

## **Report of Ukrmetrteststandard concerning Criteria of Membership in CCs set out in CIPM-D-01**

### **1) Ukrmetrteststandard is charged with establishing national standards in the fields of activity covered by the CCEM:**

Name of the standard	Current Designation	Year of establishing
National primary standard of capacitance and dissipation factor units	DETU 08-06-01	2001
National primary standard of electrical power and power factor units	DETU 08-08-02	2002
National primary standard of inductance and dissipation factor units	DETU 08-09-09	2009
National primary standard of the phase angle between two voltages units	DETU 08-07-11	2011
National primary standard of the unit of electrical DC voltage in the range from 1 kV to 180 kV	DETU 08-04-99	1999
National primary standard of units of AC electric voltage in the range from 1 to $1,2 \cdot 330/\sqrt{3}$ kV and coefficient of scale transformation of electric voltage at frequency 50 Hz	DETU 08-05-99	1999
National primary standard unit of electrical voltage from 0.1 V to 1000 V AC in the frequency range from 10 Hz to 1 MHz	DETU 08-07-02	2002
National primary standard of a unit of coefficient of scale transformation of electric voltage to $1,2 \cdot 750/\sqrt{3}$ kV	NDETU EM-01-2019	2019
National primary standard of a unit of alternative current	NDETU EM-02-2019	2019
National primary standard of a unit of coefficient of scale transformation of AC current of industrial frequency	NDETU EM-03-2020	2020

### **2) Recent publications in research journals of international repute**

#### **Publications of the comparisons reports in *Metrologia* (2020-2011):**

1. Oleh Velychko and Jon Bartholomew. Final report on GULFMET supplementary comparison of AC energy (GULFMET. EM-S5.1). *Metrologia*, 2020, Vol. 57, Number 1A, Tech. Supplement 01015
2. Oleh Velychko, Stanislav Karpenko, Hüseyin Çayci and Jon Bartholomew. Final report on GULFMET supplementary comparison of AC energy (GULFMET. EM-S5). *Metrologia*, 2020, Vol. 57, Number 1A, Tech. Supplement 01003
3. Oleh Velychko, Sergii Shevkun, Jon Bartholomew and Abdullah M Alrobaish. Final Report on GULFMET Supplementary Comparison of Inductance at 10 mH and 100 mH at 1 kHz (GULFMET.EM-S4). *Metrologia*, 2019, Vol. 56, Number 1A, Tech. Supplement 01013
4. Oleh Velychko and Stanislav Karpenko. Final report on COOMET key comparison of power (COOMET.EM-K5). *Metrologia*, 2019, Vol. 56, Number 1A, Tech. Supplement 01010
5. O Velychko and O Akhmadov. Final Report on COOMET Supplementary Comparison of Capacitance at 100 pF (COOMET.EM-S4). *Metrologia*, 2017, Vol. 54, Number 1A, Tech. Supplement 01006
6. O Velychko and O Akhmadov. Final Report on COOMET Key Comparison of Capacitance at 10 pF (COOMET.EM-K4). *Metrologia*, 2017, Vol. 54, Number 1A, Tech. Supplement 01005

7. G P Telitchenko. Supplementary bilateral comparison of the national AC/DC voltage transfer references between VNIIM (Russia) and Ukrmetrteststandard (Ukraine) (COOMET.EM-S1). *Metrologia*, 2017, Vol. 54, Number 1A, Tech. Supplement 01004
8. O Velychko and Yu Darmenko. Final Report on COOMET key comparison of AC/DC voltage transfer references (COOMET.EM-K6.a). *Metrologia*, 2016, Vol. 53, Number 1A, Tech. Supplement 01011
9. O Velychko, S Karpenko, V Gachok and O Akhmadov. Final report: COOMET 344/UA/05 supplementary comparison of 50/60 Hz power (COOMET.EM-S2). *Metrologia*, 2015, Vol. 52, Tech. Supplement 01008
10. COOMET.EM-S8 (469/RU-a/09). International supplementary comparison of inductance standards at frequencies up to 10 MHz. *Metrologia*, 2015, Vol. 52, Tech. Supplement 01007
11. Oleh Velychko and Sergii Shevkun. Final report: COOMET supplementary comparison of capacitance at 10 pF and 100 pF (COOMET.EM-S13). *Metrologia*, 2015, Vol. 52, Tech. Supplement 01005
12. V N Kikalo, M L Petrovich, N G Lobzhanidze, V V Kisilev and R Styblikova. Final report on COOMET.EM-S5: Supplementary comparison of AC voltage ratio standards (COOMET project 396/UA/07). *Metrologia*, 2013, Vol. 50, Tech. Supplement 01003
13. E Dierikx, A Nestor, J Melcher, A Kölling and L Callegaro. Final report on the supplementary comparison EURAMET.EM-S26: inductance measurements of 100 mH at 1 kHz (EURAMET project 816). *Metrologia*, 2012, Vol. 49, Tech. Supplement 01002
14. Hüseyin Çaycı. Final report on key comparison EURAMET.EM-K5.1 (EURAMET Project No. 687): Comparison of 50/60 Hz power. *Metrologia*, 2011, Vol. 48, Tech. Supplement 01009

#### **Other publications (2020–2018)**

1. O Velychko, T Gordiyenko, S Karpenko. Evaluation of the results of regional metrology organisation comparisons and national inter-laboratory comparisons for electrical quantities. *Acta IMEKO*, vol. 9, no. 2, article 4, June 2020, pp. 18–24
2. O Velychko, T Gordiyenko. Main Results of GULFMET.EM-S5/5.1 Supplementary Comparisons for Electrical Energy at Frequencies of 50/53 Hz. *Ukrainian Metrological Journal*, 2020, No. 3, pp. 12–19
3. O Velychko, S Shevkun and M Dobroliubova, Features of Calibration of Precision LCR Meters. *Sensors and Transducers*, Vol. 237, Issue 9–10, 2019, September-October, pp. 171–177
4. Iu Kuzmenko, O Velychko, S Shevkun and M Dobroliubova. Estimation of Uncertainty in Calibration of LCR-meters of Precision on the State Primary Standard of Units of Inductance and Tangent Angles of Losses. 5th International Conference on Sensors and Electronic Instrumentation Advances (SEIA'2019). *Proceedings*, Adaje, Canary Islands (Tenerife), Spain, 2019 (September, 25-27), pp. 331–332
5. O Velychko and T Gordiyenko. Possibilities of Linking Results of EURAMET and COOMET Key Comparisons for Power. *Ukrainian Metrological Journal*, 2019, No 4, pp. 15-22 (WoS)
6. O Velychko, S Shevkun and T Gordiyenko. Main Results of GULFMET.EM-S4 Supplementary Comparison of Inductance for 10 and 100 mH at 1 kHz. *Ukrainian Metrological Journal*, 2019, No 3, pp. 14-22 (WoS)
7. O Velychko and I Karpenko. Alternative Method for Processing of International Comparison Results. *Ukrainian Metrological Journal*, 2019, No 2, pp. 10-15 (WoS)
8. O Velychko and S Karpenko. Main Results of COOMET.EM-K5 Key Comparison of Power. *Ukrainian Metrological Journal*, 2019, No 1, pp. 15-22 (WoS)
9. V Isaiev, O Velychko, Y Anokhin. Comparator effect on equivalence of results of calibrating current transformers. *Eastern-European Journal of Enterprise Technologies. Applied physics*, 2019, № 5/5 (101), pp. 6–15

10. O Velychko, V Isaiev. Comparison of Two Methods for Phase Angle Measurement. *IEEE Transactions on Instrumentation and Measurement*, Vol. 68, Issue 6, June 2019, pp. 1740–1747
11. Oleh Velychko. Possibilities of Linking Results of Key and Supplementary Comparisons in Field of Electricity and Magnetism. *Measurement*, Vol. 144, 2019, pp. 167–172  
O Velychko, V Isaiev. Measurement of instantaneous and average values of phase angle using precision voltmeter. *ARPN Journal of Engineering and Applied Sciences*, Vol. 14, No. 14, July 2019, pp. 2621–2629
12. O Velychko, T Gordiyenko. Metrological Traceability at Different Measurement Levels. *Standards, Methods and Solutions of Metrology* / Edited by Luigi Cocco. Published by IntechOpen, in London, United Kingdom, 2019, October, 102 p. (Chapter 1, pp. 1–21)
13. O Velychko, V Isaiev. Interlaboratory comparison in context of inappropriate results of voltage thermal converter calibration. *Journal of Electrical Engineering and Information Technologies*, Vol. 3, 2018, No. 1–2, Article 146, pp. 5–12
14. O Velychko. Linking results of key and supplementary comparisons of AC/DC voltage transfer standard. *International Journal of Metrology and Quality Engineering*, Vol. 9, 2018, Numb. 4, 7 p.
15. O Velychko, V Isaiev. A comparative analysis of AC/DC transfer standards for comparison of national standards. *Eastern-European Journal of Enterprise Technologies*, 2018, № 6/5(96), pp. 14–24
16. O Velychko, S Shevkun, T Gordiyenko, M Dobroliubova. Metrological Traceability of Impedance Parameter Measurements in Ukraine. *Eastern-European Journal of Enterprise Tech. Information and controlling systems*, 2018, № 4/9(94), pp. 43–49
17. O Velychko, T Gordiyenko. Linking Results of International Comparisons of the National Standard and the National Inter-Laboratory Comparisons. *XXII World Congress of the International Measurement Confederation (IMEKO 2018)*. *Journal of Physics: Conf. Series*, IOP Publication, Vol. 1065, 2018, 072004, 4 p.
18. S Karpenko, O Velychko. Evaluation Standard Uncertainty Depends on Travelling Standard Instability during Key Comparison. *Digest of 2018 Conference on Precision Electromagnetic Measurement (CPEM 2018)*, Paris, France, 2018 (June, 8–13), 2 p.
19. O Velychko, V Isaiev, Yu Kulish. Comparison of phase angle measurement results by means of two methods. *Digest of 2018 Conference on Precision Electromagnetic Measurement (CPEM 2018)*, Paris, France, 2018 (June, 8–13), 2 p.
20. O Velychko, R Vendychanskyi. Research of the National Primary Standard of the High DC Voltage. *Digest of 2018 Conference on Precision Electromagnetic Measurement (CPEM 2018)*, Paris, France, 2018 (June, 8–13), 2 p.
21. T Gordiyenko, O Velychko, A Salceanu. The Expert's Competence Evaluation in Electrical Engineering Education. *Proceedings of the 2018 International Conference and Exposition on Electrical and Power Engineering (EPE 2018)*, Iasi, Romania, 2018 (October, 18–19), 6 p.
22. T Gordiyenko, O Velychko, A Salceanu. The Group Expert Evaluation in Electrical Engineering Education. *Proceedings of the 2018 International Conference and Exposition on Electrical and Power Engineering (EPE 2018)*, Iasi, Romania, 2018 (October, 18–19), 6 p.
23. V V Isaiev. Finding reference values to calibrate two alternating currents comparator. *World Science*, Vol. 1, 2018, No 2(30), pp. 57–61
24. S Shevkun, O Velychko, M Surdu, M Dobroliubova. The Estimation of Uncertainty in the Calibration of Inductance Measures with Using the State Primary Standards of the Units of Electrical Capacitance, Inductance and Dissipation Factor. *28th International Scientific Symposium. Metrology and Metrology Assurance 2018*. *Proceedings*, Sozopol, Bulgaria, 2018 (September, 10-14), pp. 39–43

### **Additional information**

Ukrmetrteststandard's representatives organizations dealing with metrology in electricity and magnetism: TC 1.3 COOMET "Electricity and Magnetism" (Oleh Velychko is member of TC 1.3) and IMEKO TC4 "Measurement of Electrical Quantities" (Oleh Velychko is member of TC 4).

### ***3) Participation in the international key and supplementary comparisons organised by the CCEM and regional metrology organisations***

Ukrmetrteststandard has demonstrated competence by participation in international comparisons organized by regional metrology organizations EURAMET, COOMET and GULFMET. In comparisons COOMET.EM-K4, COOMET.EM-K5, COOMET.EM-K6.a, COOMET.EM-S2, COOMET.EM-S4, COOMET.EM-S5, COOMET.EM-S13, COOMET.EM-S14, GULFMET.EM-S4, GULFMET.EM-S5, GULFMET.EM-S5.1 Ukrmetrteststandard was a pilot laboratory.

#### **Capacitance:**

COOMET.EM-K4, COOMET Key Comparison of Capacitance at 10 pF;

COOMET.EM-S4, COOMET Supplementary Comparison of Capacitance at 100 pF;

COOMET.EM-S13, COOMET Supplementary Comparison of Capacitance at 10 pF and 100 pF.

#### **Inductance:**

EURAMET.EM-S26, Supplementary Comparison Inductance Measurements of 100 mH at 1 kHz;

COOMET.EM-S14, COOMET Supplem. Comparison of Inductance for 10 mH and 100 mH at 1 kHz;

GULFMET.EM-S4, GULFMET Supplem. Comparison of Inductance for 10 mH and 100 mH at 1 kHz.

#### **AC power and energy:**

EURAMET.EM-K5.2018, Key Comparison of 50/60 Hz power;

EURAMET.EM-K5.1, Key Comparison of 50/60 Hz power;

COOMET.EM-S2, COOMET Supplementary Comparison of 50/60 Hz Power;

COOMET.EM-K5, COOMET Key Comparison of Power;

GULFMET.EM-S5, GULFMET supplementary comparison of AC energy;

GULFMET.EM-S5.1, GULFMET supplementary comparison of AC energy.

#### **AC/DC voltage transfer:**

COOMET.EM-K6.a, COOMET Key Comparison of AC/DC Voltage Transfer References;

COOMET.EM-S1, COOMET Supplementary Comparison of AC/DC Voltage Transfer References.

#### **High AC voltage and current:**

COOMET.EM-S5, COOMET Supplementary Comparison of AC Voltage Ratio Standards;

COOMET.EM-S22, Supplementary Comparison of AC high current ratio using measuring system for current transformers.

#### **High DC voltage:**

COOMET 203/UA/00, COOMET Supplementary Comparison of the DC high voltage and AC voltage ratio and others.

Based upon the comparisons results, 41 entries of Ukrmetrteststandard CMCs for Electricity and Magnetism (EM) have been published in the KCDB database in 2019–2008.

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