FINAL REPORT OF KEY COMPARISON EUROMET.AUV.V-K1

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Abstract

The first key comparison (KC) in the Regional Metrology Organization (RMO) EUROMET in the area of "vibration" (EUROMET.AUV.V-K1, Project Ref.-No. 579) was carried out from July 2003 to March 2005, piloted by the PTB. The objective was to link 11 European countries, which had not participated in the CIPM KC, to the key comparison reference values (KCRVs) established in the CIPM KC CCAUV.V-K1. The linking of the RMO KC to the CIPM KC was based on the "weighted mean method" using the results of three laboratories that had participated in both KCs. To measure the charge sensitivity of two transfer standards (accelerometers) at six specified frequencies in the range from 40 Hz to 5 kHz, ten laboratories used laser interferometry (ISO 16063-11) and four laboratories used comparison with a reference transducer (ISO 16063-21) traceable to PTB (EUROMET project ref. No. 198 providing traceability). The degrees of equivalence were computed for all calibration results of the RMO laboratories regarding (i) the KCRV, (ii) the other RMO laboratories' results, and (iii) the results of the 12 laboratories which had participated in the CIPM KC. In all cases the deviation D_i relative to the KCRV is smaller than the relative expanded uncertainty U_i (k = 2) of this difference, $D_i < U_i$ .The deviations D_{ij} between the laboratories are in nearly 99 % of all cases smaller than the relative expanded uncertainty U_{ij} (k = 2) of these differences. None of the calibration results (40 Hz to 5 kHz) exceeds a relative deviation of 1 % from the KCRV, and only a few results deviate by more than 0.5 % from the KCRV.

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1 Introduction

This report presents the results of the first key comparison (KC) in the Regional Metrology Organization (RMO) EUROMET in the area of “Vibration” (quantity of acceleration), EUROMET.AUV.V-K1. The RMO KC has been performed within the framework of the Agreed EUROMET Project Ref.-No. 579 with the title “European comparison in accelerometer calibration (EUROMET AUV.V-K1)” [1].

This report has the status of a Final report and, as such, supersedes the Draft B report of May, 2006 which was approved by the participants and the CCAUV. The Draft B report was based on the Draft A report. All participants had the opportunity to comment on and to agree to the contents. The complete set of results was accepted as presented in Draft A reported including the Appendices A, B and C. No controversial or contradictory comments were received by the pilot institute (coordinator of the Agreed EUROMET Project Ref.-No. 579). The participants have reached consensus on the methodology for linking the calibration results with those of the corresponding CIPM KC CCAUV.V-K1 [2]. In accordance with the Guidelines [6], [7] the methodology for linking and the resulting degrees of equivalence (DOEs) relative to the Key comparison reference value (KCRV) and to the results of the participants of CCAUV-K1 are reported in an Appendix of this Final report, i.e. Appendix A. The Appendices of Report A are no longer valid: The information given in the Appendices of Report A has been implemented appropriately in the main part of Report B and its Appendices A, B and C, and, thus, in the Final report.

A Draft Report B dated March 2006 was distributed to all participating laboratories for comments. Draft Report B including the comments (see Appendix C) was discussed at the Meeting of the EUROMET TC – AUV, Sub-Committee “Acceleration and Vibration” held in April 2006 in Copenhagen. Report B was unanimously approved at that Meeting (including the approval by the NMi-VSL representative who had explained the NMi-VSL-internal problems which prevented to submit a calibration report - see section 2 Participants). Taking the (editorial) amendments discussed at the Sub-Committee Meeting of Copenhagen into account, the updated Report B of May 2006 was issued and submitted to the BIPM (Executive Secretary of CCAUV) and to the EUROMET TC – AUV Chairman. The BIPM distributed Report B to the CCAUV members for review. No adverse comments were received.

The Final report was approved at the 5th Meeting of the CIPM Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV) which took place in September 2006 at the BIPM in Sèvres.

The Technical Protocol [3] specifies in detail the aim and the task of the comparison, the conditions of measurement, the transfer standards used, measurement instructions, time schedule and other items. A brief overview is given in the following sections.

2 Participants

In Table 1, 16 institutes/laboratories which calibrated the travelling standards are listed.

Results of NMi-VSL were not available for this report.

Results of CSIC-IA are given in Appendix B of this report.

NOTE:
Spain is represented by its National Metrology Institute CEM, the results of which have been included in the linking procedures and will appear in Appendix B of the KCDB. Treating the results of the CSIC-IA in an Appendix is appropriate as only one official participant per country can feature in the KCDB. In this way, the CSIC-IA results are not included in any linking mechanism, nor will their results appear in Appendix B of the KCDB with degrees of equivalence. They are, however, included in the report appendix with an appropriate discussion about the deviations of their calibration results from the other results for one of the two travelling standards (SE accelerometer) at high frequencies. This may satisfy the needs of the CSIC-IA towards their accreditation in the field of vibration. This way of accepting CSIC-IA as participant of EUROMET.AUV-V-K1 with the specific presentation and treatment of the CSIC-IA results as above stated is based on a decision by the BIPM in agreement with the coordinator of the agreed EUROMET Project Ref.-No. 579 and the Chairman of EUROMET TC AUV.

Table 1: List of institutes/laboratories which calibrated the travelling standards [1)]

Participant (laboratory name)	Acronym	Country	Country Code	Calibration period
Bundesamt für Eich- und Vermessungswesen	BEV	Austria	AT	July 2004
Bureau National de Métrology – CEA/CESTA/LEA	BNM - CEA/CESTA/ LEA	France	FR	July/August 2003
Spanish Center of Metrology	CEM	Spain	ES	September 2004
Czech Metrology Institute	CMI	Czech Republic	CZ	May 2004
Institute of Metrology "G. Colonnetti"-CNR	IGMC-CNR	Italy	IT	December 2003
CSIC-Institute of Acoustics [2)]	CSIC-IA	Spain	ES	March 2004
Danish Primary Laboratory of Acoustics	DPLA	Denmark	DK	October 2003
Budapest University of Technology and Economics	GBARL	Hungary	HU	June 2004
Central Office of Measures	GUM	Poland	PL	September 2003
National Institute of Engineering, Technology and Innovation	INETI	Portugal	PT	March 2004
Metrologie und Akkreditierung Schweiz	METAS	Switzerland	CH	October 2004
Netherlands Meetinstituut, Van Swinden Laboratorium [3)]	NMi-VSL	Netherlands	NL	November 2003 [4)] July 2004 [5)]
Physikalisch-Technische Bundesanstalt	PTB	Germany	DE	July 2003 [6)]
SIRA Instrument Test and Calibration	SIRA	United Kingdom	UK	November 2004 [7)] March 2005 [8)]
Swedish National Testing and Research Institute	SP	Sweden	SE	February 2004
Tübitak Ulusal Metroloji Enstitüsü	UME	Turkey	TR	May/June 2004

[1)]The Institutes/Laboratories are listed here in alphabetical order. Note that in the tables and graphs presenting the results, the numbers *i* have been assigned in another order (see section 9.2). From the 16 laboratories listed in Table 1, two laboratories marked by [2)] and [3)] have not been included in the tables prepared for linking the results with those of the corresponding CCAUV Key comparison.

[2)] For the reasons outlined in the NOTE the results of CSIC-IA are given in an individual way, see Appendix B

[3)] Results of NMi-VSL were not available for this report.

[4)] The contact person of NMi-VSL declared later that at this scheduled date, no reliable calibration results were achieved for NMi-VSL internal reasons. He asked to send him the travelling standards once more.

[5)] Second calibration of both travelling standards at NMi-VSL.

[6)] In addition, interim calibrations/checks were carried out at the PTB in September 2003, January 2004, April 2004, July 2004, December 2004, January 2005.

[7)] Calibration of BB accelerometer. For SIRA-internal reasons SIRA had applied to calibrate the SE accelerometer at a later date.

[8)] Calibration of SE accelerometer (see [7)])

3 Aim and task of the comparison

The EUROMET KC of accelerometer calibration, EUROMET.AUV.V-K1, was organized to disseminate the key comparison reference values, which were established in the CIPM KC CCAUV.V-K1, within the RMO EUROMET. The first KC in the area of vibration organized under the auspices of the Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV) and piloted by the Physikalisch-Technische Bundesanstalt (PTB) was carried out between January 2000 and June 2001. Twelve National Metrology Institutes (NMIs) from the five RMOs APMP, COOMET, EUROMET, SADCMET, and SIM participated. All NMIs used laser interferometry in compliance with the International Standard ISO 16063-11:1999 [4] to measure the charge sensitivity of two transfer standards from 40 Hz to 5 kHz at 22 frequencies (third-octave frequency series) with specified uncertainties. The "weighted mean method" was selected and used for computing the key comparison reference values (KCRVs) and the degrees of equivalence relative to the KCRVs. The results of the CCAUV.V-K1 are a set of KCRVs, their uncertainties, and degrees of equivalence both for each laboratory with respect to the KCRV and between the laboratories. The results and conclusions of the key comparison CCAUV.V-K1 are specified in detail in *Metrologia* 40 Tech. Suppl. 09001, 2003 [2].

In accordance with the procedures defined by the BIPM, the dissemination of the KCRVs established in CCAUV.V-K1 to the European countries (i.e. those within the RMO EUROMET) is to be provided by the "linking laboratories". The laboratories, which have calibrated the respective travelling standards in both the CIPM KC and the EUROMET KC were NMIs: BNM-CESTA, CMI, NMi-VSL and PTB. As no calibration results from NMi-VSL within this EUROMET comparison were available, the link-up of the EUROMET comparison to the CIPM comparison will be provided by the three linking laboratories BNM - CEA/CESTA/LEA, CMI and PTB.

The principal task of each participating laboratory of the comparison is the measurement of the charge sensitivity of two accelerometer standards (one of single-ended design and one of back-to-back design) at frequencies and acceleration amplitudes specified in clause 4. The charge sensitivity shall be calculated as the ratio of the amplitude of the output charge of the accelerometer to the amplitude of the acceleration at its reference surface. The reference surface is the base or mounting surface of the accelerometer of single-ended design, and the top surface of the accelerometer of back-to-back design. The charge sensitivity shall be given in pico coulombs per metres per second squared: pC/(m/s²), for the different measurement conditions specified below.

To calibrate two accelerometers, Primary vibration calibration by laser interferometry in accordance with ISO 16063-11 [4] or vibration calibration by comparison to a reference accelerometer in accordance with ISO 16063-21 [5] was to be used. The latter method was applicable only if the participating laboratory had been supplied with traceability by primary calibration of reference accelerometers at the PTB on the basis of the agreed EUROMET project ref. No. 198.

To measure the output charge of the accelerometer standards, a calibrated charge amplifier shall be used. For the calibration of the charge amplifier, see clause 5.

<u>Recommendation: expanded uncertainty of measurement</u> (coverage factor k = 2) determined by the participating laboratories should be in the approximate range of

- 0,5 % to 1 % or smaller, if laser interferometry is used,
- 1 % to 2 % or smaller, if the comparison method is used.

Note: The participating laboratory was required to report the measurement results of the charge sensitivity and the associated uncertainties individually as they were calculated for any specified measurement condition (in particular, for a given frequency), <u>without</u> applying any curve fitting procedure which is frequently used to suppress deviations from a "flat" frequency response.

4 Conditions of measurement

The participating laboratories observed fully or to a large extent the conditions stated in the Technical Protocol, i.e.:

- frequencies in Hz :

  40 Hz, 80 Hz, 160 Hz, 800 Hz, 2 kHz and 5 kHz (160 Hz is reference frequency)

  Calibrations at these frequencies were mandatory and will be linked to the respective frequencies of the CIPM Key comparison. Optionally, several laboratories measured at other frequencies in addition. All calibration results submitted to the coordinator of the EUROMET Project [1] were reported in Appendix A of Report A but the linking to the CIPM-KC will only performed for the six comparison frequencies stated above.
- amplitudes: The recommended range of 10 m/s² to 200 m/s² (preferably:100 m/s², if needed: up to 300 m/s²) was complied with.
- ambient temperature and accelerometer temperature during the calibration:

  23°C ± 3 K (actual values to be stated within tolerances of ±0,5 K).
- relative humidity: max. 75%.
- mounting torque of the accelerometer: (2 ± 0,1) N·m.

The comparison was performed in compliance with the “Guidelines for CIPM key comparisons” [6].

5 Transfer standards

During the preparatory stage of 18 months (July 2002 to June 2003), the pilot laboratory thoroughly investigated the characteristics (long-term stability, linearity, etc.) of various reference standard accelerometers (property of PTB) considered to be candidates for the transfer standards to be used in the key comparison. As transfer standards, PTB selected three piezoelectric accelerometers appropriate to compare the capabilities of the participating laboratories for calibration of accelerometers of back-to-back (BB) design and of single-ended (SE) design. The investigation of the long-term stability was continued throughout the circulation period. The results of the PTB stability measurements and other individual data of the transfer standards are given in sub-section 9.2 (RESULTS – PART 1).
PTB provided the following transfer standards:

(a) BB accelerometer for (primary) vibration calibration by laser interferometry
(b) BB accelerometer for (secondary) vibration calibration by comparison
(c) SE accelerometer for vibration calibration by laser interferometry and comparison, respectively
The BB and SE accelerometers were of the same type as those used in the CIPM KC (BB type 8305, SE type 8305 WH 2335, manufacturer Brüel & Kjær).

BB accelerometer (a) was provided by PTB with the top surface polished for sensing the motion without any additional reflector. The reflectivity of the polished top surface was 80% or higher, and the flatness over the top surface in the order of 1 μm.

BB accelerometer (b) was a usual back-to-back version allowing a laboratory reference accelerometer of single-ended design to be mounted on the top surface. In this way, the vibration calibration of the BB accelerometer (b) by comparison could be performed as “Secondary calibration” with a reference accelerometer that had been calibrated by laser interferometry at PTB within the Agreed EUROMET Project Ref.-No. 198 [8].

SE accelerometer (c) was a usual single-ended version to be mounted on an optically reflecting moving part or adapter for calibration by laser interferometry [4] or on the top surface of the laboratory BB reference accelerometer for calibration by comparison [5].

Specifications of Accelerometer A: transfer standard accelerometer (single ended), type 8305 WH 2335 (manufacturer Brüel & Kjær); weight: 26 grams, length: 22 mm, width over flats of hexagonal faces: 16 mm, mounting thread: 10-32 UNF-2B, electrical connector: coaxial 10-32 UNF-2A thread, accelerometer capacitance: ≈ 75 pF, sensitivity:≈ 0,13 pC/(m/s^2). For further details, see sub-section 9.1.

Specifications of Accelerometer B and Accelerometer C: reference standard accelerometer (back-to-back) type 8305 (manufacturer Brüel & Kjær), weight: 40 grams, length: 29 mm, width over flats of hexagonal faces: 16 mm, mounting thread: 10 - 32 UNF - 2B, electrical connector: coaxial 10 – 32 UNF - 2A thread, accelerometer capacitance: ≈ 75 pF, sensitivity: ≈ 0,13 pC/(m/s^2 For further details, see sub-section 9.2.

6 Circulation type and transportation

A modified star type was applied with loops through two to three participating laboratories and the pilot laboratory. The pilot laboratory checked the long-term stability and the state of the mounting surfaces. In all cases, the mounting surfaces were re-lapped to provide optimum conditions for the following loop.

The transfer standards were transported in a closed box by an international transportation agency (e.g. TNT).

7 Measurement instructions

In accordance with the Technical Protocol [3], the participating laboratories observed the following instructions:

- The charge amplifier used in the laboratory was to be calibrated using a standard capacitor and standard voltmeter, both traceable to national standards. The calibration of the charge amplifier was to be carried out shortly before the calibration, using values of the electric quantities similar to those found in accelerometer calibration.
- In order to suppress the effect of any non-rectilinearity of the motion, the displacement was to be measured at least at three different points. These points were to be equally spaced on the top surface of the back-to-back accelerometer or on the base surface of the single-ended accelerometer. For the linking laboratories (cf. section 3), this was a requirement. For the other participating laboratories using laser interferometry, this was a recommendation.
- For the accelerometer of single-ended design, the reference surface for acceleration measurement is, by definition, the basis surface (mounting surface) of the accelerometer. If this surface was covered during calibration, the motion had to be sensed on the moving part close to the accelerometer. Alternatively, the motion could be sensed at the base surface of the accelerometer via longitudinal holes in the moving part of the vibration exciter.
- For the accelerometer of back-to-back design, the motion was to be sensed at the top surface (polished) without any dummy mass; no reflector (e.g. corner cube) had to be attached to the top surface. The reflectivity of the polished top surface was to be 80% or higher, and the flatness over the top surface was in the order of 1 μm.
- The mounting surfaces of the accelerometer and the moving part of the vibration exciter were to be slightly lubricated before mounting.
- In calibration of BB accelerometer (a) by laser interferometry the motion was to be sensed at the top surface (polished) without any dummy mass; no reflector (e.g. corner cube) must be attached to the top surface.
- In secondary calibration of BB accelerometer (b) by comparison to a SE reference accelerometer of the laboratory, mounted on the top surface of the BB accelerometer (b) must have been periodically calibrated at PTB by laser interferometry (ISO 16063-11 [5]) within the framework of the Agreed EUROMET Project Ref.-No. 198 [8] providing traceability.

- Primary calibration of SE accelerometer (c) by laser interferometry:

  The reference surface for acceleration measurement is by definition the base or mounting surface of the accelerometer. If this surface is covered during the calibration, the motion is to be sensed on the moving part close to the accelerometer. Alternatively, the motion could be sensed at the mounting surface of the accelerometer via longitudinal holes in the moving part of the vibration exciter. ISO 16063-11 was to be observed.

- Calibration of SE accelerometer (c) by comparison to a reference accelerometer:

  The accelerometer was to be calibrated according to ISO 16063-21 by comparison to a reference accelerometer traceable to PTB in accordance with the Agreed EUROMET Project Ref.-No. 198 [8]. The reference accelerometer of the calibrating laboratory could be of the so-called back-to-back type meant for direct mounting of the accelerometer (c) to be calibrated on top of it in a so-called back-to-back configuration. It could also be a reference accelerometer with normal mounting provisions used underneath a fixture in line with accelerometer (c). For calibrators, the reference accelerometer could be an integral part of a moving element. In each case, traceability to PTB within the framework of the Agreed EUROMET Project [8] was a prerequisite for participation of those laboratories not equipped with laser interferometry, in the EUROMET KC.

- For each of the two accelerometers, the calibration was carried out in accordance with the usual procedure of the laboratory.

8 Communication of the results to the pilot laboratory

The calibration report should be submitted to the pilot laboratory within 6 weeks after the calibration and contain detailed descriptions of:

- the calibration equipment
- the calibration method(s) used
- the ambient conditions
- the mounting technique
- the calibration results
- the uncertainty budget(s)

In addition to the calibration report, the measurement results should be submitted to the pilot laboratory on a diskette formatted to be compatible with a 3.5 inch PC disk drive or on a CD, and in advance by electronic mail, with the data in *Excel* or ASCII text format.

For reporting the calibration results, clause 10 of ISO 16063-11:1999 [4] and clause 7 of ISO 16063-21 [5], respectively, should be taken into account. For uncertainty, the following instructions were given:

The list(s) of the principal components of the uncertainty budget should be in accordance with ISO 16063-11:1999, Annex A for the primary calibration by laser interferometry according to method 1 ("fringe-counting method"), method 2 ("minimum-point method") and/or method 3 ("sine-approximation method"). For vibration calibration by comparison to a reference accelerometer, Annex A of ISO

16063-21 should be taken into account. In each case, the uncertainties should be determined in accordance with the Guide to the expression of uncertainty in measurement [9], which is adapted to the calibration of vibration and shock transducers in ISO 16063-1:1998 [10], Annex A.

9 RESULTS OF THE MEASUREMENTS

9.1. General considerations

The tables and figures in sub-section 9.2 are marked by the letter “S” for “standard” to indicate that investigated metrological characteristics of the travelling standards are reported.

For the sake of distinction “R” will be used in sub-section 9.3 to mark the official calibration results submitted by the participating laboratories. Moreover, the acronym of the respective laboratory (e.g. BEV) is given to identify the individual laboratory results.

Letter “E” is used to mark those tables and figures that provide data for the degrees of equivalence of the participants’ results on the EUROMET level (i.e. between each other and to the EUROMET reference value established for the reasons explained in 9.4).

The letter “L” is used to mark those tables and figures which provide data for linking the EUROMET calibration results to the CIPM KC results, see Appendix A.

In each case, the letters “a”, “b” and “c” are added to mark the accelerometer for which a table or figure is valid. In Section 5, this marking was introduced in the following way:

(a) BB accelerometer for (primary) vibration calibration by laser interferometry

(b) BB accelerometer for (secondary) vibration calibration by comparison

(c) SE accelerometer for vibration calibration by laser interferometry and comparison, respectively.

For the sake of lucidity of the captions of tables and figures, the accelerometers “a”, and “b” are named:

(a) BB accelerometer for primary calibration

(b) BB accelerometer for secondary calibration

Table 2: Numbering of the participating institutes/laboratories for presentation of results

numbering *i*	**NMI**
Lab. 1	PTB
Lab. 2	BNM-CEA/CESTA/LEA
Lab. 3	GUM
Lab. 4	DPLA
Lab. 5	CNR-IMGC
Lab. 6	SP
Lab. 7	INETI
Lab. 8	CMI
Lab. 9	UME
Lab. 10	GBARL
Lab. 11	BEV
Lab. 12	CEM
Lab. 13	METAS
Lab. 14	SIRA

9.2. RESULTS - PART 1: Data of individual transfer standards (accelerometers)

9.2.1. Survey

The Technical Protocol specified for the individual accelerometer standards (briefly referred to as BB and SE accelerometers)

- the nominal charge sensitivity of 0.13 pC/(m/s²) and
- the max. transverse sensitivity at 30 Hz: ≤ 1%

In addition, the PTB measured

- the frequency response,
- the long-term stability,
- the amplitude linearity

and provided data about

- the individual max. transverse sensitivity
- the temperature sensitivity
- the torque sensitivity
- the loading mass influence on BB accelerometer sensitivity.

In addition to the initial investigations of the metrological behaviour of the accelerometers, PTB carried out interim calibrations and checks whenever they returned from any loop through a couple of partner laboratories (modified star type of circulation, see section 6). In this way it was possible to identify a change of sensitivity of the SE accelerometer which clearly had happened at any time during its loop through the laboratories SP (February 2004) - INETI (March 2004) – CSIC-IA (March 2004). The check performed at PTB in January 2004 after the preceding loop (i.e. return of the transfer standards from CNR-IMGC) had confirmed that the SE sensitivity had not changed significantly since the beginning of the long-term stability tests (see sub-section 9.2.3) before transportation to SP by TNT (for transportation, see section 6). The check measurements performed at PTB in April 2004 after return of the two travelling accelerometers from CSIC-IA revealed that the SE sensitivity had dramatically changed (up to 0.7 %, frequency-dependent). Moreover PTB noted some traces of inappropriate handling of the SE accelerometer. To identify which laboratory had damaged the SE accelerometer, the coordinator (PTB) contacted the three laboratories SP, INETI and CSIC-IA, and analyzed the available results of 15 laboratories (including CSIC-IA). It was not possible to clarify unequivocally where at what time during the loop (February to March 2004) the damage happened. However, PTB succeeded in identifying the long-term stability of the SE accelerometer after its damage so that its changed sensitivity could be taken into account by correction of all SE calibration results obtained in the further loops (beginning with CMI in May 2004). Moreover, a specific procedure is applicable to link - in accordance with GUM [9] - also the two laboratories SP and INETI to the CIPM KC, considering the uncertainty whether their SE calibration results were already affected by the change in sensitivity or not. (As explained in section 2 and Appendix B, CSIC-IA is not included in the linking procedure).

For details see subsection 9.2.3 (Long-term stability).

9.2.2. Frequency response

When calibrating single-ended accelerometers by laser interferometer, any laboratory faces the well-known problem that the motion to be measured at the reference surface (i.e. mounting surface at the bottom of the accelerometer) is usually not accessible to the measuring laser light beam. The motion sensed by the laser light spot close to the accelerometer may differ from that which the accelerometer is exposed to. Such “relative motion“ often occurs at high frequencies in the kHz range due to membrane-like vibrations of the exciter’s moving part or of any mounting fixture used (e.g. an optically reflecting steel disk mounted between moving table and accelerometer).

Piezo-electric accelerometers behave like second-order mechanical systems with a high resonance frequency. The measurement of their frequency response measurement is distorted just by the amount of the relative motion which also increases with frequency.

The special acceleration exciters designed and developed at PTB as sub-systems of the national standards used (Medium-frequency acceleration standard and High-frequency acceleration standard, briefly referred to as MF-A Standard and HF-A Standard, respectively) are free of significant relative motion effects over the operational frequency ranges. This was confirmed by investigations using scanning interferometry and differential “two-point” laser vibrometers.

Moreover, to measure the frequency response of the transfer standards accurately and reliably, primary calibrations of each of the three accelerometers were carried out at the PTB by using different methods and techniques: with the MF-A Standard (Michelson homodyne interferometer, fringe-counting method), and the high HF-A Standard (Mach-Zehnder heterodyne interferometer, sine-approximation method). The air-borne acceleration exciters of the two standard devices (national standards) largely differ in design and dimensions.

Further information on the “real” frequency response of the accelerometers was obtained by PTB measurements of their resonance frequencies and damping.

The investigations revealed that the transfer standards behave in good approximation as second-order systems whose charge sensitivity increases by ~2 % (BB accelerometers) and ~3 % (SE accelerometer) if the frequency changes from 40 Hz to 5 kHz. This is demonstrated in

- Figure S1a for BB accelerometer type 8305 S/N 2355677
- Figure S1b for BB accelerometer type 8305 S/N 606559
- Figure S1c for SE accelerometer type 8305WH2335 S/N 2361558

However, the frequency response given in Tables S1c (MF) and S1c (HF) as well as in Figure S1c was measured before the SE accelerometer was affected by some damage (see sub-sections 9.2.1 and 9.2.3).

In the following tables, the calibration methods used are abbreviated with FCM (Fringe-counting method) and SAM (Sine-approximatiom method), see sub-section 9.3.1.

BB accelerometer 8305 S/N 2355677
MF Acceleration standard (Method: FCM)

Table S1a (MF): Charge sensitivity of BB accelerometer for primary calibration as a function of frequency. PTB results obtained by FCM (MF-A Standard)

Frequency Hz	**Charge sensitivity (Mean)** pC/(m/s²)	**Rel. standard deviation (Trials)** $\times 10^{-2}$	**Rel. combined uncertainty (k = 1)** $\times 10^{-2}$
10	0.12805	0.07	0.05
12.5	0.12804	0.15	0.05
16	0.12799	0.05	0.05
20	0.12801	0.05	0.05
25	0.12799	0.06	0.05
32	0.12798	0.05	0.05
40	0.12798	0.06	0.05
50	0.12798	0.05	0.05
63	0.12796	0.05	0.05
80	0.12797	0.04	0.05
100	0.12797	0.05	0.05
125	0.12800	0.04	0.05
160	0.12801	0.05	0.05
200	0.12813	0.08	0.05
250	0.12814	0.06	0.05
315	0.12813	0.04	0.05
400	0.12810	0.04	0.05
500	0.12813	0.04	0.05
630	0.12818	0.04	0.05
800	0.12826	0.06	0.05
1000	0.12830	0.09	0.10
1250	0.12830	0.07	0.10
1600	0.12830	0.15	0.10
2000	0.12855	0.09	0.10
2500	0.12890	0.32	0.10

BB accelerometer 8305 S/N 2355677
HF Acceleration standard (Method: SAM)

Table S1a (HF): Charge sensitivity of BB accelerometer for primary calibration as a function of frequency. PTB results obtained by SAM (HF-A Standard)

Frequency **Hz**	**Charge sensitivity (Mean)** **pC/(m/s²)**	**Rel. standard deviation (Trials)** **$\times 10^{-2}$**	**Rel. combined uncertainty (k = 1)** **$\times 10^{-2}$**
500	0.12802	0.05	0.05
630	0.12806	0.03	0.05
800	0.12813	0.03	0.05
900	0.12812	0.05	0.05
1000	0.12815	0.04	0.05
1100	0.12819	0.04	0.05
1250	0.12826	0.04	0.05
1400	0.12829	0.03	0.05
1600	0.12838	0.04	0.05
1800	0.12846	0.04	0.05
2000	0.12855	0.04	0.05
2200	0.1286	0.08	0.10
2500	0.12881	0.05	0.10
2800	0.12894	0.04	0.10
3000	0.12912	0.04	0.10
3150	0.12918	0.03	0.10
3500	0.12942	0.07	0.10
4000	0.12978	0.12	0.10
4500	0.13019	0.14	0.10
5000	0.13077	0.08	0.10

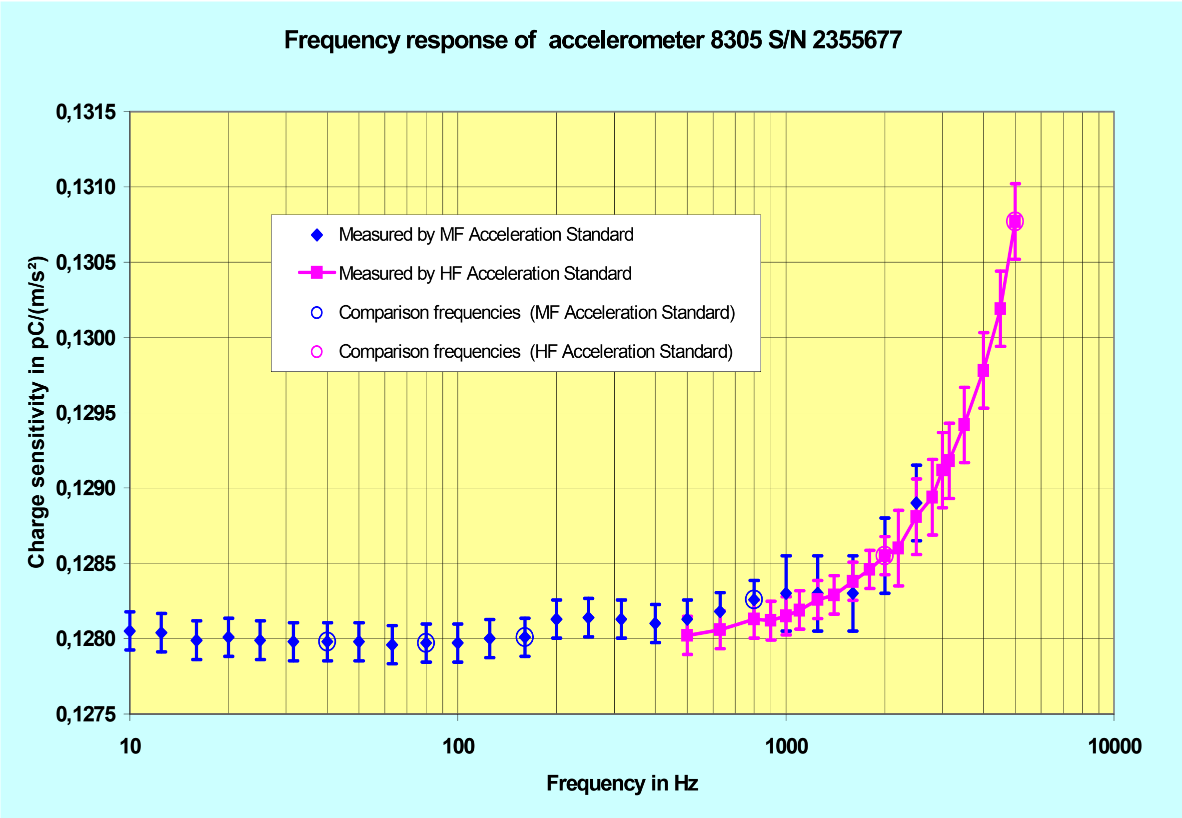

Figure S1a: Frequency response of BB accelerometer for primary calibration according Tables S1a (MF) and S1a (HF). Uncertainty bar is valid for coverage factor k = 2.

BB accelerometer 8305 S/N 606559
MF Acceleration standard (Method: FCM)

Table S1b (MF): Charge sensitivity of BB accelerometer for secondary calibration as a function of frequency. PTB results obtained by FCM (MF-A Standard)

Frequency Hz	**Charge sensitivity (Mean)** pC/(m/s²)	**Rel. standard deviation (Trials)** $\times 10^{-2}$	**Rel. combined uncertainty (k = 1)** $\times 10^{-2}$
10	0.12646	0.15	0.05
12.5	0.12651	0.12	0.05
16	0.12651	0.09	0.05
20	0.12650	0.07	0.05
25	0.12650	0.06	0.05
31.5	0.12649	0.06	0.05
40	0.12648	0.06	0.05
50	0.126470	0.08	0.05
63	0.12645	0.07	0.05
80	0.12644	0.06	0.05
100	0.12644	0.05	0.05
125	0.12645	0.07	0.05
160	0.12646	0.08	0.05
200	0.12652	0.09	0.05
250	0.12648	0.06	0.05
315	0.12676	0.26	0.05
400	0.12648	0.06	0.05
500	0.12648	0.05	0.05
630	0.12650	0.06	0.05
800	0.12655	0.08	0.05
1000	0.12656	0.07	0.10
1250	0.12659	0.09	0.10
1600	0.12640	0.33	0.10
2000	0.12664	0.10	0.10
2500	0.12723	0.41	0.10

BB accelerometer 8305 S/N 606559
HF Acceleration standard (Method: SAM)

Table S1b (HF): Charge sensitivity of BB accelerometer for secondary calibration as a function of frequency. PTB results obtained by SAM (HF-A Standard)

Frequency **Hz**	**Charge sensitivity (Mean)** **pC/(m/s²)**	**Rel. standard deviation (Trials)** **$\times 10^{-2}$**	**Rel. combined uncertainty (k = 1)** **$\times 10^{-2}$**
900	0.12645	0.05	0.05
1000	0.12647	0.05	0.05
1100	0.12651	0.05	0.05
1250	0.12656	0.05	0.05
1400	0.12657	0.04	0.05
1600	0.12665	0.04	0.05
1800	0.12672	0.03	0.05
2000	0.12678	0.04	0.05
2200	0.12688	0.07	0.1
2500	0.12709	0.15	0.1
2800	0.12718	0.05	0.1
3000	0.12733	0.06	0.1
3150	0.12741	0.07	0.1
3500	0.12767	0.08	0.1
4000	0.12806	0.14	0.1
4500	0.12848	0.09	0.1
5000	0.12900	0.10	0.1

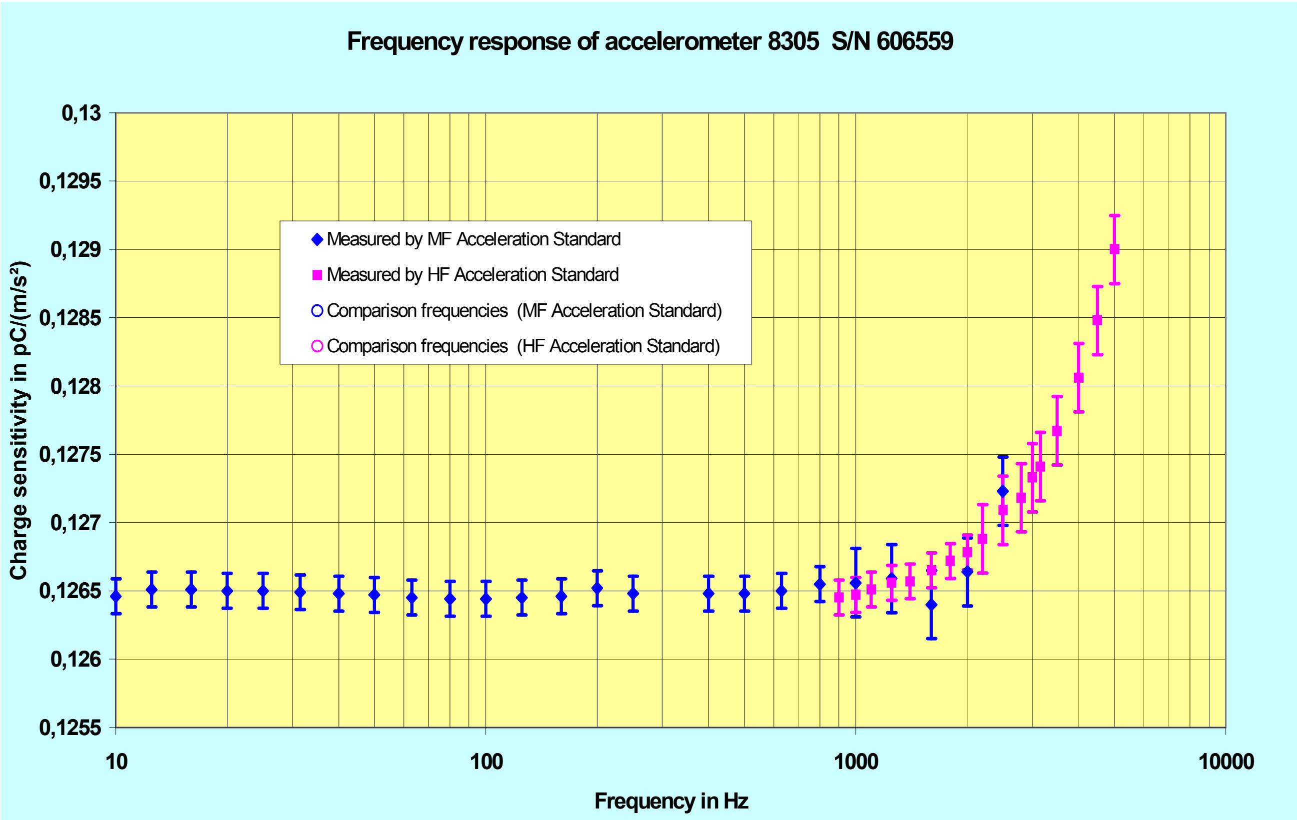

Figure S1b: Frequency response of BB accelerometer for secondary calibration according to Tables S1b (MF) and S1b (HF). Uncertainty bar is valid for coverage factor k = 2.

SE accelerometer 8305WH2335 S/N 2361558
MF Acceleration standard (Method: FCM)

Table S1c (MF): Charge sensitivity of SE accelerometer as a function of frequency. PTB results obtained by FCM (MF-A Standard)

Frequency **Hz**	**Charge sensitivity (Mean)** **pC/(m/s²)**	**Rel. standard deviation (Trials)** **$\times 10^{-2}$**	**Rel. combined uncertainty (k = 1)** **$\times 10^{-2}$**
10	0.12588	0.10	0.05
12.5	0.12588	0.08	0.05
16	0.12587	0.07	0.05
20	0.12586	0.09	0.05
25	0.12588	0.07	0.05
31.5	0.12588	0.07	0.05
40	0.12588	0.06	0.05
50	0.12587	0.07	0.05
63	0.12587	0.07	0.05
80	0.12589	0.07	0.05
100	0.12589	0.07	0.05
125	0.12589	0.06	0.05
160	0.12592	0.06	0.05
200	0.12603	0.10	0.05
250	0.12602	0.09	0.05
315	0.12604	0.08	0.05
400	0.12605	0.06	0.05
500	0.12610	0.06	0.05
630	0.12614	0.05	0.05
800	0.12619	0.09	0.05
1000	0.12626	0.10	0.10
1250	0.12631	0.11	0.10
1600	0.12633	0.11	0.10
2000	0.12665	0.17	0.10
2500	0.12699	0.23	0.10

Accelerometer 8305WH2335 S/N 2361558
HF Acceleration standard (Method: SAM)

Table S1c (HF): Charge sensitivity of SE accelerometer according as a function of frequency. PTB results obtained by SAM (HF-A Standard)

Frequency **Hz**	**Charge sensitivity (Mean)** **pC/(m/s²)**	**Rel. standard deviation (Trials)** **$\times 10^{-2}$**	**Rel. combined uncertainty (*k* = 1)** **$\times 10^{-2}$**
500	0.12601	0.07	0.05
630	0.12603	0.08	0.05
800	0.12612	0.06	0.05
900	0.12611	0.05	0.05
1000	0.12616	0.04	0.05
1100	0.12620	0.04	0.05
1250	0.12630	0.04	0.05
1400	0.12632	0.03	0.05
1600	0.12645	0.05	0.05
1800	0.12654	0.04	0.05
2000	0.12665	0.04	0.05
2200	0.12677	0.04	0.1
2500	0.12698	0.06	0.1
2800	0.12717	0.05	0.1
3000	0.12736	0.05	0.1
3150	0.12755	0.11	0.1
3500	0.12784	0.06	0.1
4000	0.12837	0.06	0.1
4500	0.12892	0.16	0.1
5000	0.12955	0.07	0.1

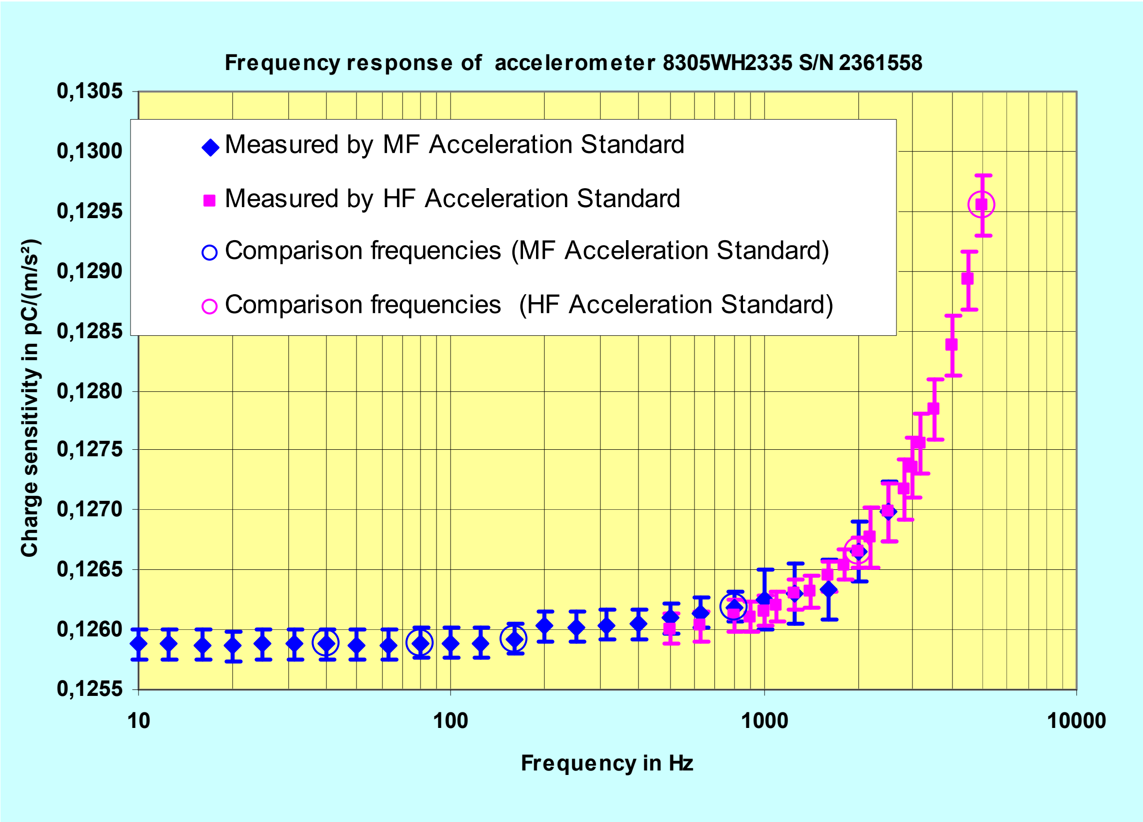

Figure S1c: Frequency response of SE accelerometer according to Tables S1c (MF) and S1c (HF). Uncertainty bar is valid for coverage factor *k* = 2.

9.2.3. Long-term stability

The investigations of the long-term stability were carried out at PTB during the preparatory stage (July 2002 to June 2003) and continued over the circulation period whenever the transfer standards returned to PTB during and at the end of the circulation period. Different tests were carried out at the PTB to investigate the long-term stability. At the reference frequency of 160 Hz, repeated series of charge sensitivity measurements were carried over a period of about 2 years. Moreover, long-term tests were performed in order to observe the long-term stability in the extended frequency series from 10 Hz to 10 kHz.

Tables S2a and 2b as well as Figures S2a and S2b show that no significant change in the charge sensitivity of the two BB accelerometers type 8305 No 2355677 and No 606559 occurred during the circulation period. If there was any drift at all, it was far below 0.1%. As the long-term stability investigations proved the stable behaviour of both accelerometers, their charge sensitivity is considered constant during the circulation period.

BB Accelerometer 8305 No 2355677

Table S2a: Charge sensitivity of BB accelerometer for primary calibration as a function of time. PTB results

Date	Time	Charge sensitivity	Rel. combined uncertainty (k = 1)
month year	in months	in pC/(m/s²)	$\times 10^{-2}$
Sep 2002	1	0.12811	0.05
Nov 2002	3	0.12811	0.05
May 2003	9	0.12816	0.05
Jun 2003	10	0.12812	0.05
Sep 2003	13	0.12811	0.05
Jan 2004	17	0.12816	0.05
Apr 2004	20	0.12815	0.05
Jul 2004	23	0.12813	0.05

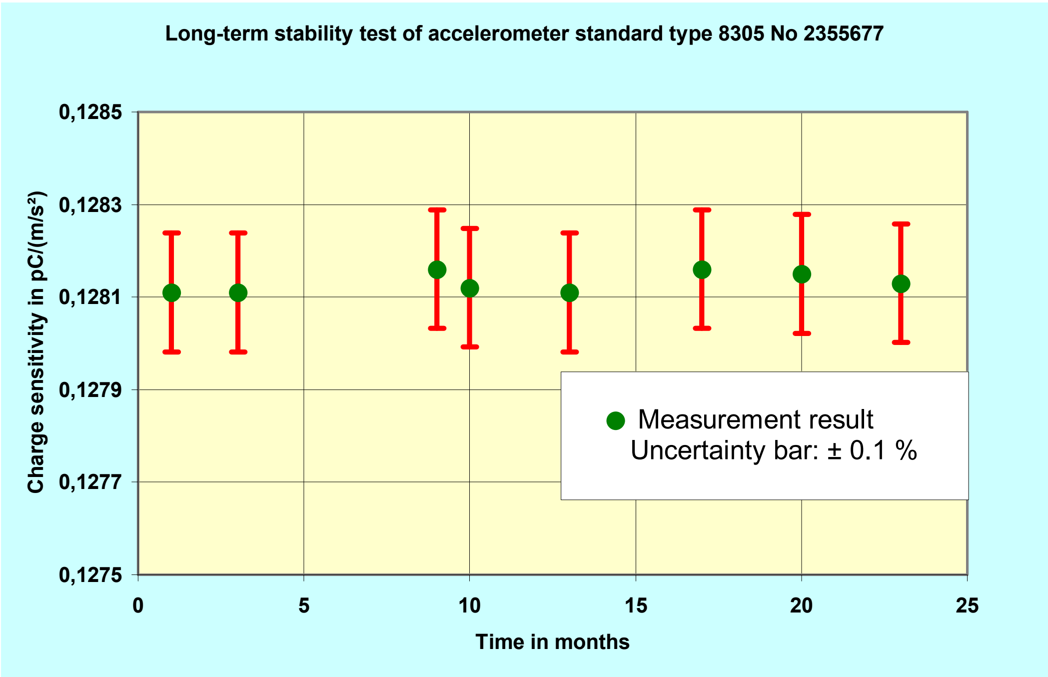

Figure S2a: Long-term stability of BB accelerometer for primary calibration according to Table S2a. Uncertainty bar is valid for coverage factor k = 2.

BB Accelerometer 8305 No 606559

Table S2b: Charge sensitivity of BB accelerometer for secondary calibration as a function of time. PTB results

Date month year	Time in months	Charge sensitivity in pC/(m/s²)	Rel. standard uncertainty (k = 1) $\times 10^{-2}$
Mar 2003	1	0.12662	0.05
May 2003	3	0.12659	0.05
Jul 2003	5	0.12648	0.05
Nov 2003	9	0.12657	0.05
Mar 2004	13	0.12653	0.05
Apr 2004	14	0.12648	0.05
Jun 2004	16	0.12646	0.05
Dec 2004	22	0.12659	0.05
Jan 2005	23	0.12660	0.05
Apr 2005	26	0.12662	0.05

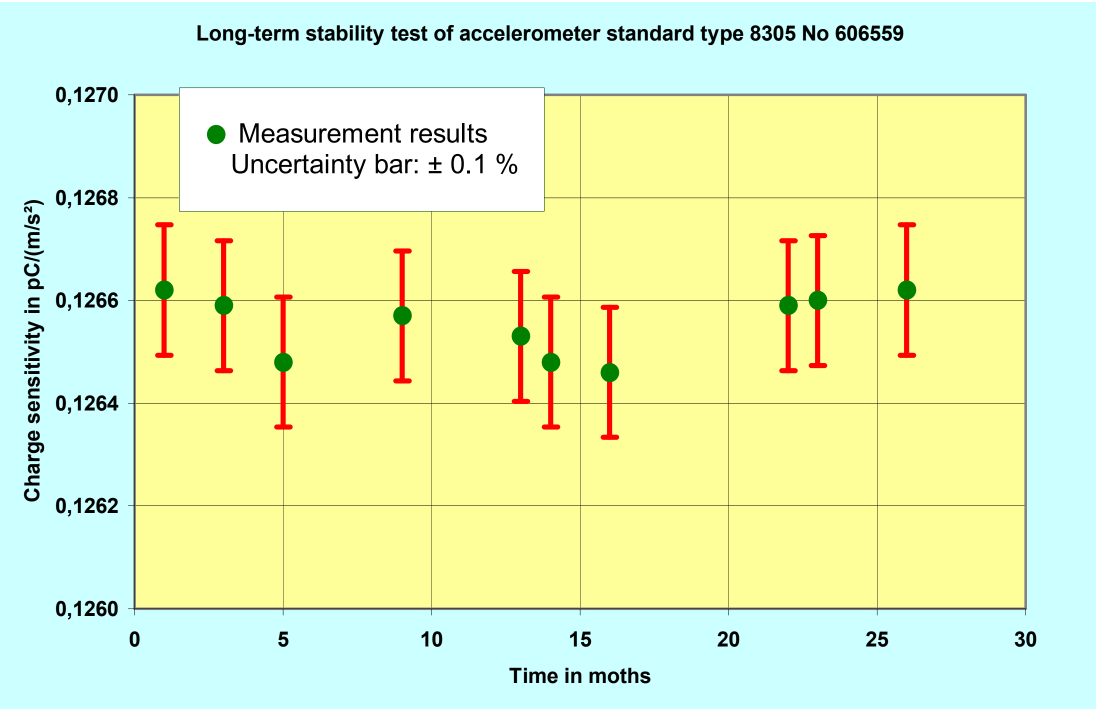

Figure S2b: Long-term stability of BB for secondary calibration accelerometer according to Table S2b. Uncertainty bar is valid for coverage factor k = 2.

Long-term stable behaviour was identified for the SE Accelerometer 8305WH2335 No 2361558 from the beginning of the investigations up to January 2004 (see Table S2c and Figure S2c). To observe the behaviour of the SE accelerometer after damage which happened at any time between February and March 2004 (see 9.2.1), PTB re-calibrated the SE accelerometer repeatedly at any occasion between the loops. To identify the change in sensitivity as accurately as possible, the charge sensitivity values specified in Table S2c are mean values over the comparison frequencies of 40 Hz, 80 Hz, 160 Hz, 800 Hz (MF), 2000 Hz (HF); the result for 5000 Hz was not included because of the greater (specified) uncertainty. Figure S2c reveals that the change in sensitivity was approximately permanent (i.e. irreversible) over the circulation period after the damage. It turned out, however, that the change in sensitivity after damage was frequency-dependent. Therefore, the mean value specified above was used only to identify a step-wise sensitivity change. For the correction of the sensitivity change, the change in frequency response is to be taken into account.
All SE accelerometer calibration results obtained after damage - i.e. laboratories code-number 8 (CMI) to code-number 14 (SIRA) – were to be corrected by a frequency-dependent correction given in Table S1c (corr). A correction of half the sensitivity deviation with (±) an additional standard uncertainty of half the magnitude of the deviation was applied to the SE accelerometer results of SP (code-number 6) and INETI (code-number 7) which reflects a probability of 50 % of whether the SE sensitivity before or after damage was valid during their calibrations. In terms of GUM [9] the additional standard uncertainty of half the sensitivity change represents the standard deviation a binomial distribution model with the bounds ±half the sensitivity change symmetrical to zero (type B evaluation of standard uncertainty). This standard uncertainty contribution due to the (uncertain) behaviour of the SE accelerometer during the calibrations by SP and INETI is not charged to their calibration results but may influence the Degrees of Equivalence (DOS) relative to the KCRV and to other laboratories, respectively. As the degree of equivalence is a pair of values expressing the laboratory deviation from the KCRV (or from the other laboratory) and the uncertainty of this deviation, the uncertainty of the deviation will be increased. As a laboratory confirms its CMCs if its deviation is not greater than the uncertainty of this deviation (normalized error $E_n \leq 1$), no negative consequences for SP and INETI will arise from the correction procedure outlined above.

The charge sensitivity values determined at the six comparison frequencies before and after damage (Table S1c+) have been used to define the corrections applicable to transform the sensitivity values obtained after damage into those which would have existed without damage, see Table S1c (corr).

SE Accelerometer 8305WH2335 No 2361558

Table S2c: Charge sensitivity of SE accelerometer as a function of time. PTB results

Date month year	Time in months	Charge sensitivity* in pC/(m/s²)	Rel. standard uncertainty (k = 1) $\times 10^{-2}$
Oct 02	1	0.12613	0.05
Mar 03	6	0.12620	0.05
May 03	8	0.12609	0.05
Jun 03	9	0.12600	0.05
Sep 03	12	0.12607	0.05
Jan 04	16	0.12617	0.05
Apr 04	19	0.12688	0.05
Jul 04	22	0.12652	0.05
Dec 04	27	0.12648	0.05
Jan 05	28	0.12670	0.05

* Mean over frequencies of 40 Hz, 80 Hz, 160Hz, 800 Hz (MF), 2000 Hz (HF)

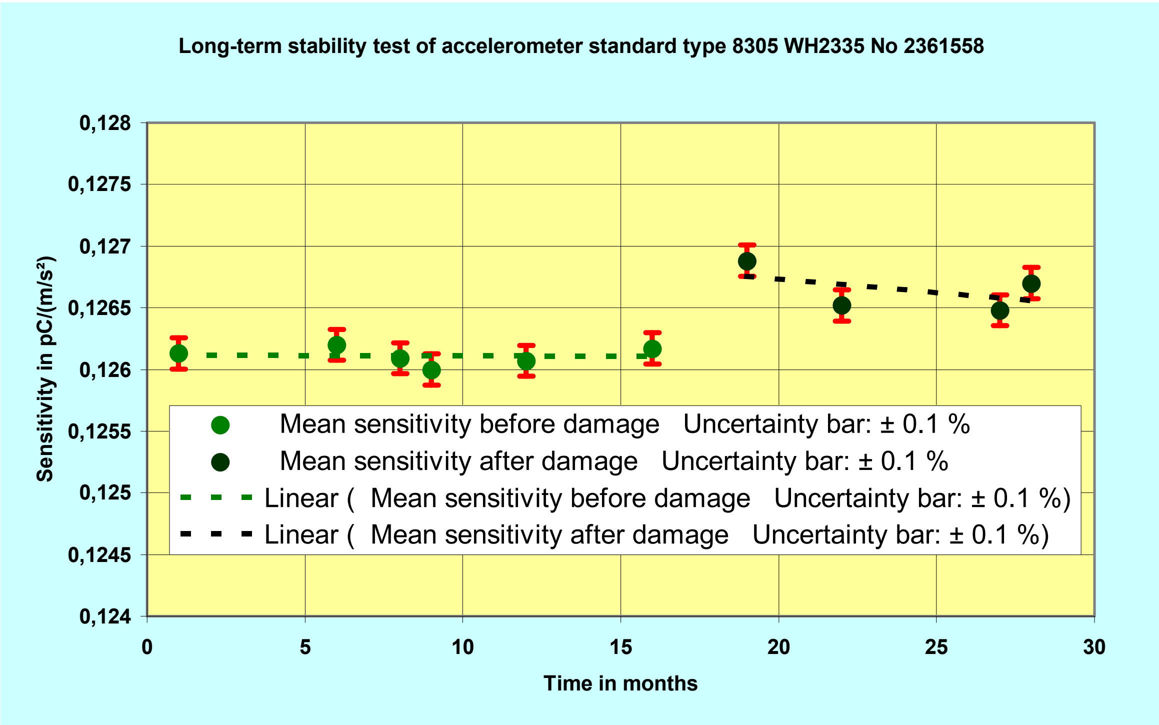

Figure S2c: Long-term stability of SE accelerometer according to Table S2c. Uncertainty bar is valid for coverage factor k = 2.

SE Accelerometer 8305WH2335 No 2361558 before damage:

Table S1c+: Frequency response of SE accelerometer before and after damage (comparison frequencies). PTB results

Frequency Hz	Measurement period	Charge sensitivity (Mean) pC/(m/s²)	Rel. standard deviation (Trials) $\times 10^{-2}$	Rel. standard deviation (Mean trials) $\times 10^{-2}$	Rel. standard uncertainty (k = 1) $\times 10^{-2}$
40	Before damage of SE accelerometer	0.12588	0.06	0.018	0.035
80		0.12589	0.07	0.021	0.035
160		0.12592	0.06	0.018	0.035
800		0.12619	0.09	0.027	0.035
2000		0.12665	0.04	0.012	0.035
5000		0.12955	0.07	0.020	0.035
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX					
40	After damage of SE accelerometer	0.12634	0.16	0.046	0.035
80		0.12634	0.15	0.043	0.035
160		0.12647	0.13	0.038	0.035
800		0.12682	0.16	0.046	0.035
2000		0.12731	0.06	0.019	0.035
5000		0.13043	0.05	0.016	0.035

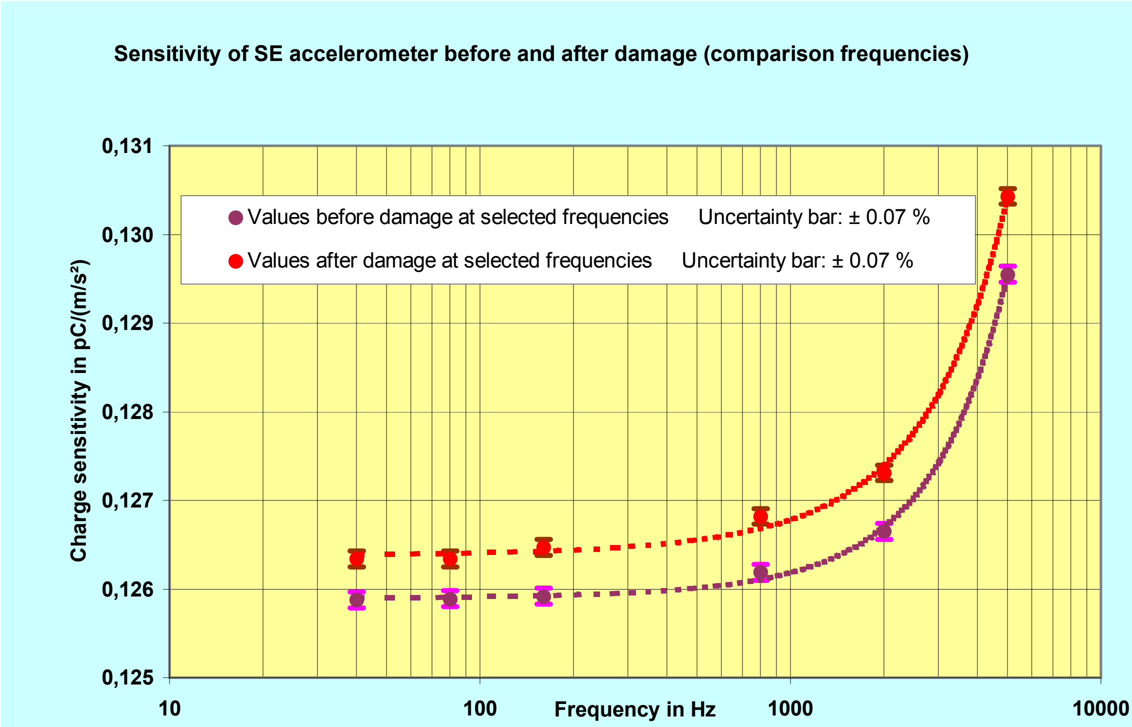

Figure S1c+: Frequency response of SE accelerometer according to *Table* S1c+ (comparison frequencies). Uncertainty bar is valid for coverage factor k = 2. Dashed lines are fitted theoretical curves.

Table S1c (corr): Systematic deviations and corrections for SE accelerometer to eliminate the effects of accelerometer damage

Frequency Hz	Rel. deviation of charge sensitivity after damage from sensitivity before damage $\times 10^{-2}$	Rel. combined uncertainty (k = 1) $\times 10^{-2}$
40	0.37	0.05
80	0.36	0.05
160	0.44	0.05
800	0.50	0.05
2000	0.52	0.05
5000	0.68	0.05

Table S2c (corr): Results of laboratories 6 to 14 for the SE-accelerometer before and after correction due to the damage:

	Frequency Hz	Sensitivity pC/(m/s²)	Stated rel. combined uncertainty $\times 10^{-2}$	Sensitivity after SE-correction pC/(m/s²)	Rel. combined uncertainty including that of SE-correction $\times 10^{-2}$
SP	40	0.12610	0.20	0.12587	0.277
	80	0.12610	0.20	0.12587	0.274
	160	0.12620	0.20	0.12592	0.302
	800	0.12650	0.20	0.12618	0.324
	2000	0.12710	0.40	0.12677	0.480
	5000	0.13090	0.75	0.13046	0.826
INETI	40	0.12510	0.42	0.12487	0.458
	80	0.12610	0.16	0.12587	0.247
	160	0.12590	0.20	0.12562	0.304
	800	0.12600	0.23	0.12568	0.347
	2000	-	-	-	-
	5000	-	-	-	-
CMI	40	0.12610	0.25	0.12563	0.256
	80	0.12610	0.25	0.12565	0.256
	160	0.12610	0.25	0.12555	0.256
	800	0.12620	0.25	0.12557	0.256
	2000	0.12670	0.50	0.12604	0.505
	5000	0.12970	1.00	0.12882	1.008

UME	40	0.12640	0.25	0.12593	0.256
	80	0.12630	0.25	0.12585	0.256
	160	0.12631	0.25	0.12576	0.256
	800	0.12642	0.25	0.12579	0.256
	2000	0.12720	0.50	0.12654	0.505
	5000	0.13087	0.50	0.12999	0.506
GBARL	40	0.12620	0.26	0.12573	0.261
	80	0.12620	0.25	0.12575	0.251
	160	0.12620	0.25	0.12565	0.251
	800	0.12660	0.24	0.12597	0.241
	2000	0.12710	0.25	0.12644	0.251
	5000	0.13000	0.35	0.12912	0.351
BEV	40	0.12600	0.24	0.12553	0.246
	80	0.12630	0.21	0.12585	0.217
	160	0.12650	0.21	0.12595	0.217
	800	0.12690	0.21	0.12627	0.217
	2000	0.12750	0.24	0.12684	0.246
	5000	0.13000	0.27	0.12912	0.276
CEM	40	0.12630	0.30	0.12583	0.305
	80	0.12650	0.30	0.12605	0.305
	160	0.12650	0.30	0.12595	0.305
	800	0.12680	0.30	0.12617	0.306
	2000	0.12730	0.30	0.12664	0.306
	5000	0.13010	0.33	0.12922	0.336
Metas	40	0.12620	0.37	0.12573	0.372
	80	0.12640	0.35	0.12595	0.350
	160	0.12660	0.34	0.12605	0.345
	800	0.12690	0.34	0.12627	0.344
	2000	0.12760	0.38	0.12694	0.385
	5000	0.13050	0.49	0.12962	0.497
SIRA	40	0.12650	0.30	0.12603	0.305
	80	0.12640	0.30	0.12595	0.305
	160	0.12660	0.30	0.12605	0.305
	800	0.12680	0.30	0.12617	0.306
	2000	0.12750	0.30	0.12684	0.306
	5000	0.13100	0.30	0.13012	0.306

9.2.4. Linearity

The linearity of the three accelerometers is a prerequisite of accurate comparison results as the participating laboratories have been allowed to apply - within given limits – different acceleration amplitudes in accordance with their Calibration and measurement Capabilities (CMCs). The technical protocol of EUROMET.AUV.V-K1 had specified: “A range of 10 m/s² to 200 m/s² should be complied with. If needed, up to 300 m/s² will be accepted.”

Tables S3a, S3b and S3c and their diagrammatic representation in Figures S3a, S3b and S3c demonstrate the linearity of the accelerometers 8305 S/N 2355677, 8305 S/N 606559 and 8305WH2335 S/N 2361558 at reference frequency 160 Hz.

In addition linearity tests were carried out at 5 kHz, and the results of the linearity investigation of the accelerometers (same types 8305 and 8305WH2335) used in the CIPM Key comparison CCAUV.V-K1 were taken into account (see [2]).

It revealed that the charge sensitivity of the three accelerometers used in EUROMET.AUV.V-K1 was constant within the standard uncertainty of linearity test of 0.02%, i.e. amplitude-linear behaviour of the accelerometers could be assumed in very good approximation.

BB Accelerometer 8305 No 2355677 - Linearity test at frequency 160 Hz

Table S3a: Charge sensitivity of BB accelerometer for primary calibration as a function of acceleration amplitude. PTB results at 160 Hz

Acceleration amplitude m/s^2	Charge sensitivity in $pC/(m/s^2)$	Rel. uncertainty of mean (k = 1) %
6.5	0.12812	0.02
18.3	0.12812	0.02
20.5	0.12813	0.02
28.2	0.12812	0.02
36.6	0.12812	0.02
43.3	0.12811	0.02
50.4	0.12811	0.02
68.6	0.12811	0.02
78.8	0.12812	0.02
86.2	0.12812	0.02

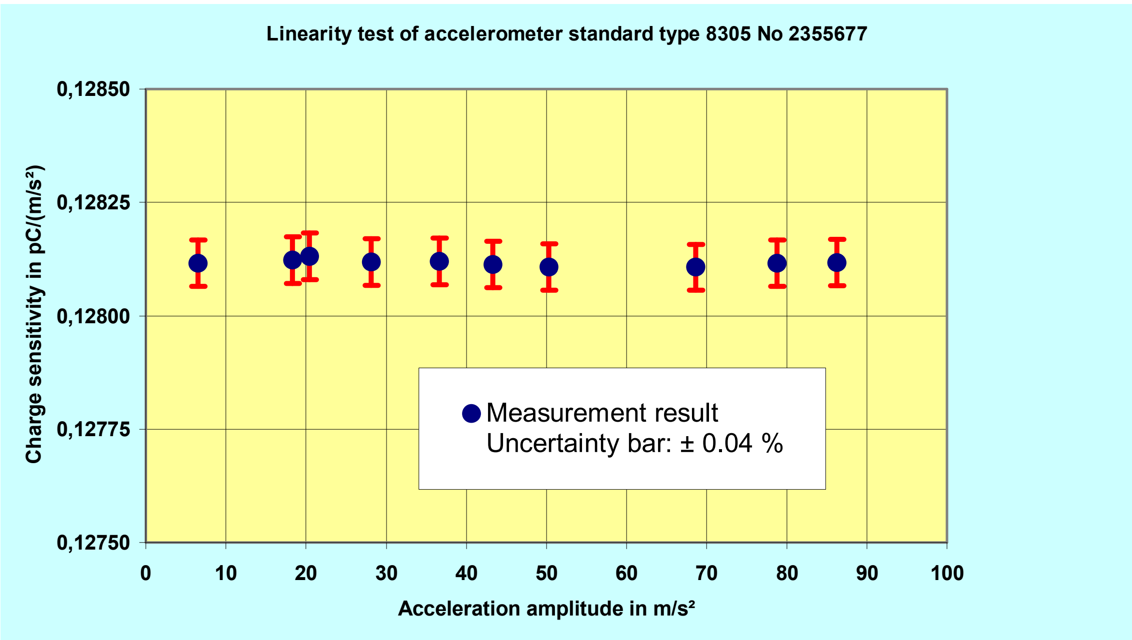

Figure S3a: Amplitude linearity of BB accelerometer for primary calibration according to Table S3a. Uncertainty bar is valid for coverage factor k = 2.

BB Accelerometer 8305 No 606559 - Linearity test at frequency 160 Hz

Table S3b: Charge sensitivity of BB accelerometer for secondary calibration as a function of acceleration amplitude. PTB results at 160 Hz

Acceleration amplitude m/s^2	Charge sensitivity in pC/(m/s²)	Rel. uncertainty of mean (k = 1) %
6.2	0.12647	0.02
17.4	0.12641	0.02
19.5	0.12641	0.02
26.9	0.12640	0.02
35.0	0.12640	0.02
41.5	0.12640	0.02
48.3	0.12640	0.02
66.0	0.12641	0.02
75.9	0.12640	0.02
83.3	0.12640	0.02

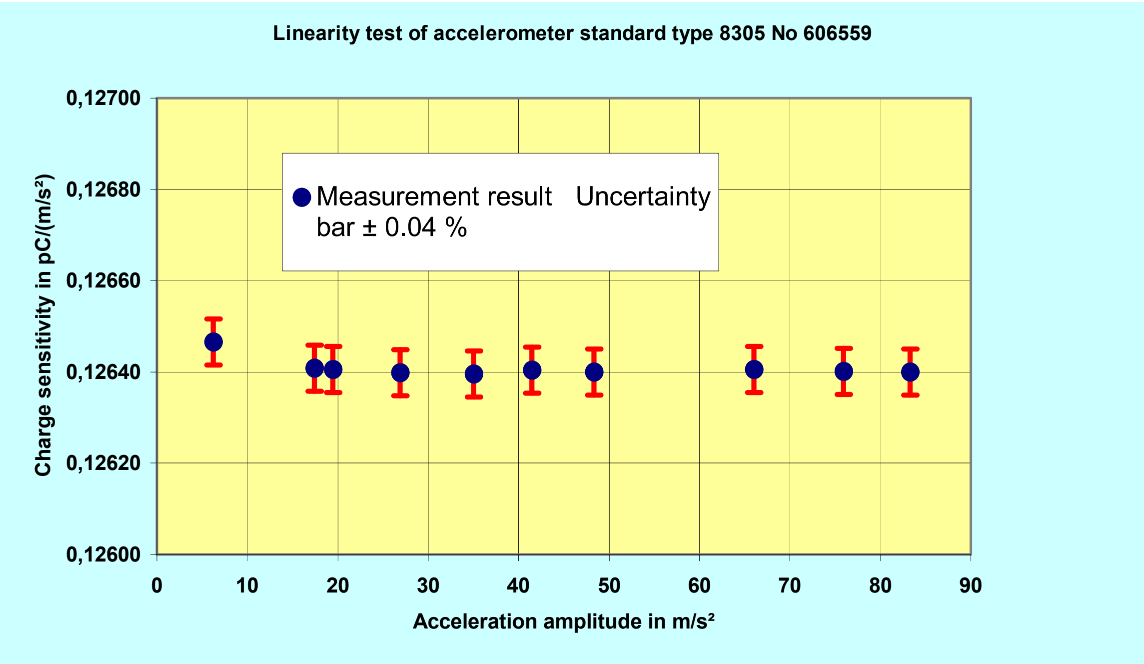

Figure S3b: Amplitude linearity of BB accelerometer for secondary calibration according to Table S3b. Uncertainty bar is valid for coverage factor k = 2.

SE Accelerometer 8305WH2335 No 2361558 - Linearity test at frequency 160 Hz

Table S3c: Charge sensitivity of SE accelerometer as a function of acceleration amplitude. PTB results at 160 Hz

Acceleration amplitude m/s^2	Charge sensitivity in pC/(m/s²)	Rel. uncertainty of mean (k = 1) %
6.37	0.12595	0.02
17.86	0.12593	0.02
20.01	0.12592	0.02
27.61	0.12591	0.02
35.95	0.12591	0.02
42.56	0.12592	0.02
49.61	0.12591	0.02
67.72	0.12591	0.02
77.86	0.12591	0.02
85.40	0.12591	0.02

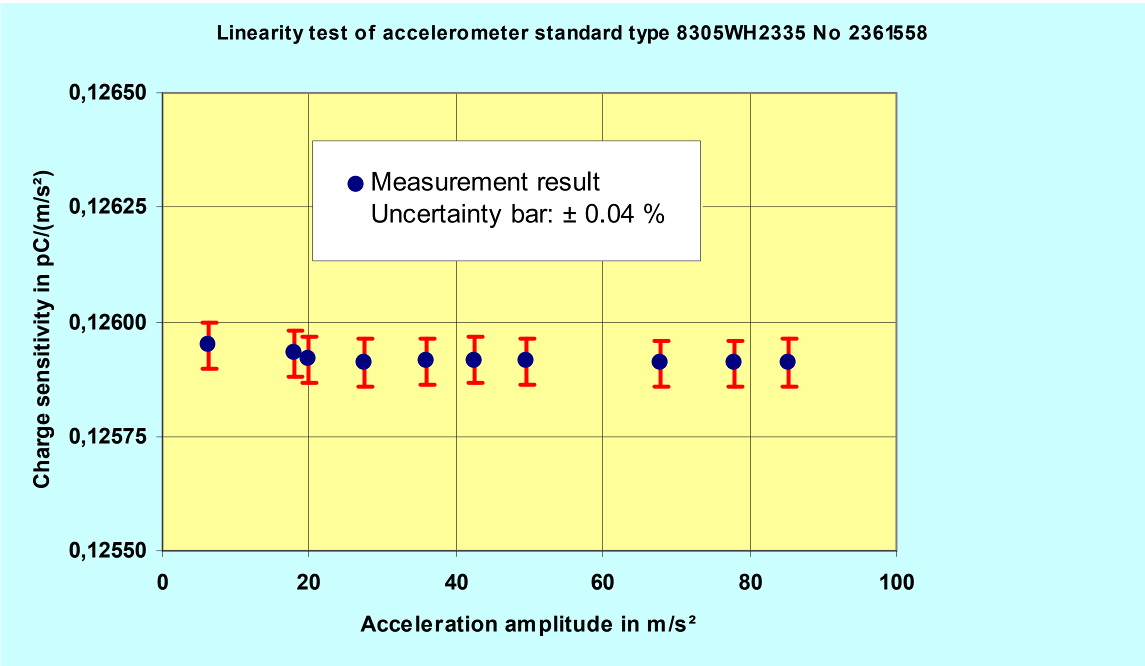

Figure S3c Amplitude linearity of SE accelerometer according to Table S3c. Uncertainty bar is valid for coverage factor k = 2.

9.2.5. Other metrological characteristics

9.2.5.1. Transverse sensitivity

The ratio of the maximum transverse sensitivity to the sensitivity in the measurement direction (main axis) expressed as percentage was

- 0.94 % for BB Accelerometer 8305 No 2355677
- 1.60 % for BB Accelerometer 8305 No 606559
- 0.83 % for SE Accelerometer 8305WH2335 No 2361558

9.2.5.2. Temperature sensitivity

Based on PTB investigations on several accelerometers of the accelerometer types 8305 (BB) and 8305 WH 2335 (SE) manufactured by Brüel & Kjaer, the temperature sensitivity (temperature coefficient) was assessed to be ≤0.03 %/K for the three accelerometers used, expressed as the relative change of the charge sensitivity per Kelvin in the applicable temperature range stated in clause 4.

9.2.5.3. Torque sensitivity

Based on manufacturer's specification (as typical torque sensitivity) and PTB investigations on several accelerometers of the types 8305 (BB) and 8305 WH 2335 (SE), manufactured by Brüel & Kjaer, the relative change in the charge sensitivity due to deviations from the nominal torque was assessed to be <0.05 %/(N m) for the two BB accelerometers and <0.1 %/(N m) for the SE accelerometer.

9.2.5.4. Mass loading effect

Generally the charge sensitivity of a back-to-back (BB) accelerometer depends on the mass mounted on its top surface. In comparison calibration, the mass mounted on top of the BB accelerometer is a single-ended (SE) accelerometer. At PTB, the mass loading effect on charge sensitivity has been investigated by using "dummy masses" which simulate the loading conditions in comparison calibration. The four laboratories BEV, METAS, CEM and SIRA calibrated by comparison the BB accelerometer "B" (i.e. 8305 S/N 606559) using their laboratory standards of the type 8305 WH2335 (mass of 26 g) or Endevco 2270 M8 (mass of 20 g). The PTB investigated the mass influence choosing different dummy masses including the "no mass" state. Taking a relative uncertainty of 0.05 % of the mass influence test into account, no significant systematic mass influence could be identified up to 5 kHz for BB accelerometer 8305 S/N 606559. Hence, at the 6 comparison frequencies up to 5 kHz, no correction was applied, and an uncertainty contribution of the test was assigned to the PTB calibration of the BB accelerometer at the frequencies 800 Hz, 2 kHz and 5 kHz, resulting in a relative combined standard uncertainty of 0.1 % at 800 Hz and 2 kHz, and 0.15 % at 5 kHz.

9.3. RESULTS - PART 2: Laboratory individual measurements (mean results for standard frequency series)

9.3.1. Tables of stated methods, results and standard uncertainties of all laboratories

Table R1m: Applied calibration methods in accordance with ISO 16063-11 or 16063-21 (for comparison method) stated by the individual laboratories with respect to comparison frequencies.

Frequency ⇒ ***Lab i* ⇓**	**40 Hz**	**80 Hz**	**160 Hz**	**800 Hz**	**2000 Hz**	**5000 Hz**
PTB/DE	FCM	FCM	FCM	FCM	SAM	SAM
BNM - CEA/ CESTA/LEA/ FR	FCM	FCM	FCM	FCM/MPM	MPM	MPM
GUM/PL	SAM	SAM	SAM	SAM	SAM	SAM
DPLA/DK	FCM	FCM	FCM	FC/MP	MPM	MPM
CNR-IMGC/IT	FCM	FCM	FCM	FCM	MPM	MPM
SP/SE	SAM	SAM	SAM	SAM	SAM	SAM
INETI/PT	FCM	FCM	FCM	FCM		
CMI/CZ	FCM	FCM	FCM	FCM	MPM	MPM
UME/TR	FCM	FCM	FCM	FCM	MPM	MPM
GBARL/HU	SAM	SAM	SAM	SAM	SAM	SAM
BEV/AU	CMP	CMP	CMP	CMP	CMP	CMP
CEM/ES	CMP	CMP	CMP	CMP	CMP	CMP
METAS/CH	CMP	CMP	CMP	CMP	CMP	CMP
SIRA/UK	CMP	CMP	CMP	CMP	CMP	CMP

FCM Primary vibration calibration according ISO 16063-11, Method 1 (fringe counting)
MPM Primary vibration calibration according ISO 16063-11, Method 2 (minimum point detection)
SAM Primary vibration calibration according ISO 16063-11, Method 3 (sine approximation method)
CMP Secondary vibration calibration according ISO 16063-21

Table R1a: Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 2355677. All individual mean results stated for the standard frequencies

x_i*: result of measurement carried out by laboratory *i

u_i*: relative combined standard uncertainty of *x_i

Frequency ⇒	**40 Hz**		**80 Hz**		**160 Hz**		**800 Hz**		**2000 Hz**		**5000 Hz**	
	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i
Lab *l* ⇓	/pC/(m/s^2)	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**
PTB/DE	0.12798	0.05	0.12797	0.05	0.12801	0.05	0.12826	0.05	0.12855	0.05	0.13077	0.1
BNM - CEA/ CESTA/LEA/ FR	0.1278	0.25	0.128	0.25	0.128	0.25	0.128	0.25	0.1282	0.25	0.131	0.25
GUM/PL	0.12793	0.30	0.12784	0.30	0.12782	0.30	0.1279	0.30	0.12828	0.30	0.1306	0.30
DPLA/DK	0.12776	0.173	0.1278	0.111	0.1279	0.102	0.12818	0.219	0.12829	0.232	0.13054	0.149
CNR-IMGC/IT	0.1278	0.17	0.1279	0.17	0.1279	0.17	0.1281	0.17	0.1285	0.24	0.1304	0.28
SP/SE	0.1283	0.2	0.1284	0.2	0.1284	0.2	0.1284	0.2	0.1286	0.4	0.1312	0.65
INETI/PT	0.1278	0.42	0.1281	0.171	0.1278	0.2	0.128	0.222	-	-	-	-
CMI/CZ	0.12769	0.25	0.12775	0.25	0.12785	0.25	0.12792	0.25	0.12812	0.35	0.13105	0.4
UME/TR	0.12803	0.25	0.12799	0.25	0.12799	0.25	0.12809	0.25	0.12829	0.5	0.13135	0.5
GBARL/HU	0.12796	0.18	0.12798	0.17	0.12801	0.165	0.12811	0.125	0.12848	0.145	0.13063	0.145
BEV/AU	-	-	-	-	-	-	-	-	-	-	-	-
CEM/ES	-	-	-	-	-	-	-	-	-	-	-	-
METAS/CH	-	-	-	-	-	-	-	-	-	-	-	-
SIRA/UK	-	-	-	-	-	-	-	-	-	-	-	-

Table R1b: Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 606559. All individual mean results stated for the standard frequencies

x_i: result of measurement carried out by laboratory i

u_i: relative combined standard uncertainty of x_i

Frequency ⇒	**40 Hz**		**80 Hz**		**160 Hz**		**800 Hz**		**2000 Hz**		**5000 Hz**	
	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i
Lab i ⇓	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**	**/pC/(m/s^2)**	**/10^{-2}**
PTB/DE	0.12648	0.05	0.12644	0.05	0.12646	0.05	0.12655	0.10	0.12678	0.10	0.129	0.15
BNM - CEA/ CESTA/LEA/ FR	-	-	-	-	-	-	-	-	-	-	-	-
GUM	-	-	-	-	-	-	-	-	-	-	-	-
DPLA/DK	-	-	-	-	-	-	-	-	-	-	-	-
CNR-IMGC/IT	-	-	-	-	-	-	-	-	-	-	-	-
SP/SE	-	-	-	-	-	-	-	-	-	-	-	-
INETI/PT	-	-	-	-	-	-	-	-	-	-	-	-
CMI/CZ	-	-	-	-	-	-	-	-	-	-	-	-
UME/TR	-	-	-	-	-	-	-	-	-	-	-	-
GBARL/HU	-	-	-	-	-	-	-	-	-	-	-	-
BEV/AU	0.1261	0.3	0.1261	0.28	0.1262	0.28	0.1265	0.28	0.127	0.3	0.1291	0.33
CEM/ES	0.1267	0.3	0.1263	0.3	0.1265	0.3	0.1267	0.3	0.127	0.3	0.129	0.33
METAS/CH	0.1258	0.366	0.1258	0.344	0.1258	0.338	0.1259	0.338	0.1262	0.379	0.1281	0.466
SIRA/UK	0.1263	0.3	0.1262	0.30	0.1263	0.30	0.1264	0.30	0.1267	0.30	0.1293	0.30

Table R1c: Charge sensitivity of single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558. All individual mean results stated for the standard frequencies

x_i: result of measurement carried out by laboratory i

u_i: relative combined standard uncertainty of x_i

Frequency ⇒	**40 Hz**		**80 Hz**		**160 Hz**		**800 Hz**		**2000 Hz**		**5000 Hz**	
	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i	x_i	u_i/x_i
Lab i ⇓	**/pC/(m/s²)**	**/10⁻²**	**/pC/(m/s²)**	**/10⁻²**	**/pC/(m/s²)**	**/10⁻²**	**/pC/(m/s²)**	**/10⁻²**	**/pC/(m/s²)**	**/10⁻²**	**/pC/(m/s²)**	**/10⁻²**
PTB/DE	0.12588	0.05	0.12589	0.05	0.12592	0.05	0.12619	0.05	0.12665	0.05	0.12955	0.10
BNM - CEA/ CESTA/LEA/ FR	0.1259	0.25	0.1259	0.25	0.126	0.25	0.1262	0.25	0.1265	0.25	0.1297	0.25
GUM	0.12588	0.30	0.12581	0.30	0.12578	0.30	0.12593	0.30	0.12645	0.30	0.12929	0.30
DPLA/DK	0.12573	0.173	0.12582	0.111	0.1259	0.102	0.12617	0.218	0.12645	0.184	0.1293	0.147
CNR-IMGC/IT	0.1256	0.17	0.1257	0.17	0.1257	0.17	0.1258	0.17	0.1265	0.24	0.1289	0.28
SP/SE 1)	0.1261	0.2	0.1261	0.2	0.1262	0.2	0.1265	0.2	0.1271	0.4	0.1309	0.75
INETI/PT 1)	0.1251	0.415	0.1261	0.161	0.1259	0.203	0.126	0.233	-	-	-	-
CMI/CZ 1)	0.1261	0.25	0.1261	0.25	0.1261	0.25	0.1262	0.25	0.1267	0.5	0.1297	1
UME/TR 1)	0.1264	0.25	0.1263	0.25	0.12631	0.25	0.12642	0.25	0.1272	0.5	0.13087	0.5
GBARL/HU	0.1262	0.255	0.1262	0.245	0.1262	0.245	0.1266	0.235	0.1271	0.245	0.13	0.345
BEV/AU 1)	0.126	0.24	0.1263	0.21	0.1265	0.21	0.1269	0.21	0.1275	0.24	0.13	0.27
CEM/ES 1)	0.1263	0.3	0.1265	0.3	0.1265	0.3	0.1268	0.3	0.1273	0.3	0.1301	0.33
METAS/CH 1)	0.1262	0.367	0.1264	0.345	0.1266	0.34	0.1269	0.339	0.1276	0.38	0.1305	0.491
SIRA/UK 1)	0.1265	0.3	0.1264	0.30	0.1266	0.30	0.1268	0.30	0.1275	0.30	0.131	0.30

1) The results of this laboratories were corrected before the further calculation due to the change in the sensitivity of the SE accelerometer (c.f. Table S2c (corr)), The values given here are stated without the correction.

9.3.2. Diagrams of stated results and expanded uncertainties of all laboratories

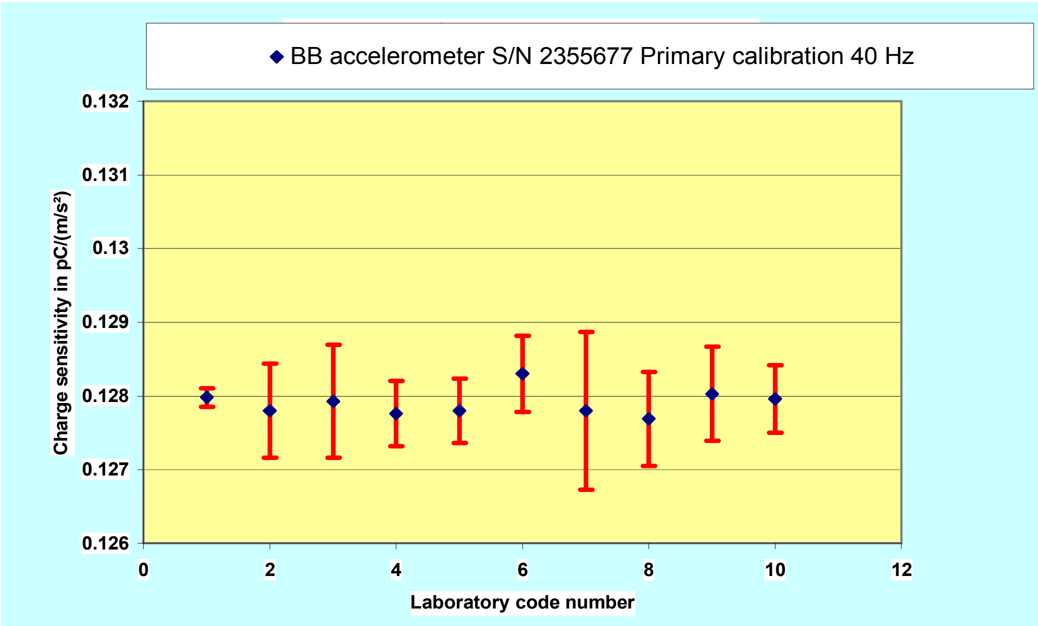

Figure R1a (40 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 2355677. All individual mean results stated for the frequency 40 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

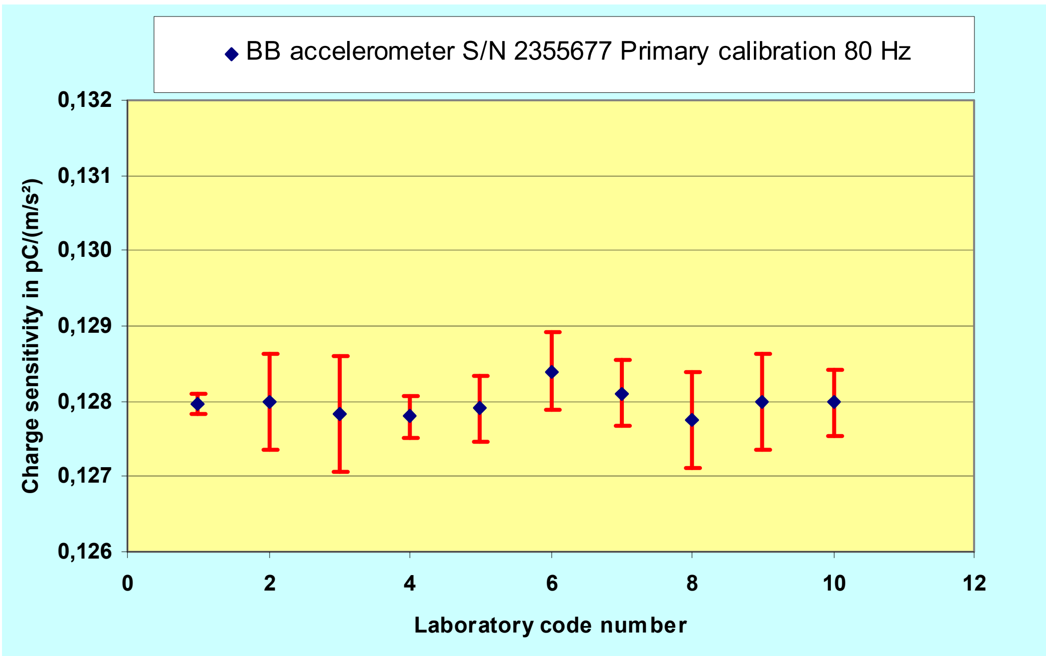

Figure R1a (80 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 2355677. All individual mean results stated for the frequency 80 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

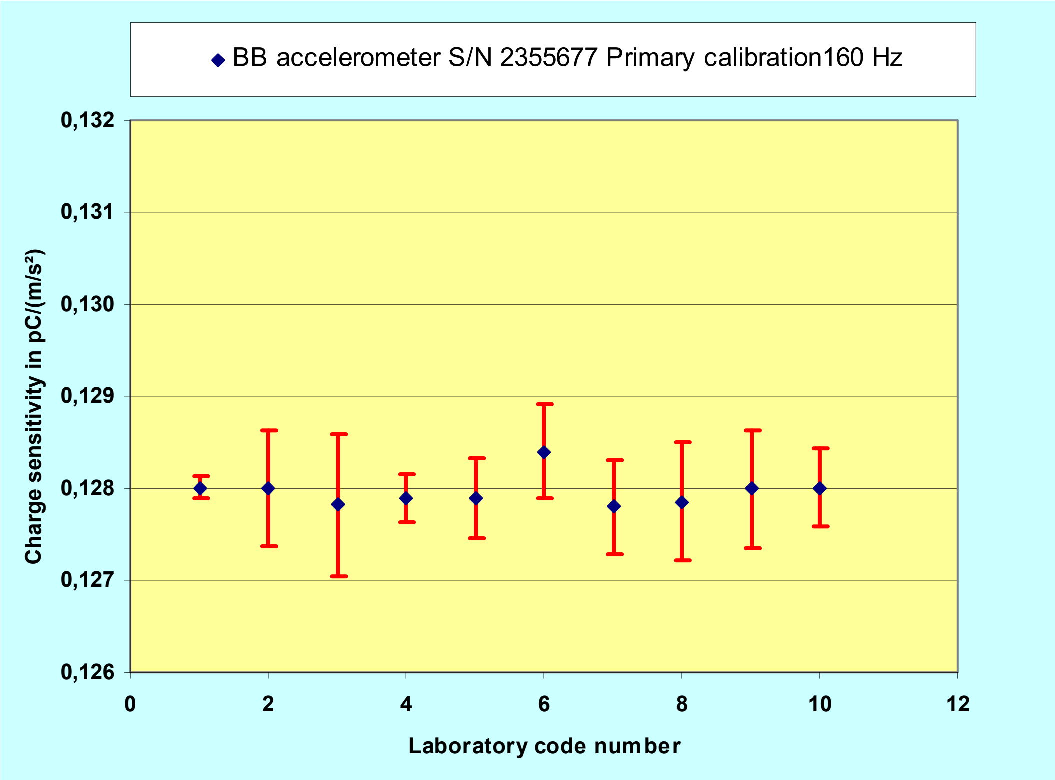

Figure R1a (160 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 2355677. All individual mean results stated for the frequency 160 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

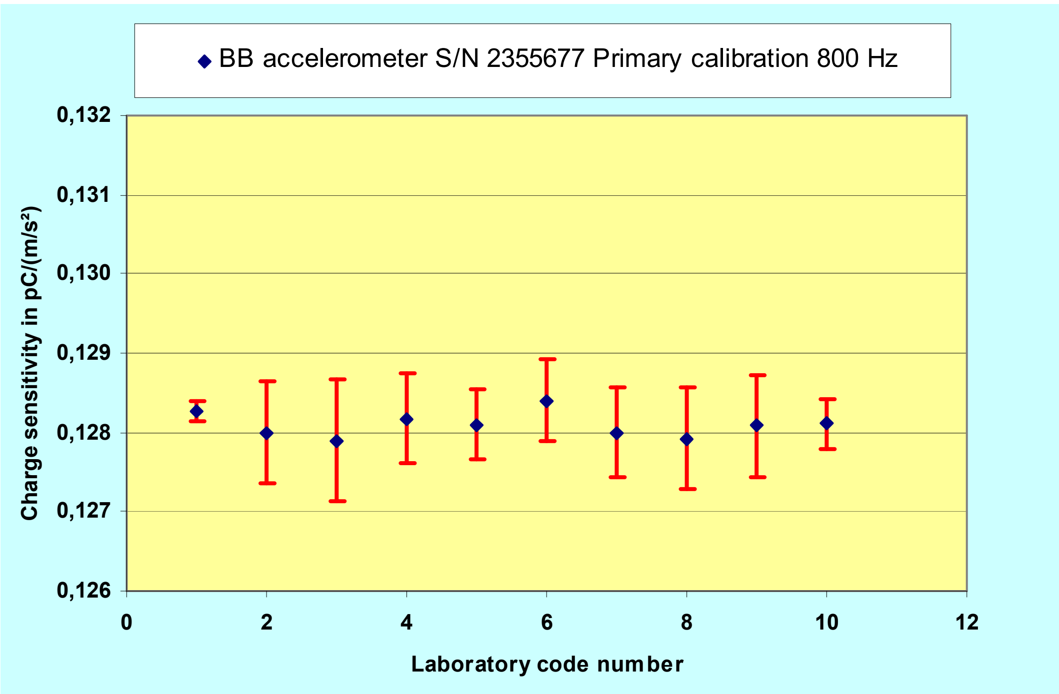

Figure R1a (800 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 2355677. All individual mean results stated for the frequency 800 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

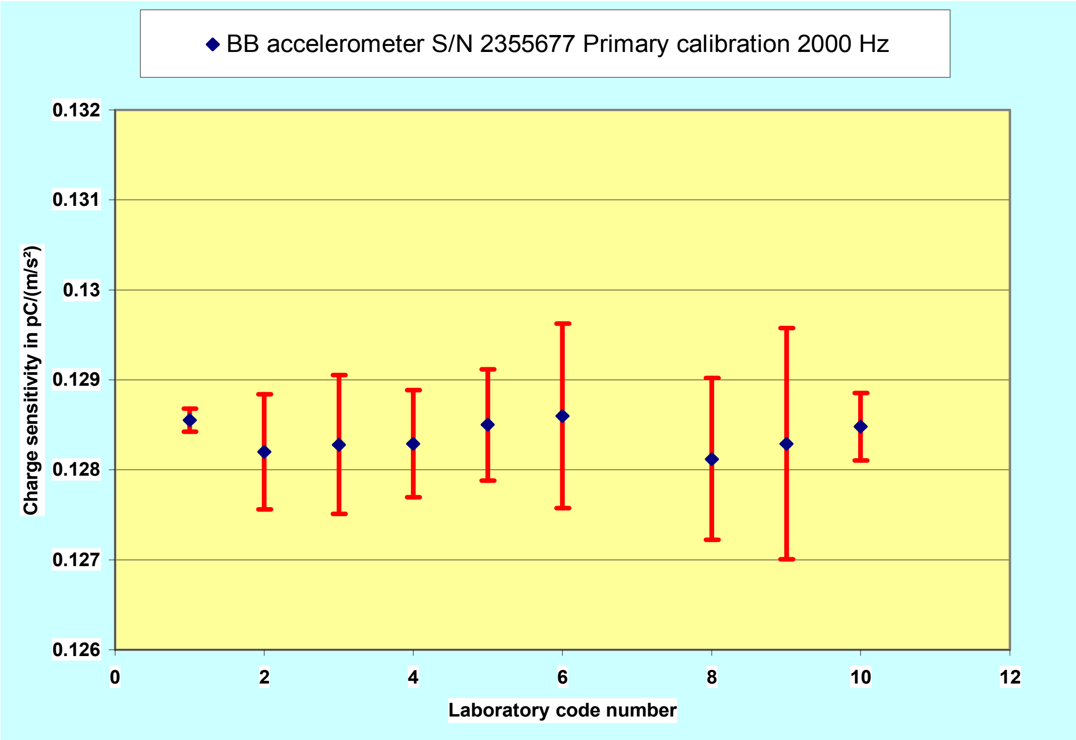

Figure R1a (2000 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 2355677. All individual mean results stated for the frequency 2000 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

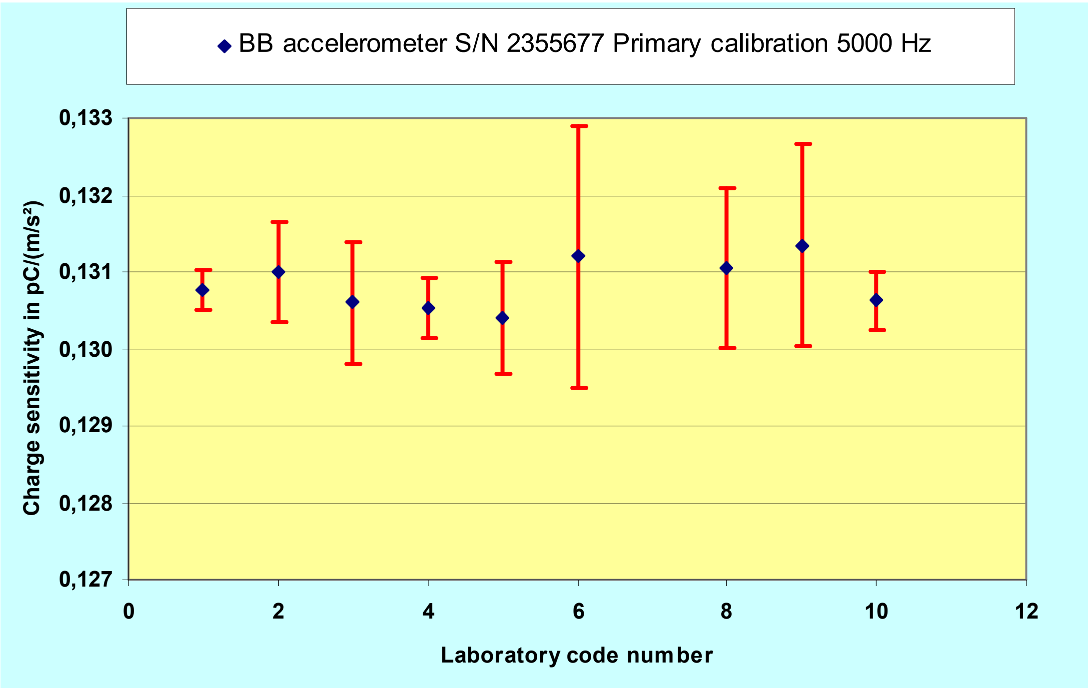

Figure R1a (5000 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 2355677. All individual mean results stated for the frequency 5000 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

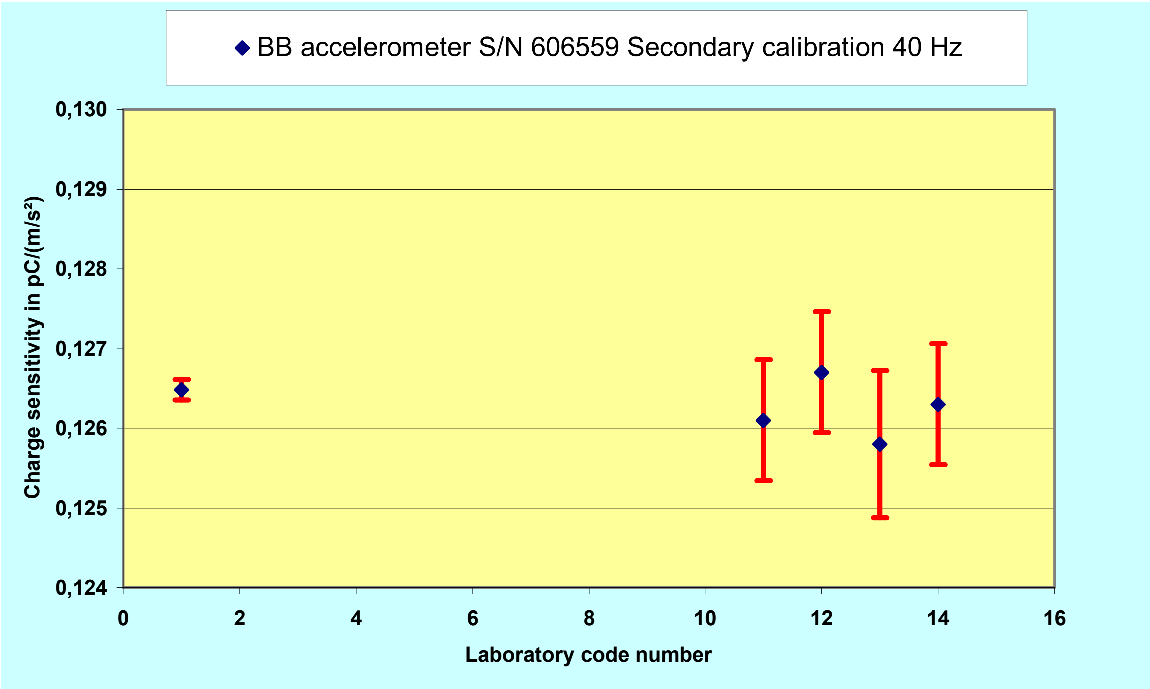

Figure R1b (40 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 606559. All individual mean results stated for the frequency 40 Hz. Uncertainty bar shown for coverage factor k = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

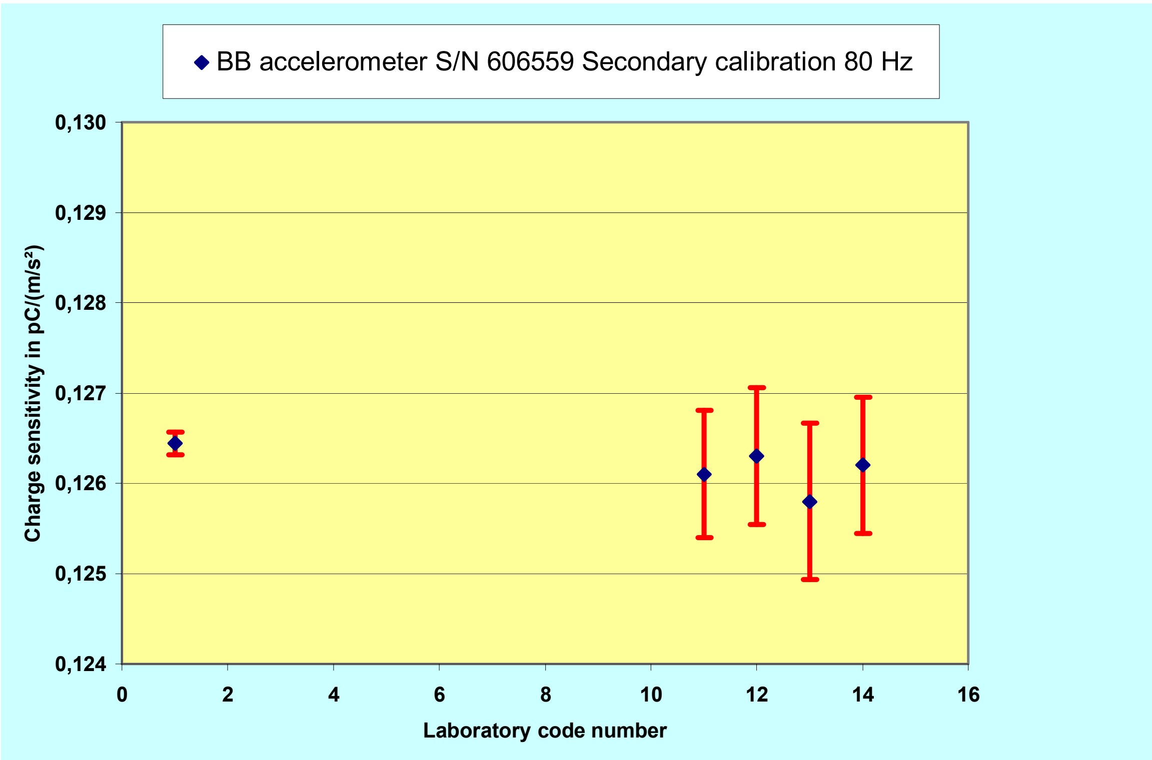

Figure R1b (80 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 606559. All individual mean results stated for the frequency 80 Hz. Uncertainty bar shown for coverage factor k = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

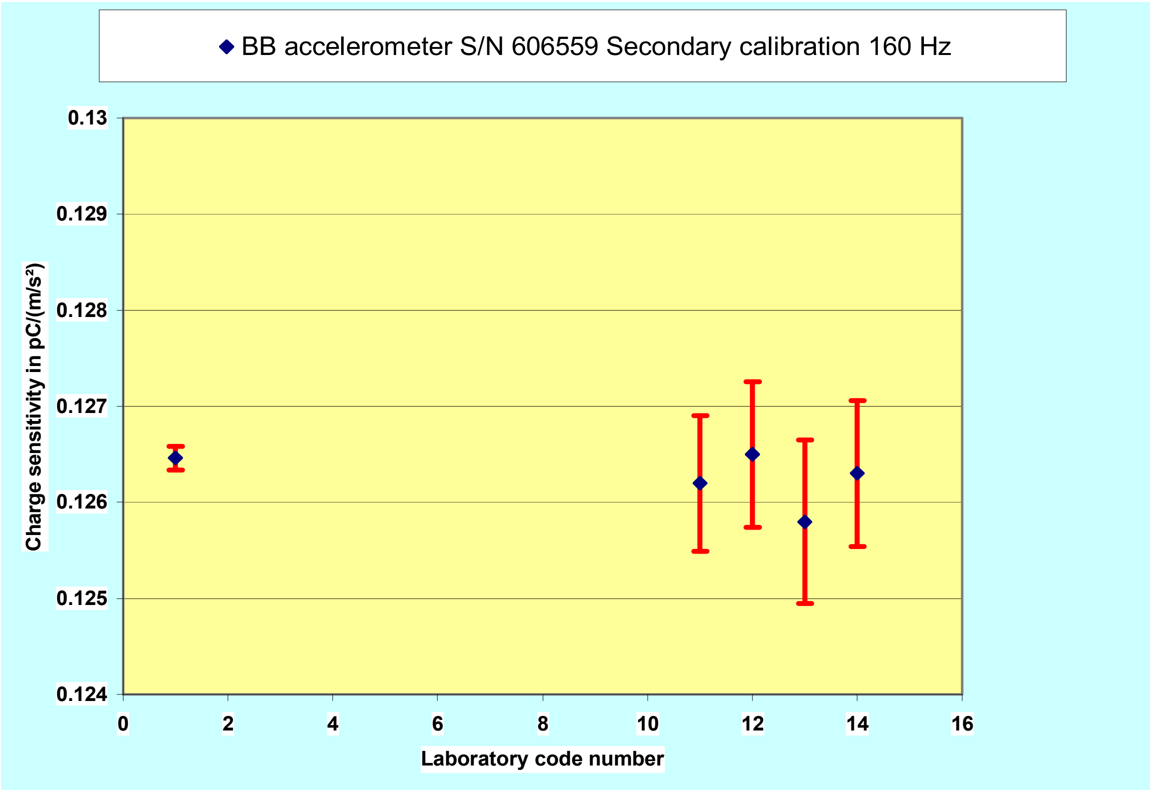

Figure R1b (160 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 606559. All individual mean results stated for the frequency 160 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

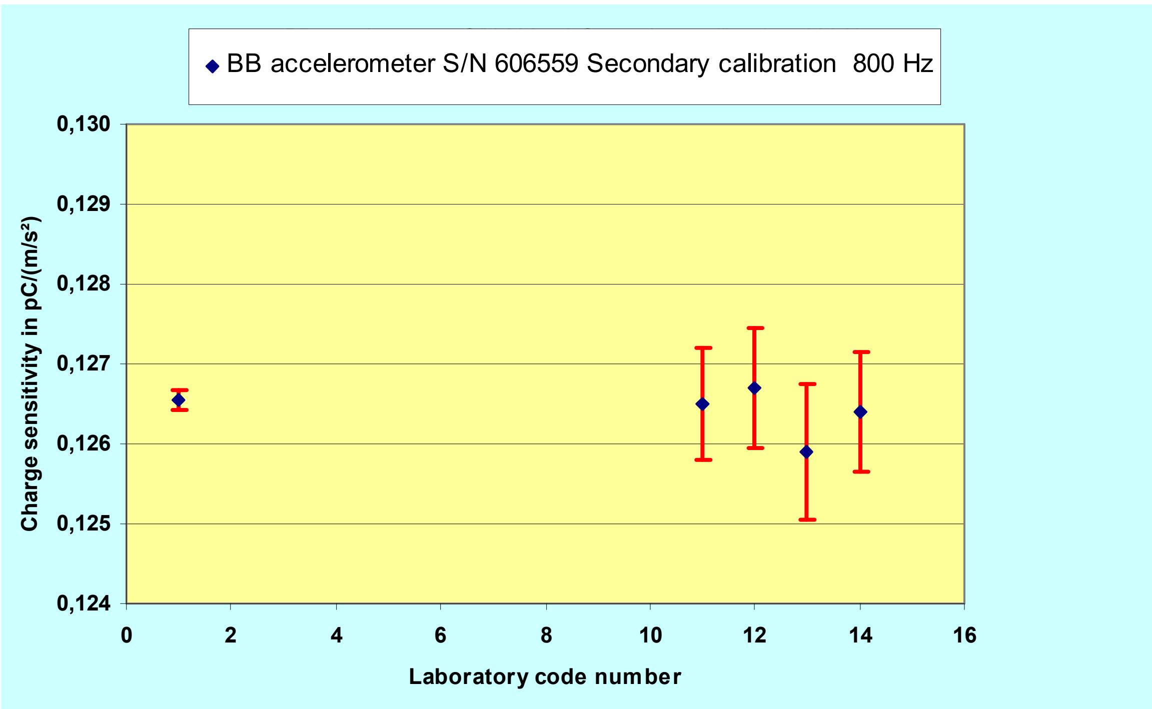

Figure R1b (800 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 606559. All individual mean results stated for the frequency 800 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

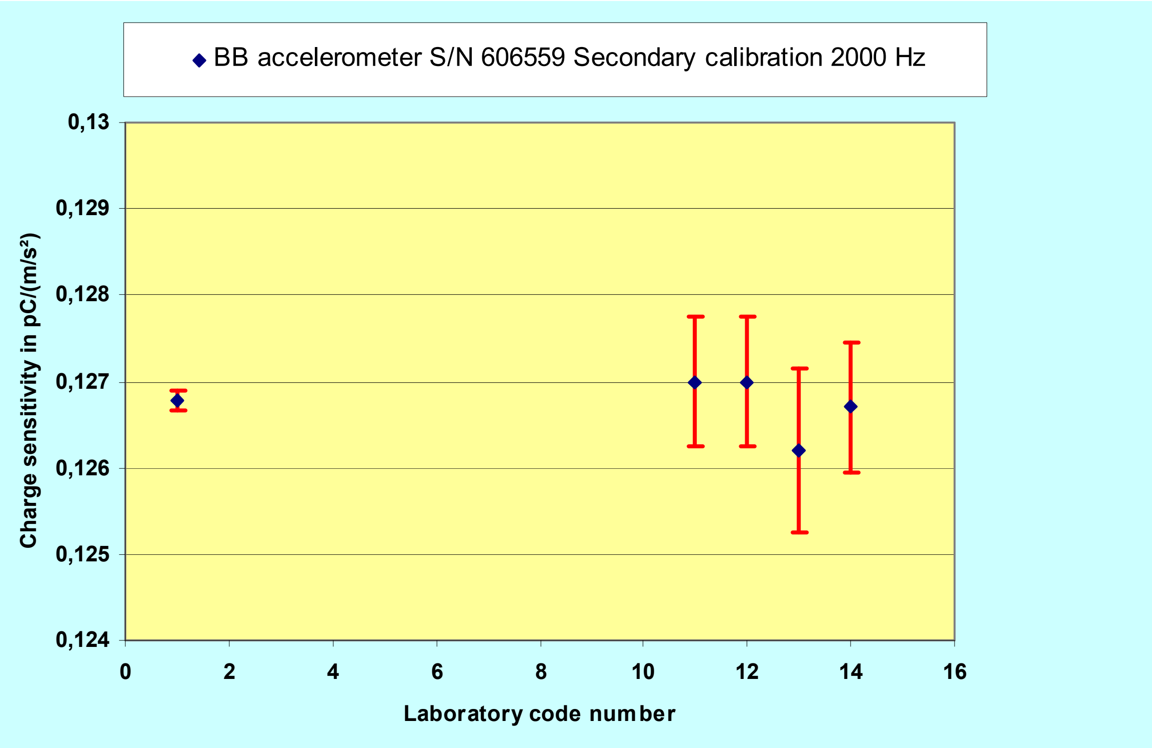

Figure R1b (2000 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 606559. All individual mean results stated for the frequency 2000 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

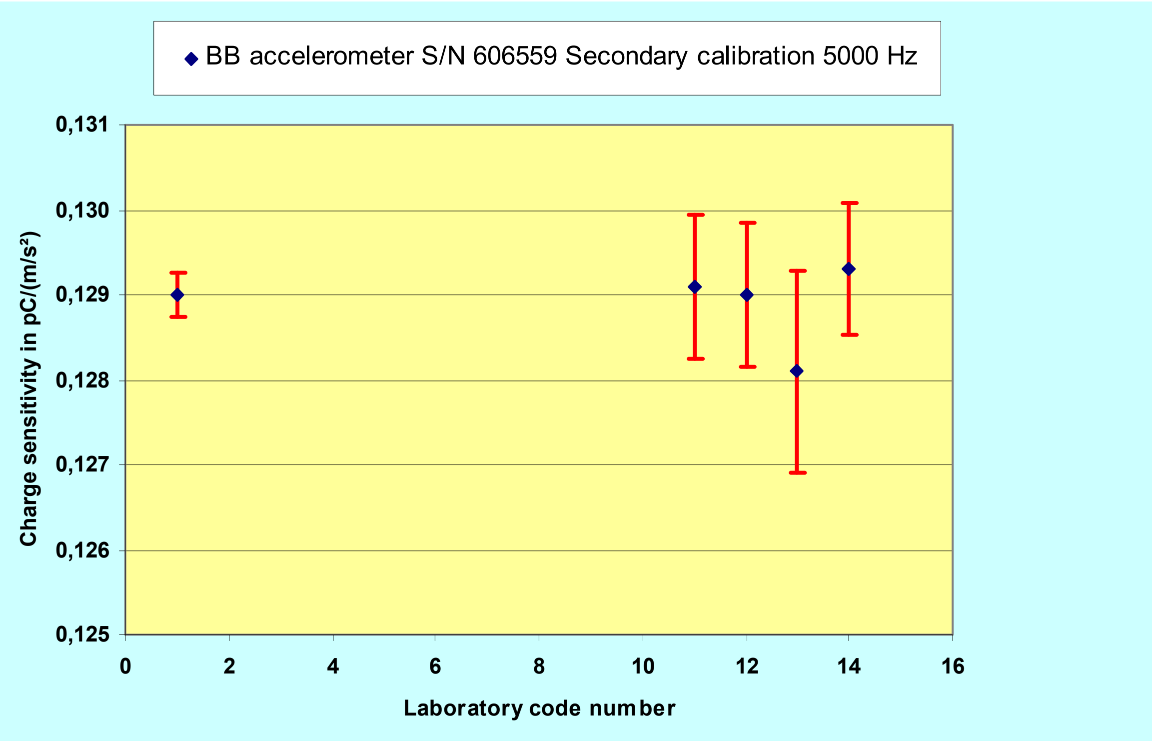

Figure R1b (5000 Hz): Charge sensitivity of back-to-back (BB) accelerometer type 8305 S/N 606559. All individual mean results stated for the frequency 5000 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

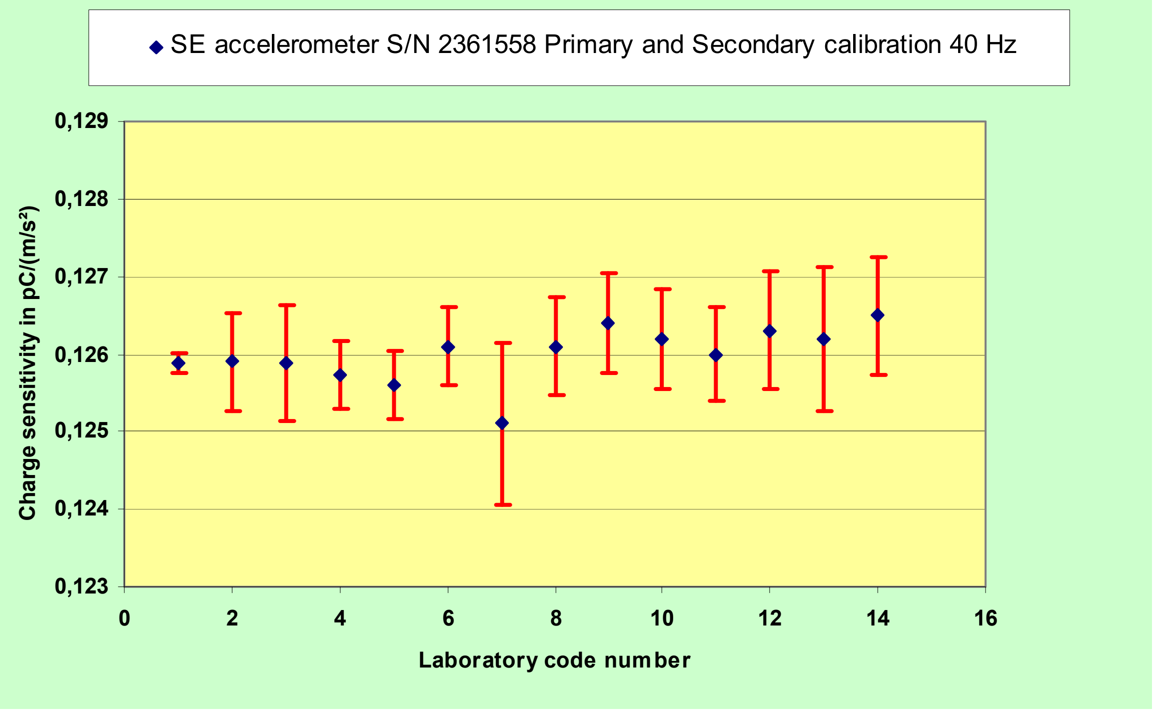

Figure R1c (40 Hz): Charge sensitivity of single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558. All individual mean results stated for the frequency 40 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

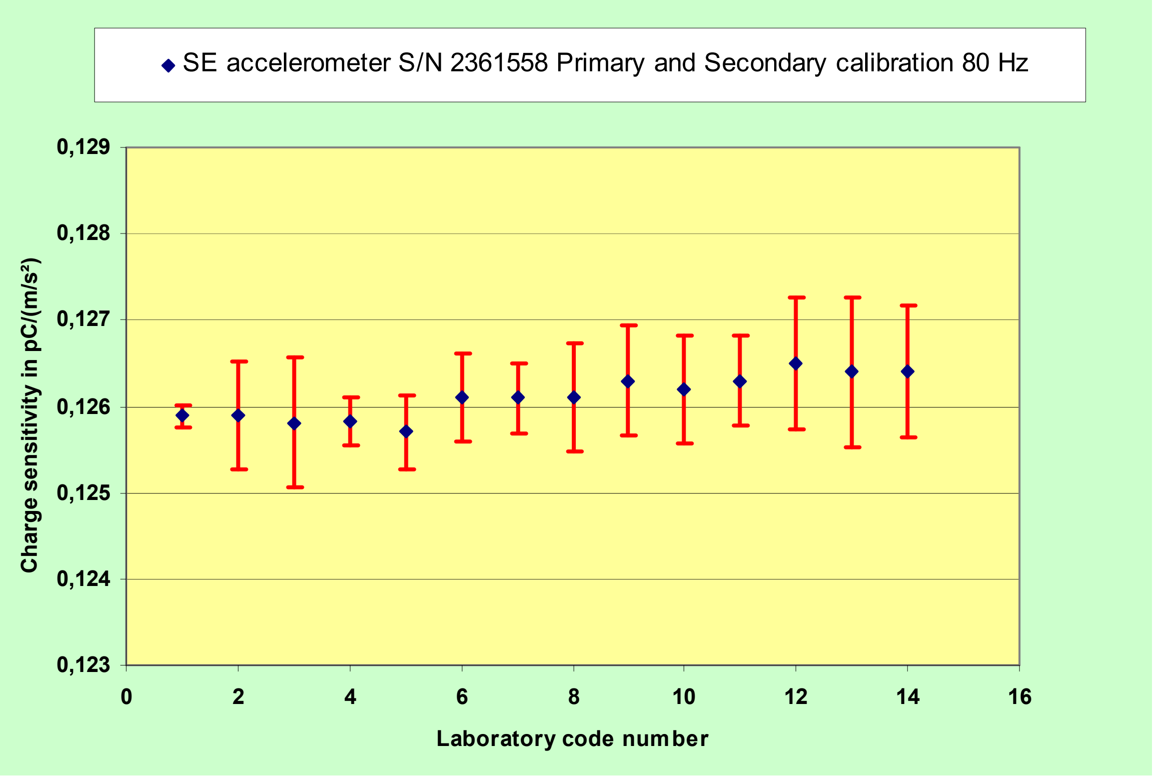

Figure R1c (80 Hz): Charge sensitivity of single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558. All individual mean results stated for the frequency 80 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

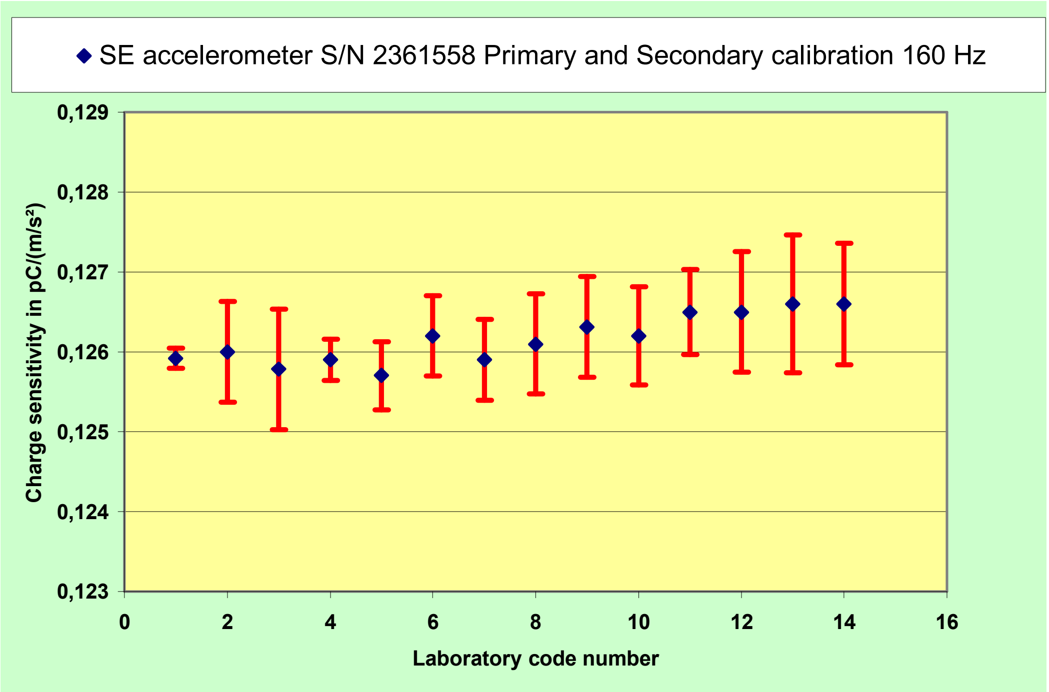

Figure R1c (160 Hz): Charge sensitivity of single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558. All individual mean results stated for the frequency 160 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

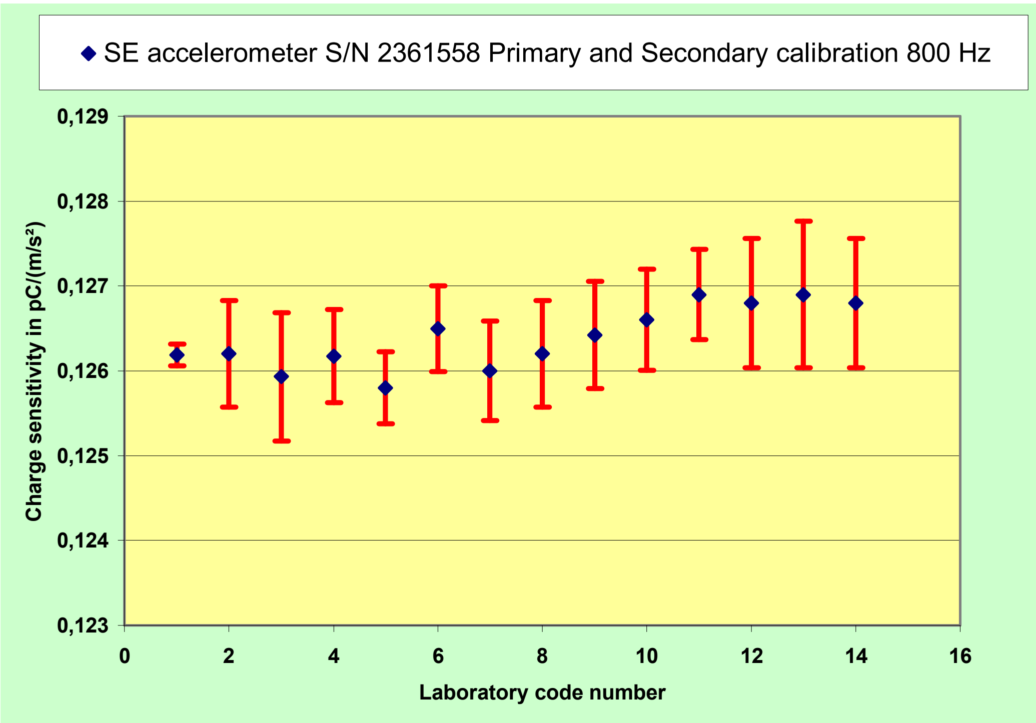

Figure R1c (800 Hz): Charge sensitivity of single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558. All individual mean results stated for the frequency 800 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

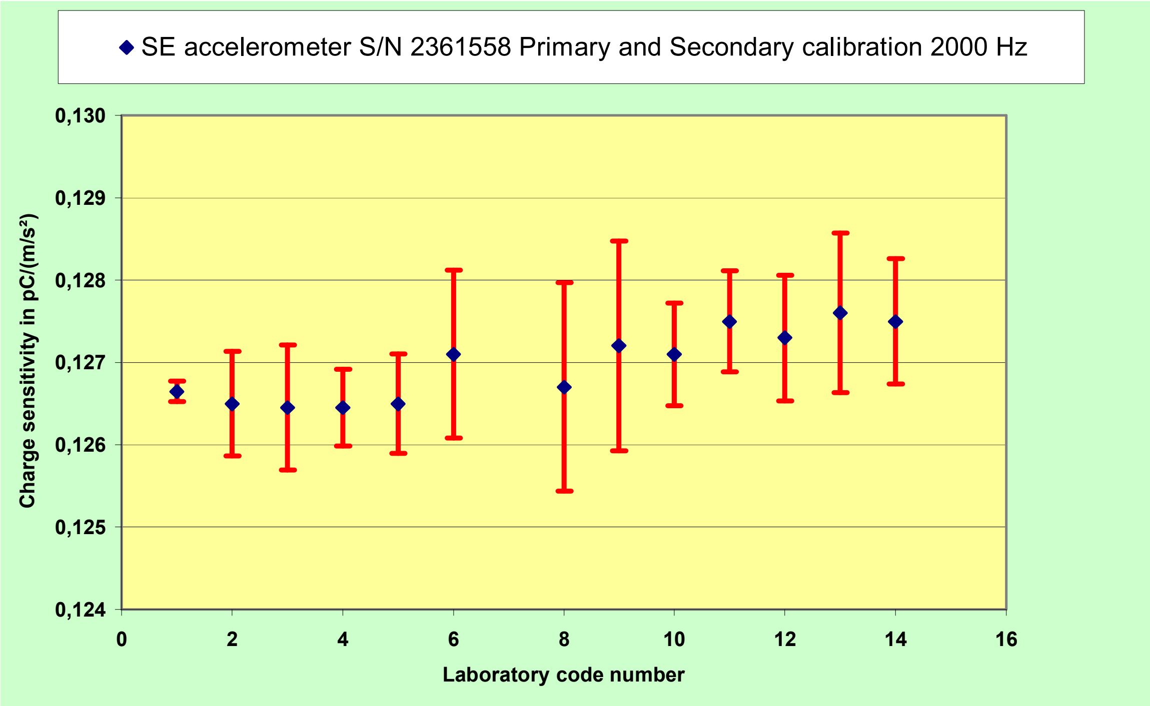

Figure R1c (2000 Hz): Charge sensitivity of single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558. All individual mean results stated for the frequency 2000 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

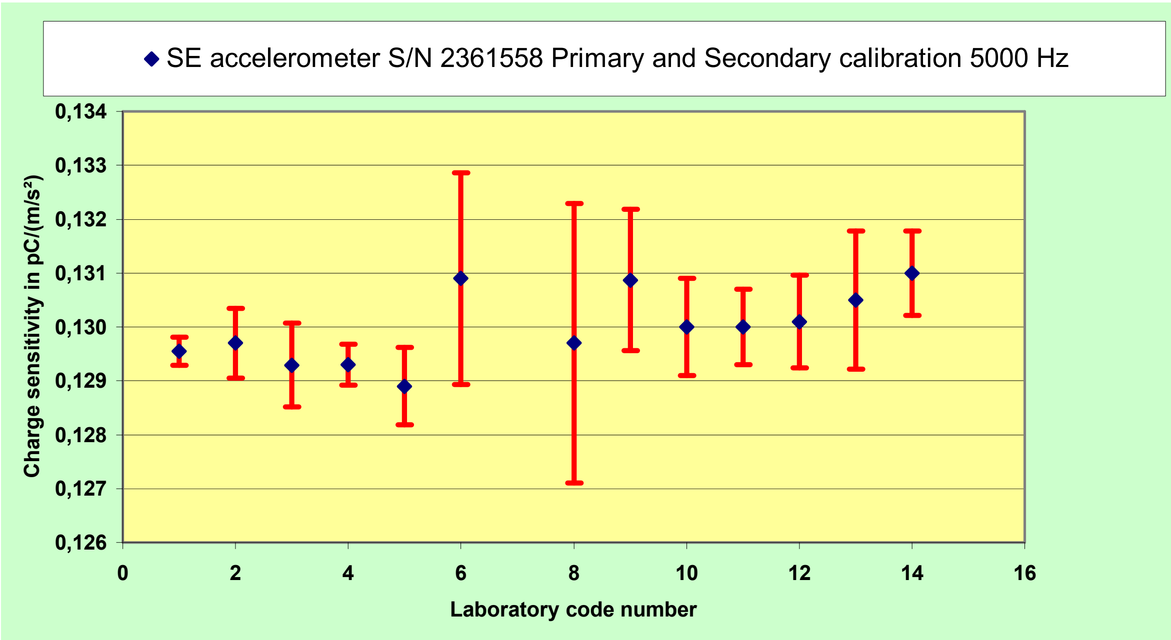

Figure R1c (5000 Hz): Charge sensitivity of single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558. All individual mean results stated for the frequency 5000 Hz. Uncertainty bar shown for coverage factor *k* = 2. Laboratory code number according to Table 2 in section 9.1 (i.e. sequence of above Tables R1a, R1b and R1c)

9.4. RESULTS - PART 3: Comparison between the individual participants of EUROMET.AUV.V-K1

9.4.1. Comparison of results for the accelerometers BB77 and BB59

The four participating laboratories METAS, BEV, CEM, SIRA and the pilot laboratory of the PTB (see Table L4) calibrated the accelerometer BB59 at the frequencies of 40 Hz, 80 Hz, 160 Hz, 800 Hz, 2000 Hz and 5000 Hz. The mentioned four laboratories provided results obtained by using secondary calibration, i.e. by comparison to a reference transducer in accordance with ISO 16063-21. The calibration by the pilot laboratory is based on laser interferometry in accordance with ISO 16063-11. To compare the calibration results of these five laboratories the influence of mass loading effects on the accelerometer calibration has been analysed by the pilot laboratory (Details are given in subsection 9.2.5). As a result, to account for mass loading effects the uncertainty of the PTB results for the BB59 accelerometer was increased in the kHz range. The resulting relative combined standard uncertainties are 0.1 % at the frequencies of 800 Hz and 2 kHz and 0.15 % at the frequency of 5 kHz.

The accelerometer BB77 was calibrated by 10 laboratories as listed in Table L3. The results are based on primary calibration by laser interferometry (ISO 16063-11). Results of the pilot laboratory are given with uncertainties corresponding to the documented measurement capability.

To demonstrate the calibration capability of the four laboratories using the secondary calibration method, the calibration results for the accelerometer BB59 are transformed in quantities allowing the comparison with results of the BB77. Since the pilot laboratory provided calibration results for both accelerometers, a transformation can be defined following the linking procedure of Appendix A. Then, the comparison of secondary and primary calibrations is analogue to linking RMO results to those of a CIPM comparison.

Denoting the results of accelerometer BB77 (best estimates and associated standard uncertainties of the laboratories) by x_1, $u(x_1)$, …, x_N, $u(x_N)$ and the results of BB59 by y_1, $u(y_1)$, …, y_N, $u(y_N)$ allows directly to apply the mathematics of the linking procedure given in Appendix A. The transformation factor is determined by the ratio of the weighted mean calculated from BB77 results of the ten laboratories and PTB calibration result for the accelerometer BB59. The transformed results of the five laboratories for the BB59 are determined using equation (4) of Appendix A. The differences and associated uncertainties between the transformed results and the weighted mean of the BB77 results are supplied by equations (5) and (6). Finally, the degrees of equivalence between the laboratories calibrating the BB59 and those calibrating BB77 are defined by equations (7) and (8) of Appendix A.

The results of the comparison in terms of degrees of equivalence are shown in the following sections.

9.4.2. Reference Values (RVs) of EUROMET.AUV.V-K1

Table E1a: Reference values computed from participants results for the Back-to-back (BB) accelerometer type 8305 S/N 2355677

Frequency / Hz	$x_{R(E)}$ / pC/(m/s^2)	$U_{R(E)}$ / pC/(m/s^2)	$U_R/x_{R(E)}$ / 10^{-2}
40	0.12796	0.00006	0.05
80	0.12796	0.00005	0.04
160	0.12799	0.00005	0.04
800	0.12820	0.00006	0.04
2000	0.12851	0.00006	0.05
5000	0.13071	0.00009	0.07

Table E1b: Reference values computed from PTB results for the Back-to-back (BB) accelerometer type 8305 S/N 606559

Frequency / Hz	$x_{R(E)}$ / pC/(m/s^2)	$U_{R(E)}$ / pC/(m/s^2)	$U_R/x_{R(E)}$ / 10^{-2}
40	0.12646	0.00006	0.05
80	0.12641	0.00006	0.05
160	0.12644	0.00006	0.05
800	0.12651	0.00011	0.09
2000	0.12678	0.00011	0.09
5000	0.12900	0.00014	0.12

Table E1c: Reference values computed from participants results for the Single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558

Frequency / Hz	$x_{R(E)}$ / pC/(m/s^2)	$U_{R(E)}$ / pC/(m/s^2)	$U_R/x_{R(E)}$ / 10^{-2}
40	0.12583	0,00005	0.04
80	0.12586	0,00005	0.04
160	0.12589	0,00005	0.04
800	0.12613	0,00005	0.04
2000	0.12663	0,00005	0.04
5000	0.12945	0,00009	0.07

9.4.3. Degrees of equivalence relative to the EUROMET Reference Value (RV)

Table E2ab: Degrees of equivalence of the participants with respect to the EUROMET RV, Back-to-back (BB) accelerometer type 8305 S/N 2355677 or S/N 606559 (for comparison method only).

Frequency ⇒	40 Hz		80 Hz		160 Hz		800 Hz		2000 Hz		5000 Hz	
	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.2**	0.7	**0.1**	0.8	**0.2**	0.8	**0.6**	0.8	**0.4**	0.6	**0.6**	2.0
BNM-CESTA	**-1.6**	6.3	**0.4**	6.3	**0.1**	6.3	**-2.0**	6.3	**-3.1**	6.3	**2.9**	6.3
GUM	**-0.3**	7.6	**-1.2**	7.6	**-1.7**	7.6	**-3.0**	7.6	**-2.3**	7.6	**-1.1**	7.7
DPLA	**-2.0**	4.3	**-1.6**	2.7	**-0.9**	2.4	**-0.2**	5.5	**-2.2**	5.8	**-1.7**	3.5
CNR-IMGC	**-1.6**	4.2	**-0.6**	4.2	**-0.9**	4.2	**-1.0**	4.2	**-0.1**	6.1	**-3.1**	7.1
SP	**3.4**	5.0	**4.4**	5.0	**4.1**	5.0	**2.0**	5.0	**0.9**	10.2	**4.9**	17.0
INETI	**-1.6**	10.7	**1.4**	4.3	**-1.9**	5.0	**-2.0**	5.6				
CMI	**-2.7**	6.3	**-2.1**	6.3	**-1.4**	6.3	**-2.8**	6.3	**-3.9**	8.9	**3.4**	10.4
UME	**0.7**	6.3	**0.3**	6.3	**0.0**	6.3	**-1.1**	6.3	**-2.2**	12.8	**6.4**	13.0
GBARL	**0.0**	4.5	**0.2**	4.2	**0.2**	4.1	**-0.9**	3.0	**-0.3**	3.6	**-0.8**	3.4
BEV	**-3.6**	7.5	**-3.1**	7.0	**-2.4**	7.0	**-0.1**	6.8	**2.2**	7.3	**1.0**	8.0
CEM	**2.4**	7.5	**-1.1**	7.5	**0.6**	7.5	**1.9**	7.3	**2.2**	7.3	**0.0**	8.0
METAS	**-6.6**	9.1	**-6.1**	8.6	**-6.4**	8.4	**-6.1**	8.2	**-5.8**	9.3	**-9.0**	11.6
SIRA	**-1.6**	7.5	**-2.1**	7.5	**-1.4**	7.5	**-1.1**	7.3	**-0.8**	7.3	**3.0**	7.2

Table E2c: Degrees of equivalence of the participants with respect to the EUROMET RV, Single Ended (SE) accelerometer type 8305 WH 2335 S/N 2361558.

Frequency ⇒	40 Hz		80 Hz		160 Hz		800 Hz		2000 Hz		5000 Hz	
	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.5**	0.7	**0.3**	0.8	**0.3**	0.8	**0.6**	0.7	**0.2**	0.7	**1.0**	2.0
BNM-CESTA	**0.7**	6.2	**0.4**	6.2	**1.1**	6.2	**0.7**	6.2	**-1.3**	6.2	**2.5**	6.3
GUM	**0.5**	7.5	**-0.5**	7.5	**-1.1**	7.5	**-2.0**	7.5	**-1.8**	7.5	**-1.6**	7.6
DPLA	**-1.0**	4.2	**-0.4**	2.6	**0.1**	2.4	**0.4**	5.4	**-1.8**	4.5	**-1.5**	3.4
CNR-IMGC	**-2.3**	4.1	**-1.6**	4.2	**-1.9**	4.2	**-3.3**	4.2	**-1.3**	6.0	**-5.5**	7.0
SP	**0.4**	6.9	**0.1**	6.8	**0.4**	7.5	**0.6**	8.1	**1.4**	12.1	**10.1**	21.5
INETI	**-9.6**	11.4	**0.1**	6.1	**-2.6**	7.6	**-4.4**	8.6				
CMI	**-2.0**	6.3	**-2.2**	6.4	**-3.4**	6.4	**-5.6**	6.4	**-5.9**	12.7	**-6.3**	25.9
UME	**1.0**	6.4	**-0.2**	6.4	**-1.3**	6.4	**-3.4**	6.4	**-0.9**	12.7	**5.4**	13.0
GBARL	**-1.0**	6.5	**-1.2**	6.2	**-2.4**	6.2	**-1.6**	6.0	**-1.9**	6.3	**-3.3**	8.9
BEV	**-3.0**	6.1	**-0.2**	5.4	**0.6**	5.4	**1.4**	5.4	**2.1**	6.2	**-3.3**	6.9
CEM	**0.0**	7.6	**1.8**	7.6	**0.6**	7.6	**0.4**	7.6	**0.1**	7.7	**-2.3**	8.5
METAS	**-1.0**	9.3	**0.8**	8.8	**1.6**	8.6	**1.4**	8.6	**3.1**	9.7	**1.7**	12.8
SIRA	**2.0**	7.6	**0.8**	7.6	**1.6**	7.6	**0.4**	7.6	**2.1**	7.7	**6.7**	7.8

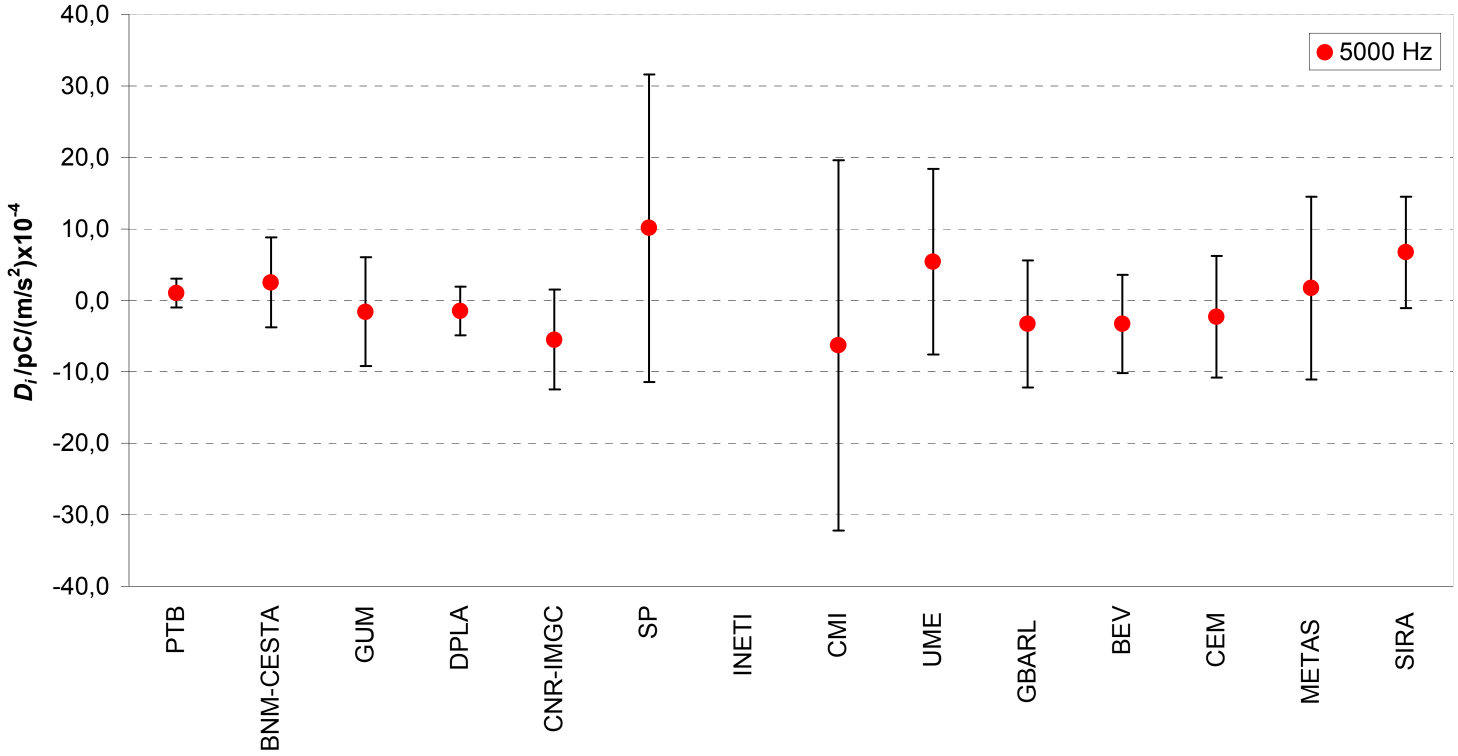

Figure E2c (5000 Hz): Deviations $D_i = d_i$ of the results in the RMO comparison from the EUROMET RV and corresponding expanded uncertainties (k = 2). SE accelerometer type 8305 WH 2335, S/N 2361558. Frequency 5000 Hz

9.4.4. Matrices of Equivalence between the participants of EUROMET.AUV.V-K1

Table E3ab (40 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 40 Hz

Lab j ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**1.8**	6.5	**0.5**	7.8	**2.2**	4.6	**1.8**	4.5	**-3.2**	5.3	**1.8**	10.8
BNM-CESTA	**-1.8**	6.5			**-1.3**	10.0	**0.4**	7.8	**0.0**	7.7	**-5.0**	8.2	**0.0**	12.5
GUM	**-0.5**	7.8	**1.3**	10.0			**1.7**	8.9	**1.3**	8.8	**-3.7**	9.2	**1.3**	13.2
DPLA	**-2.2**	4.6	**-0.4**	7.8	**-1.7**	8.9			**-0.4**	6.2	**-5.4**	6.8	**-0.4**	11.6
CNR-IMGC	**-1.8**	4.5	**0.0**	7.7	**-1.3**	8.8	**0.4**	6.2			**-5.0**	6.7	**0.0**	11.6
SP	**3.2**	5.3	**5.0**	8.2	**3.7**	9.2	**5.4**	6.8	**5.0**	6.7			**5.0**	11.9
INETI	**-1.8**	10.8	**0.0**	12.5	**-1.3**	13.2	**0.4**	11.6	**0.0**	11.6	**-5.0**	11.9		
CMI	**-2.9**	6.5	**-1.1**	9.0	**-2.4**	10.0	**-0.7**	7.8	**-1.1**	7.7	**-6.1**	8.2	**-1.1**	12.5
UME	**0.5**	6.5	**2.3**	9.0	**1.0**	10.0	**2.7**	7.8	**2.3**	7.7	**-2.7**	8.2	**2.3**	12.5
GBARL	**-0.2**	4.8	**1.6**	7.9	**0.3**	9.0	**2.0**	6.4	**1.6**	6.3	**-3.4**	6.9	**1.6**	11.7
BEV	**-4.1**	7.8	**-2.3**	10.0	**-3.6**	10.9	**-1.9**	8.9	**-2.3**	8.8	**-7.3**	9.2	**-2.3**	13.2
CEM	**2.0**	7.8	**3.8**	10.0	**2.5**	10.9	**4.2**	8.9	**3.8**	8.9	**-1.2**	9.3	**3.8**	13.2
METAS	**-7.1**	9.4	**-5.3**	11.3	**-6.6**	12.1	**-4.9**	10.3	**-5.3**	10.3	**-10.3**	10.7	**-5.3**	14.2
SIRA	**-2.1**	7.8	**-0.3**	10.0	**-1.6**	10.9	**0.1**	8.9	**-0.3**	8.8	**-5.3**	9.3	**-0.3**	13.2

Table E3ab (40 Hz): (continued)

Lab j ⇒	CMI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**2.9**	6.5	**-0.5**	6.5	**0.2**	4.8	**4.1**	7.8	**-2.0**	7.8	**7.1**	9.4	**2.1**	7.8
BNM-CESTA	**1.1**	9.0	**-2.3**	9.0	**-1.6**	7.9	**2.3**	10.0	**-3.8**	10.0	**5.3**	11.3	**0.3**	10.0
GUM	**2.4**	10.0	**-1.0**	10.0	**-0.3**	9.0	**3.6**	10.9	**-2.5**	10.9	**6.6**	12.1	**1.6**	10.9
DPLA	**0.7**	7.8	**-2.7**	7.8	**-2.0**	6.4	**1.9**	8.9	**-4.2**	8.9	**4.9**	10.3	**-0.1**	8.9
CNR-IMGC	**1.1**	7.7	**-2.3**	7.7	**-1.6**	6.3	**2.3**	8.8	**-3.8**	8.9	**5.3**	10.3	**0.3**	8.8
SP	**6.1**	8.2	**2.7**	8.2	**3.4**	6.9	**7.3**	9.2	**1.2**	9.3	**10.3**	10.7	**5.3**	9.3
INETI	**1.1**	12.5	**-2.3**	12.5	**-1.6**	11.7	**2.3**	13.2	**-3.8**	13.2	**5.3**	14.2	**0.3**	13.2
CMI			**-3.4**	9.0	**-2.7**	7.9	**1.2**	10.0	**-4.9**	10.0	**4.2**	11.3	**-0.8**	10.0
UME	**3.4**	9.0			**0.7**	7.9	**4.6**	10.0	**-1.5**	10.0	**7.6**	11.3	**2.6**	10.0
GBARL	**2.7**	7.9	**-0.7**	7.9			**3.9**	9.0	**-2.2**	9.0	**6.9**	10.4	**1.9**	9.0
BEV	**-1.2**	10.0	**-4.6**	10.0	**-3.9**	9.0			**-6.0**	10.7	**3.0**	11.9	**-2.0**	10.7
CEM	**4.9**	10.0	**1.5**	10.0	**2.2**	9.0	**6.0**	10.7			**9.0**	11.9	**4.0**	10.7
METAS	**-4.2**	11.3	**-7.6**	11.3	**-6.9**	10.4	**-3.0**	11.9	**-9.0**	11.9			**-5.0**	11.9
SIRA	**0.8**	10.0	**-2.6**	10.0	**-1.9**	9.0	**2.0**	10.7	**-4.0**	10.7	**5.0**	11.9		

Table E3ab (80 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 80 Hz

Lab *j* ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**-0.3**	6.5	**1.3**	7.8	**1.7**	3.1	**0.7**	4.5	**-4.3**	5.3	**-1.3**	4.6
BNM-CESTA	**0.3**	6.5			**1.6**	10.0	**2.0**	7.0	**1.0**	7.7	**-4.0**	8.2	**-1.0**	7.8
GUM	**-1.3**	7.8	**-1.6**	10.0			**0.4**	8.2	**-0.6**	8.8	**-5.6**	9.2	**-2.6**	8.8
DPLA	**-1.7**	3.1	**-2.0**	7.0	**-0.4**	8.2			**-1.0**	5.2	**-6.0**	5.9	**-3.0**	5.2
CNR-IMGC	**-0.7**	4.5	**-1.0**	7.7	**0.6**	8.8	**1.0**	5.2			**-5.0**	6.7	**-2.0**	6.2
SP	**4.3**	5.3	**4.0**	8.2	**5.6**	9.2	**6.0**	5.9	**5.0**	6.7			**3.0**	6.8
INETI	**1.3**	4.6	**1.0**	7.8	**2.6**	8.8	**3.0**	5.2	**2.0**	6.2	**-3.0**	6.8		
CMI	**-2.2**	6.5	**-2.5**	9.0	**-0.9**	10.0	**-0.5**	7.0	**-1.5**	7.7	**-6.5**	8.2	**-3.5**	7.7
UME	**0.2**	6.5	**-0.1**	9.1	**1.5**	10.0	**1.9**	7.0	**0.9**	7.7	**-4.1**	8.2	**-1.1**	7.8
GBARL	**0.1**	4.5	**-0.2**	7.7	**1.4**	8.8	**1.8**	5.2	**0.8**	6.2	**-4.2**	6.7	**-1.2**	6.2
BEV	**-3.5**	7.3	**-3.8**	9.6	**-2.2**	10.5	**-1.8**	7.7	**-2.8**	8.4	**-7.8**	8.8	**-4.8**	8.4
CEM	**-1.5**	7.8	**-1.8**	10.0	**-0.2**	10.9	**0.2**	8.2	**-0.8**	8.9	**-5.8**	9.3	**-2.8**	8.9
METAS	**-6.6**	8.9	**-6.9**	10.9	**-5.3**	11.7	**-4.9**	9.2	**-5.9**	9.8	**-10.9**	10.2	**-7.9**	9.8
SIRA	**-2.5**	7.8	**-2.8**	10.0	**-1.2**	10.9	**-0.8**	8.2	**-1.8**	8.8	**-6.8**	9.3	**-3.8**	8.9

Table E3ab (80 Hz): (continued)

Lab j ⇒ / Lab i ⇓	CMI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**2.2**	6.5	**-0.2**	6.5	**-0.1**	4.5	**3.5**	7.3	**1.5**	7.8	**6.6**	8.9	**2.5**	7.8
BNM-CESTA	**2.5**	9.0	**0.1**	9.1	**0.2**	7.7	**3.8**	9.6	**1.8**	10.0	**6.9**	10.9	**2.8**	10.0
GUM	**0.9**	10.0	**-1.5**	10.0	**-1.4**	8.8	**2.2**	10.5	**0.2**	10.9	**5.3**	11.7	**1.2**	10.9
DPLA	**0.5**	7.0	**-1.9**	7.0	**-1.8**	5.2	**1.8**	7.7	**-0.2**	8.2	**4.9**	9.2	**0.8**	8.2
CNR-IMGC	**1.5**	7.7	**-0.9**	7.7	**-0.8**	6.2	**2.8**	8.4	**0.8**	8.9	**5.9**	9.8	**1.8**	8.8
SP	**6.5**	8.2	**4.1**	8.2	**4.2**	6.7	**7.8**	8.8	**5.8**	9.3	**10.9**	10.2	**6.8**	9.3
INETI	**3.5**	7.7	**1.1**	7.8	**1.2**	6.2	**4.8**	8.4	**2.8**	8.9	**7.9**	9.8	**3.8**	8.9
CMI			**-2.4**	9.0	**-2.3**	7.7	**1.3**	9.6	**-0.7**	10.0	**4.4**	10.9	**0.3**	10.0
UME	**2.4**	9.0			**0.1**	7.7	**3.7**	9.6	**1.7**	10.0	**6.8**	10.9	**2.7**	10.0
GBARL	**2.3**	7.7	**-0.1**	7.7			**3.6**	8.4	**1.6**	8.9	**6.7**	9.8	**2.6**	8.8
BEV	**-1.3**	9.6	**-3.7**	9.6	**-3.6**	8.4			**-2.0**	10.4	**3.0**	11.2	**-1.0**	10.4
CEM	**0.7**	10.0	**-1.7**	10.0	**-1.6**	8.9	**2.0**	10.4			**5.0**	11.5	**1.0**	10.7
METAS	**-4.4**	10.9	**-6.8**	10.9	**-6.7**	9.8	**-3.0**	11.2	**-5.0**	11.5			**-4.0**	11.5
SIRA	**-0.3**	10.0	**-2.7**	10.0	**-2.6**	8.8	**1.0**	10.4	**-1.0**	10.7	**4.0**	11.5		

Table E3ab (160 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 160 Hz

Lab *j* ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**0.1**	6.5	**1.9**	7.8	**1.1**	2.9	**1.1**	4.5	**-3.9**	5.3	**2.1**	5.3
BNM-CESTA	**-0.1**	6.5			**1.8**	10.0	**1.0**	6.9	**1.0**	7.7	**-4.0**	8.2	**2.0**	8.2
GUM	**-1.9**	7.8	**-1.8**	10.0			**-0.8**	8.1	**-0.8**	8.8	**-5.8**	9.2	**0.2**	9.2
DPLA	**-1.1**	2.9	**-1.0**	6.9	**0.8**	8.1			**0.0**	5.1	**-5.0**	5.8	**1.0**	5.7
CNR-IMGC	**-1.1**	4.5	**-1.0**	7.7	**0.8**	8.8	**0.0**	5.1			**-5.0**	6.7	**1.0**	6.7
SP	**3.9**	5.3	**4.0**	8.2	**5.8**	9.2	**5.0**	5.8	**5.0**	6.7			**6.0**	7.2
INETI	**-2.1**	5.3	**-2.0**	8.2	**-0.2**	9.2	**-1.0**	5.7	**-1.0**	6.7	**-6.0**	7.2		
CMI	**-1.6**	6.5	**-1.5**	9.0	**0.3**	10.0	**-0.5**	6.9	**-0.5**	7.7	**-5.5**	8.2	**0.5**	8.2
UME	**-0.2**	6.5	**-0.1**	9.1	**1.7**	10.0	**0.9**	6.9	**0.9**	7.7	**-4.1**	8.2	**1.9**	8.2
GBARL	**0.0**	4.4	**0.1**	7.7	**1.9**	8.8	**1.1**	5.0	**1.1**	6.1	**-3.9**	6.7	**2.1**	6.6
BEV	**-2.9**	7.3	**-2.8**	9.6	**-1.0**	10.5	**-1.8**	7.7	**-1.8**	8.4	**-6.8**	8.8	**-0.8**	8.8
CEM	**0.2**	7.8	**0.3**	10.0	**2.1**	10.9	**1.3**	8.2	**1.3**	8.9	**-3.7**	9.3	**2.3**	9.3
METAS	**-6.9**	8.7	**-6.8**	10.8	**-5.0**	11.6	**-5.8**	9.0	**-5.8**	9.7	**-10.8**	10.1	**-4.8**	10.0
SIRA	**-1.8**	7.8	**-1.7**	10.0	**0.1**	10.9	**-0.7**	8.1	**-0.7**	8.9	**-5.7**	9.3	**0.3**	9.3

Table E3ab (160 Hz): (continued)

Lab *j* ⇒ / Lab *i* ⇓	CMI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**1.6**	6.5	**0.2**	6.5	**0.0**	4.4	**2.9**	7.3	**-0.2**	7.8	**6.9**	8.7	**1.8**	7.8
BNM-CESTA	**1.5**	9.0	**0.1**	9.1	**-0.1**	7.7	**2.8**	9.6	**-0.3**	10.0	**6.8**	10.8	**1.7**	10.0
GUM	**-0.3**	10.0	**-1.7**	10.0	**-1.9**	8.8	**1.0**	10.5	**-2.1**	10.9	**5.0**	11.6	**-0.1**	10.9
DPLA	**0.5**	6.9	**-0.9**	6.9	**-1.1**	5.0	**1.8**	7.7	**-1.3**	8.2	**5.8**	9.0	**0.7**	8.1
CNR-IMGC	**0.5**	7.7	**-0.9**	7.7	**-1.1**	6.1	**1.8**	8.4	**-1.3**	8.9	**5.8**	9.7	**0.7**	8.9
SP	**5.5**	8.2	**4.1**	8.2	**3.9**	6.7	**6.8**	8.8	**3.7**	9.3	**10.8**	10.1	**5.7**	9.3
INETI	**-0.5**	8.2	**-1.9**	8.2	**-2.1**	6.6	**0.8**	8.8	**-2.3**	9.3	**4.8**	10.0	**-0.3**	9.3
CMI			**-1.4**	9.0	**-1.6**	7.7	**1.3**	9.6	**-1.8**	10.0	**5.3**	10.8	**0.2**	10.0
UME	**1.4**	9.0			**-0.2**	7.7	**2.7**	9.6	**-0.4**	10.0	**6.7**	10.8	**1.6**	10.0
GBARL	**1.6**	7.7	**0.2**	7.7			**2.9**	8.3	**-0.2**	8.8	**6.9**	9.6	**1.8**	8.8
BEV	**-1.3**	9.6	**-2.7**	9.6	**-2.9**	8.3			**-3.0**	10.4	**4.0**	11.1	**-1.0**	10.4
CEM	**1.8**	10.0	**0.4**	10.0	**0.2**	8.8	**3.0**	10.4			**7.0**	11.4	**2.0**	10.7
METAS	**-5.3**	10.8	**-6.7**	10.8	**-6.9**	9.6	**-4.0**	11.1	**-7.0**	11.4			**-5.0**	11.4
SIRA	**-0.2**	10.0	**-1.6**	10.0	**-1.8**	8.8	**1.0**	10.4	**-2.0**	10.7	**5.0**	11.4		

Table E3ab (800 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 800 Hz

Lab j ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			2.6	6.5	3.6	7.8	0.8	5.8	1.6	4.5	-1.4	5.3	2.6	5.8
BNM-CESTA	-2.6	6.5			1.0	10.0	-1.8	8.5	-1.0	7.7	-4.0	8.2	0.0	8.6
GUM	-3.6	7.8	-1.0	10.0			-2.8	9.5	-2.0	8.8	-5.0	9.2	-1.0	9.5
DPLA	-0.8	5.8	1.8	8.5	2.8	9.5			0.8	7.1	-2.2	7.6	1.8	8.0
CNR-IMGC	-1.6	4.5	1.0	7.7	2.0	8.8	-0.8	7.1			-3.0	6.7	1.0	7.2
SP	1.4	5.3	4.0	8.2	5.0	9.2	2.2	7.6	3.0	6.7			4.0	7.7
INETI	-2.6	5.8	0.0	8.6	1.0	9.5	-1.8	8.0	-1.0	7.2	-4.0	7.7		
CMI	-3.4	6.5	-0.8	9.0	0.2	10.0	-2.6	8.5	-1.8	7.7	-4.8	8.2	-0.8	8.6
UME	-1.7	6.5	0.9	9.1	1.9	10.0	-0.9	8.5	-0.1	7.7	-3.1	8.2	0.9	8.6
GBARL	-1.5	3.5	1.1	7.2	2.1	8.3	-0.7	6.5	0.1	5.4	-2.9	6.1	1.1	6.5
BEV	-1.1	7.7	1.5	9.9	2.5	10.8	-0.3	9.4	0.5	8.7	-2.5	9.1	1.5	9.5
CEM	1.0	8.2	3.6	10.3	4.6	11.1	1.8	9.8	2.6	9.2	-0.4	9.6	3.6	9.9
METAS	-7.1	9.0	-4.5	11.0	-3.5	11.8	-6.3	10.6	-5.5	9.9	-8.5	10.3	-4.5	10.6
SIRA	-2.1	8.1	0.5	10.3	1.5	11.1	-1.3	9.8	-0.5	9.1	-3.5	9.5	0.5	9.8

Table E3ab (800 Hz): (continued)

Lab *j* ⇒ / **Lab *i* ⇓**	**CMI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**3.4**	6.5	**1.7**	6.5	**1.5**	3.5	**1.1**	7.7	**-1.0**	8.2	**7.1**	9.0	**2.1**	8.1
BNM-CESTA	**0.8**	9.0	**-0.9**	9.1	**-1.1**	7.2	**-1.5**	9.9	**-3.6**	10.3	**4.5**	11.0	**-0.5**	10.3
GUM	**-0.2**	10.0	**-1.9**	10.0	**-2.1**	8.3	**-2.5**	10.8	**-4.6**	11.1	**3.5**	11.8	**-1.5**	11.1
DPLA	**2.6**	8.5	**0.9**	8.5	**0.7**	6.5	**0.3**	9.4	**-1.8**	9.8	**6.3**	10.6	**1.3**	9.8
CNR-IMGC	**1.8**	7.7	**0.1**	7.7	**-0.1**	5.4	**-0.5**	8.7	**-2.6**	9.2	**5.5**	9.9	**0.5**	9.1
SP	**4.8**	8.2	**3.1**	8.2	**2.9**	6.1	**2.5**	9.1	**0.4**	9.6	**8.5**	10.3	**3.5**	9.5
INETI	**0.8**	8.6	**-0.9**	8.6	**-1.1**	6.5	**-1.5**	9.5	**-3.6**	9.9	**4.5**	10.6	**-0.5**	9.8
CMI			**-1.7**	9.1	**-1.9**	7.2	**-2.3**	9.9	**-4.4**	10.3	**3.7**	11.0	**-1.3**	10.3
UME	**1.7**	9.1			**-0.2**	7.2	**-0.6**	9.9	**-2.7**	10.3	**5.4**	11.0	**0.4**	10.3
GBARL	**1.9**	7.2	**0.2**	7.2			**-0.4**	8.2	**-2.5**	8.7	**5.6**	9.5	**0.6**	8.6
BEV	**2.3**	9.9	**0.6**	9.9	**0.4**	8.2			**-2.0**	10.4	**6.0**	11.1	**1.0**	10.4
CEM	**4.4**	10.3	**2.7**	10.3	**2.5**	8.7	**2.0**	10.4			**8.0**	11.4	**3.0**	10.7
METAS	**-3.7**	11.0	**-5.4**	11.0	**-5.6**	9.5	**-6.0**	11.1	**-8.0**	11.4			**-5.0**	11.4
SIRA	**1.3**	10.3	**-0.4**	10.3	**-0.6**	8.6	**-1.0**	10.4	**-3.0**	10.7	**5.0**	11.4		

Table E3ab (2000 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 2000 Hz

Lab *j* ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**3.5**	6.5	**2.7**	7.8	**2.6**	6.1	**0.5**	6.3	**-0.5**	10.4		
BNM-CESTA	**-3.5**	6.5			**-0.8**	10.0	**-0.9**	8.7	**-3.0**	8.9	**-4.0**	12.1		
GUM	**-2.7**	7.8	**0.8**	10.0			**-0.1**	9.7	**-2.2**	9.9	**-3.2**	12.8		
DPLA	**-2.6**	6.1	**0.9**	8.7	**0.1**	9.7			**-2.1**	8.6	**-3.1**	11.9		
CNR-IMGC	**-0.5**	6.3	**3.0**	8.9	**2.2**	9.9	**2.1**	8.6			**-1.0**	12.0		
SP	**0.5**	10.4	**4.0**	12.1	**3.2**	12.8	**3.1**	11.9	**1.0**	12.0				
INETI														
CMI	**-4.3**	9.1	**-0.8**	11.0	**-1.6**	11.8	**-1.7**	10.8	**-3.8**	10.9	**-4.8**	13.6		
UME	**-2.6**	12.9	**0.9**	14.3	**0.1**	15.0	**0.0**	14.1	**-2.1**	14.2	**-3.1**	16.4		
GBARL	**-0.7**	3.9	**2.8**	7.4	**2.0**	8.6	**1.9**	7.0	**-0.2**	7.2	**-1.2**	10.9		
BEV	**1.8**	8.2	**5.3**	10.3	**4.5**	11.1	**4.4**	10.0	**2.3**	10.2	**1.3**	13.1		
CEM	**1.8**	8.2	**5.3**	10.3	**4.5**	11.1	**4.4**	10.0	**2.3**	10.2	**1.3**	13.1		
METAS	**-6.3**	10.0	**-2.8**	11.8	**-3.6**	12.6	**-3.7**	11.6	**-5.8**	11.7	**-6.8**	14.3		
SIRA	**-1.2**	8.1	**2.3**	10.3	**1.5**	11.1	**1.4**	10.0	**-0.7**	10.1	**-1.7**	13.1		

Table E3ab (2000 Hz): (continued)

Lab *j* ⇒	**CMI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**4.3**	9.1	**2.6**	12.9	**0.7**	3.9	**-1.8**	8.2	**-1.8**	8.2	**6.3**	10.0	**1.2**	8.1
BNM-CESTA	**0.8**	11.0	**-0.9**	14.3	**-2.8**	7.4	**-5.3**	10.3	**-5.3**	10.3	**2.8**	11.8	**-2.3**	10.3
GUM	**1.6**	11.8	**-0.1**	15.0	**-2.0**	8.6	**-4.5**	11.1	**-4.5**	11.1	**3.6**	12.6	**-1.5**	11.1
DPLA	**1.7**	10.8	**0.0**	14.1	**-1.9**	7.0	**-4.4**	10.0	**-4.4**	10.0	**3.7**	11.6	**-1.4**	10.0
CNR-IMGC	**3.8**	10.9	**2.1**	14.2	**0.2**	7.2	**-2.3**	10.2	**-2.3**	10.2	**5.8**	11.7	**0.7**	10.1
SP	**4.8**	13.6	**3.1**	16.4	**1.2**	10.9	**-1.3**	13.1	**-1.3**	13.1	**6.8**	14.3	**1.7**	13.1
INETI														
CMI			**-1.7**	15.7	**-3.6**	9.7	**-6.1**	12.1	**-6.1**	12.1	**2.0**	13.4	**-3.1**	12.0
UME	**1.7**	15.7			**-1.9**	13.4	**-4.4**	15.2	**-4.4**	15.2	**3.7**	16.2	**-1.4**	15.1
GBARL	**3.6**	9.7	**1.9**	13.4			**-2.5**	8.9	**-2.5**	8.9	**5.6**	10.6	**0.5**	8.9
BEV	**6.1**	12.1	**4.4**	15.2	**2.5**	8.9			**0.0**	10.8	**8.0**	12.2	**3.0**	10.8
CEM	**6.1**	12.1	**4.4**	15.2	**2.5**	8.9	**0.0**	10.8			**8.0**	12.2	**3.0**	10.8
METAS	**-2.0**	13.4	**-3.7**	16.2	**-5.6**	10.6	**-8.0**	12.2	**-8.0**	12.2			**-5.0**	12.2
SIRA	**3.1**	12.0	**1.4**	15.1	**-0.5**	8.9	**-3.0**	10.8	**-3.0**	10.8	**5.0**	12.2		

Table E3ab (5000 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 5000 Hz

Lab *j* ⇒	**PTB**		**BNM-CESTA**		**GUM**		**DPLA**		**CNR-IMGC**		**SP**		**INETI**	
	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}***
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**-2.3**	7.1	**1.7**	8.3	**2.3**	4.7	**3.7**	7.8	**-4.3**	17.3		
BNM-CESTA	**2.3**	7.1			**4.0**	10.2	**4.6**	7.6	**6.0**	9.8	**-2.0**	18.3		
GUM	**-1.7**	8.3	**-4.0**	10.2			**0.6**	8.7	**2.0**	10.7	**-6.0**	18.8		
DPLA	**-2.3**	4.7	**-4.6**	7.6	**-0.6**	8.7			**1.4**	8.3	**-6.6**	17.5		
CNR-IMGC	**-3.7**	7.8	**-6.0**	9.8	**-2.0**	10.7	**-1.4**	8.3			**-8.0**	18.6		
SP	**4.3**	17.3	**2.0**	18.3	**6.0**	18.8	**6.6**	17.5	**8.0**	18.6				
INETI														
CMI	**2.8**	10.8	**0.5**	12.4	**4.5**	13.1	**5.1**	11.2	**6.5**	12.8	**-1.5**	20.0		
UME	**5.8**	13.4	**3.5**	14.7	**7.5**	15.3	**8.1**	13.7	**9.5**	15.0	**1.5**	21.5		
GBARL	**-1.4**	4.6	**-3.7**	7.6	**0.3**	8.7	**0.9**	5.4	**2.3**	8.2	**-5.7**	17.5		
BEV	**0.4**	9.7	**-1.9**	11.4	**2.1**	12.2	**2.7**	10.1	**4.1**	11.9	**-3.9**	19.4		
CEM	**-0.6**	9.7	**-2.9**	11.4	**1.1**	12.2	**1.7**	10.1	**3.1**	11.8	**-4.9**	19.4		
METAS	**-9.7**	12.9	**-12.0**	14.2	**-8.0**	14.8	**-7.4**	13.2	**-6.0**	14.6	**-14.0**	21.2		
SIRA	**2.4**	9.0	**0.1**	10.8	**4.1**	11.7	**4.7**	9.5	**6.1**	11.3	**-1.9**	19.1		

Table E3ab (5000 Hz): (continued)

Lab j ⇒	CMI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**-2.8**	10.8	**-5.8**	13.4	**1.4**	4.6	**-0.4**	9.7	**0.6**	9.7	**9.7**	12.9	**-2.4**	9.0
BNM-CESTA	**-0.5**	12.4	**-3.5**	14.7	**3.7**	7.6	**1.9**	11.4	**2.9**	11.4	**12.0**	14.2	**-0.1**	10.8
GUM	**-4.5**	13.1	**-7.5**	15.3	**-0.3**	8.7	**-2.1**	12.2	**-1.1**	12.2	**8.0**	14.8	**-4.1**	11.7
DPLA	**-5.1**	11.2	**-8.1**	13.7	**-0.9**	5.4	**-2.7**	10.1	**-1.7**	10.1	**7.4**	13.2	**-4.7**	9.5
CNR-IMGC	**-6.5**	12.8	**-9.5**	15.0	**-2.3**	8.2	**-4.1**	11.9	**-3.1**	11.8	**6.0**	14.6	**-6.1**	11.3
SP	**1.5**	20.0	**-1.5**	21.5	**5.7**	17.5	**3.9**	19.4	**4.9**	19.4	**14.0**	21.2	**1.9**	19.1
INETI														
CMI			**-3.0**	16.8	**4.2**	11.1	**2.4**	14.0	**3.4**	14.0	**12.5**	16.4	**0.4**	13.6
UME	**3.0**	16.8			**7.2**	13.7	**5.4**	16.1	**6.4**	16.1	**15.5**	18.2	**3.4**	15.7
GBARL	**-4.2**	11.1	**-7.2**	13.7			**-1.8**	10.1	**-0.8**	10.1	**8.3**	13.2	**-3.8**	9.4
BEV	**-2.4**	14.0	**-5.4**	16.1	**1.8**	10.1			**1.0**	12.0	**10.0**	14.7	**-2.0**	11.5
CEM	**-3.4**	14.0	**-6.4**	16.1	**0.8**	10.1	**-1.0**	12.0			**9.0**	14.7	**-3.0**	11.5
METAS	**-12.5**	16.4	**-15.5**	18.2	**-8.3**	13.2	**-10.0**	14.7	**-9.0**	14.7			**-12.0**	14.2
SIRA	**-0.4**	13.6	**-3.4**	15.7	**3.8**	9.4	**2.0**	11.5	**3.0**	11.5	**12.0**	14.2		

Table E3c (40 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Single-ended (SE) accelerometers type 8305 WH 2335 S/N 2361558 at 40 Hz

Lab *j* ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**-0.2**	6.4	**0.0**	7.7	**1.5**	4.5	**2.8**	4.5	**0.1**	7.1	**10.1**	11.5
BNM-CESTA	**0.2**	6.4			**0.2**	9.8	**1.7**	7.6	**3.0**	7.6	**0.3**	9.4	**10.3**	13.1
GUM	**0.0**	7.7	**-0.2**	9.8			**1.5**	8.7	**2.8**	8.7	**0.1**	10.3	**10.1**	13.7
DPLA	**-1.5**	4.5	**-1.7**	7.6	**-1.5**	8.7			**1.3**	6.1	**-1.4**	8.2	**8.6**	12.2
CNR-IMGC	**-2.8**	4.5	**-3.0**	7.6	**-2.8**	8.7	**-1.3**	6.1			**-2.7**	8.2	**7.3**	12.2
SP	**-0.1**	7.1	**-0.3**	9.4	**-0.1**	10.3	**1.4**	8.2	**2.7**	8.2			**10.0**	13.4
INETI	**-10.1**	11.5	**-10.3**	13.1	**-10.1**	13.7	**-8.6**	12.2	**-7.3**	12.2	**-10.0**	13.4		
CMI	**-2.5**	6.6	**-2.7**	9.0	**-2.5**	9.9	**-1.0**	7.8	**0.3**	7.7	**-2.3**	9.5	**7.7**	13.1
UME	**0.5**	6.6	**0.3**	9.0	**0.5**	9.9	**2.0**	7.8	**3.3**	7.7	**0.7**	9.5	**10.7**	13.1
GBARL	**-1.5**	6.7	**-1.7**	9.1	**-1.5**	10.0	**0.0**	7.9	**1.3**	7.8	**-1.3**	9.6	**8.7**	13.2
BEV	**-3.5**	6.3	**-3.7**	8.8	**-3.5**	9.8	**-2.0**	7.5	**-0.7**	7.5	**-3.3**	9.3	**6.7**	13.0
CEM	**-0.5**	7.8	**-0.7**	9.9	**-0.5**	10.8	**1.0**	8.8	**2.3**	8.8	**-0.3**	10.4	**9.7**	13.8
METAS	**-1.5**	9.4	**-1.7**	11.3	**-1.5**	12.0	**0.0**	10.3	**1.3**	10.3	**-1.3**	11.7	**8.7**	14.8
SIRA	**1.5**	7.8	**1.3**	9.9	**1.5**	10.8	**3.0**	8.8	**4.3**	8.8	**1.7**	10.4	**11.7**	13.8

Table E3c (40 Hz): (continued)

Lab *j* ⇒ / Lab *i* ⇓	CMI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**2.5**	6.6	**-0.5**	6.6	**1.5**	6.7	**3.5**	6.3	**0.5**	7.8	**1.5**	9.4	**-1.5**	7.8
BNM-CESTA	**2.7**	9.0	**-0.3**	9.0	**1.7**	9.1	**3.7**	8.8	**0.7**	9.9	**1.7**	11.3	**-1.3**	9.9
GUM	**2.5**	9.9	**-0.5**	9.9	**1.5**	10.0	**3.5**	9.8	**0.5**	10.8	**1.5**	12.0	**-1.5**	10.8
DPLA	**1.0**	7.8	**-2.0**	7.8	**0.0**	7.9	**2.0**	7.5	**-1.0**	8.8	**0.0**	10.3	**-3.0**	8.8
CNR-IMGC	**-0.3**	7.7	**-3.3**	7.7	**-1.3**	7.8	**0.7**	7.5	**-2.3**	8.8	**-1.3**	10.3	**-4.3**	8.8
SP	**2.3**	9.5	**-0.7**	9.5	**1.3**	9.6	**3.3**	9.3	**0.3**	10.4	**1.3**	11.7	**-1.7**	10.4
INETI	**-7.7**	13.1	**-10.7**	13.1	**-8.7**	13.2	**-6.7**	13.0	**-9.7**	13.8	**-8.7**	14.8	**-11.7**	13.8
CMI			**-3.0**	9.1	**-1.0**	9.2	**1.0**	8.9	**-2.0**	10.0	**-1.0**	11.3	**-4.0**	10.0
UME	**3.0**	9.1			**2.0**	9.2	**4.0**	8.9	**1.0**	10.0	**2.0**	11.4	**-1.0**	10.0
GBARL	**1.0**	9.2	**-2.0**	9.2			**2.0**	9.0	**-1.0**	10.1	**0.0**	11.4	**-3.0**	10.1
BEV	**-1.0**	8.9	**-4.0**	8.9	**-2.0**	9.0			**-3.0**	9.9	**-2.0**	11.2	**-5.0**	9.9
CEM	**2.0**	10.0	**-1.0**	10.0	**1.0**	10.1	**3.0**	9.9			**1.0**	12.1	**-2.0**	10.9
METAS	**1.0**	11.3	**-2.0**	11.4	**0.0**	11.4	**2.0**	11.2	**-1.0**	12.1			**-3.0**	12.1
SIRA	**4.0**	10.0	**1.0**	10.0	**3.0**	10.1	**5.0**	9.9	**2.0**	10.9	**3.0**	12.1		

Table E3c (80 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Single-ended (SE) accelerometers type 8305 WH 2335 S/N 2361558 at 80 Hz

Lab j ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**-0.1**	6.4	**0.8**	7.7	**0.7**	3.1	**1.9**	4.5	**0.2**	7.0	**0.2**	6.3
BNM-CESTA	**0.1**	6.4			**0.9**	9.8	**0.8**	6.9	**2.0**	7.6	**0.3**	9.3	**0.3**	8.8
GUM	**-0.8**	7.7	**-0.9**	9.8			**-0.1**	8.0	**1.1**	8.7	**-0.6**	10.2	**-0.6**	9.8
DPLA	**-0.7**	3.1	**-0.8**	6.9	**0.1**	8.0			**1.2**	5.1	**-0.5**	7.4	**-0.5**	6.8
CNR-IMGC	**-1.9**	4.5	**-2.0**	7.6	**-1.1**	8.7	**-1.2**	5.1			**-1.7**	8.1	**-1.7**	7.5
SP	**-0.2**	7.0	**-0.3**	9.3	**0.6**	10.2	**0.5**	7.4	**1.7**	8.1			**0.0**	9.3
INETI	**-0.2**	6.3	**-0.3**	8.8	**0.6**	9.8	**0.5**	6.8	**1.7**	7.5	**0.0**	9.3		
CMI	**-2.4**	6.6	**-2.5**	9.0	**-1.6**	9.9	**-1.7**	7.0	**-0.5**	7.7	**-2.3**	9.4	**-2.3**	8.9
UME	**-0.4**	6.6	**-0.5**	9.0	**0.4**	9.9	**0.3**	7.0	**1.5**	7.7	**-0.3**	9.4	**-0.3**	8.9
GBARL	**-1.4**	6.4	**-1.5**	8.9	**-0.6**	9.8	**-0.7**	6.9	**0.5**	7.6	**-1.3**	9.3	**-1.3**	8.9
BEV	**-0.4**	5.6	**-0.5**	8.3	**0.4**	9.3	**0.3**	6.1	**1.5**	6.9	**-0.3**	8.8	**-0.3**	8.3
CEM	**1.6**	7.8	**1.5**	9.9	**2.4**	10.8	**2.3**	8.2	**3.5**	8.8	**1.7**	10.3	**1.7**	9.9
METAS	**0.6**	8.9	**0.5**	10.8	**1.4**	11.6	**1.3**	9.2	**2.5**	9.8	**0.7**	11.2	**0.7**	10.8
SIRA	**0.6**	7.8	**0.5**	9.9	**1.4**	10.8	**1.3**	8.2	**2.5**	8.8	**0.7**	10.3	**0.7**	9.9

Table E3c (80 Hz): (continued)

Lab *j* ⇒ / **Lab *i* ⇓**	**CMI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**2.4**	6.6	**0.4**	6.6	**1.4**	6.4	**0.4**	5.6	**-1.6**	7.8	**-0.6**	8.9	**-0.6**	7.8
BNM-CESTA	**2.5**	9.0	**0.5**	9.0	**1.5**	8.9	**0.5**	8.3	**-1.5**	9.9	**-0.5**	10.8	**-0.5**	9.9
GUM	**1.6**	9.9	**-0.4**	9.9	**0.6**	9.8	**-0.4**	9.3	**-2.4**	10.8	**-1.4**	11.6	**-1.4**	10.8
DPLA	**1.7**	7.0	**-0.3**	7.0	**0.7**	6.9	**-0.3**	6.1	**-2.3**	8.2	**-1.3**	9.2	**-1.3**	8.2
CNR-IMGC	**0.5**	7.7	**-1.5**	7.7	**-0.5**	7.6	**-1.5**	6.9	**-3.5**	8.8	**-2.5**	9.8	**-2.5**	8.8
SP	**2.3**	9.4	**0.3**	9.4	**1.3**	9.3	**0.3**	8.8	**-1.7**	10.3	**-0.7**	11.2	**-0.7**	10.3
INETI	**2.3**	8.9	**0.3**	8.9	**1.3**	8.9	**0.3**	8.3	**-1.7**	9.9	**-0.7**	10.8	**-0.7**	9.9
CMI			**-2.0**	9.1	**-1.0**	9.0	**-2.0**	8.4	**-4.0**	10.0	**-3.0**	10.9	**-3.0**	10.0
UME	**2.0**	9.1			**1.0**	9.0	**0.0**	8.4	**-2.0**	10.0	**-1.0**	10.9	**-1.0**	10.0
GBARL	**1.0**	9.0	**-1.0**	9.0			**-1.0**	8.3	**-3.0**	10.0	**-2.0**	10.8	**-2.0**	9.9
BEV	**2.0**	8.4	**0.0**	8.4	**1.0**	8.3			**-2.0**	9.4	**-1.0**	10.4	**-1.0**	9.4
CEM	**4.0**	10.0	**2.0**	10.0	**3.0**	10.0	**2.0**	9.4			**1.0**	11.7	**1.0**	10.9
METAS	**3.0**	10.9	**1.0**	10.9	**2.0**	10.8	**1.0**	10.4	**-1.0**	11.7			**0.0**	11.7
SIRA	**3.0**	10.0	**1.0**	10.0	**2.0**	9.9	**1.0**	9.4	**-1.0**	10.9	**0.0**	11.7		

Table E3c (160 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Single-ended (SE) accelerometers type 8305 WH 2335 S/N 2361558 at 160 Hz

Lab *j* ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**-0.8**	6.4	**1.4**	7.7	**0.2**	2.9	**2.2**	4.5	**0.0**	7.7	**3.0**	7.7
BNM-CESTA	**0.8**	6.4			**2.2**	9.8	**1.0**	6.8	**3.0**	7.6	**0.8**	9.9	**3.8**	9.9
GUM	**-1.4**	7.7	**-2.2**	9.8			**-1.2**	8.0	**0.8**	8.7	**-1.4**	10.7	**1.6**	10.7
DPLA	**-0.2**	2.9	**-1.0**	6.8	**1.2**	8.0			**2.0**	5.0	**-0.2**	8.0	**2.8**	8.1
CNR-IMGC	**-2.2**	4.5	**-3.0**	7.6	**-0.8**	8.7	**-2.0**	5.0			**-2.2**	8.7	**0.8**	8.8
SP	**0.0**	7.7	**-0.8**	9.9	**1.4**	10.7	**0.2**	8.0	**2.2**	8.7			**3.0**	10.8
INETI	**-3.0**	7.7	**-3.8**	9.9	**-1.6**	10.7	**-2.8**	8.1	**-0.8**	8.8	**-3.0**	10.8		
CMI	**-3.7**	6.6	**-4.5**	9.0	**-2.3**	9.9	**-3.5**	6.9	**-1.5**	7.7	**-3.8**	10.0	**-0.8**	10.0
UME	**-1.6**	6.6	**-2.4**	9.0	**-0.2**	9.9	**-1.4**	6.9	**0.6**	7.7	**-1.7**	10.0	**1.3**	10.0
GBARL	**-2.7**	6.4	**-3.5**	8.9	**-1.3**	9.8	**-2.5**	6.8	**-0.5**	7.6	**-2.8**	9.9	**0.2**	9.9
BEV	**0.3**	5.6	**-0.5**	8.3	**1.7**	9.3	**0.5**	6.0	**2.5**	6.9	**0.2**	9.4	**3.2**	9.4
CEM	**0.3**	7.8	**-0.5**	9.9	**1.7**	10.8	**0.5**	8.1	**2.5**	8.8	**0.2**	10.8	**3.2**	10.8
METAS	**1.3**	8.8	**0.5**	10.7	**2.7**	11.5	**1.5**	9.1	**3.5**	9.7	**1.2**	11.6	**4.2**	11.6
SIRA	**1.3**	7.8	**0.5**	9.9	**2.7**	10.8	**1.5**	8.1	**3.5**	8.8	**1.2**	10.8	**4.2**	10.8

Table E3c (160 Hz): (continued)

Lab *j* ⇒ / Lab *i* ⇓	CMI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**3.7**	6.6	**1.6**	6.6	**2.7**	6.4	**-0.3**	5.6	**-0.3**	7.8	**-1.3**	8.8	**-1.3**	7.8
BNM-CESTA	**4.5**	9.0	**2.4**	9.0	**3.5**	8.9	**0.5**	8.3	**0.5**	9.9	**-0.5**	10.7	**-0.5**	9.9
GUM	**2.3**	9.9	**0.2**	9.9	**1.3**	9.8	**-1.7**	9.3	**-1.7**	10.8	**-2.7**	11.5	**-2.7**	10.8
DPLA	**3.5**	6.9	**1.4**	6.9	**2.5**	6.8	**-0.5**	6.0	**-0.5**	8.1	**-1.5**	9.1	**-1.5**	8.1
CNR-IMGC	**1.5**	7.7	**-0.6**	7.7	**0.5**	7.6	**-2.5**	6.9	**-2.5**	8.8	**-3.5**	9.7	**-3.5**	8.8
SP	**3.8**	10.0	**1.7**	10.0	**2.8**	9.9	**-0.2**	9.4	**-0.2**	10.8	**-1.2**	11.6	**-1.2**	10.8
INETI	**0.8**	10.0	**-1.3**	10.0	**-0.2**	9.9	**-3.2**	9.4	**-3.2**	10.8	**-4.2**	11.6	**-4.2**	10.8
CMI			**-2.1**	9.1	**-1.0**	9.0	**-4.0**	8.4	**-4.0**	10.0	**-5.0**	10.8	**-5.0**	10.0
UME	**2.1**	9.1			**1.1**	9.0	**-1.9**	8.4	**-1.9**	10.0	**-2.9**	10.8	**-2.9**	10.0
GBARL	**1.0**	9.0	**-1.1**	9.0			**-3.0**	8.3	**-3.0**	10.0	**-4.0**	10.7	**-4.0**	10.0
BEV	**4.0**	8.4	**1.9**	8.4	**3.0**	8.3			**0.0**	9.4	**-1.0**	10.3	**-1.0**	9.4
CEM	**4.0**	10.0	**1.9**	10.0	**3.0**	10.0	**0.0**	9.4			**-1.0**	11.6	**-1.0**	10.9
METAS	**5.0**	10.8	**2.9**	10.8	**4.0**	10.7	**1.0**	10.3	**1.0**	11.6			**0.0**	11.6
SIRA	**5.0**	10.0	**2.9**	10.0	**4.0**	10.0	**1.0**	9.4	**1.0**	10.9	**0.0**	11.6		

Table E3c (800 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Single-ended (SE) accelerometers type 8305 WH 2335 S/N 2361558 at 800 Hz

Lab *j* ⇒	**PTB**		**BNM-CESTA**		**GUM**		**DPLA**		**CNR-IMGC**		**SP**		**INETI**	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**-0.1**	6.4	**2.6**	7.7	**0.2**	5.6	**3.9**	4.5	**0.1**	8.3	**5.1**	8.8
BNM-CESTA	**0.1**	6.4			**2.7**	9.8	**0.3**	8.4	**4.0**	7.6	**0.2**	10.3	**5.2**	10.8
GUM	**-2.6**	7.7	**-2.7**	9.8			**-2.4**	9.3	**1.3**	8.7	**-2.5**	11.1	**2.5**	11.5
DPLA	**-0.2**	5.6	**-0.3**	8.4	**2.4**	9.3			**3.7**	7.0	**-0.1**	9.9	**4.9**	10.3
CNR-IMGC	**-3.9**	4.5	**-4.0**	7.6	**-1.3**	8.7	**-3.7**	7.0			**-3.8**	9.2	**1.2**	9.7
SP	**-0.1**	8.3	**-0.2**	10.3	**2.5**	11.1	**0.1**	9.9	**3.8**	9.2			**5.0**	12.0
INETI	**-5.1**	8.8	**-5.2**	10.8	**-2.5**	11.5	**-4.9**	10.3	**-1.2**	9.7	**-5.0**	12.0		
CMI	**-6.2**	6.6	**-6.3**	9.0	**-3.6**	9.9	**-6.0**	8.5	**-2.3**	7.7	**-6.2**	10.4	**-1.2**	10.8
UME	**-4.0**	6.6	**-4.1**	9.0	**-1.4**	9.9	**-3.8**	8.5	**-0.1**	7.7	**-4.0**	10.4	**1.0**	10.8
GBARL	**-2.2**	6.2	**-2.3**	8.8	**0.4**	9.7	**-2.0**	8.2	**1.7**	7.4	**-2.2**	10.2	**2.8**	10.6
BEV	**0.8**	5.6	**0.7**	8.4	**3.4**	9.3	**1.0**	7.8	**4.7**	6.9	**0.8**	9.8	**5.8**	10.3
CEM	**-0.2**	7.8	**-0.3**	10.0	**2.4**	10.8	**0.0**	9.5	**3.7**	8.8	**-0.2**	11.2	**4.8**	11.6
METAS	**0.8**	8.8	**0.7**	10.7	**3.4**	11.5	**1.0**	10.3	**4.7**	9.7	**0.8**	11.9	**5.8**	12.3
SIRA	**-0.2**	7.8	**-0.3**	10.0	**2.4**	10.8	**0.0**	9.5	**3.7**	8.8	**-0.2**	11.2	**4.8**	11.6

Table E3c (800 Hz): (continued)

Lab *j* ⇒ / Lab *i* ⇓	CMI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**6.2**	6.6	**4.0**	6.6	**2.2**	6.2	**-0.8**	5.6	**0.2**	7.8	**-0.8**	8.8	**0.2**	7.8
BNM-CESTA	**6.3**	9.0	**4.1**	9.0	**2.3**	8.8	**-0.7**	8.4	**0.3**	10.0	**-0.7**	10.7	**0.3**	10.0
GUM	**3.6**	9.9	**1.4**	9.9	**-0.4**	9.7	**-3.4**	9.3	**-2.4**	10.8	**-3.4**	11.5	**-2.4**	10.8
DPLA	**6.0**	8.5	**3.8**	8.5	**2.0**	8.2	**-1.0**	7.8	**0.0**	9.5	**-1.0**	10.3	**0.0**	9.5
CNR-IMGC	**2.3**	7.7	**0.1**	7.7	**-1.7**	7.4	**-4.7**	6.9	**-3.7**	8.8	**-4.7**	9.7	**-3.7**	8.8
SP	**6.2**	10.4	**4.0**	10.4	**2.2**	10.2	**-0.8**	9.8	**0.2**	11.2	**-0.8**	11.9	**0.2**	11.2
INETI	**1.2**	10.8	**-1.0**	10.8	**-2.8**	10.6	**-5.8**	10.3	**-4.8**	11.6	**-5.8**	12.3	**-4.8**	11.6
CMI			**-2.2**	9.1	**-4.0**	8.9	**-7.0**	8.5	**-6.0**	10.0	**-7.0**	10.8	**-6.0**	10.0
UME	**2.2**	9.1			**-1.8**	8.9	**-4.8**	8.5	**-3.8**	10.1	**-4.8**	10.8	**-3.8**	10.1
GBARL	**4.0**	8.9	**1.8**	8.9			**-3.0**	8.2	**-2.0**	9.8	**-3.0**	10.6	**-2.0**	9.8
BEV	**7.0**	8.5	**4.8**	8.5	**3.0**	8.2			**1.0**	9.5	**0.0**	10.3	**1.0**	9.5
CEM	**6.0**	10.0	**3.8**	10.1	**2.0**	9.8	**-1.0**	9.5			**-1.0**	11.6	**0.0**	10.9
METAS	**7.0**	10.8	**4.8**	10.8	**3.0**	10.6	**0.0**	10.3	**1.0**	11.6			**1.0**	11.6
SIRA	**6.0**	10.0	**3.8**	10.1	**2.0**	9.8	**-1.0**	9.5	**0.0**	10.9	**-1.0**	11.6		

Table E3c (2000 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Single-ended (SE) accelerometers type 8305 WH 2335 S/N 2361558 at 2000 Hz

Lab *j* ⇒	PTB		BNM-CESTA		GUM		DPLA		CNR-IMGC		SP		INETI	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**1.5**	6.5	**2.0**	7.7	**2.0**	4.8	**1.5**	6.2	**-1.2**	12.2		
BNM-CESTA	**-1.5**	6.5			**0.5**	9.9	**0.5**	7.8	**0.0**	8.8	**-2.7**	13.7		
GUM	**-2.0**	7.7	**-0.5**	9.9			**0.0**	8.9	**-0.5**	9.7	**-3.2**	14.4		
DPLA	**-2.0**	4.8	**-0.5**	7.8	**0.0**	8.9			**-0.5**	7.6	**-3.2**	13.0		
CNR-IMGC	**-1.5**	6.2	**0.0**	8.8	**0.5**	9.7	**0.5**	7.6			**-2.7**	13.6		
SP	**1.2**	12.2	**2.7**	13.7	**3.2**	14.4	**3.2**	13.0	**2.7**	13.6				
INETI														
CMI	**-6.1**	12.8	**-4.6**	14.2	**-4.1**	14.8	**-4.1**	13.6	**-4.6**	14.1	**-7.3**	17.6		
UME	**-1.1**	12.8	**0.4**	14.3	**0.9**	14.9	**0.9**	13.6	**0.4**	14.2	**-2.3**	17.7		
GBARL	**-2.1**	6.5	**-0.6**	9.0	**-0.1**	9.9	**-0.1**	7.9	**-0.6**	8.8	**-3.3**	13.7		
BEV	**1.9**	6.4	**3.4**	8.9	**3.9**	9.8	**3.9**	7.8	**3.4**	8.7	**0.7**	13.7		
CEM	**-0.1**	7.8	**1.4**	10.0	**1.9**	10.8	**1.9**	9.0	**1.4**	9.8	**-1.3**	14.4		
METAS	**2.9**	9.9	**4.4**	11.6	**4.9**	12.4	**4.9**	10.8	**4.4**	11.5	**1.7**	15.6		
SIRA	**1.9**	7.9	**3.4**	10.0	**3.9**	10.8	**3.9**	9.0	**3.4**	9.8	**0.7**	14.4		

Table E3c (2000 Hz): (continued)

Lab *j* ⇒ / **Lab *i* ⇓**	**CMI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**6.1**	12.8	**1.1**	12.8	**2.1**	6.5	**-1.9**	6.4	**0.1**	7.8	**-2.9**	9.9	**-1.9**	7.9
BNM-CESTA	**4.6**	14.2	**-0.4**	14.3	**0.6**	9.0	**-3.4**	8.9	**-1.4**	10.0	**-4.4**	11.6	**-3.4**	10.0
GUM	**4.1**	14.8	**-0.9**	14.9	**0.1**	9.9	**-3.9**	9.8	**-1.9**	10.8	**-4.9**	12.4	**-3.9**	10.8
DPLA	**4.1**	13.6	**-0.9**	13.6	**0.1**	7.9	**-3.9**	7.8	**-1.9**	9.0	**-4.9**	10.8	**-3.9**	9.0
CNR-IMGC	**4.6**	14.1	**-0.4**	14.2	**0.6**	8.8	**-3.4**	8.7	**-1.4**	9.8	**-4.4**	11.5	**-3.4**	9.8
SP	**7.3**	17.6	**2.3**	17.7	**3.3**	13.7	**-0.7**	13.7	**1.3**	14.4	**-1.7**	15.6	**-0.7**	14.4
INETI														
CMI			**-5.0**	18.0	**-4.0**	14.2	**-8.0**	14.2	**-6.0**	14.9	**-9.0**	16.1	**-8.0**	14.9
UME	**5.0**	18.0			**1.0**	14.3	**-3.0**	14.2	**-1.0**	14.9	**-4.0**	16.1	**-3.0**	15.0
GBARL	**4.0**	14.2	**-1.0**	14.3			**-4.0**	8.9	**-2.0**	10.0	**-5.0**	11.7	**-4.0**	10.0
BEV	**8.0**	14.2	**3.0**	14.2	**4.0**	8.9			**2.0**	9.9	**-1.0**	11.6	**0.0**	10.0
CEM	**6.0**	14.9	**1.0**	14.9	**2.0**	10.0	**-2.0**	9.9			**-3.0**	12.5	**-2.0**	11.0
METAS	**9.0**	16.1	**4.0**	16.1	**5.0**	11.7	**1.0**	11.6	**3.0**	12.5			**1.0**	12.5
SIRA	**8.0**	14.9	**3.0**	15.0	**4.0**	10.0	**0.0**	10.0	**2.0**	11.0	**-1.0**	12.5		

Table E3c (5000 Hz): Matrix of Degrees of equivalence between the participants of EUROMET.AUV.V-K1 for the Single-ended (SE) accelerometers type 8305 WH 2335 S/N 2361558 at 5000 Hz

Lab j ⇒	**PTB**		**BNM-CESTA**		**GUM**		**DPLA**		**CNR-IMGC**		**SP**		**INETI**	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**-1.5**	7.0	**2.6**	8.2	**2.5**	4.6	**6.5**	7.7	**-9.1**	21.7		
BNM-CESTA	**1.5**	7.0			**4.1**	10.1	**4.0**	7.5	**8.0**	9.7	**-7.6**	22.5		
GUM	**-2.6**	8.2	**-4.1**	10.1			**-0.1**	8.6	**3.9**	10.6	**-11.7**	22.9		
DPLA	**-2.5**	4.6	**-4.0**	7.5	**0.1**	8.6			**4.0**	8.2	**-11.6**	21.9		
CNR-IMGC	**-6.5**	7.7	**-8.0**	9.7	**-3.9**	10.6	**-4.0**	8.2			**-15.6**	22.7		
SP	**9.1**	21.7	**7.6**	22.5	**11.7**	22.9	**11.6**	21.9	**15.6**	22.7				
INETI	**0.0**	0.0	**0.0**	0.0	**0.0**	0.0	**0.0**	0.0	**0.0**	0.0	**0.0**	0.0		
CMI	**-7.3**	26.1	**-8.8**	26.8	**-4.7**	27.1	**-4.8**	26.2	**-0.8**	27.0	**-16.4**	33.8		
UME	**4.4**	13.4	**2.9**	14.7	**7.0**	15.3	**6.9**	13.7	**10.9**	15.0	**-4.7**	25.3		
GBARL	**-4.3**	9.4	**-5.8**	11.1	**-1.7**	11.9	**-1.8**	9.8	**2.2**	11.6	**-13.4**	23.4		
BEV	**-4.3**	7.6	**-5.8**	9.6	**-1.7**	10.5	**-1.8**	8.1	**2.2**	10.2	**-13.4**	22.7		
CEM	**-3.3**	9.1	**-4.8**	10.8	**-0.7**	11.6	**-0.8**	9.5	**3.2**	11.3	**-12.4**	23.2		
METAS	**0.7**	13.1	**-0.8**	14.4	**3.3**	15.0	**3.2**	13.4	**7.2**	14.8	**-8.4**	25.1		
SIRA	**5.7**	8.4	**4.2**	10.3	**8.3**	11.1	**8.2**	8.8	**12.2**	10.8	**-3.4**	23.0		

Table E3c (5000 Hz): (continued)

Lab *j* ⇒ Lab *i* ⇓	CMI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**7.3**	26.1	**-4.4**	13.4	**4.3**	9.4	**4.3**	7.6	**3.3**	9.1	**-0.7**	13.1	**-5.7**	8.4
BNM-CESTA	**8.8**	26.8	**-2.9**	14.7	**5.8**	11.1	**5.8**	9.6	**4.8**	10.8	**0.8**	14.4	**-4.2**	10.3
GUM	**4.7**	27.1	**-7.0**	15.3	**1.7**	11.9	**1.7**	10.5	**0.7**	11.6	**-3.3**	15.0	**-8.3**	11.1
DPLA	**4.8**	26.2	**-6.9**	13.7	**1.8**	9.8	**1.8**	8.1	**0.8**	9.5	**-3.2**	13.4	**-8.2**	8.8
CNR-IMGC	**0.8**	27.0	**-10.9**	15.0	**-2.2**	11.6	**-2.2**	10.2	**-3.2**	11.3	**-7.2**	14.8	**-12.2**	10.8
SP	**16.4**	33.8	**4.7**	25.3	**13.4**	23.4	**13.4**	22.7	**12.4**	23.2	**8.4**	25.1	**3.4**	23.0
INETI														
CMI			**-11.7**	29.1	**-3.0**	27.5	**-3.0**	26.9	**-4.0**	27.4	**-8.0**	29.0	**-13.0**	27.2
UME	**11.7**	29.1			**8.7**	16.0	**8.7**	15.0	**7.7**	15.8	**3.7**	18.4	**-1.3**	15.4
GBARL	**3.0**	27.5	**-8.7**	16.0			**0.0**	11.5	**-1.0**	12.6	**-5.0**	15.7	**-10.0**	12.1
BEV	**3.0**	26.9	**-8.7**	15.0	**0.0**	11.5			**-1.0**	11.2	**-5.0**	14.7	**-10.0**	10.7
CEM	**4.0**	27.4	**-7.7**	15.8	**1.0**	12.6	**1.0**	11.2			**-4.0**	15.5	**-9.0**	11.8
METAS	**8.0**	29.0	**-3.7**	18.4	**5.0**	15.7	**5.0**	14.7	**4.0**	15.5			**-5.0**	15.1
SIRA	**13.0**	27.2	**1.3**	15.4	**10.0**	12.1	**10.0**	10.7	**9.0**	11.8	**5.0**	15.1		

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Appendix A

Linking the results of the regional key comparison EUROMET.AUV.V-K1 to those of the CIPM key comparison CCAUV.V-K1

A 1 Introduction

A comparison within a regional metrology organization (RMO) can be approved as a regional key comparison within the framework of the MRA [L1] and included in the Key comparison data base (KCDB) if the results are linked to the key comparison reference values (KCRVs) of the respective CIPM key comparison. It is therefore required to link the results of the European comparison carried out within the agreed EUROMET Project Ref.-number 579 (in BIPM terms the RMO key comparison EUROMET.AUV.V-K1) to the KCRVs established in the CIPM key comparison CCAUV.V-K1. There are clear regulations to be complied with, such as the guidelines for linking RMO key comparisons to the CIPM KCRV [L2]. In different fields of metrology, different methods have been used to link the results of regional comparisons to those of CIPM key comparisons. In the field of vibration (measurand acceleration and charge sensitivity of accelerometers) the methodology presented and demonstrated in [L3] proved to be applicable. Its application to the APMP comparison [L4] [L5] of accelerometer calibrations was approved by the CCAUV at its Meeting September 2004 at the BIPM in Sèvres.
This methodology is used to link the results of the regional key comparison EUROMET.AUV.V-K1 to those of the CIPM key comparison CCAUV.V-K1.
In the following, the CIPM key comparison CCAUV.V-K1 is referred to as the CIPM comparison and the RMO key comparison EUROMET.AUV.V-K1 is referred to as the RMO comparison.

A 2 Task of linking

The CIPM has well established key comparison reference values (KCRVs) [L6] at frequencies from 40 Hz to 5 kHz (third octave frequency series) for the calibration of a BB accelerometer and from 40 Hz to 2 kHz for the calibration of a SE accelerometer (primary vibration calibration by laser interferometry in accordance with ISO 16063-11 [L7]). The degrees of equivalence between each result of the 12 laboratories (NMIs) participating in the CIPM and KCRV as well as the degrees of equivalence (DOEs) between each pair of NMIs were calculated [L6].

The participating laboratories of the RMO submitted results for the calibration of two BB accelerometers and one SE accelerometer at 6 selected frequencies in the frequency range from 40 Hz to 5000 Hz, using either laser interferometry in accordance with ISO 16063-11 [L7] or comparison to a reference transducer in accordance with ISO 16063-21 [L8]. The DOEs were calculated of the laboratories' results relative to the respective KCRV for the BB accelerometer and the SE accelerometer separately, i.e. at 40 Hz, 80 Hz, 160 Hz, 800 Hz, 2000 Hz and 5000 Hz for the BB accelerometer and at these frequencies but 5000 Hz for the SE accelerometer.

The following abbreviations are used for the accelerometers used in the CIPM and RMO comparisons:

BB77 for Back-to-back accelerometer type 8305 S/N 2355677 (RMO)

BB59 for Back-to-back accelerometer type 8305 S/N 606559 (RMO)

SE58 for Single ended accelerometer type 8305 WH 2335 S/N 2361558 (RMO)

BB37 for Back-to-back accelerometer type 8305 S/N 1483337 (CIPM)

SE74 for Single ended accelerometer type 8305 WH 2335 S/N 1610174 (CIPM)

The linking task requires the transformation of the RMO calibration results of the accelerometers BB77 and BB59 into quantities appropriate for comparison with the CIPM results of the BB37 and the transformation of the RMO results of SE58 for comparison with the CIPM results of the accelerometer SE74. The transformed RMO results can be compared with the CIPM comparison. It includes the calculation of (a) the differences between the transformed RMO results and the corresponding KCRV [L6] and (b) the differences between the transformed RMO results and the CIPM quantities (results of the NMIs participating in the CIPM comparison).

A 3 Linking procedure

The measurand in the CIPM comparison is denoted by *X*. The values $x_1, u(x_1), \ldots, x_N, u(x_N)$ denote the best estimates and associated standard uncertainties of the laboratories.

The measurand in the RMO comparison is denoted by *Y.* The values $y_1, u(y_1), \ldots, y_M, u(y_M)$ denote the best estimates and associated standard uncertainties of the laboratories.

Furthermore, $G = \{1, \ldots, p\}$ ($p \leq \min(N,M)$) is the index set of the linking laboratories which participate in both the CIPM and RMO comparison. The laboratories are labelled such that any number within *G* denotes the same laboratory in both comparisons.

The value $R = X/Y$ denotes the transformation factor between the two measurands to make the link between the two comparisons. The transformation factor is estimated using the KCRV of the CIPM comparison and the combined results in the RMO comparison of the linking laboratories. The estimated transformation factor is then applied to the results of the RMO comparison.

Since no information about correlations is available, the estimators $X_1, \ldots, X_N$, $Y_1, \ldots, Y_M$ are treated as being uncorrelated. Let *x* denote the KCRV of the CIPM comparison and *y* the weighted mean of the linking laboratories in the RMO comparison

$$x = \sum_{l=1}^{N} \frac{x_l}{u^2(x_l)} \Bigg/ \sum_{l=1}^{N} \frac{1}{u^2(x_l)} \qquad u^2(x) = \frac{1}{\sum_{l=1}^{N} \frac{1}{u^2(x_l)}} \tag{1}$$

$$y = \sum_{l \in G} \frac{y_l}{u^2(y_l)} \Bigg/ \sum_{l \in G} \frac{1}{u^2(y_l)} \qquad u^2(y) = \frac{1}{\sum_{l \in G} \frac{1}{u^2(y_l)}} . \tag{2}$$

Then R is estimated according to

$$r = \frac{x}{y} \qquad u^2(r) = \frac{u^2(x)}{y^2} + \frac{x^2}{y^4}u^2(y) \tag{3}$$

$Z = RY$ denotes the corrected measurand in the regional comparison and

$$z_l = ry_l \qquad u^2(z_l) = y_l^2 u^2(r) + r^2 u^2(y_l) + 2ry_l u(r, y_l), \qquad l = 1, \ldots, M \tag{4}$$

$$u(r, y_l) = \begin{cases} -\dfrac{x}{y^2}u^2(y), & l \in G \\ 0, & \text{otherwise} \end{cases}$$

are the corresponding estimates including the associated uncertainties.

The degrees of equivalence are defined as the differences between the corrected results in the RMO comparison and the KCRV of the CIPM comparison

$$d_i = z_i - x, \qquad i = 1, \ldots, M \tag{5}$$

and the uncertainties associated with these differences where

$$u^2(d_i) = u^2(z_i) + \left[1 - 2\frac{z_i}{x}\right]u^2(x), \qquad i = 1, \ldots, M. \tag{6}$$

Furthermore, the degrees of equivalence between the laboratories of the RMO comparison and the CIPM comparison are defined as the differences

$$d_{ij} = x_i - z_j, \quad i = 1, \ldots, N, \quad j = 1, \ldots, M \tag{7}$$

and the uncertainties associated with these differences where

$$u^2(x_i - z_j) = u^2(x_i) + u^2(z_j) - 2\frac{z_j}{x}u^2(x), \qquad i = 1, \ldots, N, \quad j = 1, \ldots, M \tag{8}$$

A 4 Results

A 4.1 General

The 12 participants of the CIPM comparison are given in Table L1. They are listed in a sequence appropriate for the linking procedure, beginning with the linking laboratories in the CIPM comparison. For the calibrated accelerometer BB37, the KCRVs have been established at frequencies from 40 Hz to 5 kHz (see Table L1a), whereas for the accelerometer SE74 of the CIPM comparison, the KCRVs have been stated up to 2 kHz (see Table L1c).

The participants of the RMO comparison are grouped in relation to their calibration results supplied. Tables L2, L3 and L4 display the participants providing calibration for the accelerometers BB77, BB59 and SE58, respectively. Each table starts with linking laboratories. The grouped calibration results of the RMO comparison have been linked to the corresponding results of the CIPM comparison separately; namely, the two groups of results supplied by the participants listed in Tables L3 and 4 have been linked separately to the CIPM results of the BB37 accelerometer and the RMO results of the calibration of the accelerometer SE58 have been compared with the CIPM results obtained for the accelerometer SE74.

Note that the numbering of laboratories is different from those applied to the presentation of the calibration results in the main body of the Report B of the RMO key comparison EUROMET.AUV.V-K1 and in the Final report of the CIPM key comparison CCAUV.V-K1.

A 4.2 Linking the RMO results of the accelerometer BB77 to the CIPM results for the accelerometer BB37

The ten laboratories listed in Table L3 provided the RMO calibration results of the accelerometer BB77 using laser interferometry in accordance with ISO 16063-11 [L7]. The first three laboratories constitute the set of linking laboratories. They participated in both the CIPM and the RMO comparison. The transformation factor of the linking procedure is calculated as ratio of the CIPM weighted mean and the weighted mean of the linking laboratories in the RMO, according to equation (3). The calculated differences between the corrected results in the RMO comparison and the KCRV of the CIPM comparison (degrees of equivalence) with associated uncertainties, d_i and $u(d_i)$, are given in Table L2ab and shown in Figure L2ab (40 Hz) to Figure L2ab (5000 Hz). In Tables L3ab (40 Hz) to L3ab (5000 Hz) the degrees of equivalence between the laboratories of the RMO comparison and the CIPM comparison with associated uncertainties, $d_{i,j}$ and $u(d_{i,j})$ are given. Note that the linking results for the accelerometer BB59 (specific procedure see 4.3) have been implemented in the Tables and Figures specified above.

Degrees of equivalence were determined for the results at frequencies of 40 Hz, 80 Hz, 160 Hz, 800 Hz, 2000 Hz and 5000 Hz.

A 4.3 Linking the RMO results of the accelerometer BB59 to the CIPM results for the accelerometer BB37

Four laboratories (METAS, BEV, CEM, SIRA in) of the RMO comparison provided calibration results of the accelerometer BB59 using a reference transducer in accordance with ISO 16063-21 [L8]. The PTB calibration results of the BB59 accelerometer are used to link the RMO results to the CIPM results. To account for mass loading effects the uncertainty of the PTB results for the BB59 accelerometer was increased in the kHz range. The resulting relative combined standard uncertainties are 0.1 % at the frequencies of 800 Hz and 2 kHz and 0.15 % at the frequency of 5 kHz. For the transformed RMO results, the calculated degrees of equivalence are given in Tables L2ab and L3ab (40 Hz) to L3ab (5000 Hz). The Degrees of Equivalence with respect to the KCRV are demonstrated in Figure L2ab (40 Hz) to Figure L2ab (5000 Hz).

A 4.4 Linking the RMO results of the accelerometer SE58 to the CIPM results for the accelerometer SE74

14 laboratories participating in the RMO (Table L2) calibrated the accelerometer SE58 of single-ended design. These results are linked to the CIPM results for the single-ended accelerometer SE74. Laboratories 1, 2 and 3 of Tables L1 and L2 are the linking laboratories. The linking procedure was applied to the results (after the SE-correction, cf. section 9.2.3 where applicable) given at the frequencies of 40 Hz,

80 Hz, 160 Hz, 800 Hz and 2000 Hz. The degrees of equivalence are listed in Tables L2c and L3c (40 Hz) to L3c (5000 Hz). The Degrees of Equivalence with respect to the KCRV are demonstrated in Figure L2c (40 Hz) to Figure L2c (2000 Hz).
The degrees of equivalence obtained demonstrate the capabilities of the 14 participating laboratories to calibrate accelerometers of single-ended design.

Table L1: Participants of CCAUV.AUV.V-K1 (* linking laboratories).

Participant acronym	**Country**	**Code number**
PTB *	Germany (DE)	1
BNM-CEA/ CESTA *	France (F)	2
CMI *	Czech Republic (CZ)	3
CENAM	Mexico (MX)	4
CSIR	South Africa (ZA)	5
CSIRO (NML)	Australia (AU)	6
KRISS	Korea (KR)	7
NIST	United States (US)	8
NMi-VSL	Netherlands (NL)	9
NRCC (INMS)	Canada (CA)	10
AIST	Japan (JP)	11
VNIIM	Russian Federation (RU)	12

Table L2: Participants of EUROMET.AUV.V-K1, supplying calibration results of the accelerometer SE58 (* linking laboratories).

Participant acronym	**Country**	**Code number**
PTB *	Germany (DE)	1
BNM/CESTA *	France (F)	2
CMI *	Czech Republic (CZ)	3
CNR-IGMC	Italy (IT)	6
DPLA	Denmark (DK)	5
GBARL	Hungary (HU)	10
GUM	Poland (PL)	4
INETI	Portugal (PT)	8
METAS	Switzerland (CH)	13
SP	Sweden (SE)	7
UME	Turkey (TR)	9
BEV	Austria (AT)	11
CEM	Spain (ES)	12
SIRA	United Kingdom (UK)	14

Table L3: Participants of EUROMET.AUV.V-K1, supplying calibration results of the accelerometer BB 77 (* linking laboratories).

Participant acronym	**Country**	**Code number**
PTB *	Germany (DE)	1
BNM/CESTA *	France (F)	2
CMI *	Czech Republic (CZ)	3
CNR-IGMC	Italy (IT)	6
DPLA	Denmark (DK)	5
GBARL	Hungary (HU)	10
GUM	Poland (PL)	4
INETI	Portugal (PT)	8
SP	Sweden (SE)	7
UME	Turkey (TR)	9

Table L4: Participants of EUROMET.AUV.V-K1, supplying calibration results of the accelerometer BB 59 (* linking laboratory)

Participant acronym	Country	Code number
PTB *	Germany (DE)	1
BEV	Austria (AT)	11
CEM	Spain (ES)	12
METAS	Switzerland (CH)	13
SIRA	United Kingdom (UK)	14

A 4.5 Key Comparison Reference Values (KCRVs) of CCAUV.V-K1

In CCAUV-V-K1, the two transfer standards BB37 and SE74 were calibrated at 22 frequencies from 40 Hz to 5000 Hz (third-octave series of frequencies). From the tables of KCRVs given in [L6], the KCRVs for the comparison frequencies of EUROMET.AUV.V-K1 were selected as specified in tables L1a and L1c.

Table L1a: KCRVs of CCAUV.V-K1 for the Back-to-back (BB) accelerometer type 8305 S/N 1483337

Frequency / Hz	x_R / pC/(m/s^2)	u_R / pC/(m/s^2)	u_R/x_R / 10^{-2}
40	**0.12659**	**0.00005**	**0.04**
80	**0.12658**	**0.00005**	**0.04**
160	**0.12663**	**0.00005**	**0.04**
800	**0.12673**	**0.00005**	**0.04**
2000	**0.12713**	**0.00005**	**0.04**
5000	**0.12936**	**0.00010**	**0.08**

Table L1c: Reference values computed from participants results for the Single-ended (SE) accelerometer type 8305 WH 2335 S/N 1610174

Frequency / Hz	x_R / pC/(m/s^2)	u_R / pC/(m/s^2)	u_R/x_R / 10^{-2}
40	**0.12899**	**0.00005**	**0.04**
80	**0.12898**	**0.00005**	**0.04**
160	**0.12899**	**0.00005**	**0.04**
800	**0.12919**	**0.00005**	**0.04**
2000	**0.12988**	**0.00005**	**0.04**
5000	**no KCRV**		

A 4.6 Degrees of Equivalence with respect to the KCRV

Table L2ab: Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the key comparison reference value of CCAUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method)

Frequency ⇒	40 Hz		80 Hz		160 Hz		800 Hz		2000 Hz		5000 Hz	
	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	0.2	0.3	0.1	0.3	0.1	0.3	0.2	0.3	0.2	0.3	-0.2	0.6
BNM-CESTA	-1.6	6.2	0.4	6.2	0	6.2	-2.3	6.2	-3.2	6.2	2.6	10.1
CMI	-2.7	6.2	-2.1	6.2	-1.5	6.2	-3.1	6.2	-4	8.8	2.1	6.9
GUM	-0.3	7.7	-1.2	7.7	-1.8	7.7	-3.3	7.7	-2.5	7.7	-1.8	8.1
DPLA	-2	4.5	-1.6	3.1	-1	2.9	-0.6	5.7	-2.4	6	-2.4	4.6
CNR-IMGC	-1.6	4.5	-0.6	4.5	-1	4.5	-1.4	4.5	-0.3	6.2	-3.8	7.6
SP	3.3	5.2	4.3	5.2	3.9	5.2	1.6	5.2	0.7	10.3	4.1	17.1
INETI	-1.6	10.7	1.4	4.5	-2	5.2	-2.3	5.7				
UME	0.7	6.4	0.3	6.4	-0.1	6.4	-1.5	6.4	-2.4	12.7	5.6	13.2
GBARL	0	4.7	0.2	4.5	0.1	4.4	-1.3	3.4	-0.5	3.9	-1.5	4.5
BEV	-3.8	7.7	-3.4	7.2	-2.6	7.2	-0.5	7.5	2.2	8.1	1.0	9.4
CEM	2.2	7.7	-1.4	7.7	0.4	7.7	1.5	8	2.2	8.1	0.0	9.4
METAS	-6.8	9.3	-6.4	8.8	-6.6	8.6	-6.5	8.9	-5.8	9.9	-9.0	12.6
SIRA	-1.8	7.7	-2.4	7.7	-1.6	7.7	-1.5	8	-0.8	8	3.0	8.7

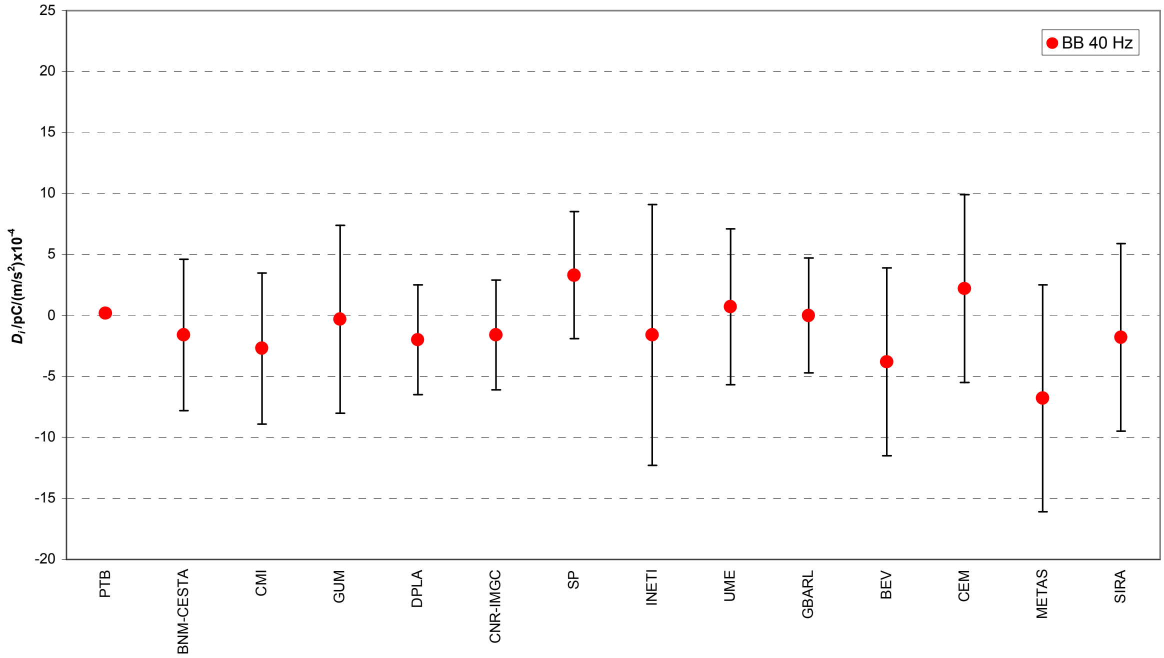

Figure L2ab (40 Hz): Deviations $D_i = d_i$ of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). BB accelerometers type 8305, S/N 2355677 and S/N 606559. Frequency 40 Hz

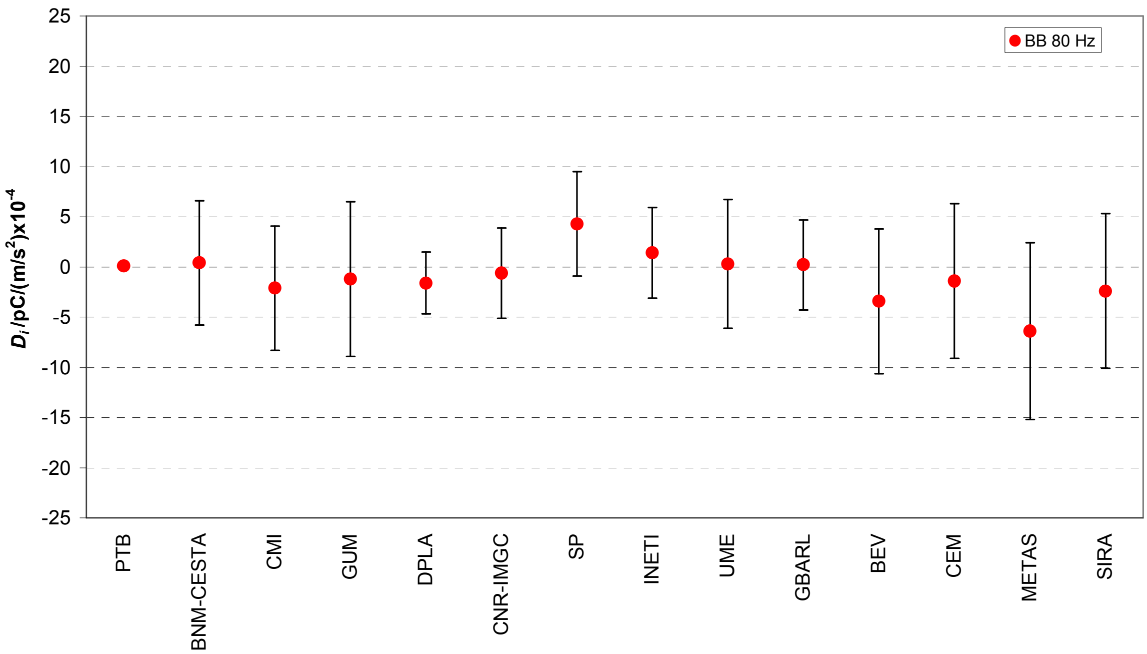

Figure L2ab (80 Hz): Deviations $D_i = d_i$ of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). BB accelerometers type 8305, S/N 2355677 and S/N 606559. Frequency 80 Hz.

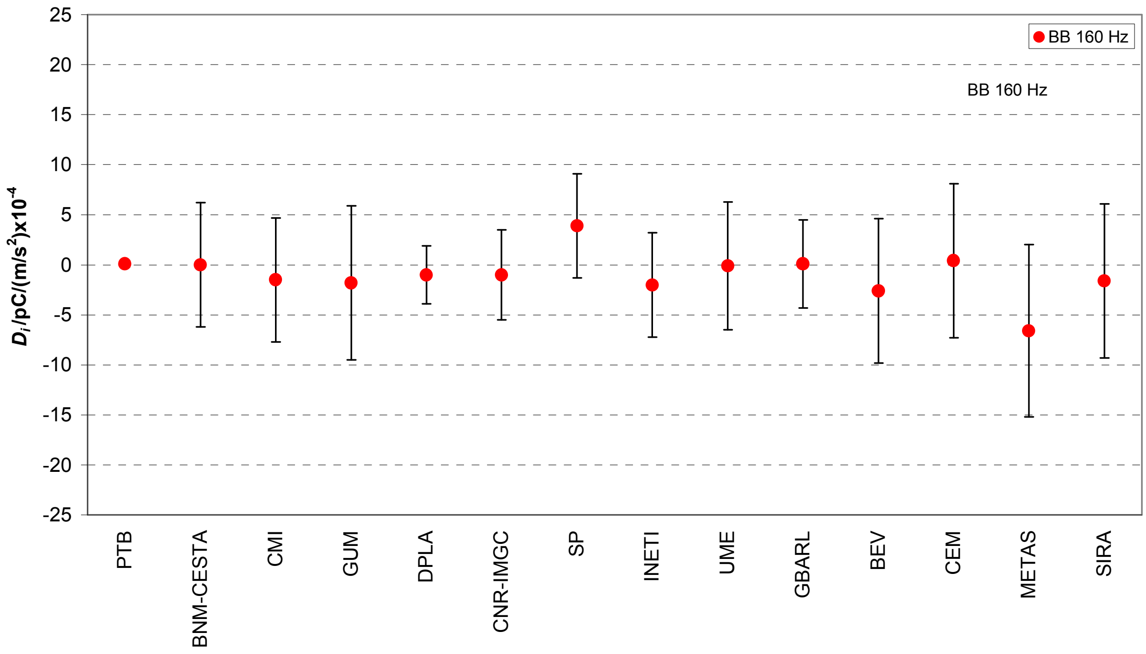

Figure L2ab (160 Hz): Deviations $D_i = d_i$ of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). BB accelerometers type 8305, S/N 2355677 and S/N 606559. Frequency 160 Hz.

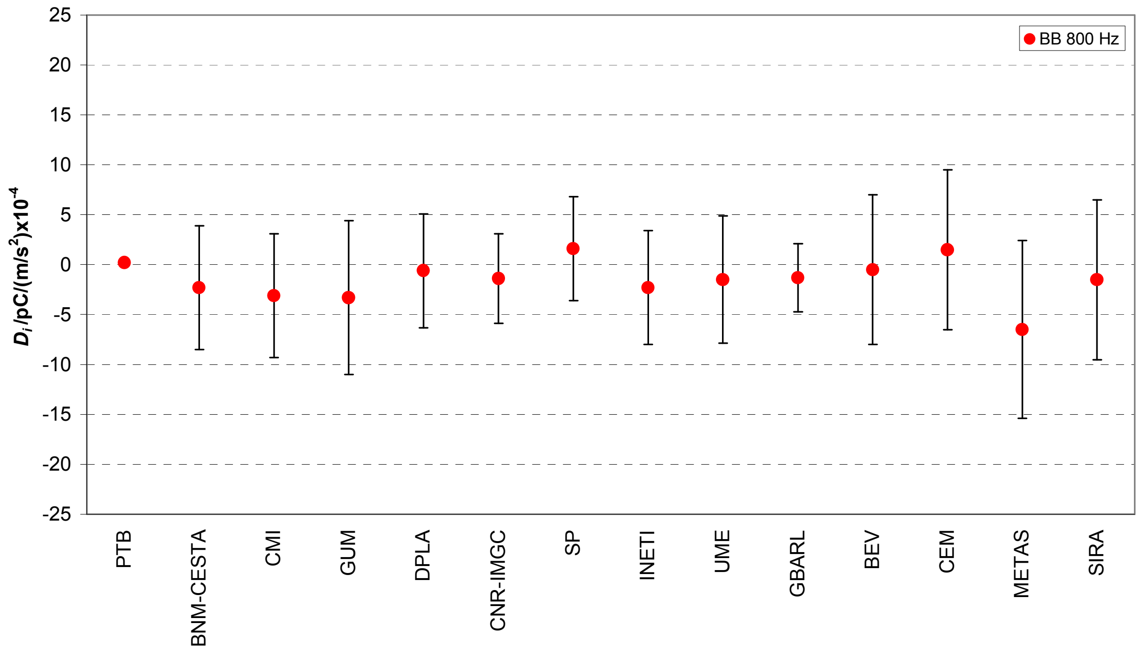

Figure L2ab (800 Hz): Deviations $D_i = d_i$ of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). BB accelerometers type 8305, S/N 2355677 and S/N 606559. Frequency 800 Hz.

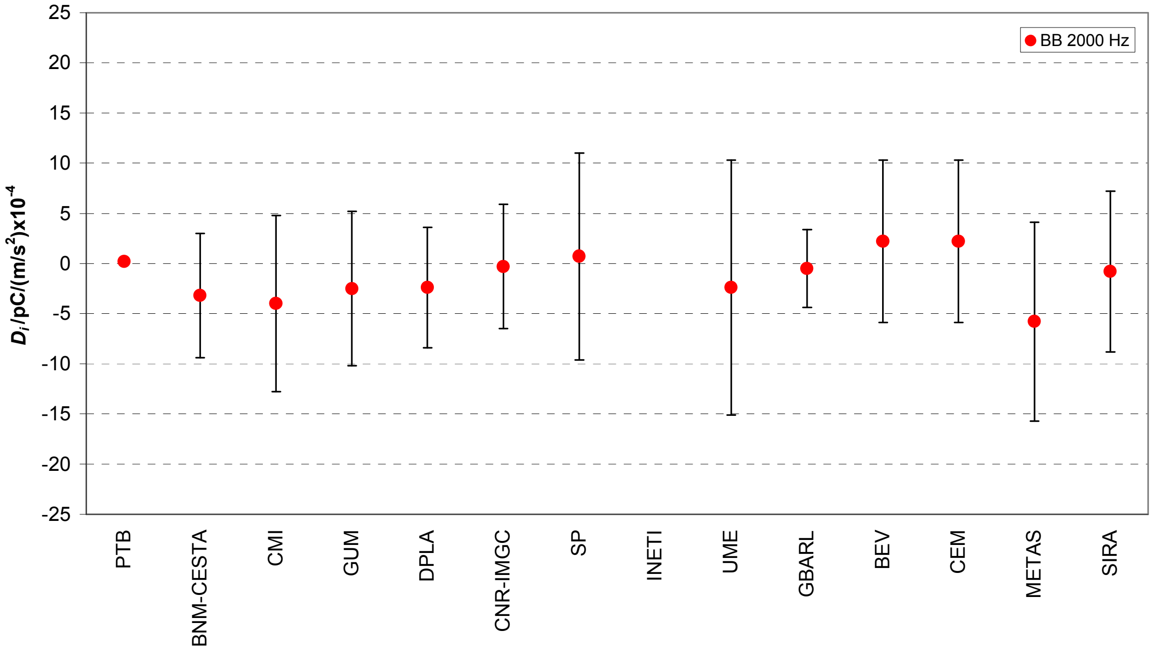

Figure L2ab (2000 Hz): Deviations $D_i = d_i$ of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). BB accelerometers type 8305, S/N 2355677 and S/N 606559. Frequency 2000 Hz.

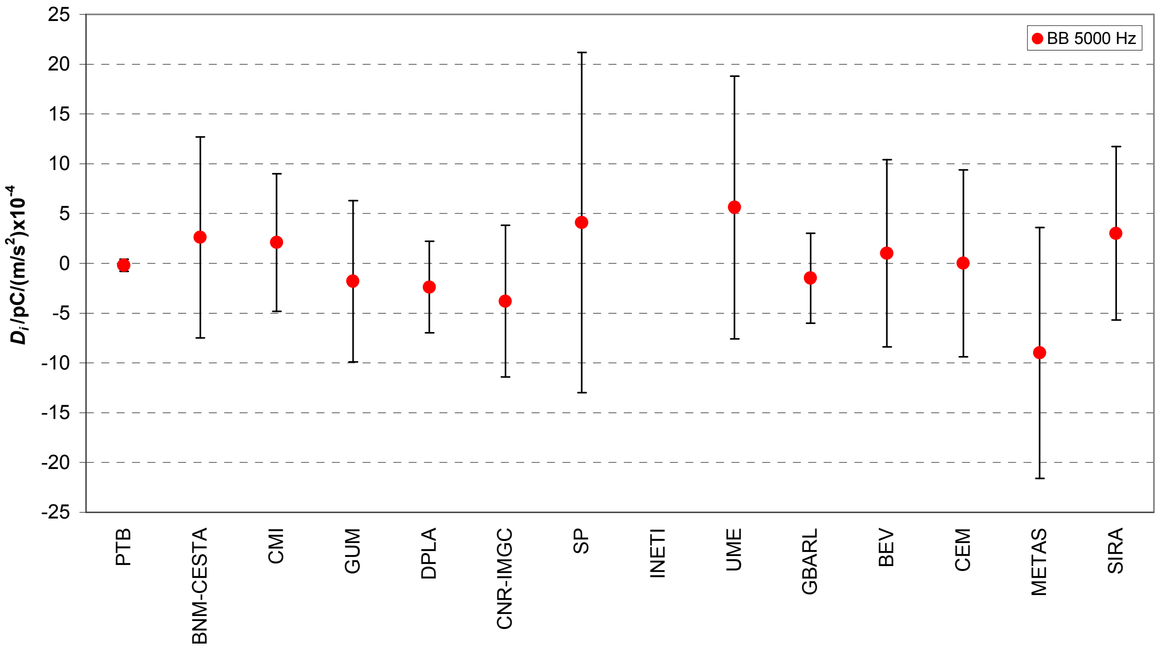

Figure L2ab (5000 Hz): Deviations $D_i = d_i$ of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). BB accelerometers type 8305, S/N 2355677 and S/N 606559. Frequency 5000 Hz.

Table L2c: Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the key comparison reference value of CCAUV.V-K1 for the Single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558

Frequency ⇒	**40 Hz**		**80 Hz**		**160 Hz**		**800 Hz**		**2000 Hz**		**5000 Hz**	
	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.1**	0.3	**0.1**	0.3	**0.1**	0.3	**0.2**	0.3	**0.1**	0.3		
BNM-CESTA	**0.3**	6.3	**0.2**	6.3	**0.9**	6.3	**0.3**	6.3	**-1.4**	6.4		
CMI	**-2.4**	6.5	**-2.4**	6.5	**-3.7**	6.5	**-6.1**	6.5	**-6.1**	13.0		
GUM	**0.1**	7.8	**-0.7**	7.8	**-1.3**	7.8	**-2.4**	7.8	**-1.9**	7.9		
DPLA	**-1.5**	4.6	**-0.6**	3.1	**-0.1**	2.9	**0.0**	5.8	**-1.9**	4.9		
CNR-IMGC	**-2.8**	4.5	**-1.9**	4.6	**-2.1**	4.6	**-3.8**	4.6	**-1.4**	6.4		
SP	**-0.1**	7.3	**-0.1**	7.2	**0.1**	7.9	**0.2**	8.5	**1.4**	12.6	**No KCRV**	
INETI	**-10.3**	11.8	**-0.1**	6.5	**-2.9**	7.9	**-5.0**	9.0				
UME	**0.6**	6.7	**-0.4**	6.7	**-1.6**	6.7	**-3.9**	6.7	**-1.0**	13.2		
GBARL	**-1.4**	6.8	**-1.4**	6.6	**-2.7**	6.6	**-2.0**	6.4	**-2.0**	6.6		
BEV	**-3.5**	6.5	**-0.4**	5.7	**0.4**	5.7	**1.0**	5.7	**2.1**	6.5		
CEM	**-0.4**	8.0	**1.7**	8.0	**0.4**	8.0	**0.0**	8.0	**0.0**	8.0		
METAS	**-1.4**	9.7	**0.7**	9.1	**1.4**	9.0	**1.0**	9.0	**3.1**	10.1		
SIRA	**1.7**	8.0	**0.7**	8.0	**1.4**	8.0	**0.0**	8.0	**2.1**	8.1		

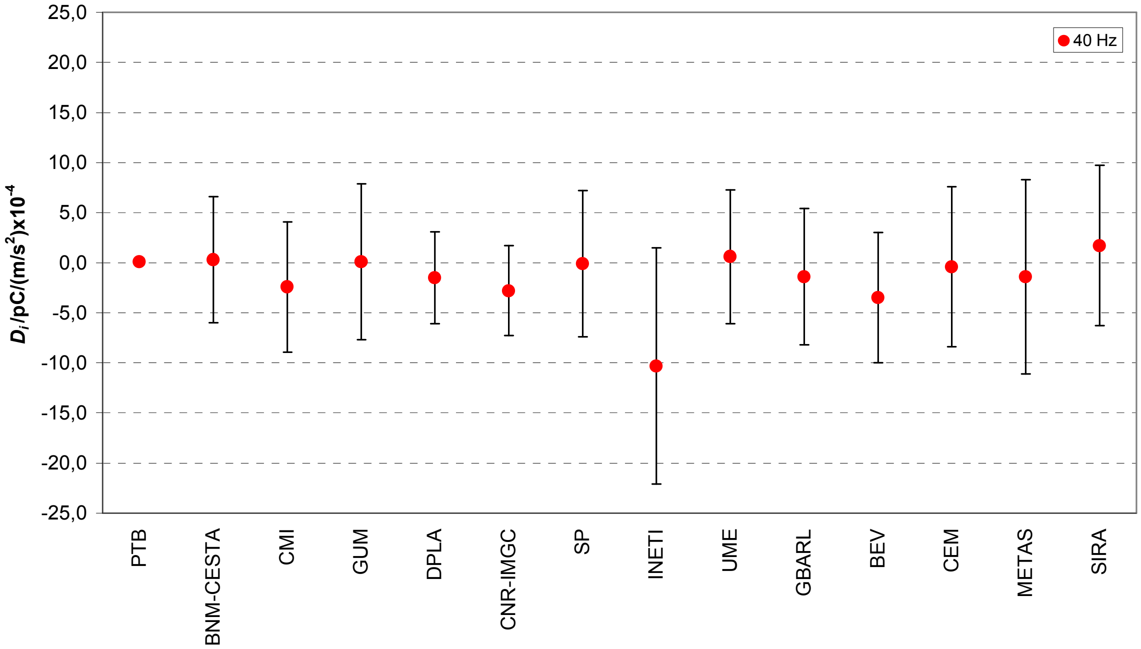

Figure L2c (40 Hz): Deviations D_i = d_i of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). SE accelerometer type 8305 WH 2335 S/N 2361558. Frequency 40 Hz

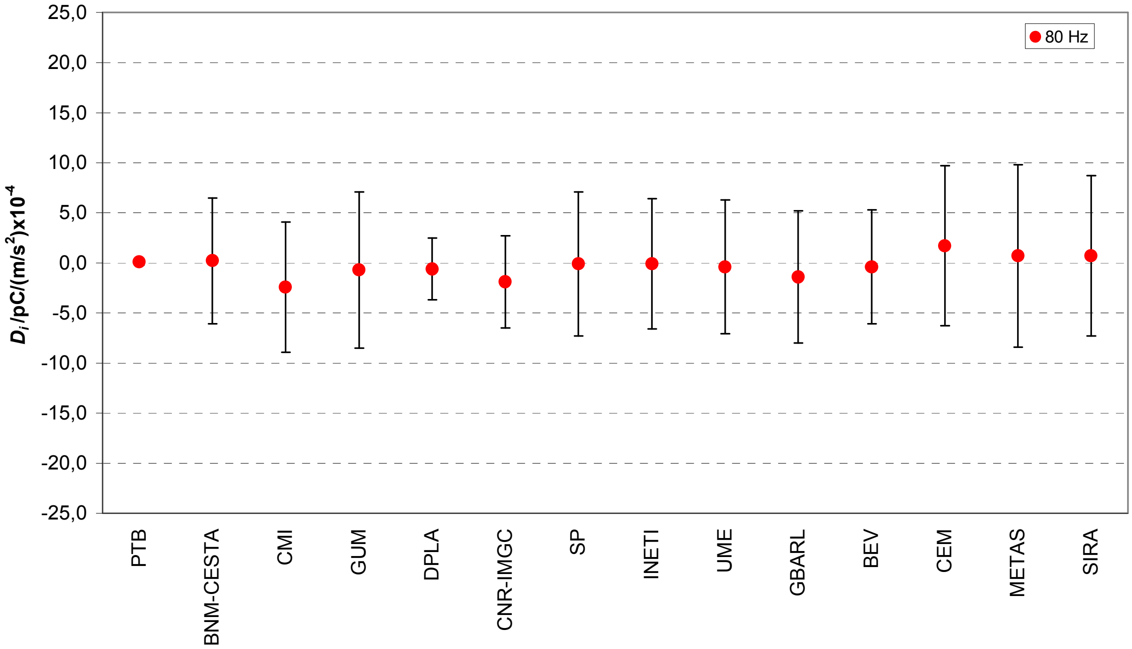

Figure L2c (80 Hz): Deviations D_i = d_i of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). SE accelerometer type 8305 WH 2335 S/N 2361558. Frequency 80 Hz

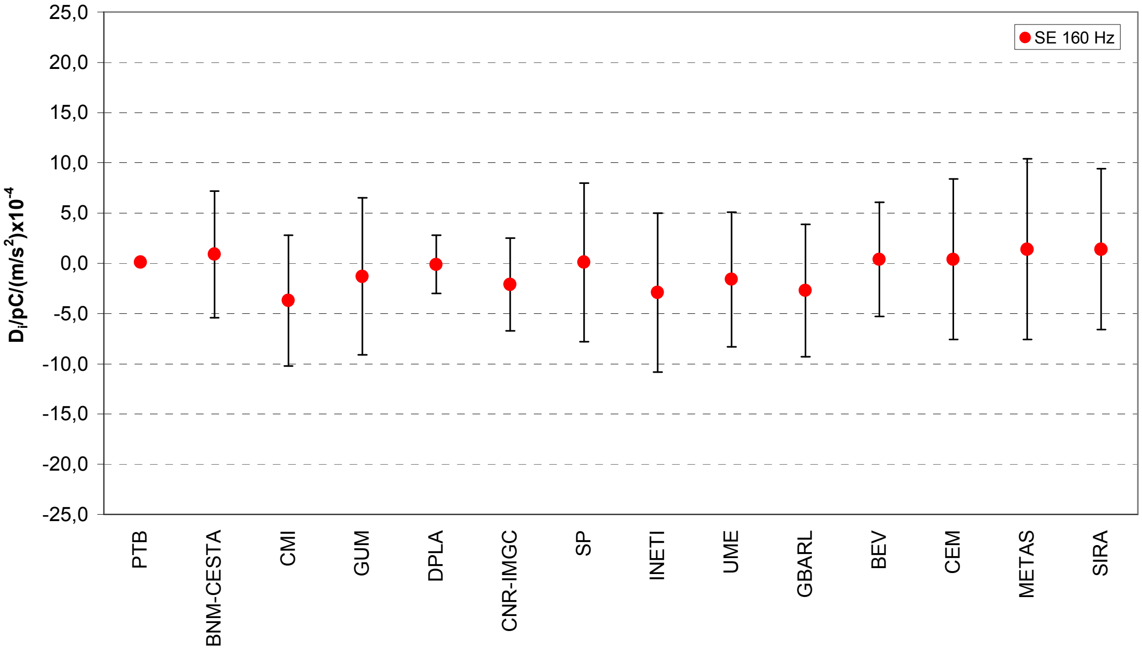

Figure L2c (160 Hz): Deviations D_i = d_i of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). SE accelerometer type 8305 WH 2335 S/N 2361558. Frequency 160 Hz

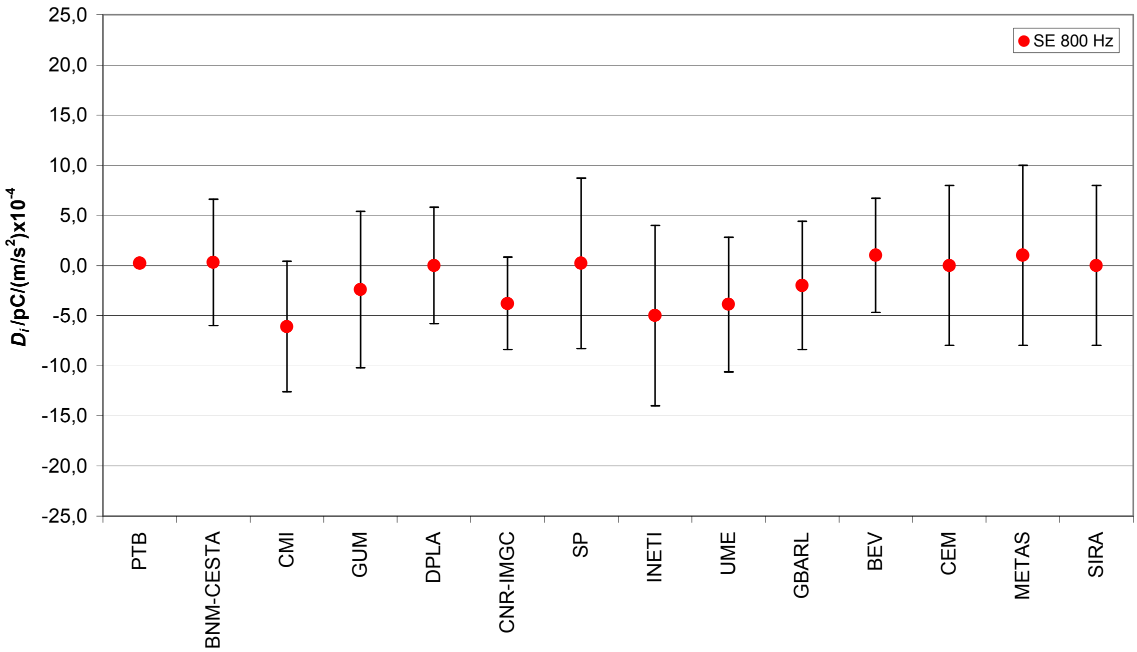

Figure L2c (800 Hz): Deviations D_i = d_i of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). SE accelerometer type 8305 WH 2335 S/N 2361558. Frequency 800 Hz

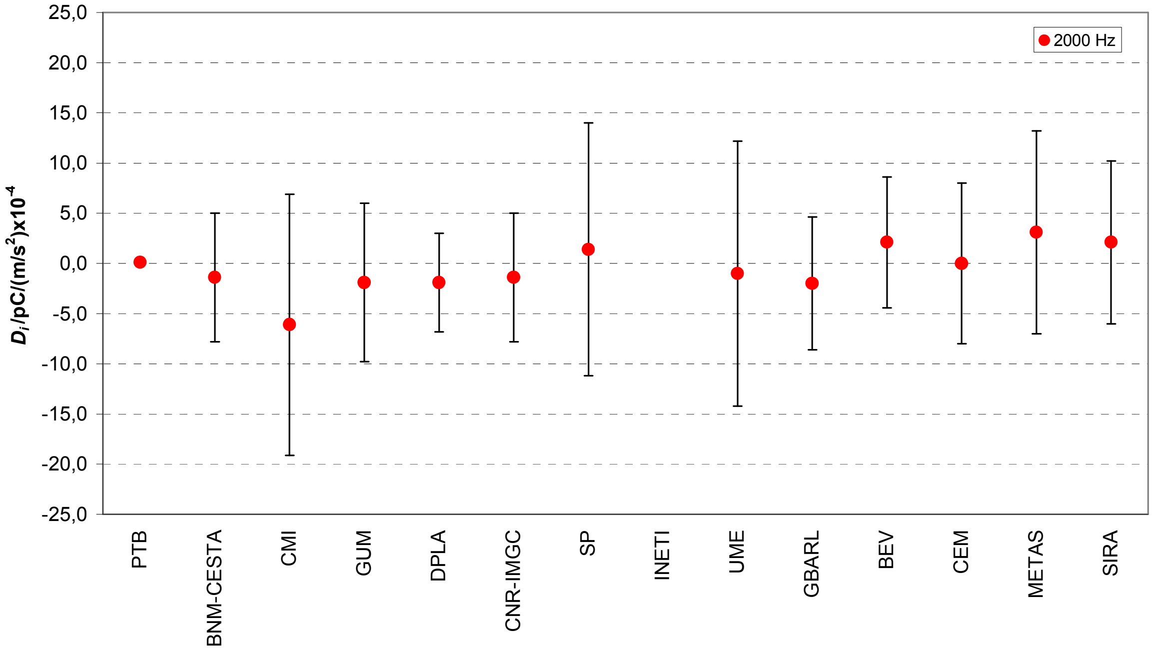

Figure L2c (2000 Hz): Deviations D_i = d_i of the corrected results in the RMO comparison from the KCRV of the CIPM comparison and corresponding expanded uncertainties (k = 2). SE accelerometer type 8305 WH 2335 S/N 2361558. Frequency 2000 Hz

A 4.7 Degrees of Equivalence with respect to the Participants of CCAUV.AUV.V-K1

Table L3ab (40 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 40 Hz

Lab *j* ⇒	**PTB**		**BNM-CESTA**		**CMI**		**GUM**		**DPLA**		**CNR-IMGC**		**SP**	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.4**	0.9	**2.2**	6.3	**3.3**	6.3	**0.9**	7.7	**2.6**	4.6	**2.2**	4.5	**-2.7**	5.3
BNM-CESTA	**1.0**	6.3	**2.8**	8.8	**3.9**	8.8	**1.5**	9.9	**3.2**	7.7	**2.8**	7.7	**-2.2**	8.2
CMI	**-1.1**	5.8	**0.7**	8.5	**1.8**	8.4	**-0.6**	9.6	**1.1**	7.3	**0.7**	7.3	**-4.3**	7.8
CSIRO-NML	**1.0**	5.0	**2.8**	8.0	**3.9**	7.9	**1.5**	9.2	**3.2**	6.7	**2.8**	6.7	**-2.2**	7.2
CSIR-NML	**9.0**	11.4	**10.8**	13.0	**11.9**	13.0	**9.5**	13.8	**11.2**	12.3	**10.8**	12.3	**5.8**	12.6
CENAM	**-1.9**	6.3	**-0.1**	8.8	**1.0**	8.8	**-1.4**	9.9	**0.3**	7.7	**-0.1**	7.7	**-5.1**	8.1
NRC	**-1.3**	3.7	**0.5**	7.2	**1.6**	7.2	**-0.8**	8.5	**0.9**	5.9	**0.5**	5.8	**-4.5**	6.4
KRISS	**-1.3**	4.5	**0.5**	7.6	**1.6**	7.6	**-0.8**	8.9	**0.9**	6.4	**0.5**	6.3	**-4.5**	6.9
NMIJ	**-3.1**	5.2	**-1.3**	8.1	**-0.2**	8.1	**-2.6**	9.3	**-0.9**	6.9	**-1.3**	6.9	**-6.3**	7.4
VNIIM	**-5.6**	5.0	**-3.8**	7.9	**-2.7**	7.9	**-5.1**	9.1	**-3.4**	6.7	**-3.8**	6.7	**-8.8**	7.2
NIST	**1.0**	3.7	**2.8**	7.2	**3.9**	7.2	**1.5**	8.5	**3.2**	5.8	**2.8**	5.8	**-2.2**	6.4
NMi-VSL	**-1.1**	3.2	**0.7**	7.0	**1.8**	7.0	**-0.6**	8.3	**1.1**	5.5	**0.7**	5.5	**-4.2**	6.1

Table L3ab (40 Hz): (continued)

Lab *j* ⇒	**INETI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
Lab *i* ⇓	**pC/(m/s²)x10^{-4}**		**pC/(m/s²)x10^{-4}**		**pC/(m/s²)x10^{-4}**		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**2.2**	10.7	**-0.1**	6.5	**0.6**	4.8	**4.4**	7.7	**-1.6**	7.8	**7.4**	9.3	**2.4**	7.7
BNM-CESTA	**2.8**	12.4	**0.5**	9.0	**1.2**	7.8	**5.0**	9.9	**-1.0**	9.9	**8.0**	11.2	**3.0**	9.9
CMI	**0.7**	12.1	**-1.6**	8.6	**-0.9**	7.4	**2.9**	9.6	**-3.1**	9.6	**5.9**	10.9	**0.9**	9.6
CSIRO-NML	**2.8**	11.8	**0.5**	8.1	**1.2**	6.9	**5.0**	9.1	**-1.0**	9.2	**8.0**	10.5	**3.0**	9.2
CSIR-NML	**10.8**	15.7	**8.5**	13.1	**9.2**	12.4	**13.0**	13.8	**7.0**	13.8	**16.0**	14.7	**11.0**	13.8
CENAM	**-0.1**	12.4	**-2.4**	9.0	**-1.7**	7.8	**2.1**	9.9	**-3.9**	9.9	**5.1**	11.2	**0.1**	9.9
NRC	**0.5**	11.3	**-1.8**	7.4	**-1.1**	6.0	**2.7**	8.5	**-3.3**	8.6	**5.7**	10.0	**0.7**	8.5
KRISS	**0.5**	11.6	**-1.8**	7.8	**-1.1**	6.5	**2.7**	8.9	**-3.3**	8.9	**5.7**	10.3	**0.7**	8.9
NMIJ	**-1.3**	11.9	**-3.6**	8.3	**-2.9**	7.0	**0.9**	9.3	**-5.1**	9.3	**3.9**	10.7	**-1.1**	9.3
VNIIM	**-3.8**	11.8	**-6.1**	8.1	**-5.4**	6.8	**-1.6**	9.1	**-7.6**	9.2	**1.4**	10.5	**-3.6**	9.1
NIST	**2.8**	11.3	**0.5**	7.4	**1.2**	6.0	**5.0**	8.5	**-1.0**	8.5	**8.0**	10.0	**3.0**	8.5
NMi-VSL	**0.7**	11.1	**-1.6**	7.2	**-0.9**	5.7	**2.9**	8.3	**-3.1**	8.3	**5.9**	9.8	**0.9**	8.3

Table L3ab (80 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 80 Hz

Lab *j* ⇒	**PTB**		**BNM-CESTA**		**CMI**		**GUM**		**DPLA**		**CNR-IMGC**		**SP**	
	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}
Lab *i* ⇓	pC/(m/s²) x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.3**	0.9	**0.0**	6.3	**2.5**	6.3	**1.6**	7.7	**2.0**	3.2	**1.0**	4.6	**-3.9**	5.3
BNM-CESTA	**2.2**	6.3	**1.9**	8.8	**4.3**	8.8	**3.4**	9.9	**3.8**	7.0	**2.9**	7.7	**-2.1**	8.2
CMI	**0.2**	5.5	**-0.1**	8.3	**2.3**	8.3	**1.4**	9.4	**1.8**	6.3	**0.9**	7.1	**-4.1**	7.6
CSIRO-NML	**0.2**	3.7	**-0.1**	7.2	**2.3**	7.2	**1.4**	8.5	**1.8**	4.8	**0.9**	5.8	**-4.1**	6.4
CSIR-NML	**-4.8**	8.8	**-5.1**	10.8	**-2.7**	10.7	**-3.6**	11.7	**-3.2**	9.3	**-4.1**	9.9	**-9.1**	10.2
CENAM	**-1.1**	6.3	**-1.4**	8.8	**1.0**	8.8	**0.1**	9.9	**0.5**	7.0	**-0.4**	7.7	**-5.4**	8.2
NRC	**3.9**	3.6	**3.6**	7.2	**6.0**	7.2	**5.1**	8.5	**5.5**	4.7	**4.6**	5.7	**-0.4**	6.3
KRISS	**-1.1**	4.5	**-1.4**	7.6	**1.1**	7.6	**0.2**	8.9	**0.6**	5.4	**-0.4**	6.3	**-5.4**	6.9
NMIJ	**-0.2**	6.0	**-0.5**	8.6	**1.9**	8.6	**1.0**	9.8	**1.4**	6.7	**0.5**	7.5	**-4.5**	8.0
VNIIM	**-4.6**	5.0	**-4.9**	7.9	**-2.5**	7.9	**-3.4**	9.1	**-3.0**	5.8	**-3.9**	6.7	**-8.9**	7.2
NIST	**-0.8**	3.7	**-1.1**	7.2	**1.3**	7.2	**0.4**	8.5	**0.8**	4.8	**-0.1**	5.8	**-5.1**	6.4
NMi-VSL	**-1.7**	2.5	**-2.0**	6.7	**0.4**	6.7	**-0.5**	8.1	**-0.1**	3.9	**-1.0**	5.1	**-6.0**	5.8

Table L3ab (80 Hz): (continued)

Lab *j* ⇒ / Lab *i* ⇓	INETI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**-1.0**	4.6	**0.1**	6.5	**0.2**	4.6	**3.8**	7.2	**1.8**	7.7	**6.8**	8.8	**2.8**	7.7
BNM-CESTA	**0.9**	7.7	**2.0**	9.0	**2.1**	7.7	**5.6**	9.5	**3.6**	9.9	**8.6**	10.8	**4.6**	9.9
CMI	**-1.1**	7.1	**0.0**	8.5	**0.1**	7.1	**3.6**	9.0	**1.6**	9.5	**6.6**	10.3	**2.6**	9.4
CSIRO-NML	**-1.1**	5.8	**0.0**	7.4	**0.1**	5.8	**3.6**	8.1	**1.6**	8.5	**6.6**	9.5	**2.6**	8.5
CSIR-NML	**-6.1**	9.9	**-5.0**	10.9	**-4.9**	9.9	**-1.4**	11.3	**-3.4**	11.7	**1.6**	12.4	**-2.4**	11.7
CENAM	**-2.4**	7.7	**-1.3**	9.0	**-1.2**	7.7	**2.3**	9.5	**0.3**	9.9	**5.3**	10.8	**1.3**	9.9
NRC	**2.6**	5.8	**3.7**	7.4	**3.8**	5.7	**7.3**	8.0	**5.3**	8.5	**10.3**	9.5	**6.3**	8.5
KRISS	**-2.4**	6.3	**-1.3**	7.8	**-1.2**	6.3	**2.4**	8.5	**0.4**	8.9	**5.4**	9.8	**1.4**	8.9
NMIJ	**-1.5**	7.5	**-0.4**	8.8	**-0.3**	7.5	**3.2**	9.4	**1.2**	9.8	**6.2**	10.6	**2.2**	9.8
VNIIM	**-5.9**	6.7	**-4.8**	8.1	**-4.7**	6.7	**-1.2**	8.7	**-3.2**	9.2	**1.8**	10.1	**-2.2**	9.1
NIST	**-2.1**	5.8	**-1.0**	7.4	**-0.9**	5.8	**2.6**	8.1	**0.6**	8.5	**5.6**	9.5	**1.6**	8.5
NMi-VSL	**-3.0**	5.1	**-1.9**	6.9	**-1.8**	5.1	**1.7**	7.6	**-0.3**	8.1	**4.7**	9.1	**0.7**	8.1

Table L3ab (160 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 160 Hz

Lab j ⇒	PTB		BNM-CESTA		CMI		GUM		DPLA		CNR-IMGC		SP	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.0**	0.9	**0.1**	6.3	**1.6**	6.3	**1.9**	7.7	**1.1**	3.0	**1.1**	4.5	**-3.8**	5.3
BNM-CESTA	**0.6**	6.3	**0.7**	8.8	**2.2**	8.8	**2.5**	9.9	**1.7**	6.9	**1.7**	7.7	**-3.2**	8.2
CMI	**-0.4**	5.8	**-0.3**	8.5	**1.2**	8.5	**1.5**	9.6	**0.7**	6.4	**0.7**	7.3	**-4.2**	7.8
CSIRO-NML	**-0.4**	3.7	**-0.3**	7.2	**1.2**	7.2	**1.5**	8.5	**0.7**	4.7	**0.7**	5.8	**-4.2**	6.4
CSIR-NML	**-0.4**	6.3	**-0.3**	8.8	**1.2**	8.8	**1.5**	9.9	**0.7**	6.9	**0.7**	7.7	**-4.2**	8.2
CENAM	**-0.4**	6.3	**-0.3**	8.8	**1.2**	8.8	**1.5**	9.9	**0.7**	6.9	**0.7**	7.7	**-4.2**	8.2
NRC	**1.1**	3.7	**1.2**	7.2	**2.7**	7.2	**3.0**	8.5	**2.2**	4.7	**2.2**	5.8	**-2.7**	6.4
KRISS	**-1.5**	4.5	**-1.4**	7.6	**0.1**	7.6	**0.4**	8.9	**-0.4**	5.3	**-0.4**	6.3	**-5.3**	6.9
NMIJ	**-0.4**	5.5	**-0.3**	8.3	**1.2**	8.3	**1.5**	9.4	**0.7**	6.2	**0.7**	7.1	**-4.2**	7.6
VNIIM	**1.8**	5.0	**1.9**	8.0	**3.4**	8.0	**3.7**	9.2	**2.9**	5.7	**2.9**	6.7	**-2.0**	7.2
NIST	**-1.4**	3.7	**-1.3**	7.2	**0.2**	7.2	**0.5**	8.5	**-0.3**	4.7	**-0.3**	5.8	**-5.2**	6.4
NMi-VSL	**-0.4**	4.2	**-0.3**	7.5	**1.2**	7.5	**1.5**	8.8	**0.7**	5.1	**0.7**	6.1	**-4.2**	6.7

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Table L3ab (160 Hz): (continued)

Lab *j* ⇒ / **Lab *i* ⇓**	**INETI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**2.1**	5.3	**0.2**	6.5	**0.0**	4.4	**2.7**	7.2	**-0.3**	7.8	**6.7**	8.6	**1.7**	7.7
BNM-CESTA	**2.7**	8.1	**0.8**	9.0	**0.6**	7.6	**3.3**	9.5	**0.3**	9.9	**7.3**	10.6	**2.3**	9.9
CMI	**1.7**	7.8	**-0.2**	8.6	**-0.4**	7.2	**2.3**	9.2	**-0.7**	9.6	**6.3**	10.3	**1.3**	9.6
CSIRO-NML	**1.7**	6.4	**-0.2**	7.4	**-0.4**	5.7	**2.3**	8.1	**-0.7**	8.5	**6.3**	9.4	**1.3**	8.5
CSIR-NML	**1.7**	8.1	**-0.2**	9.0	**-0.4**	7.6	**2.3**	9.5	**-0.7**	9.9	**6.3**	10.6	**1.3**	9.9
CENAM	**1.7**	8.1	**-0.2**	9.0	**-0.4**	7.6	**2.3**	9.5	**-0.7**	9.9	**6.3**	10.6	**1.3**	9.9
NRC	**3.2**	6.4	**1.3**	7.4	**1.1**	5.7	**3.8**	8.1	**0.8**	8.5	**7.8**	9.4	**2.8**	8.5
KRISS	**0.6**	6.8	**-1.3**	7.8	**-1.5**	6.2	**1.2**	8.5	**-1.8**	8.9	**5.2**	9.7	**0.2**	8.9
NMIJ	**1.7**	7.6	**-0.2**	8.5	**-0.4**	7.0	**2.3**	9.0	**-0.7**	9.5	**6.3**	10.2	**1.3**	9.5
VNIIM	**3.9**	7.2	**2.0**	8.1	**1.8**	6.6	**4.5**	8.7	**1.5**	9.2	**8.5**	9.9	**3.5**	9.2
NIST	**0.7**	6.4	**-1.2**	7.4	**-1.4**	5.7	**1.3**	8.1	**-1.7**	8.5	**5.3**	9.4	**0.3**	8.5
NMi-VSL	**1.7**	6.7	**-0.2**	7.7	**-0.4**	6.0	**2.3**	8.3	**-0.7**	8.8	**6.3**	9.6	**1.3**	8.8

Table L3ab (800 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 800 Hz

Lab *j* ⇒	**PTB**		**BNM-CESTA**		**CMI**		**GUM**		**DPLA**		**CNR-IMGC**		**SP**	
	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}***
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**-0.6**	0.8	**2.0**	6.3	**2.7**	6.2	**2.9**	7.7	**0.2**	5.7	**1.0**	4.5	**-2.0**	5.3
BNM-CESTA	**2.5**	6.3	**5.0**	8.8	**5.8**	8.8	**6.0**	9.9	**3.2**	8.5	**4.0**	7.7	**1.1**	8.2
CMI	**-0.5**	6.8	**2.0**	9.2	**2.8**	9.2	**3.0**	10.2	**0.2**	8.8	**1.0**	8.1	**-1.9**	8.5
CSIRO-NML	**-0.5**	3.7	**2.0**	7.2	**2.8**	7.2	**3.0**	8.5	**0.2**	6.8	**1.0**	5.8	**-1.9**	6.4
CSIR-NML	**1.5**	6.3	**4.0**	8.8	**4.8**	8.8	**5.0**	9.9	**2.2**	8.5	**3.0**	7.7	**0.1**	8.2
CENAM	**-0.8**	6.3	**1.7**	8.8	**2.5**	8.8	**2.7**	9.9	**-0.1**	8.4	**0.7**	7.7	**-2.2**	8.1
NRC	**1.2**	5.4	**3.7**	8.2	**4.5**	8.2	**4.7**	9.4	**1.9**	7.8	**2.7**	7.0	**-0.2**	7.5
KRISS	**-1.0**	4.5	**1.6**	7.6	**2.3**	7.6	**2.5**	8.9	**-0.2**	7.2	**0.6**	6.3	**-2.4**	6.9
NMIJ	**-1.4**	6.6	**1.1**	9.1	**1.9**	9.1	**2.1**	10.1	**-0.7**	8.7	**0.1**	8.0	**-2.8**	8.4
VNIIM	**3.3**	5.5	**5.8**	8.3	**6.6**	8.3	**6.8**	9.4	**4.0**	7.9	**4.8**	7.1	**1.9**	7.6
NIST	**-3.5**	10.8	**-1.0**	12.5	**-0.2**	12.5	**0.0**	13.3	**-2.8**	12.2	**-2.0**	11.7	**-4.9**	12.0
NMi-VSL	**4.5**	6.3	**7.1**	8.8	**7.9**	8.8	**8.1**	9.9	**5.3**	8.5	**6.1**	7.7	**3.1**	8.2

Table L3ab (800 Hz): (continued)

Lab *j* ⇒ / Lab *i* ⇓	INETI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**2.0**	5.8	**1.1**	6.5	**0.9**	3.5	**0.1**	7.6	**-1.9**	8.1	**6.1**	8.9	**1.1**	8.0
BNM-CESTA	**5.0**	8.5	**4.1**	9.0	**3.9**	7.1	**3.2**	9.8	**1.2**	10.2	**9.2**	10.9	**4.2**	10.2
CMI	**2.0**	8.9	**1.1**	9.3	**0.9**	7.6	**0.2**	10.1	**-1.8**	10.5	**6.2**	11.2	**1.2**	10.5
CSIRO-NML	**2.0**	6.8	**1.1**	7.4	**0.9**	5.0	**0.2**	8.4	**-1.8**	8.8	**6.2**	9.6	**1.2**	8.8
CSIR-NML	**4.0**	8.5	**3.1**	9.0	**2.9**	7.1	**2.2**	9.8	**0.2**	10.2	**8.2**	10.9	**3.2**	10.2
CENAM	**1.7**	8.5	**0.8**	9.0	**0.6**	7.1	**-0.1**	9.8	**-2.1**	10.2	**5.9**	10.9	**0.9**	10.2
NRC	**3.7**	7.9	**2.8**	8.4	**2.6**	6.4	**1.9**	9.3	**-0.1**	9.7	**7.9**	10.4	**2.9**	9.6
KRISS	**1.6**	7.3	**0.7**	7.8	**0.5**	5.6	**-0.3**	8.7	**-2.3**	9.2	**5.7**	9.9	**0.7**	9.2
NMIJ	**1.1**	8.8	**0.2**	9.2	**0.0**	7.4	**-0.7**	10.0	**-2.7**	10.4	**5.3**	11.1	**0.3**	10.4
VNIIM	**5.8**	8.0	**4.9**	8.5	**4.7**	6.5	**4.0**	9.3	**2.0**	9.7	**10.0**	10.5	**5.0**	9.7
NIST	**-1.0**	12.3	**-1.9**	12.6	**-2.1**	11.3	**-2.8**	13.2	**-4.8**	13.5	**3.2**	14.0	**-1.8**	13.5
NMi-VSL	**7.1**	8.5	**6.2**	9.0	**6.0**	7.1	**5.2**	9.8	**3.2**	10.2	**11.2**	10.9	**6.2**	10.2

Table L3ab (2000 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 2000 Hz

Lab *j* ⇒	PTB		BNM-CESTA		CMI		GUM		DPLA		CNR-IMGC		SP	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.1**	0.8	**3.6**	6.3	**4.4**	8.8	**2.8**	7.7	**2.7**	6.1	**0.6**	6.3	**-0.4**	10.3
BNM-CESTA	**1.5**	6.3	**5.0**	8.8	**5.7**	10.8	**4.2**	9.9	**4.1**	8.7	**2.0**	8.8	**1.0**	12.0
CMI	**-0.9**	6.0	**2.6**	8.6	**3.3**	10.6	**1.8**	9.8	**1.7**	8.5	**-0.4**	8.7	**-1.4**	11.9
CSIRO-NML	**-0.5**	3.7	**3.0**	7.2	**3.7**	9.5	**2.2**	8.5	**2.1**	7.0	**0.0**	7.2	**-1.0**	10.9
CSIR-NML	**-0.5**	7.6	**3.0**	9.8	**3.7**	11.6	**2.2**	10.8	**2.1**	9.7	**0.0**	9.8	**-1.0**	12.7
CENAM	**0.6**	10.1	**4.1**	11.9	**4.8**	13.4	**3.3**	12.7	**3.2**	11.8	**1.1**	11.9	**0.1**	14.4
NRC	**0.5**	8.3	**4.0**	10.4	**4.7**	12.1	**3.2**	11.4	**3.1**	10.3	**1.0**	10.4	**0.0**	13.2
KRISS	**-1.4**	4.7	**2.1**	7.8	**2.9**	10.0	**1.3**	9.0	**1.2**	7.6	**-0.9**	7.8	**-1.9**	11.3
NMIJ	**-1.3**	5.6	**2.2**	8.4	**2.9**	10.4	**1.4**	9.5	**1.3**	8.2	**-0.8**	8.4	**-1.8**	11.7
VNIIM	**17,5**	5,6	**21,0**	8,4	**21,7**	10,4	**20,2**	9,5	**20,1**	8,2	**18,0**	8,4	**17,0**	11,7
NIST	**-4.5**	8.6	**-1.0**	10.6	**-0.3**	12.3	**-1.8**	11.5	**-1.9**	10.5	**-4.0**	10.6	**-5.0**	13.3
NMi-VSL	**-2.3**	5.4	**1.1**	8.2	**1.9**	10.3	**0.3**	9.4	**0.2**	8.1	**-1.9**	8.2	**-2.8**	11.6

Table L3ab (2000 Hz): (continued)

Lab *j* ⇒	INETI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**2.7**	12.8	**0.8**	4.0	**-1.9**	8.1	**-1.9**	8.1	**6.1**	9.9	**1.1**	8.1
BNM-CESTA			**4.1**	14.2	**2.2**	7.4	**-0.5**	10.2	**-0.5**	10.2	**7.5**	11.7	**2.5**	10.2
CMI			**1.7**	14.1	**-0.2**	7.2	**-2.9**	10.0	**-2.9**	10.0	**5.1**	11.6	**0.1**	10.0
CSIRO-NML			**2.1**	13.3	**0.2**	5.3	**-2.5**	8.8	**-2.5**	8.8	**5.5**	10.6	**0.5**	8.8
CSIR-NML			**2.1**	14.8	**0.2**	8.5	**-2.5**	11.0	**-2.5**	11.0	**5.5**	12.5	**0.5**	11.0
CENAM			**3.2**	16.3	**1.3**	10.8	**-1.4**	12.9	**-1.4**	12.9	**6.6**	14.2	**1.6**	12.9
NRC			**3.1**	15.2	**1.2**	9.2	**-1.5**	11.6	**-1.5**	11.6	**6.5**	13.0	**1.5**	11.6
KRISS			**1.2**	13.6	**-0.7**	6.1	**-3.4**	9.3	**-3.4**	9.3	**4.7**	11.0	**-0.3**	9.3
NMIJ			**1.3**	13.9	**-0.6**	6.8	**-3.3**	9.8	**-3.3**	9.8	**4.7**	11.4	**-0.3**	9.8
VNIIM			**20,1**	13,9	**18,2**	6,8	**15,5**	9,8	**15,5**	9,8	**23,5**	11,4	**18,5**	9,8
NIST			**-1.9**	15.4	**-3.8**	9.4	**-6.5**	11.7	**-6.5**	11.7	**1.5**	13.1	**-3.5**	11.7
NMi-VSL			**0.2**	13.8	**-1.7**	6.6	**-4.3**	9.7	**-4.3**	9.7	**3.7**	11.3	**-1.3**	9.7

Table L3ab (5000 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Back-to-back (BB) accelerometers type 8305 S/N 2355677 and S/N 606559 (for comparison method) at 5000 Hz

Lab j ⇒	PTB		BNM-CESTA		CMI		GUM		DPLA		CNR-IMGC		SP	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**-0.1**	1.8	**-2.9**	10.2	**-2.4**	7.2	**1.6**	8.3	**2.2**	4.9	**3.5**	7.8	**-4.4**	17.1
BNM-CESTA														
CMI	**0.0**	7.5	**-2.8**	12.6	**-2.3**	10.2	**1.7**	11.1	**2.3**	8.8	**3.7**	10.7	**-4.2**	18.6
CSIRO-NML	**1.5**	4.9	**-1.3**	11.2	**-0.8**	8.5	**3.2**	9.5	**3.8**	6.6	**5.2**	9.0	**-2.7**	17.7
CSIR-NML	**-1.5**	8.9	**-4.3**	13.4	**-3.8**	11.2	**0.2**	12.0	**0.8**	10.0	**2.2**	11.7	**-5.7**	19.2
CENAM	**-0.4**	10.2	**-3.2**	14.3	**-2.7**	12.3	**1.3**	13.0	**1.9**	11.2	**3.3**	12.7	**-4.6**	19.9
NRC	**-0.5**	13.8	**-3.3**	17.1	**-2.8**	15.5	**1.2**	16.0	**1.8**	14.5	**3.2**	15.8	**-4.7**	21.9
KRISS	**1.1**	5.3	**-1.7**	11.3	**-1.2**	8.7	**2.8**	9.7	**3.4**	7.0	**4.8**	9.3	**-3.1**	17.8
NMIJ	**-0.4**	17.0	**-3.2**	19.7	**-2.7**	18.3	**1.3**	18.8	**1.9**	17.6	**3.3**	18.6	**-4.6**	24.1
VNIIM	**13,9**	8,7	**11,1**	13,3	**11,6**	11,1	**15,6**	11,9	**16,2**	9,8	**17,6**	11,6	**9,7**	19,1
NIST	**-1.5**	15.4	**-4.3**	18.4	**-3.8**	16.9	**0.2**	17.4	**0.8**	16.1	**2.2**	17.2	**-5.7**	23.0
NMi-VSL	**-0.6**	48.8	**-3.4**	49.9	**-2.9**	49.3	**1.1**	49.5	**1.7**	49.0	**3.1**	49.4	**-4.9**	51.7

Table L3ab (5000 Hz): (continued)

Lab *j* ⇒	INETI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**-5.9**	13.3	**1.3**	4.8	**-1.3**	9.5	**-0.3**	9.5	**8.7**	12.7	**-3.3**	8.9
BNM-CESTA														
CMI			**-5.7**	15.2	**1.4**	8.8	**-1.1**	12.0	**-0.1**	12.0	**8.9**	14.7	**-3.2**	11.5
CSIRO-NML			**-4.2**	14.1	**2.9**	6.6	**0.4**	10.5	**1.4**	10.5	**10.4**	13.5	**-1.7**	9.9
CSIR-NML			**-7.2**	15.9	**-0.1**	9.9	**-2.6**	12.9	**-1.6**	12.9	**7.4**	15.4	**-4.7**	12.4
CENAM			**-6.1**	16.7	**1.0**	11.1	**-1.5**	13.8	**-0.5**	13.8	**8.5**	16.2	**-3.6**	13.4
NRC			**-6.2**	19.1	**0.9**	14.5	**-1.6**	16.7	**-0.6**	16.7	**8.4**	18.7	**-3.7**	16.3
KRISS			**-4.6**	14.2	**2.5**	6.9	**-0.1**	10.7	**0.9**	10.7	**10.0**	13.6	**-2.1**	10.1
NMIJ			**-6.1**	21.5	**1.0**	17.5	**-1.5**	19.4	**-0.5**	19.4	**8.5**	21.1	**-3.6**	19.1
VNIIM			**8,2**	15,8	**15,3**	9,8	**12,8**	12,8	**13,8**	12,8	**22,8**	15,3	**10,7**	12,3
NIST			**-7.2**	20.3	**-0.1**	16.0	**-2.6**	18.0	**-1.6**	18.0	**7.4**	19.9	**-4.7**	17.7
NMi-VSL			**-6.3**	50.6	**0.8**	49.0	**-1.8**	49.7	**-0.8**	49.7	**8.3**	50.4	**-3.8**	49.6

Table L3c (40 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558 at 40 Hz

Lab *j* ⇒	**PTB**		**BNM-CESTA**		**CMI**		**GUM**		**DPLA**		**CNR-IMGC**		**SP**	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.3**	0.9	**0.0**	6.4	**2.8**	6.5	**0.3**	7.9	**1.8**	4.7	**3.1**	4.6	**0.4**	7.3
BNM-CESTA	**1.1**	6.4	**0.9**	9.0	**3.6**	9.1	**1.1**	10.1	**2.6**	7.9	**3.9**	7.8	**1.2**	9.7
CMI	**-2.4**	5.8	**-2.6**	8.6	**0.1**	8.7	**-2.4**	9.8	**-0.9**	7.4	**0.4**	7.4	**-2.3**	9.3
CSIRO-NML	**1.1**	5.1	**0.9**	8.1	**3.6**	8.2	**1.1**	9.3	**2.6**	6.9	**3.9**	6.8	**1.2**	8.9
CSIR-NML	**6.1**	9.0	**5.9**	11.0	**8.6**	11.1	**6.1**	11.9	**7.6**	10.1	**8.9**	10.1	**6.2**	11.6
CENAM	**-0.6**	6.4	**-0.8**	9.0	**1.9**	9.1	**-0.6**	10.1	**0.9**	7.9	**2.2**	7.8	**-0.5**	9.7
NRC	**-2.3**	3.8	**-2.5**	7.4	**0.2**	7.5	**-2.3**	8.7	**-0.8**	6.0	**0.5**	5.9	**-2.2**	8.2
KRISS	**-2.7**	4.5	**-2.9**	7.8	**-0.2**	7.9	**-2.7**	9.1	**-1.2**	6.5	**0.2**	6.4	**-2.6**	8.6
NMIJ	**-4.6**	5.3	**-4.8**	8.3	**-2.1**	8.4	**-4.6**	9.5	**-3.1**	7.0	**-1.8**	7.0	**-4.5**	9.0
VNIIM	**-6.7**	5.0	**-6.9**	8.1	**-4.2**	8.2	**-6.7**	9.3	**-5.2**	6.8	**-3.9**	6.8	**-6.6**	8.8
NIST	**6.1**	3.8	**5.9**	7.4	**8.6**	7.5	**6.1**	8.7	**7.6**	6.0	**8.9**	5.9	**6.2**	8.2
NMi-VSL	**0.6**	11.8	**0.4**	13.4	**3.1**	13.5	**0.6**	14.2	**2.1**	12.7	**3.4**	12.7	**0.7**	13.9

Table L3c (40 Hz): (continued)

Lab *j* ⇒	**INETI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**10.6**	11.8	**-0.3**	6.8	**1.7**	6.9	**3.8**	6.5	**0.7**	8.0	**1.7**	9.7	**-1.3**	8.0
BNM-CESTA	**11.5**	13.4	**0.5**	9.3	**2.6**	9.3	**4.6**	9.1	**1.5**	10.2	**2.6**	11.6	**-0.5**	10.2
CMI	**8.0**	13.2	**-3.0**	8.9	**-0.9**	9.0	**1.1**	8.7	**-2.0**	9.9	**-0.9**	11.3	**-4.0**	9.9
CSIRO-NML	**11.5**	12.8	**0.5**	8.4	**2.6**	8.5	**4.6**	8.2	**1.5**	9.4	**2.6**	10.9	**-0.5**	9.5
CSIR-NML	**16.5**	14.8	**5.5**	11.2	**7.6**	11.3	**9.6**	11.1	**6.5**	12.0	**7.6**	13.2	**4.5**	12.0
CENAM	**9.8**	13.4	**-1.2**	9.3	**0.9**	9.3	**2.9**	9.1	**-0.2**	10.2	**0.9**	11.6	**-2.2**	10.2
NRC	**8.1**	12.4	**-2.9**	7.7	**-0.8**	7.8	**1.2**	7.5	**-1.9**	8.8	**-0.8**	10.4	**-3.9**	8.8
KRISS	**7.7**	12.6	**-3.3**	8.1	**-1.2**	8.2	**0.8**	7.9	**-2.2**	9.2	**-1.2**	10.7	**-4.3**	9.2
NMIJ	**5.8**	12.9	**-5.2**	8.6	**-3.1**	8.7	**-1.1**	8.4	**-4.2**	9.6	**-3.1**	11.0	**-6.2**	9.6
VNIIM	**3.7**	12.8	**-7.3**	8.4	**-5.2**	8.5	**-3.2**	8.2	**-6.3**	9.4	**-5.2**	10.9	**-8.3**	9.4
NIST	**16.5**	12.4	**5.5**	7.7	**7.6**	7.8	**9.6**	7.5	**6.5**	8.8	**7.6**	10.4	**4.5**	8.8
NMi-VSL	**10.9**	16.7	**0.0**	13.6	**2.1**	13.7	**4.1**	13.5	**1.0**	14.3	**2.1**	15.3	**-1.0**	14.3

Table L3c (80 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558 at 80 Hz

Lab *j* ⇒	**PTB**		**BNM-CESTA**		**CMI**		**GUM**		**DPLA**		**CNR-IMGC**		**SP**	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.3**	0.9	**0.2**	6.4	**2.7**	6.5	**1.1**	7.9	**1.0**	3.2	**2.2**	4.6	**0.4**	7.2
BNM-CESTA	**3.1**	6.4	**3.0**	9.0	**5.6**	9.1	**3.9**	10.1	**3.8**	7.1	**5.1**	7.8	**3.3**	9.6
CMI	**-1.4**	5.9	**-1.5**	8.6	**1.1**	8.7	**-0.6**	9.8	**-0.7**	6.6	**0.6**	7.4	**-1.2**	9.3
CSIRO-NML	**-0.9**	3.8	**-1.0**	7.4	**1.6**	7.5	**-0.1**	8.7	**-0.2**	4.9	**1.1**	5.9	**-0.7**	8.1
CSIR-NML	**2.1**	9.0	**2.0**	11.0	**4.6**	11.1	**2.9**	11.9	**2.8**	9.5	**4.1**	10.1	**2.3**	11.5
CENAM	**-0.4**	6.4	**-0.5**	9.0	**2.1**	9.1	**0.4**	10.1	**0.3**	7.1	**1.6**	7.8	**-0.2**	9.6
NRC	**3.8**	3.7	**3.7**	7.3	**6.3**	7.4	**4.6**	8.6	**4.5**	4.8	**5.8**	5.8	**4.0**	8.0
KRISS	**-2.6**	4.5	**-2.7**	7.8	**-0.1**	7.9	**-1.7**	9.1	**-1.8**	5.5	**-0.6**	6.4	**-2.4**	8.5
NMIJ	**-2.1**	6.1	**-2.2**	8.8	**0.4**	8.9	**-1.3**	9.9	**-1.4**	6.9	**-0.1**	7.6	**-1.9**	9.4
VNIIM	**-4.1**	5.1	**-4.2**	8.1	**-1.6**	8.2	**-3.3**	9.3	**-3.4**	5.9	**-2.1**	6.8	**-3.9**	8.8
NIST	**0.1**	3.8	**0.0**	7.4	**2.6**	7.5	**0.9**	8.7	**0.8**	4.9	**2.1**	5.9	**0.3**	8.1
NMi-VSL	**-1.8**	3.0	**-1.9**	7.0	**0.7**	7.1	**-1.0**	8.4	**-1.1**	4.3	**0.1**	5.4	**-1.6**	7.8

Table L3c (80 Hz): (continued)

Lab *j* ⇒	**INETI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.4**	6.5	**0.7**	6.8	**1.7**	6.6	**0.7**	5.8	**-1.4**	8.0	**-0.3**	9.2	**-0.3**	8.0
BNM-CESTA	**3.3**	9.1	**3.6**	9.3	**4.6**	9.2	**3.6**	8.6	**1.5**	10.2	**2.5**	11.1	**2.5**	10.2
CMI	**-1.2**	8.7	**-0.9**	8.9	**0.1**	8.8	**-0.9**	8.2	**-3.0**	9.9	**-2.0**	10.8	**-2.0**	9.9
CSIRO-NML	**-0.7**	7.5	**-0.4**	7.7	**0.6**	7.6	**-0.4**	6.8	**-2.5**	8.8	**-1.5**	9.9	**-1.5**	8.8
CSIR-NML	**2.3**	11.1	**2.6**	11.2	**3.6**	11.1	**2.6**	10.7	**0.5**	12.0	**1.5**	12.8	**1.5**	12.0
CENAM	**-0.2**	9.1	**0.1**	9.3	**1.1**	9.2	**0.1**	8.6	**-2.0**	10.2	**-1.0**	11.1	**-1.0**	10.2
NRC	**4.0**	7.4	**4.3**	7.6	**5.3**	7.5	**4.3**	6.8	**2.2**	8.8	**3.2**	9.8	**3.2**	8.8
KRISS	**-2.4**	7.9	**-2.1**	8.1	**-1.1**	8.0	**-2.1**	7.3	**-4.2**	9.2	**-3.1**	10.2	**-3.1**	9.2
NMIJ	**-1.9**	8.9	**-1.6**	9.1	**-0.6**	9.0	**-1.6**	8.4	**-3.7**	10.0	**-2.7**	11.0	**-2.7**	10.0
VNIIM	**-3.9**	8.2	**-3.6**	8.4	**-2.6**	8.3	**-3.6**	7.6	**-5.7**	9.4	**-4.7**	10.4	**-4.7**	9.4
NIST	**0.3**	7.5	**0.6**	7.7	**1.6**	7.6	**0.6**	6.8	**-1.5**	8.8	**-0.5**	9.9	**-0.5**	8.8
NMi-VSL	**-1.6**	7.1	**-1.4**	7.3	**-0.3**	7.2	**-1.4**	6.4	**-3.4**	8.5	**-2.4**	9.6	**-2.4**	8.5

Table L3c (160 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558 at 160 Hz

Lab *j* ⇒	PTB		BNM-CESTA		CMI		GUM		DPLA		CNR-IMGC		SP	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**0.2**	0.9	**-0.7**	6.4	**4.0**	6.5	**1.6**	7.9	**0.4**	3.0	**2.4**	4.6	**0.1**	7.9
BNM-CESTA	**3.0**	6.4	**2.1**	9.0	**6.8**	9.1	**4.4**	10.1	**3.2**	7.0	**5.2**	7.8	**2.9**	10.2
CMI	**0.0**	5.9	**-0.9**	8.6	**3.8**	8.7	**1.4**	9.8	**0.2**	6.5	**2.2**	7.4	**-0.1**	9.8
CSIRO-NML	**-1.0**	3.8	**-1.9**	7.4	**2.8**	7.5	**0.4**	8.7	**-0.8**	4.7	**1.2**	5.9	**-1.1**	8.7
CSIR-NML	**-3.0**	6.4	**-3.9**	9.0	**0.8**	9.1	**-1.6**	10.1	**-2.8**	7.0	**-0.8**	7.8	**-3.1**	10.1
CENAM	**-1.4**	6.4	**-2.3**	9.0	**2.4**	9.1	**0.0**	10.1	**-1.2**	7.0	**0.8**	7.8	**-1.5**	10.1
NRC	**1.4**	3.7	**0.5**	7.3	**5.2**	7.4	**2.8**	8.6	**1.6**	4.7	**3.6**	5.8	**1.3**	8.7
KRISS	**-2.0**	4.5	**-2.8**	7.8	**1.8**	7.9	**-0.6**	9.0	**-1.8**	5.4	**0.2**	6.4	**-2.0**	9.1
NMIJ	**-2.2**	5.5	**-3.1**	8.4	**1.6**	8.5	**-0.8**	9.5	**-2.0**	6.2	**0.0**	7.1	**-2.3**	9.6
VNIIM	**-1.8**	5.1	**-2.7**	8.1	**2.0**	8.2	**-0.4**	9.3	**-1.6**	5.8	**0.4**	6.8	**-1.9**	9.4
NIST	**1.0**	3.8	**0.1**	7.4	**4.8**	7.5	**2.4**	8.7	**1.2**	4.7	**3.2**	5.9	**0.9**	8.7
NMi-VSL	**-0.5**	4.3	**-1.4**	7.6	**3.3**	7.8	**0.9**	8.9	**-0.3**	5.2	**1.7**	6.2	**-0.6**	9.0

Table L3c (160 Hz): (continued)

Lab *j* ⇒	**INETI**		**UME**		**GBARL**		**BEV**		**CEM**		**METAS**		**SIRA**	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**3.2**	8.0	**1.8**	6.8	**3.0**	6.6	**-0.1**	5.8	**-0.1**	8.0	**-1.1**	9.0	**-1.1**	8.0
BNM-CESTA	**6.0**	10.2	**4.6**	9.3	**5.8**	9.2	**2.7**	8.6	**2.7**	10.2	**1.7**	11.0	**1.7**	10.2
CMI	**3.0**	9.9	**1.6**	8.9	**2.8**	8.8	**-0.3**	8.2	**-0.3**	9.9	**-1.3**	10.7	**-1.3**	9.9
CSIRO-NML	**2.0**	8.8	**0.6**	7.7	**1.8**	7.6	**-1.3**	6.8	**-1.3**	8.8	**-2.3**	9.7	**-2.3**	8.8
CSIR-NML	**0.0**	10.2	**-1.4**	9.2	**-0.2**	9.2	**-3.3**	8.6	**-3.3**	10.2	**-4.3**	11.0	**-4.3**	10.2
CENAM	**1.6**	10.2	**0.2**	9.3	**1.4**	9.2	**-1.7**	8.6	**-1.7**	10.2	**-2.7**	11.0	**-2.7**	10.2
NRC	**4.4**	8.7	**3.0**	7.6	**4.2**	7.5	**1.1**	6.8	**1.1**	8.8	**0.1**	9.7	**0.1**	8.8
KRISS	**1.0**	9.1	**-0.3**	8.1	**0.8**	8.0	**-2.3**	7.3	**-2.3**	9.2	**-3.3**	10.1	**-3.3**	9.2
NMIJ	**0.8**	9.6	**-0.6**	8.6	**0.6**	8.5	**-2.5**	7.9	**-2.5**	9.7	**-3.5**	10.5	**-3.5**	9.7
VNIIM	**1.2**	9.4	**-0.2**	8.4	**1.0**	8.3	**-2.1**	7.6	**-2.1**	9.4	**-3.1**	10.3	**-3.1**	9.5
NIST	**4.0**	8.8	**2.6**	7.7	**3.8**	7.6	**0.7**	6.8	**0.7**	8.8	**-0.3**	9.8	**-0.3**	8.8
NMi-VSL	**2.5**	9.0	**1.1**	8.0	**2.3**	7.9	**-0.8**	7.2	**-0.8**	9.1	**-1.8**	10.0	**-1.8**	9.1

Table L3c (800 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558 at 800 Hz

Lab *j* ⇒	PTB		BNM-CESTA		CMI		GUM		DPLA		CNR-IMGC		SP	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**-0.5**	0.8	**-0.6**	6.4	**5.9**	6.5	**2.2**	7.9	**-0.3**	5.8	**3.5**	4.6	**-0.4**	8.5
BNM-CESTA	**2.9**	6.4	**2.8**	9.0	**9.3**	9.1	**5.6**	10.1	**3.1**	8.6	**6.9**	7.8	**3.0**	10.6
CMI	**1.9**	8.5	**1.8**	10.6	**8.3**	10.7	**4.6**	11.5	**2.1**	10.3	**5.9**	9.6	**2.0**	12.0
CSIRO-NML	**-1.1**	3.7	**-1.2**	7.4	**5.3**	7.5	**1.6**	8.7	**-0.9**	6.9	**2.9**	5.9	**-1.0**	9.3
CSIR-NML	**3.9**	7.7	**3.8**	10.0	**10.3**	10.1	**6.6**	11.0	**4.1**	9.6	**7.9**	8.9	**4.0**	11.5
CENAM	**0.2**	6.4	**0.1**	9.0	**6.6**	9.1	**2.9**	10.1	**0.4**	8.6	**4.2**	7.8	**0.3**	10.6
NRC	**2.3**	5.5	**2.2**	8.4	**8.7**	8.5	**5.0**	9.6	**2.5**	8.0	**6.3**	7.1	**2.4**	10.1
KRISS	**-2.1**	4.5	**-2.2**	7.8	**4.2**	7.9	**0.5**	9.0	**-1.9**	7.3	**1.9**	6.4	**-2.1**	9.6
NMIJ	**-3.1**	8.6	**-3.2**	10.7	**3.3**	10.7	**-0.4**	11.6	**-2.9**	10.3	**0.9**	9.7	**-3.0**	12.1
VNIIM	**-4.9**	5.6	**-5.0**	8.4	**1.5**	8.5	**-2.2**	9.6	**-4.7**	8.0	**-0.9**	7.2	**-4.8**	10.1
NIST	**1.9**	11.1	**1.8**	12.8	**8.3**	12.8	**4.6**	13.6	**2.1**	12.5	**5.9**	12.0	**2.0**	13.9
NMi-VSL	**5.9**	5.4	**5.8**	8.3	**12.3**	8.4	**8.6**	9.5	**6.2**	7.9	**9.9**	7.0	**6.0**	10.0

Table L3c (800 Hz): (continued)

Lab j ⇒	INETI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**4.7**	9.0	**3.6**	6.8	**1.8**	6.4	**-1.3**	5.8	**-0.3**	8.0	**-1.3**	9.0	**-0.3**	8.0
BNM-CESTA	**8.1**	11.0	**7.0**	9.3	**5.2**	9.0	**2.1**	8.6	**3.1**	10.2	**2.1**	11.0	**3.1**	10.2
CMI	**7.1**	12.4	**6.0**	10.8	**4.2**	10.6	**1.1**	10.2	**2.1**	11.7	**1.1**	12.4	**2.1**	11.7
CSIRO-NML	**4.1**	9.7	**3.0**	7.7	**1.2**	7.4	**-1.9**	6.8	**-0.9**	8.8	**-1.9**	9.7	**-0.9**	8.8
CSIR-NML	**9.1**	11.9	**8.0**	10.2	**6.2**	10.0	**3.1**	9.6	**4.1**	11.1	**3.1**	11.8	**4.1**	11.1
CENAM	**5.4**	11.0	**4.3**	9.3	**2.5**	9.0	**-0.6**	8.6	**0.4**	10.2	**-0.6**	11.0	**0.4**	10.2
NRC	**7.5**	10.5	**6.4**	8.7	**4.6**	8.4	**1.5**	7.9	**2.5**	9.7	**1.5**	10.5	**2.5**	9.7
KRISS	**3.0**	10.1	**2.0**	8.1	**0.1**	7.8	**-3.0**	7.3	**-1.9**	9.2	**-3.0**	10.1	**-1.9**	9.2
NMIJ	**2.1**	12.4	**1.0**	10.9	**-0.8**	10.7	**-3.9**	10.3	**-2.9**	11.7	**-3.9**	12.4	**-2.9**	11.7
VNIIM	**0.3**	10.6	**-0.8**	8.7	**-2.6**	8.4	**-5.7**	8.0	**-4.7**	9.7	**-5.7**	10.6	**-4.7**	9.7
NIST	**7.1**	14.3	**6.0**	13.0	**4.2**	12.8	**1.1**	12.5	**2.1**	13.7	**1.1**	14.3	**2.1**	13.7
NMi-VSL	**11.1**	10.5	**10.1**	8.6	**8.2**	8.3	**5.1**	7.9	**6.2**	9.6	**5.1**	10.5	**6.2**	9.6

Table L3c (2000 Hz): Degrees of equivalence of the participants of EUROMET.AUV.V-K1 relative to the participants of CCAUV.V-K1 for the Single-ended (SE) accelerometer type 8305 WH 2335 S/N 2361558 at 2000 Hz

Lab j ⇒	PTB		BNM-CESTA		CMI		GUM		DPLA		CNR-IMGC		SP	
	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}
Lab i ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB	**-0.1**	0.8	**1.5**	6.4	**6.2**	13.0	**2.0**	7.9	**2.0**	5.0	**1.5**	6.4	**-1.3**	12.6
BNM-CESTA	**0.1**	6.4	**1.7**	9.0	**6.4**	14.5	**2.2**	10.2	**2.2**	8.1	**1.7**	9.0	**-1.1**	14.1
CMI	**1.6**	8.0	**3.2**	10.2	**7.9**	15.3	**3.7**	11.2	**3.7**	9.4	**3.2**	10.2	**0.4**	14.9
CSIRO-NML	**-0.9**	3.7	**0.7**	7.4	**5.4**	13.5	**1.2**	8.7	**1.2**	6.2	**0.7**	7.4	**-2.1**	13.1
CSIR-NML	**4.1**	7.7	**5.7**	10.0	**10.4**	15.1	**6.2**	11.0	**6.2**	9.2	**5.7**	10.0	**2.9**	14.8
CENAM	**0.6**	10.3	**2.2**	12.1	**6.9**	16.6	**2.7**	13.0	**2.7**	11.5	**2.2**	12.1	**-0.6**	16.3
NRC	**-3.2**	8.5	**-1.6**	10.6	**3.1**	15.5	**-1.1**	11.6	**-1.1**	9.8	**-1.6**	10.6	**-4.4**	15.2
KRISS	**-4.1**	6.1	**-2.6**	8.8	**2.1**	14.4	**-2.0**	10.0	**-2.0**	7.9	**-2.6**	8.8	**-5.3**	14.0
NMIJ	**11.2**	6.3	**12.8**	9.0	**17.5**	14.5	**13.3**	10.1	**13.3**	8.0	**12.8**	9.0	**10.0**	14.1
VNIIM	**-7.7**	5.6	**-6.1**	8.5	**-1.4**	14.1	**-5.6**	9.7	**-5.6**	7.4	**-6.1**	8.5	**-8.9**	13.7
NIST	**-1.9**	8.8	**-0.3**	10.8	**4.4**	15.7	**0.2**	11.8	**0.2**	10.0	**-0.3**	10.8	**-3.1**	15.3
NMi-VSL	**5.2**	12.7	**6.8**	14.2	**11.5**	18.2	**7.3**	15.0	**7.3**	13.7	**6.8**	14.2	**4.0**	17.9

Table L3c (2000 Hz): (continued)

Lab *j* ⇒	INETI		UME		GBARL		BEV		CEM		METAS		SIRA	
	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}
Lab *i* ⇓	pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}		pC/(m/s²)x10^{-4}	
PTB			**1.1**	13.2	**2.1**	6.7	**-2.0**	6.6	**0.0**	8.1	**-3.0**	10.1	**-2.0**	8.1
BNM-CESTA			**1.2**	14.6	**2.3**	9.2	**-1.8**	9.1	**0.2**	10.3	**-2.9**	12.0	**-1.8**	10.3
CMI			**2.7**	15.4	**3.8**	10.4	**-0.3**	10.3	**1.7**	11.3	**-1.4**	12.9	**-0.3**	11.3
CSIRO-NML			**0.2**	13.7	**1.3**	7.6	**-2.8**	7.5	**-0.8**	8.9	**-3.9**	10.8	**-2.8**	8.9
CSIR-NML			**5.2**	15.3	**6.3**	10.2	**2.2**	10.1	**4.2**	11.2	**1.1**	12.7	**2.2**	11.2
CENAM			**1.7**	16.7	**2.8**	12.3	**-1.3**	12.2	**0.7**	13.1	**-2.4**	14.5	**-1.3**	13.1
NRC			**-2.1**	15.7	**-1.0**	10.8	**-5.1**	10.7	**-3.1**	11.7	**-6.2**	13.2	**-5.1**	11.7
KRISS			**-3.0**	14.5	**-2.0**	9.0	**-6.1**	9.0	**-4.0**	10.1	**-7.1**	11.8	**-6.1**	10.1
NMIJ			**12.3**	14.6	**13.4**	9.2	**9.3**	9.1	**11.3**	10.2	**8.2**	11.9	**9.3**	10.2
VNIIM			**-6.6**	14.3	**-5.5**	8.7	**-9.6**	8.6	**-7.6**	9.8	**-10.7**	11.5	**-9.6**	9.8
NIST			**-0.8**	15.8	**0.3**	11.0	**-3.8**	10.9	**-1.8**	11.9	**-4.9**	13.4	**-3.8**	11.9
NMi-VSL			**6.3**	18.3	**7.4**	14.4	**3.3**	14.3	**5.3**	15.1	**2.2**	16.3	**3.3**	15.1

References

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[L2] Brief guidelines for linking RMO key comparisons to the CIPM KCRV, Doc. CCAUV/04-27, BIPM 26 May 2004

[L3] Elster C., Link A., Wöger W., Proposal for linking the results of CIPM and RMO key comparisons, 2003, Metrologia, 40, 189-194.

[L4] H.-J. von Martens, C. Elster, A. Link, W. Wöger, P.J Allisy, 2004, Linking the results of the regional key comparison APMP.AUV.V-K1 to those of the CIPM key comparison CCAUV.V-K1, http://www.bipm.org

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[L7] ISO standard 16063-11, 1999, Methods to calibrate vibration and shock transducers – Part 11: Primary vibration calibration using laser interferometry

[L8] ISO standard 16063-21, 2003, Methods to calibrate vibration and shock transducers – Part 21: Vibration calibration by comparison to a reference transducer

Appendix B
Results of CSIC-IA/ES

B 1 Status of CSIC-IA as partner in the EUROMET Key comparison (Agreed EUROMET Project Ref.-No.579)

In the EUROMET.AUV.V-K1 key comparison Spain is represented by its National Metrology Institute CEM. As another partner in the agreed EUROMET Project Ref.-No. 579 CSIC-IA/ES had calibrated the travelling standards, too. The coordinator of the EUROMET Project Ref.-No.579 consulted the BIPM about the question of the status of CSIC-IA within the framework of reporting the results. He provided for BIPM the background information and suggested to present CSIC-IA results in an appendix of Report B without including them in the analysis and linking procedures applied to the results of the other laboratories. At the same time, the coordinator brought the matter to the attention of the Chairman of the EUROMET TC AUV.

Decision by BIPM:

"Treating the results of the CSIC-IA in an Appendix would be appropriate as we can only have one official participant per country that features in the KCDB. In this way, the CSIC result would not be included in any linking mechanism, nor would their results appear in Appendix B of the KCDB with degrees of equivalence. They would however, be included in the report appendix with the appropriate discussion as to why their results are different from the others…."*

* This applies to the specific results for the SE accelerometer at high frequencies only.

Both the Chairman of EUROMET TC AUV and the coordinator of EUROMET Project Ref.-No.579 expressed that the BIPM decision has met their suggestions.

B 2 Results of CSIC-IA

CSIC-IA submitted to the pilot laboratory the calibration reports

(1)

LMA-CSIC REPORT nº: CC-02/04

TYPE OF REPORT:	Calibration Report
APPARATUS:	Standard Accelerometer
MANUFACTURER:	BRÜEL & KJÆR
MODEL:	8305 (back-to back)
SERIAL NUMBER:	2355677
CUSTUMER:	EUROMET PROJECT Nº 579
NUMBER OF PAGES OF THIS REPORT:	4
ISSUING DATE:	2005.05.27

and

(2)

LMA-CSIC REPORT nº: CC-03/04

TYPE OF REPORT:	Calibration Report
APPARATUS:	Standard Accelerometer
MANUFACTURER:	BRÜEL & KJÆR
MODEL:	8305 WH 2335 (single ended)
SERIAL NUMBER:	2361558
CUSTUMER:	EUROMET PROJECT Nº 579
NUMBER OF PAGES OF THIS REPORT:	4
ISSUING DATE:	2005.05.27

Both calibration reports were completely given in Appendix C of Report A. In this Report B, copies of the tables with the calibration results are given only, in conjunction with some relevant statements on the compliance with the Technical Protocol of EUROMET.AUV.V-K1.

(1) Results for back-to-back (BB) accelerometer Type 8305 S/N 2355677

Frequency (Hz)	*Accelerometer Charge Sensitivity (modulus) (pC/ms^{-2})*	*Uncertainty (k = 2) (%)*
40	*0.1278*	*± 0.6*
80	*0.1278*	*± 0.6*
160	*0.1279*	*± 0.6*
800	*0.1281*	*± 0.6*
2000	*0.1288*	*± 1*
5000	*0.1310*	*± 1*

(2) Results for single-ended (SE) accelerometer Type 8305 WH 2335 S/N 2361558

Frequency (Hz)	*Accelerometer Charge Sensitivity (modulus) (pC/ms^{-2})*	*Uncertainty (k = 2) (%)*
40	*0.1261*	*± 0.6*
80	*0.1262*	*± 0.6*
160	*0.1263*	*± 0.6*
800	*0.1259*	*± 0.6*
2000	*0.1240*	*± 1*
5000	*0.1213*	*± 2*

The calibration reports contain detailed descriptions of:

- the calibration equipment
- the calibration method(s) used
- the ambient conditions
- the mounting technique
- the calibration results
- the uncertainty budget(s)

The CSIC-IA laboratory applied laser interferometry specified in ISO 16063-11:1999 and observed the technical conditions and measurement instructions specified in the Technical Protocol [3].

B 3 Explanations of IA-CSIC for the high frequency deviations found for the SE standard accelerometer (CSIC-IA Doc. AACC03_04SAev)

B 3.1 General

The origin of the deviations lies in the impossibility of attaching directly the SE accelerometer to the used shaker due to the position of the output electrical connector at the base of the SE accelerometer.

B 3.2 Mounting structure

To solve this problem, an extension rod, in fact a "dead", that is non active, BB accelerometer was used. Therefore, the mounting structure for the SE measurements was: shaker-BB accelerometer-reflecting ring-SE accelerometer. However, this fact is not enough to explain fully the total amount of the deviation.

B 3.3 Previous measurements

This is so because before carrying out the SE measurements, the viability of the mounting system was tested by using it with the BB accelerometer used in the comparison. As it can be seen in the table below, the differences between the two set of values, those obtained with direct mounting on shaker and those with mounting on extension rod, are much lower than the differences obtained when this mounting system was used with the SE accelerometer.

Frequency (Hz)	*Accelerometer Charge Sensitivity (modulus) (pC/ms^{-2}) Direct attachment*	*Accelerometer Charge Sensitivity (modulus) (pC/ms^{-2}) BB attachment*
40	*0.1278*	*0.1278*
80	*0.1278*	*O.1279*
160	*0.1279*	*0.1280*
800	*0.1281*	*0.1280*
2000	*0.1288*	*O.1279*
5000	*0.1310*	*0.1295*

B 3.4 Reflecting ring

The additional disturbing element in the case of the SE accelerometer was the necessity of using a reflecting plate, placed between the top of the mounting BB accelerometer and the base of the SE accelerometer, to sense the vibration in order to determine, by laser interferometry, the acceleration amplitude at the reference surface, the base of the SE accelerometer in accordance with the comparison measuring protocol.
Although several plates made from diverse materials, among them cooper, iron alleys and stainless steel, cut in different shapes and sizes were tested, at the light of the final results, it seems clear that a suitable design was not found.

B 3.5 Physical explanations

At present, testing is made to try to understand the physics processes behind the deviations found at high frequencies. We do not know whether the result of the combined effect of the mounting rod and the reflecting ring was an increase in the effective vibration applied to the ring, either by an increase of transversal vibrations or by a defective holding, a reduction of the vibration amplitude applied to accelerometer due to a lost of energy caused by a defective coupling in the complex bonding structure, or both.
We do not know whether the problem has been a global increase in transversal vibrations or a lost of energy in the bonding structure or both, or something different, but research is being conducted and it is expected to find a suitable answer soon.

B 4 Correcting actions

Research is being conducted on new mounting systems and reflecting plates to be used in the calibration of SE accelerometers. Advice will be sought from the shaker producer and other research centres in these aspects.
Since the outcome of the above mentioned research is uncertain, it has been decided to acquire a new shaker suited to the direct attachment of SE accelerometers. In fact, a new shaker made by TIRA, a TV 51075, that has just been obtained by IA-CSIC, in principle, for other purposes, is going to be tested to check its applicability to this purpose.