro in quadrature estimates:	-K8 nal dew-poin of measure led] d] st-point temp	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should be	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	
eas 1 eas 2 eas 3 eas 4 Incertail tandard u td uncert	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C due to short due to long-due to resoli due to non-le a between a point of these segrees of frees the effective	LATE FOR is one sprear for notes output in ohm 119.3634 119.3414 119.3414	Output in °C 49.886 49.855 49.855 49.855 enabling star aveiling star ave	me instrument) ipperature different COINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.124 -0.127 -0.127 -0.127 -0.127 -0.127 in quadrature in quadrature sestimates: freedom will be language of the content of the cont	-K8 nal dew-poin of measure led] d] st-point temp	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should be	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	
eas 1 eas 2 eas 3 eas 4 Incertail tandard u td uncert	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C due to short due to long-due to resoli due to non-le a between a point of these segrees of frees the effective	LATE FOR is one sprear for notes output in ohm 119.3634 119.3414 119.3414 119.3414 119.3414 119.3414 119.3414 119.3416 1	Output in °C 49.886 49.855 49.855 49.855 enabling star aveiling star ave	me instrument) ipperature different COINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.124 -0.127 -0.127 -0.127 -0.127 -0.127 in quadrature in quadrature sestimates: freedom will be language of the content of the cont	-K8 nal dew-poin of measure led] d] st-point temp	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should be	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	
eas 1 eas 2 eas 3 eas 4 Incertail tandard u td uncert	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C due to short due to short due to long-due to resol due to resol due to mon-le between applied to	LATE FOR is one sprear for notes output in ohm 119.3634 119.3414 119.3414 119.3414 119.3414 119.3414 119.3414 119.3416 1	Output in °C 49.886 49.855 49.855 49.855 enabling star aveiling star ave	me instrument) ipperature different COINT IN CCTG mmary per nomin ROBERT: Type serial number: 08-1215 or 08-1216 Difference (meas dp - applied dp) in °C -0.124 -0.127 -0.127 -0.127 -0.127 -0.127 in quadrature in quadrature sestimates: freedom will be language of the content of the cont	-K8 nal dew-poin of measure led] d] st-point temp	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should be	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	
eas 1 eas 2 eas 3 eas 4 Incertail tandard u ta	Hygrometer Applied dew-point in °C 50.011 49.985 49.999 49.982 Inties (in °C Incertainty or due to short due to long-due to resolute to non-le between all the short due to short due to non-le between all the short due to short due to non-le between all the short due to short due to non-le between all the short due to short due to non-le between all the short due to short due to non-le between all the short due to non-le b	LATE FOR to mean dew- tor notes 08-1215 Resistance output in ohm 119.3634 119.3478 119.3414 The properties of the translation of trave inearity of troplied and mean tandard unce number of of to be taken ults	Output in °C 49.886 49.855 49.855 49.855 distravelling staravelling st	Difference (meas dp - applied dp) in °C - 0.127 - 0.12	-K8 nal dew-poin of measure led] d] st-point temp	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should be	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	
eas 1 eas 2 eas 3 eas 4 eas 4 eas candard uncertain duncert du uncert du unc	Hygrometer Applied dew-point in °C 50.011 49.985 49.982 Inties (in °C incertainty of due to shorte due to non-less the effection of resulted on of these segrees of free esting small, need dew-point te	LATE FOR to one sprear for notes to note some sprear for notes to note some sprear for notes. O8-1215 Resistance output in ohm 119,3534 119,3412 119,3414	Output in °C 49.886 49.857 49.872 49.855 dition by (from staravelling	Difference (meas dp - applied dp) in °C - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 - 0.127 in quadrat [if needed] standard [if nee	ce for the ins	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004 NOTE: onl	e "t" should be	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	
eas 1 eas 2 eas 3 eas 3 eas 4 ncertail andard u duncert duncert duncert duncert duncert duncert guncert guncert duncert	Hygrometer Applied dew-point in °C 50.011 49.985 49.982 Applied due to non-le between applied to	LATE FOR IS one spread for notes Is one spread for the sprea	Output in °C 49.886 49.857 49.872 49.855 difference ertainty of legrees of into account ifference reproductive interproduction in the contraction	Difference (meas dp - applied dp) in °C - 0.127 - 0.12	ce for the ins	ments of trav	the comparis	on; labeled "dat	50 a t°C", whe Hygromet Meas 1 0.0219 0.0004	e "t" should be	08-1215 Meas 3 0.0219 0.0003	Meas 4 0.0219 0.0004	





REPORT	ING TEMP	LATE FOR	DE W-F	POINT IN CCTG-F	10			Nominal value:	85	°C	Lab name	NMIJ	
- each parti	cipant submit	s one spread	Isheet su	ımmary per nomina	I dew-point r	neasured in	the comparis	on; labeled "dat	a t°C", whe	re "t" should	be replace	ed by the no	minal de
out cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1215	/										
	Applied dew-point in °C	Resistance output in ohm	Output in °C	Difference (meas dp - applied dp) in °C									
Meas 1	85.004	132.7711	84.915	-0.088									
Meas 2	84.986	132.7641	84.897	-0.089									
Meas 3	84.982	132.7667	84.904										
Meas 4	84.995	132.7690	84.910	-0.086									
Uncertair	nties (in °C)							Hygromet	er	08-1215		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	ncertainty o	f applied con	dition						0.0305	0.0305	0.0305	0.0305	
				tandard deviation) o	of measurem	ents of trave	elling stand	ard (type A)	0.0009	0.0013	0.0014	0.0012	
Std uncert	due to long-	term drift of t	ravelling	standard [if neede	d]								
Std uncert	due to resol	ution of trave	lling sta	ndard [if needed]									
Std uncert	due to non-l	inearity of tra	evelling	standard [if needed]									
Covariance	between a	oplied and m	easured	values of dew/frost	-point tempe	rature [if ne	eded]						
Combinatio	on of these s	tandard unce	ertainties	in quadrature					0.030542	0.030556	0.030563	0.030554	
Effective de	egrees of fre	edom of unc	ertainty (estimates:		1776							
				freedom will be large									
lf significant	ly small, need	to be taken i	nto accou	unt throughout the cal	culation.				NOTE: onl	y fill in fiel	ds with gr	een backgr	ound
Aggregat	tion of res	ults											
		mperature di							-0.085				
		-	_	cibility of difference	results				0.0049				
				ame instrument)	fautha ir -t-				0.0200				
	ncertainty o	ı mean dew-	point ten	nperature difference	ior the instr	ument			0.0309				



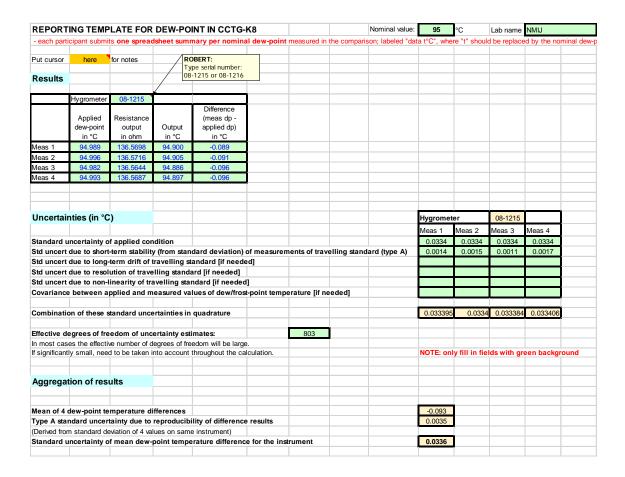
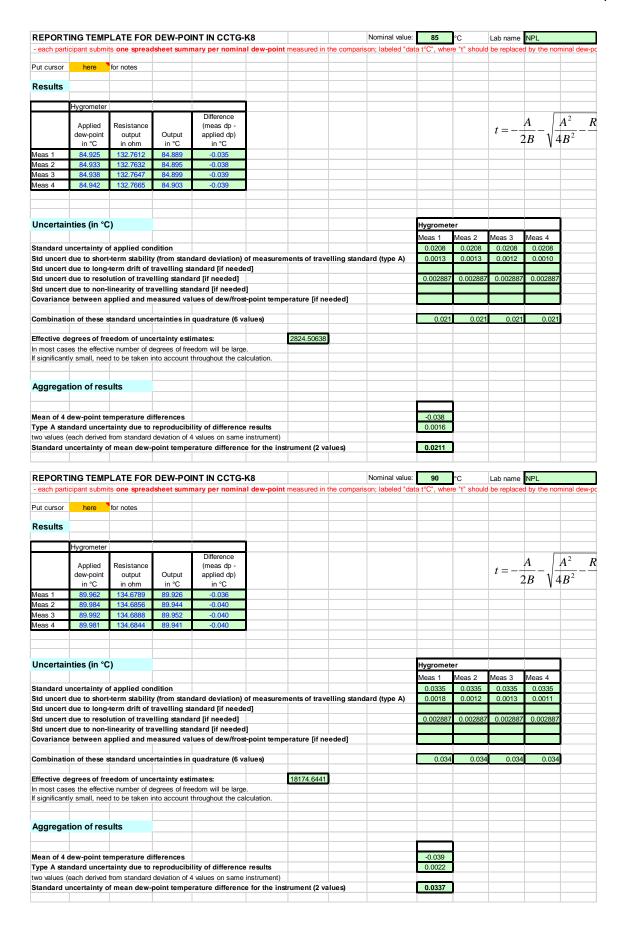


Fig. 12.6.k Results reported by NPL in Loop 2

anah narti	4.00			NT IN CCTG-				Nominal value:	30	°C		NPL	
acii paili	cipant submit	s one spread	dsheet sumn	nary per nomina	al dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal c
cursor	here	for notes											
esults													
	Hygrometer				1								
	riygiometer			Difference								. [12
	Applied	Resistance		(meas dp -							t =	$\frac{A}{2B} - \sqrt{\frac{A}{4}}$	A^{-}
	dew-point	output	Output	applied dp)							1 - 2	$2B = \sqrt{4}$	B^2
leas 1	in °C 30.027	in ohm 111.6499	in °C 29.941	in °C -0.086								1	
leas 1	30.027	111.6508	29.941	-0.086									
leas 3	30.030	111.6512	29.944	-0.086									
leas 4	30.029	111.6501	29.941	-0.088									
Incortair	nties (in °C	١							Hygromete				
riccitali		,							Meas 1	Meas 2	Mass 2	Meas 4	
tandard u	ncortainty o	f applied cor	dition						0.0104	0.0104	Meas 3 0.0104	0.0104	_
				dard deviation)	of measuren	nents of trave	elling stand	ard (type A)	0.0014	0.0013	0.0013	0.0015	
				andard [if neede			Jiming Glarie	(i)po /ij	0.0011	0.0010	0.0010	0.0010	
				rd [if needed]	i i				0.002887	0.002887	0.002887	0.002887	
td uncert	due to non-l	inearity of tra	avelling star	ndard [if needed	i]								
ovariance	between a	oplied and m	easured va	lues of dew/fros	t-point tempe	erature [if ne	eded]						
ombir-"	n of 45	tondord ····	ortoletis - !	auadratus: 10	alnoc,				0.044	0.041	0.041	0.044	
ompinatio	or these s	andard unce	ertainties in	quadrature (6 va	aiues)				0.011	0.011	0.011	0.011	_
ffective de	grees of fre	edom of unc	ertaintv esti	mates:		197.934794	1						
	_		-	edom will be large	э.								
				hroughout the ca									
\aareas	ion of res	ılte											
.ggreyat		ailo											
lean of 4 c	dew-point te	mperature d	ifferences						-0.087				
ype A star	ndard uncer	ainty due to	reproducibi	lity of difference	eresults				0.0007				
wo values (e	each derived	from standard	deviation of 4	values on same	instrument)								
tandard u	ncertainty o	f mean dew-	naint tampa										
		LATE FOR	DEW-PO	NT IN CCTG-				Nominal value:	0.0109 50	°C	Lab name		
		LATE FOR	DEW-PO		K8				50	-			ninal c
each parti	cipant submi	LATE FOR	DEW-PO	NT IN CCTG-	K8				50	-			ninal c
each particular each particula	cipant submi	LATE FOR	DEW-PO	NT IN CCTG-	K8				50	-			minal c
each partic	cipant submi	LATE FOR	DEW-PO	NT IN CCTG-	K8				50	-			ninal c
	cipant submit	LATE FOR	DEW-PO	NT IN CCTG-	K8				50	-			minal o
each partic	cipant submi	LATE FOR	DEW-PO	NT IN CCTG-	K8				50	-	be replaced	d by the non	
each partic	here Hygrometer Applied	LATE FOR some spread for notes	DEW-POI	NT IN CCTG- nary per nomina Difference (meas dp -	K8				50	-	be replaced	d by the non	
each partic	here Hygrometer Applied dew-point	LATE FOR s one spread for notes Resistance output	DEW-POI	NT IN CCTG- nary per nomina Difference (meas dp - applied dp)	K8				50	-	be replaced	d by the non	
each parti	here Hygrometer Applied dew-point in °C	LATE FOR Some spread for notes Resistance output in ohm	Output in °C	NT IN CCTG- nary per nomina Difference (meas dp - applied dp) In °C	K8				50	-	be replaced		
Put cursor Results	here Hygrometer Applied dew-point in °C 50.035	LATE FOR some spread for notes Resistance output in ohm 119.3837	Output in °C	NT IN CCTG- nary per nomina Difference (meas dp - applied dp) in °C -0.070	K8				50	-	be replaced	d by the non	
Put cursor Results	here Hygrometer Applied dew-point in °C	LATE FOR Some spread for notes Resistance output in ohm	Output in °C	NT IN CCTG- nary per nomina Difference (meas dp - applied dp) In °C	K8				50	-	be replaced	d by the non	
each particular version of the control of the contr	here Hygrometer Applied dew-point in °C 50.035 50.033	Resistance output in ohm 119,3837	Output in °C 49.965 49.962	Difference (meas dp - applied dp) in °C -0.070 -0.071	K8				50	-	be replaced	d by the non	
each partiut cursor Results	here Hygrometer Applied dew-point in °C 50.035 50.033	Resistance output in ohm 119.3826	Output in °C 49.962 49.962	Difference (meas dp - applied dp) in °C -0.070 -0.071 -0.072	K8				50	-	be replaced	d by the non	
each partiut cursor Results leas 1 leas 2 leas 3	here Hygrometer Applied dew-point in °C 50.035 50.033	Resistance output in ohm 119.3826	Output in °C 49.962 49.962	Difference (meas dp - applied dp) in °C -0.070 -0.071 -0.072	K8				50	-	be replaced	d by the non	
each particular cursor Results Heas 1 Heas 2 Heas 3 Heas 4	here Hygrometer Applied dew-point in °C 50.035 50.034 50.039	Resistance output in ohm 119.3837 119.3826 119.3845	Output in °C 49.962 49.962	Difference (meas dp - applied dp) in °C -0.070 -0.071 -0.072	K8				50 a t°C", wher	e "t" should	be replaced	d by the non	
each particular cursor Results Heas 1 Heas 2 Heas 3 Heas 4	here Hygrometer Applied dew-point in °C 50.035 50.033	Resistance output in ohm 119.3837 119.3826 119.3845	Output in °C 49.962 49.962	Difference (meas dp - applied dp) in °C -0.070 -0.071 -0.072	K8				50 a t°C", wher	e "t" should	$t = -\frac{1}{2}$	$\frac{A}{2B} - \sqrt{\frac{1}{4}}$	
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Jncertair	Hygrometer Applied dew-point in °C 50.035 50.034 50.039	LATE FOR S one spread for notes Resistance output in ohm 119.3827 119.3826 119.3826 119.3845	Output in °C 49.965 49.962 49.967	Difference (meas dp - applied dp) in °C -0.070 -0.071 -0.072	K8				50 a t°C", when	e "t" should	$t=-rac{1}{2}$	$A = \sqrt{\frac{A}{4}}$	
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Jncertair	Hygrometer Applied dew-point in °C 50.035 50.033 50.034 50.039	LATE FOR s one spread for notes Resistance output in ohm 119.3837 119.3826 119.3826) f applied cor	Output in °C 49.965 49.962 49.967	Difference (meas dp - applied dp) in °C -0.070 -0.071 -0.072	K8 al dew-point	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104	e "t" should	$t=-rac{-2}{2}$	$\frac{A}{2B} - \sqrt{\frac{A}{4}}$	
Put cursor Results Meas 1 Meas 2 Meas 3 Meas 4 Uncertair Standard u Std uncert of	Hygrometer Applied dew-point in °C 50.033 50.034 50.039	Resistance output in 19.3837 119.3826 119.3845	Output in °C 49.962 49.962 49.967	Difference (meas dp - applied dp) in °C -0.072 -0.072 -0.072	K8 al dew-point	measured in	the comparis	son; labeled "dat	50 a t°C", when	e "t" should	$t=-rac{1}{2}$	$A = \sqrt{\frac{A}{4}}$	
Put cursor Results Aleas 1 Aleas 2 Aleas 3 Aleas 4 Jincertair Standard u std uncert of the uncert	Hygrometer Applied dew-point in °C 50.035 50.034 50.039	Resistance output in ohm 119.3837 119.3826 119.3845	Output in °C 49.965 49.962 49.967	Difference (meas dp - applied dp) in °C -0.070 -0.071 -0.072	K8 al dew-point	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104	e "t" should	$t=-rac{-2}{2}$	$\frac{A}{2B} - \sqrt{\frac{A}{4}}$	
Put cursor Results Reas 1 Reas 2 Reas 3 Reas 4 Jncertair Read uncert of durcert of durc	Hygrometer Applied dew-point in °C 50.035 50.034 50.039	LATE FOR S one spread for notes Resistance output in ohm 119.3826 119.3826 119.3826) f applied cor term stabilit term drift of ution of trave	Output in °C 49.965 49.962 49.967	Difference (meas dp - applied dp) In °C - 0.070 - 0.072 - 0.072 dard deviation) andard [if neede	K8 al dew-point of measuren ed]	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should	$t = -\frac{1}{2}$	A 2B √4 Meas 4 0.0104 0.0010	
leas 1 leas 2 leas 3 leas 4 Jncertair tandard u tanduncert of	Hygrometer Applied dew-point in °C 50.035 50.033 50.034 50.039 httes (in °C concertainty of due to short due to resol due to resol due to ron-ldue to non-ldue to	LATE FOR sone spread for notes Resistance output in ohm 119.3837 119.3826 119.3826 119.3845) f applied coreterm stabiliterm drift of ution of trave uiton of trave inearity of tr.	Output in °C 49.965 49.962 49.967	Difference (meas dp - applied dp) in °C -0.070 -0.072 -0.072 -0.072 dard deviation) andard [if needer If [if needed]	K8 al dew-point dew-point dew-point dew-point dew-point	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should	$t = -\frac{1}{2}$	A 2B √4 Meas 4 0.0104 0.0010	
each particular cursor Results leas 1 leas 2 leas 3 leas 4 Uncertair tid uncert tid uncert tid uncert tid uncert tid uncert tid uncert covariance	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 hties (in °C necertainty of due to short due to long-due to resol due to non-le between a	Resistance output in ohm 119.3837 119.3845 119.3845	Output in °C 49.965 49.962 49.967 output tan °C 49.965 and tan output tan out	Difference (meas dp - applied dp in °C - 0.070 - 0.071 - 0.072 - 0.072 - 0.072 dard deviation) andard [if needed] dard [if needed] dard [if needed] use of dew/fros	K8 al dew-point of measuren al j a-point tempe	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
each particular cursor Results leas 1 leas 2 leas 3 leas 4 Uncertair tid uncert tid uncert tid uncert tid uncert tid uncert tid uncert covariance	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 hties (in °C necertainty of due to short due to long-due to resol due to non-le between a	Resistance output in ohm 119.3837 119.3845 119.3845	Output in °C 49.965 49.962 49.967 output tan °C 49.965 and tan output tan out	Difference (meas dp - applied dp) in °C -0.070 -0.072 -0.072 -0.072 dard deviation) andard [if needed and [if needed]	K8 al dew-point of measuren al j a-point tempe	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should	$t = -\frac{1}{2}$	A 2B √4 Meas 4 0.0104 0.0010	
leas 1 leas 2 leas 3 leas 4 Jncertair tandard u tit uncert tit un	Hygrometer Applied dew-point in °C 50.033 50.034 50.039 nties (in °C uncertainty of due to short due to long-due to non-10 between all on of these s	LATE FOR sone spread for notes Resistance output in ohm 119.3837 119.3826 119.3826 119.3845) f applied conterm stabiliterm drift of tution of trave incentive of trapplied and management of the population of trave incentive of trapplied and management of the population of trave incentive of trapplied and management of the population of trave incentive of trapplied and management of the population of travel trapplied and management of the population of travel trapplied and management of trapplied an	Output in °C 49.965 49.962 49.967 outling standa aveiling stan	Difference (meas dp - applied dp) in °C -0.070 -0.072 -0.0	K8 al dew-point of measuren al j a-point tempe	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 Meas 2 Meas 3 Meas 4 Joncertair Standard ustid uncert of u	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 httes (in °C ncertainty of due to short due to short due to non-le between a length of these segrees of free	Resistance output in ohm 119.3837 119.3826 119.3845	Output in °C 49.962 49.962 49.967 Output in °C adjusted in °C adju	Difference (meas dp - applied dp) in °C -0.070 -0.072 -0.072 -0.072 dard deviation) andard [if needed] did fight fine dewlfrost quadrature (6 vimates:	K8 al dew-point of measuren ed] il] -r-point tempo	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 leas 2 leas 2 leas 3 leas 4 Joncertair tandard uncert and uncertainty and uncertaint	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 htties (in °C in °C i	Resistance output in ohm 119.3826 119.3	Output in °C 49.965 49.962 49.962 49.967 output travelling standavelling	Difference (meas dp - applied dp - 0.070 - 0.071 - 0.072 - 0.0	K8 al dew-point of measuren ed] t-point temper alues)	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 leas 1 leas 2 leas 2 leas 3 leas 4 Joncertair id uncert of	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 htties (in °C in °C i	Resistance output in ohm 119.3826 119.3	Output in °C 49.965 49.962 49.962 49.967 output travelling standavelling	Difference (meas dp - applied dp) in °C -0.070 -0.072 -0.072 -0.072 dard deviation) andard [if needed] did fight fine dewlfrost quadrature (6 vimates:	K8 al dew-point of measuren ed] t-point temper alues)	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 leas 1 leas 2 leas 2 leas 3 leas 4 Joncertair id uncert of	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 htties (in °C in °C i	Resistance output in ohm 119.3826 119.3	Output in °C 49.965 49.962 49.962 49.967 output travelling standavelling	Difference (meas dp - applied dp - 0.070 - 0.071 - 0.072 - 0.0	K8 al dew-point of measuren ed] t-point temper alues)	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 leas 1 leas 2 leas 2 leas 3 leas 4 Joncertair itid uncert of the	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 htties (in °C in °C i	Resistance output in ohm 119.3837 119.3826 119.3845)) f applied corterm stabilit term drift of ution of trave inearity of tr. opplied and m tandard unce edom of unce e number of c to be taken i	Output in °C 49.965 49.962 49.962 49.967 output travelling standavelling	Difference (meas dp - applied dp - 0.070 - 0.071 - 0.072 - 0.0	K8 al dew-point of measuren ed] t-point temper alues)	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 leas 1 leas 2 leas 2 leas 3 leas 4 Joncertair itid uncert of the	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 ncertainty o due to short due to long-due to resol due to non-lo between a long of these segrees of frees the effective y small, need	Resistance output in ohm 119.3837 119.3826 119.3845)) f applied corterm stabilit term drift of ution of trave inearity of tr. opplied and m tandard unce edom of unce e number of c to be taken i	Output in °C 49.965 49.962 49.962 49.967 output travelling standavelling	Difference (meas dp - applied dp - 0.070 - 0.071 - 0.072 - 0.0	K8 al dew-point of measuren ed] t-point temper alues)	measured in	the comparis	son; labeled "dat	50 a t°C", where Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 leas 1 leas 2 leas 3 leas 4 Jncertair tandard u tid uncert of ti	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 hties (in °C ncertainty of due to short due to short due to non-lebetween a lebetween a lebet	Resistance output in ohm 119.3837 119.3826 119.3845	Output in °C 49.965 49.962 49.967 Output tan °C 49.962 49.967 Output tan °C 49.962 A9.962 A9.967 Output tavelling standavelling	Difference (meas dp - applied dp - 0.070 - 0.071 - 0.072 - 0.0	K8 al dew-point of measuren ed] t-point temper alues)	measured in	the comparis	son; labeled "dat	Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 leas 2 leas 2 leas 3 leas 4 Uncertair ttandard u tt duncert tt duncert tt duncert tt duncert treatment to ovariance ombination ffective de most case significant	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 httes (in °C necrtainty or due to hond-due to hond-due to hond-due to non-due to hond-due to	Resistance output in ohm 119.3826 119.3	Output in °C 49.965 49.962 49.967 output travelling standavelling standa	Difference (meas dp - applied d	K8 al dew-point of measuren ed] t-point tempe alues)	measured in	the comparis	son; labeled "dat	Hygromete Meas 1 0.0104 0.002887	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	
leas 1 leas 1 leas 2 leas 2 leas 3 leas 4 Joncertair to uncert of	Hygrometer Applied dew-point in °C 50.035 50.034 50.039 nties (in °C ncertainty of due to short due to long-due to resol due to non-le between all on of these segrees of free ses the effectively small, need to long-due to resol due to non-le between all on of these segrees of free seg	Resistance output in ohm 119.3837 119.3826 119.3	Output in °C 49.965 49.962 49.962 49.967 output standard values and values an	Difference (meas dp - applied dp - 0.070 - 0.071 - 0.072 - 0.0	K8 al dew-point of measuren ed] i] t-point tempo alues) a. iculation.	measured in	the comparis	son; labeled "dat	Hygromete Meas 1 0.0104 0.0010	e "t" should er Meas 2 0.0104 0.0009	$t = -\frac{1}{2}$ Meas 3 0.0104 0.0007	A 2B √4 Meas 4 0.0104 0.002887	

				NT IN CCTG-K8			Nominal value:	65	°C	Lab name		
each parti	cipant submi	ts one spread	lsheet sum	nary per nominal d	ew-point measured in	n the comparis	on; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nom	ninal d
Put cursor	here	for notes										
D												
Results												
	Hygrometer											
	Applied dew-point in °C	Resistance output in ohm	Output in °C	Difference (meas dp - applied dp) in °C						$t = -\frac{1}{2}$	$\frac{A}{2B} - \sqrt{\frac{A}{4}}$	$\frac{A^2}{B^2}$
Meas 1	64.999	125.1387	64.944	-0.055								
Meas 2	65.000	125.1389	64.945	-0.055								
Meas 3	65.006	125.1410	64.950	-0.055								
Meas 4	65.008	125.1415	64.952	-0.056								
Uncertair	nties (in °C	;)						Hygromete	er			
								Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	ncertainty o	f applied con	dition					0.0107	0.0107	0.0107	0.0107	
Std uncert	due to short	term stability	(from stan	dard deviation) of n	neasurements of tra	velling standa	ard (type A)	0.0009	0.0004	0.0006	0.0009	
				andard [if needed]								
				rd [if needed]				0.002887	0.002887	0.002887	0.002887	
				ndard [if needed]								
Covariance	between a	pplied and m	easured va	lues of dew/frost-po	oint temperature [if r	needed]						
Combine	n of those s	tondord unce	rtointios!=	quadrature (6 value	201			0.011	0.011	0.011	0.011	
Compinatio	on or triese s	sanuaru unce	namues in	quadrature (o Value	= 5)			0.011	0.011	0.011	0.011	
Effective de	earees of fre	edom of unce	ertainty esti	mates:	219.50123	4						
	•			edom will be large.		_						
				hroughout the calcul	ation.							
Aggregat	tion of res	ults										
								0.055				
	•	mperature di		lity of difference	culto			-0.055				
				lity of difference re values on same inst				0.0006				
								0.0446				
Standard u	incertainty of	r mean dew-	point tempe	rature difference to	or the instrument (2 v	vaiues)		0.0111				

REPORT	TING TEMP	LATE FOR	DEW-PO	INT IN CCTG-	K8			Nominal value:	80	°C	Lab name	NPL	
- each par	ticipant submi	ts one spread	lsheet sumr	mary per nomina	I dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	ninal de
out cursor	here	for notes											
ut cuisoi	Horo	ioi riotes											
Results													
	li.			ļ									
	Hygrometer			Difference									
	Applied	Resistance		(meas dp -								$\frac{A}{2B} - \sqrt{\frac{A}{4}}$	A^2
	dew-point	output	Output	applied dp)							$t = -\frac{1}{2}$	- 1-	D2
	in °C	in ohm	in °C	in °C							2	^{2}B 4	B^z
Meas 1	80.008	130.8836	79.965	-0.042									
Meas 2	80.037	130.8936	79.992	-0.045									
Meas 3	80.051	130.8993	80.007	-0.045									
Meas 4	80.063	130.9021	80.014	-0.049									
Uncertai	inties (in °C	;)							Hygromete	er			1
									Meas 1	Meas 2	Meas 3	Meas 4	1
Standard	uncertainty o	f applied con	dition						0.0144	0.0144	0.0144	0.0144	1
Std uncert	due to short	-term stability	y (from stan	dard deviation)	of measurem	ents of trave	elling stand	ard (type A)	0.0016	0.0008	0.0010	0.0008	
Std uncert	due to long-	term drift of t	travelling st	andard [if neede	d]]
Std uncert	due to resol	ution of trave	lling standa	ard [if needed]					0.002887	0.002887	0.002887	0.002887	
Std uncert	due to non-	inearity of tra	avelling star	ndard [if needed]								
Covarianc	e between a	pplied and m	easured va	lues of dew/frost	-point tempe	erature [if ne	eded]						ļ
Combinati	on of these s	tandard unce	ertainties in	quadrature (6 va	alues)				0.015	0.015	0.015	0.015	1
		edom of unc	-			672.908508							
				edom will be large									
ii sigiiiican	lly Siliali, fiee	I to be taken i	nio account	throughout the cal	culation.								
Aggrega	tion of res	ults											
.55.05													
Mean of 4	dew-point te	mperature di	ifferences						-0.045				
		-		ility of difference	results				0.0029				
IVDE A STA		,	-	-									
	(each derived	from standard	deviation of	4 values on same	instrument)								

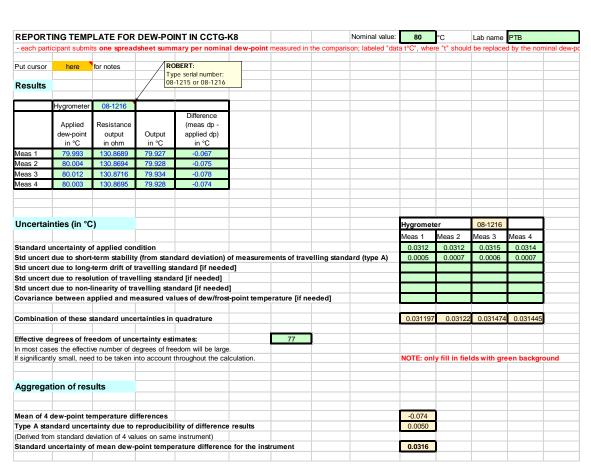


REPORT	ING TEMP	LATE FOR	DEW-PO	INT IN CCTG-	K8			Nominal value:	95	°C	Lab name	NPL	
each part	icipant submi	ts one spread	Isheet sumi	mary per nomina	al dew-poin	t measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the non	ninal d
out cursor	here	for notes											
Results													-
	Hygrometer				1								
	Applied dew-point in °C	Resistance output in ohm	Output in °C	Difference (meas dp - applied dp) in °C							$t = -\frac{1}{2}$	$\frac{A}{2B} - \sqrt{\frac{A}{4}}$	$\frac{A^2}{B^2}$
Meas 1	94.853	136.5368	94.814	-0.039									
Meas 2	94.988	136.5826	94.934	-0.054									
Meas 3	95.058	136.6122	95.012	-0.046									
Meas 4	95.064	136.6140	95.017	-0.047									
Uncertai	nties (in °C	;)							Hygromet	er			
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard ı	incertainty o	f applied con	dition						0.0530	0.0530	0.0530	0.0530	
	-			dard deviation)	of measure	ments of trave	elling stand	lard (type A)	0.0017	0.0030	0.0018	0.0020	
Std uncert	due to long-	term drift of t	travelling st	andard [if neede	ed]								
Std uncert	due to resol	ution of trave	lling stand	ard [if needed]					0.002887	0.002887	0.002887	0.002887	
				ndard [if needed									
Covariance	between a	pplied and m	easured va	lues of dew/fros	t-point tem	perature [if ne	eded]						
Combinati	on of these s	tandard unce	rtainties in	quadrature (6 v	aluee)				0.053	0.053	0.053	0.053	-
Combinati	on or these s	sanuaru unce	riannues m	quadrature (6 v	aiuesj				0.055	0.055	0.055	0.055	
Effective d	egrees of fre	edom of unc	ertainty est	imates:		100446.002							
In most cas	es the effecti	ve number of d	legrees of fre	edom will be large	э.								
If significant	ly small, nee	d to be taken i	nto account	throughout the ca	lculation.								
Aggrega	tion of res	ults											
	dew-point te	mperature di	ifferences						-0.046				
Mean of 4					roculte				0.0061				
	ndard uncer	tainty due to	reproducib	inty of amerence	e resurts								
Type A sta			•	4 values on same									

Fig. 12.6.I Results reported by PTB in Loop 2

	ING TEMP									Nominal value:	30	°C	Lab name		
each parti	cipant submi	ts one spread	isheet su	ımmary	per nomina	al dew-	point	measured ir	the comp	arison; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	ninal de
ıt cursor	here	for notes		ROBER	т	_									
at Cursor	nere	ior notes			erial number:										
esults				08-121	5 or 08-1216										
			/												
	Hygrometer	08-1216													
					Difference										
	Applied dew-point	Resistance output	Output		meas dp - applied dp)										
	in °C	in ohm	in °C		in °C										
leas 1	30.001	111.6391	29.913	_	-0.088										
leas 2	30.003	111.6387	29.912		-0.091										
leas 3	29.999	111.6367	29.907	7	-0.093										
leas 4	29.999	111.6352	29.902	2	-0.096										
															-
Incortoi	ı nties (in °C	•\									Hygromete		08-1216		
nic e rtan	lues (III C	·)													
		famuliad ass									Meas 1	Meas 2	Meas 3	Meas 4	
		f applied cor		tondore	l doviotion)	of mos		onto of tra	volling eta	ndard (type A)	0.0098	0.0098	0.0098	0.0098	-
		term drift of					Suren	lents or tra	vening sta	iluaru (type A)	0.0002	0.0002	0.0002	0.0002	
		ution of trave]									
		inearity of tra				il I									
		pplied and m					tempe	erature [if n	eeded]						
ombinatio	on of these s	tandard unce	ertainties	s in qua	drature						0.009755	0.009755	0.009757	0.009758	
	_	edom of unc						137							
		ve number of d					_				NOTE		late coder		<u> </u>
significant	iy small, nee	d to be taken i	nto accou	unt throu	ugnout the ca	iiculatio	n.				NOTE: onl	y till in fie	as with gre	een backgr	ound
				_											
agregat	tion of res	ults													
.555															
lean of 4 of	dew-point te	mperature di	fference	s							-0.092				
vpe A star	ndard uncer	tainty due to									0.0024				
					of difference	eresul	s				0.0034				
Derived from	n standard de	eviation of 4 va	lues on sa	ame ins	trument)										
Derived from tandard u	n standard de Incertainty o		lues on sa point terr	ame ins	trument) ire differenc	e for th		rument		Nominal value:	0.0103	°C	Lab name	РТВ	
Derived from standard u REPORT each parti	n standard de incertainty o ING TEMP cipant submi	eviation of 4 varif mean dew-	point ten	POINT	trument) ire differenc IN CCTG- / per nomina	e for th	e inst		n the compa	Nominal value:	0.0103				ninal de
Derived from standard u REPORT each parti	n standard de incertainty o	eviation of 4 va of mean dew-	point ten	POINT	trument) Ire difference IN CCTG- per nomina	e for th	e inst		n the compa		0.0103				ninal de
Derived from tandard under REPORT each partinut cursor	n standard de incertainty o ING TEMP cipant submi	eviation of 4 varif mean dew-	point ten	POINT IMMARY ROBER Type se	trument) ire differenc IN CCTG- / per nomina	e for th	e inst		n the compa		0.0103				ninal de
Derived from Standard u REPORT each parti	n standard de incertainty o ING TEMP cipant submi	eviation of 4 varif mean dew-	point ten	POINT IMMARY ROBER Type se	IN CCTG- / per nomina	e for th	e inst		n the compa		0.0103				ninal de
Derived from the control of the cont	in standard de incertainty o	eviation of 4 va of mean dew- PLATE FOR its one spread for notes	point ten	POINT IMMARY ROBER Type se	IN CCTG- / per nomina	e for th	e inst		n the compa		0.0103				ninal de
Derived from Standard u REPORT each parti	n standard de incertainty o ING TEMP cipant submi	eviation of 4 varif mean dew-	point ten	POINT Immary ROBER Type St 08-121	IN CCTG- / per nomina	e for th	e inst		n the compa		0.0103				ninal de
Derived from tandard under REPORT each partinut cursor	in standard de incertainty o	eviation of 4 va of mean dew- PLATE FOR its one spread for notes	point ten	POINT Immary ROBER Type St 08-121	IN CCTG- per nomina T: erial number: 5 or 08-1216	e for th	e inst		n the compa		0.0103				ninal de
Derived from Standard u REPORT each parti	in standard de incertainty of incert	eviation of 4 va if mean dew- PLATE FOR its one spread for notes 08-1216 Resistance output	DEW-F	POINT Immary ROBER Type so 08-121	IN CCTG- y per nomina RT: erial number: 5 or 08-1216 Difference meas dp - applied dp)	e for th	e inst		n the compa		0.0103				ninal de
Derived from transfer of the control	ING TEMP cipant submi here Hygrometer Applied dew-point in °C	Putation of 4 valid mean dew- LATE FOR its one spread for notes 08-1216 Resistance output in ohm	DEW-Fisheet su	POINT Immary ROBER Type so 08-121	IN CCTG- y per nomina ET: erial number: 5 or 08-1216 Difference meas dp - applied dp) in °C	e for th	e inst		the compa		0.0103				ninal de
Derived from transfer of the control	ING TEMP cipant submi here Hygrometer Applied dew-point in °C 49.997	PLATE FOR Is one spread for notes 08-1216 Resistance output in ohm 119.3592	DEW-Fisheet su Output in °C 49.901	POINT Immary ROBER Type so 08-121	IN CCTG- y per nomina IT: eral number: 5 or 08-1216 Difference meas d - applied dp) in °C -0.096	e for th	e inst		the comp		0.0103				ninal de
Derived from transfer of the control	ING TEMP cipant submi here Applied dew-point in "C" 49,997 50,003	Putation of 4 valid mean dew- LATE FOR its one spread for notes 08-1216 Resistance output in ohm 119,3592 119,3627	DEW-F Isheet su Output in °C 49.901	POINT Immary ROBER Type so 08-121	IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN COMMINISTRICT IN	e for th	e inst		the compa		0.0103				ninal de
REPORT each parti ut cursor Results	ING TEMP cipant submi here Applied dew-point in °C 49.997 50.003 50.005	ULATE FOR to one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610	Output in °C 49.901	POINT Immary ROBER Type sc 08-121	IN CCTG- IN CTG-	e for th	e inst		a the comp		0.0103				ninal de
REPORT each partiut cursor Results	ING TEMP cipant submi here Applied dew-point in "C" 49,997 50,003	Putation of 4 valid mean dew- LATE FOR its one spread for notes 08-1216 Resistance output in ohm 119,3592 119,3627	DEW-F Isheet su Output in °C 49.901	POINT Immary ROBER Type sc 08-121	IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN COMMINISTRICT IN	e for th	e inst		the comp		0.0103				ninal de
REPORT each partiut cursor Results	ING TEMP cipant submi here Applied dew-point in °C 49.997 50.003 50.005	Putation of 4 valid mean dew- LATE FOR its one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610	Output in °C 49.901	POINT Immary ROBER Type sc 08-121	IN CCTG- IN CTG-	e for th	e inst		n the comp		0.0103				ninal de
REPORT each partiut cursor Results	ING TEMP cipant submi here Applied dew-point in °C 49.997 50.003 50.005	Putation of 4 valid mean dew- LATE FOR its one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610	Output in °C 49.901	POINT Immary ROBER Type sc 08-121	IN CCTG- IN CTG-	e for th	e inst		a the compa		0.0103				ninal de
REPORT each partiut cursor Results	n standard de incertainty of incerta	waition of 4 va f mean dew- LATE FOR its one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610 119.3473	Output in °C 49.901	POINT Immary ROBER Type sc 08-121	IN CCTG- IN CTG-	e for th	e inst		n the comp		0.0103	e "t" should			ninal de
REPORT each partiut cursor Results	ING TEMP cipant submi here Applied dew-point in °C 49.997 50.003 50.005	waition of 4 va f mean dew- LATE FOR its one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610 119.3473	Output in °C 49.901	POINT Immary ROBER Type sc 08-121	IN CCTG- IN CTG-	e for th	e inst		a the comp		0.0103 50 a t°C", when	e "t" should	d be replace	d by the nor	ninal de
Derived from tandard under the tandard under tandard	n standard de incertainty of standard de incerta	Deviation of 4 valid mean dew- LATE FOR is one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610 119.3473	Output in °C 49.901 49.910 49.871	POINT Immary ROBER Type sc 08-121	IN CCTG- IN CTG-	e for th	e inst		the compa		0.0103 50 a t°C", where	e "t" should	08-1216 Meas 3	d by the nor	ninal de
REPORT each partiut cursor Results	ING TEMP cipant submi here Applied dew-point in °C 49.997 50.003 50.005 49.963	eviation of 4 va f mean dew- land the service of the service of the service of the service output in ohm 119,3692 119,3610 119,3473	Output Output in °C 49.901 49.911	POINT ROBER Type s (08-121	IN CCTG- IN CCTG- IN CCTG- IP or nomina IT: rial number: 5 or 08-1216 Difference meas dp - applied dp) in °C -0.096 -0.093 -0.098 -0.092	K8 al dew	point	measured in		arison; labeled "dat	0.0103 50 a t°C", whet Meas 1 0.0150	e "t" should e "t" should Meas 2 0.0150	08-1216 Meas 3 0.0150	d by the nor	ninal de
REPORT each partiut cursor Results	ING TEMP cipant submi here Applied dew-point in °C 49.997 50.003 50.005 49.963	eviation of 4 va f mean dew- land the service of the service of the service of the service output in ohm 119,3692 119,3610 119,3473	Output in °C 49.901 49.911 49.906 49.871	POINT Type sign of the first term of the first t	IN CCTG- IN CTG-	K8 All dew-	point	measured in			0.0103 50 a t°C", where	e "t" should	08-1216 Meas 3	d by the nor	ninal de
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertain tandard ut td uncert	ING TEMP cipant submi here Applied dew-point in °C 49.993 50.005 49.963 Auties (in °C uncertainty of the total of the t	waition of 4 va if mean dew- lack transfer of the same and the same an	Output in °C 49.901 49.871 49.871	POINT ROBER Type s to 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CTG-	K8 All dew-	point	measured in		arison; labeled "dat	0.0103 50 a t°C", whet Meas 1 0.0150	e "t" should e "t" should Meas 2 0.0150	08-1216 Meas 3 0.0150	d by the nor	ninal de
Derived from tandard uncert tid u	Hygrometer Applied dew-point in °C 49.997 50.003 50.005 49.963 Applied dew-point in °C 49.997 60.003 60.005 49.963	Deviation of 4 va if mean dew- LATE FOR its one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610 119.3473	Output in °C 49.901 49.911 49.906 49.871	POINT POINT ROBER Type ss 08-121	IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN CCTG- IN COMMINISTRICT IN	K8 Ral dew- of mea	point	measured in		arison; labeled "dat	0.0103 50 a t°C", whet Meas 1 0.0150	e "t" should e "t" should Meas 2 0.0150	08-1216 Meas 3 0.0150	d by the nor	ninal de
Derived from tandard uncert tid u	Hygrometer Applied dew-point in °C 49.993 50.005 49.963 nties (in °C uncertainty of due to short due to long-due to non-due to long-due to ron-ludue to ron-ludue to ron-ludue to ron-ludue to ron-ludue to ron-ludue to ron-	Partition of 4 valid frame and dew- CLATE FOR its one spread for notes O8-1216 Resistance output in ohm 119,3592 119,3627 119,3610 119,3473	Output in °C 49.901 49.871 dition y (from stravelling	POINT ROBER 11 1 6 6 1 1 1 1 6 6 1 1 1 1 1 1 1 1 1	IN CCTG- IN CTG-	K8 al dew- of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", whet Meas 1 0.0150	e "t" should e "t" should Meas 2 0.0150	08-1216 Meas 3 0.0150	d by the nor	ninal de
REPORT each partiut cursor Results Reas 1 leas 2 leas 3 leas 4 Incertain tandard ut duncert tid uncert tid u	ING TEMP cipant subminer Hygrometer Applied dew-point in °C 49.993 50.005 49.963 Applied dew-point in °C 49.963 Applied dew-point in °C a	wation of 4 va f mean dew- land the mean dew- land	Output in °C 49.901 49.901 49.871 dition by (from staravelling staravelling staravellers)	POINT ROBER Type s to 8-121	IN CCTG- IN CTG-	K8 al dew- of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	ninal de
REPORT each partiut cursor Results Reas 1 leas 2 leas 3 leas 4 Incertain tandard ut duncert tid uncert tid u	ING TEMP cipant subminer Hygrometer Applied dew-point in °C 49.993 50.005 49.963 Applied dew-point in °C 49.963 Applied dew-point in °C a	Deviation of 4 va if mean dew- framean dew- land transport of the state of the stat	Output in °C 49.901 49.901 49.871 dition by (from staravelling staravelling staravellers)	POINT ROBER Type s to 8-121	IN CCTG- IN CTG-	K8 al dew- of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", whet Meas 1 0.0150	e "t" should e "t" should Meas 2 0.0150	08-1216 Meas 3 0.0150 0.0002	d by the nor	ninal de
REPORT each partiut cursor Results leas 1 leas 2 leas 3 leas 4 Jincertain tandard uncert tid uncert combination ombination ombination.	Hygrometer Applied dew-point in °C 49.993 50.005 49.963 nties (in °C incertainty of due to short due to long-due to roon-le between a	Deviation of 4 valid from the mean dew- LATE FOR the one spread for notes O8-1216 Resistance output in ohm 119.3592 119.3627 119.3610 119.3473 The option of the mean that is a specific to the mean that is a specifi	Output in °C 49.901 49.871 dition y (from stravelling sliling state) assured to the control of t	POINT POINT ROBER Type ss 08-121	IN CCTG- IN	K8 al dew- of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	ninal de
REPORT each particular cursor Results leas 1 leas 2 leas 3 leas 4 Juncertair tandard uncert to ombination of fective defective defecti	Hygrometer Applied dew-point in °C 49.993 50.005 49.963 Applied dew-point in °C due to short due to long-due to resol due	eviation of 4 va if mean dew- PLATE FOR its one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610 119.3473 If applied core-term stability term drift of it ution of trave inearity of trapplied and metandard unceredom of unc	Output in °C 49.901 49.911 49.906 49.871	POINT ROBER Type ss to 8-121 t t s f f f f f f f f f f f f f f f f f	IN CCTG- per nomina Tr. rial number: 5 or 08-1216 Difference meas dp - applied dp) in °C -0.096 -0.098 -0.098 -0.092	K8 Al dew. of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	ninal de
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertain tandard u t	ING TEMP cipant subminer Hygrometer Applied dew-point in °C 49.997 50.003 50.005 49.963 Applied dew-point in °C 49.997 be developed in °C commercial in °C commerci	wation of 4 va f mean dew- land the mean dew- land	Output in °C 49.901 49.901 49.871 49.871 ceasured ertainty elegrees of	POINT ROBER Type s (8-121) t t	IN CCTG- per nomina T: real number: 5 or 08-1216 Difference meas dp - ppplied dp) in °C -0.096 -0.098 -0.092 d deviation) ard [if needed; if needed] d [if needed; of dew/fros drature es: n will be large	K8 Al dew. of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertail tandard u td uncert td uncert td uncert td uncert td uncert tourincert owniance ombinatio	ING TEMP cipant subminer Hygrometer Applied dew-point in °C 49.997 50.003 50.005 49.963 Applied dew-point in °C 49.997 be developed in °C commercial in °C commerci	eviation of 4 va if mean dew- PLATE FOR its one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3610 119.3473 If applied core-term stability term drift of it ution of trave inearity of trapplied and metandard unceredom of unc	Output in °C 49.901 49.901 49.871 49.871 ceasured ertainty elegrees of	POINT ROBER Type s (8-121) t t	IN CCTG- per nomina T: real number: 5 or 08-1216 Difference meas dp - ppplied dp) in °C -0.096 -0.096 -0.098 -0.092 d deviation) ard [if needed; if needed] d [if needed: of dew/fros drature es: n will be large	K8 Al dew. of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertail tandard u td uncert td uncert td uncert td uncert td uncert tourincert owniance ombinatio	ING TEMP cipant subminer Hygrometer Applied dew-point in °C 49.997 50.003 50.005 49.963 Applied dew-point in °C 49.997 be developed in °C commercial in °C commerci	wation of 4 va f mean dew- land the mean dew- land	Output in °C 49.901 49.901 49.871 49.871 ceasured ertainty elegrees of	POINT ROBER Type s (8-121) t t	IN CCTG- per nomina T: real number: 5 or 08-1216 Difference meas dp - ppplied dp) in °C -0.096 -0.096 -0.098 -0.092 d deviation) ard [if needed; if needed] d [if needed: of dew/fros drature es: n will be large	K8 Al dew. of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertail tandard ut td uncert td uncert td uncert td uncert td uncert to uncert	ING TEMP cipant subminer Applied dew-point in °C 49.993 So.005 49.963 Applied dew-point in °C 49.963 Miles (in °C Incertainty of due to short due to short due to long-due to resold due to non-le between as perses of frees the effectify small, need	waition of 4 va if mean dew- if mean dew- if mean dew- it can be spread to recomply the source output in ohm 119.3592 119.3627 119.3610 119.3473 If applied core- iterm stability term drift of the spread of the s	Output in °C 49.901 49.901 49.871 49.871 ceasured ertainty elegrees of	POINT ROBER Type s (8-121) t t	IN CCTG- per nomina T: real number: 5 or 08-1216 Difference meas dp - ppplied dp) in °C -0.096 -0.096 -0.098 -0.092 d deviation) ard [if needed; if needed] d [if needed: of dew/fros drature es: n will be large	K8 Al dew. of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertail tandard ut td uncert td uncert td uncert td uncert td uncert to uncert	ING TEMP cipant subminer Hygrometer Applied dew-point in °C 49.997 50.003 50.005 49.963 Applied dew-point in °C 49.997 be developed in °C commercial in °C commerci	waition of 4 va if mean dew- if mean dew- if mean dew- it can be spread to recomply the source output in ohm 119.3592 119.3627 119.3610 119.3473 If applied core- iterm stability term drift of the spread of the s	Output in °C 49.901 49.901 49.871 49.871 ceasured ertainty elegrees of	POINT ROBER Type s (8-121) t t	IN CCTG- per nomina T: real number: 5 or 08-1216 Difference meas dp - ppplied dp) in °C -0.096 -0.096 -0.098 -0.092 d deviation) ard [if needed; if needed] d [if needed: of dew/fros drature es: n will be large	K8 Al dew. of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Incertail tandard u td uncert td	ING TEMP cipant subminer Applied dew-point in °C 49.993 So.005 49.963 Applied dew-point in °C 49.963 Miles (in °C Incertainty of due to short due to short due to long-due to resold due to non-le between as perses of frees the effectify small, need	waition of 4 va if mean dew- if mean dew- if mean dew- it can be spread to recomply the source output in ohm 119.3592 119.3627 119.3610 119.3473 If applied core- iterm stability term drift of the spread of the s	Output in °C 49.901 49.901 49.871 49.871 ceasured ertainty elegrees of	POINT ROBER Type s (8-121) t t	IN CCTG- per nomina T: real number: 5 or 08-1216 Difference meas dp - ppplied dp) in °C -0.096 -0.096 -0.098 -0.092 d deviation) ard [if needed; if needed] d [if needed: of dew/fros drature es: n will be large	K8 Al dew. of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	
REPORT each parti ut cursor Results leas 1 leas 2 leas 3 leas 4 Jncertair tandard u td uncert	Hygrometer Applied dew-point in °C 49.993 So.005 A9.963 Agriculture to long-due to long-due to long-due to long-due to mon-le between a segrees of frees the effectity small, need to not resident of resident of the segrees of the segrees of frees the effectity small, need to not resident of the segrees of frees the effectity small, need to not resident of the segrees of frees the effectity small, need to not resident of the segrees of frees the effectity small, need to not resident of the segrees of frees the effectity small, need to not resident of the segrees of the segrees of frees the effectity small, need to not resident of the segrees of the segrees of frees the effective segrees of the segrees of	waition of 4 va if mean dew- if mean dew- if mean dew- it can be spread to recomply the source output in ohm 119.3592 119.3627 119.3610 119.3473 If applied core- iterm stability term drift of the spread of the s	Output in °C 49.901 49.901 49.871 49.871 dition by (from staravelling	POINT ROBER Type sign on the sign of the s	IN CCTG- per nomina T: real number: 5 or 08-1216 Difference meas dp - ppplied dp) in °C -0.096 -0.096 -0.098 -0.092 d deviation) ard [if needed; if needed] d [if needed: of dew/fros drature es: n will be large	K8 Al dew. of mea	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	
Derived from tandard uncertain tandard uncertain tandard uncert tid uncert ti	Hygrometer Applied dew-point in °C 49.997 50.003 50.005 49.963 Atties (in °C incertainty of due to short due to long-due to resol due to non-le between a bon of these segrees of frees the effectively small, need	Position of 4 valid frame and dew- LATE FOR to one spread for notes 08-1216 Resistance output in ohm 119.3592 119.3627 119.3627 119.3610 119.3473 If applied conterm stability term drift of fution of trave inearity of trave i	Output of the control	POINT ROBER Type ss constant and are standard [standard standard s	trument) trument) trument) trument difference trice in trument in	K8 al dew- of mea ed] i] a-point	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", when Hygromete Meas 1 0.0150 0.0001	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	
REPORT each partiut cursor Results leas 1 leas 2 leas 3 leas 4 Uncertain tandard uncert to uncert uncert to uncert uncertain	Hygrometer Applied dew-point in "C 49.993" 50.003 50.005 49.963 htties (in "C view to short due to long-due to non-le between a bin of these s the effectify small, need to of the short due to resolution of residue view point in view properties to non-le between a bin of these s	Position of 4 valid mean dew- PLATE FOR its one spread for notes O8-1216 Resistance output in ohm 119,3592 119,3627 119,3610 119,3473 If applied core-term stability term drift of the ution of trave linearity of trapplied and mean damaged and mean damaged in the core of the core	Output in °C	POINT ROBER Type is 08-121 (IN CCTG- IN CCTG- IN CCTG- IP or nomina IT: retal number: 5 or 08-1216 Difference meas dp - papplied dp) in "C0.096 -0.093 -0.098 -0.092 Id deviation) ard [if needed] Id [if needed] Id [if needed] Id [if needed] If it needed] If it needed is of dew/fros If a will be large If it is a will be wil	K8 al dew- of mea ed] i] a-point	point surem	measured in	velling sta	arison; labeled "dat	0.0103 50 a t°C", where Hygrometr Meas 1 0.0150 0.0001 NOTE: onl	e "t" should e "t" should e "t" should	08-1216 Meas 3 0.0150 0.0002	Meas 4 0.0150 0.0002	

REPORT	ING TEMP	LATE FOR	DEW-F	OINT IN CCTG-K	8			Nominal value:	65	°C	Lab name	PTB	
each parti	cipant submi	ts one spread	Isheet su	mmary per nominal	dew-point	measured in	the comparis	son; labeled "dat	a t°C", wher	e "t" should	be replace	d by the nor	ninal de
out cursor	here	for notes		ROBERT: Type serial number:									
Results				08-1215 or 08-1216									
	Hygrometer	08-1216											
	Applied dew-point in °C	Resistance output in ohm	Outpu in °C	Difference (meas dp - applied dp) in °C									
Meas 1	64.995	125.1307	64.924	-0.071									
Meas 2	65.009	125.1359	64.937	-0.071									
Meas 3	65.000	125.1316	64.926	-0.074									
Meas 4	65.001	125.1320	64.927	-0.074									
Uncertair	nties (in °C	;)							Hygromete	er	08-1216		
									Meas 1	Meas 2	Meas 3	Meas 4	
Standard u	ncertainty o	f applied cor	dition						0.0179	0.0179	0.0179	0.0179	
Std uncert	due to short	-term stability	y (from s	andard deviation) of	measurem	ents of trav	elling stand	ard (type A)	0.0004	0.0004	0.0004	0.0002	
Std uncert	due to long-	term drift of	travelling	standard [if needed]								
				ndard [if needed]									
				standard [if needed]									
Covariance	between a	pplied and m	easured	values of dew/frost-p	oint tempe	rature [if ne	eded]						
Combinatio	on of these s	tandard unce	ertainties	in quadrature					0.017931	0.017928	0.017897	0.017896	
Effective d	agrage of fre	edom of unc	ortainty	etimatee		131							
	•			freedom will be large.		131							
				int throughout the calcu	ulation.				NOTE: onl	y fill in fiel	ds with gre	en backgr	ound
Aggregat	tion of res	ults											
Mean of 4	dew-point te	mperature di	ifference	s					-0.073				
	•	•		bility of difference r	esults				0.0016				
			_	ame instrument)									
`				perature difference	for the inst	rument			0.0180				



12.7 UNCERTAINTY BUDGET REPORTED BY ALL PARTICIPANTS

Fig. 12.7.a Uncertainty budget reported by **BEV/E+E** at 30 °C dew-point temperature.

Ungarta	inty analysis of day point termorature	Nominal value:	30	°C			BEV/E+E			
	inty analysis of dew point temperature	1				Lab name	DEVICE			
	Comparison in humidity (dew-point temperature) CCT-K									
each partic	cipant submits one spreadsheet summary per nominal dew-point me	asured in the o	comparison;	labeled "U_gen t°0	C", where	"t" should be	replaced by	the nominal of	dew-point temperature	
Quantity	Components	Stand	dard	Degrees of fre	edom	Sens	itivity	Uncert	ainty	Calculation
(symbol)		uncer	tainty	components ev	aluated	coeff		contrib		of degrees
				by a type A me						of freedom
Q _i		U(Qi)	unit	V i	unit	Ci	unit	ui	unit	
	lew-point generator				-					
Saturation	temperature	+			+					
	Calibration uncertainty (sensor and indicator unit)	0.0040	°C	50	-	1.000	K/K	0.0040	°C	5.11688E-12
	Long-term stability (sensor and indicator)	0.0010	°C	50	-	1.000	K/K	0.0010	°C	1.99878E-14
	Self-heating and residual heat fluxes (sensor)	0.0010	°C	50	-	1.000	K/K	0.0010	°C	1.99878E-14
	Resolution and accuracy or linearity (indicator unit)	0.0023	°C	50	-	1.000	K/K	0.0023	°C	5.59341E-1
	Saturator:									
	Temperature homogeneity	0.0020	°C	50	-	1.000	K/K	0.0020	°C	3.19805E-13
	Temperature stability	0.0002	°C	>50	-	1.000	K/K	0.0002	°C	1.27054E-1
Saturation	Pressure	+	_		+					
	Calibration uncertainty (sensor and indicator unit)	0.05	hPa	50	1 -	0.017	K/hPa	0.0008	°C	7.53008E-15
	Long-term stability (sensor and indicator)	0.29	hPa	50	1 -	0.017	K/hPa	0.0048	°C	1.05283E-1
	Resolution and accuracy or linearity (indicator unit)	0.10	hPa	50	-	0.017	K/hPa	0.0017	°C	1.48857E-13
	Pressure differences in the saturator cell	0.30	hPa	50	-	0.017	K/hPa	0.0050	°C	1.20574E-1
	Stability of the pressure	0.07	hPa	>50	-	0.017	K/hPa	0.0011	°C	3.46697E-1
	Effect of the tubing between the saturator and the pressure gauge	0.00	hPa	50	-	0.017	K/hPa	0.0000	°C	0
	ure at the generator outlet:	-			-					
	Pressure gauge: Calibration uncertainty (sensor and indicator unit)	0.05	hPa	50	-	0.017	K/hPa	0.0008	°C	7.53008E-15
	Long-term stability (sensor and indicator)	0.29	hPa	50	+ -	0.017	K/hPa	0.0048	°C	1.05788E-11
	Resolution and accuracy or linearity (indicator unit)	0.10	hPa	50	-	0.017	K/hPa	0.0017	°C	1.49569E-13
	Stability of the pressure	0.07	hPa	>50	-	0.017	K/hPa	0.0012	°C	3.672E-14
	Effect of the tubing between the saturator and the pressure gauge	0.00	hPa	50	-	0.017	K/hPa	0.0000	°C	0
Flow measu					-					
	Flow meter	0.00	Martin	50		0.007	16/0/	0.0004		0.004005.40
	Stability of the flow Reproducibility	0.02	I/min I/min	50 50	+-	0.007	K/(l/min) K/(l/min)	0.0001	°C	8.66138E-18 5.41336E-19
Saturation e		0.01	7111111	30	_	0.007	10 (0111111)	0.0001		3.41330E-13
	Saturation efficiency	0.0021	hPa	50	-	0.409	K/hPa	0.0009	°C	1.14652E-14
Correlation	between pressure and temperature measurement (if relevant)			1						
	Correlation between pressure and temperature measurement if relevant				-				°C	
	due to formulae/calculations									
	Saturation vapour pressure formula(e)	0.0019	hPa	50	-	0.409	K/hPa	0.0008	°C	7.93078E-15
	Water vapour enhancement formula(e)	0.0041	hPa	50	-	0.409	K/hPa	0.0017	℃	1.52733E-13
Other uncer		0.0030	°C	50	-	1.000	K/K	0.0030	°C	1.62E-12
comment	effect of temperature difference between saturator and outlet-line	0.0030	10	50	+ -	1.000	N/N	0.0030	.€	1.02E-12
									°€	
Combined u	uncertainty				-			0.0110	°C	
	grees of freedom			350	-				°C	4.13775E-11
Expanded u	incertainty				-			0.0219	°C	
					-					
		+	-		+		_			
		+			+					
		+			+					
Additiona	I uncertainty in applied condition at point of use									
	Pressure drop between point of realisation and measuring instrument	0.0250	hPa	>50	-	0.017	K/hPa	0.0004	°C	5.84256E-1
	Other				-				°C	
	method the number of degrees of freedom will be considered as being larg				1	L	1			
(Degrees of fr	freedom of 50 for a component of type B corresponds 10 % in relative unc	ertainty of the	uncertainty	estimate u _{Qi} ; see /	Annex G	of the ISO Gu	ide)			
		-	-		+		-			
		_	_		+	-	_			+
Combined	uncertainty				-			0,0110	°C	
Combined u	uncertainty egrees of freedom			351	-			0.0110	°C	4.13781E-1

Fig. 12.7.b Uncertainty budget reported by BEV/E+E at 95 °C dew-point temperature.

Uncerta	inty analysis of dew point temperature	Nominal value:	95	°C		Lab name	BEV/E+E	1		
		1.00.00				Lab name				
	Comparison in humidity (dew-point temperature) CCT-K									
each partic	cipant submits one spreadsheet summary per nominal dew-point me	asured in the	comparison;	labeled "U_gen t°C"	, where	"t" should be	replaced by	the nominal	dew-point temperature	
Quantity	Components	Stan		Degrees of free		Sens		Uncert		Calculatio
(symbol)		uncer	tainty	components eva		coeffi	icient	contrib	oution	of degree
				by a type A met						of freedon
Qi		U(Qi)	unit	V i	unit	Ci	unit	ui	unit	
	lew-point generator									
Saturation	n temperature	-	_			-	_			
	Calibration uncertainty (sensor and indicator unit)	0.0040	°C	50		1.000	K/K	0.0040	°C	5.11674E-
	Long-term stability (sensor and indicator)	0.0040	℃	50	-	1.000	K/K	0.0040	.€	1.99873E-
	Self-heating and residual heat fluxes (sensor)	0.0010	°C	50	-	1.000	K/K	0.0010	°C	1.99873E-
	Resolution and accuracy or linearity (indicator unit)	0.0023	°C	50	-	1.000	K/K	0.0023	°C	5.59325E-
	Saturator:							0.000		
	Temperature homogeneity	0.0020	°C	50	-	1.000	K/K	0.0020	°C	3.19796E-
	Temperature stability	0.0001	°C	>50	-	1.000	K/K	0.0001	°C	7.15351E-
Saturation										
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	0.05	hPa	50	-	0.025	K/hPa	0.0012	°C	4.15681E-
	Long-term stability (sensor and indicator)	0.29	hPa	50	-	0.025	K/hPa	0.0074	°C	5.84926E-
	Resolution and accuracy or linearity (indicator unit)	0.10	hPa	50	-	0.025	K/hPa	0.0025	°C	8.27007E-
	Pressure differences in the saturator cell	0.30	hPa	50	-	0.025	K/hPa	0.0076	°C	6.69876E-
	Stability of the pressure	0.14	hPa hPa	>50 50	-	0.025	K/hPa K/hPa	0.0036	ဗင	3.4552E-
	Effect of the tubing between the saturator and the pressure gauge	0.00	nPa	50	-	0.025	K/nPa	0.0000	-0	0
Gas press	ure at the generator outlet: Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	0.05	hPa	50	-	0.025	K/hPa	0.0012	°C	4.15681E
	Long-term stability (sensor and indicator)	0.29	hPa	50	-	0.025	K/hPa	0.0074	°C	5.87293E
	Resolution and accuracy or linearity (indicator unit)	0.10	hPa	50	-	0.025	K/hPa	0.0025	°C	8.30353E
	Stability of the pressure	0.14	hPa	>50	-	0.025	K/hPa	0.0036	°C	3.4921E-
	Effect of the tubing between the saturator and the pressure gauge	0.00	hPa	50	-	0.025	K/hPa	0.0000	°C	0
low meas										
	Flow meter									
	Stability of the flow	0.02	I/min	50	-	0.065	K/(l/min)	0.0013	°C	5.72846E-
	Reproducibility	0.01	I/min	50	-	0.065	K/(l/min)	0.0007	℃	3.58029E-
Saturation										
	Saturation efficiency	0.0424	hPa	50	-	0.032	K/hPa	0.0014	°C	7.08916E-
correlation	between pressure and temperature measurement (if relevant)				-				°C	
	Correlation between pressure and temperature measurement if relevant due to formulae/calculations									
ncertainty	Saturation vapour pressure formula(e)	0.0152	hPa	50	-	0.032	K/hPa	0.0005	°C	1.18833E-
	Water vapour enhancement formula(e)	0.0420	hPa	50	-	0.032	K/hPa	0.0003	°C	6.83448E-
Other unce		0.0420	III a	30		0.002	TOTH &	0.0014		0.00THOL
	effect of temperature difference between saturator and outlet-line	0.0030	°C	50	-	1.000	K/K	0.0030	°C	1.62E-12
					-				°C	
					-				°C	
Combined	uncertainty				-			0.0158	°C	
ffective de	egrees of freedom			313	-				°C	2.00754E-
xpanded ı	uncertainty				-			0.0317	°C	
									 	
		_							-	
	<u> </u>								 	-
\ al al isi a	l uncertainty in applied condition at point of	+								
Auditiona	al uncertainty in applied condition at point of use	0.0055	LD:	50	-	0.005	K/I-D	0.0005	200	0.0405==
	Pressure drop between point of realisation and measuring instrument Other	0.0250	hPa	>50	_	0.025	K/hPa	0.0006	°C	3.24357E-
	Other									-
for type B	 method the number of degrees of freedom will be considered as being larg	er than 50	-				-		 	
	freedom of 50 for a component of type B corresponds 10 % in relative unc		uncertainty	estimate u cec A	nnex G	of the ISO Co.	ide)			
Dogrees UI		January Of title	- Containty	Journale ag, 566 Al					 	
		+								
Combined	uncertainty				-			0.0158	°C	
	egrees of freedom			314	-				°C	2.00758E
Expanded (uncertainty				-			0.0317	°C	

Fig. 12.7.c Uncertainty budget reported by **INTA** at 30 °C dew-point temperature.

I In corto	into analysis of days naint termosature	Nominal	30	°C			INTA2			
	inty analysis of dew point temperature	value:				Lab name				
	Comparison in humidity (dew-point temperature) CCT-K									
each parti	cipant submits one spreadsheet summary per nominal dew-point mea	sured in the o	comparison;	labeled "U_gen t°C"	, where	"t" should be	replaced by	the nominal of	dew-point temperature	
Quantity	Components	Stand		Degrees of free		Sensi		Uncert		Calculation
(symbol)		uncer	tainty	components eva		coeffi	cient	contrib	oution	of degrees
				by a type A met						of freedom
Q _i		U(Qi)	unit	V i	unit	Ci	unit	ui	unit	
	dew-point generator									
Saturation	n temperature		_		_		-			
	Calibration uncertainty (sensor and indicator unit)	0.0025	°C	50	_	0.963		0.0024	°C	6.7274E-
	Long-term stability (sensor and indicator)	0.0023	°C	62	-	0.963		0.0024	°C	1.56847E-
	Self-heating and residual heat fluxes (sensor)	0.0017	°C	50	-	0.963		0.0017	°C	1.54997E-
	Resolution and accuracy or linearity (indicator unit)	0.0004	Ohm/Ohm	50	-	0.963		0.0004	°C	4.60675E-
	Saturator:									
	Temperature homogeneity	0.0058	°C	50	-	0.963		0.0056	°C	1.91355E-
	Temperature stability	0.0100	°C	19	-	0.963		0.0096	°C	4.53209E-
Saturation	n pressure									
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	7	Pa	50	-	-1.29E-04		-0.0009	°C	1.32514E-
	Long-term stability (sensor and indicator)	18	Pa	50	-	-1.29E-04		-0.0023	°C	5.66334E-
	Resolution and accuracy or linearity (indicator unit)	1	Pa	50	-	-1.29E-04		-0.0001	°C	6.13234E-
	Pressure differences in the saturator cell	29	Pa Pa	50	-	-1.29E-04		-0.0037	°C	3.83271E- 1.88231E-
	Stability of the pressure Effect of the tubing between the saturator and the pressure gauge	60	Pa Pa	19 50	-	-1.29E-04 -1.29E-04		-0.0077 -0.0007	°C	6.13234E-
Gac proce	ure at the generator outlet:		га	30		-1.29L-04		-0.0007	C	0.13234L*
Gas piess	Pressure gauge:									-
	Calibration uncertainty (sensor and indicator unit)	6	Pa	50	-	1.71E-04		0.0010	°C	2.24013E-
	Long-term stability (sensor and indicator)	15	Pa	50	-	1.71E-04		0.0026	°C	9.04964E-
	Resolution and accuracy or linearity (indicator unit)	6	Pa	50	-	1.71E-04		0.0010	°C	1.92055E-1
	Stability of the pressure	20	Pa	19	-	1.71E-04		0.0034	°C	7.27788E-1
	Effect of the tubing between the saturator and the pressure gauge	6	Pa	50	-	1.71E-04		0.0010	°C	1.92055E-1
Flow meas	urement:									
	Flow meter									
	Stability of the flow				-				°C	
	Reproducibility				-				°C	
Saturation										
0	Saturation efficiency				-				°C	
Correlation	between pressure and temperature measurement (if relevant) Correlation between pressure and temperature measurement if relevant	_							°C	
Incortaint	due to formulae/calculations								C	
Unicertainty	Saturation vapour pressure formula(e)	0.00003	%	50	-	17.34		0.0005	°C	1.25651E-1
	Water vapour enhancement formula(e)	0.00003	%	50	-	17.41		0.0012	°C	4.8066E-1
Other unce		0.00007	70	30		17.71		0.0012	Ŭ	4.0000L
outer unoc	Saturation vapour pressure formula(e) at tc	0.00003	%	50	-	-17.41		-0.0005	°C	1.27471E-1
	Water vapour enhancement formula(f) at tc, pc	0.00003	%	50	-	-17.41		-0.0005	°C	1.71322E-1
	()		,,,		-				°C	
Combined	uncertainty				-			0.015	°C	
Effective de	egrees of freedom				-	85			°C sur	n 6.74274E-1
Expanded (uncertainty				-	2.030		0.031	°C	
		-								
		-								
					_					
A -1 -1141					_		-			
Additiona	al uncertainty in applied condition at point of use									
	Pressure drop between point of realisation and measuring instrument Other	1.8040	Pa	50		1.71E-04		0.0003	°C	1.83069E-
	Other								-0	-
for type B	I method the number of degrees of freedom will be considered as being large	r than 50							 	
	freedom of 50 for a component of type B corresponds 10 % in relative unce		Incertainty	estimate us: eec A	nnex G	of the ISO Cod	de)			
pogrees 01	incodern or 50 for a component of type B corresponds 10 % In relative drice	Trainity of the	linetranity	osumate uq, see Al	IIIEX G (in the ISO Gui	UC)		 	
Combined	uncertainty							0.015	°C	
	egrees of freedom					85				n 6.74274E-
	uncertainty					2.030		0.031	°C	

Fig. 12.7.d Uncertainty budget reported by **INTA** at 95 °C dew-point temperature.

Uncerta	ainty analysis of dew point temperature	Nominal value:	95	°C		Lab name	INTA2			
	Comparison in humidity (dew-point temperature) CCT-k	(8								
	cipant submits one spreadsheet summary per nominal dew-point me		comparison	; labeled "U_gen t°C	c", where	"t" should be	replaced by	the nominal of	dew-point temperature	
					-					
					-					
Quantity	Components	Stan	dard	Degrees of fre	edom	Sensi	tivity	Uncert	ainty	Calculation
(symbol)	Components		tainty	components ev		coeffi		contrib		of degrees
				by a type A me	thod *					of freedom
Qi		U(Qi)	unit	V i	unit	Ci	unit	ui	unit	
	dew-point generator									
Saturation	n temperature				+					
	Calibration uncertainty (sensor and indicator unit)	0.0026	°C	55	-	0.969		0.0024	°C	6.37038E-1
	Long-term stability (sensor and indicator)	0.0018	°C	62	-	0.969		0.0017	°C	1.48253E-1
	Self-heating and residual heat fluxes (sensor)	0.0017	°C	50	-	0.969		0.0016	°C	1.464E-1
	Resolution and accuracy or linearity (indicator unit)	0.0004	Ohm/Ohm	50	-	0.969		0.0004	°C	4.70088E-1
	Saturator:	0.0087	°C	50	_	0.969		0.0082	°C	0.440075.4
	Temperature homogeneity Temperature stability	0.0100	.€	19	+ -	0.969		0.0082	°C	9.14997E-1 4.28069E-1
Saturation	n pressure	0.0100		15		0.503		0.0000		F.20003E*1
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	7	Pa	50	-	-2.24E-04		-0.0016	°C	1.20238E-1
	Long-term stability (sensor and indicator)	18	Pa	50	-	-2.24E-04		-0.0040	°C	5.13869E-1
	Resolution and accuracy or linearity (indicator unit) Pressure differences in the saturator cell	1 29	Pa Pa	50 50	-	-2.24E-04 -2.24E-04		-0.0001 -0.0065	°C	5.56424E-1 3.47765E-1
	Stability of the pressure	60	Pa	19	+ -	-2.24E-04		-0.0065	°C	1.70793E-0
	Effect of the tubing between the saturator and the pressure gauge	6	Pa	50	-	-2.24E-04		-0.0013	°C	5.56424E-1
Gas press	sure at the generator outlet:									
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	6 15	Pa Pa	50 50	-	2.67E-04 2.67E-04		0.0016 0.0040	°C	1.32519E-1 5.35349E-1
	Long-term stability (sensor and indicator) Resolution and accuracy or linearity (indicator unit)	6	Pa Pa	50	1	2.67E-04 2.67E-04		0.0040	°C	1.13614E-1
	Stability of the pressure	20	Pa	19	+ -	2.67E-04		0.0053	°C	4.30537E-1
	Effect of the tubing between the saturator and the pressure gauge	6	Pa	50	-	2.67E-04		0.0015	°C	1.13614E-13
Flow meas										
	Flow meter Stability of the flow				_				°C	
	Reproducibility				+÷				°C	
Saturation										
	Saturation efficiency				-				°C	
Correlation	between pressure and temperature measurement (if relevant)									
	Correlation between pressure and temperature measurement if relevant				-				°C	
Uncertainty	/ due to formulae/calculations Saturation vapour pressure formula(e)	0.00003	%	50	1 -	27.09		0.0008	°C	7.48099E-1
	Water vapour enhancement formula(e)	0.00003	%	50	+ -	27.48		0.0006	°C	3.29726E-1
Other unce			1					0.0000		
	Saturation vapour pressure formula(e) at tc	0.00003	%	50	-	-27.48		-0.0008	°C	7.92145E-1
	Water vapour enhancement formula(f) at tc, pc	0.00002	%	50	-	-27.48		-0.0005	°C	1.74021E-1
					-				°C	
Combined	uncertainty				_			0.022	°C	
	egrees of freedom				-	94		0.022		n 2.31731E-0
	uncertainty				-	2.027		0.044	°C	
					-					
					+					
					+					
Additiona	al uncertainty in applied condition at point of use									
	Pressure drop between point of realisation and measuring instrument	1.8040	Pa	50		2.67E-04		0.0005	°C	1.08298E-1
	Other								°C	
		1								
	method the number of degrees of freedom will be considered as being large		L.	1	1	(1) - 100 0 1	1			
(Degrees of	freedom of 50 for a component of type B corresponds 10 % in relative und	ertainty of the	uncertainty	estimate uo; see A	nnex G	or the ISO Gui	ae)			
		+	-		+				 	
									 	
	uncertainty							0.022	°C	
	egrees of freedom					94				n 2.31731E-0
Expanded	uncertainty					2.027		0.044	°C	

Fig. 12.7.e Uncertainty budget reported by **INRiM** at 30 °C dew-point temperature.

I Incorto	inty analysis of dew point temperature	Nominal value:	30	°C		lab accord	INRIM			
		varuo.			-	Lab name				
	Comparison in humidity (dew-point temperature) CCT-K									
each partic	cipant submits one spreadsheet summary per nominal dew-point me	asured in the	comparison;	labeled "U_gen t°0	C", where	"t" should be	replaced by	the nominal of	dew-point temperature	
					-					
					-					
					_					
Quantity	Components	Stand	dard	Degrees of fre	edom	Sensi	itivity	Uncert	aintv	Calculation
(symbol)	,	uncer		components ev	aluated	coeffi		contrib		of degrees
				by a type A m						of freedom
Q _i		U(Qi)	unit	V i	unit	Ci	unit	ui	unit	
	lew-point generator									
Saturation	temperature Thermometer:				+					
	Calibration uncertainty (sensor and indicator unit)	0.0100	°C	50	-	1.00	°C/°C	0.010	°C	2E-1
	Long-term stability (sensor and indicator)	0.0029	°C	50	-	1.00	°C/°C	0.003	°C	1.39549E-1
	Self-heating and residual heat fluxes (sensor)	0.0000	°C	50	-	1.00	°C/°C	0.000	°C	
	Resolution and accuracy or linearity (indicator unit)	0.0003	°C	50	-	1.00	°C/°C	0.000	°C	1.39549E-1
	Saturator:	0.0010	°C	50	-	1.00	°C/°C	0.001	°C	2F-1
	Temperature homogeneity Temperature stability	0.0010	°C	20	+ -	1.00	°C/°C	0.001	°C	2E-1 8E-1
Saturation		0.0020		20		1.00	G 0	0.002		OL-1
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	17.5000	Pa	50	-	-1.7E-04	°C/Pa	-0.003	°C	1.42082E-1
	Long-term stability (sensor and indicator)	15.0000	Pa	50	-	-1.7E-04	°C/Pa	-0.002	°C	7.66922E-1
	Resolution and accuracy or linearity (indicator unit) Pressure differences in the saturator cell	0.1000 15.0000	Pa Pa	50 50	-	-1.7E-04 -1.7E-04	°C/Pa	0.000 -0.002	°C	1.51491E-2 7.66922E-1
	Stability of the pressure	13.0000	Pa Pa	20	+÷	-1.7E-04 -1.7E-04	°C/Pa	-0.002	°C	1.08168E-1
	Effect of the tubing between the saturator and the pressure gauge	0.1000	Pa	50	-	-1.7E-04	°C/Pa	0.000	°C	1.51491E-2
Gas pressi	ure at the generator outlet:			-				0.000		
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	2.0000	Pa	50	-	-1.7E-04	°C/Pa	0.000	°C	2.42385E-1
	Long-term stability (sensor and indicator)	2.5000 0.0010	Pa Pa	50 50	+ :	-1.7E-04 -1.7E-04	°C/Pa	0.000	℃	5.91761E-1 1.51491E-2
	Resolution and accuracy or linearity (indicator unit) Stability of the pressure	0.0010	Pa Pa	20	+ -	-1.7E-04 -1.7E-04	°C/Pa	0.000	°C	3.22034E-1
	Effect of the tubing between the saturator and the pressure gauge	0.1000	Pa	50	+ :	-1.7E-04	°C/Pa	0.000	℃	1.51491E-2
Flow meas								0.000		
	Flow meter									
	Stability of the flow	0.001	I/min	60	-	0.013	°C/I/min	0.000	°C	1.94976E-2
Saturation	Reproducibility	0.0087	l/min	50	-	0.013	°C/I/min	0.000	°C	3.22838E-1
Saturation	Saturation efficiency	0.003	°C	50	-	1.00	°C/°C	0.003	°C	1.39549E-1
Correlation	between pressure and temperature measurement (if relevant)	0.000	T T	00		1.00	0, 0	0.000		1.000102 1
	Correlation between pressure and temperature measurement if relevant	0.0000	Pa	50	-	-1.7E-04	°C/Pa	0.000	°C	
Uncertainty	due to formulae/calculations									
	Saturation vapour pressure formula(e)				-				°C	
Other unce	Water vapour enhancement formula(e)				-				°C	
Other uncer	Desorption Effect	0.00	°C	50	-	1.00	°C/°C	0.000	°C	
	Bath homogeneity	0.006	°C	50	-	1.00	°C/°C	0.006	°C	2.23278E-1
	Flow meter - Resolution	0.001	l/min	50	-	0.013	°C/I/min	0.000	°C	5.7122E-2
Combined (-			0.013	°C	
	egrees of freedom			142	-			0.0269	°C sur	n 2.29976E-1
Expanded ι	incertainty				-			0.0269	-0	
Additiona	al uncertainty in applied condition at point of use									
	Pressure drop between point of realisation and measuring instrument Other	10.0000	Pa	50	-	-1.7E-04	°C/Pa	-0.002	°C	1.51491E-1
	Other									
for type B r	! method the number of degrees of freedom will be considered as being large	er than 50.								
	freedom of 50 for a component of type B corresponds 10 % in relative unce		uncertainty	estimate u _{Qi} ; see i	Annex G	of the ISO Gui	ide)			
					_			0.000		
	uncertainty egrees of freedom			147				0.014	°C sur	n 2.30128E-1
	uncertainty			147				0.027	°C sur	2.30120E-1
	unou unity							0.027		

Fig. 12.7.f Uncertainty budget reported by **INRiM** at 95 °C dew-point temperature.

l Incerte	inty analysis of dew point temperature	Nominal value:	95	°C		Lab name	INRIM			
		1				Lab name				
	Comparison in humidity (dew-point temperature) CCT-K									
each partic	cipant submits one spreadsheet summary per nominal dew-point mea	sured in the	comparison;	labeled "U_gen t°C"	', where	"t" should be	replaced by	the nominal	dew-point temperature	
Quantity	Components	Stand		Degrees of free		Sensi		Uncert		Calculatio
(symbol)		uncer	tainty	components eva		coeffi	cient	contrib	oution	of degrees
				by a type A met						of freedon
Q _i		U(Qi)	unit	V i	unit	Ci	unit	ui	unit	
	lew-point generator				-					
Saturation	n temperature				-					
	Calibration uncertainty (sensor and indicator unit)	0.0100	°C	50		1.00	°C/°C	0.010	°C	2E-
	Long-term stability (sensor and indicator)	0.0029	°C	50		1.00	°C/°C	0.003	°C	1.39549E-
	Self-heating and residual heat fluxes (sensor)	0.0000	°C	50	-	1.00	°C/°C	0.000	°C	1.000 102
	Resolution and accuracy or linearity (indicator unit)	0.0003	°C	50	-	1.00	°C/°C	0.000	°C	1.39549E-
	Saturator:									
	Temperature homogeneity	0.0058	°C	50	-	1.00	°C/°C	0.006	°C	2.23278E-
	Temperature stability	0.0200	°C	20	-	1.00	°C/°C	0.020	°C	0.0000000
Saturation	pressure									
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	17.5000	Pa	50	-	-2.6E-04	°C/Pa	-0.005	.€	8.40739E-
	Long-term stability (sensor and indicator)	15.0000	Pa	50	-	-2.6E-04	°C/Pa	-0.004	℃	4.5381E-
	Resolution and accuracy or linearity (indicator unit)	0.1000	Pa	50	-	-2.6E-04	°C/Pa	0.000 -0.004	°C	8.96414E-
	Pressure differences in the saturator cell	15.0000	Pa	50 20	-	-2.6E-04	°C/Pa	-0.004	∞ °	4.5381E-
	Stability of the pressure Effect of the tubing between the saturator and the pressure gauge	90.0000	Pa Pa	50	-	-2.6E-04 -2.6E-04	°C/Pa	0.000	℃	1.47034E- 8.96414E-
Gac proces	ure at the generator outlet:	0.1000	га	30	_	*2.0L*04	C/Fa	0.000	C	0.30414L
Gas piessi	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	2.0000	Pa	50	-	-2.6E-04	°C/Pa	-0.001	°C	1.43426E-
	Long-term stability (sensor and indicator)	2.5000	Pa	50	-	-2.6E-04	°C/Pa	-0.001	°C	3.50162E-
	Resolution and accuracy or linearity (indicator unit)	0.0010	Pa	50	-	-2.6E-04	°C/Pa	0.000	°C	8.96414E-
	Stability of the pressure	7.0000	Pa	20	-	-2.6E-04	°C/Pa	-0.002	°C	5.38073E-
	Effect of the tubing between the saturator and the pressure gauge	0.1000	Pa	50	-	-2.6E-04	°C/Pa	0.000	°C	8.96414E-
low meas										
	Flow meter									
	Stability of the flow	0.040	l/min	60	-	0.020	°C/I/min	0.001	°C	6.82667E-
`atıat!a	Reproducibility	0.0087	I/min	50	-	0.020	°C/I/min	0.000	℃	1.80855E-
Saturation	Saturation efficiency	0.003	°C	50	-	1.00	°C/°C	0.003	°C	1.39549E-
orrelation	between pressure and temperature measurement (if relevant)	0.003	- 0	50		1.00	10/10	0.003		1.39349E-
Joinelation	Correlation between pressure and temperature measurement (in relevant)	0.0000	Pa	50	-	-2.6E-04	°C/Pa	0.000	°C	
Incertainty	due to formulae/calculations	0.0000		00		2.02 01	O/I u	0.000		
,	Saturation vapour pressure formula(e)				-				°C	
	Water vapour enhancement formula(e)				-				°C	
Other unce										
	Desorption Effect	0.00	°C	50	-	1.00	°C/°C	0.000	°C	
	Bath homogeneity	0.006	°C	50	-	1.00	°C/°C	0.006	°C	2.23278E-
	Flow meter - Resolution	0.010	l/min	50	-	0.020	°C/I/min	0.000	°C	3.2E-
	uncertainty				-			0.034	°C	
	egrees of freedom			61	-					2.29689E-
xpanded u	uncertainty				-			0.0687	℃	
Additiona	al uncertainty in applied condition at point of use									
	Pressure drop between point of realisation and measuring instrument	10.0000	Pa	50	-	-2.6E-04	°C/Pa	-0.003	°C	8.96414E-
	Other								°C	
for type B r	: method the number of degrees of freedom will be considered as being large	r than 50.								
Degrees of t	freedom of 50 for a component of type B corresponds 10 % in relative unce	rtainty of the	uncertainty	estimate u _{Qi} ; see Aı	nnex G	of the ISO Gui	ide)			
	uncertainty							0.034	°C	
	egrees of freedom			61						2.29698E-
	uncertainty							0.069	°C	

Fig. 12.7.g Uncertainty budget reported by KRISS at 30 °C dew-point temperature.

l Incorto	into analysis of day point temperature	Nominal value:	30	°C			KRISS			
	inty analysis of dew point temperature			-		Lab name				
	Comparison in humidity (dew-point temperature) CCT-K									
each partic	cipant submits one spreadsheet summary per nominal dew-point mea	asured in the	comparison;	labeled "U_gen t°C"	, where	"t" should be	replaced by	the nominal of	dew-point temperature	
Quantity	Components	Stand		Degrees of free		Sensi		Uncert		Calculatio
(symbol)		uncer	tainty	by a type A met	luated	coeffi	cient	contrib	ution	of degrees
Qi			unit	by a type A met	unit	Ci	unit	Ui	unit	of freedon
	l dew-point generator	U(Qi)	unit	V 1	unit	ч	unit	uı	unit	
	n temperature									
oaturation	Thermometer:									
	Calibration uncertainty (sensor and indicator unit)	0.0020	°C	60	-	1.000	°C	0.0020	°C	2.66667E-
	Long-term stability (sensor and indicator)	0.0050	°C	60	-	1.000	°C	0.0050	°C	1.04167E-
	Self-heating and residual heat fluxes (sensor)	0.0050	°C	60	-	1.000	°C	0.0050	°C	1.04167E-
	Resolution and accuracy or linearity (indicator unit)	0.0010	°C	60	-	1.000	°C	0.0010	°C	1.66667E-
	Saturator:									
	Temperature homogeneity	0.0050	°C	60	-	1.000	°C	0.0050	°C	1.04167E-
	Temperature stability	0.0020	°C	99	-	1.000	°C	0.0020	°C	1.61616E-
Saturation					-				0.009	
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	7.15	Pa	60	-	1.713E-04	°C/Pa	0.0012	°C	3.753E-
	Long-term stability (sensor and indicator)	5.77	Pa	60	-	1.713E-04	°C/Pa	0.0010	°C	1.59555E-
	Resolution and accuracy or linearity (indicator unit) Pressure differences in the saturator cell	1.30 50.00	Pa Pa	60	-	1.713E-04 1.713E-04	°C/Pa	0.0002 0.0086	°C	4.10135E- 8.97499E-
	Stability of the pressure	5.00	Pa	20	-	1.713E-04 1.713E-04	°C/Pa	0.0009	°C	2.6925E-
	Effect of the tubing between the saturator and the pressure gauge	10.00	Pa	60	-	1.713E-04	°C/Pa	0.0003	°C	1.436E-
Gae nrace	ure at the generator outlet:	10.00	ıα	00		1.7152-04	O/I a	0.0017	0.009	
Ous press	Pressure gauge:								0.003	
	Calibration uncertainty (sensor and indicator unit)	3.30	Pa	60	-	1.713E-04	°C/Pa	0.0006	°C	1.70298E-
	Long-term stability (sensor and indicator)	5.80	Pa	60	-	1.713E-04	°C/Pa	0.0010	°C	1.62505E-
	Resolution and accuracy or linearity (indicator unit)	1.30	Pa	60	-	1.713E-04	°C/Pa	0.0002	°C	4.10135E-
	Stability of the pressure	3.00	Pa	20	-	1.713E-04	°C/Pa	0.0005	°C	3.48948E-
	Effect of the tubing between the saturator and the pressure gauge	10.00	Pa	60	-	1.713E-04	°C/Pa	0.0017	°C	1.436E-1
Flow meas									0.002	
	Flow meter									
	Stability of the flow			60	-			0.0050	°C	1.04167E-1
N = 4 4'	Reproducibility			60	-			0.0050	°C	1.04167E-1
Saturation		_		60				0.0050	°C	1.04167E-1
Corrolation	Saturation efficiency between pressure and temperature measurement (if relevant)			60	-			0.0050	-0	1.04167E-
Joneration	Correlation between pressure and temperature measurement (if relevant)			60	-			0.0000	°C	
Incertainty	due to formulae/calculations			- 00				0.0000		
Jilcertainty	Saturation vapour pressure formula(e)	0.0160	%	100	-	0.175	°C	0.0028	°C	6.14656E-
	Water vapour enhancement formula(e)	0.0050	%	100	-	-0.175	°C	-0.0009	°C	5.86182E-
Other unce		0.0000	-,-						0.003	0.000.000
				100	-			0.0000	°C	
				100	-			0.0000	°C	
				100	-			0.0000	°C	
Combined (uncertainty				-			0.0159	°C	
	egrees of freedom			412.31	-					1.53704E-1
Expanded ι	uncertainty				-			0.0317	°C	
		+	+		-					
		+	_		_					-
		+	-		-	-				-
Addition	I uncertainty in applied condition at point of use									
Huuliiona		10,0000	De	60		4 7425 04	0C/Da	0.0005	°C	4.463465
	Pressure drop between point of realisation and measuring instrument Other (moisture ad/desorpsion in tubing from saturator to hygrometer)	10.0000	Pa	60		1.713E-04	°C/Pa	0.0005 0.0050	°C	1.16316E-
				- 00				0.0000		04107E*
for type B	! method the number of degrees of freedom will be considered as being large	er than 50.			<u> </u>					
	freedom of 50 for a component of type B corresponds 10 % in relative unce		uncertainty	estimate uo: see Ai	nnex G	of the ISO Gui	de)			
-5.200 01	State				1	50 50	- 9			
		1	1							
					İ					
Combined	uncertainty							0.0166	°C	
Effective de	egrees of freedom			467.53					°C sun	1.64122E-
					_			0.0333	°C	1

Fig. 12.7.h Uncertainty budget reported by KRISS at 95 °C dew-point temperature.

I Incorte:	nty analysis of day point temperature	Nominal value:	95	°c			KRISS			
	nty analysis of dew point temperature					Lab name				
	Comparison in humidity (dew-point temperature) CCT-K									
each particip	pant submits one spreadsheet summary per nominal dew-point me	asured in the o	comparison;	labeled "U_gen t°C"	, where	"t" should be	replaced by	the nominal of	dew-point temperature	
Quantity	Components	Stand		Degrees of free		Sensi		Uncert		Calculatio
(symbol)		uncer	tainty	by a type A met	luated	coeffi	cient	contrib	ution	of degrees
Qi			unit	by a type A met	unit	Ci	unit	Ui	unit	or treedon
	ew-point generator	U(Qi)	unit	V 1	unit	ч	unit	uı	unit	
	temperature									
	Thermometer:									
	Calibration uncertainty (sensor and indicator unit)	0.0020	°C	60	-	1.000	°C	0.0020	°C	2.66667E-
	ong-term stability (sensor and indicator)	0.0050	°C	60	-	1.000	°C	0.0050	°C	1.04167E-
	Self-heating and residual heat fluxes (sensor)	0.0050	°C	60	-	1.000	°C	0.0050	°C	1.04167E-
	Resolution and accuracy or linearity (indicator unit)	0.0010	°C	60	-	1.000	°C	0.0010	°C	1.66667E-
5	Saturator:									
Т	Temperature homogeneity	0.0050	°C	60	-	1.000	°C	0.0050	°C	1.04167E-
T	Temperature stability	0.0020	°C	99	- 1	1.000	°C	0.0020	°C	1.61616E-
Saturation p					_				0.009	
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	7.15	Pa	60	-	2.676E-04	°C/Pa	0.0019	°C	2.23487E-
	ong-term stability (sensor and indicator)	5.77 1.30	Pa Pa	60 60	-	2.676E-04 2.676E-04	°C/Pa °C/Pa	0.0015	°C	9.50135E- 2.44231E-
	Resolution and accuracy or linearity (indicator unit) Pressure differences in the saturator cell	50.00	Pa Pa	60	-	2.676E-04 2.676E-04	°C/Pa	0.0003	°C	5.34451E-
	Stability of the pressure	5.00	Pa	20	-	2.676E-04	°C/Pa	0.00134	°C	1.60335E-
	Effect of the tubing between the saturator and the pressure gauge	10.00	Pa	60	-	2.676E-04	°C/Pa	0.0013	°C	8.55121E-
	re at the generator outlet:	10.00	ıα	00	_	2.070L-04	O/I a	0.0027	0.014	
	Pressure gauge:								0.014	
	Calibration uncertainty (sensor and indicator unit)	3.30	Pa	60	-	2.676E-04	°C/Pa	0.0009	°C	1.01411E-
	ong-term stability (sensor and indicator)	5.80	Pa	60	-	2.676E-04	°C/Pa	0.0016	°C	9.67698E-
	Resolution and accuracy or linearity (indicator unit)	1.30	Pa	60	-	2.676E-04	°C/Pa	0.0003	°C	2.44231E-
	Stability of the pressure	3.00	Pa	20	-	2.676E-04	°C/Pa	0.0008	°C	2.07794E-
	Effect of the tubing between the saturator and the pressure gauge	10.00	Pa	60	-	2.676E-04	°C/Pa	0.0027	°C	8.55121E-1
Flow measur	ement:								0.003	
	Flow meter									
	Stability of the flow			60	-			0.0050	°C	1.04167E-
	Reproducibility			60	-			0.0050	°C	1.04167E-1
Saturation ef										
	Saturation efficiency			60	-			0.0050	°C	1.04167E-1
	petween pressure and temperature measurement (if relevant) Correlation between pressure and temperature measurement if relevant			60	_			0.0000	°C	
	due to formulae/calculations			60				0.0000	L C	
	Saturation vapour pressure formula(e)	0.0090	%	100	_	0.270	°C	0.0024	°C	3.48678E-
	Vater vapour enhancement formula(e)	0.0030	%	100	-	-0.270	°C	-0.0008	°C	4.30467E-
Other uncerta		0.0030	70	100		-0.210		-0.0000	0.003	4.30407 E
Julier direction	umueo			100	-			0.0000	°C	
				100	-			0.0000	°C	
				100	-			0.0000	°C	
Combined un	ncertainty				-			0.0193	°C	
Effective deg	rees of freedom			229.22	-					6.00066E-
Expanded un	ncertainty				-			0.0385	°C	
		-			_			-		
		1								
	uncertainty in applied condition at point of use									
	Pressure drop between point of realisation and measuring instrument	10.0000	Pa	60		2.676E-04	°C/Pa	0.0005	°C	1.16316E-
C	Other (moisture ad/desorpsion in tubing from saturator to hygrometer)			60				0.0150	°C	8.4375E-
for turn D	othed the number of degrees of freedom will be associated as for the term	or thon 50								
	ethod the number of degrees of freedom will be considered as being large		I montriet	octimate (* : cos ^:	nnov C	f the ICO C	do)		 	
Degrees of fre	seedom of 50 for a component of type B corresponds 10 % in relative unce	ntainty of the	uncertainty (esumate u _{Qi} ; see Ai	mex G C	n me iso Gui	ue)			
		+								
-		+								
Combined un	ncertainty							0.0244	°C	
					_					
	rees of freedom			246.14					°C sun	1.44382E-0

Fig. 12.7.i Uncertainty budget reported by **NIST** at 30 °C dew-point temperature.

Uncerta	inty analysis of dew point temperature	Nominal value:	30	°C		Lab name	NIST	1		
		10.00				Lab name				
	Comparison in humidity (dew-point temperature) CCT-K									
each partic	cipant submits one spreadsheet summary per nominal dew-point me	asured in the	comparison;	; labeled "U_gen t°C	, where	"t" should be	replaced by	the nominal of	dew-point temperature	
0	0	0	de ed	D				Universe	-1-4-	0-11-6-
Quantity (symbol)	Components	Stan	dard tainty	Degrees of free components eva		Sens coeffi		Uncert contrib		Calculation of degree
(Syllibol)		uncer	taility	by a type A me		COEIII	CIEIIL	COILLIE	Julion	of freedo
Qi		U(Qi)	unit	V i	unit	Ci	unit	Ui	unit	0
	lew-point generator	-(u.)				-	-			
	temperature									
	Thermometer:									
	Calibration uncertainty (sensor and indicator unit)	0.0005	°C	50	-	1.000		0.0005	°C	1.25E
	Long-term stability (sensor and indicator)	0.0010	°C	50	-	1.000		0.0010	°C	2E
	Self-heating and residual heat fluxes (sensor)	0.0005	°C	50	-	1.000	-	0.0005	°C	1.25E
	Resolution and accuracy or linearity (indicator unit)	0.0005	°C	50	-	1.000		0.0005	°C	1.25E
	Saturator:									
	Temperature homogeneity	0.0010	°C	50	-	1.000	-	0.0010	°C	2E
	Temperature stability	0.0012	°C	10	-	1.000		0.0012	°C	2.0736E
Saturation					_					
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	31.0000	Pa	50	-	0.000	°C/Pa	0.0050	°C	1.27215E
	Long-term stability (sensor and indicator)	7.0000	Pa	50	-	0.000	°C/Pa	0.0011	°C	3.30737E
	Resolution and accuracy or linearity (indicator unit)	7.0000	Pa	50		0.000	°C/Pa	0.0011	°C	3.30737E
	Pressure differences in the saturator cell	7.0000	Pa	50	-	0.000	°C/Pa	0.0011	°C	3.30737E
	Stability of the pressure	8.0000 0.0000	Pa Pa	10 50	-	0.000	°C/Pa	0.0013	°C	2.82111E
^	Effect of the tubing between the saturator and the pressure gauge	0.0000	Pa	50	-	0.000	-C/Pa	0.0000	-0	
Gas press	ure at the generator outlet: Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	18.0000	Pa	50	_	0.000	°C/Pa	0.0031	°C	1.79517E
	Long-term stability (sensor and indicator)	7.0000	Pa	50	-	0.000	°C/Pa	0.0031	°C	4.10588E
	Resolution and accuracy or linearity (indicator unit)	1.0000	Pa	50	-	0.000	°C/Pa	0.0012	°C	1.71007E
	Stability of the pressure	13.0000	Pa	10	-	0.000	°C/Pa	0.0022	°C	2.44207E
	Effect of the tubing between the saturator and the pressure gauge	0.0000	Pa	50	-	0.000	°C/Pa	0.0000	°C	Z. TIZOTZ
low meas							9,1.2	0.0000		
	Flow meter									
	Stability of the flow	0.0100	L/min	50	-	0.000	°C·min/L	0.0000	°C	
	Reproducibility	0.0100	L/min	50	-	0.000	°C·min/L	0.0000	°C	
Saturation	efficiency									
	Saturation efficiency	0.0020	°C	50	-	1.000		0.0020	°C	3.2E
Correlation	between pressure and temperature measurement (if relevant)									
	Correlation between pressure and temperature measurement if relevant	0.0000		50	-			0.0000	°C	
Incertainty	due to formulae/calculations									
	Saturation vapour pressure formula(e)	0.2714	Pa	50	-	0.004	°C/Pa	0.0011	°C	2.72098E
	Water vapour enhancement formula(e)	0.0002		50	-	17.300		0.0034	°C	2.70425E
Other unce	rtainties									
		0.0000		50	-				°C	
		0.0000		50	-				°C	
		0.0000		50	-				°C	
	uncertainty				-			0.0082	°C	
	egrees of freedom				-					2.06837E
xpanded i	uncertainty				-			0.0160	°C	
			_			-				
		1			_					
		_								
ممانات	I uncertainty in applied condition at point of use	+								
aditiona		3,0000	Pa	50		0.000	°C/Pa	0.0005	°C	4.005405
	Pressure drop between point of realisation and measuring instrument Other	3.0000	Pa	50		0.000	°C/Pa	0.0005	°C	1.38516E
	Uner			50					-0	-
for type P	 method the number of degrees of freedom will be considered as being large	ar than 50	_			-	-			
	freedom of 50 for a component of type B corresponds 10 % in relative unce		uncertaint:	petimate // : coc ^:	nnev C	of the ISO Co.	ide)			
Dogrees of	recoons or 50 for a component of type is corresponds 10 % in relative unce	mainty Of the	uncertainty	Sumate UQi, See A	iiiex G (or trie iou gu	100)			-
		_	_			-	-			
		+				<u> </u>	+			
Combined	uncertainty							0.0082	°C	
	egrees of freedom							0.0002		2.06851E
	uncertainty							0.0165	°C Gain	
,										

Fig. 12.7.j Uncertainty budget reported by **NIST** at 85 °C dew-point temperature.

Uncerta	inty analysis of dew point temperature	Nominal value:	85	°C		Lab name	NIST			
	Comparison in humidity (dew-point temperature) CCT-K	8								
	cipant submits one spreadsheet summary per nominal dew-point me		comparison:	labeled "U_gen_t°C"	. where	"t" should be	replaced by	the nominal	dew-point temperature	
ouon punn		acured in the i	Jonipanoon,	laboloa o_gon t o	,	C Gridaia Bo	ropiacoa by	trio riominar	dow point tomporature	
Quantity	Components	Stand	dard	Degrees of free	dom	Sensi	tivity	Uncert	ainty	Calculatio
(symbol)	Componente	uncer		components eva		coeffi		contrib		of degree
(,			•	by a type A met						of freedor
Qi		u _(Qi)	unit	v i	unit	c _i	unit	ui	unit	
Primary d	lew-point generator									
	1 temperature									
	Thermometer:									
	Calibration uncertainty (sensor and indicator unit)	0.0005	°C	50	-	1.000	-	0.0005	°C	1.25E
	Long-term stability (sensor and indicator)	0.0010	°C	50	-	1.000	-	0.0010	°C	2E
	Self-heating and residual heat fluxes (sensor)	0.0005	°C	50	-	1.000		0.0005	°C	1.25E
	Resolution and accuracy or linearity (indicator unit)	0.0005	℃	50	-	1.000		0.0005	°C	1.25E
	Saturator:									
	Temperature homogeneity	0.0082	°C	50	-	1.000		0.0082	°C	9.04244E
	Temperature stability	0.0025	°C	15	-	1.000	-	0.0025	°C	2.60417E
Saturation		+							-	_
	Pressure gauge:	31.0000	Pa	50	-	0.000	°C/Pa	0.0076	°C	6.67244E
	Calibration uncertainty (sensor and indicator unit)	7.0000	Pa Pa	50	-	0.000	°C/Pa	0.0076	°C	1.73472E
	Long-term stability (sensor and indicator)	7.0000	Pa	50	-	0.000	°C/Pa	0.0017	℃	1.73472E
	Resolution and accuracy or linearity (indicator unit) Pressure differences in the saturator cell	7.0000	Pa	50	-	0.000	°C/Pa	0.0017	℃	1.73472E
	Stability of the pressure	27.0000	Pa	15		0.000	°C/Pa	0.0066	°C	1.27989E
	Effect of the tubing between the saturator and the pressure gauge	0.0000	Pa	50		0.000	°C/Pa	0.0000	°C	1.27303L
Gae nrace	ure at the generator outlet:	0.0000	ıα	30		0.000	Oyra	0.0000		_
Ous press	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	18.0000	Pa	50	-	0.000	°C/Pa	0.0045	°C	8.20125E
	Long-term stability (sensor and indicator)	7.0000	Pa	50	-	0.000	°C/Pa	0.0018	°C	1.87578E
	Resolution and accuracy or linearity (indicator unit)	1.0000	Pa	50	-	0.000	°C/Pa	0.0003	°C	7.8125E
	Stability of the pressure	33.0000	Pa	15	-	0.000	°C/Pa	0.0083	°C	3.08834E
	Effect of the tubing between the saturator and the pressure gauge	0.0000	Pa	50	-	0.000	°C/Pa	0.0000	°C	
low meas										
	Flow meter									
	Stability of the flow	0.0100	L/min	50	-	0.000	°C·min/L	0.0000	°C	
	Reproducibility	0.0100	L/min	50	-	0.000	°C·min/L	0.0000	°C	
Saturation										
	Saturation efficiency	0.0020	°C	50	-	1.000		0.0020	°C	3.2E
Correlation	between pressure and temperature measurement (if relevant)									
	Correlation between pressure and temperature measurement if relevant	0.0000		50	-			0.0000	°C	
Jncertainty	due to formulae/calculations									
	Saturation vapour pressure formula(e)	3.6073	Pa	50	-	0.000	°C/Pa	0.0016	°C	1.2464E
	Water vapour enhancement formula(e)	0.0001		50	-	25.465	-	0.0015	°C	1.09596E
Other unce	rtainties	0.0000		50						_
		0.0000		50	-				°C	_
		0.0000		50	-				°C	_
		0.0000		50	-				°C	_
`ambinad.	uncertainty				-			0.0169	°C	
	egrees of freedom				-			0.0169		m 6.06062E
	uncertainty				-			0.0338	°C su	0.00002L
xpanded t	uncertainty				-			0.0336	<u> </u>	_
		+								
Additiona	al uncertainty in applied condition at point of use	+								
· · · · · · · · · · · · · · · · · · ·	Pressure drop between point of realisation and measuring instrument	3.0000	Pa	50		0.000	°C/Pa	0.0008	°C	6.32813E
	Other	3.0000	ıα	50		0.000	0/1 α	0.0000	°C	0.320132
	- Canada			30						
for type B r	method the number of degrees of freedom will be considered as being larg	er than 50.								
	freedom of 50 for a component of type B corresponds 10 % in relative unc		uncertainty	estimate uni: see Ar	nex G	of the ISO Gui	ide)			
		1								
Combined (uncertainty							0.0169	°C	
	uncertainty egrees of freedom							0.0169		m 6.06069E

Fig. 12.7.k Uncertainty budget reported by NMC, A*STAR at 30 °C dew-point temperature.

Uncerta	inty analysis of dew point temperature	Nominal value:	30	°C		Lab name	NMC, A*S	TAR			
	Comparison in humidity (dew-point temperature) CCT-K	3									
	cipant submits one spreadsheet summary per nominal dew-point mea		comparison;	labeled "U_gen t°C"	, where	"t" should be	replaced by	the nominal dew	-point temp	perature	
Quantity (symbol)	Components	Stand		Degrees of free components eva by a type A met	luated	Sensi coeffi		Uncertai contribut			Calculation of degrees of freedom
Qi		u _(Qi)	unit	v i	unit	ci	unit	ui	unit		or freedom
	lew-point generator										
Saturation	temperature										
	Thermometer:										
	Calibration uncertainty (sensor and indicator unit)	0.005	°C	1000	-	1	∘C	0.005	°C		6.25E-
	Long-term stability (sensor and indicator) Self-heating and residual heat fluxes (sensor)	0.000	∞			1	∘C	0.000	ან		#¡DIV/0! #¡DIV/0!
	Resolution and accuracy or linearity (indicator unit)	0.000	∘C		-	1	°C	0.000	°C		#¡DIV/0!
	Saturator:										
	Temperature homogeneity	0.020	°C	1000	-	1	°C	0.020	°C		1.6E-
	Temperature stability (std of 110 readings)	0.0014	°C	109	<u> </u>	1	°C	0.0014	°C		3.65231E-
Saturation	PRT was used to measure the stauration temperature during the measuren	nent. The star	idard uncert	ainty of the SPRT, i	ncluding	cal un, drift,	selfheating,	resolution, linear	ity, etc, is	5 mK	
Saturation	Pressure gauge:										
	Calibration uncertainty (sensor and indicator unit)	42	Pa	1000	-	-0.0001792	°C/Pa	-0.0075	°C		3.20816E-
	Long-term stability (sensor and indicator)	45	Pa	1000	-	-0.0001792	°C/Pa	-0.0081	°C		4.22775E-
	Resolution and accuracy or linearity (indicator unit)	1	Pa	1000	-	-0.0001792	°C/Pa	-0.0002	°C		1.031E-
	Pressure differences in the saturator cell	10	Pa	1000	-	-0.0001792	°C/Pa	-0.0018	°C		1.031E-
	Stability of the pressure Effect of the tubing between the saturator and the pressure gauge	14.7 10	Pa Pa	109 1000	-	-0.0001792 -0.0001792		-0.0026 -0.0018	°C		4.39973E- 1.031E-
Vote 2 The s	saturation pressure is measured by a precison pressure reference. The reference	rence sensor	is palced at	the same level of th		tor	C/Fa	-0.0018	C		1.031E*
	ure at the generator outlet:	101100 0011001	lo paloda at	The dame level of the	- Catalo						
	Pressure gauge:										
	Calibration uncertainty (sensor and indicator unit)	12	Pa	1000	-	0.0001778	°C/Pa	0.0021	°C		2.07021E-
	Long-term stability (sensor and indicator)	15	Pa	1000	-	0.0001778	°C/Pa	0.0000	°C		0.000055
	Resolution and accuracy or linearity (indicator unit) Stability of the pressure	3.4	Pa Pa	1000 109	-	0.0001778 0.0001778	°C/Pa	0.0002 0.0006	°C		9.98365E- 1.17018E-
	Effect of the tubing between the saturator and the pressure gauge	10	Pa	1000	-	0.0001778	°C/Pa	0.0008	°C		9.98365E-
Note 3: The	pressure at the transfer standard side is measured by a precision pressure	reference. Th	e reference	sensor is palced at				0.0010	Ŭ		0.000002
Flow meas											
	Flow meter										
	Stability of the flow	0.0012	l/min	1000	-	-		0.000	°C		
	Reproducibility	0.0114	I/min	1000				0.000	°C		
Saturation	efficiency			I							
	Saturation efficiency	0.025	°C	1000	-	1	°C	0.025	°C		3.90625E-
	saturation efficiency is taken from Thunder Scientific's estimation which is	0.143 % of sa	turation pre	ssure							
Correlation	between pressure and temperature measurement (if relevant)								00		# DD / (0)
Incertainty	Correlation between pressure and temperature measurement if relevant due to formulae/calculations				-				°C		#¡DIV/0!
oncertainty	Saturation vapour pressure formula(e)	0.002	°C	1000	-	1	°C	0.002	°C		1.6E-
	Water vapour enhancement formula(e)	0.002	°C	1000	-	1	°C	0.002	°C		1.6E-
	water saturation vapor pressure is calculated based on Bob Hardy ITS-90 fume un uncertainty on the water saturation vapor pressure formulation of 0.										
Note 8: The	enhancement factor is calculated based on Greenspan formulation										
Vote 9: The Other unce		ell-Smith's fit i	to the origina	al uncertainty of the	Greensp	an formulatio	n				
					-				°C		#¡DIV/0!
					-				°C		#¡DIV/0!
					-				°C		#¡DIV/0!
Combined :	uncertainty							0.0347	°C		
	uncertainty egrees of freedom				-			2588.3604	- (Sun	5.59247E-
	uncertainty				-			0.0694	°C	k=	0.002 172
Additiona	I uncertainty in applied condition at point of use										
	Pressure drop between point of realisation and measuring instrument	0.001	°C	1000	-	1.000	°C	0.0010	°C		1E-
	bridge calibration (correction, cal uncertainty, long term drift resolution)	0.002	°C	1000	-	1.000	°C	0.0020	°C		1.6E-
lote 10. For	I r type B method the number of degrees of freedom is taken as infiitive, a la	ge number is	inserted for	calculation.							
	uncertainty							0.0348	°C		
	egrees of freedom							2609.8393			5.59264E-
Expanded ι	uncertainty							0.0695	°C	k=	
											4.77000F
	Reproducibility			3				0.003459333			
	Reproducibility generator stability			3 9				0.003459332 0.0053			
	generator stability Transfer artefact stability							0.0053 0.0052			8.7672E-
	generator stability			9				0.0053		Sum	4.77362E- 8.7672E- 6.7079E- 7.0138E-

Fig. 12.7.I Uncertainty budget reported by NMC, A*STAR at 90 °C dew-point temperature.

Uncerta	inty analysis of dewpoint temperature	Nominal value:	90	°C		Lab name	NMC, A*STAR				
CCT Key	Comparison in humidity (dew-point temperature) CCT-K8										
	cipant submits one spreadsheet summary per nominal dew-point measu	red in the co	mparison;	labeled "U_stand	t°C", whe	re "t" should b	e replaced by the	e nominal de	w-point te	emperature	
									Ė		
Oue militur	Commonante	Stan		Degrees of fre		C	sitivity	Uncerta		_	Calculation
Quantity (symbol)	Components		dard tainty	components ev			ficient	contribu			of degrees
(ayınıbon)		uncer	tanny	by a type A m			III CICIIL	COILLIDE	10011		of freedom
Qi		u _(Qi)	unit	νi	unit	Ci	unit	ui	unit		
Calibratio	on system with a standard hygrometer										
Humidity st	andard: Chilled mirror hygrometer	0.40	°C	1000		0.500		0.0500	°C		0.055.0
	Calibration uncertainty	0.10	°C	1000	-	0.500		0.0500	°C		6.25E-0 6.9453E-1
	Long-term stability	0.050	°C	1000	-	0.577	_	0.0289	°C		6.9453E-1 9.0011E-1
	Linearity Resolution	0.0005	°C	1000	-	0.577		0.0017	°C		6.9453E-1
	Effect of non-ideal condensed layer	0.0005	.€	1000	-	0.577		0.0058	°C		1.1112E-1
	Short-term stability (103 readings)	0.0033	ohm	1000	-	2.630	_	0.0086	°C		5.3546E-1
Uncartaint	originated from the climatic chamber	0.0033	OHIII	102	-	2.030		0.0000	C		3.3040E*1
Unicertainty	Chamber uniformity	0.016	°C	1000	-	0.577		0.0092	°C		7.2826E-1
	Pressure effect	0.020	°C	1000		0.577		0.0032	°C		1.778E-1
	Difference between Thunder 2500 and Weiss chamber at 65 °C	0.020	℃	1000	-	0.577		0.0075	∘℃		3.1738E-1
Flow meas		0.013		1000		0.577		0.0073		-	3.1730E-1
1 low illeas	Flow meter										
	Stability of the flow	0.0184	l/min	1000	-	-		0.0000	°C		
	Reproducibility	0.0009	l/min	1000	-	-		0.0000	°C		
Other unce	rtainties										
					-				°C		#¡DIV/0!
					-				°C		#¡DIV/0!
					-				°C		#¡DIV/0!
O1									°C		
	uncertainty egrees of freedom				-		+ +		°C	sum	#¡DIV/0!
Expanded					-				ာင	Suiii	# DIV/0:
Expandou	anoranny										
Additiona	al uncertainty in applied condition at point of use										
	bridge calibration (correction, cal uncertainty, long term drift resolution)	0.002	°C	1000	-	1.000	°C	0.0020	°C		1.6E-1
Note 4 Fee	type B method the number of degrees of freedom is taken as infiitive, a large it		and and for a	alaulation.							
Note I. For	type is method the number of degrees of freedom is taken as militive, a rarge i	lumber is ins	erted for c	alculation.							1
O 1 1								0.0040	°C		
	uncertainty egrees of freedom				-		1	0.0610 1972.0750	°C	sum	7.0274E-0
	uncertainty				-		+	0.1220	°C	k=	7.0274E-0
		1						5220	Ť		
	P			_				0.000045==			0.5000= :
	Reproducibility Transfer artefact stability			102				0.00321558 0.00859747	_		3.5638E-1
	Combined		_	102				0.00859747			5.3565E-1
	Effective degrees of freedom							2036.50281		Sum	7.1166E-0
	Enouge augreeous neodom							2000.00201		k=2	7TOOL-0

Fig. 12.7.m Uncertainty budget reported by NMIJ at 30 °C dew-point temperature.

Uncerta	inty analysis of dew point temperature	Nominal value:	30	°C		Lab name	NMIJ			
	Comparison in humidity (dew-point temperature) CCT-K									
each partio	cipant submits one spreadsheet summary per nominal dew-point me	asured in the	comparison	; labeled "U_gen t°C	*, where	"t" should be	replaced by	the nominal	dew-point temperature	9
Quantity (symbol)	Components	Stand		Degrees of free components eva		Sensit coeffic		Uncert contrib		Calculation of degree
(Symbol)		uncer	tainty	by a type A met		coemic	cient	CONTIN	oution	of freedor
Qi		u _(Qi)	unit	v _i	unit	C _i	unit	ui	unit	
	lew-point generator									
Saturation	n temperature Thermometer:									
	Calibration, Freezing Point of Indium	0.0030	°C			0.852		0.0026	°C	
	Calibration, Triple point of H2O	0.0030	°C			0.852		0.0026	°C	
	Interpolation	0.0010	°C			0.852		0.0009	°C	
	ice point check	0.0055	°C			0.852		0.0047	°C	
	Long-term stability (sensor and indicator) Self-heating and residual heat fluxes (sensor)	0.0005 0.0005	ohm			2.131	°C/ohm	0.0011	°C	
	Resistance bridge:	0.0003	OHH			2.131	C/OIIII	0.0011		-
	accuracy	0.0005	°C			0.852		0.0004	°C	
	resolution	0.0000	ohm			2.131	°C/ohm	0.0001	°C	
	linearity Standard resistance:	0.0001	ohm			2.131	°C/ohm	0.0002	°C	-
	Standard resistance: calibration	0.0001	ohm			2.131	°C/ohm	0.0003	°C	<u> </u>
	temp dep	0.0001	ohm			2.131	°C/ohm	0.0038	°C	
	drift	0.0010	ohm			2.131	°C/ohm	0.0021	°C	
	Saturator:									
	Temperature homogeneity	0.0010 0.0020	°C	99 99		0.852 0.852		0.0009 0.0017	°C	5.32946E 8.52714E
Saturation	Temperature stability	0.0020	·C	99		0.652		0.0017	C	0.52/14
	Pressure gauge:									L
	Calibration uncertainty (sensor and indicator unit)	15.5800	Pa			5.590E-05	°C/Pa	0.0009	°C	
	interpolation (calibration curve)	2.8700	Pa			5.590E-05	°C/Pa	0.0002	°C	
	Long-term stability (sensor and indicator)	13.8564	Pa			5.590E-05	°C/Pa	0.0008	°C	
	Resolution and accuracy or linearity (indicator unit) temperature dependence	2.8868 17.1473	Pa Pa			5.590E-05 5.590E-05	°C/Pa	0.0002 0.0010	°C	
	lean of the pressure gauge	26.9430	Pa			5.590E-05	°C/Pa	0.0015	°C	
	repeatability	2.8000	Pa			5.590E-05	°C/Pa	0.0002	°C	
	reproducibility	117.7706	Pa			5.590E-05	°C/Pa	0.0066	°C	
	Pressure differences in the saturator cell	0.0000	D-	20		F F00F 0F	00/D-	0.0000	20	0.000045
	Stability of the pressure Effect of the tubing between the saturator and the pressure gauge	2.8000 3.3948	Pa Pa	29		5.590E-05 5.590E-05	°C/Pa	0.0002	°C	2.06994
Gas pressi	ure at the generator outlet:	3.3340	га			3.390E-03	Gra	0.0002		
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	5.0000	Pa			1.720E-04	°C/Pa	0.0009	°C	
	interpolation (calibration curve)	0.0000 13.8564	Pa Pa			1.720E-04 1.720E-04	°C/Pa	0.0000 0.0024	°C	-
	Long-term stability (sensor and indicator) Resolution and accuracy or linearity (indicator unit)	0.2887	Pa Pa			1.720E-04 1.720E-04	°C/Pa	0.0024	°C	-
	temperature dependence	3.1835	Pa			1.720E-04	°C/Pa	0.0005	°C	
	lean of the pressure gauge	5.0037	Pa			1.720E-04	°C/Pa	0.0009	°C	
	repeatability	1.1000	Pa			1.720E-04	°C/Pa	0.0002	°C	
	reproducibility	18.2739 1.1000	Pa Pa	29		1.720E-04 1.720E-04	°C/Pa	0.0031	°C	4 44 44 75
	Stability of the pressure Effect of the tubing between the generator and the hygrometer	1.1000	Ра	29		1.720E-04	-C/Pa	0.0002	-0	4.41417E
	altitude	3.3948	Pa			1.720E-04	°C/Pa	0.0006	°C	
	pressure drop (sample line)	24.1385	Pa			1.720E-04	°C/Pa	0.0042	°C	
	pressure drop (td port)	16.0000	Pa			1.720E-04	°C/Pa	0.0028	°C	
low meas	urement:									
	Stability of the flow				-				°C	
	Reproducibility				-				°C	
aturation	efficiency									
	Saturation efficiency	0.0092	°C			1.000		0.0092	℃	
orrelation	Correlation between pressure and temperature measurement (if relevant)								°C	
Incertainty	Correlation between pressure and temperature measurement if relevant due to formulae/calculations								U	
oo.amily	Saturation vapour pressure formula(t1)	5.00E-05				17.419	°C	0.0009	°C	
	Saturation vapour pressure formula(td)	5.00E-05				17.419	°C	0.0009	°C	
	Water vapour enhancement formula(p1t1)	4.70E-04				17.419	°C	0.0082	°C	
MI	Water vapour enhancement formula(p2td)	1.37E-04				17.419	℃	0.0024	°C	
ther unce	Italilues				-				°C	
					-				°C	
					-				.€	
	uncertainty				-			0.0176	℃	0.0005==
	egrees of freedom uncertainty				-			1069601 0.0353	°C sun	9.06657E
ueu t								0.0000		
		1	1					-		
	<u> </u>	+			-				 	-
Additions	I uncertainty in applied condition at point of use									
uiliOIId	Pressure drop between point of realisation and measuring instrument								°C	
	Other								°C	
	method the number of degrees of freedom will be considered as being large									
Degrees of t	freedom of 50 for a component of type B corresponds 10 % in relative unco	ertainty of the	uncertainty	estimate u _{Qi} ; see A	nnex G	of the ISO Gui	de)			
		1	1							
ombined i	uncertainty								°C	
	egrees of freedom								°C sum	9.066578

Fig. 12.7.n Uncertainty budget reported by NMIJ at 95 °C dew-point temperature.

Uncerta	inty analysis of dew point temperature	Nominal value:	95	°C		Lab name	NMIJ			
CT Key	Comparison in humidity (dew-point temperature) CCT-K									
each parti	cipant submits one spreadsheet summary per nominal dew-point me	asured in the	comparison	; labeled "U_gen t°C	*, where	"t" should be	replaced by	the nominal	dew-point temperature	
Quantity (symbol)	Components	Stand		Degrees of free components eva		Sensit coeffic		Uncert contrib		Calculation of degree
(Symbol)		uncer	tainty	by a type A met		coemic	cient	Contrib	oution	of freedor
Qi		u _(Qi)	unit	νi	unit	C _i	unit	ui	unit	
	lew-point generator									
Saturation	n temperature Thermometer:									
	Calibration, Freezing Point of Indium	0.0030	°C			0.988		0.0030	°C	
	Calibration, Triple point of H2O	0.0030	°C			0.988		0.0030	°C	
	Interpolation	0.0010	°C			0.988		0.0010	°C	
	ice point check	0.0055	°C			0.988	****	0.0054	°C	
	Long-term stability (sensor and indicator) Self-heating and residual heat fluxes (sensor)	0.0005 0.0005	ohm ohm			2.469 2.469	°C/ohm	0.0012 0.0012	°C	
	Resistance bridge:	0.0000	Criiii			2.100	O/O/IIII	0.0012	- u	
	accuracy	0.0005	°C			0.988		0.0005	°C	
	resolution	0.0000	ohm			2.469	°C/ohm	0.0001	°C	
	Standard resistance:	0.0001	ohm			2.469	°C/ohm	0.0002	°C	-
	calibration	0.0001	ohm			2.469	°C/ohm	0.0003	°C	H
	temp dep	0.0018	ohm			2.469	°C/ohm	0.0044	°C	
	drift	0.0010	ohm			2.469	°C/ohm	0.0025	°C	
	Saturator:	0.0000		60		0.000		0.0100	**	4.507000
	Temperature homogeneity Temperature stability	0.0200	℃	99 99		0.988		0.0198	°C	1.53796E 6.00766E
Saturation	n pressure	0.0000		33		0.300		0.0043		0.007001
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	10.0000	Pa			2.492E-04	°C/Pa	0.0025	°C	
	interpolation (calibration curve)	2.8700	Pa			2.492E-04	°C/Pa	0.0007	°C	-
	Long-term stability (sensor and indicator) Resolution and accuracy or linearity (indicator unit)	13.8564 2.8868	Pa Pa			2.492E-04 2.492E-04	°C/Pa	0.0035 0.0007	°C	-
	temperature dependence	17.1473	Pa			2.492E-04	°C/Pa	0.0007	°C	
	lean of the pressure gauge	26.9430	Pa			2.492E-04	°C/Pa	0.0067	°C	
	repeatability	2.8000	Pa			2.492E-04	°C/Pa	0.0007	°C	
	reproducibility	74.4535	Pa			2.492E-04	°C/Pa	0.0186	°C	
	Pressure differences in the saturator cell Stability of the pressure	2.8000	Pa	29		2.492E-04	°C/Pa	0.0007	°C	8.180218
	Effect of the tubing between the saturator and the pressure gauge	3.3948	Pa	29		2.492E-04	°C/Pa	0.0007	°C	0.100211
Gas press	ure at the generator outlet:									
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	5.0000 0.0000	Pa Pa			2.682E-04 2.682E-04	°C/Pa	0.0013	°C	
	interpolation (calibration curve) Long-term stability (sensor and indicator)	13.8564	Pa Pa			2.682E-04 2.682E-04	°C/Pa	0.0000	°C	
	Resolution and accuracy or linearity (indicator unit)	0.2887	Pa			2.682E-04	°C/Pa	0.0001	°C	
	temperature dependence	3.1835	Pa			2.682E-04	°C/Pa	0.0009	°C	
	lean of the pressure gauge	5.0037	Pa			2.682E-04	°C/Pa	0.0013	°C	
	repeatability	1.1000	Pa			2.682E-04	°C/Pa	0.0003	°C	
	reproducibility Stability of the pressure	18.2739 1.1000	Pa Pa	29		2.682E-04 2.682E-04	°C/Pa	0.0049	°C	2.61199E
	Effect of the tubing between the generator and the hygrometer	1.1000		20		L.OOLL OI	- O/1 G	0.0000		2.011002
	altitude	3.3948	Pa			2.682E-04	°C/Pa	0.0009	°C	
	pressure drop (sample line)	24.1385	Pa			2.682E-04	°C/Pa	0.0065	°C	
	pressure drop (td port)	16.0000	Pa			2.682E-04	°C/Pa	0.0043	°C	
low meas	Flow meter									
	Stability of the flow				-				°C	
	Reproducibility				-				°C	
aturation		0.0000				4.555		0.5555		
	Saturation efficiency	0.0092	°C			1.000		0.0092	℃	
orrelation	between pressure and temperature measurement (if relevant) Correlation between pressure and temperature measurement if relevant								°C	
Incertainty	due to formulae/calculations									
	Saturation vapour pressure formula(t1)	5.00E-05				27.168	°C	0.0014	°C	
	Saturation vapour pressure formula(td)	5.00E-05				27.168	°C	0.0014	°C	
	Water vapour enhancement formula(p1t1) Water vapour enhancement formula(p2td)	0.00E+00 0.00E+00				27.168 27.168	℃	0.0000	°C	1
Other unce		U.UUE+UU				21.100		0.0000		
									°C	
					-				°C	
					-				℃	$\overline{}$
Combined	uncertainty				-			0.0334	°C	-
	egrees of freedom							803		1.54398E
	uncertainty							0.0667	°C	2 .300L
		-			_				 	-
Additiona	al uncertainty in applied condition at point of use									
	Pressure drop between point of realisation and measuring instrument								°C	
	Other								°C	
for tour - P	and the supplier of decrees of free decrees 200 for a constitution of the constitution		_							_
	method the number of degrees of freedom will be considered as being larg- freedom of 50 for a component of type B corresponds 10 % in relative unco		uncertaint	petimate // : coc ^:	nney C	of the ISO Co	de)			
Jegiees of	ineccom of ou for a component of type is corresponds 10 % in relative unco	Trainity Of the	uncertainty	Sumate u _{Qi} ; see A	IIIEX G (n trie ISO GUI	ue)		 	-
ombined	uncertainty egrees of freedom								°C sun	1.54398

Fig. 12.7.o Uncertainty budget reported by **NPL** at 30 °C dew-point temperature.

Uncerta	inty analysis of dew point temperature	Nominal value:	30	°C		Lab name	NPL			
		1				Lab name				
	Comparison in humidity (dew-point temperature) CCT-K			1-1-1-1-1111		BOT - 1 1 - 1 - 1		the second of		
each parti	cipant submits one spreadsheet summary per nominal dew-point me	asured in the	comparison;	labeled "U_gen t°C"	, where	"t" should be	replaced by	the nominal	dew-point temperature	
Quantity	Components	Stan	dard	Degrees of free	dom	Sens	itivity	Uncert	ainty	Calculation
(symbol)		uncer	tainty	components eva		coeffi	cient	contrib	oution	of degrees
_		-	T*	by a type A met						of freedom
Q _i	low naint concretes	U(Qi)	unit	V i	unit	Ci	unit	ui	unit	
	dew-point generator n temperature	_								
Oaturation	Thermometer:									
	Calibration uncertainty (sensor and indicator unit)			Infinite	-			0.0025	°C	
	Long-term stability (sensor and indicator)			Infinite	-			0.0030	°C	
	Self-heating and residual heat fluxes (sensor)			Infinite	-			0.0030	°C	-
	Resolution and accuracy or linearity (indicator unit)			Infinite	-	-		0.0016	°C	
	Saturator: Temperature homogeneity			Infinite	-			0.0050	°C	
	Temperature stability			9.00E+00	-			0.0050	°C	6.94E-11
Saturation										
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)				-				°C	
	Long-term stability (sensor and indicator) Resolution and accuracy or linearity (indicator unit)				_		-		°C	
	Pressure differences in the saturator cell			Infinite	-			0.0018	°C	
	Stability of the pressure			minite	-			0.0018	°C	
	Effect of the tubing between the saturator and the pressure gauge				-				°C	
Gas press	ure at the generator outlet:									
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)				-				°C	
	Long-term stability (sensor and indicator)				-				°€	
	Resolution and accuracy or linearity (indicator unit) Stability of the pressure				-				°C	
	Effect of the tubing between the saturator and the pressure gauge				-				°C	
Flow meas										
	Flow meter									
	Stability of the flow				-				°C	
Saturation	Reproducibility				-				°C	
Saturation	Saturation efficiency			Infinite	-			0.0030	°C	
	Draw off rate			Infinite	-			0.0030	°C	
Correlation	between pressure and temperature measurement (if relevant)									
	Correlation between pressure and temperature measurement if relevant				-				°C	
Uncertainty	due to formulae/calculations									
	Saturation vapour pressure formula(e)				-				°C	
Other unce	Water vapour enhancement formula(e)				-				°C	
Other unce	Contamination			Infinite	-			0.0010	°C	
	Desorption and leaks			Infinite	-			0.0000	°C	
	Temperature conditioning of gas			Infinite	-			0.0000	°C	(
	uncertainty				-			0.0100	°C	
	egrees of freedom				-			0.0199	°C sun	6.94444E-1
Expanded (uncertainty				-			0.0199	-0	
		+								
			-				-			
Additiona	al uncertainty in applied condition at point of use									
	Pressure drop between point of realisation and measuring instrument Other			Infinite				0.0029	°C	-
	Other								C	
for type B	! method the number of degrees of freedom will be considered as being larg	er than 50.	1			1	1			
	freedom of 50 for a component of type B corresponds 10 % in relative unc		uncertainty	estimate u _{Qi} ; see Ar	nnex G	of the ISO Gu	ide)			
-										
Combine 1	uncertainty							0.0104	°C	
	uncertainty egrees of freedom							166.0490		6.94444E-1
Expanded (0.0207	°C sun	0.0 -144 E-1
Panasu i								0.0207		

Fig. 12.7.p Uncertainty budget reported by **NPL** at 95 °C dew-point temperature.

Ilncarta	inty analysis of dew point temperature	Nominal value:	95	°C		Lab name	NPL			
	<u> </u>	1				Lab name				
	Comparison in humidity (dew-point temperature) CCT-K									
each parti	cipant submits one spreadsheet summary per nominal dew-point mea	sured in the	comparison;	labeled "U_gen t°C"	, where	"t" should be	replaced by	the nominal of	lew-point temperature	
Quantity	Components	Stand		Degrees of free		Sensi		Uncert		Calculation
(symbol)		uncer	tainty	components eva		coeffi	cient	contrib	ution	of degree
				by a type A met						of freedor
Q _i		U(Qi)	unit	V i	unit	Ci	unit	ui	unit	
	lew-point generator									
Saturation	n temperature	-								
		_		Infinite				0.0025	°C	_
	Calibration uncertainty (sensor and indicator unit) Long-term stability (sensor and indicator)			Infinite				0.0025	°C	
	Self-heating and residual heat fluxes (sensor)			Infinite	-			0.0030	°C	
	Resolution and accuracy or linearity (indicator unit)			Infinite	-			0.0030	°C	
	Saturator:			minite				0.0010		
	Temperature homogeneity			Infinite	-			0.0150	°C	
	Temperature stability			9.00E+00	-			0.0050	°C	6.94E
Saturation										5.512
	Pressure gauge:			Ì						
	Calibration uncertainty (sensor and indicator unit)				-				°C	
	Long-term stability (sensor and indicator)				-				°C	
	Resolution and accuracy or linearity (indicator unit)				-				°C	
	Pressure differences in the saturator cell			Infinite	-			0.0030	°C	
	Stability of the pressure				-				°C	
	Effect of the tubing between the saturator and the pressure gauge				-				°C	
Gas press	ure at the generator outlet:									
	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)				-				°C	
	Long-term stability (sensor and indicator)				-				°C	
	Resolution and accuracy or linearity (indicator unit)				-		-		°C	
	Stability of the pressure				-				°C	
low meas	Effect of the tubing between the saturator and the pressure gauge				-				-0	
riow illeas	Flow meter	1								
	Stability of the flow				-				°C	
	Reproducibility				-				°C	
Saturation										
	Saturation efficiency			Infinite	-			0.0500	°C	
	Draw off rate			Infinite	-			0.0030	°C	
Correlation	between pressure and temperature measurement (if relevant)									
	Correlation between pressure and temperature measurement if relevant				-				°C	
Jncertainty	due to formulae/calculations									
	Saturation vapour pressure formula(e)				-				°C	
	Water vapour enhancement formula(e)				-				°C	
Other unce	rtainties									
	Contamination			Infinite	-			0.0010	°C	
	Desorption and leaks			Infinite	-			0.0000	°C	
	Temperature conditioning of gas			Infinite	-			0.0000	°C	
	uncertainty				-			0.0529	°C	
	egrees of freedom				-					6.94444E
xpanded	uncertainty				-			0.1058	°C	
		-								
			-				-			_
Additions	al uncertainty in applied condition at point of use									
-GUIUOII	Pressure drop between point of realisation and measuring instrument			Infinite				0.0029	°C	_
	Other			mimite				0.0029	°C	-
	Othor									
for type B	I method the number of degrees of freedom will be considered as being large	r than 50								
	freedom of 50 for a component of type B corresponds 10 % in relative unce		uncertainty	estimate u~ see A	nnex G	of the ISO Gui	ide)			
				I I I I I I I I I I I I I I I I I I I			, 			
Combined	uncertainty							0.0530	°C	
Effective de	egrees of freedom							113230.3656	°C sun	6.94444E
								0.1059	°C	

Fig. 12.7.q Uncertainty budget reported by **PTB** at 30 °C dew-point temperature.

Uncerta	ninty analysis of dew point temperature	Nominal value:	30	°C		Lab name	РТВ				
EUROME	T Key Comparison in humidity (dew-point temperature)	P717 / EUR	AMET.T-	K8							
	cipant submits one spreadsheet summary per nominal dew-point me				" whore	"t" chould bo	roploced by	the neminal	low point tor	mooratura	
- each parti	cipant submits one spreadsneet summary per nominal dew-point me	asureu in the t	companson,	labeled U_gen (C	, where	t snould be	repraced by	the nominal t	zew-point ter	nperature	
					-						
Quantity	Components	Stand	dard	Degrees of fre	edom	Sens	itivity	Uncert	ainty		Calculation
(symbol)		uncer	tainty	components ev		coeffi	coefficient		ution	of de	of degrees
				by a type A me	thod *						of freedom
Qi		u _(Qi)	unit	V i	unit	Ci	unit	ui	unit		
Primary of	dew-point generator										
	n temperature										
	Thermometer:										
	Calibration uncertainty (sensor and indicator unit)	0.0008	°C	50	-	1.000	K/K	0.0008	°C		9.3845E-15
	Long-term stability (sensor and indicator)	0.0073	°C	50	-	1.000	K/K	0.0073	°C		5.62648E-11
	Self-heating and residual heat fluxes (sensor)	0.0025	°C	50	-	1.000	K/K	0.0025	∘C		7.59734E-13
	Resolution and accuracy or linearity (indicator unit)	0.0003	°C	50	-	1.000	K/K	0.0003	°C		1.38889E-16
	Saturator:										
	Temperature homogeneity	0.0041	°C	50	-	1.000	K/K	0.0041	°C		5.64704E-12
	Temperature stability	0.0000	°C	109	+ -	1.000	K/K	0.0000	°C		1.76208E-20
Caturation	n pressure	0.0000		103		1.000	TOIC	0.0000			1.70200L-20
Saturation	Pressure gauge:	+									
	Calibration uncertainty (sensor and indicator unit)	0.3795	hPa	50	-	-0.002	K/hPa	-0.0007	°C		4.73022E-15
	Long-term stability (sensor and indicator)	1.8764	hPa	50	+ -	-0.002	K/hPa	-0.0007	.€		2.82838E-12
	Resolution and accuracy or linearity (indicator unit)	0.0289	hPa	50	-	-0.002	K/hPa	-0.0034	.€		1.58447E-19
	Pressure differences in the saturator cell	0.0269	nea	50	-	-0.002	N/IIPa	-0.0001	.€		1.30447E-18
							-				
	Stability of the pressure	0.0415	hPa	109	-	-0.002	K/hPa	-0.0001	°C		3.09672E-19
_	Effect of the tubing between the saturator and the pressure gauge	0.1010	hPa	50	-	-0.002	K/hPa	-0.0002	°C		2.3777E-17
Gas press	sure at the generator outlet:										
	Pressure gauge:										
	Calibration uncertainty (sensor and indicator unit)	0.0423	hPa	50		0.017	K/hPa	0.0007	°C		5.45562E-15
	Long-term stability (sensor and indicator)	0.1155	hPa	50	-	0.017	K/hPa	0.0020	°C		3.02335E-13
	Resolution and accuracy or linearity (indicator unit)	0.0029	hPa	50	-	0.017	K/hPa	0.0000	°C		1.181E-19
	Stability of the pressure	0.0021	hPa	109	-	0.017	K/hPa	0.0000	°C		1.55774E-20
	Effect of the tubing between the saturator and the pressure gauge	0.0196	hPa	50	-	0.017	K/hPa	0.0003	°C		2.52513E-16
Flow meas											
	Flow meter										
	Stability of the flow	0.0000	I/min	109	-	-0.010	K/(l/min)	0.0000	°C		3.85544E-28
	Reproducibility	0.0058	l/min	50	-	-0.010	K/(l/min)	-0.0001	℃		2.57908E-19
Saturation											
	Saturation efficiency	0.0010	K	50	-	1.000	K	0.0010	°C		2E-14
Correlation	between pressure and temperature measurement (if relevant)										
	Correlation between pressure and temperature measurement if relevant	-	-		-	-	-	-	°C		
Uncertainty	due to formulae/calculations										
	Saturation vapour pressure formula(e)	0.0030	hPa	50	-	0.072	K/hPa	0.0002	°C		4.28177E-17
	Water vapour enhancement formula(e)	0.0006	-	50	-	0.072	K/hPa	0.0000	°C		5.54058E-20
Other unce											
	Pressure drop between point of realisation and measuring instrument	0.0006	K	50		1.000	K/K	0.0006	°C		2.58686E-15
					-				°C		
					-				°C		
Combined	uncertainty				-			0.010	°C		
	egrees of freedom			137	-			0.0.0	.€	sum	6.58449E-11
	uncertainty				+ -			0.020	°C	Jani	2.001.02-11
LAPAHUEU	uncertainty							0.020			

Fig. 12.7.r Uncertainty budget reported by **PTB** at 80 °C dew-point temperature.

Uncerta	inty analysis of dew point temperature	Nominal value:	80	°C		Lab name	РТВ			
EUROME	T Key Comparison in humidity (dew-point temperature)	P717 / EUR	AMET.T-	K8						
	cipant submits one spreadsheet summary per nominal dew-point me				" where	"t" chould be	replaced by	the nominal o	lew-point tempe	atura
- each pain	cipant submits one spreadsneet summary per nominal dew-point me	asuleu III IIIe I	Companson	, labeled O_gent C	, where	t Should be	replaced by	the nominal t	Jew-point temper	ature
		-								
0	0	01	da a d	D	- dam	0	at the	Uncert		Calculation
Quantity (symbol)	Components	Stand		components eva			Sensitivity coefficient		ution	of degrees
(Syllibol)		uncer	tannty	by a type A me		Coein	Clent	COMMIN	ution	of freedom
Q;		u _(Qi)	unit	ν _i	unit	Ci	unit	ui	unit	00000
	l lew-point generator	G(QI)	u	V1	unit	9	unit	- 4	uniii	
	n temperature	+								
Saturation	Thermometer:									
	Calibration uncertainty (sensor and indicator unit)	0.0008	°C	50	-	1.000	K/K	0.0008	°C	9.3845E-15
	Long-term stability (sensor and indicator)	0.0008	∞	50	-	1.000	K/K	0.0008	°C	5.62648E-11
	Self-heating and residual heat fluxes (sensor)	0.0073	°C	50		1.000	K/K	0.0073	°C	7.59734E-13
	Resolution and accuracy or linearity (indicator unit)	0.0023	∞	50	-	1.000	K/K	0.0023	°C	1.38889E-16
	Saturator:	0.0003		30		1.000	TOIC	0.0003	<u> </u>	1.50003E-10
	Temperature homogeneity	0.0083	°C	50	-	1.000	K/K	0.0083	°C	9.29248E-11
	Temperature stability	0.0003	∘℃	109		1.000	K/K	0.0003	°C	1.15587E-18
Saturation	n pressure	0.0001		103		1.000	TOIL	0.0001		1.1330712-10
Saturation	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	0.3795	hPa	50	-	-0.015	K/hPa	-0.0056	°C	2.03579E-11
	Long-term stability (sensor and indicator)	1.8764	hPa	50	-	-0.015	K/hPa	-0.0279	°C	1.21728E-08
	Resolution and accuracy or linearity (indicator unit)	0.0289	hPa	50		-0.015	K/hPa	-0.0004	°C	6.81925E-16
	Pressure differences in the saturator cell	0.0203	III a	30	+ -	-0.013	TOTH &	-0.0004	°C	0.01323E-10
	Stability of the pressure	0.0199	hPa	109		-0.015	K/hPa	-0.0003	°C	7.04669E-17
	Effect of the tubing between the saturator and the pressure gauge	0.1010	hPa	50		-0.015	K/hPa	-0.0003	°C	1.02331E-13
Gas nress	ure at the generator outlet:	0.1010	III a	30		-0.013	TOTH &	-0.0013	- U	1.023312-10
Ous press	Pressure gauge:									
	Calibration uncertainty (sensor and indicator unit)	0.0423	hPa	50	-	0.024	K/hPa	0.0010	°C	2.07157E-14
	Long-term stability (sensor and indicator)	0.1155	hPa	50	-	0.024	K/hPa	0.0028	°C	1.14801E-12
	Resolution and accuracy or linearity (indicator unit)	0.0029	hPa	50	-	0.024	K/hPa	0.0001	°C	4.48441E-19
	Stability of the pressure	0.0062	hPa	109	-	0.024	K/hPa	0.0001	°C	4.36473E-18
	Effect of the tubing between the saturator and the pressure gauge	0.0196	hPa	50	-	0.024	K/hPa	0.0005	°C	9.58828E-16
Flow meas						0.02.				
	Flow meter									
	Stability of the flow	0.0005	l/min	109	-	-0.009	K/(I/min)	0.0000	°C	4.39316E-24
	Reproducibility	0.0058	l/min	50	-	-0.009	K/(l/min)	-0.0001	°C	1.73651E-19
Saturation										
	Saturation efficiency	0.0010	K	50	-	1.000	K	0.0010	°C	2E-14
Correlation	between pressure and temperature measurement (if relevant)									
	Correlation between pressure and temperature measurement if relevant				-				°C	
Uncertaint	due to formulae/calculations			Ì						
	Saturation vapour pressure formula(e)	0.0335	hPa	50	-	0.100	K/hPa	0.0034	°C	2.54944E-12
	Water vapour enhancement formula(e)	0.0001	-	50	-	0.100	K/hPa	0.0000	°C	1.46026E-22
Other unce										,
	Pressure drop between point of realisation and measuring instrument	0.0030	K	50		1.000	K/K	0.0030	°C	1.68775E-12
					-				°C	/
					-				°C	
Combined	uncertainty				-			0.0312	°C	
	egrees of freedom			77	-				°C	sum 1.23486E-08
	uncertainty				-			0.0624	°C	

12.8 IEC 60751 RELATIONSHIP

Based on the international standard IEC 60751:2008 [IEC08], a nominal resistance-temperature characteristic of the PRT in the travelling standard can be defined as follows:

$$R_t = R_0(1 + At + Bt^2)^2$$
 Eq. 12.8.a

where:

 $t = \text{Temperature (ITS-90) in }^{\circ}\text{C}$

 $R_{\rm t}$ = Resistance of the PRT at temperature t in Ω

 R_0 = Nominal resistance of 100 Ω at 0 °C

 $A = 3.9083 \cdot 10^{-3} \, ^{\circ}\text{C}^{-1}$

 $B = -5.775 \cdot 10^{-7} \, ^{\circ}\text{C}^{-2}$

Solving the quadratic equation, the temperature can be calculated with:

$$t = -\frac{A}{2B} - \sqrt{\frac{A^2}{4B^2} - \frac{R_0 - R_T}{BR_0}}$$
 Eq. 12.8.b

12.9 TECHNICAL PROTOCOL

CCT-K8 Comparison of realizations of local scales of dew-point temperature of humid gas

Dew-point Temperature: 30 °C to 95 °C

Technical protocol (Approved CCT WG.KC)

Contents

1		INTRODUCTION	4
2		ORGANIZATION	4
	2.1	PARTICIPANTS	5
	2.2	COMPARISON SCHEME	6
	2.3	COMPARISON SCHEDULE	7
3		COMPARISON METHOD	9
	3.1	TRAVELLING STANDARDS	9
	3.2	REPORTING	9
	3.3	IMPARTIALITY	10
4		PERFORMANCE OF THE TRAVELLING STANDARDS	11
	4.1	CHARACTERIZATION AND CHOICE OF TRANSFER STANDARDS	11
	4.2	PROBLEMS WITH THE TRANSFER STANDARDS	12
	4.3	STABILITY STUDY	13
5		LOCAL DEW POINT TEMPERATURE SCALES	17
	5.1	BEV/E+E	17
	5.2	INRiM	17
	5.3	INTA	18
	5.4	KRISS	19
	5.5	NIST	19
	5.6	NMC, A*STAR	20
	5.7	NMIJ	20
	5.8	NPL	21
	5.9	PTB	21

ь		WEASUREMENT RESULTS	
	6.1	ANALYSIS OF RESULTS	22
7		BILATERAL EQUIVALENCE	<u>'</u> 4
	7.1	ANALYSIS METHOD	24
	7.2	RESULTS	26
8		KEY COMPARISON REFERENCE VALUE	1
	8.1	CALCULATION METHOD	31
	8.2	CONSISTENCY TEST AND DISCUSSION	32
	8.3	RESULTS	33
9		CONCLUSIONS	13
10		ACKNOWLEDGEMENTS4	15
11		REFERENCES	ا6
12		ANNEXES	18
	12.1	ANALYSIS METHOD	18
	12.2	ANALYSIS METHOD OF KCRV	52
	12.3	SUMMARY TABLE OF ALL PARTICIPANTS	54
	12.4	ABBREVIATIONS	58
	12.5	DETAILS OF PARTICIPATING INSTITUTES	59
	12.6	RESULTS REPORTED BY ALL PARTICIPANTS	51
	12.7	UNCERTAINTY BUDGET REPORTED BY ALL PARTICIPANTS 10)6
		IEC 60751 RELATIONSHIP	
	12.9	TECHNICAL PROTOCOL	25
1.	IN	ITRODUCTION	
1.1	ed ke	nder the Mutual Recognition Arrangement (MRA) ¹ the metrological quivalence of national measurement standards will be determined by a set by comparisons chosen and organized by the Consultative Committees of e CIPM working closely with the Regional Metrology Organizations (RMOs	
1.2	C _e	t the 24 th Meeting of the CCT in May 2008, it was agreed to organise a CC omparison in dew-point temperature (high range) as a follow-up of the kisting CCT-K6 dew-point temperature comparison, as proposed by CCT-YG6 (Now WG-Hu).	Γ
1.3	ke	ne completed registration form for the proposed CCT-Kx high range dew-points comparison was submitted on 26/09/2008 and registered in the KCD atabase on 29/09/2008	

¹ MRA, Mutual Recognition Arrangement, BIPM, 1999.

- 1.4 This technical protocol has been drawn up by the Coordinator in consultation with the nominated participants listed in Section 2. It is based on the protocol developed by CCT/WG6 and designed to encourage coherence between CCT-K8 and the corresponding RMO-K8s.
- 1.5 The procedure outlined in this document cover the technical operations to be followed during measurement of the travelling standards. The procedure, which follows the guidelines established by the BIPM^{2,3} is based on current best practice in the use of dew/frost-point hygrometers and takes account of the experience gained from the CCT-K6, EURAMET.T-K6, EURAMET.T-K8 and APMP.T-K8.
- 1.6 This comparison is aimed at establishing the degree of equivalence between realisations of local scales of dew-point temperature of humid gas, in the range from 30 °C to 95 °C, among the participating national metrology institutes (NMI)⁴.

² T.J. Quinn, "Guidelines for key comparisons carried out by Consultative Committees", Appendix F to the MRA, BIPM, Paris.

³ CIPM MRA-D-05. "Measurement comparisons in the CIPM MRA"

⁴ The term national metrology institute and acronym (NMI) also encompasses the designated institutes (DI) throughout the document.

2. ORGANIZATION

2.1 Participants

- 2.1.1 A list of participants is given in table 1. Details of mailing and electronic addresses are given in **Appendix A**.
- 2.1.2 The participants are divided into two groups. Each group will form a comparison loop. To link the loops to each other, the loops have besides the two Pilots one common participant who measures also both travelling standards.
- 2.1.3 INTA is the Coordinator of the comparison and the Pilot for both loops, taking main responsibility for running the comparison. NIST is Assistant Pilot. The third, common participant is BEV/E+E who also covers the full range of the comparison, complementing the capability of NIST.
- 2.1.4 By their declared intention to participate in this key comparison, the laboratories accept the general instructions and the technical protocol written down in this document and commit themselves to follow strictly the procedures of this protocol as well as the version of the "Guidelines for Key Comparisons" in effect at the time of the initiation of the Key Comparison.
- 2.1.5 Once the protocol and list of participants have been approved, no change to the protocol or list of participants may be made without prior agreement of all participants.
- 2.1.6 All participants must submit an uncertainty budget of their humidity standards.

Table 1 List of participants (*C*=Coordinator, *P*=Pilot, *L*=Linking laboratory)

RMO	NMI	Country	Role	Loop
APMP	Korea Research Institute of Standards and Science (KRISS)	KR		1
AFIVIF	National Metrology Centre (NMC, A*STAR)	SG		1
	National Metrology Institute of Japan (NMIJ), AIST	JP		1
COOMET				
	Instituto Nacional de Técnica Aeroespacial (INTA)	ES	C, P	1, 2
	Istituto Nazionale di Ricerca Metrologica (INRiM)	IT		2
EURAMET	National Physical Laboratory (NPL)	GB		2
	Physikalisch-Technische Bundesanstalt (PTB)	DE		2
	E+E Elektronik Ges.m.b.H. (BEV/E+E)	AT	L	1, 2
SIM	National Institute for Standards and Technology (NIST)	US	P	1, 2

4. 2.2 Method of comparison

- 2.2.1 The comparison is of the realization of local scales of dew-point temperature at the participating NMIs.
- 2.2.2 The comparison will be made by calibration of travelling standards purchased by *Centro Español de Metrología* (CEM) and deposited at INTA as part of the Spanish humidity national metrology infrastructure. The travelling standards

- will measure dew-point temperature of a sample of moist gas produced by a participant's standard generator.
- 2.2.3 The comparison is carried out in two parallel loops with separate travelling standards (See Fig. 2.2.1). Measurements will start in the Pilot and Assistant Pilot laboratories. The other participants in the loop will then perform comparison measurements at the dew-point temperatures required. The last participant will then return the travelling standard to the Pilot to carry out final measurements to monitor drift. The draft of a time schedule for this comparison can be found in **Appendix B**. Allowing between 4 and 6 weeks per set of measurements (including shipping), this comparison will have a duration of approximately 10 months.

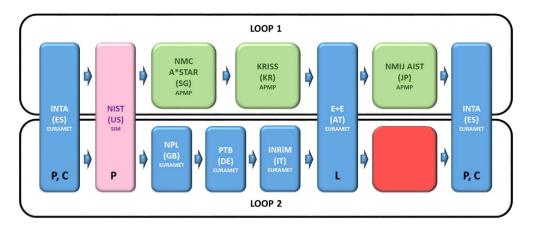


Fig. 2.2.1 Circulation scheme

- 2.2.4 All results are to be communicated directly to the Pilot (INTA) within three weeks after the completion of the measurements by a laboratory. If this time is seriously exceeded without coordination with the Pilot, the results of this laboratory may be excluded from the comparison. Exclusion of a participant's results from the report may occur if the results are not available in time to prepare the draft report.
- 2.2.5 Each participant must inform the Pilot within 24 hours of the arrival and despatch of the travelling standards, with copy to the Coordinator. If for some reason, the measurement facility is not ready or customs clearance takes too much time in a country, the participating laboratory must contact the Pilot immediately.
- 2.2.6 In case of serious difficulty with customs, or other delays which might over-run the time period of the ATA Carnet, the Pilot may request the instruments be returned to the holder of the ATA Carnet (INTA) or to the Assistant Pilot laboratory (NIST), or the sequence of participation may be changed to the most practical arrangement.
- 2.2.7 The Coordinator (INTA) must be informed about any delays in the schedule.

2.3 Handling of artefacts

- 2.3.1 The artefacts should be examined immediately upon receipt at the laboratory. All participants are expected to follow all instructions in the operator's manual provided by the instrument manufacturer. For proper unpacking, subsequent packing and shipping to the next participant, detailed instructions have been provided in **Appendix C** of this protocol. During packing and unpacking, all participants should check the contents with the packing list.
- 2.3.2 The travelling standards should only be handled by authorized persons and stored in such a way as to prevent damage.
- 2.3.3 During operation of the travelling standards, if there is any unusual occurrence, e.g., loss of heating control, large oscillations, etc. the Pilot laboratory should be notified immediately before proceeding.

2.4 Transport of artefacts

- 2.4.1 The transportation process begins when the artefact leaves the sending laboratory and does not end until it reaches the destination laboratory. All participants should follow the following general guidelines:
 - (1) Plan the shipment well in advance. The recipient should be aware of any customs issues in their country that could delay the testing schedule. The shipping laboratory must be aware of any national regulations covering the travelling standard to be exported.
 - (2) Mark the shipping container "FRAGILE SCIENTIFIC INSTRUMENTS" "TO BE OPENED ONLY BY LABORATORY STAFF" and with arrows showing "THIS WAY UP"; attach shock indicators and seal the container (e.g. with old calibration marks etc.).
 - (3) Determine the best way to ship the travelling standard to the next participant. In general ground transportation by truck with an approved courier must be preferred.
 - (4) Obtain the recipient's current shipping address. If possible, have it shipped directly to the laboratory. Note that the addresses in **Appendix A** may be outdated.
 - (5) Coordinate the shipping schedule with the recipient. The sending laboratory should provide the recipient with the details of the carrier, the tracking number (AWB or other reference), the exact travel mode, and the estimated time of arrival.
 - (6) Instruct the recipient to confirm receipt and condition upon arrival to the sender and the Pilot. A form for reporting on the receipt of the travelling standards is shown in **Appendix D.**
- 2.4.2 Each travelling standard is supplied with its shipping container, which is sufficiently robust to ensure safe transportation.

2.4.3 The artefacts will be accompanied by a suitable customs ATA Carnet. Care should be taken with the timing of the ATA Carnet, which only lasts for one year.

2.5. Costs

- 2.5.1 Each laboratory is responsible for the cost of shipping to the next participant including any customs charges and insurance.
- 2.5.2 Each laboratory pays its share of the services⁵ provided by MBW Calibration AG. The participants will be invoiced by MBW Calibration AG after completion of the comparison.

3. DESCRIPTION OF THE TRAVELLING STANDARDS

3.1. Artefacts

3.1.1 Centro Español de Metrología (CEM) lends one travelling standard per loop for the key comparison. The instruments are state-of-the-art, commercially available chilled-mirror dew-point hygrometers.

3.1.2 Details of travelling standards:

The two travelling standards are new and of the same type:

Model: MBW 373 HX Size (in packing case): 75 x 55 x 58 cm

Weight (in packing case): 40 kg

Manufacturer: MBW Calibration AG

Owner: Centro Español de Metrología (CEM)

Electrical supply: 230 V / 50 Hz

Electrical connection: Instrument socket IEC/EN 60320-2-2

(socket C14/plug C13)

The instrument is supplied with a Schuko (Continental Europe) plug Standard CEE 7/VII

Power consumption: 300 W

Tube connectors: Swagelok® 6 mm

Accessories: Endoscope, 4-wire cable for resistance

measurements (3 m), heated flexible hose with

6 mm Swagelok® connectors, pressure measurement insert, condensation trap,

flowmeter, operating manual

Approximate value

for insurance and customs

declaration: 40 000 EUR

Serial numbers of the instruments are:

Loop 1 Loop 2

⁵ MBW Calibration AG, will provide technical support on site with the transfer standards or at the factory premises in Switzerland, as applicable.

4. MEASUREMENT INSTRUCTIONS

4.1. Measurement process

- 4.1.1 All participants should refer to the operating manuals for instructions and precautions for using the travelling standards. Participants may perform any initial checks of the operation of the hygrometers that would be performed for a normal calibration. In the case of an unexpected instrument failure at a participant institute, the Pilot institute should be informed in order to revise the time schedule, if necessary, as early as possible.
- 4.1.2 Sample gas generated by a participant's standard generator, is introduced into the inlet of a travelling standard hygrometer through the supplied heated flexible hose terminated with Swagelok® 6 mm connectors. The electrical connector of the hose is plugged into the appropriate socket near the gas inlet terminal. For all dew-point temperatures, normal precautions (heating) should be used to protect against condensation in sample lines. Special care has to be taken with the connection between the end of the heated hose and the input terminal of the instrument. This point has to be heated externally to prevent condensation at high dew-point temperatures.
- 4.1.3 Measurements are carried out at nominal dew-point temperatures of 30 °C, 50 °C, 65 °C, 80 °C, 85 °C, 90 °C and 95 °C (refer to 4.1.4 for limited range at high dew-point temperatures). These values are chosen in accordance with the maximum dew-point, participants can generate.
- 4.1.4 If the scope of a laboratory does not cover the whole range of this comparison, the laboratory is allowed to limit measurements to the highest nominal dewpoint temperature specified in 4.1.3 that is within the scope.
- 4.1.5 Measurements should be done in rising order of dew-point temperature.
- 4.1.6 The values of dew-point temperature applied to the travelling standards should be within $\pm\,0.5\,^{\circ}\text{C}$ of the agreed nominal values for the comparison, and ideally closer than this. Deviations greater than this may increase the uncertainty in the comparison, for a particular result.
- 4.1.7 The measurements are to be performed at a system absolute pressure not to exceed 108 kPa. Participants should take into account that the flow which has to be adjusted for a constant volumetric at the conditions of the mirror depends strongly on the system pressure and the ambient pressure. Please note that the supplied rotameters are calibrated for use at 1013.25 hPa and 20 °C. it is recommended that all measurements are performed at the same nominal system pressure that is applicable to the laboratory conditions. For laboratories at a suitable altitude above sea level, it is recommended that the nominal system pressure be set to 101.3 kPa and for other laboratories at the most convenient value up to 105.0 kPa.

4.1.8 If the type of generator used (e.g. two pressure generator) requires a precise pressure measurement at the point of condensation (mirror), pressure should be measured as close as possible to the outlet terminal of the hygrometer. The hygrometers are **NOT** equipped with a gas pump, so the outlet of the measuring cell is directly connected to the rear outlet terminal. The remaining pressure drop between the point of condensation and the point of pressure measurement shall be determined as accurately as possible. A possible value for this pressure drop found during the initial tests in the Pilot laboratories is approximately 18 Pa at a flow rate of the wet gas of 0.5 l/min. This should be verified with own measurements by each participant. For this purpose, a special adaptor has been provided to be inserted instead of the endoscope to act as a pressure measurement port.

Attention: Great care should be placed when inserting or removing this so as not to damage the internal o-ring seal in the endoscope port. It should be inserted or removed slowly whilst turning slightly to avoid pinching the O-ring.

A 6 mm connector is also available at the top of the 12 mm tee at the instrument outlet (see Fig. 1) in order to connect for measurement of pressure drop between head and exit.

Important: For the purpose of this comparison the reference point for all measurements is taken as the point of condensation (mirror). Therefore, the applied reference dew-point temperature should be given for this condition, making due allowance for any pressure drops between the point of saturation and the point of condensation.

- 4.1.9 Special care has to be taken to avoid condensation and subsequently plugging by water in the outlet lines. A suitable heating and tubes with a greater inner diameter while measuring high dew-point temperatures will help prevent this fault.
- 4.1.10 Due to dew-point temperatures above ambient temperature the condensing water from the outlet of the hygrometer must be separated before entering the variable area flowmeter (rotameter) e.g. by a condensation trap (use hoses or tubes with large inner diameter). Doing this, the water content exceeding saturation conditions at room temperature is removed. This requires a correction of the flow rate indicated by the variable-area flow meter and the laboratory's flow measurement ⁶. Further examples are given in **Appendix G**. Participants should contact the pilot in advance of receiving the instruments if they require assistance in determining the values for their exact laboratory conditions. The following table shows this correction assuming saturation condition at 20 °C (room temperature), volume expansion, according to the system pressure of 101.3 kPa and temperature of the heated head and tube and is calculated for a wet gas flow of 0.5 l/min.

133

⁶ Mitter H, Böse N, Benyon R and T. Vicente, "Pressure drop considerations in the characterization of dew-point transfer standards at high temperatures". Int. Journal of Thermophysics (2012), Vol. 33, Issue 8-9, pp 1726-1740

Dew-point	Head	Volume of	Indicated flow rate after the
temperature	temperature	water	condensation trap
°C	°C	%	l/min
30	60	4.2	0.44
50	80	12.3	0.38
65	95	24.9	0.31
80	110	47.1	0.21
85	115	57.4	0.17
90	115	69.5	0.12
95	115	83.7	0.06

Table 2: Example of indicated flow rate after the condensation trap for the selected dew-point for a system pressure of 101.3 kPa, room temperature 20 °C.

4.1.11 A suitable condensation trap and variable-area flowmeter (rotameter) has been provided⁷. This should be connected to the instrument outlet directly (see Fig. 1).

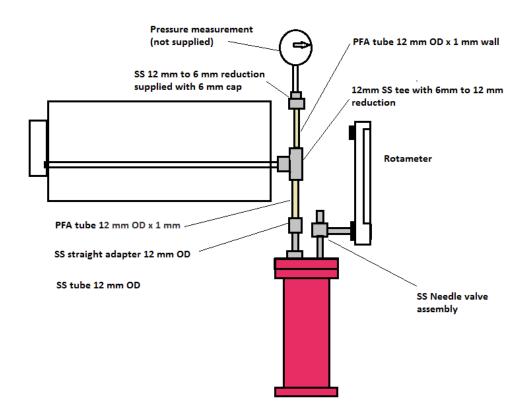


Fig. 1: Schematic of connection of condensation trap with pressure measurement port

4.1.12 Once the flow has been set, the flowmeter should be removed⁸ and purged with dry gas. Care must be taken not to touch the needle valve setting whilst removing the flowmeter.

⁷ NOTE: Participants may use their own condensation trap if this is more convenient with their generation system.

⁸ NOTE: This is to avoid condensation in the flow meter at higher dew-point temperatures after accumulating water in the condensation trap that could lead to wetting of the flow

- 4.1.13 Four sets of measurements are carried out at each generated nominal dewpoint temperature. The condensate should be cleared and the mirror cleaned if necessary. The flow after the condensation trap should be readjusted. Where relevant (e.g. significant contribution due to lack of reproducibility of the reference value), values should be taken after returning from another value). This is to reduce the effect of any irreproducibility of the travelling standards ⁹.
- 4.1.14 The condensate on the mirror should be cleared and re-formed for each value or repetition of dew-point temperature performing a "Manual Mirror Check" (fixed function key at the bottom bar). The "Automatic Mirror Check" must be disabled (Menu Keys: "Control Setup" → "Mirror Check").

4.1.15 Operation with the travelling standards

Before any humidity measurements, initial actions should be taken:

- 1) Read the manual "Operating Instructions" delivered by the manufacturer (a copy of the manual is in the transport case).
- 2) At a volumetric flow rate of 0.5 l/min, the flow-rate indications of the hygrometer, the rotameter and the laboratory flow meter are compared to each other (at a pressure corresponding to the sample gas pressure during dew-point temperature measurements). It is highly recommended to carry out the test in the generator system used in the comparison. In a case of strongly fluctuating sample gas flow, the flow indicator of the hygrometer may show incorrect value. For this test, the dew-point temperature should not exceed room temperature to avoid condensation.
- 3) When the hygrometer is in a standby mode (i.e. mirror temperature control is switched off), the dew-point temperature indication, resistance of a PRT embedded in the mirror, measured with an external bridge or multimeter, and mirror temperature reading from the RS-232 port are recorded during ten minutes (at least ten measurements). This result should be sent to the Pilot, together with the results of the measurement indicated in section 5.2, as soon as possible, in order to check the condition of the transfer standard.
- 4) Set the hygrometer ready for cleaning with "Mirror Cleaning".
- 5) Remove the endoscope carefully following the instructions.
- 6) Open the measuring head carefully according to the instructions given in the operating manual.

meter and consequent change the flow through the instrument. Also, sometimes flowmeters tend to oscillate with a back-effect on the instrument.

NOTE: It is assumed that the reproducibility of the reference generator is already known. The characterization of the transfer standards has shown that the principal contribution due to lack of reproducibility is the flow setting after the condensation trap and the existence of contamination on the mirror.

- 7) Clean the mirror surface using a suitable lint-free tissue or cloth or cotton tips with distilled or de-ionised water preceded by initial cleaning with pure ethanol of p.a. grade if necessary. As the last act of the cleaning procedure it is advantageous to rinse pure distilled water over the mirror which is collected with a cloth below the mirror.
- 8) Close the measuring head carefully according to the instructions given in the operating manual.
- 9) Replace the endoscope carefully.
- 10) Press "OK" for successfully performed mirror cleaning.

<u>Dew-point temperature measurements:</u>

- 1) Clean the mirror if needed according to the instructions above (no sample gas flow).
- 2) Set the heater control for the measuring head and the inlet tube to 'Fixed Mode' with the target value 30 K **above** the nominal dew-point temperature (Menu Keys: "Control Setup" → "Heater"→"Fixed Mode Target") and switch on the Heater with the fixed function key at the bottom bar. **Note:** The maximum selectable head temperature is 115 °C. This applies also for dew-point temperatures of 90 °C and above.
- 3) Wait until the head temperature has stabilized to the pre-set value. To watch this stabilization process, the 'head temperature' and the 'external tube temperature' should be displayed each on a display line.
- 4) Set the flow rate of wet sample gas at 0.5 l/min¹⁰ according to an indication by the supplied variable-area flow meter taken from the table 2 in section 4.1.9.
- 5) **Important:** Press and hold the 0-key (the numerical button for 0) for about 3 seconds until a short beep sounds. This is a special need with both transfer standards to indicate a clean mirror at the right temperature. We have decided to switch off the AUTOLAMP parameter in the instrument setup as this process of manual setting the reflected light intensity to zero gives more stable results over a long period.
- 6) Start measurements with "Dew/Frost Control" key at the bottom bar (Fixed Function Keys).
- 7) A homogenous condensate should appear on the mirror; if not, the condensate should be cleared and re-formed with "Mirror Check" (Fixed Function Keys). If necessary, the mirror is cleaned again according to the instructions above. If you experience an oscillating layer thickness with oscillation of the indicated value at very high dew-point temperatures, a new cleaning process may be necessary.

¹⁰ NOTE: Volumetric flow-rate at the measurement head conditions (temperature and pressure).

- 8) After appropriate time of stabilisation, measurements are carried out. The process of collecting data is described below (chapter 4.2). At this time the head temperature and the tube temperature must not increase or decrease.
- 9) Before changing the sample gas dew-point temperature, make sure that the head temperature and the tube temperature are high enough for the new desired dew-point (see instructions 2 above).
- 10) Before measuring at the next measurement point, the condensate should be cleared and re-formed with "Mirror Check" (Fixed Function Keys)
- 4.1.16 Participants should avoid lengthy additional measurements, except those necessary to give confidence in the results of this comparison.
- 4.1.17 The travelling standards used in this comparison must not be modified, adjusted, or used for any purpose other than described in this document, nor given to any party other than the participants in the comparison. Important: Instrument parameters available in the Extended-Access-Menu or via command line on the serial interface of the instrument, must NOT be amended without prior written permission of the Pilot.
- 4.1.18 The Pilot will make an assessment of any drift in the travelling standards during the comparison, based on measurements at the Pilot laboratory at the beginning and end of the comparison period. If drift is found, this will be taken into account in the final analysis of the comparison results.
- 4.1.19 If poor performance or failure of a travelling standard is detected, the Pilot of the loop will propose a course of action, subject to agreement of the participants.

4.2. Data collection

4.2.1 In the travelling standards, there are two 100-ohm platinum resistance thermometers (PRT) embedded beneath the surface of the chilled-mirror to measure the dew/frost-point temperature. One is used for system measurement and control. The resistance of the other one is measured via a Lemo connector in the rear panel. Dew-point temperature readings used primarily in this comparison are obtained from the resistance of the second PRT. The current applied to the PRT should be nominally 1 mA. The resistance of the PRT should be measured using a calibrated multi-meter or a resistance bridge, and then converted to a corresponding dew-point temperature. The calculation of the temperature is done according to IEC 60751 and is described in Appendix E.

Note: The internal parameters also of the first PRT used for the display and the data communication via RS-232 have been set to the nominal values according to IEC 60751. No individual calibration coefficients are stored in the instruments.

- 4.2.2 Each measured value (incl. its standard uncertainty) is obtained calculating the mean and standard deviation of at least 10 readings of the resistance of the PRT recorded during 10 to 20 minutes.
- 4.2.3 Participants may apply their own criteria of stability for acceptance of measurements according to their normal calibration procedures.
- 4.2.4 As a supporting measurement, the digital display readings (and/or digital signal through a serial port in the rear panel) for dew-point temperature, head temperature, flow rate and head pressure in the travelling standard should be monitored. The mean and standard deviation of a set of at least 10 readings, taken over the same period as the dew-point temperature measurements should be reported.
- 4.2.5 Values reported for dew-point temperatures produced by a participant's standard generator should be the value applied to the instruments, after any allowances for pressure and temperature differences between the point of realisation (laboratory standard generator or reference hygrometer) and the point of use (travelling standards).

5. REPORTING OF MEASUREMENT RESULTS

- 5.1 Participants must report their measurement results of four reproduced measurements, within three weeks of completing their measurements to the Pilot (refer to section 2.2.4).
- 5.2 The participants shall report to the Pilot the first measurement at a nominal dewpoint temperature of 30 °C within 48 h of it being measured, together with the initial tests performed in **4.1.14**, to check the correct performance of the transfer standard(s).
- 5.3 The Pilot shall accumulate data continually and should analyse the results for possible anomalies in the travelling standard. If problems arise, the Pilot should consult with the participant that submitted the data as soon as possible, and certainly before the distribution of Draft A of the Report of the comparison.
- 5.4 The parameter to be compared between the laboratories in this comparison is the difference found between the travelling standards and the laboratory dewpoint temperature standard. Note that the values of dew-point temperature reported are "arbitrary" values calculated from the measured resistance output, because of the use of the generalised IEC 60751 relationship. The travelling standards are used simply as comparators.
- 5.5 Participants should report results to the Pilot in terms of dew-point temperature. The main measurement results comprise:
 - values of dew-point temperature applied to the travelling standard, and associated standard uncertainty

- values measured using the travelling standard (and the associated uncertainties derived from standard deviation of the set of readings)
- values of difference between applied dew-point and measured dew-point temperature.

Participants shall submit their results in electronic form, using the Excel template provided in **Appendix F**. Use of this format, including calculations of means and differences, allows participants to see clearly the values and uncertainties of the parameters they are submitting for comparison.

- 5.6 From the data measured by each participant, results will be analysed in terms of differences between applied and measured dew-point temperatures. In each case, the difference will be taken between the applied (realised) value and the mean (mid-point) between the hydrometer values.
- 5.7 In addition, the difference between the hygrometer reading on all occasions will be analysed and will serve as a check of consistency.
- 5.8 The participants should report the conditions of realisation and measurement, as background information to support the main results. These conditions may include, pressure and temperature in saturator or reference hygrometer, pressure difference between saturator or reference hygrometer and travelling standards, measurement traceability, frequency of AC (or DC) resistance measurement, and other items. A template for reporting conditions of measurement is included in the Excel workbook provided in **Appendix F**.
- 5.9 Participants should provide a description of the operation of their dew-point facilities used in the comparison.
- 5.10 Participants should also provide an example plot of equilibrium condition (resistance versus time) at a nominal dew-point temperature of 50 °C, over at least one hour.
- 5.11 Any information obtained relating to the use of any results obtained by a participant during the course of the comparison shall be sent only to the Pilot laboratory and as quickly as possible. The Pilot laboratory will be responsible for coordinating how the information should be disseminated to other participants. No communication whatsoever regarding any details of the comparison other than the general conditions described in this protocol shall occur between any of the participants or any party external to the comparison without the written consent of the Coordinator. The Coordinator will in turn seek permission of all the participants. This is to ensure that no bias from whatever accidental means can occur. Draft B is the first public version.
- 5.12 If a participant significantly delays reporting of results to the Pilot, then a deadline will be agreed among the participants. If that deadline is not met, then inclusion of those results in the comparison report will not be guaranteed.

6. UNCERTAINTY OF MEASUREMENT

- 6.1 The uncertainty of the key comparison results will be derived from:
 - the quoted uncertainty of the dew-point temperature realisation (applied dew-point temperature)
 - the estimated uncertainty relating to the short-term stability of the travelling standard at the time of measurement
 - the estimated uncertainty due to any drift of the travelling standard over the period of the comparison (estimated by the Pilots)
 - the estimated uncertainty in mean values due to dispersion of repeated results (reflecting the combined reproducibility of laboratory standard and travelling standards)
 - the estimated uncertainty due to non-linearity of the travelling standards in any case where measurements are significantly away from the agreed nominal value
 - the estimated covariance between applied (laboratory standard) and measured (travelling standard) values of dew-point temperature (if found significant)
 - any other components of uncertainty that are thought to be significant.
- 6.2 Participants are required to submit detailed analyses of uncertainty for their dew-point standards. Uncertainty analysis should be according to the approach given in JCGM100 (2008): Evaluation of measurement data Guide to the expression of uncertainty in measurement. A list of the all significant components of the uncertainty budget¹¹ should be evaluated, and should support the quoted uncertainties. Type B estimates of uncertainty may be regarded as having infinite degrees of freedom, or an alternative estimate of the number of degrees of freedom may be made following the methods in the Guide. A template for reporting uncertainty of measurement is included in the Excel workbook provided in **Appendix F**. Individual institutes may add to the template any additional uncertainties they consider relevant.
- 6.3 The Pilot laboratories will collect uncertainty budgets as background information to the uncertainties quoted by participants for the comparison measurements. The Pilots and the Coordinator will review the uncertainty budgets for consistency among participants.
- 6.3 The uncertainty budget stated by the participating laboratory should be referenced to an internal report and/or a published article.

7. BILATERAL EQUIVALENCE

7.1 Bilateral equivalences at each dew point will be calculated from differences D_{ij} between participants i and j, where

¹¹ For example, see J. Nielsen, J. Lovell-Smith, M.J. de Groot, S. Bell, Uncertainty in the Generation of Humidity, CCT/03-20 (BIPM, Sèvres Cedex, France, 2003)

$$Dij = R_i - R_j, \tag{1}$$

The bilateral degree of equivalence (DoE) is determined as

$$(D_{ij}, U_{ij}) = (D_{ij}, ku(D_{ij})),$$
 (2)

where the coverage factor k=2 provides a coverage probability of 95 % for sufficiently large effective number of degrees of freedom of $u(D_{ij})^{12}$.

In this case, $u(D_{ij})$ is given by

$$u^{2}(D_{ii}) = u^{2}(x_{i}) + u^{2}(x_{i}) + u^{2}_{drift},$$
(3)

where u^2_{drift} is the uncertainty in the comparison due to drift of the hygrometer at a given dew point value. For simplicity, u^2_{drift} , is assigned a single generalised value at each dew point, irrespective of whether participants measured in immediate succession or separated in time. If drift is observed then then clause 8.4 will be applied.

The DoE will be calculated for each pair of participants at each nominal measurement point.

8. THE KEY COMPARISON REFERENCE VALUE (KCRV)

- 8.1 The outputs of the key comparison are expected to be:
 - Results of individual participants for comparison of the hygrometers against their dew-point temperature reference in terms of mean values for each hygrometer at each measured value, estimated standard uncertainty of each mean result and estimated standard uncertainty of comparison process (e.g. effect of long-term stability and non-linearity of the travelling standards) if necessary.
 - Estimates of bilateral equivalence between every pair of participants at each measured dew-point temperature.
 - A key comparison reference value (KCRV) for each nominal value of dewpoint temperature in the comparison. The KCRV will be calculated as a weighted mean of all valid results.
 - Estimates of equivalence of each participant to the KCRV. This might be expressed in terms of the Degree of Equivalence (DOE) given as a difference and its uncertainty (Δ ±U), in °C.
- 8.2 In the field of dew-point standards, the KCRV does not have any absolute significance with respect to an SI unit. It is calculated only for purposes such as the presentation and inter-relation of key comparison data for the MRA.

¹² Cox, M., The evaluation of key comparison data, Metrologia **39** (2002) 589-595

8.3 In this comparison and other corresponding RMO comparisons, a reference value is calculated for each nominal value of dew point, treating them as separate data populations for this purpose.

For each nominal dew point value, a key comparison reference value (KCRV)¹² will be calculated as the weighted mean, y, of results

$$y = \frac{x_1/u^2(x_1) + \dots + x_N/u^2(x_N)}{1/u^2(x_1) + \dots + 1/u^2(x_N)},$$
(4)

this method of calculation has been agreed by CCT Working Group 6 and applied successfully in CCT-K6. For comparison, values of arithmetic mean and median will also calculated. The uncertainty in weighted mean due to dispersion will be calculated from

$$\frac{1}{u^2(y)} = \frac{1}{u^2(x_1)} + \dots + \frac{1}{u^2(x_N)}.$$
 (5)

After collection of participant results, data will be checked for outliers, and calculation of the weighted mean will be made both with and without the outlying results. Values of arithmetic mean and median will also be calculated. As well as the uncertainty in weighted mean due to dispersion, an additional uncertainty in KCRV due to drift of the travelling standard will be include, if necessary, as defined in the next section.

- 8.4 The Pilots will make an assessment of any drift in the travelling standards during the comparison. The assessment will be based on initial and final measurements done by the Pilot. If drift is found, this will be taken into account in the final analysis of the comparison results. If the drift is small compared with uncertainty values reported by the participants, an estimate for the drift may be set to zero with a standard uncertainty calculated according to the ISO Guide. In a case of a significant drift, the effect is taken into account by assigning a time-dependent value to KCRV, or by other suitable method so that the estimates of equivalence can be meaningfully calculated between results taken at different times.
- 8.5 If a travelling standard fails or performs poorly during the comparison, the Coordinator and Pilots will propose a course of action, subject to agreement of the participants.
- 8.6 A chi-squared test will be carried out on the results with and without any identified outliers, as a measure of the consistency of the data and uncertainties.

Discrepant results will be identified using the criterion:

$$|R_{lab} - R_{KCRV}| > 2\sqrt{u^2(R_{lab}) - u^2(R_{KCRV})}$$
 (6)

The decision whether to exclude marginally-outlying data will be based on the impact on the KCRV.

Austria

6. Appendix A.DETAILS OF PARTICIPATING INSTITUTES

E+E Elektronik (BEV/E+E)

Address: Langwiesen 7, A-4209 Engerwitzdorf, Austria

Contact: Dr Helmut Mitter
Phone: +43 7235 605 320
Fax: +43 7235 605 383

E-mail: helmut.mitter@epluse.at

Instituto Nacional de Técnica Aeroespacial (INTA)

Spain

Address: Centro de Metrología y Calibración, Ctra. a Ajalvir, km. 4

ES-28850 Torrejón de Ardoz

Contact: Dr Robert Benyon
Phone: +34 915 201 711
Fax: +34 915 201 645
E-mail: benyonpr@inta.es

Istituto Nazionale di Ricerca Metrologica (INRiM)

Address: Strada delle Cacce, 73, I-10135 – Torino

Contact: Dr Vito Fernicola
Phone: +39 011 3977 337
Fax: +39 011 3977 347
E-mail: v.fernicola@inrim.it

Korea Research Institute of Standards and Science (KRISS)

R. of Korea

Address: 267 Gajeong-Ro Yuseong-Gu Daejeon 305-340

Contact: Dr. Byung II Choi Phone: +82 428685275 Fax: +82 428685290 Email: cbi@kriss.re.kr

National Institute for Standards and Technology (NIST)

United States

Address: Bldg. 221, Rm. B131. 100 Bureau Dr. of America

Gaithersburg, MD 20899

Contact; Dr. Christopher Meyer Phone: +1 301 975 4825

Fax: +1 301 975 4825 Fax: +1 301 548 0206

E-mail: <u>christopher.meyer@nist.gov</u>

National Metrology Centre (NMC, A*STAR) Singapore

Address: 1 Science Park Drive. PSB Building.

Singapore 118221

Contact Dr. Wang Li Phone: 65 6279 1959 Fax: 65 6279 1996

Email: wang_li@nmc.a-star.edu.sg

National Metrology Institute of Japan (NMIJ), AIST

Address: AIST Tsukuba Central 3,

Tsukuba 305-8563

Contact: Dr Hisashi Abe
Phone +81 29 861 6845
Fax: +81 29 861 4068
Email: abe.h@aist.go.jp

National Physical Laboratory (NPL)

United

Japan

Address: Hampton Road, Teddington, Middlesex, TW11 0LW

Kingdom

Contact: Dr Stephanie Bell Phone: +44 20 8943 6402 Fax: +44 20 8943 6306

Email: Stephanie.Bell@npl.co.uk

Physikalisch-Technische Bundesanstalt (PTB)

Germany

Address: Bundesallee 100, D-38116 Braunschweig

Contact: Dr.-Ing. Regina Deschermeier

Prof. Dr. Volker Ebert

Phone: +49 531 592 3241

+49 531 592 3200

Fax: +49 531 592 69 3241

E-mail: regina.deschermeier@ptb.de

volker.ebert@ptb.de

7. Appendix B.PROVISIONAL TIME SCHEDULE FOR THE COMPARISON

Year			2	0	1	6										2	0	1	7									
Month		(0	1	٧		D	J	F	١	1	-	4	N	M	,	J	,	J	A	4	,	S	(C	1	7)
Spain	ES			Х																								
United States of America	US						Х																					
Singapore	SG								Х																			
Republic of Korea	KR											Х																
Austria	AT														Х													
Japan	JP																	Х										
Spain	ES																											

Figure 1: Comparison scheme of loop 1 (One column corresponds to two weeks; = measurement, X = measurement / transportation).

Year			2	0	1	6											2	0	1	7									
Month		(C	١	1	[)	J		F	١	Λ	/	4	ſ	M		J	,	J	1	4	,	S	(C	١	1	D
Spain	ES			Χ																									
United States of America	US						Х																						
United Kingdom	GB								Х																				
Germany	DE										Х																		
Italy	IT												Х																
Austria	AT															Х													
																			Х										
Spain	ES																												

Figure 2: Comparison scheme of loop 2 (One column corresponds to two weeks; \blacksquare = measurement, X = measurement / transportation).

Activity	Start Month	Provisional date
Draft of technical protocol completed by the		Nov. 2016
Coordinator and sent to participants		
All comments received from participants		Nov. 2016
Submission of a revised protocol to		Nov. 2016
participants for unanimous approval		
Submission of revised protocol to CCT/WG6		Nov. 2016
and TC THERM Chairman		
Travelling standards characterized by the		Jan. 2009 –
Pilots		Nov 2016
The first set of key comparison	INTA: Month 1	Oct. 2016
measurements according to the protocol at	NIST: Month 2	Nov 2016
the Pilot laboratories		
Travelling standards sent to participant by	Month 3	Dec. 2016
Co-Pilot		
Completion of measurements	Month 11 approx.	Aug. 2017
Draft A ready	Month 13 approx.	Oct. 2017
Deadline for comments on draft A	Month 14	Nov. 2017
Draft B ready and submitted to CCT/WG.KC	Month 15	Dec. 2017

Appendix C.PACKING / UNPACKING INSTRUCTIONS

CCT-K8 PACKING / UNPACKING INSTRUCTIONS

Table of contents

1	INTRODUCTION	2
2	UNPACKING INSTRUCTIONS 2.1 Unpacking 2.2 Assembly of condensation trap	2 2 5
3	PACKING INSTRUCTIONS 3.1 Preparation of the transfer standard 3.2 Disassembly of the condensation trap 3.3 Packing	6 6 6

1. INTRODUCTION

Each instrument is packed in a ZARGES aluminium case that has 10 removable layers of shock-absorbent foam. The layers of foam should be handled with great care to avoid separation of the pre-formed segments.

IMPORTANT:

PACKING & UNPACKING SHOULD ONLY BE PERFORMED BY QUALIFIED LABORATORY PERSONNEL

2. UNPACKING INSTRUCTIONS

2.1 Unpacking

Place transport box in the laboratory at a location close to the point of use and clear an area on a bench/table large enough to take all the contents (hygrometer, condensation trap and accessories). Keep the supplied pallet for despatch. Open the case, releasing the two fastners on one side (it will be necessary to cut the tie wraps blocking the fastners.

Step 1: Remove layer 1 that is the top cover. This exposes layer 2.



Fig.1: Layer 2



Fig.2: Layer 2 (with instrument operation manual removed)

This has the following contents, that should be removed:

- a) Instrument operation manual in an envelope.
- b) Shielded cable with LEMO connector for 2nd PRT measurements.
- c) Mains cable fitted with European Schuko.
- d) 24 V MBW SS heated hose terminated in LEMO connector (for use at inlet if required).
- e) 75 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nuts.
- f) 100 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nut one end.
- g) Short PFE 12 mm OD tube fitted with 12 mm Swagelok nut on one end and a Swagelok 12 mm to 6 mm connector with a 6 mm cap on the other. (For use with condensation trap).
- h) Condensation trap support base.

3

<u>Step 2:</u> Successively remove layers 2 to 6, being careful not to tear the foam and remove the transfer standard. This is best done by two persons, one taking care of the foam. The instrument has two handles that can only be fully opened when the instrument is out of the box, so care has to be taken when removing the instrument. Do not hold by the measuring head.



Fig.3: Layer 5

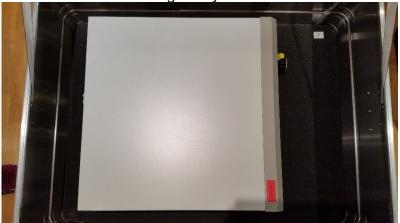


Fig.4: Layer 7

Step 3: Successively remove layers 7 to 10. Once layer 9 has been removed, the condensation trap main body will be visible.



Fig.5: Layer 10

Once layer 10 has been removed, the bottom layer (that should not be removed) is visible:



Fig.6: Bottom layer

It contains:

- a) Box of lint-free tissues.
- b) Swagelok box that contains [Swagelok SS tee 12 mm with adaptor to 6 mm to connect to instrument outlet, a Swagelok SS 12 mm to 6 mm adaptor to be used as alternative instead of tee if more convenient in instrument set-up, a spare SS 12 mm nut, 12 mm ferrules and insert, a spare LEMO connector for PRT measurement, a SS needle valve assembly with two short lengths of SS tube with 6 mm Swagelok fittings for use with condensation trap] and a ½" Swagelok connector with o-ring and support ring and a spare o-ring (only to be used if the laboratory needs to have the instrument with ½" inlet instead of 6 mm). Four SS adaptors from 6 mm to ½" Swagelok.
- c) Spare blank head in red bubble wrap bag. 13
- d) Endoscope case that contains, endoscope, MBW insert for pressure measurement terminated in 6 mm Swagelok fitting, ¼"cap, ¼" nut, set of ¼" nylon ferrules (see Fig. 7).
- e) ABB Flowmeter with 6 mm Swagelok at inlet and yellow and red caps (to be removed prior to use).
- f) Stainless Steel 12 mm OD insert exit tube for condensation trap.
- g) 50 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nuts.
- h) Main body of condensation trap.



Fig.7: Contents of endoscope case

¹³ The spare head is provided forr use in case of troubleshooting or failure of endoscope, photodiode or detector in the main measuring head.

2.2 Assembly of condensation trap

Assemble the condensation trap as follows:

- a) Attach the base to the four stainless steel legs of the condensation trap using the Allen screws and washers. The base gas a stand-off so that the screw heads do not touch the work bench. Place the condensation trap in the vertical position (see Fig. 8).
- b) Insert the stainless-steel exit insert tube into the 12 mm bore-through coupling and hand tighten the 12 mm Swagelok nut and then tighten just under ¼ turn. (the end with the 12 mm straight connector should protrude from the condensation trap
- c) Connect the needle valve assembly and hand tighten the 6 mm Swagelok on the condensation trap end and then tighten just under ¼ turn. Check that the needle valve Swagelok couplings are tight (just under ¼ turn from hand tight).
- d) Remove the yellow and red plastic protection caps at the inlet and outlet and attach the flowmeter inlet to the needle valve, keeping the flowmeter vertical. Tighten the 6 mm Swagelok nuts to just under ¼ turn from hand tight.



Fig.8: Condensation trap assembled with flowmeter

3. PACKING INSTRUCTIONS

3.1 Preparation of the transfer standard

Once the instrument has been purged with dry gas at the end of the calibration, switch off the instrument and unplug the mains cable from the mains supply and the instrument. Turn off the generator gas supply to the instrument. Open the condensation trap drain valve and allow the instrument head to depressurize.

Carefully remove the endoscope and place it in its case, together with the pressure measurement insert, the nylon ferrules, the ¼" Swagelok nut, ¼" and Swagelok cap (see Fig. 7). Close the endoscope case.

Place the yellow screw on cap on the endoscope port on the measurement head. Disconnect the gas lines at the outlet and inlet of the instrument and place the yellow screw on caps on the inlet and outlet Swagelok connectors. Unplug the heated line LEMO connector.

3.2 Disassembly of the condensation trap

The following instructions are to be followed to prepare the condensation trap for packing:

- a) Ensure the condensation trap is empty by opening the drain valve.
- b) Remove the flowmeter by loosening the 6 mm Swagelok nut at the flowmeter inlet and place the yellow and red plastic protection caps at the inlet and outlet, respectively.
- c) Remove the needle valve assembly by loosening the 6 mm Swagelok on the trap end. (The needle valve Swagelok nuts should not be loosened and the valve assembly should be the valve and the two short lengths of 6 mm tube with their Swagelok nuts and ferrules).
- d) Disconnect the PFE inlet tube assembly from the condensation trap inlet Swagelok 12 mm adaptor.
- e) Remove the stainless steel exit insert tube (that should retain its 12 mm adaptor) by loosening the 12 mm Swagelok nut on the condensation trap end.
- f) Remove the condensation trap base by loosening the four stainless steel screws and replacing them afterwards in the four support legs of the condensation trap.
- g) Disconnect the two 12 mm nuts on the ends of the 12 mm tee (leave the 12 mm to 6 mm adapter on the short length with its 6 mm cap untouched).

3.3 Packing

Step 1: Open the case and carefully remove layers 1 to 9 of the packaging foam until the bottom unnumbered layer is visible. Place the following in the corresponding cut out sections ¹⁴ (refer to figure 6):

- a) Box of lint-free tissues.
- b) Swagelok box that contains [Swagelok SS tee 12 mm with adaptor to 6 mm to connect to instrument outlet, a Swagelok SS 12 mm to 6 mm adaptor to be used as alternative instead of tee if more convenient in instrument set-up, a spare SS 12 mm nut, 12 mm ferrules and insert, a spare LEMO connector for PRT measurement, a SS needle valve assembly with two short lengths of SS tube with 6 mm Swagelok fittings for use with condensation trap] and a ¼" Swagelok connector with o-ring and support ring and a spare o-ring (only to be used if the laboratory needs to have the instrument with ¼" inlet instead of 6 mm).
- c) Spare blank head in red bubble wrap bag.

¹⁴ Note: As each element is placed in the box, please tick it off on the despatch form in the measurement protocol

- d) Endoscope case that contains, endoscope, MBW insert for pressure measurement terminated in 6 mm Swagelok fitting, ¼"cap, ¼" nut, set of ¼" nylon ferrules (see Fig. 7).
- e) ABB Flowmeter with 6 mm Swagelok at inlet and yellow and red caps (to be removed prior to use).
- f) Stainless Steel 12 mm OD insert exit tube for condensation trap (including 12 mm adaptor).
- g) 50 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nuts.
- h) Main body of condensation trap.

Step 2: Place layer 10 (see Fig. 5).

Step 3: Place layers 9, 8 and 7 and put the transfer standard in place (check it has the yellow caps on inlet, outlet and endoscope port (see Fig. 4).

Step 4: Place layers 6 and 5 and put the transfer standard in place (see Fig. 3).

Step 5: Place layers 4, 3 and 2 and place the following components in the cut out (see Fig. 1 & 2).

- a) 24 V MBW SS heated hose terminated in LEMO connector (for use at inlet if required)
- b) 75 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nuts.
- c) 100 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nut one end.
- d) Short PFE 12 mm OD tube fitted with 12 mm Swagelok nut on one end and a Swagelok 12 mm to 6 mm connector with a 6 mm cap on the other. (For use with condensation trap).
- e) Condensation trap support base
- f) Shielded cable with LEMO connector for 2nd PRT measurements.
- g) Mains cable fitted with European Schuko plug.
- h) Instrument operation manual in an envelope.

<u>Step 6</u>: If you are in an EU member state and the destination is also an EU member State then place the ATA carnet on top of the instrument manual.

Step 7: Place layer 1 and close the case. Place tie-wraps on the two fasteners.

Step 8: If the ATA carnet is to be used then place it in a large envelope marked "ATA CARNET" And fix to the outer top surface of the case.

<u>Step 9</u>: Clearly label the outside of the case in at least two places with the destination¹⁵ and origin address and contact details (be sure to remove the old labels from the previous shipment). Please ensure all the shock indicators are attached and are not in the RED alarm condition. Otherwise replace with new ones.

<u>Step 10</u>: Fix the aluminium transport case to a standard pallet suitable for international shipment. If the laboratory is shipping two instruments in their transport case these should be fitted on one large pallet side by side and never shipped with two separate pallets (See Fig. 9).



Fig.9: Details of cases on pallet

8. Appendix D. FORM FOR REPORTING ON RECEIPT OF TRAVELLING STANDARDS

¹⁵ Please check current details with next participant as defined in the measurement protocol.

TO: (/	Pilot Laboratory)	
Dr. Robe	ert Benyon	
Fax: 00	0 34 91520 1645	
FROM:	(Participating Laboratory)	
	(i. d. no,pading	
Fax:	E-mail:	
	firm having received the travelling standard of the CCT Compariso point Temperature (CCT/K8):	n
	Loop 1: S/N: 08-1215;	
П	Loop 2: S/N: 08-1216;	
	on:	(date)
After vi	isual inspection	
	No damage has been noticed;	
П	The following damage must be reported (attach photograph):	
	The following damage must be reported (attach photograph).	
	ne hygrometer transportation packages been opened during transit ustoms	?
	No	
	Don't know (no seals applied)	
	Yes: Please give details:	
Is there	any damage to the transportation packages?	
П	No	

Yes: Please give details (attach photograph):
Are there any visible signs of damage to the instruments?
□ No
Yes: Please give details (attach photograph):
Do you believe the travelling standards are functioning correctly?
Yes
No: Please indicate your concerns:

PACKING LIST

Received	Items	Dispatched
	Instrument operation manual in an envelope	
	Shielded cable with LEMO connector for 2nd PRT measurements	
	Power cord with Standard CEE 7/VII plug	
	24 V MBW SS heated hose terminated in LEMO connector (for use at	
	inlet if required) and terminated in 6 mm Swagelok	
	24 V MBW SS heated hose terminated in LEMO connector (for use at	
	inlet if required) and terminated in ¼" Swagelok	
	75 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nuts	
	100 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nut one end	
	Short PFE 12 mm OD tube fitted with 12 mm Swagelok nut on one	
	end and a Swagelok 12 mm to 6 mm connector with a 6 mm cap on	
	the other. (For use with condensation trap).	
	Condensation trap support base	
	Dew-point hygrometer MBW 373 HX S/N:* with 2 yellow	
	caps on gas inlet and outlet and endoscope port.	
	Box of lint-free tissues	
	Swagelok box that contains:	
	Swagelok SS tee 12mm with adaptor to 6 mm to connect to	
	instrument outlet, a	
	Swagelok SS 12mm to 6 mm adaptor	
	Spare SS 12 mm nut, 12 mm ferrules and insert	
	Spare LEMO connector for PRT measurement	
	SS needle valve assembly with two short lengths of SS tube with	
	6 mm Swagelok fittings for use with condensation trap	
	SS Swagelok Tube Fitting, Male Connector, 1/4 in. Tube OD x	
	1/8 in. Male ISO Parallel Thread, Straight Shoulder (SS-400-1-	
	2RS) with o-ring, support ring and spare o-ring.	
	Two SS Swagelok Tube Fittings, Reducer, 1/4 in. x 6 mm Tube	
	OD SS-400-R-6M with fitted 6mm nut and ferrules.	
	• 6 mm Plug SS-400-P	
	• ¼" Plug SS-6M0-P	
	Spare blank head in red bubble wrap bag	
	Endoscope case that contains:	
	• Endoscope: S/N:*	
	MBW insert for pressure measurement terminated in 6 mm	
	Swagelok fitting	
	• ½"cap, ½" nut, set of ½" nylon ferrules.	
	ABB Flowmeter with 6 mm Swagelok at inlet and yellow and red caps.	
	Stainless Steel 12 mm OD insert exit tube for condensation trap	
	50 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nuts	
	Main body of condensation trap	
	Zarges K470 IP 65 Aluminium transport case	

	- /4 cap, /4 riut, set of /4 riylori ferrules.	i l
	ABB Flowmeter with 6 mm Swagelok at inlet and yellow and red caps.	
	Stainless Steel 12 mm OD insert exit tube for condensation trap	
	50 cm PFE 12 mm OD tube fitted with 12 mm Swagelok nuts	
	Main body of condensation trap	
	Zarges K470 IP 65 Aluminium transport case	
) Please add Laboratory: Date:	serial numberSignature:	

9. Appendix E.IEC 60751 RELATIONSHIP

Based on the international standard IEC 60751:2008, a nominal resistance-temperature characteristic of the PRT in the travelling standard can be defined as follows:

$$R_t = R_0(1 + At + Bt^2)$$

where:

 $t = \text{Temperature (ITS-90) in }^{\circ}\text{C},$

 R_t = Resistance of the PRT at temperature t in Ω

 R_0 = Nominal resistance of 100 Ω at 0 °C,

A = $3.9083 \times 10^{-3} \, ^{\circ}\text{C}^{-1}$ and

B = $-5.775 \times 10^{-7} \, ^{\circ}\text{C}^{-2}$

Solving the quadratic equation, the temperature can be calculated with

$$t = -\frac{A}{2B} - \sqrt{\frac{A^2}{4B^2} - \frac{R_0 - R_t}{BR_0}}$$

10. Appendix F. TEMPLATE FOR SUBMISSION OF RESULTS

The template for submission of results is available in electronic form only (Excel workbook). It consists of three worksheets (Results, Conditions and Uncertainty). It will be sent to the participants during the comparison.

11. Appendix G. EXAMPLES OF FLOW-METER SETTINGS

The following table summarises the flowmeter settings for a laboratory temperature of 22 °C and ambient pressure of 980 hPa and 1013.25 hPa as a function of system pressure.

	ibient ditions		pressure Pa]	1013.25				1030		1050				
Temp. [ºC]	Pressure [hPa]	dew- point temp. [°C]	head temp. [ºC]	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)		
		30	60	0.44	0.44	0.44	0.44	0.44	0.45	0.44	0.45	0.46		
		50	80	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.39	0.40		
		65	95	0.31	0.31	0.31	0.31	0.32	0.32	0.31	0.32	0.33		
22	1013.25	80	110	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.23		
		85	115	0.17	0.17	0.17	0.17	0.17	0.18	0.17	0.18	0.18		
		90	115	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13		
		95	115	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08		
		30	60	0.44	0.45	0.46	0.44	0.46	0.46	0.44	0.47	0.47		
		50	80	0.38	0.39	0.40	0.38	0.40	0.40	0.38	0.41	0.41		
		65	95	0.31	0.32	0.32	0.31	0.33	0.33	0.31	0.34	0.34		
22	980	80	110	0.21	0.22	0.22	0.21	0.22	0.23	0.22	0.23	0.23		
		85	115	0.17	0.17	0.17	0.17	0.18	0.18	0.17	0.19	0.19		
		90	115	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.14	0.14		
		95	115	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	80.0		

⁽¹⁾ Volume flow after condensation

CCT-K8 comparison protocol 22/02/2017

⁽²⁾ Volume flow after needle valve (there occurs some expansion from system pressure to ambient which changes the flow)

⁽³⁾ Volume flow indicated by the flow meter (here the calibration parameters 1013.25 hPa and 20 °C are corrected to the real conditions ambient temperature and pressure.

12. Appendix H.GUIDE ON USE OF SWAGELOK FITTINGS

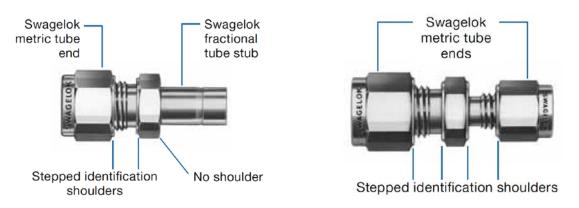
For the correct use of the instruments it is important to distinguish between metric and fractional measurements of connectors and couplings and to correctly tighten them for reproducible, leak-free operation.

Intermix/Interchange with Other Manufacturers' Components

The critical interaction of precision parts is essential for reliability and safety. Components of other manufacturers should not be intermixed with the Swagelok fittings supplied.

Metric Swagelok Tube Fittings

Metric tube fittings have a stepped shoulder on the body hex.



Shaped fittings, such as elbows, crosses, and tees, are stamped MM for metric tubing and have no step on the forging.

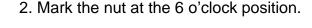
Safety Precautions

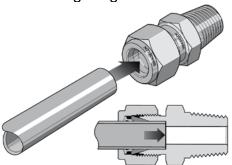
- Do not bleed system by loosening fitting nut or fitting plug.
- Do not assemble and tighten fittings when system is pressurized.
- Make sure that the tubing rests firmly on the shoulder of the tube fitting body before tightening the nut.
- Do not mix materials or fitting components from various manufacturers—tubing, ferrules, nuts, and fitting bodies.
- Never turn fitting body. Instead, hold fitting body and turn nut.
- Avoid unnecessary disassembly of unused fittings.

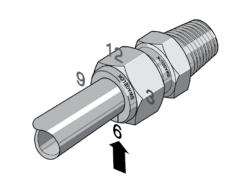
Swagelok Tube Fittings Up to 1 in./25 mm

These instructions apply both to traditional fittings and to fittings with the advanced back-ferrule geometry.

1. Fully insert the tube into the fitting and against the shoulder rotate the nut finger-tight.

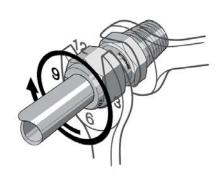






3. While holding the fitting body steady, tighten the nut one and one quarter turns to the 9 o'clock position.

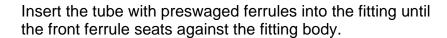
For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the nut threequarters turn to the 3 o'clock position.

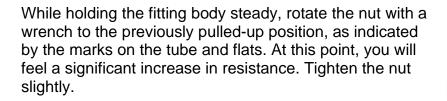


Reassembly—All Sizes

You may disassemble and reassemble Swagelok tube fittings many times. Always depressurize the system before disassembling a Swagelok tube fitting.

Prior to disassembly, mark the tube at the back of the nut; mark a line along the nut and fitting body flats. Use these marks to ensure that you return the nut to the previously pulled-up position.







13. Appendix I. DOCUMENT REVISION HISTORY

The following table includes the document revision history. Document version is identified by date.

Date	Description	Changes
10/11/2016	First draft sent to participants and CCT-WG/Hu.	
26/11/2016	Second draft sent to participants	Addressing comments of PTB, BEV/E+E and NMIJ.
14/12/2016	Revised version submitted to CCT WG.KC	Addressing comments of CCT. WG-KC Additional section on Swagelok fittings
21/12/2016	Revised version submitted to CCT WG.KC	Addressing comments of CCT. WG-KC Clarification of spare head and section 4.1.13
22/02/2017	Final version approved by CCT WG.KC	Section 4.1.13 reverted to that of 14/12/2016 (including footnote)