HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO:

FCC 47CFR part 15: 2021, subpart B, Class B
ICES-003: 2020 Issue 7, Class B
VCCI-CISPR 32: 2016, Class B
AS/NZS CISPR 32: 2015 + A1(20), Class B
EN 55032: 2015 + A1(20) + A11(20), Class B
EN IEC 61000-6-3: 2021
EN IEC 61000-6-2: 2019
EN IEC 61000-3-2: 2019 + A1(21)
EN 61000-3-3: 2013 + A1(19)
EN 55035: 2017 + A11(20)
EN 301 489-52: V1.2.1: 2021, Class B
EN 301 489-17: V3.2.4: 2020, Class B
EN 301 489-1: V2.2.3: 2019, Class B

FOR:

C-LAB Ltd.

Configurable fanless industrial computer

Model: Tensor-I22

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1 Applicant information

Client name:	C-LAB Ltd.
Address:	HaYetzira street. 17, "Mordot HaCarmel" Industrial park, P.O.Box 687, Yokneam Ilit 20692, Israel
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E-mail:	erkes@compulab.co.il
Contact name:	Mr. Moshe Erkes

2 Equipment under test attributes

Product definition:	Configurable fanless industrial computer
Product name:	Tensor
Trade Mark:	Compulab
Model:	Tensor-I22
Part number:	TENSOR-I22-C6305-D16-TPM-M512-W-J4E
Serial number:	1221219-00101
Hardware version:	1.0
Software release:	NA
Receipt date:	21-Mar-23

3 Manufacturer information

Manufacturer name:	C-LAB Ltd.
Address:	HaYetzira street. 17, "Mordot HaCarmel" Industrial park, P.O.Box 687, Yokneam Ilit 20692, Israel
Telephone:	+972 4-8290113
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Contact name:	Mr. Moshe Erkes

4 Test details

Project ID:	49723
Location:	Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started:	21-Mar-23
Test completed:	27-Mar-23
Test specifications:	FCC 47CFR part 15: 2021, subpart B, Class B
	ICES-003: 2020 Issue 7, Class B
	VCCI-CISPR 32: 2016, Class B
	AS/NZS CISPR 32: 2015 + A1(20), Class B
	EN 55032: 2015 + A1(20) + A11(20), Class B
	EN IEC 61000-6-3: 2021
	EN IEC 61000-6-2: 2019
	EN IEC 61000-3-2: 2019 + A1(21)
	EN 61000-3-3: 2013 + A1(19)
	EN 55035: 2017 + A11(20)
	EN 301 489-52: V1.2.1: 2021, Class B
	EN 301 489-17: V3.2.4: 2020, Class B
	EN 301 489-1: V2.2.3: 2019, Class B

5 Tests summary

Test	Status
FCC 47 CFR part 15, subpart B	
FCC 47 CFR, Section 15.107, Class B, AC power lines conducted emissions	Pass
FCC 47 CFR, Section 15.109, Class B, Radiated emissions	Pass
ICES-003	
ICES-003, Section 3.2.1, Class B, AC power lines conducted emissions	Pass
ICES-003, Section 3.2.2, Class B, Radiated emissions	Pass
VCCI-CISPR 32	
Class B, Conducted emissions from AC mains power ports	Pass
Class B, Conducted emissions from wired network ports	Pass
Class B, Radiated emissions	Pass
EN 55032 / AS/NZS CISPR 32	
Section 5, Annex A.3, Class B, Conducted emissions from AC mains power ports	Pass
Section 5, Annex A.3, Class B, Conducted emissions from wired network ports	Pass
Section 5, Annex A.2, Class B, Radiated emissions	Pass
EN IEC 61000-6-3	
Conducted emission measurements at AC mains power port	Pass
Conducted emission measurements at DC power port	Not required
Conducted emission measurements at wired network port	Pass
Radiated emission measurements	Pass
EN IEC 61000-3-2	
Harmonic current emissions	Pass
EN 61000-3-3	
Voltage fluctuations and flicker	Pass
EN 55035	
Immunity to electrostatic discharge (ESD)	Pass
Continuous RF electromagnetic field disturbances, swept and spot tests	Pass
Conducted immunity to electrical fast transients/ bursts (EFT/ B)	Pass
Conducted immunity to voltage surges	Pass
Immunity to continuous induced RF disturbances	Pass
Radiated immunity to power frequency magnetic field	Pass
Conducted immunity to voltage dips and short interruptions	Pass
Immunity to conducted broadband impulsive disturbances	Not required
EN IEC 61000-6-2	
Immunity to electrostatic discharge (ESD)	Pass
Radiated immunity to radio frequency electromagnetic field	Pass
Conducted immunity to electrical fast transients/ bursts (EFT/ B)	Pass
Conducted immunity to voltage surges	Pass
Conducted immunity to disturbances induced by radio frequency field	Pass
Radiated immunity to power frequency magnetic field	Pass
Conducted immunity to voltage dips and short interruptions	Pass
EN 301 489-17/52/1	
Conducted emission measurements at AC mains input port, Class B	Pass
Conducted emission measurements at DC power input/output port	Not required
Conducted emission measurements at wired network ports, Class B	Pass
Radiated emission measurements, Class B	Pass
Harmonic current emissions at AC mains input port	Pass
Voltage fluctuations and flicker at AC mains input port	Pass
Immunity to electrostatic discharge (ESD)	Pass
Radiated immunity to radio frequency electromagnetic field	Pass
Conducted immunity to electrical fast transients/ bursts (EFT/ B)	Pass
Conducted immunity to voltage surges	Pass
Conducted immunity to disturbances induced by radio frequency field	Pass
Immunity to transients and surges in the vehicular environment	Not required
Conducted immunity to voltage variations, dips and short interruptions	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mr. B. Attar, EMC Team Leader	March 27, 2023	
Reviewed by:	Ms. N. Averin, Certification Specialist, EMC & Radio	July 17, 2023	
Approved by:	Mr. A. Troupiansky, Team Leader, EMC & Radio	July 26, 2023	

6 EUT description

Note: The following data in this clause is provided by the customer and represents his sole responsibility.

6.1 General information

The EUT is a configurable fanless industrial computer, which incorporates Wi-Fi, Bluetooth and 4G/LTE cellular modules. The EUT is powered from AC mains via AC/DC adapter.

6.2 EUT parts

Description	Manufacturer	Model or P/N
Wi-Fi & Bluetooth module	Intel	Intel AX210.NGWG.NV, FCC ID: PD9AX210NG
LTE cellular module (EU bands)	Sierra Wireless	EM7421
LTE cellular module (US bands)	Sierra Wireless	EM7411, FCC ID: N7NEM74B
AC/DC adapter	FSP Group Inc.	FSP060-DHAN3

6.3 Ports and lines

Port type	Port description	Connected		Qty.	Cable type	Cable length	Indoor / outdoor
		From	To				
Power	AC power	AC/DC adapter	AC mains	1	Unshielded	1.2 m	Indoor
Power	12 VDC power	EUT	AC/DC adapter	1	Unshielded	0.8 m*	Indoor
Wired network	Ethernet (LAN 1/2)	EUT	Loop	2	FTP	10 m**	Indoor
Signal	HDMI	EUT	HDMI Emulator	1	NA	NA	Indoor
Signal	USB	EUT	Keyboard	1	Shielded	1.2 m*	Indoor
Signal	USB	EUT	Mouse	1	Shielded	1.2 m*	Indoor
Signal	USB3	EUT	USB Drive (Disk-on-key)	2	NA	NA	Indoor
Signal	D.P	EUT	Monitor	1	Shielded	1.2 m*	Indoor
RF	Wi-Fi 2.4 GHz, 5 GHz, 6 GHz	EUT	Wi-Fi antenna	2	NA	NA	Indoor
RF	LTE	EUT	Antenna	2	NA	NA	Indoor

* Always shorter than 3 m.
** Always not longer than 30 m.

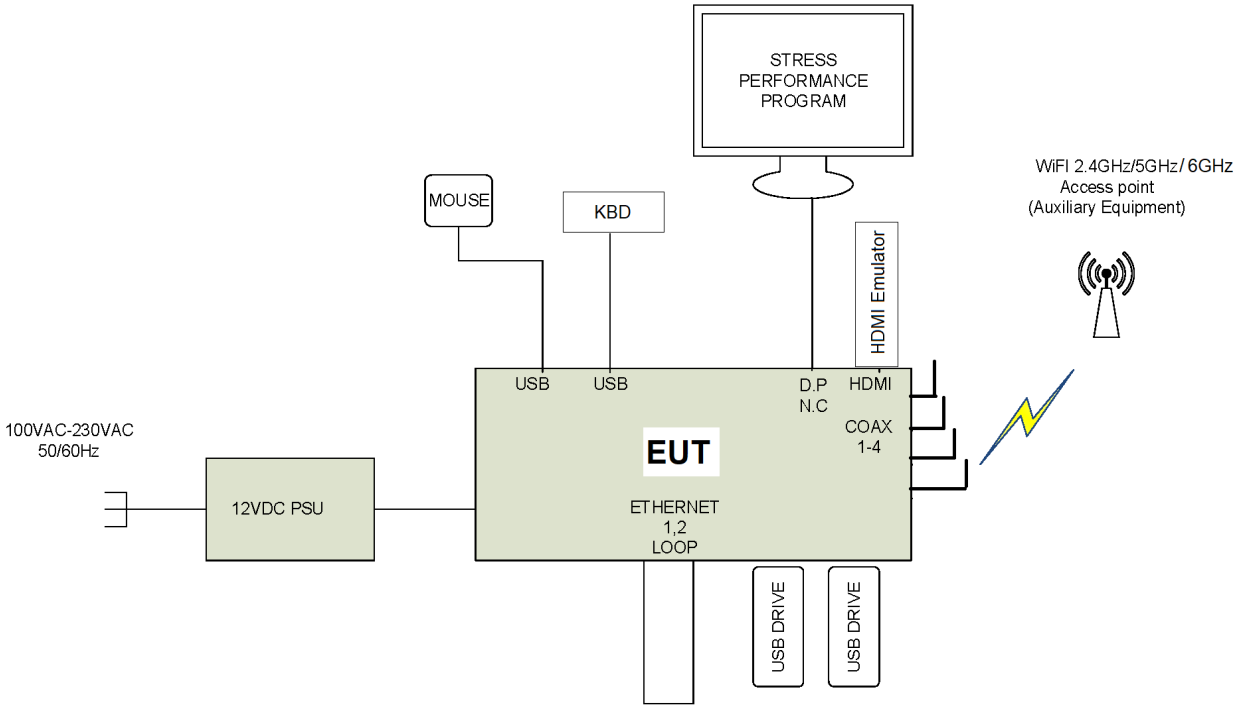
6.4 Auxiliary equipment

Description	Manufacturer	Model number
DHCP Server (Monitor)	Compulab	FitPC2
Wireless-G Access Point (Wi-Fi)	Netgear	P/N: 332:-10704-01
Monitor	Dell	P2414HB
HDMI Emulator	Compulab	fit-Headless

6.5 Operating frequencies

Source	Frequency, MHz					
LTE-FDD	1920-1980	2110-2170	1710-1785	1805-1880	824-849	869-894
	2500-2570	2620-2690	880-915	925-960	832-862	791-821
	702-748	758-803	1452-1496	2570-2620	50	200
	2300-2400	1002496-1002690		1943400-1943600		3600-3800
	1850-1910	1930-1990	1710-1755	2110-2155	699-716	729-746
	777-787	746-756	814-849	859-894	788-798	758-768
	1850-1915	1930-1995	2496-2690	2003550-2003700		2110-2200
	1501710-1501780		663-698	617-652	---	---
Wi-Fi	2400-2483.5	5150-5350	5470-5725	5725-5875	---	---
Bluetooth	2400-2483.5	---	---	---	---	---
Clock	25	38.4	100	---	---	---

6.6 Test configuration



6.7 Performance criteria

6.7.1 General performance criteria of EN 55035, Section 8

6.7.1.1 Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

6.7.1.2 Performance criterion B

During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test. After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

6.7.1.3 Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.
Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

6.7.2 Specific performance criteria of EN 55035, Annex F.3.3 (Networking functions)

6.7.2.1 Performance criterion A

Where relevant, during the application of the test the network function shall, as a minimum, operate ensuring that:
• established connections shall be maintained throughout the application of the test;
• no change of operational state or corruption of stored data occurs;
• no increase in error rate above the figure defined by the manufacturer occurs. The manufacturer should select the most appropriate performance measurement criteria for the product or system, for example bit error rate, block error rate;
• no request for retry above the figure defined by the manufacturer;
• the data transmission rate does not reduce below the figure defined by the manufacturer;
• no protocol failure occurs;
• the audio noise level at a two-wire analogue interface (supporting telephony) shall satisfy the requirements of Table G.3. The audio level measurements shall be performed at the demodulated frequency of the disturbance using a narrowband filter with a 3 dB bandwidth of 100 Hz using the method defined in table clause G.1.4. See G.6.1.
As described in the example given in J.3.5 the networking function is monitored during testing using direct functions specified elsewhere in this document. If needed to verify the operation of the protocol, the following functions shall be verified as described in Table H.1 when performing the additional spot frequency tests contained in Clause 5:
• ability to establish a connection,
• ability to clear a connection.
Where an EUT has supervisory functions they shall not be affected. Elements that should be monitored include, but are not limited to:
• alarms,
• signalling lamps,
• printer output errors,
• network traffic rates,
• network monitor errors,
• measured network parameters.

6.7.2.2 Performance criterion B

Established connections shall be maintained throughout the test, or shall self-recover in a way and timescale that is imperceptible to the user. The error rate, request for retry and data transmission rates may be degraded during the application of the test. Degradation of the performance as described in criterion A is permitted, provided that the normal operation of the EUT is self-recoverable to the condition established prior to the application of the test. Where required, as defined in Clause 5, the acceptable operation of the function shall be verified at the completion of the test as described in Table H.1, by confirming the following:
• the EUT's ability to establish a connection,
• the EUT's ability to clear a connection.
During surge testing disconnection is allowed on the analogue/digital data port being tested. If the EUT is a supervisory equipment, it shall not impact the normal operation of the network being monitored. In addition, any supervisory functions impacted during the period of the test shall return to the state prior to the test. Elements to consider include:
• alarms,
• signalling lamps,
• printer output,
• network traffic rates,
• network monitoring.

6.7.2.3 Performance criterion C

Degradation of performance as described in criteria A and B is permitted provided that the normal operation of the EUT is self-recoverable to the condition immediately before the application of the test, or can be restored after the test by the operator.

6.7.3 Performance criteria according to EN 301-489-1

6.7.3.1 Performance criteria for continuous phenomena, Section 6.1

During the test, the equipment shall:

• continue to operate as intended;
• not unintentionally transmit;
• not unintentionally change its operating state;
• not unintentionally change critical stored data.

6.7.3.2 Performance criteria for transient phenomena, Section 6.2

For all ports and transient phenomena with the exception described below, the following applies:

• The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data.
• After application of the transient phenomena, the equipment shall operate as intended.

For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:

• For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.
• For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

6.7.3.3 Performance criteria for voltage dips and interruptions, Section 9.7.3

For a 0 % residual voltage dip tests the following performance criteria apply:

• The performance criteria for transient phenomena shall apply (as specified in clause 6.2).

For a 70 % residual voltage dip and voltage interruption tests, the following performance criteria apply:

• in the case where the equipment is fitted with or connected to a battery back-up, the performance criteria for transient phenomena shall apply as specified in clause 6.2);
• in the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need not to be maintained and lost functions should be recoverable by user or operator;
• no unintentional responses shall occur at the end of the test, when the voltage is restored to nominal;
• in the event of loss of function(s) or in the event of loss of user stored data, this fact shall be recorded.

6.7.4 Performance criteria according to EN 301-489-17

6.7.4.1 General performance criteria, Section 6.1

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

6.7.4.2 Performance table, Section 6.2

Criteria	During test	After test
A	Shall operate as intended (see note) Shall be no loss of function Shall be no unintentional transmissions	Shall operate as intended Shall be no degradation of performance Shall be no loss of function Shall be no loss of critical stored data
B	May be loss of function	Functions shall be self-recoverable Shall operate as intended after recovering Shall be no loss of critical stored data
C	May be loss of function	Functions shall be recoverable by the operator Shall operate as intended after recovering Shall be no loss of critical stored data
NOTE 1: Operate as intended during the test allows a level of degradation in accordance with clause 6.2.2 of EN 301 489-17.		

6.7.4.3 Performance criteria for continuous phenomena, Section 6.3

The performance criteria A shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur during the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur during the test.

6.7.4.4 Performance criteria for transient phenomena, Section 6.4

The performance criteria B shall apply, except for voltage dips greater than or equal to 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as a result of the application of the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur as a result of the application of the test.

6.7.5 Performance criteria according to EN 301-489-52, Sections 6.1.1 / 6.2

6.7.5.1 Performance criteria for continuous phenomena applied to transmitters (CT), Section 6.1.1.1

With a link established, during the test, the uplink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).

NOTE: When there is a high-level background noise present, the filter bandwidth may be reduced down to a minimum of 40 Hz.

In idle mode, the transmitter shall not operate unintentionally.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.

6.7.5.2 Performance criteria for continuous phenomena applied to receivers (CR), Section 6.1.1.2

During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence. In the case of narrow band responses, the procedure in clause 4.4.1 shall be followed. During the test, the downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).

NOTE: When there is a high-level background noise present, the filter bandwidth may be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.

6.7.5.3 Performance criteria for transient phenomena, Section 6.2

At the conclusion of each exposure of the transient phenomena, the EUT shall operate without loss of the communication link. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended without loss of user control functions or critical stored data.

In addition where the EUT supports idle mode it should be verified that the transmitter shall not unintentionally operate when transient phenomena are applied.

6.7.6 General performance criteria of EN IEC 61000-6-2, Section 4

6.7.6.1 Performance criterion A

The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. If the performance level is not specified by the manufacturer, this may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

6.7.6.2 Performance criterion B

The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test degradation of performance is allowed but no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

6.7.6.3 Performance criterion C

Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls.

6.8 Acceptance criteria

Dedicated stress test running on EUT should display pass status on auxiliary monitor.

Test specification:	FCC 47 CFR, Section 15.107 / ICES-003, Section 3.2.1, Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 109 VAC, 50 Hz
Remarks:			

7 Emissions tests according to FCC 47CFR part 15 subpart B and ICES-003 requirements

7.1 Conducted emissions

7.1.1 General

This test was performed to measure common mode conducted emissions at the EUT power port. The specification test limits are given in Table 7.1.1.

Table 7.1.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)		Class A limit, dB(μV)	
	QP	AVRG	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*	79	66
0.5 - 5.0	56	46	73	60
5.0 - 30	60	50	73	60

* The limit decreases linearly with the logarithm of frequency.

7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1 and the associated photograph, energized and the EUT performance was checked.

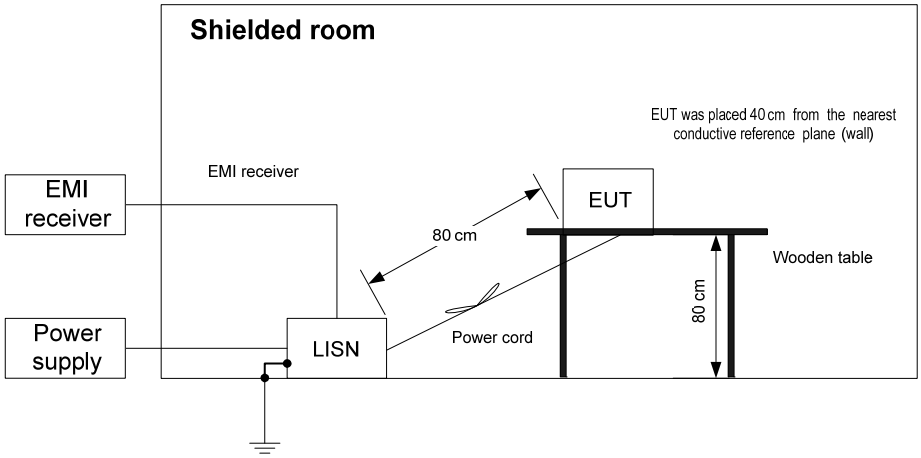
7.1.2.2 The measurements were performed at the EUT mains terminals with the LISN, connected to the EMI receiver in the frequency range referred to in Table 7.1.2. The unused coaxial connector of the LISN was terminated with 50 Ohm.

7.1.2.3 The position of the EUT cables was varied to find the highest emission.

7.1.2.4 The worst test results with respect to the limits were recorded in Table 7.1.2 and shown in the associated plots.

Test specification:	FCC 47 CFR, Section 15.107 / ICES-003, Section 3.2.1, Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 109 VAC, 50 Hz
Remarks:			

Figure 7.1.1 Setup for conducted emission measurements, table-top EUT



Photograph 7.1.1 Setup for conducted emissions measurements

Test specification:	FCC 47 CFR, Section 15.107 / ICES-003, Section 3.2.1, Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 109 VAC, 50 Hz
Remarks:			

Table 7.1.2 Conducted emission test results

LINE: AC mains input of AC/DC adapter
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Quasi-peak			Average			Line ID	Verdict
	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.150	51.76	66.00	-14.24	35.39	56.00	-20.61	L1	Pass
0.152	49.82	65.89	-16.07	30.19	55.89	-25.70		
0.440	38.65	57.05	-18.40	30.89	47.05	-16.16		
0.442	39.03	57.02	-17.99	31.13	47.02	-15.89		
0.444	39.19	56.98	-17.79	31.17	46.98	-15.81		
0.447	39.19	56.94	-17.75	31.07	46.94	-15.87		
0.166	49.22	65.14	-15.92	36.09	55.14	-19.05	L2	Pass
0.168	49.30	65.04	-15.74	37.91	55.04	-17.13		
0.170	49.20	64.94	-15.74	38.65	54.94	-16.29		
0.172	48.86	64.84	-15.98	38.10	54.84	-16.74		
0.442	37.64	57.02	-19.38	31.33	47.02	-15.69		
0.444	37.83	56.98	-19.15	31.66	46.98	-15.32		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

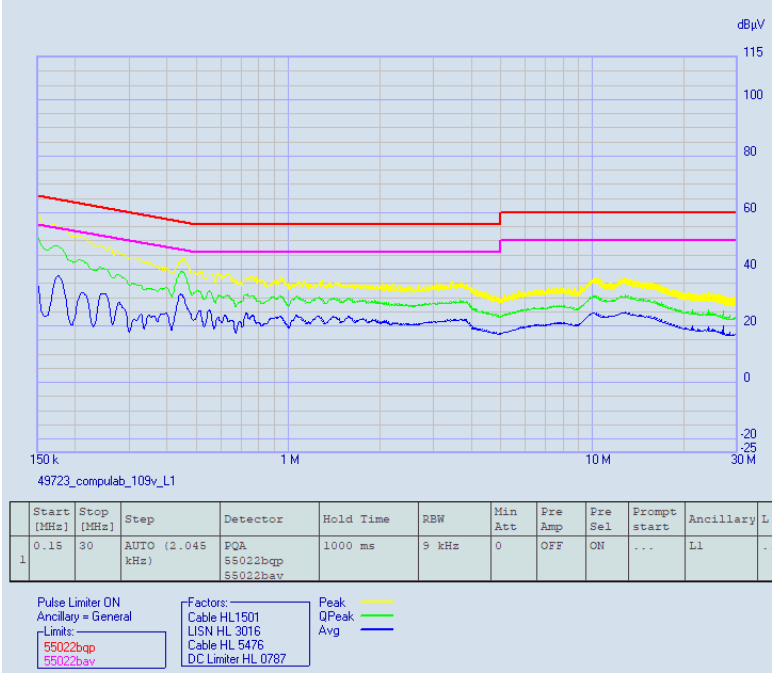
HL 5707	HL 0787	HL 1205	HL 2382	HL 3016	HL 5476		

Full description is given in Appendix A.

Test specification:	FCC 47 CFR, Section 15.107 / ICES-003, Section 3.2.1, Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 109 VAC, 50 Hz
Remarks:			

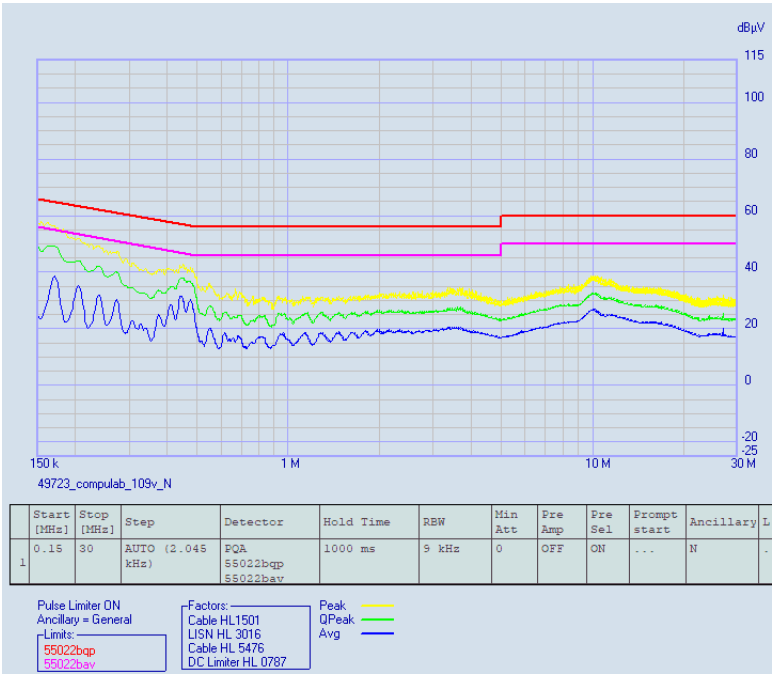
Plot 7.1.1 Conducted emission measurements, AC mains input of AC/DC adapter

LINE: L1
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.1.2 Conducted emission measurements, AC mains input of AC/DC adapter

LINE: L2
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	FCC 47 CFR, Section 15.109 / ICES-003, Section 3.2.2, Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

7.2 Radiated emission measurements

7.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits are given in Table 7.2.1.

Table 7.2.1 Radiated emission test limits

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
FCC 47 CFR, Section 15.109				
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
Above 960	43.5*	54.0	49.5	60.0*
ICES-003, Section 3.2.2				
30 - 88	30.0	40.0	40.0	50.0
88 - 216	33.1	43.5	43.5	54.0
216 - 230	35.6	46.0	46.4	56.9
230 - 960	37.0	47.0	47.0	57.0
960 - 1000	43.5	54.0	49.5	60.0
1000 - 40000	---	74 (Peak) / 54 (AVR)	---	80 (Peak) / 60 (AVR)

* - The limit for a test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – the standard defined and the test distance respectively in meters.

7.2.2 Test procedure

7.2.2.1 **30 – 1000 MHz range.** The EUT was set up as shown in Figure 7.2.1 and the associated photographs, energized and the EUT performance was checked.

7.2.2.2 The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

7.2.2.3 **1000 – 40000 MHz range.** The EUT was set up as shown in Figure 7.2.2 and the associated photographs, energized and the EUT performance was checked.

7.2.2.4 The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. In order to stay within the 3 dB beamwidth while keeping the antenna height scanned from 1 to 4 m, a few sweeps with different antenna angles over the entire height were performed.

7.2.2.5 The worst test results with respect to the limits were recorded in Table 7.2.2 and shown in the associated plots.

Test specification:	FCC 47 CFR, Section 15.109 / ICES-003, Section 3.2.2, Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Figure 7.2.1 Setup for radiated emission measurements in semi anechoic chamber in 30 – 1000 MHz range, table-top EUT

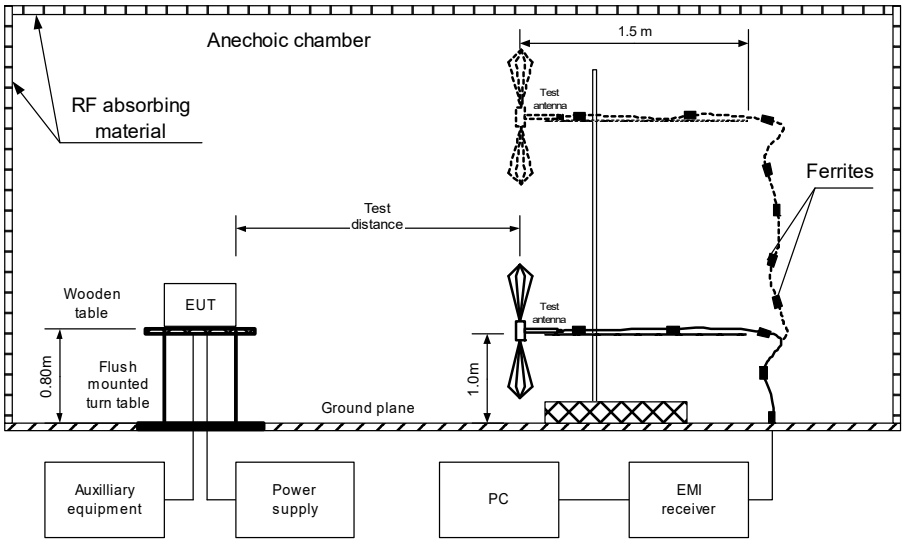
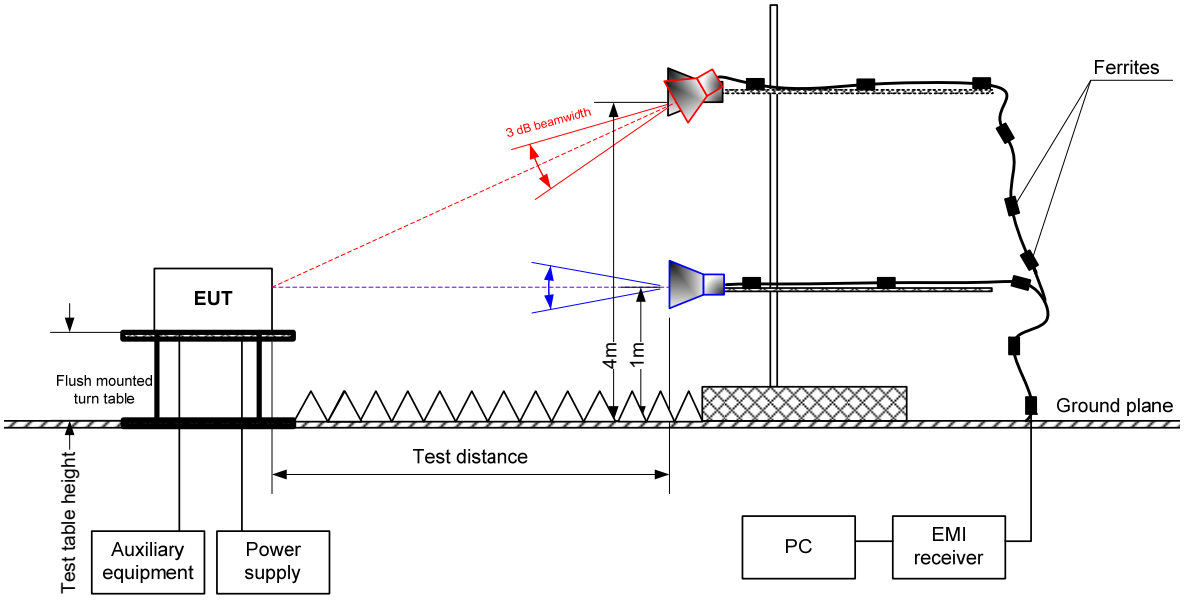
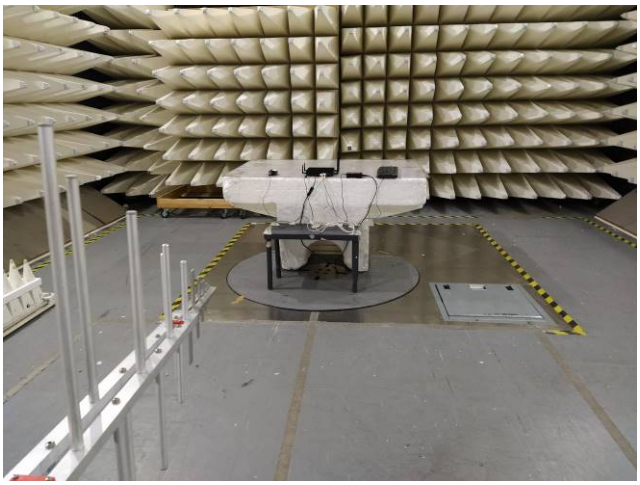


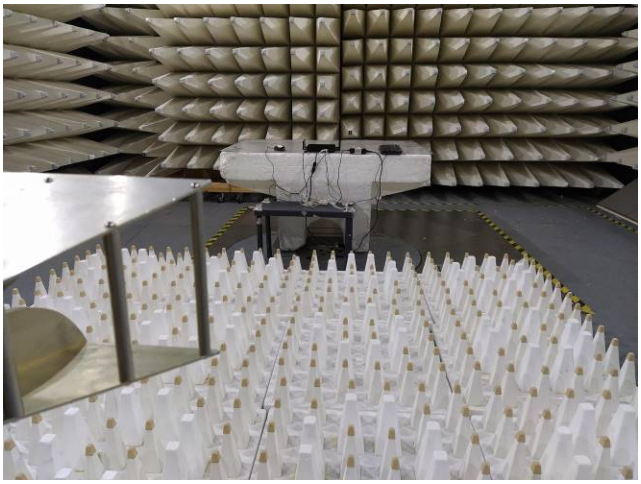
Figure 7.2.2 Setup for radiated emission measurements in semi anechoic chamber in 1000 – 40000 MHz range, table-top EUT

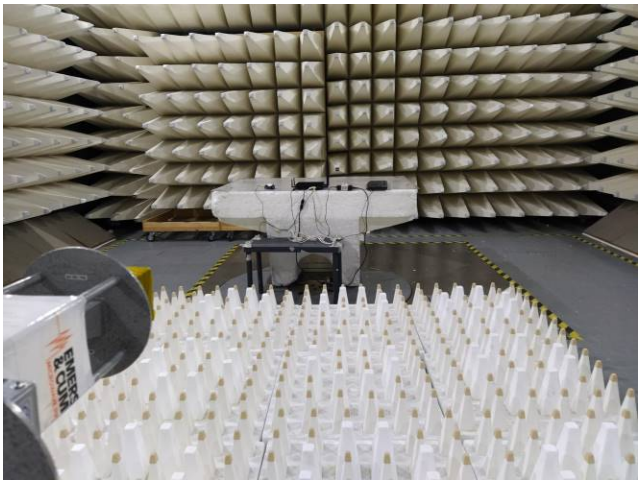


Test specification:	FCC 47 CFR, Section 15.109 / ICES-003, Section 3.2.2, Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

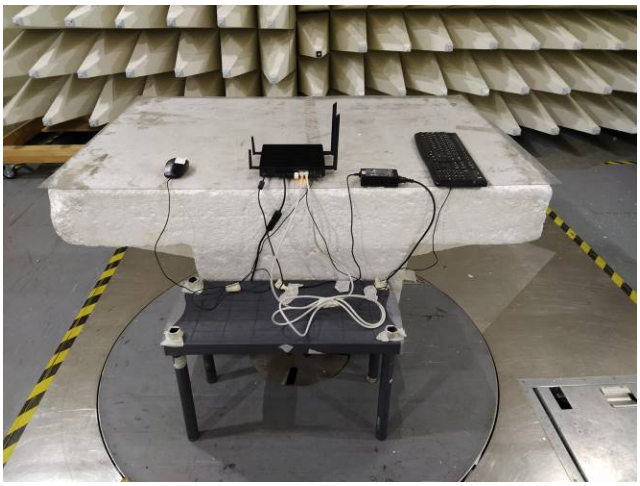
Photograph 7.2.1 Setup for radiated emission measurements, general view







Photograph 7.2.2 Setup for radiated emission measurements, EUT cabling



Test specification:	FCC 47 CFR, Section 15.109 / ICES-003, Section 3.2.2, Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Table 7.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
38.617	36.06	29.94	40.00	-10.06	Vertical	1.00	180	Pass
107.340	37.46	31.04	43.50	-12.46	Vertical	1.00	23	
381.287	44.98	39.75	46.00	-6.25	Horizontal	1.00	129	
634.200	43.50	36.39	46.00	-9.61	Horizontal	1.24	57	
890.962	44.02	38.40	46.00	-7.60	Horizontal	1.02	-75	
955.319	48.00	41.17	46.00	-4.83	Horizontal	1.02	131	

FREQUENCY RANGE: 1000 MHz – 40000 MHz
DETECTORS USED: PEAK / AVERAGE
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna tilt, degrees	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*					
1310.187	50.23	74.00	-23.77	38.38	54.00	-15.62	Horizontal	3.8	1.00	5	Pass
2227.313	49.29	74.00	-24.71	39.17	54.00	-14.83	Horizontal	3.8	1.00	-37	

*- Margin = Measured emission - specification limit.
**- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

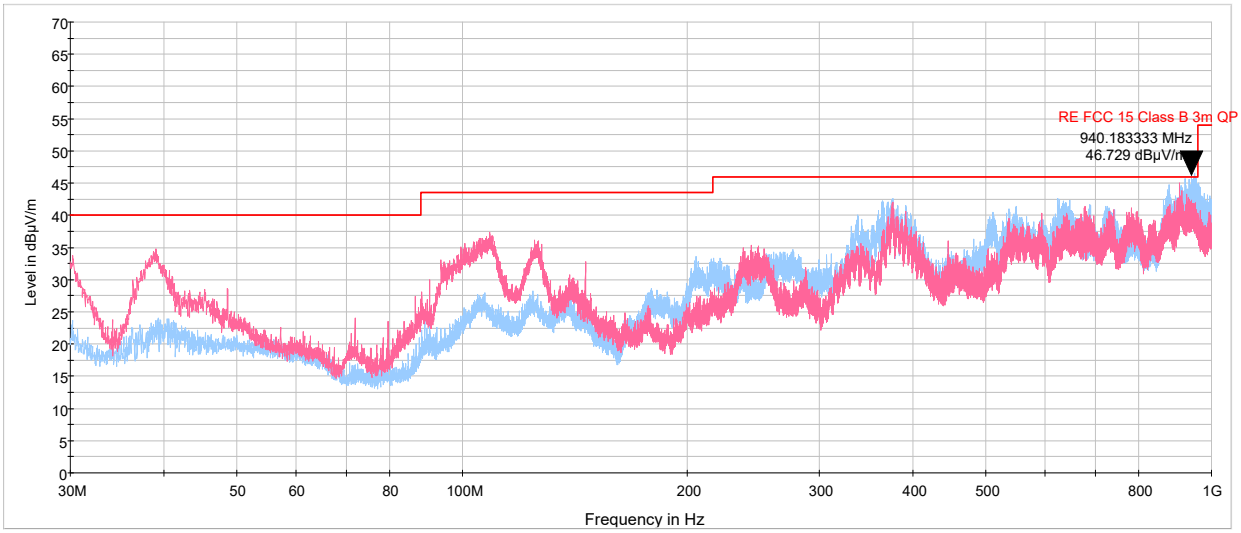
HL 3903	HL 4933	HL 4956	HL 5085	HL 5288	HL 5902	HL 7585	

Full description is given in Appendix A.

Test specification:	FCC 47 CFR, Section 15.109 / ICES-003, Section 3.2.2, Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

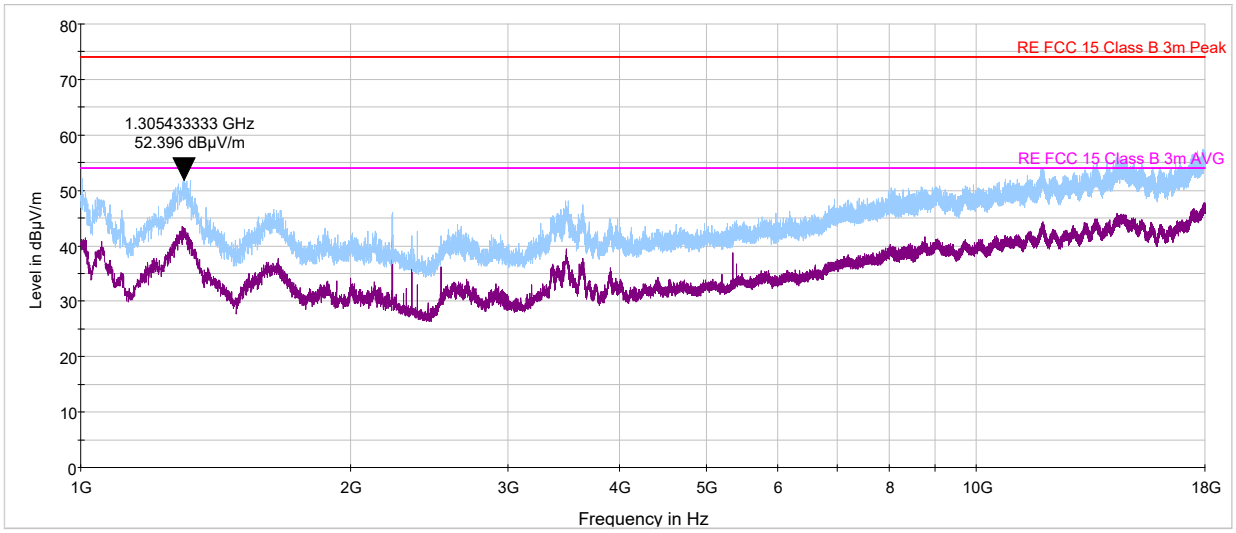
Plot 7.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.2.2 Radiated emission measurements in 1000 - 18000 MHz range, vertical & horizontal antenna polarization

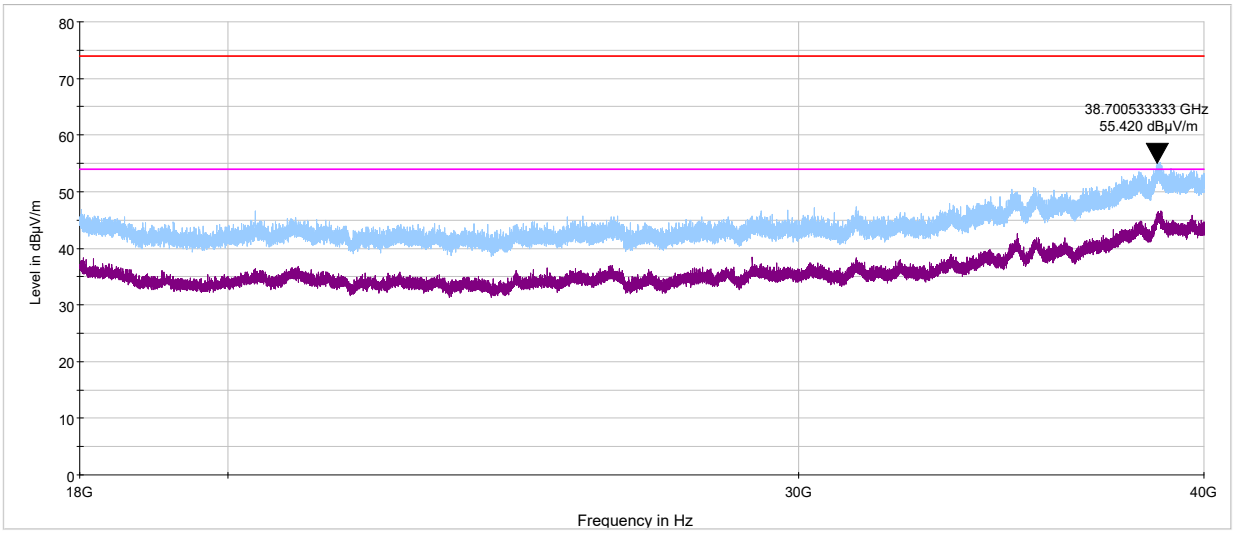
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	FCC 47 CFR, Section 15.109 / ICES-003, Section 3.2.2, Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.2.3 Radiated emission measurements in 18000 - 40000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Annex A.3, Class B, Conducted emissions from AC mains power ports		
Test procedure:	VCCI-CISPR 32, Annex A.3, Table A.8/9/10, Annex C.3, Section C.3.5; CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 109 VAC, 50 Hz
Remarks:			

8 Emissions tests according to VCCI-CISPR 32 requirements

8.1 Conducted emissions from AC mains power ports

8.1.1 General

This test was performed to measure the common mode conducted emissions at the EUT AC mains power ports. The specification test limits are given in Table 8.1.1.

Table 8.1.1 Limits for conducted emissions from AC mains power ports

Frequency, MHz	Class B limit, dB(μV)		Class A limit, dB(μV)	
	QP	AVRG	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*	79	66
0.5 - 5.0	56	46	73	60
5.0 - 30	60	50	73	60

* - The limit decreases linearly with the logarithm of frequency.

8.1.2 Test procedure

8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and the associated photograph, energized and the EUT performance was checked.

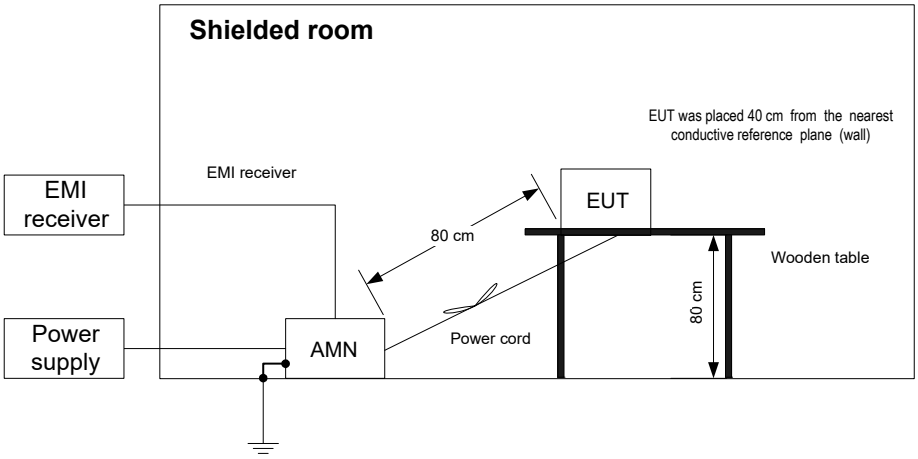
8.1.2.2 The measurements were performed at the EUT mains terminals with the AMN connected to the EMI receiver in the frequency range referred to in Table 8.1.2. The unused coaxial connector of the AMN was terminated with 50 Ohm.

8.1.2.3 The position of the EUT cables was varied to find the highest emission.

8.1.2.4 The worst test results with respect to the limits were recorded in Table 8.1.2 and shown in the associated plots.

Test specification:	Annex A.3, Class B, Conducted emissions from AC mains power ports		
Test procedure:	VCCI-CISPR 32, Annex A.3, Table A.8/9/10, Annex C.3, Section C.3.5; CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 109 VAC, 50 Hz
Remarks:			

Figure 8.1.1 Setup for conducted emissions from AC mains power ports, table-top EUT



Photograph 8.1.1 Setup for conducted emissions from AC mains power ports

Test specification:	Annex A.3, Class B, Conducted emissions from AC mains power ports		
Test procedure:	VCCI-CISPR 32, Annex A.3, Table A.8/9/10, Annex C.3, Section C.3.5; CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 109 VAC, 50 Hz
Remarks:			

Table 8.1.2 Conducted emissions from AC mains power ports test results

LINE: AC mains input of AC/DC adapter
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Quasi-peak			Average			Line ID	Verdict
	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.150	51.76	66.00	-14.24	35.39	56.00	-20.61	L1	Pass
0.152	49.82	65.89	-16.07	30.19	55.89	-25.70		
0.440	38.65	57.05	-18.40	30.89	47.05	-16.16		
0.442	39.03	57.02	-17.99	31.13	47.02	-15.89		
0.444	39.19	56.98	-17.79	31.17	46.98	-15.81		
0.447	39.19	56.94	-17.75	31.07	46.94	-15.87		
0.166	49.22	65.14	-15.92	36.09	55.14	-19.05	L2	Pass
0.168	49.30	65.04	-15.74	37.91	55.04	-17.13		
0.170	49.20	64.94	-15.74	38.65	54.94	-16.29		
0.172	48.86	64.84	-15.98	38.10	54.84	-16.74		
0.442	37.64	57.02	-19.38	31.33	47.02	-15.69		
0.444	37.83	56.98	-19.15	31.66	46.98	-15.32		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

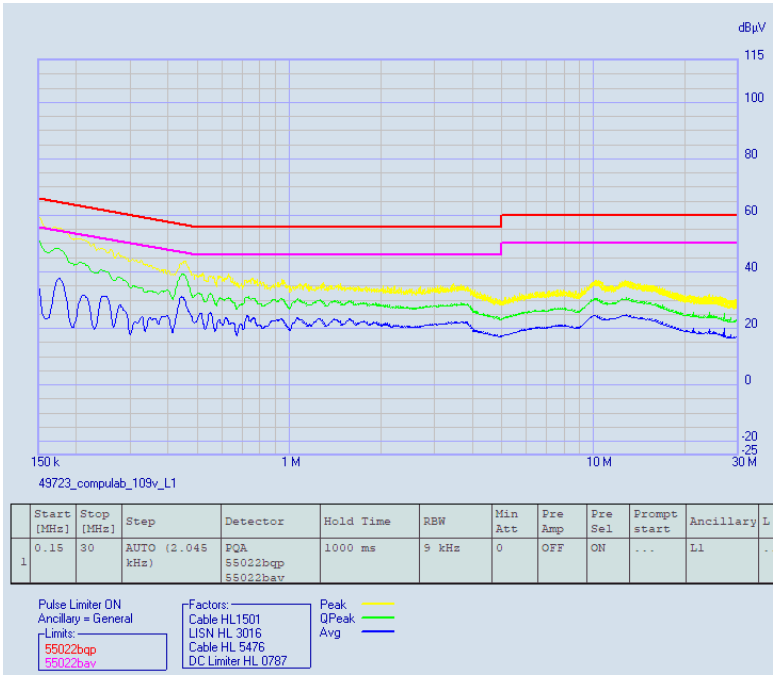
HL 5707	HL 0787	HL 1205	HL 2382	HL 3016	HL 5476		

Full description is given in Appendix A.

Test specification:	Annex A.3, Class B, Conducted emissions from AC mains power ports		
Test procedure:	VCCI-CISPR 32, Annex A.3, Table A.8/9/10, Annex C.3, Section C.3.5; CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 109 VAC, 50 Hz
Remarks:			

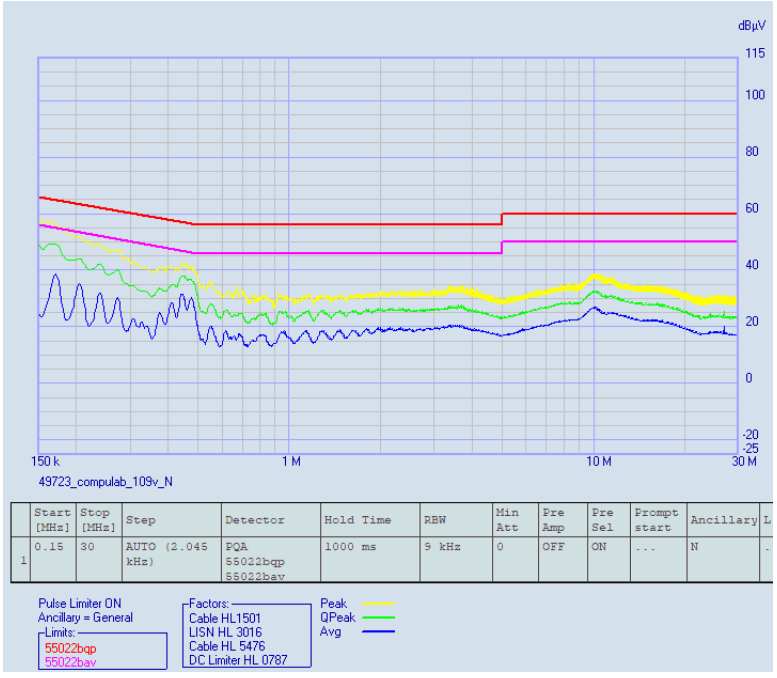
Plot 8.1.1 Conducted emissions from AC mains power ports, AC mains input of AC/DC adapter

LINE: L1
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 8.1.2 Conducted emissions from AC mains power ports, AC mains input of AC/DC adapter

LINE: L2
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Annex A.3, Class B, Conducted emissions from wired network ports		
Test procedure:	VCCI-CISPR 32, Annex A.3, Table A.8/11/12, Annex C.3, Section C.3.6, Annex C.4, Section C.4.1; CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

8.2 Conducted emission measurements at wired network ports

8.2.1 General

This test was performed to measure common mode conducted emissions at the EUT wired network port. The specification test limits are given in Table 8.2.1.

Table 8.2.1 Limits conducted emissions at wired network ports

Frequency, MHz	Class A				Class B			
	Voltage limits, dB(μV)		Current limits, dB(μA)		Voltage limits, dB(μV)		Current limits, dB(μA)	
	QP	AVRG	QP	AVRG	QP	AVRG	QP	AVRG
0.15 - 0.5	97 - 87*	84 - 74*	53 - 43*	40 - 30*	84 - 74*	74 - 64*	40 - 30*	30 - 20*
0.5 - 30	87	74	43	30	74	64	30	20

* - The limit decreases linearly with the logarithm of frequency.

8.2.2 Test procedure for conducted disturbance measurements with current probe and 150 Ohm termination

8.2.2.1 The EUT was set up as shown in Figure 8.2.1 and the associated photograph, energized and the EUT performance was checked.

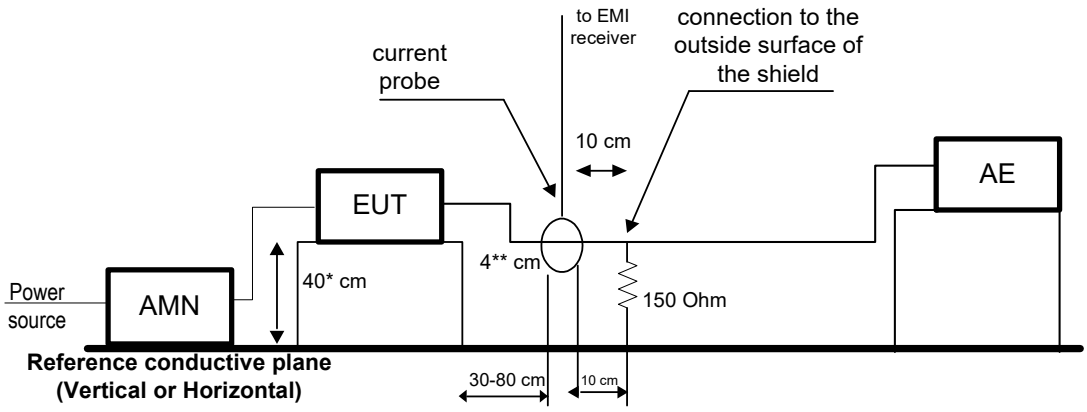
8.2.2.2 The measurements were performed at the EUT wired network port with the current probe connected to the EMI receiver and 150-Ohm reference impedance provided between the outer surface of the shield and the reference ground in the specified frequency range as referred to in Table 8.2.2.

8.2.2.3 The position of the EUT cables was varied to find the highest emission.

8.2.2.4 The worst test results with respect to the limits were recorded in Table 8.2.2 and shown in the associated plot.

Test specification:	Annex A.3, Class B, Conducted emissions from wired network ports		
Test procedure:	VCCI-CISPR 32, Annex A.3, Table A.8/11/12, Annex C.3, Section C.3.6, Annex C.4, Section C.4.1; CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

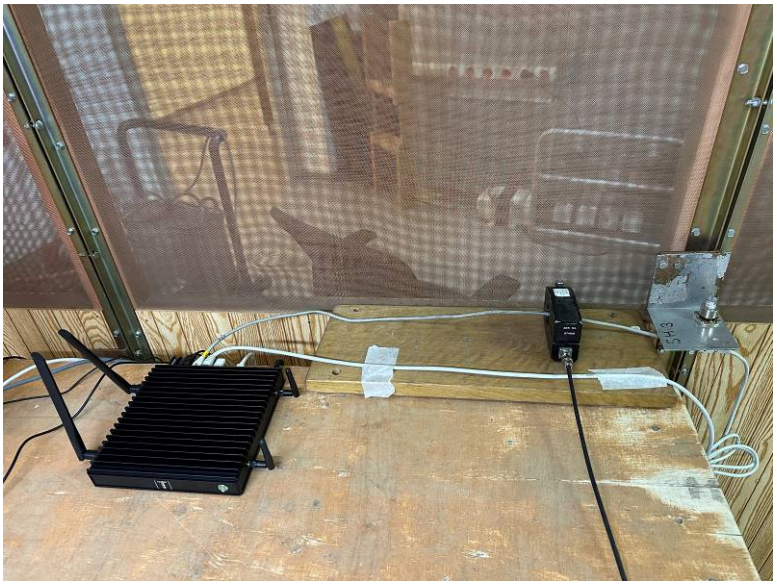
Figure 8.2.1 Setup for conducted emission measurements at wired network ports with current probe



*Distance to the reference ground plane Vertical or Horizontal.

**Distance to the reference ground plane Vertical.

Photograph 8.2.1 Setup for conducted emission measurements at wired network port with current probe



Test specification:	**Annex A.3, Class B, Conducted emissions from wired network ports**		
Test procedure:	VCCI-CISPR 32, Annex A.3, Table A.8/11/12, Annex C.3, Section C.3.6, Annex C.4, Section C.4.1; CISPR 16-2-1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1006 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

Table 8.2.2 Conducted emission at wired network ports test results

LINE IDENTIFICATION: Ethernet
TEST COUPLING: CURRENT PROBE
LINE TERMINATION: 150 Ohm
EUT SET UP: TABLE TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz – 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Quasi-peak			Average			Verdict
	Measured emission, dB(µA)	Limit, dB(µA)	Margin, dB*	Measured emission, dB(µA)	Limit, dB(µA)	Margin, dB*	
0.326	16.88	33.56	-16.68	13.07	23.56	-10.49	Pass
0.328	16.77	33.50	-16.73	13.46	23.50	-10.04	
0.330	16.19	33.45	-17.26	13.20	23.45	-10.25	
26.800	14.55	30.00	-15.45	9.44	20.00	-10.56	
26.802	15.60	30.00	-14.40	11.04	20.00	-8.96	
26.805	15.67	30.00	-14.33	11.15	20.00	-8.85	

*- Margin = Measured emission - specification limit.

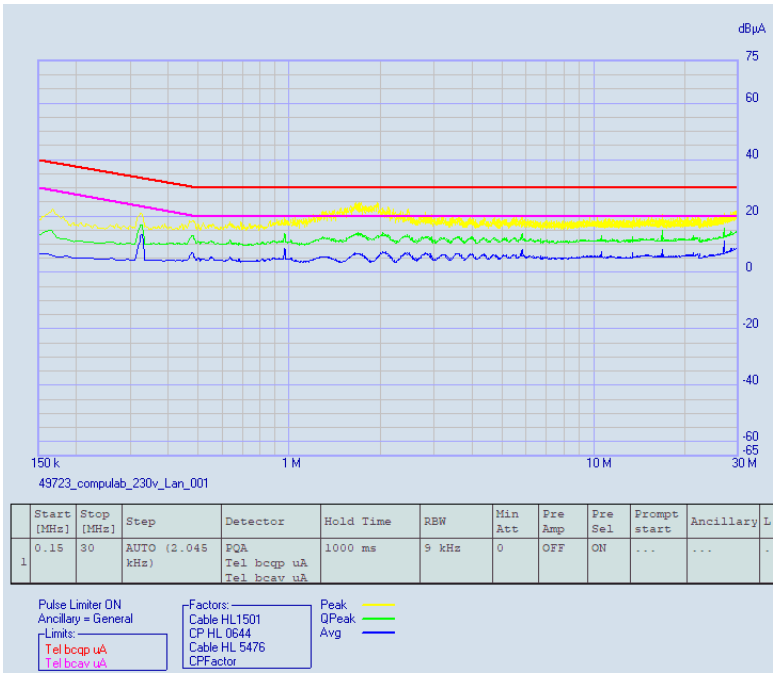
Reference numbers of test equipment used

HL 0644	HL 1205	HL 2382	HL 3016	HL 5476	HL 5707		

Full description is given in Appendix A.

Plot 8.2.1 Conducted emission measurements at wired network port

LINE: Ethernet
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Annex A.2, Class B, Radiated emissions		
Test procedure:	VCCI-CISPR 32, Annex A.2, Table A.1/2/3/4/5, Annex C.3, Section C.3.4; CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

8.3 Radiated emissions measurements

8.3.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits are given in Table 8.3.1.

Table 8.3.1 Radiated emissions limits

Frequency, MHz	Class B limit, dB(μV/m)				Class A limit, dB(μV/m)			
	Peak	Quasi-peak		Average	Peak	Quasi-peak		Average
	@3 m	@10 m	@3 m	@3 m	@3 m	@10 m	@3 m	@3 m
30 - 230	——	30.0	40.0*	——	——	40.0	50.0*	——
230 - 1000	——	37.0	47.0*	——	——	47.0	57.0*	——
1000 – 3000	70	——	——	50	76	——	——	56
3000 - 6000	74	——	——	54	80	——	——	60

* The limit for 3 meters test distance was calculated by adding 10 dB to the 10 meters limit.

8.3.2 Test procedure

8.3.2.1 **30 – 1000 MHz range.** The EUT was set up as shown in Figure 8.3.1 and the associated photographs, energized and the EUT performance was checked.

8.3.2.2 The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations.

8.3.2.3 **1000 – 6000 MHz range.** The EUT was set up as shown in Figure 8.3.2 and the associated photographs, energized and the EUT performance was checked.

8.3.2.4 The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was installed at fixed height pointed to the physical center of the EUT in both, vertical and horizontal polarizations.

8.3.2.5 The worst test results with respect to the limits were recorded in Table 8.3.2 and shown in the associated plots.

Test specification:	Annex A.2, Class B, Radiated emissions		
Test procedure:	VCCI-CISPR 32, Annex A.2, Table A.1/2/3/4/5, Annex C.3, Section C.3.4; CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Figure 8.3.1 Setup for radiated emissions measurements in semi anechoic chamber below 1 GHz, table-top EUT

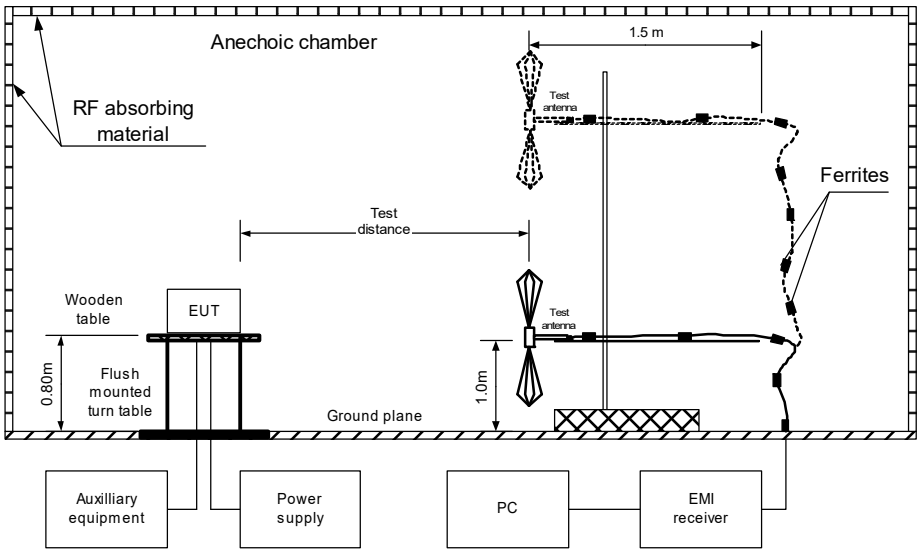
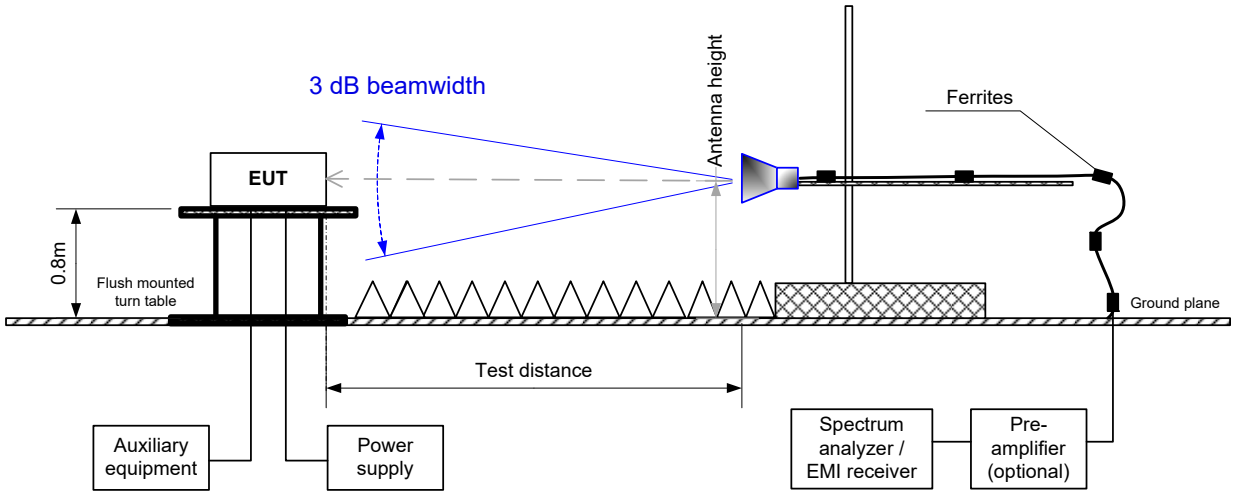
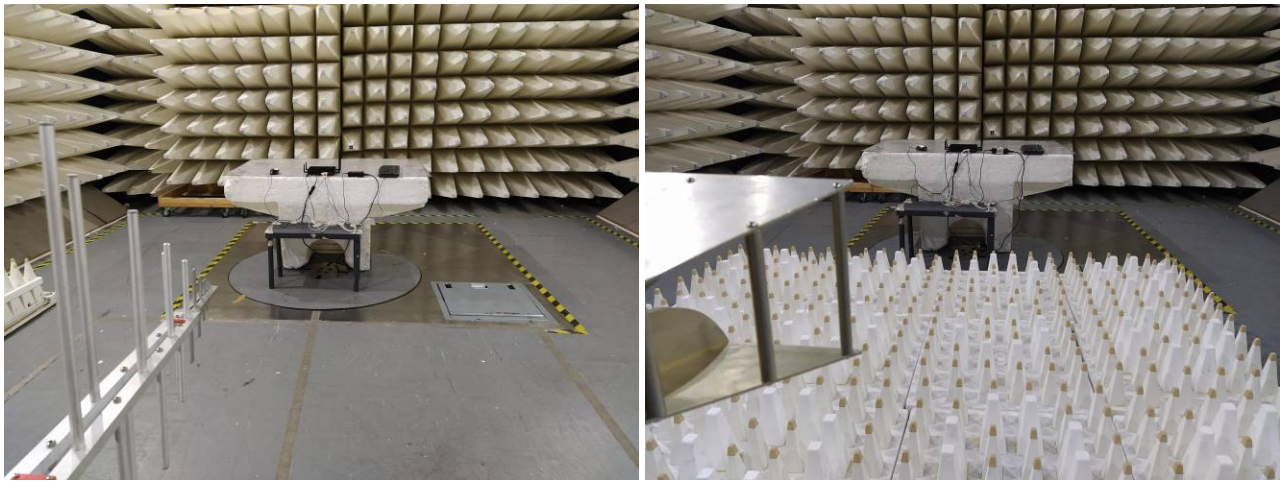


Figure 8.3.2 Setup for radiated emission measurements in semi anechoic chamber above 1 GHz, table-top EUT

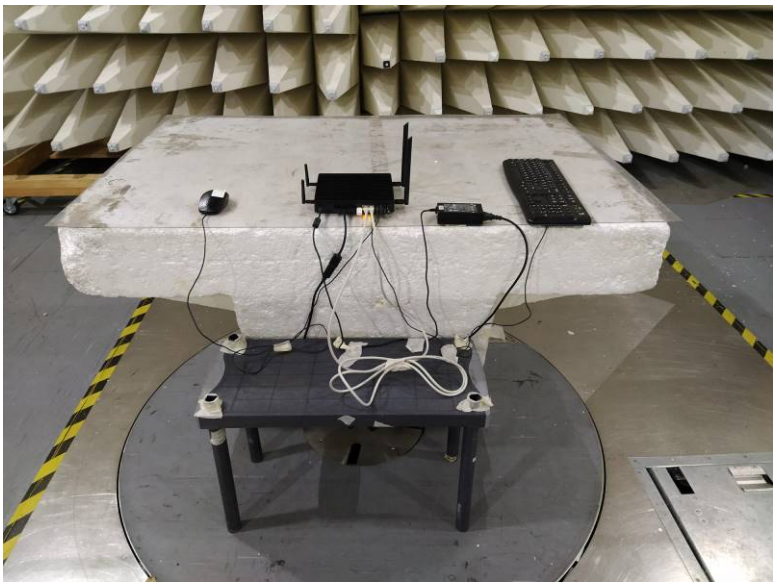


Test specification:	Annex A.2, Class B, Radiated emissions		
Test procedure:	VCCI-CISPR 32, Annex A.2, Table A.1/2/3/4/5, Annex C.3, Section C.3.4; CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Photograph 8.3.1 Setup for radiated emissions measurements, general view



Photograph 8.3.2 Setup for radiated emissions measurements, EUT cabling



Test specification:	Annex A.2, Class B, Radiated emissions		
Test procedure:	VCCI-CISPR 32, Annex A.2, Table A.1/2/3/4/5, Annex C.3, Section C.3.4; CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Table 8.3.2 Radiated emissions test results

EUT SET UP: TABLE-TOP
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
38.617	36.06	29.94	40.00	-10.06	Vertical	1.00	180	Pass
107.340	37.46	31.04	40.00	-8.96	Vertical	1.00	23	
381.287	44.98	39.75	47.00	-7.25	Horizontal	1.00	129	
634.200	43.50	36.39	47.00	-10.61	Horizontal	1.24	57	
890.962	44.02	38.40	47.00	-8.60	Horizontal	1.02	-75	
955.319	48.00	41.17	47.00	-5.83	Horizontal	1.02	131	

FREQUENCY RANGE: 1000 MHz – 6000 MHz
DETECTORS USED: PEAK / AVERAGE
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
1310.187	50.23	70.00	-19.77	38.38	50.00	-11.62	Horizontal	1.00	5	Pass
2227.313	49.29	70.00	-20.71	39.17	50.00	-10.83	Horizontal	1.00	-37	

Frequency, MHz	Antenna beam width (θ_{3dB}), degrees	Exposed area of antenna (w), m	EUT exposed heights, m	
			h_{min}	h_{max}
1310.000	59.6	3.44	0	2.72
2227.000	50.6	2.84	0	2.42

*- Margin = Measured emission - specification limit.
**- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

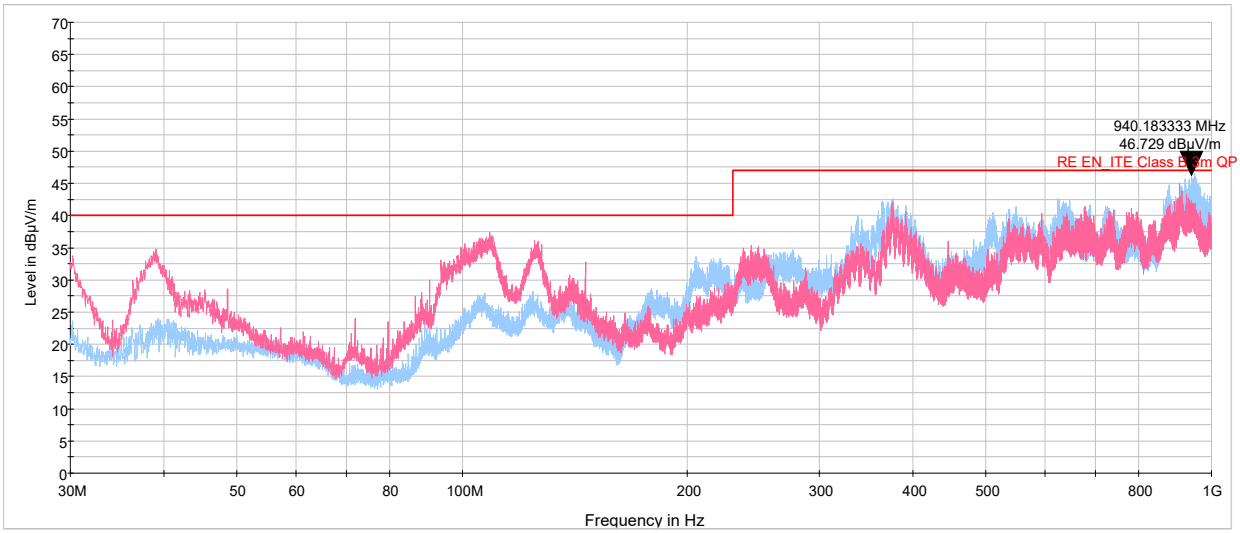
HL 3903	HL 4933	HL 5085	HL 5288	HL 5902	HL 7585		

Full description is given in Appendix A.

Test specification:	Annex A.2, Class B, Radiated emissions		
Test procedure:	VCCI-CISPR 32, Annex A.2, Table A.1/2/3/4/5, Annex C.3, Section C.3.4; CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 110 VAC, 50 Hz
Remarks:			

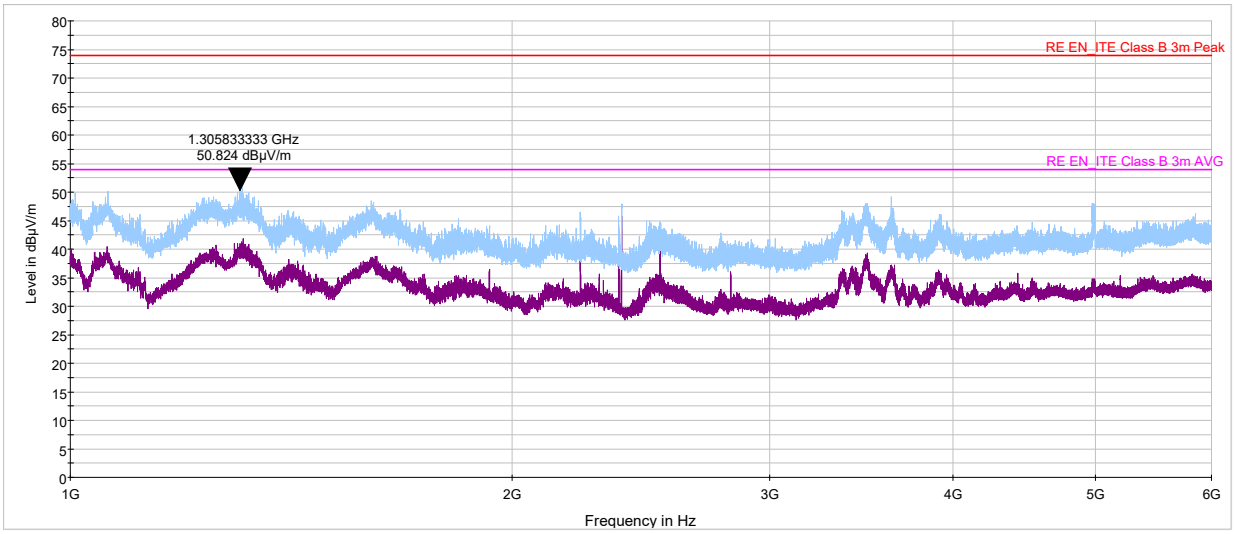
Plot 8.3.1 Radiated emissions measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 8.3.2 Radiated emissions measurements in 1000 - 6000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Class B, Conducted emissions from AC mains power ports		
Test procedure:	EN 301 489-1, Section 8.4, EN 55032, AS/NZS CISPR 32, Annex A.3, Table A.8/A.9, Annex C.3, Section C.3.5; EN IEC 61000-6-3, Table 4, CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

9 Emissions tests according to EN 55032, AS/NZS CISPR 32, EN IEC 61000-6-3 and EN 301 489-17/52/1 requirements

9.1 Conducted emission measurements at AC mains input port

9.1.1 General

This test was performed to measure common mode conducted emissions at the EUT power port. The specification test limits are given in Table 9.1.1.

Table 9.1.1 Limits for conducted emissions at AC mains input port

Frequency, MHz	Class B limit, dB(μV)		Class A limit, dB(μV)	
	QP	AVRG	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*	79	66
0.5 - 5.0	56	46	73	60
5.0 - 30	60	50	73	60

* The limit decreases linearly with the logarithm of frequency.

9.1.2 Test procedure

9.1.2.1 The EUT was set up as shown in Figure 9.1.1 and the associated photograph, energized and the EUT performance was checked.

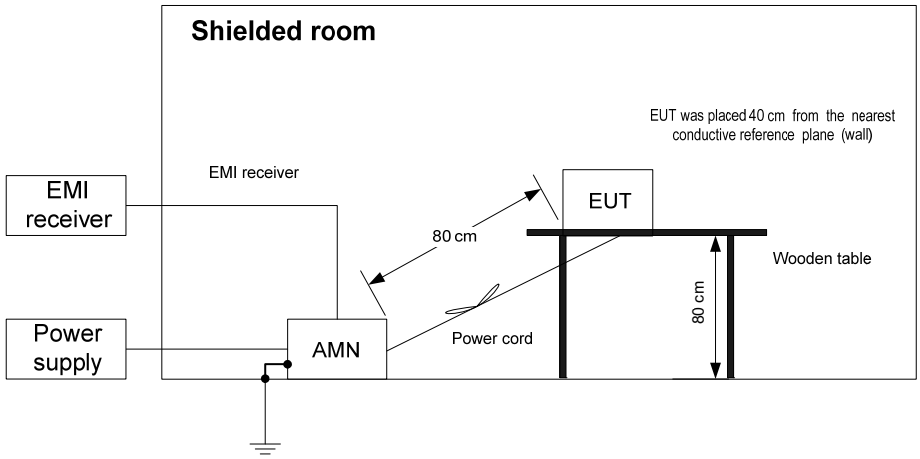
9.1.2.2 The measurements were performed at the EUT power terminals with the AMN, connected to the EMI receiver in the frequency range referred to in Table 9.1.2. The unused coaxial connector of the AMN was terminated with 50 Ohm.

9.1.2.3 The position of the EUT cables was varied to find the highest emission.

9.1.2.4 The worst test results with respect to the limits were recorded in Table 9.1.2 and shown in the associated plots.

Test specification:	Class B, Conducted emissions from AC mains power ports		
Test procedure:	EN 301 489-1, Section 8.4, EN 55032, AS/NZS CISPR 32, Annex A.3, Table A.8/A.9, Annex C.3, Section C.3.5; EN IEC 61000-6-3, Table 4, CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 9.1.1 Setup for conducted emission measurements at AC mains input port, table-top EUT



Photograph 9.1.1 Setup for conducted emission measurements at AC mains input port

Test specification:	Class B, Conducted emissions from AC mains power ports		
Test procedure:	EN 301 489-1, Section 8.4, EN 55032, AS/NZS CISPR 32, Annex A.3, Table A.8/A.9, Annex C.3, Section C.3.5; EN IEC 61000-6-3, Table 4, CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 9.1.2 Conducted emissions at AC mains input port test results

LINE: AC mains input of AC/DC adapter
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Quasi-peak			Average			Line ID	Verdict
	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.150	53.92	66.00	-12.08	44.65	56.00	-11.35	L1	Pass
0.152	53.96	65.89	-11.93	46.18	55.89	-9.71		
0.154	53.79	65.78	-11.99	46.71	55.78	-9.07		
0.156	53.34	65.67	-12.33	45.81	55.67	-9.86		
0.158	52.89	65.56	-12.67	44.12	55.56	-11.44		
0.189	49.58	64.09	-14.51	42.19	54.09	-11.90		
0.150	55.66	66.00	-10.34	44.58	56.00	-11.42	L2	Pass
0.152	55.70	65.89	-10.19	45.64	55.89	-10.25		
0.154	55.54	65.78	-10.24	45.63	55.78	-10.15		
0.156	55.25	65.67	-10.42	44.29	55.67	-11.38		
0.158	54.77	65.56	-10.79	42.23	55.56	-13.33		
0.160	53.72	65.45	-11.73	39.57	55.45	-15.88		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

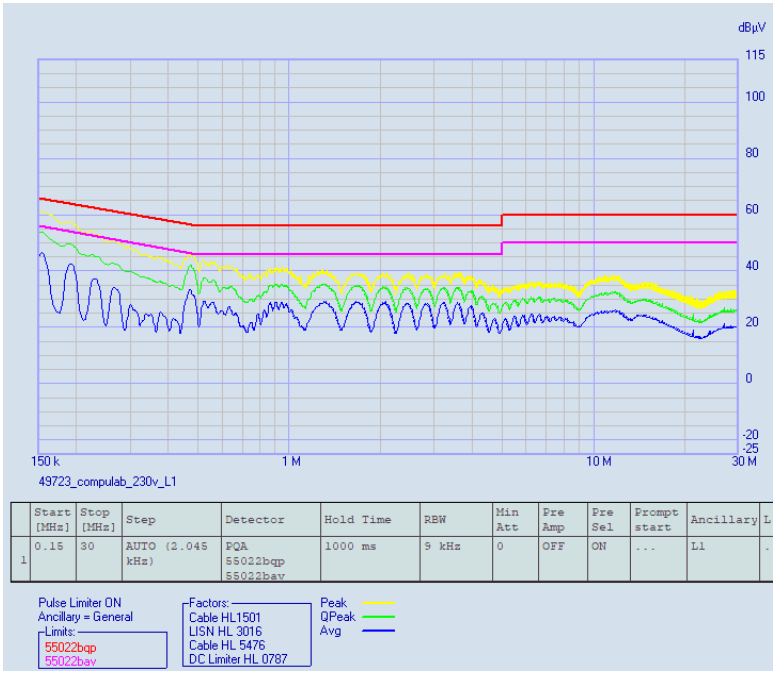
HL 5707	HL 0787	HL 1205	HL 2382	HL 3016	HL 5476		

Full description is given in Appendix A.

Test specification:	Class B, Conducted emissions from AC mains power ports		
Test procedure:	EN 301 489-1, Section 8.4, EN 55032, AS/NZS CISPR 32, Annex A.3, Table A.8/A.9, Annex C.3, Section C.3.5; EN IEC 61000-6-3, Table 4, CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

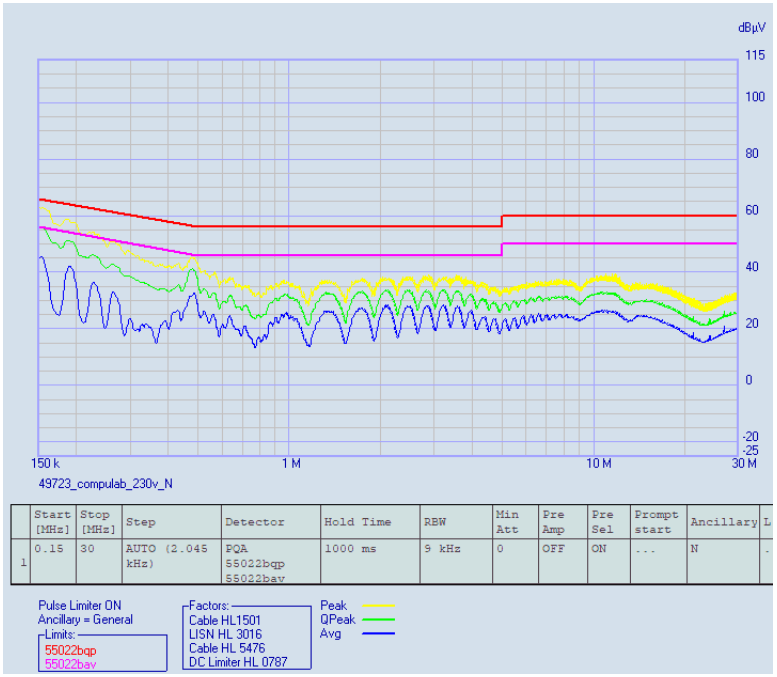
Plot 9.1.1 Conducted emissions at AC mains input port, AC mains input of AC/DC adapter

LINE: L1
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 9.1.2 Conducted emissions at AC mains input port, AC mains input of AC/DC adapter

LINE: L2
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Class B, Conducted emissions from wired network ports		
Test procedure:	EN 301 489-1, Section 8.7, EN 55032, AS/NZS CISPR 32, Annex A.3, Table A.10/A.11, Annex C.3, Section C.3.6, Annex C.4, Section C.4.1; EN IEC 61000-6-3, Table 6, CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

9.2 Conducted emission measurements at wired network ports

9.2.1 General

This test was performed to measure common mode conducted emissions at the EUT wired network port. The specification test limits are given in Table 9.2.1.

Table 9.2.1 Limits conducted emissions at wired network ports

Frequency, MHz	Class A				Class B			
	Voltage limits, dB(μV)		Current limits, dB(μA)		Voltage limits, dB(μV)		Current limits, dB(μA)	
	QP	AVRG	QP	AVRG	QP	AVRG	QP	AVRG
0.15 - 0.5	97 - 87*	84 - 74*	53 - 43*	40 - 30*	84 - 74*	74 - 64*	40 - 30*	30 - 20*
0.5 - 30	87	74	43	30	74	64	30	20

* - The limit decreases linearly with the logarithm of frequency.

9.2.2 Test procedure for conducted disturbance measurements with current probe and 150 Ohm termination

9.2.2.1 The EUT was set up as shown in Figure 9.2.1 and the associated photograph, energized and the EUT performance was checked.

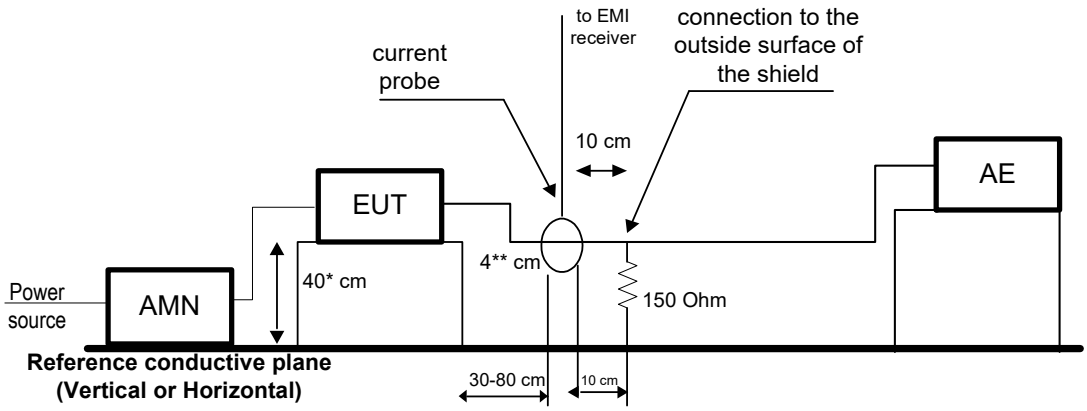
9.2.2.2 The measurements were performed at the EUT wired network port with the current probe connected to the EMI receiver and 150-Ohm reference impedance provided between the outer surface of the shield and the reference ground in the specified frequency range as referred to in Table 9.2.2.

9.2.2.3 The position of the EUT cables was varied to find the highest emission.

9.2.2.4 The worst test results with respect to the limits were recorded in Table 9.2.2 and shown in the associated plot.

Test specification:	Class B, Conducted emissions from wired network ports		
Test procedure:	EN 301 489-1, Section 8.7, EN 55032, AS/NZS CISPR 32, Annex A.3, Table A.10/A.11, Annex C.3, Section C.3.6, Annex C.4, Section C.4.1; EN IEC 61000-6-3, Table 6, CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

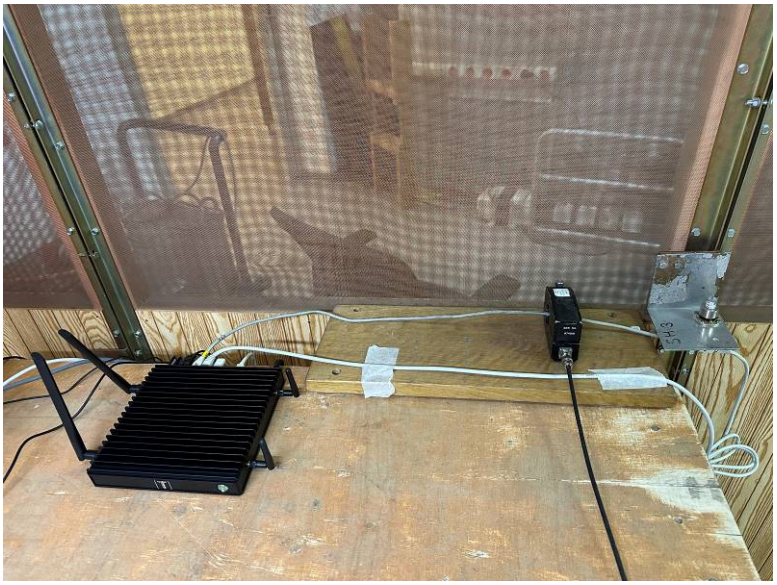
Figure 9.2.1 Setup for conducted emission measurements at wired network ports with current probe



*Distance to the reference ground plane Vertical or Horizontal.

**Distance to the reference ground plane Vertical.

Photograph 9.2.1 Setup for conducted emission measurements at wired network port with current probe



Test specification:	Class B, Conducted emissions from wired network ports		
Test procedure:	EN 301 489-1, Section 8.7, EN 55032, AS/NZS CISPR 32, Annex A.3, Table A.10/A.11, Annex C.3, Section C.3.6, Annex C.4, Section C.4.1; EN IEC 61000-6-3, Table 6, CISPR 16-2-1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 49 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 9.2.2 Conducted emission at wired network ports test results

LINE IDENTIFICATION: Ethernet
TEST COUPLING: CURRENT PROBE
LINE TERMINATION: 150 Ohm
EUT SET UP: TABLE TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz – 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Quasi-peak			Average			Verdict
	Measured emission, dB(µA)	Limit, dB(µA)	Margin, dB*	Measured emission, dB(µA)	Limit, dB(µA)	Margin, dB*	
0.326	16.88	33.56	-16.68	13.07	23.56	-10.49	Pass
0.328	16.77	33.50	-16.73	13.46	23.50	-10.04	
0.330	16.19	33.45	-17.26	13.20	23.45	-10.25	
26.800	14.55	30.00	-15.45	9.44	20.00	-10.56	
26.802	15.60	30.00	-14.40	11.04	20.00	-8.96	
26.805	15.67	30.00	-14.33	11.15	20.00	-8.85	

*- Margin = Measured emission - specification limit.

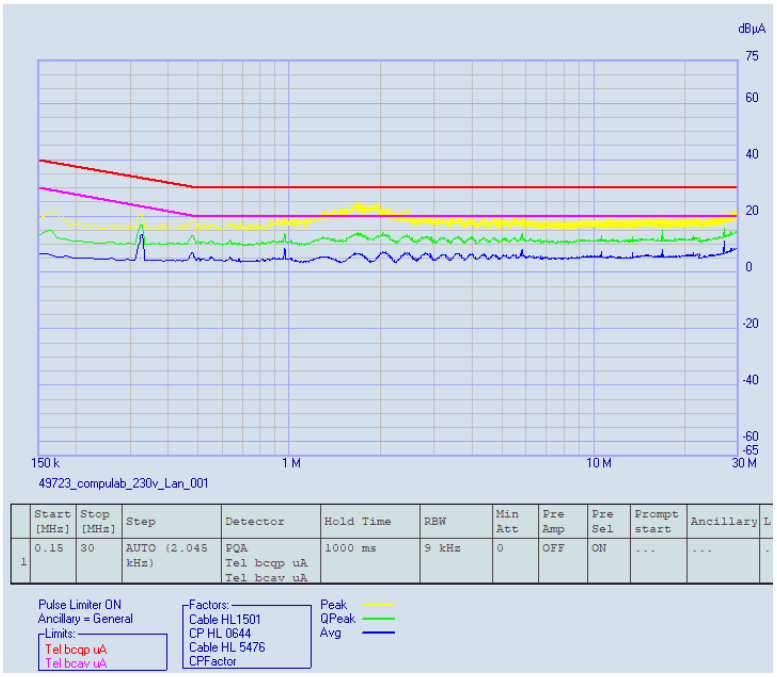
Reference numbers of test equipment used

HL 0644	HL 1205	HL 2382	HL 3016	HL 5476	HL 5707		

Full description is given in Appendix A.

Plot 9.2.1 Conducted emission measurements at wired network port

LINE: Ethernet
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Class B, Radiated emissions		
Test procedure:	EN 301 489-1, Section 8.2, EN 55032, AS/NZS CISPR 32, Section 8, Table 1, Annex A.2, Table A.2/3, Table A.4/5, Annex C.3, Section C.3.4; EN IEC 61000-6-3, Table 3, CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 230 VAC, 50 Hz
Remarks:			

9.3 Radiated emission measurements

9.3.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits are given in Table 9.3.1.

Table 9.3.1 Radiated emission limits

Frequency, MHz	Class B limit, dB(µV/m)				Class A limit, dB(µV/m)			
	Peak	Quasi-peak		Average	Peak	Quasi-peak		Average
	@3 m	@10 m	@3 m	@3 m	@3 m	@10 m	@3 m	@3 m
30 - 230	——	30.0	40.0*	——	——	40.0	50.0*	——
230 - 1000	——	37.0	47.0*	——	——	47.0	57.0*	——
1000 - 3000	70	——	——	50	76	——	——	56
1000 - 6000	74	——	——	54	80	——	——	60

* The limit for 3 meters test distance was calculated by adding 10 dB to the 10 meters limit.

9.3.2 Test procedure

9.3.2.1 **30 – 1000 MHz range.** The EUT was set up as shown in Figure 9.3.1 and the associated photographs, energized and the EUT performance was checked.

9.3.2.2 The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

9.3.2.3 **1000 – 6000 MHz range.** The EUT was set up as shown in Figure 9.3.2 and the associated photographs, energized and the EUT performance was checked.

9.3.2.4 The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was installed at fixed height pointed to the physical center of the EUT in both, vertical and horizontal polarizations.

9.3.2.5 The worst test results with respect to the limits were recorded in Table 9.3.2 and shown in the associated plots.

Test specification:	Class B, Radiated emissions		
Test procedure:	EN 301 489-1, Section 8.2, EN 55032, AS/NZS CISPR 32, Section 8, Table 1, Annex A.2, Table A.2/3, Table A.4/5, Annex C.3, Section C.3.4; EN IEC 61000-6-3, Table 3, CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 9.3.1 Setup for radiated emission measurements in semi anechoic chamber below 1 GHz, table-top EUT

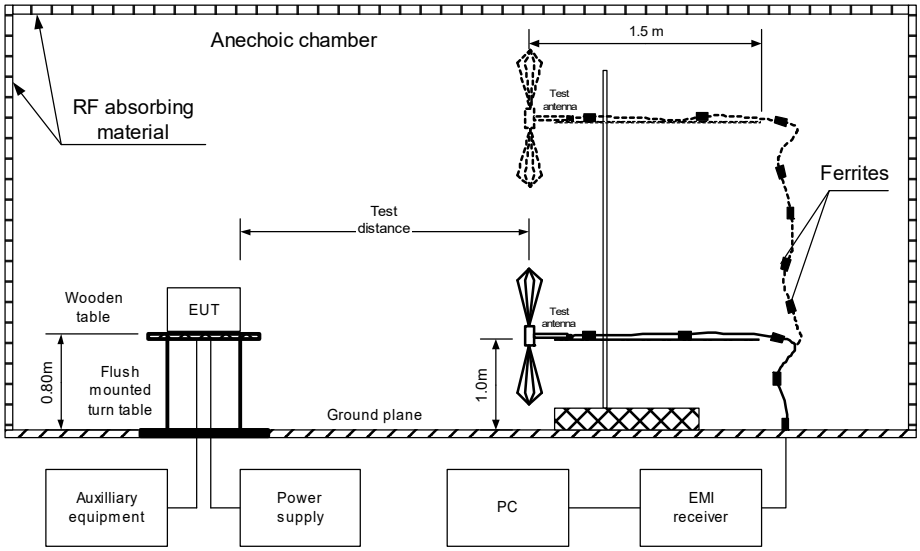
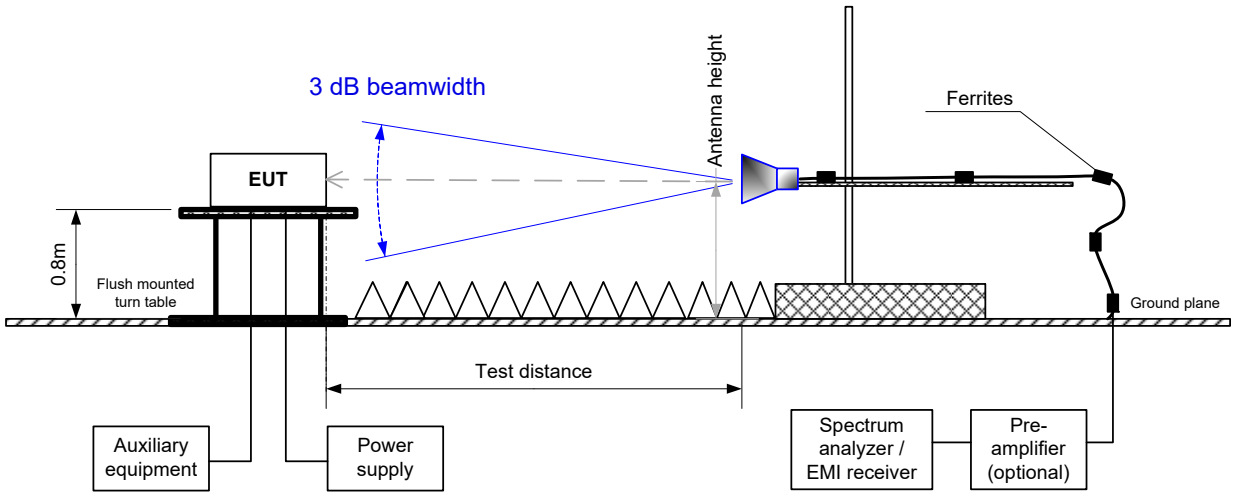


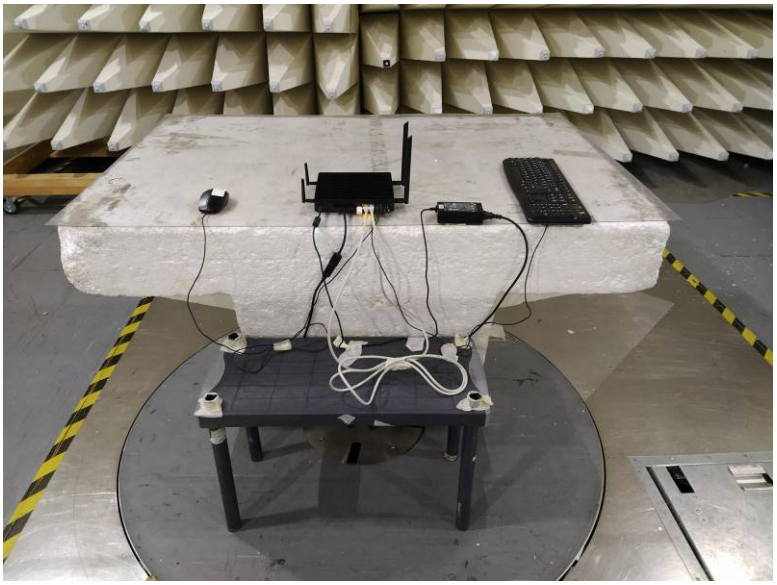
Figure 9.3.2 Setup for radiated emission measurements in semi anechoic chamber above 1 GHz, table-top EUT



Test specification:	Class B, Radiated emissions		
Test procedure:	EN 301 489-1, Section 8.2, EN 55032, AS/NZS CISPR 32, Section 8, Table 1, Annex A.2, Table A.2/3, Table A.4/5, Annex C.3, Section C.3.4; EN IEC 61000-6-3, Table 3, CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Photograph 9.3.1 Setup for radiated emission measurements, general view

Photograph 9.3.2 Setup for radiated emission measurements, EUT cabling



Test specification:	Class B, Radiated emissions		
Test procedure:	EN 301 489-1, Section 8.2, EN 55032, AS/NZS CISPR 32, Section 8, Table 1, Annex A.2, Table A.2/3, Table A.4/5, Annex C.3, Section C.3.4; EN IEC 61000-6-3, Table 3, CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 9.3.2 Radiated emission test results

EUT SET UP: TABLE-TOP
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
38.709	36.50	30.09	40.00	-9.91	Vertical	1.00	180	Pass
106.986	37.97	31.85	40.00	-8.15	Vertical	1.00	-3	
375.974	46.61	40.40	47.00	-6.60	Horizontal	1.00	129	
537.813	42.19	35.38	47.00	-11.62	Horizontal	1.00	-39	
734.231	44.11	37.03	47.00	-9.97	Horizontal	1.82	55	
952.668	48.56	41.66	47.00	-5.34	Horizontal	1.00	131	

FREQUENCY RANGE: 1000 MHz - 6000 MHz
DETECTORS USED: PEAK / AVERAGE
RESOLUTION BANDWIDTH: 1 MHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
1306.837	54.21	70.00	-15.79	42.17	50.00	-7.83	Vertical	1.00	8	Pass
2227.488	48.89	70.00	-21.11	39.23	50.00	-10.77	Horizontal	1.00	-39	

*- Margin = Measured emission - specification limit.
**- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

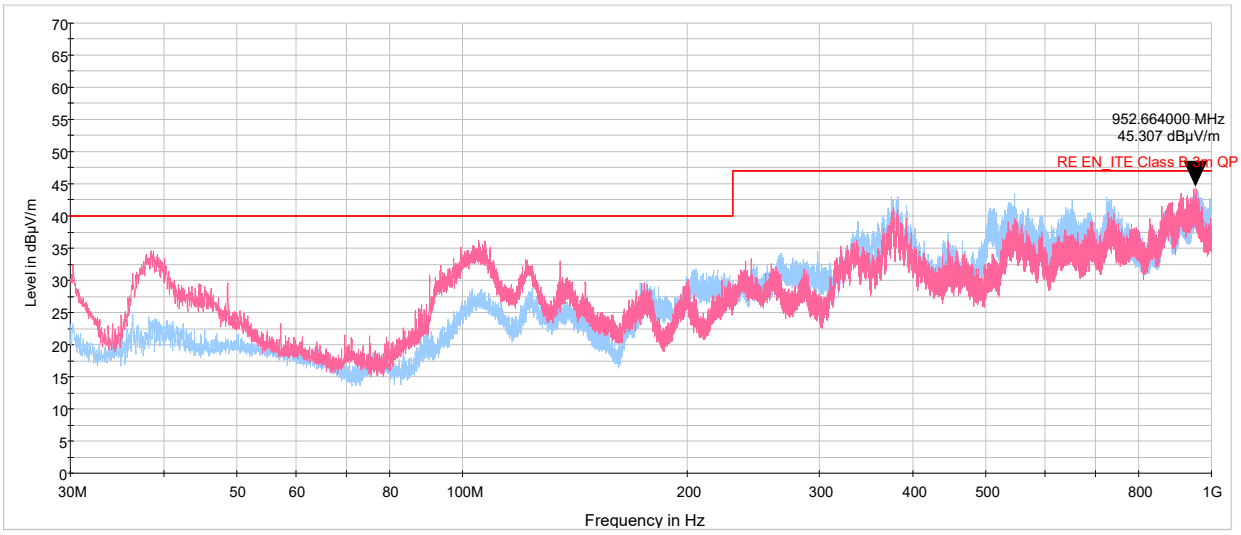
HL 3903	HL 4933	HL 5085	HL 5288	HL 5902	HL 7585		

Full description is given in Appendix A.

Test specification:	Class B, Radiated emissions		
Test procedure:	EN 301 489-1, Section 8.2, EN 55032, AS/NZS CISPR 32, Section 8, Table 1, Annex A.2, Table A.2/3, Table A.4/5, Annex C.3, Section C.3.4; EN IEC 61000-6-3, Table 3, CISPR 16-2-3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-23		
Temperature: 21 ºC	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 230 VAC, 50 Hz
Remarks:			

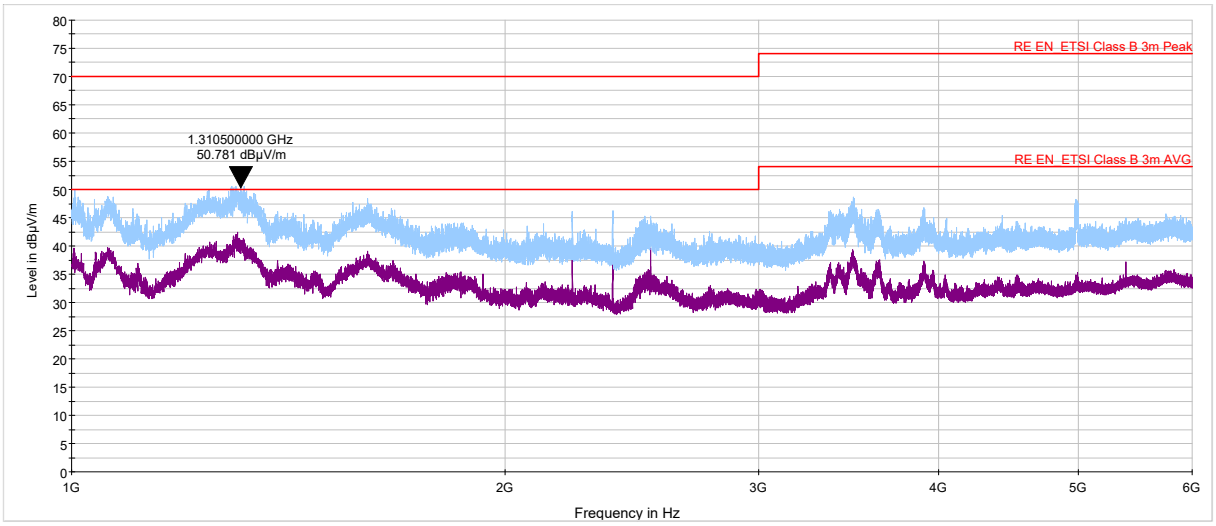
Plot 9.3.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 9.3.2 Radiated emission measurements in 1000 - 6000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Harmonic current emissions at AC mains input port		
Test procedure:	EN IEC 61000-3-2, EN IEC 61000-6-3, Table 4, EN 301 489-1, Section 8.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

9.4 Harmonic current emissions at AC mains input port

9.4.1 General

This test was performed to measure the harmonic currents injected into the public supply system. The specification test limits are given in Table 9.4.1.

Table 9.4.1 Harmonic current emission limits

Harmonic order, n	Equipment class A	Equipment class D	
	Maximum permissible harmonic current, A	Maximum permissible harmonic current per watt, mA/W	Maximum permissible harmonic current, A
Odd harmonics			
3	2.30	3.4	2.30
5	1.14	1.9	1.14
7	0.77	1.0	0.77
9	0.40	0.5	0.40
11	0.33	0.35	0.33
13	0.21	0.30	0.21
$15 \leq n \leq 39$	0.15 X 15/n	3.85/n	0.15 X 15/n
Even harmonics			
2	1.08	NA	
4	0.43		
6	0.30		
$8 \leq n \leq 40$	0.23 X 8/n		

9.4.2 Test procedure

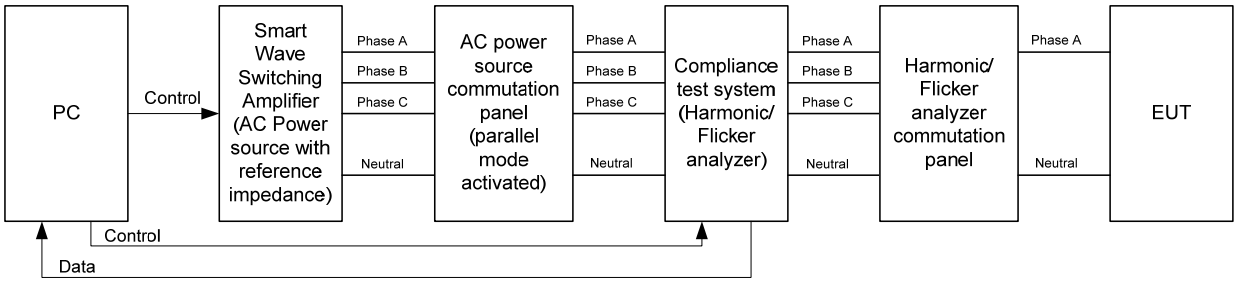
9.4.2.1 The EUT was set up as shown in Figure 9.4.1 and the associated photograph, energized and the EUT performance was checked.

9.4.2.2 The EUT was operated under normal operating and load conditions.

9.4.2.3 The harmonic currents for transitory and steady states conditions were measured with the computerized setup. The test results are provided in the associated tables.

Test specification:	Harmonic current emissions at AC mains input port		
Test procedure:	EN IEC 61000-3-2, EN IEC 61000-6-3, Table 4, EN 301 489-1, Section 8.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 9.4.1 Setup for harmonic current emissions test



Photograph 9.4.1 Setup for harmonic current emissions test

Test specification:	Harmonic current emissions at AC mains input port		
Test procedure:	EN IEC 61000-3-2, EN IEC 61000-6-3, Table 4, EN 301 489-1, Section 8.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 9.4.2 Fluctuating harmonics summary results

Test category: Class-A (European limits) Test Margin: 100
Test Result: Pass Source qualification: Normal
Highest parameter values during test:

V_RMS (Volts):	233.41	Frequency(Hz):	50.00
I_Peak (Amps):	1.691	I_RMS (Amps):	0.289
I_Fund (Amps):	0.099	Crest Factor:	6.100
Power (Watts):	22.3	Power Factor:	0.331

Table 9.4.3 Fluctuating harmonics test results

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.002	1.080	0.2	0.004	1.620	0.23	Pass
3	0.087	2.300	3.8	0.091	3.450	2.64	Pass
4	0.001	0.430	0.3	0.003	0.645	0.44	Pass
5	0.085	1.140	7.5	0.088	1.710	5.14	Pass
6	0.001	0.300	0.4	0.002	0.450	0.50	Pass
7	0.083	0.770	10.8	0.086	1.155	7.41	Pass
8	0.001	0.230	0.6	0.002	0.345	0.61	Pass
9	0.080	0.400	20.1	0.083	0.600	13.77	Pass
10	0.001	0.184	0.7	0.002	0.276	0.71	Pass
11	0.077	0.330	23.3	0.079	0.495	15.97	Pass
12	0.001	0.153	0.8	0.002	0.230	0.76	Pass
13	0.073	0.210	34.8	0.075	0.315	23.82	Pass
14	0.001	0.131	1.0	0.002	0.197	0.93	Pass
15	0.069	0.150	45.8	0.070	0.225	31.27	Pass
16	0.001	0.115	1.1	0.002	0.173	1.09	Pass
17	0.064	0.132	48.4	0.065	0.199	32.88	Pass
18	0.001	0.102	1.3	0.002	0.153	1.23	Pass
19	0.059	0.118	49.7	0.060	0.178	33.83	Pass
20	0.001	0.092	1.4	0.002	0.138	1.38	Pass
21	0.054	0.107	50.1	0.055	0.161	34.03	Pass
22	0.001	0.084	1.5	0.002	0.125	1.50	Pass
23	0.048	0.098	49.4	0.049	0.147	33.56	Pass
24	0.001	0.077	1.5	0.002	0.115	1.60	Pass
25	0.043	0.090	47.7	0.044	0.135	32.47	Pass
26	0.001	0.071	1.6	0.002	0.106	1.64	Pass
27	0.038	0.083	45.2	0.039	0.125	30.80	Pass
28	0.001	0.066	1.6	0.002	0.099	1.69	Pass
29	0.033	0.078	42.0	0.033	0.116	28.75	Pass
30	0.001	0.061	1.5	0.002	0.092	1.66	Pass
31	0.028	0.073	38.2	0.028	0.109	26.07	Pass
32	0.001	0.058	1.5	0.001	0.086	1.61	Pass
33	0.023	0.068	33.9	0.024	0.102	23.30	Pass
34	0.001	0.054	1.4	0.001	0.081	1.56	Pass
35	0.019	0.064	29.3	0.019	0.096	20.27	Pass
36	0.001	0.051	1.3	0.001	0.077	1.59	Pass
37	0.015	0.061	24.6	0.016	0.091	17.20	Pass
38	0.001	0.048	1.1	0.001	0.073	1.59	Pass
39	0.011	0.058	19.9	0.012	0.087	14.09	Pass
40	0.000	0.046	1.0	0.001	0.069	1.56	Pass

Reference numbers of test equipment used

HL 2364	HL 2417	HL 2666					

Full description is given in Appendix A.

Test specification:	Voltage fluctuations and flicker at AC mains input port		
Test procedure:	EN 61000-3-3, EN IEC 61000-6-3, Table 4, EN 301 489-1, Section 8.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

9.5 Voltage fluctuations and flicker at AC mains input port

9.5.1 General

This test was performed to measure the voltage fluctuations and flicker impressed on the public low-voltage system at the supply terminals of the EUT. The specification test limits are given in Table 9.5.1.

Table 9.5.1 Voltage fluctuations and flicker limits

No.	Criteria
1.	The value of short term flicker shall not be greater then 1.0
2.	The value of long term flicker shall not be greater then 0.65
3.	The relative steady state voltage shall not exceed 3.3%
4.	The maximum relative voltage change shall not exceed 4%
5.	The value of the relative voltage change waveform shall not exceed 3.3% for more than 500 ms.

9.5.2 Test procedure

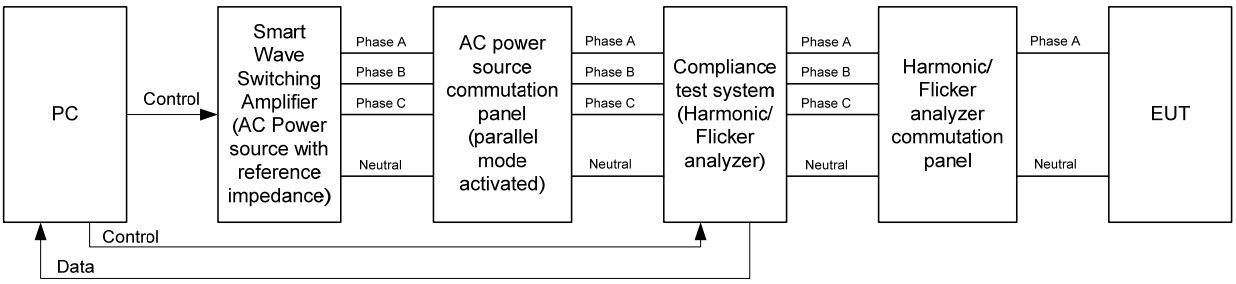
9.5.2.1 The EUT was set up as shown in Figure 9.5.1 and the associated photograph, energized and the EUT performance was checked.

9.5.2.2 The EUT was operated under normal operating and load conditions.

9.5.2.3 The voltage fluctuations and flickers for transitory and steady states conditions were measured with the computerized setup. The test results are provided in the associated table.

Test specification:	Voltage fluctuations and flicker at AC mains input port		
Test procedure:	EN 61000-3-3, EN IEC 61000-6-3, Table 4, EN 301 489-1, Section 8.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 9.5.1 Setup for voltage fluctuations and flicker test



Photograph 9.5.1 Setup for voltage fluctuations and flicker test

Test specification:	Voltage fluctuations and flicker at AC mains input port		
Test procedure:	EN 61000-3-3, EN IEC 61000-6-3, Table 4, EN 301 489-1, Section 8.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 23 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 9.5.2 Voltage fluctuations and short term flicker test results

Test category: All parameters (European limits) Test Margin: 100
Test Result: Pass Status: Test Completed

Vrms at the end of test (Volt):	230.44			
Highest dt (%):	0.00	Test limit (%):	3.30	Pass
Time(mS) > dt:	0.0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	0.00	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.001	Test limit:	1.000	Pass

Long term flicker test was considered unnecessary as the value of short term flicker was lower than 0.65 under the most unfavourable sequence of the EUT operation.

Reference numbers of test equipment used

HL 2364	HL 2417	HL 2666					

Full description is given in Appendix A.

Test specification:	Immunity to electrostatic discharge (ESD)		
Test procedure:	EN 61000-4-2; EN 55035, Section 4.2.1, Table 1; EN IEC 61000-6-2, Table 1.4; EN 301 489-1, Section 9.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Mar-23		
Temperature: 22 ºC	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

10 Immunity tests according to EN 55035, EN IEC 61000-6-2 and EN 301 489-17/52/1 requirements

10.1 Immunity to electrostatic discharge (ESD)

10.1.1 General

This test was performed to verify the EUT immunity to electrostatic discharges from operators directly and from adjacent objects. The ESDs were applied to all parts of the EUT, which are accessible during normal operation and maintenance.
The ESD levels, performance criterion and test results are referred to in Table 10.1.1.

10.1.2 Test procedure

10.1.2.1 The EUT was set up as shown in Figure 10.1.1 and the associated photographs, energized and the EUT performance was checked.

10.1.2.2 Single contact discharges of both polarities with 1 s time interval between pulses were applied to the horizontal coupling plane (HCP) at 10 centimeter distance from the EUT. Each side of the EUT was subjected to ESDs.

10.1.2.3 Single contact discharges of both polarities with 1 s time interval between pulses were applied to the vertical coupling plane (VCP) placed 10 centimeters from the EUT. The VCP was moved, in turn, to all sides of the EUT and it was subjected to the ESDs.

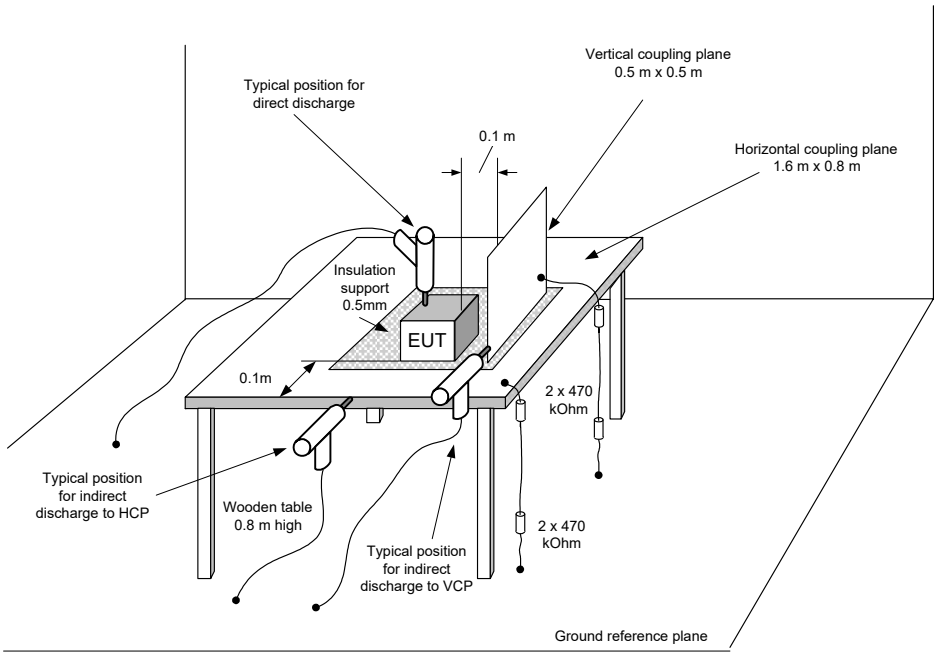
10.1.2.4 Single contact discharges of both polarities with 1 s time interval between pulses were applied to conductive parts of the EUT cabinet.

10.1.2.5 Single air discharges of both polarities with 1 s time interval between pulses were applied to non-conductive parts of the EUT.

10.1.2.6 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

10.1.2.7 Upon this the test was completed.

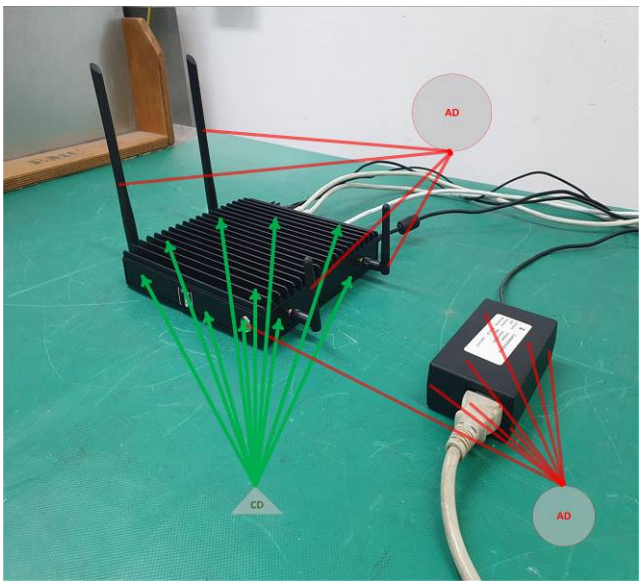
Figure 10.1.1 Setup for immunity to ESD, table-top EUT

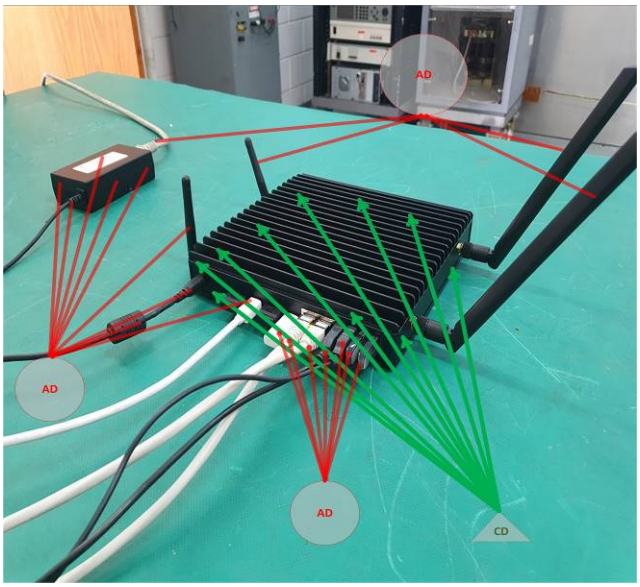


Test specification:	Immunity to electrostatic discharge (ESD)		
Test procedure:	EN 61000-4-2; EN 55035, Section 4.2.1, Table 1; EN IEC 61000-6-2, Table 1.4; EN 301 489-1, Section 9.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Mar-23		
Temperature: 22 ºC	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Photograph 10.1.1 Setup for immunity to ESD, general view

Photograph 10.1.2 Setup for immunity to ESD, EUT test points





Test specification:	Immunity to electrostatic discharge (ESD)		
Test procedure:	EN 61000-4-2; EN 55035, Section 4.2.1, Table 1; EN IEC 61000-6-2, Table 1.4; EN 301 489-1, Section 9.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Mar-23		
Temperature: 22 ºC	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 10.1.1 Immunity to ESD test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: B (EN 55035, EN IEC 61000-6-2)
Section 9.3.3 (EN 301 489-1)
NUMBER OF DISCHARGES AT EACH POINT & EACH LEVEL: 10 POSITIVE / 10 NEGATIVE

ESD applied to	Test voltage, kV	Number of test points	EUT performance description during the test	Verdict
Air discharge				
EUT	2	31*	NP	Pass
	4		NP	
	8		NP	
Contact discharge				
EUT	2	40	NP	Pass
	4		NP	
HCP	2	4	NP	Pass
	4		NP	
VCP	2	4	NP	Pass
	4		NP	

* 10 positive / 10 negative air discharges were applied only to the test points, where discharges occurred. At all other points dielectric was examined for sufficient insulation to prevent disruption.

Reference numbers of test equipment used

HL 4502	HL 4668	HL 4841	HL 4979				

Full description is given in Appendix A.

Test specification:	Continuous RF electromagnetic field disturbances, swept and spot tests		
Test procedure:	EN 61000-4-3; EN 55035, Section 4.2.2.1/2, Table 1; EN IEC 61000-6-2, Table 1.2/3; EN 301 489-1, Section 9.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	23-Mar-23		
Temperature: 24 ºC	Relative Humidity: 44 %	Air Pressure: 1007 hPa	Power: 230 VAC, 50 Hz
Remarks:			

10.2 Continuous RF electromagnetic field disturbances, swept and spot tests

10.2.1 General

This test was performed to verify the EUT immunity to radiated radio frequency electromagnetic field.
The radiated RF electromagnetic field levels, performance criterion and test results are referred to in Table 10.2.1.

10.2.2 Test procedure

10.2.2.1 The EUT was set up as shown in Figure 10.2.1 and the associated photographs, energized and the EUT performance was checked.

10.2.2.2 The electric field generating antenna was installed facing the EUT front panel at the specified distance.

10.2.2.3 The test setup was adjusted to produce the required field strength level. The field strength was monitored by the isotropic field probe, which was placed near the EUT.

10.2.2.4 The signal frequency was scanned throughout the frequency range.

10.2.2.5 The test was performed with the antennas in both vertical and horizontal polarization.

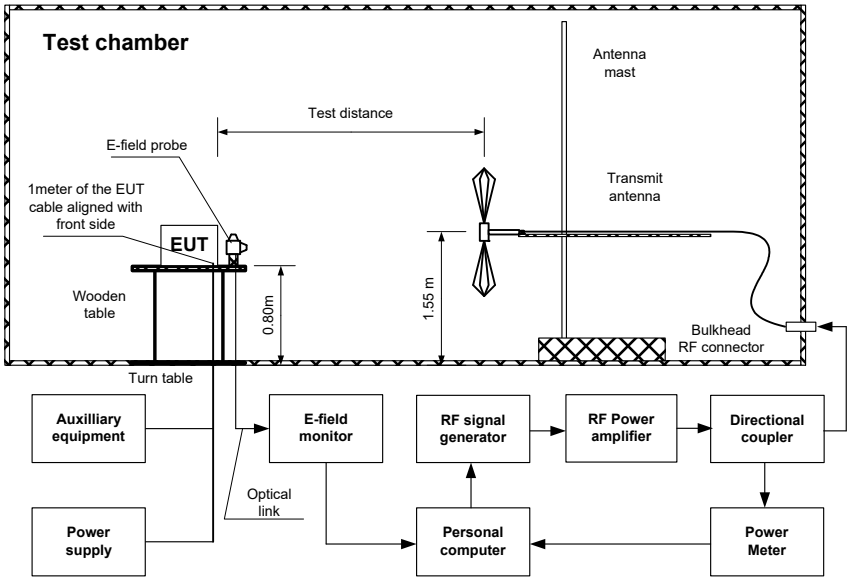
10.2.2.6 The test was repeated at spot frequencies.

10.2.2.7 The test was repeated for the rest of the EUT orientations.

10.2.2.8 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

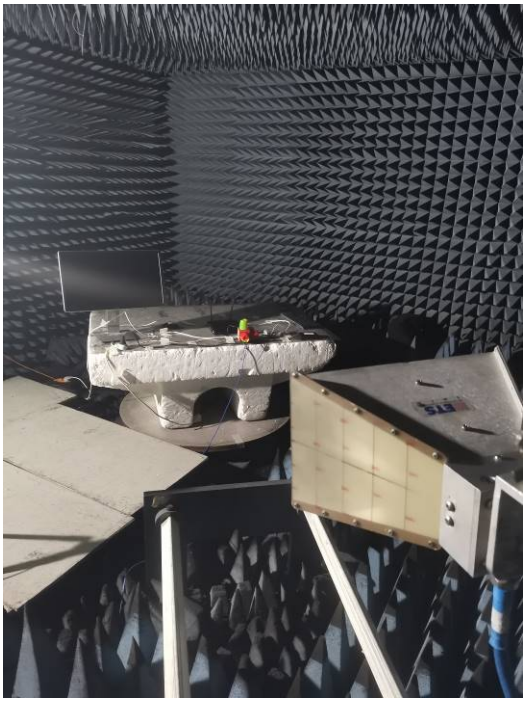
10.2.2.9 Upon this the test was completed.

Figure 10.2.1 Setup for radiated immunity to RF electromagnetic field test, table-top EUT



Test specification:	Continuous RF electromagnetic field disturbances, swept and spot tests		
Test procedure:	EN 61000-4-3; EN 55035, Section 4.2.2.1/2, Table 1; EN IEC 61000-6-2, Table 1.2/3; EN 301 489-1, Section 9.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	23-Mar-23		
Temperature: 24 ºC	Relative Humidity: 44 %	Air Pressure: 1007 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Photograph 10.2.1 Setup for radiated immunity to RF electromagnetic field test, general view



Photograph 10.2.2 Setup for radiated immunity to RF electromagnetic field test, EUT cabling

Test specification:	Continuous RF electromagnetic field disturbances, swept and spot tests		
Test procedure:	EN 61000-4-3; EN 55035, Section 4.2.2.1/2, Table 1; EN IEC 61000-6-2, Table 1.2/3; EN 301 489-1, Section 9.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	23-Mar-23		
Temperature: 24 ºC	Relative Humidity: 44 %	Air Pressure: 1007 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 10.2.1 Radiated immunity to RF electromagnetic field test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: A (EN 55035, EN IEC 61000-6-2)
Section 9.2.3 (EN 301 489-1)
TEST SITE: ANECHOIC CHAMBER
ANTENNA TO EUT DISTANCE: 2.4 m
MODULATION: 80% AM with 1 kHz
DWELL TIME: 1 s
FREQUENCY STEP: 1 % of current frequency
FREQUENCY RANGE: 80 – 1000 MHz

EUT orientation*	Antenna polarization	Field strength**, V_{rms}/m	EUT performance description during the test	Verdict
0°	Vertical	10	NP	Pass
	Horizontal		NP	
90°	Vertical		NP	Pass
	Horizontal		NP	
180°	Vertical		NP	Pass
	Horizontal		NP	
270°	Vertical		NP	Pass
	Horizontal		NP	

FREQUENCY RANGE: 1000 – 6000 MHz (EN 301 489-1, EN IEC 61000-6-2)
SPOT FREQUENCIES: 1800, 2600, 3500, 5000 MHz (±1%) (EN 55035)

EUT orientation*	Antenna polarization	Field strength**, V_{rms}/m	EUT performance description during the test	Verdict
0°	Vertical	3	NP	Pass
	Horizontal		NP	
90°	Vertical		NP	Pass
	Horizontal		NP	
180°	Vertical		NP	Pass
	Horizontal		NP	
270°	Vertical		NP	Pass
	Horizontal		NP	

* - 0° = antenna installed facing the EUT front panel.
**- Field strength measured prior to modulation.

Reference numbers of test equipment used

HL 2432	HL 2697	HL 4705	HL 5110	HL 5571	HL 5673	HL 5942	

Full description is given in Appendix A.

Test specification:	Conducted immunity to electrical fast transients/ bursts (EFT/ B)		
Test procedure:	EN 61000-4-4; EN 55035, Section 4.2.4, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.5, 3.3, 2.3; EN 301 489-1, Section 9.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

10.3 Conducted immunity to electrical fast transient/ burst (EFT/ B)

10.3.1 General

This test was performed to verify the EUT conducted immunity to the electrical fast transient/ burst (EFT/B) applied to the EUT power and analogue/digital lines.
The EFT/B levels, performance criterion and test results are referred to in Table 10.3.1.

10.3.2 Test procedure for three-wire power line application

10.3.2.1 The EUT was set up as shown in Figure 10.3.1 and the associated photograph, energized and the EUT performance was checked.

10.3.2.2 The EFT/B generator output parameters (voltage, frequency repetition and duration) were adjusted as referred to in Table 10.3.1 and the bursts were applied to the EUT power line.

10.3.2.3 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

10.3.2.4 Upon this the test was completed.

10.3.3 Test procedure for analogue/digital line application

10.3.3.1 The EUT was set up as shown in Figure 10.3.2 and the associated photograph, energized and the EUT performance was checked.

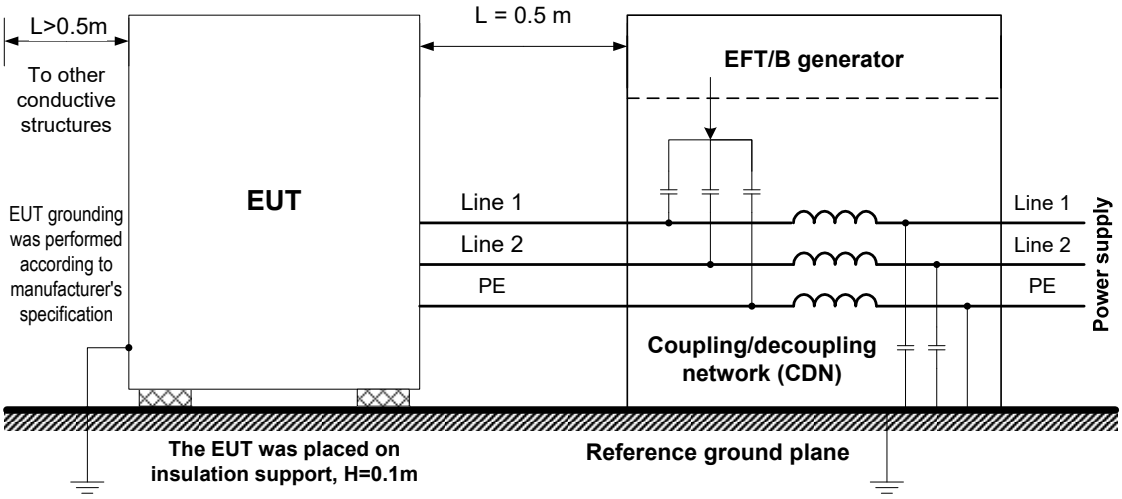
10.3.3.2 The line was placed into the capacitive coupling clamp. The EFT/B generator output parameters (voltage, frequency repetition and duration) were adjusted as referred to in Table 10.3.1 and the bursts were applied to the EUT analogue/digital line.

10.3.3.3 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

10.3.3.4 Upon this the test was completed.

Test specification:	Conducted immunity to electrical fast transients/ bursts (EFT/ B)		
Test procedure:	EN 61000-4-4; EN 55035, Section 4.2.4, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.5, 3.3, 2.3; EN 301 489-1, Section 9.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

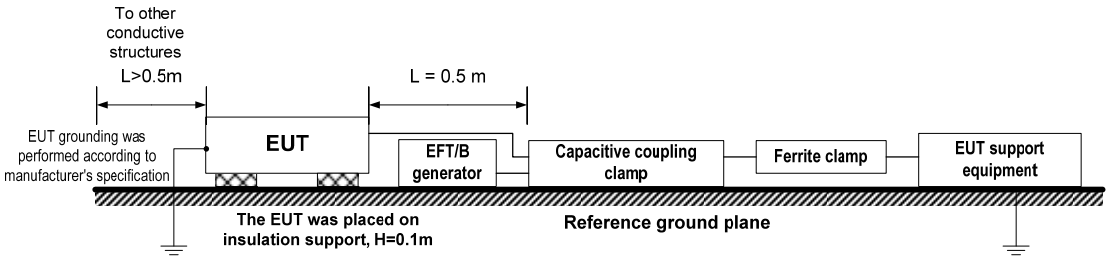
Figure 10.3.1 Setup for conducted immunity to EFT/B test at power supply line, table-top EUT



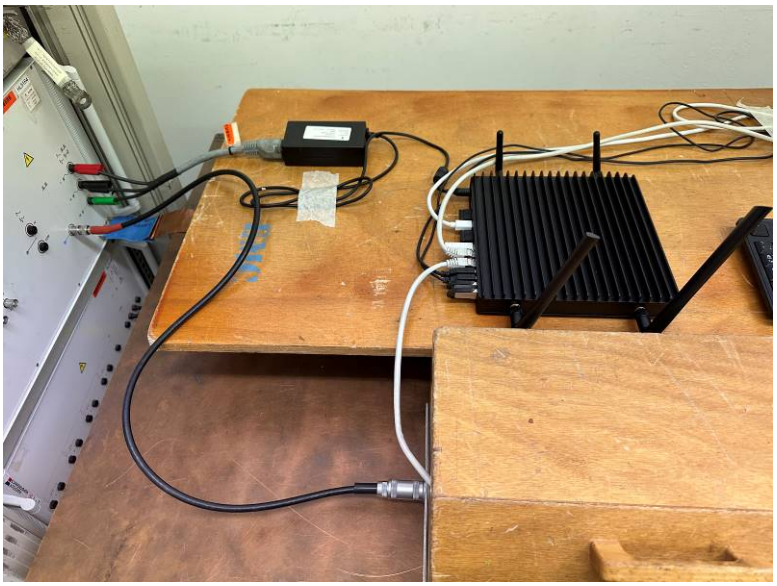
Photograph 10.3.1 Setup for conducted immunity to EFT/B at AC power supply line

Test specification:	Conducted immunity to electrical fast transients/ bursts (EFT/ B)		
Test procedure:	EN 61000-4-4; EN 55035, Section 4.2.4, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.5, 3.3, 2.3; EN 301 489-1, Section 9.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 10.3.2 Setup for conducted immunity to EFT/B test at analogue/digital line, table-top EUT



Photograph 10.3.2 Setup for conducted immunity to EFT/B at analogue/digital line



Test specification:	Conducted immunity to electrical fast transients/ bursts (EFT/ B)		
Test procedure:	EN 61000-4-4; EN 55035, Section 4.2.4, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.5, 3.3, 2.3; EN 301 489-1, Section 9.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 10.3.1 Conducted immunity to EFT/ B test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: B (EN 55035, EN IEC 61000-6-2)
Section 9.4.3 (EN 301 489-1)
DURATION: 1 min
REPETITION FREQUENCY: 5 kHz
PULSE RISE TIME/ DURATION: 5 / 50 ns
BURST DURATION/ PERIOD: 15 / 300 ms

Type of disturbed line	Line description	Test voltage, kV	EFT/B polarity	EUT performance description during the test	Verdict
AC power of AC/DC adapter	Line 1, Line 2 & PE	2	Positive	NP	Pass
			Negative	NP	
Analogue/digital data	Ethernet	1	Positive	NP	Pass
			Negative	NP	

Reference numbers of test equipment used

HL 5184	HL 0516						

Full description is given in Appendix A.

Test specification:	Conducted immunity to voltage surges		
Test procedure:	EN 61000-4-5; EN 55035, Section 4.2.5, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.4, 3.2, 2.2; EN 301 489-1, Section 9.8		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

10.4 Conducted immunity to voltage surges

10.4.1 General

This test was performed to verify the EUT immunity to high-energy surges produced by switching and indirect lightning transients.
The surge levels, performance criterion and test results are referred to in the associated table.

10.4.2 Test procedure for three-wire power line application

10.4.2.1 The EUT was set up as shown in Figure 10.4.1 and the associated photograph, energized and the EUT performance was checked.

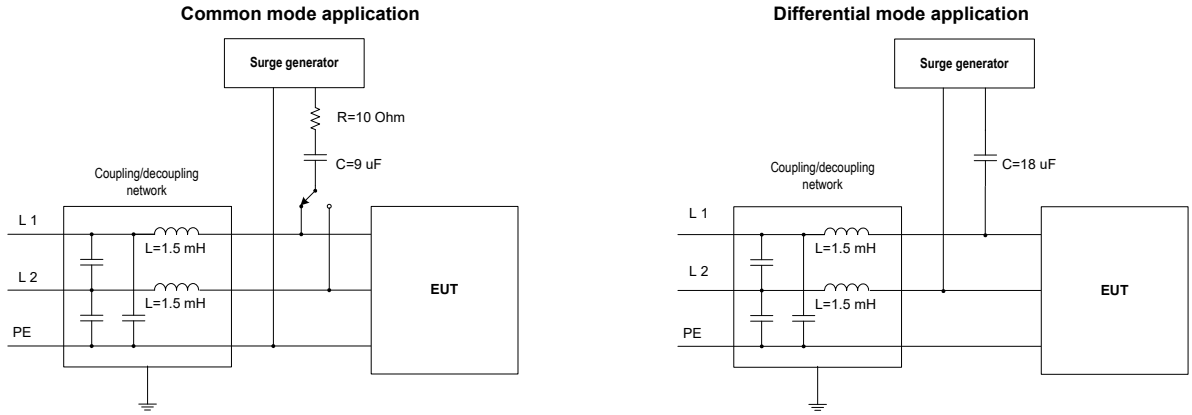
10.4.2.2 The surge generator output parameters (voltage and pulse shape) were adjusted as referred to in Table 10.4.1. Voltage surges of both polarities were applied to the EUT power port in differential (line to line) and common (line to ground) modes with 1 per minute repetition rate.

10.4.2.3 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

10.4.2.4 Upon this the test was completed.

Test specification:	Conducted immunity to voltage surges		
Test procedure:	EN 61000-4-5; EN 55035, Section 4.2.5, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.4, 3.2, 2.2; EN 301 489-1, Section 9.8		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 10.4.1 Setup for conducted immunity to voltage surges test, three-wire power line



Photograph 10.4.1 Setup for conducted immunity to voltage surges at AC power line

Test specification:	Conducted immunity to voltage surges		
Test procedure:	EN 61000-4-5; EN 55035, Section 4.2.5, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.4, 3.2, 2.2; EN 301 489-1, Section 9.8		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 10.4.1 Conducted immunity to voltage surges test results, three-wire power line

PERFORMANCE CRITERIA: B (EN 55035, EN IEC 61000-6-2)
Section 9.8.3 (EN 301 489-1)
SURGE PULSE SHAPE, Tr/Th: 1.2/50 µs
NUMBER OF PULSES: 5/5 (positive/negative) in each phase
PHAZE SYNCHRONIZATION: 0°, 90°, 180° and 270° of sine wave

Line description	Surge application	Applied voltage, kV	EUT performance description during the test	Verdict
Common mode				
AC power of AC/DC adapter	L 1 to GND	2.0	NP	Pass
	L 2 to GND	2.0	NP	Pass
Differential mode				
AC power of AC/DC adapter	L 1 to L 2	1.0	NP	Pass

Reference numbers of test equipment used

HL 5184							

Full description is given in Appendix A.

Test specification:	Immunity to continuous induced RF disturbances		
Test procedure:	EN 61000-4-6; EN 55035, Section 4.2.2.3, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.1, 3.1, 2.1; EN 301 489-1, Section 9.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Mar-23		
Temperature: 22 ºC	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

10.5 Immunity to continuous induced RF disturbances

10.5.1 General

This test was performed to verify the EUT immunity to conducted disturbances, induced by RF fields into the power and analogue/digital lines from 0.15 to 80 MHz.
The conducted disturbances levels, performance criterion and test results are referred to in Table 10.5.1.

10.5.2 Test procedure for power line application

10.5.2.1 The EUT was set up as shown in Figure 10.5.1 and the associated photograph, energized and the EUT performance was checked.

10.5.2.2 The test setup was adjusted to produce disturbing signal as referred to in Table 10.5.1. The disturbance signal was injected into the EUT power line. The signal frequency was scanned with step less than 1% of the fundamental frequency and sweep rate less than $1.5x10^{-3}$ decade/s throughout the specified frequency range.

10.5.2.3 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

10.5.2.4 Upon this the test was completed.

10.5.3 Test procedure for analogue/digital line application, CDN injection method

10.5.3.1 The EUT was set up as shown in Figure 10.5.2 and the associated photograph, energized and the EUT performance was checked.

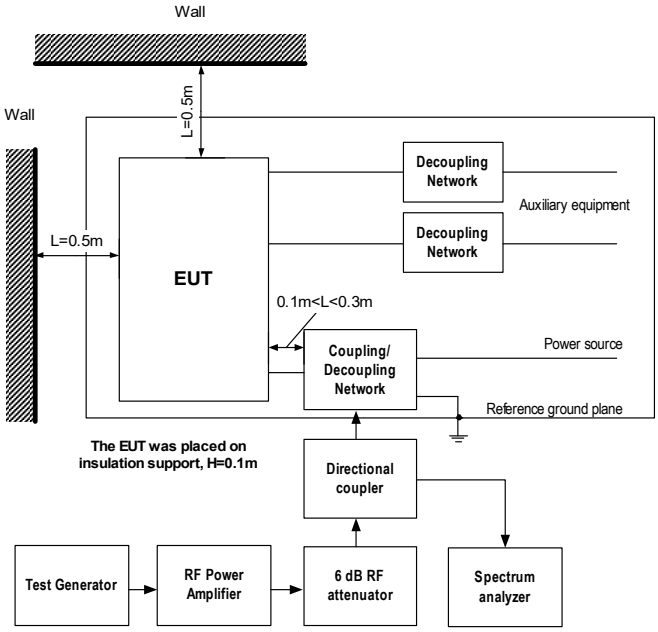
10.5.3.2 The test setup was adjusted to produce disturbing signal as referred to in Table 10.5.1. The disturbance signal was injected into the EUT analogue/digital line. The signal frequency was scanned with step less than 1% of the fundamental frequency and sweep rate less than $1.5x10^{-3}$ decade/s throughout the specified frequency range.

10.5.3.3 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

10.5.3.4 Upon this the test was completed.

Test specification:	Immunity to continuous induced RF disturbances		
Test procedure:	EN 61000-4-6; EN 55035, Section 4.2.2.3, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.1, 3.1, 2.1; EN 301 489-1, Section 9.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Mar-23		
Temperature: 22 ºC	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

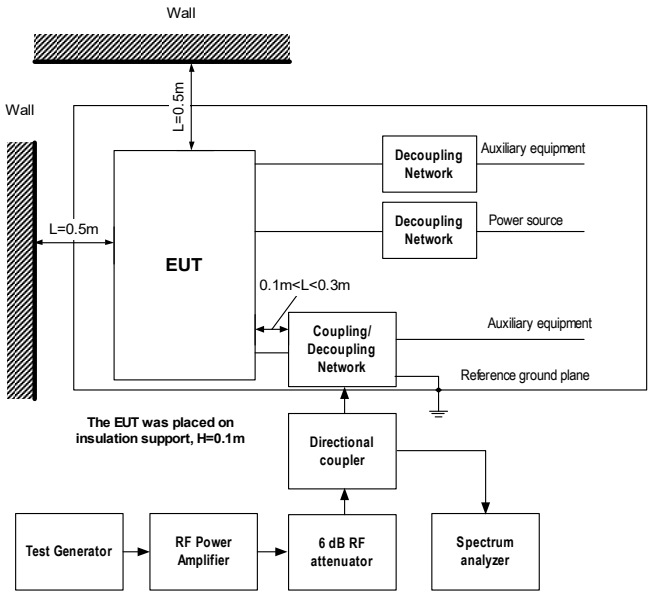
Figure 10.5.1 Setup for immunity to conducted disturbances induced by radio frequency fields at power supply line



Photograph 10.5.1 Setup for immunity to conducted disturbances induced by RF fields at AC power supply line

Test specification:	Immunity to continuous induced RF disturbances		
Test procedure:	EN 61000-4-6; EN 55035, Section 4.2.2.3, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.1, 3.1, 2.1; EN 301 489-1, Section 9.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Mar-23		
Temperature: 22 ºC	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 10.5.2 Setup for immunity to conducted disturbances induced by radio frequency fields at analogue/digital line, CDN injection method



Photograph 10.5.2 Setup for immunity to conducted disturbances induced by radio frequency fields at analogue/digital line, CDN injection method

Test specification:	**Immunity to continuous induced RF disturbances**		
Test procedure:	EN 61000-4-6; EN 55035, Section 4.2.2.3, Tables 2, 3, 4; EN IEC 61000-6-2, Tables 4.1, 3.1, 2.1; EN 301 489-1, Section 9.5		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Mar-23		
Temperature: 22 ºC	**Relative Humidity:** 42 %	**Air Pressure:** 1006 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

Table 10.5.1 Immunity to conducted disturbances induced by radio frequency fields test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: A (EN 55035, EN IEC 61000-6-2)
Section 9.5.3 (EN 301 489-1)
FREQUENCY RANGE: 0.15 – 80 MHz
TYPE OF MODULATION: AM 80% @ 1 kHz
TEST VOLTAGE: 10 V_{rms} prior to modulation
DWELL TIME: 1 s
FREQUENCY STEP: 1 % of current frequency

Type of disturbed line	Test coupling	EUT performance during the test	Verdict
AC power of AC/DC adapter	CDN M3	NP	Pass
Ethernet	CDN ST	NP	Pass

Reference numbers of test equipment used

HL 0539	HL 0675	HL 2276	HL 2421	HL 2874	HL 3971	HL 4492	HL 4960

Full description is given in Appendix A.

Test specification:	Radiated immunity to power frequency magnetic field		
Test procedure:	EN 61000-4-8; EN 55035, Section 4.2.3, Table 1; EN IEC 61000-6-2, Table 1.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

10.6 Immunity to power frequency magnetic fields

10.6.1 General

This test was performed to verify the EUT immunity to magnetic fields caused by power frequency.
The magnetic field levels, performance criterion and test results are referred to in Table 10.6.1.

10.6.2 Test procedure

10.6.2.1 The EUT was set up as shown in Figure 10.6.1 and the associated photograph, energized and the EUT performance was checked.

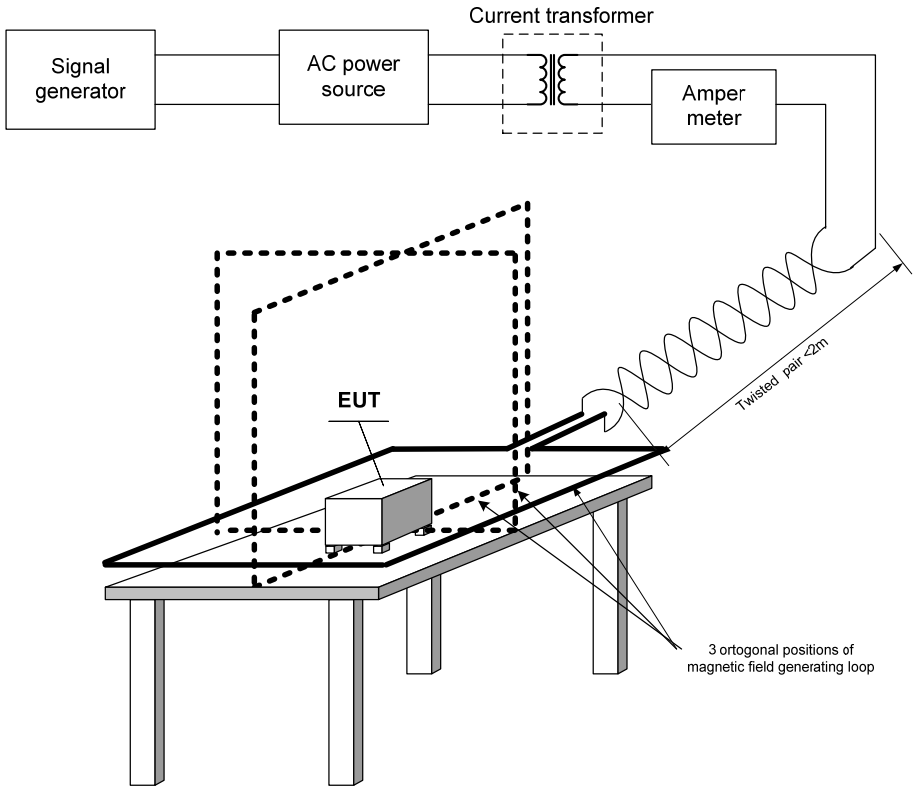
10.6.2.2 The test setup was adjusted to produce continuous magnetic field and the EUT was exposed.

10.6.2.3 The procedure was repeated for the rest two orthogonal positions of the EUT.

10.6.2.4 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

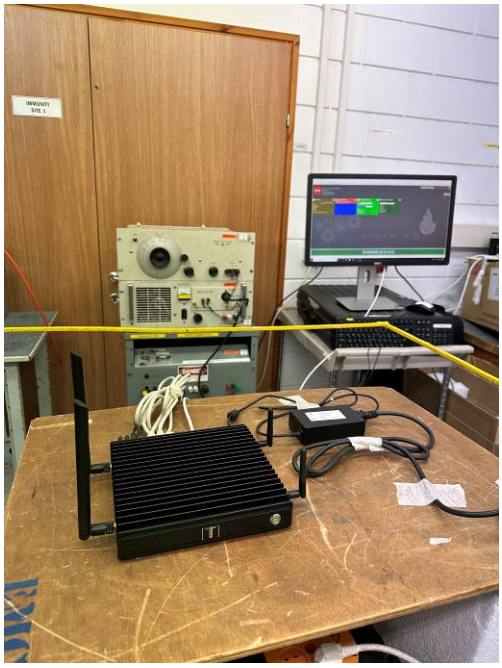
10.6.2.5 Upon this the test was completed.

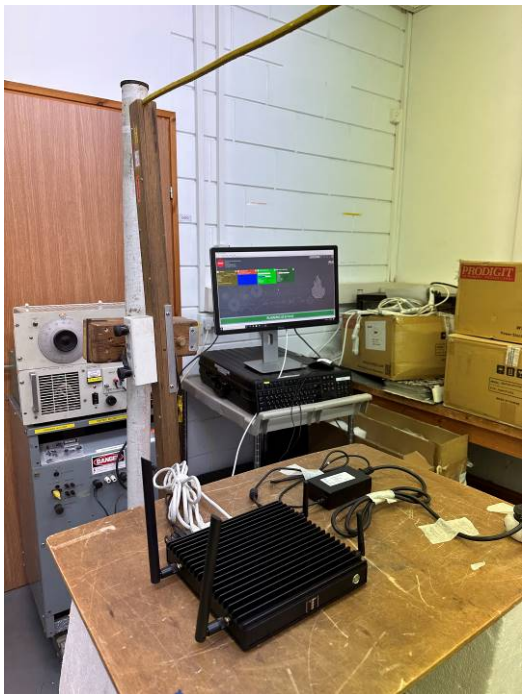
Figure 10.6.1 Setup for immunity to power frequency magnetic field test



Test specification:	Radiated immunity to power frequency magnetic field		
Test procedure:	EN 61000-4-8; EN 55035, Section 4.2.3, Table 1; EN IEC 61000-6-2, Table 1.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 60 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Photograph 10.6.1 Setup for immunity to power frequency magnetic field





Test specification:	**Radiated immunity to power frequency magnetic field**		
Test procedure:	EN 61000-4-8; EN 55035, Section 4.2.3, Table 1; EN IEC 61000-6-2, Table 1.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	**Relative Humidity:** 60 %	**Air Pressure:** 1006 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

Table 10.6.1 Immunity to power frequency magnetic fields test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: A (EN 55035, EN IEC 61000-6-2)
DURATION: 10 min
MAGNETIC FIELD STRENGTH: 30 A/m
FREQUENCY: 50 Hz

EUT orthogonal positions	EUT performance description during the test	Verdict
X	NP	Pass
Y	NP	Pass
Z	NP	Pass

Reference numbers of test equipment used

HL 0133	HL 2489	HL 4952					

Full description is given in Appendix A.

Test specification:	Conducted immunity to voltage dips and short interruptions		
Test procedure:	EN 61000-4-11, EN 55035, Section 4.2.6, Table 4; EN IEC 61000-6-2, Table 4.2/3; EN 301 489-1, Section 9.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 62 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

10.7 Immunity to voltage dips and short interruptions

10.7.1 General

This test was performed to verify the EUT immunity to voltage dips and short interruptions presented at AC power input.
The voltage dips and interruptions levels, performance criterion and test results are referred to in Table 10.7.1.

10.7.2 Test procedure

10.7.2.1 The EUT was set up as shown in Figure 10.7.1 and the associated photograph, energized and the EUT performance was checked.

10.7.2.2 The test setup was adjusted to produce voltage reduction as referred to in Table 10.7.1.

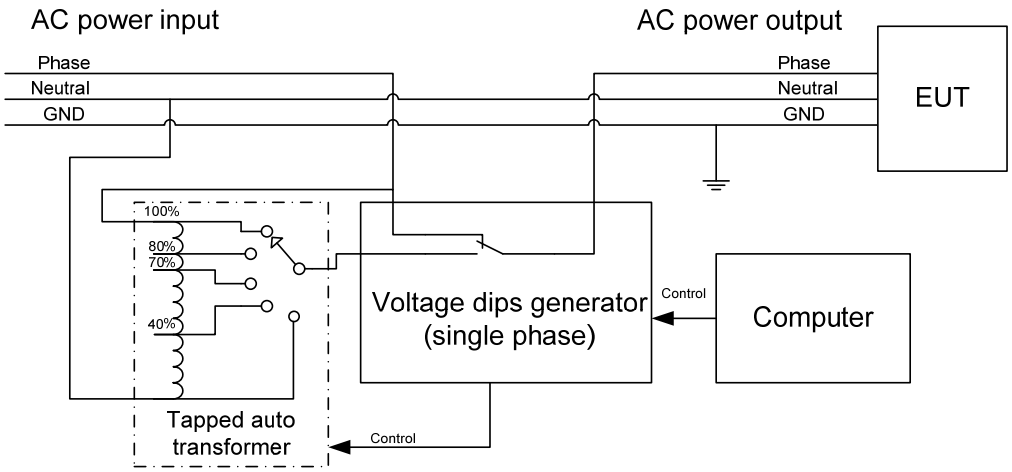
10.7.2.3 Voltage dips of each level were applied to the EUT power line.

10.7.2.4 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

10.7.2.5 Upon this the test was completed.

Test specification:	Conducted immunity to voltage dips and short interruptions		
Test procedure:	EN 61000-4-11, EN 55035, Section 4.2.6, Table 4; EN IEC 61000-6-2, Table 4.2/3; EN 301 489-1, Section 9.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 62 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 10.7.1 Setup for immunity to voltage dips and short interruptions test



Photograph 10.7.1 Setup for immunity to voltage dips and short interruptions

Test specification:	Conducted immunity to voltage dips and short interruptions		
Test procedure:	EN 61000-4-11, EN 55035, Section 4.2.6, Table 4; EN IEC 61000-6-2, Table 4.2/3; EN 301 489-1, Section 9.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Mar-23		
Temperature: 22 ºC	Relative Humidity: 62 %	Air Pressure: 1006 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 10.7.1 Immunity to voltage dips and short interruptions test results

EUT SET UP: TABLE-TOP
NUMBER OF DIPS: 3
REPETITION RATE: 0.1 Hz
STANDARD REFERENCE: EN 55035, EN IEC 61000-6-2

Voltage reduction, % of V nom	Test voltage, V	Duration, ms	Performance criterion	EUT performance description during and after the test	Verdict
100% voltage dip	0	10	B	NP	Pass
100% voltage dip	0	20	B	NP	Pass
30% voltage dip	161	500	C	NP	Pass
60% voltage dip	92	200	C	NP	Pass
>95% voltage interruption	0	5000	C	The EUT stopped to operate during the test and self returned to NP after the test without operator intervention.	Pass

STANDARD REFERENCE: EN 301 489-1/17/52
PERFORMANCE CRITERIA: EN 301 489-1, Section 9.7.3; EN 301 489-52, Section 7.1.2.2, Table 2

Voltage reduction, % of V nom	Test voltage, V	Duration, ms	EUT performance description during and after the test	Verdict
100% voltage dip	0	10	NP	Pass
100% voltage dip	0	20	NP	Pass
30% voltage dip	161	10	NP	Pass
30% voltage dip	161	500	NP	Pass
100% voltage interruption	0	5000	The EUT stopped to operate during the test and self returned to NP after the test without operator intervention.	Pass

Reference numbers of test equipment used

HL 5184	HL 5186						

Full description is given in Appendix A.

11 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./Check	Due Cal./Check
0133	Generator Audio, 5 Hz - 600 kHz	Hewlett Packard	200CDR	60A77719	28-Dec-22	28-Dec-23
0516	Coupling Clamp, 100 pF	Schaffner Electronic AG	CDN 125	516	15-Dec-22	15-Dec-23
0539	Generator Signal, 10 kHz - 1.2 GHz	Marconi Instruments	2023	112121/041	18-Aug-22	18-Aug-23
0644	Probe current, 20 Hz - 100 MHz	Solar Electronics	6741-1	874916	22-Sep-22	22-Sep-23
0675	Coupler Directional, high power, 0.01 - 250 MHz, 500 W	WERLATONE	C5100	5788	15-Feb-23	15-Feb-24
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A01877	11-Sep-22	11-Sep-23
1205	One phase voltage regulator, 2kVA, 0-250V	Hermon Laboratories	TDGC-2	109	03-May-23	03-May-24
2276	Attenuator 6 dB, 150 W, DC-1000 MHz, with 230VAC / 12VDC adapter	Hermon Laboratories	6-150	2276	12-Mar-23	12-Mar-24
2364	SmartWave Switching Amplifier	Elgar	SW5250AE-4	0317A00596	07-Nov-22	07-Nov-23
2382	Transformer, Isolation, 230/230, 1.8 kVA	Taiyo Yuden, Inc.	LGY1.8-21	FJ0411	15-Mar-23	15-Mar-24
2417	Power source connection panel (for HL2364)	Hermon Laboratories	PCP-1	2417	06-Jul-22	06-Jul-23
2421	Power cable shielded, retractable sheat stacking banana plugs, 2.3 m, 3x2.5mm sq	Hermon Laboratories	PCSBR-2.3	2421	23-Jan-23	23-Jan-24
2432	Antenna, Double-Ridged Waveguide Horn 1 to 18 GHz	EMC Test Systems	3115	00027177	01-Sep-22	01-Sep-23
2489	AC High current generator for magnetic field immunity tests	Hermon Laboratories	MFG-130A	2489	28-Dec-22	28-Dec-23
2666	Compliance Test System	California Instruments	PACS-3	72342	22-Sep-22	22-Sep-23
2697	Antenna, 30 MHz - 3.0 GHz	Sunol Sciences. Corp.	JB3	A022805	28-May-23	28-May-24
2874	Life - Guard Extreme Isolation Transformer, 230/230, 50 Hz, 1Phase,1.8 kVA	Taiyo Yuden, Inc.	LGY1.8k-21	FI0412	15-Mar-23	15-Mar-24
3016	LISN, Two-line V-network, 9 kHz to 30 MHz, (50 uH+5 Ohm), CISPR16-1, MIL-461E	Rohde & Schwarz	ESH 3-Z5	892239/002	07-Feb-23	07-Feb-24
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	16-Apr-23	16-Apr-24
3971	Coupling-decoupling network, 150 kHz -300 MHz	Hermon Laboratories	300-M3	NA	02-May-23	02-May-24
4492	Coupling-Decoupling network, CDN/ISN, CAT 6 , 150 kHz - 230 MHz, STD EN61000-4-6	Hermon Laboratories	S-T	NA	01-May-23	01-May-24
4502	Resistor for ESD tests EN 61000-4-2 470 kOhm X 2	Hermon Laboratories	R470 x 2	NA	10-Aug-22	10-Aug-23
4668	ESD Generator	Schaffner-Chase EMC	NSG 435	2532	30-Aug-22	30-Aug-23
4705	Isotropic Field Monitor	Amplifier Research	FM2000	23307	22-Jan-23	22-Jan-24
4841	Coupling Plane Vertical, EN 61000-4-2	Hermon Laboratories	CPV-2	NA	15-Mar-23	15-Mar-24
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	19-Jan-23	19-Jan-24
4952	Induction coil according to EN 61000-4-8, 1mx1m	Hermon Laboratories	IC-2	001	16-Jan-23	16-Jan-26
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	08-Mar-23	08-Mar-24
4960	Power amplifier, 150 kHz to 250 MHz, 100 W	COM-POWER CORPORATION	ACS-250-100W	711968	08-Jan-23	08-Jan-24
4979	Resistor for ESD tests EN 61000-4-2 470 kOhm X 2	Hermon Laboratories	R470x2	NA	09-Mar-23	09-Mar-24
5085	Attenuator, 4 dB, DC - 6 GHz, 1 W	Mini-Circuits	UNAT-4+	NA	24-Mar-22	24-Mar-25

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./Check	Due Cal./Check
5110	RF cable, 18 GHz, 3 m, N-type	Huber-Suhner	ST18A/Nm/Nm/3000	600818/18A	24-Jul-22	24-Jul-23
5184	EMC Compact Tester	Haefely Hipotronics	AXOS 8	184076	26-Feb-23	26-Feb-24
5186	Tapped Dips Transformer for AXOS	Haefely Hipotronics	DIP 116	184143	01-Mar-23	01-Mar-24
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	24-Mar-22	24-Mar-25
5476	Cable, BNC/BNC, 10.5 m	Western wire	MIL-C-17G	NA	11-May-23	11-May-24
5571	Signal Analyzer system, 4 channels	Data Physics	DP240	22206	29-Nov-22	29-Nov-23
5673	Cable SF126EA/11N(x2)/2M, 18GHz	Huber-Suhner	SF126EA	506756/126EA	14-May-23	14-May-24
5707	EMI receiver	PMM / Narda	PMM 9010F	060WW91101	22-Jun-23	22-Jun-24
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/11N/11N/6000	NA	08-Dec-22	08-Dec-23
5942	Signal Generator, 8.0 kHz to 6.0 GHz	Rohde & Schwarz	SMB-100B	102327	10-Jan-23	10-Jan-24
7585	EMI Test Receiver, 1 Hz to 44 GHz	Rohde & Schwarz	ESW44	103130	19-May-22	19-Nov-23

12 APPENDIX B Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.
Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers for OATS are R-10808 for RE measurements below 1 GHz, G-20112 for RE measurements above 1 GHz, R-11082 for anechoic chamber for RE measurements below 1 GHz, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).
The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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13 APPENDIX C Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
CDN	coupling/ decoupling network
CR	continuous phenomena applied to receivers
CT	continuous phenomena applied to transmitters
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
dBΩ	decibel referred to one Ohm
DC	direct current
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EN	European Norm
EUT	equipment under test
GHz	gigahertz
GND	ground
H	height
HCP	horizontal coupling plane
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
kV	kilovolt
L	length
LISN	line impedance stabilization network
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
NP	normal performance
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
s	second
TR	transient phenomena applied to receivers
TT	transient phenomena applied to transmitters
V	volt
VA	volt-ampere
VCP	vertical coupling plane
W	width

14 APPENDIX D Test equipment correction factors

Correction factor
Line impedance stabilization network
Model ESH 3-Z5
Rhode&Schwarz
Insertion Loss Calibration result

Frequency, kHz	Voltage division factor (insertion loss)				Uncertainty, dB
	L1, dB	L2 (N), dB	L1, with limiter, dB	L2 (N), with limiter, dB	
9	0.87	1.04	11.27	11.25	±0.12
10	0.79	0.95	11.44	11.38	±0.12
15	0.50	0.60	11.47	11.40	±0.12
20	0.34	0.42	11.10	11.06	±0.12
25	0.26	0.32	10.82	10.79	±0.12
30	0.21	0.26	10.63	10.61	±0.08
40	0.15	0.19	10.40	10.39	±0.08
50	0.14	0.16	10.28	10.27	±0.08
60	0.12	0.14	10.21	10.19	±0.09
70	0.11	0.13	10.16	10.15	±0.09
80	0.11	0.12	10.14	10.12	±0.09
90	0.10	0.12	10.12	10.10	±0.09
100	0.11	0.12	10.10	10.10	±0.09
150	0.10	0.11	10.07	10.05	±0.09
170	0.11	0.11	10.06	10.05	±0.09
200	0.11	0.12	10.06	10.05	±0.09
250	0.10	0.11	10.06	10.05	±0.09
300	0.11	0.12	10.05	10.05	±0.09
350	0.11	0.12	10.05	10.05	±0.09
400	0.11	0.12	10.05	10.05	±0.09
500	0.11	0.12	10.06	10.04	±0.09
600	0.11	0.12	10.05	10.05	±0.09
700	0.12	0.13	10.06	10.05	±0.09
800	0.13	0.13	10.07	10.05	±0.09
900	0.13	0.14	10.07	10.05	±0.09
1000	0.13	0.14	10.07	10.06	±0.09
1200	0.13	0.14	10.08	10.07	±0.16
1500	0.14	0.15	10.08	10.07	±0.16
2000	0.16	0.17	10.11	10.09	±0.16
2500	0.17	0.17	10.13	10.10	±0.16
3000	0.19	0.19	10.14	10.12	±0.16
4000	0.23	0.22	10.19	10.15	±0.16
5000	0.27	0.26	10.23	10.19	±0.16
7000	0.39	0.36	10.36	10.30	±0.16
10000	0.52	0.45	10.48	10.38	±0.16
15000	0.87	0.79	10.85	10.73	±0.16
20000	1.09	0.96	11.13	10.91	±0.16
30000	1.44	1.13	11.64	11.18	±0.32

The correction factor in dB is to be added to meter readings of an interference analyzer or a spectrum analyzer.

Current probe factor

Solar Electronics, model 6741-1, serial number 874916

No.	Parameter	Set / Applied	Historical	Measured	Deviation	Tolerance	Uncertainty
1	Transfer Admittance	0.02 kHz	52.3 dB(S)	52.1 dB(S)	-0.2	NA	+0.97/-1.25 dB
2		0.03 kHz	48.8 dB(S)	48.6 dB(S)	-0.2	NA	+0.61/-0.72 dB
3		0.05 kHz	43.8 dB(S)	44.3 dB(S)	0.4	NA	+0.44/-0.49 dB
4		0.1 kHz	38.1 dB(S)	38.3 dB(S)	0.3	NA	+0.33/-0.36 dB
5		0.3 kHz	28.7 dB(S)	29.0 dB(S)	0.3	NA	+0.32/-0.35 dB
6		0.5 kHz	24.4 dB(S)	24.7 dB(S)	0.3	NA	+0.32/-0.35 dB
7		1 kHz	18.5 dB(S)	18.8 dB(S)	0.3	NA	+0.32/-0.35 dB
8		2 kHz	12.9 dB(S)	13.2 dB(S)	0.3	NA	+0.32/-0.35 dB
9		3 kHz	9.8 dB(S)	10.1 dB(S)	0.3	NA	+0.32/-0.35 dB
10		4 kHz	7.9 dB(S)	8.1 dB(S)	0.2	NA	+0.32/-0.35 dB
11		5 kHz	6.5 dB(S)	6.7 dB(S)	0.2	NA	+0.32/-0.35 dB
12		6 kHz	5.5 dB(S)	5.7 dB(S)	0.2	NA	+0.32/-0.35 dB
13		7 kHz	4.8 dB(S)	4.9 dB(S)	0.1	NA	+0.32/-0.35 dB
14		8 kHz	4.3 dB(S)	4.4 dB(S)	0.1	NA	+0.32/-0.35 dB
15		9 kHz	3.9 dB(S)	4.0 dB(S)	0.0	NA	+0.32/-0.35 dB
16		10 kHz	3.6 dB(S)	3.7 dB(S)	0.0	NA	+0.32/-0.35 dB
17		20 kHz	2.9 dB(S)	2.9 dB(S)	0.0	NA	+0.26/-0.28 dB
18		30 kHz	3.1 dB(S)	3.0 dB(S)	-0.1	NA	+0.42/-0.46 dB
19		40 kHz	3.2 dB(S)	3.1 dB(S)	-0.1	NA	+0.42/-0.47 dB
20		50 kHz	3.2 dB(S)	3.2 dB(S)	-0.1	NA	+0.42/-0.47 dB
21		60 kHz	3.3 dB(S)	3.2 dB(S)	-0.1	NA	+0.42/-0.47 dB
22		70 kHz	3.3 dB(S)	3.2 dB(S)	-0.1	NA	+0.42/-0.47 dB
23		80 kHz	3.3 dB(S)	3.2 dB(S)	-0.1	NA	+0.42/-0.47 dB
24		90 kHz	3.3 dB(S)	3.2 dB(S)	-0.1	NA	+0.42/-0.47 dB
25		100 kHz	3.3 dB(S)	3.2 dB(S)	-0.1	NA	+0.42/-0.47 dB
26		200 kHz	3.2 dB(S)	3.1 dB(S)	-0.1	NA	+0.42/-0.47 dB
27		300 kHz	3.1 dB(S)	3.1 dB(S)	0.0	NA	+0.47/-0.52 dB
28		400 kHz	3.1 dB(S)	3.1 dB(S)	0.0	NA	+0.47/-0.52 dB
29		500 kHz	3.0 dB(S)	3.0 dB(S)	0.0	NA	+0.47/-0.52 dB
30		600 kHz	3.0 dB(S)	3.0 dB(S)	0.0	NA	+0.47/-0.52 dB
31		700 kHz	3.0 dB(S)	3.0 dB(S)	0.0	NA	+0.47/-0.52 dB
32		800 kHz	2.9 dB(S)	2.9 dB(S)	0.0	NA	+0.47/-0.52 dB
33		900 kHz	2.9 dB(S)	2.9 dB(S)	0.0	NA	+0.47/-0.52 dB
34		1000 kHz	2.9 dB(S)	2.9 dB(S)	0.0	NA	+0.47/-0.52 dB
35		2000 kHz	2.8 dB(S)	2.8 dB(S)	0.0	NA	+0.47/-0.52 dB
36		3000 kHz	2.8 dB(S)	2.8 dB(S)	0.0	NA	+0.47/-0.52 dB
37		4000 kHz	2.8 dB(S)	2.8 dB(S)	0.0	NA	+0.47/-0.52 dB
38		5000 kHz	2.7 dB(S)	2.7 dB(S)	0.0	NA	+0.47/-0.52 dB
39		6000 kHz	2.7 dB(S)	2.7 dB(S)	0.0	NA	+0.47/-0.52 dB
40		7000 kHz	2.7 dB(S)	2.7 dB(S)	0.0	NA	+0.47/-0.52 dB
41		8000 kHz	2.7 dB(S)	2.7 dB(S)	0.0	NA	+0.47/-0.52 dB
42		9000 kHz	2.7 dB(S)	2.7 dB(S)	0.0	NA	+0.47/-0.52 dB
43		10000 kHz	2.7 dB(S)	2.7 dB(S)	0.0	NA	+0.47/-0.52 dB
44		20000 kHz	2.5 dB(S)	2.4 dB(S)	-0.2	NA	+0.55/-0.63 dB
45		30000 kHz	3.5 dB(S)	3.3 dB(S)	-0.2	NA	+0.55/-0.63 dB
46		40000 kHz	7.0 dB(S)	7.2 dB(S)	0.2	NA	+0.55/-0.63 dB
47		50000 kHz	3.4 dB(S)	3.5 dB(S)	0.0	NA	+0.55/-0.63 dB
48		60000 kHz	4.9 dB(S)	4.9 dB(S)	0.0	NA	+0.55/-0.63 dB
49		70000 kHz	8.6 dB(S)	8.6 dB(S)	0.0	NA	+0.55/-0.63 dB
50		80000 kHz	6.9 dB(S)	6.4 dB(S)	-0.5	NA	+0.55/-0.63 dB
51		90000 kHz	5.7 dB(S)	4.9 dB(S)	-0.8	NA	+0.55/-0.63 dB
52		100000 kHz	7.6 dB(S)	6.8 dB(S)	-0.8	NA	+0.55/-0.63 dB

Trilog antenna factor, 25 MHz - 8 GHz, 100W
Frankonia, model ALX-8000E, serial number00809

Freq (MHz)	ACF (dB)	Gain (dBi)
30	15.3	-15.5
35	14.9	-13.8
40	16.3	-14.1
45	17.6	-14.3
50	18.2	-14.0
55	17.8	-12.8
60	16.7	-11.0
70	13.3	-6.2
80	10.8	-2.5
90	13.6	-4.4
100	16.0	-5.8
120	14.1	-2.3
140	12.0	1.1
160	12.9	1.4
180	13.6	1.7
200	15.6	0.6
250	16.5	1.6
300	17.5	2.2
350	19.3	1.8
400	20.0	2.2
450	20.1	3.1
500	21.4	2.8
550	22.1	2.9
600	23.4	2.4
650	23.6	2.8
700	24.4	2.7
750	25.3	2.4
800	25.5	2.7
850	26.4	2.4
900	27.0	2.3
950	27.1	2.7
1000	27.5	2.7

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Horn antenna factor
COM-POWER CORPORATION, Model AHA-118, Serial number 701046

Frequency, MHz	Measured antenna factor, dB/m
1000	-15.59
1050	-14.07
1100	-14.65
1150	-14.87
1200	-14.33
1250	-14.11
1300	-13.57
1350	-14.30
1400	-14.34
1450	-14.82
1500	-14.69
1550	-14.64
1600	-14.06
1650	-14.73
1700	-14.31
1750	-13.34
1800	-13.35
1850	-13.03
1900	-12.67
1950	-12.26
2000	-11.69
2050	-11.46
2100	-10.84
2150	-11.79
2200	-12.60
2250	-12.57
2300	-12.25
2350	-12.21
2400	-12.13
2450	-10.96
2500	-11.35
2550	-11.61
2600	-11.17
2650	-10.71
2700	-10.82
2750	-10.64
2800	-9.96
2850	-10.91
2900	-10.61
2950	-10.04
3000	-10.74
3050	-10.83
3100	-9.73
3150	-9.61
3200	-10.37
3250	-8.66
3300	-6.85
3350	-6.43
3400	-6.76
3450	-7.31
3500	-8.51

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Horn antenna factor (continued)
COM-POWER CORPORATION, Model AHA-118, Serial number 701046

Frequency, MHz	Measured antenna factor, dB/m
3550	-9.49
3600	-9.53
3650	-9.52
3700	-9.74
3750	-9.72
3800	-9.51
3850	-9.53
3900	-9.74
3950	-9.59
4000	-9.46
4050	-8.95
4100	-8.34
4150	-7.91
4200	-8.02
4250	-8.20
4300	-8.35
4350	-7.88
4400	-7.56
4450	-7.16
4500	-7.01
4550	-7.08
4600	-7.17
4650	-7.17
4700	-6.97
4750	-6.29
4800	-5.49
4850	-5.19
4900	-5.43
4950	-5.46
5000	-5.48
5050	-5.29
5100	-5.01
5150	-4.44
5200	-3.97
5250	-3.69
5300	-3.73
5350	-4.16
5400	-4.35
5450	-4.11
5500	-3.91
5550	-3.52
5600	-3.63
5650	-3.90
5700	-4.26
5750	-4.62
5800	-4.51
5850	-4.22
5900	-3.61
5950	-3.07
6000	-3.10
6050	-3.29
6100	-3.63

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Horn antenna factor (continued)
COM-POWER CORPORATION, Model AHA-118, Serial number 701046

Frequency, MHz	Measured antenna factor, dB/m
6150	-3.74
6200	-3.62
6250	-3.67
6300	-3.45
6350	-3.57
6400	-3.59
6450	-3.64
6500	-3.44
6550	-3.36
6600	-2.83
6650	-2.51
6700	-2.32
6750	-2.26
6800	-2.43
6850	-2.64
6900	-2.53
6950	-2.24
7000	-1.87
7050	-1.59
7100	-1.41
7150	-1.22
7200	-1.12
7250	-1.04
7300	-0.99
7350	-0.95
7400	-0.91
7450	-0.87
7500	-0.69
7550	-0.60
7600	-0.41
7650	0.00
7700	0.29
7750	0.58
7800	0.97
7850	1.02
7900	0.85
7950	1.04
8000	1.12
8050	1.26
8100	1.49
8150	1.77
8200	1.89
8250	1.90
8300	1.85
8350	2.00
8400	2.02
8450	2.17
8500	2.42
8600	2.52
8650	2.20
8700	1.77
8750	1.54

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Horn antenna factor (continued)
COM-POWER CORPORATION, Model AHA-118, Serial number 701046

Frequency, MHz	Measured antenna factor, dB/m
8800	1.85
8850	2.33
8900	2.61
8950	2.33
9000	1.76
9050	1.19
9100	0.80
9150	1.03
9200	1.39
9250	1.49
9300	1.07
9350	0.70
9400	0.54
9450	0.80
9500	1.37
9550	1.58
9600	1.59
9650	1.25
9700	0.86
9750	0.71
9800	0.84
9850	1.43
9900	1.67
9950	1.65
10000	1.45
10100	1.26
10200	1.82
10300	1.85
10400	1.55
10500	1.93
10600	2.87
10700	2.73
10800	1.41
10900	1.51
11000	2.06
11100	1.88
11200	1.93
11300	2.61
11400	2.56
11500	2.12
11600	2.56
11700	3.15
11800	2.38
11900	2.04
12000	2.61
12100	2.25
12200	1.86
12300	2.92
12400	3.44
12600	2.65
12700	3.28
12800	2.42

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Horn antenna factor (continued)
COM-POWER CORPORATION, Model AHA-118, Serial number 701046

Frequency, MHz	Measured antenna factor, dB/m
12900	2.00
13000	2.92
13100	3.39
13200	3.02
13300	2.92
13400	3.25
13500	3.11
13600	2.72
13700	2.97
13800	3.46
13900	4.46
14000	4.38
14100	4.52
14200	4.39
14300	3.81
14400	4.74
14500	5.12
14600	5.96
14700	7.05
14800	6.94
14900	5.69
15000	4.38
15100	3.54
15200	2.65
15300	1.94
15400	2.21
15500	2.53
15600	1.75
15700	0.63
15800	1.60
15900	2.33
16000	1.44
16100	0.84
16200	1.74
16300	2.09
16400	1.18
16500	1.04
16600	1.23
16700	1.08
16800	1.37
16900	1.85
17000	1.99
17100	1.78
17200	2.18
17300	2.96
17400	3.14
17500	3.88
17600	4.71
17700	5.08
17800	6.12
17900	6.28
18000	6.72

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Active horn antenna factor
COM-POWER CORPORATION, Model AHA-840
Serial number 105004

Frequency, MHz	Measured antenna factor, dB/m
18000	4.4
18250	2.6
18500	2.4
18750	1.4
19000	0.9
19250	0.1
19500	-0.1
19750	-0.2
20000	-0.2
20250	0.1
20500	0.4
20750	0.4
21000	0.6
21250	0.4
21500	-0.1
21750	0.2
22000	-0.2
22250	-1.1
22500	-0.6
22750	-1.3
23000	-1.6
23250	-1.2
23500	-1.7
23750	-1.7
24000	-1.8
24250	-1.7
24500	-2.1
24750	-2.1
25000	-2.0
25250	-2.3
25500	-2.1
25750	-2.4
26000	-2.5
26250	-2.2
26500	-2.5
26500	-2.5
26750	-3.3
27000	-2.6
27250	-3.1
27500	-3.1
27750	-2.5
28000	-3.0
28250	-2.6
28500	-2.2
28750	-3.0
29000	-1.7
29250	-1.7

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Active horn antenna factor (continued)
COM-POWER CORPORATION, Model AHA-840
Serial number 105004

Frequency, MHz	Measured antenna factor, dB/m
29500	-2.6
29750	-2.0
30000	-2.2
30250	-2.1
30500	-1.9
30750	-2.4
31000	-2.2
31250	-1.9
31500	-2.5
31750	-3.4
32000	-3.4
32250	-3.5
32500	-4.1
32750	-4.2
33000	-4.6
33250	-3.9
33500	-4.1
33750	-4.1
34000	-3.7
34250	-3.7
34500	-4.3
34750	-3.6
35000	-3.5
35250	-3.5
35500	-2.6
35750	-3.1
36000	-2.5
36250	-2.0
36500	-2.4
36750	-1.0
37000	-0.7
37250	-0.7
37500	0.3
37750	1.0
38000	2.0
38250	2.0
38500	2.0
38750	1.3
39000	0.6
39250	0.0
39500	-0.5
39750	-0.8
40000	-0.5

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

15 APPENDIX E Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions at mains port with LISN and HP 8542E or HP 8546A receiver	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Conducted emissions at telecommunication port with HP 8542E or HP 8546A receiver	ISN: ± 3.3 dB Current probe: ± 3.5 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Harmonic current	± 4.0%
Voltage fluctuations and flickers	± 5.3%
ESD	It has been demonstrated that calibration results are within the limits specified in the EN 61000-4-2 standard reduced by uncertainty of calibration that prove compliance with standard requirements with at least a 95% confidence. Parameters that have been calibrated and tolerances are shown below: First peak current of discharge: ±10% (refer to standard Table 2) Current at 30 ns: ±30% (refer to standard Table 2) Current at 60 ns: ±30% (refer to standard Table 2) Rise time: 0.7 – 1 (ns)
Radiated immunity AR FP2000 E-field probe AR FP2080 E-field probe	 10 kHz to 250 MHz: ± 1.9 dB; 250 MHz to 1 GHz: ± 2.1 dB 80 MHz to 26 GHz: ± 2.7 dB; 26 GHz to 40 GHz: ± 4.0 dB
Conducted RF immunity - CDN injection - Current probe injection - Direct injection	 ± 1.3 dB ± 3.1 dB ± 3.1 dB

Test description	Expanded uncertainty
EFT - CDN injection - Capacitive clamp injection	It has been demonstrated that calibration results are within the limits specified in the EN 61000-4-4 standard reduced by uncertainty of calibration, that prove compliance with standard requirements with at least a 95% confidence. Parameters that have been calibrated and tolerances are shown below: Peak voltage: (0.125 to 2 kV) ±10% at 50 Ω Peak voltage: (0.24 to 3.8 kV) ±10% at 1000 Ω Rise time: 5 ns ±30% at 50 Ω / 5 ns ±30% at 1000 Ω Crest time: 50 ns ±30% at 50 Ω / 50 ns -15 ns / +100 ns at 1000 Ω Burst duration: 15 ms ± 20% at 5 kHz / 0.75 ms ± 20% at 100 kHz Burst period: 300 ms ± 20% Repetition frequency: 5 or 100 kHz ±20% Peak voltage at CDN output: (0.125 to 2 kV) ±10% at 50 Ω under 4 kV Rise time at CDN output: 5 ns ±30% at 50 Ω under 4 kV Crest time at CDN output: 50 ns ±30% at 50 Ω under 4 kV
High voltage surges	It has been demonstrated that calibration results are within the limits specified in the EN 61000-4-5 standard reduced by uncertainty of calibration, that prove compliance with standard requirements with at least a 95% confidence. Parameters that have been calibrated and tolerances are shown below: **1.2/50 µs combination wave generator:** Open-circuit output voltage: (0.5 to 6 kV) ±10% Short-circuit output current: (0.25 to 3 kA) ±10% Effective output impedance: 2 Ω ±10% Phase shifting: 0 to 360º ±10º Undershoot: < 30% of the output voltage Coupling: Direct / 18 µF / 9 µF+10 Ω Open-circuit front time: 1.2 µs ±30% / 1.2 µs ±30% / 1.2 µs ±30% Open-circuit time to half-value: 50 µs ±20% / 50 µs ±10 µs / 50 µs +10/-25 µs Short-circuit front time: 8 µs ±20% / 8 µs ±20% / 2.5 µs ±30% Short-circuit time to half-value: 20 µs ±20% / 20 µs ±20% / 25 µs ±30% **10/700 µs combination wave generator:** Open-circuit output voltage: (0.5 to 6 kV) ±10% Short-circuit output current: (12.5 A to 150 A) ±10% Effective output impedance: 40 Ω ±10% Open-circuit front time: 10 µs ± 30% Open-circuit time to half-value: 700 µs ± 20% Short-circuit front time: 5 µs ± 20% Short-circuit time to half-value: 320 µs ± 20%
Voltage dips, short interruptions and variations	It has been demonstrated that calibration results are within the limits specified in the EN 61000-4-11 standard reduced by uncertainty of calibration, that prove compliance with standard requirements with at least a 95% confidence. Parameters that have been calibrated and tolerances are shown below: Open-circuit voltage: ±5% Voltage change under full load: Nominal voltage: ±5% 70% of nominal voltage: ±7% 40% of nominal voltage: ±10%
Immunity to electrical transient	± 6.96%

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

16 APPENDIX F Specification references

FCC 47CFR part 15: 2021 subpart B	Radio Frequency Devices
ICES-003: 2020, Issue 7	Information Technology Equipment (Including Digital Apparatus)
ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
VCCI-CISPR 32: 2016	Electromagnetic compatibility of multimedia equipment — Emission requirements Technical Requirements
AS/NZS CISPR 32: 2015 + A1(20)	Electromagnetic compatibility of multimedia equipment — Emission requirements
EN 301 489-17 V3.2.4: 2020	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard for ElectroMagnetic Compatibility
EN 301 489-52 V1.2.1: 2021	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services. Part 52: Specific conditions for Cellular Communication User Equipment (UE) radio and ancillary equipment; Harmonised Standard for ElectroMagnetic Compatibility
EN 301 489-1 V2.2.3: 2019	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility
EN 55032: 2015 + A1(20) + A11(20)	Electromagnetic compatibility of multimedia equipment — Emission requirements
CISPR 32: 2015 + A1(19)	Electromagnetic compatibility of multimedia equipment — Emission requirements
EN IEC 61000-6-3: 2021	Electromagnetic compatibility (EMC)–Part 6-3: Generic standards – Emission standard for equipment in residential environments
CISPR 16-1-1: 2019	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus
CISPR 16-2-1: 2014 + A1(17)	Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements
CISPR 16-2-3: 2016	Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements
EN IEC 61000-3-2: 2019 + A1(21)	Electromagnetic compatibility (EMC) - Part 3: Limits. Section 2. Limits for harmonic current emissions for equipment with input current <16 A
EN 61000-3-3: 2013 + A1(19)	Electromagnetic compatibility (EMC) - Part 3: Limits. Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current <16 A
EN 55035: 2017 + A11(20)	Electromagnetic compatibility of multimedia equipment – Immunity requirements
CISPR 35: 2016	Electromagnetic compatibility of multimedia equipment – Immunity requirements
EN IEC 61000-6-2: 2019	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
EN 61000-4-2: 2009	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 2: Electrostatic discharge immunity test
EN 61000-4-3: 2006+A1(08)+A2(10)	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 3: Radiated, radio frequency, electromagnetic field immunity test
EN 61000-4-4: 2012	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 4: Electrical fast transient/burst immunity test
EN 61000-4-5: 2014	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 5: Surge immunity test
EN 61000-4-6: 2014	Electromagnetic compatibility (EMC) Part 4: testing and measurement techniques. Section 6: Immunity to conducted disturbances, inducted by radio-frequency fields
EN 61000-4-8: 2010	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 8: Power - frequency magnetic field immunity test
EN 61000-4-11: 2004	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques Section 11: Voltage dips, short interruptions and voltage variations immunity test
ISO 7637-2: 2004	Road vehicles – Electrical disturbance from conduction and coupling. Part 2: Electrical transient conduction along supply lines only

END OF DOCUMENT