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SMBNC/85/DV

2025-10-17

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### STANDARDIZATION MANAGEMENT BOARD

#### SUBJECT

Proposal for a new PC on *Measurement and computational methodologies for antenna characterization and data representation*

#### BACKGROUND

The attached proposal from the Italian NC for a new Project Committee (PC) on *Measurement and computational methodologies for antenna characterization and data representation* is submitted to all IEC National Committees in accordance with the process described in the ISO/IEC Directives, Part 1, §1.10 and Annex K.

##### K.1 Proposal stage

Votes shall be returned within 12 weeks.

Acceptance requires:

- a) approval by a 2/3 majority of the National Bodies voting;
- b) a commitment to participate actively by at least five National Bodies that approved the new work item proposal and nominated technical experts.

**Annex:** Italian NC proposal

#### ACTION

IEC National Committees are invited to vote on the proposal for a new PC on *Measurement and computational methodologies for antenna characterization and data representation*, using the IEC electronic voting system **by 2026-01-09**.



## PROPOSAL FOR A NEW FIELD OF TECHNICAL ACTIVITY

PROPOSER:  
ITALY NC

DATE OF CIRCULATION:  
2025-10-17

A proposal for a new field of technical activity shall be submitted to the IEC Secretariat, which will assign it a reference number and process the proposal in accordance with ISO/IEC Directives, Part 1, 1.5. Guidelines for proposing and justifying a new field of activity are given in the ISO/IEC Directives, Part 1, Annex C.

THE PROPOSAL (to be completed by the proposer):

TITLE (the title shall be described unambiguously and as concisely as possible)

Measurement and Computational Methodologies for Antenna Characterization and Data Representation

SCOPE (the scope shall define precisely the limits of the proposed new field of activity and shall begin with "Standardization of ..." or "Standardization in the field of ...")

The proposal for a Project Committee is devoted to developing a standardization project on Antenna characteristics. The standardization deliverable includes the definition of measurement and computational methodologies for determining radiating and performance characteristics, including associated uncertainty, and their representation in common electronic formats. The project aims to cover the frequency range up to 300 GHz, for any type of antenna.

The scope of the project includes the following aspects of Antenna characterization:

1. Antenna measurement methods
2. Antenna computational methodologies
3. Antenna electronic data representation

The part related to measurement methods comprises standardization of both traditional and emerging measurement techniques for antenna design and characterization such as far-field, near-field, compact range testing, and their associated transformations. It will address the characterization challenges posed by advanced antenna technologies including reconfigurable, adaptive, beamforming, beamsteering and software-defined antennas.

The integration of computational electromagnetics for modern antenna design is an essential complement to be represented in conjunction with measurement techniques, including digital twin approaches for antenna characterization.

This third point, but not least for importance, to be included in the project is the need of establishing unified protocols for representing antenna parameters including gain, radiation patterns, polarization, impedance, and bandwidth across the electromagnetic spectrum.

The development of standardized digital formats for antenna parameters and patterns will improve the quality of data exchange between manufacturers, test facilities, and end users, building upon existing formats while ensuring compatibility with modern computational and design tools.

The evaluation and characterization of the uncertainty associated to antenna parameters, determined by measurement or by simulations, is a key point to be included in the standardization activities.

This project will not prescribe antenna performance specifications but will focus on creating a comprehensive framework for measurement and computational procedures, validation methods, and digital data representation to facilitate accurate characterization and seamless information exchange across the antenna ecosystem.

Performance requirements for antennas (such as radiation pattern specifications, sidelobe level limits, gain requirements, etc.) adopted for specific radio services are excluded from the scope of this standardization activity where they are already covered by ITU, ETSI, FCC or other specific institutions.

The proposed project will complement and not overlap with existing standardization frameworks. On the contrary, relevant existing standards will be actively considered and referenced during the development of this standardization program. Coordination with ITU-R can be relevant for terminology harmonization. It is worth observing that ITU-R Recommendations for Terms and Definitions refer to IEV terminology.

Specific requirements for antenna or antenna measurements related to EMC or human exposure to EMF are excluded from the scope of this project.

**PURPOSE AND JUSTIFICATION** (the justification shall endeavour to assess the economic and social advantages which would result from the adoption of International Standards in the proposed new field)

Antennas are a topic in fast and continuous evolution in many areas...

- Antenna performances are input into many industrial design processes
- A standardized approach to characterizing and representing antenna performance is essential for design processes, enabling a common technical language
- In IEC there is no Specific topic on Antennas
- To consider a specific task in IEC implementing a work stream on Antennas with the scope to create a standard frame, integrating experiences coming from other institutions (see next slides)

Having standardized procedures for any type of antenna for any frequency range is beneficial to the whole industry ecosystem since the common understanding for any parameter associated with antennas. Clearly defined parameters allow the entire industry to converge on a common understanding, eliminating potential misinterpretations.

The presence of a standardization body that, constantly, follows and update standards with the technological innovations and improvement in the field of antennas allows the entire ecosystem to manage novelties in a common and clear process. Collaborations and Liaisons with other Standardization Bodies or Institutions are desirable since making the standards applicable worldwide, to avoid replications, saving time and strengthening the whole antenna ecosystem.

Standardization in the field of Antennas is not a new topic, but there is a lack of a harmonized approach. This project, working on basic standards related to measurement methods and digital representation aims to tackle this challenge. The outcome of this project could support establishing a coherent conformity assessment framework.

Please select any UN Sustainable Development Goals (SDGs) that this committee will support. For more information about SDGs, please visit our website at <https://www.iec.ch/SDG/>

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| <input type="checkbox"/> <b>GOAL 1: No Poverty</b>   | <input type="checkbox"/> <b>GOAL 10: Reduced Inequality</b>                            |
| <input type="checkbox"/> <b>GOAL 2: Zero Hunger</b>  | <input checked="" type="checkbox"/> <b>GOAL 11: Sustainable Cities and Communities</b> |
| <input type="checkbox"/> <b>GOAL 3: Good Health and Well-being</b>                           | <input type="checkbox"/> <b>GOAL 12: Responsible Consumption &amp; Production</b>      |
| <input type="checkbox"/> <b>GOAL 4: Quality Education</b>                                    | <input type="checkbox"/> <b>GOAL 13: Climate Action</b>                                |
| <input type="checkbox"/> <b>GOAL 5: Gender Equality</b>                                      | <input type="checkbox"/> <b>GOAL 14: Life Below Water</b>                              |
| <input type="checkbox"/> <b>GOAL 6: Clean Water and Sanitation</b>                           | <input type="checkbox"/> <b>GOAL 15: Life on Land</b>                                  |
| <input type="checkbox"/> <b>GOAL 7: Affordable and Clean Energy</b>                          | <input type="checkbox"/> <b>GOAL 16: Peace, Justice Strong Institutions</b>            |
| <input type="checkbox"/> <b>GOAL 8: Decent Work &amp; Economic Growth</b>                    | <input type="checkbox"/> <b>GOAL 17: Partnerships to achieve the Goals</b>             |
| <input checked="" type="checkbox"/> <b>GOAL 9: Industry, Innovation &amp; Infrastructure</b> |  |

**PROGRAMME OF WORK** (list of principal questions which the proposer wishes to be included within the limits given in the proposed scope, indicating what aspects of the subject should be dealt with, e.g. terminology, test methods, dimensions and tolerances, performance requirements, technical specifications, etc.)

This PC will develop an international standard IS comprises the following topics:

1. Measurement methods: including method description, performances and uncertainty evaluation possibly in collaboration/Liaison with IEEE
2. Computational methodologies: including description, validation and uncertainty evaluation possibly in collaboration/Liaison with IEEE
3. Electronic data representation of Antenna parameters – possibly in Liaison with NGMN BASTA

The third point of the standard includes but not limits to the following topics

- a. Antenna Characteristics and Performance Data
- b. File Format for the 3D representation of Radiation Patterns (NGMN BASTA white paper is considered as reference)
- c. Common File Format for the representation of antenna chars (NGMN BASTA white paper is considered as reference)

The international standard can be structured including the following parts:

Antenna parameters – Part 1 General principles

Antenna parameters – Part 2: Measurement Methods: Description, Performances and Uncertainty evaluation

Antenna parameters – Part 3: Computational Methodologies: Description, Validation and Uncertainty evaluation

Antenna parameters – Part 4: ELECTRONIC Data Representation of Antenna Parameters

## PREFERRED TYPE OF DELIVERABLES

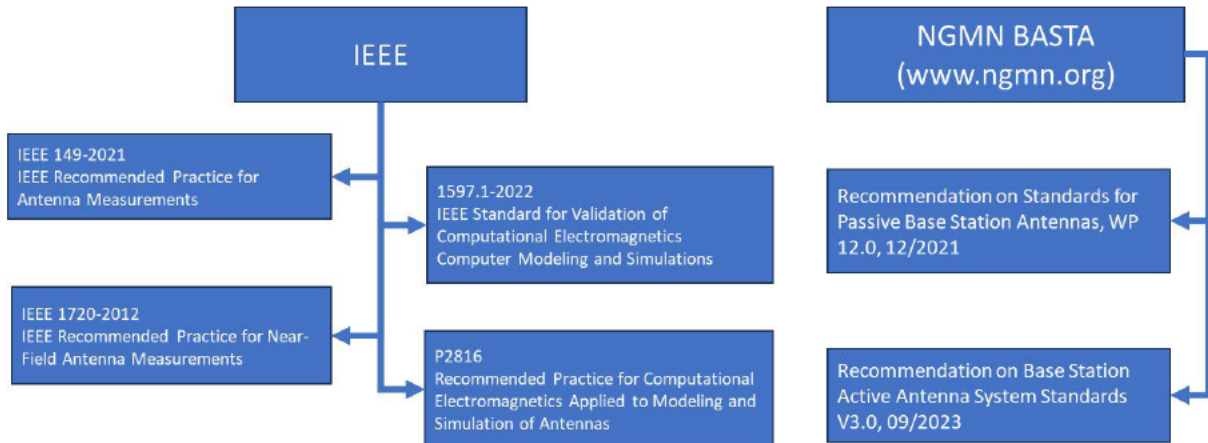
IS

RELEVANT EXISTING DOCUMENTS AT THE INTERNATIONAL, REGIONAL AND NATIONAL LEVELS (relevant documents to be considered: national standards or other normative documents)

In the field of Antenna design many standardization initiatives are already in place from several regional and international organizations and consortia.

In IEC the relevant standards on terminology are IEC 60050-705 "Radio wave Propagation" and IEC 60050-712 "Antennas"

The following existing works are relevant for the present proposal:



### IEEE Standardization Activities

- **IEEE 1597.1-2022: IEEE Standard for Validation of Computational Electromagnetics Computer Modeling and Simulations:** This standard specifies methods to validate computational electromagnetics (CEM) computer modeling and simulation (M&S) techniques, codes, and models. It is applicable to a wide variety of electromagnetic (EM) applications including but not limited to the fields of electromagnetic compatibility (EMC), radar cross section (RCS), signal integrity (SI), and antennas. Validation of a particular solution data set can be achieved by comparison to the data set obtained by measurements, alternative codes, canonical methods, or analytic methods.
- **IEEE 149-2021: IEEE Recommended Practice for Antenna Measurements:** This document comprises recommended practices for the measurement of antenna transmitting and receiving properties. It is a comprehensive revision and extension of ANSI/IEEE Std 149™-1979 (Revision of IEEE Std 149-1963) IEEE Standard Test Procedures for Antennas. Throughout this standard it may be assumed that the antenna to be measured can be treated as a passive, linear, and reciprocal device. Therefore, its radiation properties can be measured in either the transmitting or the receiving mode.
- **IEEE 1720-2012: IEEE Recommended Practice for Near-Field Antenna Measurements:** Scope: This document describes near-field test practices for the measurement of antenna properties. It provides information on developments in near-field measurements that have occurred since the writing of IEEE Std 149-1979 (IEEE Standard Test Procedures for Antennas). This document recommends near-field measurement practices for the three principal geometries: cylindrical, planar, and spherical, and also recommends measurement practices for the calibration of probes used as reference antennas in near-field measurements
- **IEEE P2816: IEEE Recommended Practice for Computational Electromagnetics Applied to Modeling and Simulation of Antennas:** This recommended practice defines the concepts, techniques, benchmark models, validation procedures, uncertainties and limitations of computational electromagnetics techniques and tools used for modeling and simulation of antennas in free space. It recommends and provides guidance on the numerical modeling of antennas and benchmark results to verify the general approach for the numerical simulations of such antennas. It defines acceptable numerical modeling requirements and guidance on meshing.

### Consortium NGMN BASTA

- **White Paper Passive Antennas 12.0:** The performance of a BSA is a key factor in the overall performance and quality of the cellular communication link between a handset and the radio and, by extension, of the performance of a single cell, or of an entire cellular network. The BSA's influence on coverage, capacity, and QoS is extensive,

and yet there exists no comprehensive, global, standard focusing on the base station antenna. [...] A format for the electronic transfer of BSA specifications from vendor to operator.

- White Paper Active Antennas 3.0: The main scope of the present document is to describe and capture the electrical and mechanical key performance parameters of Active Antenna System (AAS) and how to exchange this data electronically. In addition, for the purpose of complying with RF-EMF exposure regulation requirements, mechanisms to monitor and limit the power radiated by AAS are described. The topic related to Hybrid Passive and Active Antennas (HPAA) systems is addressed in [...]

#### RELATION TO AND IMPACT ON EXISTING WORK

- TC3: Documentation, graphical symbols and representations of technical information
  - Representation of Antenna parameters
- TC86 example of TC dedicated to a Specific Topic
- TC46 example of TC dedicated to a Specific Topic
  - Il TC 46 ha pubblicato nel 2022 uno standard, IEC 62037-7:2022, sul PIM
- TC103: Transmitting and receiving equipment for radiocommunication
  - Measurements of Radiation Patterns at THz frequencies
  - There is not a specific SC or activities on Antennas
- TC 106 Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure
  - Representation of Antenna parameters can be of interest for some of TC 106 activities

#### RELEVANT COUNTRY PARTICIPATION

LIAISON ORGANIZATIONS (list of organizations or external or internal bodies with which co-operation and liaison should be established)

IEEE, NGMN, ITU and ETSI

CISPR A, TC 3, TC 77, TC 103, TC 106

#### STAKEHOLDERS

TLC Network operators, Antenna manufacturers, any Industry dealing with antennas (ex: automotive, aerospace, etc), Authorities in charge of controlling environmental electromagnetic noise, Measurement systems manufacturers, Testing and Certification Laboratories, Academia

#### LEADERSHIP COMMITMENT

Project Leader: Mr. Andrea Schiavoni [andrea.schiavoni@fibercop.com](mailto:andrea.schiavoni@fibercop.com)

#### OTHER COMMENTS (if any)

#### COMMENTS OF THE SECRETARY-GENERAL (to be completed by the IEC Secretariat):

The IEC Secretariat thanks the Italian NC for submitting this proposal. As per SMB Decision 184/11, following initial discussions held at the June 2025 SMB meeting and after reviewing the updated proposal, SMB confirmed the need for new standardization activities in this field and acknowledged that no existing IEC Committees could take up this work.