

## **CCTF WGMRA Guideline 2** (Rev.Dec2011-July2012)

### **The estimation of uncertainties for T&F CMC entries**

In the field of time and frequency metrology, the performance of the measurement system of an NMI is estimated by daily time keeping procedures such as international time comparisons using GNSS CV, GNSS AV, TWSTFT, comparisons of individual atomic clocks and so on. The CCTF WGMRA has decided to accept the definition of Calibration Measurement Capability (CMC) (1) for the CMC table entries as the uncertainty level of NMI's measurement system. Therefore each NMI can claim the uncertainty of its calibration system in the hypothetical case of a nearly ideal Device Under Test (DUT) (2). The calibration certificates issued by NMIs, however, have to indicate the uncertainty of the calibration results including the influence of the DUT.

#### References:

- (1) CIPM-MRA D-04 Calibration and Measurement Capabilities in the context of the CIPM MRA – Version 2 : “A CMC is a calibration and measurement capability available to customers under normal conditions”
- (2) JCRB -8/9 Uncertainty contributions of the device under calibration or measurement
- (3) CIPM/2007-11: Calibration and Measurement Capabilities – A paper by the joint BIPM/ILAC working group.

## **CCTF WGMRA Guideline 3** (Rev. Dec 2011 – July 2012)

### **The uncertainty interpolation for T&F CMC entries**

The results of a Key Comparison (KC) will provide the deviation and its uncertainty for each participating laboratory. This uncertainty will be reflected in the corresponding CMC entry and should be considered as its lowest uncertainty limit.

The CCTF has declared UTC-UTC( $k$ ) as published in *BIPM Circular T* as the sole KC in the T&F field. BIPM Circular T is giving the deviation for each contributing laboratory in the form of UTC-UTC( $k$ ) with a given combined uncertainty for intervals of 5 days.

From this, the corresponding deviation and its uncertainty for frequency and time interval at 5 days can be derived.

Real calibrations at NMIs may be done and specified at intervals and averaging times  $\tau$  shorter than 5 days. In that case there is a need to interpolate the 5-day results of the KC to express the uncertainty in each CMC entry for shorter averaging times. Interpolation should take into account the properties (TDEV, ADEV, MDEV, drift, ageing) of the Reference Standard used for calibration, obtained from generally accepted and published studies or from specifications of the manufacturer, and according to a fully documented procedure. Only in the case of an uncertainty claim better than this interpolation result, a special review in the RMO is necessary.