Report of the WG on MRA to the 20th CCTF meeting

Mauricio López

Chairman

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WG on MRA members

- Chairman

  Dr Mauricio López R. (CENAM)

- Secretary

  Dr Gianna Panfilo (BIPM)

- Members

  a. Chairpersons of the RMO technical committees for time and frequency;

  b. Experts from time laboratories : Dr Bruce Warrington (NMIA), Dr Erik Dierikx (VSL);

  c. Experts from the BIPM: Dr Gianna Panfilo (BIPM)

WG on MRA members

- Dr J. Mauricio López R. (Chairman)
- Dr Gianna Panfilo (Secretary)
- Dr Hamid Ramiz (EURAMET)
- Mr Michael Lombardi (SIM)
- Dr Chris Matthee (AFRIMET)
- Dr Huang Tien Lin (APMP)
- Dr Vitaly Palchikov (COOMET)
- Dr Bruce Warrington (Invited expert)
- Dr Erik Dierikx (Invited expert)

1. Terms of reference

Are functions of the CCTF WG on the MRA:

- Authorization on a provisional basis for any action needed between meetings of the CCTF as indicated by the CIPM MRA, in consultation with the CCTF President;
- Perform coordination activities relating to the CIPM MRA between RMOs;
- Act as point of contact for the BIPM and JCRB on CIPM MRA matters;
- Report actions to the next CCTF meeting, the CCTF revising the decisions as required;
- Identify areas where additional key comparisons and supplementary comparisons are needed, and develop the necessary guidelines and procedures;
- Provide guidance on the range of CMCs supported by particular key and supplementary comparisons;
- Establish and maintain a list of service categories, and where necessary rules for the preparation of CMC entries;
- Agree on detailed technical review criteria;
- Coordinate the review of existing CMCs in the context of new results of key and supplementary comparisons.

2. Guidelines

- Guideline 1: *Service category classification for T&F CMC table entries*
- Guideline 2: *The estimation of uncertainties for T&F CMC entries*
- Guideline 3: *The uncertainty interpolation for T&F CMC entries*
- Guideline 4: *The uncertainty in frequency*
- Guideline 5: *The prediction uncertainty (revised)*
- Guideline 6: *Rules for participation on the computation of the UTC (new)*
- *Guideline 7: Participation in the key comparison CCTF-K001.UTC (new)*

3. Status of the CMCs for Time and Frequency

49 countries are currently listed in the KCDB as suppliers of calibration services for Time and Frequency

- Time scale difference: 36 countries
- Frequency: 49 countries
- Time Interval: 40 countries
- Total of CMC's in Time and Frequency registered in the KCDB: 738
- The dates of approval of these CMCs range from 2005 to 2015

4. Key Comparison CCTF.K001.UTC

- Following the decision taken at the CCTF 2012 a new publication of the degrees of equivalence between the key comparison results and the UTC(k) data is reported on the KCDB starting from March 2015.

4.1 Example of new publication of CCTF.K001.UTC

CCTF-K001.UTC

↘ Results

Laboratory individual measurements | **Equivalence statements** | Degrees of equivalence | Graph(s) of equivalence

The key comparison reference value of the key comparison CCTF-K001.UTC is **UTC**, as decided by the CCTF at its 15th meeting held in 2001.

The degree of equivalence of each laboratory ***k*** with respect to the key comparison reference value is given by a pair of terms both expressed in ns:
$D_k = [UTC - UTC(k)]$, where **UTC(*k*)** is the local representation of **UTC** maintained by laboratory ***k***, and
U_k, the expanded uncertainty (coverage factor equal to 2), of D_k.

The KCDB gives access to the degrees of equivalence for the last month.

$U_k = 2\,u_k$ where u_k is the combined standard uncertainty of $[UTC - UTC(k)]$.
U_k does not include the *prediction component* due to the delay of publication of $[UTC - UTC(k)]$.
The u_k values are valid for the whole month of calculation.

No pair-wise degrees of equivalence are computed for this key comparison.

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Key comparison CCTF-K001.UTC - Results
Degrees of equivalence $D_k = [UTC - UTC(k)]$ for August 2015
Computed 2015 SEPTEMBER 08, 10h UTC

Coordinated Universal Time **UTC** and its local realizations **UTC(*k*)** in National Metrology Institutes and Designated Institutes.

Computed values of $[UTC - UTC(k)]$ and uncertainties valid for the period of this publication

Date 2015 0h UTC	AUG 5	AUG 10	AUG 15	AUG 20	AUG 25	AUG 30	Uncertainty/ns
MJD	57239	57244	57249	57254	57259	57264	
Laboratory *k*			$[UTC - UTC(k)]$/ns				U_k
ANM	11924.0	12093.4	12274.3	12462.4	12674.5	-	40.0
BelGIM	10.1	11.1	5.4	5.7	4.8	4.3	14.4
BEV	33.6	26.6	14.6	5.4	3.9	0.8	6.2
BIM	2545.3	2585.0	2596.2	2631.5	2640.4	2693.2	14.4
BMM	1002.0	1305.2	1569.2	1836.4	2115.2	2421.1	41.2
BSMI	13.6	13.9	11.7	9.1	7.0	4.9	10.0
CENAM	-4.8	-4.9	-3.2	-4.0	-0.5	-1.9	11.6
CENAMEP AIP	-56.3	-31.1	-5.0	-11.4	-5.5	-16.1	12.4
DMDM	-6.5	2.9	6.3	3.6	2.0	0.4	14.0
EIM	15.4	-	-	-	-	-	18.0
ESA	0.7	0.8	-0.6	-1.0	1.0	0.7	10.2
FTMC	966.0	967.3	965.8	967.0	964.2	962.2	10.8
GUM	-22.1	-22.9	-19.7	-9.9	1.6	6.6	10.0
IMBIH	4.7	7.2	10.6	13.2	21.5	28.2	14.2
INM	1066.7	1057.6	1040.9	1044.1	1055.8	1048.5	41.0
INMETRO	-31.4	-24.4	-17.2	-19.9	-24.1	-23.6	40.0
INPL	46.1	46.2	49.0	54.1	68.5	68.2	14.2
INRIM	-1.4	-2.0	-1.8	-2.3	-3.5	-4.5	2.6
INTI	63.1	48.8	51.2	43.3	40.3	40.5	40.4
IPE/ASCR	-46.2	-45.0	-45.6	-41.7	-35.3	-35.6	10.2
JV	-29.9	-34.5	-39.1	-43.3	-45.1	-38.6	40.0
KazInMetr	-744.1	-736.8	-729.5	-716.6	-717.0	-699.4	14.4
KEBS	-2026.8	-2313.8	-	-	-	-	40.2
KIM-LIPI	656.5	656.7	674.5	707.7	748.3	762.5	40.2
KRISS	28.1	25.5	22.7	19.0	15.8	12.5	10.0
LNE/SYRTE	-1.6	-1.5	-1.1	-0.8	-0.4	-0.3	2.6

5. New and revised guidelines proposed to the CCTF

- A new guideline (6) “Rules for the participation to the computation of UTC at the BIPM” has been prepared to clarify the difference of request for the National Metrology Institutes (NMIs), other Institutes located in a Member State of the BIPM or Associate to the CGPM and International organizations signatories of the CIPM MRA to participate on the computation of UTC.

5. New and revised guidelines proposed to the CCTF

- The guideline “The prediction uncertainty” has been revised to refine results. This guideline is strictly related to the service category “Time scale difference – Local clock versus UTC” giving a model to compute the uncertainty in predicting the time error of two types of reference clocks (cesium and hydrogen maser) commonly used for a UTC(k) generation, over a time span of 20 days as is commonly found in the CMCs tables.

6. Proposed tasks for the 20th CCTF meeting

According to the duties assigned to the WGMRA and to the activities performed on that sense, it is proposed to approve the following documents:

- CCTF WGMRA Guideline 6 “Rules for the participation to the Computation of UTC at BIPM” 2015,
- CCTF WGMRA *Guideline 7 “Participation in the key comparison CCTF-K001.UTC”,*
- CCTF WGMRA Guideline 5 “The prediction uncertainty” (revised).

7. Open issues

- Develop a guideline on the technical criteria for the CMCs review and their periodical evaluation,
- Collect regularly the information on regional RMO comparisons or pilot projects in the field of the CCTF,
- Establish a rule for a periodical evaluation of the degree of equivalence of the CMCs claimed by the NMIs and available in the KCDB.