

TEST REPORT

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.231(e)

FOR:

Xsense Ltd.

CU series gateway

Model: CU2-4G

FCC ID: XCCXSENSE-CU

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.
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1 Applicant information

Client name: Xsense Ltd.
Address: 33 Dolev Str., Migdal Tefen 2495900, Israel
Telephone: 04-9122800
Fax: 04-9122801
E-mail: Kasemg@xsense.co
Contact name: Mr. Kasem Gadban

2 Equipment under test attributes

Product name: CU series gateway
Product type: Transceiver
Model(s): CU2-4G
Serial number: 0696100161
Hardware version: v102
Software release: 4.20
Receipt date 07-Oct-24

3 Manufacturer information

Manufacturer name: Xsense Ltd.
Address: 33 Dolev Str., Migdal Tefen 2495900, Israel
Telephone: 04-9122800
Fax: 04-9122801
E-Mail: Kasemg@xsense.co
Contact name: Mr. Kasem Gadban

4 Test details

Project ID: 55395
Location: Hermon Laboratories Ltd. 66 HaTachana str., P.O. Box 23, Binyamina 3055001, Israel
Test started: 11-Dec-24
Test completed: 31-Jan-25
Test specification(s): FCC 47CFR part 15, subpart C, §15.231(e)

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Part 15, Section 231(e) Periodic operation requirements	Pass*
FCC Part 15, Section 231(e) Field strength of emissions	Pass*
FCC Part 15, Section 231(c) Occupied bandwidth	Pass*
FCC Part 15, Section 207 Conducted emission	Pass*
FCC Part 15, Section 203 Antenna requirements	Pass*

* The relevant tests were performed to support Application for Class II permissive changes certification.

The change under this application is:

1. The new LTE module.

Except outlined above, Certified product remain identical to original one.

This test report supersedes the previously issued test report identified by Doc ID: XSERAD_FCC.55395_Rev1

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:	Mrs. E. Pitt, test engineer, EMC & Radio Mr. S. Sugatov, test engineer, EMC & Radio	11-Dec-24 – 31-Jan-25	 
Reviewed by:	Mrs. S. Peysahov Sheynin, certification engineer, EMC & Radio	30-Aug-25	
Approved by:	Mr. M. Nikishin, group leader, EMC & Radio	22-Sep-26	

6 EUT description

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

6.1 General information

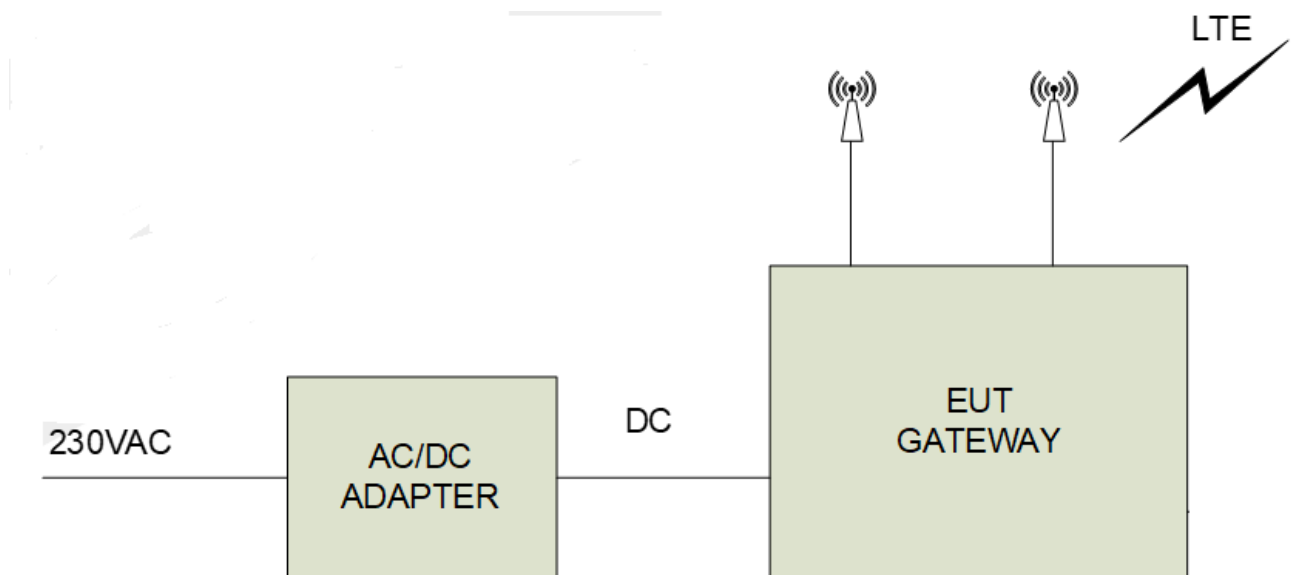
The EUT, CU2.5 series gateway, is used for reading data from HiTag2™ data loggers. CU2.5 series gateways initiate communications with Xsense® HiTag2™ data loggers over sub-Giga RF. The data loggers pass the readings they have stored to the gateway, which processes them and then passes them to Xsense® Cloud via LAN or Cellular connection. The EUT incorporates RF module operating at 433 MHz and LTE 4G modem (manufactured by Telit, model LE910C1-WWX, FCC ID: LE910C1-WWX).

The EUT is powered from AC mains via AC/DC adapter manufactured by Shenzhen keyu power supply technology, model KA3602A-1203000P and contains 6V 7Ah backup battery.

6.2 Operating frequencies

Source	Frequency, MHz
4G cellular modem	800-2100
RF Tx/Rx	433

6.3 Test configuration



6.4 Changes made in EUT

No changes were implemented in the EUT during testing.



6.5 Transmitter characteristics

Type of equipment						
X	Stand-alone (Equipment with or without its own control provisions)					
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)					
	Plug-in card (Equipment intended for a variety of host systems)					
Operating frequencies		433.75 – 434.2 MHz				
Maximum rated output power		At transmitter 50 Ω RF output connector		dBm		
		Field strength at 3 m distance		82.86 dB(μ V/m) -peak 70.62 dB(μ V/m)-average		
Is transmitter output power variable?		X	No			
		Yes		continuous variable		
				stepped variable with stepsize	dB	
				minimum RF power	dBm	
			maximum RF power	dBm		
Antenna connection						
X	unique coupling	standard connector	integral	X	with temporary RF connector without temporary RF connector	
Antenna/s technical characteristics						
Type	Manufacturer		Model number		Gain	
External	Panorama Antennas		MFXU-TNC-433		1dBi	
Type of modulation		FSK				
Transmitter aggregate data rate/s		9.6 kbps				
Transmitter power source						
X	Battery	Nominal rated voltage	6VDC	Battery type	Rechargeable sealed Lead-Acid	
X	DC	Nominal rated voltage	12VDC			
	AC mains	Nominal rated voltage	VAC			
Common power source for transmitter and receiver				X	yes no	



Test specification: FCC Part 15, Section 231(e), Periodic operation requirements			
Test procedure: Supplier declaration		Verdict: PASS	
Test mode: Compliance			
Date(s): 11-Dec-24			
Temperature: 23 °C	Relative Humidity: 35 %	Air Pressure: 1018 hPa	Power: 12.0 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 Periodic operation requirements

7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- Duration of each transmission shall not be greater than 1 second;
- Silent period between transmissions shall be at least 30 times the duration of the transmission;
- Silent period between transmissions shall be in no case less than 10 seconds.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

7.1.2 Test procedure for transmitter shut down test

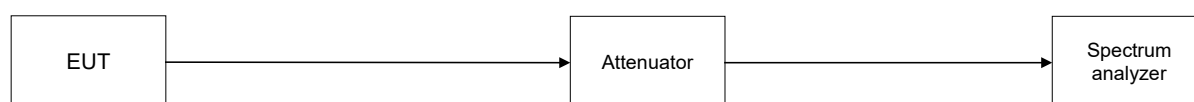
7.1.2.1 The EUT was set up as shown in Figure 7.1.1

7.1.2.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.2.3 The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

7.1.2.4 The transmission time was captured and shown in the associated plots. The test results were recorded in Table 7.1.2

Figure 7.1.1 Setup for transmitter shut down test



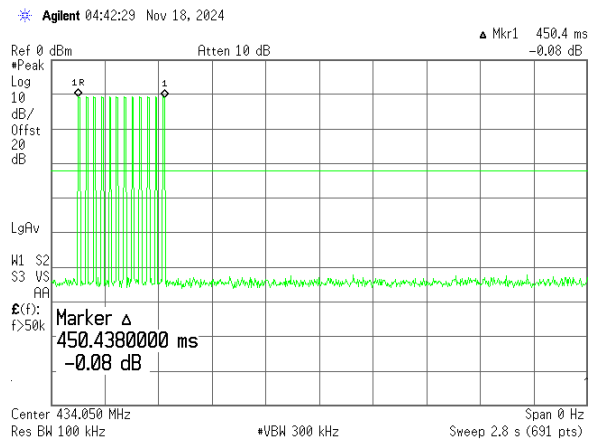


Test specification: FCC Part 15, Section 231(e), Periodic operation requirements			
Test procedure: Supplier declaration			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-24			
Temperature: 23 °C	Relative Humidity: 35 %	Air Pressure: 1018 hPa	Power: 12.0 VDC
Remarks:			

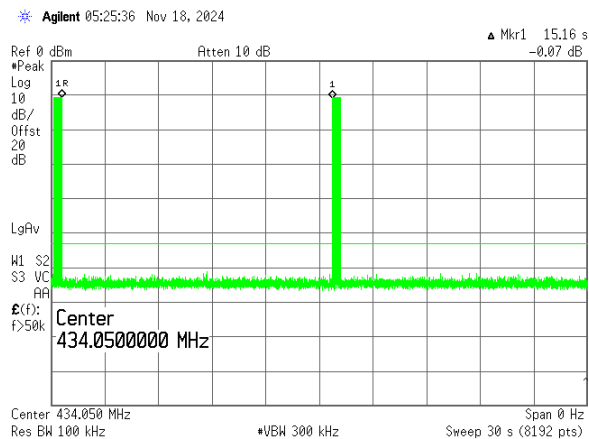
Table 7.1.1 Periodic operation requirements

Requirement	Rationale	Verdict
Continuous transmissions are not permitted	Supplier declaration	Comply
Duration of each transmission shall not be greater than 1 second	Plots 7.1.1	Comply
Silent period between transmissions shall be at least 30 times the duration of the transmission	Plots 7.1.2	Comply
Silent period between transmissions shall be in no case less than 10 seconds	Plots 7.1.2	Comply

Plot 7.1.1 Transmitter pulse duration



Plot 7.1.2 Transmitter pulse period





Test specification: FCC Part 15, Section 231(e), Periodic operation requirements			
Test procedure: Supplier declaration			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-24			
Temperature: 23 °C	Relative Humidity: 35 %	Air Pressure: 1018 hPa	Power: 12.0 VDC
Remarks:			

Table 7.1.2 Total duration of transmissions

Tx frequency is 434.05 MHz

Total transmission duration, ms	Total transmission duration limit, ms	Period between transmissions, sec	Period between transmissions limit, sec	Verdict
450.4	<1000.0	15.2	>10.0	Pass

Reference numbers of test equipment used

HL 4355	HL 5626	HL 5642					
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Full description is given in Appendix A.



Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

7.2 Field strength of emissions

7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
434.05	92.9	72.9

Table 7.2.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**		
0.090 – 0.110	NA	108.5 – 106.8**	NA		
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**		
0.490 – 1.705	NA	73.8 – 63.0**	NA		
1.705 – 30.0*		69.5			
30 – 88		40.0			
88 – 216		43.5			
216 – 960		46.0			
960 - 1000		54.0			
Above 1000	74.0	NA	54.0		

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lims}_2 = \text{Lims}_1 + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

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

The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

Note 2: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.



Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

7.2.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

7.2.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

7.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.



Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz

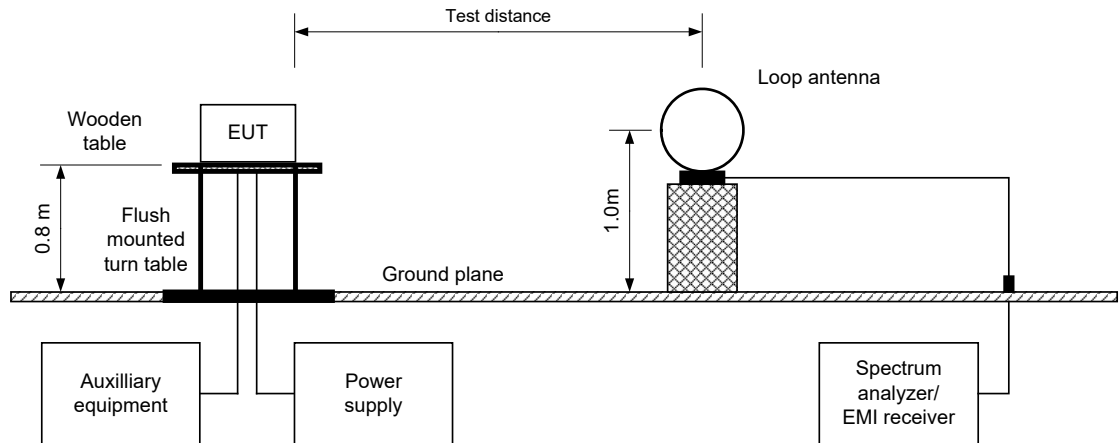
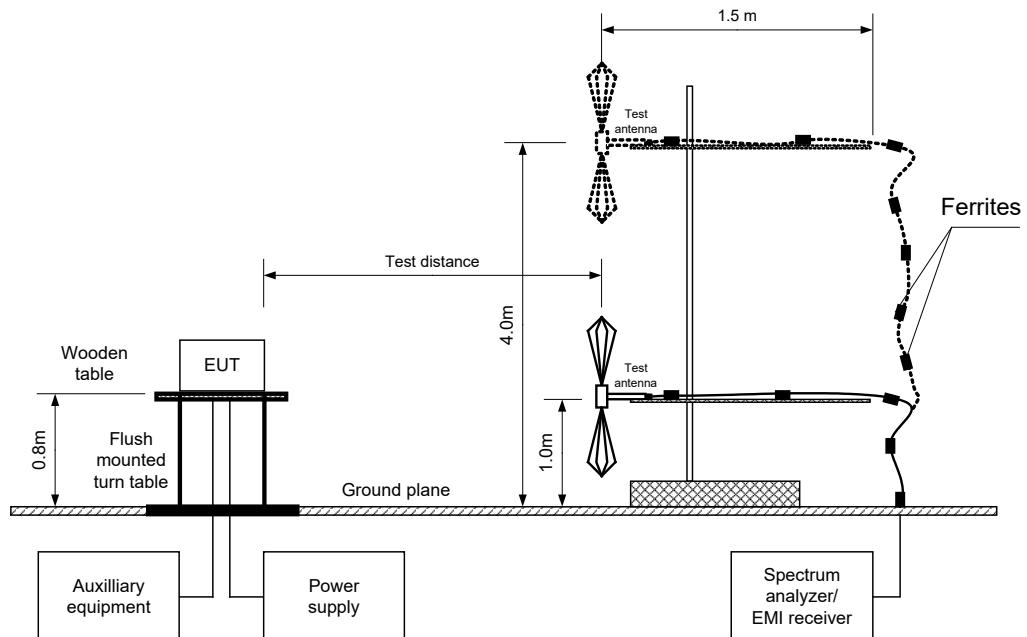
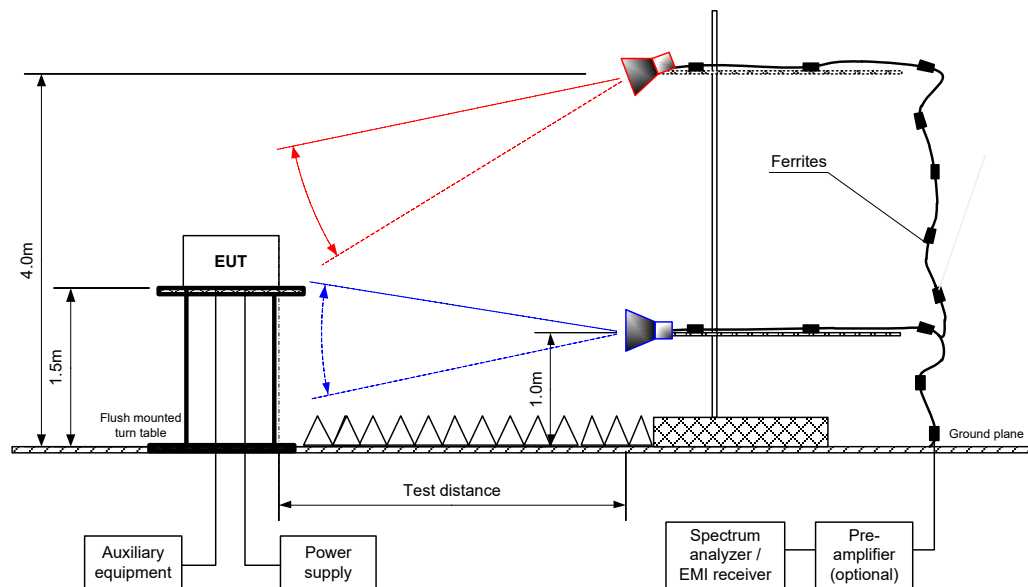


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Figure 7.2.3 Setup for spurious emission field strength measurements above 1000 MHz





Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies below 1 GHz

TEST DISTANCE: 3 m
EUT POSITION: Typical
MODULATION: FSK
BIT RATE: 9.6 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
INVESTIGATED FREQUENCY RANGE: 0.009 – 4500 MHz
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
9.0 kHz (150 kHz – 30 MHz)
120 kHz (30 MHz – 1000 MHz)
1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

Double ended guide (above 1000 MHz)											
F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Average field strength				Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Calculated, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
Fundamental emission 434.05 MHz											
434.05	V	1.00	15	82.86	92.9	-10.04	N/A	70.62	72.9	-2.28	Pass
Spurious emissions											
41.79	V	1.00	15	36.40	72.9	-36.50	N/A	24.16	52.9	-28.74	Pass
868.10	H	1.00	15	38.47	72.9	-34.43	N/A	26.23	52.9	-26.67	

*- EUT front panel refers to 0 degrees position of turntable.

*- EUT front panel refers to 0 degrees position of turntable.

**- Margin = dB below (negative if above) specification limit.

*** Max value was obtained in X (Y, Z)-axis orthogonal position and at Unom (115%Unom, 85%Unom) input power voltage.

Table 7.2.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
8.145	39.420	NA	NA	NA	-12.24

*- Average factor was calculated as follows for pulse train longer than 100 ms:

$$\text{Average factor} = 20 \times \log_{10} \left(\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{100 \text{ ms}} \times \text{Number of bursts within 100 ms} \right)$$

Reference numbers of test equipment used

HL 3903	HL 4933	HL 5288	HL 5902	HL 7585			
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Full description is given in Appendix A.



Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Table 7.2.5 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE: 3 m
 EUT POSITION: Typical
 MODULATION: FSK
 BIT RATE: 9.6 kbps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 – 4500 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 1.0 MHz (above 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)

Basic frequency grid (430.0 - 430.5 MHz)								
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*				
No emissions were found								

*- Margin = Measured emission - specification limit.

**- EUT front panel refer to 0 degrees position of turntable.



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Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Table 7.2.6 Restricted bands according to FCC 15, Section 205

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.290 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.420 - 16.423	156.7 - 156.9	1660 - 1710	5350 - 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	



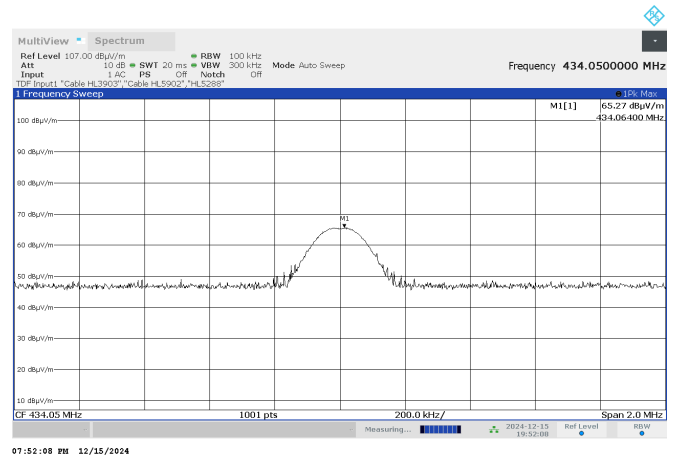
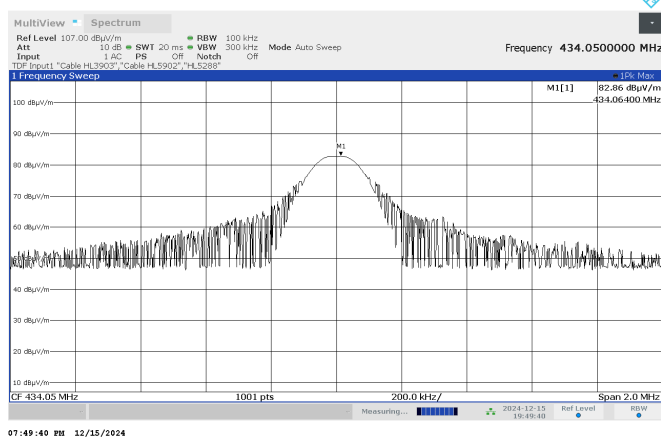
HERMON LABORATORIES

Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Plot 7.2.1 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and horizontal
EUT POSITION: Typical

Horizontal



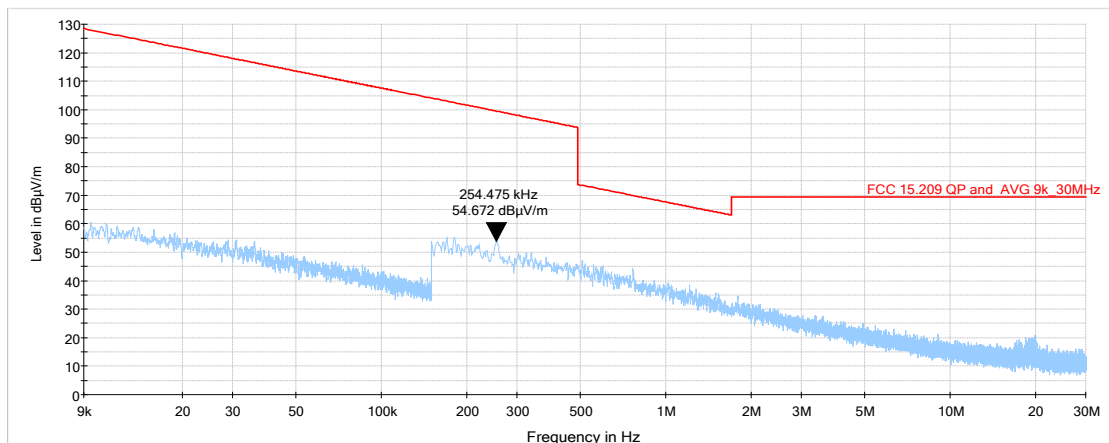


HERMON LABORATORIES

Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Plot 7.2.2 Radiated emission measurements from 9 to 30 MHz

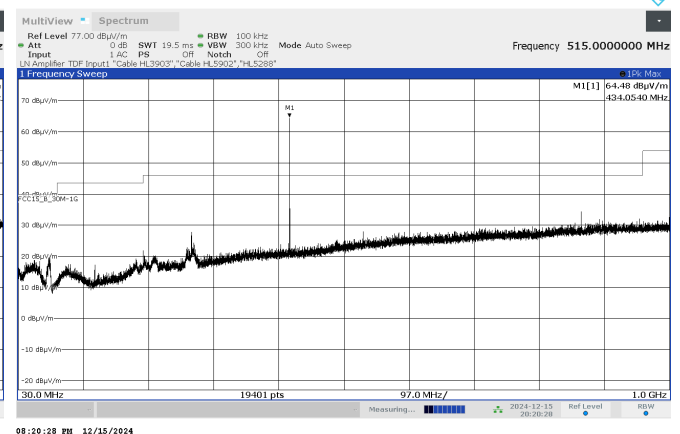
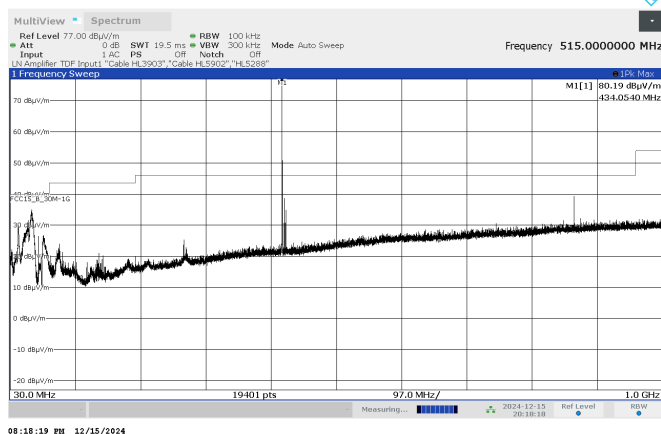
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical



Plot 7.2.3 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical

Horizontal





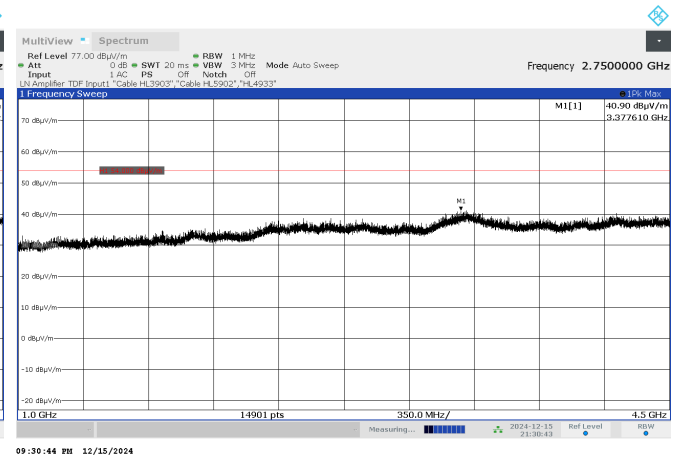
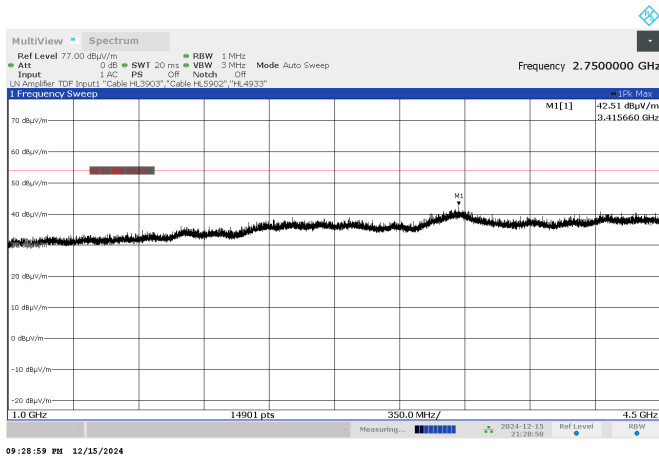
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Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Plot 7.2.4 Radiated emission measurements from 1000 to 4500 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical

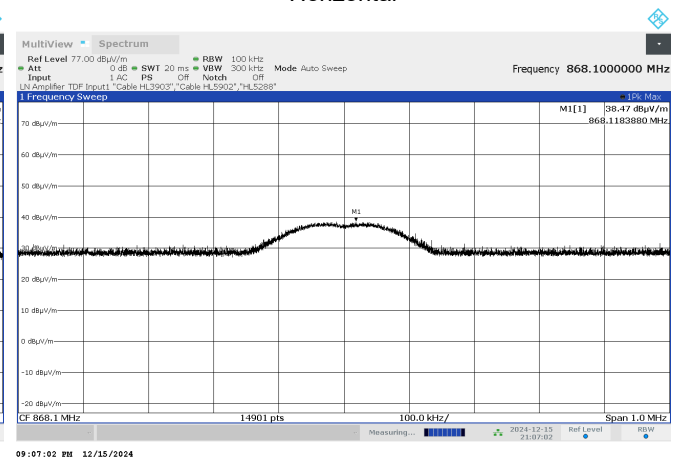
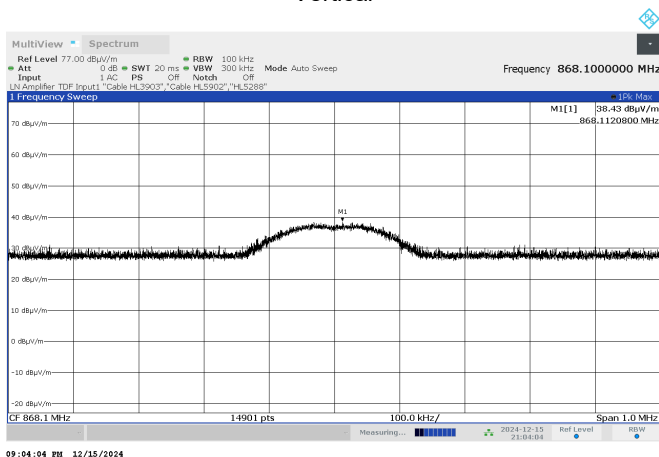
Horizontal



Plot 7.2.5 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and horizontal
EUT POSITION: Typical

Horizontal

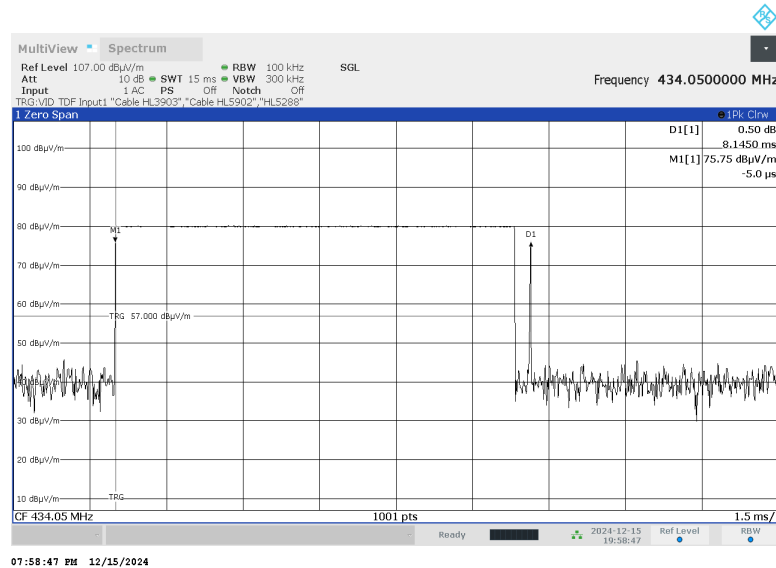




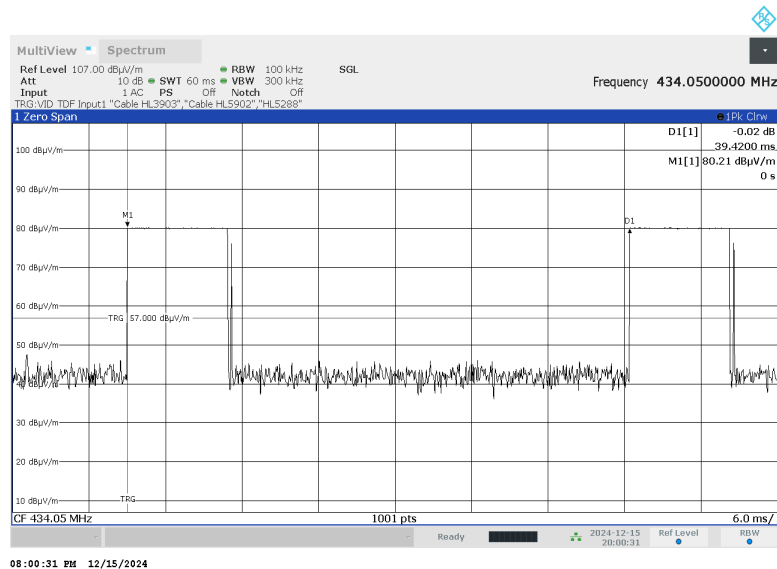
HERMON LABORATORIES

Test specification: FCC Part 15, Section 231(e), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1023 hPa	Power: 12 VDC
Remarks:			

Plot 7.2.6 Transmission pulse duration



Plot 7.2.7 Transmission pulse period





Test specification: FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth			
Test procedure: ANSI C63.10 section 6.9.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-24			
Temperature: 23 °C	Relative Humidity: 34 %	Air Pressure: 1018 hPa	Power: 12 VDC
Remarks:			

7.3 Occupied bandwidth test

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, % of the carrier frequency
70 - 900	20.0	0.25

*- Modulation envelope reference points provided in terms of attenuation below modulated carrier.

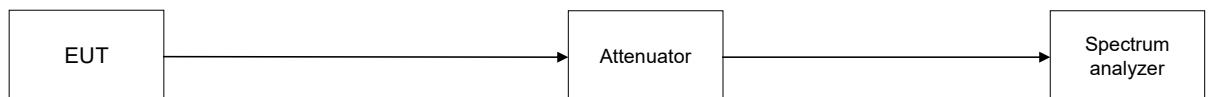
7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

7.3.2.2 The EUT was set to transmit modulated carrier.

7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and associated plot.

Figure 7.3.1 Occupied bandwidth test setup





Test specification: FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth			
Test procedure: ANSI C63.10 section 6.9.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-24			
Temperature: 23 °C	Relative Humidity: 34 %	Air Pressure: 1018 hPa	Power: 12 VDC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 30 kHz
VIDEO BANDWIDTH: 100 kHz
MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
MODULATION: FSK

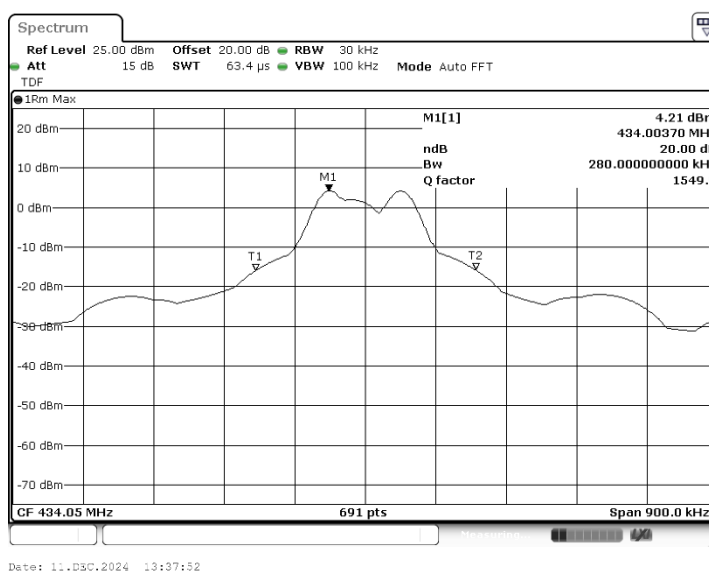
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
434.050	280.0	0.25	1083	-803.0	Pass

Reference numbers of test equipment used

HL 4355	HL 5626	HL 5642						
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Full description is given in Appendix A.

Plot 7.3.1 Occupied bandwidth test result





Test specification: FCC Part 15, Section 207			
Test procedure: ANSI C63.4, Section 7.3 and 12.2.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 31-Jan-25			
Temperature: 23 °C	Relative Humidity: 35 %	Air Pressure: 1022 hPa	Power: 110 VAC, 50 Hz
Remarks:			

7.4 Conducted emissions

7.4.1 General

This test was performed to measure the common mode conducted emissions at the EUT power port. The specification test limits are given in Table 7.4.1.

Table 7.4.1 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.

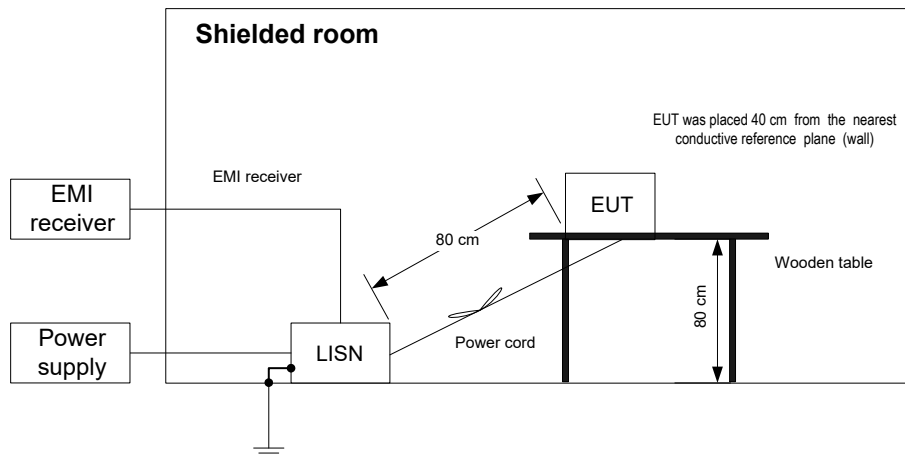
7.4.2 Test procedure

- 7.4.2.1** The EUT was set up as shown in Figure 7.4.1 and the associated photograph, energized and the EUT performance was checked.
- 7.4.2.2** The measurements were performed at the EUT power terminals with the LISN connected to the EMI receiver in the frequency range referred to in Table 7.4.2. The unused coaxial connector of the LISN was terminated with 50 Ohm.
- 7.4.2.3** The position of the EUT cables was varied to find the highest emission.
- 7.4.2.4** The worst test results with respect to the limits were recorded in Table 7.4.2 and shown in the associated plots.



Test specification: FCC Part 15, Section 207			
Test procedure: ANSI C63.4, Section 7.3 and 12.2.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 31-Jan-25			
Temperature: 23 °C	Relative Humidity: 35 %	Air Pressure: 1022 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Figure 7.4.1 Setup for conducted emission measurements, table-top EUT



Photograph 7.4.1 Setup for conducted emission measurements





Test specification: FCC Part 15, Section 207			
Test procedure: ANSI C63.4, Section 7.3 and 12.2.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 31-Jan-25			
Temperature: 23 °C	Relative Humidity: 35 %	Air Pressure: 1022 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Table 7.4.2 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*		
0.516	36.16	56.00	-19.84	25.60	46.00	-20.40	L1	Pass
0.518	36.25	56.00	-19.75	25.30	46.00	-20.70		
0.520	36.31	56.00	-19.69	25.44	46.00	-20.56		
0.522	36.33	56.00	-19.67	25.56	46.00	-20.44		
0.524	36.33	56.00	-19.67	25.74	46.00	-20.26		
0.526	36.13	56.00	-19.87	25.71	46.00	-20.29		
1.792	28.35	56.00	-27.65	26.64	46.00	-19.36	L2	Pass
1.794	28.34	56.00	-27.66	26.61	46.00	-19.39		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0787	HL 1501	HL 3016	HL 5476	HL 5707			
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Full description is given in Appendix A.

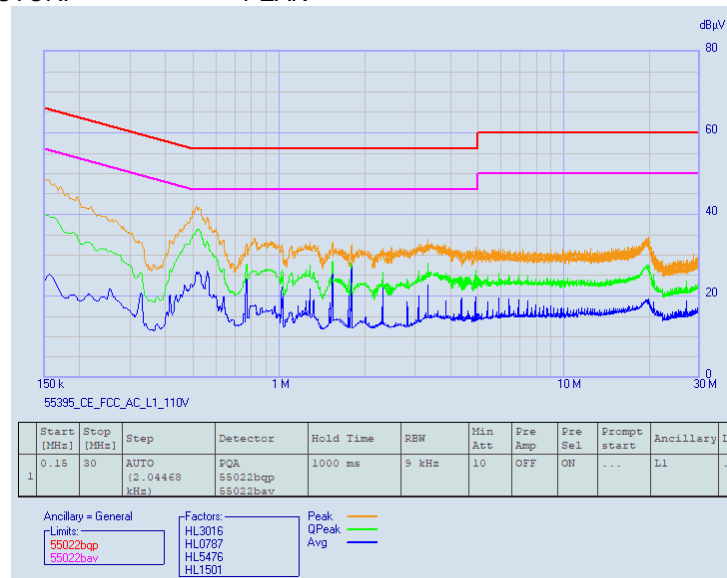


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Test specification: FCC Part 15, Section 207			
Test procedure: ANSI C63.4, Section 7.3 and 12.2.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 31-Jan-25			
Temperature: 23 °C	Relative Humidity: 35 %	Air Pressure: 1022 hPa	Power: 110 VAC, 50 Hz
Remarks:			

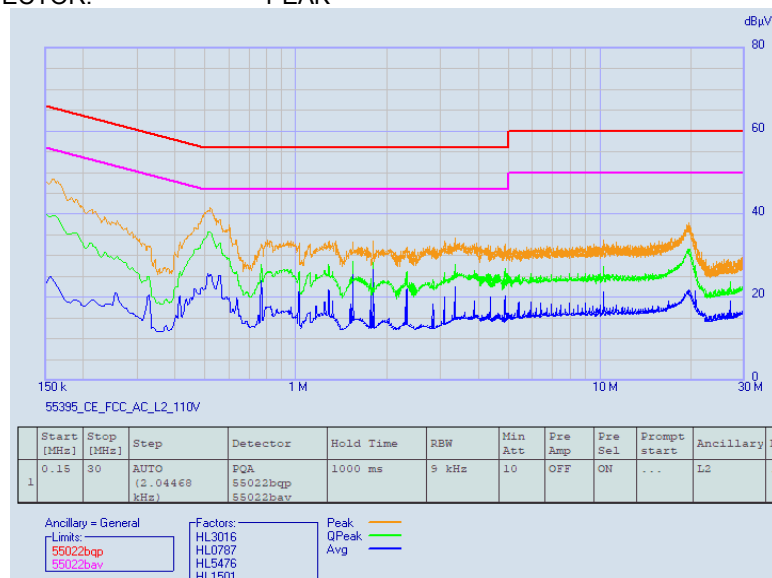
Plot 7.4.1 Conducted emission measurements

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



Plot 7.4.2 Conducted emission measurements

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





Test specification: FCC Part 15, Section 203			
Test procedure: Visual inspection / supplier declaration			
Test mode: Compliance		Verdict: PASS	
Date(s): 31-Jan-25			
Temperature: 23 °C	Relative Humidity: 35 %	Air Pressure: 1022 hPa	Power: 230 VAC, 50 Hz
Remarks:			

7.5 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.5.1.

Table 7.5.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	N/A	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	Supplier declaration	

8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1226/2A	06-May-24	06-May-25
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	101630	19-Jun-24	19-Jun-25
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	20-Feb-24	20-Feb-25
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	24-Mar-22	24-Mar-25
5626	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini Circuits	BW-N20W5+	NA	05-Aug-24	05-Aug-25
5642	Cable, 50 Ohm, DC to 18 GHz, 1.8 m, SMA/SMA	Mini Circuits	CBL-6FT-SMSM+	NA	29-Jul-24	29-Jul-25
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/11N/11N/6000	NA	17-Nov-24	17-Nov-25
7585	EMI Test Receiver, 1 Hz to 44 GHz	Rohde & Schwarz	ESW44	103130	24-Sep-24	24-Sep-25

9 APPENDIX B Test equipment correction factors

HL 4933: Active Horn Antenna
COM-POWER CORPORATION, model: AHA-118, s/n 701046

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
1000	-16.1
1500	-15.1
2000	-10.9
2500	-11.9
3000	-11.1
3500	-10.6
4000	-8.6
4500	-8.3
5000	-5.9
5500	-5.7
6000	-3.3
6500	-4.0
7000	-2.2
7500	-1.7
8000	1.1
8500	-0.8
9000	-1.5
9500	-0.2

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
10000	1.8
10500	1.0
11000	0.3
11500	-0.5
12000	3.1
12500	1.4
13000	-0.3
13500	-0.4
14000	2.5
14500	2.2
15000	1.9
15500	0.5
16000	2.1
16500	1.2
17000	0.6
17500	3.1
18000	4.2

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.

HL 5288: Trilog Antenna
Frankonia, model: ALX-8000E, s/n: 00809
30-1000 MHz

Frequency, MHz	Antenna factor, dB/m
30	14.96
35	15.33
40	16.37
45	17.56
50	17.95
60	16.87
70	13.22
80	10.56
90	13.61
100	15.46
120	14.03
140	12.23

Frequency, MHz	Antenna factor, dB/m
160	12.67
180	13.34
200	15.40
250	16.42
300	17.28
400	19.98
500	21.11
600	22.90
700	24.13
800	25.25
900	26.35
1000	27.18

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.

above 1000 MHz

Frequency, MHz	Antenna factor, dB/m
1000	26.9
1100	28.1
1200	28.4
1300	29.6
1400	29.1
1500	30.4
1600	30.7
1700	31.5
1800	32.3
1900	32.6
2000	32.5
2100	32.9
2200	33.5
2300	33.2
2400	33.7
2500	34.6
2600	34.7
2700	34.6
2800	35.0
2900	35.5
3000	36.2
3100	36.8
3200	36.8
3300	37.0
3400	37.5
3500	38.2

Frequency, MHz	Antenna factor, dB/m
3600	38.9
3700	39.4
3800	39.4
3900	39.6
4000	39.7
4100	39.8
4200	40.5
4300	40.9
4400	41.1
4500	41.4
4600	41.3
4700	41.6
4800	41.9
4900	42.3
5000	42.7
5100	43.0
5200	42.9
5300	43.5
5400	43.6
5500	44.3
5600	44.7
5700	45.0
5800	45.0
5900	45.3
6000	45.9

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.

10 APPENDIX C Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 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
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

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.

11 APPENDIX D 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 are R-10808 for OATS, R-1082 for anechoic chamber, 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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12 APPENDIX E Specification references

FCC 47CFR part 15: 2024
ANSI C63.10: 2013

Radio Frequency Devices
American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt

END OF DOCUMENT