Specific Accreditation Criteria

ISO/IEC 17025 Application Document

Manufactured Goods - Annex

Electromagnetic Compatibility (EMC) testing

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Table of Contents ***to be updated at final draft***

Electromagnetic Compatibility (EMC) testing

This document provides interpretative criteria and recommendations for the application of ISO/IEC 17025 for both applicant and accredited facilities conducting EMC testing.

Applicant and accredited facilities must comply with all relevant documents in the NATA Accreditation Criteria (NAC) package for Manufactured Goods (refer to the publication *NATA procedures for accreditation*).

The clause numbers in this document follow those of ISO/IEC 17025; however, since not all clauses require interpretation, the numbering may not be consecutive.

Scope of Accreditation

The scope of accreditation will identify test sites, such as Open Area Test Sites (OATS) and Anechoic Chambers.

The addition of test sites will be processed as a variation to the scope of accreditation following receipt of a written request from a facility.

6 Resource requirements

6.3 Facilities and environmental conditions

6.3.5

Antenna calibration methods

The facility shall take necessary precautions to ensure that any systemic imperfections or responses in the calibration/verification site are not transferred to testing. For example, by using different sites for calibration/verification activities and testing activities or using different parts of the same site.

A facility that performs calibrations on antennas that are used for IEC/CISPR radiated emission testing are expected to demonstrate that the site meets the applicable CALTS (Calibration Test Site) requirements, e.g. CISPR 16.1.5, ANSI C63.5, SAE ARP958, etc.

Test sites – ambient signals

In the case of anechoic test chambers, the facility must be able to demonstrate that testing is not affected by any unwanted signals in the test environment, e.g., due to leakage from ambient signals outside the test chamber.

It is not acceptable to exclude part of the frequency range from testing due to unwanted emissions.

Note: Facilities seeking accreditation for radiated measurements conducted at an OATS will be asked to submit details of ambient signals prior to lodging an application.

The ambient levels for the OATS must be monitored and records made available at assessment. Facilities will be expected to demonstrate their management of sites with high ambient levels through their methodology, procedures, and records.

6.4 Equipment

6.4.1

Antennas for compliance measurements

Antennas must have appropriate correction factors to allow an estimate of the field strength to be formed from the measured voltage at their terminals (commonly termed an “antenna correction factor”). The antennas must comply with any ground clearance, directivity, polarisation, or other specifications within the relevant standards.

Facilities must be able to demonstrate access to particular types of antennas where these are specified by test standards within the scope, e.g., MIL-STD-461 specifies particular antenna types for some tests.

EMI receiver compliance with CISPR

Receivers used for IEC/CISPR tests must be compliant with CISPR 16 specifications.

Emissions testing

For emissions testing to radiated emission standards based on the relevant IEC/CISPR standards, the applicable equipment, instrumentation, and test facilities are all expected to comply with the requirements of the relevant parts of the CISPR 16 series, as well as any requirements of relevant product-specific standards.

Radiated and Conducted RF Immunity

The facility must be able to demonstrate that power amplifiers used for radiated and conducted immunity tests have sufficient power to produce the required output whilst meeting any requirements for harmonics and distortion contained in the applicable standard. For tests requiring amplitude modulation (for example, 80% AM, as required by IEC 61000-4-3 and IEC 61000-4-6), the additional voltage swing at the output level required to accommodate the modulated waveform must be considered.

Test sites – ambient signals

OATS must also comply with the applicable requirements of AS/NZS CISPR 16.1.4 for the entire frequency range indicated within the applicable test requirements. Sites with broad frequency bands masked by ambient signals, such that they would be classified as being in category d) of clause 5.4 in AS/NZS CISPR 16.1.4, will not be considered acceptable for accreditation.

6.4.7

Facilities must ensure that where equipment calibration and checking intervals are included in standard methods or specifications, these intervals are followed.

Facilities are advised to consider factors affecting the stability of test and measurement equipment when determining recalibration intervals, including:

- whether equipment is used outside the laboratory’s normal premises (e.g., subject to possible transit wear/damage due to frequent field work, transport to OATS);
- the effect of high transmit power on immunity equipment that is also used for emissions tests (e.g., antennas, coupling-decoupling networks);

- the effect of exposure to the moisture and temperature cycling, especially on items that are used in outdoor tests (e.g., cables and amplifiers that may be used at an OATS);
- the effect of high current loads, including high inrush currents, on items that carry EUT supply current (e.g., LISNs, transient immunity generators and coupling devices).

Equipment verifications or calibrations typically performed in-house by accredited EMC facilities may be assessed at the time of the NATA assessment. This can include RF absorber quality checks, performance checks on transient and power immunity generators, NSA (or site VSWR) measurements, insertion loss/gain measurements, and antenna calibration to SAE ARP958. For other equipment, additional assessment resources may be required to have the method and traceability of in-house calibrations adequately assessed.

The following informative table pertains to equipment having specific application to EMC testing. Facilities must consider this information in conjunction with the requirements outlined in the NATA publications *General Accreditation Criteria: Equipment assurance, in-house calibration and equipment verification,* and the *General Accreditation Criteria: Metrological Traceability Policy.*

Item	Calibration interval (years)	Checking interval (months)	Comments
Amplifiers			
RF amplifiers where the gain is used to correct systematic errors in the measurement system	1		The amplifier's S-parameters should be checked annually to provide information about gain and impedance match, both of which can contribute to measurement errors in a complex system.
Antennas (EMC, non-ionising radiation hazards)			
Antennas and loop probes used for measuring RF field strength	1 to 3		Working antennas used for field strength measurements should be calibrated against a reference antenna annually. Reference antennas should be calibrated every 3 years and their storage and use between calibrations should be carefully managed. The NSA for test sites is recommended to occur at least every 12 months.
Attenuators			
Attenuators used in RF measurements where the loss is compensated as a systematic error in the measurement system	1		S-parameters should be checked annually, for example by using a network analyser as a reference instrument.

Item	Calibration interval (years)	Checking interval (months)	Comments
Cables (coaxial)			
Coaxial cables used where their loss is accounted for as a systematic error	1		Annual check, for example using a network analyser as a reference instrument.
Current Probes (RF)			
Clamp-on RF current probes where the coupling factor is used to compensate for systematic errors in the measurement system	1		Calibration should be performed annually to ensure that the probe is in good working order and to provide the coupling factor across the frequency range of interest. RF current probes usually use ferrite and are susceptible to damage due to dropping or impact.
RF and EMC equipment			
Spectrum analysers, signal generators, network analysers, RF power meters and sensors, oscilloscopes, function generators	1 – 2 years or OEM recommendation		Calibration intervals should be chosen by the laboratory, taking account of the equipment's use environment (laboratory or field), the equipment manufacturer's recommendations.
Transient disturbance generators (e.g. ESD, EFT, Lightning, etc.)	1 – 2 years or OEM recommendation		Additional verification of the waveform may be required by the technical standard specifying the test. In some cases, verification of the waveform may be sufficient without additional calibration.
RF field strength meters and probes	1 – 2 years or OEM recommendation	Check on use as required by the application	Field strength meters may be damaged in transit to field sites or by exposure to excessive RF field strength, which is dangerous when they are used for RF hazard testing (failure mode can be to read zero). Best practice in RF hazard measurement is to perform pre- and post-survey reference checks on the probe.
RF power amplifiers	Not generally required		The output of RF power amplifiers used in EMC and RF testing is usually verified during the test with a calibrated reference instrument such as a current probe or field strength meter. Calibration of the amplifier itself is not normally required for these applications.

Item	Calibration interval (years)	Checking interval (months)	Comments
Impedance Stabilisation Networks (ISNs)			
LISNs (Line Impedance Stabilisation Networks)	1		Calibrate across frequency range of use. Calibration should include magnitude and phase response for all lines, and should include load and no-load tests unless inductors are air-cored. Calibration should also include the coupling factor between the EUT terminals and the measurement port, if fitted.
Telecommunications and network ISNs and coupling adapters	1 or OEM recommendation		Calibrate across frequency range of use as required by the standard specifying use of the ISN.

EMI receiver compliance with CISPR

It is recognised that the CISPR requirements for pulse response calibration present difficulties in sourcing complete and traceable calibrations. Other parameters can be calibrated by accredited facilities within Australia.

In the absence of either a CISPR pulse calibration service by the NMI or an accredited facility within Australia, facilities are required to source what calibrations are available.

7 Process requirements

7.2 Selection, verification and validation of methods

7.2.1 Selection and verification of methods

7.2.1.1

Antenna calibration methods

For antenna calibrations (refer section 6.4 for limits on applicability), the methods used are to be consistent with those referenced by the test standards covered by the facility's scope of accreditation.

Appropriate uncertainty budgets for antenna calibrations and reference checks, in accordance with any requirements in the referenced methods, are necessary.

Pre-screening of equipment

Facilities using OATS with ambient signals above the limits which would place them in categories b) or c) as defined in CISPR 16.1.4 are to apply pre-screening of equipment under test and maintain records of this activity. This is to ensure that emissions which might be masked by ambient signals are identified and quantified.

Compliance with the relevant clause of the standard cannot be stated unless the testing has been performed over the entire frequency range defined.

Testing above 1 GHz for IEC/CISPR Standards

Facilities must be able to demonstrate their ability to test above 1 GHz, otherwise the scope of accreditation will be restricted to an appropriate frequency range.

Test site validation

When performing a normalised site validation, it must be noted that the data obtained will have uncertainties of such magnitude that will make it difficult to determine unequivocal compliance with the CISPR requirements (i.e. all points to be within ± 4 dB of the theoretical curve). As such, consideration should be given to how these uncertainties may be kept to a minimum.

The Normalised Site Attenuation or Voltage Standing Wave Ratio (CISPR 16.1.4 above 1 GHz) for the site must comply with CISPR 16.1.4.

US FCC rules

Facilities seeking accreditation for US FCC Rules Part 15 must meet the requirements for accreditation to CISPR 32 or ANSI C63.4 as well as the additional requirements specified in Part 15 itself.

7.2.1.3

US FCC rules

Facilities seeking accreditation for US FCC Rules must demonstrate that they have adequate systems in place to ensure that their copies of FCC Rules are up-to-date, and that they have a reliable system for monitoring new FCC rulings relating to this area.

7.5 Technical records

7.5.1

Radiated and conducted RF immunity

Facilities must ensure that data used to correlate the forward RF power to the output level (field strength, induced current or voltage, as applicable) is stored appropriately for each test performed, so that tests could be reproduced using the same reference forward power data if necessary.

Data can be manually or automatically recorded. If automatic (e.g., computer controlled) systems are used, the stored reference data and test results must be identified with the relevant system software version details, including relevant information regarding the software operational environment.

The facility's records system must be able to link every test performed to an applicable set of calibration data, captured at the time of the test.

7.6 Evaluation of measurement uncertainty

7.6.1 Measurement uncertainty estimates for radiated emission tests must properly account for test distance and antenna type, where the interaction between these two parameters can influence the measurement result.

7.8 Reporting of results

7.8.1 General

7.8.1.2 In addition to the requirements specified for test reports (including any customer or regulatory requirements), the following information is to be included in reports on EMC tests:

- for CISPR-based testing, where other than a 'category a)' OATS has been used, a statement that additional screening procedures have been used to identify emissions masked by ambient signals;
- information which will adequately identify any modifications made to the equipment under test for compliance purposes in the course of the testing;
- where appropriate, diagrams or photographs which show test configurations critical to the measurement results;
- clear identification of any ambient emissions in cases where test results are provided in a tabular or graphical form;
- a clear description of the test configuration and operating conditions during the test; and,
- photographs of test setups.

Facilities accredited for US FCC Rules Part 15

Customers who intend to use the FCC Supplier's Declaration of Conformity (SDoC) or Declaration of Conformity (DoC) must be provided with the additional information as required by the FCC.

References

This section lists publications referenced in this document. The year of publication is not included as it is expected that only current versions of the references shall be used.

Standards

AS/NZS IEC 61000.4.3	*Electromagnetic compatibility (EMC) Testing and measurement techniques - Radiated radiofrequency electromagnetic field immunity test*
AS/NZS IEC 61000.4.6	*Electromagnetic compatibility (EMC) Testing and measurement techniques - Immunity to conducted disturbances, induced by radiofrequency fields*
AS/NZS CISPR 16.1.4	*Specification for radio disturbance and immunity measuring apparatus and methods, Part 1.4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements (CISPR 16-1-4:2019 (ED 4.0) MOD)*
AS/NZS CISPR 16.1.5	*Specification for radio disturbance and immunity measuring apparatus and methods, Part 1.5: Radio disturbance and immunity measuring apparatus - Antenna calibration sites and reference test sites for 5 MHz to 18 GHz*
AS/NZS CISPR 32	*Electromagnetic compatibility of multimedia equipment - Emission requirements*
FCC Rules Part 15	*US Code of Federal Regulations, Title 47, Part 15 - Radio Frequency Devices*
IEEE/ANSI C63.4	*Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz*
IEEE/ANSI C63.5	*Radiated Emission Measurements in Electromagnetic Interference (EMI) Control--Calibration and Qualification of Antennas (9 kHz to 40 GHz)*
ISO/IEC 17025	*General requirements for the competence of testing and calibration laboratories*
MIL-STD-461	*Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment*
SAE ARP398	*Electromagnetic Interference Measurement Antennas; Calibration Method*

NATA publications

NATA Accreditation Criteria (NAC) package for Manufactured Goods

Amendment Table

The table below provides a summary of changes made to the document with this issue.

Section or Clause	Amendment
Whole document	Minor editorial amendments.
6.4.7	Additional informative table of equipment calibration and checking intervals.
7.8.1.2	Added new reporting requirement.