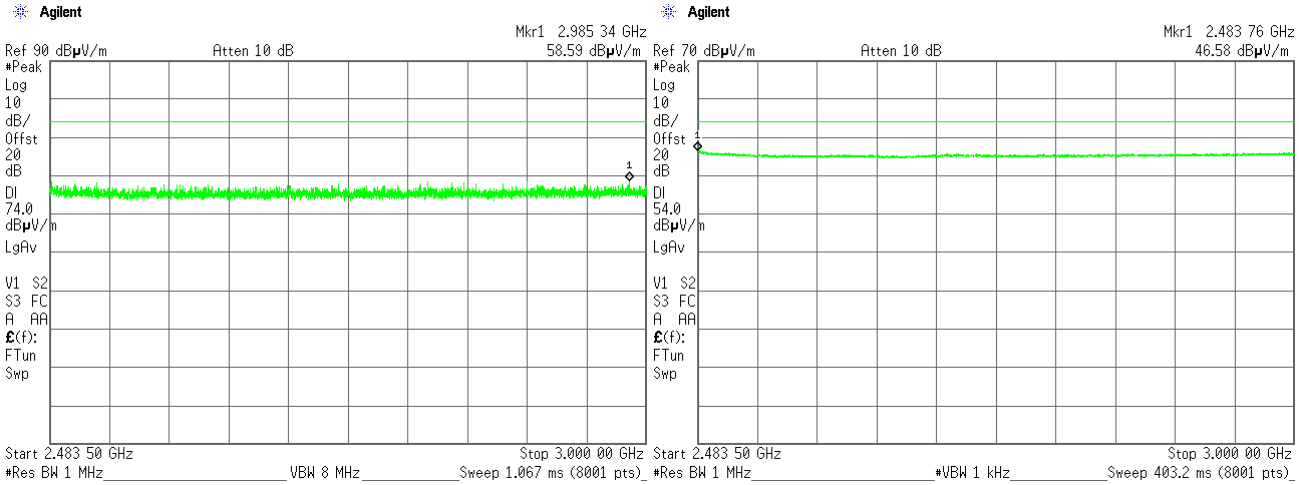
Test specification:	**Section 15.247(d), Band edge emissions**		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	15-Mar-21 - 18-May-21		
Temperature: 23 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1007 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

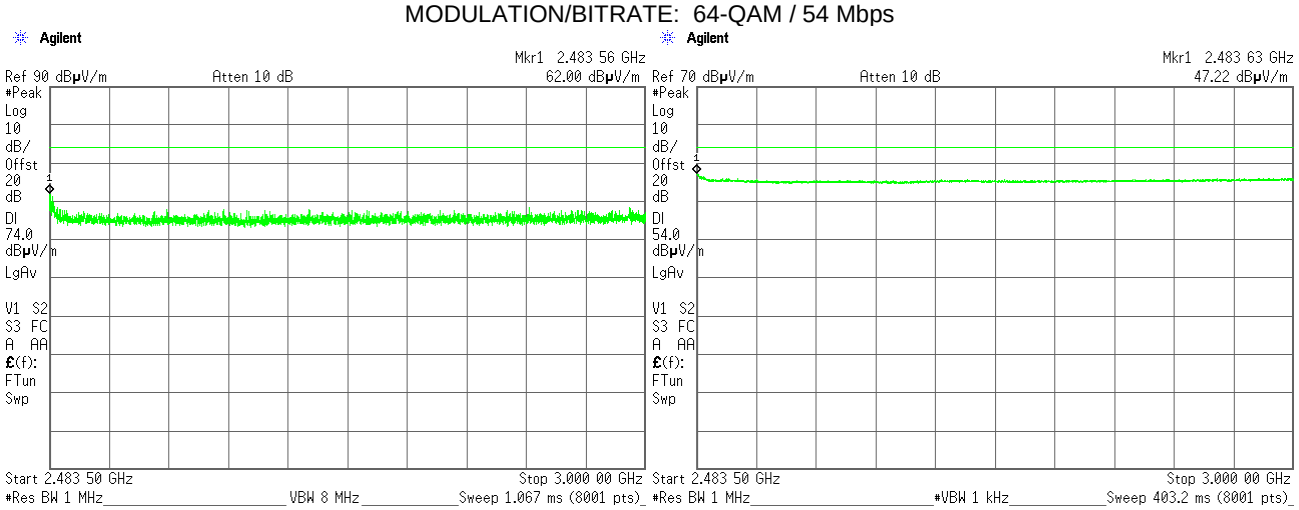
Plot 7.3.25 The highest emission level within restricted band at high carrier frequency

CHANNEL BANDWIDTH: 20MHz
MODULATION/BITRATE: BPSK / 6 Mbps



Plot 7.3.26 The highest emission level within restricted band at high carrier frequency

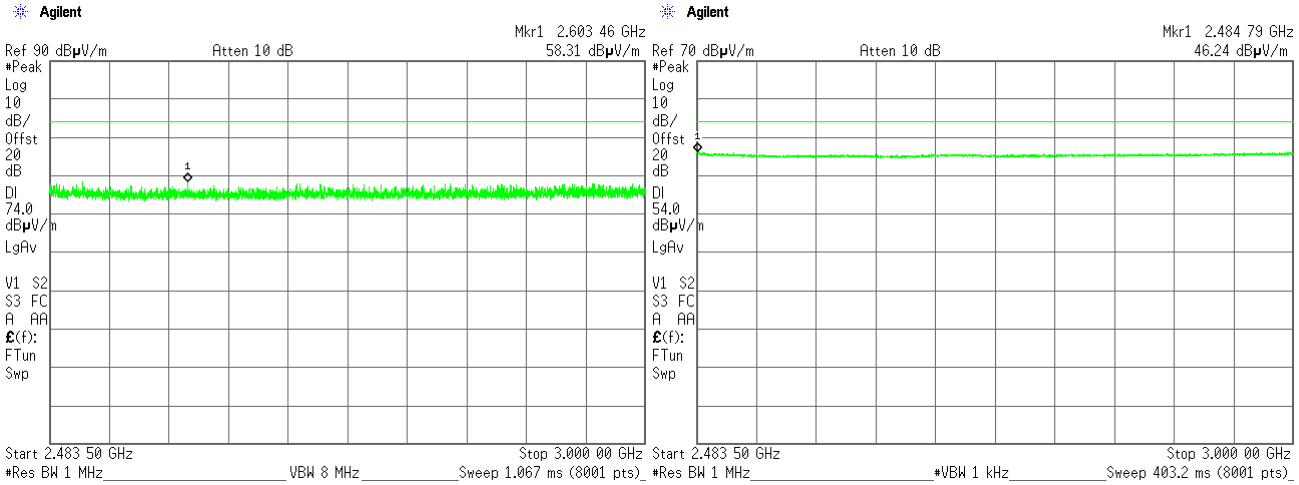
CHANNEL BANDWIDTH: 20MHz
MODULATION/BITRATE: 64-QAM / 54 Mbps



Test specification:	**Section 15.247(d), Band edge emissions**		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	15-Mar-21 - 18-May-21		
Temperature: 23 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1007 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

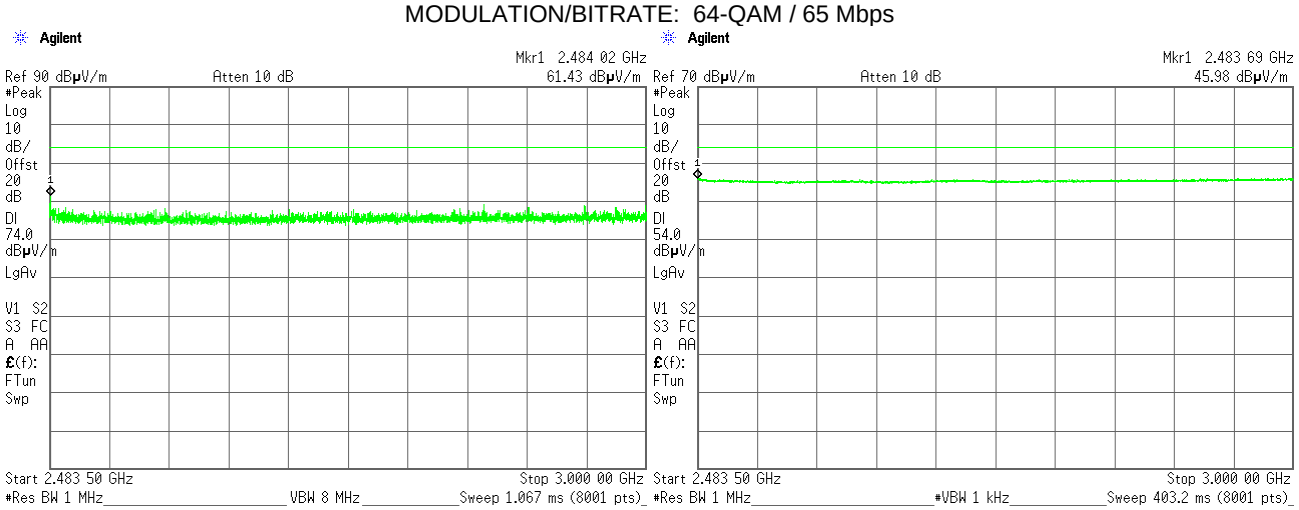
Plot 7.3.27 The highest emission level within restricted band at high carrier frequency

CHANNEL BANDWIDTH: 20MHz
MODULATION/BITRATE: BPSK / 6.5 Mbps



Plot 7.3.28 The highest emission level within restricted band at high carrier frequency

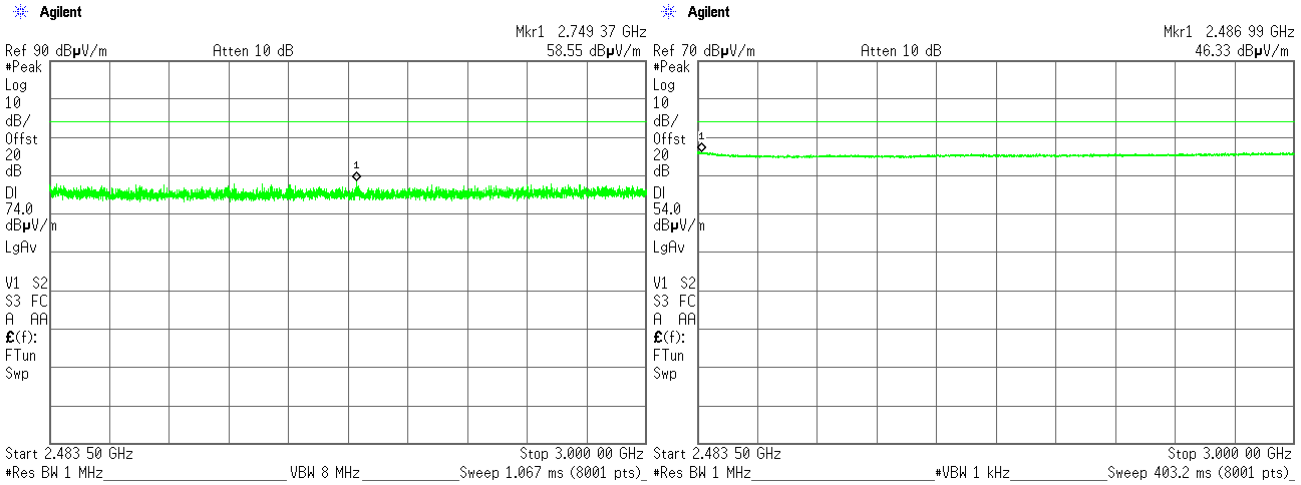
CHANNEL BANDWIDTH: 20MHz
MODULATION/BITRATE: 64-QAM / 65 Mbps



Test specification:	**Section 15.247(d), Band edge emissions**		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	15-Mar-21 - 18-May-21		
Temperature: 23 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1007 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

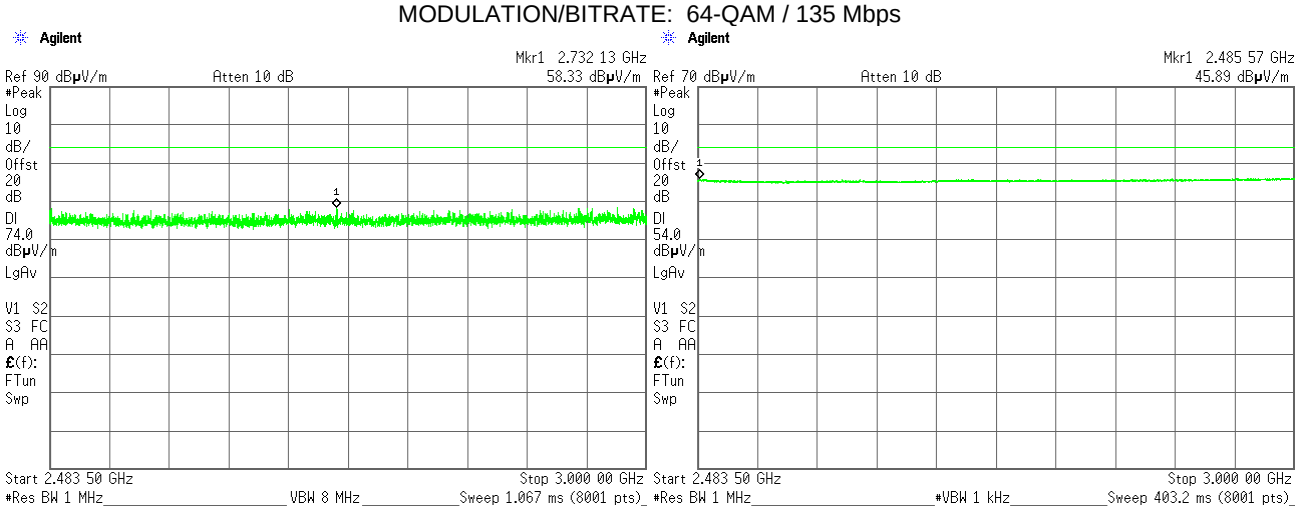
Plot 7.3.29 The highest emission level within restricted band at high carrier frequency

CHANNEL BANDWIDTH: 40MHz
MODULATION/BITRATE: BPSK / 13.5 Mbps



Plot 7.3.30 The highest emission level within restricted band at high carrier frequency

CHANNEL BANDWIDTH: 40MHz
MODULATION/BITRATE: 64-QAM / 135 Mbps



Test specification:	Section 15.203, Antenna requirements		
Test procedure:	Visual inspection		
Test mode:	Compliance	Verdict:	PASS
Date(s):	06-Apr-21 - 07-Apr-21		
Temperature: 23 ºC	Relative Humidity: 47 %	Air Pressure: 1017 hPa	Power: 230 VAC, 50 Hz
Remarks:			

7.4 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 7.4.1

Table 7.4.1 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 7.4.1 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):	06-Apr-21 - 07-Apr-21		
Temperature: 23 ºC	Relative Humidity: 47 %	Air Pressure: 1017 hPa	Power: 230 VAC, 50 Hz
Remarks:			

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

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: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

8.1.2 Test procedure for measurements in semi-anechoic chamber

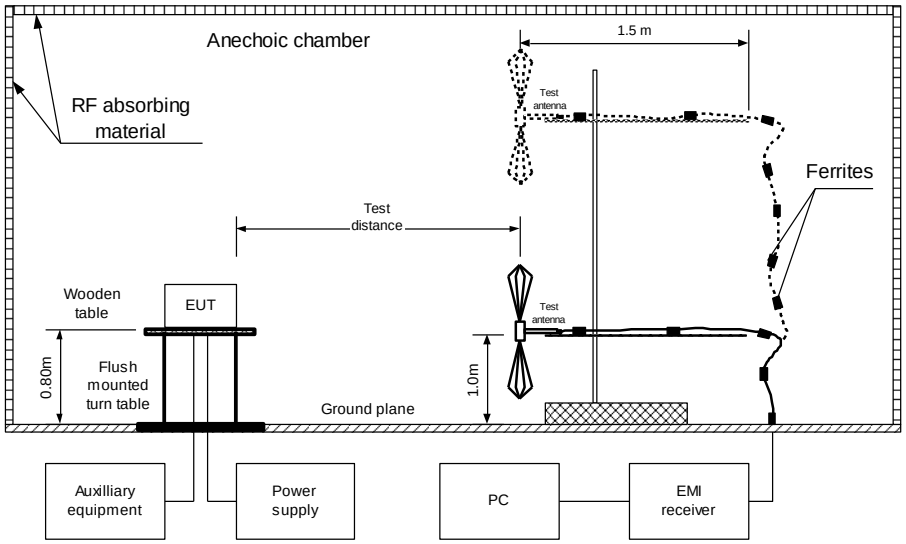
8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photograph/s, energized and the performance check was conducted.

8.1.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360^0, 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 Table 8.1.3 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):	06-Apr-21 - 07-Apr-21		
Temperature: 23 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1017 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

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



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):	06-Apr-21 - 07-Apr-21		
Temperature: 23 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1017 hPa	**Power:** 230 VAC, 50 Hz
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

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

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):	06-Apr-21 - 07-Apr-21		
Temperature: 23 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1017 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

Table 8.1.3 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

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

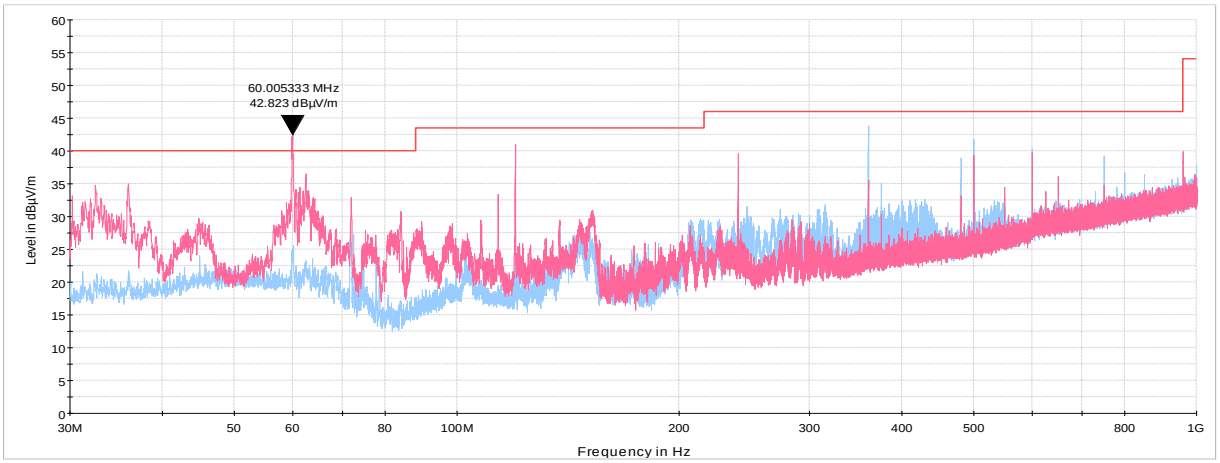
HL 3903	HL 4360	HL 4933	HL 4956	HL 5288	HL 5085	HL 5112	HL 5902

Full description is given in Appendix A.

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):	06-Apr-21 - 07-Apr-21		
Temperature: 23 ºC	Relative Humidity: 47 %	Air Pressure: 1017 hPa	Power: 230 VAC, 50 Hz
Remarks:			

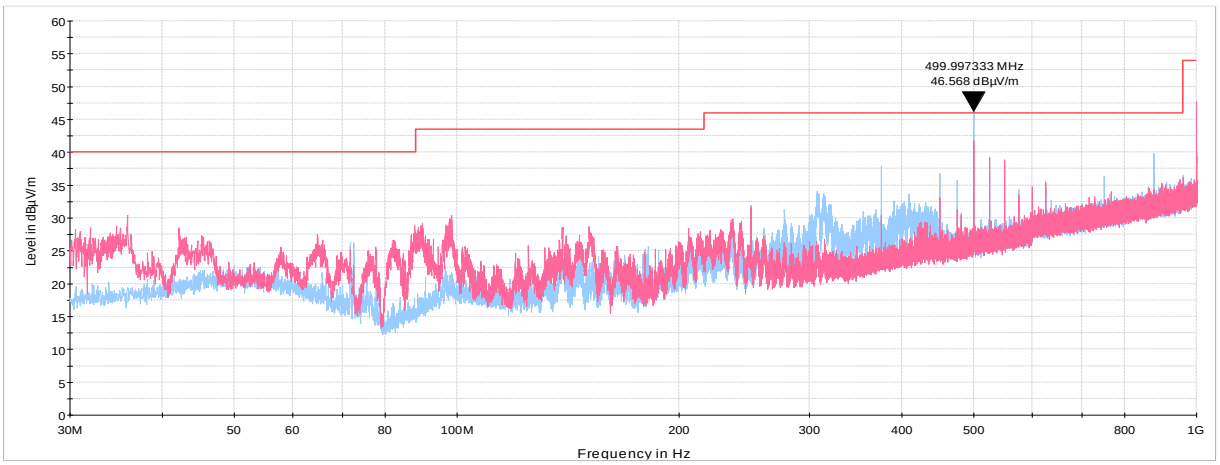
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

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



Plot 8.1.2 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

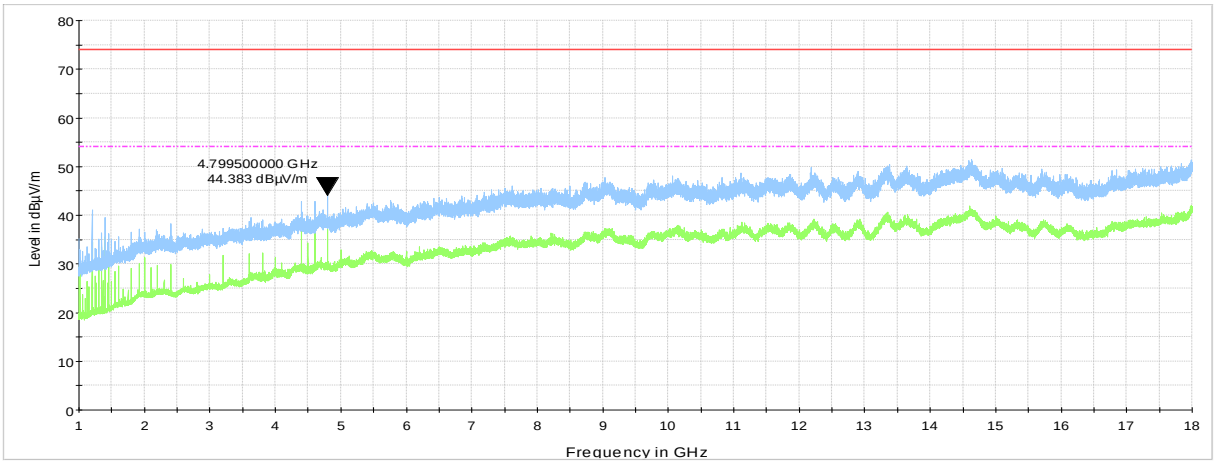
TEST SITE:	Semi anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive
EUT CONFIGURATION:	without box



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):	06-Apr-21 - 07-Apr-21		
Temperature: 23 ºC	Relative Humidity: 47 %	Air Pressure: 1017 hPa	Power: 230 VAC, 50 Hz
Remarks:			

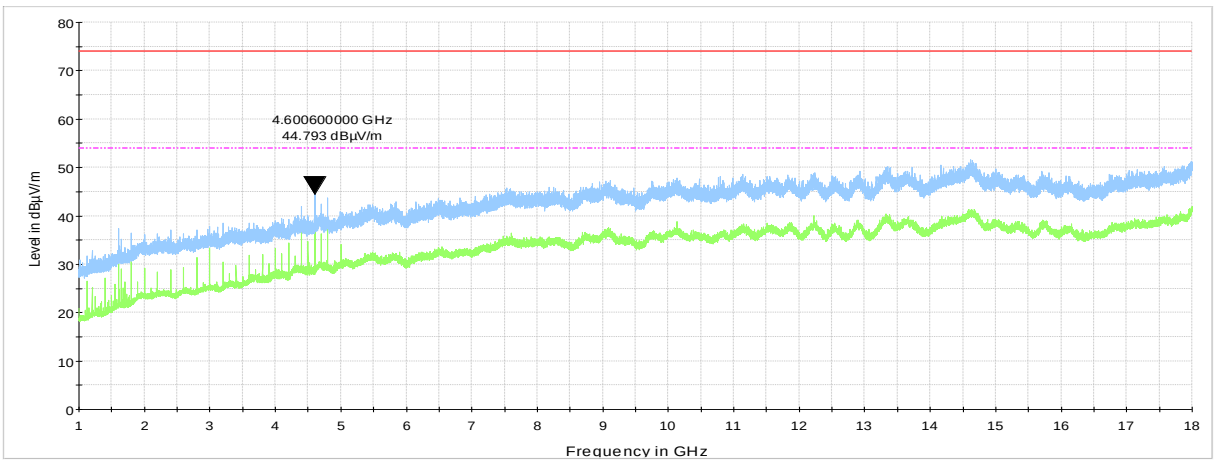
Plot 8.1.3 Radiated emission measurements in 1000 - 18000 MHz range, vertical and horizontal antenna polarization

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



Plot 8.1.4 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:	Section 15.247(b), Peak output power		
Test procedure:	ANSI C63.10 section 7.8.5, 11.9.1.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 30-Apr-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

9 Transmitter tests according to 47CFR part 15 subpart C requirements

9.1 Peak output power at BT and BLE protocols

9.1.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.1.1.

Table 9.1.1 Peak output power limits

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)**
		W	dBm	
902.0 – 928.0	6.0	1.0	30.0	131.2
2400.0 – 2483.5				
5725.0 – 5850.0				

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

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

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

9.1.2 Test procedure

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

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

9.1.2.3 The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept in both vertical and horizontal polarizations.

9.1.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.1.2 and associated plots.

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

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

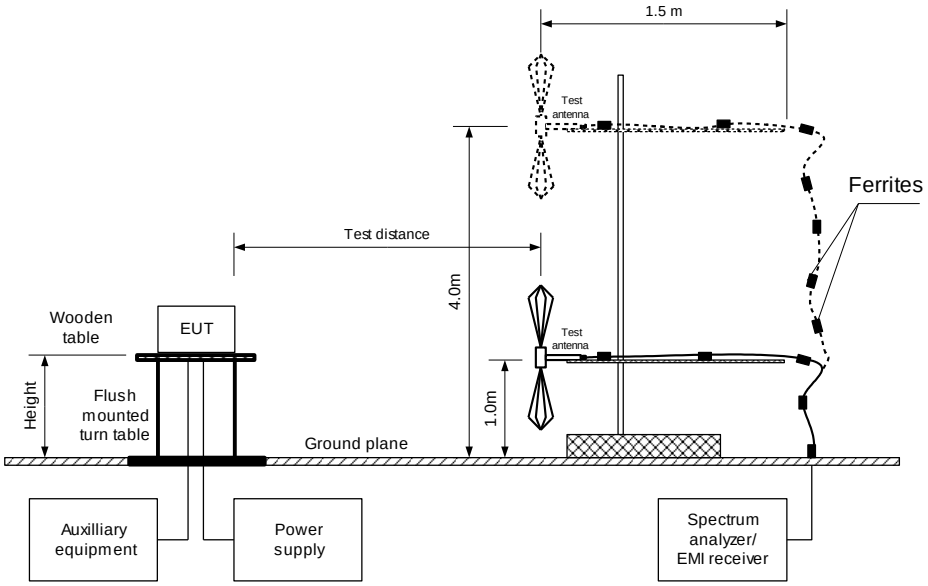
where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.
The above equation was converted in logarithmic units for 3 m test distance:

Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi – 95.2 dB

9.1.2.6 The worst test results (the lowest margins) were recorded in Table 7.1.2.

Test specification:	Section 15.247(b), Peak output power		
Test procedure:	ANSI C63.10 section 7.8.5, 11.9.1.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 30-Apr-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 9.1.1 Setup for carrier field strength measurements



Test specification:	**Section 15.247(b), Peak output power**		
Test procedure:	ANSI C63.10 section 7.8.5, 11.9.1.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	07-Apr-21 - 30-Apr-21		
Temperature: 25 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1008 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

Table 9.1.2 Peak output power test results

ASSIGNED FREQUENCY: 2400.0 – 2483.5 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 1.5 m
DETECTOR USED: Peak
TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 3 MHz
VIDEO BANDWIDTH: 3 MHz
MODULATION/BITRATE: 8DPSK

PROTOCOL: BLE

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402.0	85.91	Vertical	1.5	0	2.5	-12.09	30	-42.09	Pass
2440.0	87.31	Vertical	1.5	50	2.5	-10.69	30	-40.69	Pass
2480.0	86.93	Vertical	1.5	30	2.5	-11.07	30	-41.07	Pass

PROTOCOL: BT

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402.0	87.82	Vertical	1.5	0	2.5	-10.18	30	-40.18	Pass
2440.0	88.44	Vertical	1.5	50	2.5	-9.56	30	-39.56	Pass
2480.0	88.70	Vertical	1.5	30	2.5	-9.30	30	-39.3	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.
Note: Maximum peak output power was obtained at Unom (115%Unom, 85%Unom) input power voltage.

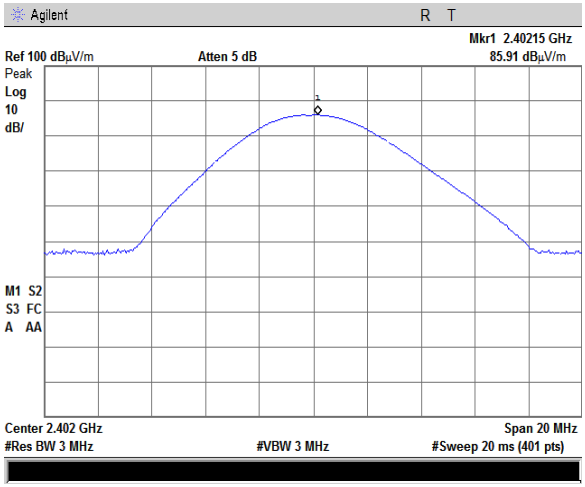
Reference numbers of test equipment used

HL 3818	HL 3903	HL 5902	HL 4933	HL 3442			

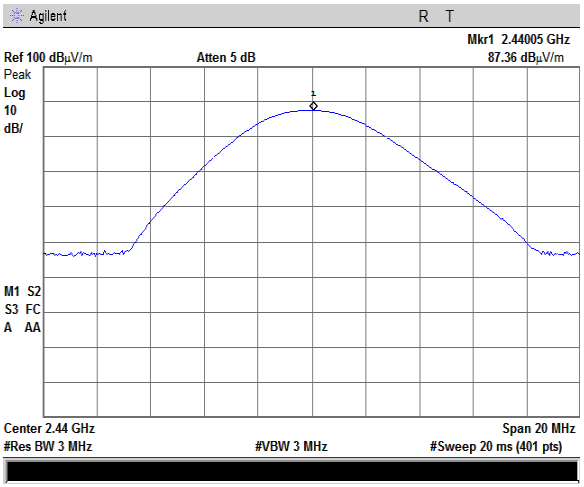
Full description is given in Appendix A.

Test specification:	Section 15.247(b), Peak output power		
Test procedure:	ANSI C63.10 section 7.8.5, 11.9.1.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 30-Apr-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 9.1.1 Field strength of carrier at low frequency at BLE protocol

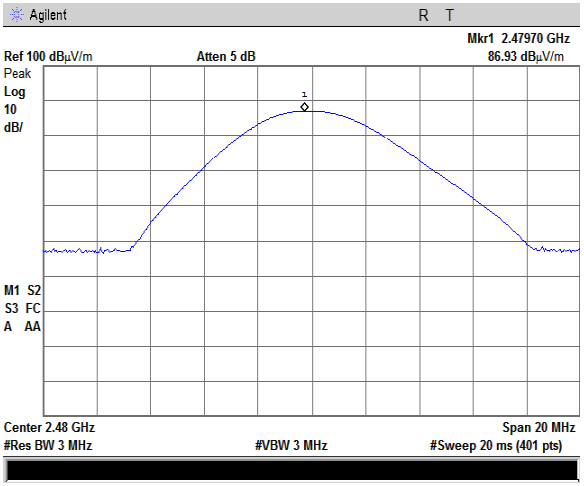


Plot 9.1.2 Field strength of carrier at mid frequency at BLE protocol



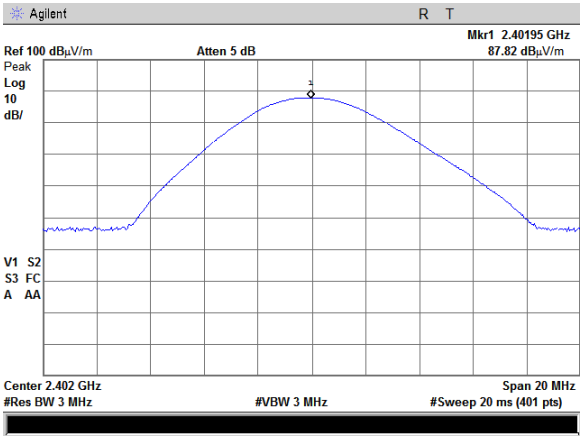
Test specification:	Section 15.247(b), Peak output power		
Test procedure:	ANSI C63.10 section 7.8.5, 11.9.1.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 30-Apr-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 9.1.3 Field strength of carrier at high frequency at BLE protocol

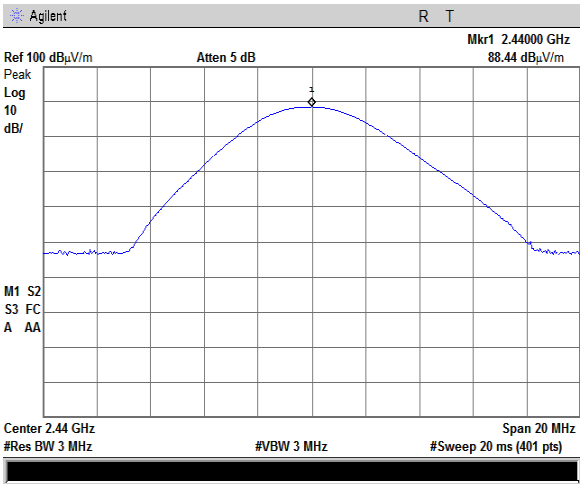


Test specification:	Section 15.247(b), Peak output power		
Test procedure:	ANSI C63.10 section 7.8.5, 11.9.1.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 30-Apr-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 9.1.4 Field strength of carrier at low frequency at BT protocol

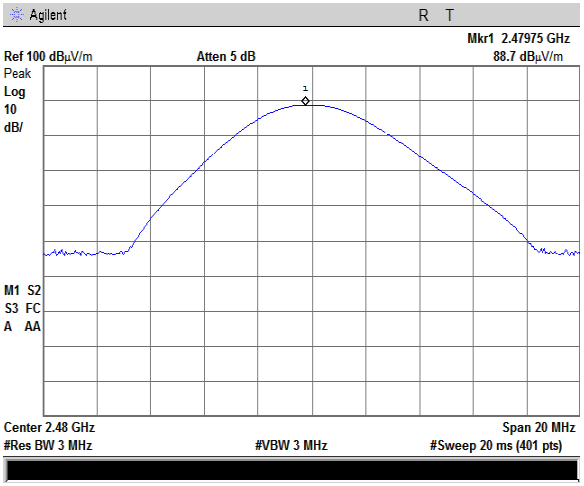


Plot 9.1.5 Field strength of carrier at mid frequency at BT protocol



Test specification:	Section 15.247(b), Peak output power		
Test procedure:	ANSI C63.10 section 7.8.5, 11.9.1.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 30-Apr-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 9.1.6 Field strength of carrier at high frequency at BT protocol



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

9.2 Field strength of spurious emissions at BT protocol

9.2.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 9.2.1.

Table 9.2.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***
	Peak	Quasi Peak	Average	
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**	
0.490 – 1.705	NA	73.8 – 63.0**	NA	
1.705 – 30.0*		69.5		
30 – 88		40.0		
88 – 216		43.5		
216 – 960		46.0		
960 - 1000		54.0		
1000 – 10th harmonic	74.0	NA	54.0	

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

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

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.

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

9.2.2.1 The EUT was set up as shown in Figure 9.2.1, energized and the performance check was conducted.

9.2.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.

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

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

9.2.3.1 The EUT was set up as shown in Figure 9.2.2, Figure 1.1.3, energized and the performance check was conducted.

9.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

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

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

Figure 9.2.1 Setup for spurious emission field strength measurements below 30 MHz

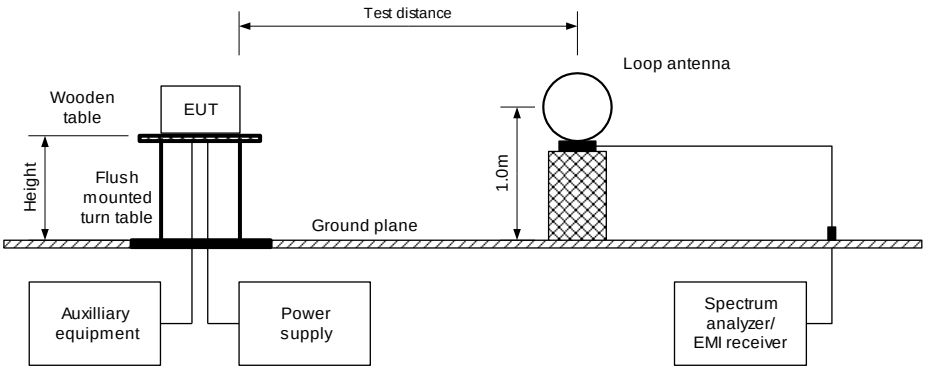
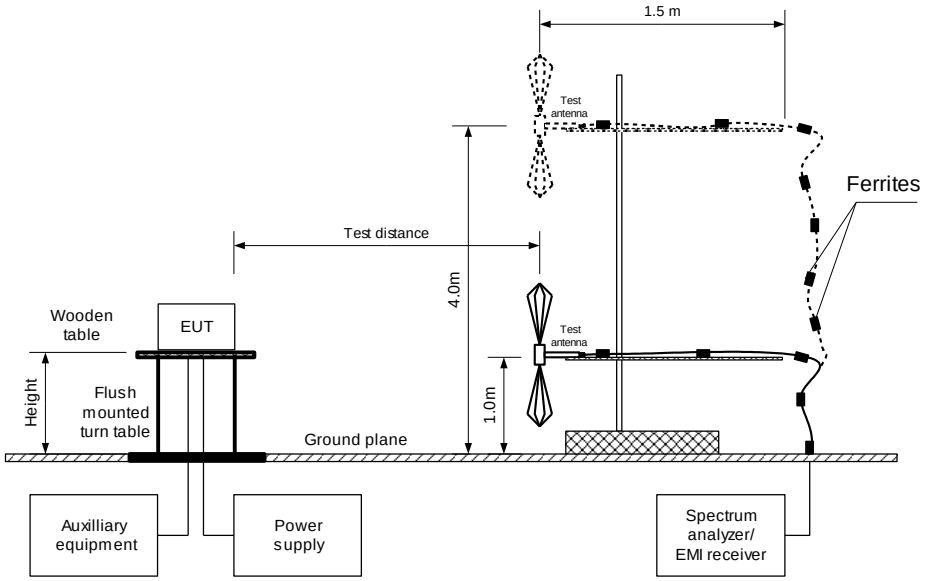
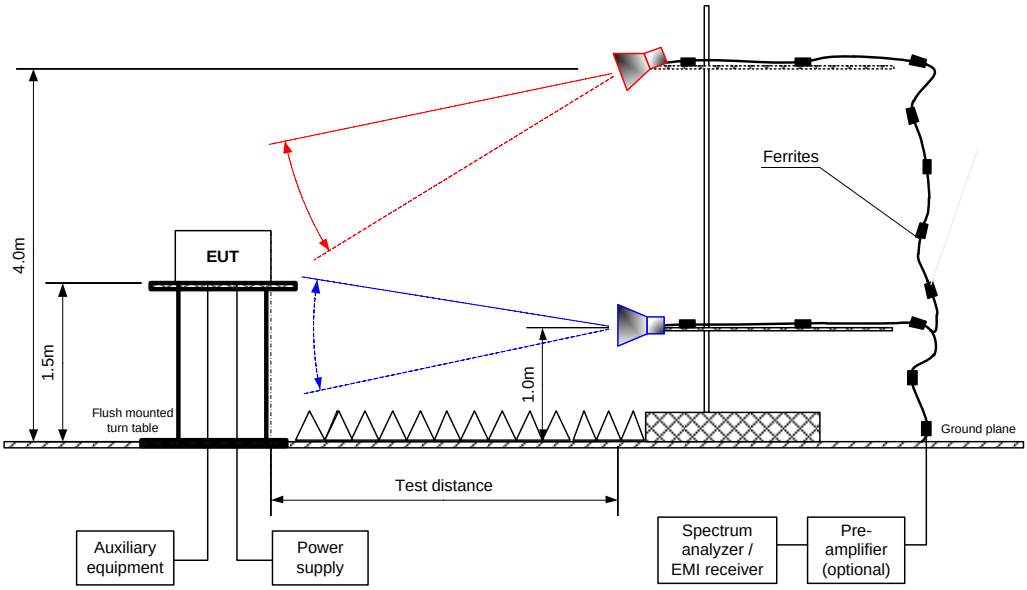


Figure 9.2.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz



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

Figure 9.2.3 Setup for spurious emission field strength measurements above 1000 MHz



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

Table 9.2.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY:	2400.0 – 2483.5 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 - 25000 MHz
TEST DISTANCE:	3 m
MODULATION:	GFSK
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength of spurious, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(µV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
Low carrier frequency 2402 MHz									
3.473	43.54	Vertical	1.05	65	87.71	44.17	20.0	24.17	Pass
60.00	39.83	Vertical	1.65	-97		47.88		27.88	
Mid carrier frequency 2440 MHz									
3.489	43.58	Vertical	1.15	80	87.85	44.27	20.0	24.27	Pass
60.04	38.51	Vertical	1.43	-105		49.34		29.34	
High carrier frequency 2480 MHz									
3.385	43.44	Vertical	1.00	35	88.61	45.17	20.0	25.17	Pass
60.00	39.52	Vertical	1.39	-120		49.09		29.09	

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = Attenuation below carrier – specification limit.

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

Table 9.2.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY: 2400.0 – 2483.5 MHz
INVESTIGATED FREQUENCY RANGE: 1000 - 25000 MHz
TEST DISTANCE: 3 m
MODULATION: GFSK
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 1000 kHz
TEST ANTENNA TYPE: Double ridged guide

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)				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 2402 MHz											
4804.05	Vertical	1.5	30	45.9	74	-28.1	45.9	43.7	54	-10.3	Pass
Mid carrier frequency 2440 MHz											
4880.15	Vertical	1.5	30	44.3	74	-29.7	44.3	42.1	54	-11.9	Pass
High carrier frequency 2480 MHz											
4960.07	Vertical	1.5	30	44.8	74	-29.2	44.8	42.6	54	-11.4	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.

Table 9.2.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
2.9	3.75	NA	NA	NA	-2.2

*- Average factor was calculated as follows

for pulse train shorter than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train\right)$$

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

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

Table 9.2.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY:	2400.0 – 2483.5 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	8DPSK
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
120.006398	45.27	42.37	43.50	-1.13	V	1.02	-53	

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

Table 9.2.6 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 9.2.7 Restricted bands according to RSS-Gen

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

Reference numbers of test equipment used

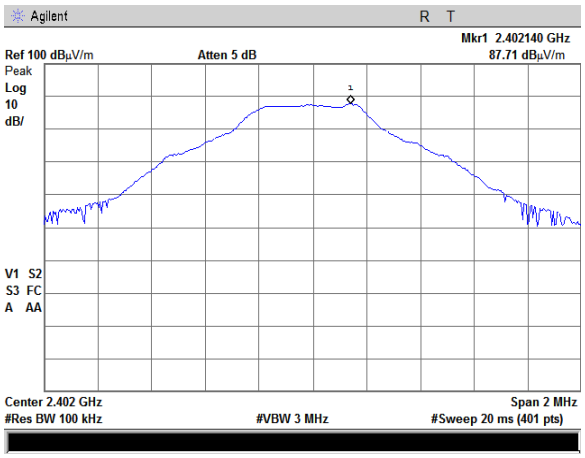
HL 4360	HL 3903	HL 4933	HL 446	HL 4956	HL 5288	HL 5085	HL 5112
HL 5902	HL 4378	HL 5286					

Full description is given in Appendix A.

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

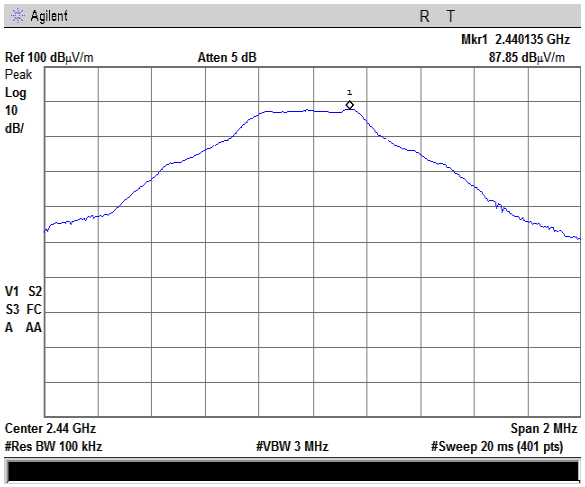
Plot 9.2.1 Radiated emission measurements at the low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 9.2.2 Radiated emission measurements at the mid carrier frequency

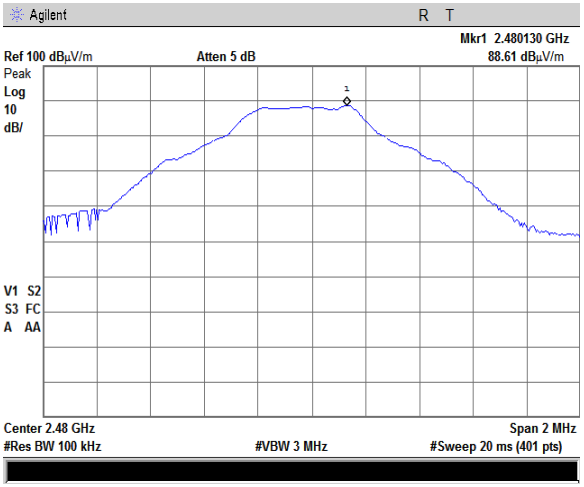
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



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

Plot 9.2.3 Radiated emission measurements at the high carrier frequency

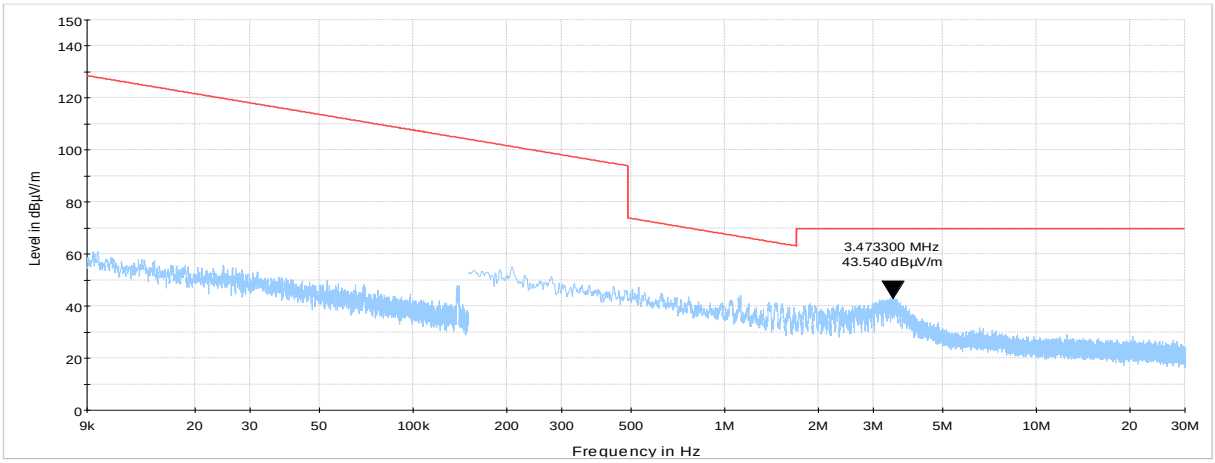
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



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

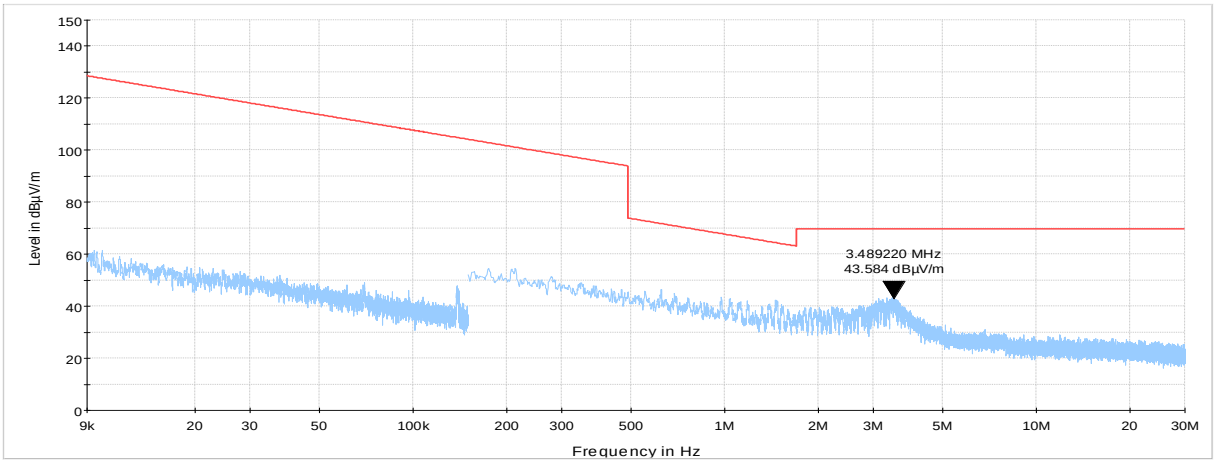
Plot 9.2.4 Radiated emission measurements from 9 kHz to 30 MHz at the low carrier frequency

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



Plot 9.2.5 Radiated emission measurements from 9 kHz to 30 MHz at the mid carrier frequency

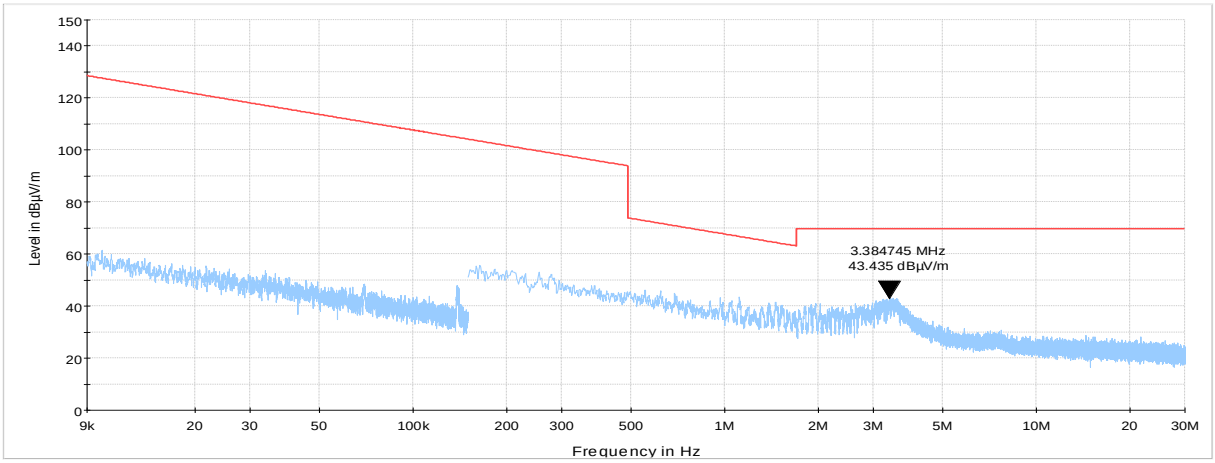
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



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

Plot 9.2.6 Radiated emission measurements from 9 kHz to 30 MHz at the high carrier frequency

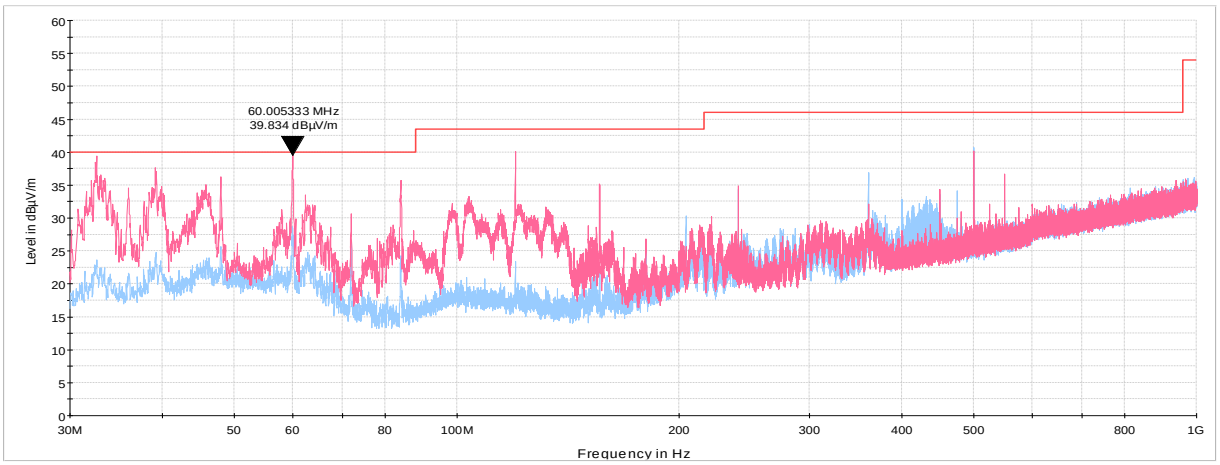
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



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

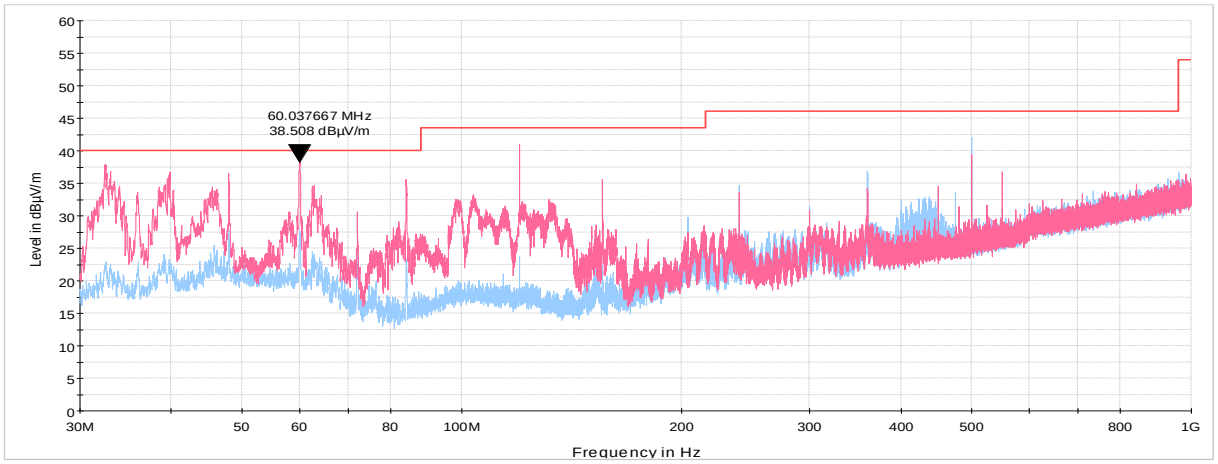
Plot 9.2.7 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

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



Plot 9.2.8 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency

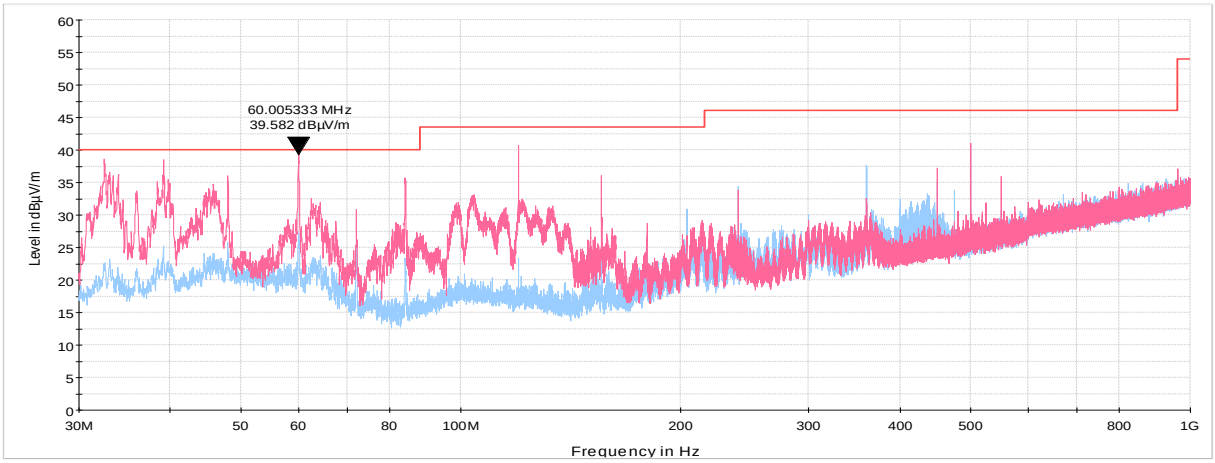
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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

Plot 9.2.9 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

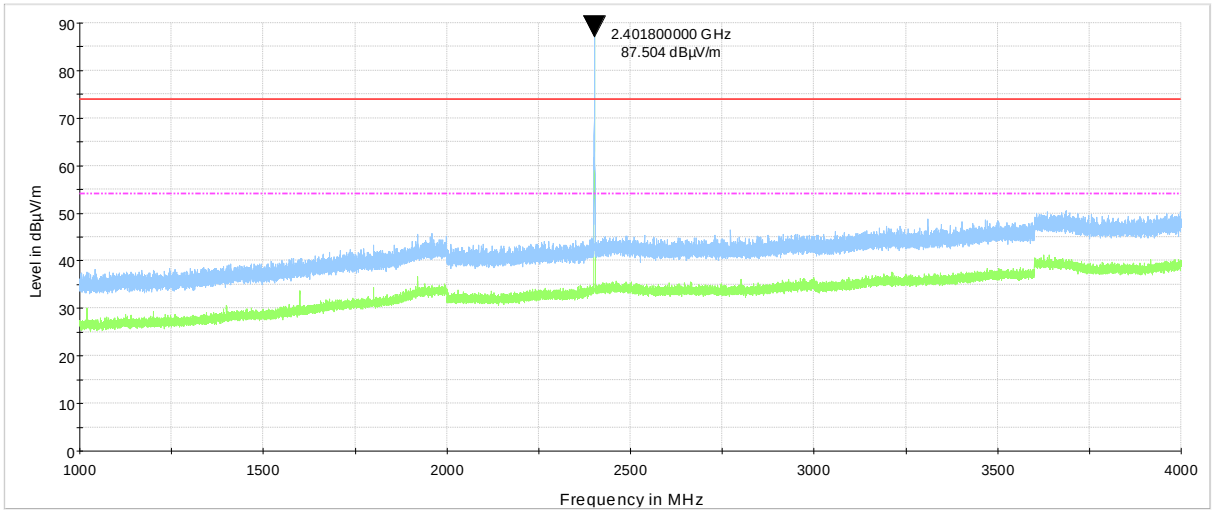
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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

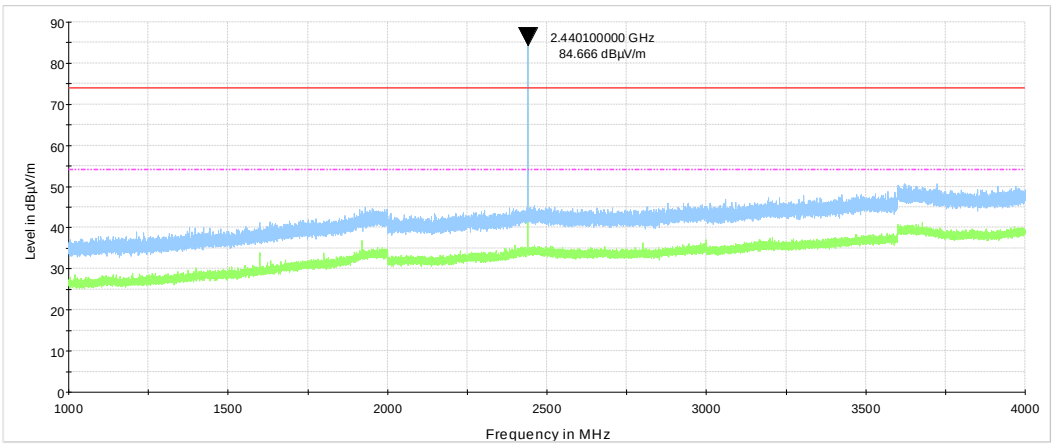
Plot 9.2.10 Radiated emission measurements from 1000 to 4000 MHz at the low carrier frequency

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



Plot 9.2.11 Radiated emission measurements from 1000 to 4000 MHz at the mid carrier frequency

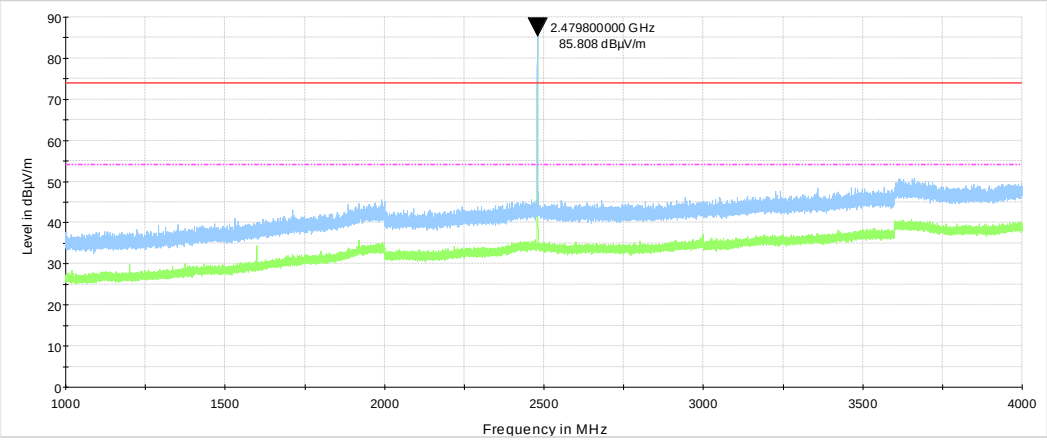
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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

Plot 9.2.12 Radiated emission measurements from 1000 to 4000 MHz at the high carrier frequency

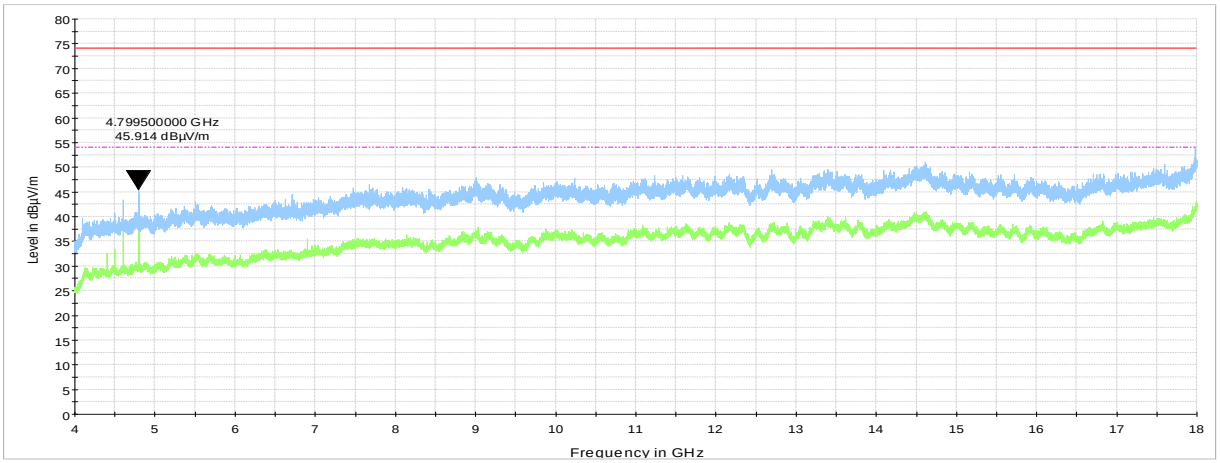
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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

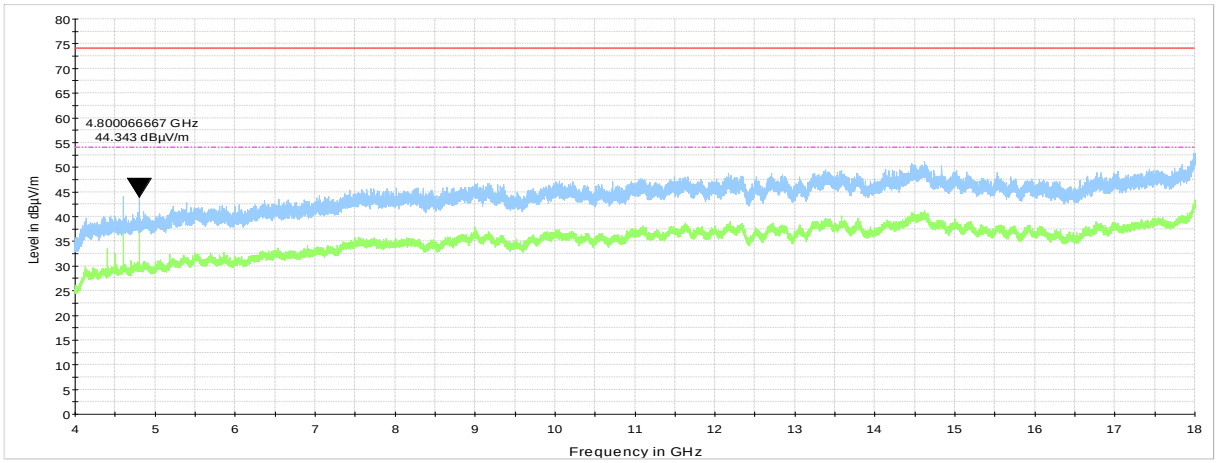
Plot 9.2.13 Radiated emission measurements from 4000 to 18000 MHz at the low carrier frequency

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



Plot 9.2.14 Radiated emission measurements from 4000 to 18000 MHz at the mid carrier frequency

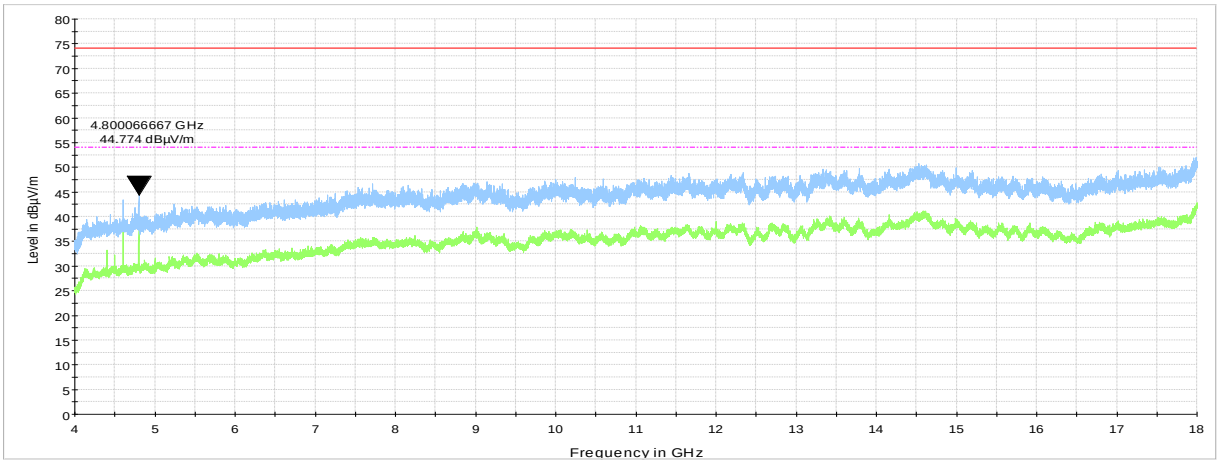
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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

Plot 9.2.15 Radiated emission measurements from 4000 to 18000 MHz at the high carrier frequency

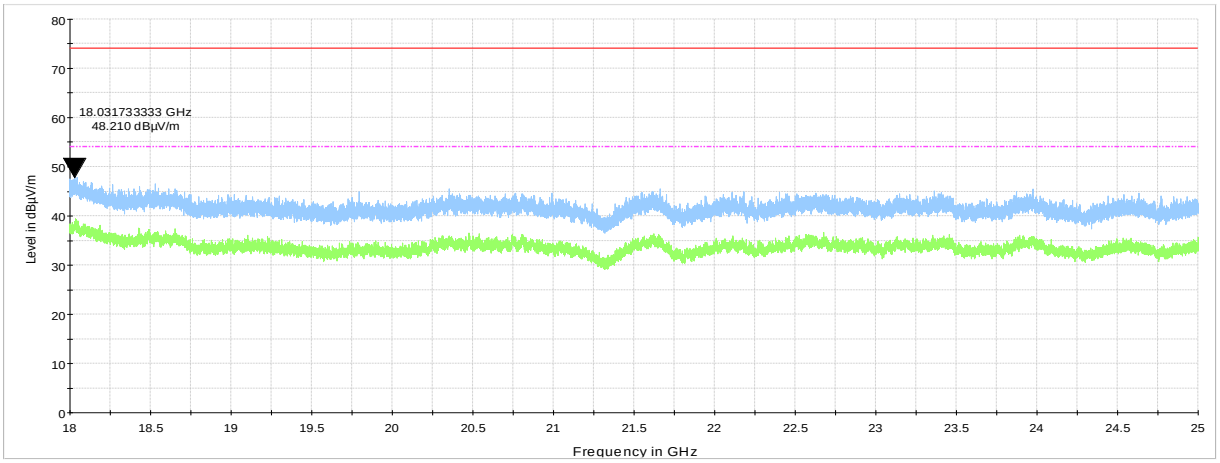
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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

Plot 9.2.16 Radiated emission measurements from 18 GHz to 25 GHz at the low carrier frequency

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



Plot 9.2.17 Radiated emission measurements from 18 GHz to 25 GHz at the mid carrier frequency

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