EMI

مجلس أبوظبي للجودة والمطابقة
Abu Dhabi Quality & Conformity Council

A Taxonomy of Electrical Measurands

Jon Bartholomew, Mark Kuster, Michael Schwartz

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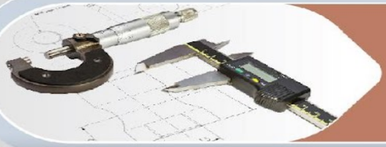
EMI's Facilities & Capabilities

EMI
معهد الإمارات للمترولوجيا
Emirates Metrology Institute

Operation of "state of the art" calibration laboratories providing environmental control in accordance with international standards.



1 Dimension Laboratory

2 Mass, Volume, Density and Flow Laboratory

3 Force, Pressure and Torque Laboratory

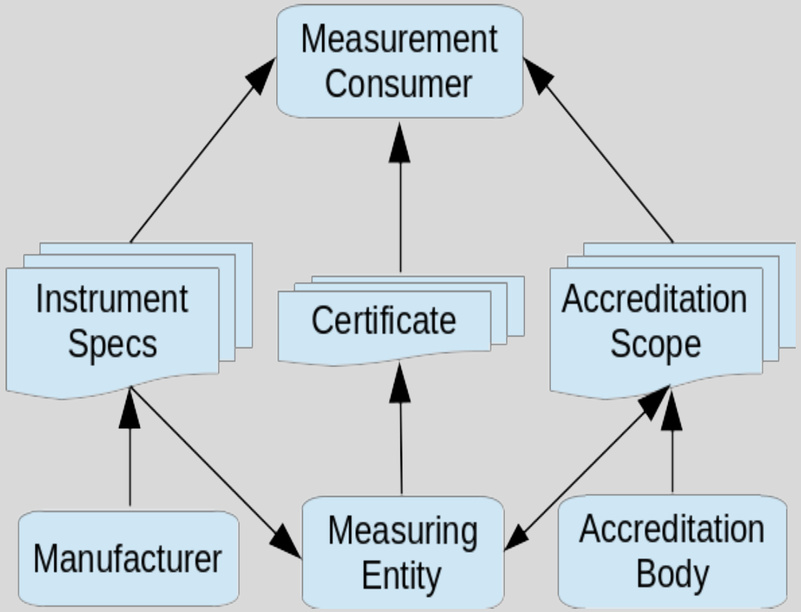
4 Electrical, Time and Frequency Laboratory

5 Temperature and Humidity Laboratory

6 Chemical Metrology Capability (Future Plan)

Introduction

- Some years ago, the NCSLI MII & Automation Committee and its collaborators began developing a taxonomy to uniquely identify and distinguish measurands in machine-actionable digital metrology documents such as calibration certificates, accreditation scopes, and instrument specifications.
- The committee has set a goal to link one or more measurand taxon to each calibration and measurement capability (CMC) contained in the key-comparison database (KCDB) managed at the International Bureau of Weights and Measures (BIPM).
- Given that the KCDB CMCs catalog most NMI services from which lower-level laboratories derive accredited capabilities, the committee expects that the resulting taxonomy will cover most worldwide calibration services.
- This paper outlines the taxonomy structure and presents current progress toward covering the KCDB's electricity and magnetism measurement area.



Joint Statement of Intent

On the digital transformation in the international scientific and quality infrastructure

Facing the Digital Challenge

- Signing the Joint Statement


ISO

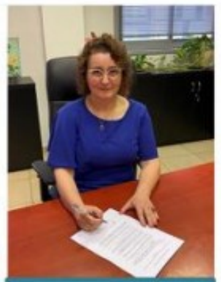

CIPM


ISC


CODATA


CIE


IEC


ILAC


IMEKO

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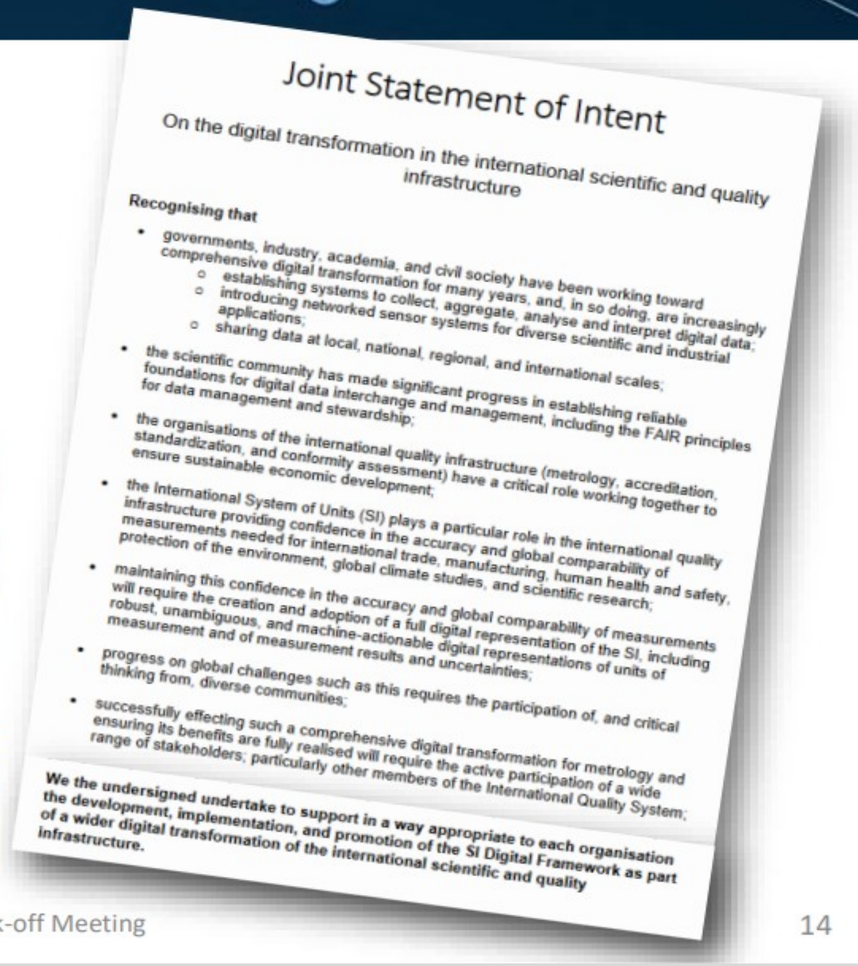
NCSLi



Joint Statement of Intent

On the digital transformation in the international scientific and quality infrastructure

Recognising that

- governments, industry, academia, and civil society have been working toward comprehensive digital transformation for many years, and, in so doing, are increasingly
  - establishing systems to collect, aggregate, analyse and interpret digital data;
  - introducing networked sensor systems for diverse scientific and industrial applications;
  - sharing data at local, national, regional, and international scales;
- the scientific community has made significant progress in establishing reliable foundations for digital data interchange and management, including the FAIR principles for data management and stewardship;
- the organisations of the international quality infrastructure (metrology, accreditation, standardization, and conformity assessment) have a critical role working together to ensure sustainable economic development;
- the International System of Units (SI) plays a particular role in the international quality infrastructure providing confidence in the accuracy and global comparability of measurements needed for international trade, manufacturing, human health and safety, protection of the environment, global climate studies, and scientific research;
- maintaining this confidence in the accuracy and global comparability of measurements will require the creation and adoption of a full digital representation of the SI, including robust, unambiguous, and machine-actionable digital representations of units of measurement and of measurement results and uncertainties;
- progress on global challenges such as this requires the participation of, and critical thinking from, diverse communities;
- successfully effecting such a comprehensive digital transformation for metrology and ensuring its benefits are fully realised will require the active participation of a wide range of stakeholders, particularly other members of the International Quality System;

We the undersigned undertake to support in a way appropriate to each organisation the development, implementation, and promotion of the SI Digital Framework as part of a wider digital transformation of the international scientific and quality infrastructure.

Slide from Kick-off Meeting of the Forum on Metrology and Digitalisation, Courtesy of Joachim Ullrich, Chair of the Forum 21 November 2023

EMI Strategy for Digital Transformation

1 INTEGRATE EMI SYSTEMS

- ★ Easy data exchange
- ★ Avoidance re-entering data
- ★ Reuse data

2 AUTOMATE EMI SERVICES

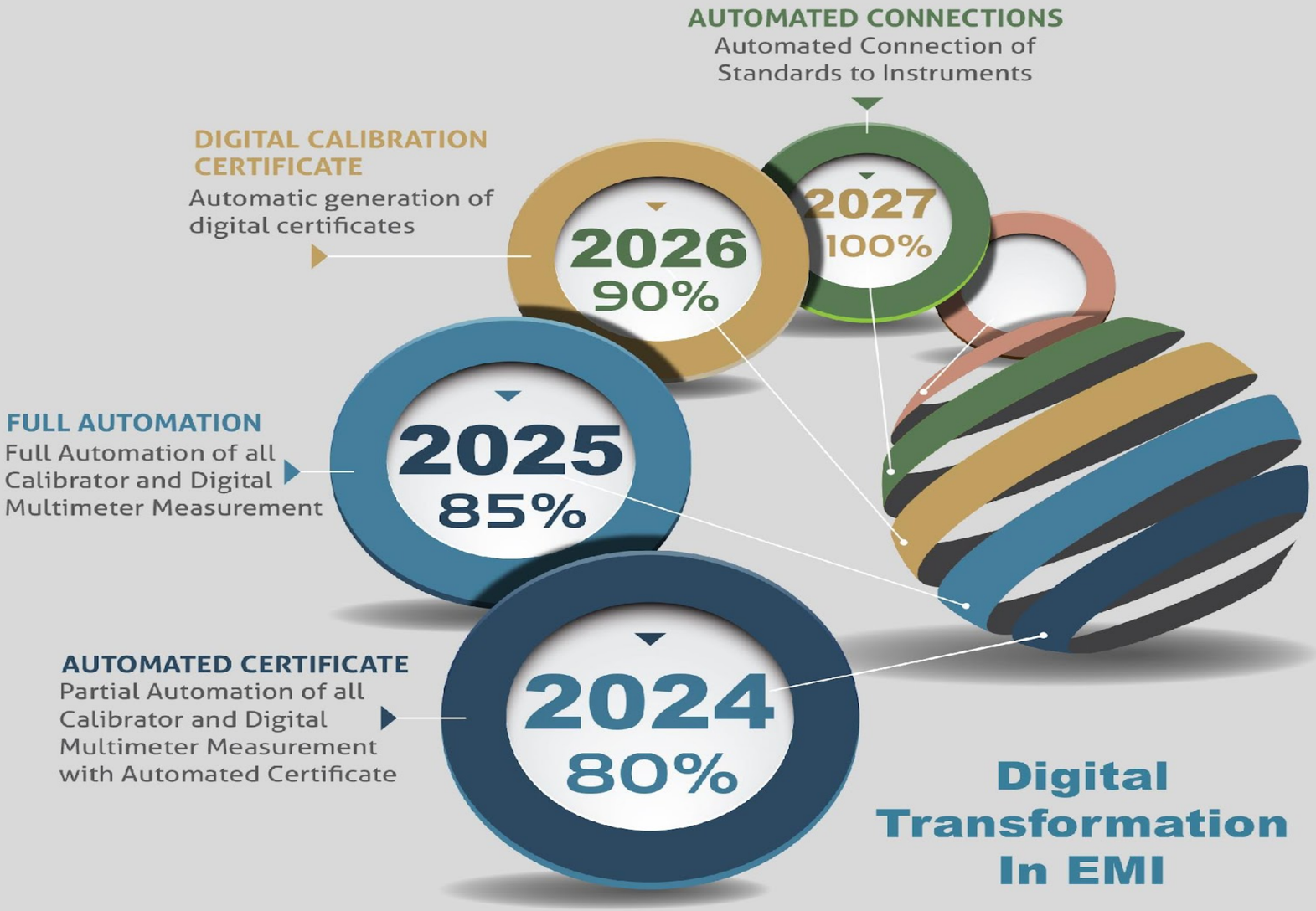
- ★ Automate services
- ★ Software standardization

3 INVESTIGATE DCC REQUIREMENTS

- ★ Data type included in DCC.
- ★ DCC format
- ★ Issue DCC

4 RESEARCH APPLICATION AI & ML

- ★ Understand AI and ML
- ★ Applications of AI & ML
- ★ Peers Applications



MII Measurand Taxonomy

- Digital CMCs should unambiguously describe laboratory services for machine consumption.
- The aim of the MII Measurand Taxonomy is:

  Unique measurand IDs with unlimited human-readable aliases
  Fully qualifies measurands for interoperable digital documents

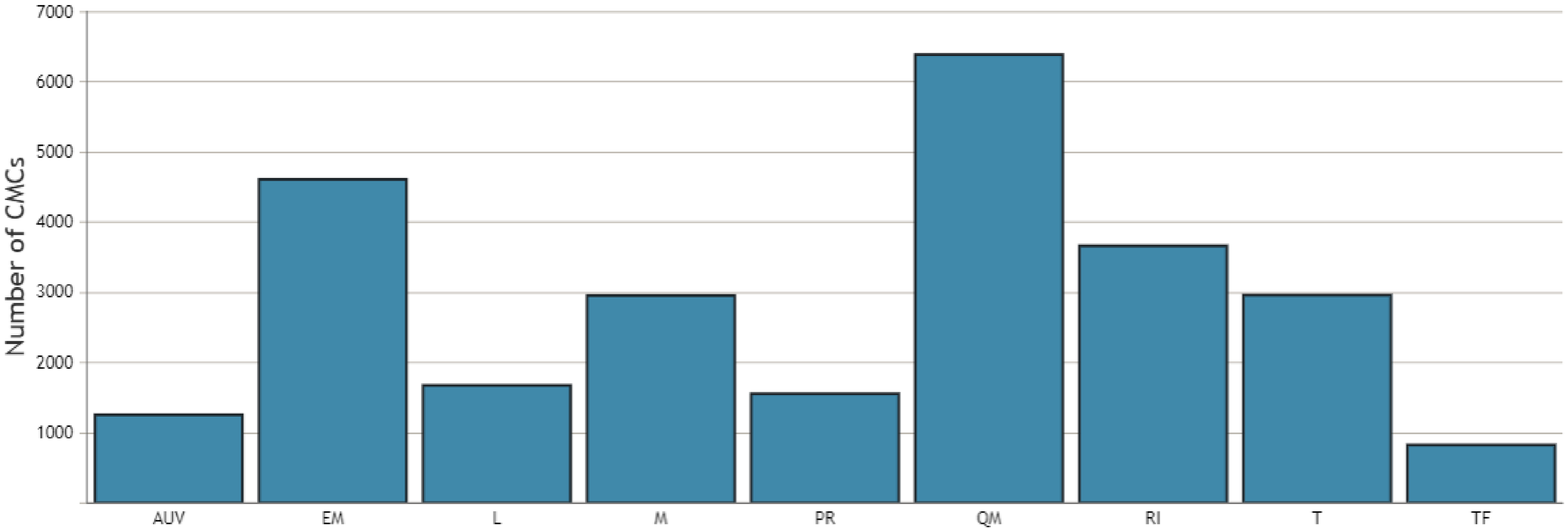
- The NCSLI MII & Automation Committee (MII&AC) and its collaborators continues to develop a taxonomy to uniquely identify and distinguish measurands in machine-actionable digital metrology documents such as calibration certificates, accreditation scopes, and instrument specifications.

Instrument Specification:	Source.Voltage.DC
Scope of Accreditation:	Measure.Voltage.DC
Calibration Certificate:	Source.Voltage.DC

- The taxonomy constitutes a publicly available reference metadata set, the mortar that joins the building blocks of digital measurement data together.

The BIPM Key Comparison Database

- The BIPM KCDB publishes the CMCs of NMIs and DIs participating in the CIPM MRA
- Nearly 26,000 CMCs organized by metrology area
- 4575 CMCs in Electricity and Magnetism



KCDB Classification of Services

Service Number	Service
BRANCH: DC VOLTAGE, CURRENT, AND RESISTANCE	
1	DC voltage (up to 1100 V, for higher voltages see 8.1)
2	DC resistance
3	DC current (up to 100 A, for higher currents see 8.7)
BRANCH: IMPEDANCE UP TO THE MEGAHERTZ RANGE	
4	Impedance (up to the MHz range)
BRANCH: AC VOLTAGE, CURRENT, AND POWER	
5	AC voltage (up to the MHz range)
6	AC current
7	AC power
BRANCH: HIGH VOLTAGE AND CURRENT	
8	High voltage and current
BRANCH: OTHER DC AND LOW FREQUENCY MEASUREMENTS	
9	Other DC and low frequency measurements
BRANCH: ELECTRIC AND MAGNETIC FIELDS	
10	Electric and magnetic fields
BRANCH: RADIO FREQUENCY MEASUREMENTS	
11	Radio frequency measurements
BRANCH: MATERIALS	
12	Measurements on materials

Taxa in “DC Voltage”.

Classification	Taxon
1. DC voltage (up to 1100 V, for higher voltages see 8.1)	
1.1 DC voltage sources	
1.1.1 Single values: standard cell, solid state voltage standard	Measure.Voltage.DC
1.1.2 Low value ranges (below or equal to 10 V): DC voltage source, multifunction calibrator	Measure.Voltage.DC
1.1.3 Intermediate values (above 10 V to 1100 V): DC voltage source, multifunction calibrator	Measure.Voltage.DC
1.1.4 Noise voltages (for noise currents see 3.1.5, for RF noise see 11.4): DC voltage source, DC amplifier	**Measure.Voltage.AC.Ripple.OnDC**
1.2 DC voltage meters	
1.2.1 Very low values (below or equal to 1 mV): nanovoltmeter, microvoltmeter	Source.Voltage.DC
1.2.2 Intermediate values (above 1 mV to 1100 V): DC voltmeter, multimeter, multifunction transfer standard	Source.Voltage.DC
1.3 DC voltage ratios (for input voltages up to 1100 V)	
1.3.1 Up to 1100 V: resistive divider, ratio meter	**Source.Ratio.Voltage.DC** **Measure.Ratio.Voltage.DC**
1.3.2 Attenuation: attenuators	Measure.Ratio.Voltage.DC

Taxa in “DC Resistance”.

Classification	Taxon
2. DC resistance	
2.1 DC resistance standards and sources	
2.1.1 Low values (below or equal to 1 Ω): fixed resistor, resistance box	Measure.Resistance.DC
2.1.2 Intermediate values (above 1 μΩ to 1 MΩ): fixed resistor, resistance box	Measure.Resistance.DC
2.1.3 High values (above 1 MΩ): fixed resistor, three terminal resistor, resistance box	Measure.Resistance.DC
2.1.4 Standards for high current: DC shunt	Measure.Resistance.DC
2.1.5 Multiple ranges: multifunction calibrator	Measure.Resistance.DC
2.1.6 Temperature, power and pressure coefficients: fixed resistor	**Measure.Coefficient.Resistance.Temperature.DC** **Measure.Coefficient.Resistance.Power.DC** **Measure.Coefficient.Resistance.Pressure.DC**
2.2 DC resistance meters	
2.2.1 Low values (below or equal to 1 Ω): microohmmeter, multimeter, multifunction transfer standard, resistance bridge	Source.Resistance.DC
2.2.2 Intermediate values (above 1 Ω to 1 GΩ): ohmmeter, multimeter, multifunction transfer standard, resistance bridge	Source.Resistance.DC
2.2.3 High values (above 1 GΩ): multimeter, multifunction transfer standard, teraohmmeter, resistance bridge	Source.Resistance.DC
2.3 DC resistance ratios	
2.3.1 DC resistance ratios: resistance ratio devices	Measure.Ratio.Resistance.DC

Taxa in “DC Current”.

Classification	Taxon
3. DC current (up to 100 A, for higher currents see 8.7)	
3.1 DC current sources	
3.1.1 Low values (below or equal to 0.1 mA): current generator, multifunction calibrator	Measure.Current.DC
3.1.2 Intermediate values (above 0.1 mA to 20 A): current generator, multifunction calibrator	Measure.Current.DC
3.1.3 High values (above 20 A to 100 A): current generator	Measure.Current.DC
3.1.4 Transconductance ratio	Measure.Conductance.DC
3.1.5 Noise currents (for noise voltages see 1.1.4, for RF noise see 11.4): DC current source, DC amplifier	**Measure.Current.AC.Ripple.OnDC**
3.2 DC current meters	
3.2.1 Low values (below or equal to 0.1 mA): picoammeter, nanoammeter, multimeter, multifunction transfer standard	Source.Current.DC
3.2.2 Intermediate values (above 0.1 mA to 20 A): current comparator	Source.Current.DC
3.2.3 High values (above 20 A to 100 A): current transducer, dedicated equipment for heavy current	Source.Current.DC
3.3 DC current ratios	
3.3.1 Ratios up to 100 A: resistive dividers, DC current comparators, current transducers	Source.Ratio.Current.DC

Taxa in “Impedance up to the Megahertz Range”

Classification	Taxon
4. Impedance (up to the MHz range)	
4.1 AC resistance	
4.1.1 Real component (or modulus) and imaginary component (or argument or time constant): fixed resistor	**Measure.Resistance.AC.Sinewave**
4.1.2 AC/DC difference: fixed resistor	Measure.Resistance.AC.Sinewave.Delta.Frequency
4.1.3 Resistors for high current: AC current shunt	Measure.Resistance.AC.Sinewave
4.1.4 Meters: LCR meter (LCR: Inductance, Capacitance, Resistance)	Source.Resistance.AC.Sinewave
4.1.5 AC resistance ratios: resistance ratio devices	Measure.Ratio.Resistance.AC.Sinewave
4.2 Capacitance	
4.2.1 Capacitance and dissipation factor for low loss capacitors: standard capacitor (sealed, dry nitrogen or fused silica dielectric)	**Measure.Capacitance** **Measure.Ratio.Impedance.DissipationFactor**
4.2.2 Capacitance and dissipation factor for dielectric capacitors: fixed capacitor, switched capacitor, capacitance box	Measure.Capacitance Measure.Ratio.Impedance.DissipationFactor
4.2.3 Capacitance and dissipation factor for transformed capacitors: fixed capacitor, switched capacitor	Measure.Capacitance Measure.Ratio.Impedance.DissipationFactor
4.2.4 Meters: capacitance bridge, LCR meter (LCR: Inductance, Capacitance, Resistance)	Source.Capacitance Source.Ratio.Impedance.DissipationFactor

Taxa in “Impedance up to the Megahertz Range”

Classification	Taxon
4. Impedance (up to the MHz range)	
4.3 Inductance	
4.3.1 Self-inductance and equivalent series resistance, low values (lower than 1 mH): fixed inductor, variable inductor, inductance box	Measure.Inductance Measure.Resistance.SeriesEquivalent.Inductance
4.3.2 Self-inductance and equivalent series resistance, intermediate values (above or equal to 1mH to 1 H): fixed inductor, variable inductor, inductance box	Measure.Inductance Measure.Resistance.SeriesEquivalent.Inductance
4.3.3 Self-inductance and equivalent series resistance, high values (higher than 1 H): fixed inductor, variable inductor, inductance box	Measure.Inductance Measure.Resistance.SeriesEquivalent.Inductance
4.3.4 Mutual inductance: fixed mutual inductor	Measure.Inductance
4.3.5 Meters: LCR meter (LCR: Inductance, Capacitance, Resistance)	Source.Inductance
4.3.6 Quality factor: Q-standards	Measure.Ratio.Impedance.QualityFactor

Taxa in “AC Voltage”

Classification	Taxon
5. AC voltage (up to the MHz range)	
5.1 AC/DC voltage transfer (for frequencies higher than 1 MHz see 11.7.1)	
5.1.1 AC/DC transfer difference at low voltages (typically below or equal to 0.5 V): thermal converter with amplifier, micropotentiometer, AC/DC transfer standard	Measure.Voltage.AC.Sinewave.Delta.Frequency
5.1.2 AC/DC transfer difference at medium voltages (typically above 0.5 V to 5 V): thermal converter (directly connected), AC/DC transfer standard	Measure.Voltage.AC.Sinewave.Delta.Frequency
5.1.3 AC/DC transfer difference at higher voltages (typically above 5 V): thermal converter with range extender, AC/DC transfer standard	Measure.Voltage.AC.Sinewave.Delta.Frequency
5.2 AC voltage up to 1100 V (for high voltage see 8.3)	
5.2.1 Sources: multifunction calibrator	Measure.Voltage.AC.Sinewave
5.2.2 Meters: AC voltmeter, multimeter, multifunction transfer standard	Source.Voltage.AC.Sinewave
5.3 AC voltage ratio up to 1100 V (voltage transformers excluded), attenuation and gain (for high voltage and voltage transformers, see 8.3)	
5.3.1 Real component (or modulus) and imaginary component (or argument): inductive voltage divider, AC bridge standard, attenuator box, syncro-resolver	Measure.Ratio.Voltage.AC.Sinewave
5.3.2 Attenuation and gain: passive device, attenuator box, inductive voltage divider	Measure.Ratio.Voltage.AC.**Sinewave**

Taxa in “AC Current”

Classification	Taxon
6. AC current	
6.1 AC/DC current transfer	
6.1.1 AC/DC transfer difference: thermal converter plus shunt, AC/DC transfer standard plus shunt	Measure.Current.AC.Sinewave.Delta.Frequency
6.2 AC current up to 100 A (for high current see 8.6)	
6.2.1 Sources: multifunction calibrator, transconductance amplifier	Measure.Current.AC.Sinewave **Measure.Conductance.AC.Sinewave**
6.2.2 Meters: AC ammeter, multimeter, multifunction transfer standard	Source.Current.AC.Sinewave
6.3 AC current ratio up to 100 A (current transformers excluded, for high current and current transformers, see 8.6)	
6.3.1 Real component (or modulus) and imaginary component (or argument)	Measure.Ratio.Current.AC.Sinewave

Taxa in “AC Power”

Classification	Taxon
7. AC power; 7.1 AC power and energy	
7.1.1 Single phase (frequencies below or equal to 400 Hz): power meter, energy meter, power converter, wattmeter 7.1.2 Single phase (frequencies above 400 Hz): power meter, energy meter, power converter, wattmeter	Source.Power.AC.Sinewave.**1Phase**
	Measure.Power.AC.Sinewave.1Phase
	Source.Energy.AC.Sinewave.1Phase
	Measure.Energy.AC.Sinewave.1Phase
	Source.Power.AC.Sinewave.1Phase.**Simulated**
	Measure.Power.AC.Sinewave.1Phase.Simulated
	Source.Energy.AC.Sinewave.1Phase.Simulated
	Measure.Energy.AC.Sinewave.1Phase.Simulated
7.1.3 Three phase: power meter, energy meter	Source.Power.AC.Sinewave.**3Phase**
	Measure.Power.AC.Sinewave.3Phase
	Source.Energy.AC.Sinewave.3Phase
	Measure.Energy.AC.Sinewave.3Phase
	Source.Power.AC.Sinewave.3Phase.Simulated
	Measure.Power.AC.Sinewave.3Phase.Simulated
	Source.Energy.AC.Sinewave.3Phase.Simulated
	Measure.Energy.AC.Sinewave.3Phase.Simulated

Taxa in “Radio Frequency Measurements”

Classification	Taxon
11 EM/RF Radio frequency measurements	
11.1 EM/RF RF power	
11.1.1 EM/RF Absolute power in coaxial line 11.1.2 EM/RF Absolute power in waveguide	Measure.Power.**AC**.Sinewave Source.Power.**AC**.Sinewave
11.1.3 EM/RF Calibration factor and effective efficiency in coaxial line 11.1.4 EM/RF Calibration factor and effective efficiency in waveguide	Measure.Ratio.Power.**AC**.Sinewave.Delta.Frequency Source.Ratio.Power.**AC**.Sinewave.Delta.Frequency
11.1.5 EM/RF Non-CW power (absolute or relative)	Measure.Power.AC.**PulseModulation** Measure.Ratio.Power.AC.PulseModulation.Delta.Sinewave Measure.Power.AC.DigitalModulation Source.Power.AC.PulseModulation Source.Ratio.Power.AC.PulseModulation.Delta.Sinewave Source.Power.AC.DigitalModulation
11.1.6 EM/RF Power measurements in balanced lines	Measure.Ratio.Power.Transmission.AC.Sinewave Measure.Ratio.Power.Reflection.AC.Sinewave

Taxa in “Radio Frequency Measurements”

Classification	Taxon
11.2 EM/RF Scalar RF reflection coef. and attenuation	
11.2.1 EM/RF Reflection coefficient in coaxial line 11.2.2 EM/RF Reflection coefficient in waveguide	Measure.Ratio.Power.Reflection.AC.Sinewave
11.2.3 EM/RF Attenuation in coaxial line (values in dB) 11.2.4 EM/RF Attenuation in waveguide (values in dB)	Measure.Ratio.Power.Transmission.AC.Sinewave
11.2.5 EM/RF Directivity, effective source match	Measure.Ratio.Power.Directivity.AC.Sinewave Measure.Ratio.Power.SourceMatch.AC.Sinewave
11.2.6 EM/RF Reflection and attenuation measurements in balanced lines	Measure.Ratio.Power.Reflection.AC.Sinewave Measure.Ratio.Power.Transmission.AC.Sinewave

Taxa in “Radio Frequency Measurements”

Classification	Taxon
11.3 EM/RF Scattering parameters (vectors)	
11.3.1 EM/RF Reflection coefficient in coaxial line (real and imaginary) 11.3.2 EM/RF Reflection coefficient in waveguide (real and imaginary)	Measure.Ratio.Power.Reflection.AC.Sinewave Measure.Phase.Reflection.AC.Sinewave
11.3.3 EM/RF Transmission coefficient in coaxial line (real and imaginary) 11.3.4 EM/RF Transmission coefficient in waveguide (real and imaginary)	Measure.Ratio.Power.Transmission.AC.Sinewave Measure.Phase.Transmission.AC.Sinewave
11.3.5 EM/RF Directivity, effective source match	Measure.Ratio.Power.Directivity.AC.Sinewave Measure.Ratio.Power.SourceMatch.AC.Sinewave
11.3.6 EM/RF Reflection coefficient for common mode systems	Measure.Ratio.Power.Reflection.AC.Sinewave Measure.Phase.Reflection.AC.Sinewave
11.3.7 EM/RF Transmission coefficient for common mode systems	Measure.Ratio.Power.Transmission.AC.Sinewave Measure.Phase.Transmission.AC.Sinewave
11.3.8 EM/RF Reflection coefficient (Sii) in planar line systems	Measure.Ratio.Power.Reflection.AC.Sinewave Measure.Phase.Reflection.AC.Sinewave
11.3.9 EM/RF Transmission coefficient (Sij) in planar line systems	Measure.Ratio.Power.Transmission.AC.Sinewave Measure.Phase.Transmission.AC.Sinewave

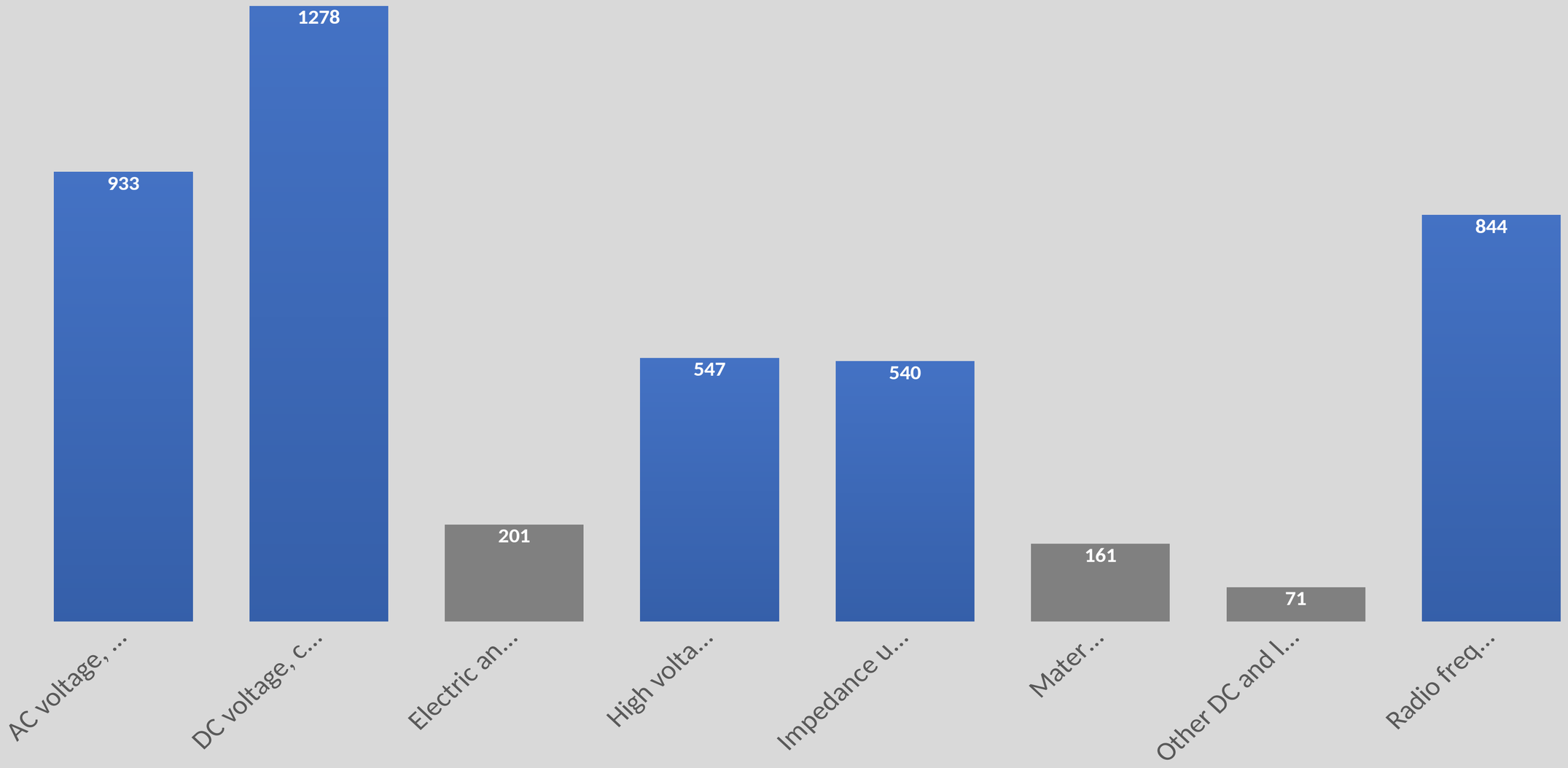
Taxa in “Radio Frequency Measurements”

Classification	Taxon
11.4 EM/RF Noise	
11.4.1 EM/RF Noise temperature or excess noise ratio in coaxial line 11.4.2 EM/RF Noise temperature or excess noise ratio in waveguide	Measure.Noise.AC Measure.Ratio.Noise.AC
11.4.3 EM/RF Amplifier noise parameters	Measure.Ratio.Noise.AC.Delta.Power
11.4.4 EM/RF Phase noise	Measure.Ratio.Noise.Sideband
11.4.5 EM/RF Radio brightness temperature, spectral radiance in free space	**Measure.Noise.AC**
11.5 EM/RF Antenna properties	
11.5.1 EM/RF Antenna factor	Measure.Ratio.Power.AntennaFactor
11.5.2 EM/RF Antenna gain	Measure.Ratio.Power.AntennaGain
11.5.3 EM/RF Other properties (pattern, beam width, . . .)	**TBD**
11.6 EM/RF Signal and pulse characteristics	
11.6.1 EM/RF Pulse amplitude	Measure.Power.AC.PulseModulation
11.6.2 EM/RF Pulse time parameters	Measure.Time.Transition.PulsedRF
11.6.3 EM/RF Modulation, AM and FM	Measure.Ratio.AmplitudeModulation Measure.Frequency.FrequencyModulation.Deviation
11.6.4 EM/RF Distortion and harmonic content	Measure.Ratio.Power.AC.Sinewave.Harmonic Measure.Ratio.Distortion.AmplitudeModulation Measure.Ratio.Distortion.FrequencyModulation Measure.Ratio.Distortion.PhaseModulation

Taxa in “Radio Frequency Measurements”

Classification	Taxon
11.7.4 EM/RF RF current	Measure.Current.AC.Sinewave Source.Current.AC.Sinewave
11.7.5 EM/RF RF transfer impedance	**TBD**
11.7.6 EM/RF RF voltage division factor	Measure.Ratio.Current.AC.Sinewave
11.7.7 EM/RF RF coupling factor	Measure.Ratio.Power
11.7.8 EM/RF Flatness of RF voltage sources	Measure.Ratio.Power.Delta.Frequency
11.7.9 EM/RF Flatness of RF voltage meters	Source.Ratio.Power.Delta.Frequency
11.8 EM/RF Lumped impedance - admittance	
11.8.1 EM/RF Resistance or conductance	**Measure.Resistance.AC** **Measure.Conductance**
11.8.2 EM/RF Inductance	**Measure.Inductance**
11.8.3 EM/RF Capacitance	**Measure.Capacitance**
11.8.4 EM/RF Quality factor	**Measure.Ratio.Impedance.QualityFactor**
11.9 EM/RF RF characteristic impedance	
11.9.1 EM/RF Mechanical dimensions	**Measure.Length.Diameter.Inner** **Measure.Length.Diameter.Outer** **Measure.Length**
11.9.2 EM/RF Electrical parameters	Measure.Impedence

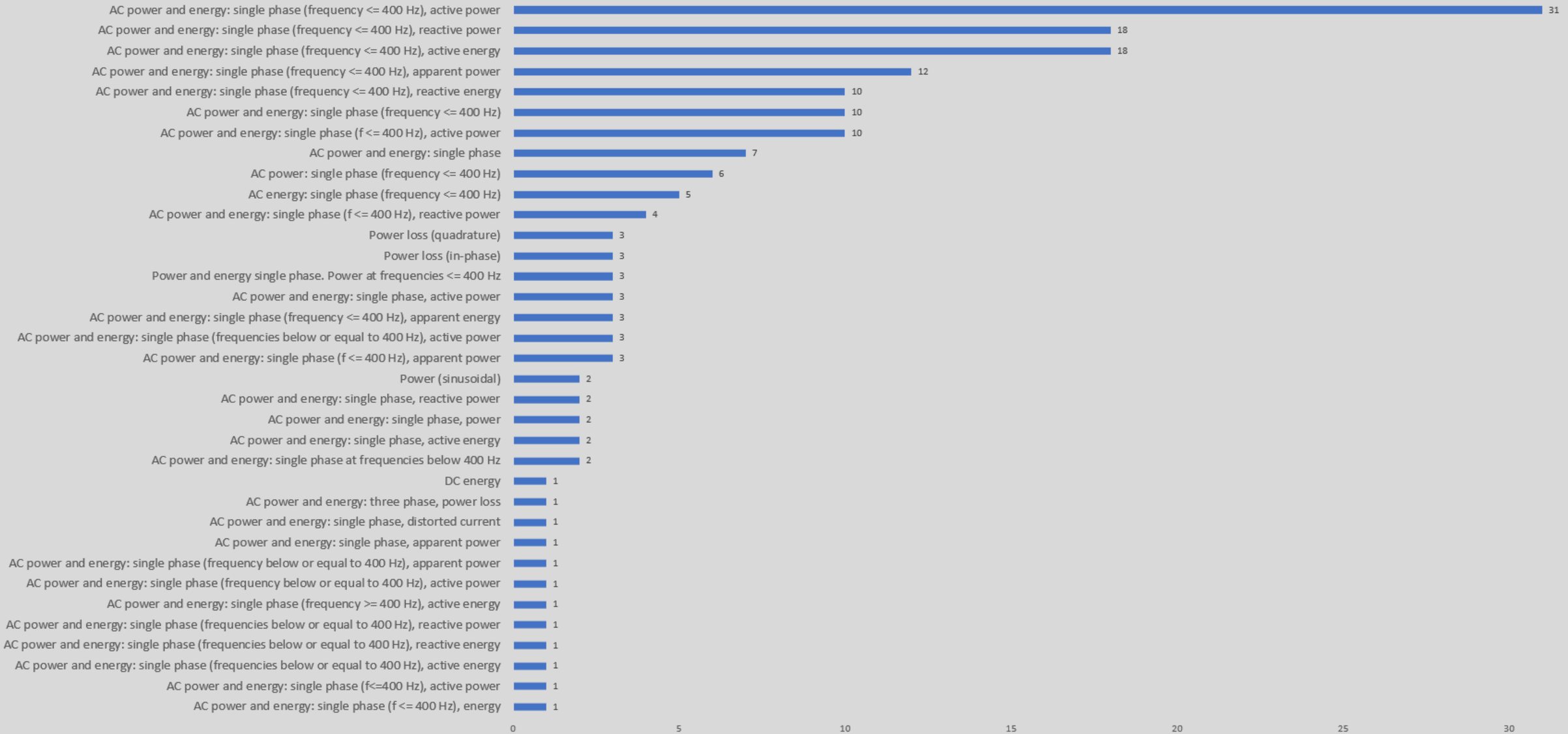
Results and CMC Coverage



Taxa in “AC Power”

Classification	Taxon
7. AC power; 7.1 AC power and energy	
7.1.1 Single phase (frequencies below or equal to 400 Hz): power meter, energy meter, power converter, wattmeter 7.1.2 Single phase (frequencies above 400 Hz): power meter, energy meter, power converter, wattmeter	Source.Power.AC.Sinewave.1Phase
	Measure.Power.AC.Sinewave.1Phase
	Source.Energy.AC.Sinewave.1Phase
	Measure.Energy.AC.Sinewave.1Phase
	Source.Power.AC.Sinewave.1Phase.Simulated
	Measure.Power.AC.Sinewave.1Phase.Simulated
	Source.Energy.AC.Sinewave.1Phase.Simulated
	Measure.Energy.AC.Sinewave.1Phase.Simulated
7.1.3 Three phase: power meter, energy meter	Source.Power.AC.Sinewave.3Phase
	Measure.Power.AC.Sinewave.3Phase
	Source.Energy.AC.Sinewave.3Phase
	Measure.Energy.AC.Sinewave.3Phase
	Source.Power.AC.Sinewave.3Phase.Simulated
	Measure.Power.AC.Sinewave.3Phase.Simulated
	Source.Energy.AC.Sinewave.3Phase.Simulated
	Measure.Energy.AC.Sinewave.3Phase.Simulated

Results and CMC Coverage - Section 7.1.1



Quantities for Single Phase Active Power

AC power and energy: single phase (f <= 400 Hz), active power
AC power and energy: single phase (f<=400 Hz), active power
AC power and energy: single phase (frequencies below or equal to 400 Hz), active power
AC power and energy: single phase (frequency <= 400 Hz), active power
AC power and energy: single phase (frequency below or equal to 400 Hz), active power
AC power and energy: single phase, active power

Summary

The review of the KCDB “Classification of Services in Electricity and Magnetism” has provided a valuable test of the MII taxonomy.

This project will likely result in updates to the draft taxonomy specification document under development via the GitHub repository [5], such as clarifying the guidance and strategy for using tokens as opposed to parameters to distinguish similar measurands.

The KCDB classification scheme provides a definitive list of the measurement services provided by NMIs and DIs and mapping this to the MII taxonomy provides a confidence check on the completeness of both classification systems.

In most branches the individual service in the classification system would map to 1 or at most 2 taxa, but there are some branches where the relationships are more complicated.

We have proposed updates to the MII taxonomy and will provide similar comments to the CCEM for their consideration.

Acknowledgments

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Further Information

- CIPM MRA: https://www.bipm.org/en/cipm-mra
- KCDB (and API): https://www.bipm.org/kcdb/
- BIPM Digital transformation: https://www.bipm.org/en/digital-transformation
- More info on the MII: http://miiknowledge.wikidot.com/
- Public taxonomy project: https://github.com/NCSLI-MII/measurand-taxonomy
- Monday meetings on the taxonomy (1 pm US Mountain): https://global.gotomeeting.com/join/909871373

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Thank you for listening