

Progress Report on Electricity and Magnetism Field at the National Institute of Standards (NIS), Egypt

(From March, 2023 to February, 2025)

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1- Calibration and Measuring Capabilities (CMCs)

1.1 Published CMCs

The following CMCs had been approved and published in the BIPM-KCDB website on 4th July, 2023:

1.1.1 DC resistance, DC resistance standards: low values: **1.00 Ω , Fixed resistor**

Relative expanded uncertainty: **1.3 $\mu\Omega/\Omega$**

Direct current comparator bridge (DCC bridge)

Temperature: Oil Bath Temperature: 23 °C $\pm$ 0.1°C, Room Temperature: 23°C $\pm$ 1°C

1.1.2 DC resistance, DC resistance standards: Intermediate values: **1E+01 Ω to 1E+04 Ω , Fixed resistor**

Relative expanded uncertainty: **3.0E-1 $\mu\Omega/\Omega$ to 1.1 $\mu\Omega/\Omega$**

Direct current comparator bridge (DCC bridge)

Temperature: Oil Bath Temperature: 23 °C $\pm$ 0.1°C for 10 Ohm, Room Temperature: 23°C $\pm$ 1°C

1.2 Submitted CMCs

There are 2 CMCs under evaluation in the Microwave activity as following:

1.2.1 RF power: calibration factor in coaxial line: **Power sensor: 50 Ω , Type-N**

Relative expanded uncertainty: **6.2E-3 to 2.5E-2**

Direct comparison method

Frequency: 2 GHz to 18 GHz, Connector type: 50 Ohm, Type-N, Power level: -30 dBm

1.2.2 Scattering parameters: reflection coefficient (Sii) in coaxial line, magnitude: **RF signal generator**

Relative expanded uncertainty: **2.6E-2 to 9.2E-2**

Injection method technique

Frequency: 150 MHz to 18 GHz, Connector type: 50 Ohm, Type-N, Power level: 30 dBm

 N	AFRIMETS-EM-EG-00000PW3-1	Radio frequency measurements	Radio frequency measurements	RF power: calibration factor in coaxial line	Power sensor: 50 Ω , Type-N	NIS-22C014	2024-06-06
	AFRIMETS-EM-EG-00000PW4-1	Radio frequency measurements	Radio frequency measurements	Scattering parameters: reflection coefficient (Sii) in coaxial line, magnitude	RF signal generator	NIS-22C017	2024-06-06

2- Comparisons

2.1 Completed and Approved Comparisons

2.1.1 Final Report of AFRIMETS.EM-S2 supplementary comparison in calibration of multimeter was completed in 2024.

2.1.2 Final Report of ARAMET comparison in calibration of multimeter (6.5 digits) was completed in 2024.

2.2 Ongoing Comparisons

There is one running comparison that the electrical metrology division at NIS participated in it. Issuing the draft B report of it is in progress.

Year	Identifier	Description	Participants	Pilot	Status
2018	EURAMET Project 1512	It is aimed to check results of primary level effective efficiency for Type-N thermistor power sensors in the frequency range 10 MHz to 18 GHz. The measurement frequencies for this comparison are 50 MHz, 500 MHz, 1 GHz, 2 GHz, 4 GHz, 6 GHz, 8 GHz, 10 GHz, 12 GHz, 14 GHz, 16 GHz and 18 GHz.	UME, NPL, NIS, PTB, NMISA	UME	Draft B

3- Research Activities

From March 2023 to February 2025, around **16 publications** had been accepted and published in scientific journals and conferences indexed in SCOPUS. These publications are listed as following:

- D.A. Abd El-Aziz, Hadia El. H., Rasha S. M. Ali, and A.M. Attiya, "Comparative Study of Microwave Relative Phase Measurement Methods", MAPAN Journal, Published Online (DOI: 10.1007/s12647-024-00790-x), 2025.
- A. S. Haiba, "Implementation and Evaluation of An On-site Calibration Approach for High Voltage Testing Systems up to 600 kV," Chinese J. Electr. Eng., Accepted for publication, 2025.
- A. S. Haiba, and M. Halawa, "Development and evaluation of an on-site calibration technique for energy meter reference standards", Meas. Sci. Technol., Vol. 35, no. 9, p. 095010, doi: 10.1088/1361-6501/ad56b9, Sep. 2024.
- Ahmed Haiba S., and A. Eliwa Gad, "Artificial neural network analysis for classification of defected high voltage ceramic insulators", Scientific Reports Journal, Vol. 14 (1), art. no. 1513, 2024.
- E. M. Hosny, M. S. Soliman, H. M. A. Mageed, M. A. Samy, and A. Y., "Optimal Sizing of a Microgrid Based on PV-Wind: A Case Study of a Resort in Matruh Government, Egypt", 25th International Middle East Power System Conference (MEPCON), 2024.
- Ahmed H. Ali, "Innovative Strategies for Enhancing Web Application Performance: A Contemporary Load Testing Approach", International Journal of Engineering Trends and Technology, Vol. 72 (10), pp. 246 - 256, 2024.
- E. M. Hosny, H. M. A. Mageed, and A. S. Nada, "Adopted Climatic Chamber Solar Simulator for Testing Solar Radiation Effects on Electricity Meters at NIS," MAPAN, Vol. 39, pp. 673–680, 2024, doi: 10.1007/s12647-024-00745, 2024.
- Ahmed H. Ali, and Ahmed A. Hagag, "An enhanced AI-based model for financial fraud detection", International Journal of Advanced and Applied Sciences, Vol. 11 (10), pp. 114 - 121, 2024.

- Ahmed H. Ali , “From Reactive to Proactive: Enhancing industrial machine Maintenance through intelligent fault detection and Diagnosis” International Journal of Intelligent Systems and Applications in Engineering, 12(4), 4029–4039, 2024.
- Ahmed H. Ali, “Micro services-based Integral Architecture for Digital Transformation: A Scalable and Modular Approach”, International Journal on Engineering Applications, Vol 12, No 4, 2024.
- Ahmed H. Ali, “Innovative Strategies for Enhancing Web Application Performance A Contemporary Load Testing Approach” International Journal of Engineering Trends and Technology, 2024.
- Ahmed H. Ali “Dynamic user Engagement Analysis through Migrating Load Testing: Unveiling Performance Variability and Optimization Strategies” International journal of applied engineering and technology, Vol. 5 No. 3, pp. 61-68., September 2023.
- Nahed A. monaem, Rasha S. M. Ali, and Hamdy S., "Establishment of new automated multi range thermal current converter", International Journal of Power Electronics and Drive Systems, Vol. 14 (2), pp. 842 - 851, 2023.
- D.A. Abd El-Aziz, A. E. Zekry, Rasha S. M. Ali, and A.M. Attiya, "Wideband Microwave Phase Shift Measurement Technique", National Radio Science Conference (NRSC) Proceedings, pp. 33–39, May 2023.
- S. Ahmad, T. John , P.S. Negi, M. Flaifel, S.A. Zaher, Rasha S. M. Ali , and ---, "Supplementary comparison on digital multimeter", Metrologia, Vol. 60 (1), 01006, 2023.
- D. Bailey, K. Hutto, P. Wallace, A. El-Shahat, J. Qian, and H. M. A. Mageed, “Active Battery Management System for Electric Longboard”, IEEE IAS Global Conference on Renewable Energy and Hydrogen Technologies, GlobConHT 2023, doi: 10.1109/GlobConHT56829.2023.10087575, 2023.
- R. Almarzooqi, A. El-Shahat, and H. M. A. Mageed, “Sizing Residential Photovoltaic Systems in Different Climate Regions in the US”, IEEE IAS Global Conference on Renewable Energy and Hydrogen Technologies, GlobConHT 2023, doi: 10.1109/GlobConHT56829.2023.10087431, 2023.
- Z. B. N. Durham, A. El-Shahat, H. M. A. Mageed, S. Blitch, and Z. Mirza, “Solar Charging Dock for Personal Electric Vehicles”, IEEE IAS Global Conference on Renewable Energy and Hydrogen Technologies, GlobConHT 2023, doi: 10.1109/GlobConHT56829.2023.10087698, 2023.
- E. F. Ahmed, E. S. S. A. Said, H. M. Abdel Mageed, and A. A. Ammar, “A Real-Time PWM-CSI Design and Implementation for an Improved Residential Grid Harmonics Spectral”, Int. Rev. Electr. Eng., vol. 18, no. 2, doi: 10.15866/iree.v18i2.22638, 2023.
- S. Barakat, H. M. A. Mageed, and M. Samy, “Eco-Efficient Mobility: Comparative Optimization of PV-Wind EV Charging Solutions”, 24th International Middle East Power System Conference (MEPCON), pp. 1–7. doi: 10.1109/MEPCON58725.2023.10462329, 2023.

4- Improved Measurement Capabilities

4.1 High Resistance Meter/Bridge MI model 6652A and High Resistance Standards MI model 9331G, Reference Multimeter model 8588A, Four new Microwave Fixed Attenuators, RF and Microwave Signal Generator R&S model SMA100B, and ASTEL System for Meter Test Equipment with Energy Reference Standard model RX-33 were newly purchased for improving our measurement capabilities.

4.2 Electromagnetic Field Strength Measurements from 1 Hz to 40 GHz was added as a new customer service.

4.3 Scope of AC high voltage measurement up to 1500 kV instead of 300 kV was extended to increase our capabilities.

4.4 Passing the re-assessment for accreditation that was done for some activities in the field of AC/DC HV, Power, and Energy measurements, and some tests of electrical energy meters.

4.5 Traceability will be provided to some devices by calibrating some of them at BIPM and others at some NMIs.

5- Digitalization Activity

5.1 Participating in the 3rd International Digital Calibration Certificate (DCC) Conference and two abstracts had been published and presented at that conference that are entitled:

- Digital Transformation of NMI: Practical Experience on DCC and Beyond @ NIS-Egypt.
- On the Construction and Dissemination of Digital Metrology Datasets for Research and Development Purposes.

5.2 Participating in the Second CJED National Consultative Dialogue in Egypt conference on "Overview of the Smart Specialization Strategy (S3) Concept and its Role in Promoting Economic Growth.". The introduced presentation entitled:

- Digital Transformation infrastructure.