Guidelines for RMO PR Supplementary Comparisons

CCPR-G7 – *approved by WG-KC on Dec, 14, 2018*

These guidelines are prepared by CCPR WG-KC and the RMO P&R representatives, and approved by CCPR, to provide guidance and ensure that RMO supplementary comparisons are prepared and performed in a uniform manner. This document is to supplement the CIPM guidelines on measurement comparisons [1]. This document does not cover RMO KCs and bilateral KCs, for which other Guideline documents, CCPR-G5 and CCPR-G6, are available.

1. Preparation for the comparison

1.1 Proposal of a supplementary comparison

1.1.1 Supplementary comparisons are conducted when a comparison is needed for a quantity other than Key Comparison (KC) quantities, especially when it is difficult to relate the quantity to one of the KC quantities as supporting evidence for CMC.

1.1.2 Supplementary comparisons are also conducted for a comparison of a KC quantity but measuring a very different type of artifact (e.g., LED as opposed to tungsten lamp), where the KC cannot demonstrate the measurement capability for the specific type of artifact.

1.1.3 Under the current CIPM rule, all supplementary comparisons are carried out by RMOs; therefore, there will be no new CCPR supplementary comparisons.

1.1.4 A supplementary comparison is proposed and organized in an RMO. However, since supplementary comparisons are often of interest to all members of CCPR, participation should basically be open to members of all RMOs.

1.1.5 Due to the common interest, the needs for supplementary comparisons can be raised in WG-KC and WG-CMC, as well as in RMOs.

1.1.6 CCPR will maintain a list of planned RMO key and supplementary comparisons, which is mad e available publicly on the CCPR website. A plan for a new supplementary comparison shall be entered on the list.

1.1.7 Participation of laboratories from other RMOs would be encouraged (to avoid bilateral comparisons of the same quantity), but acceptance of participants from other RMOs may be subject to the capacity of the pilot laboratory. (See 1.3.1)

1.2 Appointment of the pilot laboratory

1.2.1 A pilot laboratory is appointed by the organizing RMO PR TC. The pilot laboratory is not required to be a member of CCPR.

1.2.2 The pilot laboratory is responsible for developing the comparison protocol, preparing and distributing transfer standards (transfer standards may also be prepared by participants), conducting measurements of all transfer standards, and preparing the comparison report.

1.2.3 It is important for the pilot laboratory to have small reproducibility uncertainty (not necessarily small systematic uncertainty of the realization of the unit or the scale of the quantity) in the calibration of the comparison quantity so that

sufficiently small uncertainties can be obtained in the results.

1.3 Call for participants

1.3.1 The pilot laboratory sends out an announcement and call for participants to all member NMIs of the RMO with the information of the comparison quantity (and wavelength range, geometry, etc. as applicable).

1.3.2 A copy of the invitation should be sent to CCPR Executive Secretary, who will distribute it to other RMO PR TC Chairs. The RMO PR TC chairs will distribute it to members within each RMO.

1.4 Task Group

1.4.1 If a Task Group for the comparison is needed, the members are appointed by the RMO PR TC, and may include members from other RMOs.

2. Development of Technical Protocol

2.1 The technical protocol is developed by the pilot laboratory of the comparison (and the Task Group if it is formed).

2.2 The technical protocol should describe a sequence of measurements that allows the stability of the transfer standards to be verified. In most cases, the measurement sequence should use at least one of the following elementary patterns:

A) Transfer standards are first measured by the pilot lab, sent to each participant for their measurement, then sent back to the pilot lab for the second measurement. (Pilot – Participant – Pilot)

B) The transfer standards are first measured by each participant, sent to the pilot lab for their measurements, then sent back to each participant for the second measurement. (Participant – Pilot– Participant)

Measurement sequences other than A) or B), e.g., mixture of star type and round robin, may also be used for supplementary comparisons where this is agreed in the development of the Technical Protocol. Also, there can be several rounds of measurement campaigns if there are not enough number of transfer standards.

2.3 The technical protocol should include the following information.

2.3.1 Complete specification of the comparison quantity, wavelength range and geometrical conditions, etc. as applicable.

2.3.2 The pilot laboratory, list of participants (NMIs) and their contact information.

2.3.3 Time table (month, year) including

- delivery of transfer artifacts to each participant (if pilot lab prepares transfer artifacts) or submission of transfer artifacts and results by each participant (if each participant prepares the artifacts)
- measurements by each participant and pilot lab
- distribution of Pre-Draft A data (stability of artifacts and internal consistency), following the *G2: Guidelines for CCPR comparison report preparation.*
- distribution of Draft A
- a statement that, participants will be given a deadline date for submitting the

results, and if they do not meet the deadline, they will be disqualified.
- distribution of Draft B

2.3.4 Description of transfer artifacts. If the participants are to procure the artifacts, the detailed product information of the artifacts.

2.3.5 Detailed operating conditions of the transfer artifacts including electrical parameters and method for alignment.

2.3.6 Advice on handling the travelling standards, including unpacking and subsequent packing and shipping for return.

2.3.7 Instructions to perform measurements using the facilities and procedures that the participant laboratory normally uses for their calibration services, while meeting the conditions of measurement specified by the technical protocol.

2.3.8 Instructions for submitting the measurement results including uncertainty budget as soon as possible and at the latest six weeks after the measurements are completed. For example, if the participants perform measurements two times (before and after measurement by pilot lab), whether they send the results after each of 1st and 2nd measurement or both results after 2nd measurement.

2.3.9 Instructions to submit the information below. These should be submitted before or at the time of submitting final measurement results.
- information of the traceability of the scale of the comparison quantity of the laboratory
- detailed uncertainty budget, including the list of uncertainty contributions identifying uncertainty components related to correlated and uncorrelated effects between measurements rounds (if available), for the laboratory's measurement results.
- description of the laboratory facility for the quantity

2.3.10 Method of data analysis.

2.4 The technical protocol must be agreed by all the participants.

3. Review of the protocol by WG-KC and Registration to KCDB

3.1 The pilot laboratory sends the protocol document to the RMO PR TC Chair for comments and approval by the RMO PR TC.

3.2 When the technical protocol is approved by the RMO PR TC, the RMO PR TC Chair will submit it to WG-KC for comments. (Approval by WG-KC is not required for supplementary comparisons.)

3.3 After the review period (usually 3 to 4 weeks) is over, WG-KC chair will inform RMO PR TC Chair that review is done and any comments received.

3.4 If there are comments, the RMO PR TC Chair will ask the pilot laboratory to consider the comments from WG-KC and revise it if necessary. If the protocol is revised, the RMO PR TC chair will send the final protocol to WG-KC chair.

3.5 The RMO PR TC chair will send the KCDB entry form and the Final Protocol to the CCPR Executive Secretary, who will confirm reception and pass it on to the KCDB manager to register the comparison.

3.6 Upon the registration of the comparison in the KCDB, the comparison is given a designation as RMO-Sx. RMO is the name of the RMO of the pilot laboratory, x is a

serial number of supplementary comparisons from that RMO.

4. Monitoring the comparison

4.1 After the comparison is registered in the KCDB and during the process of the comparison (until the report is published), pilot laboratories are required to send a progress report to the participants and to the RMO TC Chair – normally before RMO PR TC meeting and before WG-KC meeting. The RMO Chair will include this in the report to the WG-KC.

4.2 If significant delay occurs, the pilot laboratory is required to notify the participants and the RMO Chair promptly at any time between the periodic reports.

4.3 The RMO PR TC Chair should remind the pilot laboratory to submit the status report as required above.

5. Measurement

5.1 Measurement can start upon the registration of the comparison at KCDB.

5.2 When the pilot laboratory sends out transfer standard artifacts to each participant, a deadline date of submitting the results should be given to the participants in line with the timetable in the technical protocol. The deadline should consider transportation time and allow reasonable time for measurement.

5.3 Participants and the pilot laboratory should inform each other upon receipt of the transfer standards.

5.4 If a participant fails to submit the results by the deadline (except for reasons such as failure of artifacts), the participant may be disqualified. This decision, proposed by the pilot laboratory, is to be agreed by all other participants.

6. Pre-Draft A process

6.1 After completion of all measurements, sections 1, 2, and 3 of the *Guidelines for CCPR Comparison Report Preparation* (CCPR G2) must be followed by the pilot laboratory, which describe the Pre-Draft A process. Section 4 (Identification of outliers and consistency check) in G2 is recommended but optional for RMO supplementary comparisons. The measurement results by participants shall not be revised after the Pre-Draft A process ended.

7. Preparation and Distribution of Draft A

7.1 After the Pre-Draft A processes are complete, the pilot laboratory prepares and distributes Draft A to all participants, which discloses the absolute results of the comparison. The Draft A should tabulate all the results as well as present them in graphical form as necessary. It is recommended that the pilot laboratory also distribute the data of the analyses in a spreadsheet file. The Draft A should be distributed within three months after completion of Pre-Draft A process.

7.2 The results should be analyzed following the basic concepts in the *Guidelines G2 for CCPR Key Comparison Report Preparation,* but with some differences in the final steps. The resulting reference value may be simply called “Reference Value (RV)”

instead of KCRV used in Key Comparisons. Normally, the RV and the differences of each participant's results from the RV, together with their uncertainties, are presented.

7.3 If other analysis methods are preferred, these should be discussed before distribution of Draft A and may be used with consensus of all the participants and the RMO PR TC Chair (WG-KC approval is not required).

7.4 Draft A must be approved by all the participants. The version finally approved by all the participants becomes Draft B.

7.5 Qualifying the authors of the report must follow the CIPM-MRA-G-04, which, amongst other requirements, emphasizes that every individual who made a substantial contribution in the execution of the comparison should be included in the author list, and that from every participating NMI/DI at least one person will qualify as a co-author. The final author list must be agreed by all participants.

8. Approval of Draft B

8.1 The pilot submits the Draft B to the RMO PR TC for approval.

8.2 When the Draft B is approved by the RMO PR TC, the RMO PR TC Chair submits it to WG-KC for comments (not for approval). WG-KC will not appoint a designated reviewer. The review period is normally 4 to 6 weeks depending on the length of the draft.

8.3 After the review period is over, the WG-KC chair will inform the RMO PR TC Chair that review is done and forward any comments received.

8.4 If there are comments, the RMO PR TC Chair will ask the pilot laboratory to consider the comments from WG-KC and revise the report if necessary.

8.5 Any versions of Draft B are not considered confidential, and may be the subject of a publication with the exception of the proposals for the RV and differences from the RV.

9. Publication of Final Report

9.1 After completion of the WG-KC review of the Draft B report, the RMO PR TC Chair sends the final report to CCPR Executive Secretary, who will distribute it to CCPR members for information (not for approval).

9.2 The CCPR Executive Secretary will forward the final report to KCDB manager and the Metrologia editor.

9.3 The final reports will be published in the *Technical Supplement of Metrologia* (electronic media on the website). If the participants chooses to do so, the reports can also be published in a printed journal.

9.4 After the final report has been published, and if the comparison quantity is listed in the CMC category, the RMO PR TC Chair will send all participants a reminder to check the consistency of their CMCs with the comparison results.

9.5 RMO TCs are encouraged to report the status of consistency check of their CMCs

after completion of comparisons, at annual WG-KC meetings.

References

1. CIPM MRA-D-05, Measurement comparisons in the CIPM MRA, available at http://www.bipm.org/utils/common/CIPM_MRA/CIPM_MRA-D-05.pdf
2. CIPM MRA-G-04, CIPM MRA Guidelines for Authorship of Key, Supplementary and Pilot Study Comparison Reports, available at http://www.bipm.org/utils/common/CIPM_MRA/CIPM_MRA-G-04.pdf