Authorship and Imprint
This document was developed by EURAMET e.V.
Version 1.0, 02-06-2008

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Official language
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ISBN 978-3-942992-23-7

Further information
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EURAMET procedures and review criteria for CMCs

This EURAMET Guidance Document specifies requirements and the procedures for reviewing calibration and measurement capabilities (CMCs) declared by NMIs¹ being Member or Associate of EURAMET under CIPM’s Mutual Recognition Arrangement of national measurement standards and of calibration and measurement certificates issued by national metrology institutes (CIPM MRA²).

The measurement capabilities of each NMI are published after final approval in Appendix C of the BIPM key comparison database (KCDB)³, maintained by the BIPM and publicly available on the Web. In order for CMCs to be approved for publication in Appendix C, they must first be reviewed and approved by the appropriate Technical Committee of EURAMET. Once this approval is obtained, CMCs undergo an inter regional review, where TC/WGs⁴ from other RMOs verify that the JCRB Criteria for acceptance of data for Appendix C⁵ have been followed, thus providing the technical confidence required for publication.

TC/WGs play a key role in this process as they conduct the intra regional and inter regional technical reviews and eventual approval of each CMC submission. This document specifies the requirements and explains the steps EURAMET TC Chairpersons need to follow in order to carry out this process.

This edition is based on EUROMET Guide 8 version 2.2 (2002) and is a complete revision, taking into account the latest JCRB documents for drawing up and reviewing CMCs and the new organisational structure of EURAMET.

¹ In this document the acronym NMI is used both in reference to National Metrology Institutes and/or further Designated Institutes (see document CIPM2005-07 NMIs and other Designated Institutes for more details)
³ http://www.bipm.org/kcdb
⁴ Groups of technical experts in each area are called "Technical Committees" in APMP, COOMET and EURAMET, and "Working Groups" in SADCMET and SIM
⁵ http://www.bipm.org/utils/common/documents/jcrb/AppC_criteria.pdf
1 General policy

Calibration and measurement capabilities to be recognised under the CIPM MRA consist of the best measurement capabilities ordinarily available to the customer through the NMI’s services. In addition, each one of these CMCs must be supported in range and uncertainty of measurement by a fully implemented Quality Management System satisfying the MRA requirements and being approved and regularly reviewed by EURAMET TC-Quality as described in document TCQ_03_01 QMS Review Procedure\(^5\).

The CMCs are to be reviewed by the appropriate EURAMET Technical Committee under the responsibility of the Chairperson, based on this guide and according to the procedure described in chapter 3. Depending on the subject field, additional field specific requirements may apply.

2 Drawing up CMC Excel files

CMCs should normally be submitted by country, by metrology area, and where necessary by category (i.e. TC-QM). NMIs which submit their first set of CMCs or a larger number of new CMCs in a metrology area or a branch shall fill in a questionnaire (Appendix 1) which gives additional information to the reviewer(s). Modifications of CMCs must only be made on the Excel files available from the link "Get published CMCs", located in the summary box of the JCRB Website\(^7\). These files have been produced by the BIPM KCDB office from the files posted for final approval and it has been verified that they do not contain any formatting errors. Submitting NMIs can view this page using the following information:

Username: guest
Password: guest2001

It is required that all CMC information should be submitted in a consistent format. Detailed instructions on how to draw up these files can be found in the JCRB web page\(^8\). A zip file with documentation related to this topic can be downloaded from the JCRB web page for "Open access JCRB documents" in the section "Related articles" by clicking on the link labelled "Instructions for drawing up CMC Excel files". Additional advice on the preparation of Excel files can be given by the coordinator of the KCDB.

NMIs that do not hold primary standards or primary measurement capabilities are required to have traceability to the SI (or if not yet feasible to another internationally agreed reference) of the national standards or measurement capabilities established through the BIPM or through adequate calibration services of another NMI or other designated institute published in Appendix C of the CIPM MRA.

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\(^{5}\) http://www.euramet.org/index.php?id=tc-quality-open
\(^{6}\) http://www.bipm.org/JCRBCMCs/
\(^{7}\) http://www.bipm.org/en/committees/jc/jcrb/cmc_excel_files.html
3 CMC review criteria

The JCRB requires that the range and uncertainty of the CMCs submitted is consistent with information from some or all of the following sources:

1. Results of key and supplementary comparisons
2. Documented results of past CC, RMO or other comparisons (including bilateral)
3. Knowledge of technical activities by other NMI's, including publications
4. On-site peer assessment reports
5. Active participation in RMO projects
6. Other available knowledge and experience

Technical support for CMCs is achieved mainly through the results of comparisons. Key comparisons are designed to provide evidence on the proficiency of NMI's in the principal techniques in each field. Supplementary comparisons are undertaken by RMOs when CMCs require additional support not provided by key comparisons. While it is important that each CMC submission is supported by some comparison evidence and EURAMET NMI's are encouraged to participate in comparisons whenever they have the possibility to do so, it is not the intention of the MRA to have a one-to-one correspondence between CMCs and comparisons.

While the results of comparisons are the ideal supporting evidence, all other sources may be considered to underpin CMCs not directly related to the available comparison results and those for which comparison results are not yet available. The NMI's that issue the CMCs are primarily responsible for providing the information that they believe is necessary to support their claims. This is preferably done by means of a questionnaire (Appendix 1) which serves as a tool to gain more information about the submitted CMCs. The experts involved in the intra or inter regional review may request additional information, if needed. Knowledge of the NMI's work and activities may require on-site visits by peers.

4 CMC review process

In order for CMCs to be approved for publication in Appendix C, they must first be reviewed and approved by the appropriate Technical Committee within EURAMET (Intra regional review). Once this approval is obtained, CMCs undergo an inter regional review, where the TC/WGs from other RMOs verify that the review criteria have been followed, thus providing the technical confidence required for publication.

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9 Document JCRB-14/06(2a).final
10 Document CIPM/07-25 ACCEPTED
Intra regional reviews

NMIs through their contact persons forward CMCs to the relevant EURAMET TC Chair. These CMCs must have been approved by the NMI's management and fully covered by its quality management system. Some TCs have installed a Working Group for CMC Review and set a fixed date for submission (i.e., the annual TC meeting) and a fixed period for intra regional review. In this case, the TC Chair collects the CMC sets and send them to the members of the working group for review. Otherwise, the Contact Persons of the TC are directly involved in this process, and the results of the review will be discussed at the coming TC meeting. The CMC review is performed by direct contact between the reviewers and the persons responsible from the submitting NMIs until a consensus can be reached. In case that not all concerns can be resolved, the TC Chair contacts the reviewers and the submitting NMIs for resolution, the final decision being with the EURAMET Chairperson. The results of the review together with possible comments of the reviewers and the submitting NMIs are listed in the CMC tables. The intra regional review process is presented in flowchart form in Appendix 2. The intra regional review must cover all submitted CMCs, sample review will only be accepted for the inter regional review.

For a CMC entry, the statement of an uncertainty must be based on a careful consideration of all uncertainty contributions of Type A and B following the “Guide to the expression of uncertainty in measurement” (GUM). Results of key, supplementary and bilateral comparisons are important information providing evidence for validity of CMC claims. But uncertainties of CMC claims must be equal or larger than the corresponding results of a key comparison, and reference to key, supplementary or bilateral comparisons can only be used to support uncertainties that are larger or equal than those stated for the corresponding measurement in the key comparison. A laboratory may, however, wish to re-evaluate the uncertainties after a successful key comparison or because of changes and improvements in the technical equipment, methods and procedures, staff education, or other conditions. In this case a new uncertainty budget must be drawn up.

Inter regional reviews

The inter regional review procedure is explained in a JCRB- document\(^1\), which is also presented in flowchart form\(^2\). The CMC review process is carried out through a password-protected web page which can be entered via the JCRB section of the BIPM site\(^3\) by clicking on the link labelled “JCRB CMC site”. TC Chairs can obtain a username and a password from the JCRB Executive Secretary. The CMC files to be reviewed can be downloaded from this page. The JCRB requires that CMCs submitted for publication in Appendix C are accompanied by an RMO report indicating that the local TC/WG has approved the range and uncertainty of said CMCs and that each of them is supported by a fully implemented Quality Management System reviewed and approved by the local RMO. Once the files are posted for review, the corresponding technical contacts in each area get in touch directly with each other to exchange comments or concerns.

\(^1\) JCRB-14/06(1) JCRB "Rules of Procedure for CMC entry into Appendix C"
\(^2\) JCRB-12/06a_rev "JCRB CMC review process"
\(^3\) http://www.bipm.org/JCRBCMCs/
Fast track approval of revised CMCs

An NMI may request through its TC/WG Chair that a small group of already-published CMCs be reviewed by the other TC/WG in the same area without the formality of posting the file in the webpage. This may occur, for example, when an upgrade of the laboratory facilities justifies an improvement of the declared scope of the published CMCs. In this case, all communications will be done directly among the TC/WG Chairs. After they reach a consensus on the new scope of the revised CMCs, these will be entered into Appendix C.

Modifying CMCs already published in Appendix C

Modifications of a published CMC usually arise for reasons falling into one of three categories:

a) material or editorial errors and improvements to the explanatory text
b) increase of the uncertainty or reduction in scope
c) change of the method of measurement or reduction of the uncertainty or increase in scope.

For modifications of categories a) and b), the intra- and inter-RMO reviews are unnecessary. The NMI will send its proposal for change to the EURAMET TC Chair, who will contact the coordinator of the BIPM database. If a NMI decides to withdraw CMCs from the BIPM database, the same procedure will be applied. Modifications under category c) should follow the full procedure of intra- and inter-RMO review, as if they were new CMCs, or the fast track approval.

5 Impact of comparison results on CMCs

It must be ensured that CMC claims made by an NMI are consistent with the results obtained in key and supplementary comparisons. A measurement of a key comparison is considered to be discrepant when the degree of equivalence represented by the difference $d_i = x_i - x_{KCRV}$ and the expanded uncertainty $U(d) = k \cdot u(d)$ do not fulfil the condition $|d_i| < U(d)$ $^{14}$. The NMI making the CMC claim has primary and principal responsibility, i.e., it must check the comparison results against its CMC claims and state whether or not these claims are supported by the comparison results. If not, it must take appropriate measures to remove this inconsistency.

Through its TCs, EURAMET must monitor the impact of key and supplementary comparison results on CMC claims for its member NMIs. This can best be done by means of a comparison executive report in which the participants of a comparison declare in writing, that they have checked their CMC claims in the light of the comparison results. This comparison executive report is confidential to the comparison participants, the TC Chair and the corresponding RMO working group and is not part of the publicly available comparison report. Reasons for withdrawals or changes in results must also be given in this report.

Appendix 1: Questionnaire for the Review of EURAMET CMCs

<table>
<thead>
<tr>
<th>NMI/DI:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person responsible:</td>
</tr>
<tr>
<td>Metrology area</td>
</tr>
<tr>
<td>Branch</td>
</tr>
<tr>
<td>Service</td>
</tr>
<tr>
<td>Sub-service: (Consistent with items in KCDB)</td>
</tr>
</tbody>
</table>

(Please specify area, branch and service to which the information reported below applies)

<table>
<thead>
<tr>
<th>Participation in comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC or EUROMET KCs?</td>
</tr>
</tbody>
</table>

(Please name comparison identifier)

<table>
<thead>
<tr>
<th>Supplementary Comp.?</th>
</tr>
</thead>
</table>

(Please name comparison identifier)

<table>
<thead>
<tr>
<th>Past comparisons?</th>
</tr>
</thead>
</table>

(CIPM, EUROMET/EURAMET or others, please specify)

<table>
<thead>
<tr>
<th>Bilateral comparisons?</th>
</tr>
</thead>
</table>

(Please specify)

<table>
<thead>
<tr>
<th>Technical activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement methods</td>
</tr>
</tbody>
</table>

(Brief description of the methods used)

<table>
<thead>
<tr>
<th>Traceability of standards</th>
</tr>
</thead>
</table>

(Name NMI/DIs which provide traceability)

<table>
<thead>
<tr>
<th>Written measurement instruc-</th>
</tr>
</thead>
<tbody>
<tr>
<td>tions</td>
</tr>
</tbody>
</table>

(Written procedures available? Language?)

<table>
<thead>
<tr>
<th>Uncertainty budgets</th>
</tr>
</thead>
</table>

(Are they already available? If yes, are they calculated following the ISO Guide to the Expression of Uncertainty in Measurement?)

<table>
<thead>
<tr>
<th>Key publications</th>
</tr>
</thead>
</table>

(Please specify)
Quality management system

<table>
<thead>
<tr>
<th>Question</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status of implementation of QMS ?</td>
<td>(ISO/IEC 17025 and/or ISO Guide 34 fully implemented?)</td>
</tr>
<tr>
<td>Self-declared or accredited QM system ?</td>
<td>(If accredited, please name accreditation body.)</td>
</tr>
<tr>
<td>Which CMCs are covered by the accreditation ?</td>
<td>(Are all CMCs covered by the accreditation? If not, please specify the corresponding areas of measurement)</td>
</tr>
<tr>
<td>Which CMCs are covered by self-declaration ?</td>
<td>(List here all areas of measurement which are not covered by accreditation)</td>
</tr>
<tr>
<td>Engagement in TC-Quality</td>
<td>(Participation in meetings and other activities)</td>
</tr>
<tr>
<td>QM system reviewed by TC-Quality ?</td>
<td>(Meeting when the QMS was presented, status of review)</td>
</tr>
</tbody>
</table>

Additional information

<table>
<thead>
<tr>
<th>Question</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation in EURAMET technical activities ?</td>
<td>(Projects, meetings etc; please specify)</td>
</tr>
<tr>
<td>Visits of technical experts ?</td>
<td>(Please specify name and date of visit)</td>
</tr>
<tr>
<td>On-site visits by peers ?</td>
<td>(Please specify names and date)</td>
</tr>
<tr>
<td>Any other information ?</td>
<td>(Please specify, if relevant)</td>
</tr>
</tbody>
</table>

* This questionnaire is thought to be filled in as additional information for the reviewer, when a NMI submits its first CMC set or a larger number of new CMCs in a metrology area, branch or service.
Appendix 2: Intra-regional review process

NMI
- Draws up CMCs for its services
  - Forwards new or revised CMCs

TC Chair
- Establishes and maintains a QS
  - QS documentation
  - Forwards CMC sets

TC Quality
- Informs through TC-Q annual report
  - QS approval

CMC Working Group or TC Contact Persons TC meeting
- Questions, comments, concerns
- Answers, modified CMCs
  - Reviewed CMC sets

TC Chair
- Submission to Inter-RMO review

Inter-RMO CMC WG
- RMO CMC WG
- Questions, comments, concerns
- Answers, modified CMCs
  - Inter-RMO review

Submitting NMIs

Final approval
- Publication in App. C