Calibration and measurement capabilities in the context of the CIPM MRA

Guidelines for their review, acceptance and maintenance

CIPM MRA-G-13

Version 1.3
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Contents

Acronyms used in this document are listed in CIPM MRA-P-11.

1. Introduction

The outcomes of the CIPM MRA are the internationally recognized (peer-reviewed and approved) Calibration and Measurement Capabilities (CMCs) of the participating institutes declared on the publicly available BIPM key comparison database (KCDB).

In the context of the CIPM MRA and ILAC Arrangement the common definition is:

A CMC is a calibration and measurement capability available to customers under normal conditions:

- as published in the BIPM key comparison database (KCDB) of the CIPM MRA; or
- as described in the laboratory's scope of accreditation granted by a signatory to the ILAC Arrangement.

For detailed information, see Appendix A

In the KCDB, a CMC is characterized by the measured quantity and associated measurement uncertainty (generally given at a 95 % level of confidence) for a given range, the method or instrument used, the values of influencing parameters and any other relevant information.

CMCs shall reflect the services available to customers under normal conditions and shall not be artificially subdivided. The institutes are encouraged to use the percentage of coverage of their services by CMCs as a metric of success rather than the number of CMCs. Each RMO shall establish a process to track the continued validity of all published CMCs within its authority.

This document (CIPM MRA-G-13) supersedes CIPM MRA-D-04, and together with CIPM MRA-G-12 and CIPM MRA-P-13 supersedes CIPM MRA-G-03. It incorporates the CIPM recommendations for CMC reviews set out in CIPM/2007-25 for on-site visits by peers, and the CMC requirements agreed with ILAC in CIPM/2007-11 and set out in JCRB-8/9.

2. CMC specification

CMC declarations shall be self-consistent, and a CMC specification shall not depend on references to other services. The KCDB search engine uses the categories defined by the Consultative Committees, so it is important to use the "Classification Services" that are available on the KCDB website.

CMC declarations have three unambiguous characteristics:

2.1 Measurand

Only one measurand is allowed per CMC even if several closely related variables can be reported. Examples of this are electric power and energy, or mass and volume flow rate. In these cases, each variable should be reported with the correct corresponding unit and measurement uncertainty statement.

2.2 Range

The measurement value or range shall be expressed explicitly. Entries should describe the full range and units of the measurement capability. For a CMC declared as a single value instead of a range, the same value is to be entered in both the "Lower limit" and "Upper limit" fields.

2.3 Measurement uncertainty

There should be no ambiguity as to the best measurement uncertainty that can be expected from a CMC. Open intervals are not allowed in the specification of measurement uncertainties. Measurement uncertainties shall be declared using one of the following methods:

- the measurement uncertainty is declared as a single value, which is valid throughout the measurement range;
- the measurement uncertainty is declared as a range. In this case, the assumption is that linear interpolation may be used to find the measurement uncertainty at intermediate values;
- the measurement uncertainty is declared as an explicit function of the measurand or a parameter;
- the measurement uncertainties are declared in a table, in which entries depend on the measurand and one or more other parameters.

Broad scope CMCs should follow guidance provided by the relevant Consultative Committees.

3. Criteria for acceptance of CMCs

In order to publish CMCs in the KCDB, the following criteria need to be fulfilled (further details on metrological traceability are provided in CIPM MRA-P-11):

3.1 Metrological traceability of the national standard

- via a primary realization or representation of the unit of measurement concerned, in which case traceability shall be declared to its own demonstrable realization of the SI;
- via another institute having relevant CMCs with appropriate uncertainty published in the KCDB or through calibration and measurement services offered by the BIPM, in which case traceability shall be declared through the laboratory providing the service.

3.2 Metrological traceability of supporting measuring instruments that contribute to the measurement uncertainty

For auxiliary influence quantities, not part of the main traceability path to the SI for a particular measurand and with uncertainties that can be shown to make only a minor contribution to the total combined uncertainty of the CMC, an institute is free to use measurement services provided by laboratories accredited by a signatory to the ILAC MRA.

3.3 Technical evidence

The range and measurement uncertainty of the CMCs should be consistent with information from some, or all, of the following sources:

- Results of key and supplementary comparisons;
- Publicly available information on technical activities including publications;
- On-site peer-assessment reports, including those from accreditation assessment with appropriate technical peers;
- Active participation in RMO projects;
- Other evidence of knowledge and experience, as agreed by the appropriate Consultative Committee.

While the results of key and supplementary comparisons are the ideal supporting evidence, all other sources listed above may be considered to underpin CMCs.

Consultative Committees are responsible for providing specific guidance on the required technical evidence.

3.4 Ensuring the validity of results

a) The validity of results shall be monitored according to ISO/IEC 17025 (ISO 17034 for CRMs as applicable).

b) Peer review and recognition according to the local RMO system in line with CIPM MRA-G-12.

4. Special criteria for CRMs listed in the KCDB

The CIPM MRA has provision for certified reference materials (CRMs) to be listed in the KCDB. One or more CRMs may be included in association with chemistry/biology and radionuclide metrology CMCs that are directly related to the ability of the institute to characterize and assign traceable values to CRMs.

The KCDB is not intended to be a catalogue of CRMs that can be delivered by the institutes. In order to have a CRM listed in the KCDB as a mechanism of disseminating traceability, the participant shall have demonstrated its measurement capabilities and competence in the field concerned, which are also explicitly or implicitly claimed by the participant in the KCDB. Furthermore, all CRMs listed in the KCDB shall meet the requirements, as far as applicable and useful, of ISO 17034, which pertains to the production of CRMs and to the assignment of certified values.

In order for a CRM to be listed in the KCDB, the review process should take into account the following criteria:

- The institute shall have a quality management system in accordance with CIPM MRA-G-12. The quality management system shall include a complete description of the whole CRM production and certification process, also defining the internal organization responsible for the certification process;
- Values assigned to CRMs have to be traceable to the SI or, if this is not (yet) feasible, to other internationally agreed references;
- An institute may list a CRM as a service delivery mechanism in the KCDB only if the participant has in-house competency and the measurement capabilities necessary to assign values to the measurand in question. It should also have in-house competency and the measurement capabilities for characterization (homogeneity and stability) of the CRM. The institute

shall take full responsibility and liability for the quality of the CRMs listed in the KCDB;

- Value assignment and characterization should be carried out in compliance with relevant ISO guides, such as ISO 17034;
- The value(s) assigned to a CRM can be a direct result of in-house measurements. Alternatively, the CRM value assignment can be the result of combining measurement results obtained internally with results obtained from other competent subcontracted institutes;
- The claimed measurement uncertainty in the value of a CRM shall be representative of the capabilities and competence of the institute listing the CRM as a means of delivering traceability to its customers;
- The complete certification review report should be available to a customer on request;
- The physical preparation of CRMs need not to be carried out solely by the institute, but the participant listing CRMs should carry out the value assignment and include measurements that demonstrate adequate homogeneity and stability of the CRM;
- If an institute, in addition to its in-house capabilities and competences in the field concerned, collaborates with another (non-designated) laboratory for part of the work, the conditions in this document and those mentioned in CIPM MRA-P-13 have to be fulfilled;
- CRMs listed in the KCDB may be subject to comparisons;
- The institute listing CRMs in the KCDB should participate in relevant Consultative Committee and/or RMO activities, which include Consultative Committee and RMO studies and key comparisons and RMO supplementary comparisons;
- When CMC claims and CRM listings are not directly underpinned by the results of a comparison or pilot study, sufficient additional information shall be available, justifying the claimed CMC and listed CRM, preferably by peer reviewed publications in an international journal or by an on-site peer review.

5. Open peer-review and approval process

Prior to publication, CMCs are subject to an open peer-review process. The first stage of this process is an intra-regional review, which is conducted by the appropriate

RMO TC/WG of the organization submitting the CMC; the second stage is an inter-regional review (JCRB review), which is organized among the RMOs.

CMCs are processed on the KCDB web platform with dedicated tools provided for users registered at different levels to interact. Only users approved by the corresponding RMO TC/WG Chairperson as a 'writer' can create CMCs in the KCDB.

The review process involves a set of roles implemented on the KCDB web platform:

- **Writer**: person entering CMC data, acting on behalf of his/her institute with an account approved by the local RMO TC/WG Chair;
- **TC/WG Chair**: coordinator for the technical field in the RMO, acting on behalf of the RMO with an account approved by the KCDB office;
- **TC/WG Chair on quality management systems**: coordinator for quality management system confirmation in the submitting RMO;
- **CMC reviewer**: technical expert invited to review CMCs, with an account approved by its local RMO TC/WG Chair;
- **CC WG Chair**: coordinator of the CMC review process at the Consultative Committee level, with an account approved by the KCDB office;
- **RMO Secretary**: person representing the RMO with full access to the review process in 'read only' mode. The account is generated by the KCDB office.

The flowcharts in Appendix B and Appendix C illustrate the review processes and a detailed manual for the web platform is publicly available on the KCDB website.

From the initiation of a CMC on the KCDB platform, unique identifiers for various versions of the CMCs are automatically generated by the system. These versions are available only to logged-in users, and are named following the pattern:

RMO-Area-A2-ID-V

Where,

RMO organization claiming the CMC file

Area corresponding acronym of the metrology area

A2 ISO 3166-1 Alpha-2 country code (or the abbreviation of an international organization)

ID unique CMC identifier, eight symbols in length

V alphanumerical version value from 1 to Z.

5.1 Intra-regional review

Prior to submission to the JCRB review, CMCs shall be reviewed and approved by the institute's RMO. An international organization that chooses to work through one or more RMOs (Route B: Elected option), as described in CIPM MRA-G-12, should submit their CMCs for intra-regional review to the selected RMO. In such cases, the process of intra-regional review is the same as for other RMO members.

Each RMO is responsible for establishing the process for an intra-RMO review to assure that CMCs submitted to the JCRB review have sufficient technical support. Unlike the JCRB review, the intra-regional review does not have deadlines programmed in the KCDB web platform. The RMO TC/WG Chair may engage local reviewers in the CMC review process. Every time an intervention occurs on the KCDB web platform, automatic notifications are sent to the individuals involved in the review.

CMCs that are created and submitted for intra-regional review through the KCDB web platform shall be accompanied by appropriate technical evidence and evidence ensuring the validity of results. The institutes that create CMCs are responsible for providing the information that they believe is necessary to support their CMC claims.

The intra-regional review is complete when the RMO TC/WG has accepted the CMC and the RMO TC/WG QS Chair has confirmed that the ranges and the measurement uncertainties of the CMCs are fully covered by the quality management system of the institute submitting the claims.

5.2 Inter-regional review of CMCs (JCRB review)

The JCRB review of CMCs is initiated on the KCDB web platform by an RMO TC/WG Chair who submits the intra-regionally accepted CMCs for review to the other RMOs. The reviewing RMO TC/WG Chairs are responsible for organizing the review in their region and should involve local reviewers if considered necessary.

The JCRB review process is conducted in the following steps:

1. The originating RMO TC/WG Chair submits the CMCs for review;
2. At each action, automatic submission notifications are sent to the actors concerned;
3. RMO TC/WG Chairs indicate their interest in participating in the review of submitted CMCs by acknowledging the submission notification and indicating the date by which they plan to complete the review. RMOs that are not interested in participating in the review should indicate this on the

platform, to avoid unnecessary delays in the process. The deadline for indicating participation in the review is 3 weeks after notification:

- Two weeks after notification, an automatic reminder is sent to those RMOs who have not yet responded;
- If an expression of interest to participate in the review is not made within the 3-week period, the RMO's right to review is relinquished.

NOTE 1 If RMO TC/WG Chairs do not declare interest on the KCDB web platform and/or relinquish their right to review a CMC, an additional 3-week period is automatically provided.

4. RMO TC/WG Chairs shall complete the review by the date set when they accepted to review the CMCs.
   - Three weeks before the chosen date, an automatic reminder is sent to the RMO.
   - If the review is not completed by the due date, the RMO's right to continue the review is relinquished. If the due date initially chosen needs to be extended, this can be done on the KCDB web platform before the original deadline has expired. Information about extending the deadline should be sent to the originating RMO and the JCRB Executive Secretary.
5. When all reviewing RMOs have accepted a CMC, a notification is automatically transmitted to the KCDB office for publication;
6. If at least one of the reviewing RMOs require revision, the CMC will be made available to the Writer for appropriate action;
7. The Writer shall revise the CMCs according to the comments received from the reviewing RMOs.
   - The revision process has no formal deadline, but Writers are encouraged to revise CMCs as soon as possible.
   - The Writer should communicate directly with the reviewing RMOs to resolve any issues raised in the review. CMCs may be revised several times "offline", but revised CMCs are allowed to be submitted only once through the web platform.
   - Comments posted on the platform will be available to all those involved in the review process.
8. When a revised CMC is acceptable to all reviewing RMOs, the CMC is forwarded by the Writer to the originating RMO TC/WG Chair;

9. The originating RMO TC/WG Chair submits the revised CMC for approval;
10. To complete the approval process, the reviewing RMO TC/WG Chairs shall vote on approval of the revised CMC in the KCDB platform.
    - Two weeks after submission, an automatic reminder is sent to those Chairs who have not yet voted.
    - The voting period for the revised CMC is 3 weeks.

NOTE 2 A negative vote from one or more of the voting RMO(s) prevents approval of the CMC.

After final approval, the BIPM will publish the CMCs in the KCDB. The publication is carried out by the BIPM through the KCDB Office. Publication of CMCs in the KCDB triggers automatic email notifications to the CMC Writer and TC/WG Chairs in the relevant field.

The JCRB Executive Secretary constantly monitors the review status, and failure to conduct reviews according to the CIPM MRA may require discussion with the RMOs. Any outstanding disagreements will be resolved by the JCRB, which may request arbitration by the CIPM.

5.3 On-site visits by peers during the review of CMCs

The CIPM MRA foresees on-site visits by peer reviewers as a possible way to assist the CMC review process. Institutes may also ask for an on-site visit in order to establish the required level of confidence in their CMCs.

If the information submitted to an intra-regional review is considered insufficient to judge the competence and capability of the submitting institute, the relevant RMO TC/WG may request an on-site visit by peers before deciding on acceptance of the respective claims. In addition, the RMO TC/WG may request an on-site visit by a peer reviewer, or team of reviewers, to obtain the information required if sufficient doubt is cast on CMCs that have already been published in the KCDB. If the RMO TC/WG nominates more than one peer reviewer, a team leader shall be identified who will administer the visit. Peers selected by the local RMO TC/WG and agreed with the institute for an on-site visit should meet the criteria given in the CIPM MRA-G-12.

On-site visits may also be of assistance during the JCRB review process. In such cases, it is expected that the RMOs will reach a consensus view, among all reviewers, on the review findings. In cases where agreement cannot be reached among the experts from the various RMOs during the JCRB review, involvement of the CIPM Consultative

Committee with jurisdiction in that metrology area is recommended, according to the following procedure:

1. The Chair of the Consultative Committee working group on CMCs, as described in Section 7 of this document, should report the impasse to the JCRB and ask the relevant Consultative Committee for a review and decision.
2. The Consultative Committee shall discuss the matter in working groups comprising members with the highest technical competencies in the field being reviewed. If the dispute cannot be assessed by evidence provided via correspondence, the Consultative Committee may name a peer reviewer, or a team of peer reviewers, and request an on-site visit to gather information concerning the dispute. It is advisable that the selected peer reviewer(s) fulfil the criteria outlined in document CIPM MRA-G-12.

It is expected that the Consultative Committee requesting a visit by peers and the institute submitting its CMCs for review will cooperate in the most effective way to minimize the efforts of all parties. In the case of differing opinions about the scope and time of the visit, the following recommendations are provided:

1. The President of the Consultative Committee will inform the Director of the institute and the Chairperson of the RMO that an on-site visit by peer(s) is required to progress a submission related to CMC claims. The names of the peer(s) selected for the visit and a list of open questions shall be included in the communication.
2. The institute will inform the Consultative Committee President and the RMO Chairperson whether the institute is willing to accept the proposed visit. If the participant refuses the visit, it shall provide the reasons for refusal to the Consultative Committee President and the RMO Chairperson. In this case, the RMO Chairperson will try to negotiate an agreement for an on-site visit. Until an agreement is reached, the review is placed on hold. If the visit is requested for the confirmation of CMCs already in the KCDB, the CMCs have to be greyed-out if no agreement about an on-site visit has been achieved within one year.
3. If the institute accepts the visit but rejects the suggested peer(s), the President of the Consultative Committee and the Director of the submitting institute will try to reach a proper agreement. The review will remain on hold until an agreement is reached.

It is the responsibility of the institute being visited to cover the travel and subsistence costs of the peer(s), unless otherwise agreed by the parties involved.

No later than 90 days after the visit, the peer(s) will provide a written report on their findings, including responses to any open questions. The report shall be submitted to the Consultative Committee President with copies to the RMO Chairperson and the Director of the institute visited.

The Consultative Committee will then decide – with the help of the report – on the validity of the CMC claims of the institute.

6. BIPM interventions on CMCs

Prior to publication of the CMC in the KCDB, the BIPM may make certain modifications to assure compliance with JCRB rules. The criteria normally reviewed by the BIPM are:

- Spelling and format;
- CMC range and measurement uncertainty specification.

Spelling and format modifications are done by the BIPM KCDB office following CMC approval. The CMC Writer may be consulted to clarify certain points if the BIPM KCDB office deems it necessary.

If the KCDB office finds an anomaly in the CMC submission, it notifies the JCRB Executive Secretary who will take appropriate action.

7. JCRB review conducted through CC working groups

The CIPM Consultative Committees have working groups to facilitate the JCRB review. The objectives of the working groups are to:

a) establish and maintain lists of service categories, and, where necessary, rules for the preparation of CMC entries;

b) agree on detailed technical review criteria;

c) coordinate and, where necessary, conduct JCRB reviews of CMCs submitted by RMOs to the KCDB;

d) provide guidance on the range of CMCs supported by particular key and supplementary comparisons;

e) identify areas where additional key and supplementary comparisons are needed;

f) coordinate the review of existing CMCs in the context of new results from key and supplementary comparisons.

These working groups should include representation from all RMOs that have institutes active in the relevant technical area. Working group membership is expected to come from the relevant RMO committees involved in CMC reviews; appropriate experts being chosen according to the particular field under review.

Working groups on CMCs may establish their own rules for coordinating the JCRB review on CMCs. However, CMC should be processed on the KCDB web platform.

8. Modification of published CMCs

Institutes may modify published CMCs in the KCDB. In such cases, the Writer shall describe the modifications using the comment tool provided in the CMC form. The modification categories are:

8.1. material or editorial errors and improvements to the explanatory text for a quantity, instrument, method etc. This does not change the essence of the CMC (instrument, range of the quantity and of the parameters, method, measurement uncertainty, traceability), but improves the content for the KCDB users. Intra-regional and JCRB reviews are not required, but changes need to be confirmed by the local RMO TC/WG Chair.

8.2. voluntary updating of a CMC by reducing its range and/or increasing its measurement uncertainty when an institute wants to reduce their engagement in a particular measurement activity. Intra-regional and JCRB reviews are not required, but changes need to be confirmed by the local RMO TC/WG Chair.

8.3. significant unresolved deviation from a comparison result with respect to a CMC, in which case a reduced range or an increase of the measurement uncertainty may be required. In such cases, the RMO TC/WG Chair shall verify that the reduced range or increased measurement uncertainty is sufficient to assure the equivalence of the measurements.

8.4. change of the method of measurement, reduction of the measurement uncertainty or increase in scope. In this case, modifications shall follow the full procedure of intra-regional and JCRB review as if they were new CMCs.

9. Responsibilities for CMCs' consistency with comparison results

The responsibility for ensuring that CMC claims made by the institute are consistent with the results obtained in comparisons, are as follows:

1. the institute making the CMC claim has the primary responsibility to modify, temporarily withdraw (grey-out) or delete the impacted CMC(s) from the KCDB;
2. the RMOs, through their TC/WGs, should monitor the impact of key and supplementary comparison results on CMC claims for their institutes;
3. the Consultative Committees, through their CMC or technical working groups (as applicable) are responsible for:
    a. providing guidance on the range of CMCs supported by particular key and supplementary comparisons;
    b. identifying areas where additional key and supplementary comparisons may be needed;
    c. coordinating the review of existing CMCs in the context of new results of key and supplementary comparisons.

If the CMCs published in the KCDB are found to be inconsistent with comparison results, the institute has the choice between:

- increasing the corresponding measurement uncertainties, as described in Section 8.2;
- within six months, demonstrating that appropriate actions have been taken to eliminate the root source of the inconsistency (see also Section 11 of CIPM MRA-G-11); or
- temporarily withdrawing (greying-out) the CMCs;
- deleting them from the KCDB.

10. CMC 'grey-out'

A greyed-out CMC is a calibration and measurement capability published in the KCDB that has been temporarily withdrawn, with the intention of being reinstated at a later date. The greyed-out CMCs are not visible on the public KCDB website but are retained in the database for possible reinstatement and visible to the writer and the institute holding the greyed-out CMC.

Greyed-out CMCs usually arise because of non-compliance with the criteria for acceptance of CMCs as described in Section 3 but may also occur when an institute indicates that the service has been temporarily withdrawn. In agreement with Section 9, this responsibility lies with the institute declaring the CMC.

The maximum period for greyed-out status is five years. Reinstatement of CMCs within the five-year period is made on case-based evaluations of evidence showing that the reasons behind the greying-out have been identified and solved. This process is generally under the auspice of the institute holding the greyed-out CMC and can be initiated by this institute at any time within the 5-year-period. General adherence to the acceptance criteria as laid down in Sections 3 and 4 of this guideline as well as on modification rules as laid down in Section 8 are under the responsibility of the RMO where the institute holding the greyed-out CMC is a member.

Records on the greyed-out CMCs are kept in the KCDB (visible for logged in users) and are available through the KCDB Statistics. This information is reported at each JCRB meeting as part of the regular KCDB report.

The institute holding the greyed-out CMC will be informed when greyed-out CMCs are exceeding the fourth year of the five-year period by an automated alert from the KCDB copied to the JCRB Executive Secretary, the RMO representative to the JCRB, the relevant RMO TC/WG Chair, and the RMO TC/WG Chair of quality management systems. An alert will be raised at each JCRB meeting when CMCs are within six months of the five-year limit for greyed-out status.

There are two possible courses of action during the period for greyed-out status:

- **Reinstatement:** The institute holding the greyed-out CMC, after consulting with the relevant RMO TC/WG Chair and when appropriate, the RMO TC/WG Chair of quality management systems, initiates a reinstatement of the CMC. Confirmation that the CMCs have been reinstated is sent as an automated note by the KCDB to the institute holding the greyed-out CMC copied to the JCRB Executive Secretary, the RMO representative to the JCRB, the relevant RMO TC/WG Chair, and the RMO TC/WG Chair of quality management systems.

- **Deletion of the CMC:** This course of action occurs either when the institute concludes its greyed-out CMC is no longer required and: uses the functionality of the KCDB to delete the CMC, or requests the JCRB Executive Secretary to arrange the deletion of the CMC; or when the 5-years-limit has expired. In this case a notification is sent to the contact list specified above.

11. Resources related to the CIPM MRA

CIPM-D-01, *Rules of procedure for the Consultative Committees (CCs) created by the CIPM, CC working groups and CC workshops.*

CIPM MRA (https://www.bipm.org/en/cipm-mra/cipm-mra-text/)

CIPM MRA-P-11, *Overview and implementation of the CIPM MRA*

CIPM MRA-P-12, *Coordination within the CIPM MRA: Consultative Committees, Regional Metrology Organizations, JCRB*

CIPM MRA-P-13, *Participation in the CIPM MRA: National Metrology Institutes, Designated Institutes, International organizations*

CIPM MRA-G-11, *Measurement comparisons in the CIPM MRA: Guidelines for organizing, participating and reporting*

CIPM MRA-G-12, *Quality management systems in the CIPM MRA: Guidelines for monitoring and reporting*

CIPM MRA-G-13, *CMCs in the context of the CIPM MRA: Guidelines for their review, acceptance and maintenance*

JCGM 100:2008, *Evaluation of measurement data – Guide to the expression of uncertainty in measurement (GUM)*

ILAC-CIPM guidance on the accreditation of NMIs, *Joint ILAC–CIPM Communication regarding the Accreditation of Calibration and Measurement Services of National Metrology Institutes*

PG0128E1, *Customs Convention on the temporary importation of scientific equipment* (http://www.wcoomd.org/en/about-us/legal-instruments/conventions.aspx)

JCRB directory (https://www.bipm.org/en/committees/jc/jcrb/)

KCDB web portal (https://www.bipm.org/kcdb)

RMO websites (http://www.afrimets.org; http://www.apmpweb.org; https://www.coomet.net; https://www.euramet.org; https://www.gulfmet.org; https://sim-metrologia.org)

12. Revision History

Document and Version number	Date of Issue/ last review	Summary of change
CIPM MRA-G-13 V 1.0	11 January 2021	New document following the CIPM MRA review.
CIPM MRA-G-13 V 1.1	30 March 2021	Re-entered requirement to explicitly describe CMC modifications.
CIPM MRA-G-13 V 1.2	20 July 2022	Revised greying-out procedure, Section 10.
CIPM MRA-G-13 V 1.3	25 November 2024	Inserted Note 1, Section 5.

Appendix A - Notes related to CMCs

This Appendix contains notes related to CMCs and are based on, and consistent with, CIPM document CIPM/2007-11.

NOTE 1 The meanings of the terms Calibration and Measurement Capability, CMC, (as used in the CIPM MRA), and Best Measurement Capability, BMC, (as used historically in connection with the uncertainties stated in the scope of an accredited laboratory) are identical. The terms BMC and CMC should be interpreted similarly and consistently in the current areas of application.

NOTE 2 Under a CMC, the measurement or calibration should be:

- performed according to a documented procedure and have an established uncertainty budget under the management system of the institute;
- performed on a regular basis (including on demand or scheduled for convenience at specific times in the year); and
- available to all customers.

NOTE 3 The ability of some institutes to offer "special" calibrations, with exceptionally low uncertainties which are not "under normal conditions," and which are usually offered only to a small sub-set of the institute's customers for research or for reasons of national policy, is acknowledged. These calibrations are, however, not within the CIPM MRA, cannot bear the equivalence statement drawn up by the JCRB, and cannot bear the logo of the CIPM MRA. They should not be offered to customers who then use them to provide a commercial, routinely available service. Those institutes which can offer services with a smaller uncertainty than stated in the database of Calibration and Measurement Capabilities in the KCDB of the CIPM MRA, are, however, encouraged to submit them for CMC review in order to make them available on a routine basis where practical.

NOTE 4 Normally there are four ways in which a complete statement of uncertainty may be expressed (range, equation, fixed value and a table). Uncertainties should always comply with the *Guide to the Expression of Uncertainty in Measurement* (GUM) and should include the components listed in the relevant key comparison protocols of the CIPM Consultative Committees. These can be found in the reports of comparisons published in the CIPM MRA KCDB as a key or supplementary comparison.

NOTE 5 Contributions to the uncertainty stated on the calibration certificate and which are caused by the customer's device before or after its calibration or measurement at an institute, and which would include transport uncertainties, should normally be excluded from the uncertainty statement. Contributions to the uncertainty stated on the calibration certificate include the measured performance of the device under test during its calibration at the institute. CMC uncertainty statements anticipate this situation by incorporating agreed-upon values for the best existing devices. This includes the case in which one institute provides traceability to the SI for another participant, often using a device which is not commercially available.

a) Where institutes disseminate their CMCs to customers through services such as calibrations or reference value provision, the uncertainty statement provided by the institute should generally include factors related to the

measurement procedure as it will be carried out on a sample, i.e., typical matrix effects, interferences etc. must be considered. Such uncertainty statements will not generally include contributions arising from the stability or inhomogeneity of the material. However, the institute may be requested to evaluate these effects, in which case an appropriate uncertainty should be stated on the measurement certificate. As the uncertainty associated with the stated CMC cannot anticipate these effects, the CMC uncertainty should be based on an analysis of the inherent performance of the method for typical stable and homogeneous samples.

b) Where institutes disseminate their CMCs to customers through the provision of certified reference materials (CRMs) the uncertainty statement accompanying the CRM, and as claimed in the CMC, shall indicate the influence of the material (notably the effect of instability, inhomogeneity and sample size) on the measurement uncertainty for each certified property value. The CRM certificate should also give guidance on the intended application and limitations of use of the material.

NOTE 6 The institute's CMCs which are published in the KCDB provide a unique, peer reviewed traceability route to the SI or, where this is not possible, to agreed - upon stated references or appropriate higher order standards. Assessors of accredited laboratories are encouraged always to consult the KCDB website when reviewing the uncertainty statement and budget of a laboratory in order to ensure that the claimed uncertainties are consistent with those of the institute through which the laboratory claims traceability.

NOTE 7 National measurement standards supporting CMCs from an institute are either themselves primary realizations of the SI or are traceable to primary realizations of the SI (or, where not possible, to agreed - upon stated references or appropriate higher order standards) at other institutes through the framework of the CIPM MRA. Other laboratories that are covered by the ILAC Arrangement (i.e. accredited by an ILAC Full Member Accreditation Body) also provide a recognized route to traceability to the SI through its realizations at institutes, reflecting the complementary roles of both the CIPM MRA and the ILAC Arrangement.

NOTE 8 Whereas the various parties agree that the use of the definitions and terms specified in this document should be encouraged, there can be no compulsion to do so. We believe that the terms used here are a significant improvement on those used before and provide additional guidance and help to ensure consistency in their use, understanding, and application worldwide. We therefore hope that, in due course, they will become commonly accepted and used.

Appendix B - Intra-regional review process of CMCs

Overview of the Intra-regional CMC review process programmed in the KCDB web platform. Details of the process are given in the body of this document and in the *Getting started on the KCDB web platform* document available on the BIPM website.

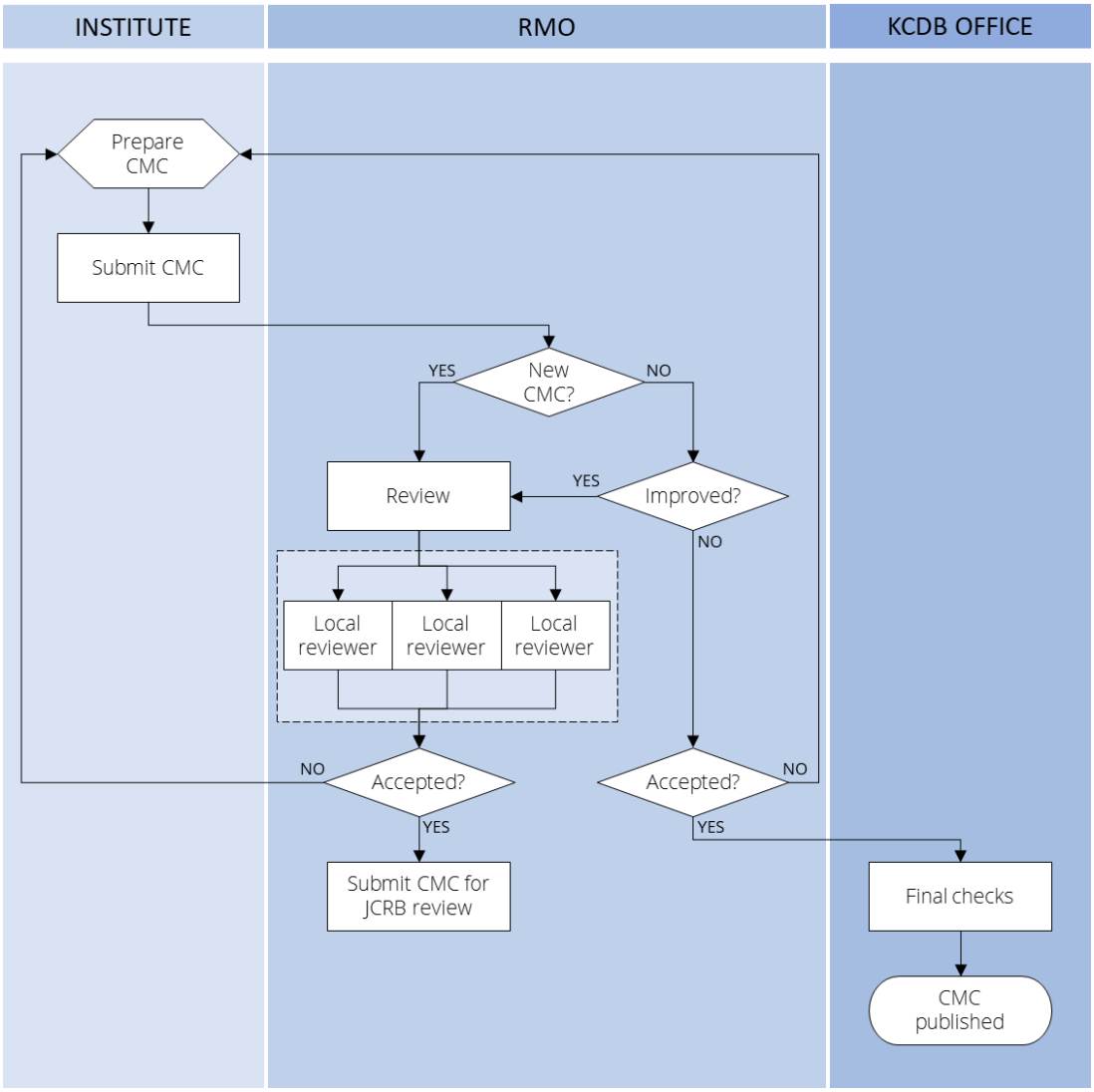

Figure 1. Intra regional review of CMCs organized through the KCDB platform.

Appendix C - JCRB review process of CMCs

Overview of the JCRB review process programmed in the KCDB web platform. Details of the process are given in the body of this document and in the *Getting started on the KCDB web platform* document available on the BIPM website.

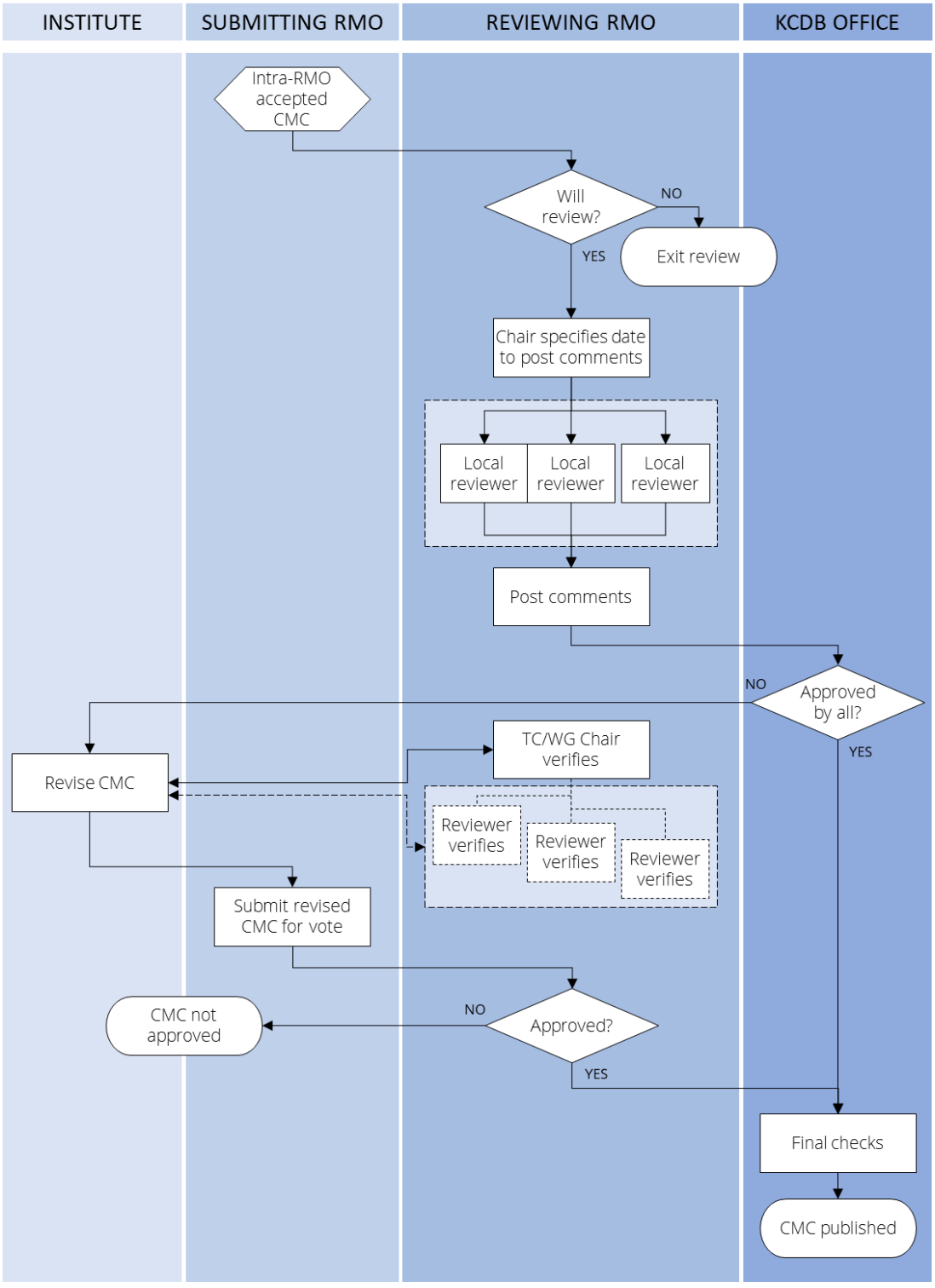

Figure 2. JCRB review of CMCs organized through the KCDB platform.

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