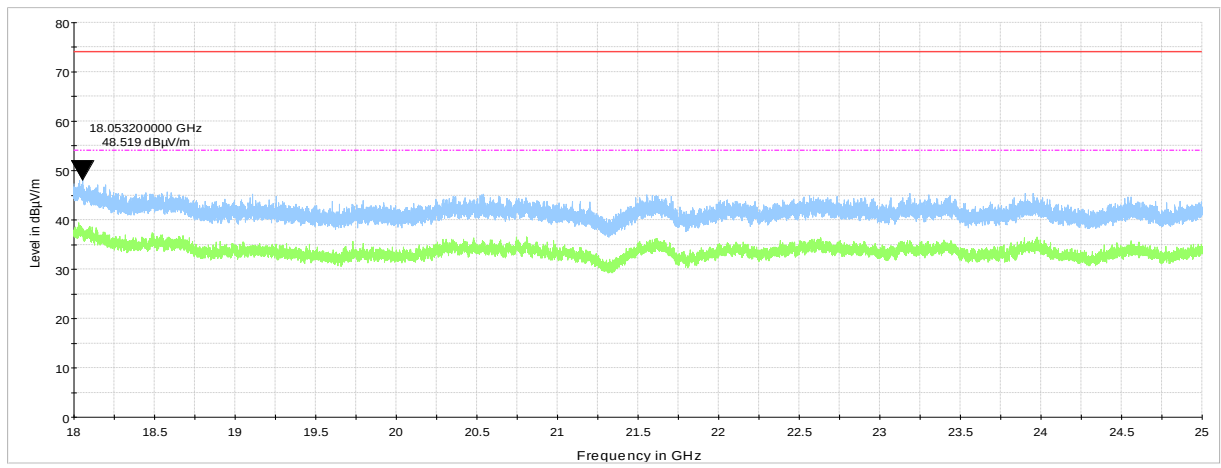




Test specification:		Section 15.247(d), Radiated spurious emissions	
Test procedure:		ANCI C63.10 section 6.5 & 6.6	
Test mode:		Verdict: PASS	
Date(s):			
06-Apr-21 - 30-Apr-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1017 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 9.2.18 Radiated emission measurements from 18 GHz to 25 GHz 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), Emissions at band edges			
Test procedure: ANSI C63.10 section 6.10			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 30-Apr-21			
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

9.3 Band edge radiated emissions at BT protocol

9.3.1 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 7.3.1.

Table 9.3.1 Band edge emission limits

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

9.3.2 Test procedure

- 9.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized normally modulated at the maximum data rate and its proper operation was checked.
- 9.3.2.2** The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 9.3.2.3** 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.
- 9.3.2.4** The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 9.3.2.5** The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.3.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 9.3.2.6** The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.
- 9.3.2.7** The above procedure was repeated with the frequency hopping function enabled.

Figure 9.3.1 Band edge emission test setup





HERMON LABORATORIES

Test specification: Section 15.247(d), Emissions at band edges			
Test procedure: ANSI C63.10 section 6.10			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 30-Apr-21			
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 9.3.2 Band edge emission outside restricted bands test results

ASSIGNED FREQUENCY RANGE: 2400.0 – 2483.5 MHz
 DETECTOR USED: Peak
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: ≥ RBW
 MODULATION/BITRATE: GFSK
 PROTOCOL: BT

Frequency, MHz	Band edge emission, dBm	Emission at carrier, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
2400	44.27	88.98	44.71	20	24.71	Pass

*- Margin = Attenuation below carrier – specification limit.

Table 9.3.3 Band edge emission inside restricted bands test results

ASSIGNED FREQUENCY RANGE: 2400.0 – 2483.5 MHz
 DETECTOR USED: Peak
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 VIDEO BANDWIDTH: ≥ RBW
 MODULATION/BITRATE: GFSK
 PROTOCOL: BT

Frequency, MHz	Peak field strength(VBW=3 MHz)			Average field strength(VBW=1 kHz)			Verdict
	Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
2483.5	61.89	74	-12.11	53.1	54	-0.9	Pass

Reference numbers of test equipment used

HL 3818	HL 3903	HL 5902	HL 4933	HL 3442	HL 5606		
---------	---------	---------	---------	---------	---------	--	--

Full description is given in Appendix A.



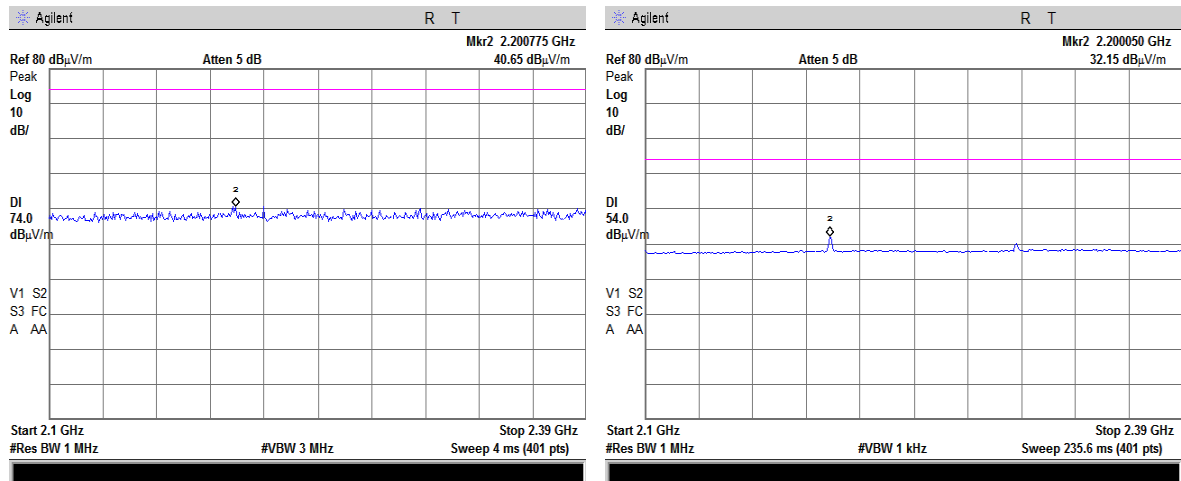
HERMON LABORATORIES

Report ID: COMRAD_FCC.41918_WiFi_BLE_Rev1

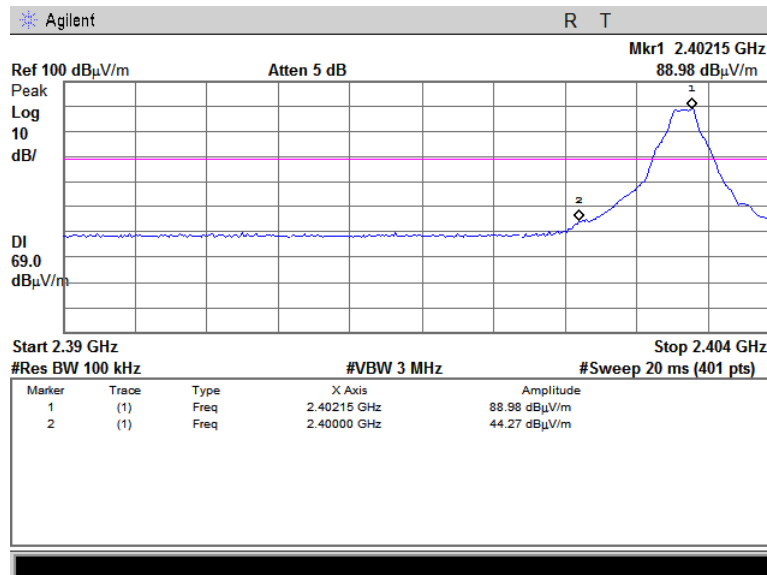
Date of Issue: 24-Oct-21

Test specification:		Section 15.247(d), Emissions at band edges	
Test procedure:		ANSI C63.10 section 6.10	
Test mode:		Verdict: PASS	
Date(s):			
07-Apr-21 - 30-Apr-21			
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 9.3.1 The highest emission level within restricted band at low carrier frequency



Plot 9.3.2 The highest emission level outside restricted band at low carrier frequency

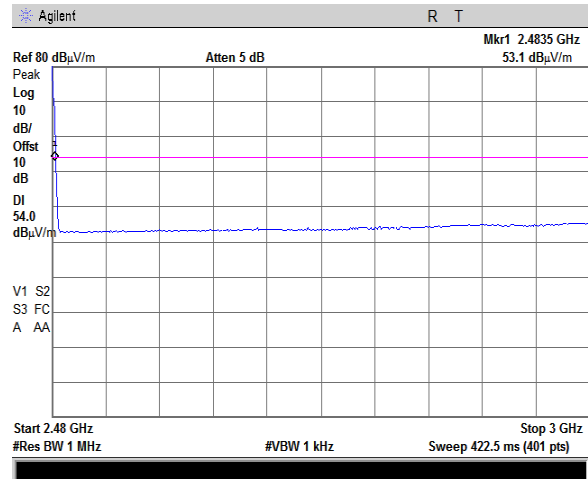
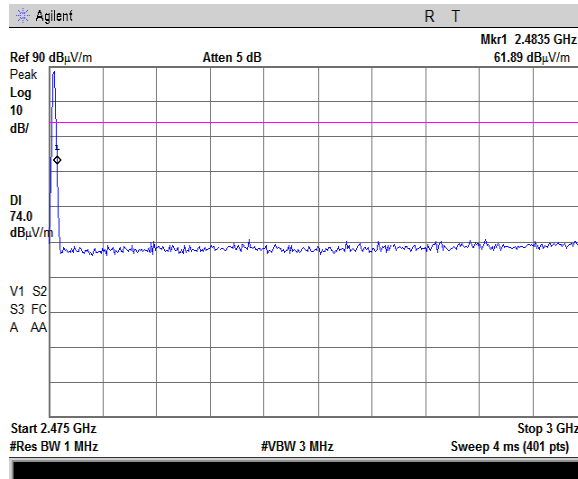




HERMON LABORATORIES

Test specification:		Section 15.247(d), Emissions at band edges	
Test procedure:		ANSI C63.10 section 6.10	
Test mode:		Verdict: PASS	
Date(s):			
07-Apr-21 - 30-Apr-21			
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 9.3.3 The highest emission level within restricted band at high carrier frequency





Test specification:		Section 15.203, Antenna requirements	
Test procedure:		Visual inspection	
Test mode:		Verdict: PASS	
Date(s):			
24-May-21			
Temperature: 24 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 230 VAC, 50 Hz
Remarks:			

9.4 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 9.4.1.

Table 9.4.1 Antenna requirements

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

Photograph 9.4.1 Antenna assembly





Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21			
Temperature: 24 °C	Relative Humidity: 48 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

10 Emission tests according to 47CFR part 15 subpart B requirements

10.1 Radiated emission measurements

10.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 10.1.1.

Table 10.1.1 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.

10.1.2 Test procedure for measurements in semi-anechoic chamber

10.1.2.1 The EUT was set up as shown in Figure 10.1.1 and associated photograph/s, energized and the performance check was conducted.

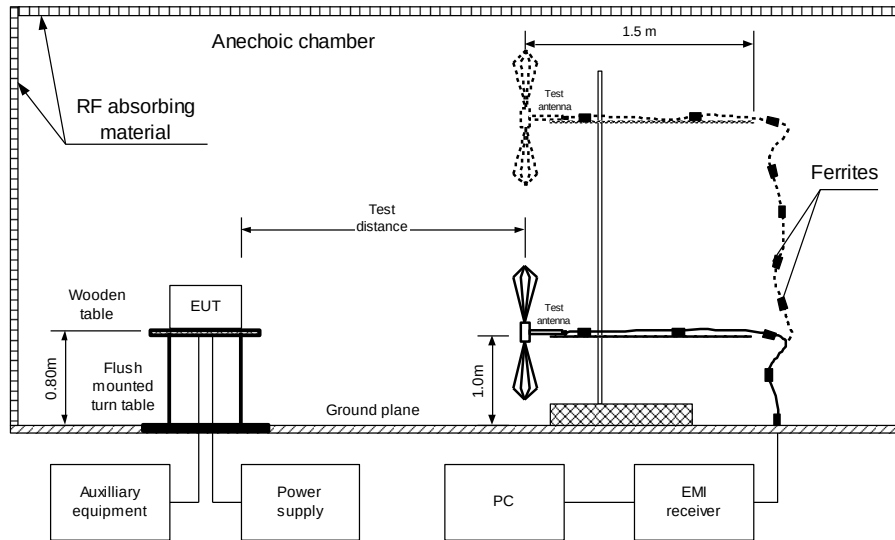
10.1.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position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

10.1.2.3 The worst test results (the lowest margins) were recorded in Table 10.1.2 and shown in the associated plots.



Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21			
Temperature: 24 °C	Relative Humidity: 48 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 10.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment





HERMON LABORATORIES

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21			
Temperature: 24 °C	Relative Humidity: 48 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 10.1.2 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

EUT CONFIGURATION: with box

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*				
32.529834	37.05	30.81	40.0	-9.19	Vertical	1.02	274	Pass
36.009233	42.27	34.50	40.0	-5.50	Vertical	1.00	150	
60.000233	45.53	35.32	40.0	-4.68	Vertical	1.02	330	
62.515975	36.04	30.36	40.0	-9.64	Vertical	1.00	360	
120.011399	41.52	38.78	43.5	-4.72	Vertical	1.02	262	
240.016600	37.89	34.81	46.0	-11.19	Vertical	2.30	285	
360.041934	46.41	44.41	46.0	-1.59	Horizontal	1.04	24	
480.041734	41.59	38.38	46.0	-7.62	Horizontal	1.00	180	
499.999000	41.91	40.28	46.0	-5.72	Horizontal	1.04	296	
599.990333	41.14	38.82	46.0	-7.18	Horizontal	1.02	183	
749.973833	39.62	36.94	46.0	-9.06	Horizontal	1.02	82	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 18000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

EUT CONFIGURATION: with box

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



HERMON LABORATORIES

Report ID: COMRAD_FCC.41918_WiFi_BLE_Rev1

Date of Issue: 24-Oct-21

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21			
Temperature: 24 °C	Relative Humidity: 48 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 10.1.3 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

EUT CONFIGURATION: without box

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*				
35.989676	42.96	34.54	40.0	-5.46	Vertical	1.04	114	Pass
98.482126	33.23	26.99	43.5	-16.51	Vertical	1.02	284	
374.991667	40.34	37.70	46.0	-8.30	Horizontal	1.02	13	
449.983667	39.90	37.93	46.0	-8.07	Horizontal	1.02	80	
499.991500	47.49	45.85	46.0	-0.15	Horizontal	1.00	307	
524.986625	40.32	38.10	46.0	-7.90	Vertical	1.02	150	
549.967915	41.26	39.40	46.0	-6.60	Vertical	1.02	173	
874.982081	40.73	37.42	46.0	-8.58	Horizontal	1.02	180	
999.980000	50.68	48.85	54.0	-5.15	Vertical	1.02	203	

*- Margin = Measured emission - specification limit.

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

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 18000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

EUT CONFIGURATION: without box

Peak				Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
Frequency, MHz	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 4360	HL 4933	HL 4956	HL 5288	HL 5085	HL 5112	HL 5902
---------	---------	---------	---------	---------	---------	---------	---------

Full description is given in Appendix A.

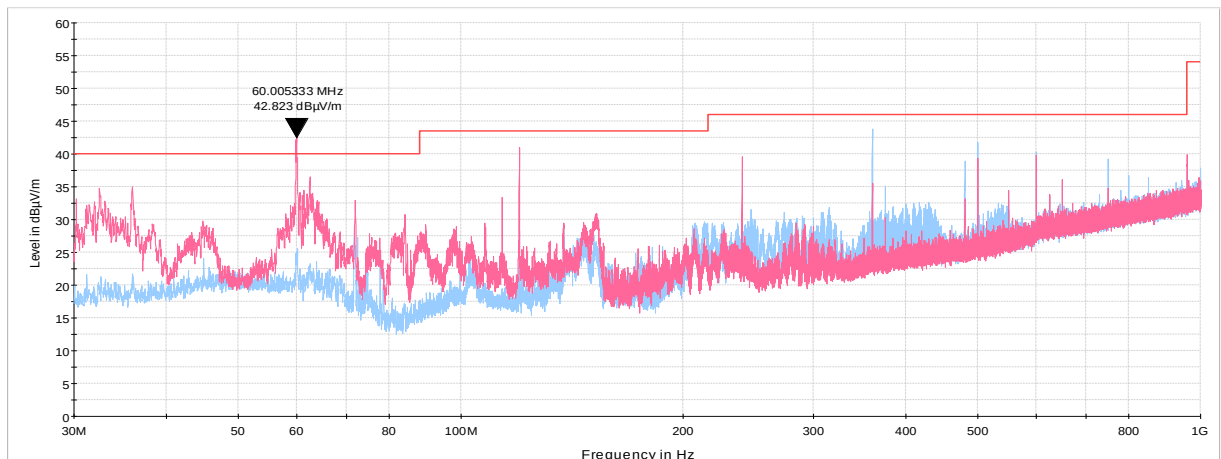


HERMON LABORATORIES

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21			
Temperature: 24 °C	Relative Humidity: 48 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

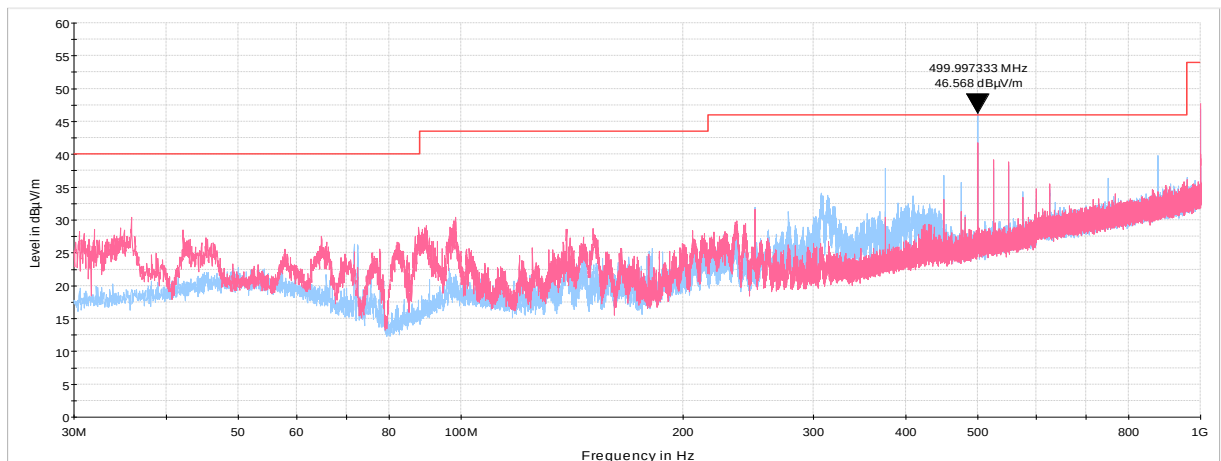
Plot 10.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

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



Plot 10.1.2 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive
EUT CONFIGURATION: without box



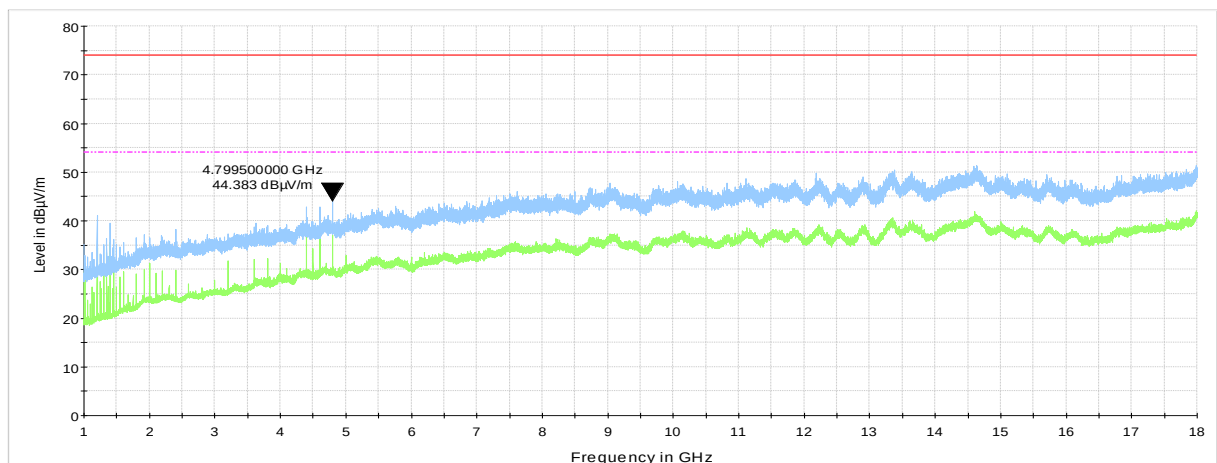


HERMON LABORATORIES

Test specification:		Section 15.109, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:		Verdict: PASS	
Date(s):			
07-Apr-21			
Temperature: 24 °C	Relative Humidity: 48 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

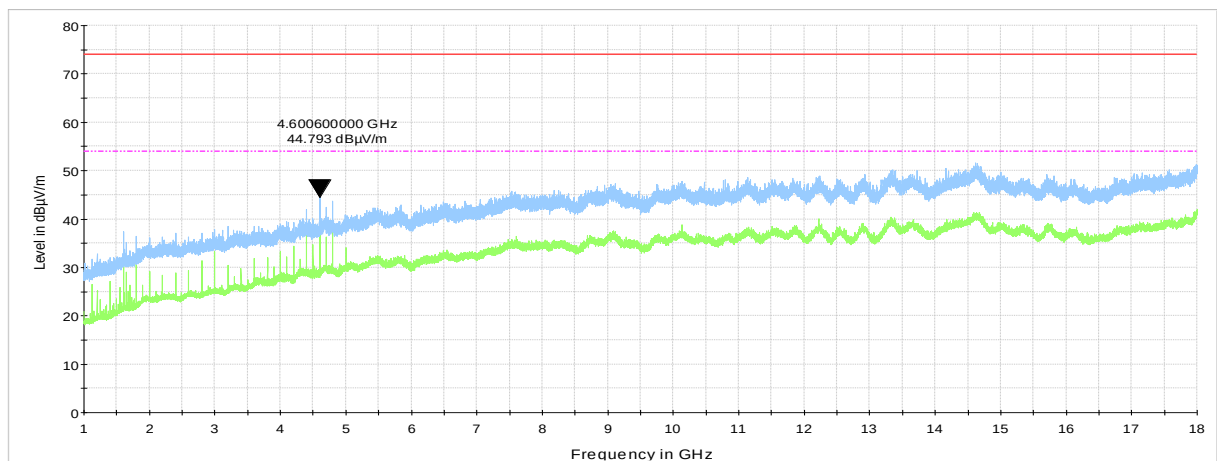
Plot 10.1.3 Radiated emission measurements in 1000 - 18000 MHz range, vertical and horizontal antenna polarization

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



Plot 10.1.4 Radiated emission measurements in 1000 - 18000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive
EUT CONFIGURATION: without box





Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

11 Transmitter tests according to 47CFR part 15 subpart E requirements

11.1 Peak output power

11.1.1 General

This test was performed to measure the maximum peak output power at the transmitter RF antenna connector. Specification test limits are given in Table 11.1.1.

Table 11.1.1 Peak output power limits

Assigned frequency range, MHz	Maximum peak transmit power	Used limit*, dBm
5150 - 5250	The lesser of 250 mW (24 dBm) or 11 dBm +10 log B	24
5725 - 5825	The lesser of 1 W (30 dBm) or 17 dBm +10 log B	30

*The maximum 26-dB emission bandwidth is B MHz, the limit is equal to:

11 dBm + 10 log B = A dBm (less than 250 mW = 24 dBm);

Note: If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value by the amount in dB that the directional gain of antenna exceeds 6 dBi.

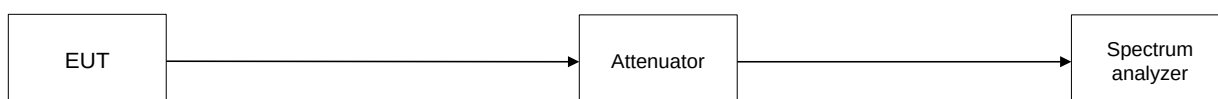
11.1.2 Test procedure

11.1.2.1 The EUT was set up as shown in Figure 11.1.1, energized and its proper operation was checked.

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

11.1.2.3 The measurements were performed in continuous transmission mode of operation for carrier (channel) frequency at low, mid and high edges with a peak detector. The power was computed by integrating the spectrum across the 26 dB bandwidth of the signal as provided in the associated tables and plots.

Figure 11.1.1 Peak output power test setup





Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 11.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 5150.0 – 5250.0 MHz / 5725.0 – 5850.0 MHz
DETECTOR USED: Peak
METHOD OF POWER MEASUREMENTS: 1 (channel power across the 26 dB EBW)
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 3 MHz

CHANNEL BANDWIDTH: 20 MHz

Carrier frequency, MHz	Peak output power, dBm	Limit, dBm	Margin*, dB	Verdict
Modulation: 256QAM				
5180.0	6.29	24.0	-17.71	Pass
5200.0	6.93	24.0	-17.07	Pass
5220.0	6.26	24.0	-17.74	Pass
Modulation: 256QAM				
5745.0	6.80	30.0	-23.20	Pass
5785.0	5.74	30.0	-24.26	Pass
5825.0	4.42	30.0	-25.58	Pass

CHANNEL BANDWIDTH: 40 MHz

Carrier frequency, MHz	Peak output power, dBm	Limit, dBm	Margin*, dB	Verdict
Modulation: 256QAM				
5190.0	2.42	24.0	-21.58	Pass
5230.0	1.49	24.0	-22.51	Pass
Modulation: 256QAM				
5755.0	2.48	30.0	-27.52	Pass
5795.0	1.21	30.0	-28.79	Pass

CHANNEL BANDWIDTH: 80 MHz

Carrier frequency, MHz	Peak output power, dBm	Limit, dBm	Margin*, dB	Verdict
Modulation: 256QAM				
5210.0	1.60	24.0	-22.40	Pass
Modulation: 256QAM				
5775.0	1.61	30.0	-28.39	Pass

* - Margin = Peak output power – limit.

Reference numbers of test equipment used

HL 4355	HL 3903	HL 5902	HL 4933	HL 3442			
---------	---------	---------	---------	---------	--	--	--

Full description is given in Appendix A.



HERMON LABORATORIES

Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

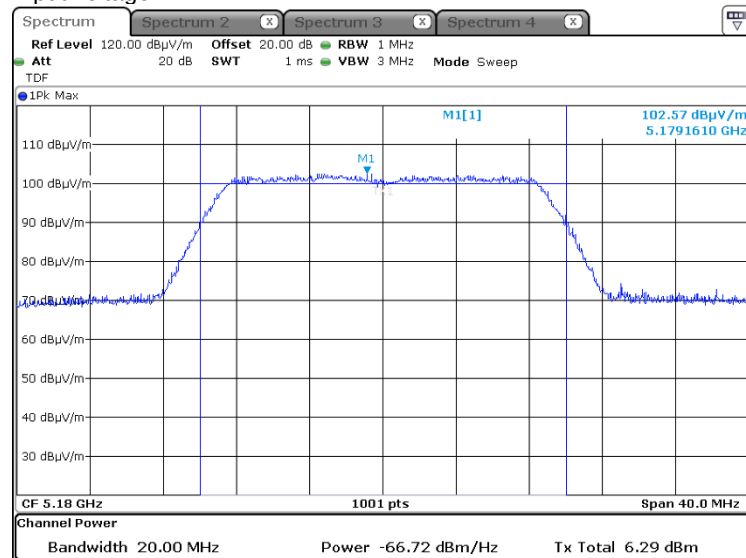
Plot 11.1.1 Peak output power at low carrier frequency test results

Frequency: 5180 MHz

Channel BW: 20 MHz

Modulation parameters: 256 QAM

Input voltage:



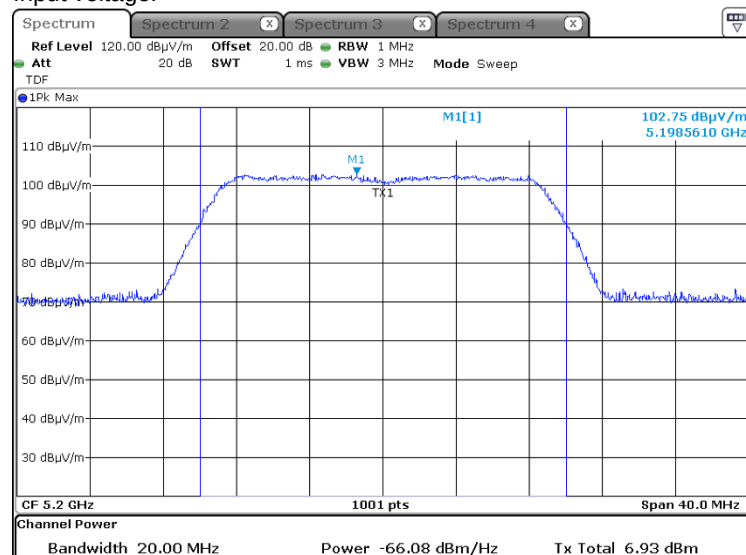
Plot 11.1.2 Peak output power at mid frequency test results

Frequency: 5200 MHz

Channel BW: 20 MHz

Modulation parameters: 256 QAM

Input voltage:





HERMON LABORATORIES

Report ID: COMRAD_FCC.41918_WiFi_BLE_Rev1

Date of Issue: 24-Oct-21

Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

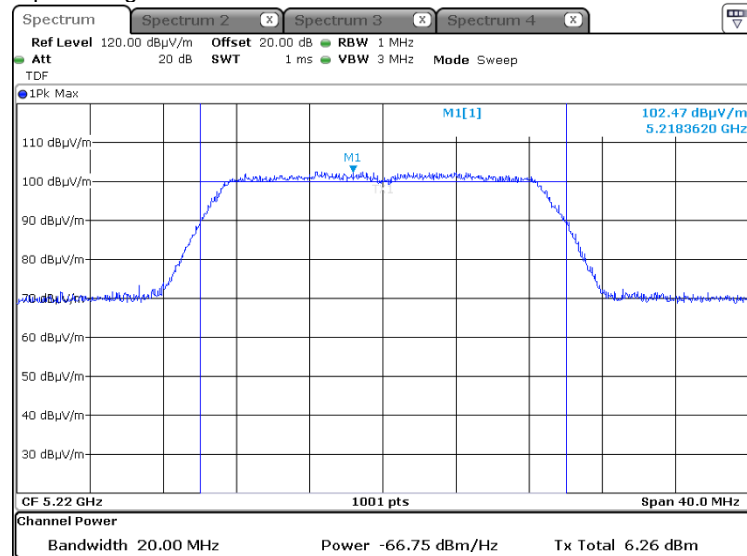
Plot 11.1.3 Peak output power at high frequency test results

Frequency: 5220 MHz

Channel BW: 20 MHz

Modulation parameters: 256 QAM

Input voltage:



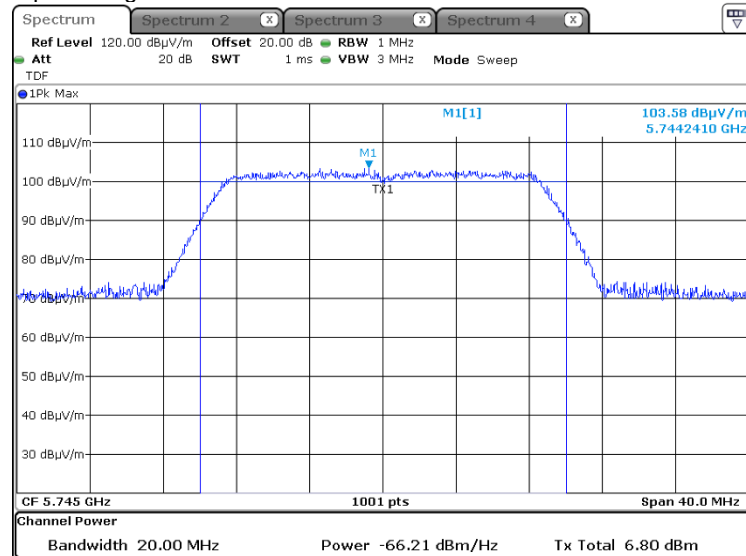


HERMON LABORATORIES

Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

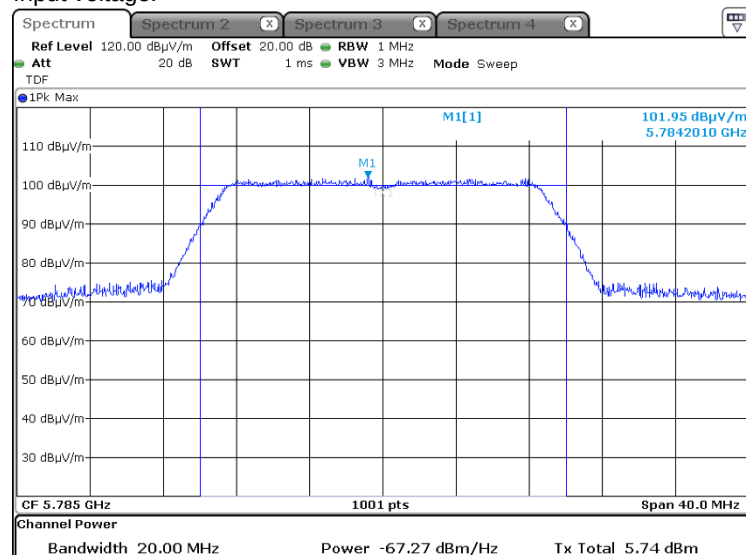
Plot 11.1.4 Peak output power at low carrier frequency test results

Frequency: 5745 MHz
Channel BW: 20 MHz
Modulation parameters: 256 QAM
Input voltage:



Plot 11.1.5 Peak output power at mid frequency test results

Frequency: 5785 MHz
Channel BW: 20 MHz
Modulation parameters: 256 QAM
Input voltage:





HERMON LABORATORIES

Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

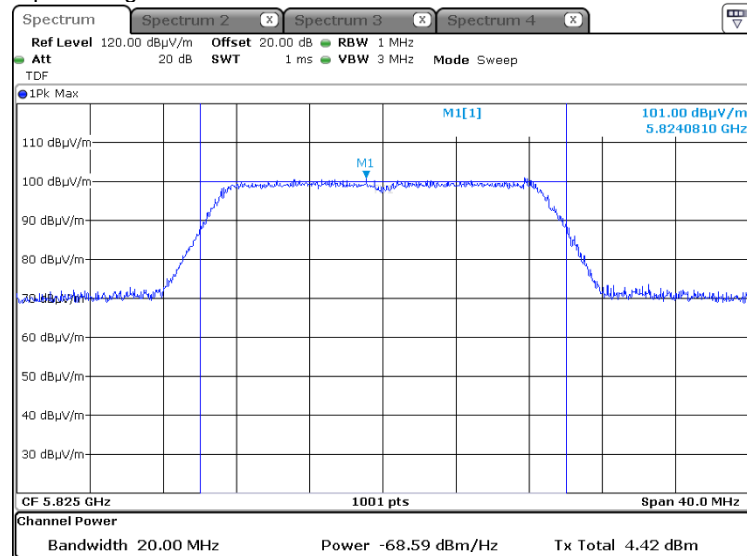
Plot 11.1.6 Peak output power at high frequency test results

Frequency: 5825 MHz

Channel BW: 20 MHz

Modulation parameters: 256 QAM

Input voltage:





HERMON LABORATORIES

Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

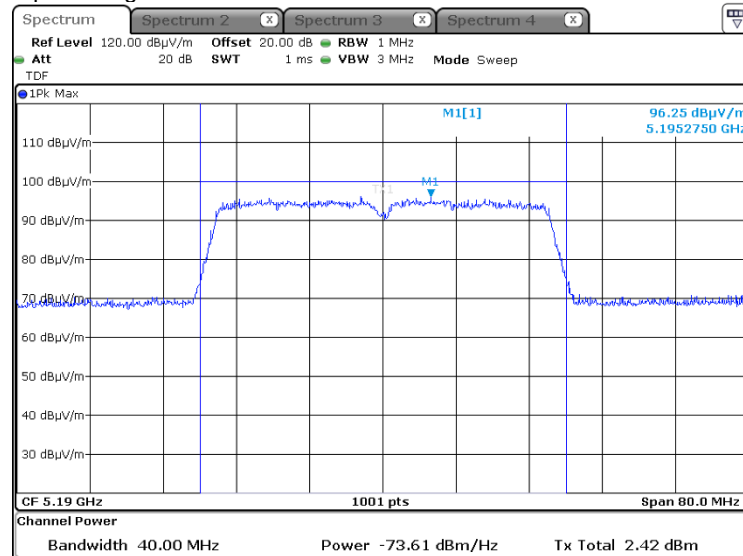
Plot 11.1.7 Peak output power at low carrier frequency test results

Frequency: 5190 MHz

Channel BW: 40 MHz

Modulation parameters: 256 QAM

Input voltage:



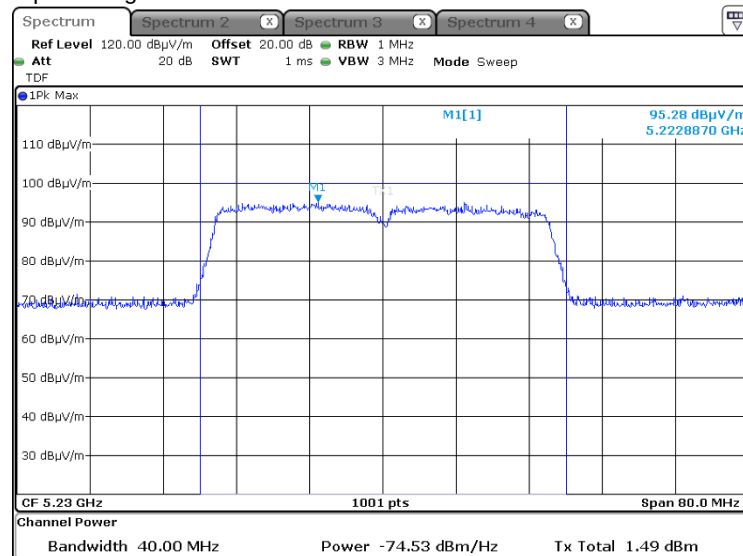
Plot 11.1.8 Peak output power at high frequency test results

Frequency: 5230 MHz

Channel BW: 40 MHz

Modulation parameters: 256 QAM

Input voltage:



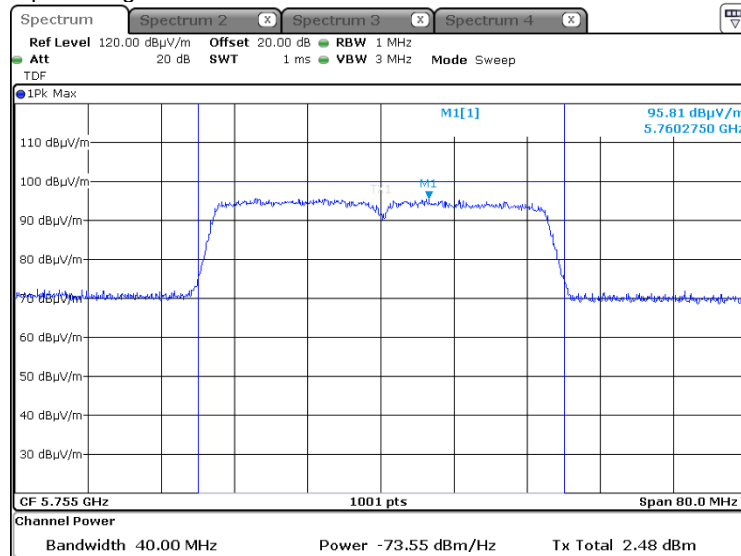


HERMON LABORATORIES

Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

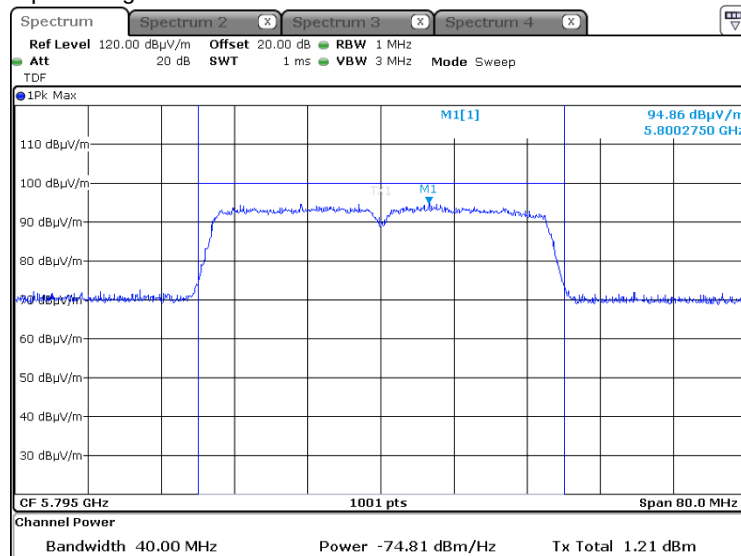
Plot 11.1.9 Peak output power at low carrier frequency test results

Frequency: 5755 MHz
Channel BW: 40 MHz
Modulation parameters: 256 QAM
Input voltage:



Plot 11.1.10 Peak output power at high frequency test results

Frequency: 5795 MHz
Channel BW: 40 MHz
Modulation parameters: 256 QAM
Input voltage:





HERMON LABORATORIES

Test specification: FCC section 15.407(a)(1-3), Peak output power			
Test procedure: FCC section 15.407(a)(4); KDB 789033, ANSI C63.10, section 12.3.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

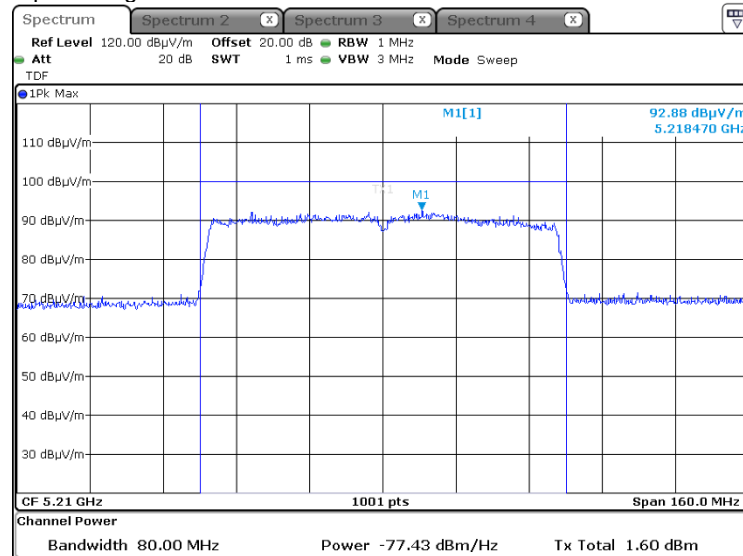
Plot 11.1.11 Peak output power at low carrier frequency test results

Frequency: 5210 MHz

Channel BW: 80 MHz

Modulation parameters: 256 QAM

Input voltage:



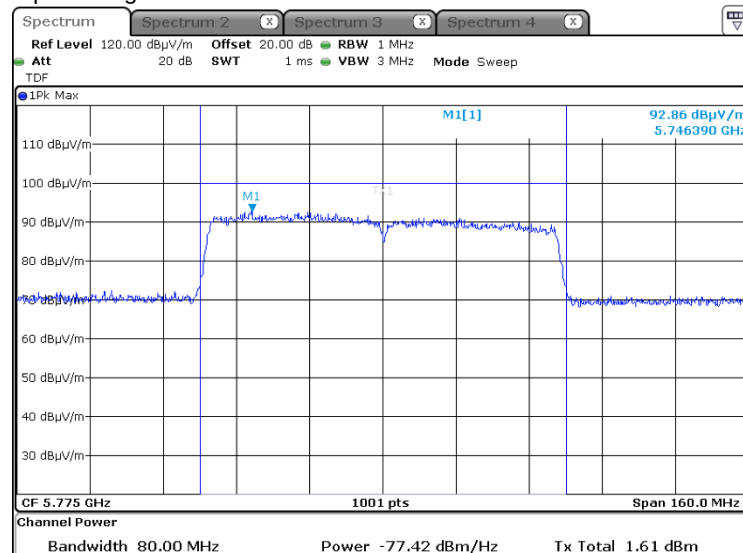
Plot 11.1.12 Peak output power at low carrier frequency test results

Frequency: 5775 MHz

Channel BW: 80 MHz

Modulation parameters: 256 QAM

Input voltage:





Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

11.2 Field strength of undesirable emissions at 5150 – 5250 MHz range

11.2.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 11.2.2. Table 12.2.2

Table 11.2.1 Unwanted emissions limits below 1 GHz and within restricted bands above 1 GHz

Frequency, MHz	Field strength at 3 m, dB(μV/m)*		
	Peak	Quasi Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**
0.090 – 0.110	NA	108.5 – 106.8**	NA
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**
0.490 – 1.705	NA	73.8 – 63.0**	NA
1.705 – 30.0*		69.5	
30 – 88		40.0	
88 – 216		43.5	
216 – 960		46.0	
960 - 1000		54.0	
1000 – 40000	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.

Table 11.2.2 EIRP of undesirable emission limits outside restricted bands (above 1 GHz)

Operating frequency band, GHz	EIRP of spurious, dBm/MHz	Field strength at 3 m, dB(μV/m)
5150 - 5250	-27	68.23
5250 - 5350	-27	68.23
5.47 – 5.725	-27	68.23
5725 - 5825	-27 (below 5.715 GHz and above 5.835 GHz)	68.23
	-17 (in 5.715 - 5.725 GHz and 5.825 - 5.835 GHz)	78.23



Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

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

11.2.2.1 The EUT was set up as shown in Figure 11.2.1 energized and the performance check was conducted.

11.2.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

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

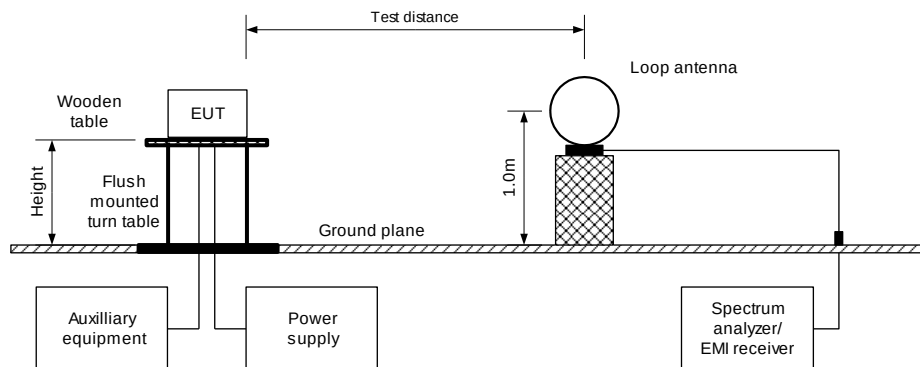
11.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

11.2.3.1 The EUT was set up as shown in Figure 11.2.2 and Figure 11.2.3, energized and the performance check was conducted.

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

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

Figure 11.2.1 Setup for spurious emission field strength measurements below 30 MHz





Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 11.2.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz

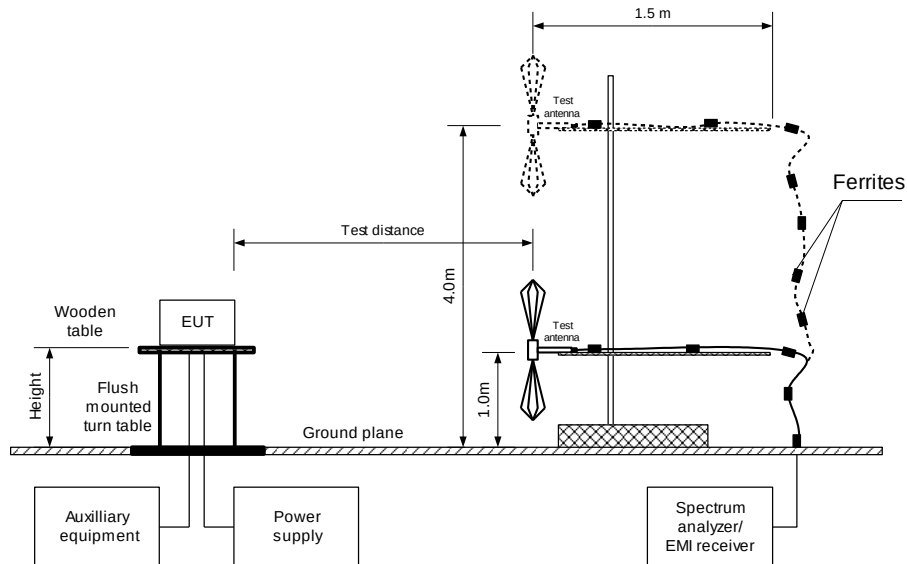
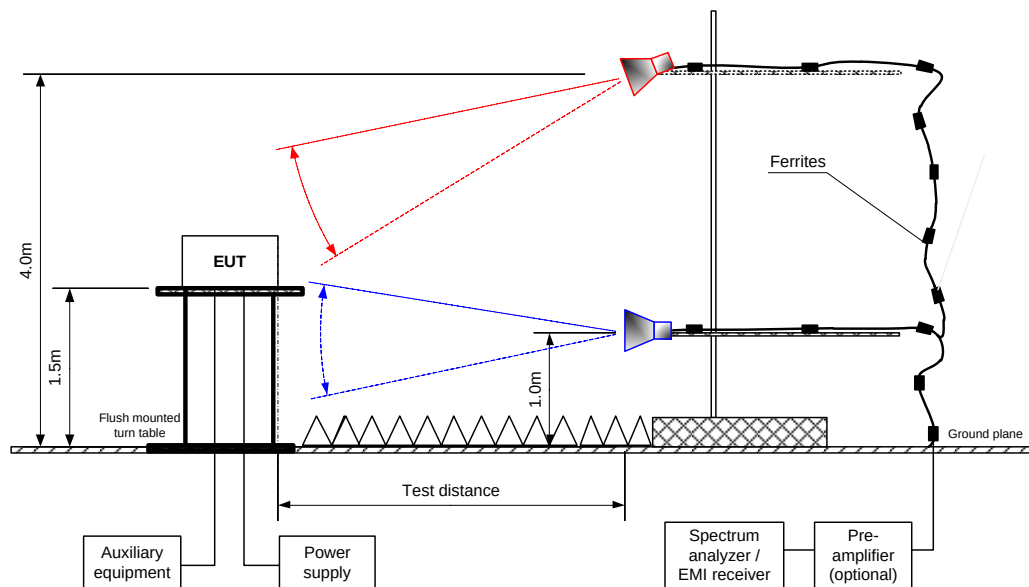


Figure 11.2.3 Setup for spurious emission field strength measurements above 1000 MHz





Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 11.2.3 Field strength of spurious emissions below 1 GHz

ASSIGNED FREQUENCY BAND: 5150 – 5250 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 TEST DISTANCE: 3 m
 MODULATION: 256QAM
 TRANSMITTER OUTPUT POWER: Maximum
 RESOLUTION BANDWIDTH: 1 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 VIDEO BANDWIDTH: > Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)

frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Low carrier frequency 5180 MHz								
120.015262	41.08	39.49	43.50	-4.01	V	1.00	-88	Pass
960.092994	41.40	38.32	54.00	-15.68	H	1.00	180	
Mid carrier frequency 5205 MHz								
120.014839	41.08	39.15	43.50	-4.35	V	1.00	-79	Pass
960.093712	41.40	38.21	54.00	-15.79	H	1.00	186	
High carrier frequency 5230 MHz								
120.013654	41.08	39.29	43.50	-4.21	V	1.00	-94	Pass
960.094563	41.40	38.41	54.00	-15.59	H	1.00	175	

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

HL 4360	HL 3903	HL 446	HL 5288	HL 5085	HL 5902		
---------	---------	--------	---------	---------	---------	--	--

Full description is given in Appendix A.



Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 11.2.4 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY BAND:	5150 – 5250 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 40 GHz
TEST DISTANCE:	3 m
MODULATION:	256QAM
TRANSMITTER OUTPUT POWER:	Maximum
DETECTOR: USED:	Peak
RESOLUTION BANDWIDTH:	1000 kHz
TEST ANTENNA TYPE:	Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Frequency, MHz	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of spurious, dB(μV/m)	Limit, dBμV/m	Margin, dB**	Verdict
Low carrier frequency 5180 MHz							
All emissions are more than 20 dB below the limit							Pass
Mid carrier frequency 5205 MHz							
All emissions are more than 20 dB below the limit							Pass
High carrier frequency 5230 MHz							
All emissions are more than 20 dB below the limit							Pass

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

**- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 4360	HL 3903	HL 4933	HL 446	HL 4956	HL 5288	HL 5085	HL 5112
HL 5902	HL 4378	HL 5286					

Full description is given in Appendix A.



Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 11.2.5 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY: 5150 – 5250 MHz
 INVESTIGATED FREQUENCY RANGE: 1000 - 40000 MHz
 TEST DISTANCE: 3 m
 MODULATION: 256QAM
 DUTY CYCLE: 100 %
 TRANSMITTER OUTPUT POWER: Maximum
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1000 kHz
 TEST ANTENNA TYPE: Double ridged guide

TEST ANTENNA FILE:			Double ended guide								
Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=1 kHz)				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 5180 MHz											
All emissions are more than 20 dB below the limit											Pass
Mid carrier frequency 5205 MHz											
All emissions are more than 20 dB below the limit											Pass
High carrier frequency 5230 MHz											
All emissions are more than 20 dB below the limit											Pass

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

** - Margin, dB = Measured, dB(μV/m) – Limit, dB(μV/m)

*** - Margin, dB = Calculated, dB(μV/m) – Limit, dB(μV/m)

Reference numbers of test equipment used

HL 4360	HL 3903	HL 4933	HL 5286	HL 4956	HL 5288	HL 5085	HL 5112
HL 5902	HL 4378						

Full description is given in Appendix A.



HERMON LABORATORIES

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 11.2.6 Restricted bands according to FCC section 15.205

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 - 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	

Table 11.2.7 Restricted bands according to RSS-Gen

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

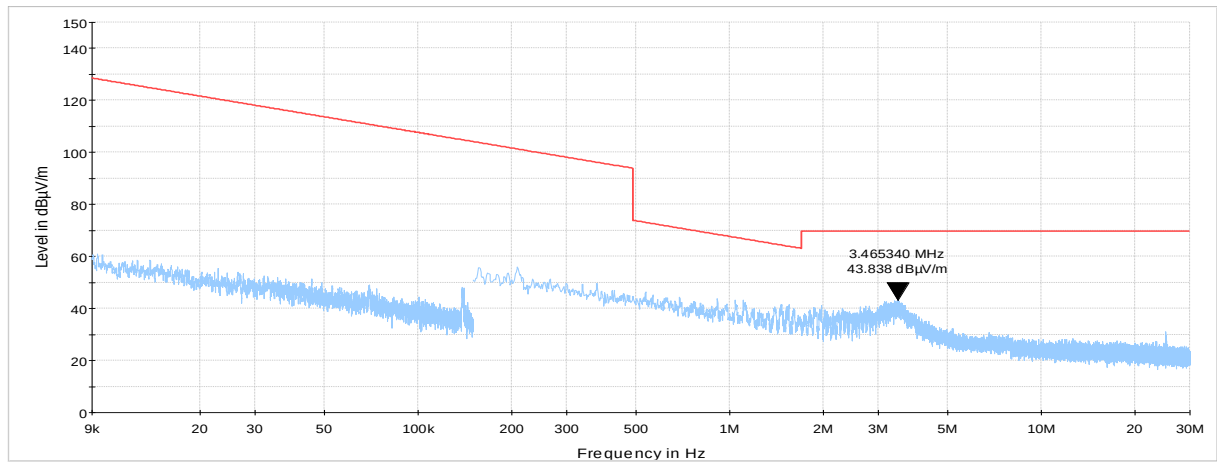


HERMON LABORATORIES

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

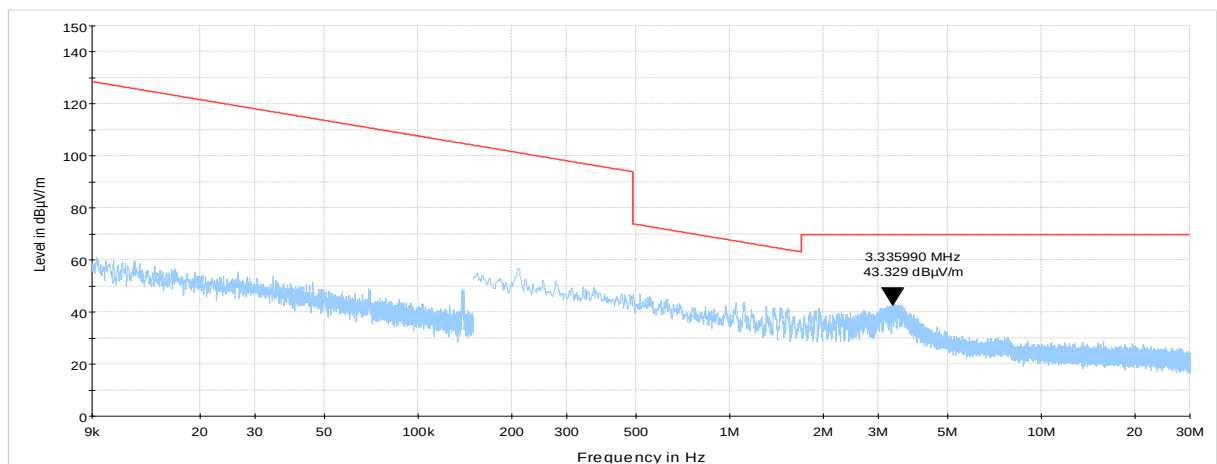
Plot 11.2.1 Radiated emission measurements from 9 kHz to 30 MHz at the low carrier frequency

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



Plot 11.2.2 Radiated emission measurements from 9 kHz to 30 MHz at the mid carrier frequency

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



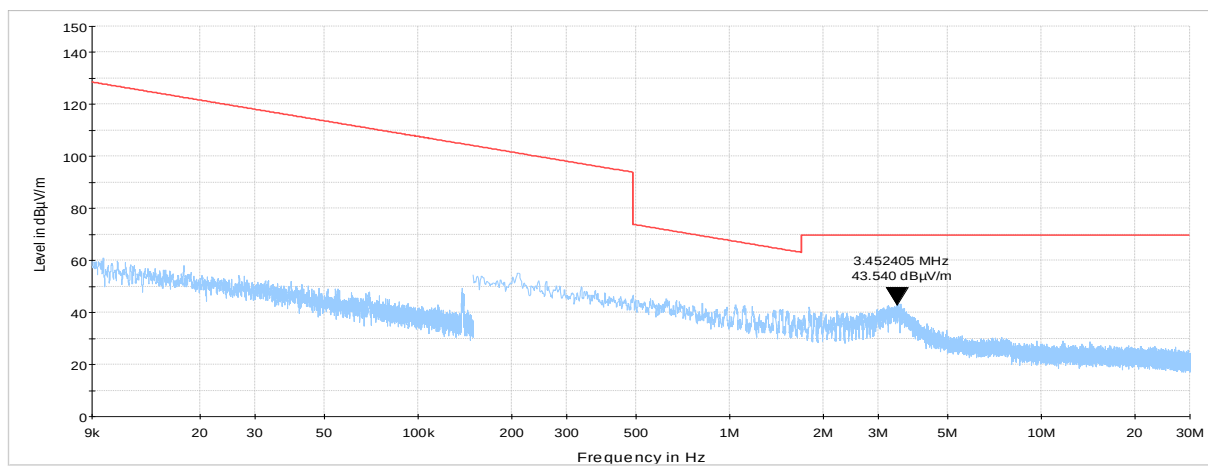


HERMON LABORATORIES

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 11.2.3 Radiated emission measurements from 9 kHz to 30 MHz at the high carrier frequency

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



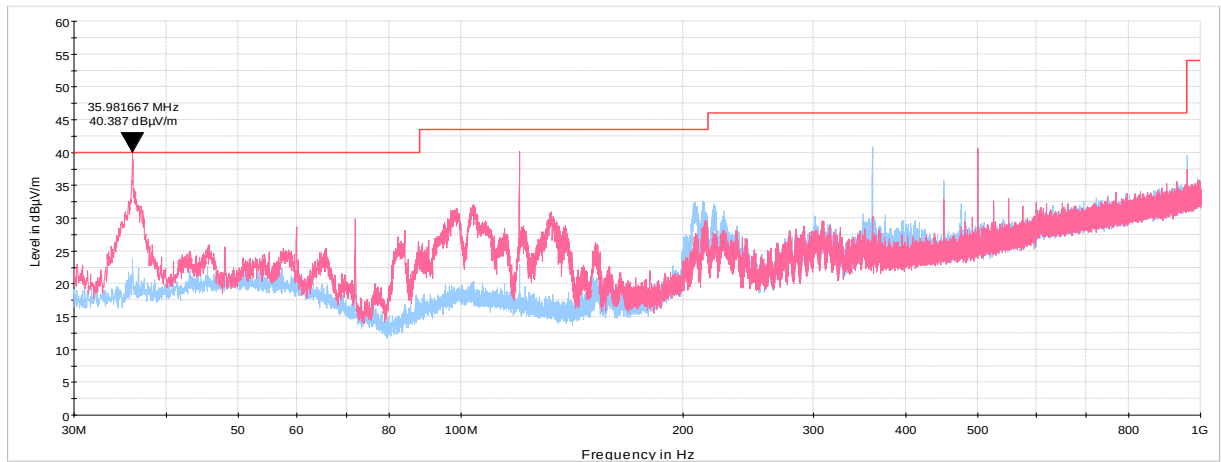


HERMON LABORATORIES

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

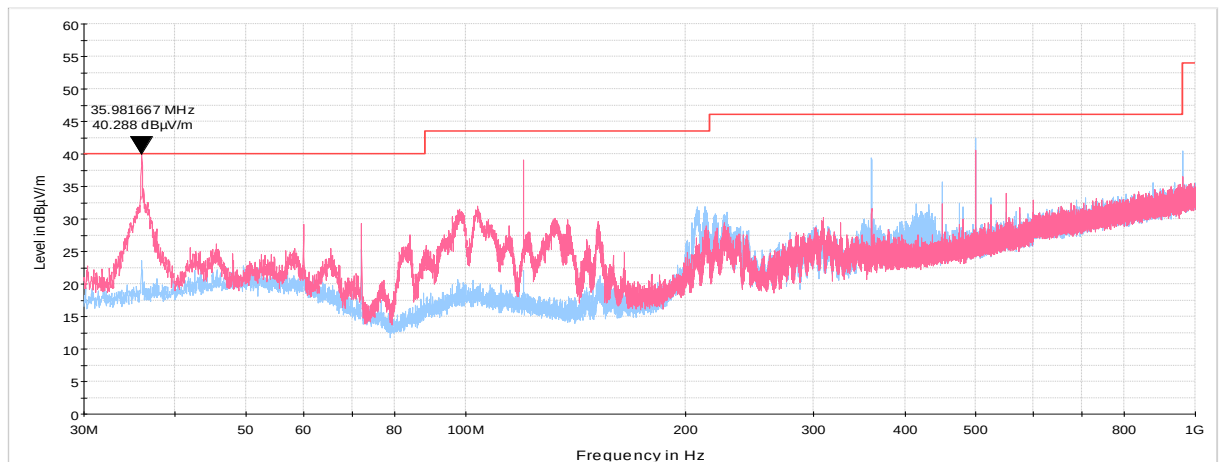
Plot 11.2.4 Radiated emission measurements from 30 MHz to 1000 MHz at the low carrier frequency

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



Plot 11.2.5 Radiated emission measurements from 30 MHz to 1000 MHz at the mid carrier frequency

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



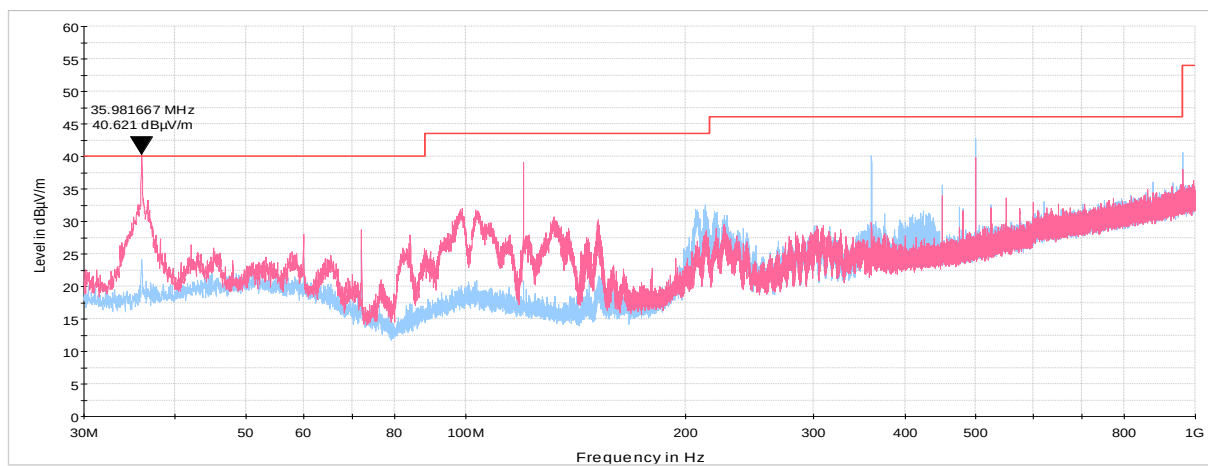


HERMON LABORATORIES

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 11.2.6 Radiated emission measurements from 30 MHz to 1000 MHz at the high carrier frequency

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





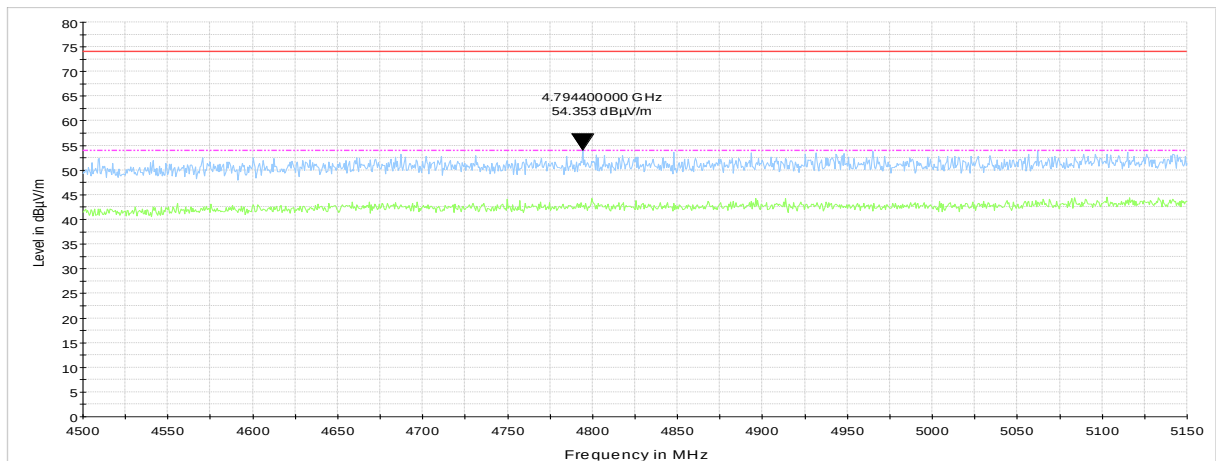
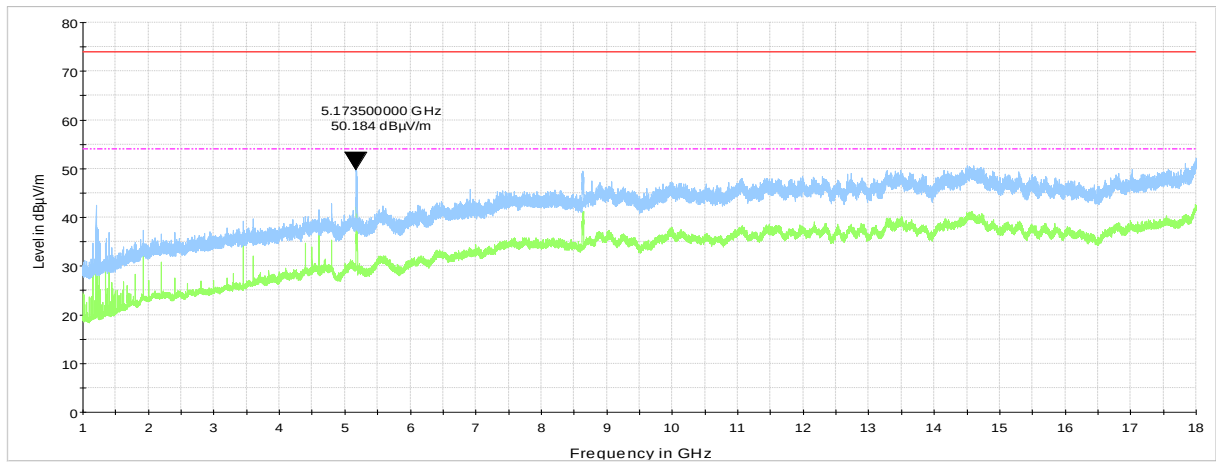
HERMON LABORATORIES

Report ID: COMRAD_FCC.41918_WiFi_BLE_Rev1
Date of Issue: 24-Oct-21

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 11.2.7 Radiated emission measurements from 1.0 to 18 GHz at the low carrier frequency

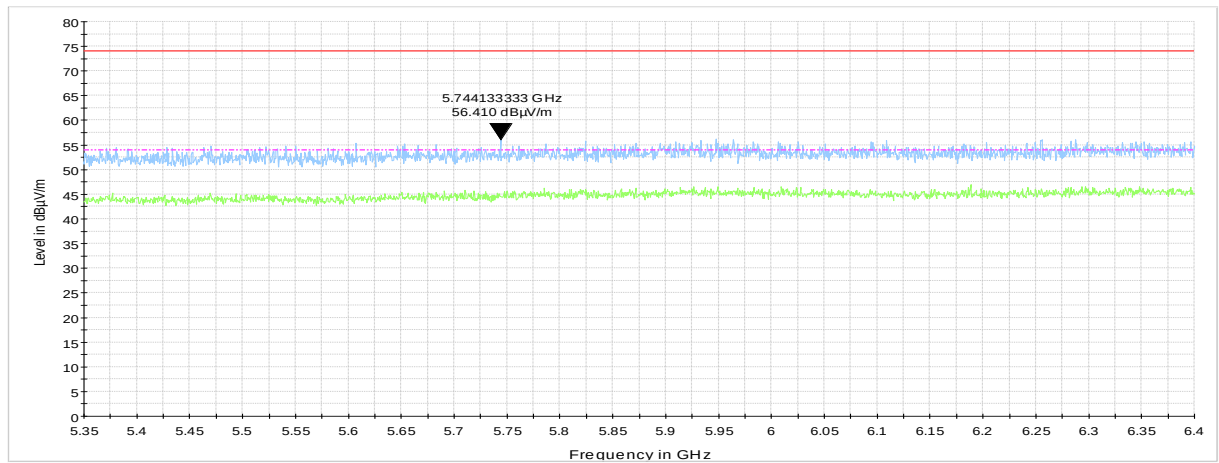
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal





HERMON LABORATORIES

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			



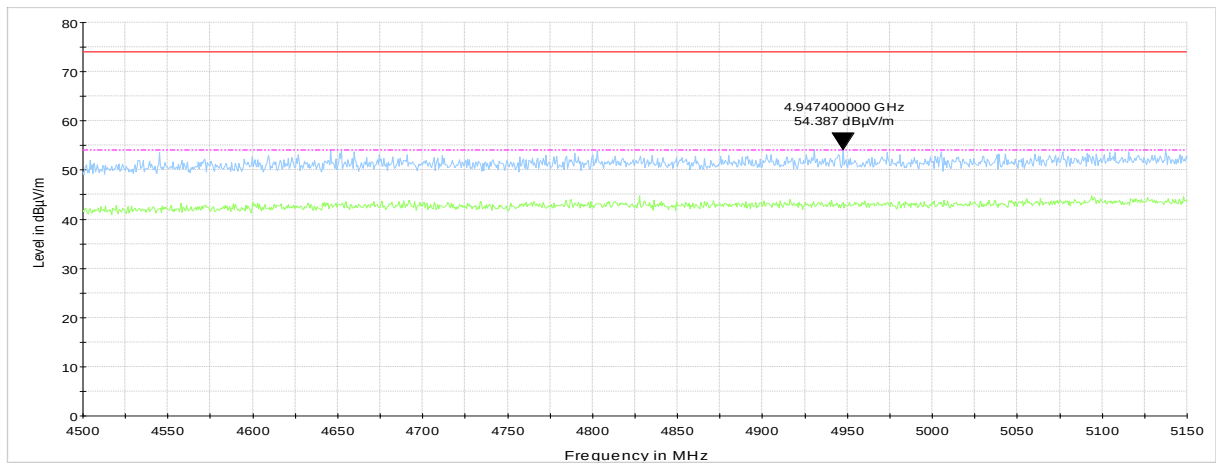
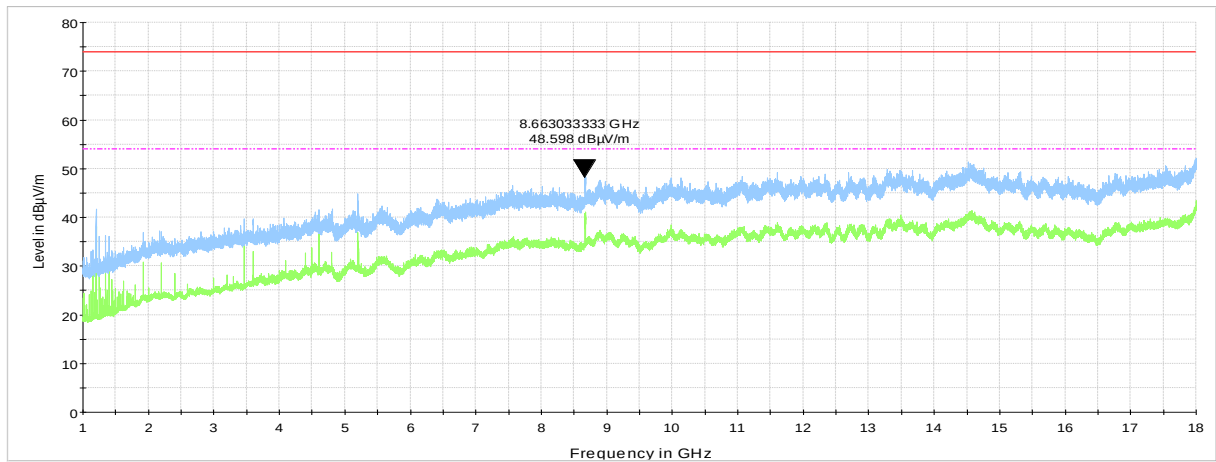


HERMON LABORATORIES

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 11.2.8 Radiated emission measurements from 1.0 to 18 GHz at the mid carrier frequency

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





HERMON LABORATORIES

Report ID: COMRAD_FCC.41918_WiFi_BLE_Rev1
Date of Issue: 24-Oct-21

Test specification: FCC section 15.407(b)1, Field strength of undesirable emissions			
Test procedure: KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Apr-21 - 20-May-21			
Temperature: 25 °C	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

