

TEST REPORT

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

FOR:

ARAD TECHNOLOGIES

AT57-7

Models:

AT57-7-21-5-P-1, AT57-7-22-5-P-1, AT57-7-1-13-P-1,

AT57-7-21-5-OM-1, AT57-7-22-5-OM-1, AT57-7-1-13-OM-1,

AT57-7-23-17-S-1, AT57-7-2-11-S-1, AT57-7-2-25-S-1

FCC ID: 2A7AA-SON2LR30DB

IC: 28664-SON2LR30DB

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.
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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.....	6
6.1	General information.....	6
6.2	Test configuration.....	6
6.3	Transmitter characteristics	7
7	Transmitter tests according to 47CFR part 15 subpart C and RSS-247 requirements.....	8
7.1	20 dB bandwidth	8
7.2	Carrier frequency separation	13
7.3	Number of hopping frequencies	15
7.4	Average time of occupancy	17
7.5	Peak output power	20
7.6	Peak output power at AT57-7-22-5-OM-1	26
7.7	Peak output power at AT57-7-23-17-S-1.....	32
7.8	Peak spectral power density	37
7.9	Field strength of spurious emissions	42
7.10	Band edge radiated emissions	62
8	APPENDIX A Test equipment and ancillaries used for tests.....	67
9	APPENDIX B Test equipment correction factors.....	68
10	APPENDIX C Measurement uncertainties	71
11	APPENDIX D Test laboratory description	72
12	APPENDIX E Specification references.....	73
13	APPENDIX F Abbreviations and acronyms.....	74
14	APPENDIX G Manufacturer's declaration	75

1 Applicant information

Client name: ARAD TECHNOLOGIES
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Telephone: 04-9935222, Ext: 271
Fax: 04-9935227
E-mail: viorel.negreanu@aradtec.com
Contact name: Mr. Vily Negreanu

2 Equipment under test attributes

Product name: AT57-7
Product type: Transceiver
AT57-7-21-5-P-1
AT57-7-22-5-P-1
AT57-7-1-13-P-1
AT57-7-22-5-OM-1
Model(s): AT57-7-21-5-OM-1
AT57-7-1-13-OM-1
AT57-7-23-17-S-1
AT57-7-2-11-S-1
AT57-7-2-25-S-1
Serial number: 70B3D5A9F087F344
Hardware version: 0B
Software release: 57.1.2.4
Receipt date 22-Apr-25

3 Manufacturer information

Manufacturer name: ARAD TECHNOLOGIES
Address: POB 537, HaMada 4, Yokneam Ind. Zone, Yokneam Ilit 20692, Israel
Telephone: 04-9935222, Ext: 271
Fax: 04-9935227
E-Mail: viorel.negreanu@aradtec.com
Contact name: Mr. Vily Negreanu

4 Test details

Project ID: 56698
Location: Hermon Laboratories Ltd. 66 HaTachana str., P.O. Box 23, Binyamina 3055001, Israel
Test started: 22-Apr-25
Test completed: 22-Jul-25
Test specification(s): FCC 47CFR part 15 subpart C §15.247 (Hybrid),
RSS-247 Issue 3:2023, RSS-Gen Issue 5

5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.247(a)1 / RSS-247 section 5.1(c), 20 dB bandwidth	Pass
Section 15.247(b) / RSS-247 section 5.4(a), Peak output power	Pass*
Section 15.247(e) / RSS-247 section 5.4(1), Peak spectral density	Pass
Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions	Pass**
Section 15.247(a)1 / RSS-247 section 5.1(b), Frequency separation	Pass
Section 15.247(a)1 / RSS-247 section 5.1(c), Number of hopping frequencies	Pass
Section 15.247(a)1 / RSS-247 section 5.1(c), Average time of occupancy	Pass
Section 15.247(i)5 / RSS-102 section 2.5, RF exposure	Pass, the exhibit to the application of certification is provided
Section 15.247(d) / RSS-247 section 5.5, Emissions at band edges	Pass
Section 15.207(a) / RSS-Gen section 8.8, Conducted emission	Not required
Section 15.203 / RSS-Gen section 8.3, Antenna requirements	Pass

* According to manufacturer's declaration provided in Appendix G the possible variants of the AT57-7-21-5-P-1, AT57-7-22-5-P-1, AT57-7-1-13-P-1, AT57-7-21-5-OM-1, AT57-7-22-5-OM-1, AT57-7-1-13-OM-1, AT57-7-23-17-S-1, AT57-7-2-11-S-1, AT57-7-2-25-S-1 fully identical and the only difference is a material that the pipe is made of and diameter and length of the pipe. Therefore, only the relevant test was performed for models AT57-7-21-5-P-1 (in the original report) and AT57-7-21-5-OM-1 and AT57-7-23-17-S-1 (in the present report). All other tests were performed only for model delivering the worst ERP. The re-issue of the Test Report is to support Application for Class II permissive changes certification. The change under this application is to add additional model variants AT57-7-22-5-P-1, AT57-7-1-13-P-1, AT57-7-22-5-OM-1, AT57-7-21-5-OM-1 and AT57-7-1-13-OM-1, AT57-7-23-17-S-1, AT57-7-2-11-S-1, AT57-7-2-25-S-1.

** This test result reuse test data provided in the test report saved under ARARAD_FCC.56698_FHSS (FHSS mode that is a higher power transmitter).

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

	Name and Title	Date	Signature
Tested by:	Mr. S. Sugatov, test engineer, EMC & Radio Mrs. N. Lenkina, test engineer, EMC & Radio	22-Apr-25 – 22-Jul-25	 
Reviewed by:	Mrs. S. Peysahov Sheynin, certification engineer, EMC & Radio	27-Jul-25	
Approved by:	Mr. M. Nikishin, group leader, EMC & Radio	05-Aug-25	

6 EUT description

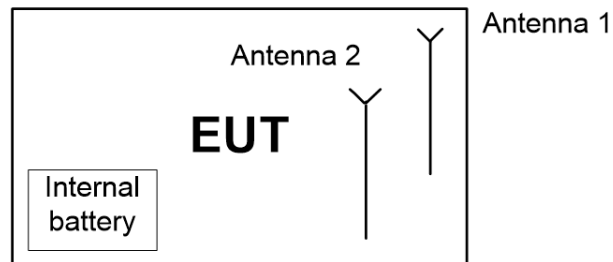
Note: The following data in this clause is provided by the customer and represents his sole responsibility

6.1 General information

The AT57-7 LoRa water meter is a fully integrated radio and antenna solution. It is a battery-operated radio transceiver designed for automated water reading. The AT57-7 provides optional online data of all kinds (water consumption, temperature, Alerts, Tampering, back flow...) It uses LoRaWAN radio for relaying water consumption data to the utility.

AT57-7 Intergrate Bluetooth Low energy for field maintenance.

6.2 Test configuration



6.3 Transmitter characteristics

Type of equipment						
X	Stand-alone (Equipment with or without its own control provisions)					
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)					
	Plug-in card (Equipment intended for a variety of host systems)					
Intended use		Condition of use				
X	fixed	Always at a distance more than 2 m from all people				
	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				
Assigned frequency ranges		902 – 928 MHz				
Operating frequencies		902.3 – 914.9 MHz				
Maximum rated output power		At transmitter 50 Ω RF output connector			dBm	
		Peak output power			9.72 dBm	
Is transmitter output power variable?		X	No			
			Yes		continuous variable	
				stepped variable with stepsize	dB	
				minimum RF power	dBm	
				maximum RF power	dBm	
Antenna connection						
unique coupling	standard connector	X	integral	with temporary RF connector		
				X without temporary RF connector		
Antenna/s technical characteristics						
Type	Manufacturer	Model number		Gain		
Integrated	Inhouse design	N/A		0dBi		
Transmitter aggregate data rate/s		980bps 5470bps				
Type of modulation		Chirp Spread Spectrum CSS				
Modulating test signal (baseband)		LoRa				
Transmitter power source						
X	Battery	Nominal rated voltage	3.6 VDC	Battery type	Lithium Inorganic battery	
	DC	Nominal rated voltage				
	AC mains	Nominal rated voltage		Frequency		
Common power source for transmitter and receiver X yes no						
Spread spectrum technique used		Frequency hopping (FHSS)				
		Digital transmission system (DTS)				
		X	Hybrid			
Spread spectrum parameters for transmitters tested per FCC 15.247 only						
FHSS	Total number of hops	8				
	Bandwidth per hop	147.59 kHz				
	Max. separation of hops	200.2 kHz				



Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth			
Test procedure: ANSI C63.10, section 7.8.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 49 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

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

7.1 20 dB bandwidth

7.1.1 General

This test was performed to measure the 20 dB bandwidth of the transmitter hopping channel. Specification test limits are given in Table 7.1.1.

Table 7.1.1 The 20 dB bandwidth limits

Assigned frequency, MHz	Maximum bandwidth, kHz	Modulation envelope reference points*, dBc
902.0 – 928.0	No Requirements	20

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

7.1.2 Test procedure

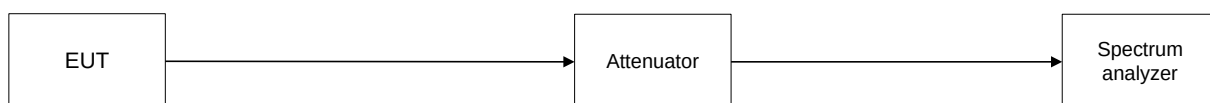
7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

7.1.2.2 The EUT was set to transmit modulated carrier at maximum data rate.

7.1.2.3 The transmitter 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.

7.1.2.4 The test was repeated for each data rate and each modulation format.

Figure 7.1.1 The 20 dB bandwidth test setup





Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth			
Test procedure: ANSI C63.10, section 7.8.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 49 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

Table 7.1.2 The 20 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902-928 MHz
 DETECTOR USED: Peak
 SWEEP TIME: Auto
 VIDEO BANDWIDTH: ≥ RBW
 FREQUENCY HOPPING: Disabled

Carrier frequency, MHz	Type of modulation	Data rate, bps	99% OBW kHz	20 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
Low frequency							
902.3	LoRa	980	126.27	140.40	NA	NA	Pass
		5470	127.47	147.19	NA	NA	Pass
Mid frequency							
902.9	LoRa	980	125.47	139.59	NA	NA	Pass
		5470	126.27	145.58	NA	NA	Pass
High frequency							
903.7	LoRa	980	125.87	140.00	NA	NA	Pass
		5470	127.47	147.59	NA	NA	Pass

Reference numbers of test equipment used

HL 4355	HL 5594	HL 5601	HL 4135	HL 5637				
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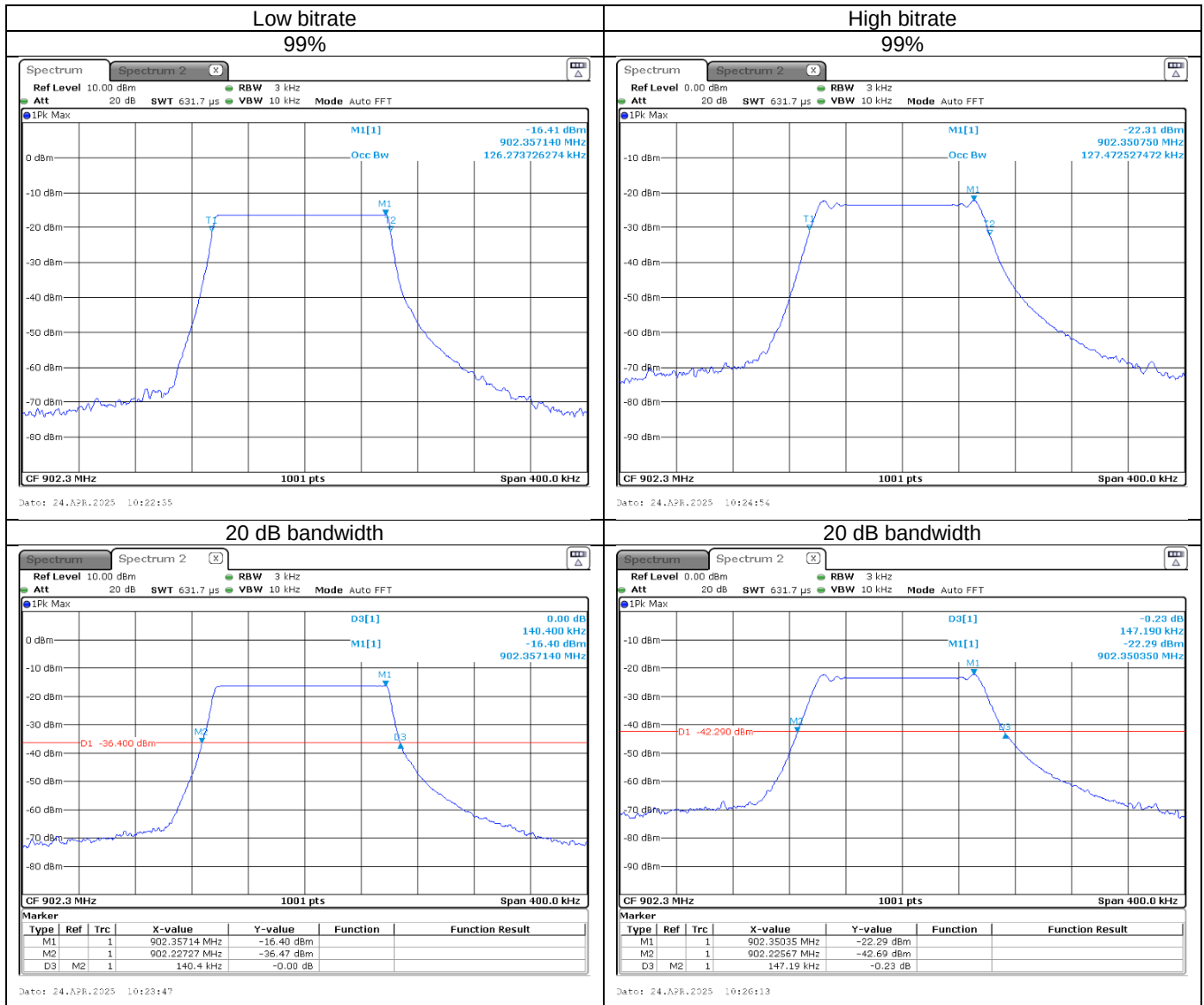
Full description is given in Appendix A.



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Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth			
Test procedure: ANSI C63.10, section 7.8.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 49 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.1.1 The 20 dB bandwidth test result at low frequency

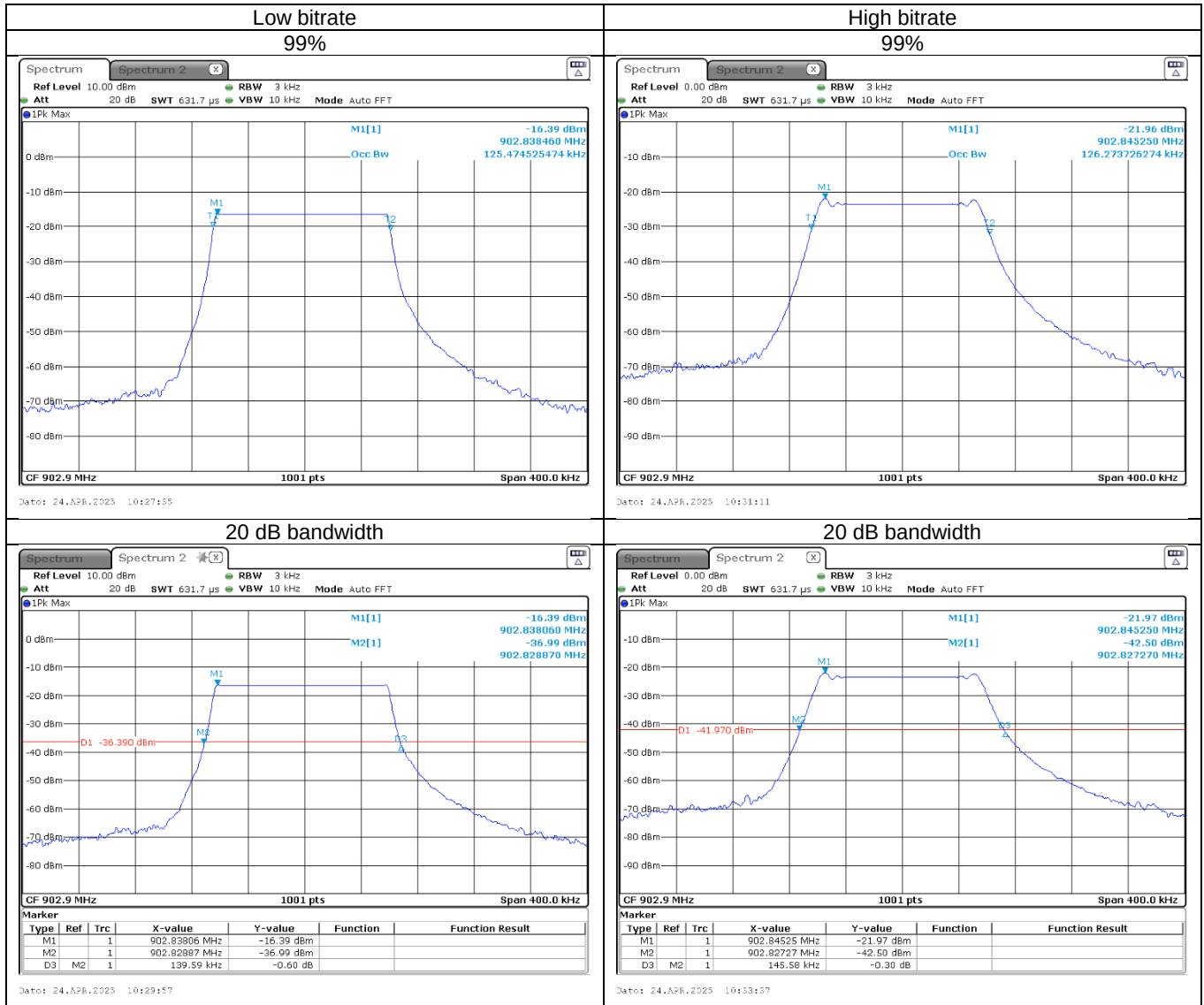




HERMON LABORATORIES

Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth			
Test procedure: ANSI C63.10, section 7.8.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 49 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.1.2 The 20 dB bandwidth test result at mid frequency

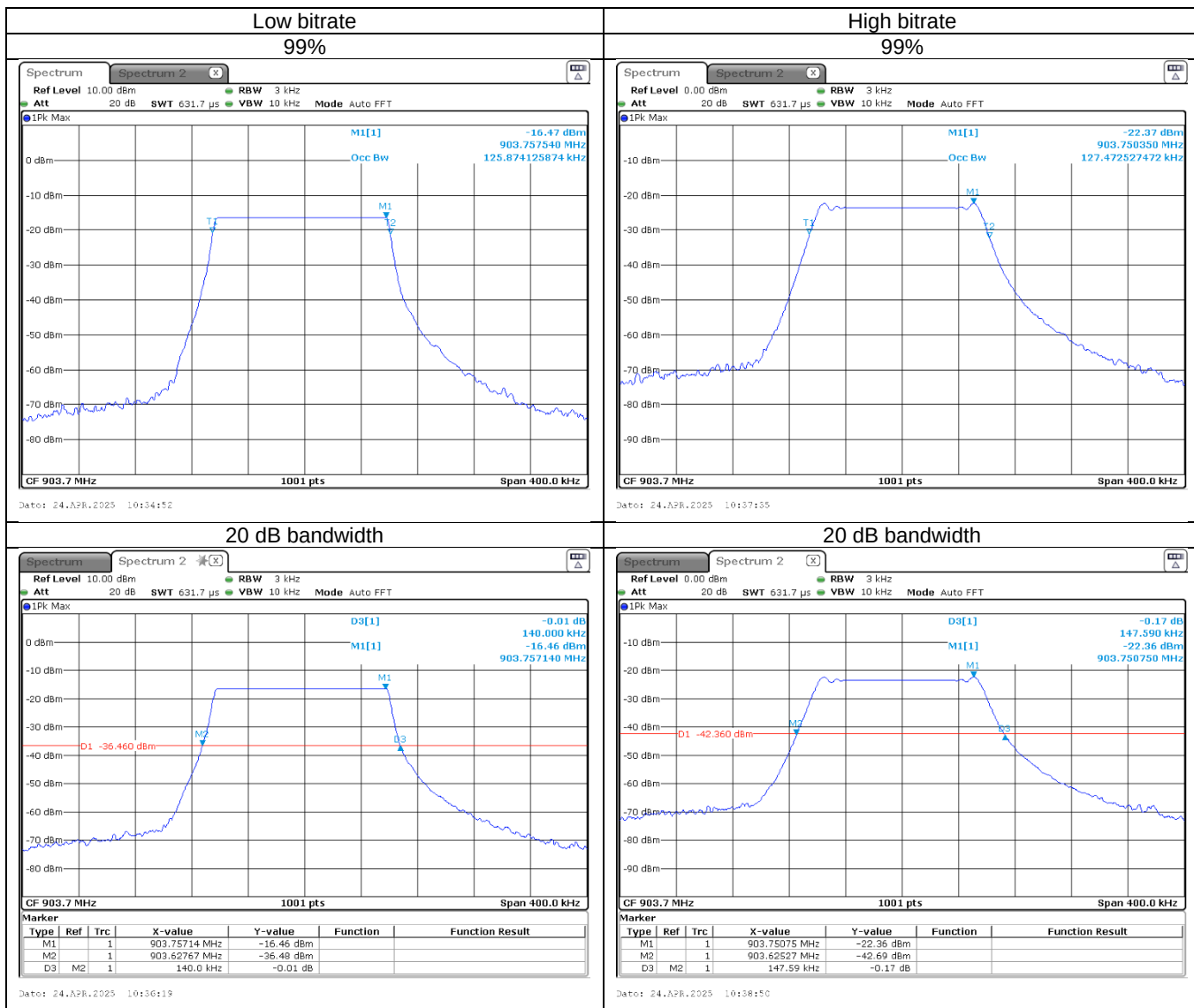




HERMON LABORATORIES

Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth			
Test procedure: ANSI C63.10, section 7.8.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 49 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.1.3 The 20 dB bandwidth test result at high frequency





Test specification: Section 15.247(a)1, RSS-247 section 5.1(2), Frequency separation			
Test procedure: ANSI C63.10, section 7.8.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 46 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

7.2 Carrier frequency separation

7.2.1 General

This test was performed to measure frequency separation between the peaks of adjacent channels. Specification test limits are given in Table 7.2.1.

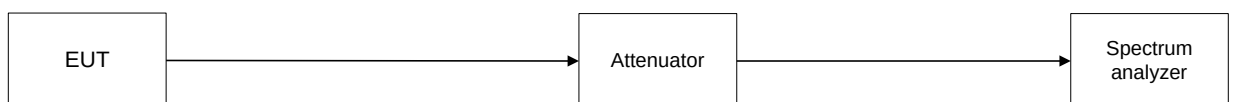
Table 7.2.1 Carrier frequency separation limits

Assigned frequency range, MHz	Carrier frequency separation	
	Output power 30 dBm	Output power 21 dBm
902.0 – 928.0	25 kHz or 20 dB bandwidth of the hopping channel, whichever is greater	25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater
2400.0 – 2483.5		
5725.0 – 5850.0		

7.2.2 Test procedure

- 7.2.2.1** The EUT was set up as shown in Figure 7.2.1, energized with frequency hopping function enabled and its proper operation was checked.
- 7.2.2.2** The spectrum analyzer span was set to capture the carrier frequency and both of adjacent channels, the lower and the higher. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.2.2.3** The spectrum analyzer was set in max hold mode and allowed trace to stabilize.
- 7.2.2.4** The frequency separation between the peaks of adjacent channels was measured as provided in Table 7.2.2 and associated plots.

Figure 7.2.1 Carrier frequency separation test setup





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Test specification: Section 15.247(a)1, RSS-247 section 5.1(2), Frequency separation			
Test procedure: ANSI C63.10, section 7.8.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 46 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

Table 7.2.2 Carrier frequency separation test results

ASSIGNED FREQUENCY: 902.0-928.0 MHz
 MODULATION: LoRa
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: $\geq 1\%$ of the span
 VIDEO BANDWIDTH: $\geq$ RBW
 FREQUENCY HOPPING: Enabled

BIT RATE: 980 bps
 20 dB BANDWIDTH: 140.40 kHz

Carrier frequency separation, kHz	Limit, kHz	Margin, kHz*	Verdict
200.20	140.40	-59.80	Pass

BIT RATE: 5470 bps
 20 dB BANDWIDTH: 147.59 kHz

Carrier frequency separation, kHz	Limit, kHz	Margin, kHz*	Verdict
198.40	147.59	-50.81	Pass

* - Margin = Carrier frequency separation – specification limit.

Reference numbers of test equipment used

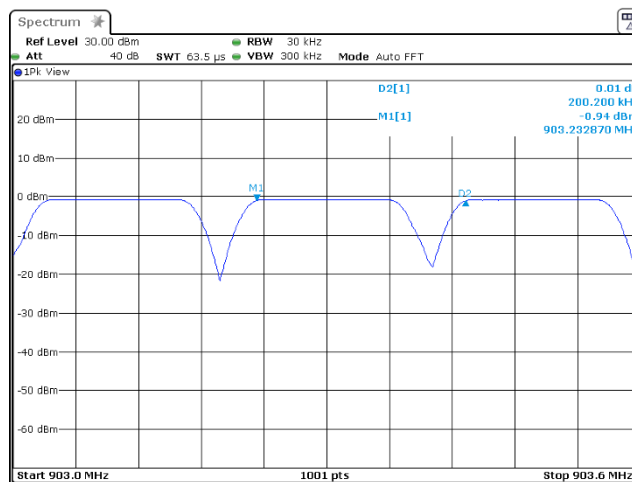
HL 4355	HL 5673	HL 4135	HL 5601	HL 5594			
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Full description is given in Appendix A.

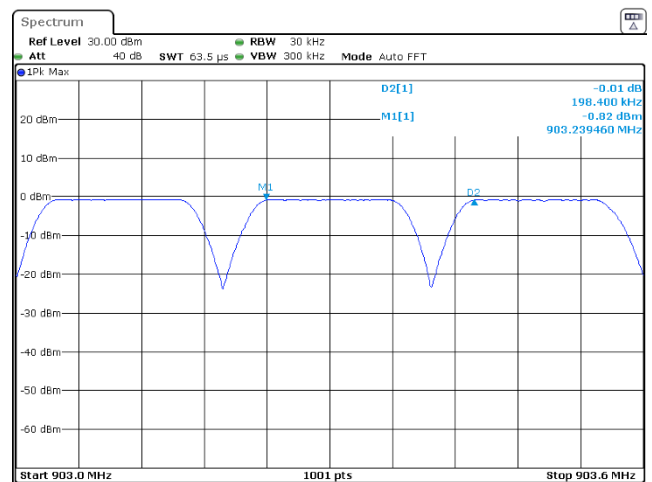
Plot 7.2.1 Carrier frequency separation

BIT RATE 980 bps

BIT RATE 5470 bps



Date: 24.APR.2025 14:17:01



Date: 24.APR.2025 14:53:57



Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), Number of hopping frequencies			
Test procedure: ANSI C63.10, section 7.8.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

7.3 Number of hopping frequencies

7.3.1 General

This test was performed to calculate the number of hopping frequencies used by the EUT. Specification test limits are given in Table 7.3.1.

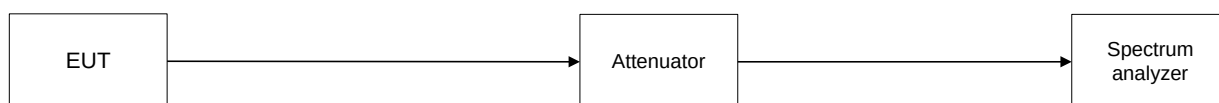
Table 7.3.1 Minimum number of hopping frequencies

Assigned frequency range, MHz	Number of hopping frequencies
902.0 – 928.0	No Requirements

7.3.2 Test procedure

- 7.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized with frequency hopping function enabled and its proper operation was checked.
- 7.3.2.2** Initially the spectrum analyzer span was set equal to frequency band of operation and the resolution bandwidth was set wider than 1 % of the frequency span. If the separate hopping channels were not clearly resolved the frequency band of operation was broken to sections and the resolution bandwidth was set wider than 1 % of the frequency span of each section.
- 7.3.2.3** The spectrum analyzer was set in max hold mode and allowed trace to stabilize.
- 7.3.2.4** The number of frequency hopping channels was calculated as provided in Table 7.3.2 and associated plots.

Figure 7.3.1 Hopping frequencies test setup





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Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), Number of hopping frequencies			
Test procedure: ANSI C63.10, section 7.8.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks:			

Table 7.3.2 Hopping frequencies test results

ASSIGNED FREQUENCY: 902.0 – 928.0 MHz
 MODULATION: LoRa
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: $\geq 1\%$ of the span
 VIDEO BANDWIDTH: $\geq$ RBW
 FREQUENCY HOPPING: Enabled

BIT RATE: 980 bps

Number of hopping frequencies	Minimum number of hopping frequencies	Margin*	Verdict
8	NA	NA	Pass

BIT RATE: 5470 bps

Number of hopping frequencies	Minimum number of hopping frequencies	Margin*	Verdict
8	NA	NA	Pass

* - Margin = Number of hopping frequencies – Minimum number of hopping frequencies.

Reference numbers of test equipment used

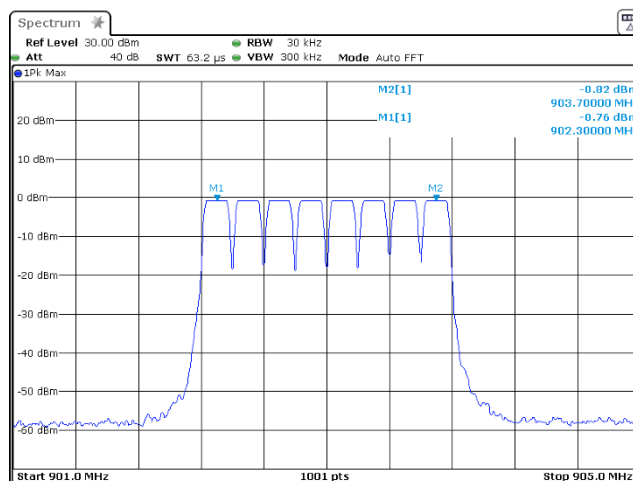
HL 4355	HL 5673	HL 4135	HL 5601	HL 5594			
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Full description is given in Appendix A.

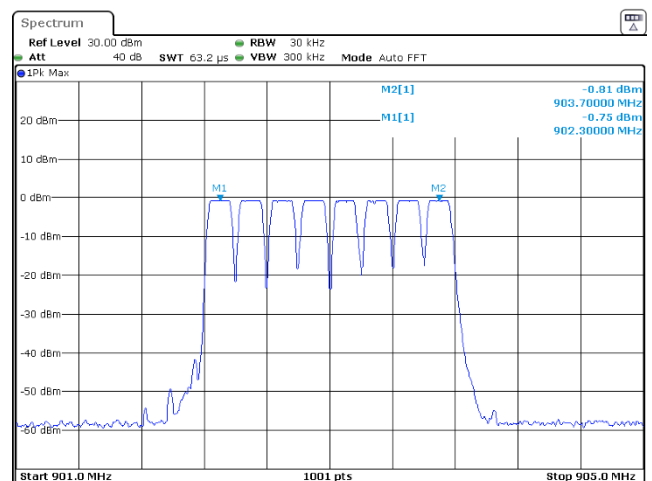
Plot 7.3.1 Number of hopping frequencies

Bit rate 980 bps

Bit rate 5470 bps



Date: 24.APR.2025 14:20:39



Date: 24.APR.2025 14:56:54



Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), Average time of occupancy			
Test procedure: ANSI C63.10, section 7.8.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks: Hybrid			

7.4 Average time of occupancy

7.4.1 General

This test was performed to calculate the average time of occupancy (dwell time) on any frequency channel of the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Average time of occupancy limits

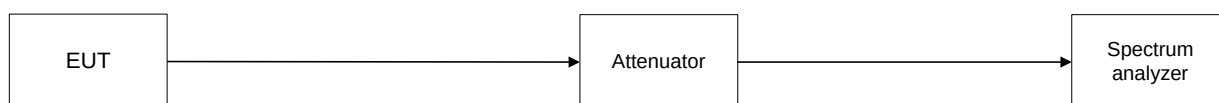
Assigned frequency range, MHz	Maximum average time of occupancy, s	Investigated period, s*
902.0 – 928.0	0.4	3.2

*The Investigated Period equal to the number of hopping frequencies employed multiplied by 0.4.

7.4.2 Test procedure

- 7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized with frequency hopping function enabled and its proper operation was checked.
- 7.4.2.2 The spectrum analyzer span was set to zero centered on a hopping channel.
- 7.4.2.3 The single transmission duration and period were measured with oscilloscope.
- 7.4.2.4 The average time of occupancy was calculated as the single transmission time multiplied by the investigated period and divided by the single transmission period.
- 7.4.2.5 The test was repeated at each data rate and modulation type as provided in Table 7.4.2 and associated plots.

Figure 7.4.1 Average time of occupancy test setup





Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), Average time of occupancy			
Test procedure: ANSI C63.10, section 7.8.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Table 7.4.2 Average time of occupancy test results

ASSIGNED FREQUENCY: 902.0-928.0 MHz
 MODULATION: LoRa
 DETECTOR USED: Peak
 NUMBER OF HOPPING FREQUENCIES: 8
 INVESTIGATED PERIOD: 3.2 s
 FREQUENCY HOPPING: Enabled

Carrier frequency, MHz	Single transmission duration, ms	Single transmission period, s	Average time of occupancy*, s	Bit rate, Mbps	Limit, s	Margin, s**	Verdict
902.3	371.0	3.2	0.37	980	0.4	-0.03	Pass
903.7	61.8	3.2	0.06	5470	0.4	-0.34	Pass

* - Average time of occupancy = (Single transmission duration × Investigated period) / (Single transmission period × number of hopping channels).

** - Margin = Average time of occupancy – specification limit.

Reference numbers of test equipment used

HL 4355	HL 5673	HL 4135	HL 5601	HL 5594			
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Full description is given in Appendix A.

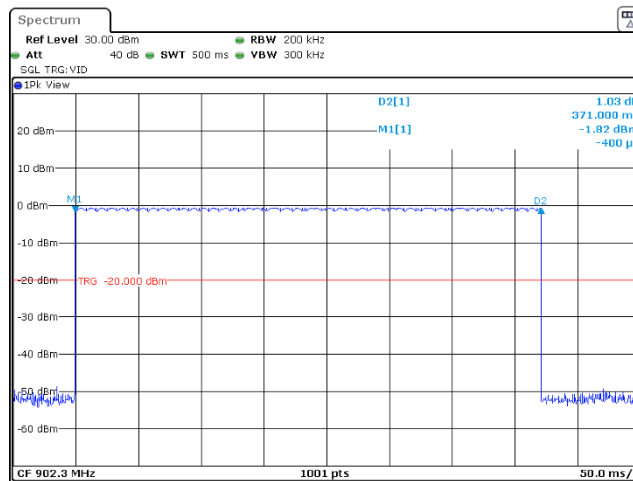


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Test specification: Section 15.247(a)1, RSS-247 section 5.1(3), Average time of occupancy			
Test procedure: ANSI C63.10, section 7.8.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 24-Apr-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 996 hPa	Power: 3.6 VDC
Remarks: Hybrid			

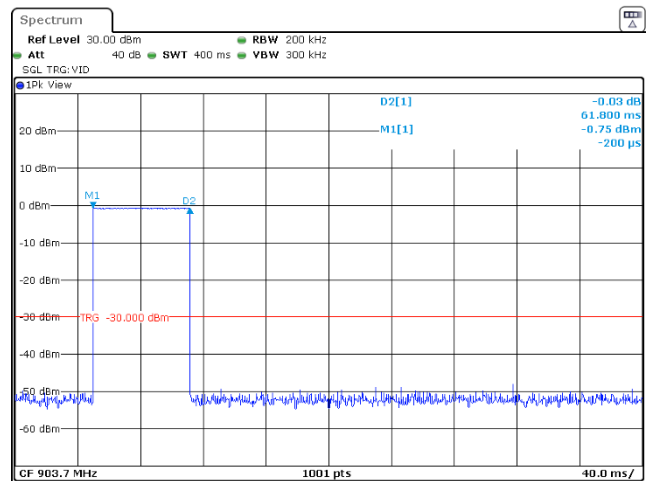
Plot 7.4.1 Single transmission duration

Data rate 980 bps



Da_w: 24.APR.2025 14:25:24

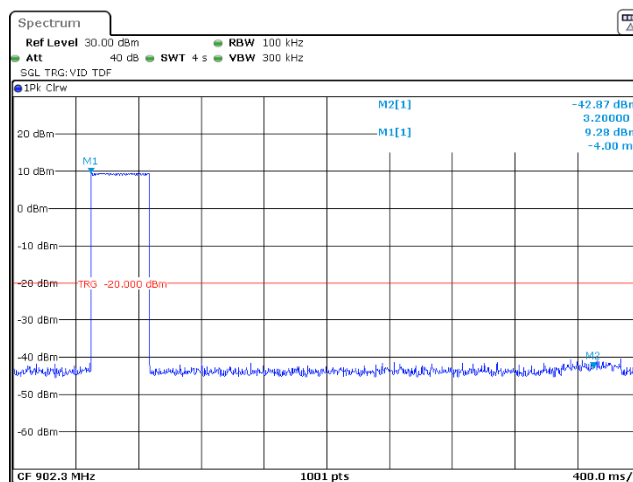
Data rate 5470 bps



Da_w: 24.APR.2025 14:44:30

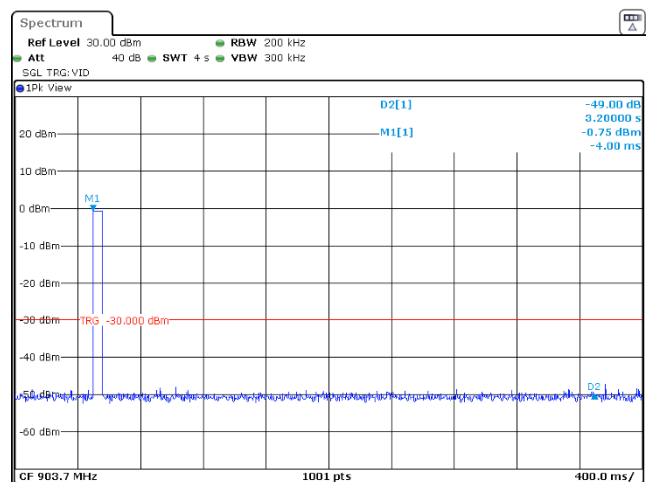
Plot 7.4.2 Single transmission period

Data rate 980 bps



Da_w: 24.APR.2025 15:10:19

Data rate 5470 bps



Da_w: 24.APR.2025 14:46:17



Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

7.5 Peak output power

7.5.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels)	24.0(<50 hopping channels)	125.2 (<50 hopping channels)	6.0*
	1.0 (≥50 hopping channels)	30.0 (≥50 hopping channels)	131.2 (≥50 hopping channels)	

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

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

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 approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.5.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.5.2 and associated plots.

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

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

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

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

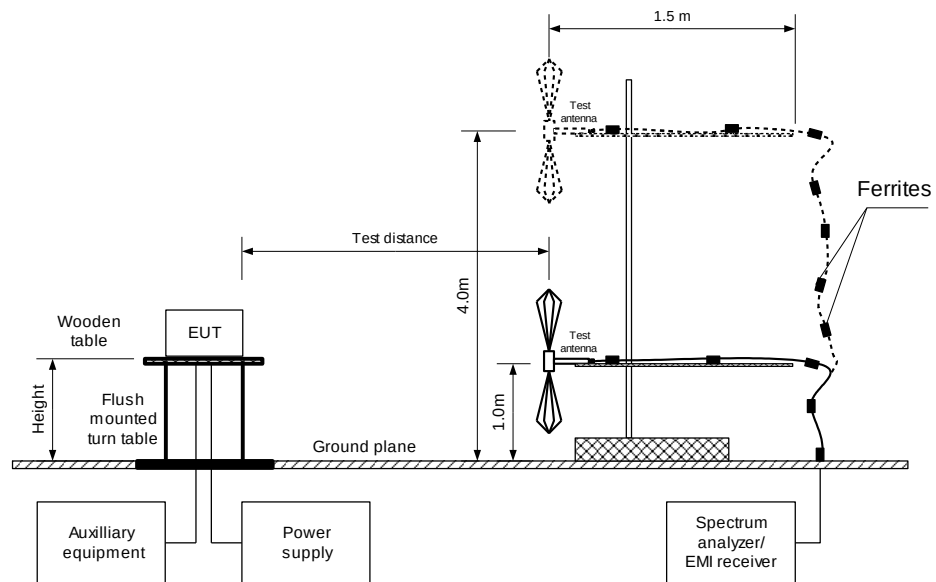
$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

7.5.2.6 The worst test results (the lowest margins) were recorded in Table 7.5.2.



Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Figure 7.5.1 Setup for carrier field strength measurements





Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Table 7.5.2 Peak output power test results

ASSIGNED FREQUENCY: 902 - 928 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 EUT HEIGHT: 0.8 m
 DETECTOR USED: Peak
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
 LORA: LoRa
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 DETECTOR USED: Peak
 EUT 6 dB BANDWIDTH: 300 kHz
 RESOLUTION BANDWIDTH: 1 MHz

BIT RATE: 980 bps

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
902.3	103.99	V	1.12	120	0	8.79	24	-15.21	Pass
902.9	103.06	V	1.14	80	0	7.86	24	-16.14	Pass
903.7	103.35	V	1.14	80	0	8.15	24	-15.85	Pass

BIT RATE: 5470 bps

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
902.3	104.22	V	1.12	130	0	9.02	24	-14.98	Pass
902.9	102.55	V	1.14	130	0	7.35	24	-16.65	Pass
903.7	103.33	V	1.14	80	0	8.13	24	-15.87	Pass

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

**- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$,
 where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi - 95.2 dB*

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

Reference numbers of test equipment used

HL 7585	HL 3903	HL 5903	HL 0604	HL 5611			
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Full description is given in Appendix A.

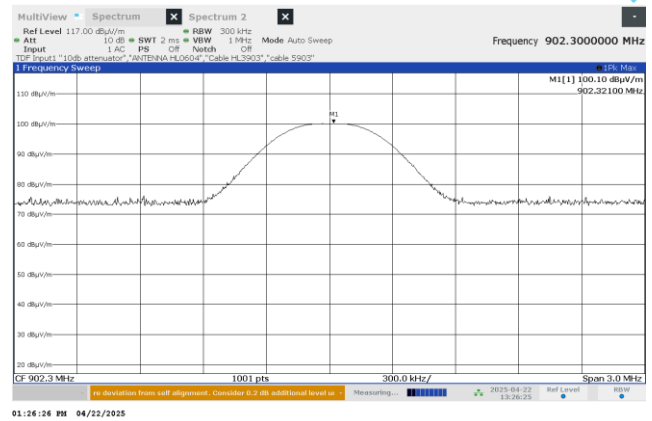
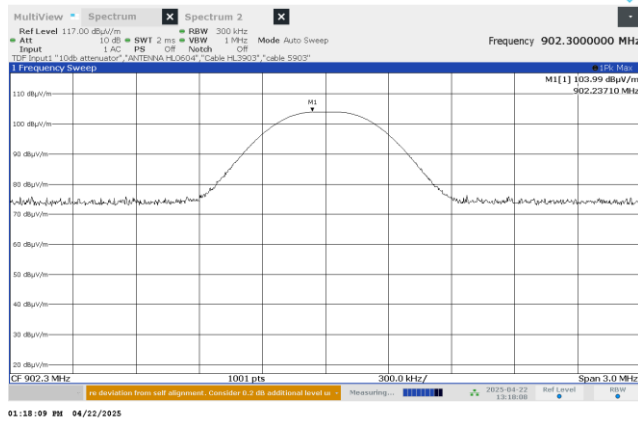


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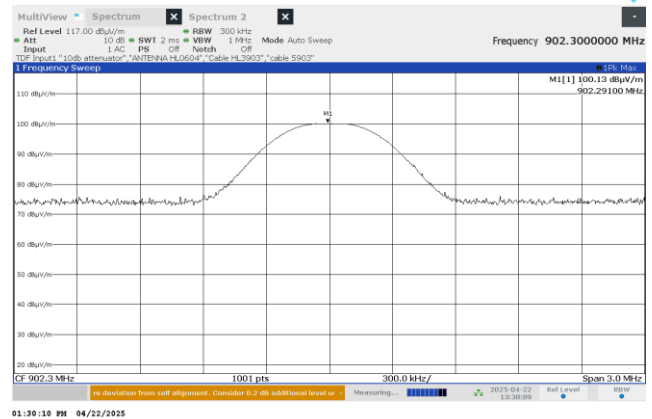
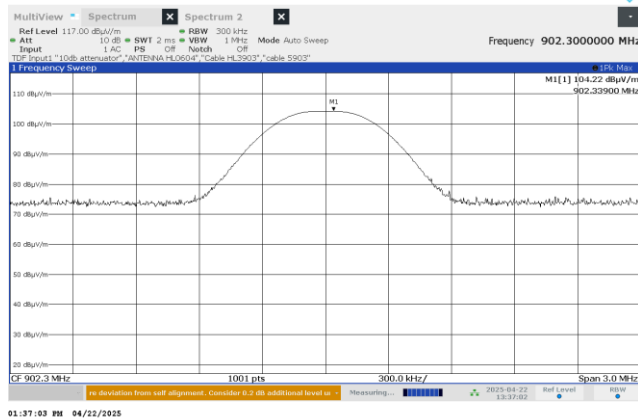
Test specification:		Section 15.247(b), RSS-247 section 5.4(1), Peak output power	
Test procedure:		ANSI C63.10, section 7.8.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Plot 7.5.1 Field strength of carrier at low frequency

Low bit rate



High bit rate



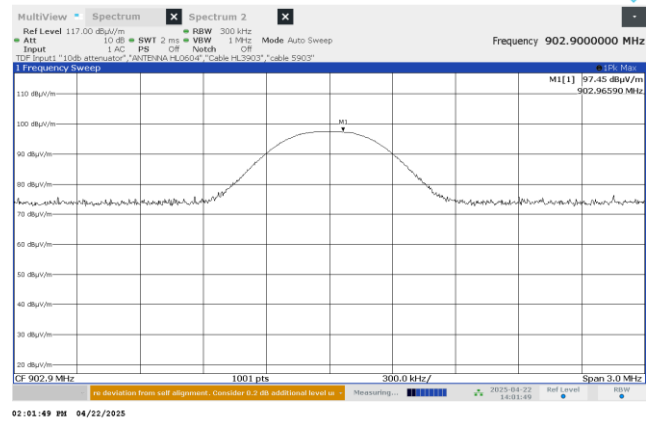
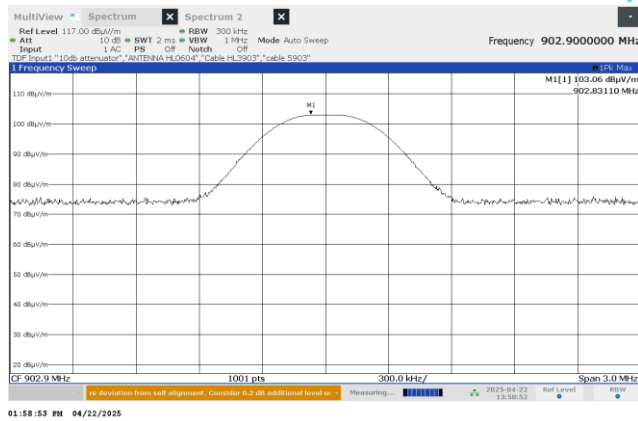


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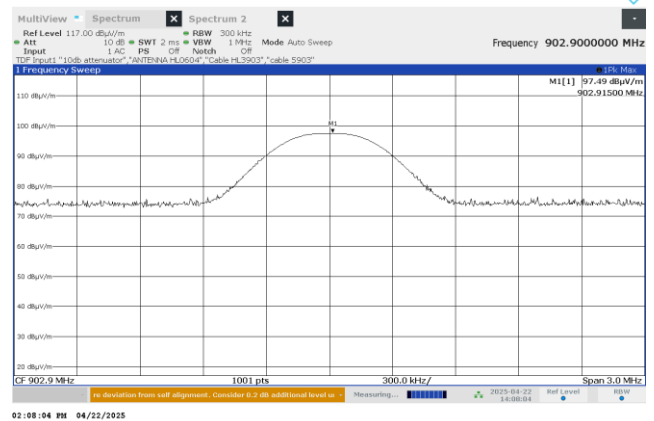
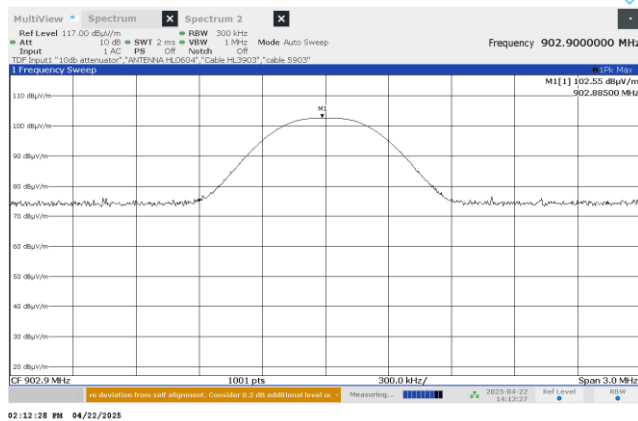
Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Plot 7.5.2 Field strength of carrier at mid frequency

Low bit rate



High bit rate



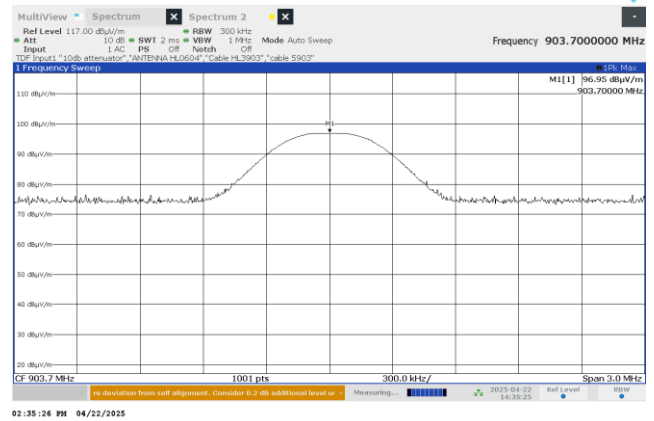
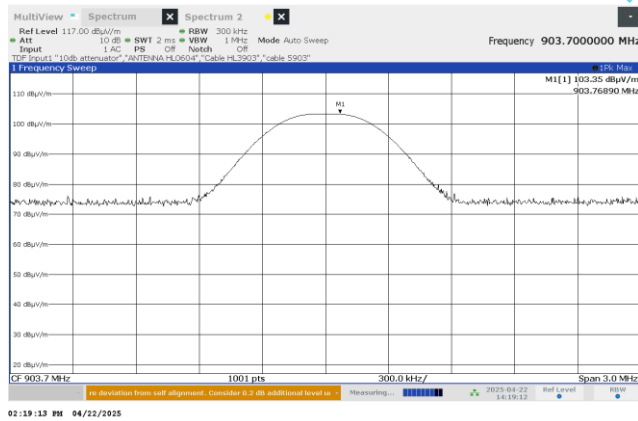


HERMON LABORATORIES

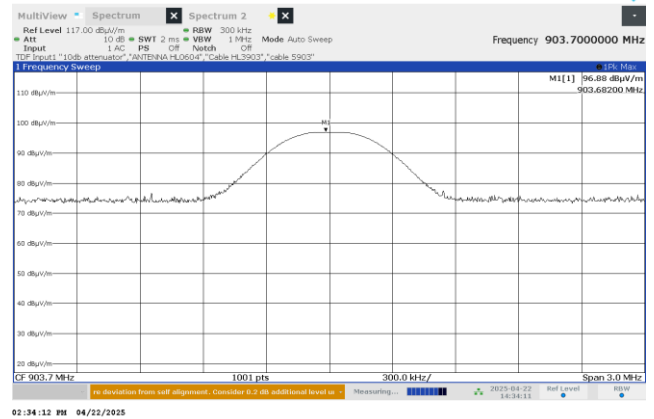
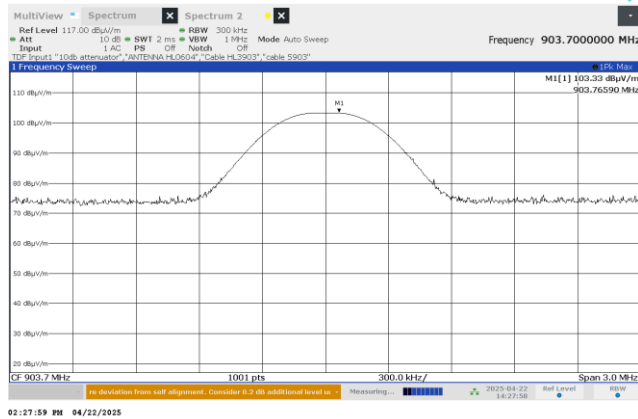
Test specification:		Section 15.247(b), RSS-247 section 5.4(1), Peak output power	
Test procedure:		ANSI C63.10, section 7.8.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Plot 7.5.3 Field strength of carrier at high frequency

Low bit rate



High bit rate





Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

7.6 Peak output power at AT57-7-22-5-OM-1

7.6.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels)	24.0(<50 hopping channels)	125.2 (<50 hopping channels)	6.0*
	1.0 (≥50 hopping channels)	30.0 (≥50 hopping channels)	131.2 (≥50 hopping channels)	

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

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

7.6.2 Test procedure

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, 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 approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.6.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.6.2 and associated plots.

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

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

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

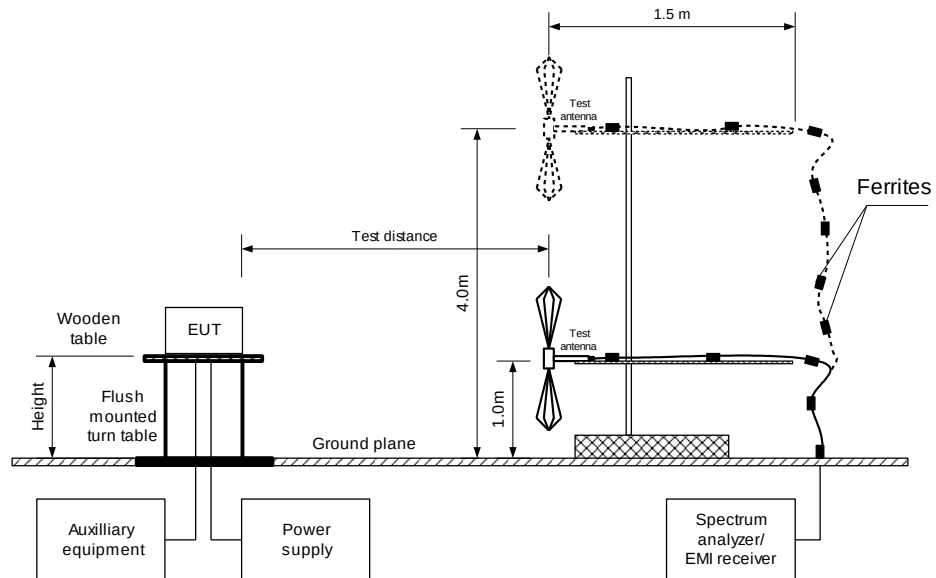
The above equation was converted in logarithmic units for 3 m test distance:

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

7.6.2.6 The worst test results (the lowest margins) were recorded in Table 7.6.2.

Test specification:		Section 15.247(b), RSS-247 section 5.4(1), Peak output power	
Test procedure:		ANSI C63.10, section 7.8.5	
Test mode:	Compliance	Verdict: PASS	
Date(s):	16-Jun-25		
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Figure 7.6.1 Setup for carrier field strength measurements





Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Table 7.6.2 Peak output power test results

ASSIGNED FREQUENCY: 902 - 928 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 EUT HEIGHT: 0.8 m
 DETECTOR USED: Peak
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
 LORA Hybrid
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 DETECTOR USED: Peak
 EUT 6 dB BANDWIDTH: 300 kHz
 RESOLUTION BANDWIDTH: 0.3 MHz

BIT RATE: 980 bps

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
902.3	104.10	Vertical	1.10	-108	0	8.87	24	-15.13	Pass
902.9	104.15	Vertical	1.10	-108	0	8.92	24	-15.08	Pass
903.7	104.19	Vertical	1.10	-108	0	8.96	24	-15.04	Pass

BIT RATE: 5470 bps

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
902.3	104.11	Vertical	1.10	-108	0	8.88	24	-15.12	Pass
902.9	104.17	Vertical	1.10	-108	0	8.94	24	-15.06	Pass
903.7	104.19	Vertical	1.10	-108	0	8.96	24	-15.04	Pass

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

**- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$,
 where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi - 95.2 dB*

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

Reference numbers of test equipment used

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

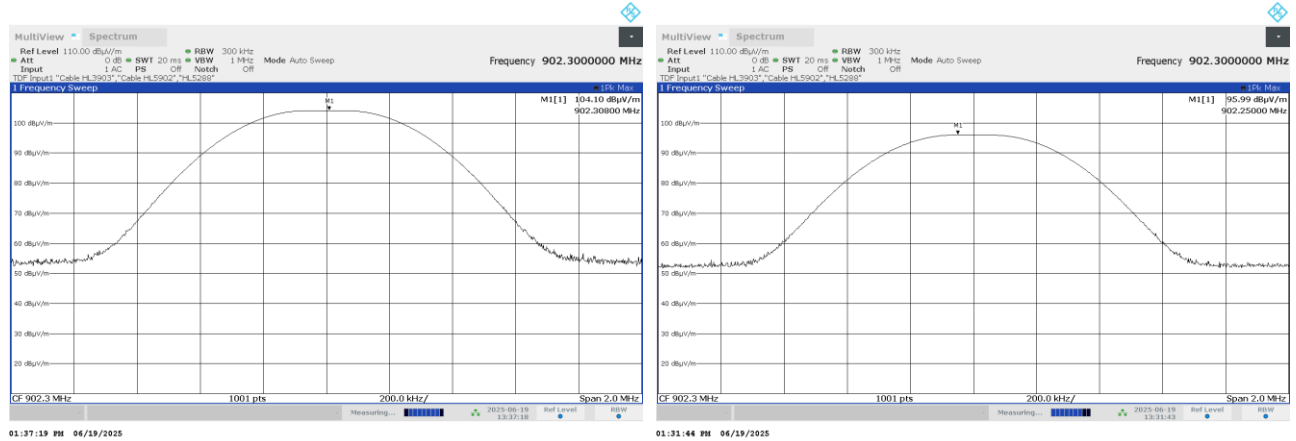


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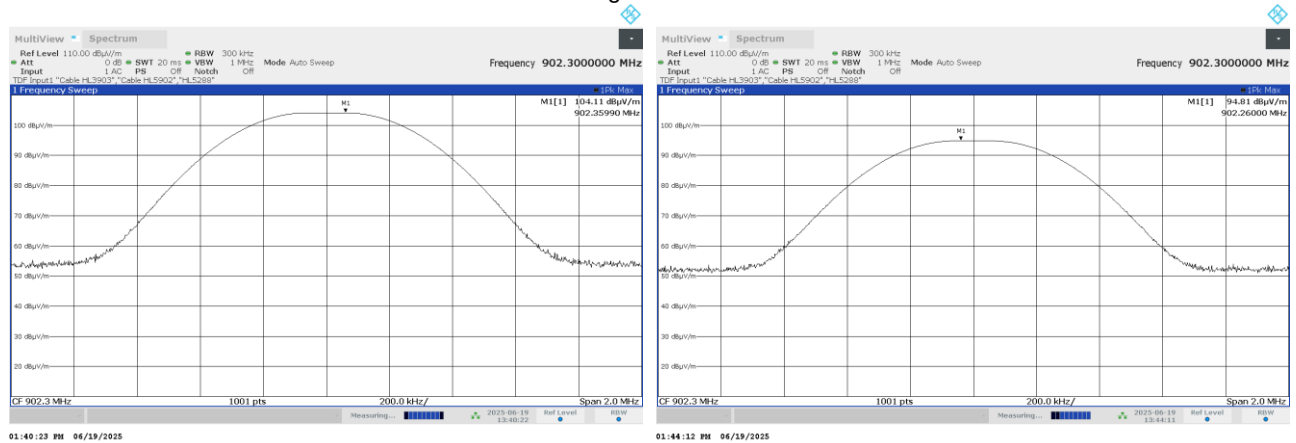
Test specification:		Section 15.247(b), RSS-247 section 5.4(1), Peak output power	
Test procedure:		ANSI C63.10, section 7.8.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Plot 7.6.1 Field strength of carrier at low frequency

Low bit rate



High bit rate



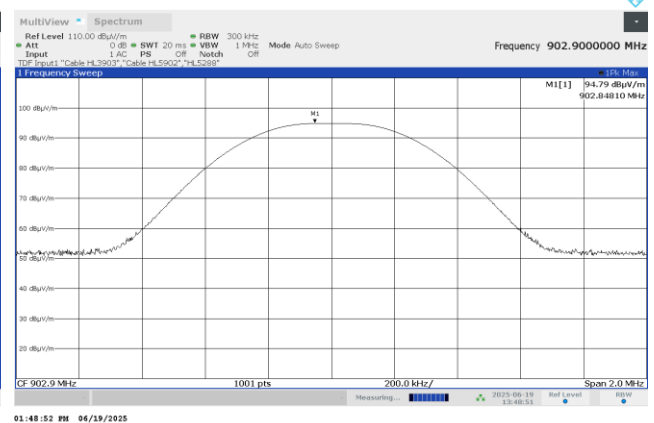
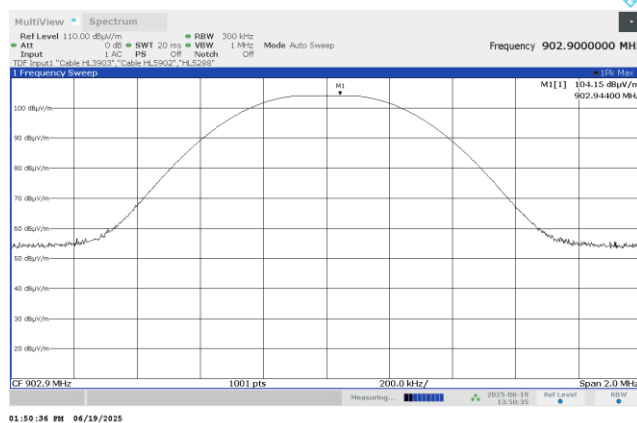


HERMON LABORATORIES

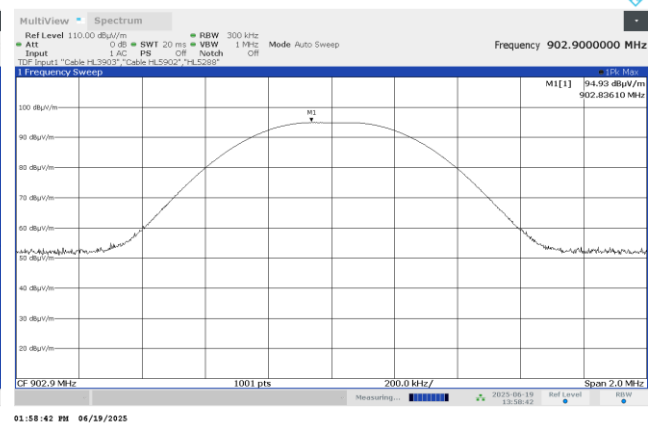
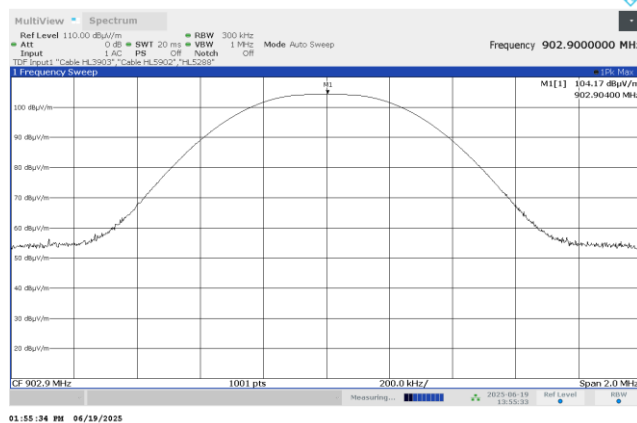
Test specification:		Section 15.247(b), RSS-247 section 5.4(1), Peak output power	
Test procedure:		ANSI C63.10, section 7.8.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Plot 7.6.2 Field strength of carrier at mid frequency

Low bit rate



High bit rate



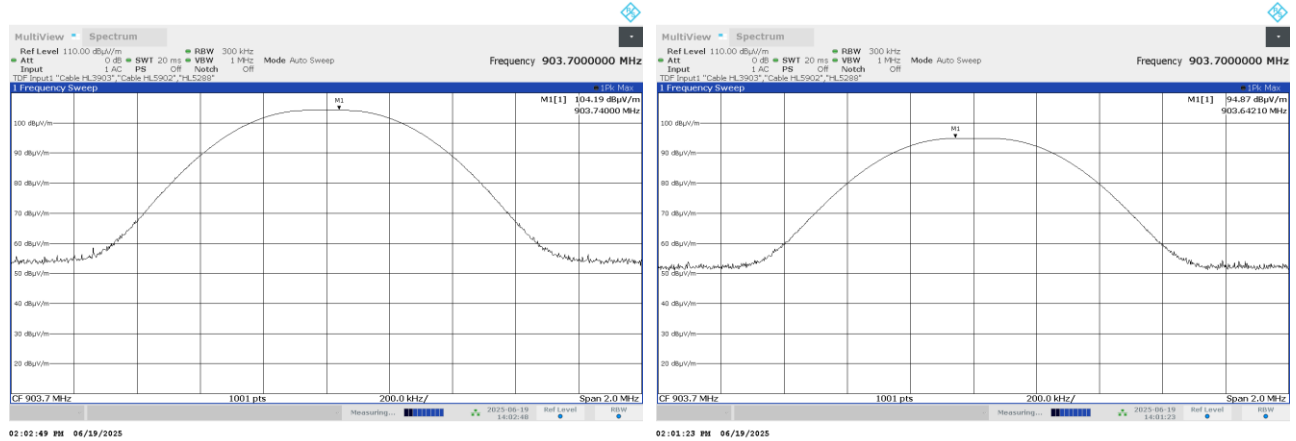


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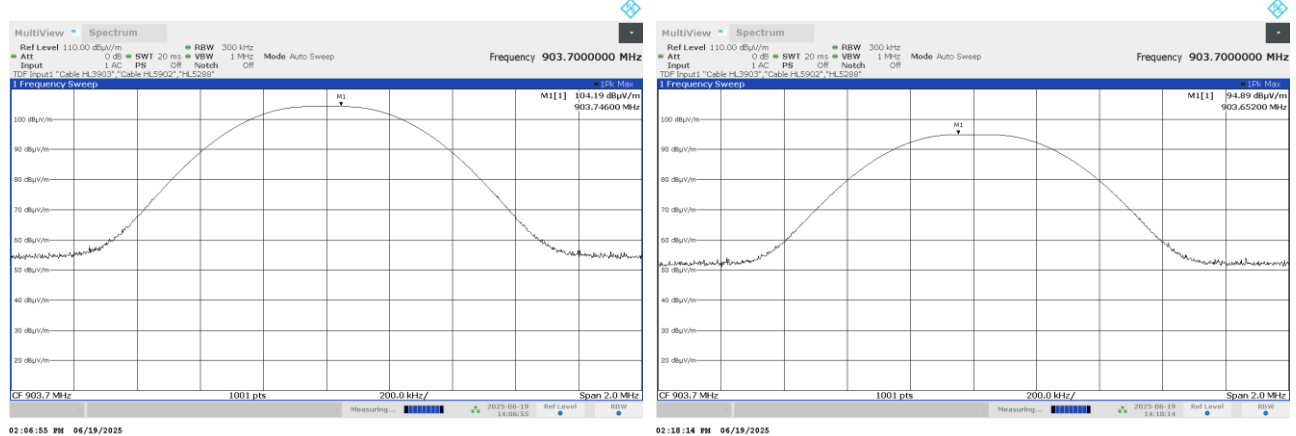
Test specification:		Section 15.247(b), RSS-247 section 5.4(1), Peak output power	
Test procedure:		ANSI C63.10, section 7.8.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Jun-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks: Hybrid			

Plot 7.6.3 Field strength of carrier at high frequency

Low bit rate



High bit rate





Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Jul-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

7.7 Peak output power at AT57-7-23-17-S-1

7.7.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels)	24.0(<50 hopping channels)	125.2 (<50 hopping channels)	6.0*
	1.0 (≥50 hopping channels)	30.0 (≥50 hopping channels)	131.2 (≥50 hopping channels)	

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

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

7.7.2 Test procedure

7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized and its proper operation was checked.

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

7.7.2.3 The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.7.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.6.2 and associated plots.

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

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

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

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

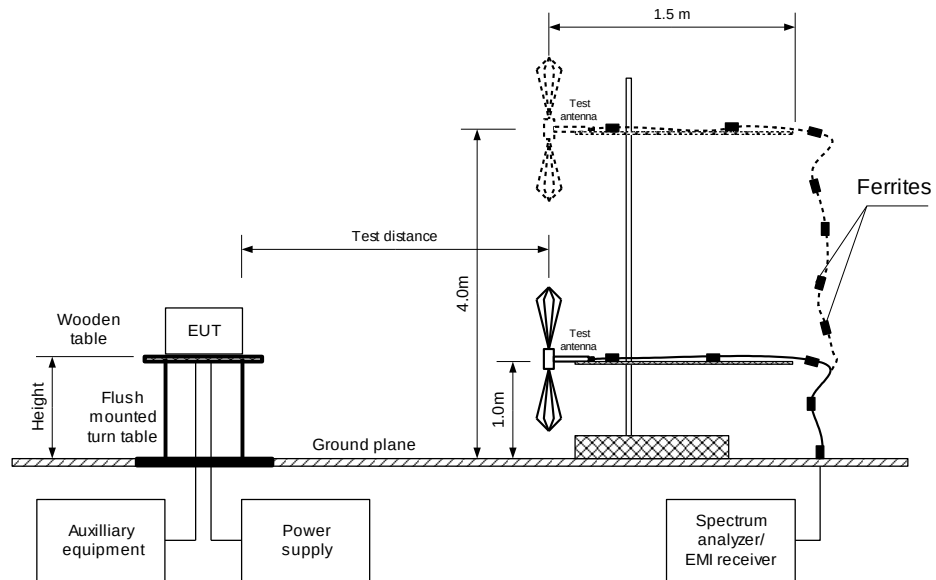
$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

7.7.2.6 The worst test results (the lowest margins) were recorded in Table 7.7.2.



Test specification:		Section 15.247(b), RSS-247 section 5.4(1), Peak output power	
Test procedure:		ANSI C63.10, section 7.8.5	
Test mode:		Verdict: PASS	
Date(s):			
22-Jul-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Figure 7.7.1 Setup for carrier field strength measurements





Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Jul-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Table 7.7.2 Peak output power test results

ASSIGNED FREQUENCY: 902 - 928 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 EUT HEIGHT: 0.8 m
 DETECTOR USED: Peak
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
 LORA Hybrid

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
902.3	104.82	Vertical	1	63	0	9.62	24	-14.38	Pass
902.9	104.92	Vertical	1	68	0	9.72	24	-14.28	Pass
903.7	104.90	Vertical	1	70	0	9.70	24	-14.3	Pass

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

** - Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$, where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi – 95.2 dB*

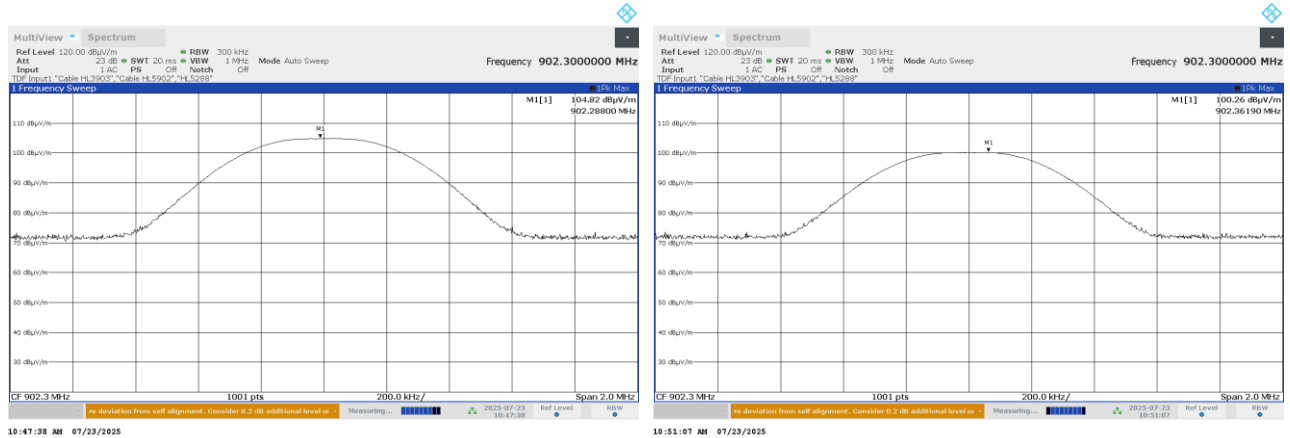
*** - Margin = Peak output power – specification limit.



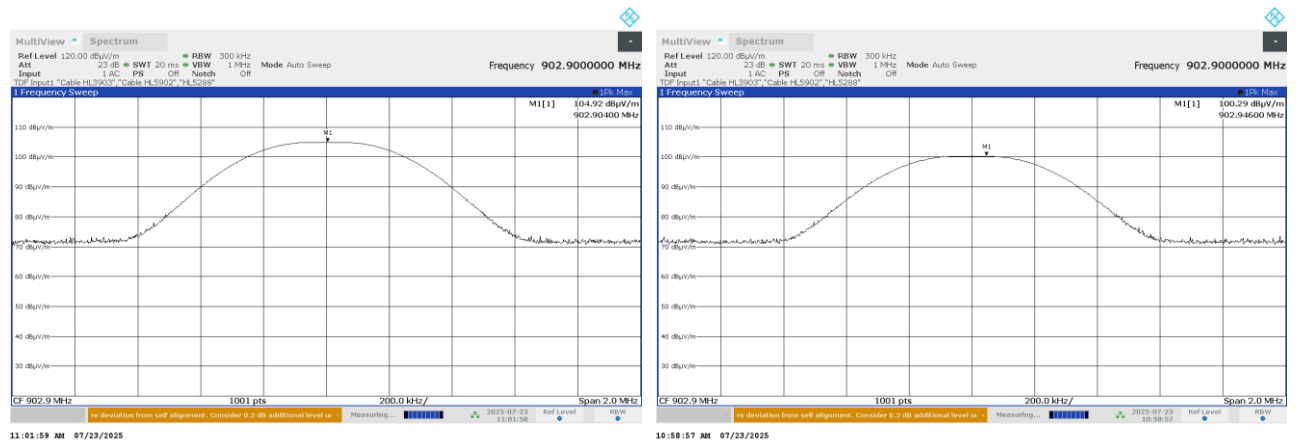
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Test specification: Section 15.247(b), RSS-247 section 5.4(1), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Jul-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.7.1 Field strength of carrier at low frequency



Plot 7.7.2 Field strength of carrier at mid frequency

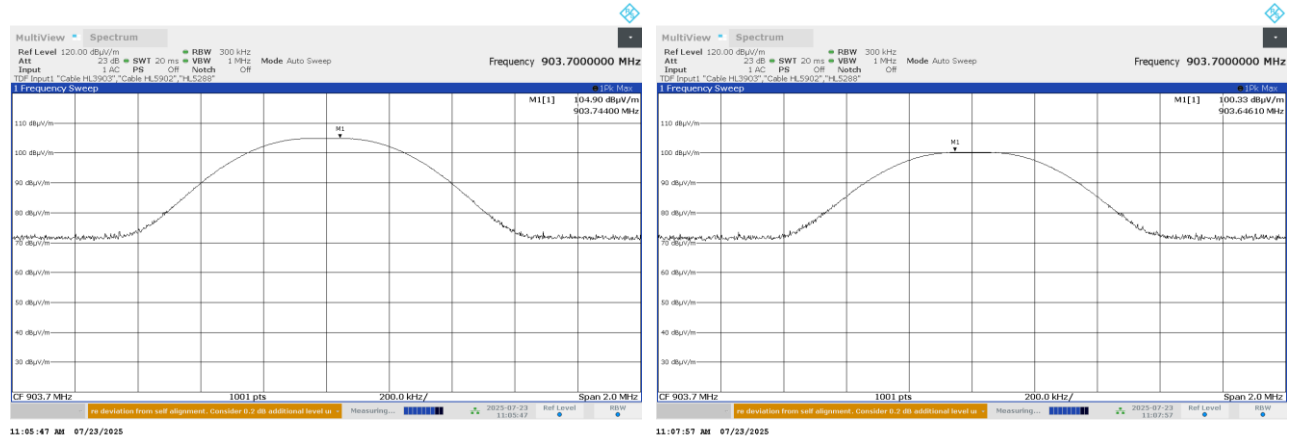




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Test specification:		Section 15.247(b), RSS-247 section 5.4(1), Peak output power	
Test procedure:		ANSI C63.10, section 7.8.5	
Test mode:		Verdict: PASS	
Date(s):			
22-Jul-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.7.3 Field strength of carrier at high frequency





Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
Test procedure: ANSI C63.10 section 11.10.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

7.8 Peak spectral power density

7.8.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.8.1.

Table 7.8.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB(μV/m)*
902.0 – 928.0	3.0	8.0	103.2
2400.0 – 2483.5			
5725.0 – 5850.0			

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

7.8.2 Test procedure for field strength measurements

7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and its proper operation was checked.

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

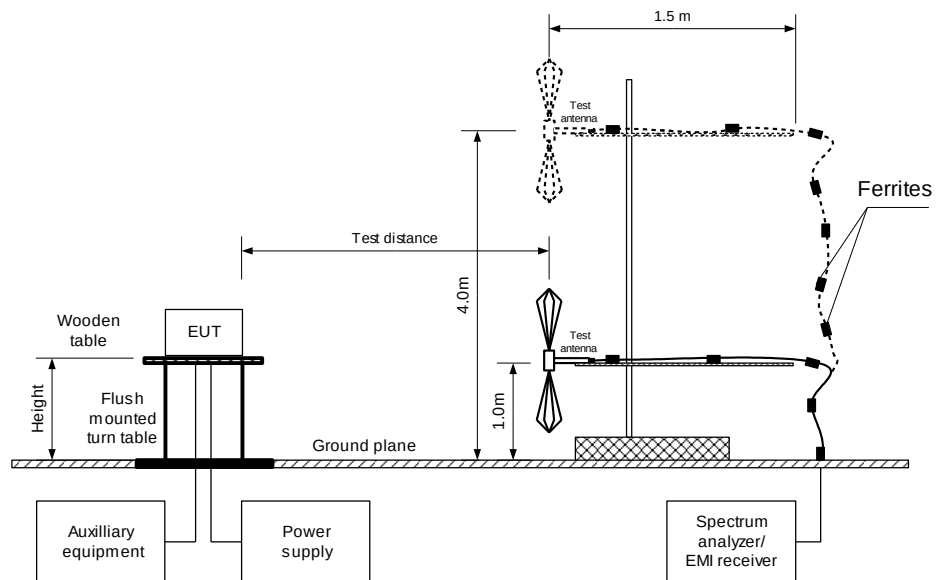
7.8.2.3 The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

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

7.8.2.5 The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.8.2 and associated plots.

Test specification:		Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density	
Test procedure:		ANSI C63.10 section 11.10.2	
Test mode:		Verdict: PASS	
Date(s):			
22-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Figure 7.8.1 Setup for carrier field strength measurements





Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
Test procedure: ANSI C63.10 section 11.10.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Table 7.8.2 Field strength measurement of peak spectral power density

ASSIGNED FREQUENCY: 902 - 928 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 EUT HEIGHT: 0.8 m
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 3 kHz
 VIDEO BANDWIDTH: 10 kHz
 TEST ANTENNA TYPE: Biconilog
 MODULATION: LORA

BIT RATE: 980 bps

Frequency, MHz	Field strength, dB(μV/m)	EUT antenna gain, dBi	Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees
902.3	102.85	0	103.2	-0.35	V	1.12	120
902.9	101.84	0	103.2	-1.36	V	1.14	80
903.7	102.12	0	103.2	-1.08	V	1.14	80

BIT RATE: 5470 bps

Frequency, MHz	Field strength, dB(μV/m)	EUT antenna gain, dBi	Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees
902.3	97.71	0	103.2	-5.49	V	1.12	130
902.9	95.96	0	103.2	-7.24	V	1.14	110
903.7	96.70	0	103.2	-6.50	V	1.14	80

*- Margin = Field strength - EUT antenna gain - calculated field strength limit.

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

Reference numbers of test equipment used

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

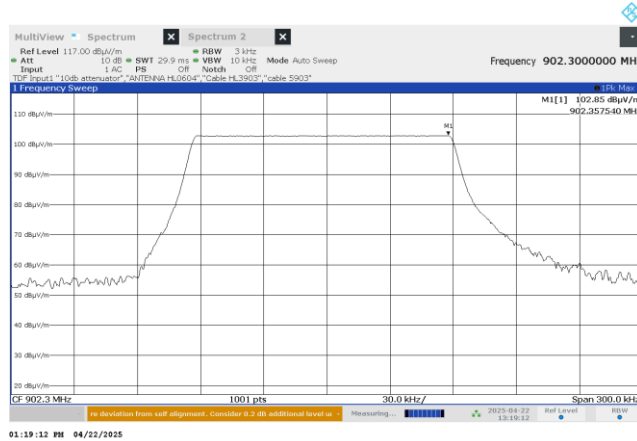


HERMON LABORATORIES

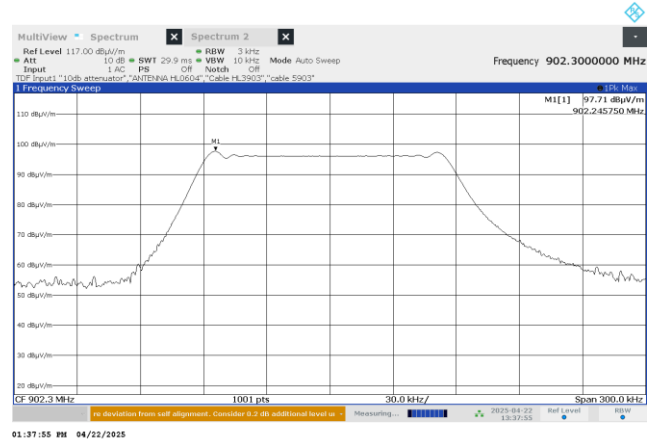
Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
Test procedure: ANSI C63.10 section 11.10.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.8.1 Peak spectral power density at low frequency

Low bit rate

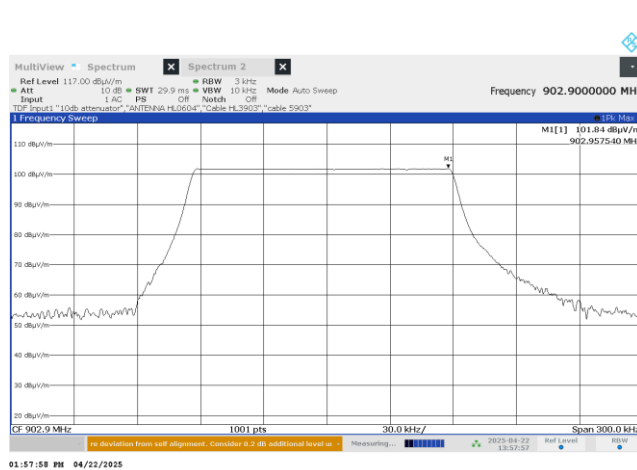


High bit rate

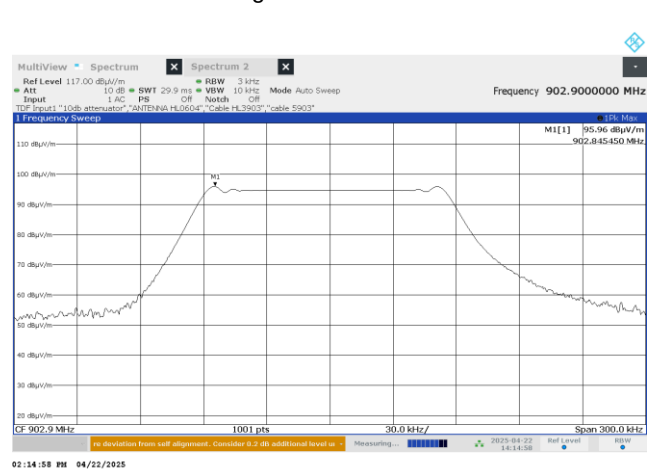


Plot 7.8.2 Peak spectral power density at mid frequency

Low bit rate



High bit rate





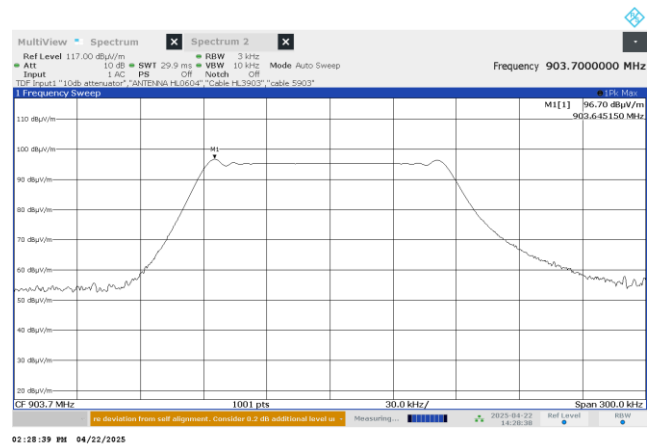
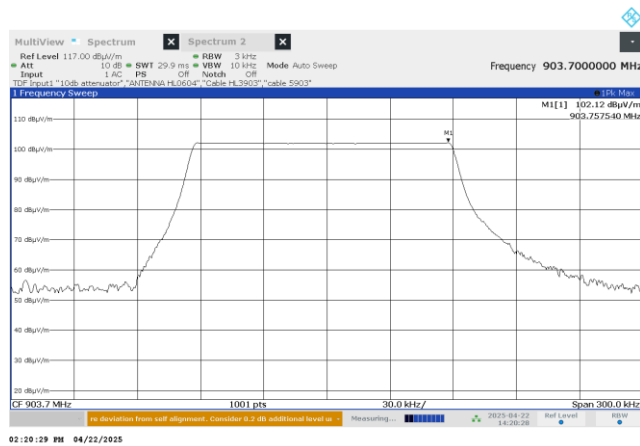
HERMON LABORATORIES

Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
Test procedure: ANSI C63.10 section 11.10.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.8.3 Peak spectral power density at high frequency

Low bit rate

High bit rate





Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

7.9 Field strength of spurious emissions

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**	20.0
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**	
0.490 – 1.705	NA	73.8 – 63.0**	NA	
1.705 – 30.0*		69.5		
30 – 88		40.0		
88 – 216		43.5		
216 – 960		46.0		
960 - 1000		54.0		
1000 – 10 th 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_1 and S_2 – 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.

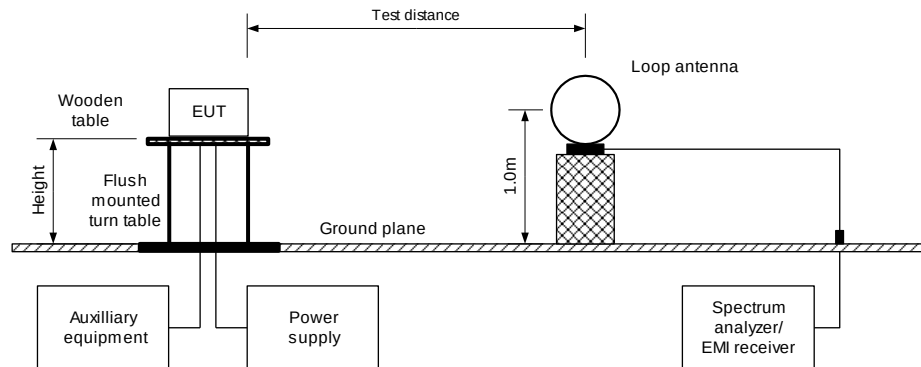
7.9.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

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



Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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





Test specification:		Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions	
Test procedure:		ANSI C63.10, sections 6.5, 6.6	
Test mode:		Verdict: PASS	
Date(s):			
23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

Figure 7.9.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz

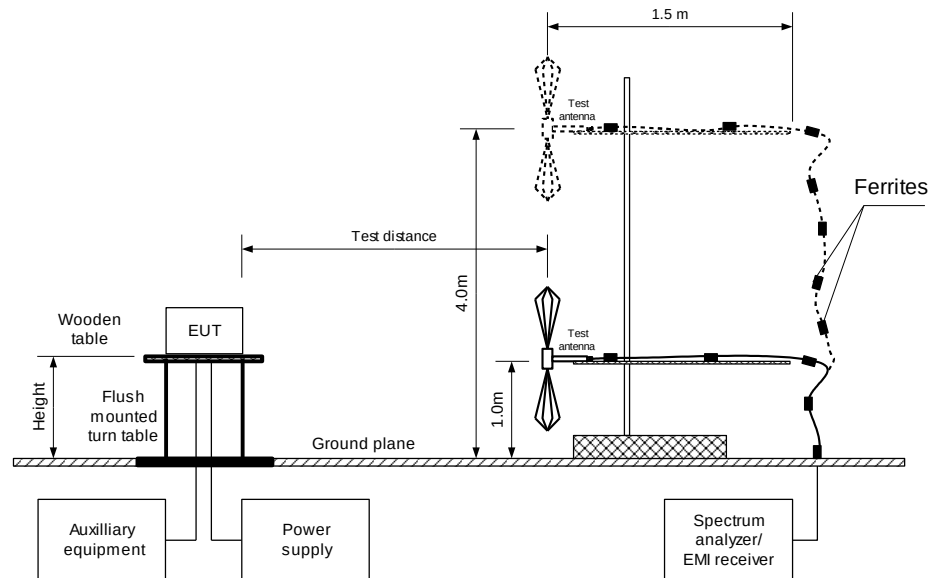
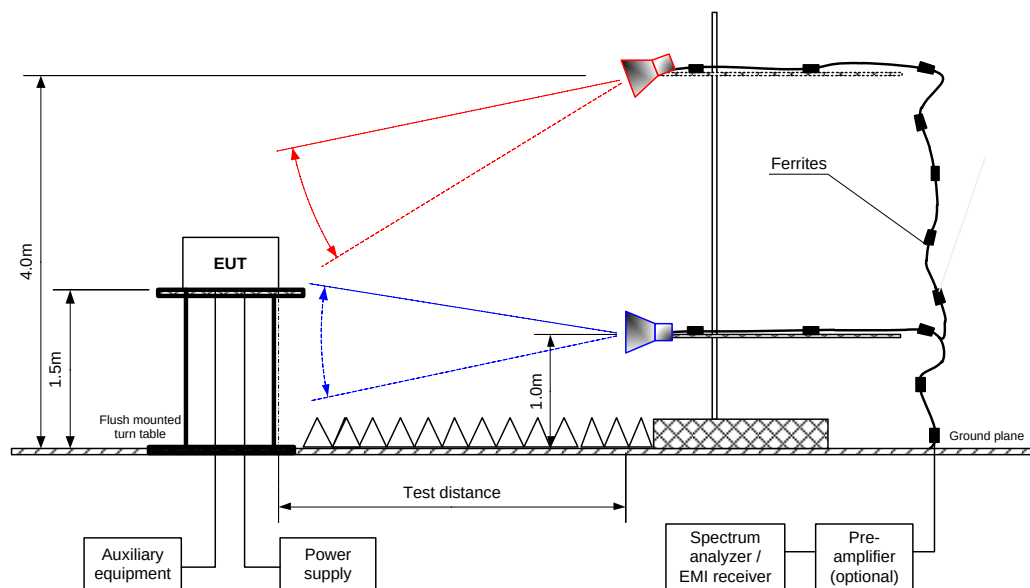


Figure 7.9.3 Setup for spurious emission field strength measurements above 1000 MHz





Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)
 FREQUENCY HOPPING: Disabled

Frequency hopping:					Disabled				
Frequency, MHz	Field strength of spurious, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(μV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
Low, Mid, High carrier frequency									
All emissions were greater than 20dB below the limit									Pass

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

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

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
 TRANSMITTER OUTPUT POWER: 29.75 dBm at low carrier frequency
 29.52 dBm at mid carrier frequency
 29.40 dBm at high carrier frequency
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1000 kHz
 TEST ANTENNA TYPE: Double ridged guide
 FREQUENCY HOPPING: Disabled

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength			Average field strength				Verdict
	Polarization	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Calculated, dB(μV/m)	Limit, dB(μV/m)	Margin, dB***	
Low carrier frequency											
2706.9	V	1.81	-72	54.27	74	-19.73	54.27	50.09	54	-3.91	Pass
Mid carrier frequency											
2726.1	V	1.80	-65	53.47	74	-20.53	53.47	49.29	54	-4.71	Pass
High carrier frequency											
2744.7	V	1.80	-70	53.23	74	-20.77	53.23	49.05	54	-4.95	Pass

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

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

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

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



HERMON LABORATORIES

Test specification:		Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions	
Test procedure:		ANSI C63.10, sections 6.5, 6.6	
Test mode:		Verdict: PASS	
Date(s):			
23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

Table 7.9.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Number of pulses within 100 ms	Duration, ms	Period, ms		
61.8	1	NA	NA	NA	-4.18

*- 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:

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



Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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
 TRANSMITTER OUTPUT POWER: 29.75 dBm at low carrier frequency
 29.52 dBm at mid carrier frequency
 29.40 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)
 Biconical (30 MHz – 200 MHz)
 Log periodic (200 MHz – 1000 MHz)
 Biconilog (30 MHz – 1000 MHz)
 FREQUENCY HOPPING: Disabled

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Low carrier frequency								
All emissions were greater then 20dB below the limit								Pass
Mid carrier frequency								
38.20	39.02	25.43	40.0	-14.57	V	1.00	-180	Pass
High carrier frequency								
74.36	37.15	22.96	40.0	-17.04	V	1.02	-165	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, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 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

HL7585	HL0446	HL0604	HL4933	HL3903	HL5903	HL4921	HL6252
HL4339							

Full description is given in Appendix A.

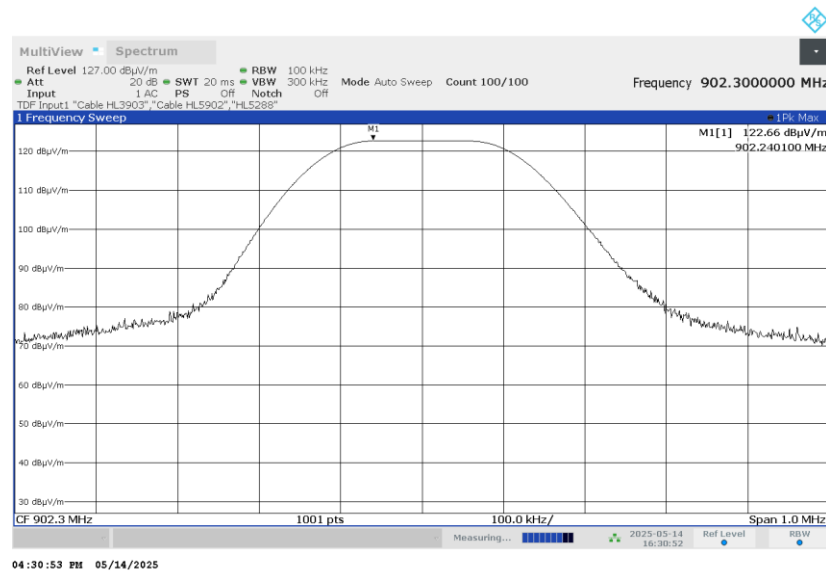


HERMON LABORATORIES

Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

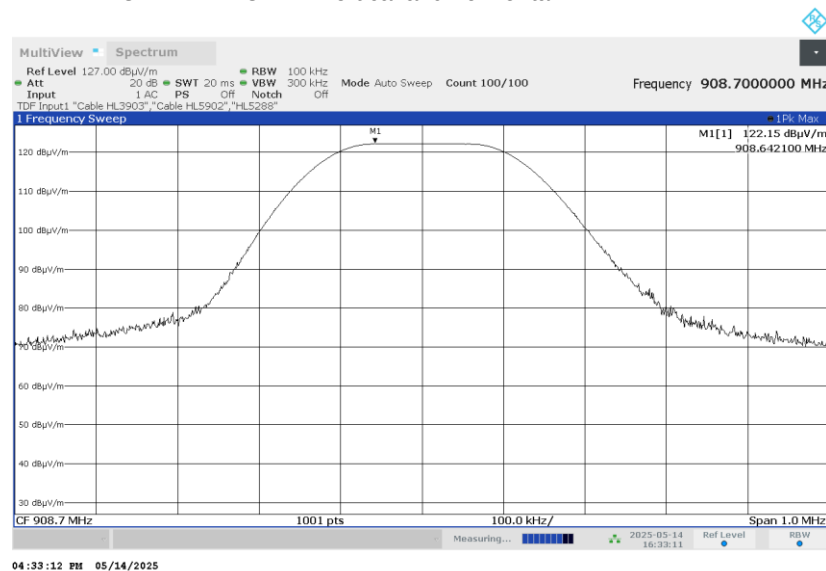
Plot 7.9.1 Radiated emission measurements at the low carrier frequency

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



Plot 7.9.2 Radiated emission measurements at the mid carrier frequency

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



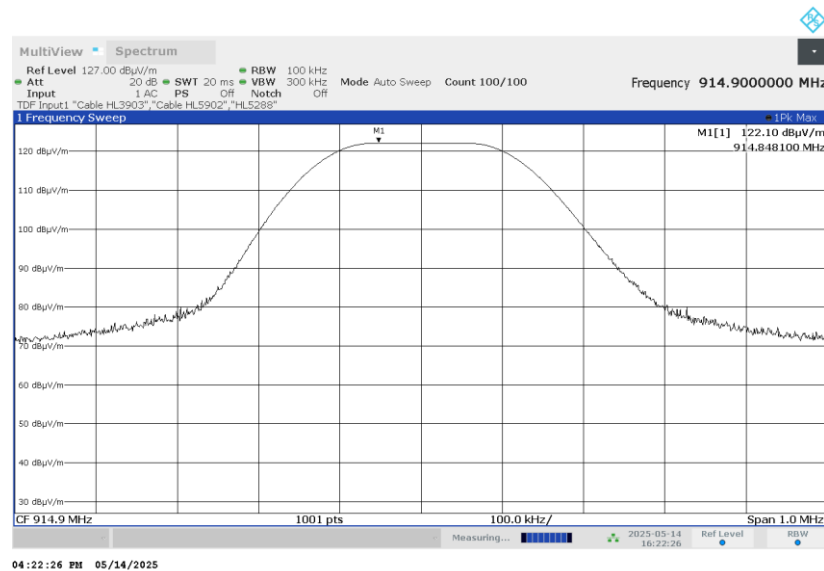


HERMON LABORATORIES

Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 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
ANTENNA POLARIZATION: Vertical and horizontal

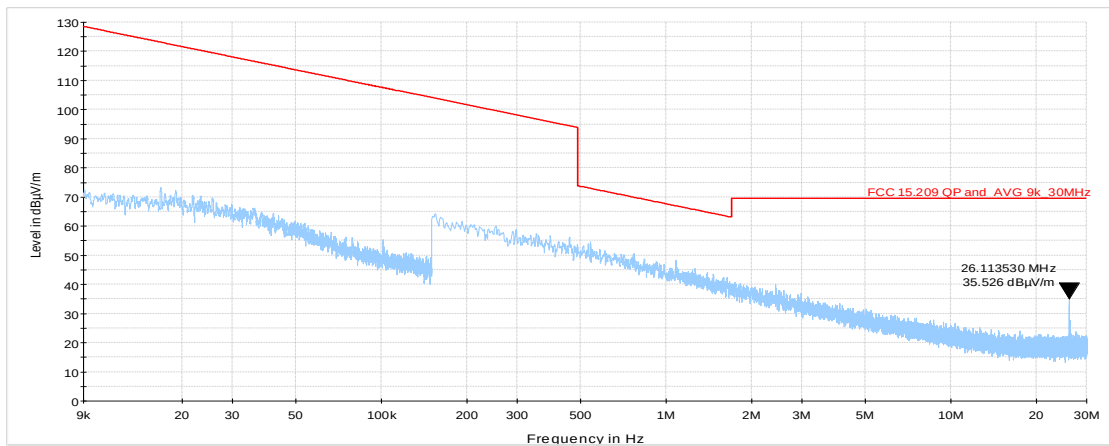




Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

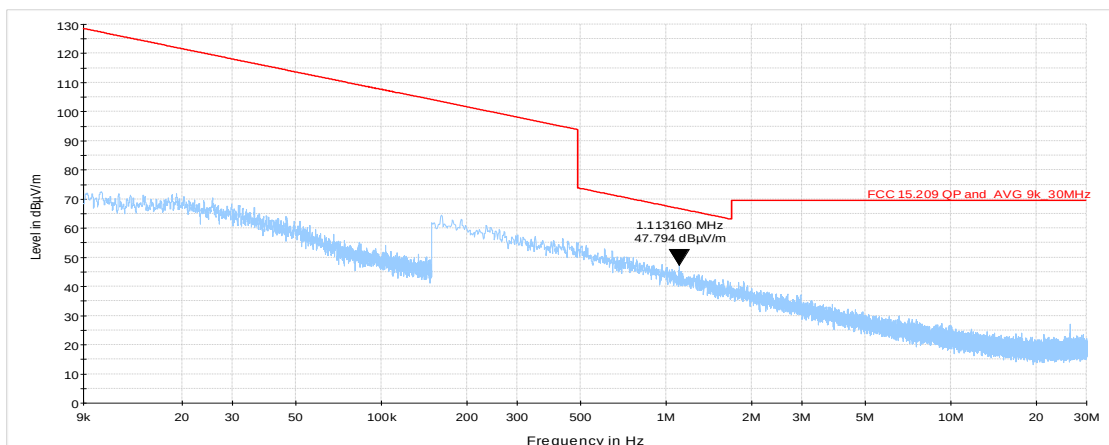
Plot 7.9.4 Radiated emission measurements from 0.009 to 30 MHz at the low carrier frequency

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



Plot 7.9.5 Radiated emission measurements from 0.009 to 30 MHz at the mid carrier frequency

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

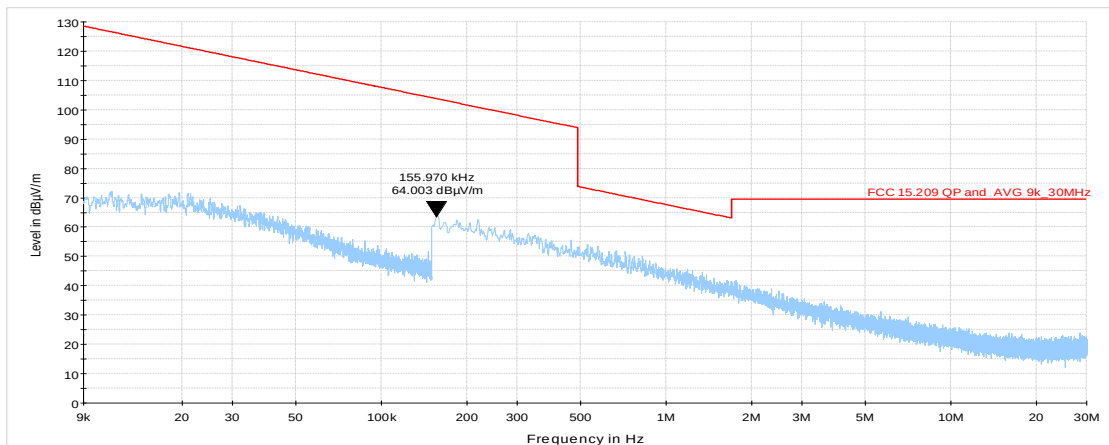




Test specification:		Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions	
Test procedure:		ANSI C63.10, sections 6.5, 6.6	
Test mode:		Verdict: PASS	
Date(s):			
23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.6 Radiated emission measurements from 0.009 to 30 MHz at the high carrier frequency

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



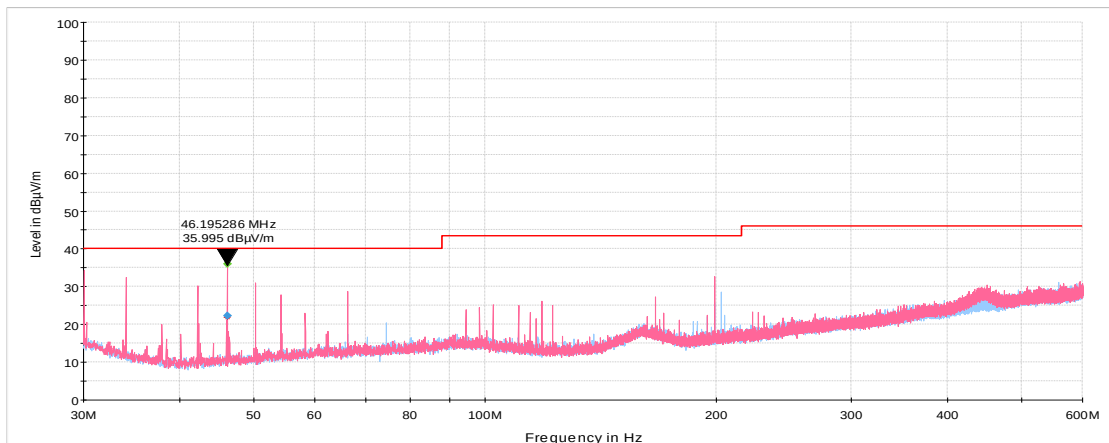


HERMON LABORATORIES

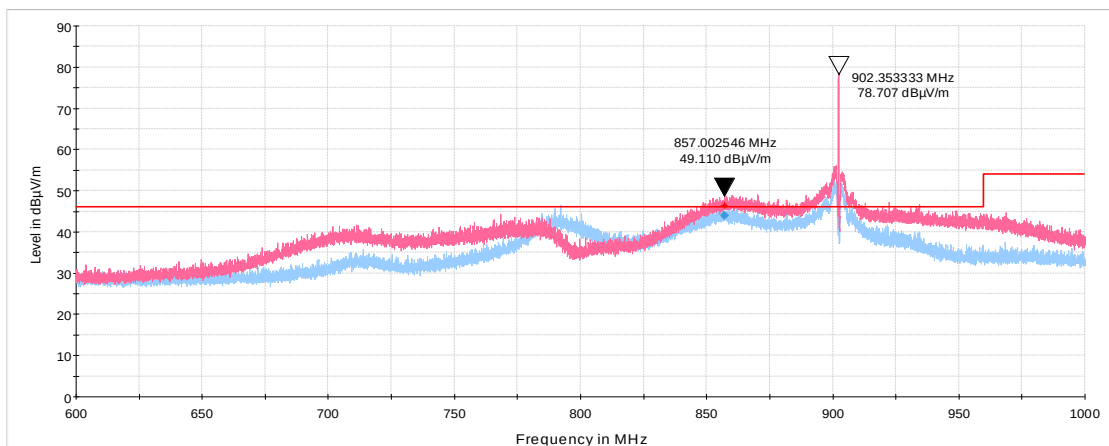
Test specification:		Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions	
Test procedure:		ANSI C63.10, sections 6.5, 6.6	
Test mode:		Verdict: PASS	
Date(s):			
23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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



With filter HL 4921



With filter HL 6252

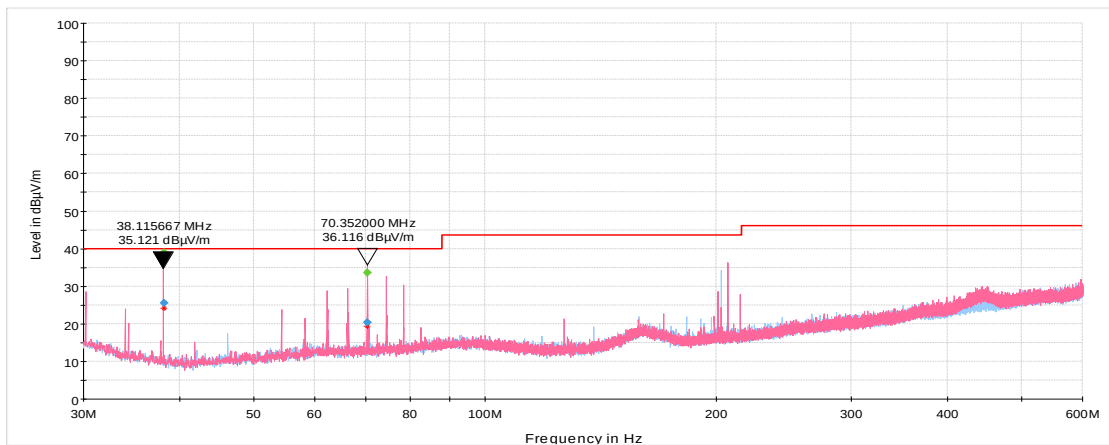


HERMON LABORATORIES

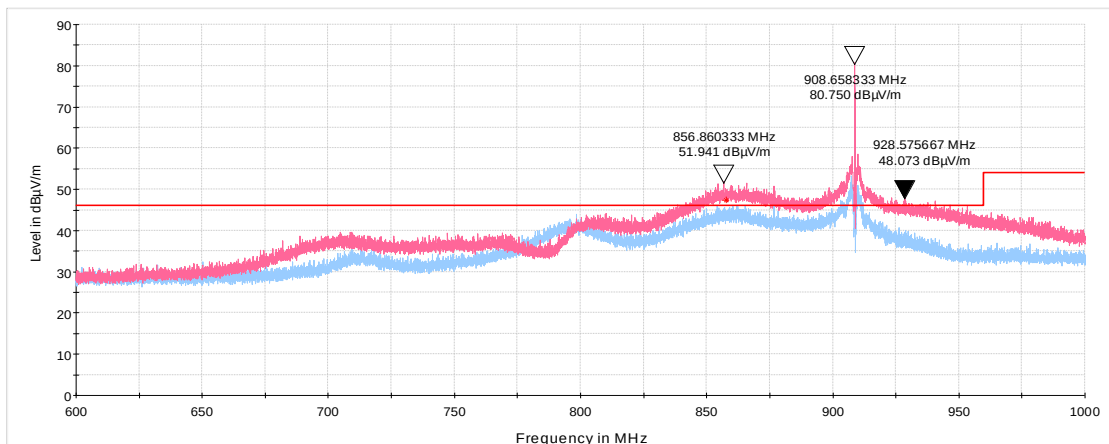
Test specification:		Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions	
Test procedure:		ANSI C63.10, sections 6.5, 6.6	
Test mode:		Verdict: PASS	
Date(s):			
23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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



With filter HL 4921



With filter HL 6252

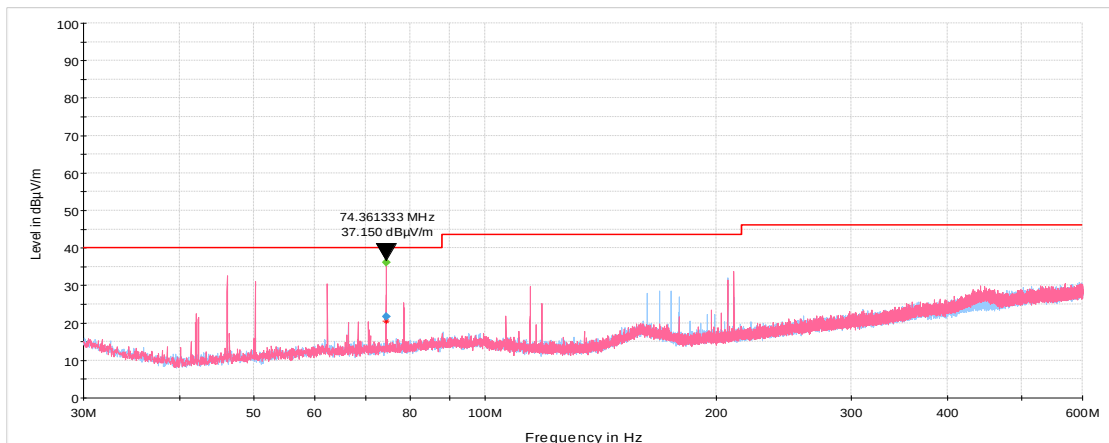


HERMON LABORATORIES

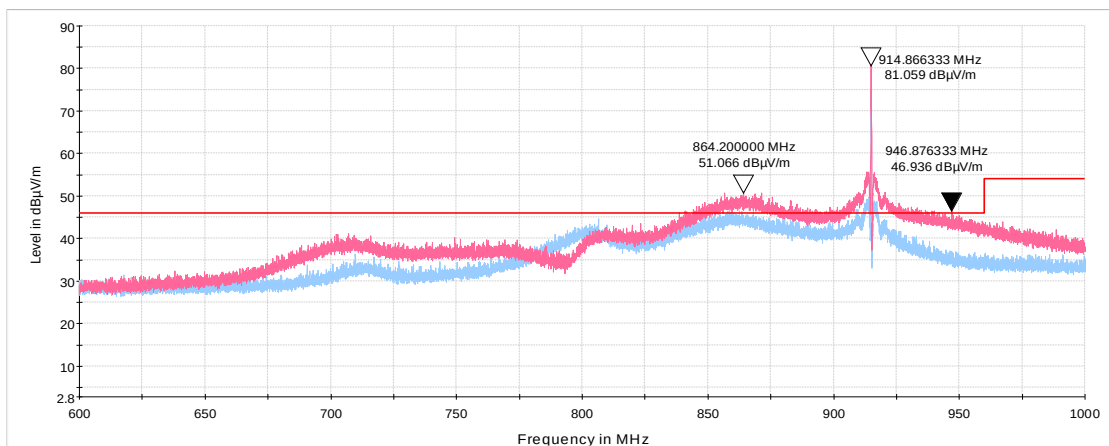
Test specification:		Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions	
Test procedure:		ANSI C63.10, sections 6.5, 6.6	
Test mode:		Verdict: PASS	
Date(s):			
23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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



With filter HL 4921



With filter HL 6252

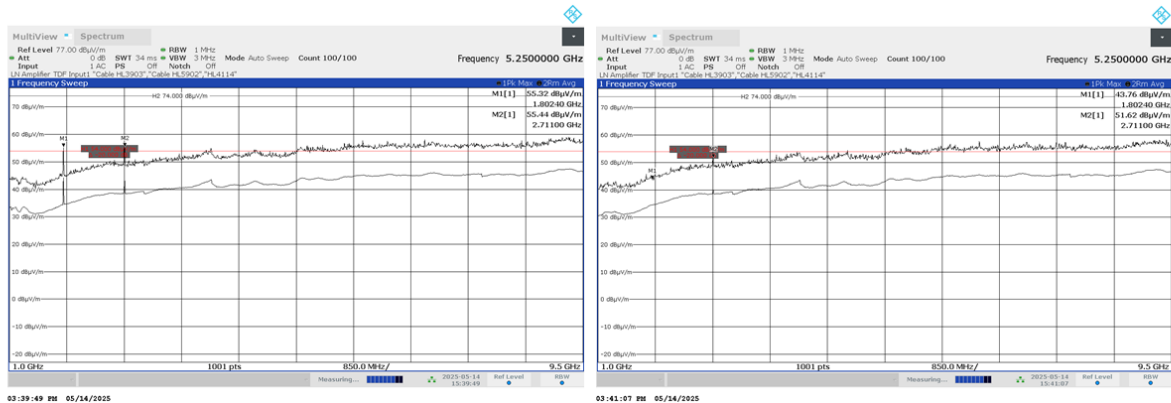


HERMON LABORATORIES

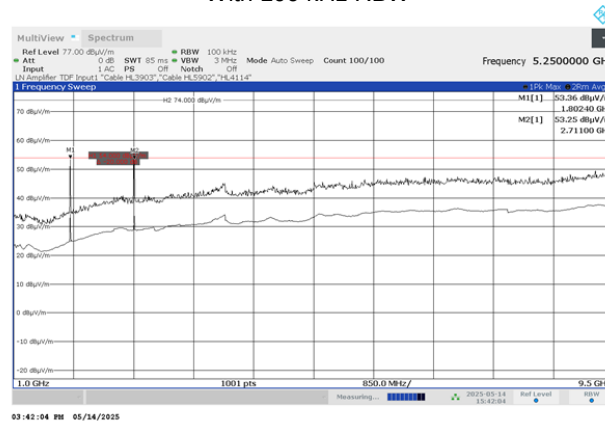
Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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



With filter HL 4339
With 100 kHz RBW



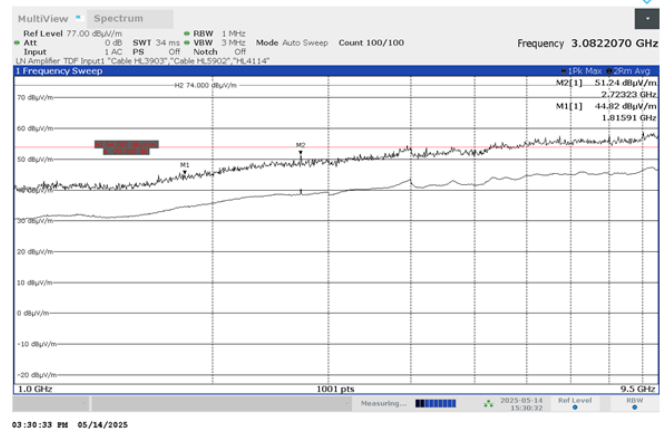
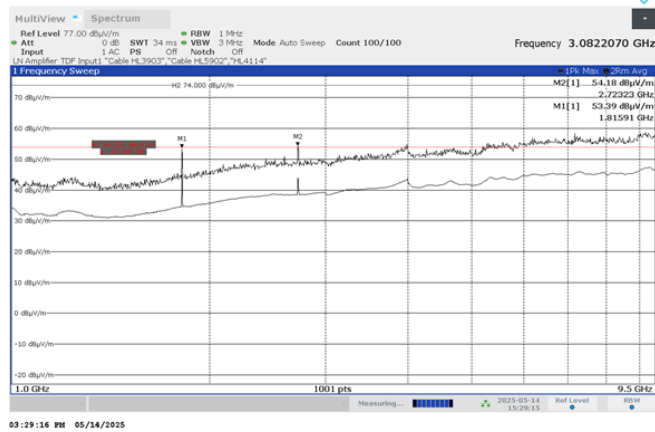


HERMON LABORATORIES

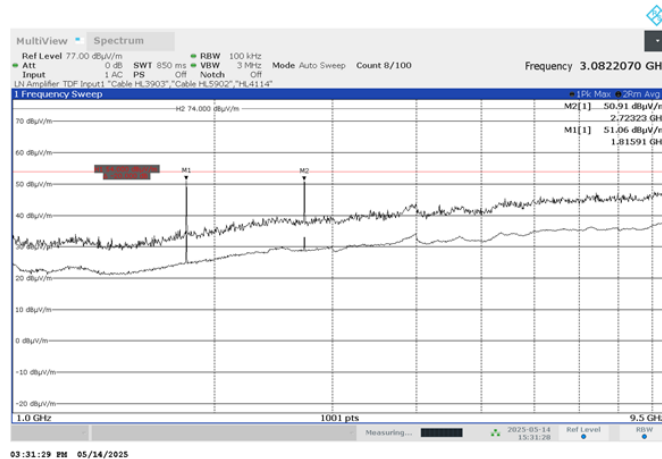
Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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



With filter HL 4339
With 100 kHz RBW



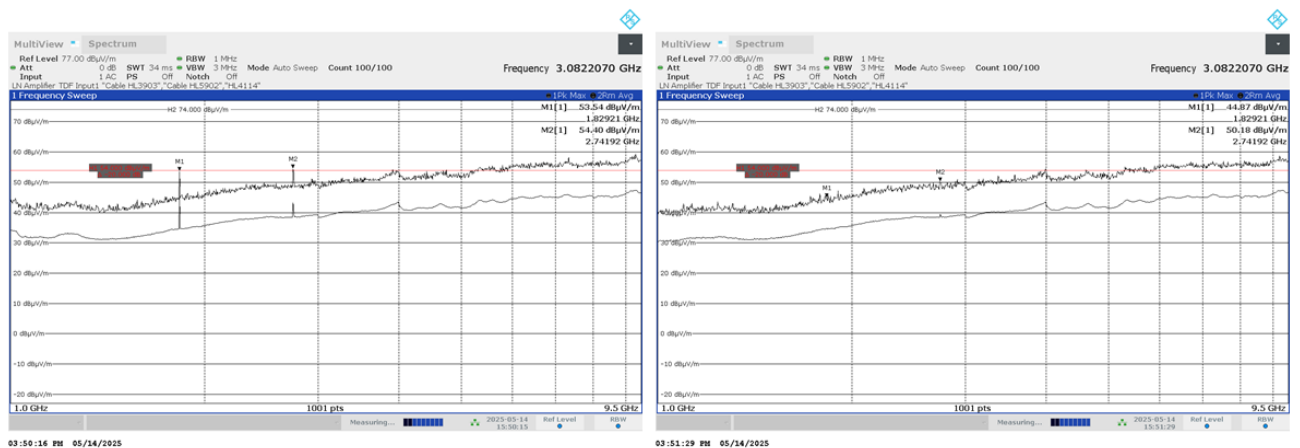


HERMON LABORATORIES

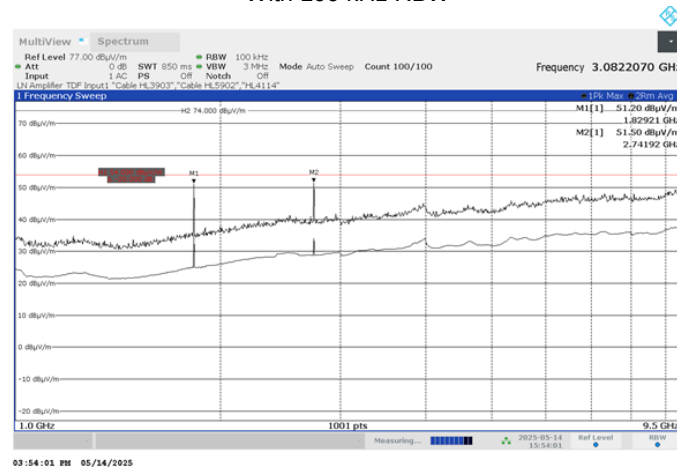
Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

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



With filter HL 4339
With 100 kHz RBW



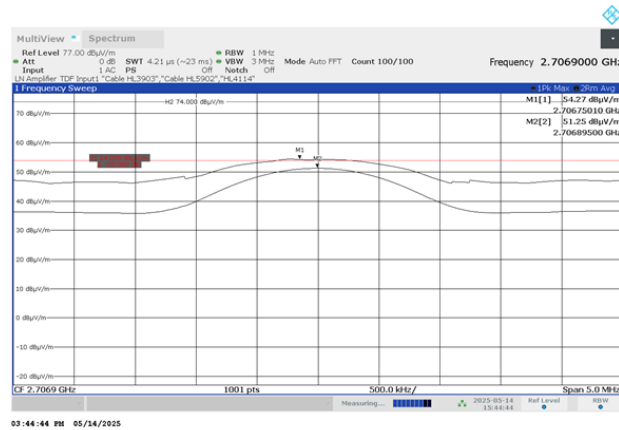


HERMON LABORATORIES

Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.9.13 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



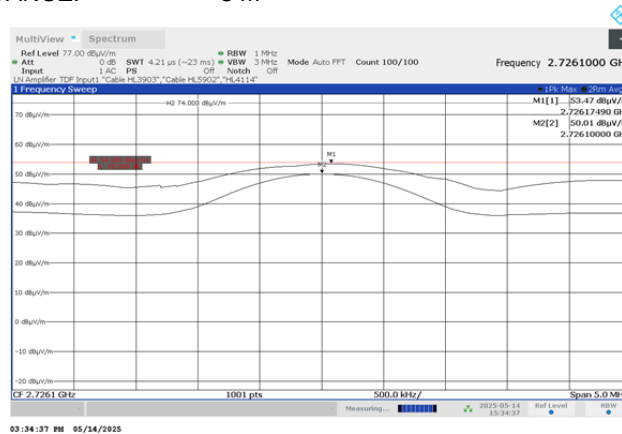


HERMON LABORATORIES

Test specification:		Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions	
Test procedure:		ANSI C63.10, sections 6.5, 6.6	
Test mode:		Verdict: PASS	
Date(s):			
23-Apr-25 - 15-May-25			
Temperature: 24 °C	Relative Humidity: 50 %	Air Pressure: 1012 hPa	Power: 3.6 VDC
Remarks:			

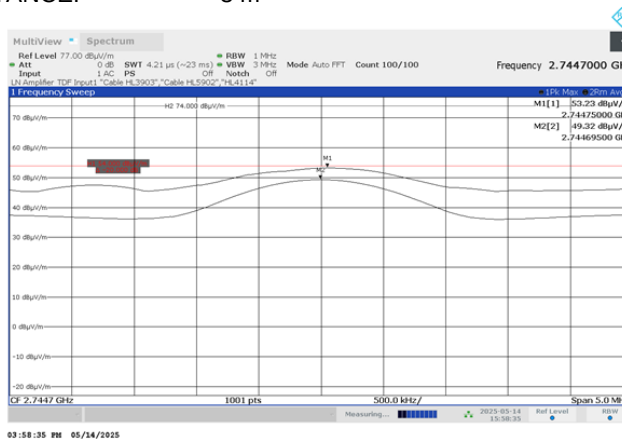
Plot 7.9.14 Radiated emission measurements at the third harmonic of mid carrier frequency

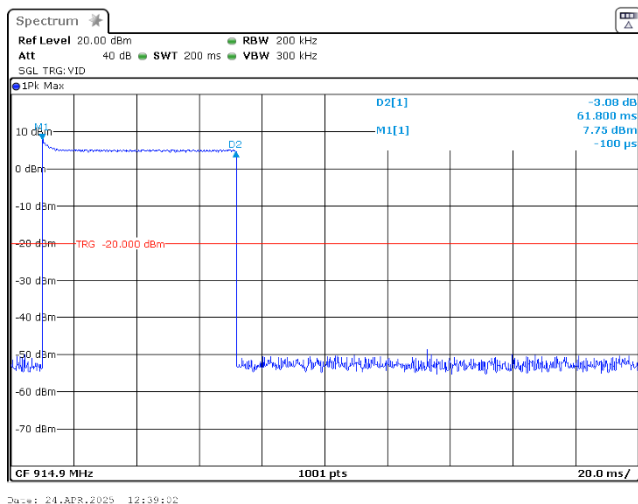
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



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

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m







Test specification: Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
Test procedure: ANSI C63.10, section 7.8.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Apr-25 - 24-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

7.10 Band edge radiated emissions

7.10.1 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 7.10.1.

Table 7.10.1 Band edge emission limits

Assigned frequency, MHz	Attenuation below carrier*, dBc
902.0 – 928.0	20.0

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

7.10.2 Test procedure

7.10.2.1 The EUT was set up as shown in Figure 7.10.1, energized normally modulated at the maximum data rate with its hopping function disabled and its proper operation was checked.

7.10.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.

7.10.2.3 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.

7.10.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.

7.10.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.10.2 and associated plots and referenced to the highest emission level measured within the authorized band.

7.10.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.

7.10.2.7 The above procedure was repeated with the frequency hopping function enabled.



Test specification:		Section 15.247(d), RSS-247 section 5.5, Emissions at band edges	
Test procedure:		ANSI C63.10, section 7.8.6	
Test mode:		Verdict: PASS	
Date(s):			
22-Apr-25 - 24-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Figure 7.10.1 Band edge emission test setup (hopping disables)

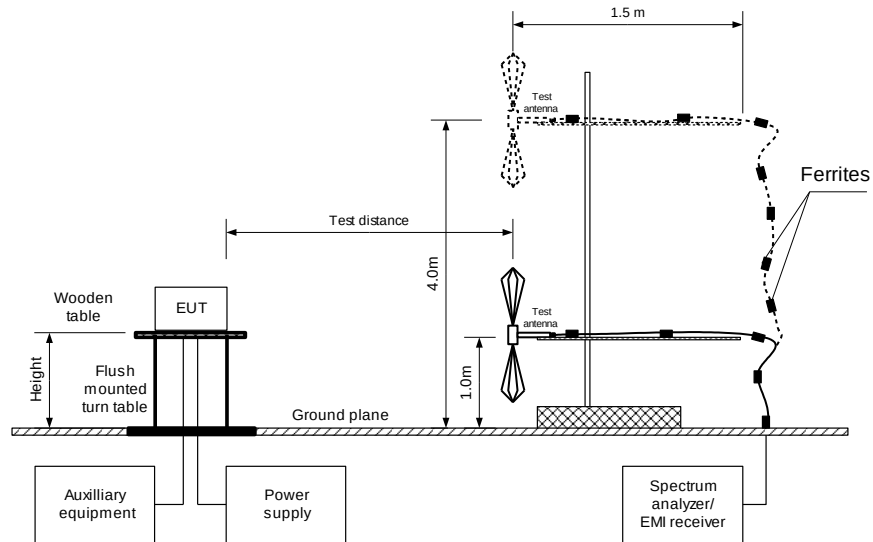


Figure 7.10.2 Band edge emission test setup (hopping enables)





HERMON LABORATORIES

Test specification: Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
Test procedure: ANSI C63.10, section 7.8.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Apr-25 - 24-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Table 7.10.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902-928 MHz
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: $\geq 1\%$ of the span
VIDEO BANDWIDTH: $\geq$ RBW

BIT RATE: 980 bps

Frequency, MHz	Band edge emission, dB(μ V/m)	Emission at carrier, dB(μ V/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Frequency hopping disabled						
902.3	69.67	104.20	34.53	20.0	14.53	Pass
903.7	69.16	103.28	34.12		14.12	
Frequency, MHz	Band edge emission, dBm	Emission at carrier, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Frequency hopping enabled						
902.3	-27.99	19.25	47.24	20.0	27.24	Pass
903.7	-33.28	19.17	52.45		32.45	

BIT RATE: 5470 bps

Frequency, MHz	Band edge emission, dB(μ V/m)	Emission at carrier, dB(μ V/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Frequency hopping disabled						
902.3	70.71	104.10	33.39	20.0	13.39	Pass
903.7	74.49	103.33	28.84		8.84	
Frequency, MHz	Band edge emission, dBm	Emission at carrier, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Frequency hopping enabled						
902.3	-32.06	19.26	51.32	20.0	31.32	Pass
903.7	-32.82	19.15	51.97		31.97	

*- Margin = Attenuation below carrier – specification limit.

Reference numbers of test equipment used

HL 7585	HL 3903	HL 5903	HL 0604	HL 5611			
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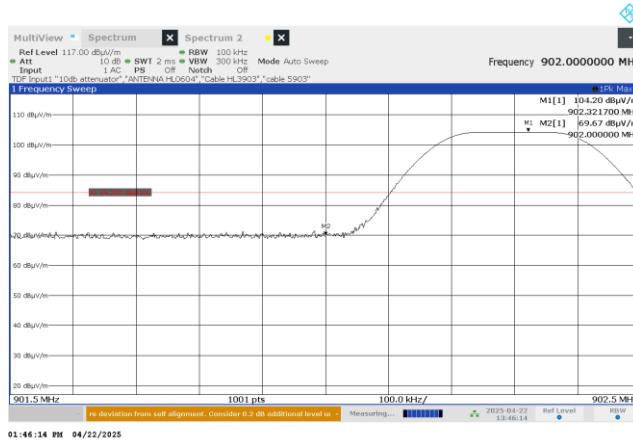
Full description is given in Appendix A.



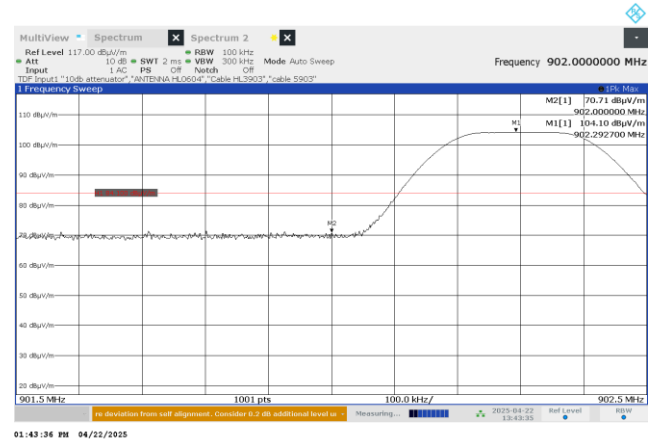
HERMON LABORATORIES

Test specification: Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
Test procedure: ANSI C63.10, section 7.8.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Apr-25 - 24-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.10.1 The highest band edge emission at low carrier frequency with hopping function disabled

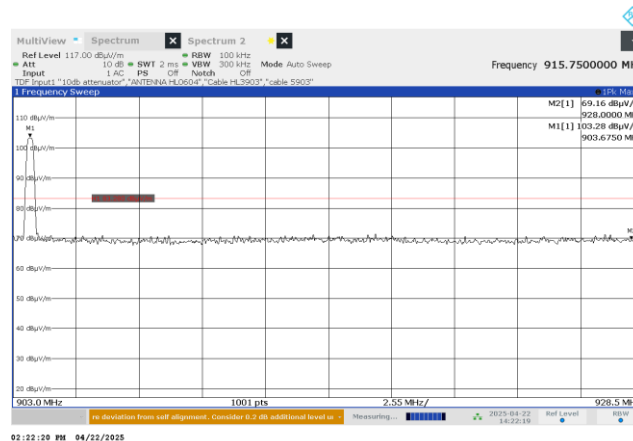


Bit rate 980 bps

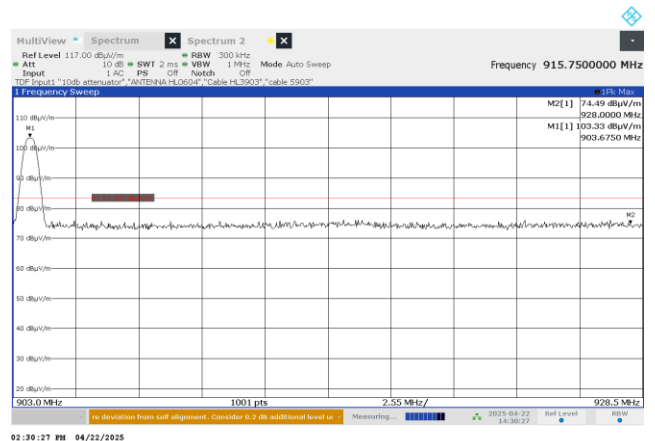


Bit rate 5470 bps

Plot 7.10.2 The highest band edge emission at high carrier frequency with hopping function disabled



Bit rate 980bps



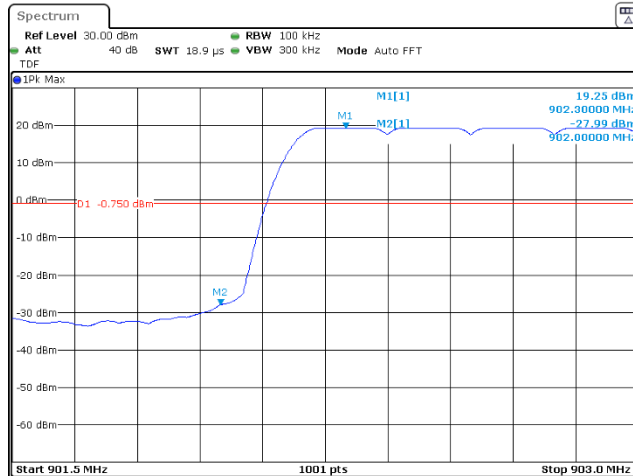
Bit rate 5470 bps



HERMON LABORATORIES

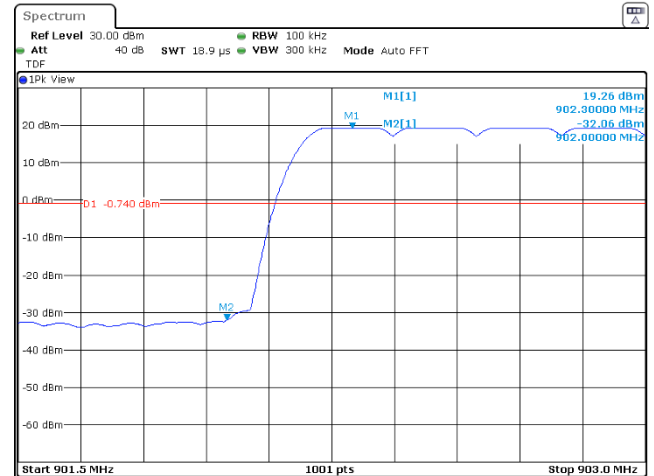
Test specification: Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
Test procedure: ANSI C63.10, section 7.8.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 22-Apr-25 - 24-Apr-25			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: 1003 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.10.3 The highest band edge emission at low carrier frequency with hopping function enabled



Date: 24.APR.2025 14:07:15

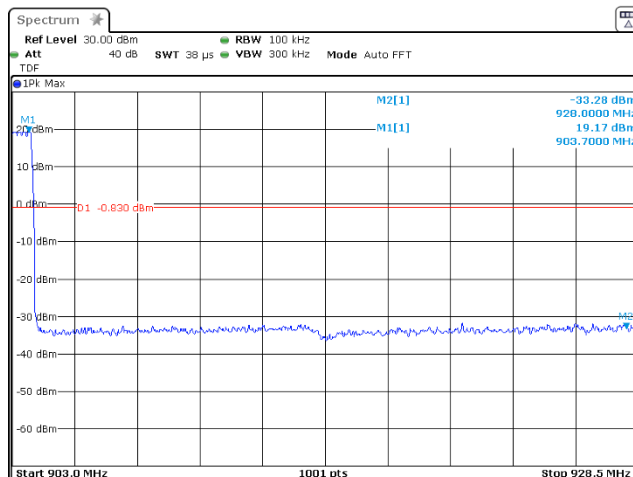
Bit rate 980bps



Date: 24.APR.2025 15:02:00

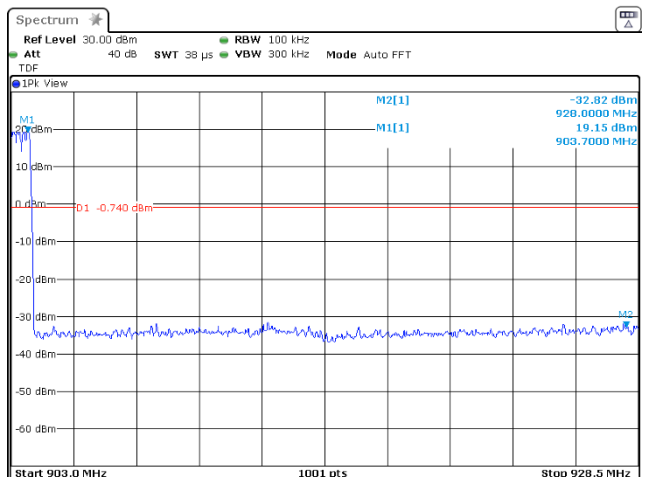
Bit rate 5470 bps

Plot 7.10.4 The highest band edge emission at high carrier frequency with hopping function enabled



Date: 24.APR.2025 14:10:10

Bit rate 980bps



Date: 24.APR.2025 15:03:56

Bit rate 5470 bps

8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 (9) kHz - 30 MHz	EMCO	6502	2857	18-Feb-25	18-Feb-26
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	23-Aug-23	23-Aug-26
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
4135	Shield Box	TESCOM CO., LTD	TC-5916A	5916A000 136	20-May-24	20-May-25
4339	High pass Filter, 50 Ohm, 1000 to 18000 MHz, SMA-FM / SMA-M	Micro-Tronics	HPM5011 5-02	001	21-Jun-23	21-Jun-25
4921	Low Pass Filter, 50 Ohm, DC to 630 MHz, SMA/M-SMA/F	Mini-Circuits	VLF-630+	NA	20-Jun-23	20-Jun-25
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	19-Feb-25	19-Feb-26
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	08-Apr-25	08-Apr-27
5594	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18000 MHz	Mini Circuits	BW-N10W5+	NA	11-Mar-24	11-Mar-25
5601	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18000 MHz	Mini Circuits	BW-N10W5+	NA	14-Aug-24	14-Aug-25
5611	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini Circuits	BW-S10W5+	NA	06-Feb-25	06-Feb-26
5637	Cable, 50 Ohm, DC to 18 GHz, 1.8 m, SMA/SMA	Mini Circuits	CBL-6FT-SMSM+	NA	21-Apr-25	21-Apr-26
5673	Cable SF126EA/11N(x2)/2M, 18GHz	Huber-Suhner	SF126EA	506756/12 6EA	19-May-24	19-May-25
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/ 11N/11N/ 6000	NA	17-Nov-24	17-Nov-25
5903	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/ 11N/11N/ 6000		06-Aug-24	06-Aug-25
6252	Tunable Bandreject Filter 800-1000 MHz	K&L Microwave Inc.	3TNF-800/1000-0.2-N/N	336	07-Nov-23	07-Nov-25
7585	EMI Test Receiver, 1 Hz to 44 GHz	Rohde & Schwarz	ESW44	103130	24-Sep-24	24-Sep-25

9 APPENDIX B Test equipment correction factors

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

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

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

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

above 1000 MHz

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

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

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

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

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

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

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

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

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

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

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

10 APPENDIX C Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

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

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

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

11 APPENDIX D Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).

The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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 E

Specification references

FCC 47CFR part 15: 2022

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 F Abbreviations and acronyms

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



14 APPENDIX G Manufacturer's declaration



AT57-7 Declaration

We, the undersigned,

Company Name: Arad Technologies LTD
Address: Hamada 4, Yokneam Ellit
Country: Israel
Telephone number: 972-4-9935222
Fax number: 972-4-9935227

Declare under our sole responsibility that the only change is with mechanical pipeline diameter and material type (see below), no change at all in AT57-7 electronics.

AT57-7-21-5-P-1	AT57-7-21-5-OM-1	AT57-7-22-5-P-1	AT57-7-22-5-OM-1	AT57-7-1-13-P-1	Short description
					Accurate water meter, using the ultrasonic principle.
3/4" Polymer	3/4" Brass	5/8" Polymer	5/8" Brass	1" Polymer	Pipeline diameter / material
7.5" inch	7.5" inch	7.5" inch	7.5" inch	10.75" inch	Pipeline length



AT57-7-1-13-OM-1	AT57-7-23-17-S-1	AT57-7-2-11-S-1	AT57-7-2-25-S-1	Short description
				Accurate water meter, using the ultrasonic principle.
1" Brass	1.5" Stainless steel	2" Stainless steel	2" Stainless steel	Pipeline diameter / material
10.75" inch	13" inch	10" inch	17" inch	Pipeline length

July 29, 2025


Gilad Elie

Project Manager

Company
Arad Technologies Ltd.

END OF DOCUMENT