

Key comparisons CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5

MEASURAND : Temperature

NOMINAL TEMPERATURE : $T_{\text{nom}} = 1300 \text{ }^{\circ}\text{C}$

Key comparison CCT-K5

Four Tungsten-strip lamps were used as transfer standards for radiance temperature measurements at specific currents corresponding to each nominal temperature T_{nom} . To shorten the measurement time significantly the set of transfer standards was split in two sets of two lamps for simultaneous comparisons in two loops. The pilot of each loop measured both lamp sets in order to establish a linkage mechanism described on page 19 of the CCT-K5 Final Report.

T_i : temperature value measured by laboratory i

u_i : standard uncertainty of T_i

Lamp S/N C564

Lab <i>i</i>	T_i / °C	u_i / °C
VSL	1301.992	0.14
NMIA	1302.032	0.02
KRISS	1301.982	0.14
NIM	1302.032	0.18
A*STAR	1301.402	0.21
NMIJ	1302.252	0.18
VNIIM	1301.512	0.47

Lamp S/N C860

Lab <i>i</i>	T_i / °C	u_i / °C
NPL	1300.182	0.23
NIST	1300.952	0.35
CENAM	1300.672	0.37
LNE-INM	1299.882	0.22
INRIM	1300.812	0.12
PTB	1300.752	0.21

Lamp S/N C681

Lab <i>i</i>	T_i / °C	u_i / °C
VSL	1302.378	0.14
NMIA	1302.428	0.02
KRISS	1302.518	0.14
NIM	1302.708	0.18
A*STAR	1301.468	0.21
NMIJ	1302.628	0.18
VNIIM	1301.628	0.47

Lamp S/N C864

Lab <i>i</i>	T_i / °C	u_i / °C
NPL	1300.185	0.23
NIST	1300.735	0.35
CENAM	1300.595	0.37
LNE-INM	1300.495	0.22
INRIM	1300.675	0.12
PTB	1300.655	0.21

Key comparison CCT-K5.1

This is a bilateral comparison between the PTB and the NRC.

T_{NRC} : temperature value measured at the NRC

u_{NRC} : standard uncertainty of T_{NRC}

Lamp C598	$T_{\text{NRC}} = 1300.20 \text{ }^\circ\text{C}$	Lamp 644C	$T_{\text{NRC}} = 1300.34 \text{ }^\circ\text{C}$
	$u_{\text{NRC}} = 0.33 \text{ }^\circ\text{C}$		$u_{\text{NRC}} = 0.33 \text{ }^\circ\text{C}$

Key comparison APMP.T-K5

Laboratory individual measurements of APMP.T-K5 participants are given in Appendix B of the APMP.T-K5 Final Report both in tabulated and in graphical forms. There were taken between 1997 and 2000.

Key comparison EUROMET.T-K5

This comparison involved eight participants and was carried out from October 1999 to February 2001.

The two transfer standards were Lamp S/N C564 and Lamp S/N C681 already used in CCT-K5.

The individual laboratory measurements and their uncertainties are given in Tables 5 to 11 of the EUROMET.T-K5 Final Report.

Key comparisons CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5

Key comparison CCT-K5

MEASURAND : Temperature

NOMINAL TEMPERATURE : $T_{\text{nom}} = 1300 \text{ }^\circ\text{C}$

The key comparison reference value T_R for each nominal temperature T_{nom} and each lamp k is calculated on the basis of the median of measured radiance temperatures $T_i(k, T_{\text{nom}})$. Its standard uncertainty, $u(T_R)$, is obtained as the standard uncertainty of the median.

Lamp	$T_R / ^\circ\text{C}$	$u(T_R) / ^\circ\text{C}$
C564	1302.090	0.087
C681	1302.370	0.053
C860	1300.720	0.041
C864	1300.640	0.056

For each temperature T_{nom} the degree of equivalence of laboratory i with respect to the key comparison reference value is given by a pair of terms: D_i and its expanded uncertainty U_i ($k = 2$) both expressed in K. The computation of D_i and U_i is explained in the Addendum to the CCT-K5 Final Report.

For each temperature T_{nom} the pair-wise degree of equivalence between laboratory i and j is given by two terms: D_{ij} and its expanded uncertainty U_{ij} ($k = 2$). The computation of D_{ij} and U_{ij} is also explained in the Addendum of the CCT-K5 Final Report.

Linking key comparison CCT-K5.1 to CCT-K5

The linkage is made through the common participation of PTB in both key comparisons, and is detailed in the CCT-K5 and CCT-K5.1 Linkage Report.

Linking key comparison APMP.T-K5 to CCT-K5

The linkage is made through the common participation of NMIJ, NIM, KRIS and NMIA in both key comparisons, and is detailed in the Addendum to the APMP.T-K5 Final Report.

Linking key comparison EUROMET.T-K5 to CCT-K5

The measurements of the EUROMET.T-K5 participants are directly linked to the key comparison reference value obtained in CCT-K5 as the protocols of the two key comparisons are identical and the transfer standards are the same (see in Chapter VII of the EUROMET.T-K5 Final Report).

Degrees of equivalence relative to the CCT-K5 key comparison reference values are computed for each of the transfer standards.

Pair-wise degrees of equivalence inside EUROMET.T-K5 are available in the EUROMET.T-K5 Final Report (Tables 15 to 36).

Key comparisons CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5

MEASURAND : Temperature

NOMINAL TEMPERATURE : $T_{nom} = 1300 \text{ }^\circ\text{C}$

Degrees of equivalence relative to the CCT-K5 key comparison reference value

Lab*i*

	D_i	U_i
	/ K	
VSL	-0.045	0.322
NPL	-0.497	0.486
NMIA	0.000	0.165
KRISS	0.020	0.343
NIM	0.140	0.437
A*STAR	-0.795	0.459
NMIJ	0.210	0.393
VNIIM	-0.660	0.956
NIST	0.164	0.719
CENAM	-0.047	0.755
LNE-INM	-0.492	0.580
INRIM	0.064	0.284
PTB	0.024	0.283
NRC	0.129	0.835
A*STAR	0.09	0.76
KIM-LIPI	1.15	2.11
CMS/TRI	0.02	1.57

Lamp S/N C564

	D_i	U_i
	/ K	
CEM	0.11	0.35
IPQ	-0.18	0.98
UME	-1.71	0.51
MKEH	-1.45	1.97
SMU	-1.39	0.40
SP	-0.80	1.10
MIKES	-0.65	1.43
VSL	0.05	0.33

Lamp S/N C681

	D_i	U_i
	/ K	
CEM	0.03	0.35
IPQ	-0.48	1.01
UME	-1.78	0.53
MKEH	-1.60	2.16
SMU	-1.08	0.37
SP	-0.86	1.09
MIKES	-0.87	1.56
VSL	-0.10	0.30

Black: participants in CCT-K5

Green: participant in CCT-K5.1

Blue: participants in APMP.T-K5

Orange: participants in EUROMET.T-K5 (measurements with Lamp S/N C564)

Grey: participants in EUROMET.T-K5 (measurements with Lamp S/N C681)

Key comparisons CCT-K5 and CCT-K5.1

MEASURAND : Temperature

NOMINAL TEMPERATURE : $T_{nom} = 1300 \text{ }^\circ\text{C}$

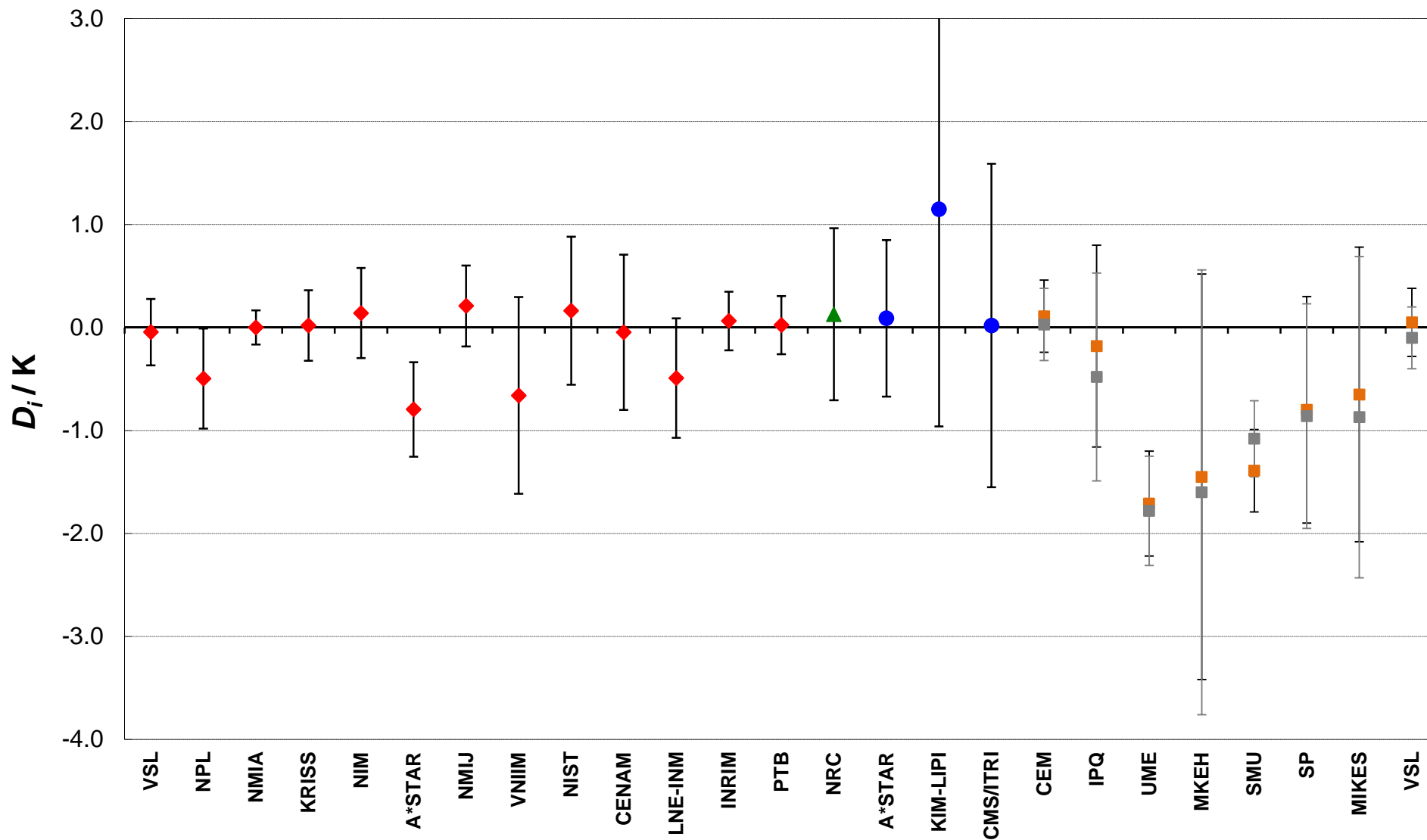
Matrix of equivalence

Pair-wise degrees of equivalence involving APMP.T-K5 participants are not computed.

Lab _i	D_i / U_i		VSL		NPL		NMIA		KRISS		NIM		A*STAR		NMIJ		VNIIM	
	D_i	U_i	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}
VSL	-0.045	0.322			0.452	0.545	-0.045	0.283	-0.065	0.403	-0.185	0.478	0.750	0.530	-0.255	0.456	0.615	0.990
NPL	-0.497	0.486	-0.452	0.545			-0.497	0.471	-0.517	0.550	-0.637	0.601	0.298	0.631	-0.707	0.591	0.163	1.051
NMIA	0.000	0.165	0.045	0.283	0.497	0.471			-0.020	0.292	-0.140	0.388	0.795	0.453	-0.210	0.362	0.660	0.951
KRISS	0.020	0.343	0.065	0.403	0.517	0.550	0.020	0.292			-0.120	0.461	0.815	0.557	-0.190	0.463	0.680	1.003
NIM	0.140	0.437	0.185	0.478	0.637	0.601	0.140	0.388	0.120	0.461			0.935	0.632	-0.070	0.531	0.800	1.045
A*STAR	-0.795	0.459	-0.750	0.530	-0.298	0.631	-0.795	0.453	-0.815	0.557	-0.935	0.632			-1.005	0.574	-0.135	1.030
NMIJ	0.210	0.393	0.255	0.456	0.707	0.591	0.210	0.362	0.190	0.463	0.070	0.531	1.005	0.574			0.870	1.015
VNIIM	-0.660	0.956	-0.615	0.990	-0.163	1.051	-0.660	0.951	-0.680	1.003	-0.800	1.045	0.135	1.030	-0.870	1.015		
NIST	0.164	0.719	0.208	0.760	0.660	0.845	0.163	0.708	0.143	0.763	0.023	0.800	0.958	0.823	-0.047	0.792	0.823	1.177
CENAM	-0.047	0.755	-0.002	0.796	0.450	0.872	-0.047	0.746	-0.067	0.798	-0.187	0.835	0.748	0.857	-0.257	0.827	0.613	1.200
LNE-INM	-0.492	0.580	-0.447	0.566	0.005	0.706	-0.492	0.493	-0.512	0.570	-0.632	0.619	0.303	0.649	-0.702	0.609	0.168	1.061
INRIM	0.064	0.284	0.108	0.379	0.560	0.524	0.063	0.259	0.043	0.385	-0.077	0.455	0.858	0.494	-0.147	0.441	0.723	0.974
PTB	0.024	0.283	0.068	0.512	0.520	0.625	0.023	0.430	0.003	0.516	-0.117	0.571	0.818	0.602	-0.187	0.560	0.683	1.034
NRC	0.129	0.835	0.174	0.895	0.625	0.966	0.129	0.851	0.109	0.902	-0.012	0.942	0.924	0.952	-0.082	0.922	0.789	1.269

Lab _i	D_i / U_i		NIST		CENAM		LNE-INM		INRIM		PTB		NRC	
	D_i	U_i	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}
VSL	-0.045	0.322	-0.208	0.760	0.002	0.796	0.447	0.566	-0.108	0.379	-0.068	0.512	-0.174	0.895
NPL	-0.497	0.486	-0.660	0.845	-0.450	0.872	-0.005	0.706	-0.560	0.524	-0.520	0.625	-0.625	0.966
NMIA	0.000	0.165	-0.163	0.708	0.047	0.746	0.492	0.493	-0.063	0.259	-0.023	0.430	-0.129	0.851
KRISS	0.020	0.343	-0.143	0.763	0.067	0.798	0.512	0.570	-0.043	0.385	-0.003	0.516	-0.109	0.902
NIM	0.140	0.437	-0.023	0.800	0.187	0.835	0.632	0.619	0.077	0.455	0.117	0.571	0.012	0.942
A*STAR	-0.795	0.459	-0.958	0.823	-0.748	0.857	-0.303	0.649	-0.858	0.494	-0.818	0.602	-0.924	0.952
NMIJ	0.210	0.393	0.047	0.792	0.257	0.827	0.702	0.609	0.147	0.441	0.187	0.560	0.082	0.922
VNIIM	-0.660	0.956	-0.823	1.177	-0.613	1.200	-0.168	1.061	-0.723	0.974	-0.683	1.034	-0.789	1.269
NIST	0.164	0.719			0.210	1.021	0.655	0.925	0.100	0.741	0.140	0.818	0.035	1.102
CENAM	-0.047	0.755	-0.210	1.021			0.445	0.928	-0.110	0.779	-0.070	0.851	-0.175	1.125
LNE-INM	-0.492	0.580	-0.655	0.925	-0.445	0.928			-0.555	0.626	-0.515	0.704	-0.620	1.016
INRIM	0.064	0.284	-0.100	0.741	0.110	0.779	0.555	0.626			0.040	0.484	-0.065	0.882
PTB	0.024	0.283	-0.140	0.818	0.070	0.851	0.515	0.704	-0.040	0.484			-0.105	0.881
NRC	0.129	0.835	-0.035	1.102	0.175	1.125	0.620	1.016	0.065	0.882	0.105	0.881		

CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5 Nominal temperature, $T_{\text{nom}} = 1300\text{ °C}$
 Degrees of equivalence, D_i , and expanded uncertainties ($k = 2$) U_i , expressed in K



Red diamonds: participants in CCT-K5
Green triangle: participant in CCT-K5.1
Blue circles: participants in APMP.T-K5

Orange squares: participants in EUROMET.T-K5 (measurements with Lamp S/N C564)
Grey squares: participants in EUROMET.T-K5 (measurements with Lamp S/N C681)