

# TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C §15.247 (DTS) and subpart B,  
RSS-247 Issue 2:2017, RSS-Gen Issue 5, ICES-003 Issue 7:2020

FOR:

**Tyco Safety Products Canada Ltd.**

**NB-937 NBIOT SMOKE CO HEAT COMBO with  
NB-IOT/Cat M1 communication**

**Model: Callisto Apollo Combo**

**FCC ID: F5323NB937**

**IC: 160A-NB937**

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.  
This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

## Table of contents

1	Applicant information .....	3
2	Equipment under test attributes .....	3
3	Manufacturer information .....	3
4	Test details .....	3
5	Tests summary .....	4
6	EUT description .....	5
6.1	General information .....	5
6.2	Test configuration .....	5
6.3	Changes made in EUT .....	5
6.4	Transmitter characteristics .....	6
7	Transmitter tests according to 47CFR part 15 subpart C and RSS-247 requirements .....	7
7.1	Minimum 6 dB and 99% bandwidth .....	7
7.2	Field strength of spurious emissions .....	12
7.3	Peak output power .....	34
7.4	Band edge radiated emissions .....	41
7.5	Peak spectral power density .....	47
7.6	Antenna requirements .....	51
8	Unintentional emissions .....	52
8.1	Radiated emission measurements .....	52
9	APPENDIX A Test equipment and ancillaries used for tests .....	57
10	APPENDIX B Measurement uncertainties .....	58
11	APPENDIX C Test equipment correction factors .....	59
12	APPENDIX D Test laboratory description .....	61
13	APPENDIX E Specification references .....	62
14	APPENDIX F Abbreviations and acronyms .....	63



## 1 Applicant information

**Client name:** Tyco Safety Products Canada Ltd.  
**Address:** 3301 Langstaff Road, Concord, Ontario L4K 4L2, Canada  
**Telephone:** 1-647-480-0430  
**Fax:** 1-647-480-0531  
**E-mail:** [dnita@tycoint.com](mailto:dnita@tycoint.com)  
**Contact name:** Mr. Dan Nita

## 2 Equipment under test attributes

**Product name:** NB-937 NBIOT SMOKE CO HEAT COMBO with NB-IOT/Cat M1 communication  
**Product type:** Transceiver  
**Model(s):** Callisto Apollo Combo  
**Serial number:** NA  
**Hardware version:** 90-210356  
**Software release:** JS-704110  
**Receipt date:** 13-Jun-22

## 3 Manufacturer information

**Manufacturer name:** Tyco Safety Products Canada Ltd.  
**Address:** 3301 Langstaff Road, Concord, Ontario L4K 4L2, Canada  
**Telephone:** 1-647-480-0430  
**Fax:** 1-647-480-0531  
**E-Mail:** [dnita@tycoint.com](mailto:dnita@tycoint.com)  
**Contact name:** Mr. Dan Nita




## 4 Test details

**Project ID:** 47337  
**Location:** Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel  
**Test started:** 06-Oct-22  
**Test completed:** 18-Oct-22  
**Test specification(s):** FCC 47CFR part 15 subpart C §15.247 (DTS) and subpart B, RSS-247 Issue 2:2017, RSS-Gen Issue 5, ICES-003 Issue 7:2020

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
FCC Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth	Pass
FCC Section 15.247(b)3/ RSS-247 section 5.4(4), Peak output power	Pass
FCC section 15.247(i) / RSS-102 section 2.5.1, RF exposure	Pass, the exhibit to the application of certification is provided
FCC Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions	Pass
FCC Section 15.247(d)/ RSS-247 section 5.5, Emissions at band edges	Pass
FCC Section 15.247(e) / RSS-247 section 5.2(2), Peak power density	Pass
FCC section 15.203 / RSS-Gen section 8.3, Antenna requirement	Pass
FCC section 15.207(a) / RSS-Gen section 8.8, Conducted emission	Not required
<b>Unintentional emissions</b>	
Section 15.107/ICES-003, Section 6.1, Class B, Conducted emission at AC power port	Not required
Section 15.109/ RSS-Gen section 7.1.2 /ICES-003, Section 6.2, Class B, Radiated emission	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
<b>Tested by:</b>	Mrs. E. Pitt, test engineer, EMC & Radio	06-Oct-22 – 18-Oct-22	
<b>Reviewed by:</b>	Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio	30-Jan-23	
<b>Approved by:</b>	Mr. M. Nikishin, group leader, EMC & Radio	20-Mar-23	

## 6 EUT description

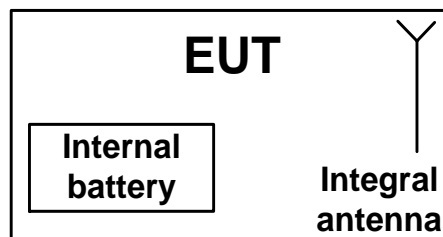
Note: The following data in this clause is provided by the customer and represents his sole responsibility

### 6.1 General information

The EUT is a Callisto Apollo Combo is battery operated smoke heat detector with approved FCC ID R17ME310G1W1 and non approved BLE module

The BLE and the NB-IOT/Cat M1 work together only at the installation stage , after it the BLE is in sleep mode, not transmission from it at the operation stage, and it will work again only if you open the device for battery replacement etc.

### 6.2 Test configuration



### 6.3 Changes made in EUT

No changes were implemented in the EUT during the testing.



### 6.4 Transmitter characteristics

<b>Type of equipment</b>					
<input checked="" type="checkbox"/>	Stand-alone (Equipment with or without its own control provisions)				
<input type="checkbox"/>	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
<input type="checkbox"/>	Plug-in card (Equipment intended for a variety of host systems)				
<b>Intended use</b>		<b>Condition of use</b>			
<input type="checkbox"/>	fixed	Always at a distance more than 2 m from all people			
<input checked="" type="checkbox"/>	mobile	Always at a distance more than 20 cm from all people			
<input type="checkbox"/>	portable	May operate at a distance closer than 20 cm to human body			
<b>Assigned frequency range</b>		2400 -2483.5 MHz			
<b>Operating frequencies</b>		2402-2480 MHz			
<b>Maximum rated output power</b>		Peak output power 5.25 dBm			
<b>Is transmitter output power variable?</b>		<input checked="" type="checkbox"/>	No		
		<input type="checkbox"/>	Yes		
		<input type="checkbox"/>	continuous variable		
		<input type="checkbox"/>	stepped variable with stepsize		dB
		<input type="checkbox"/>	minimum RF power		dBm
<input type="checkbox"/>	maximum RF power		dBm		
<b>Antenna connection</b>					
<input type="checkbox"/>	unique coupling	<input type="checkbox"/>	standard connector	<input checked="" type="checkbox"/>	Integral
<input type="checkbox"/>					with temporary RF connector
<input checked="" type="checkbox"/>					without temporary RF connector
<b>Antenna/s technical characteristics</b>					
Type	Manufacturer	Model number		Gain	
Integral	OCEAN SPRING	H-303322		Typical peak gain: -13 dBi	
<b>Transmitter aggregate data rate/s</b>		1 Mbps			
<b>Type of modulation</b>		GFSK			
<b>Modulating test signal (baseband)</b>					
<b>Transmitter power source</b>					
<input checked="" type="checkbox"/>	Battery	<b>Nominal rated voltage</b>	6 VDC	Battery type	Lithium 2xCR123A
<input type="checkbox"/>	DC	<b>Nominal rated voltage</b>			
<input type="checkbox"/>	AC mains	<b>Nominal rated voltage</b>		Frequency	Hz



<b>Test specification:</b> Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB and 99% bandwidth			
<b>Test procedure:</b> ANSI C63.10 section 11.8.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

## 7 Transmitter tests according to 47CFR part 15 subpart C and RSS-247 requirements

### 7.1 Minimum 6 dB and 99% bandwidth

#### 7.1.1 General

This test was performed to measure 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 6 dB bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Minimum bandwidth, kHz
2400.0 – 2483.5	6.0	500.0

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

Table 7.1.2 The 99% bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points	Limit, MHz
2400.0 – 2483.5	99%	NA

#### 7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

7.1.2.2 The EUT was set to transmit modulated carrier.

7.1.2.3 The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.3 and associated plot.

Figure 7.1.1 6 dB bandwidth test setup





<b>Test specification:</b> Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB and 99% bandwidth			
<b>Test procedure:</b> ANSI C63.10 section 11.8.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Table 7.1.3 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 2400-2483.5 MHz  
DETECTOR USED: Peak  
SWEEP TIME: Auto  
RESOLUTION BANDWIDTH: 100 kHz  
VIDEO BANDWIDTH: 300 kHz  
MODULATION ENVELOPE REFERENCE POINTS: 6.0 dBc  
MODULATION: GFSK  
BIT RATE: 1 Mbps

Carrier frequency, MHz	99% bandwidth, kHz	6 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2402	1050.1	573.5	500	73.5	Pass
2440	1107.5	703.8	500	203.8	Pass
2480	1050.1	597.6	500	97.6	Pass

Reference numbers of test equipment used

HL 3818								
---------	--	--	--	--	--	--	--	--

Full description is given in Appendix A.

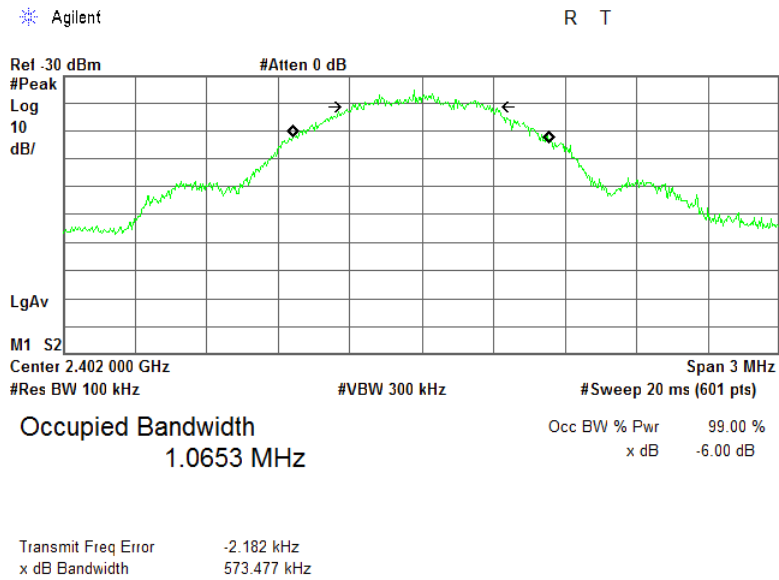




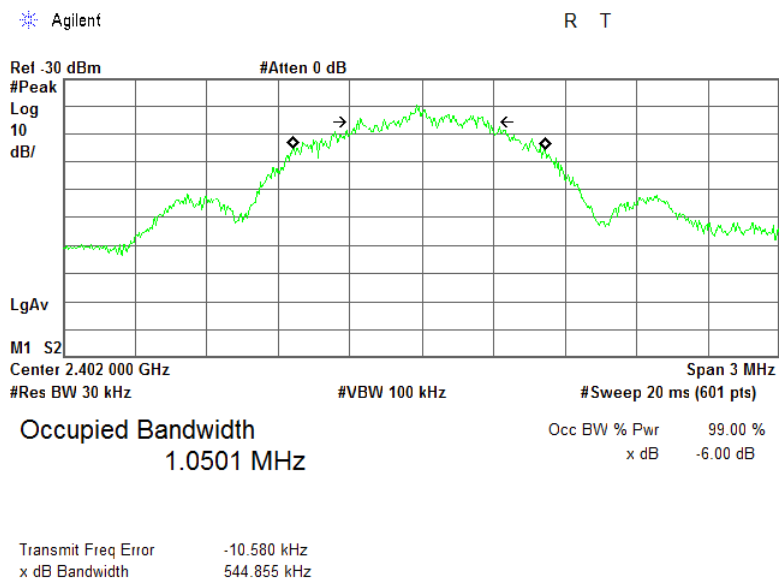
HERMON LABORATORIES

<b>Test specification: Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB and 99% bandwidth</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.8.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Plot 7.1.1 6 dB bandwidth test result at low frequency



Plot 7.1.2 99% bandwidth test result at low frequency

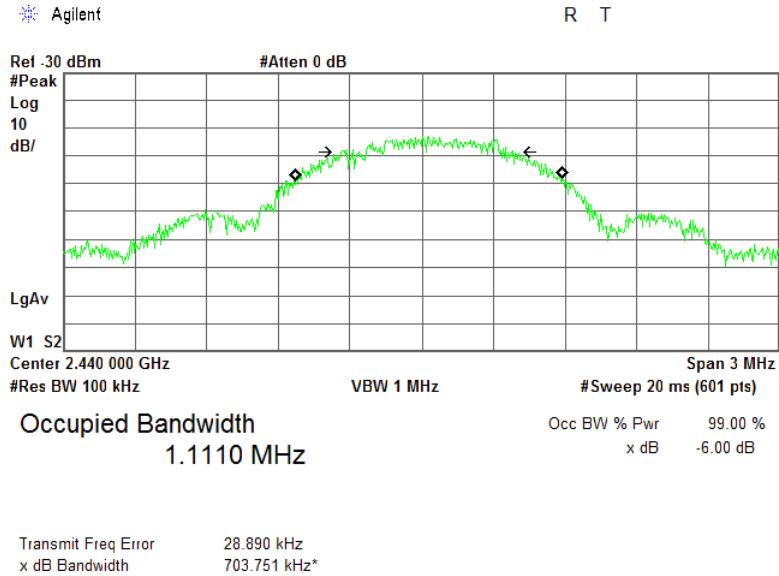




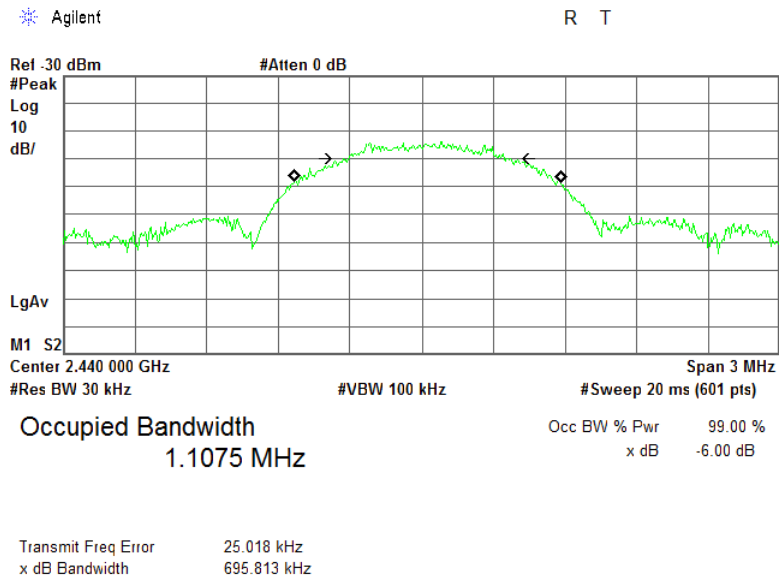
HERMON LABORATORIES

<b>Test specification: Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB and 99% bandwidth</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.8.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Plot 7.1.3 6 dB bandwidth test result at mid frequency**



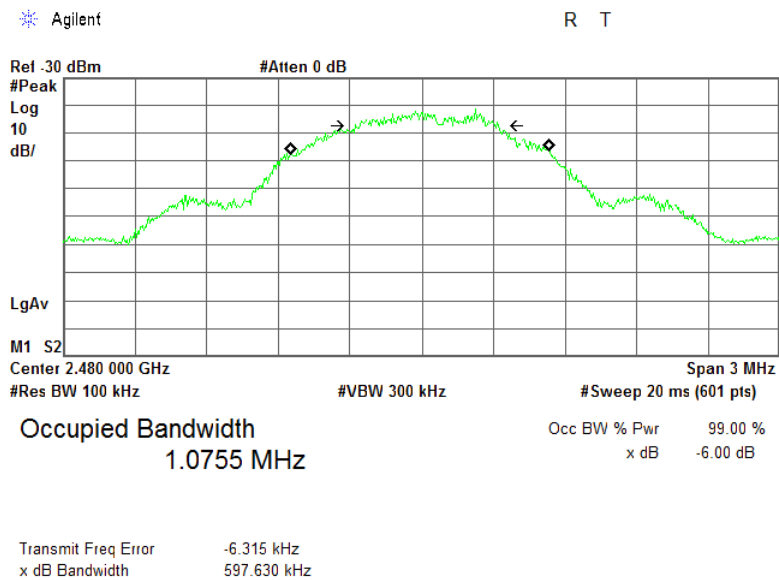
**Plot 7.1.4 99% bandwidth test result at mid frequency**



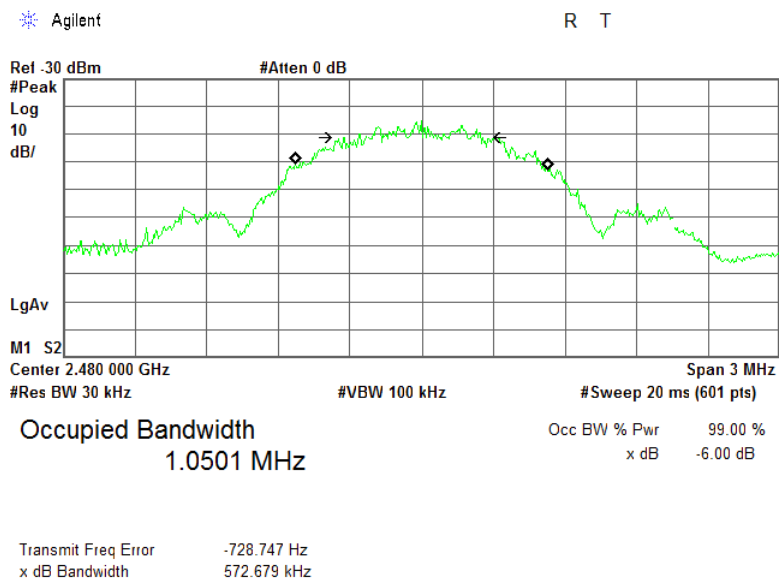


<b>Test specification: Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB and 99% bandwidth</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.8.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Plot 7.1.5 6 dB bandwidth test result at high frequency



Plot 7.1.6 99% bandwidth test result at high frequency





<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Oct-22			
Temperature: 24 °C	Relative Humidity: 37 %	Air Pressure: 1012 hPa	Power: 6 VDC
Remarks:			

## 7.2 Field strength of spurious 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 spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(µV/m)***			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***
	Peak	Quasi Peak	Average	
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0
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		
1000 – 10 <sup>th</sup> harmonic	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<sub>1</sub> and S<sub>2</sub> – standard defined and test distance respectively in meters.

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

\*\*\* - The 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.

### 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 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, Figure 7.2.3 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 and shown in the associated plots.



<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

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

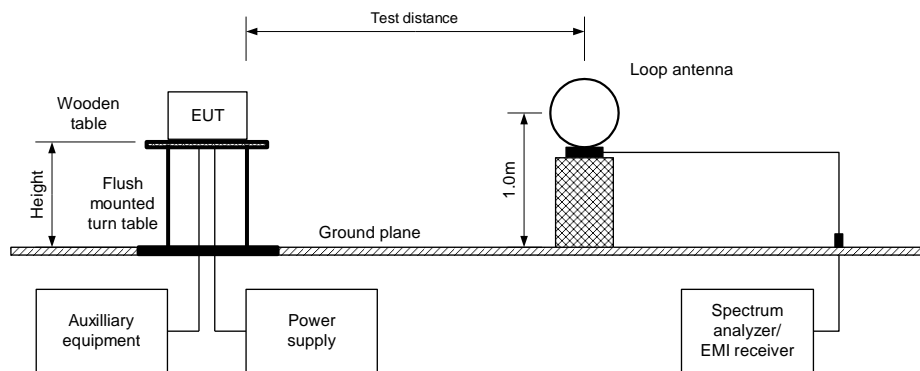
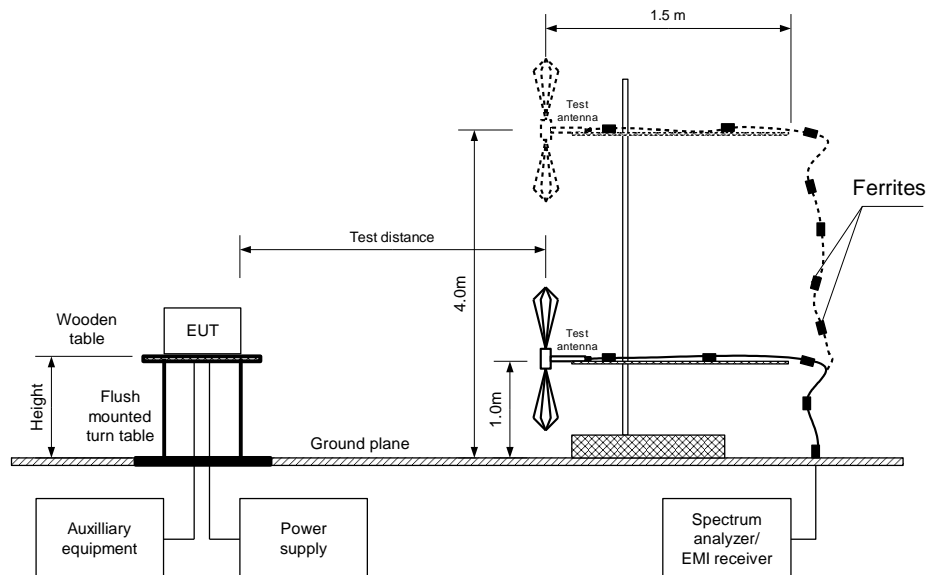


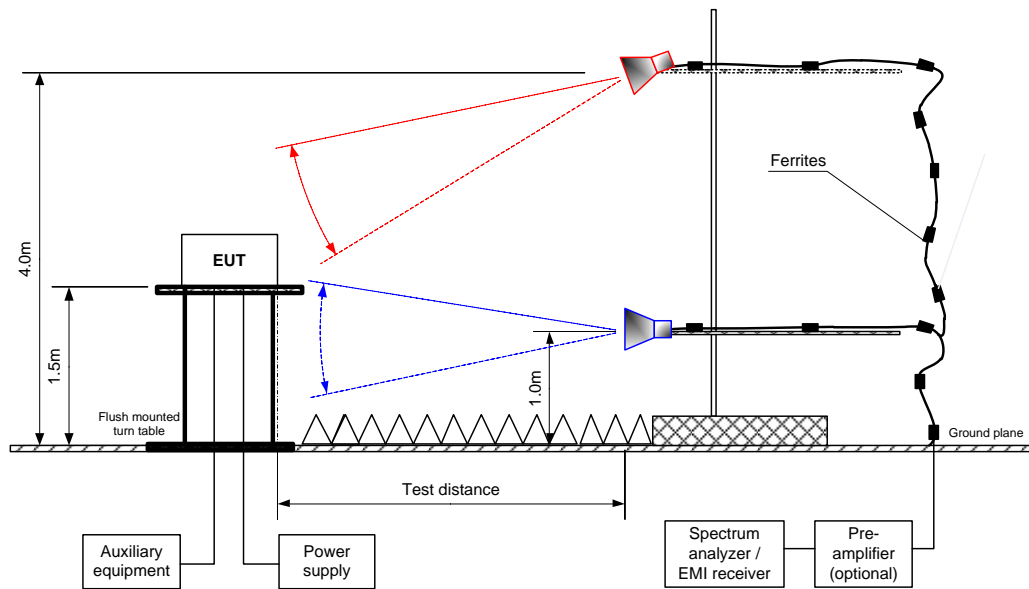
Figure 7.2.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz





<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

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





<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Table 7.2.2 Field strength of emissions outside restricted bands**

ASSIGNED FREQUENCY: 2400-2483.5 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 - 25000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 BIT RATE: 1 Mbps  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 FREQUENCY HOPPING: Disabled

Frequency, MHz	Field strength of spurious, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(μV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
All emissions are more than 20 dB below the limit									Pass

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

\*\*- Margin = Attenuation below carrier – specification limit.

**Table 7.2.3 Field strength of spurious emissions above 1 GHz within restricted bands**

ASSIGNED FREQUENCY: 2400-2483.5 MHz  
 INVESTIGATED FREQUENCY RANGE: 1000 – 25000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 BIT RATE: 1 Mbps  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide  
 FREQUENCY HOPPING: Disabled

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength			Average field strength				Verdict
	Polarization	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***	
<b>Low, mid, high carrier frequency</b>											
All emissions are more than 20 dB below the limit										Pass	



<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

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		
0.576	>100 ms	NA	NA	NA	-44.7

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

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

for pulse train longer than 100 ms:

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

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

ASSIGNED FREQUENCY: 2400-2483.5 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 BIT RATE: 1 Mbps  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 FREQUENCY HOPPING: Disabled

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*				
All emissions are more than 20 dB below the limit								Pass

\*- Margin = Measured emission - specification limit.

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





<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Table 7.2.6 Restricted bands according to FCC section 15.205

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	12.29 - 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	16.42 - 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	

Table 7.2.7 Restricted bands according to RSS-Gen

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.291 - 8.294	16.80425 - 16.80475	399.9 - 410	3260 - 3267	10.6 - 12.7
2.1735 - 2.1905	8.362 - 8.366	25.5 - 25.67	608 - 614	3332 - 3339	13.25 - 13.4
3.020 - 3.026	8.37625 - 8.38675	37.5 - 38.25	960 - 1427	3345.8 - 3358	14.47 - 14.5
4.125 - 4.128	8.41425 - 8.41475	73 - 74.6	1435 - 1626.5	3500 - 4400	15.35 - 16.2
4.17725 - 4.17775	12.29 - 12.293	74.8 - 75.2	1645.5 - 1646.5	4500 - 5150	17.7 - 21.4
4.20725 - 4.20775	12.51975 - 12.52025	108 - 138	1660 - 1710	5350 - 5460	22.01 - 23.12
5.677 - 5.683	12.57675 - 12.57725	156.52475 - 156.52525	1718.8 - 1722.2	7250 - 7750	23.6 - 24
6.215 - 6.218	13.36 - 13.41	156.7 - 156.9	2200 - 2300	8025 - 8500	31.2 - 31.8
6.26775 - 6.26825	16.42 - 16.423	240 - 285	2310 - 2390	9000 - 9200	36.43 - 36.5
6.31175 - 6.31225	16.69475 - 16.69525	322 - 335.4	2655 - 2900	9300 - 9500	Above 38.6

Reference numbers of test equipment used

HL 7585	HL 3818	HL 4529	HL 5288	HL 4933	HL 4956	HL 3903	HL 5902
HL 5112							

Full description is given in Appendix A.

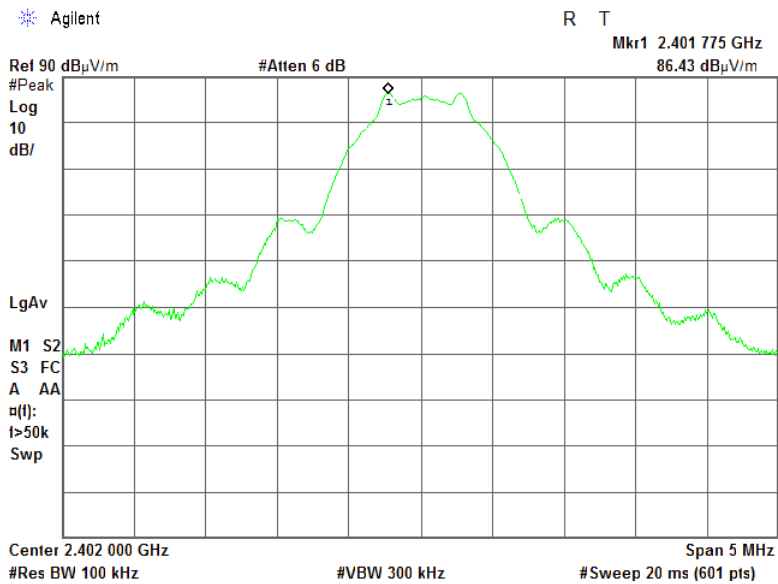


HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

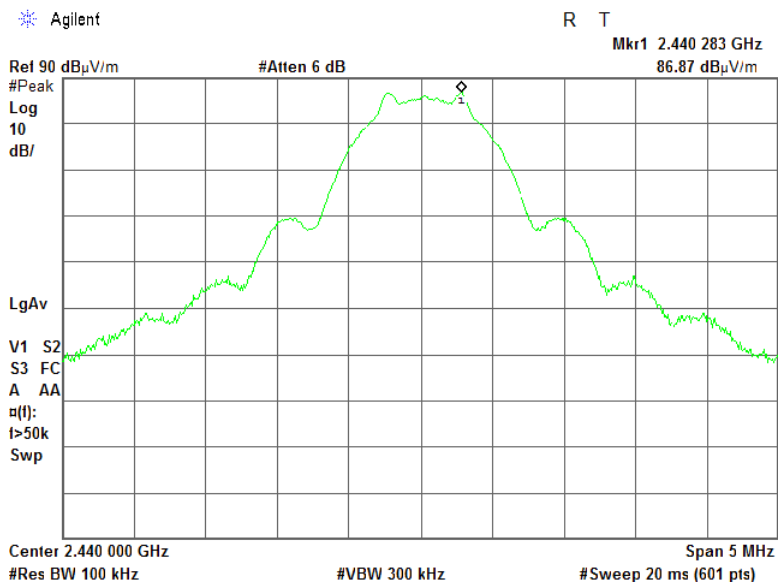
**Plot 7.2.1 Radiated emission measurements at the low carrier frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



**Plot 7.2.2 Radiated emission measurements at the mid carrier frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



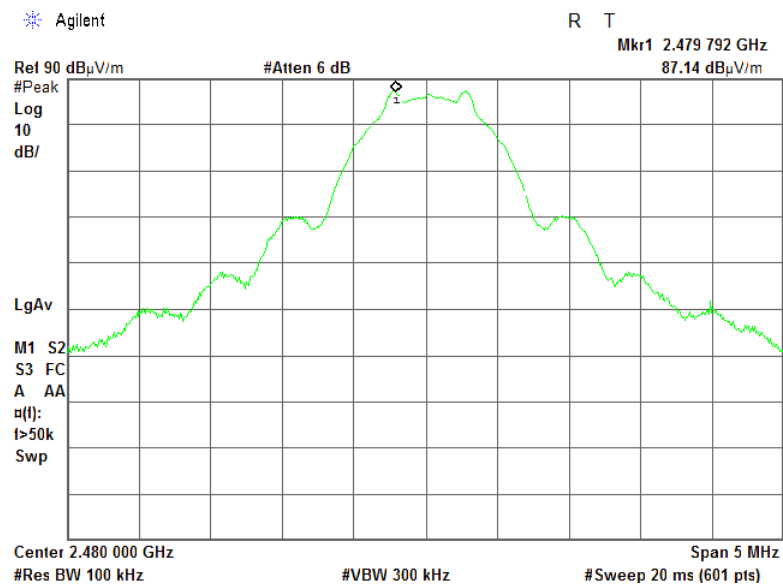


HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Plot 7.2.3 Radiated emission measurements at the high carrier frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal

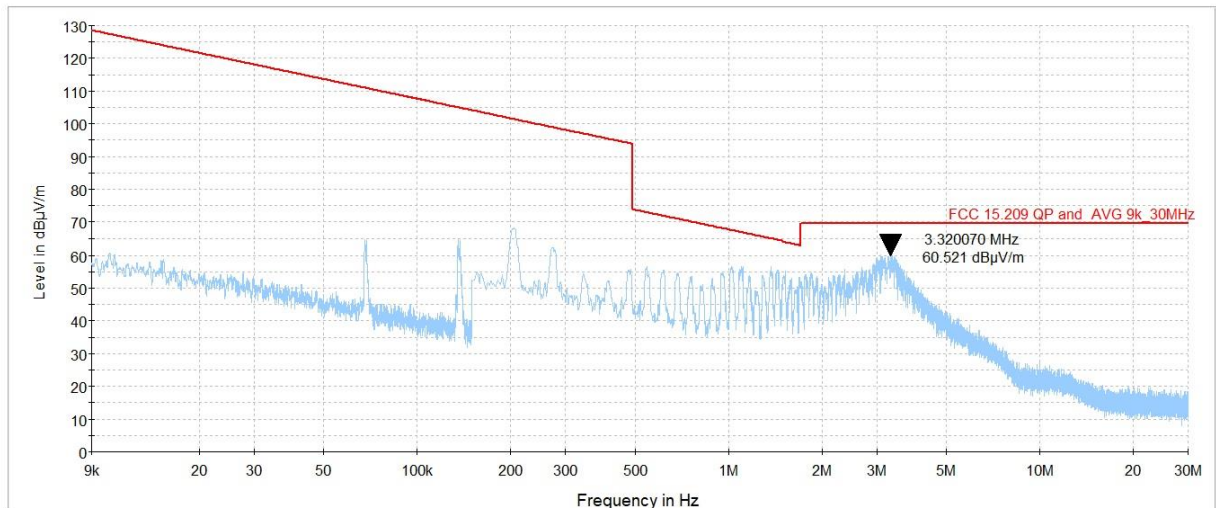




<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

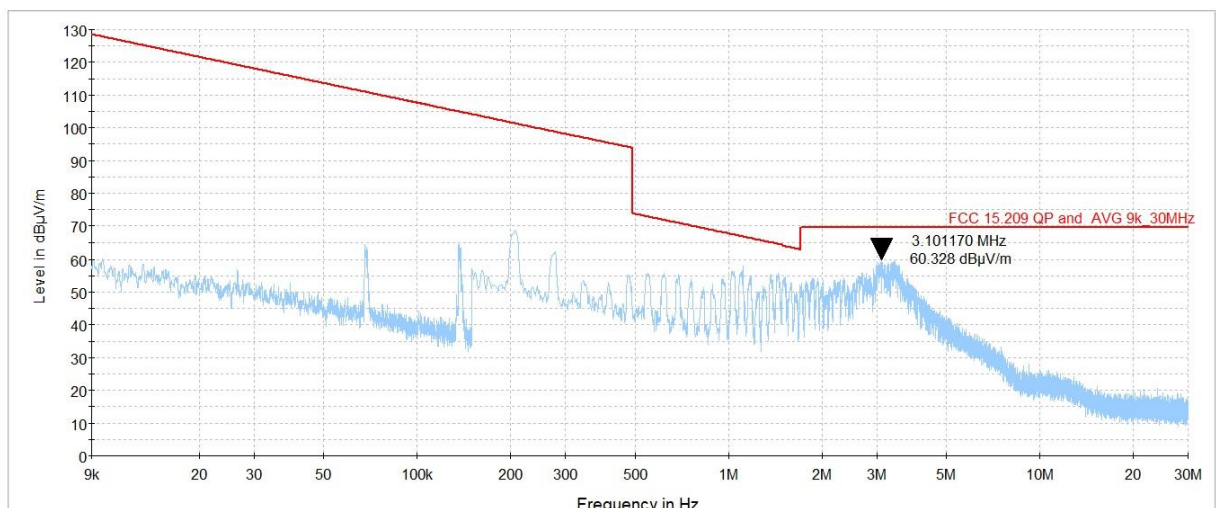
**Plot 7.2.4 Radiated emission measurements from 9 kHz to 30 MHz at the low carrier frequency**

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



**Plot 7.2.5 Radiated emission measurements from 9 kHz to 30 MHz at the mid carrier frequency**

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



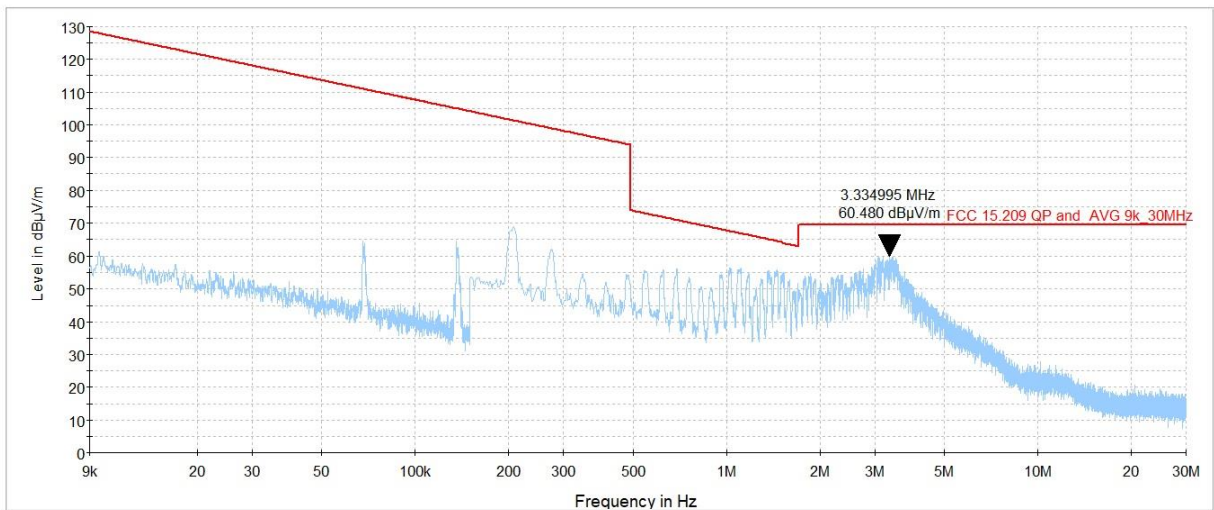


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Plot 7.2.6 Radiated emission measurements from 9 kHz to 30 MHz at the high carrier frequency**

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

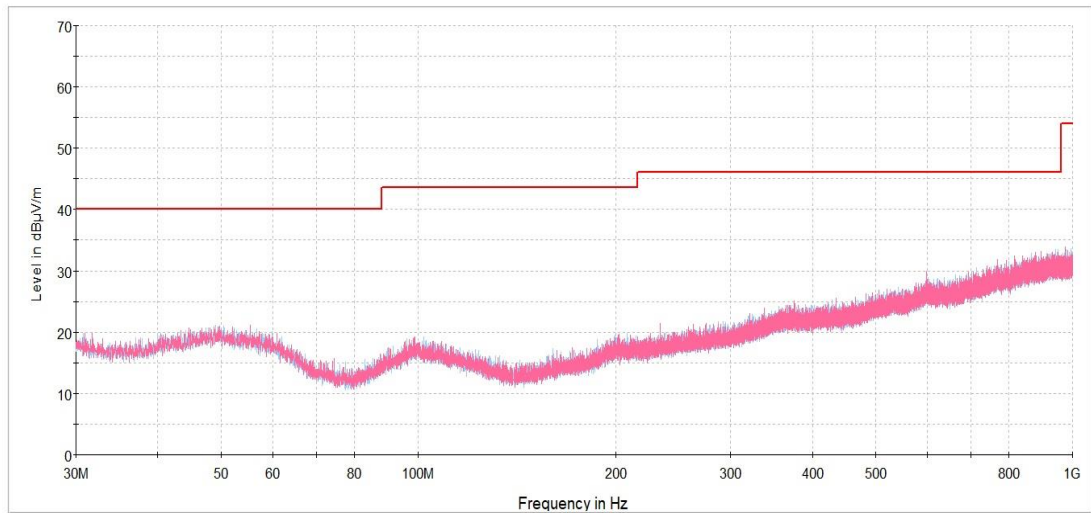


**Plot 7.2.7 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency**

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

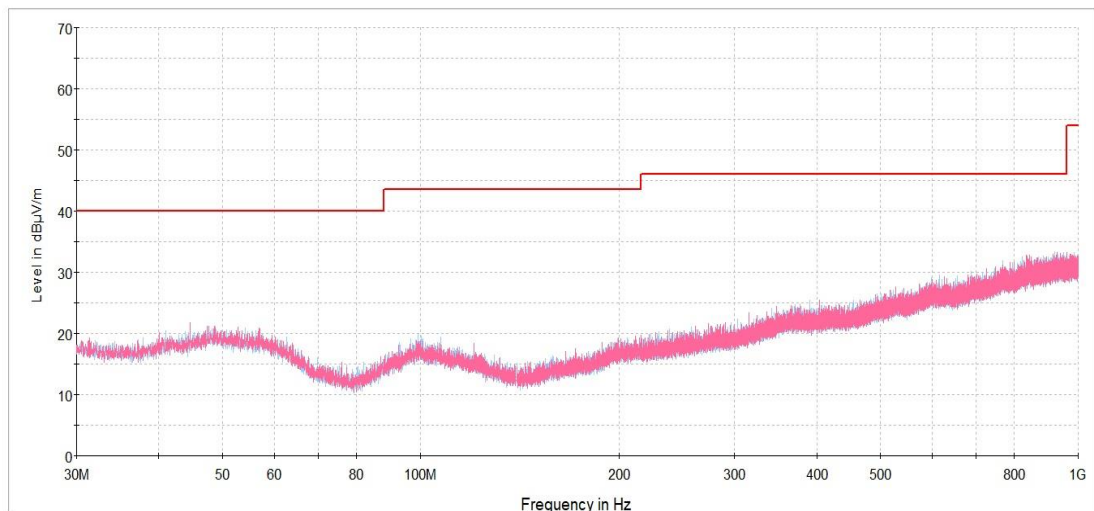


<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			



**Plot 7.2.8 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency**

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



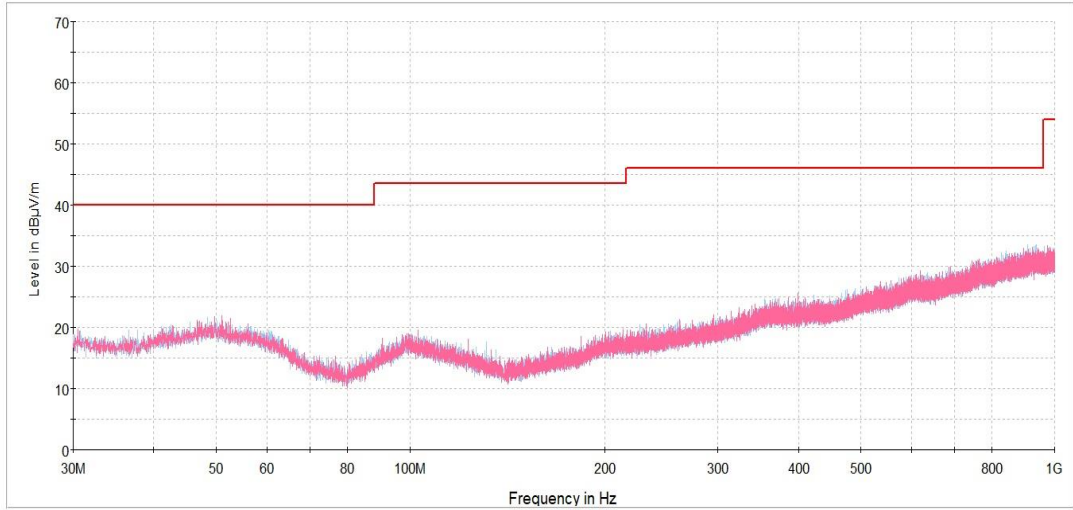
**Plot 7.2.9 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency**

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



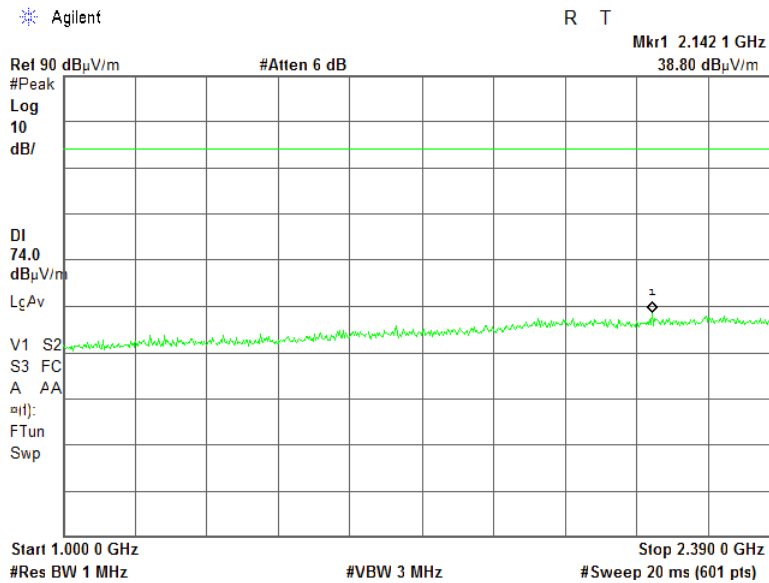
HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			



Plot 7.2.10 Radiated emission measurements from 1000 to 2400 MHz at the low carrier frequency

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



Plot 7.2.11 Radiated emission measurements from 1000 to 2400 MHz at the mid carrier frequency

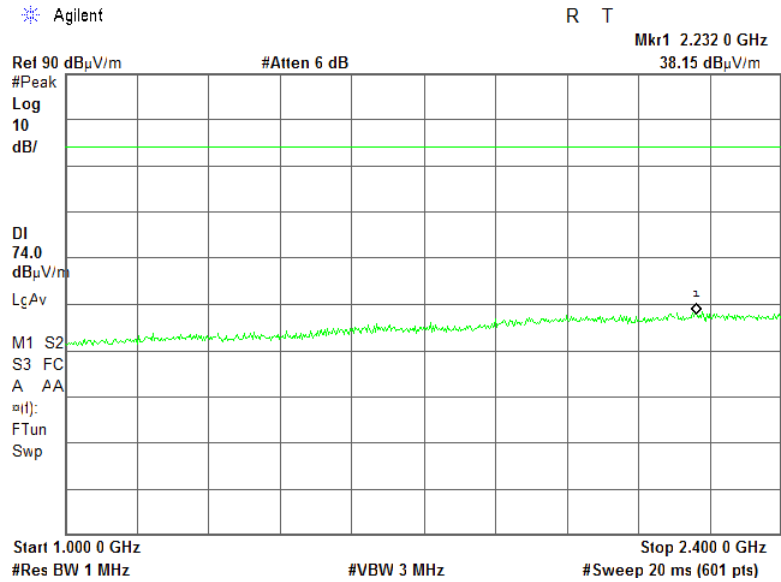
TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m



HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

ANTENNA POLARIZATION: Vertical and Horizontal





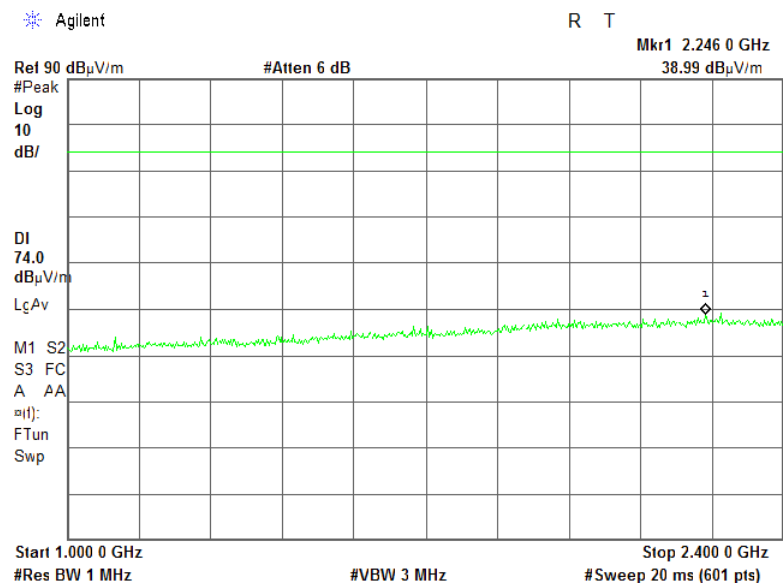


HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Oct-22			
Temperature: 24 °C	Relative Humidity: 37 %	Air Pressure: 1012 hPa	Power: 6 VDC
Remarks:			

Plot 7.2.12 Radiated emission measurements from 1000 to 2400 MHz at the high carrier frequency

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



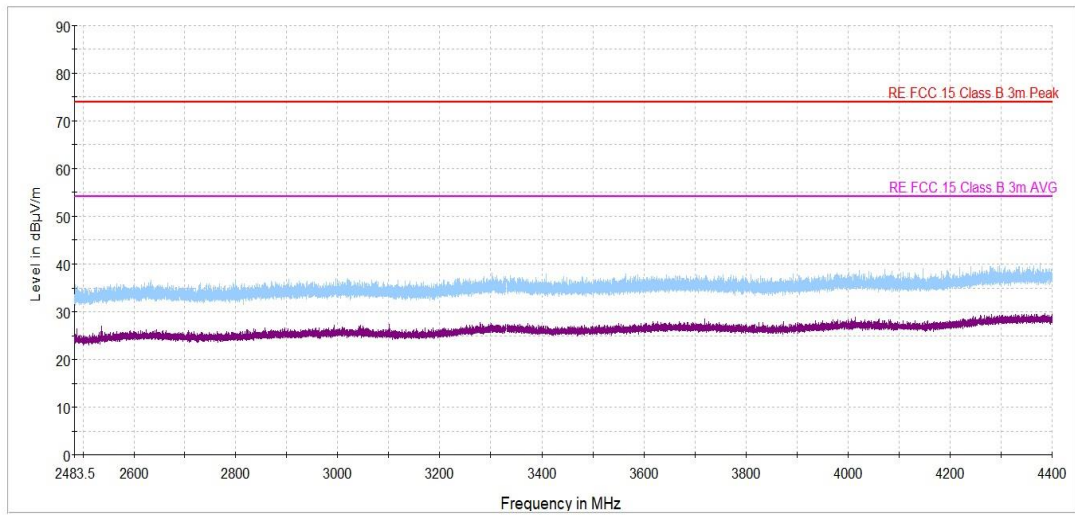
Plot 7.2.13 Radiated emission measurements from 2483.5 to 4400 MHz at the low carrier frequency

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



HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

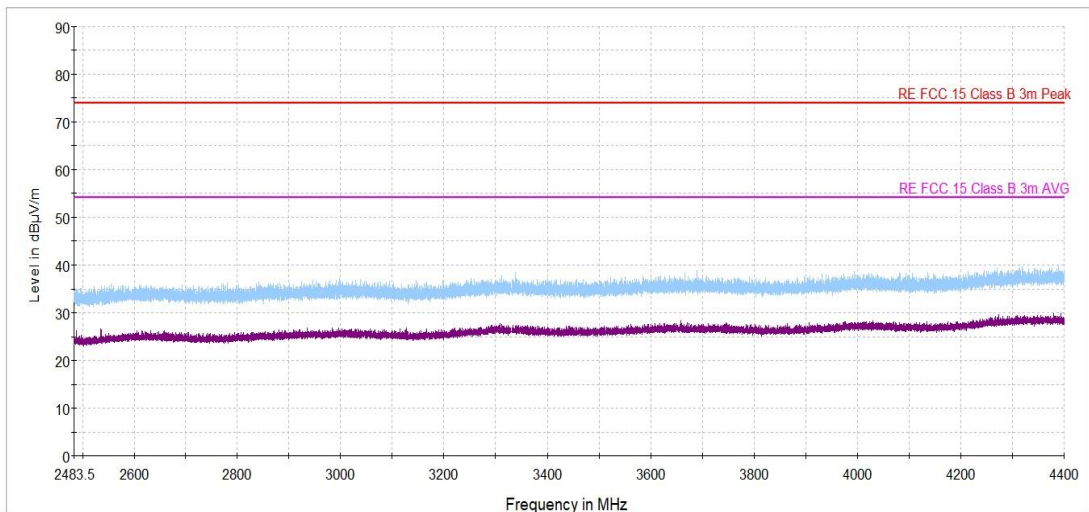




<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Plot 7.2.14 Radiated emission measurements from 2483.5 to 4400 MHz at the mid carrier frequency**

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



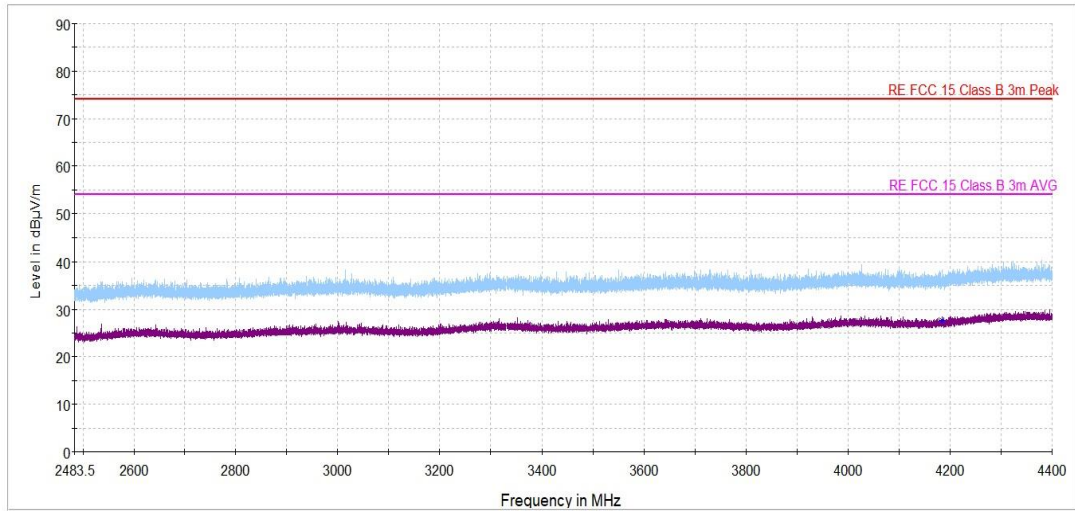
**Plot 7.2.15 Radiated emission measurements from 2483.5 to 4400 MHz at the high carrier frequency**

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



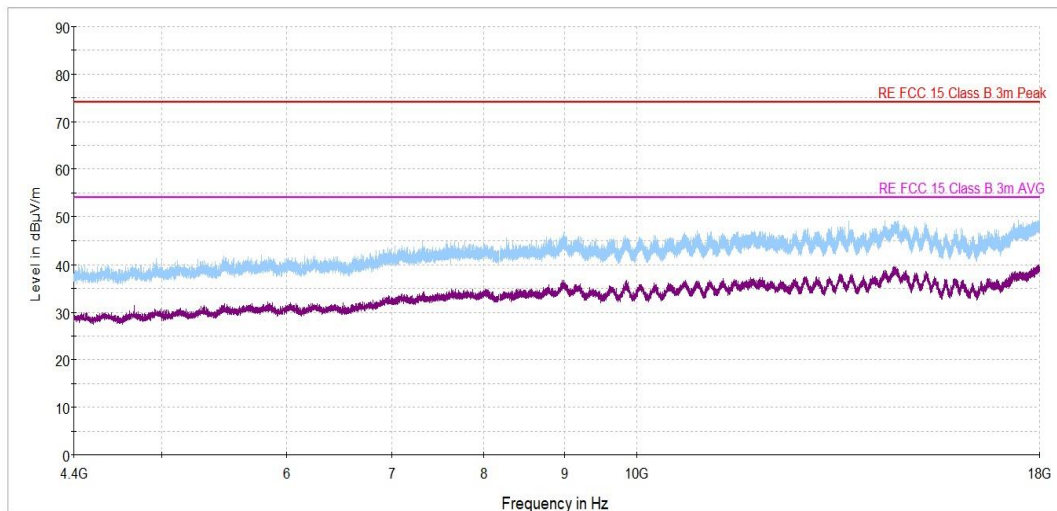
HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			



Plot 7.2.16 Radiated emission measurements from 4400 to 18000 MHz at the low carrier frequency

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



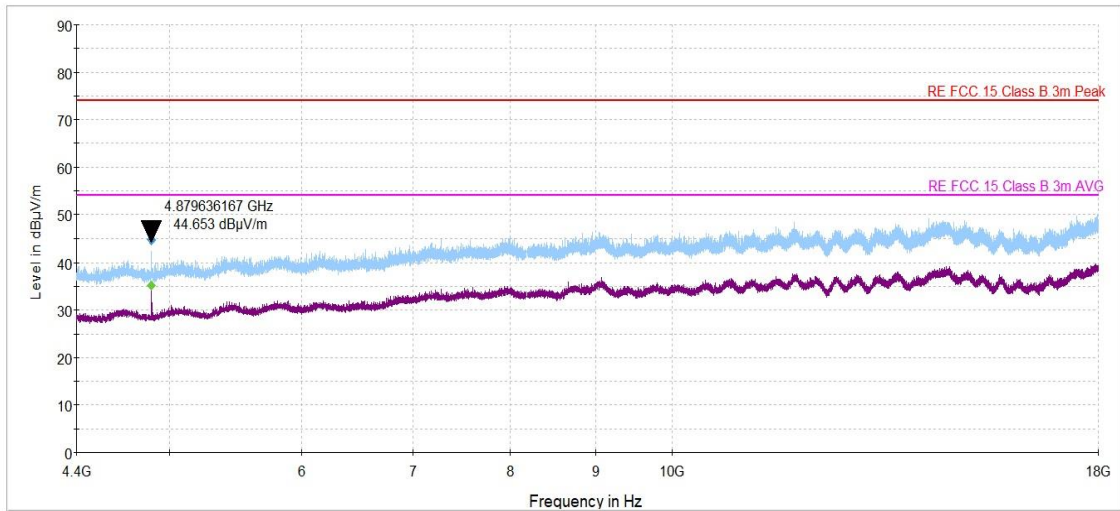
Plot 7.2.17 Radiated emission measurements from 4400 to 18000 MHz at the mid carrier frequency

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



HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

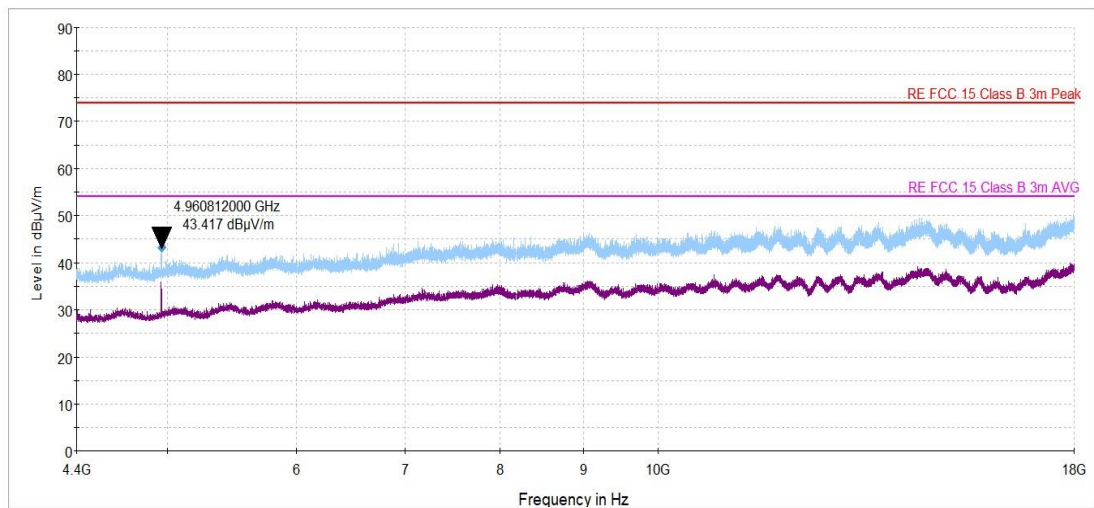




<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Plot 7.2.18 Radiated emission measurements from 4400 to 18000 MHz at the high carrier frequency

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

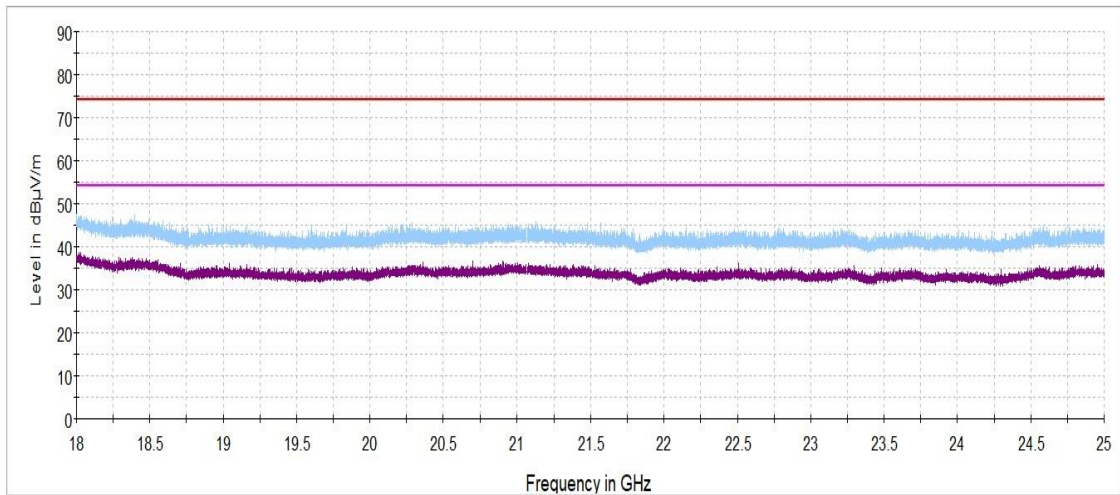


Plot 7.2.19 Radiated emission measurements from 18000 to 25000 MHz at the low carrier frequency

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

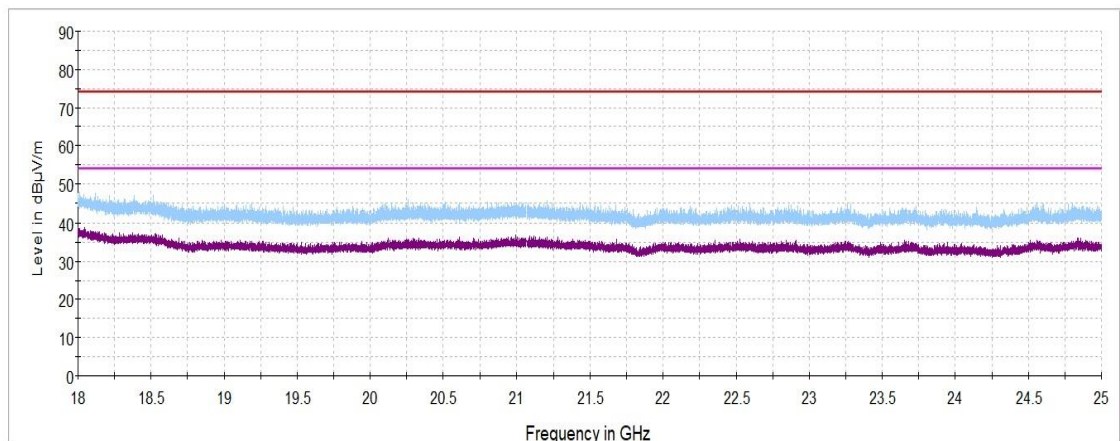


<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			



**Plot 7.2.20 Radiated emission measurements from 18000 to 25000 MHz at the mid carrier frequency**

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



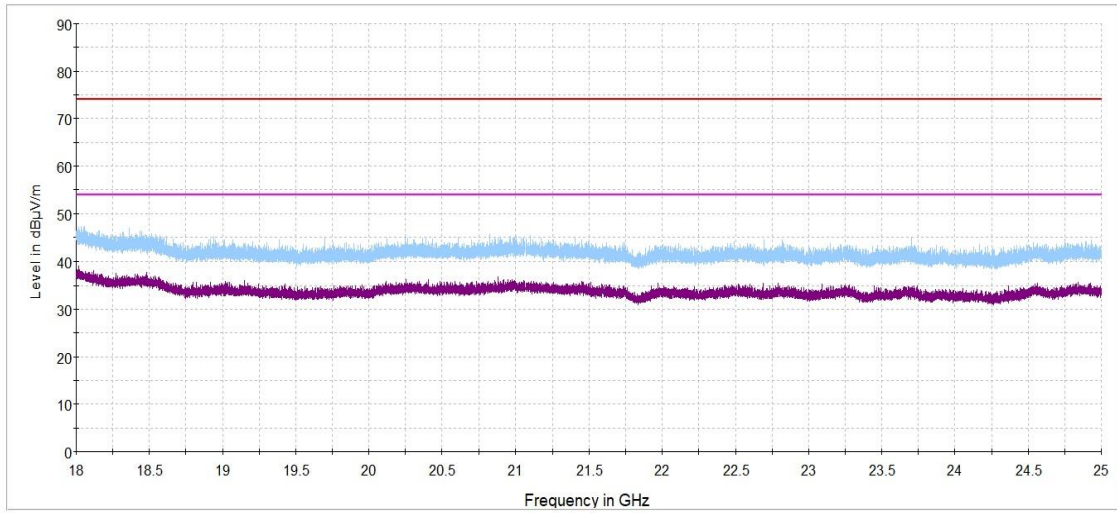
**Plot 7.2.21 Radiated emission measurements from 18000 to 25000 MHz at the high carrier frequency**

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



HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			



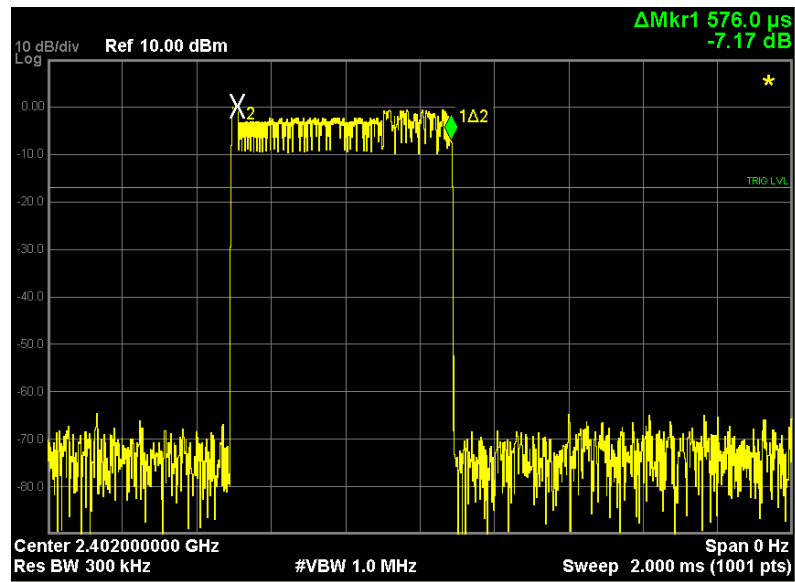




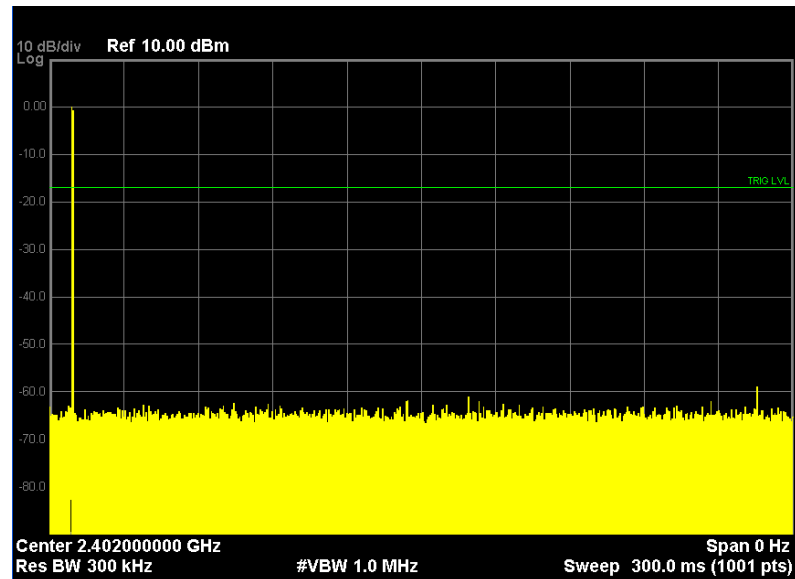
HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 37 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Plot 7.2.22 Transmission pulse duration



Plot 7.2.23 Transmission pulse period





<b>Test specification:</b> Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power			
<b>Test procedure:</b> ANSI C63.10 sections 11.9.2.2.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

### 7.3 Peak output power

#### 7.3.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Peak output power limits

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)**
		W	dBm	
2400.0 – 2483.5	6.0	1.0	30.0	131.2

\*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

- by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
- without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
- by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

\*\* - Equivalent field strength limit was calculated from the peak output power as follows:  $E = \sqrt{30 \times P \times G} / r$ , where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

#### 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 adjusted to produce maximum available to end user RF output power.

7.3.2.3 The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.3.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.3.2 and associated plots.

7.3.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

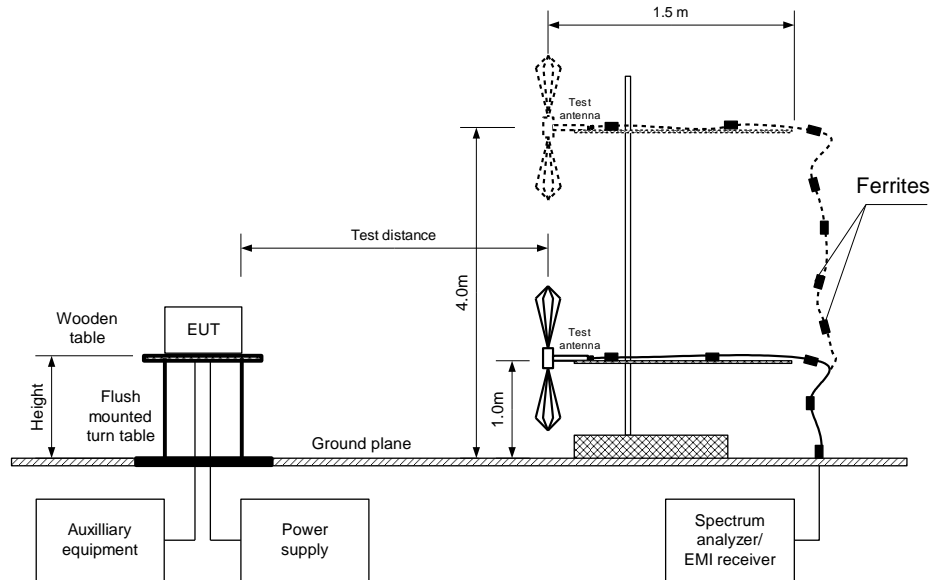
$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

7.3.2.6 The worst test results (the lowest margins) were recorded in Table 7.3.2.



<b>Test specification:</b> Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power			
<b>Test procedure:</b> ANSI C63.10 sections 11.9.2.2.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Figure 7.3.1 Setup for carrier field strength measurements





HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power			
<b>Test procedure:</b> ANSI C63.10 sections 11.9.2.2.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Table 7.3.2 Peak output power test results**

ASSIGNED FREQUENCY: 2400-2483.5 MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: Semi anechoic chamber  
 EUT HEIGHT: 1.5 m  
 DETECTOR USED: Peak  
 TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)  
 MODULATION: GFSK  
 BIT RATE: 1 Mbps  
 DETECTOR USED: Peak  
 EUT 6 dB BANDWIDTH: 703.8 kHz  
 RESOLUTION BANDWIDTH: 3 MHz  
 VIDEO BANDWIDTH: 3 MHz  
 EUT POSITION: Horizontal

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402	86.57	Horizontal	1.7	65	-13.0	4.37	30	-25.63	Pass
2440	87.29	Horizontal	1.7	61	-13.0	5.09	30	-24.91	Pass
2480	87.45	Horizontal	1.5	58	-13.0	5.25	30	-24.75	Pass

EUT POSITION: Vertical

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402	87.29	Horizontal	1.8	20	-13.0	5.09	30	-24.91	Pass
2440	87.02	Horizontal	1.8	20	-13.0	4.82	30	-25.18	Pass
2480	86.85	Horizontal	1.7	10	-13.0	4.65	30	-25.35	Pass

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

\*\* - Peak output power was calculated from the field strength of carrier as follows:  $P = (E \times d)^2 / (30 \times G)$ ,

where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi - 95.2 dB

\*\*\* - Margin = Peak output power - specification limit.

**Reference numbers of test equipment used**

HL 3818	HL 4933	HL 3903	HL 5902				
---------	---------	---------	---------	--	--	--	--

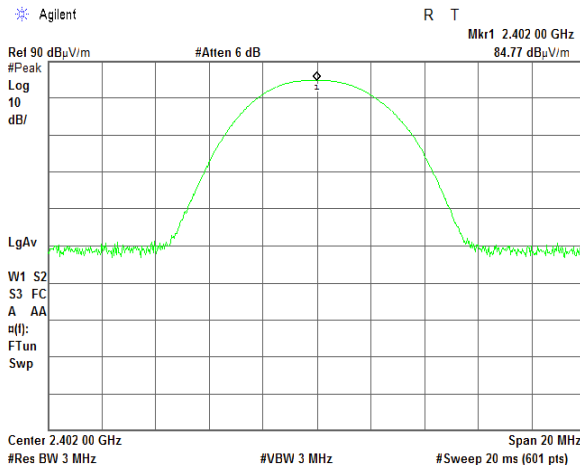
Full description is given in Appendix A.



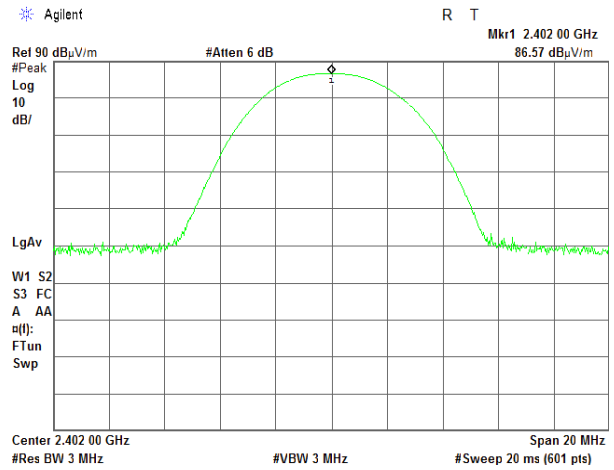
HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power			
<b>Test procedure:</b> ANSI C63.10 sections 11.9.2.2.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Plot 7.3.1 Field strength of carrier at low frequency at vertical EUT Position

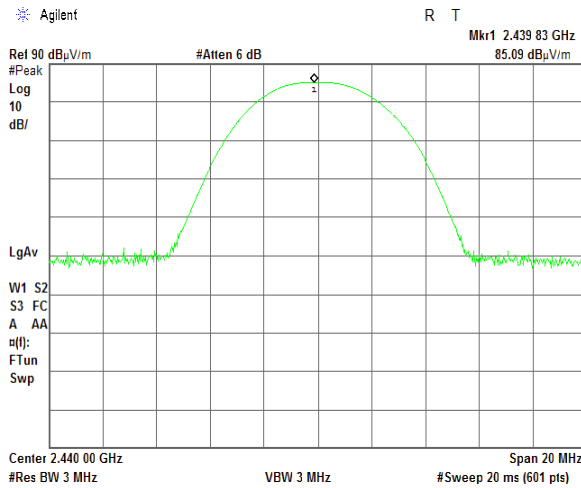


Vertical antenna polarization

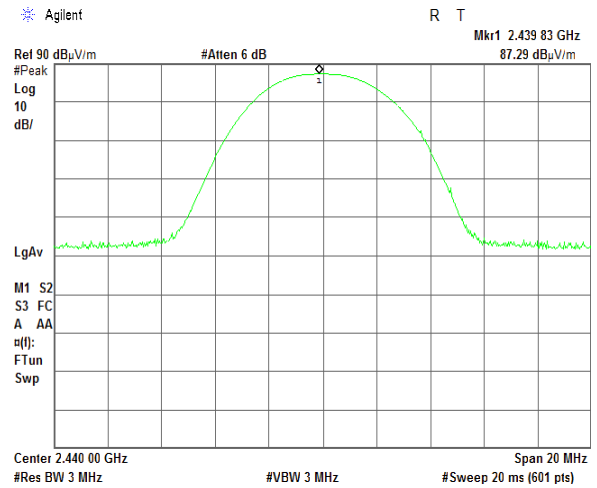


Horizontal antenna polarization

Plot 7.3.2 Field strength of carrier at mid frequency



Vertical antenna polarization



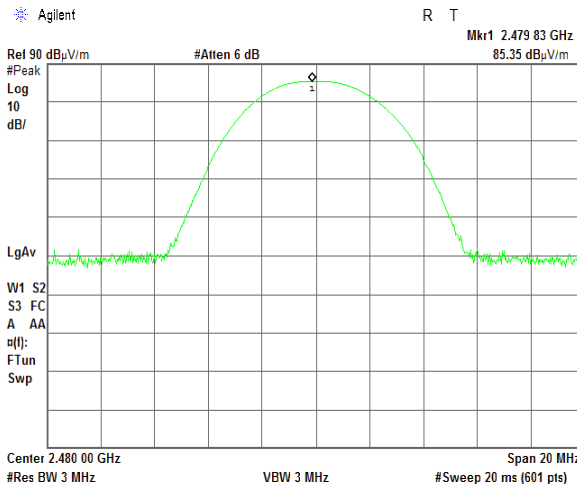
Horizontal antenna polarization



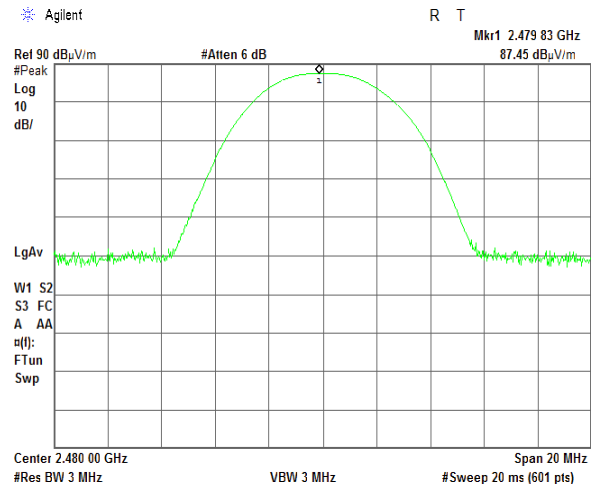
HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power			
<b>Test procedure:</b> ANSI C63.10 sections 11.9.2.2.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Plot 7.3.3 Field strength of carrier at high frequency



Vertical antenna polarization



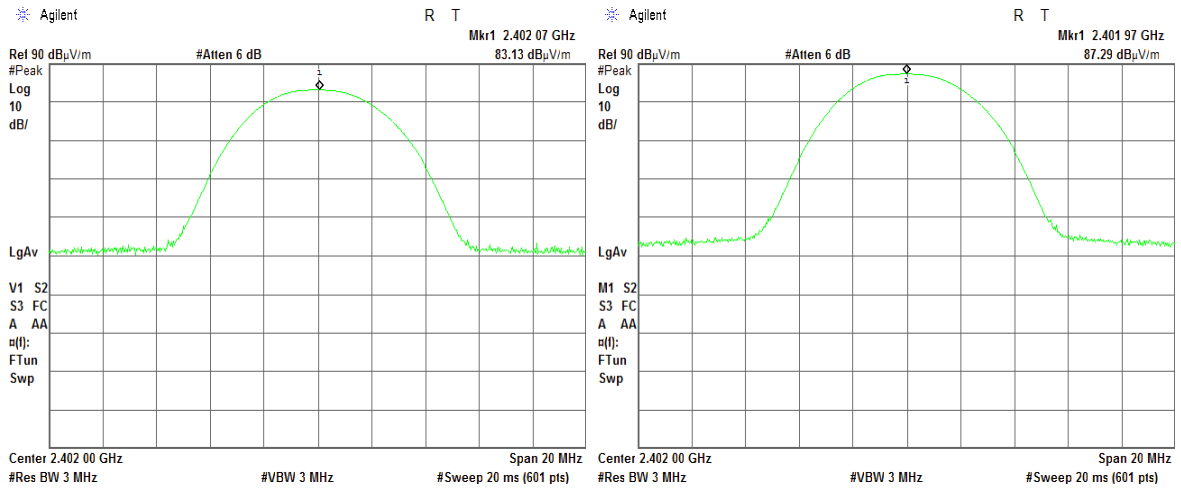
Horizontal antenna polarization



HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power			
<b>Test procedure:</b> ANSI C63.10 sections 11.9.2.2.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

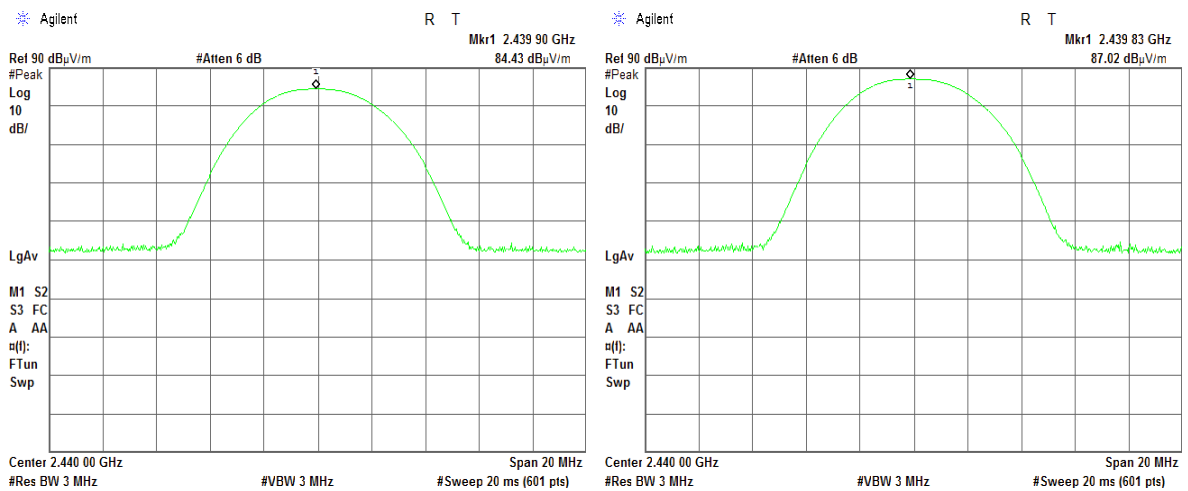
**Plot 7.3.4 Field strength of carrier at low frequency at horizontal EUT Position**



Vertical antenna polarization

Horizontal antenna polarization

**Plot 7.3.5 Field strength of carrier at mid frequency**



Vertical antenna polarization

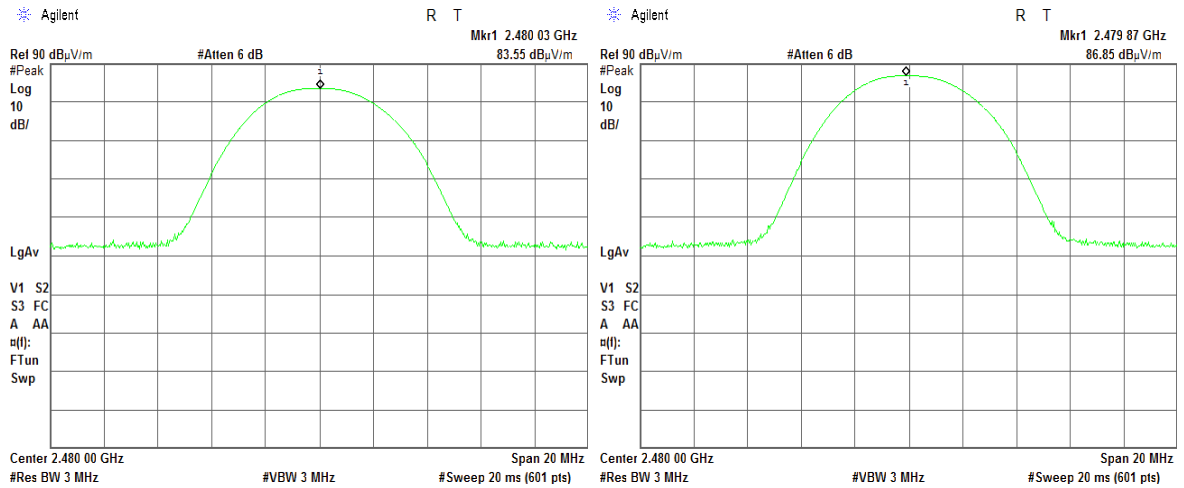
Horizontal antenna polarization



HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power			
<b>Test procedure:</b> ANSI C63.10 sections 11.9.2.2.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Plot 7.3.6 Field strength of carrier at high frequency



Vertical antenna polarization

Horizontal antenna polarization





<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

## 7.4 Band edge radiated emissions

### 7.4.1 General

This test was performed to measure emissions, radiated from the EUT at the assigned frequency band edges. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Band edge emission limits

Output power	Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(µV/m)	
			Peak	Average
Peak	2400.0 – 2483.5	20.0	74.0	54.0

\* - Band edge emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

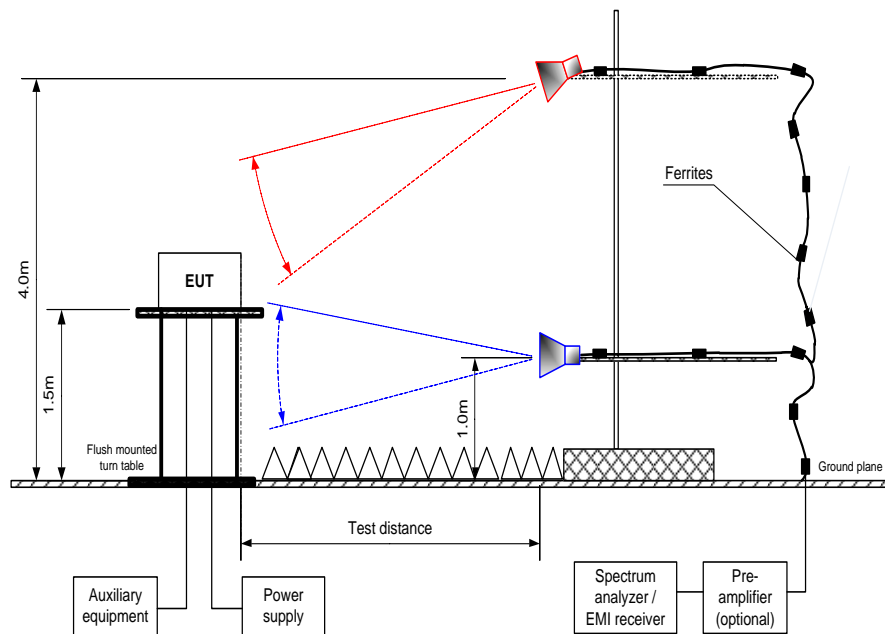
### 7.4.2 Test procedure

- 7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized normally modulated at the maximum data rate and its proper operation was checked.
- 7.4.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 7.4.2.3 The spectrum analyzer span was set to capture the carrier frequency and associated modulation products. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.4.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 7.4.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.4.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 7.4.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.
- 7.4.2.7 The above procedure was repeated with the frequency hopping function enabled.



<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Figure 7.4.1 Band edge emission test setup





<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Band edge emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Table 7.4.2 Band edge emission outside restricted band test results**

ASSIGNED FREQUENCY RANGE: 2400-2483.5 MHz  
 DETECTOR USED: Peak  
 MODULATION: GFSK  
 BIT RATE: 1 Mbps  
 RESOLUTION BANDWIDTH: ≥ 1% of the span  
 VIDEO BANDWIDTH: ≥ RBW

Frequency, MHz	Band edge emission, dBuV/m	Emission at carrier, dBuV/m	Attenuation below carrier, dBc	Limit, dBc	Margin, dB	Verdict
<b>Frequency hopping disabled</b>						
2402	44.44	86.38	41.94	20.00	21.94	Pass
<b>Frequency hopping enabled</b>						
2402	41.21	86.40	45.19	20.00	25.19	Pass

**Table 7.4.3 Band edge emission within restricted band test results**

Frequency, MHz	Peak field strength			Average field strength			Verdict
	Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Measured Peak dB(μV/m)	Limit AVR dB(μV/m)	Margin, dB**	
<b>Frequency hopping disabled</b>							
2483.5	38.74	74.0	-35.26	38.74	54.0	-15.26	Pass
<b>Frequency hopping enabled</b>							
2483.5	37.29	74.0	-36.71	37.29	54.0	-16.71	Pass

\*- Margin = Measured field strength - specification limit.

\*\*- Margin = Calculated field strength - specification limit,

Where Calculated field strength = Measured field strength + average factor.

**Reference numbers of test equipment used**

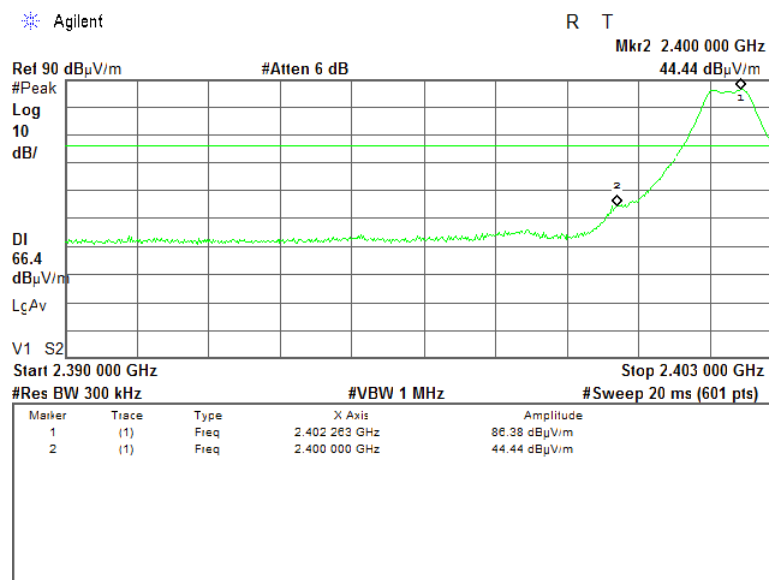
HL 4933	HL 3903	HL 5902	HL 3818			
---------	---------	---------	---------	--	--	--

Full description is given in Appendix A.



<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions</b>			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: <b>PASS</b>	
Date(s): 07-Oct-22			
Temperature: 23 °C	Relative Humidity: 49 %	Air Pressure: 1012 hPa	Power: 6 VDC
Remarks:			

Plot 7.4.1 The highest band edge emission at low carrier frequency with hopping function disabled

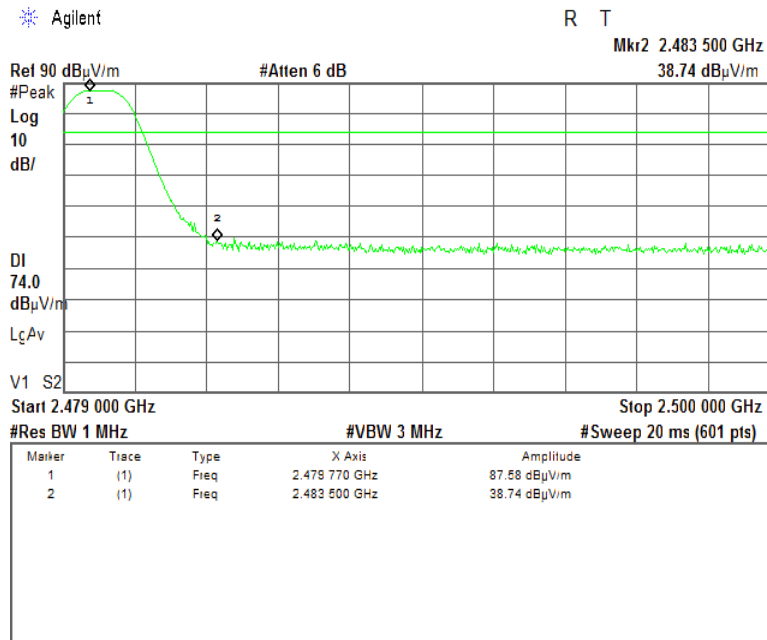


Plot 7.4.2 The highest band edge emission at high carrier frequency with hopping function disabled

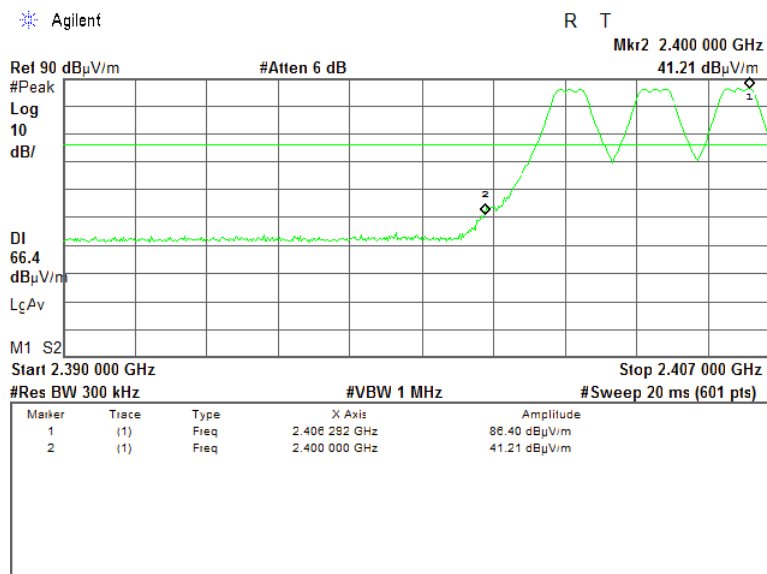


HERMON LABORATORIES

<b>Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			



Plot 7.4.3 The highest band edge emission at low carrier frequency with hopping function enabled

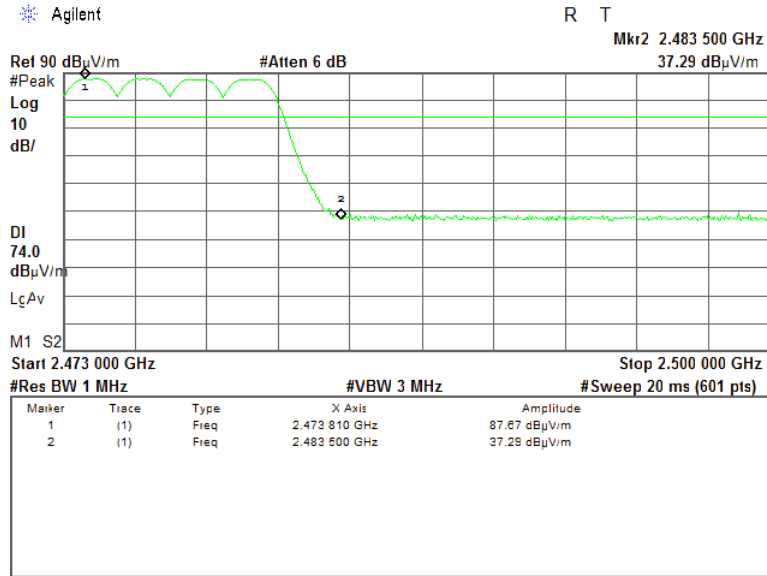


Plot 7.4.4 The highest band edge emission at high carrier frequency with hopping function enabled



HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Band edge emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.12.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			





<b>Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.10.2			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

## 7.5 Peak spectral power density

### 7.5.1 General

This test was performed to measure the peak spectral power density radiated by the transmitter RF antenna. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB(μV/m)*
2400.0 – 2483.5	3.0	8.0	103.2

\* - Equivalent field strength limit was calculated from the peak spectral power density as follows:  $E = \sqrt{30 \times P} / r$ , where P is peak spectral power density and r is antenna to EUT distance in meters.

### 7.5.2 Test procedure for field strength measurements

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

7.5.2.2 The EUT was adjusted to produce maximum available to end user RF output power.

7.5.2.3 The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.5.2.4 The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. The spectrum lines spacing was verified to be wider than 3 kHz. Otherwise the resolution bandwidth was reduced until individual spectrum lines were resolved and the power of individual spectrum lines was integrated over 3 kHz band.

7.5.2.5 The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.5.2 and associated plots.



<b>Test specification:</b> Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
<b>Test procedure:</b> ANSI C63.10 section 11.10.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Figure 7.5.1 Setup for carrier field strength measurements

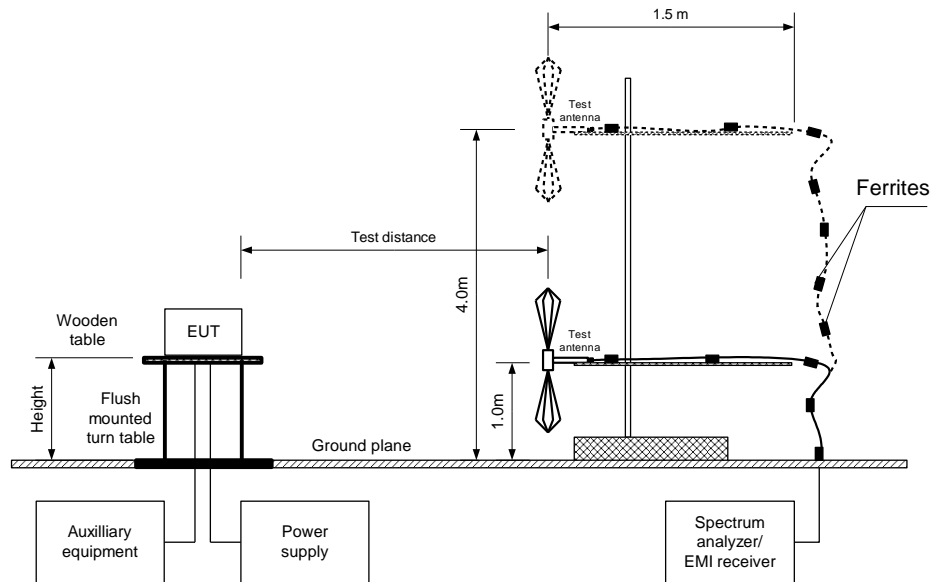


Table 7.5.2 Field strength measurement of peak spectral power density

ASSIGNED FREQUENCY: 2400-2483.5 MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: Semi anechoic chamber  
 EUT HEIGHT: 1.5m  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 3 kHz  
 VIDEO BANDWIDTH: 10 kHz  
 TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)  
 MODULATION: GFSK  
 BIT RATE: 1 Mbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees
2402	75.91	103.2	-27.29	Horizontal	1.7	65
2440	75.31	103.2	-27.89	Horizontal	1.7	61
2480	77.67	103.2	-25.53	Horizontal	1.7	58

\*- Margin = Field strength - calculated field strength limit.  
 \*\*- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 4933	HL 3818	HL 3903	HL 5902			
---------	---------	---------	---------	--	--	--

Full description is given in Appendix A.

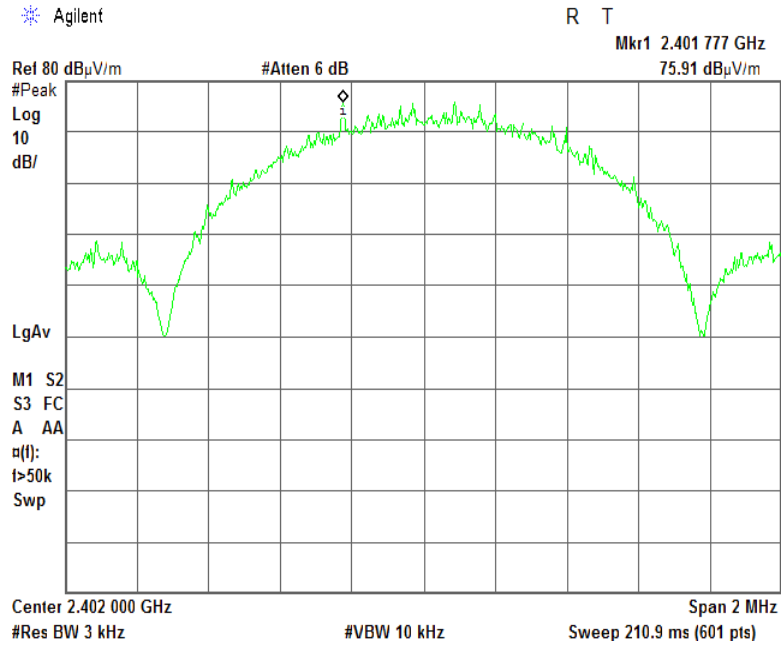




HERMON LABORATORIES

<b>Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.10.2			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Plot 7.5.1 Peak spectral power density at low frequency

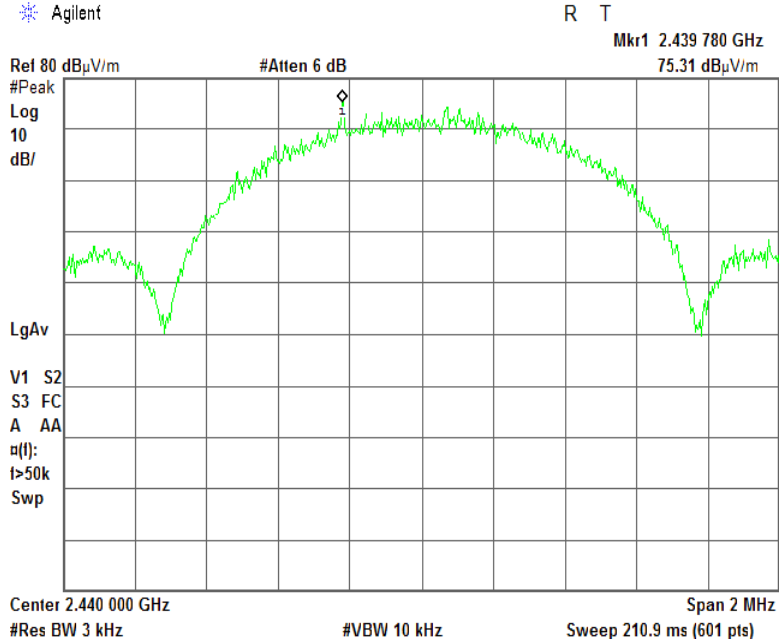


Plot 7.5.2 Peak spectral power density at mid frequency

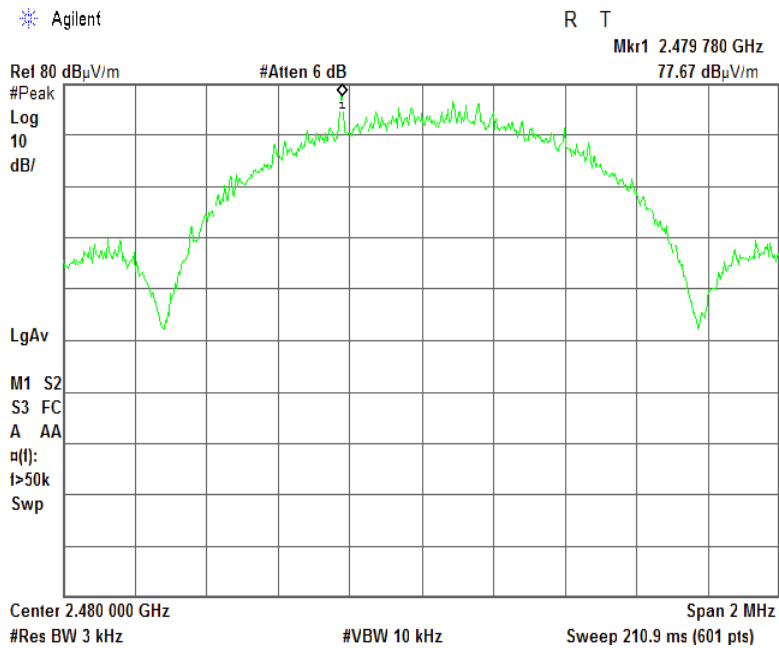


HERMON LABORATORIES

<b>Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density</b>			
<b>Test procedure:</b> ANSI C63.10 section 11.10.2			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			



Plot 7.5.3 Peak spectral power density at high frequency





<b>Test specification:</b> FCC section 15.203, RSS-Gen section 6.8, Antenna requirement			
<b>Test procedure:</b> Visual inspection			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 07-Oct-22			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

### 7.6 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 7.6.1.

Table 7.6.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	

Photograph 7.6.1 Antenna view





<b>Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission</b>			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 13-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 48 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

## 8 Unintentional emissions

### 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:  $Lims_2 = Lims_1 + 20 \log(S_1/S_2)$ , where  $S_1$  and  $S_2$  – standard defined and test distance respectively in meters.

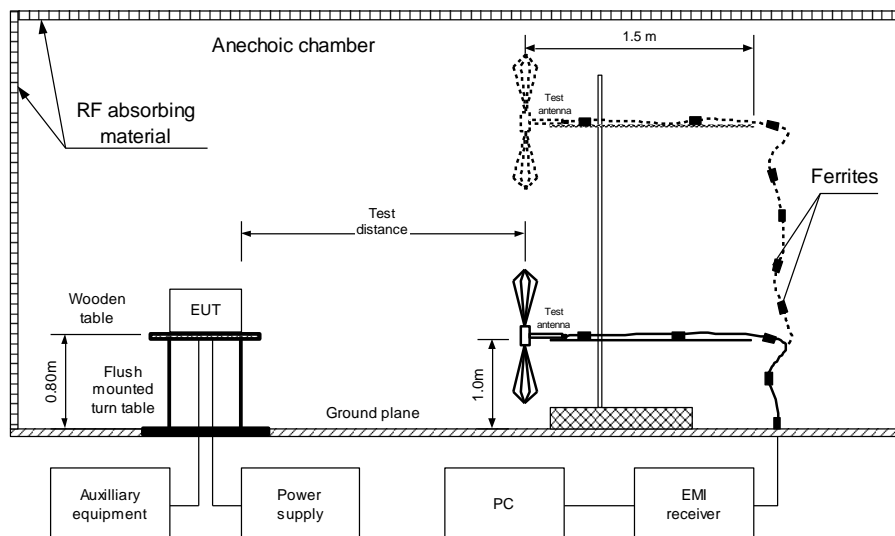
#### 8.1.2 Test procedure for measurements in semi-anechoic chamber

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°, 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 provided in the associated tables and plots.

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





<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 13-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 48 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

Table 8.1.2 Radiated emission test results

EUT SET UP: TABLE-TOP  
LIMIT: Class B  
EUT OPERATING MODE: Receive  
TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
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*				
All emissions are more than 20 dB below the limit								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*				
All emissions are more than 20 dB below the limit										Pass

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

Reference numbers of test equipment used

HL 5288	HL 4933	HL 7585	HL 3903	HL 5902			
---------	---------	---------	---------	---------	--	--	--

Full description is given in Appendix A.

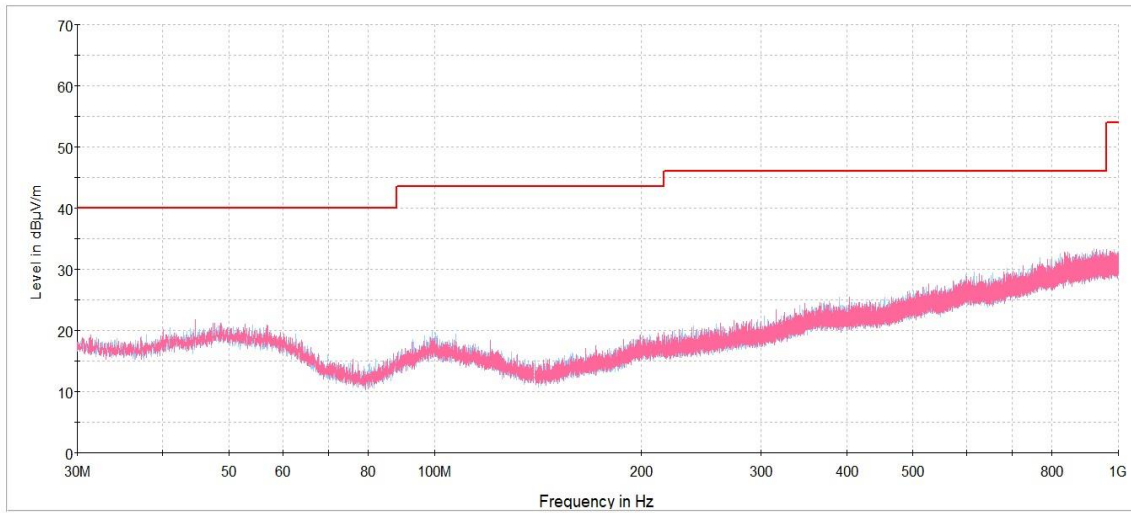


HERMON LABORATORIES

<b>Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission</b>			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 13-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 48 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive



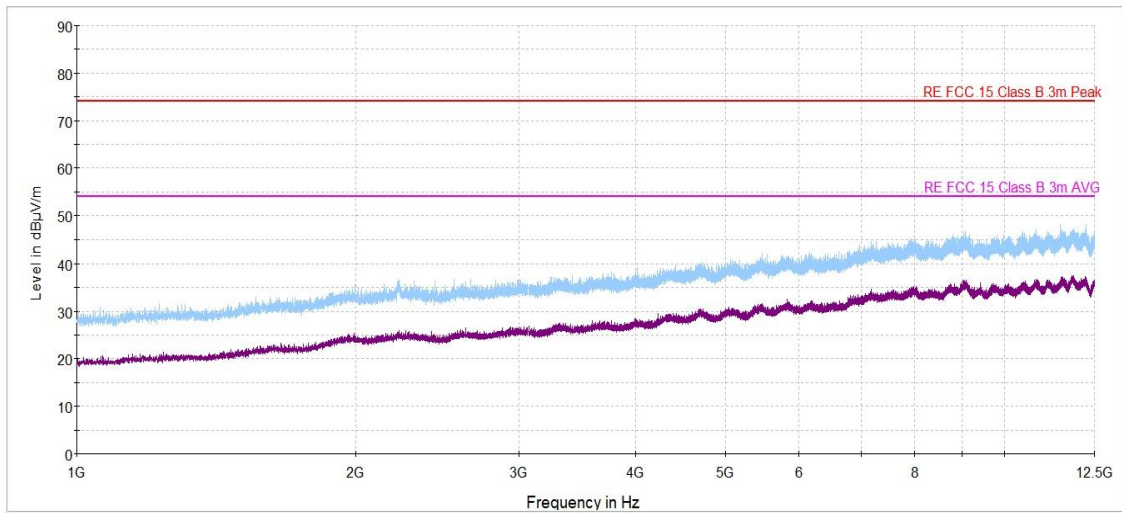


HERMON LABORATORIES

<b>Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission</b>			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 13-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 48 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			

**Plot 8.1.2 Radiated emission measurements above 1000 MHz, vertical & horizontal antenna polarization at horizontal EUT position**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m

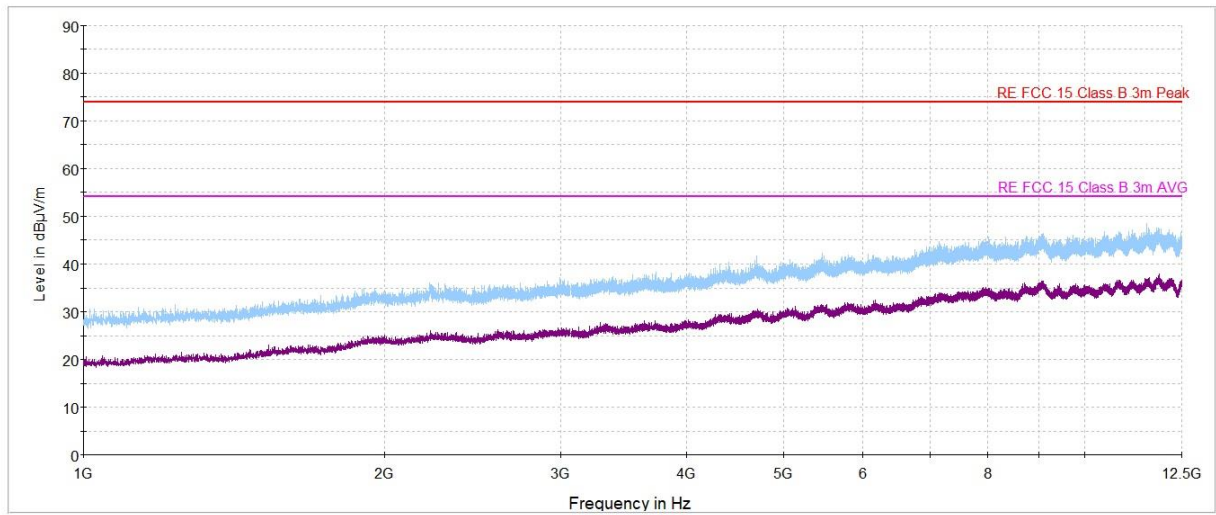


**Plot 8.1.3 Radiated emission measurements above 1000 MHz, vertical & horizontal antenna polarization at vertical EUT position**



HERMON LABORATORIES

<b>Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission</b>			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 13-Oct-22			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 48 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 6 VDC
<b>Remarks:</b>			





**9 APPENDIX A Test equipment and ancillaries used for tests**

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	19-Jul-22	19-Jul-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
4529	High Pass Filter, 50 Ohm, 4250 to 10000 MHz., SMA-FM / SMA-M	Mini-Circuits	VHF-3800+	NA	15-Jun-21	15-Jun-23
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	13-Jan-22	13-Jan-23
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	07-Mar-22	07-Mar-23
5112	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/11SK/11SK/5500MM	502494/2EA	25-Apr-22	25-Apr-23
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	24-Mar-22	24-Apr-25
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/11N/11N/6000	NA	16-Jan-22	16-Jan-23
7585	EMI Test Receiver, 1 Hz to 44 GHz	Rohde & Schwarz	ESW44	103130	19-May-22	19-May-23

**10 APPENDIX B Measurement uncertainties****Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements**

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: $\pm 1.7$ dB 12.4 GHz to 40 GHz: $\pm 2.3$ dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: $\pm 2.6$ dB 2.9 GHz to 6.46 GHz: $\pm 3.5$ dB 6.46 GHz to 13.2 GHz: $\pm 4.3$ dB 13.2 GHz to 22.0 GHz: $\pm 5.0$ dB 22.0 GHz to 26.8 GHz: $\pm 5.5$ dB 26.8 GHz to 40.0 GHz: $\pm 4.8$ dB
Occupied bandwidth	$\pm 8.0$ %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0$ %
Conducted emissions with LISN	9 kHz to 150 kHz: $\pm 3.9$ dB 150 kHz to 30 MHz: $\pm 3.8$ dB
Radiated emissions at 3 m measuring distance Horizontal polarization  Vertical polarization	Biconilog antenna: $\pm 5.3$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.3$ dB Double ridged horn antenna: $\pm 5.3$ dB Biconilog antenna: $\pm 6.0$ dB Biconical antenna: $\pm 5.7$ dB Log periodic antenna: $\pm 6.0$ dB Double ridged horn antenna: $\pm 6.0$ 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.



### 11 APPENDIX C Test equipment correction factors

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 $\mu$ V to obtain field strength in dB $\mu$ 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 $\mu$ V to obtain field strength in dB $\mu$ V/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 dB $\mu$ V to obtain field strength in dB $\mu$ V/m.



HERMON LABORATORIES

## 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).

Address: P.O. Box 23, Binyamina 3055001, Israel.  
Telephone: +972 4628 8001  
Fax: +972 4628 8277  
e-mail: mail@hermonlabs.com  
website: www.hermonlabs.com

Person for contact: Mr. Michael Nikishin, EMC&Radio group manager



## 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.
RSS-247 Issue 2: 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices
RSS-Gen Issue 5 with_amendment_1_2: 2021	General Requirements and Information for the Certification of Radiocommunication Equipment
ICES-003: 2020, Issue 7	Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement



## 14 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( $\mu$ V)	decibel referred to one microvolt
dB( $\mu$ V/m)	decibel referred to one microvolt per meter
dB( $\mu$ 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
$\mu$ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
$\Omega$	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
WB	wideband

END OF DOCUMENT