

Highlights of CCT WG-KC activities in 2021

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January 18th, 2022



WG-KC Terms of reference

- *“To oversee all aspects of key comparison documentation*
 - *Starting with the Technical Protocol*
 - *Ending with the Draft B Report and the KCDB entry*
- *Including provision of advice to pilots on:*
 - *Calculation of the Degrees of Equivalence*
 - *Key Comparison Reference Value*
 - *Linkage between RMO and CIPM key comparisons”.*
- **In practice:**
 - **Review the initial Technical Protocol and all its subsequent iterations until approval**
 - **Review the Draft B Report and all its revisions until approval**

WG-KC Membership

➤ Current membership:

- | | | |
|-----|-------------------|--|
| 1. | Megumi Akoshima | NMIJ (Japan) |
| 2. | Stephanie Bell | NPL (UK) |
| 3. | Robert Benyon | INTA (Spain) → on leave |
| 4. | Rien Bosma | Independent Researcher (the Netherlands) |
| 5. | Helen McEvoy | NPL (UK) |
| 6. | Christopher Meyer | NIST (USA) |
| 7. | Andrea Peruzzi | NRC (Canada) |
| 8. | Steffen Rudtsch | PTB (Germany) |
| 9. | Richard Rusby | NPL (UK) |
| 10. | Gregory Strouse | NIST (USA) |
| 11. | Andrew Todd | NRC (Canada) |
| 12. | Rod White | Independent researcher (New Zealand) |
| 13. | Inseok Yang | KRISS (Korea) |
| 14. | Yuan Zundong | NIM (China) |

Overview of work performed by the WG KC since October 20th, 2020

- We provided our service to 26 different comparisons

Closed comparisons (10)

➤ 5 approved comparisons:

- 2 CCT KC
- 1 RMO KC
- 2 RMO SCs

➤ 3 abandoned comparison:

- 2 RMO KC
- 1 RMO SC

➤ 2 did not gain WG-KC approval:

- 2 RMO SC

Comparison ID	Type	End date	Reason
CCT-K6.2	KC	24-02-2020	Approval
CCT-K9.1	KC	25-02-2020	Approval
APMP.T-K8	KC	08-02-2021	Approval
SIM.T-S10	SC	07-05-2021	Approval
SIM.T-S6	SC	20-09-2021	Approval
EURAMET.T-K3.4	KC	26-01-2021	Abandoned
SIM.T-S3	SC	15-03-2021	Abandoned
SIM.T-K6.6	KC	21-10-2020	Abandoned
AFRIMETS.T-S2	SC	21-10-2020	Report not approved
SIM.T-S4	SC	23-11-2021	Report not approved

Active comparisons (16) (checked in with WG-KC in the past year)

Comparison	Initiated	Protocol submitted	Protocol approved	Draft B submitted	Draft B approved
CCT-K6.1	2005	21-10-2005	10-05-2006	07-10-2020	1st review transmitted 20-09-2021
CCT-K7.2021	2020	04-01-2021	07-01-2021		
CCT-K9.2	2021	09-08-2021	19-10-2021		
CCT-K10	2014	22-07-2014	29-09-2014	05-11-2021	1st review undergoing
CCT-K11	2020	10-08-2021	2nd review transmitted 17-11-2021		
CCT-S3	2007	unknown	unknown	30-11-2020	1st review transmitted 28-07-2021
APMP.T-K3.2					
APMP.T-K3.3	2010	29-04-2010	29-04-2020		
APMP.T-K3.6	2013	19-11-2013	13-12-2013	03-03-2021	1st review transmitted 28-07-2021
APMP.T-K4.1	2013	19-11-2013	13-12-2013	03-03-2021	1st review transmitted 28-07-2021
APMP.T-K6.2013	2013	29-04-2015	13-11-2020		
APMP.T-S13	2014	29-04-2015	13-11-2020		
COOMET.T-K9.1	2017	27-10-2020	1st review transmitted 01-01-2021		
EURAMET.T-K7.4	2010	29-02-2016	20-09-2016	22-01-2021	2nd review transmitted 11-01-2022
SIM.T-K6.8	2021	16-06-2021	10-01-2022		
SIM.T-K9.2	2007	07-05-2020	no	18-02-2021	1st review transmitted 19-10-2021
SIM.T-K9.3	2014	17-08-2020	no	26-01-2021	1st review transmitted 20-09-2021
SIM.T-S11	2020	06-11-2020	27-01-2021		

Silent comparisons (18)

(have not checked in with WG-KC in the recent years)

Comparison	Initiated	Status KCDB	Last KCDB progress report	Last contact with WG-KC	Pilot
CCT-K8	2012	Measurements completed	20-11-2017	22-02-2017	INTA (Spain)
CCT-K9	2011	Measurements completed	none	Protocol approved 06-02-2012	NIST (USA)
CCT-K1.1	2006	Report in progress, Draft A	13-02-2014	Protocol approved 07-12-2006	NIST (USA)
CCT-K2.2	2012	Measurements in progress	30-01-2014	16-10-2020 "Draft B by end 2020"	INRIM (Italy)
CCT-K4.1	2012	Report in progress, Draft B	04-02-2014	15-10-2020 "Draft A ready next week"	NMIA (Australia)
APMP.T-K9		Protocol completed	02-12-2016	Protocol approved 06-12-2016	NIM (China)
APMP.T-S8	2011	Measurements in progress	04-02-2014	Comments on protocol sent 02-07-2013	NMLPHIL (Philippines)
APMP.T-S11	2013	Report in Progress, Draft A	26-08-2014	Protocol approved 07-11-2013	NMIJ AIST (Japan)
APMP.T-S12	2013	Report in Progress, Draft A	26-08-2014	Protocol approved 07-11-2013	NMIJ AIST (Japan)
APMP.T-S13	2014	Measurements in progress	17-04-2014	Comments on protocol sent 23-10-2015	NMC, A*STAR (Singapore)
COOMET.T-K6	2013	not registered in KCDB	none	Comments on protocol sent 13-12-2013	FGUP VNIIFTRI (Russia)
EURAMET.T-K6.2		Planned	19-04-2017	Comments on protocol sent 02-01-2018	MBW (Switzerland)
EURAMET.T-K8	2008	Report in Progress, Draft A	24-04-2017	Protocol approved 13-05-2013	PTB (Germany)
EURAMET.T-K9	2014	Protocol completed	03-03-2015	Protocol approved 18-02-2015	LNE/CNAM (France)
EURAMET.T-K9.2		not registered in KCDB	none	Comments on protocol sent 10-04-2017	CMI (Czech Republic)
SIM.T-S7	2015	Protocol completed	15-10-2014	Comments on protocol sent 11-07-2016	CENAM (Mexico)
SIM.T-S8	2014	Report in Progress, Draft A	31-10-2014	none	CESMEC (Chile)
SIM.T-S9	2016	Planned	09-11-2016	Comments on protocol sent 16-12-2016	NIST (USA)

CCT feedback on CIPM MRA-G-11 v1.2

- An ad-hoc Statistical Task Group, established by the JCRB, proposed a further revision of the recently revised CIPM MRA-G-11 document on “*Measurement Comparisons in the CIPM MRA: Guidelines for organizing, participating and reporting*”
- As the proposed further revision could affect the work of the CCs, the CIPM decided to ask the CCs to comment this further revision
- I collected the comments received from:
 - CCT WG-KC members (several comments)
 - CCT members (only one comment)

1. Comment on KC Working Groups

- The document could mention the possibility of having the KC protocol and report reviewed by a KC WG, such as that established by the CCT
- If the document does not mention this, the pilots will be unaware of that opportunity to avert problems
- In section 4 (Technical Protocol) it is mentioned that “*in those CCs having permanent working groups or sections responsible for specific areas of activity, the draft shall be sent to the Chair of the relevant working group or section...*”, but it looks more as the goal is to inform the Chair and not to have the protocol formally reviewed

2. Comment on hybrid comparisons

- Recently hybrid comparisons were introduced and some comparisons of this new type have already been conducted
- The revised document could:
 - mention hybrid comparisons
 - clarify their limits of applicability (only for SCs and not for KCs?)

3. Comment on the traceability route of the participating institute facilities

- Before starting a comparison, the traceability route of all the participating institute facilities should be clearly established and recorded
- This should include establishing at the outset that all significant aspects of the realization are traceable directly to an NMI, as required by the MRA
- In addition, the participant's travelling standard should not itself be the participant's top level reference instrument

4. Comment on consistency of RMO KC protocols with the preceding CIPM KC protocol

- On section 4 (Technical Protocol) it is stated that “*an RMO KC should follow the same protocol as the preceding CIPM key comparison*”
- In the past years, the CCT WG-KC noticed the tendency for obsolete measurement practices to be frozen into place because of the perceived need to be consistent with the earlier/parent comparison protocol
- A clarification on which aspects of the protocol need to be frozen is necessary. In our view, not all the aspects of the protocol need to be frozen

5. Comment on check-lists for pilots

- Within the CCT, we developed check-lists to be used by pilots when preparing comparison protocols and reports.
- These check-lists can help improving the quality of protocols and reports, particularly in the case of unexperienced pilots
- These check-lists could be useful also for the other CCs

List of headings to guide the comparison pilots in preparing the Technical Protocol (1/2)

"Acronym (CCT-KX, RMO.T-KX.Y, RMO.T-SX)"

Comparison of ...

Technical Protocol

Main authors and affiliations

Date:

Version:

1. Introduction

- Initiator of the comparison
- Objectives, quantity and range of the comparison
- Reference documents followed in drawing the technical protocol

2 Participants:

- List of participant laboratories (contact persons, their mailing and electronic addresses can be placed in a separate appendix)
- Roles (coordinating group preparing the technical protocol, pilot(s), co-pilot(s), sub-pilot(s), ...)

3 Comparison methodology

- Topology of the comparison (loops, circulation scheme, ...)
- Starting date and detailed timetable

4. Travelling standard(s)

- Detailed description of the device(s) (make, type, serial number, size, weight, packaging, ... and technical data needed for its operation)
- Advice on handling the travelling standard(s), including unpacking, subsequent packing and shipping to the next participant
- Tests to be carried out on the travelling standard(s) upon receipt before measurement
- Conditions of use of travelling standard(s) during measurement
- Final tests before packaging the travelling standard(s) and ship it to the next laboratory
- Procedure in the case of failure of the travelling standard(s)

List of headings to guide the comparison pilots in preparing the Technical Protocol (2/2)

5. Organizational aspects

- Procedure in the case of unexpected delay at participating institute
- Customs formalities and documents to accompany the travelling standard(s) (ATA carnet or others)
- Financial aspects: responsibility for travelling standard(s) costs, transport costs, customs charges, damage costs
- Insurance on travelling standard(s)

6. Communication flows

- From participant to pilot: informing the pilot of the arrival of the travelling standard(s)
- From participant to pilot: communicating measurement delays to the pilot
- From participant to participant informing the next participant when shipping the travelling standard(s)
- From participant to pilot: communicating the measurement results to the pilot
- Due dates and consequences when failing to comply with due dates

7. Measurement instructions and procedures

- Measurement instructions (state if there are any specific instructions)
- Measurement procedures (state if there are any specific procedures)

8. Reporting the results

- Instructions for reporting the results of tests carried out on the travelling standard(s) upon receipt before measurement
- Instructions for reporting the measurement results (Excel® sheet)
- Instructions for reporting the uncertainties (Excel® sheet)
- Instructions for reporting additional information

9. KCRV and Linkage mechanism

- For CIPM KCs: method for calculating the KCRV and its uncertainty
- For RMO KCs: method for linking to the KCRV of the parent CIPM KC

10. Document revision history

List of headings to guide the comparison pilots in preparing the Final Report (1/2)

"Acronym (CCT-KX, RMO.T-KX.Y, RMO.T-SX)"

Comparison of ...

Report (Draft A)

Authors

Date:

Version:

1. Introduction

- Objectives, quantity and range of the comparison
- Short history of the comparison (the comparison was initiated on..., the protocol was approved on..., the measurements were performed between... and..., ...)

2 Participants:

- List of participant laboratories (contact persons, their mailing and electronic addresses can be placed in a separate appendix)
- Roles (coordinating group preparing the technical protocol, pilot(s), co-pilot(s), sub-pilot(s), ...)

3 Comparison Pattern

- Topology of the comparison (loops, circulation scheme, ...)

4. Travelling standard(s)

- detailed description of the device(s) (make, type, serial number, size, weight, packaging, ... and technical data needed for its operation)

List of headings to guide the comparison pilots in preparing the Final Report (2/2)

5. Equipment and measuring conditions at participating laboratories

- Specific measurement instructions or procedures (if any)
- Detailed description of equipment and measuring conditions at participating laboratories

6. Measurement results

- Measurement results at each participating laboratory, including uncertainty of each participating laboratory (the full uncertainty budgets must be reported but can be placed in a separate appendix)

7. Analysis of the results

- Determination of the bilateral equivalence between the participating laboratories (for all comparisons)
- Determination of the KCRV (only for CIPM KCs) and its uncertainty
- Determination of the DoE's (for CIPM KCs and RMO KCs the DoE's must be explicitly reported)
- Linkage to the parent CIPM KC (for RMO KCs)

8. Conclusions

- Concluding remarks (were the objectives achieved?)
- Lessons learned: recommendations for future comparisons

9. Appendices

- Approved protocol
- Document control history (changes applied to the report to address reviewers' comments, ...)

6. Comment on dark uncertainty

- The document mentions the need to consider taking into account dark uncertainties to ensure mutual consistency of measurement results
- While a statement is made that the dark uncertainties should be included in evaluating the DoEs, there is no guidance given on the acceptance of a participant's reported uncertainty when claiming CMCs
- If dark uncertainty is required to be added for mutual consistency, then at least one of the participant's uncertainties must be too low and thus should not be used as a basis for a CMC claim
- Should all submitted uncertainties be increased to include the dark uncertainty component?

THANK YOU

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