Conducted Emissions Testing Procedure

Revision 1.2

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Revision History

Version	**Release Date**	**Notes**
1.0	April 2025	First draft
1.1	January 2026	• Revision History / Header (Page 1) – bumped to Rev 1.1 • Testing Methodology (≈ pages 10–11) – certification-grade details added • NEW sections inserted after Methodology (≈ pages 11–12): • Test Environment and Configuration • Load Condition Justification (50 W) • Measurement Parameters (RBW, sweep/QP) • Pass / Fail Criteria • Results & Interpretation (≈ page 12) – clarified margin & compliance logic
1.2	February 2026	• Added equipment requirements according to the ISO 16-2-1 and 16-1-x standards.

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Definitions

To ensure clarity in the analysis of electromagnetic emissions, especially in the context of compliance testing for PC power supply units (PSUs), the following key terms and concepts are defined:

Electromagnetic Interference (EMI)

EMI refers to unwanted electromagnetic energy that disrupts or degrades the performance of electronic equipment. EMI can originate from internal sources within the system or external sources such as nearby devices, and it is typically categorized into radiated and conducted emissions [1].

Electromagnetic Compatibility (EMC)

EMC is the ability of an electronic device or system to function properly in its electromagnetic environment without introducing intolerable electromagnetic disturbances to other devices in the vicinity [2]. Compliance with EMC standards ensures devices do not interfere with each other.

Conducted Emissions

Conducted emissions are high-frequency electrical noise signals that travel along power or signal lines. These emissions are generated within the electronic equipment (e.g., a PSU) and propagate through the mains cables. They are typically measured in the 150 kHz to 30 MHz frequency range.

Common Mode (CM) Emissions: Noise currents that flow in the same direction on both line and neutral conductors and return via ground. Often caused by parasitic coupling between circuits and ground.
Differential Mode (DM) Emissions: Noise currents that flow in opposite directions in the line and neutral conductors. Generally produced by asymmetries in the switching circuits of the PSU.

Radiated Emissions

Radiated emissions are electromagnetic waves emitted directly into the air from a device, typically due to high-frequency switching and layout characteristics. These emissions can couple into nearby equipment via air and cause interference.

Line Impedance Stabilization Network (LISN)

A LISN is a standardized test fixture used to measure conducted emissions. It provides a consistent impedance (usually 50 Ω) for the power lines and isolates the test equipment from the power source. It also allows emissions present on the power lines to be accurately measured by an EMI receiver or spectrum analyzer.

CISPR (Comité International Spécial des Perturbations Radioélectriques)

CISPR is a technical committee within the International Electrotechnical Commission (IEC) responsible for setting standards for controlling electromagnetic interference. CISPR 32 is one of its standards applicable to multimedia equipment.

EN 55032 / CISPR 32

These are harmonized EMC standards that define limits and methods of measurement for radio disturbances of multimedia equipment, including PCs and their PSUs. EN 55032 [3] is the European adoption of the international CISPR 32 standard. It includes requirements for both conducted and radiated emissions.

Decibel Microvolts (dBµV)

This is the unit used to express the magnitude of conducted and radiated emissions during EMC measurements. It is a logarithmic unit of voltage referenced to 1 µV.

Switching Mode Power Supply (SMPS)

A SMPS is a type of power supply that converts electrical power using high-frequency switching techniques, typically using a power transistor or MOSFET. While efficient, the switching action generates high-frequency noise, making SMPS units, significant sources of EMI.

Spectrum Analyzer / EMI Receiver

Test instruments used to measure and analyze the frequency and amplitude of emissions. EMI receivers are specifically designed to comply with EMC test standards and often include quasi-peak and average detectors as specified by CISPR.

Quasi-Peak Detector

A type of detector used in EMI testing that gives weight to both the amplitude and repetition rate of the signal. It is defined in CISPR standards and simulates how interference is perceived by analog radio receivers.

Prologue

Electromagnetic compatibility (EMC) is a critical consideration in the design and testing of electronic equipment [4]. In the context of personal computer (PC) power supply units (PSUs), ensuring that emissions are within regulatory limits is essential to avoid interference with other electronic devices and systems [5]. PC PSUs, due to their high-frequency switching circuits and wide input voltage ranges, can be significant sources of electromagnetic interference (EMI). This white paper focuses specifically on conducted emissions originating from PC PSUs under a representative 4 A DC load, using test procedures and compliance criteria as defined in the EN 55032 and CISPR 32 Class B standards.

EN 55032, harmonized with CISPR 32, governs the EMC requirements for multimedia equipment, which includes PC PSUs. These standards define both the test methodology and the allowable limits for both radiated and conducted emissions. While radiated emissions pertain to electromagnetic fields emitted into the surrounding environment, conducted emissions refer to unwanted electromagnetic noise that propagates through power lines, which can affect other equipment connected to the same electrical network [6].

ATX power supplies are widely used in consumer and industrial electronics, and as such, they must comply with electromagnetic interference (EMI) standards to ensure they do not cause harmful interference to other nearby devices. For Class B compliance under EN 55032, which targets residential environments, the conducted emissions generated by the ATX power supply must fall within strict limits across the 150 kHz to 30 MHz frequency range. These emissions are measured using a Line Impedance Stabilization Network (LISN) and evaluated through various detector modes—specifically average, peak, and quasi-peak detection.

Types of Electromagnetic Emissions

Electromagnetic emissions from electronic devices are generally classified into two major categories [7]:

1. Radiated Emissions

Radiated emissions are electromagnetic waves emitted directly from the equipment into free space. In PC PSUs, sources of radiated emissions typically include:

- Switching components and transformers (due to rapid voltage and current changes).
- Printed circuit board (PCB) traces acting as unintended antennas.
- Cables connected to the PSU (e.g., AC power cord, DC outputs).

Radiated emissions are more challenging to control in complex systems and are tested in specialized environments like semi-anechoic chambers.

2. Conducted Emissions

Conducted emissions are high-frequency noise signals that travel along the power supply lines, typically in the range of 150 kHz to 30 MHz. These emissions originate from the PSU's switching activity and can affect the operation of other devices sharing the same mains supply [8]. They are subdivided into:

- Differential Mode (DM) Emissions: Noise currents that flow in opposite directions in the line and neutral conductors. They are typically generated by imbalances or nonlinearities in the power conversion circuitry.
- Common Mode (CM) Emissions: Noise currents that flow in the same direction through both the line and neutral conductors and return via the ground. CM emissions often result from parasitic capacitances between high-frequency nodes and ground, including PCB parasitic paths and transformer inter-winding capacitance.

Both types of conducted emissions can cause interference with other electronic equipment, making mitigation crucial [9].

Importance of Conducted Emissions Testing

For PC PSUs, which are mass-market components, maintaining low conducted emissions is vital to ensure compatibility in environments with numerous interconnected devices. Some of the most important reasons are:

- Regulatory Compliance: Regulatory bodies require equipment to meet specific conducted emissions limits to minimize interference risks.
- System Reliability: Excessive EMI can cause malfunction or degradation in nearby systems, especially in sensitive environments such as medical or industrial settings.
- Market Access: Products must pass EMC testing to be legally sold in many markets (e.g., EU, North America, Asia).
- Brand Reputation: Failures in EMC compliance can lead to product recalls or customer dissatisfaction.

Testing Standards

EN 55032 is the European adaptation of CISPR 32, an international standard issued by the International Special Committee on Radio Interference (CISPR). It specifies limits and methods of measurement of radio disturbance characteristics of multimedia equipment with a rated AC mains supply voltage not exceeding 600 V.

- Class A Equipment: Intended for use in all establishments except domestic dwellings. Class A has more relaxed limits compared to Class B.
- Class B Equipment: Intended for use in residential environments, including domestic dwellings. Class B has stricter emission limits compared to Class A to ensure minimal interference with sensitive home devices such as radios, televisions, and communication equipment.

- Frequency Range for Conducted Emissions: 150 kHz to 30 MHz.
- Measurement Setup: Conducted emissions are measured using a Line Impedance Stabilization Network (LISN), which standardizes the impedance of the power line and allows accurate measurements of conducted noise.
- Test Configuration: The equipment under test (EUT) is powered via the LISN, and the noise voltage on the mains lines is measured using a spectrum analyzer or EMI receiver.

The applicable conducted emissions limits (in dBµV) depend on frequency and are lower for Class B equipment, which is intended for residential environments. Class B equipment is subject to more stringent conducted emissions limits (measured in dBµV), especially at lower frequencies, to ensure compatibility with residential RF environments. Compliance with these tighter limits is essential for devices intended for consumer markets.

According to the Intel ATX Design Guide [10], a PSU "shall comply with FCC Part 15, EN55023 and CISPR 32, 5th ed., meeting Class B for both conducted and radiated emissions with a 4 dB margin". Since these standards have been updated, Cybenetics uses the newer ones, EN 55032 and CISPR 32, as previously discussed.

Detector Types

In conducted EMI testing, particularly for compliance with standards like EN 55032, multiple detector types are used to assess the electromagnetic emissions of a device under test. The most commonly used detectors are Average (AVG), Peak (PK), and Quasi-Peak (QP). Each serves a specific purpose and applies a different measurement approach to evaluate how the emissions from a device might affect other electronics in the environment [11].

The Peak (PK) detector captures the highest amplitude of the signal within a given frequency band. It responds instantly to transients, making it a very sensitive and fast measurement method. The objective of the Peak measurement is to quickly identify the worst-case emission levels during a scan. It is often used as a first step to determine whether further, more detailed measurements (like Quasi-Peak) are necessary. Because Peak measurements are more permissive, devices often pass this test even if some emissions are close to the limit.

The Average (AVG) detector, on the other hand, smooths out short-term fluctuations by computing the average power level of emissions over a specific time window. This provides a better representation of how persistent the emissions are, particularly in terms of their potential to interfere with other electronic equipment in a typical use case. The Average detector is less responsive to brief spikes and focuses more on continuous or sustained interference.

The Quasi-Peak (QP) detector is perhaps the most challenging measurement in conducted EMI testing [12]. It is designed to weigh emissions based not only on amplitude but also on repetition rate. That means signals which occur more frequently are penalized more heavily than occasional bursts. The idea behind this is psychological and practical: frequent, low-level interference is more likely to be noticed and cause disruption than a rare high-level spike. QP detection uses a slower charging and discharging response curve, which mimics the response of traditional radio receivers to interference.

When comparing which test is harder to pass, the Quasi-Peak measurement is generally the most difficult. This is because it is more selective and penalizes both high amplitude and high repetition rate. A device that passes the Peak test might still fail the Quasi-Peak test if it emits many repetitive bursts of noise, even if those bursts aren't very strong individually. As a result, Quasi-Peak testing is often used as the final determination of compliance in borderline cases.

Environmental Conditions & Monitoring

Conducted emissions measurements are performed in a controlled laboratory environment.

Environmental conditions relevant to the validity of measurements, including ambient electromagnetic noise, are monitored and verified prior to testing. Ambient noise levels shall be at least 6 dB below the applicable EN 55032 Class B limits across the full measurement frequency range.

Laboratory ambient temperature and humidity are maintained within ranges defined by the laboratory quality system to ensure proper operation of measurement equipment.

Environmental conditions are recorded for each test session. If environmental conditions fall outside defined limits or are found to influence measurement validity, testing shall be suspended and corrective actions implemented in accordance with the laboratory quality procedures.

Personnel Competence

Conducted emissions measurements in accordance with this procedure shall be performed only by personnel who have been assessed as competent and formally authorized by the laboratory.

Personnel performing measurements shall:

- Have documented training in EMC principles and conducted emissions testing.
- Be trained in the operation of the specific measurement equipment and software used.
- Be familiar with the applicable standards (EN 55032, IEC/CISPR 16-1-x).
- Be authorized in accordance with the laboratory competence and authorization matrix.

Records of training, competence evaluation, and authorization are maintained within the laboratory quality management system.

Test Equipment

In a typical conducted emissions test setup for Class B equipment, the following components are connected in a specific configuration to ensure accurate and repeatable measurements:

DC Loader: TekBox TBOH02 Self Powered Active Load [13]: The TBOH02 is a precision self-powered active load. It does not need a separate supply voltage and operates as low as 2V. Its features include constant resistance and constant current mode.

Figure 1: TekBox TBOH02

EMI Receiver: TekBox TBMR-110M EMI-Analyzer DC-110 MHz [14]: A versatile spectrum analyzer used to measure the frequency and amplitude of conducted emissions. It provides high-resolution spectral data essential for EMI diagnostics and compliance verification.

Figure 2: TBMR-110M EMI-Analyzer DC-110 MHz

Line Impedance Stabilization Network (LISN): TekBox TBLC08 [15]: The LISN is connected directly between the AC mains power source and the DUT. It performs two key functions: it isolates the test setup from external power line noise and provides a standardized impedance for accurate emission measurements. The LISN also routes conducted noise from the EUT to the measurement instrument.

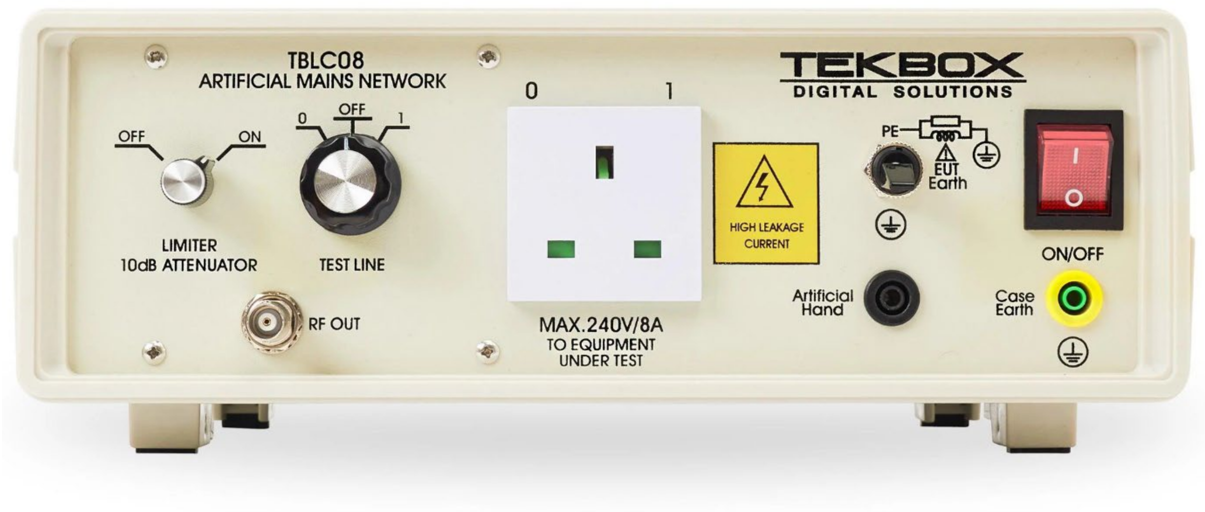

Figure 3: TEKBOX TBLC08

Testing Software

EMC View [16] is a user-friendly software tool designed for visualizing, analyzing, and logging EMI and EMC test data. Often used in conjunction with spectrum analyzers and EMI receivers, it allows users to view real-time conducted and radiated emissions, compare results against regulatory limits (such as EN 55032 Class B), and generate test reports. Its intuitive interface makes it ideal for both pre-compliance testing and full compliance evaluations.

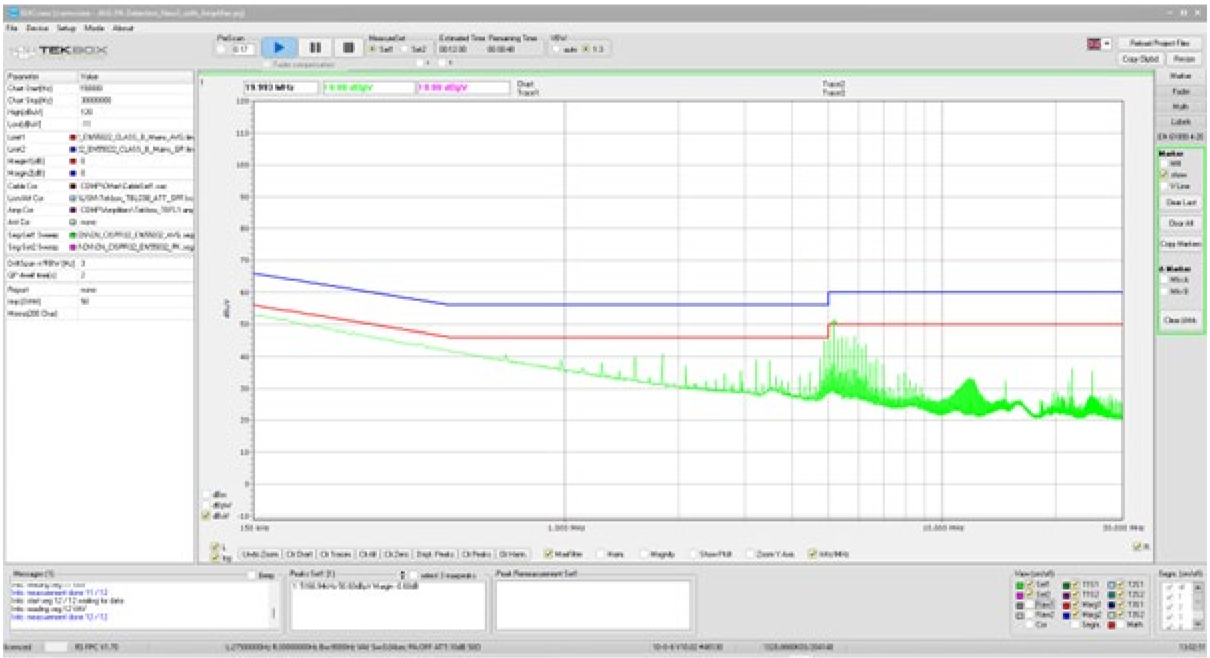

Figure 4: EMCView

Testing Methodology

The EMI testing process begins with careful preparation of the equipment and setup, as the instruments involved are sensitive and can be damaged by incorrect handling. The operator must first ensure that all devices are powered off, and the LISN Test Line knob is in the off position. This precaution is essential to prevent unintentional signal flow that might damage the measurement instruments. Once verified, the ATX power cable is connected from the DUT to the DC electronic load (FA-828 ATE), which will later be used to apply a consistent and controlled load on the PSU during the test. Simultaneously, an AC power cable is connected from the LISN to the PSU, taking special care to match the line and neutral orientation correctly to avoid electrical faults.

After all connections are confirmed, the operator proceeds to power on the equipment in a specific sequence. First, the DC Loader is switched on, followed by the LISN, and then the Spectrum Analyzer (Rohde & Schwarz FPC 1500). The latter should be allowed to warm up for at least 30 minutes to ensure stable performance. Once the warm-up period is complete, the DUT is powered on. The operator then applies a 50-watt DC load to the PSU using the loader, initiating a 10-minute warm-up period for the PSU under load, which helps simulate realistic operating conditions.

With the system stable, the EMC View software is launched on a connected PC. The software is used to control the spectrum analyzer and display real-time measurement data. Within EMC View, the operator connects to the analyzer by navigating to the device menu and selecting the appropriate connection. Once connected, the relevant test file is loaded. This file contains preconfigured measurement settings and regulatory limits required for EN 55032 Class B compliance.

To begin the conducted emissions testing, the LISN Test Line knob is turned from the off position to “0,” which activates the signal path for measurement. The average measurement is conducted first by selecting “Set 1” and starting the test. Results are displayed on a graph, where a red line represents the compliance limit for average emissions. Following this, the peak measurement is performed by selecting “Set 2” and clicking start. The blue line in this graph indicates the peak emissions limit. If the PSU passes the peak test, the testing process can conclude at this point. However, if it fails, the operator must proceed to perform the quasi-peak measurement by loading the appropriate test file and repeating the process.

Throughout the testing process, the EMC View software provides visual indicators of compliance, and any failures are clearly flagged below the graph. The user has the option to toggle the display of measurement limit lines for clarity and can also edit test report attributes via the device menu. Upon completion, the results are saved by exporting the charts and traces to a designated folder, and printed or saved as image files for documentation purposes.

The shutdown process must be performed carefully to protect the equipment. The LISN Test Line knob is returned to the off position first. Then, the DC Load is stopped, followed by powering down the DUT. Once these components are off, the remaining devices—LISN, Spectrum Analyzer, and DC Loader—can be turned off in any order. This structured procedure ensures accurate EMI measurement while maintaining the safety and longevity of the test equipment.

Method Validation and Verification

This conducted emissions measurement method has been verified and validated to confirm its suitability for the intended application in accordance with ISO/IEC 17025:2017, Clause 7.2.2.

Method verification activities include:

- Confirmation that the measurement configuration, instrumentation, detector characteristics, resolution bandwidth, and frequency range comply with the requirements of EN 55032 and IEC/CISPR 16-1-x.
- Verification of correct detector implementation (Peak, Average, Quasi-Peak) using known reference signals and instrument self-test functions.

- Repeatability assessment through multiple measurements of representative power supply units under identical test conditions, demonstrating result stability within the laboratory’s stated measurement uncertainty.

Method validation activities include:

- Evaluation of measurement repeatability and reproducibility within the laboratory.
- Comparison of historical measurement data for representative devices to confirm consistency of results.
- Technical review confirming that the selected load condition and measurement parameters represent a conservative worst-case condition for conducted emissions.

Records of method verification and validation are maintained within the laboratory quality system. The method is considered fit for purpose for conducted emissions measurements in the frequency range 150 kHz to 30 MHz.

Results

A compliant ATX PSU must exhibit emissions levels below the defined limits across all relevant frequency bands. These limits are frequency-dependent and typically decrease as the frequency increases. The results are displayed graphically in EMC View software, where the emission values (measured in dBµV) are plotted against the frequency spectrum. Horizontal lines on the graph represent the regulatory limits: the red line for average limits and the blue line for peak limits. If the emission trace remains entirely under these lines, the device is considered compliant for that test mode.

A 4 dBµV margin is typically applied during the evaluation phase as per the Intel Design Guide, to provide a buffer zone between the measured emission levels and the regulatory limit. This margin accounts for potential measurement uncertainties, environmental variations, and repeatability differences that may occur during formal compliance testing in certified labs. For example, if a particular emission is measured at 44 dBµV, and the limit at that frequency is 48 dBµV, the result is interpreted as "passing with a 4 dBµV margin." This buffer provides confidence that even with slight variations in test conditions, the product is still likely to comply under more rigorous certification environments.

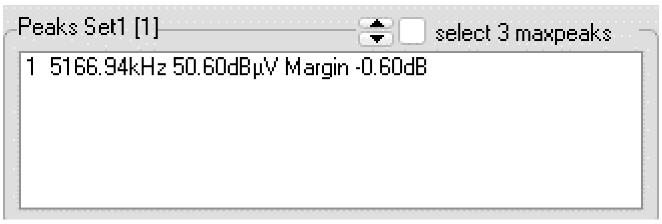

Figure 5: Example of pass with the 4 dBµV margin

If any emission peak exceeds the limit with the 4 dBµV margin, it gets flagged for further analysis. While the device may still technically pass the test, it is often advisable to optimize the design or improve shielding to reduce emissions, especially if the product is nearing production.

Peak measurements are quick and catch the highest emission levels, Average measurements assess continuous noise levels, and Quasi-Peak measurements provide a realistic middle ground by evaluating both the strength and frequency of emissions. Quasi-Peak is typically run after a DUT fails to pass. It is the most demanding, as it aligns more closely with how interference affects real-world radio and electronic systems, and is often the deciding factor in pass/fail compliance outcomes.

Table 1 presents the official limits for conducted emissions [17]:

EN55032 / CISPR 32	Limit dB(μV)	
Frequency Range (MHz)	**Quasi-peak**	**Average**
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

Table 1: Conducted Emissions Limits

Document Control

This document is a controlled procedure within the Cybenetics Ltd. quality management system.

- The current revision status of this document is indicated on the title page and in the revision history table.
- Only the latest approved revision shall be used for testing activities.
- Uncontrolled or obsolete copies shall not be used for accredited testing.
- Printed copies are considered uncontrolled unless otherwise stated.

Changes to this document are reviewed and approved by authorized personnel prior to release in accordance with the document control procedures of the laboratory.

Epilogue

Conducted emissions represent a significant aspect of electromagnetic compatibility testing, particularly in switch-mode power supplies like those used in PCs. By adhering to standards such as EN 55032 and CISPR 32, designers and manufacturers can ensure that their products do not cause excessive interference in typical usage environments.

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Annex A – Certification-Grade Test Conditions (Normative)

A.0 Measurement Equipment and Instrumentation

All equipment used for conducted emissions measurements under this procedure shall comply with the applicable requirements of the IEC/CISPR 16-1 series, specifically IEC/CISPR 16-1-1, IEC/CISPR 16-1-2, and relevant IEC/CISPR 16-1-x parts. Equipment shall be suitable for measurements in the frequency range 150 kHz to 30 MHz and operated in accordance with the laboratory quality system.

A.1 Test Environment and Configuration

All conducted emissions measurements are performed in a controlled laboratory environment using a single-phase 50 µH / 50 Ω LISN compliant with IEC/CISPR 16-1-2. The LISN is bonded to the laboratory reference ground plane. Measurements are performed separately on Line and Neutral conductors.

Ambient noise levels are verified prior to testing and shall be at least 6 dB below the applicable EN 55032 Class B limits across the full frequency range.

A.2 Measurement Instrumentation

A.2.1 Measuring Receiver / Spectrum Analyzer

(IEC/CISPR 16-1-1)

Conducted emissions shall be measured using an EMI measuring receiver or spectrum analyzer compliant with IEC/CISPR 16-1-1.

The measuring instrument shall provide:

- Frequency coverage from 150 kHz to at least 30 MHz
- 9 kHz resolution bandwidth (RBW) in accordance with CISPR requirements
- Peak (PK), Average (AVG), and Quasi-Peak (QP) detectors implemented in accordance with CISPR time constants
- 50 Ω input impedance
- Sufficient dynamic range to avoid overload or compression during measurement

Where a spectrum analyzer is used instead of a dedicated EMI receiver, equivalence to the functional requirements of IEC/CISPR 16-1-1 shall be demonstrated and documented.

A.2.2 Line Impedance Stabilization Network (LISN)

(IEC/CISPR 16-1-2)

A Line Impedance Stabilization Network (LISN) compliant with IEC/CISPR 16-1-2 shall be used for all conducted emissions measurements.

The LISN shall:

- Provide a standardized impedance of 50 µH / 50 Ω
- Cover the frequency range 150 kHz to 30 MHz
- Include a 50 Ω measurement port
- Provide isolation between the Equipment Under Test (EUT) and the mains supply
- Be bonded to the laboratory reference ground plane

Measurements shall be performed separately on the Line and Neutral conductors unless otherwise justified and documented.

A.2.3 RF Cables and Ancillary Components

(IEC/CISPR 16-1-x)

All RF cables, attenuators, adapters, and auxiliary components used in the measurement chain shall comply with the applicable parts of IEC/CISPR 16-1-x.

Ancillary RF components shall:

- Have a characteristic impedance of 50 Ω
- Exhibit stable and known insertion loss over the measurement frequency range
- Be suitable for conducted emissions measurements
- Be minimized in number to reduce measurement uncertainty

Where applicable, frequency-dependent losses shall be included in the laboratory uncertainty evaluation.

A.3 Load Condition Justification

A constant 4 A DC load is applied to the PSU during conducted emissions testing.
Low-load operating conditions are known to excite worst-case EMI behavior in modern switch-mode power supplies due to discontinuous conduction mode (DCM), burst-mode operation, and power-factor-correction transition regions.

Testing at 4 A therefore represents a conservative and repeatable worst-case condition for conducted emissions assessment.

A.4 Measurement Parameters

Measurements are performed over the frequency range 150 kHz to 30 MHz using a 9 kHz RBW in accordance with IEC/CISPR 16.

Peak and Average measurements may be performed using continuous sweep mode.
Quasi-Peak measurements are performed using stepped frequency scans with sufficient dwell time to allow detector stabilization.

A.5 Pass / Fail Criteria

According to the Intel ATX v3.x spec, a Device Under Test (DUT) is considered compliant if all measured emission levels remain below the applicable EN 55032 Class B limits after application of a 4 dBµV engineering margin. This applies ONLY to ATX v3.x testing.

If Peak or Average measurements exceed the limit minus margin, Quasi-Peak measurements shall be performed. Failure to meet Quasi-Peak limits constitutes a non-compliant result.

When conducted emissions measurements are performed within the laboratory's accredited scope, conformity with EN 55032 Class B limits is evaluated using the laboratory's approved decision rule based on the stated expanded measurement uncertainty.

The engineering margin referenced in this procedure is used for internal evaluation and pre-compliance assessment. Formal statements of conformity under accreditation are issued only in accordance with the laboratory decision rule and applicable uncertainty budget.

A.6 Calibration, Verification, and Traceability

All critical measurement equipment, including the EMI receiver, LISN, and applicable RF components, shall be calibrated at defined intervals with traceability to national or international standards.

Prior to testing, functional verification shall be performed, including:

- Instrument self-tests
- LISN bonding and continuity checks
- Ambient noise verification

Equipment found to be outside specified tolerances shall not be used for compliance or pre-compliance measurements.

The equipment and configuration defined in this annex ensure conformity with the apparatus requirements of IEC/CISPR 16-1-1, IEC/CISPR 16-1-2, and applicable IEC/CISPR 16-1-x parts, and are suitable for conducted emissions testing in accordance with EN 55032 / CISPR 32.

Annex B – Measurement Uncertainty and Non-Conformity Disclaimer

B.1 Measurement Uncertainty

Conducted emissions measurements are subject to inherent measurement uncertainty arising from instrumentation tolerances, LISN impedance variation, cable positioning, grounding, ambient noise, and repeatability effects. While this procedure follows CISPR 16 and EN 55032 recommended practices, the numerical results obtained during testing represent best estimates of the true emission levels under the defined test conditions.

Unless otherwise stated, no formal expanded measurement uncertainty budget is applied. Engineering margin (4 dBµV) is therefore used as a conservative buffer to account for measurement uncertainty and inter-laboratory variability during pre-compliance evaluation.

B.2 Non-Conformity and Disclaimer

Results obtained using this procedure may be used for internal engineering evaluation, pre-compliance assessment, and accredited testing activities when performed within the scope of Cybenetics Ltd.'s ISO/IEC 17025 accreditation. Formal statements of conformity shall only be issued when all measurements are conducted under the laboratory's accredited scope, approved uncertainty budgets, and controlled quality system.

When measurements are performed outside the accredited scope, results shall be treated as engineering data only. Cybenetics Ltd. assumes no liability for regulatory decisions made on the basis of non-accredited test results.

Annex C – Measurement Uncertainty Budget (Accredited)

The conducted emissions measurement uncertainty applied by Cybenetics Ltd. is derived from the internal uncertainty budget worksheet P19-F03 (Revision 01, 10-05-2025), developed in accordance with ISO/IEC 17025 and CISPR 16 principles.

For conducted emissions measurements expressed in dBµV over the frequency range 150 kHz to 30 MHz, the expanded measurement uncertainty has been evaluated as:

Expanded measurement uncertainty (U, k=2): ±1.70 dBmV

This expanded uncertainty corresponds to an approximate confidence level of 95%. When tests are performed within the laboratory's accredited scope, this uncertainty value shall be applied in accordance with the laboratory decision rule.