

# TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C §15.247 (DTS),  
RSS-247 Issue 3:2023, RSS-Gen Issue 5

FOR:

**ST Engineering Telematics Wireless Ltd**

**Sienna MX1**

**Model: SMX1CS**

**FCC ID: NTASMX1CS**

**IC: 4732A-SMX1CS**

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 bandwidth at LoRa modulation .....	7
7.2	Minimum 6 dB bandwidth at 2GFSK modulation.....	11
7.3	Peak output power at LoRa modulation .....	15
7.4	Peak output power at 2GFSK modulation .....	19
7.5	Peak spectral power density at LoRa modulation .....	23
7.6	Peak spectral power density at 2GFSK modulation .....	27
7.7	Band edge emissions at RF antenna connector at LoRa modulation.....	31
7.8	Band edge emissions at RF antenna connector at 2GFSK modulation.....	34
7.9	Field strength of spurious emissions at LoRa modulation .....	37
7.10	Field strength of spurious emissions at 2GFSK modulation .....	61
7.11	Antenna requirements.....	81
8	APPENDIX A Test equipment and ancillaries used for tests.....	82
9	APPENDIX B Test equipment correction factors.....	83
10	APPENDIX B Measurement uncertainties.....	85
11	APPENDIX C Test laboratory description .....	86
12	APPENDIX D Specification references .....	87
13	APPENDIX E Abbreviations and acronyms.....	88

## 1 Applicant information

**Client name:** ST Engineering Telematics Wireless Ltd  
**Address:** 26 Hamelaha street, POB 1911, Holon 5811801, Israel  
**Telephone:** +972 3557 5700  
**Fax:** +972 3557 5703  
**E-mail:** [itsikk@tlmw.com](mailto:itsikk@tlmw.com)  
**Contact name:** Mr. Itsik Kanner

## 2 Equipment under test attributes

**Product name:** Sienna MX1  
**Product type:** Transceiver  
**Model(s):** SMX1CS  
**Serial number:** 8250100917050  
**Hardware version:** Rev B  
**Software release:** Fc10  
**Receipt date** 24-Jun-24

## 3 Manufacturer information

**Manufacturer name:** ST Engineering Telematics Wireless Ltd  
**Address:** 26 Hamelaha street, POB 1911, Holon 5811801, Israel  
**Telephone:** +972 3557 5700  
**Fax:** +972 3557 5703  
**E-Mail:** [itsikk@tlmw.com](mailto:itsikk@tlmw.com)  
**Contact name:** Mr. Itsik Kanner

## 4 Test details





**Project ID:** 55429  
**Location:** Hermon Laboratories Ltd. 66 HaTachana str., P.O. Box 23, Binyamina 3055001, Israel  
**Test started:** 08-Dec-24  
**Test completed:** 24-Feb-25  
**Test specification(s):** FCC 47CFR part 15 subpart C §15.247 (DTS),  
RSS-247 Issue 3:2023, RSS-Gen Issue 5

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
FCC section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB bandwidth	Pass
FCC section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power	Pass
FCC section 15.247(i) / RSS-102 section 2.5.2, 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(e) / RSS-247 section 5.2(b), Peak power density	Pass
FCC section 15.247(d)/ RSS-247 section 5.5, Emissions at band edges	Pass
FCC section 15.203 / RSS-Gen section 6.8, Antenna requirement	Pass
FCC section 15.207(a) / RSS-Gen section 8.8, Conducted emission	Not required

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>	Mr. M. Filobodchenko, test engineer, EMC & Radio  Mr. S. Sugatov, test engineer, EMC & Radio	08-Dec-24 – 25-Feb-25	 
<b>Reviewed by:</b>	Mrs. S. Peysahov Sheynin, certification engineer, EMC & Radio	25-Mar-24 – 16-Apr-25	
<b>Approved by:</b>	Mr. M. Nikishin, group leader, EMC & Radio	08-May-25	

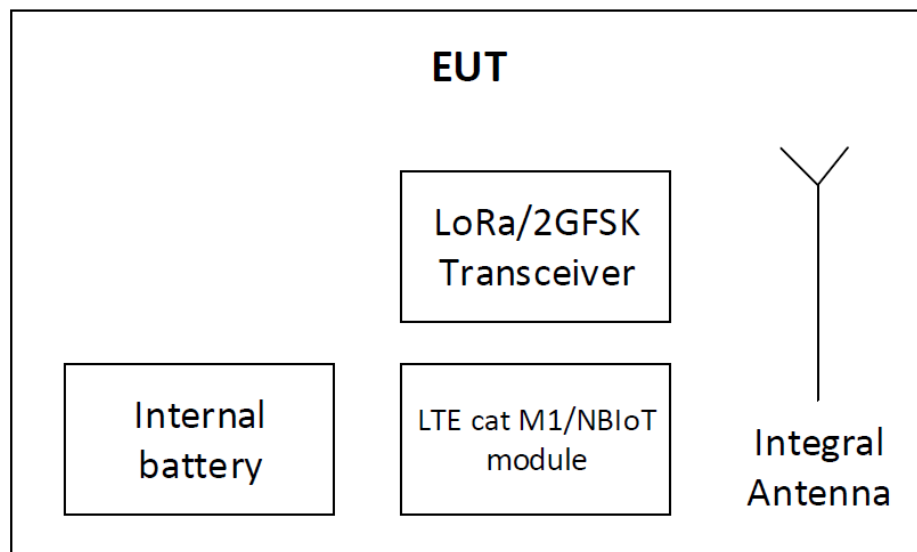
## 6 EUT description

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

### 6.1 General information

The EUT Sienna MX1 is a Meter Interface Unit that sends the water meter readings to the water management software either via cellular network or using LoRa/2GFSK modulation, to a mobile drive-by data collector. The Sienna MX1 is wired to a water meter encoder and collects the water meter data. The EUT consists of LoRa/2GFSK transceiver. The EUT is powered by 3.6V battery.

### 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>					
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)				
<b>Intended use</b>		<b>Condition of use</b>			
	fixed	Always at a distance more than 2 m from all people			
X	mobile	Always at a distance more than 20 cm from all people			
	portable	May operate at a distance closer than 20 cm to human body			
<b>Assigned frequency range</b>		902-928 MHz			
<b>Operating frequency range</b>		903 – 927 MHz			
<b>Maximum rated output power</b>		At transmitter 50 $\Omega$ RF output connector		19.21 dBm (LoRa)	
		Peak output power		13.27 dBm (2GFSK)	
<b>Is transmitter output power variable?</b>		X	No		
			Yes	continuous variable	
				stepped variable with stepsize dB	
				minimum RF power dBm	
				maximum RF power dBm	
<b>Antenna connection</b>					
unique coupling		standard connector		X	integral
				X	with temporary RF connector without temporary RF connector
<b>Antenna/s technical characteristics</b>					
Type		Manufacturer		Model number	
Printed		NA		NA	
				Gain	
				0 dBi	
<b>Type of modulation</b>		LoRa, 2GFSK			
<b>Modulating test signal (baseband)</b>		PRBS			
<b>Transmitter power source</b>					
X	Battery	<b>Nominal rated voltage</b>	3.6 VDC	Battery type	Lithium size D
	DC	<b>Nominal rated voltage</b>			
	AC mains	<b>Nominal rated voltage</b>		Frequency	



<b>Test specification:</b> Section 15.247(a)2/ RSS-247 section 5.2(a), 6 dB 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> 08-Dec-24			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1003 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

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

### 7.1 Minimum 6 dB bandwidth at LoRa modulation

#### 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
902.0 – 928.0	6.0	500.0

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

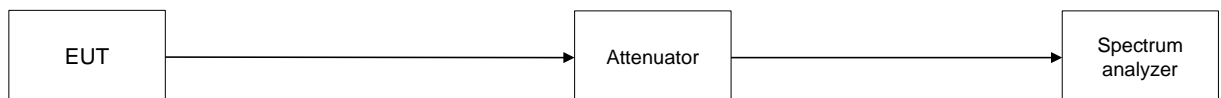
#### 7.1.2 Test procedure

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 7.1.2 and associated plot.

Figure 7.1.1 6 dB bandwidth test setup





HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(a)2/ RSS-247 section 5.2(a), 6 dB 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> 08-Dec-24			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1003 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.1.2 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902 - 928 MHz  
 DETECTOR USED: Peak  
 SWEEP MODE: Single  
 SWEEP TIME: Auto  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 MODULATION: LORA  
 BIT RATE: 1.5 kbps

Carrier frequency, MHz	6 dB bandwidth, kHz	99%, kHz	Limit, kHz	Margin, kHz	Verdict
Low frequency					
903.00	630.24	669.83	500.00	130.24	Pass
Mid frequency					
915.00	634.74	672.53	500.00	134.74	Pass
High frequency					
927.00	633.24	669.23	500.00	133.24	Pass

## Reference numbers of test equipment used

HL 4355	HL 5611	HL 5644						
---------	---------	---------	--	--	--	--	--	--

Full description is given in Appendix A.

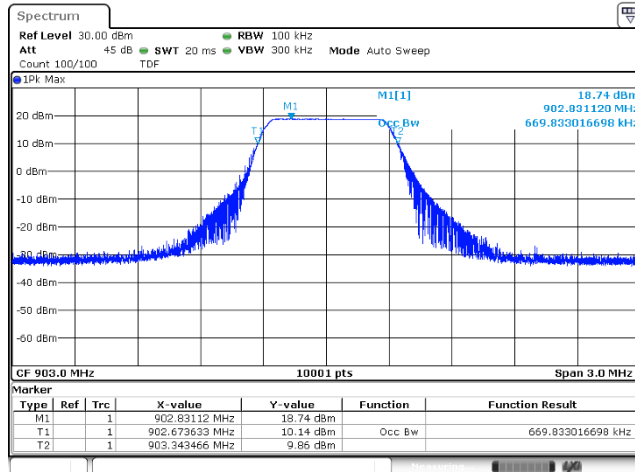




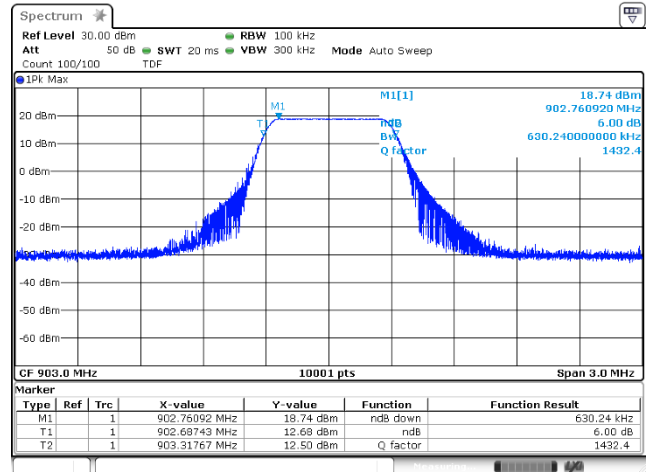
HERMON LABORATORIES

Test specification: Section 15.247(a)2/ RSS-247 section 5.2(a), 6 dB bandwidth			
Test procedure: ANSI C63.10 section 11.8.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.1.1 6 dB bandwidth test result at low frequency

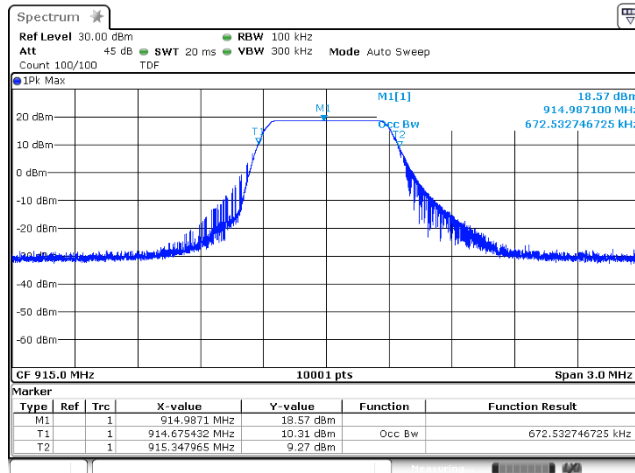


Date: 8-Dec-2024 16:00:41

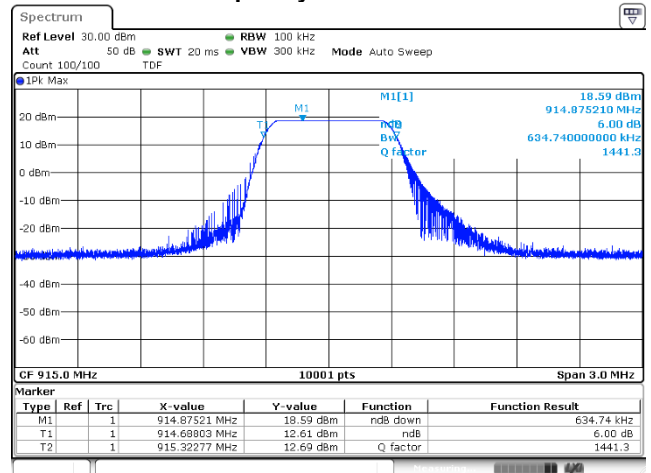


Date: 8-Dec-2024 16:06:53

Plot 7.1.2 6 dB bandwidth test result at mid frequency



Date: 8-Dec-2024 16:00:18



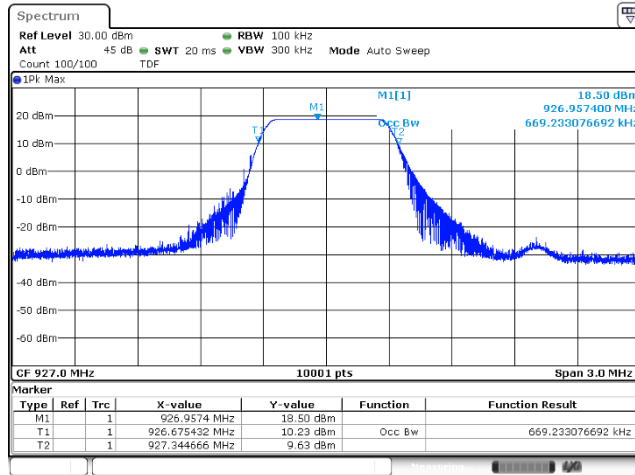
Date: 8-Dec-2024 16:03:00



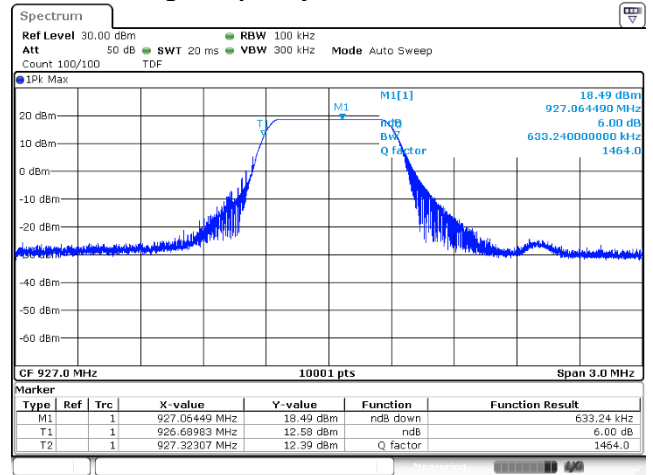
HERMON LABORATORIES

Test specification: Section 15.247(a)2/ RSS-247 section 5.2(a), 6 dB bandwidth			
Test procedure: ANSI C63.10 section 11.8.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.1.3 6 dB bandwidth test result at high frequency



Date: 8-Dec-2024 16:12:03



Date: 8-Dec-2024 16:14:07



Test specification:	Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	08-Dec-24		
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

## 7.2 Minimum 6 dB bandwidth at 2GFSK modulation

### 7.2.1 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 7.2.1 6 dB bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Minimum bandwidth, kHz
902.0 – 928.0	6.0	500.0

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

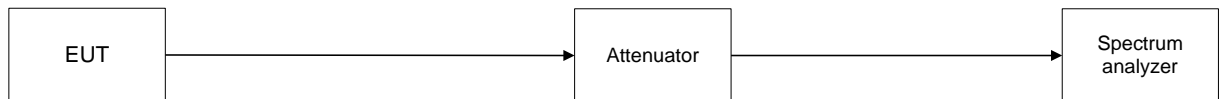
### 7.2.2 Test procedure

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

7.2.2.2 The EUT was set to transmit modulated carrier.

7.2.2.3 The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

Figure 7.2.1 6 dB bandwidth test setup





HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB 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>	08-Dec-24		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1003 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.2.2 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902 - 928 MHz  
 DETECTOR USED: Peak  
 SWEEP MODE: Single  
 SWEEP TIME: Auto  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 MODULATION ENVELOPE REFERENCE 6.0 dBc  
 POINTS:  
 MODULATION: 2GFSK  
 BIT RATE: 50 kbps

Carrier frequency, MHz	6 dB bandwidth, kHz	99%, kHz	Limit, kHz	Margin, kHz	Verdict
Low frequency					
903.00	741.23	771.22	500.00	241.23	Pass
Mid frequency					
915.00	741.23	771.52	500.00	241.23	Pass
High frequency					
927.00	741.53	771.22	500.00	241.53	Pass

## Reference numbers of test equipment used

HL 4355	HL 5611	HL 5644						
---------	---------	---------	--	--	--	--	--	--

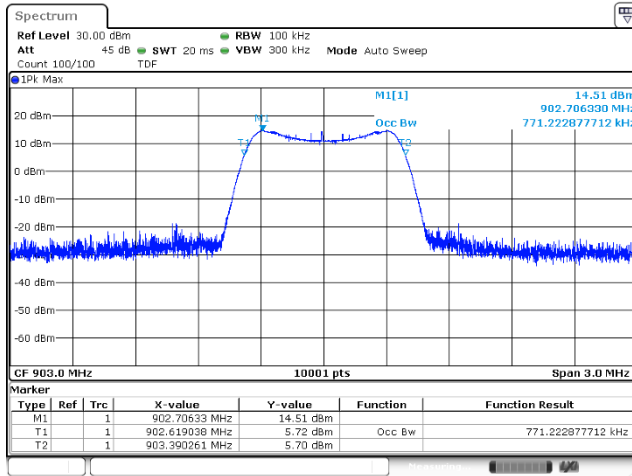
Full description is given in Appendix A.



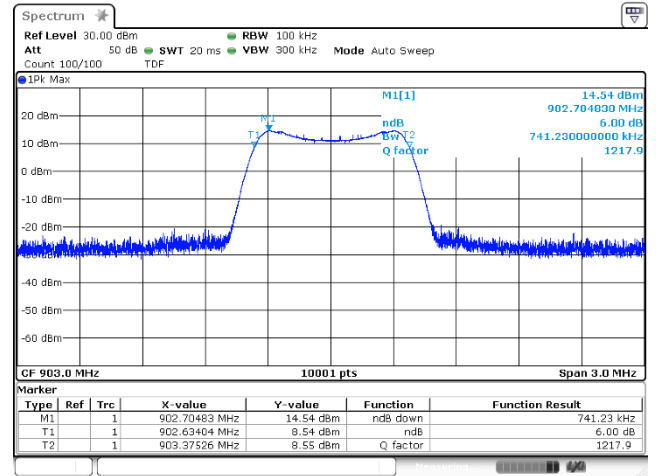
HERMON LABORATORIES

Test specification:	Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	08-Dec-24		
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.2.1 6 dB bandwidth test result at low frequency

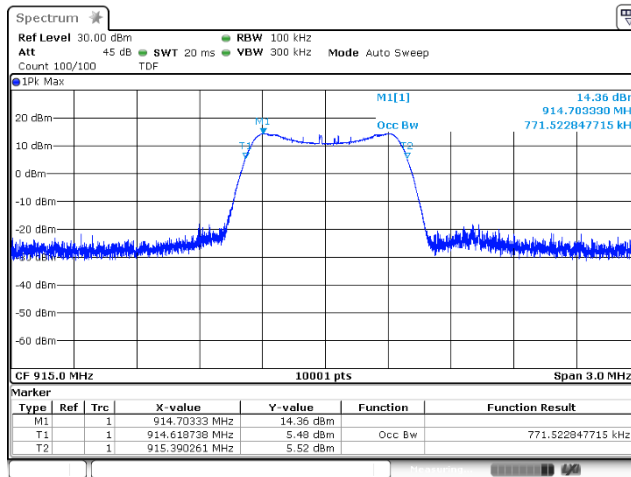


Date: 8-Dec-2024 15:25:27

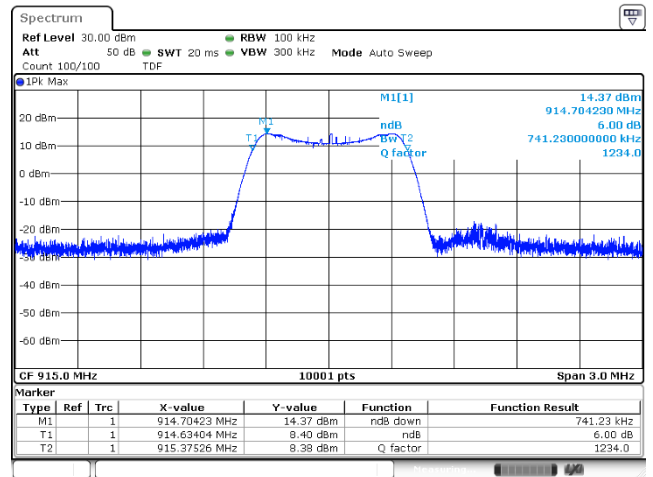


Date: 8-Dec-2024 15:24:07

Plot 7.2.2 6 dB bandwidth test result at mid frequency



Date: 8-Dec-2024 15:20:19



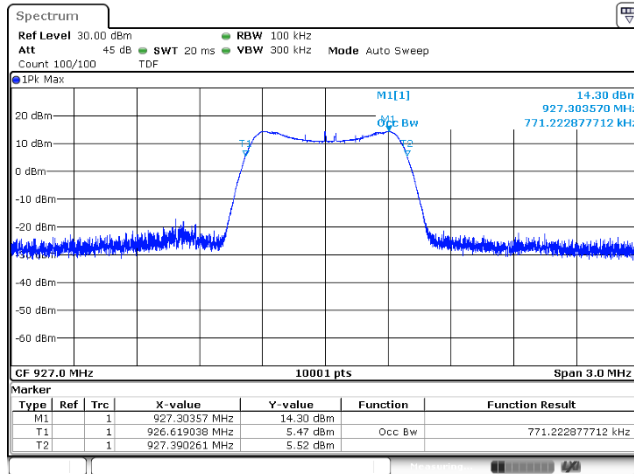
Date: 8-Dec-2024 15:21:47



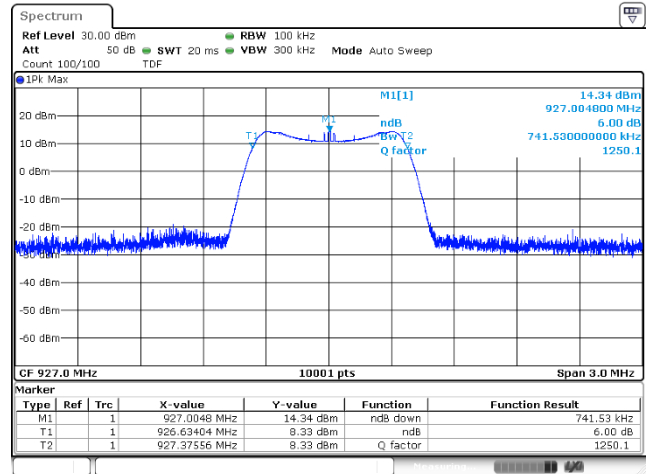
HERMON LABORATORIES

Test specification:	Section 15.247(a)2 / RSS-247 section 5.2(a), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.1		
Test mode:	Compliance	Verdict: PASS	
Date(s):	08-Dec-24		
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.2.3 6 dB bandwidth test result at high frequency



Date: 8-Dec-2024 15:10:03



Date: 8-Dec-2024 15:16:49



<b>Test specification:</b>		<b>Section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power</b>	
<b>Test procedure:</b>		ANSI C63.10 sections 11.9.2.2.4	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
14-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1018 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.3 Peak output power at LoRa modulation

### 7.3.1 General

This test was performed to measure the maximum peak output power at the transmitter RF antenna connector. 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*	
		W	dBm
902.0 – 928.0	6.0	1.0	30.0

\*- 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 the amount in dB that the directional gain of antenna exceeds 6 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 for end user RF output power.

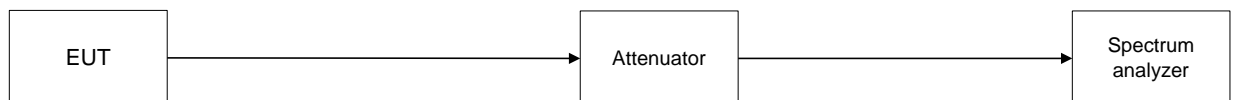
**7.3.2.3** The duty cycle of the transmitter output signal was measured and recorded.

**7.3.2.1** The frequency span of spectrum analyzer was set greater than the OBW of the transmitter at least 1.5 times. The maximum output power was measured using a power average (RMS) detector with resolution bandwidth set 1% to 5% of the OBW, VBW ≥ [3\*RBW]. The trace average at least 100 traces was performed.

**7.3.2.2** Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.

**7.3.2.3** The duty cycle correction factor was added to the measured power to compute the average power during the actual transmission times.

**Figure 7.3.1 Peak output power test setup**





<b>Test specification:</b>		<b>Section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power</b>	
<b>Test procedure:</b>		ANSI C63.10 sections 11.9.2.2.4	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
14-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1018 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.3.2 Peak output power test results

ASSIGNED FREQUENCY: 902-928 MHz  
 MODULATION: LoRa 500 kHz  
 DETECTOR USED: Average  
 EUT 20 dB BANDWIDTH: 634.74 kHz  
 RESOLUTION BANDWIDTH: 1000 kHz  
 VIDEO BANDWIDTH: 3000 kHz  
 BIT RATE: 1.5 kbps

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	DC factor, dB	Peak output power**, dBm	Limit, dBm	Margin*, dB	Verdict
903.0	16.65	Included	2.56	19.21	30.00	-10.79	Pass
915.0	16.49	Included	2.56	19.05	30.00	-10.95	Pass
927.0	16.17	Included	2.56	18.73	30.00	-11.27	Pass

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

\*\* - Peak output power = SA reading + DC factor, where

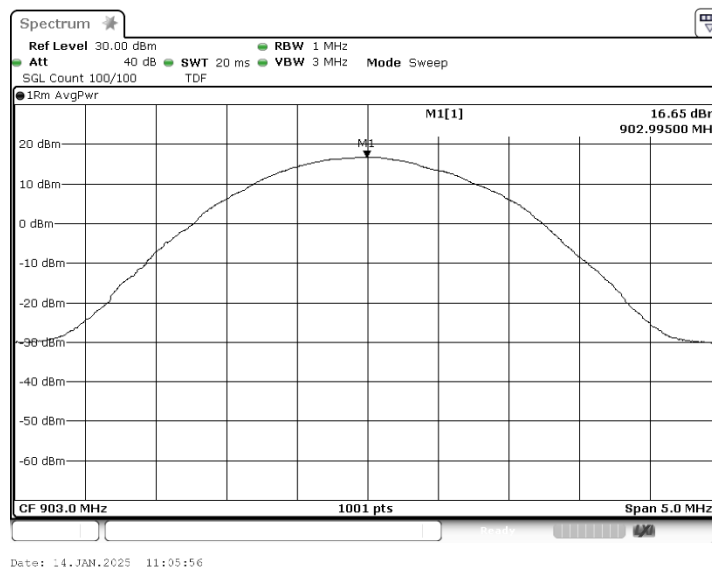
$$\text{DC Factor} = 10 \cdot \log(1 / (\text{T}_{\text{on}} / \text{T}_{\text{on}} + \text{T}_{\text{off}})) = 2.559 \text{ dB}$$

## Reference numbers of test equipment used

HL 3230	HL 3440	HL 4135	HL 4355	HL 5642	HL 5933	HL 7523	
---------	---------	---------	---------	---------	---------	---------	--

Full description is given in Appendix A.

Plot 7.3.1 Average output power at low frequency



Date: 14.JAN.2025 11:05:56

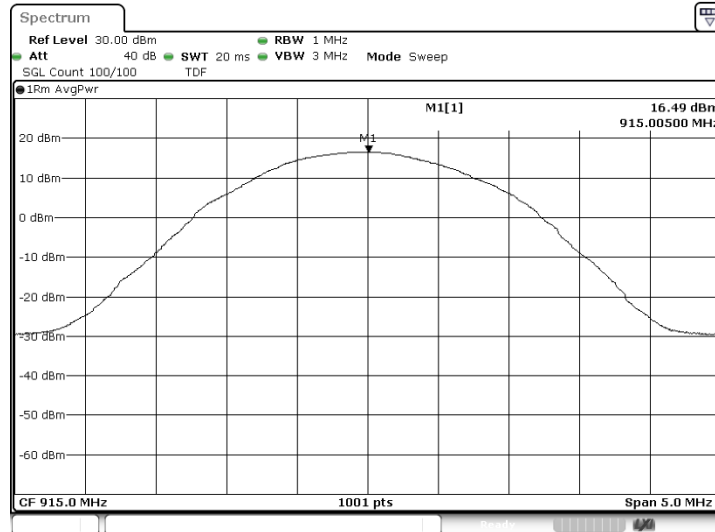




HERMON LABORATORIES

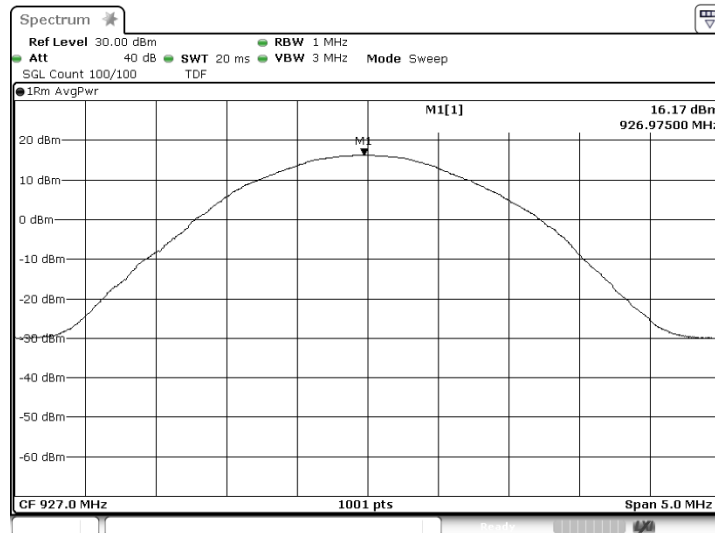
Test specification: Section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power			
Test procedure: ANSI C63.10 sections 11.9.2.2.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.3.2 Average output power at mid frequency



Date: 14.JAN.2025 10:50:55

Plot 7.3.3 Average output power at high frequency



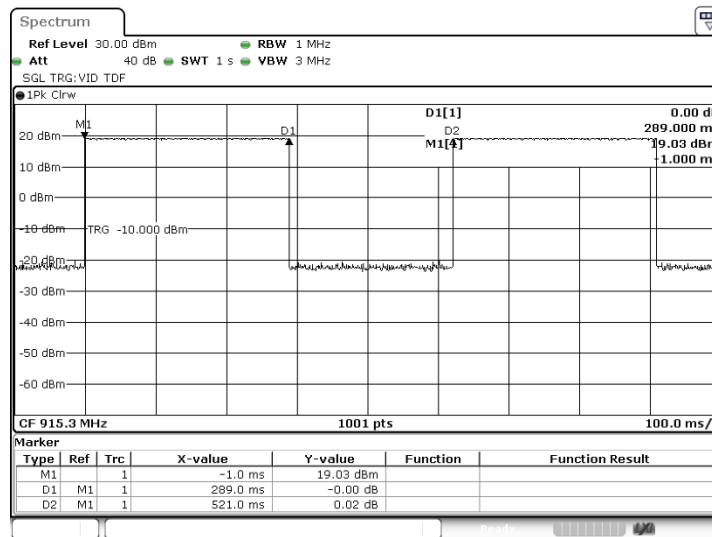
Date: 14.JAN.2025 11:09:46



HERMON LABORATORIES

Test specification:		Section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power	
Test procedure:		ANSI C63.10 sections 11.9.2.2.4	
Test mode:		Verdict: PASS	
Date(s):			
14-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.3.4 Transmission pulse duration and period



Date: 14.JAN.2025 11:47:25



<b>Test specification:</b>		<b>Section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power</b>	
<b>Test procedure:</b>		ANSI C63.10 sections 11.9.2.2.4	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
10-Feb-25			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 45 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.4 Peak output power at 2GFSK modulation

### 7.4.1 General

This test was performed to measure the maximum peak output power at the transmitter RF antenna connector. Specification test limits are given in Table 7.3.1.

**Table 7.4.1 Peak output power limits**

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*	
		W	dBm
902.0 – 928.0	6.0	1.0	30.0

\*- 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 the amount in dB that the directional gain of antenna exceeds 6 dBi.

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

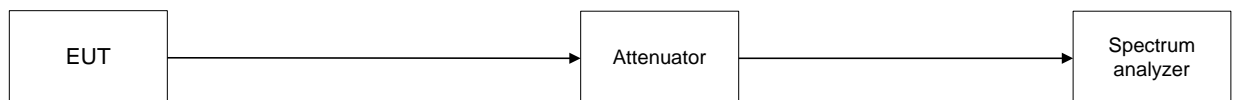
**7.4.2.3** The duty cycle of the transmitter output signal was measured and recorded.

**7.4.2.4** The frequency span of spectrum analyzer was set greater than the OBW of the transmitter at least 1.5 times. The maximum output power was measured using a power average (RMS) detector with resolution bandwidth set 1% to 5% of the OBW, VBW ≥ [3\*RBW]. The trace average at least 100 traces was performed.

**7.4.2.5** Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.

**7.4.2.6** The duty cycle correction factor was added to the measured power to compute the average power during the actual transmission times.

**Figure 7.4.1 Peak output power test setup**





HERMON LABORATORIES

<b>Test specification:</b>		<b>Section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power</b>	
<b>Test procedure:</b>		ANSI C63.10 sections 11.9.2.2.4	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
10-Feb-25			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 45 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.4.2 Peak output power test results

ASSIGNED FREQUENCY: 902-928 MHz  
 MODULATION: 2GFSK 500 kHz  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Average  
 EUT 20 dB BANDWIDTH: 741.53 kHz  
 RESOLUTION BANDWIDTH: 30 kHz  
 VIDEO BANDWIDTH: 100 kHz  
 BIT RATE: 50 kbps

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	DC factor, dB	Peak output power**, dBm	Limit, dBm	Margin*, dB	Verdict
903.0	0.401	Included	12.31	12.71	30.00	-17.29	Pass
915.0	0.963	Included	12.31	13.27	30.00	-16.73	Pass
927.0	0.396	Included	12.31	12.71	30.00	-17.29	Pass

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

\*\* - Peak output power = SA reading + DC factor, where

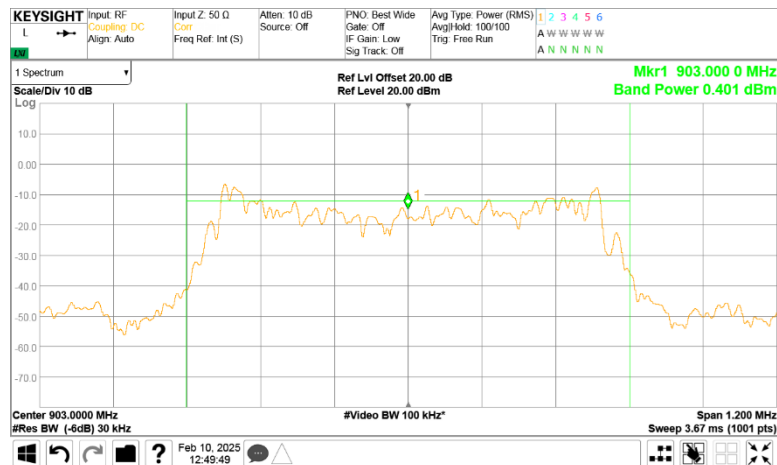
$$\text{DC Factor} = 10 \cdot \log(1 / (\text{T}_{\text{on}} / \text{T}_{\text{on}} + \text{T}_{\text{off}})) = 12.31 \text{ dB}$$

## Reference numbers of test equipment used

HL 3230	HL 3440	HL 5376	HL 5636	HL 5933	HL 7546		
---------	---------	---------	---------	---------	---------	--	--

Full description is given in Appendix A.

Plot 7.4.1 Average output power at low frequency

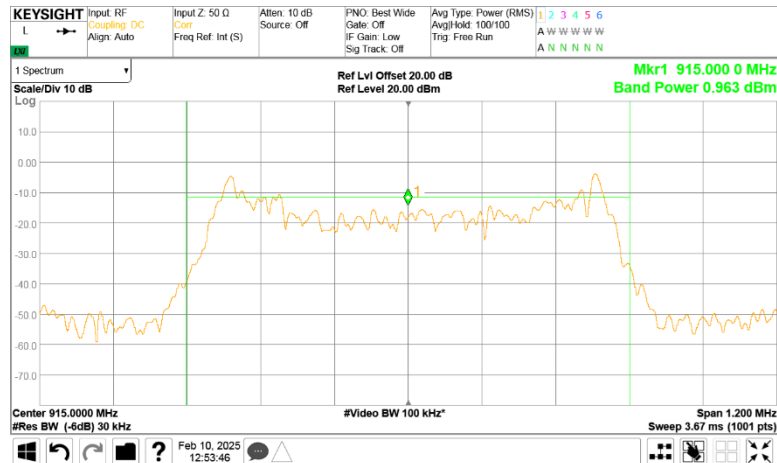




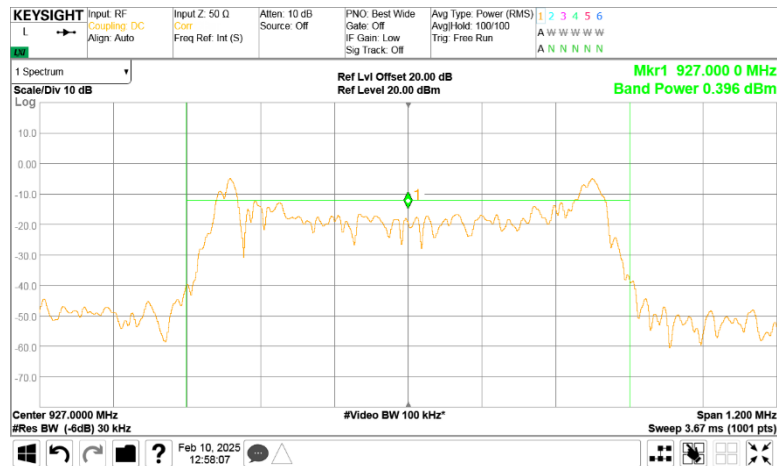
HERMON LABORATORIES

Test specification: Section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power			
Test procedure: ANSI C63.10 sections 11.9.2.2.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Feb-25			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.4.2 Average output power at mid frequency



Plot 7.4.3 Average output power at high frequency

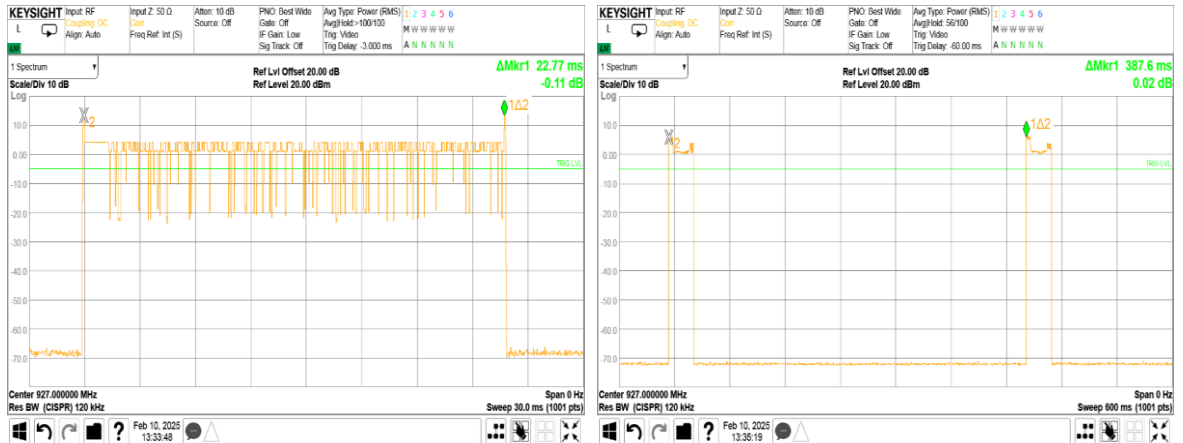




HERMON LABORATORIES

Test specification:		Section 15.247(b)3/ RSS-247 section 5.4(d), Peak output power	
Test procedure:		ANSI C63.10 sections 11.9.2.2.4	
Test mode:		Verdict: PASS	
Date(s):			
10-Feb-25			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.4.4 Transmission pulse duration and period





<b>Test specification:</b> Section 15.247(e), / RSS-247 section 5.2(b), Peak power density			
<b>Test procedure:</b> ANSI C63.10 section 11.10.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.5 Peak spectral power density at LoRa modulation

### 7.5.1 General

This test was performed to measure the peak spectral power density at the transmitter RF antenna connector. 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
902 - 928	3.0	8.0

### 7.5.2 Test procedure

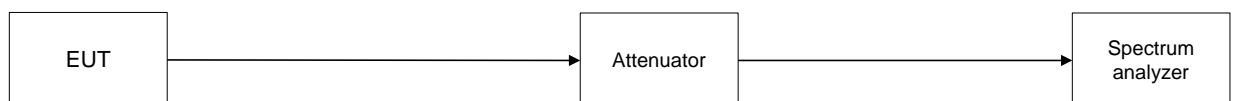
**7.5.2.1** The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

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

**7.5.2.3** The 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.

**7.5.2.4** The average detector with power averaging mode was used over a minimum of 100 traces. The peak marker function was used to determine the maximum power spectral density. To compute the average PSD during the actual transmission time the average factor was added to the measured values of PSD and the results provided in Table 7.5.2 and associated plots.

**Figure 7.5.1 Peak spectral power density test setup**





HERMON LABORATORIES

Test specification: Section 15.247(e), / RSS-247 section 5.2(b), Peak power density			
Test procedure: ANSI C63.10 section 11.10.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 3.6 VDC
Remarks:			

Table 7.5.2 Peak spectral power density test results

ASSIGNED FREQUENCY: 902 – 928 MHz  
 MODULATION: LoRa 500 kHz  
 BIT RATE: 1.5 kbps  
 DETECTOR USED: Average  
 RESOLUTION BANDWIDTH: 3 kHz  
 VIDEO BANDWIDTH: 30 kHz

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	DC factor, dB	Peak power density, dBm /3 kHz**	Limit, dBm	Margin*, dB	Verdict
903.0	-0.12	Included	2.56	2.44	8.0	-5.56	Pass
915.0	-0.44	Included	2.56	2.12	8.0	-5.88	Pass
927.0	-0.45	Included	2.56	2.11	8.0	-5.89	Pass

\* - Margin = Peak power density – specification limit.

\*\* - Peak power density = SA reading + DC factor, where  
 $DC\ Factor = 10 \cdot \log(1 / (Tx_{on} / Tx_{on} + Tx_{off})) = 2.559\text{dB}$

**Reference numbers of test equipment used**

HL 3230	HL 3440	HL 4135	HL 4355	HL 5642	HL 7523		
---------	---------	---------	---------	---------	---------	--	--

Full description is given in Appendix A.

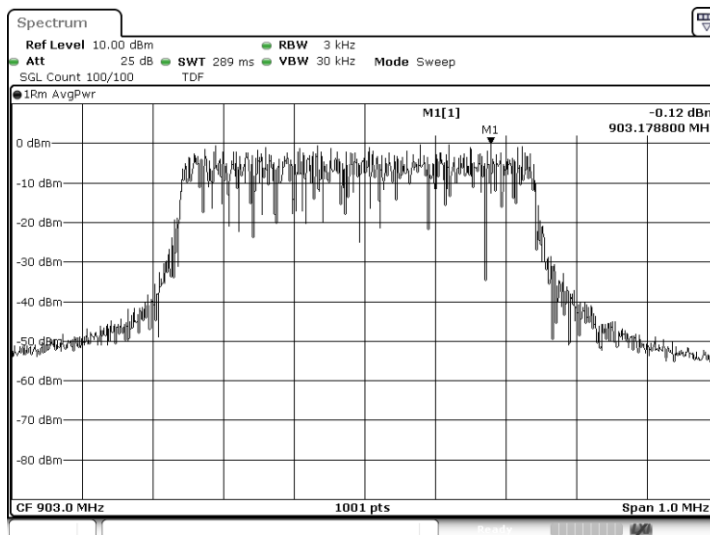




HERMON LABORATORIES

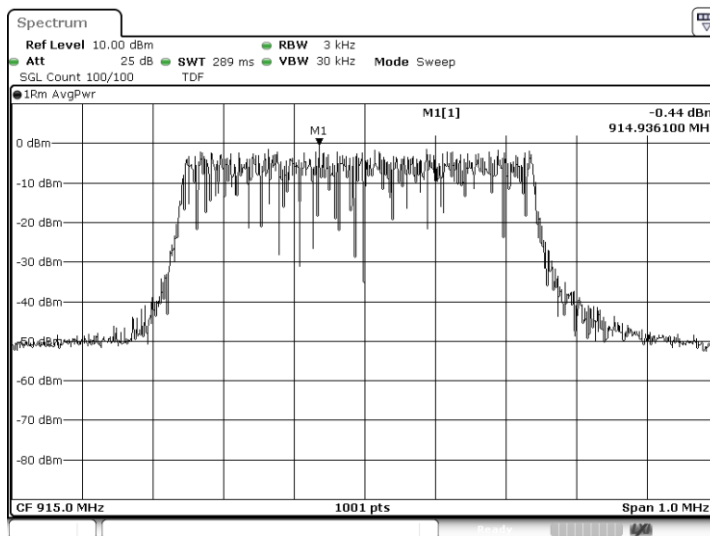
Test specification: Section 15.247(e), / RSS-247 section 5.2(b), Peak power density			
Test procedure: ANSI C63.10 section 11.10.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.5.1 Average spectral power density at low frequency



Date: 14.JAN.2025 12:47:04

Plot 7.5.2 Average spectral power density at mid frequency



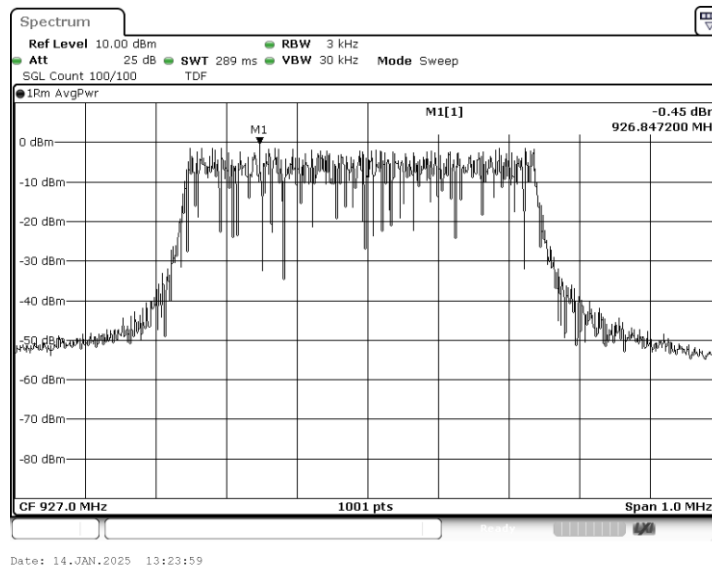
Date: 14.JAN.2025 12:41:21



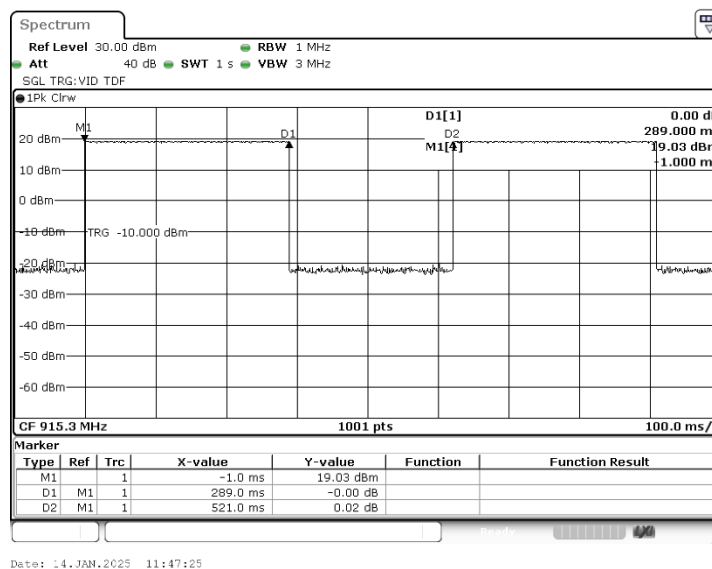
HERMON LABORATORIES

Test specification: Section 15.247(e), / RSS-247 section 5.2(b), Peak power density			
Test procedure: ANSI C63.10 section 11.10.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.5.3 Average spectral power density at high frequency



Plot 7.5.4 Transmission pulse duration and period





<b>Test specification:</b> Section 15.247(e), / RSS-247 section 5.2(b), Peak power density			
<b>Test procedure:</b> ANSI C63.10 section 11.10.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 09-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.6 Peak spectral power density at 2GFSK modulation

### 7.6.1 General

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

Table 7.6.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm
902 - 928	3.0	8.0

### 7.6.2 Test procedure

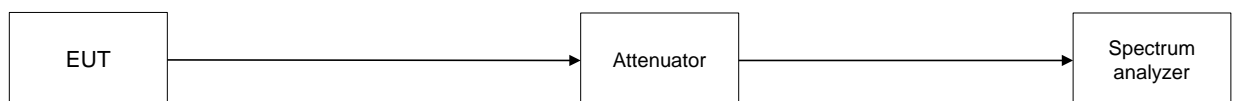
7.6.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

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

7.6.2.3 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.

7.6.2.4 The average detector with power averaging mode was used over a minimum of 100 traces. The peak marker function was used to determine the maximum power spectral density. To compute the average PSD during the actual transmission time the average factor was added to the measured values of PSD and the results provided in Table 7.6.2 and associated plots.

Figure 7.6.1 Peak spectral power density test setup





<b>Test specification:</b> Section 15.247(e), / RSS-247 section 5.2(b), Peak power density			
<b>Test procedure:</b> ANSI C63.10 section 11.10.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 09-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.6.2 Peak spectral power density test results

ASSIGNED FREQUENCY: 902 - 928 MHz  
 MODULATION: 2GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50 kbps  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 3 kHz  
 VIDEO BANDWIDTH: 30 kHz

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	DC factor, dB	Peak power density, dBm / 3 kHz**	Limit, dBm	Margin*, dB	Verdict
903	-7.95	included	12.31	4.36	8.0	-3.64	Pass
915	-6.91	included	12.31	5.40	8.0	-2.60	Pass
927	-8.69	included	12.31	3.62	8.0	-4.38	Pass

\* - Margin = Peak power density – specification limit.

\*\* - Peak power density = SA reading + DC factor, where  
 $DC\ Factor = 10 \cdot \log(1 / (T_{on} / T_{on} + T_{off})) = 12.31\text{dB}$

**Reference numbers of test equipment used**

HL 3230	HL 3440	HL 5376	HL 5636	HL 5933	HL 7546		
---------	---------	---------	---------	---------	---------	--	--

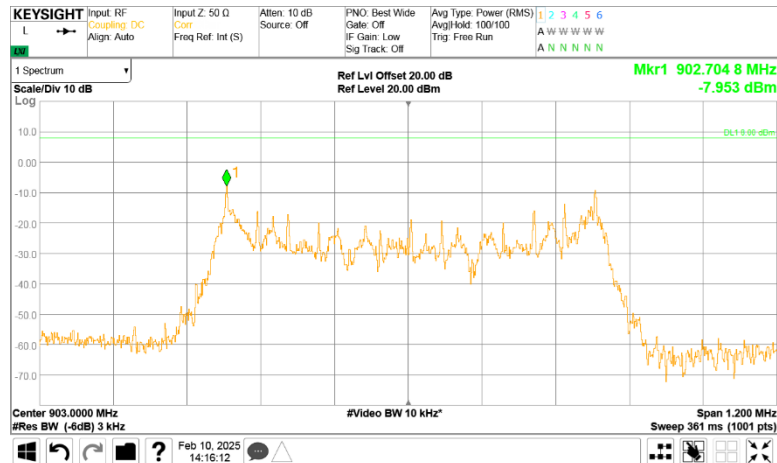
Full description is given in Appendix A.



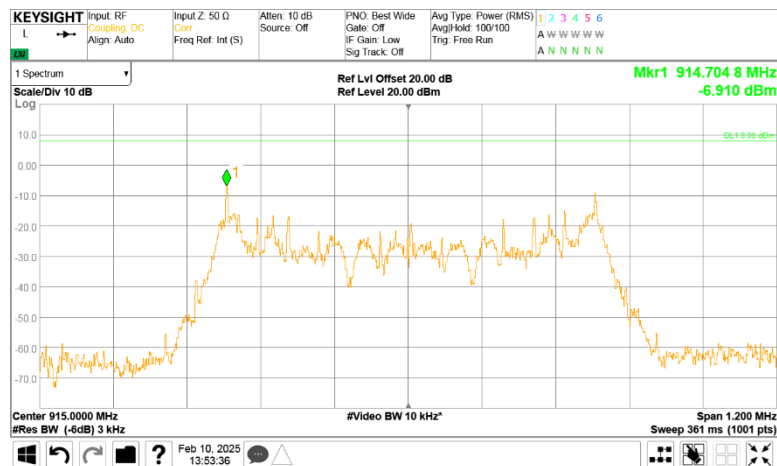
HERMON LABORATORIES

Test specification: Section 15.247(e), / RSS-247 section 5.2(b), Peak power density			
Test procedure: ANSI C63.10 section 11.10.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 09-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1014 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.6.1 Average spectral power density at low frequency



Plot 7.6.2 Average spectral power density at mid frequency

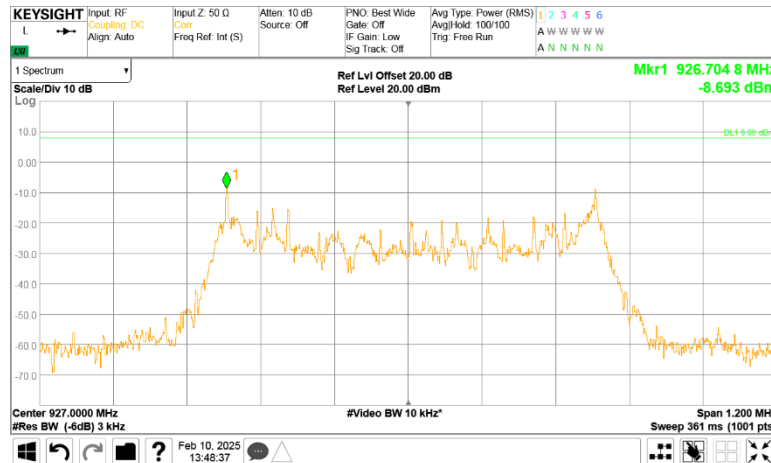




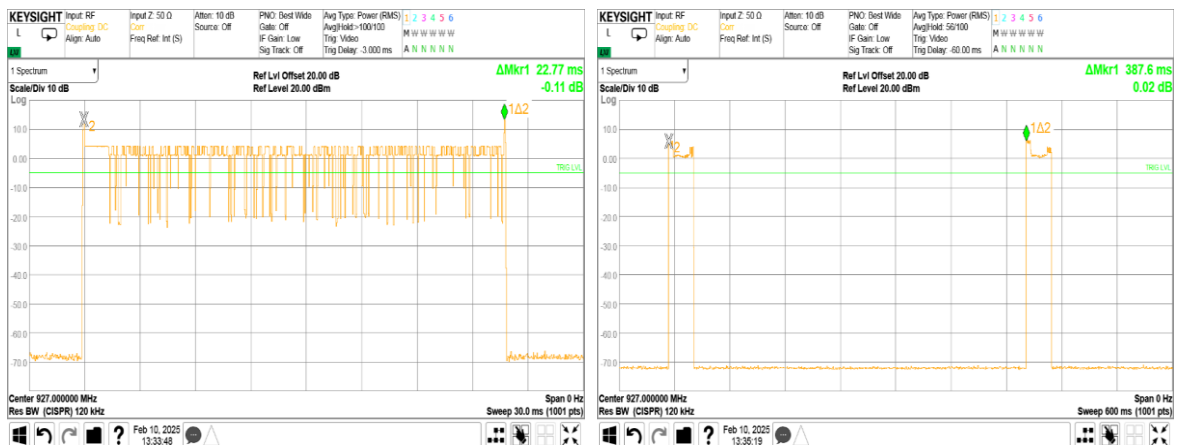
HERMON LABORATORIES

Test specification: Section 15.247(e), / RSS-247 section 5.2(b), Peak power density			
Test procedure: ANSI C63.10 section 11.10.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 09-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1014 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.6.3 Average spectral power density at high frequency



Plot 7.6.4 Transmission pulse duration and period





<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Band edge emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.13.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.7 Band edge emissions at RF antenna connector at LoRa modulation

### 7.7.1 General

This test was performed to measure band edge emissions at RF antenna connector. Specification test limits are given in Table 7.7.1.

**Table 7.7.1 Band edge emission limits**

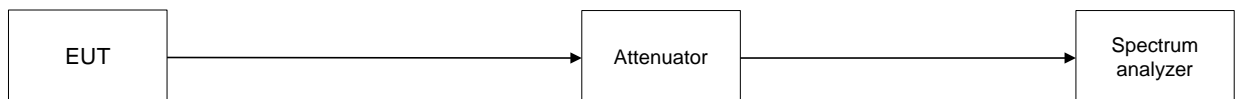
Output power	Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(μV/m)	
			Peak	Average
Peak	902.0 – 928.0	20.0	74.0	54.0
Averaged over a time interval	902.0 – 928.0	30.0	74.0	54.0

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

### 7.7.2 Test procedure

- 7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized normally modulated at the maximum data rate and its proper operation was checked.
- 7.7.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 7.7.2.3 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.
- 7.7.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 7.7.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.7.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 7.7.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.
- 7.7.2.7 The above procedure was repeated with the frequency hopping function enabled.

**Figure 7.7.1 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 11.13.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.7.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902.0 -928.0MHz  
 DETECTOR USED: Average  
 MODULATION: LoRa  
 BIT RATE: 1.5 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: ≥ RBW

Frequency, MHz	Band edge emission, dBm	Emission at carrier, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier - Peak power						
902.00	-28.23	18.94	47.17	30.0	-17.17	Pass
High carrier - Peak power						
928.00	-22.56	18.70	41.26	30.0	-11.26	Pass

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

**Reference numbers of test equipment used**

HL 3230	HL 3440	HL 4135	HL 4355	HL 5642	HL 5933	HL 7523	
---------	---------	---------	---------	---------	---------	---------	--

Full description is given in Appendix A.

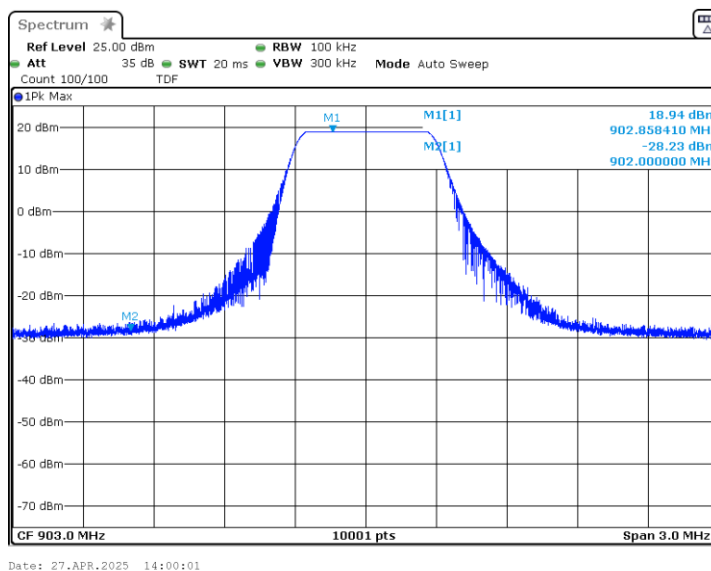




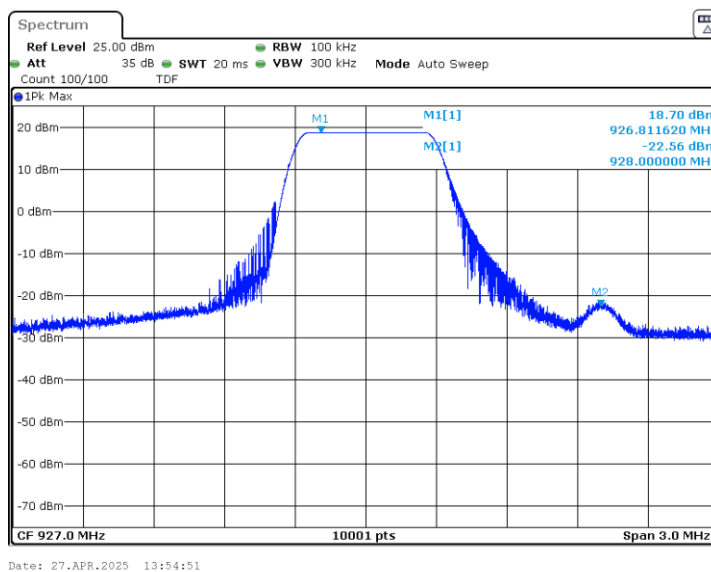
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions			
Test procedure: ANSI C63.10 section 11.13.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.7.1 The highest band edge emission at low carrier frequency



Plot 7.7.2 The highest band edge emission at high carrier frequency





<b>Test specification:</b> Section 15.247(d) / RSS-247 section 5.5, Band edge emissions			
<b>Test procedure:</b> ANSI C63.10 section 11.13.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 09-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.8 Band edge emissions at RF antenna connector at 2GFSK modulation

### 7.8.1 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 7.8.1.

**Table 7.8.1 Band edge emission limits**

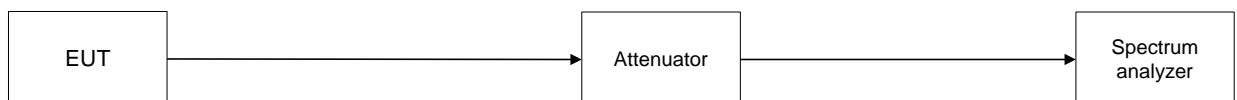
Output power	Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(μV/m)	
			Peak	Average
Peak	902.0 – 928.0	20.0	74.0	54.0
Averaged over a time interval	902.0 – 928.0	30.0	74.0	54.0

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

### 7.8.2 Test procedure

- 7.8.2.1** The EUT was set up as shown in Figure 7.8.1, energized normally modulated at the maximum data rate and its proper operation was checked.
- 7.8.2.2** The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 7.8.2.3** 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.
- 7.8.2.4** The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 7.8.2.5** The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.8.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 7.8.2.6** The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.
- 7.8.2.7** The above procedure was repeated with the frequency hopping function enabled.

**Figure 7.8.1 Band edge emission test setup**





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 11.13.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 09-Jan-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.8.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902.0 -928.0MHz  
 DETECTOR USED: Average  
 MODULATION: 2GFSK  
 BIT RATE: 50 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: ≥ RBW

Frequency, MHz	Band edge emission, dBm	Emission at carrier, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier - Peak power						
902.704	-24.19	13.31	37.50	30.0	-7.50	Pass
High carrier - Peak power						
928.00	-17.46	13.73	31.19	30.0	-1.19	Pass

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

**Reference numbers of test equipment used**

HL 3230	HL 3440	HL 5376	HL 5636	HL 5933	HL 7546		
---------	---------	---------	---------	---------	---------	--	--

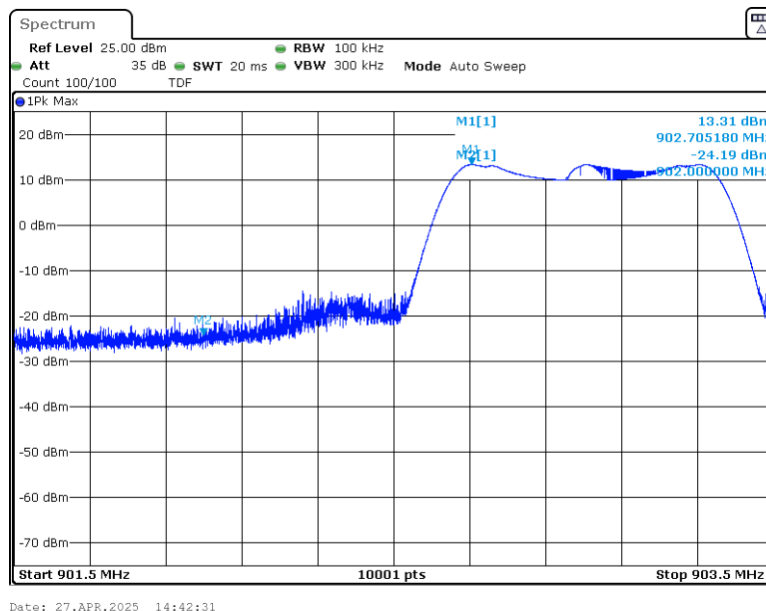
Full description is given in Appendix A.



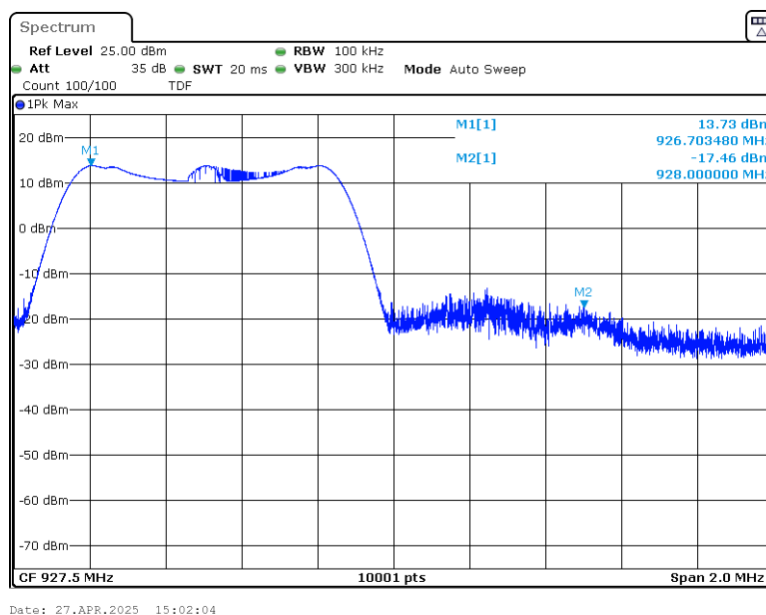
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions			
Test procedure: ANSI C63.10 section 11.13.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 09-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1014 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.8.1 The highest band edge emission at low carrier frequency



Plot 7.8.2 The highest band edge emission at high carrier frequency





<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> 22-Dec-24 - 26-Dec-24			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.9 Field strength of spurious emissions at LoRa modulation

### 7.9.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.9.1.

**Table 7.9.1 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**	30.0
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:

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

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.

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

**7.9.2.1** The EUT was set up as shown in Figure 7.9.1, energized and the performance check was conducted.

**7.9.2.2** 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.

**7.9.2.3** The worst test results (the lowest margins) were recorded and shown in the associated plots.

### 7.9.3 Test procedure for spurious emission field strength measurements above 30 MHz

**7.9.3.1** The EUT was set up as shown in Figure 7.9.2, Figure 7.9.3, energized and the performance check was conducted.

**7.9.3.2** 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.

**7.9.3.3** The worst test results (the lowest margins) were recorded and shown in the associated plots.



<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> 22-Dec-24 - 26-Dec-24			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.9.1 Setup for spurious emission field strength measurements below 30 MHz

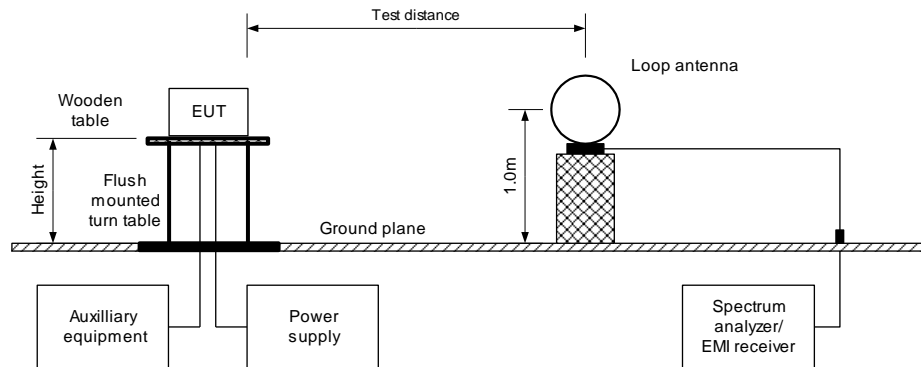
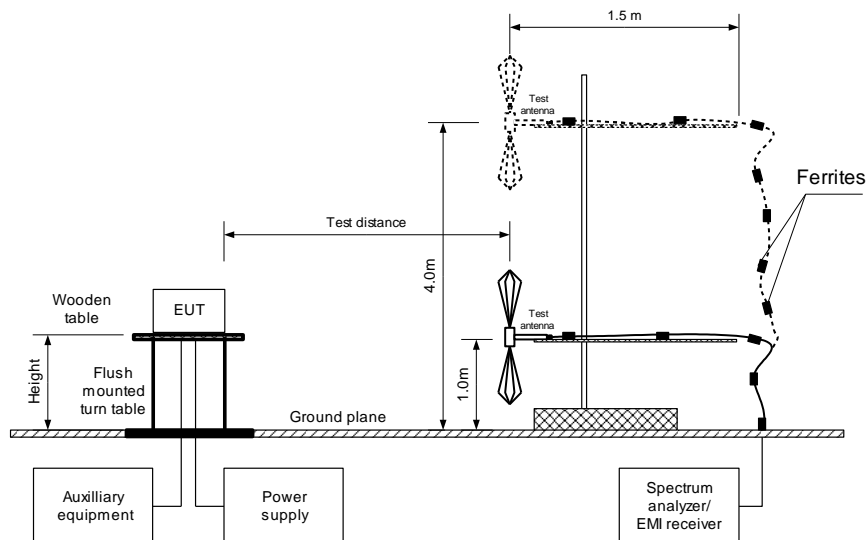


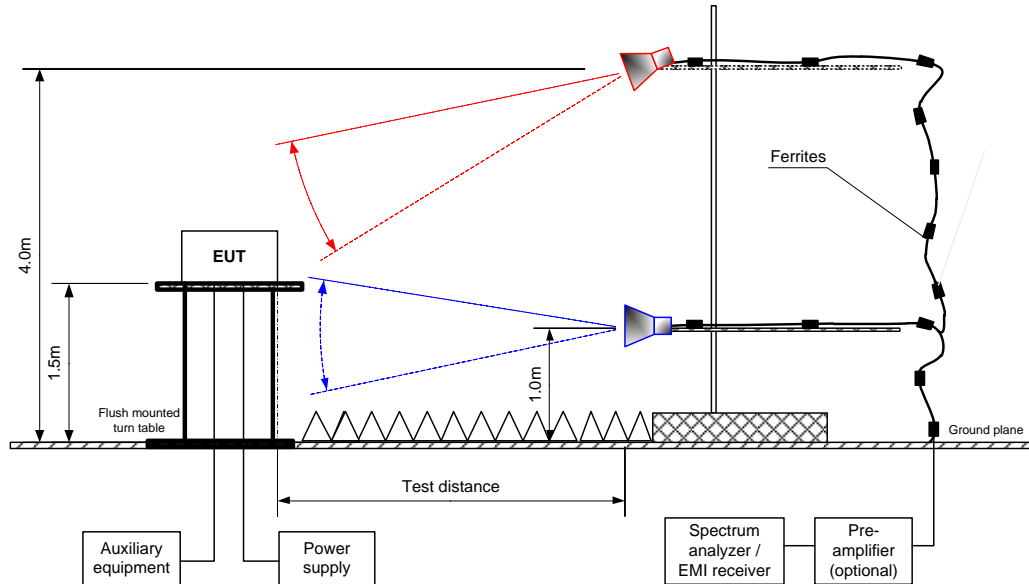
Figure 7.9.2 Setup for spurious emission field strength measurements in 30 -1000 MHz





<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> 22-Dec-24 - 26-Dec-24			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.9.3 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> 22-Dec-24 - 26-Dec-24			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.9.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY: 902 - 928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 - 9500 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: LoRa (500 kHz)  
 BIT RATE: 1.5 kbps  
 TRANSMITTER OUTPUT POWER: 19.21 dBm at low carrier frequency  
 19.05 dBm at mid carrier frequency  
 18.73 dBm at high carrier frequency  
 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)

Table 1: Test results (400 kHz to 1000 MHz)									
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
Low carrier frequency									
1830	49.15	V	1.0	180	113.69	64.54	30.0	34.54	Pass
Mid carrier frequency									
5490	54.21	V	2.1	60	113.00	58.79	30.0	28.79	Pass
6405	57.01	V	1.0	50		55.99		25.99	
High carrier frequency									
No emissions were found									Pass

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

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





Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

**Table 7.9.3 Field strength of spurious emissions above 1 GHz within restricted bands**

ASSIGNED FREQUENCY: 902 - 928 MHz  
 INVESTIGATED FREQUENCY RANGE: 1000 - 9500 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: LoRa (500 kHz)  
 BIT RATE: 1.5 kbps  
 TRANSMITTER OUTPUT POWER: 19.21 dBm at low carrier frequency  
 19.05 dBm at mid carrier frequency  
 18.73 dBm at high carrier frequency

DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide

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**	
Low carrier frequency											
2709	V	1.0	10	48.62	74	-25.38	48.62	NA	54	-5.38	Pass
3612	V	2.1	10	55.38	74	-18.62	49.67***	NA	54	-5.32	
4515	V	1.0	5	50.83	74	-23.17	50.83	NA	54	-3.17	
5418	V	1.0	-30	51.93	74	-22.07	51.93	NA	54	-2.07	
Mid carrier frequency											
2745	V	1.0	0	49.21	74	-24.79	49.21	NA	54	-4.79	Pass
3660	V	1.6	10	56.55	74	-17.45	50.44***	NA	54	-4.55	
4575	V	1.1	15	51.19	74	-22.81	51.19	NA	54	-2.81	
High carrier frequency											
2781	V	1.0	10	53.92	74	-20.08	53.92	NA	54	-0.08	Pass
3708	V	1.6	10	56.68	74	-17.32	52.04***	NA	54	-2.95	
4634	V	1.0	10	50.52	74	-23.48	50.52	NA	54	-3.48	

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

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

\*\*\* - Average field strength = SA reading + DC factor, where

$$\text{DC Factor} = 10 \times \log \left( \frac{1}{(T_{\text{xon}} / T_{\text{xon}} + T_{\text{xoff}})} \right) = 2.559 \text{ dB}$$

**Table 7.9.4 Average factor calculation**

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
NA	NA	NA	NA	NA	NA

\*- Average factor was calculated as follows

for pulse train shorter than 100 ms:

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

for pulse train longer than 100 ms:

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



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> 22-Dec-24 - 26-Dec-24			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.9.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY: 902 - 928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: LoRa (500 kHz)  
 BIT RATE: 1.5 kbps  
 TRANSMITTER OUTPUT POWER: 19.21 dBm at low carrier frequency  
 19.05 dBm at mid carrier frequency  
 18.73 dBm at high carrier frequency  
 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 polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Low carrier frequency								
No emissions were found								Pass
Mid carrier frequency								
No emissions were found								Pass
High carrier frequency								
No emissions were found								Pass

\*- Margin = Measured emission - specification limit.

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



HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Table 7.9.6 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 7.9.7 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 1915	HL 3903	HL 4114	HL 5288	HL 5902	HL 7585	HL 0446	
---------	---------	---------	---------	---------	---------	---------	--

Full description is given in Appendix A.

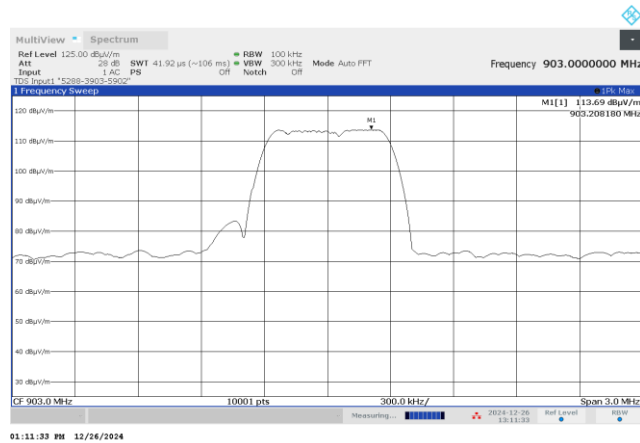


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

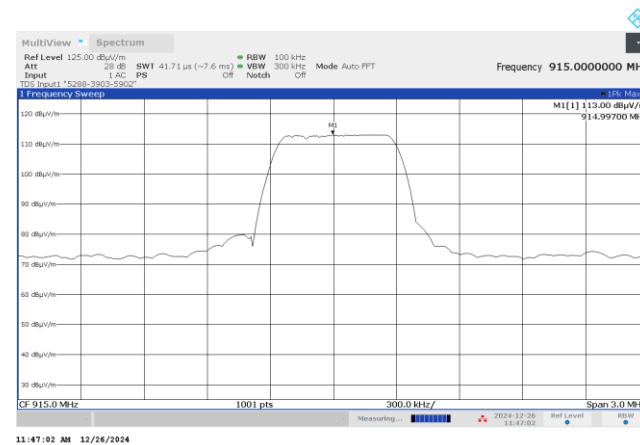
Plot 7.9.1 Radiated emission measurements at the low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.9.2 Radiated emission measurements at the mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



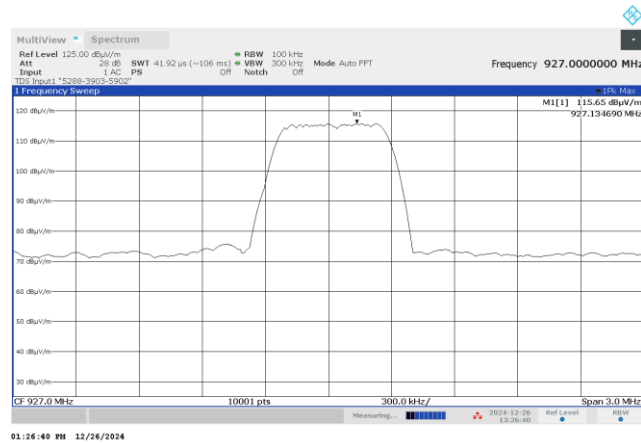


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

### Plot 7.9.3 Radiated emission measurements at the high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



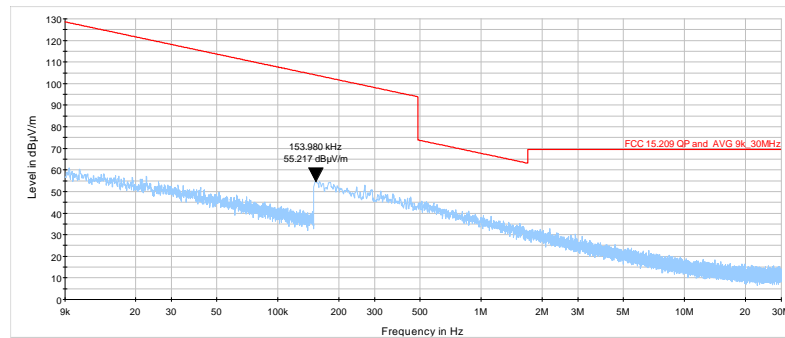


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

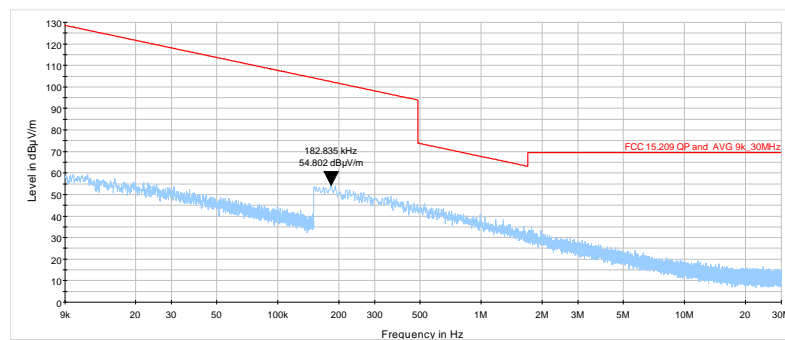
Plot 7.9.4 Radiated emission measurements from 9 kHz to 30 MHz at the low carrier frequency

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



Plot 7.9.5 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



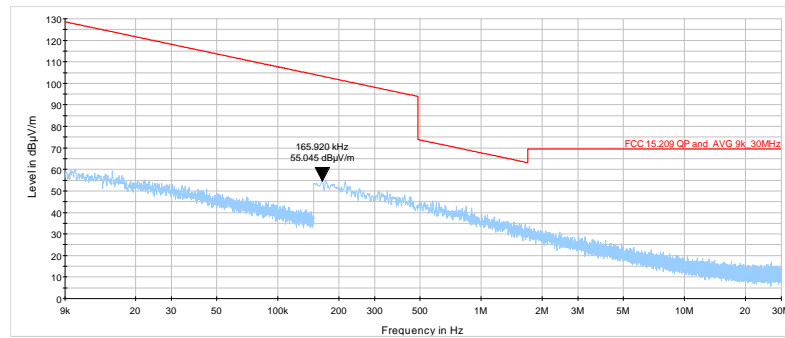


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.6 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



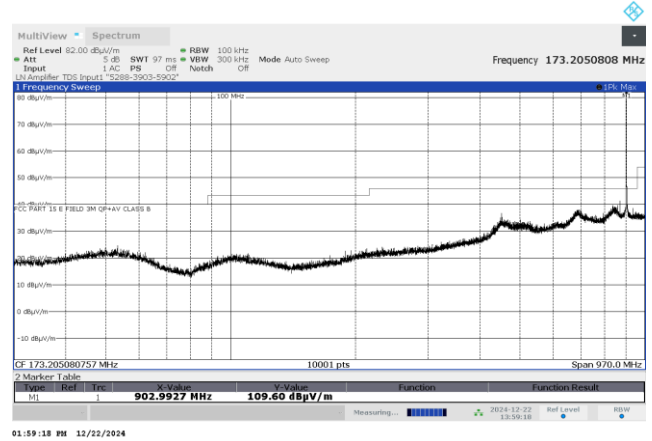
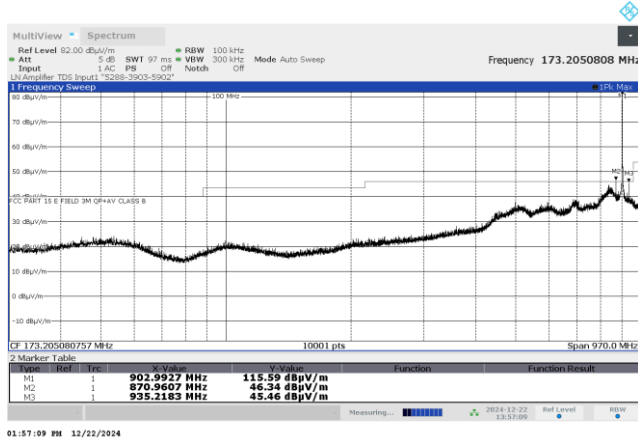


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

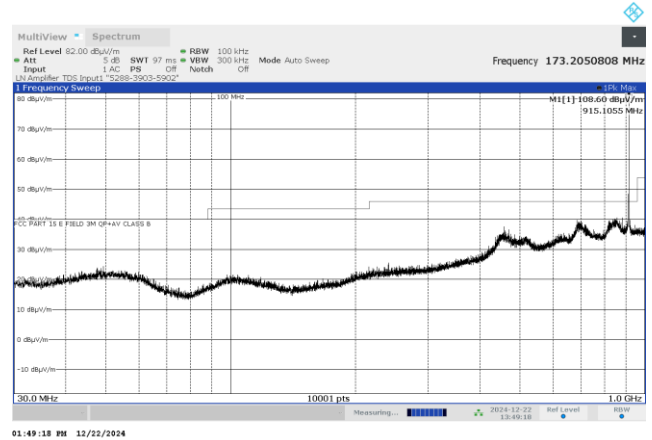
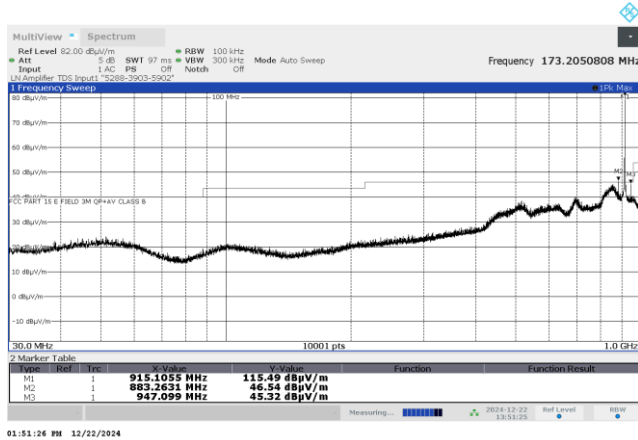
Plot 7.9.7 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

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



Plot 7.9.8 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





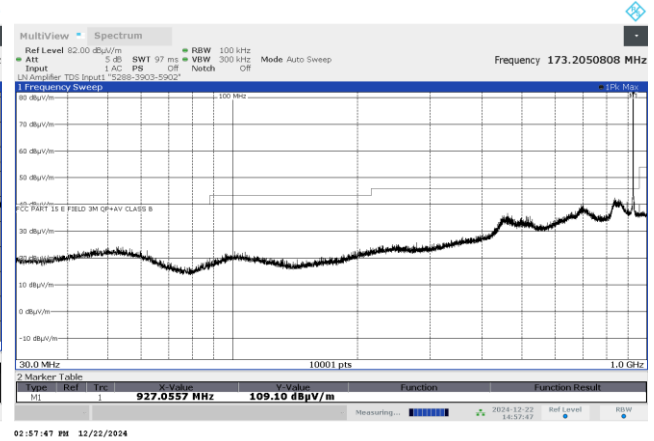
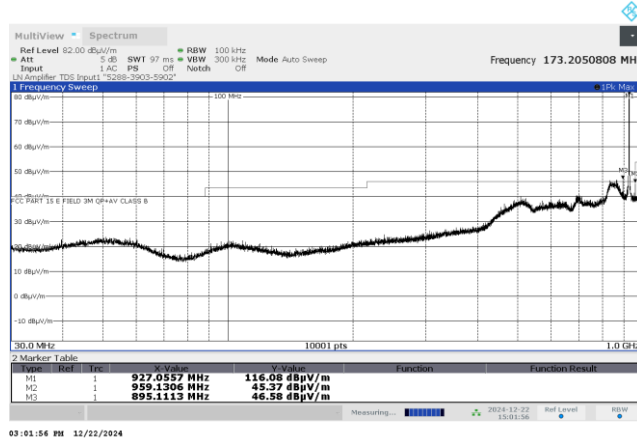


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.9 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



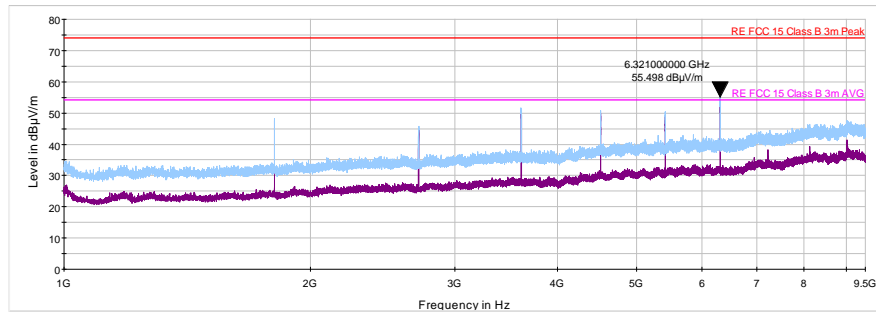


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

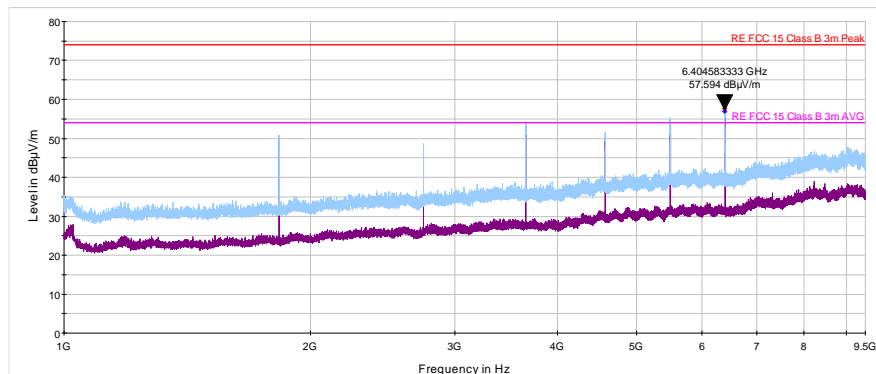
Plot 7.9.10 Radiated emission measurements from 1000 to 9500 MHz at the low carrier frequency

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



Plot 7.9.11 Radiated emission measurements from 1000 to 9500 MHz at the mid carrier frequency

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



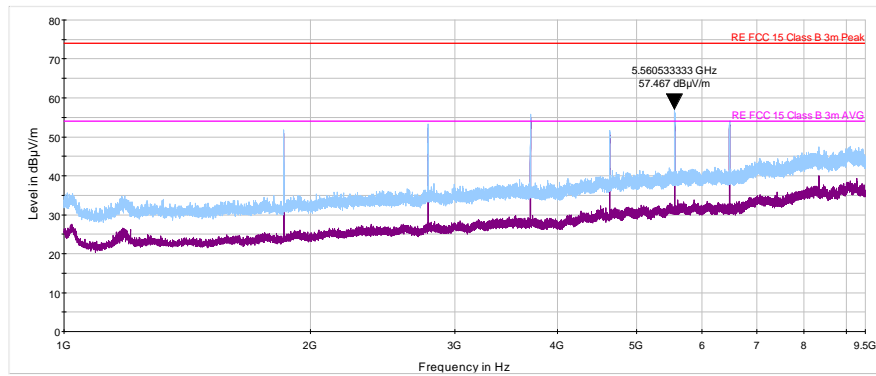


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.12 Radiated emission measurements from 1000 to 9500 MHz at the high carrier frequency

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





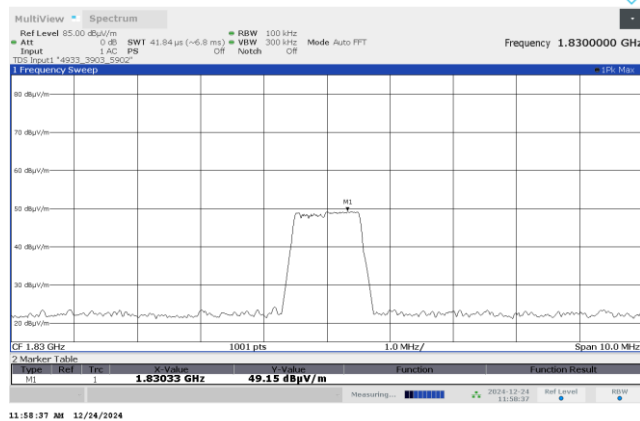
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

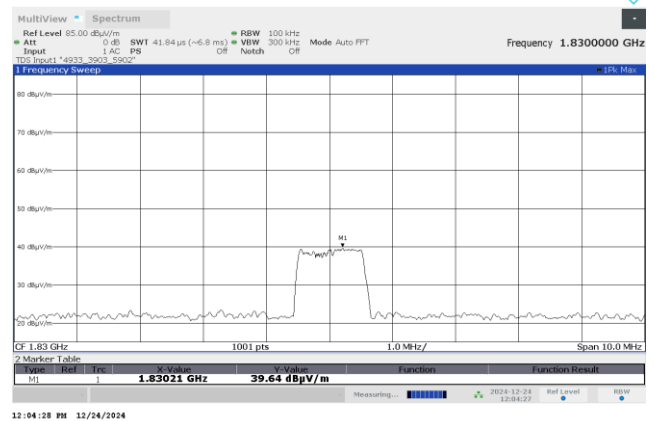
Plot 7.9.13 Radiated emission measurements at the second harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



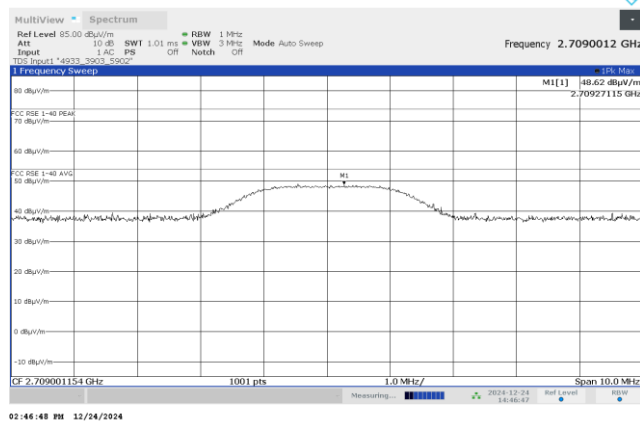
Horizontal polarization



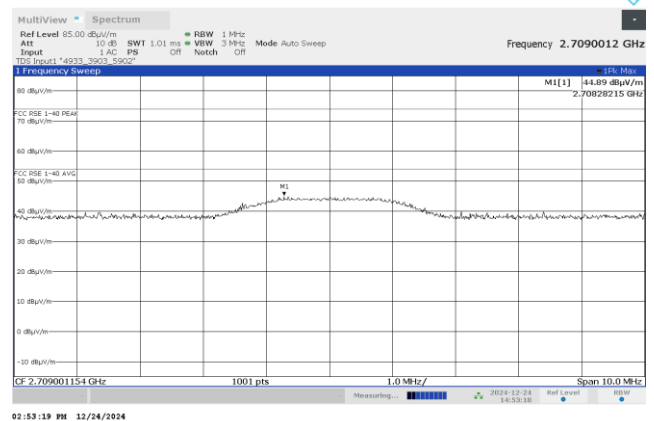
Plot 7.9.14 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



Horizontal polarization





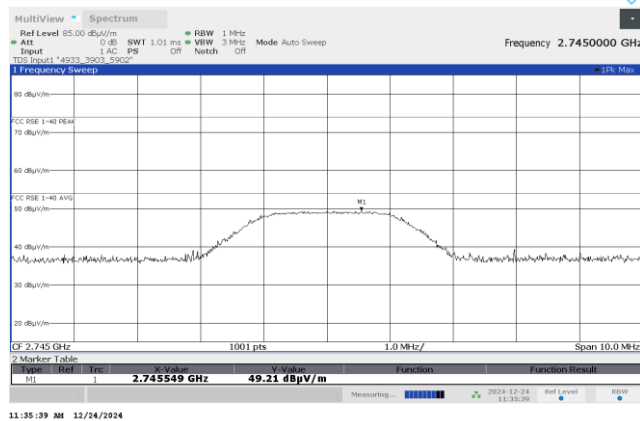
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

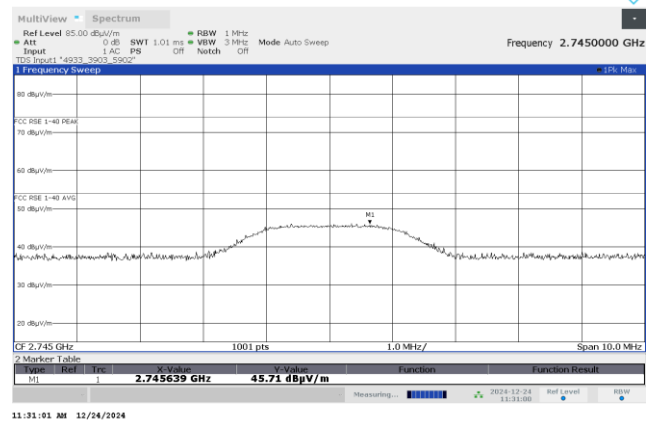
Plot 7.9.15 Radiated emission measurements at the third harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



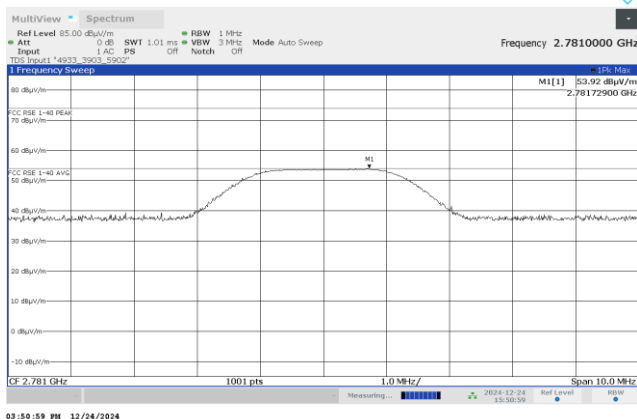
Horizontal polarization



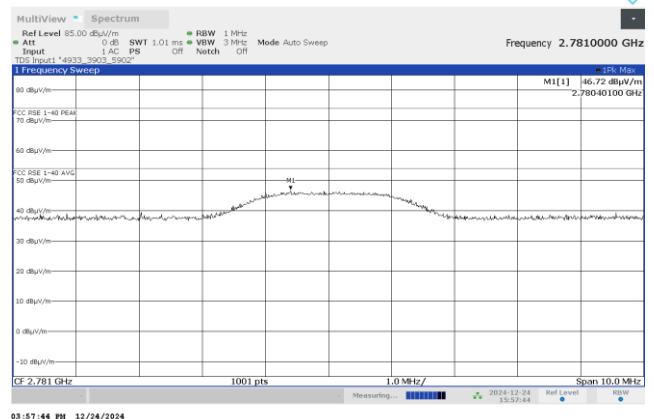
Plot 7.9.16 Radiated emission measurements at the third harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



Horizontal polarization





HERMON LABORATORIES

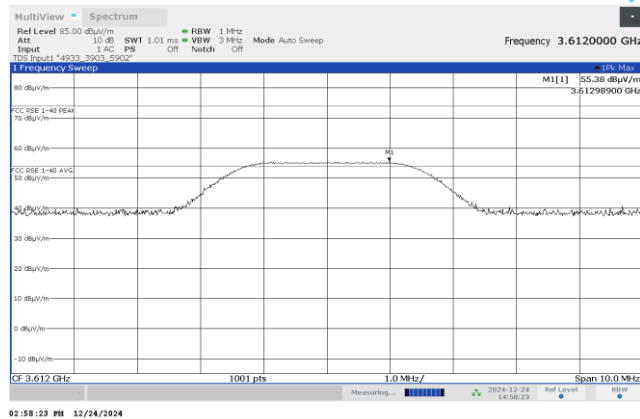
Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.17 Radiated emission measurements at the fourth harmonic of low carrier frequency

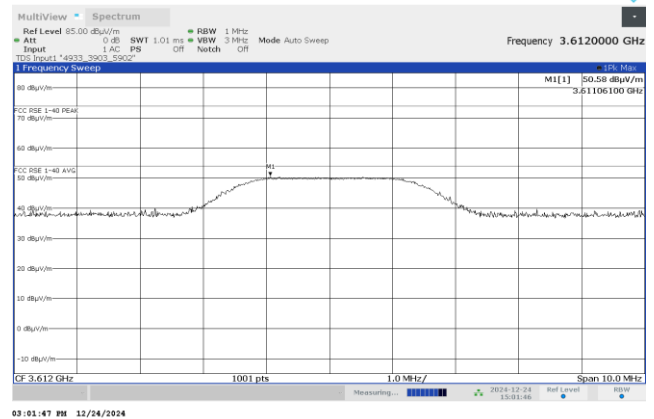
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization

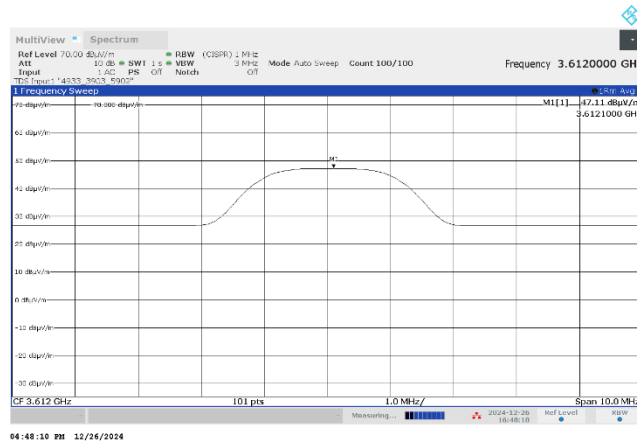
Horizontal polarization



02:58:23 PM 12/24/2024



03:01:47 PM 12/24/2024



04:48:10 PM 12/26/2024



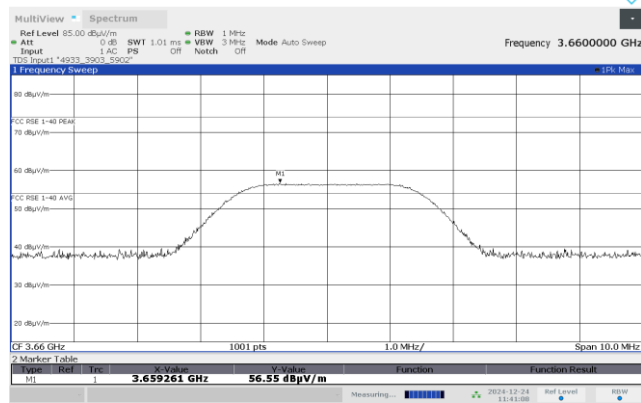
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.18 Radiated emission measurements at the fourth harmonic of mid carrier frequency

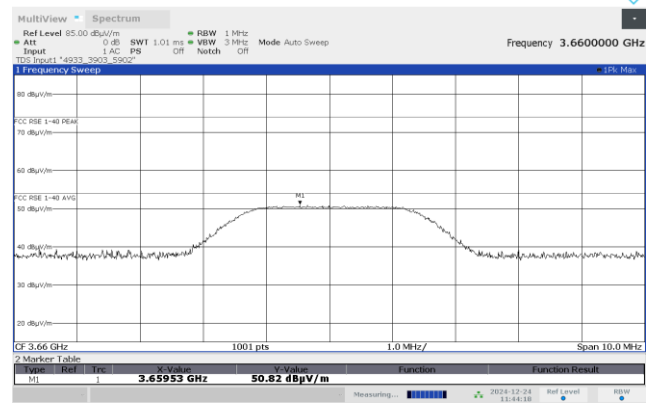
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization

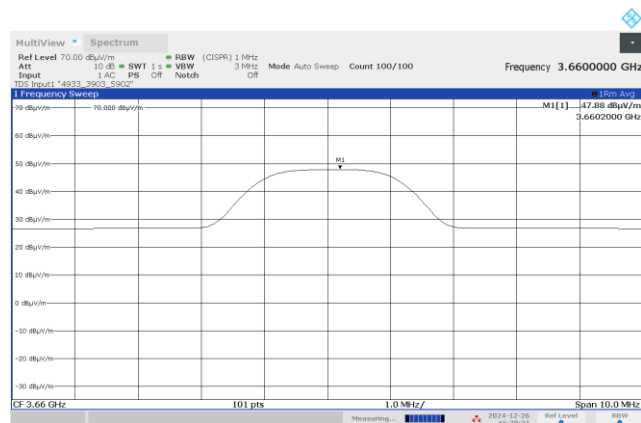


11:41:09 AM 12/24/2024

Horizontal polarization



11:44:19 AM 12/24/2024



04:38:21 PM 12/24/2024



HERMON LABORATORIES

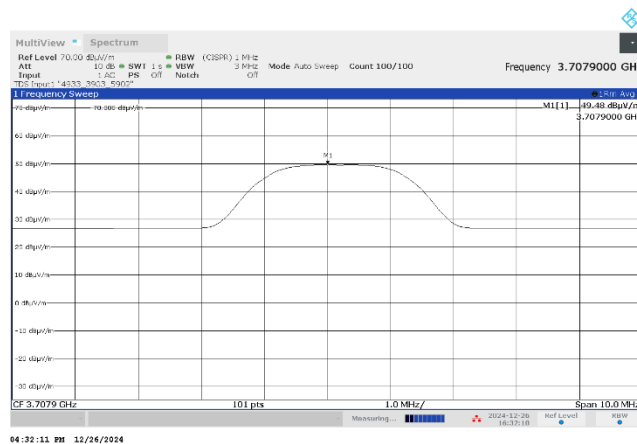
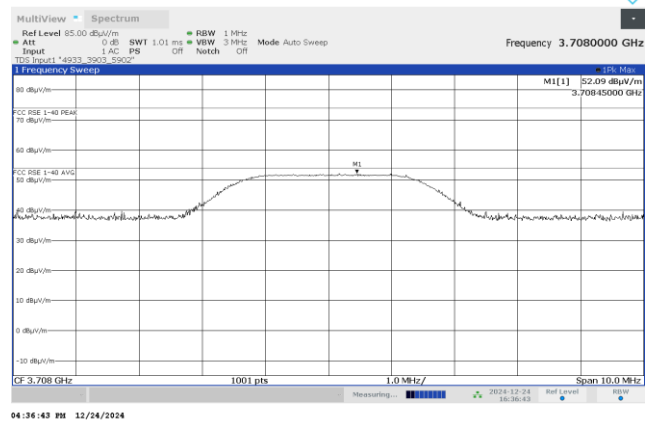
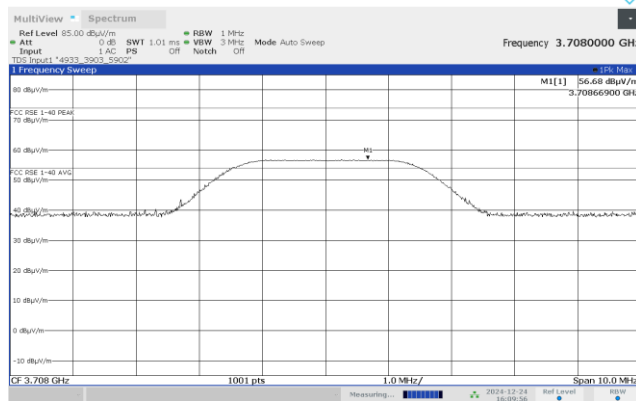
Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.19 Radiated emission measurements at the fourth harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization

Horizontal polarization







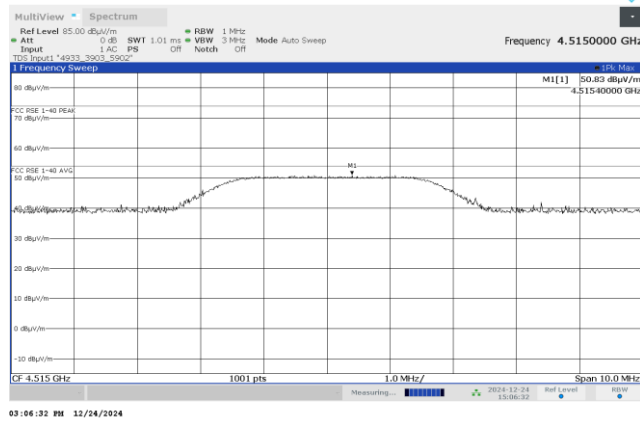
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

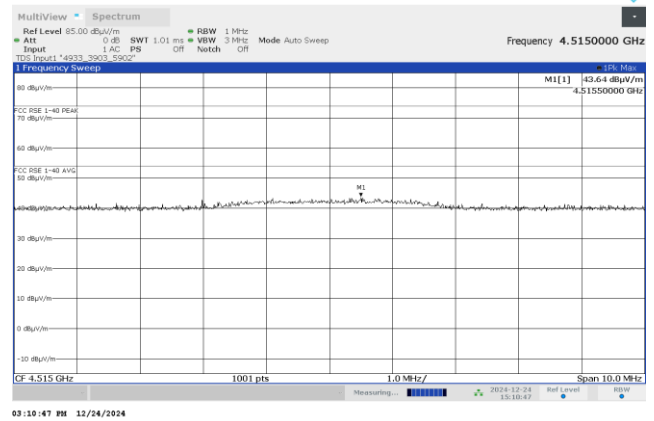
Plot 7.9.20 Radiated emission measurements at the fifth harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



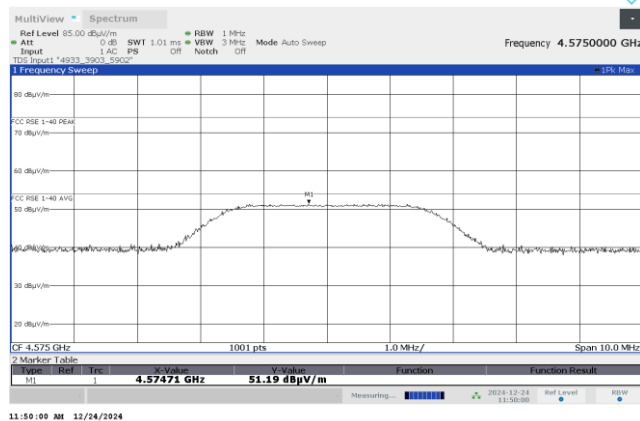
Horizontal polarization



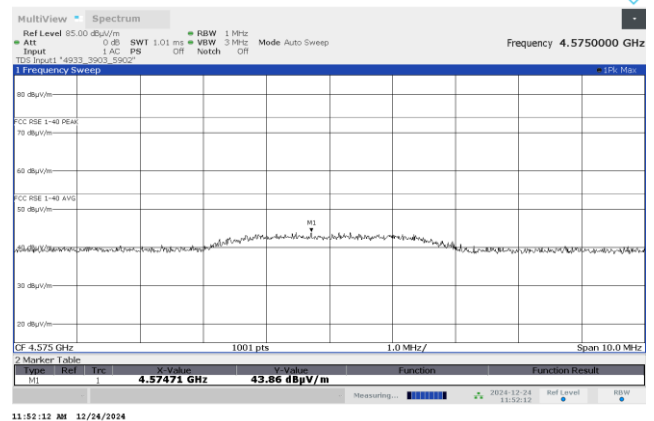
Plot 7.9.21 Radiated emission measurements at the fifth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



Horizontal polarization





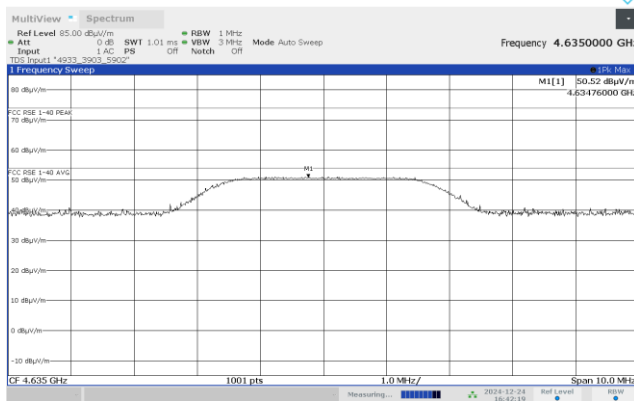
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.22 Radiated emission measurements at the fifth harmonic of high carrier frequency

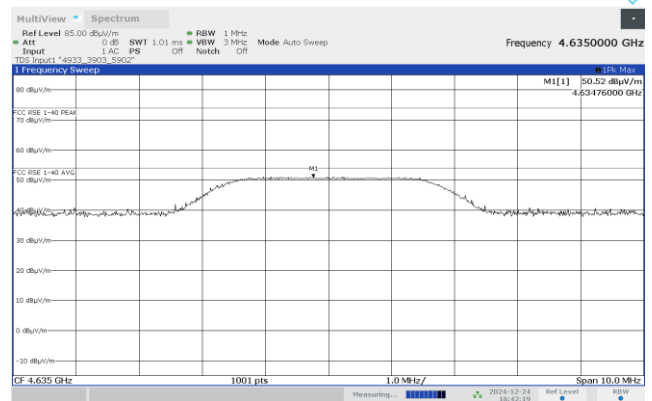
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



04:42:20 PM 12/24/2024

Horizontal polarization

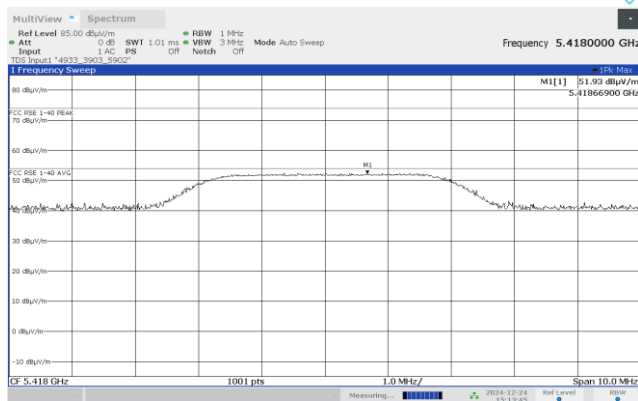


04:42:20 PM 12/24/2024

Plot 7.9.23 Radiated emission measurements at the sixth harmonic of low carrier frequency

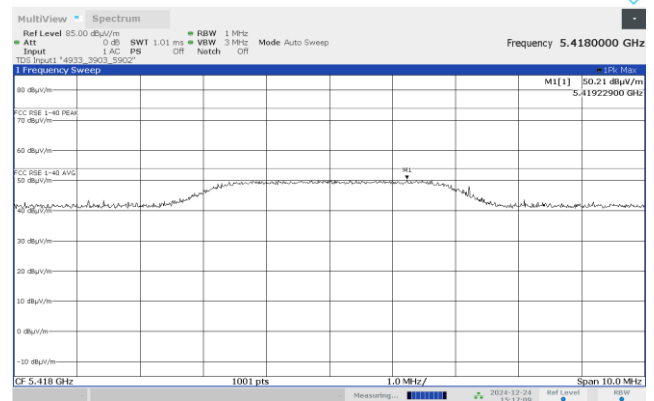
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



03:13:46 PM 12/24/2024

Horizontal polarization



03:17:10 PM 12/24/2024



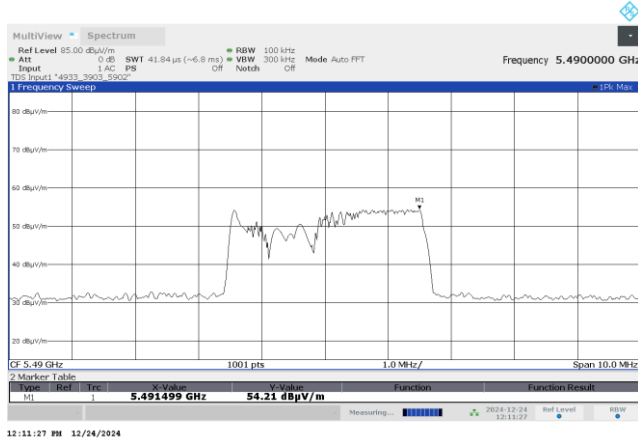
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

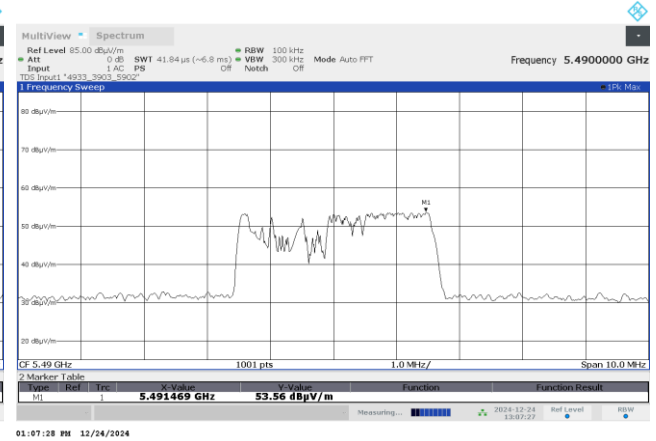
Plot 7.9.24 Radiated emission measurements at the sixth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



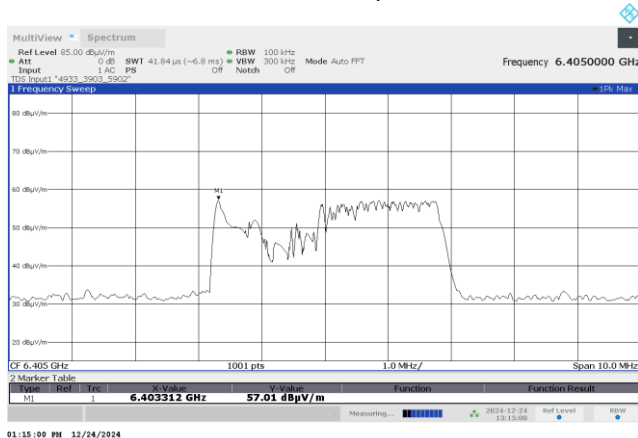
Horizontal polarization



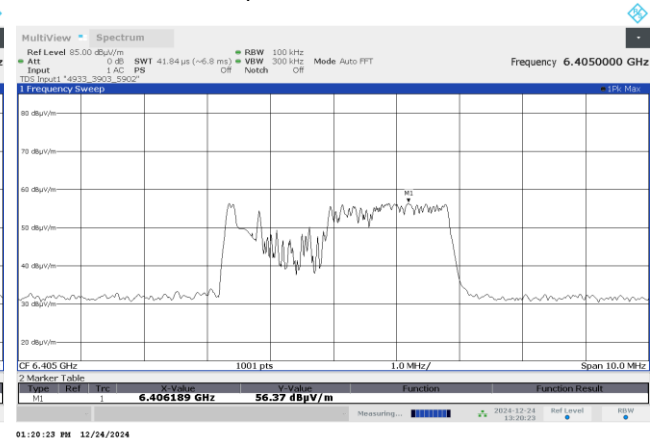
Plot 7.9.25 Radiated emission measurements at the seventh harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

Vertical polarization



Horizontal polarization

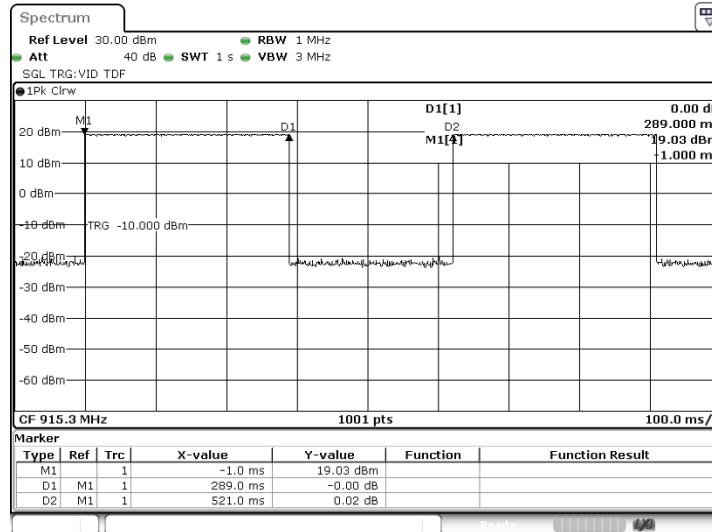




HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Dec-24 - 26-Dec-24			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.26 Transmission pulse duration and period



Date: 14.JAN.2025 11:47:25



<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> 02-Feb-25 - 24-Feb-25			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.10 Field strength of spurious emissions at 2GFSK modulation

### 7.10.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.10.1.

Table 7.10.1 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**	30.0
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:

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

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.

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

7.10.2.1 The EUT was set up as shown in Figure 7.10.1, energized and the performance check was conducted.

7.10.2.2 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.

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

### 7.10.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.10.3.1 The EUT was set up as shown in Figure 7.10.2, Figure 7.10.3, energized and the performance check was conducted.

7.10.3.2 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.

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



<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> 02-Feb-25 - 24-Feb-25			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.10.1 Setup for spurious emission field strength measurements below 30 MHz

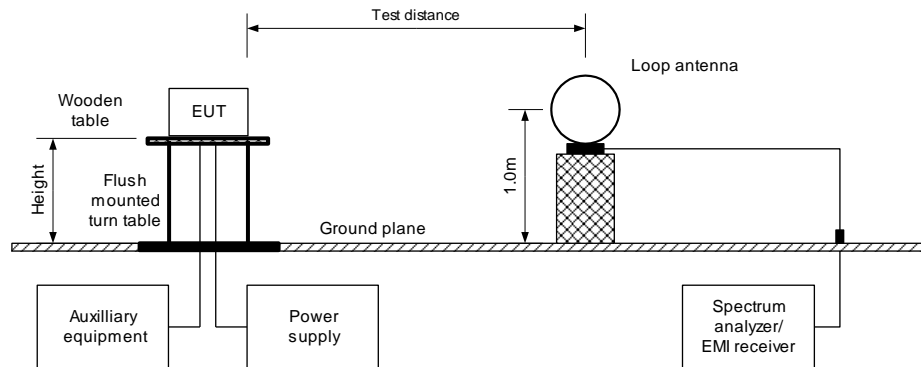
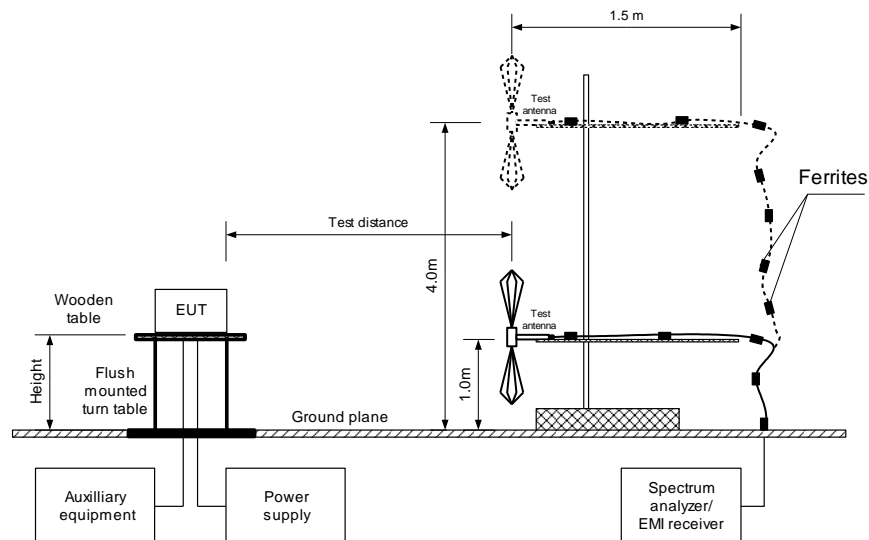


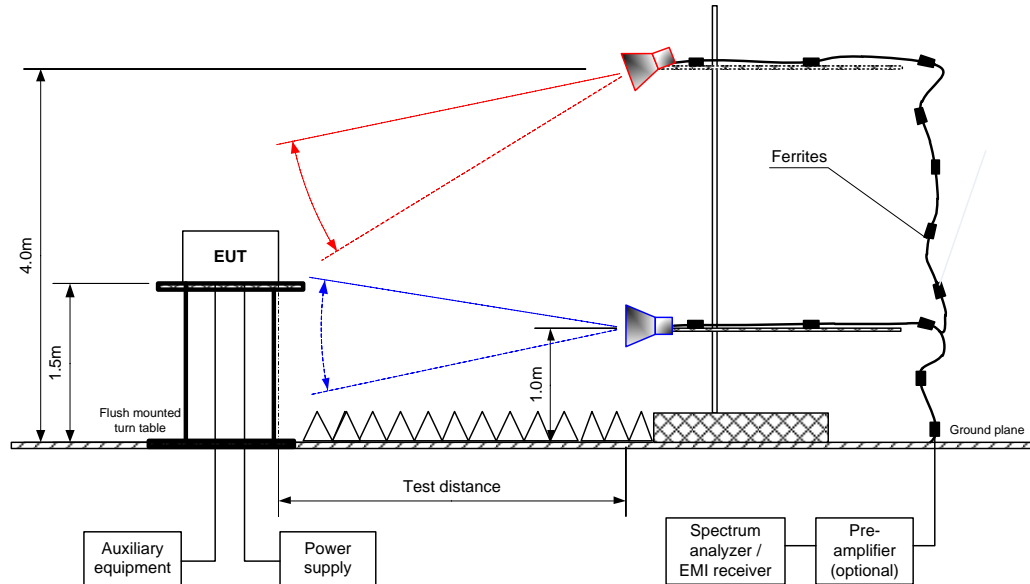
Figure 7.10.2 Setup for spurious emission field strength measurements in 30 -1000 MHz





<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> 02-Feb-25 - 24-Feb-25			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.10.3 Setup for spurious emission field strength measurements above 1000 MHz





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> 02-Feb-25 - 24-Feb-25			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.10.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY: 902 - 928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 9500 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: 2GFSK  
 BIT RATE: 50 kbps  
 TRANSMITTER OUTPUT POWER: 12.71 dBm at low carrier frequency  
 13.27 dBm at mid carrier frequency  
 12.71 dBm at high carrier frequency

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)

Double ridged guide (above 1000 MHz)									
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
Low carrier frequency									
813.492	44.55	Vertical	1.00	180	110.20	65.65	30.0	35.65	Pass
698.158	37.16	Vertical	1.00	50		73.04		43.04	
1806.420	39.33	Horizontal	1.00	60		70.87		40.87	
6318.820	46.71	Horizontal	1.00	110		63.49		33.49	
Mid carrier frequency									
467.672	35.00	Vertical	1.00	75	111.03	75.03	30.0	45.03	Pass
828.946	48.66	Vertical	1.00	120		61.37		31.37	
1830.000	46.02	Vertical	1.00	180		64.01		34.01	
5492.000	46.67	Vertical	1.00	90		63.36		33.36	
6402.900	52.84	Vertical	1.00	80		57.19		27.19	
High carrier frequency									
469.747	37.62	Vertical	1.00	130	110.52	72.90	30.0	42.90	Pass
838.888	49.39	Vertical	1.00	180		61.13		31.13	
1854.420	44.53	Vertical	1.00	90		65.99		35.99	
5560.230	48.10	Vertical	1.00	60		62.42		32.42	
6487.110	42.77	Vertical	1.00	60		67.75		37.75	

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

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





<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> 02-Feb-25 - 24-Feb-25			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.10.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY: 902 - 928 MHz  
 INVESTIGATED FREQUENCY RANGE: 1000 - 9500 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: 2-GFSK  
 BIT RATE: 50 kbps  
 TRANSMITTER OUTPUT POWER: 12.71 dBm at low carrier frequency  
 13.27 dBm at mid carrier frequency  
 12.71 dBm at high carrier frequency

DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide

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**	
Low carrier frequency											
No emissions were found											Pass
Mid carrier frequency											
2745.000	Vertical	1.00	-175	44.07	74.00	-29.93	44.07	NA	54.00	-9.93	Pass
3660.093	Vertical	1.00	-5	46.11	74.00	-27.89	46.11	NA	54.00	-7.89	
4573.541	Vertical	1.00	0	46.22	74.00	-27.78	46.22	NA	54.00	-7.78	
High carrier frequency											
No emissions were found											Pass

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

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

Table 7.10.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
27.6	387.0	N/A	N/A	N/A	-11.181

\*- Average factor was calculated as follows

for pulse train shorter than 100 ms:

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

for pulse train longer than 100 ms:

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



<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> 02-Feb-25 - 24-Feb-25			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.10.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY: 902 - 928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: 2 GFSK  
 BIT RATE: 50 kbps  
 TRANSMITTER OUTPUT POWER: 12.71 dBm at low carrier frequency  
 13.27 dBm at mid carrier frequency  
 12.71 dBm at high carrier frequency  
 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 polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Low carrier frequency								
No emissions were found								Pass
Mid carrier frequency								
No emissions were found								Pass
High carrier frequency								
No emissions were found								Pass

\*- Margin = Measured emission - specification limit.

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



HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

Table 7.10.6 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 7.10.7 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 1915	HL 3903	HL 4114	HL 5288	HL 5902	HL 7585	HL0446	
---------	---------	---------	---------	---------	---------	--------	--

Full description is given in Appendix A.

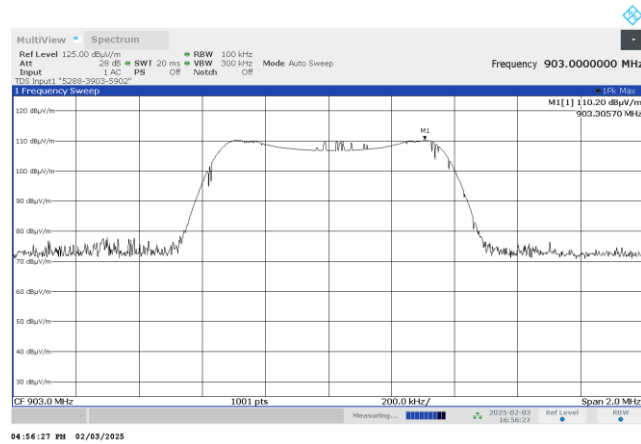


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

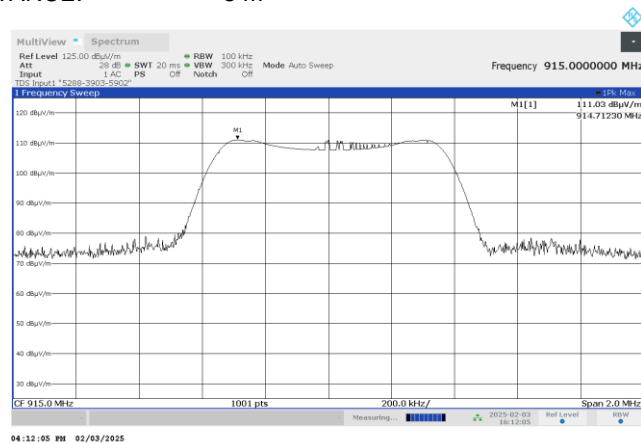
Plot 7.10.1 Radiated emission measurements at the low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.10.2 Radiated emission measurements at the mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



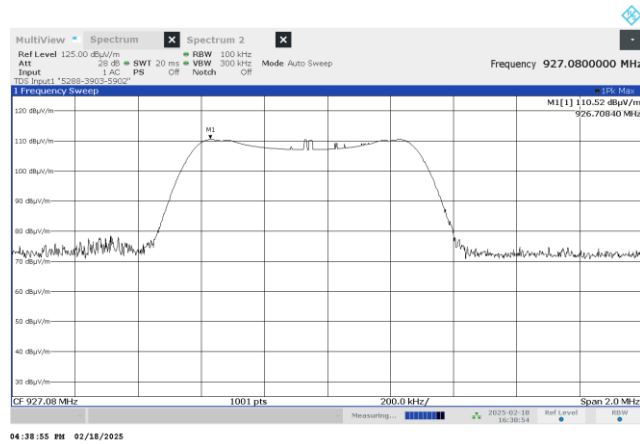


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.10.3 Radiated emission measurements at the high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



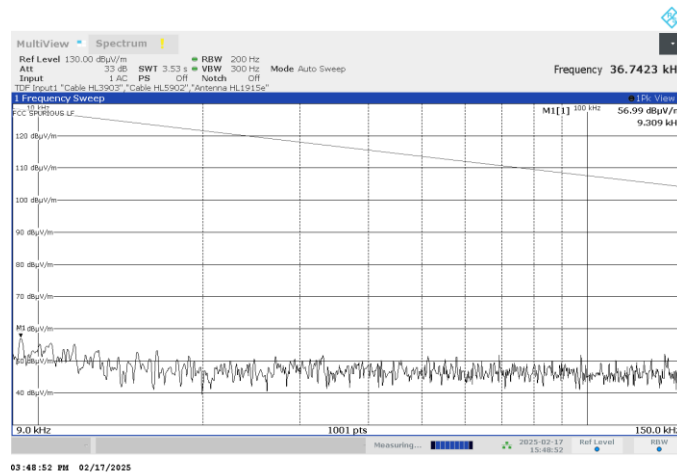


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

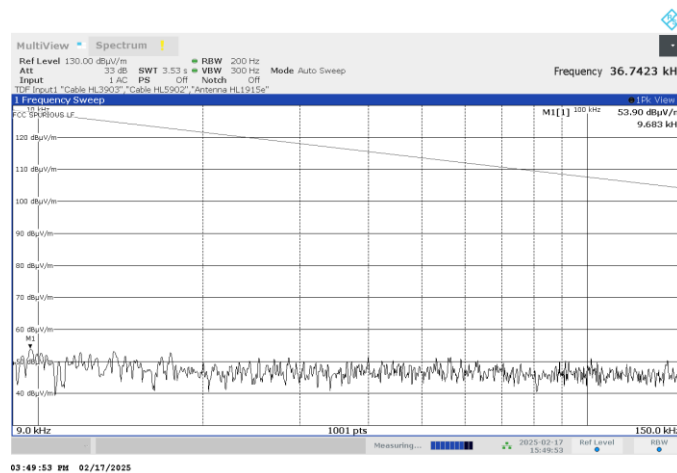
Plot 7.10.4 Radiated emission measurements from 9 kHz to 150 kHz at the low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.10.5 Radiated emission measurements from 9 kHz to 150 kHz at the mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



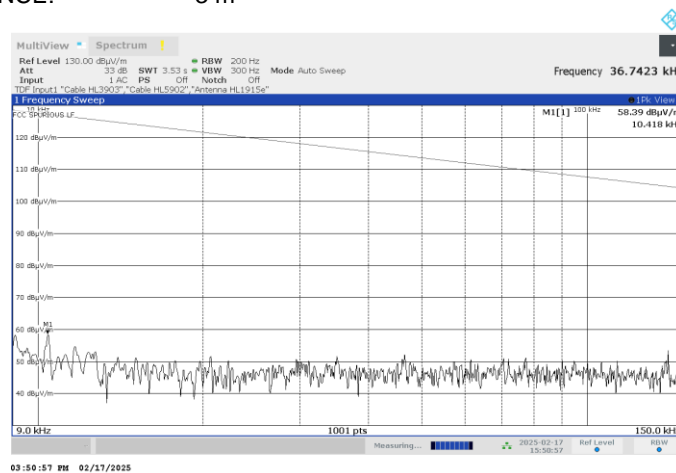


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

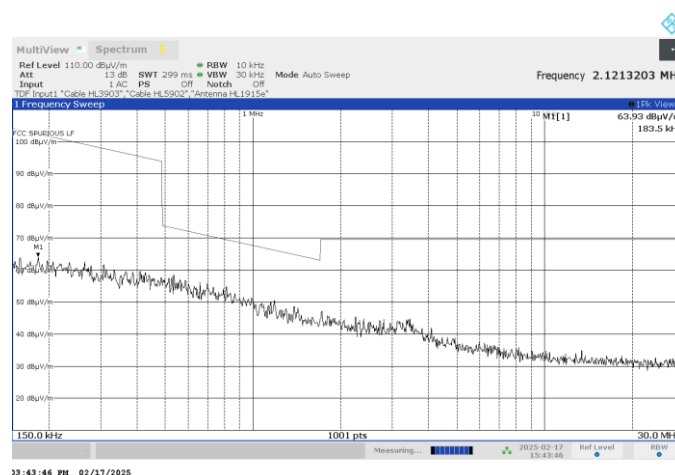
Plot 7.10.6 Radiated emission measurements from 9 kHz to 150 kHz at the high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.10.7 Radiated emission measurements from 150 kHz to 30 MHz at the low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



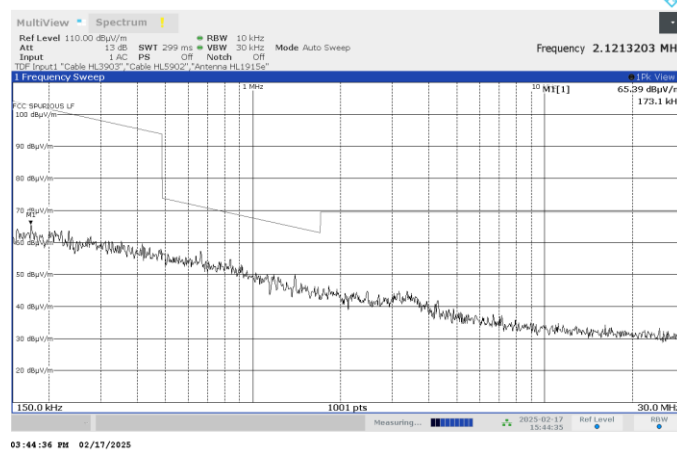


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

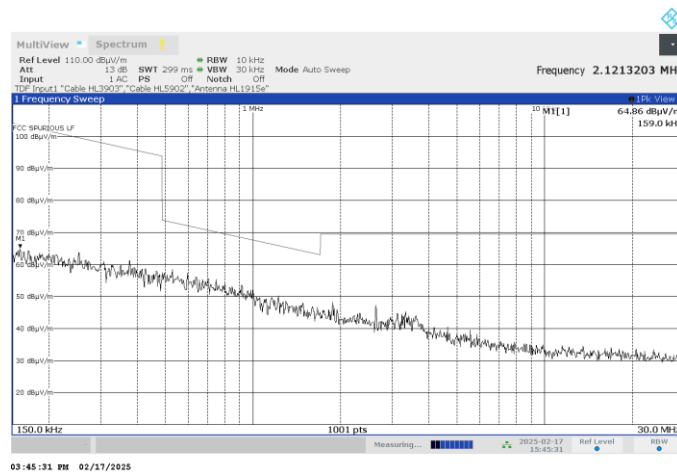
Plot 7.10.8 Radiated emission measurements from 150 kHz to 30 MHz at the mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.10.9 Radiated emission measurements from 150 kHz to 30 MHz at the high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m





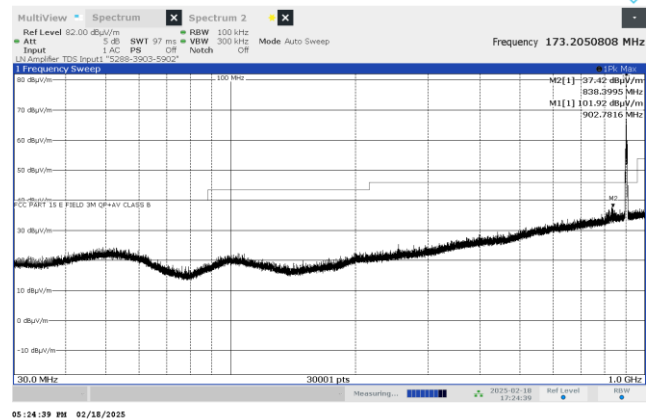
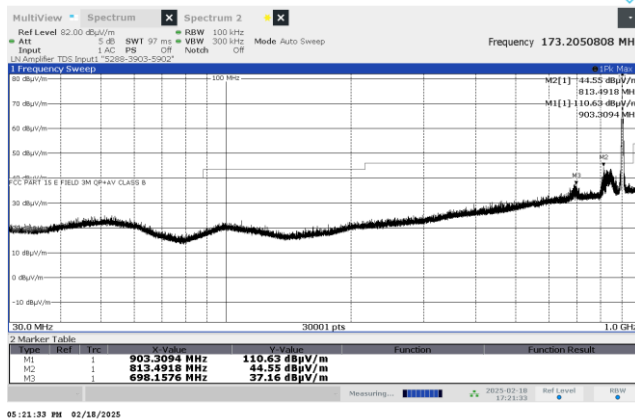


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

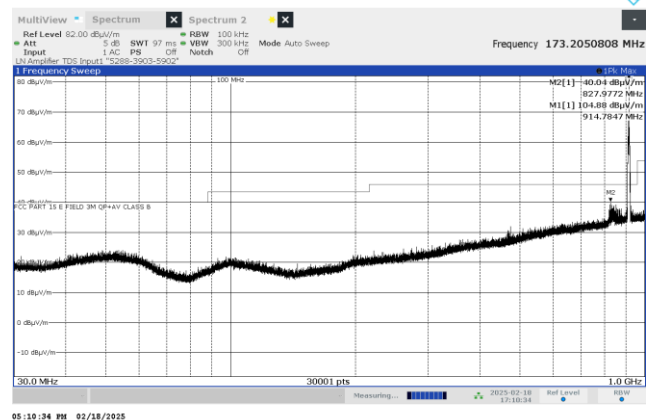
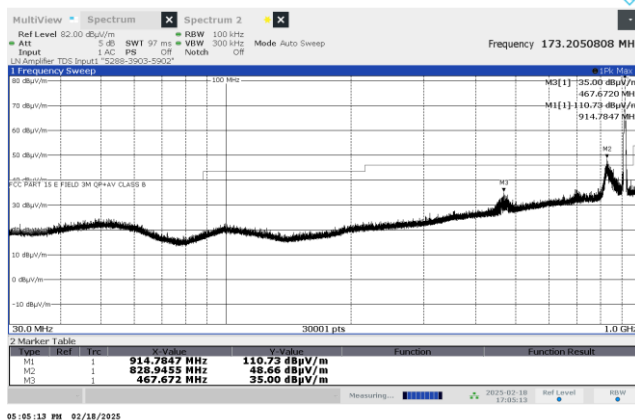
Plot 7.10.10 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

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



Plot 7.10.11 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



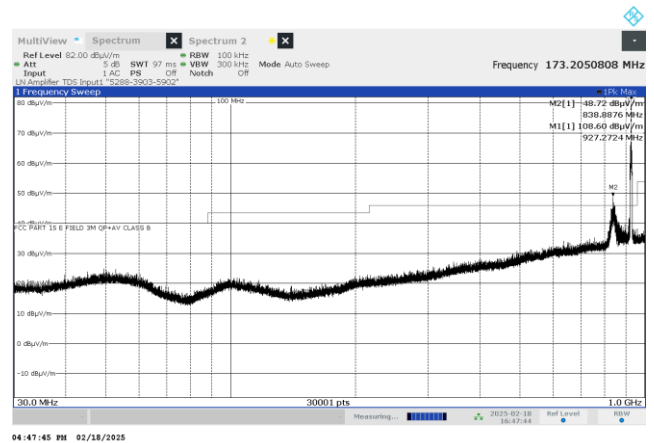
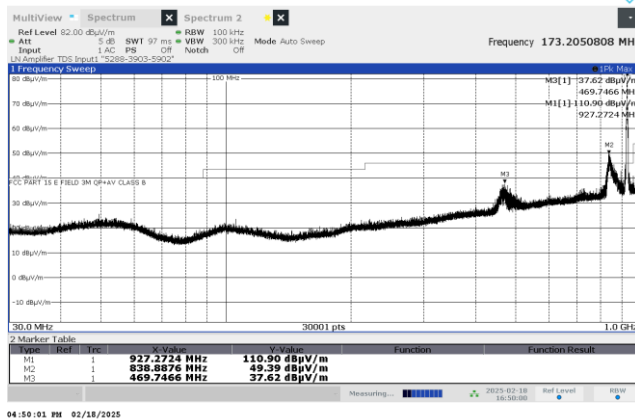


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.10.12 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



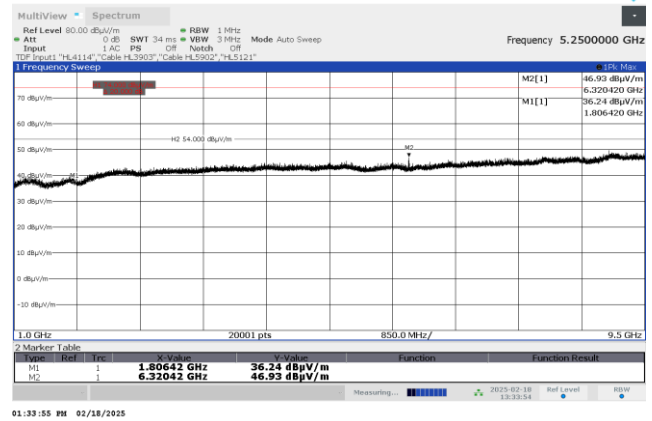
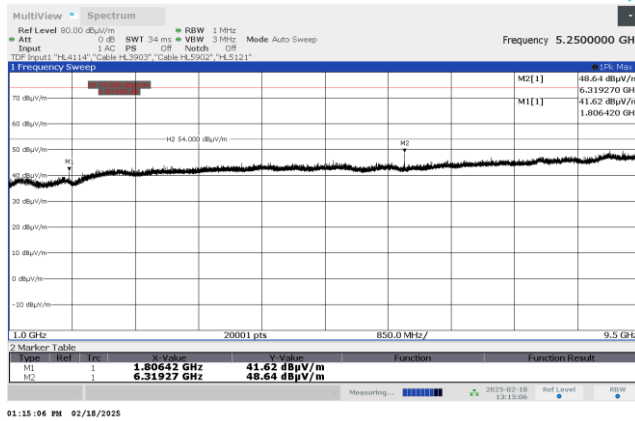


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

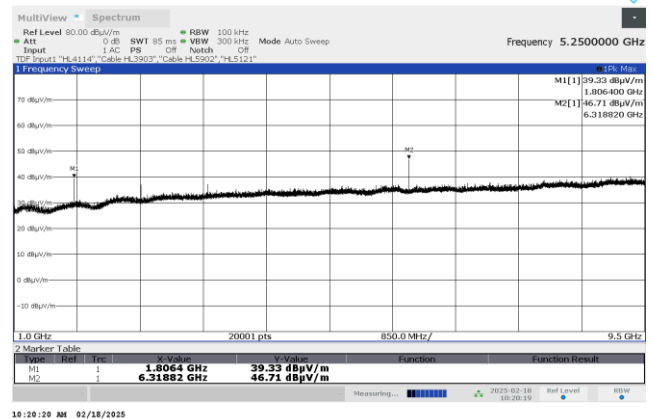
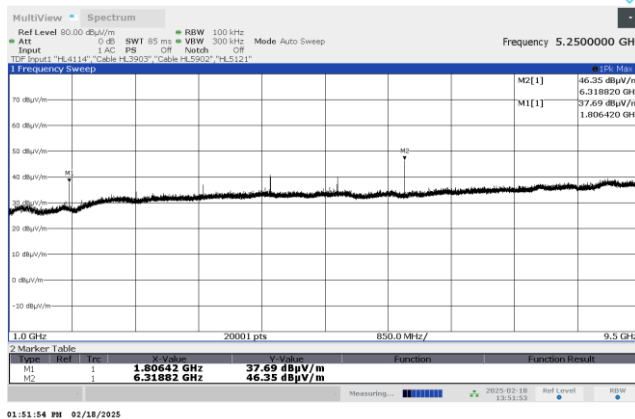
Plot 7.10.13 Radiated emission measurements from 1000 to 9500 MHz at the low carrier frequency

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



Plot 7.10.14 Radiated emission measurements from 1000 to 9500 MHz at the low carrier frequency (100 kHz RBW – Out of restricted band emissions)

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



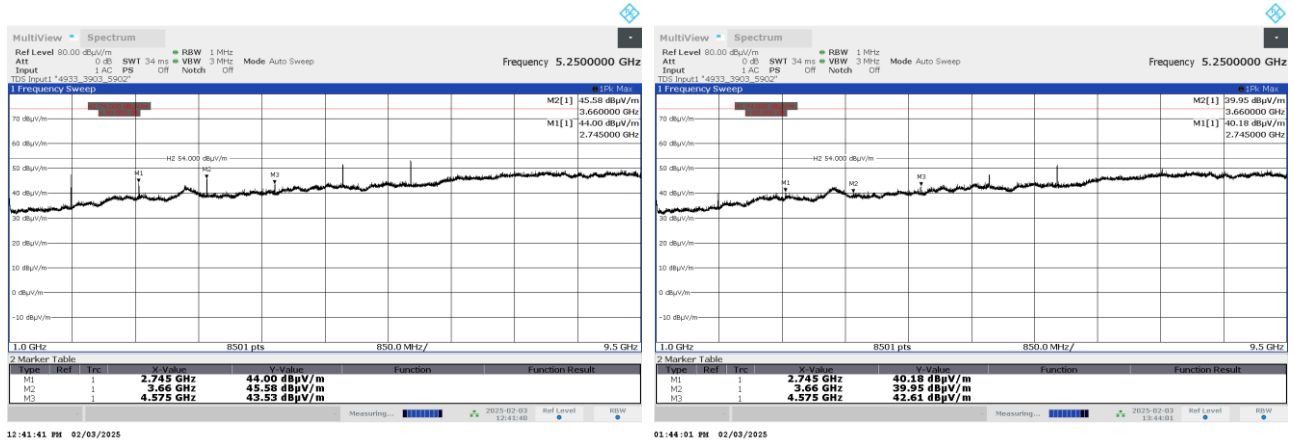


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

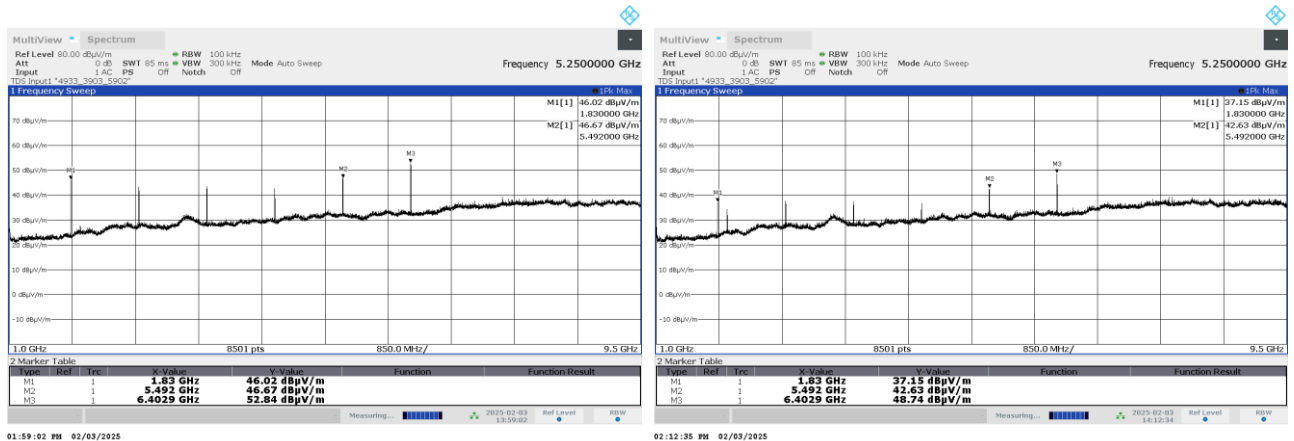
Plot 7.10.15 Radiated emission measurements from 1000 to 9500 MHz at the mid carrier frequency

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



Plot 7.10.16 Radiated emission measurements from 1000 to 9500 MHz at the mid carrier frequency (100 kHz RBW – Out of restricted band emissions)

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



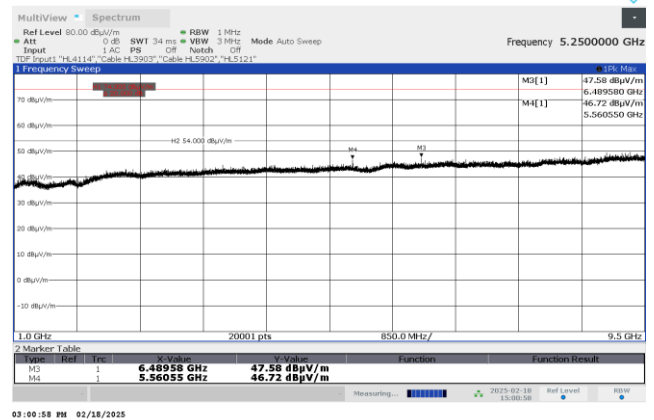
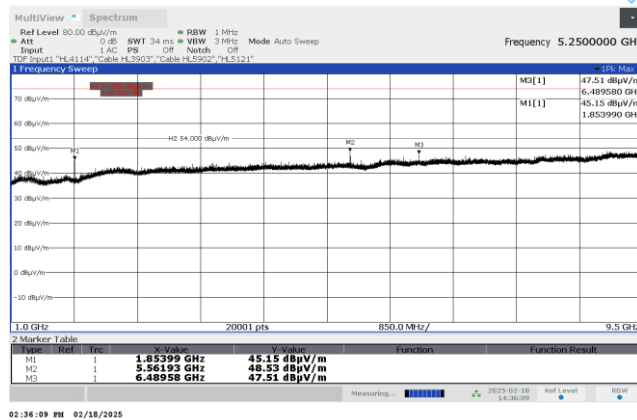


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

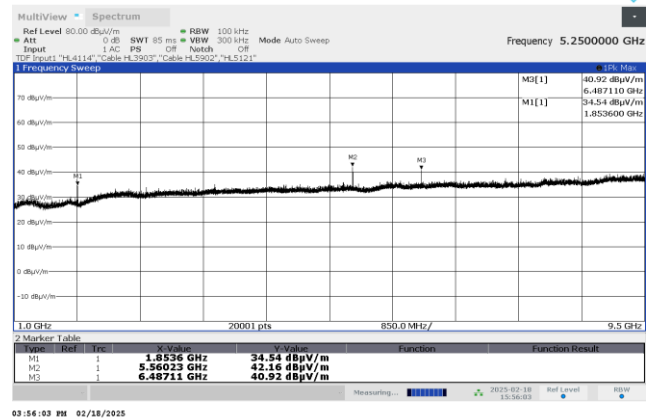
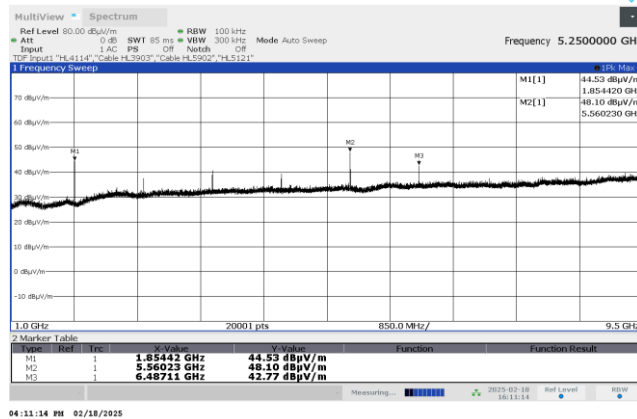
Plot 7.10.17 Radiated emission measurements from 1000 to 9500 MHz at the high carrier frequency

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



Plot 7.10.18 Radiated emission measurements from 1000 to 9500 MHz at the high carrier frequency (100 kHz RBW – Out of restricted band emissions)

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



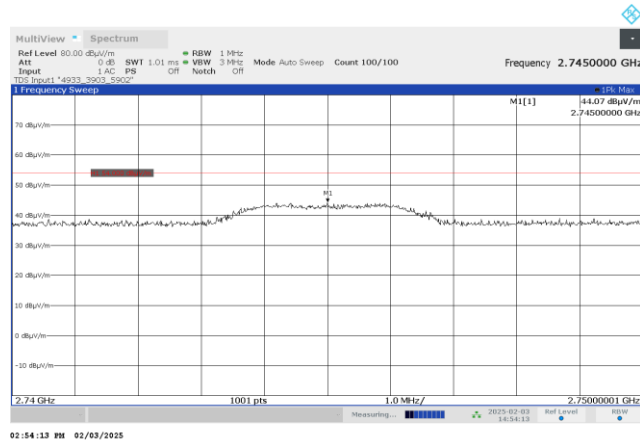


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

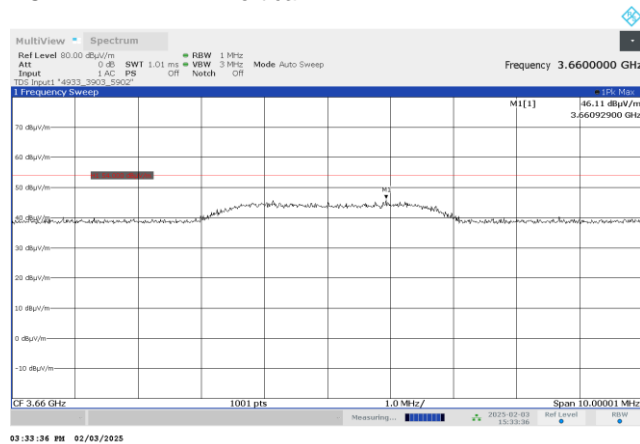
Plot 7.10.19 Radiated emission measurements at the third harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
POLARIZATION: Vertical



Plot 7.10.20 Radiated emission measurements at the fourth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
POLARIZATION: Vertical



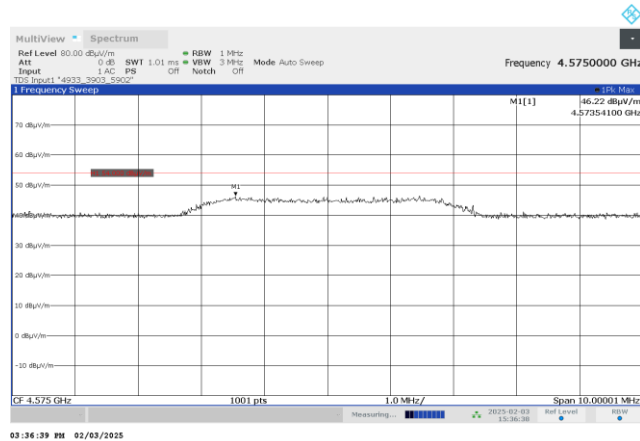


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10 section 11.12.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Feb-25 - 24-Feb-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1019 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.10.21 Radiated emission measurements at the fifth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
POLARIZATION: Vertical









<b>Test specification:</b> Section 15.203 / RSS-Gen section 6.8, Antenna requirement			
<b>Test procedure:</b> Visual inspection		<b>Verdict:</b> PASS	
<b>Test mode:</b> Compliance			
<b>Date(s):</b> 10-Feb-25			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 45 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.11 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 7.11.1.

Table 7.11.1 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	

## 8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal/ Check	Due Cal/ Check
1915	Antenna, Loop, Active Receiving, 1 kHz - 30 MHz	EMC Test Systems	6507	1457	29-Feb-24	28-Feb-25
3230	Multimeter	Fluke	115C	94173028	14-Aug-24	14-Aug-25
3440	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	05-Aug-24	05-Aug-25
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1226/2A	06-May-24	06-May-25
4114	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz	ETS Lindgren	3117	00123515	27-Oct-24	27-Oct-25
4135	Shield Box	TESCOM CO., LTD	TC-5916A	5916A000 136	20-May-24	20-May-25
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	101630	19-Jun-24	19-Jun-25
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	24-Mar-22	24-Mar-25
5376	EXA Signal Analyzer, 10 Hz - 32 GHz	Keysight Technologies	N9010B	MY574704 04	06-Jan-25	06-Jan-26
5611	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini Circuits	BW-S10W5+	NA	11-Mar-24	11-Mar-25
5636	Cable, 50 Ohm, DC to 18 GHz, 1.8 m, SMA/SMA	Mini Circuits	CBL-6FT-SMSM+	NA	17-Nov-24	17-Nov-25
5642	Cable, 50 Ohm, DC to 18 GHz, 1.8 m, SMA/SMA	Mini Circuits	CBL-6FT-SMSM+	NA	29-Jul-24	29-Jul-25
5644	Cable, 50 Ohm, DC to 18 GHz, 1.8 m, SMA/SMA	Mini Circuits	CBL-6FT-SMSM+	NA	06-May-24	06-May-25
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/ 11N/11N/ 6000	NA	17-Nov-24	17-Nov-25
5933	Thermometer Hygrometer , (0 to +50) deg., (20-95) % RH	Kkmoon	Dyimore	NA	15-May-24	15-May-25
7523	Programmable DC Power Supplies, 48VDC/38A	TDK-Lambda Ltd	GEN40-38	LOC-823A277-0004	13-Mar-24	13-Mar-25
7546	Power supply 60VDC/12.5A	Agilent Technologies	N5747A	US25F676 2C	29-May-24	29-May-25
7585	EMI Test Receiver, 1 Hz to 44 GHz	Rohde & Schwarz	ESW44	103130	24-Sep-24	24-Sep-25

## 9 APPENDIX B Test equipment correction factors

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

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

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

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

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

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

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

The antenna factor shall be added to receiver reading in dB $\mu$ 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.

## 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 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

## 12 APPENDIX D

### Specification references

FCC 47CFR part 15: 2023

ANSI C63.10: 2013

RSS-247 Issue 3: 2023

RSS-Gen Issue 5  
with\_amendment\_1\_2: 2021

Radio Frequency Devices

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

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices

General Requirements and Information for the Certification of Radiocommunication Equipment

## 13 APPENDIX E Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
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
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