Report of TL's Proficiency Testing on Frequency Calibration in 2015

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Abstract

- In order to support the calibration laboratories to meet the requirements of ISO/IEC 17025 and the demand of TAF (Taiwan Accreditation Body) for inter-laboratory comparisons, TL has organized a proficiency testing activities among frequency calibration labs during June and July in 2015.
- A Symmetricom/SA.22cLN Rubidium frequency standard was utilized as the DUT with its aging of 5.0E-12/day and temperature coefficient of 1.0E-11/ ^{o}C. According to the predetermined schedule, the DUT was transferred to each participating lab together with our calibration system, so the measurements were performed by the lab's calibration system and TL's portable one at the same time.
- Measurement results of both systems were then analyzed and compared. There are 18 participants in this activity, including 17 accredited labs and one under accreditation. Two participants have performed the measurements by using both of their current and future reference clocks.

$$E_n = \frac{X_i - X_{ref}}{\sqrt{U_{95}{}^2(X_i) + U_{95}{}^2(X_{ref})}}$$

where:

X_i *is the participating laboratory's result*

X_{ref} *is the coordinating laboratory's result*

$U_{95}(X_i)$ *is the participating laboratory's reported uncertainty* (*95%*)

$U_{95}(X_{ref})$ *is the coordinating laboratory's reported uncertainty*(*95%*)

$|E_n| \le 1$ indicates that the result and the reference value are in agreement

$|E_n| > 1$ indicates that the result is different from the reference value

Eq.1 Formula used for result calculations in the Proficiency Test

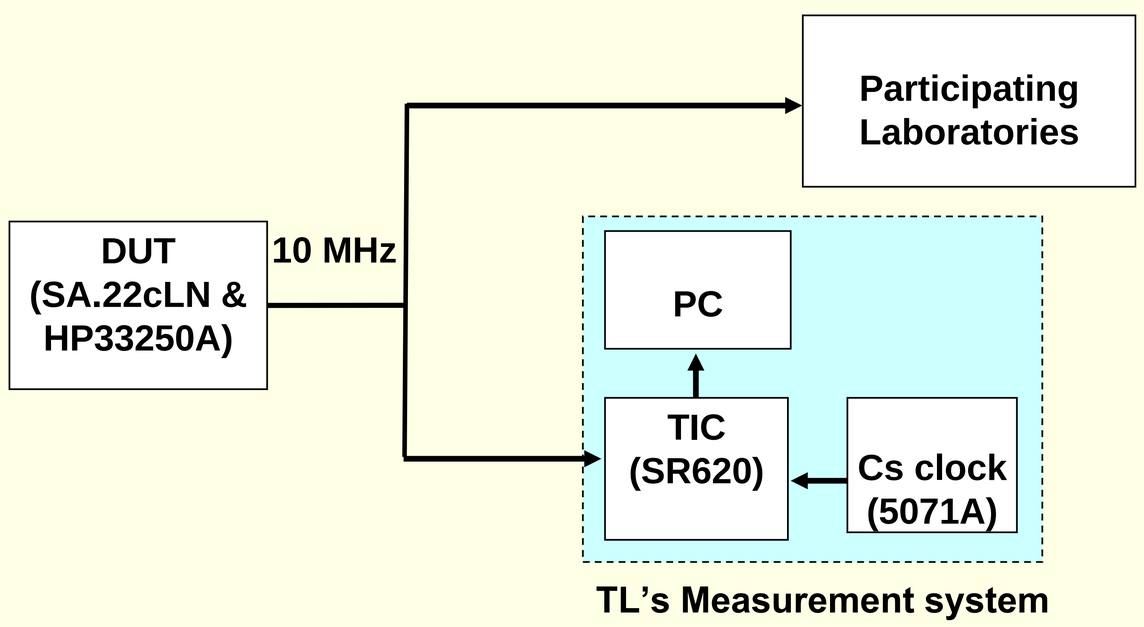

Fig. 1 The set-up of measurement system in proficiency testing activity

Method and Procedure

- Since the signal of an oscillator is non-stationary, we tried to make the DUT's signal be measured by the participant's and TL's calibration systems simultaneously.
- A set of TL's portable calibration system (see Fig.1) consists of a HP 5071A cesium clock, a SR620 time interval counter and a recording computer along with the DUT were sent to each participating lab sequentially.
- The performance of TL's reference clock (5071A) was checked before and after each trip to participating lab, so that we can confirm its accuracy and stability.

Measurement Results

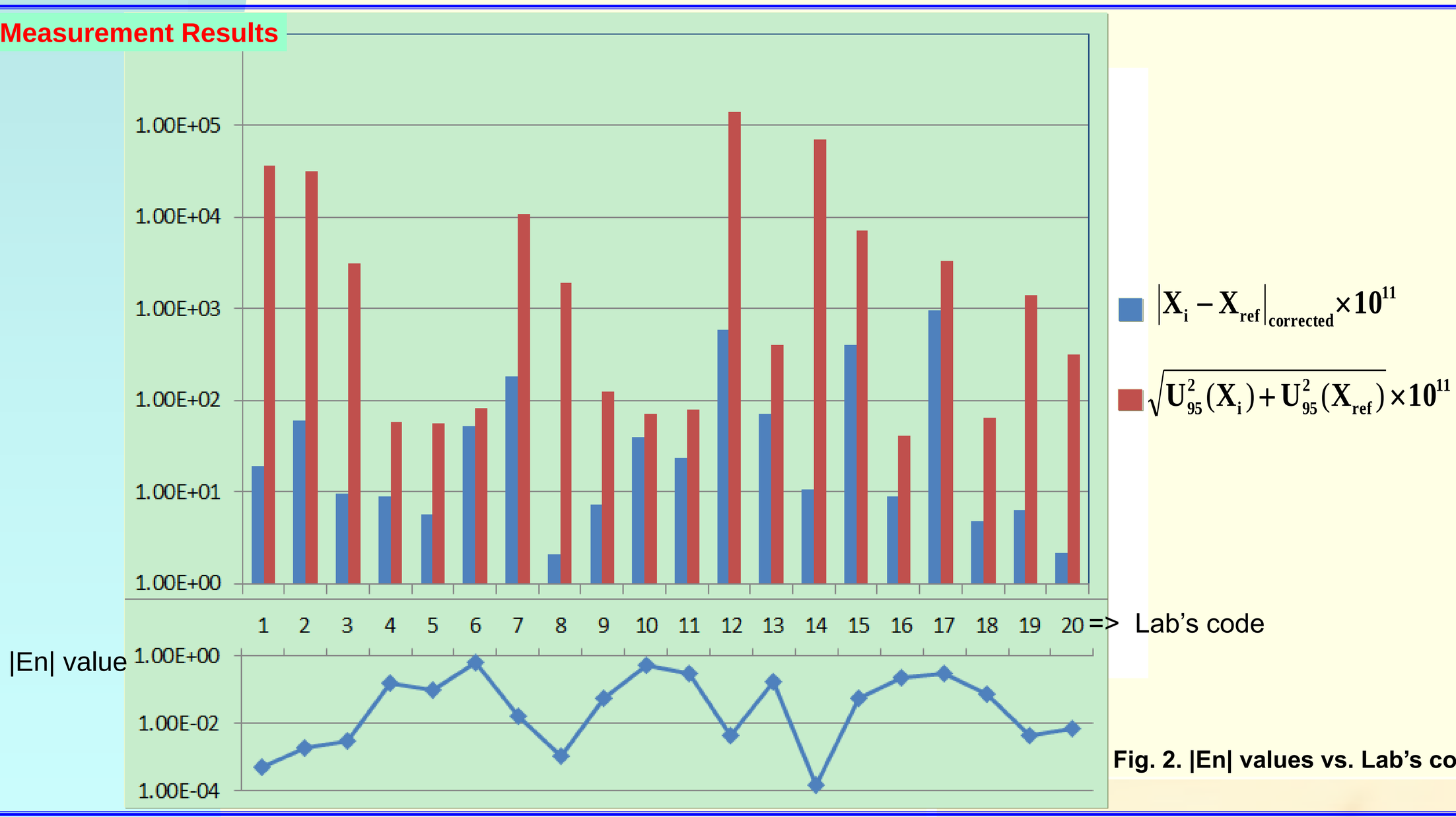

Fig. 2. |En| values vs. Lab's code

Conclusions

The |En| values of the18 participating labs are smaller than 1, which indicates that the calibration abilities of all participants are qualified. However, it's interesting to find that the |En| values distribute from 0.0002 to 0.64. The following conclusions were made.

1) The obtained |En| values are affected by their relative estimated uncertainty value , so the measurement capability of a Laboratory can not be judged only by |En|.
2) There are 7 labs, with their claimed best measurement capabilities $\leqq$7.2E-10, got the |En| values around 0.07~0.64. That shows the consistency between the claimed CMC and the measurement results.
3) There are 5 labs, with their claimed best measurement capabilities >1.0E-7, got the |En| values around 0.0002~0.02. That means their claimed CMC maybe too large, and could be reduced when they are re-assessed next time.