HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 subpart C, §15.225 and subpart B

FOR:

Medtronic (Given Imaging Ltd.)

PillCam Genius SB Capsule Endoscopy Kit

Model: Genius Link Device

FCC ID: O8PPATCH

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1 Applicant information

Client name:	Medtronic (Given Imaging Ltd.)
Address:	P.O. Box 258, Hermon Building, Yoqneam 2069204, Israel
Telephone:	+972 73-2507584
E-mail:	elad.tiran@medtronic.com
Contact name:	Mr. Elad Tiran

2 Equipment under test attributes

Product name:	PillCam Genius SB Capsule Endoscopy Kit
Product type:	Transmitter
Model(s):	Genius Link Device
Part number:	PT00169361
Serial numbers:	230400166* 230400123*
Hardware version:	REV 03
Software release:	FW 2.0.38
Receipt date	27-Mar-23

*The Genius Link Device contains Non-Rechargeable battery. Therefore, more than one Genius Link Device was used.

3 Manufacturer information

Manufacturer name:	Given Imaging Inc.
Address:	15 Hampshire Street Mansfield MA 02048, USA
Telephone:	+972 52-3142169
E-Mail:	Avishag.metzer@medtronic.com
Contact name:	Avishag Metzer

4 Test details

Project ID:	49769
Location:	Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started:	03-Apr-23
Test completed:	20-Apr-23
Test specification(s):	FCC CFR 47 PART 15 subpart C, §15.225 and subpart B

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Sections 15.225(a) (b) (c) / RSS-210, Section B.6(a), (b), (c), In band radiated emissions	Pass
FCC Sections 15.225(d) / RSS-210, Section B.6(d), Out of band radiated emissions	Pass
FCC Section 15.225(e) / RSS-210, Section B.6, Frequency stability	Pass
FCC Section 15.207(a) / RSS-Gen, Section 8.8, Conducted emission	Not required
FCC Section 15.215(c) / RSS-Gen, Section 6.6, Occupied bandwidth	Pass
FCC Section 15.203/ RSS-Gen, Section 8.3, Antenna requirements	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Not required
Section 15.109, Radiated emission	Pass

Testing was completed against all relevant requirements of the test standard. However, 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	03-Apr-23 – 20-Apr-23	
Reviewed by:	Mrs. S. Peysahov Sheynin, certification specialist, EMC & Radio	03-Aug-23	
Approved by:	Mr. M. Nikishin, group leader, EMC & Radio	15-Aug-23	

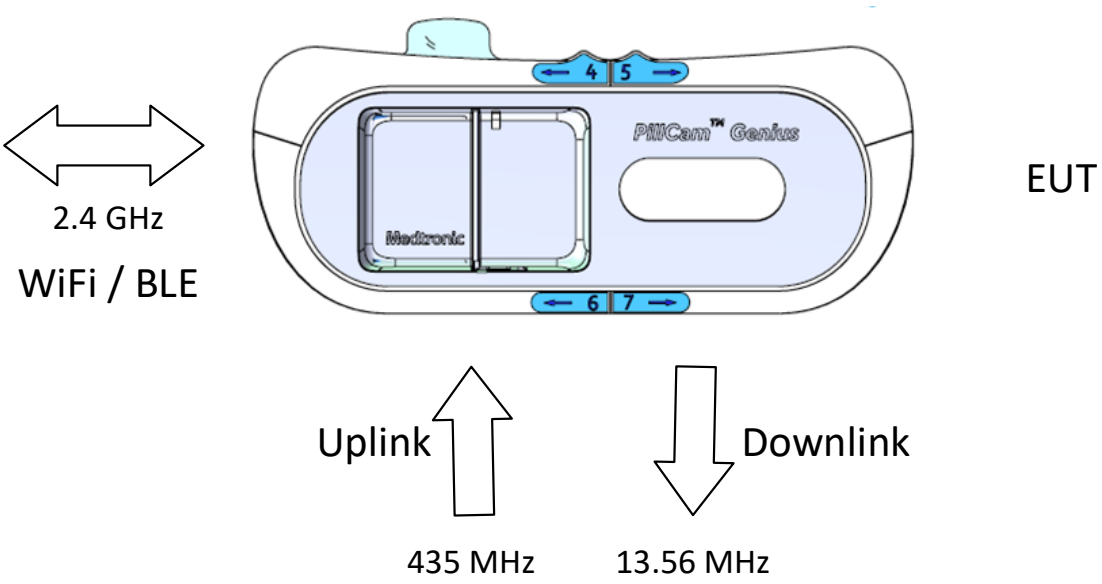
6 EUT description

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

6.1 General information

The PillCam Genius SB Capsule Endoscopy Kit is comprised of a (1) Genius SB capsule and (2) Genius link device.
The EUT is the Genius link device: a recorder that is a single-use device worn by the patient. Together with the Genius SB capsule it enables visualization of the gastrointestinal tract. It receives the acquired images from the Genius SB capsule through a 435 MHz wireless RF communication link and stores them. The device also sends control commands to the capsule by a 13.56 MHz wireless RF communication link.
In addition, the Genius link device comprises of the below Bluetooth and W-Fi links, as follows:
WiFi 2412-2462 MHz
BLE 2402-2480 MHz

6.2 Test configuration



6.3 Changes made in EUT

No changes were implemented in the EUT during testing.

6.4 Transceiver 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)					
Assigned frequency ranges	13.553 – 13.567 MHz					
Operating frequencies	13.452 MHz					
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					
unique coupling	standard connector	X	integral		with temporary RF connector
				X	without temporary RF connector

Type of modulation	CHIRP
Modulating test signal	

Transmitter power source					
X	**Battery**	**Nominal rated voltage**	3VDC	Battery type	Non Rechargeable Li-MnO2 Battery Pack 3V/2.3Ah/6.9Wh, Tamuz P/N: THLLIM0495E19

Common power source for transmitter and receiver	X	yes		No

Test specification:	Sections 15.225(a) (b) (c) / RSS-210, Section B.6(a), (b), (c), In band radiated emissions		
Test procedure:	ANSI C63.10 sections 6.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	03-Apr-23		
Temperature: 23 ºC	Relative Humidity: 48 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

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

7.1 In band radiated emissions

7.1.1 General

This test was performed to measure field strength of fundamental emission and modulation products from the EUT within the assigned band. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Radiated emission limits

Frequency, MHz	Field strength at 30 m distance*		Field strength at 3 m distance*	
	µV/m	dB(µV/m)	µV/m	dB(µV/m)**
13.110 – 13.410	106	40.5	10600	80.5
13.410 – 13.553	334	50.5	33400	90.5
13.553 – 13.567	15848	84.0	1584800	124.0
13.567 – 13.710	334	50.5	33400	90.5
13.710 – 14.010	106	40.5	10600	80.5

*- The limit is provided in quasi peak values.

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

$$Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$$

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

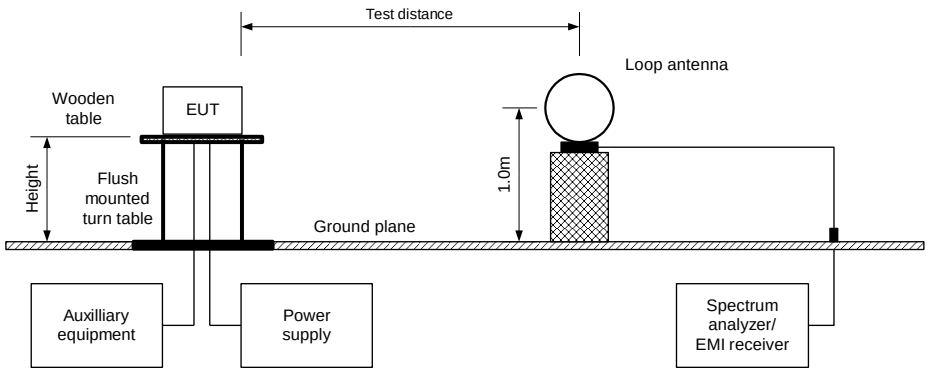
7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1 energized and the performance check was conducted.

7.1.2.2 The specified frequency range was investigated with loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

Figure 7.1.1 Setup for in band radiated emission measurements



Test specification:	**Sections 15.225(a) (b) (c) / RSS-210, Section B.6(a), (b), (c), In band radiated emissions**		
Test procedure:	ANSI C63.10 sections 6.5		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	03-Apr-23		
Temperature: 23 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1008 hPa	**Power:** 3 VDC
Remarks:			

Table 7.1.2 In band radiated emission test results

TEST DISTANCE: 3 m
EUT POSITION: 3 orthogonal (X / Y / Z)
MODULATION: CHIRP
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
INVESTIGATED FREQUENCY RANGE: 13.110 – 14.010 MHz
RESOLUTION BANDWIDTH: 9.0 kHz
VIDEO BANDWIDTH: 30.0 kHz

Carrier frequency, MHz	**Peak emission, dB(μV/m)**	**Quasi-peak**			**Antenna polarization**	**Azimuth**, degrees**	**Verdict**
		Measured emission, dB(μV/m)	**Limit, dB(μV/m)**	**Margin, dB***			**Pass**
13.452	65.75	NA	90.5	-24.75	Vertical	0	Pass

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

Reference numbers of test equipment used

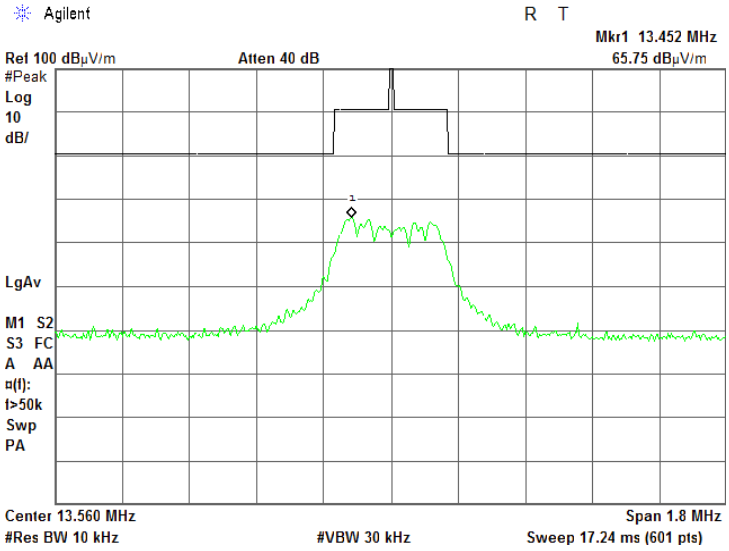
HL 0446	HL3818	HL 3903	HL 5902				

Full description is given in Appendix A.

Test specification:	**Sections 15.225(a) (b) (c) / RSS-210, Section B.6(a), (b), (c), In band radiated emissions**		
Test procedure:	ANSI C63.10 sections 6.5		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	03-Apr-23		
Temperature: 23 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1008 hPa	**Power:** 3 VDC
Remarks:			

Plot 7.1.1 Fundamental emission test result

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
DETECTOR:	Peak hold
EUT POSITION	Worst Case
INPUT VOLTAGE:	Unom



Test specification:	**Sections 15.225(d), Out of band radiated emissions**		
Test procedure:	ANSI C63.10 sections 6.5		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	03-Apr-23		
Temperature: 23 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1008 hPa	**Power:** 3 VDC
Remarks:			

7.2 Out of band radiated emissions

7.2.1 General

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

Table 7.2.1 Radiated emission limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***		
	Peak	Quasi 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	

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

$$Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.
***- The limit decreases linearly with the logarithm of frequency.

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 loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 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 360^0, 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 7.2.2 and shown in the associated plots.

Test specification:	Sections 15.225(d), Out of band radiated emissions		
Test procedure:	ANSI C63.10 sections 6.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	03-Apr-23		
Temperature: 23 ºC	Relative Humidity: 48 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Figure 7.2.1 Radiated emissions below 30 MHz test set up

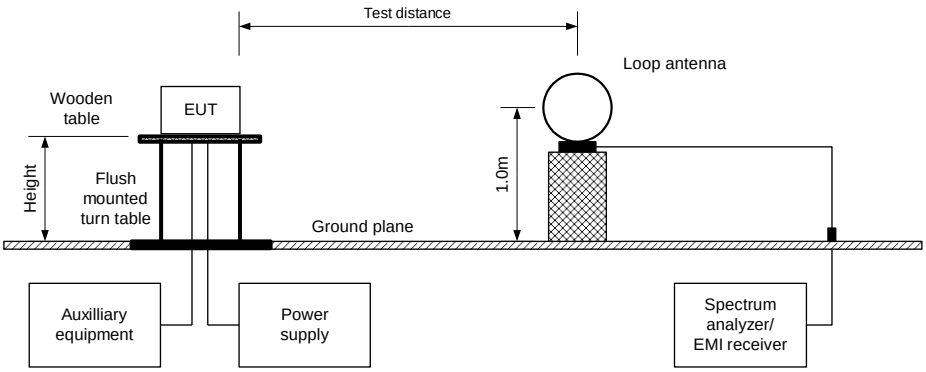
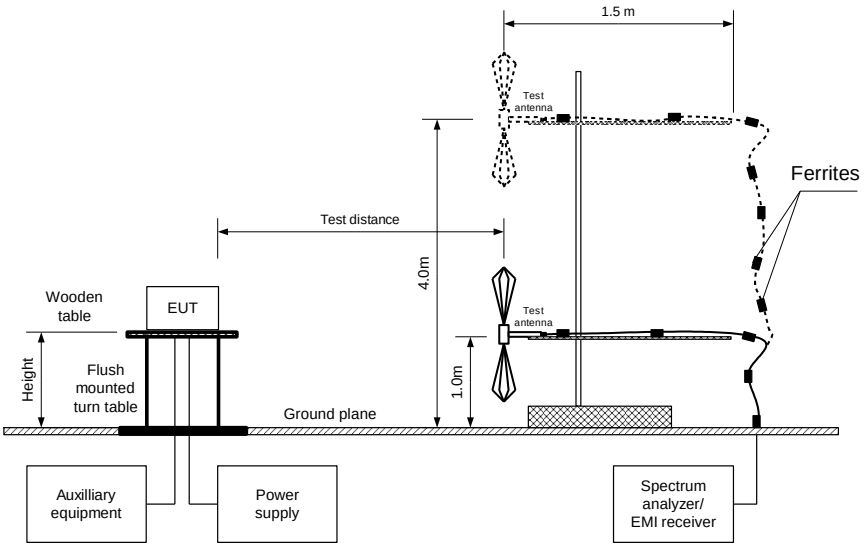


Figure 7.2.2 Radiated emissions above 30 MHz test set up



Test specification:	**Sections 15.225(d), Out of band radiated emissions**		
Test procedure:	ANSI C63.10 sections 6.5		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	03-Apr-23		
Temperature: 23 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1008 hPa	**Power:** 3 VDC
Remarks:			

Table 7.2.2 Out of band radiated emissions test results

TEST DISTANCE:	3 m
EUT POSITION:	3 orthogonal (X / Y / Z)
MODULATION:	CHIRP
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	**Peak emission, dB(µV/m)**	**Quasi-peak**			**Antenna polarizVerticalation**	**Antenna height, m**	**Turn-table position**, degrees**	**Verdict**
		Measured emission, dB(µV/m)	**Limit, dB(µV/m)**	**Margin, dB***				
40.3	39.6	37.6	40	-2.4	Vertical	1.0	77	Pass
661.7	42.6	40.1	46	-5.9	Vertical	1.0	154	
764.5	46.7	44.6	46	-1.4	Horizontal	1.0	180	
840.4	47.1	43.5	46	-2.5	Horizontal	1.0	180	
867.2	47.1	43.7	46	-2.3	Horizontal	1.0	180	

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

Reference numbers of test equipment used

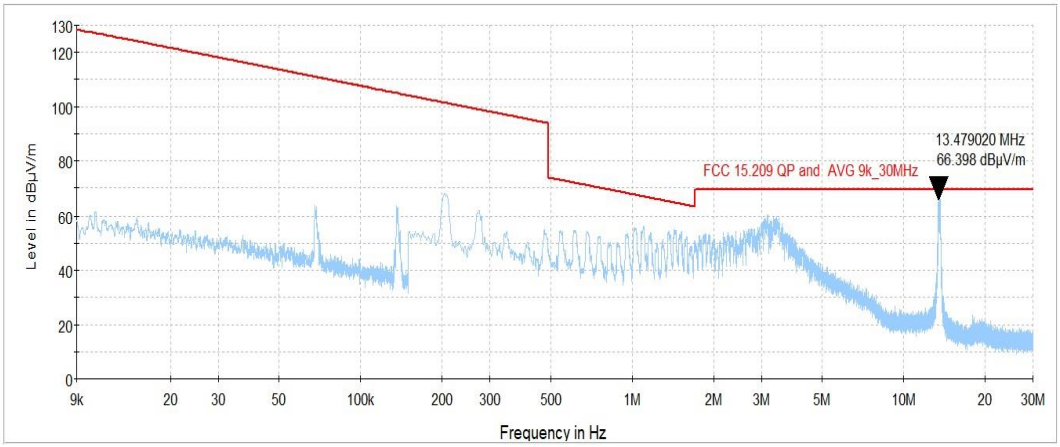
HL 3903	HL 5084	HL 5288	HL 5902	HL 7585	HL 446		

Full description is given in Appendix A.

Test specification:	**Sections 15.225(d), Out of band radiated emissions**		
Test procedure:	ANSI C63.10 sections 6.5		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	03-Apr-23		
Temperature: 23 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1008 hPa	**Power:** 3 VDC
Remarks:			

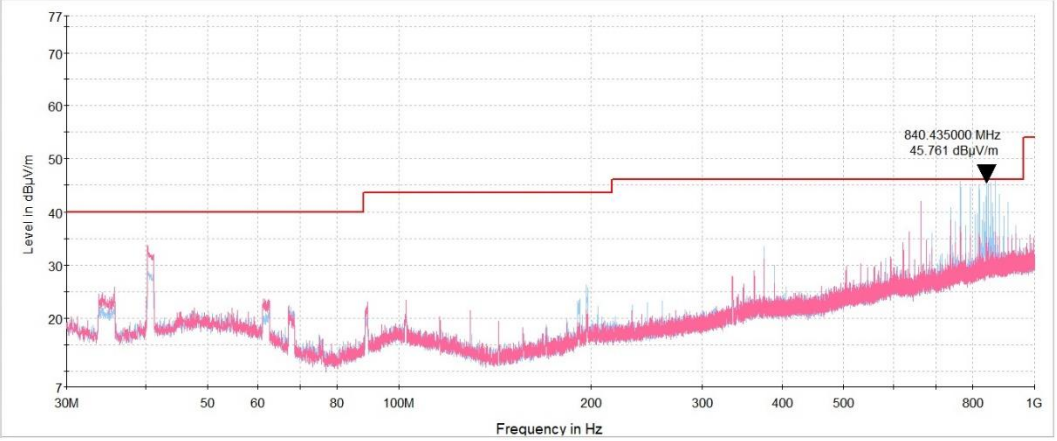
Plot 7.2.1 Radiated emission measurements from 9 kHz to 30 MHz

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
DETECTOR: Peak hold



Plot 7.2.2 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal & Vertical
DETECTOR: Peak hold



Test specification:	Section 15.225(e), Frequency stability		
Test procedure:	ANSI C63.10, Section 6.8		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-23		
Temperature: 23 ºC	Relative Humidity: 51 %	Air Pressure: 1009 hPa	Power: 3 VDC
Remarks:			

7.3 Frequency stability test

7.3.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.3.1. The test results are provided in Table 7.3.2.

Table 7.3.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	%	Hz
13.560	± 0.01 %	1356

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.

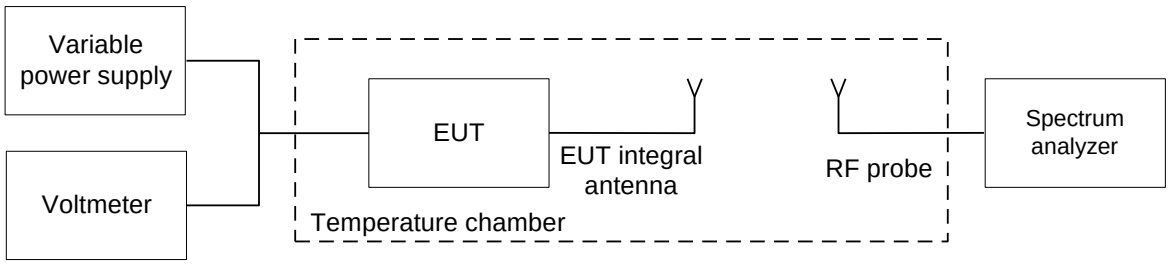
7.3.2.2 The EUT power was turned off. Temperature within test chamber was set to the required one and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.

7.3.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then after 2, 5 and 10 minutes. The EUT was powered off.

7.3.2.4 The above procedure was repeated at the rest of the test temperatures and voltages as provided in Table 7.3.2.

7.3.2.5 Frequency displacement was calculated and compared with the limit as provided in Table 7.3.2.

Figure 7.3.1 Frequency stability test setup



Test specification:	**Section 15.225(e), Frequency stability**		
Test procedure:	ANSI C63.10, Section 6.8		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Apr-23		
Temperature: 23 ºC	**Relative Humidity:** 51 %	**Air Pressure:** 1009 hPa	**Power:** 3 VDC
Remarks:			

Table 7.3.2 Frequency stability test results

OPERATING FREQUENCY:	13.560 MHz
NOMINAL POWER VOLTAGE:	3V DC
TEMPERATURE STABILIZATION PERIOD:	20 min
POWER DURING TEMPERATURE TRANSITION:	Off
SPECTRUM ANALYZER MODE:	Counter
RESOLUTION BANDWIDTH:	1 kHz
VIDEO BANDWIDTH:	3 kHz
MODULATION:	Unmodulated

Temperature, ºC	Voltage, V	Frequency, MHz				Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	2nd min	5th min	10th min	Positive	Negative			
0	3.00V	13.561013	13.561013	13.561013	13.561013	0	-72	1356	-1428	Pass
23	3.00V	13.560941	13.560941	13.560941	13.560941*	0	0		-1356	
23	2.55V	13.560941	13.560941	13.560941	13.560941	0	0		-1356	
23	2.05V	13.561013	13.561013	13.561013	13.561013	0	-72		-1428	
35	3.00V	13.560941	13.560941	13.560941	13.560941	0	0		-1356	

* - Reference frequency

Reference numbers of test equipment used

HL 4355	HL 3901	HL 5391	HL 3230	HL 7521			

Full description is given in Appendix A.

Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-23		
Temperature: 22 ºC	Relative Humidity: 51 %	Air Pressure: 1009 hPa	Power: 3 VDC
Remarks:			

7.4 Occupied bandwidth test

7.4.1 General

This test was performed to verify that the 20 dB bandwidth of the emissions was contained within the standard specified frequency band according to FCC §15.215 requirements. Specification test limits are given in Table 7.3.1.

Table 7.4.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc
13.110 – 13.410	20.0
13.410 – 13.553	
13.553 – 13.567	
13.567 – 13.710	
13.710 – 14.010	

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

7.4.2 Test procedure

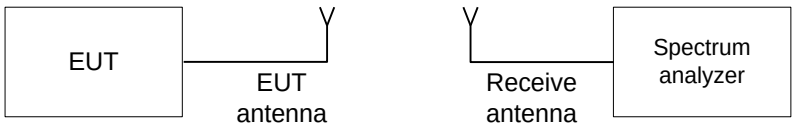
7.4.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

7.4.2.2 The spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.4.2.3 The peak of emission was measured. 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.

7.4.2.4 Modulation bandwidth was calculated by adding of the negative frequency drift to the lower measured frequency and the positive frequency drift to the higher measured frequency. The obtained modulation bandwidth was verified to be within the allowed frequency range.

Figure 7.4.1 Occupied bandwidth test setup



Test specification:	**Section 15.215(c), Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Apr-23		
Temperature: 22 ºC	**Relative Humidity:** 51 %	**Air Pressure:** 1009 hPa	**Power:** 3 VDC
Remarks:			

Table 7.4.2 Occupied bandwidth test results

ASSIGNED FREQUENCY BAND	13.11 – 14.01 MHz
DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	10kHz
VIDEO BANDWIDTH:	30kHz
MODULATION ENVELOPE REFERENCE POINTS:	20 dBc
MODULATION:	CHIRP
MODULATING SIGNAL:	Enable

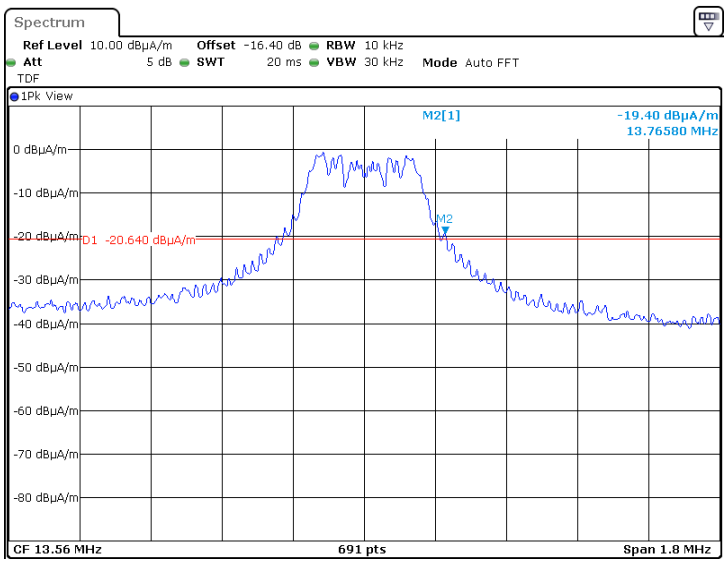
Band edge	Cross point frequency, MHz	Frequency drift, Hz		Modulation band edge, MHz	Assigned band edge, MHz	Verdict
		Negative	Positive			
Low	13.33600	72	N/A	13.33593	13.11	Pass
High	13.76580	N/A	0	13.76580	14.01	Pass

Reference numbers of test equipment used

HL 4355	HL 3901	HL 7521	HL 3230	HL 337				

Full description is given in Appendix A.

Plot 7.4.1 Occupied bandwidth test result



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-23		
Temperature: 23 ºC	Relative Humidity: 48 %	Air Pressure: 1012 hPa	Power: 3 VDC
Remarks:			

8 Emissions tests according to FCC 47CFR part 15 subpart B

8.1 Radiated emission measurements

8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1.

Table 8.1.1 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
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*

* The limit for 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 – standard defined and test distance respectively in meters.

8.1.2 Test procedure for measurements in semi-anechoic chamber

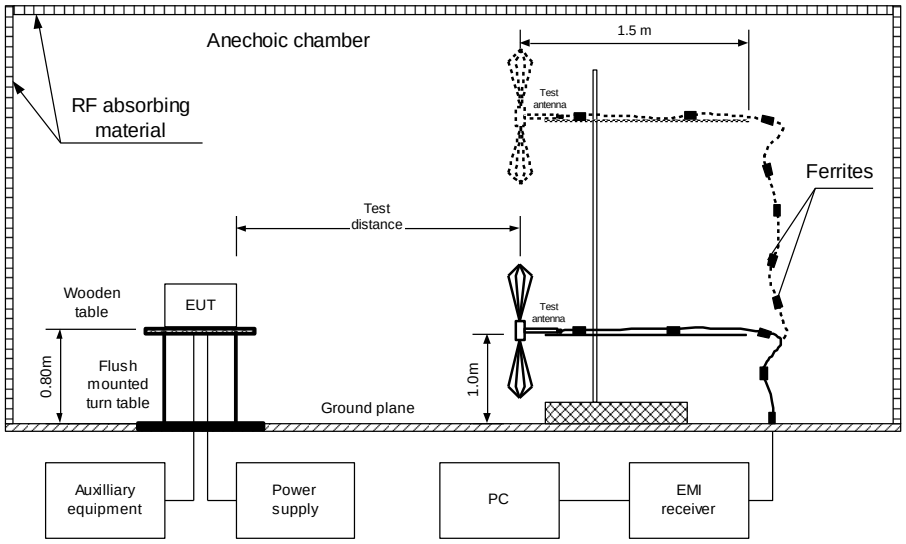
8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photograph/s, energized and the performance check was conducted.

8.1.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

8.1.2.3 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-23		
Temperature: 23 ºC	Relative Humidity: 48 %	Air Pressure: 1012 hPa	Power: 3 VDC
Remarks:			

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Apr-23		
Temperature: 23 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1012 hPa	**Power:** 3 VDC
Remarks:			

Table 8.1.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / QUASI-PEAK
FREQUENCY RANGE: 30 MHz – 1000 MHz
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*				
No emissions were found								Pass

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 12500 MHz
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*				
3215.78	42.4	74	-31.6	36.0	54	-18.0	Horizontal	1.0	-145	Pass
3249.29	43.5	74	-30.5	37.6	54	-16.4	Horizontal	1.0	-145	
3282.75	44.2	74	-29.8	38.8	54	-15.2	Horizontal	1.0	-27	

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

Reference numbers of test equipment used

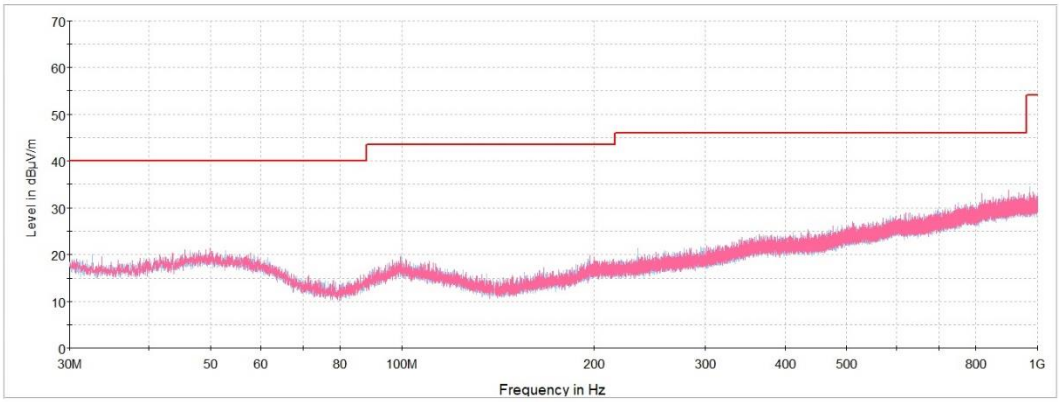
HL 7585	HL 5902	HL 3903	HL 5288	HL 4933			

Full description is given in Appendix A.

Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Apr-23		
Temperature: 23 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1012 hPa	**Power:** 3 VDC
Remarks:			

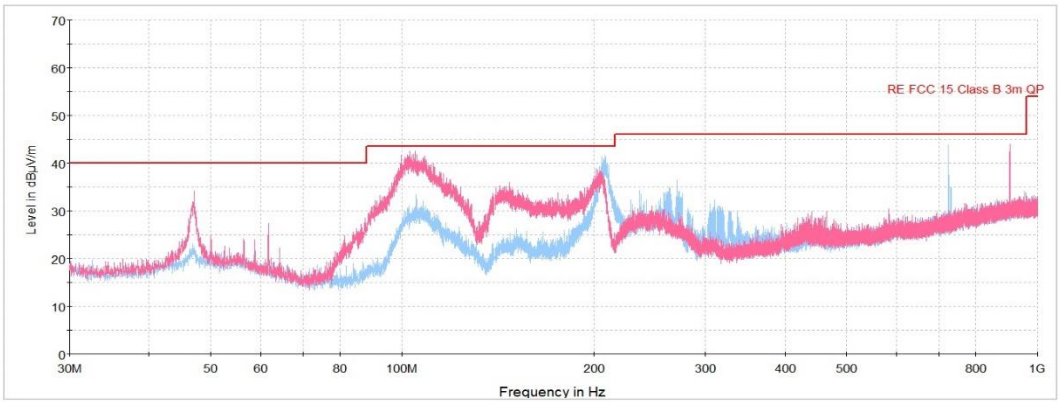
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range,

TEST SITE:	Semi anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical & Horizontal
EUT OPERATING MODE:	Stand-by at 13.56 MHz & Rx WiFi 2437 MHz



Plot 8.1.2 Radiated emission measurements in 30 - 1000 MHz range,

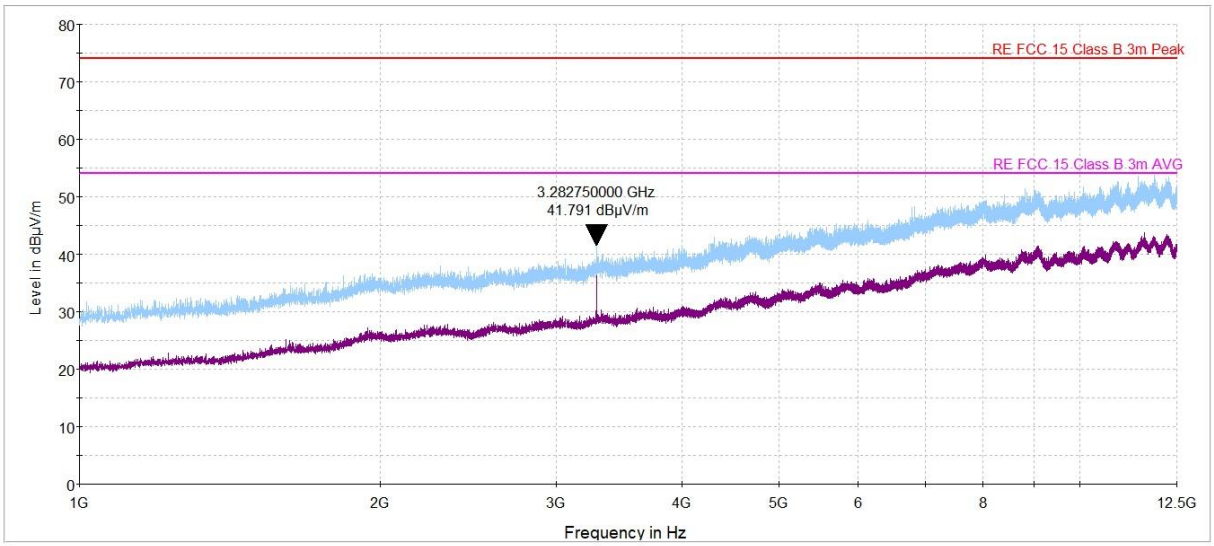
TEST SITE:	Semi anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical & Horizontal
EUT OPERATING MODE:	Laptop communication download USB



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-23		
Temperature: 23 ºC	Relative Humidity: 48 %	Air Pressure: 1012 hPa	Power: 3 VDC
Remarks:			

Plot 8.1.3 Radiated emission measurements above 1000 MHz

TEST SITE:	Semi anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical & Horizontal
EUT OPERATING MODE:	Stand-by at 13.56 MHz & Rx WiFi 2462 MHz



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	30-May-22	30-May-23
0446	Antenna, Loop, Active, 10 (9) kHz - 30 MHz	EMCO	6502	2857	07-Mar-23	07-Mar-24
3230	Multimeter	Fluke	115C	94173028	10-Jul-22	10-Aug-23
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	07-Apr-22	07-Apr-23
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	07-Apr-22	07-Apr-23
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	101630	11-Oct-22	11-Oct-23
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	19-Jan-23	19-Jan-24
5084	Attenuator, 4 dB, DC - 6 GHz, 1 W	Mini-Circuits	UNAT-4+	NA	15-May-22	15-May-24
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	24-Mar-22	24-Mar-25
5391	Temperature/Humidity Cycle Chamber, -77 - +177 deg., Humidity Range 20% RH to 95% RH	Thermotron	SM-8C	27737	14-Nov-22	14-Nov-23
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/11N/11N/6000	NA	08-Dec-22	08-Dec-23
7521	Programmable DC Power Supplies, 48VDC/38A	TDK-Lambda Ltd	GEN40-38	LOC-823A277-0002	15-Mar-23	15-Mar-24
7585	EMI Test Receiver, 1 Hz to 44 GHz	Rohde & Schwarz	ESW44	103130	19-May-22	19-Nov-23

10 APPENDIX B Test equipment correction factors

HL 0446: Active Loop Antenna
EMCO, model: 6502, s/n 2857

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
10	-33.4	±1.0
20	-37.8	±1.0
50	-40.5	±1.0
75	-41.0	±1.0
100	-41.2	±1.0
150	-41.2	±1.0
250	-41.1	±1.0
500	-41.2	±1.0
750	-41.3	±1.0
1000	-41.3	±1.0

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
2000	-41.4	±1.0
3000	-41.4	±1.0
4000	-41.5	±1.0
5000	-41.5	±1.0
10000	-41.7	±1.0
15000	-42.1	±1.0
20000	-42.7	±1.0
25000	-44.2	±1.0
30000	-45.8	±1.0

The antenna factor shall be added to receiver reading in dBμV to obtain field strength in dBμA/m

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 dBμV to obtain field strength in dBμV/m.

11 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

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.

12 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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13 APPENDIX E Specification references

FCC 47CFR part 15: 2020	Radio Frequency Devices
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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.

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AVRG	average (detector)
cm	centimeter
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
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
μs	microsecond
NA	not applicable
OATS	open area test site
Ω	Ohm
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