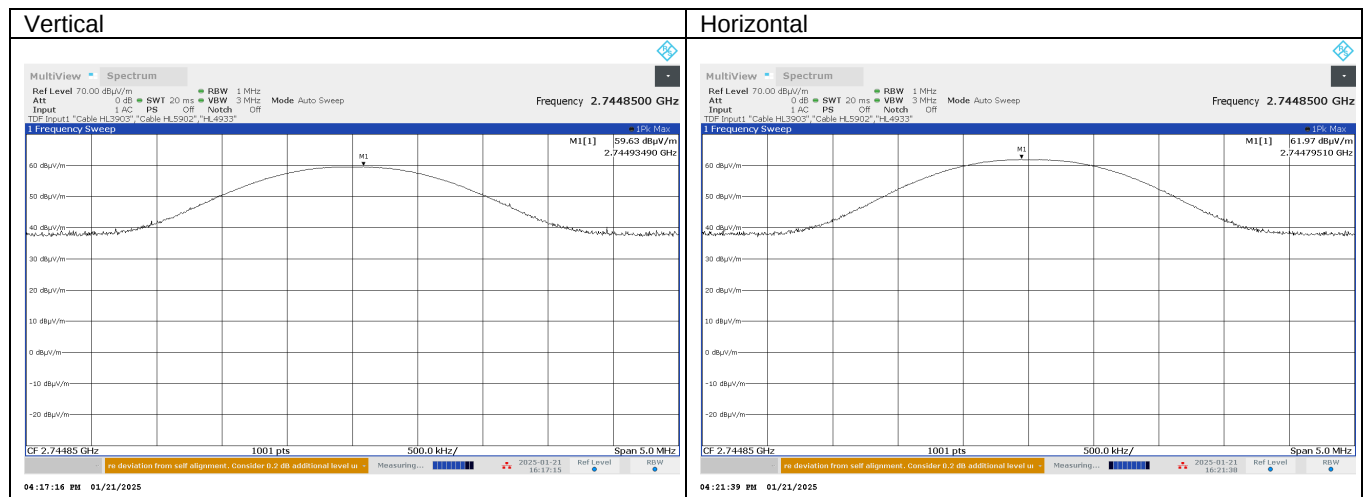


Test specification:		Section 15.247(c), RSS-247 section 5.5, Radiated spurious emissions	
Test procedure:		ANSI C63.10, sections 6.5, 6.6	
Test mode:		Verdict: PASS	
Date(s):			
23-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1013 hPa	Power: 4.5 VDC
Remarks:			

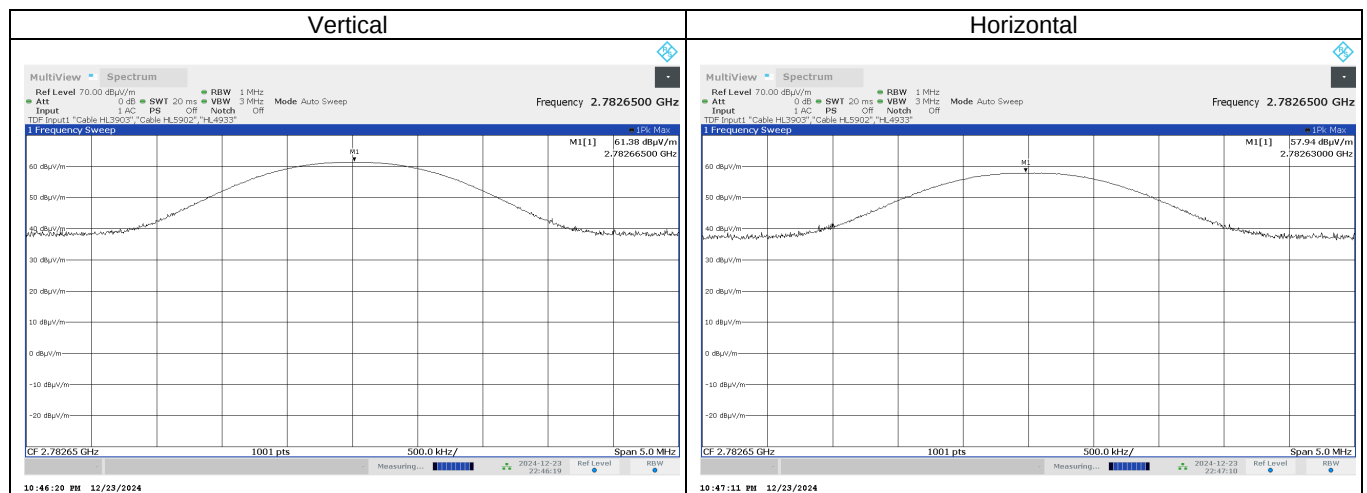
Plot 7.6.14 Radiated emission measurements at the third harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



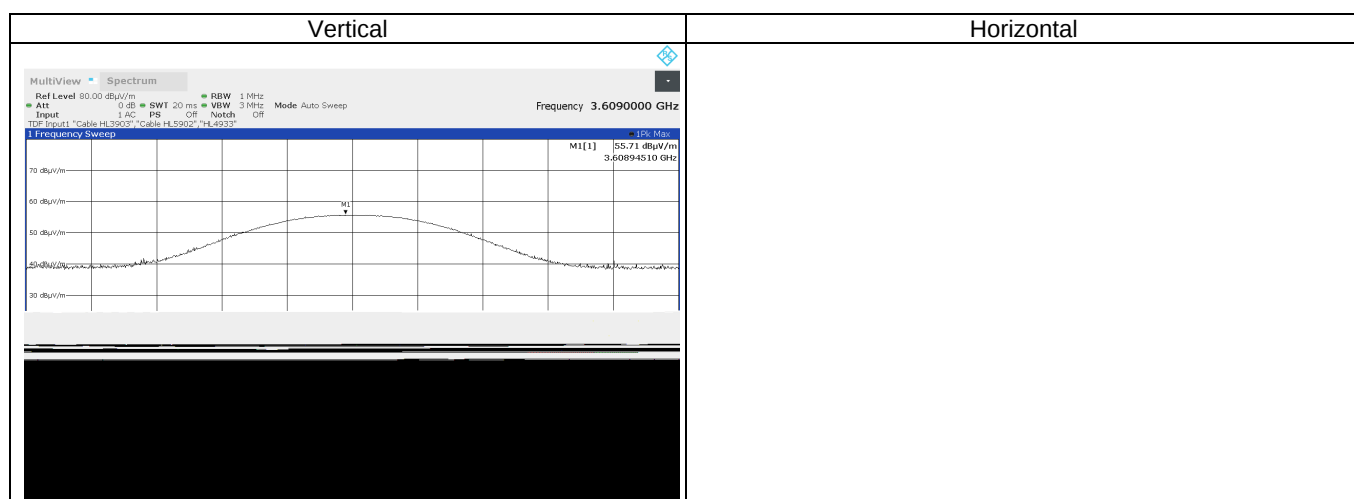
Plot 7.6.15 Radiated emission measurements at the third harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m

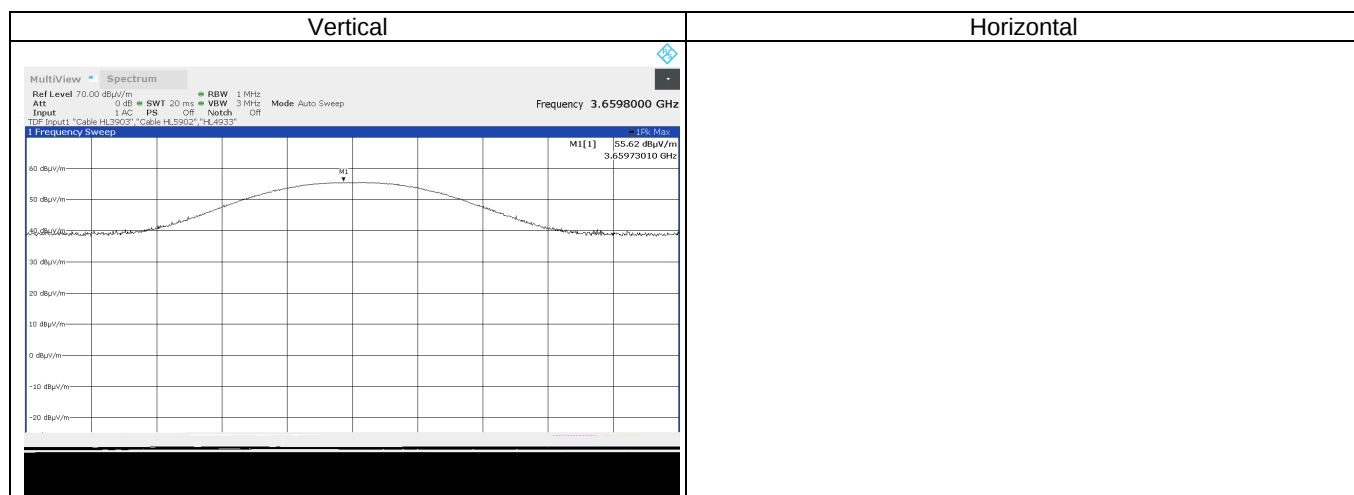




TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



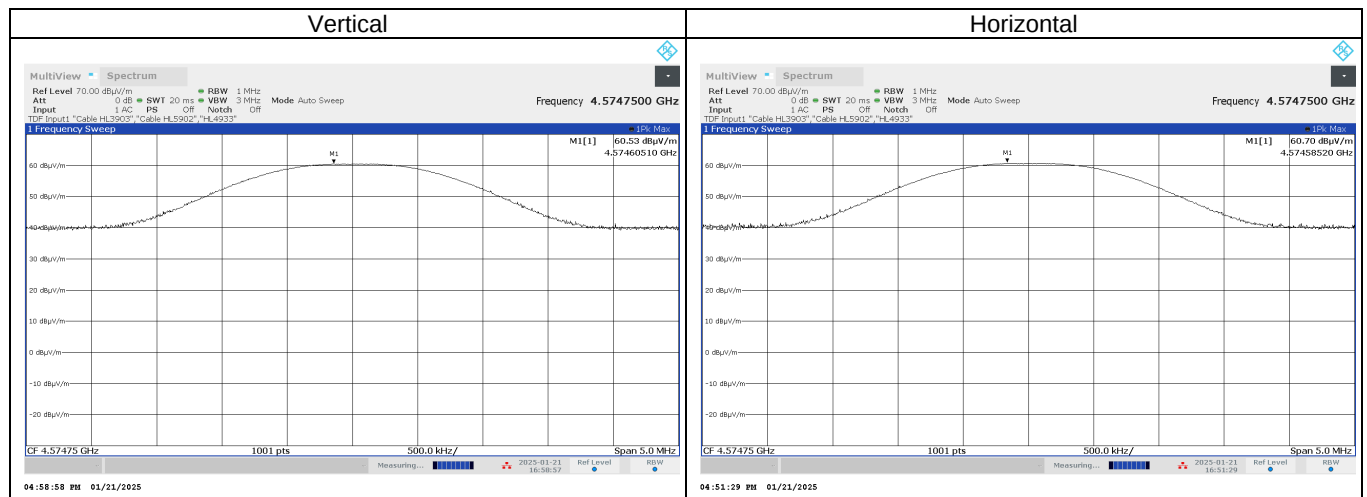
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:		Section 15.247(c), 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-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1013 hPa	Power: 4.5 VDC
Remarks:			

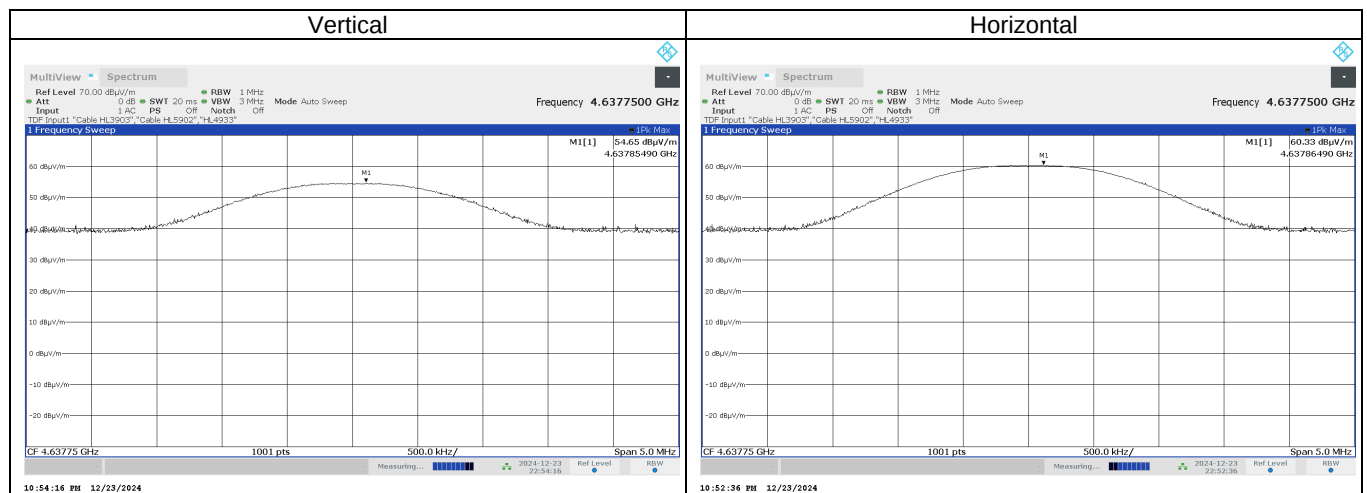
Plot 7.6.20 Radiated emission measurements at the fifth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.6.21 Radiated emission measurements at the fifth harmonic of high carrier frequency

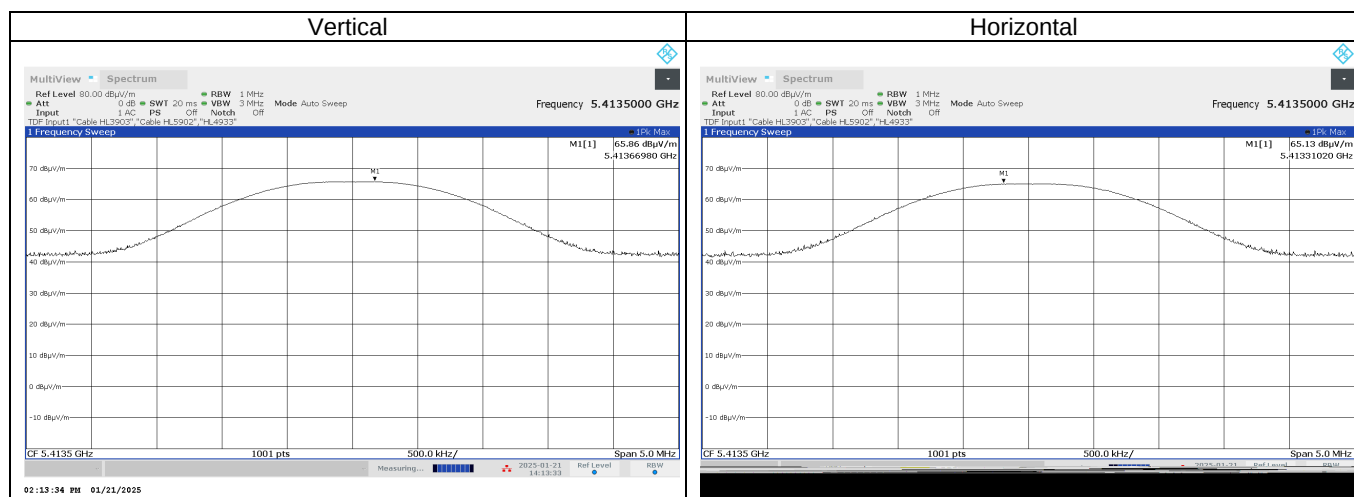
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification: Section 15.247(c), 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-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1013 hPa	Power: 4.5 VDC
Remarks:			

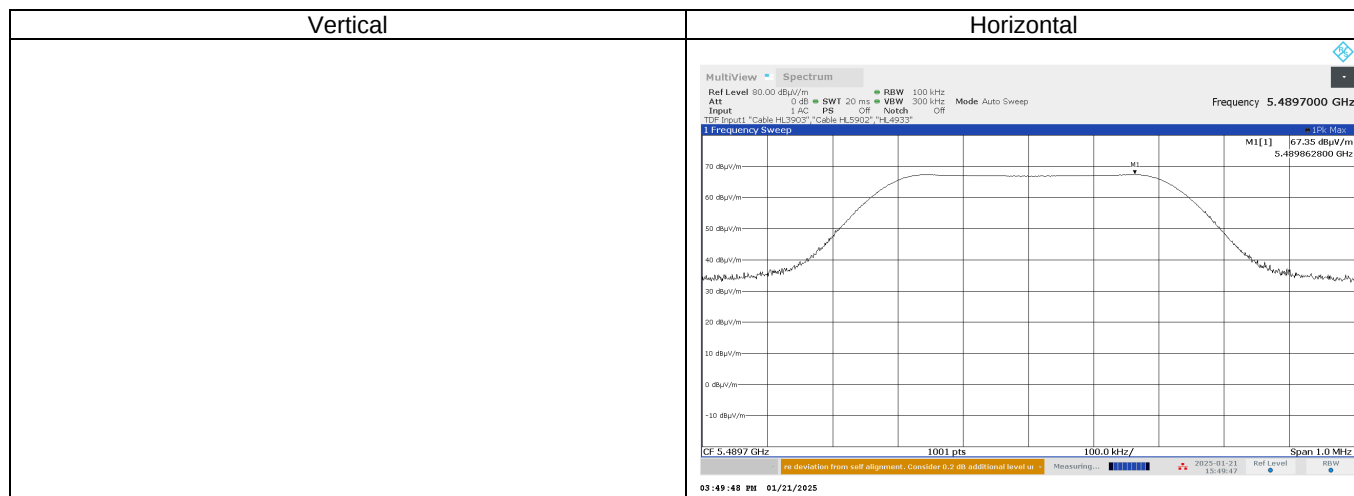
Plot 7.6.22 Radiated emission measurements at the sixth harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.6.23 Radiated emission measurements at the sixth harmonic of mid carrier frequency

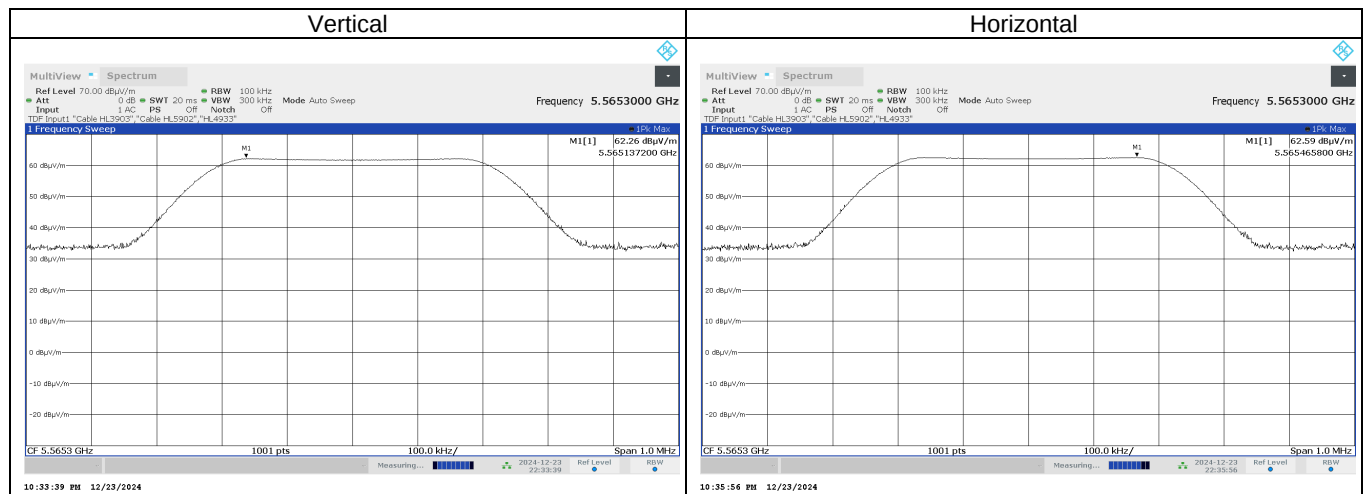
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:		Section 15.247(c), 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-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1013 hPa	Power: 4.5 VDC
Remarks:			

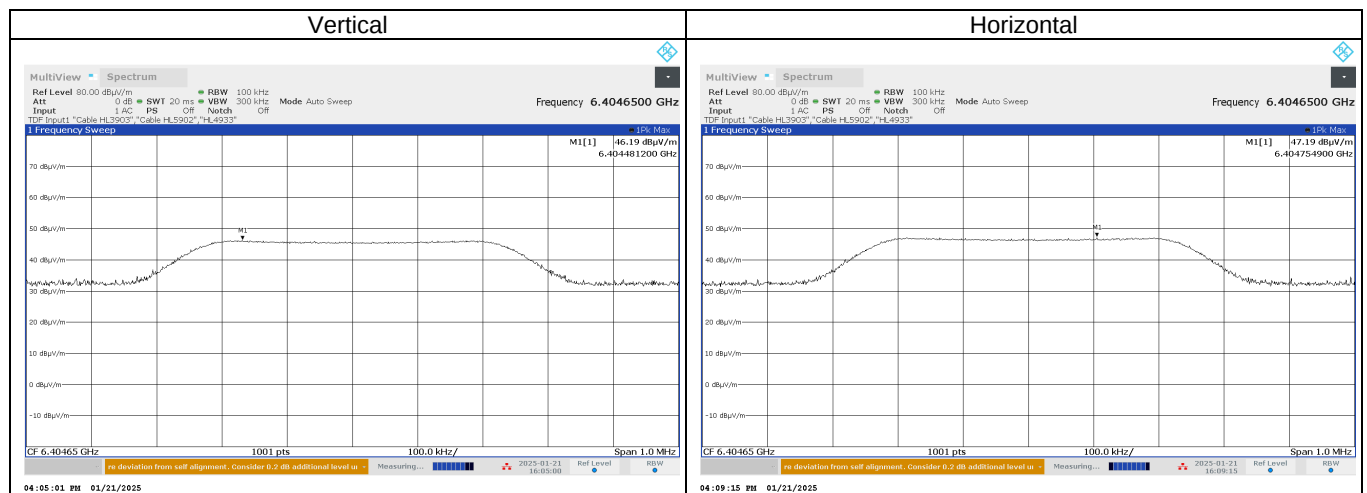
Plot 7.6.24 Radiated emission measurements at the sixth harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.6.25 Radiated emission measurements at the seventh harmonic of mid carrier frequency

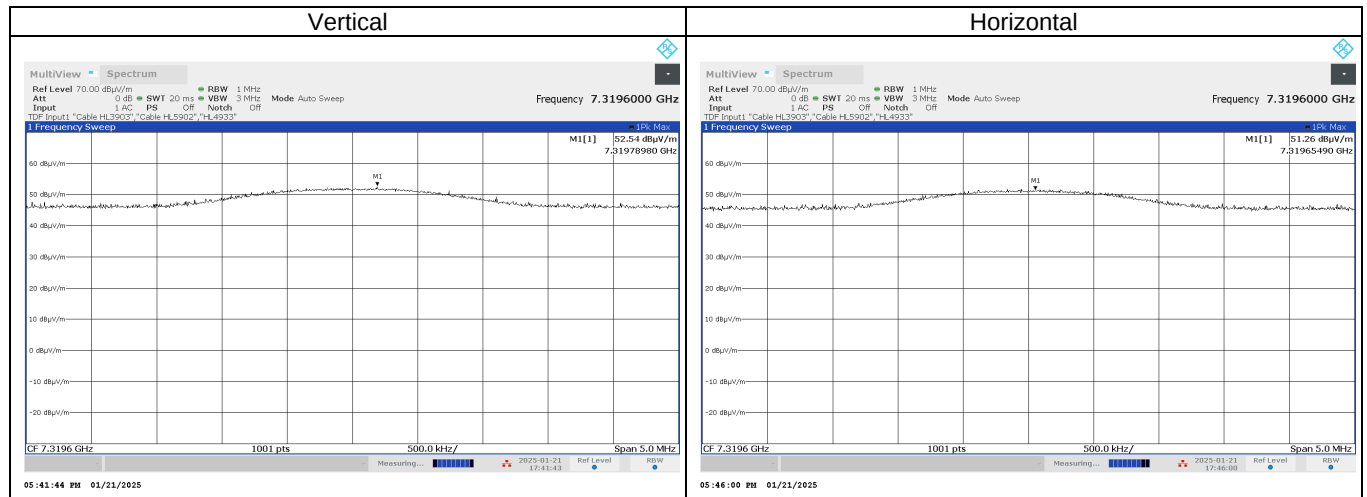
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:		Section 15.247(c), 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-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1013 hPa	Power: 4.5 VDC
Remarks:			

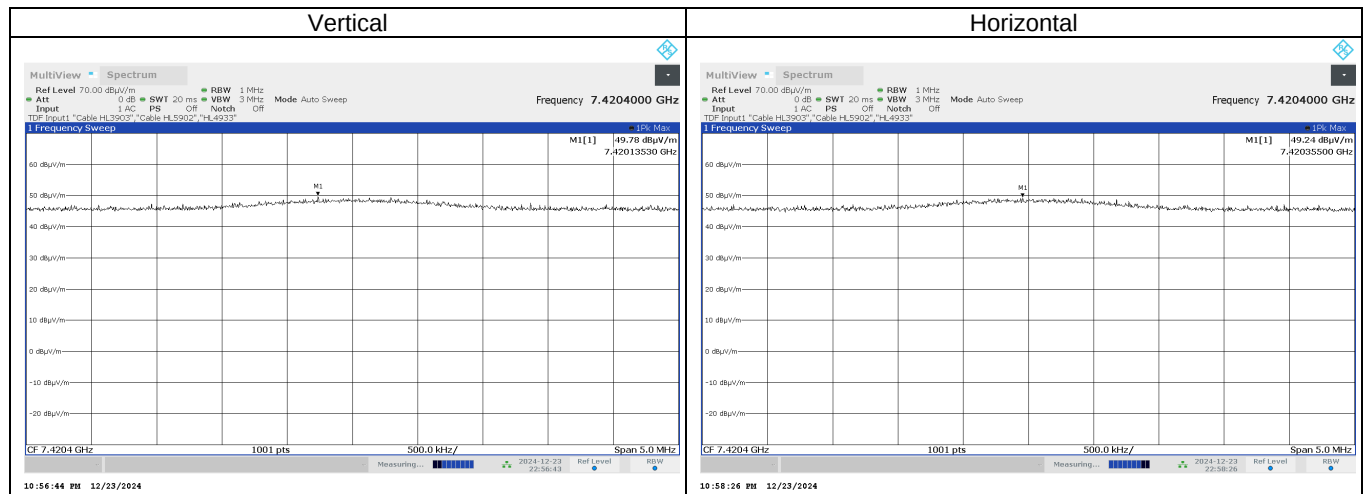
Plot 7.6.26 Radiated emission measurements at the eighth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.6.27 Radiated emission measurements at the eighth harmonic of high carrier frequency

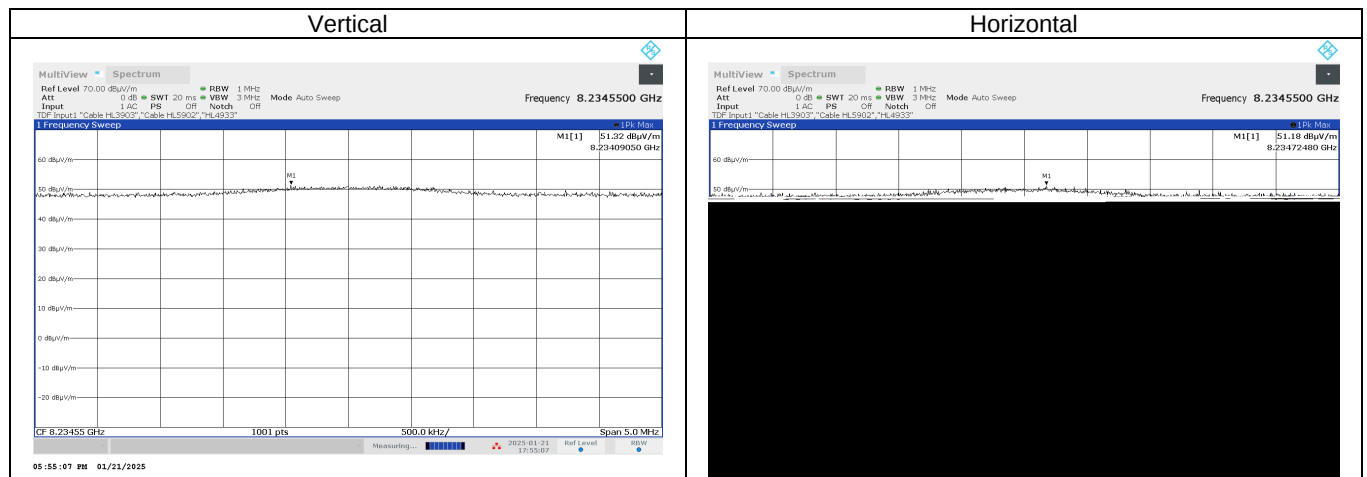
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:		Section 15.247(c), 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-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1013 hPa	Power: 4.5 VDC
Remarks:			

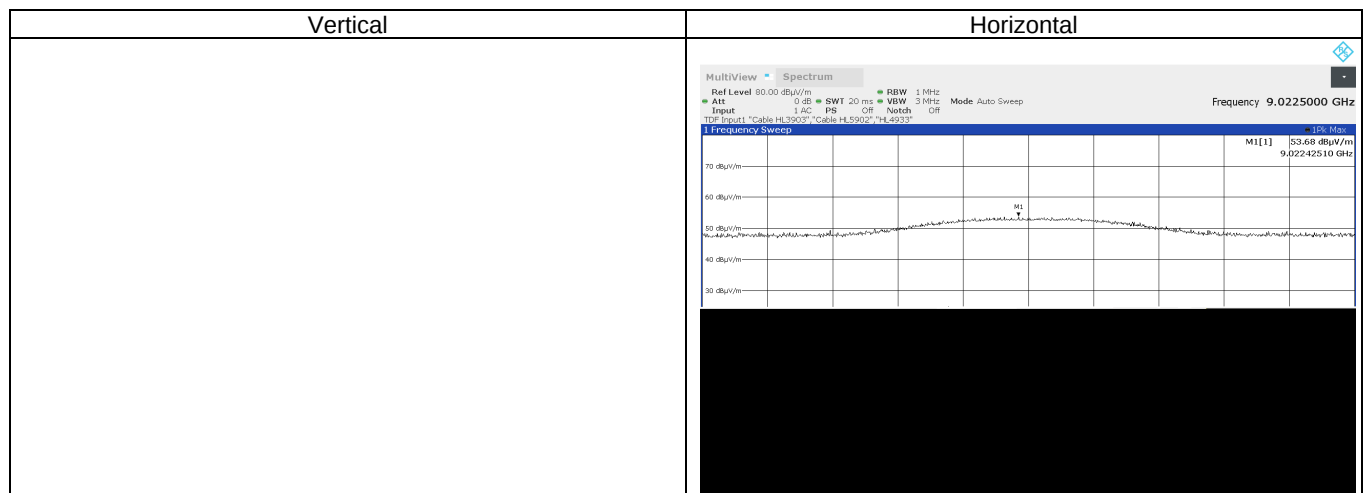
Plot 7.6.28 Radiated emission measurements at the ninth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.6.29 Radiated emission measurements at the tenth harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m





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Report ID: PARRAD_FCC.54964_TR
Date of Issue: 15-Apr-25

Test specification:		Section 15.247(c), 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-Dec-24			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1013 hPa	Power: 4.5 VDC
Remarks:			

Plot 7.6.32 Transmission pulse duration



Plot 7.6.33 Transmission pulse period

Test specification: Section 15.247(c), 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): 13-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1019 hPa	Power: 4.5 VDC
Remarks:			

7.7 Band edge radiated emissions

7.7.1 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 7.7.1.

Table 7.7.1 Band edge emission limits

Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(μV/m)	
		Peak	Average
902.0 – 928.0	20.0	74.0	54.0
2400.0 – 2483.5			
5725.0 – 5850.0			

* - 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 with its hopping function disabled 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





HERMON LABORATORIES

Report ID: PARRAD_FCC.54964_TR

Date of Issue: 15-Apr-25

Test specification: Section 15.247(c), 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): 13-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1019 hPa	Power: 4.5 VDC
Remarks:			

Table 7.7.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902-928 MHz
 DETECTOR USED: Peak
 MODULATION: GFSK
 BIT RATE: 19.2 kbps
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz

Frequency, MHz	Band edge emission, dBm	Emission at carrier, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Frequency hopping disabled						
902.22	69.64	112.43	42.79	20.0	22.79	Pass
927.55	66.78	109.86	43.08		23.08	
Frequency hopping enabled						
902.25	69.81	112.33	42.52	20.0	22.52	Pass
927.47	62.99	109.73	46.74		26.74	

*- Margin = Attenuation below carrier – specification limit.

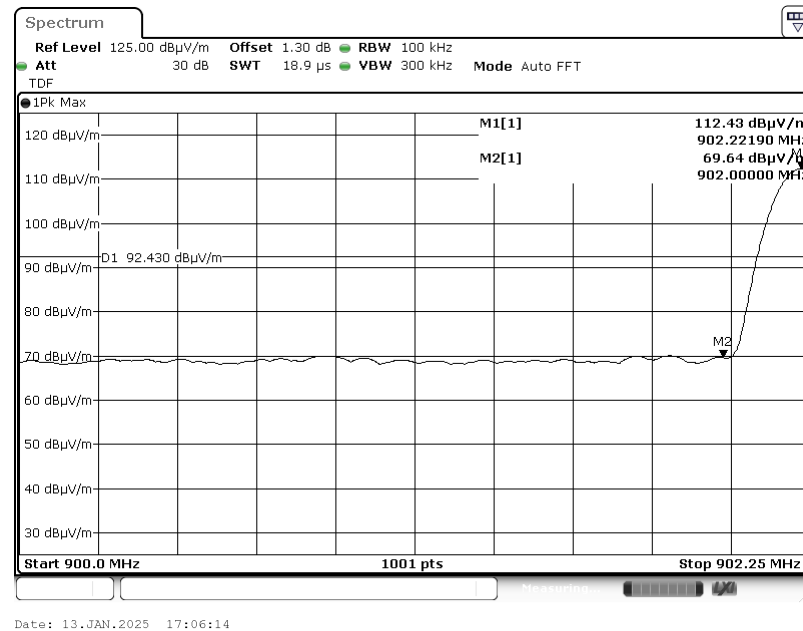
Reference numbers of test equipment used

HL 0337	HL 4135	HL 4355	HL 5644	HL 5933			
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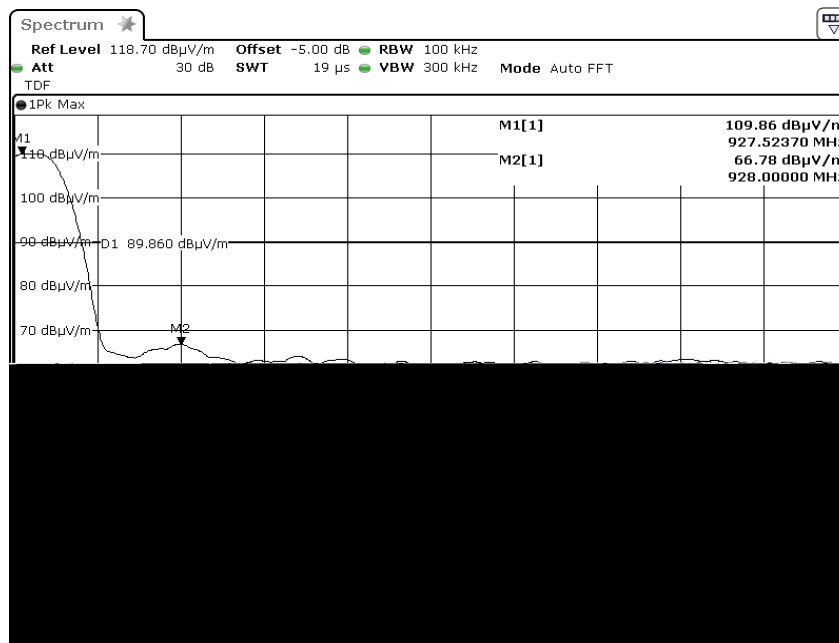
Full description is given in Appendix A.

Test specification: Section 15.247(c), 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): 13-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1019 hPa	Power: 4.5 VDC
Remarks:			

Plot 7.7.1 The highest band edge emission at low carrier frequency with hopping function disabled

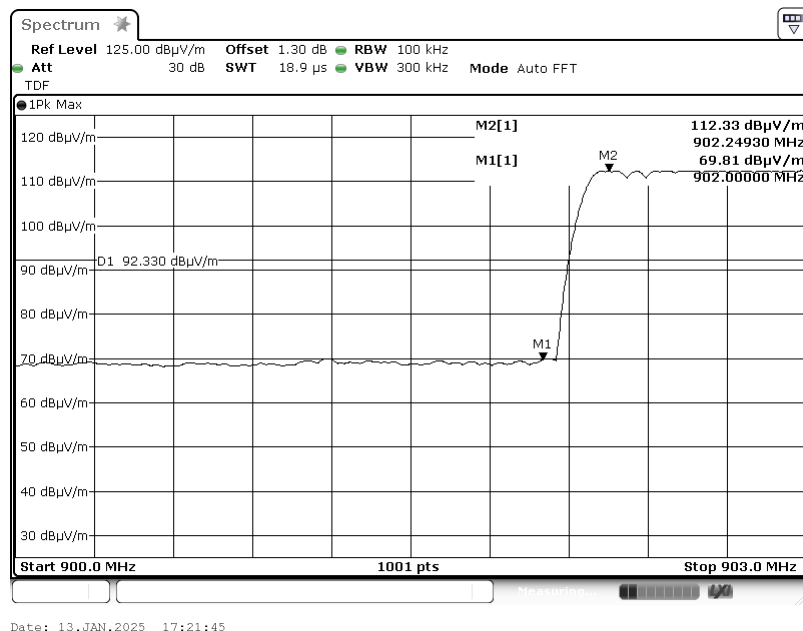


Plot 7.7.2 The highest band edge emission at high carrier frequency with hopping function disabled

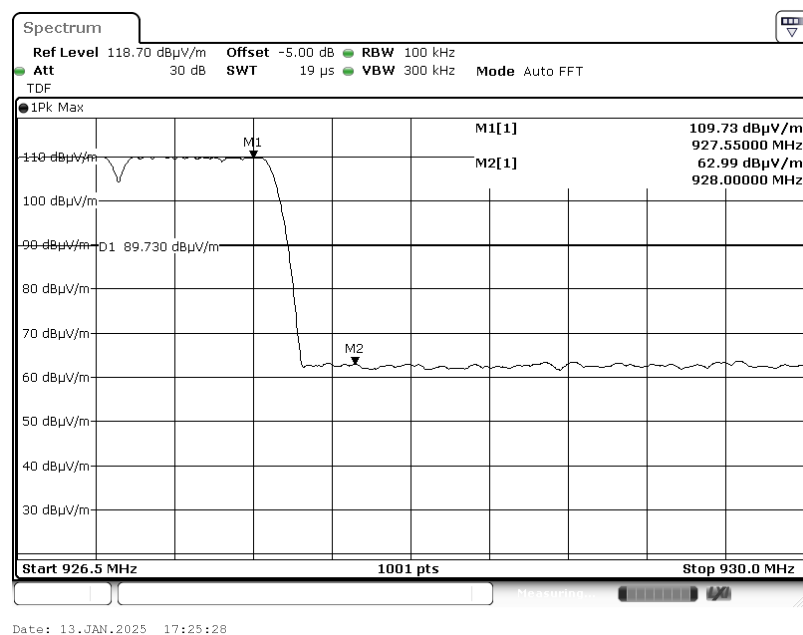


Test specification: Section 15.247(c), RSS-247 section 5.5, Emissions at band edges			
Test procedure: ANSI C63.10, section 7.8.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 13-Jan-25			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1019 hPa	Power: 4.5 VDC
Remarks:			

Plot 7.7.3 The highest band edge emission at low carrier frequency with hopping function enabled



Plot 7.7.4 The highest band edge emission at high carrier frequency with hopping function enabled





Test specification: FCC Section 15.203/ RSS-Gen, Section 7.1.4, Antenna requirement			
Test procedure: Visual inspection / supplier declaration			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Jan-25			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 4.5 VDC
Remarks:			

7.8 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 7.8.1.

Table 7.8.1 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	



Test specification:		Section 15.109, RSS-Gen section 7.3, ICES-003, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:		Verdict: PASS	
Date(s):			
21-Jan-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1005 hPa	Power: 4.5 VDC
Remarks:			

8 Unintentional emissions

8.1 Radiated emission measurements

8.1.1 General

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

Table 8.1.1 Radiated emission test limits

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
Above 960	43.5*	54.0	49.5	60.0*

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $\text{Lim}_{S2} = \text{Lim}_{S1} + 20 \log(S1/S2)$, where $S1$ and $S2$ – standard defined and test distance respectively in meters.

8.1.2 Test procedure for measurements in semi-anechoic chamber

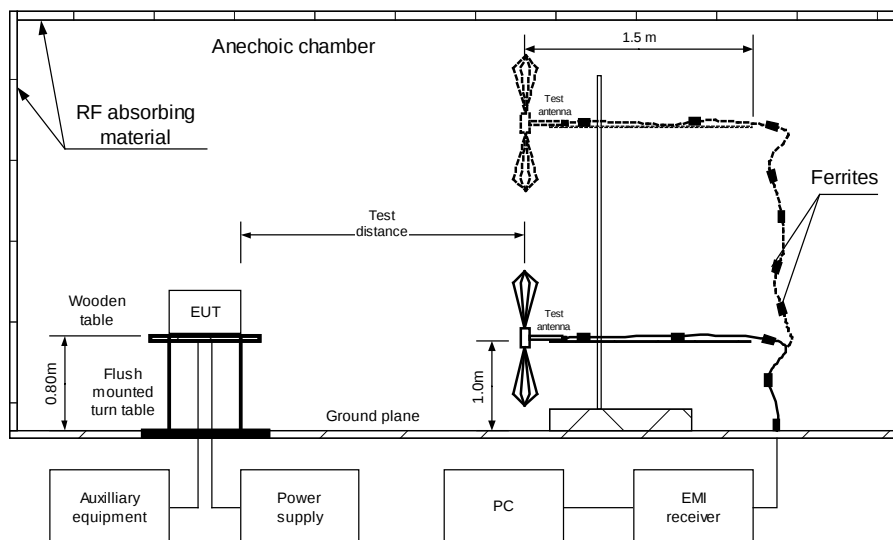
8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

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

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

Test specification: Section 15.109, RSS-Gen section 7.3, ICES-003, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 21-Jan-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1005 hPa	Power: 4.5 VDC
Remarks:			

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





HERMON LABORATORIES

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Test specification: Section 15.109, RSS-Gen section 7.3, ICES-003, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 21-Jan-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1005 hPa	Power: 4.5 VDC
Remarks:			

Table 8.1.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / QUASI-PEAK
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No emissions were found								Pass

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 – 9500 MHz -
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No emissions were found										Pass

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

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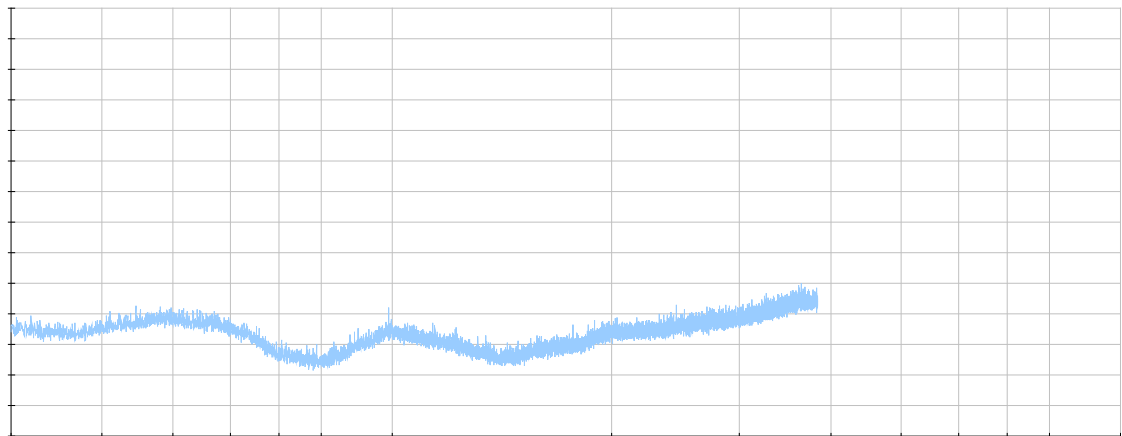
Full description is given in Appendix A.



Test specification:		Section 15.109, RSS-Gen section 7.3, ICES-003, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:		Verdict: PASS	
Date(s):			
21-Jan-25			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1005 hPa	Power: 4.5 VDC
Remarks:			

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

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



10 APPENDIX B Test equipment correction factors

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

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

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

The antenna factor shall be added to receiver reading in 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.

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.

11 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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