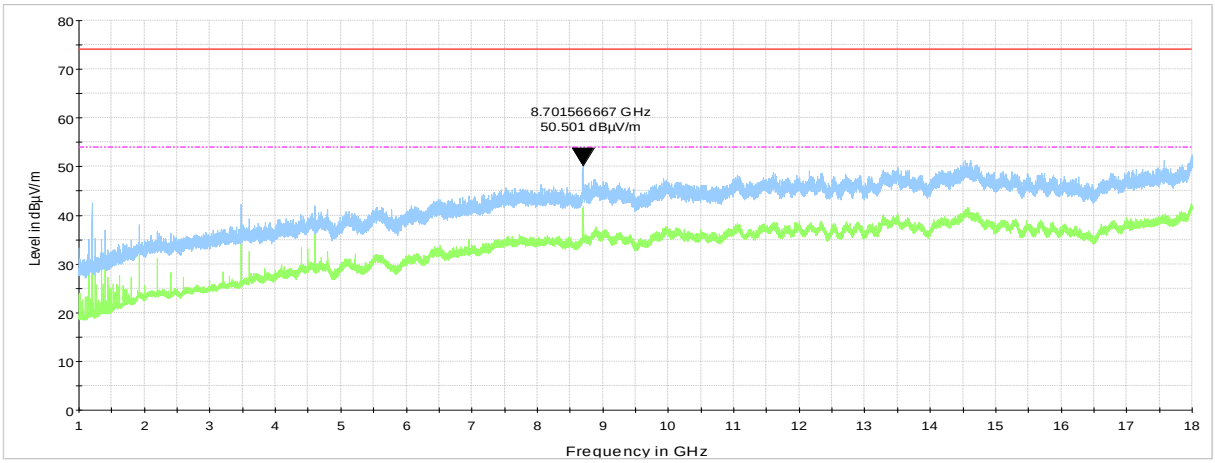
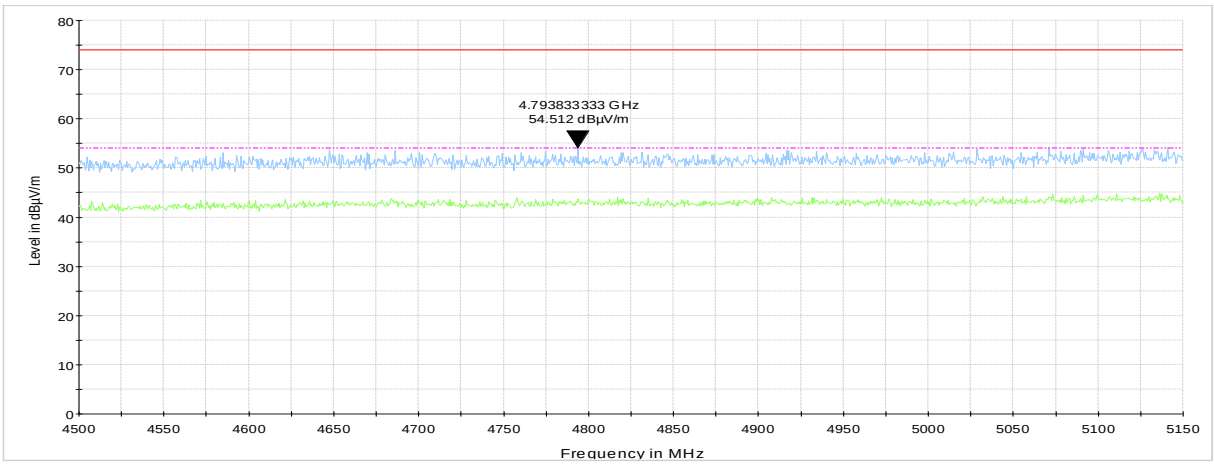
Test specification:	FCC section 15.407(b)1, Field strength of undesirable emissions		
Test procedure:	KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC,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

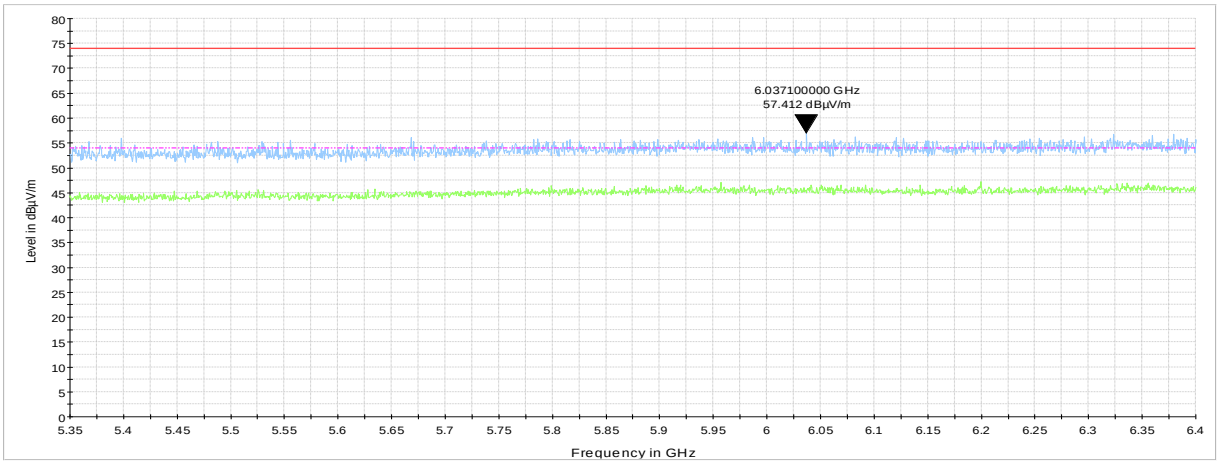
Plot 11.2.9 Radiated emission measurements from 1.0 to 18 GHz at the high carrier frequency

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





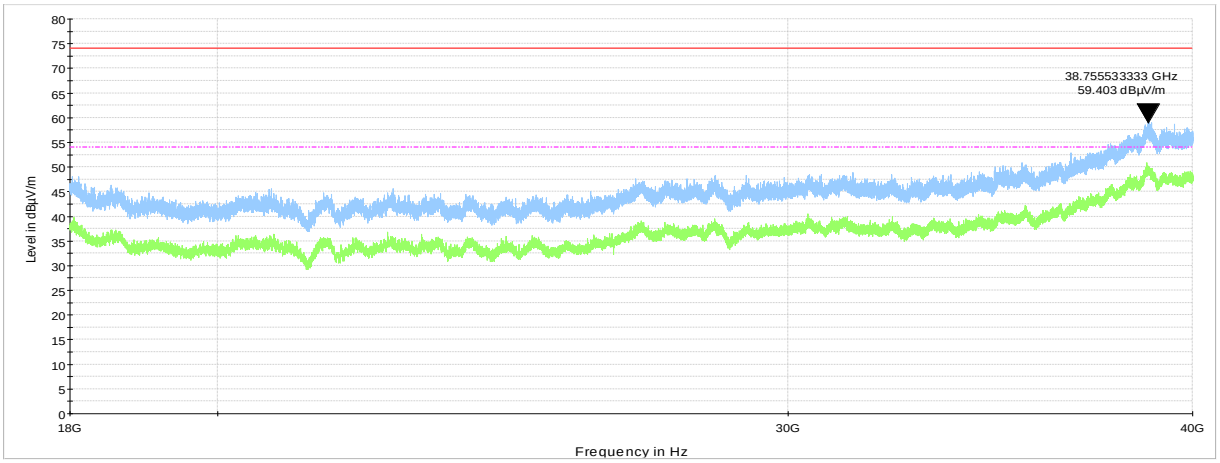
Test specification:	FCC section 15.407(b)1, Field strength of undesirable emissions		
Test procedure:	KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC,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



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

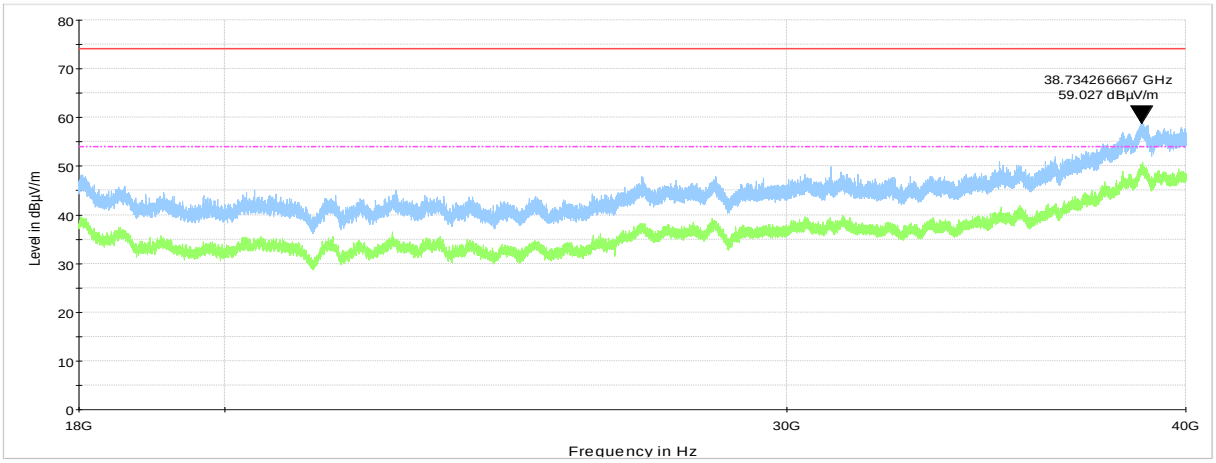
Plot 11.2.10 Radiated emission measurements from 18 to 40 GHz at the low carrier frequency

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



Plot 11.2.11 Radiated emission measurements from 18 to 40 GHz at the mid carrier frequency

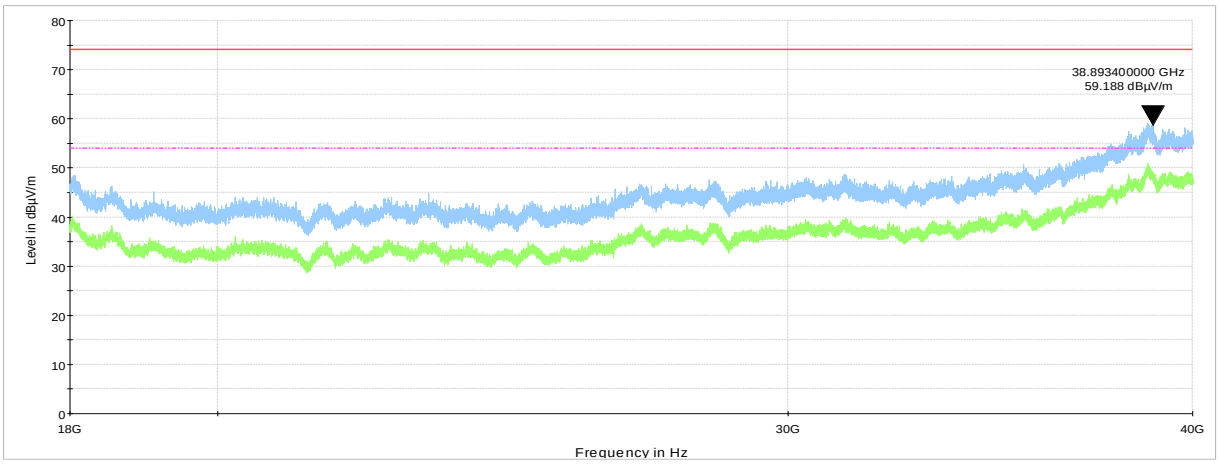
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 11.2.12 Radiated emission measurements from 18 to 40 GHz at the high carrier frequency

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



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

11.3 Field strength of undesirable emissions at 5725 – 5850 MHz range

11.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 11.3.1, Table 11.2.2.

Table 11.3.1 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:

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

where S_1 and S_2 – standard defined and test distance respectively in meters.

**- The limit decreases linearly with the logarithm of frequency.

Table 11.3.2 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)** **-17 (in 5.715 - 5.725 GHz and 5.825 - 5.835 GHz)**	**68.23** **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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

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

11.3.2.1 The EUT was set up as shown in Figure 11.3.1, energized and the performance check was conducted.

11.3.2.2 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.

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

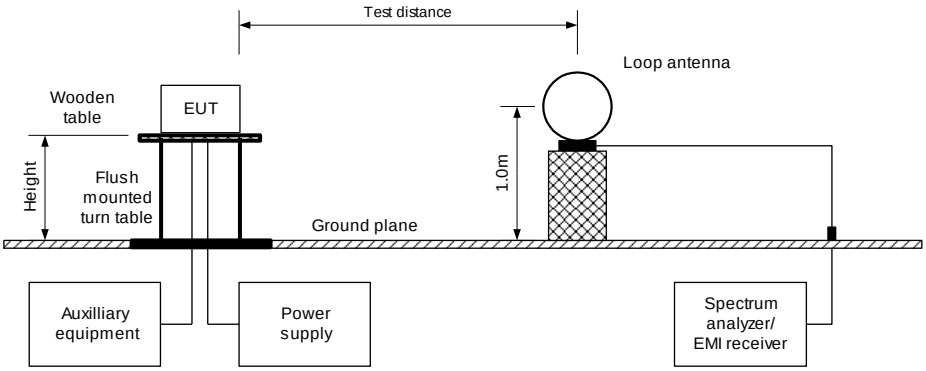
11.3.3 Test procedure for spurious emission field strength measurements above 30 MHz

11.3.3.1 The EUT was set up as shown in Figure 11.3.2, Figure 11.3.3, energized and the performance check was conducted.

11.3.3.2 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.

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

Figure 11.3.1 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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Figure 11.3.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz

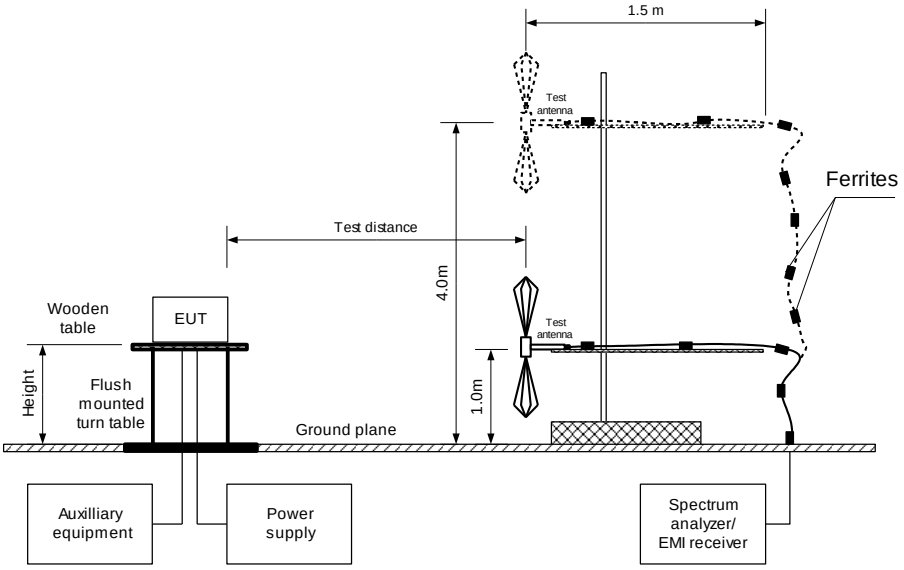
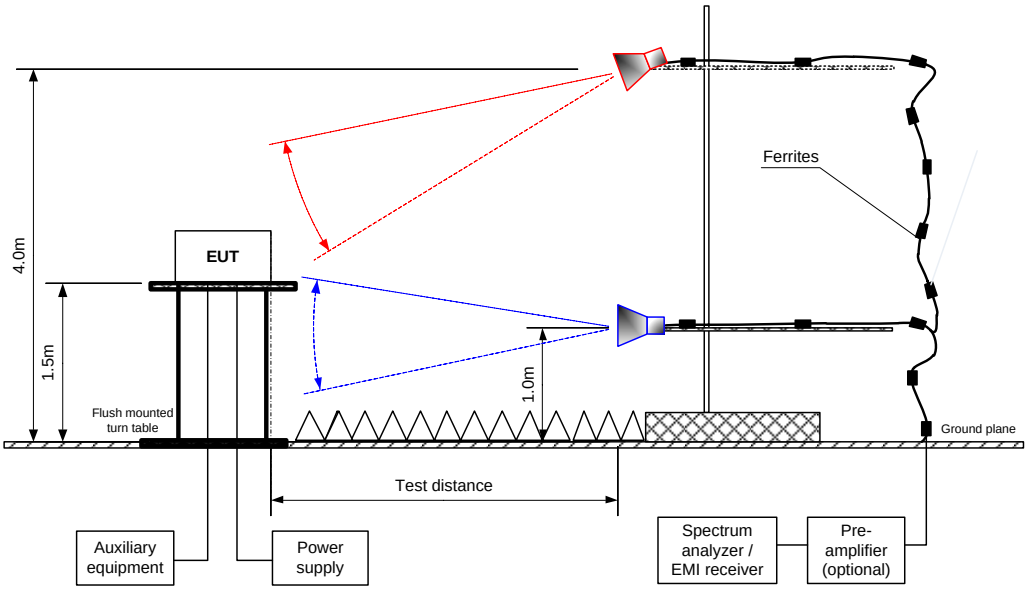


Figure 11.3.3 Setup for spurious emission field strength measurements above1000 MHz



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 11.3.3 Field strength of spurious emissions below 1 GHz

ASSIGNED FREQUENCY BAND:	5725 - 5825 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, MH	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 5745 MHz								
120.014862	40.99	39.42	43.50	-4.08	V	1.04	-88	Pass
Mid carrier frequency 5785 MHz								
120.014936	41.05	39.51	43.50	-3.99	V	1.11	-91	Pass
960.093428	41.36	38.36	54.00	-15.64	H	1.00	180	
High carrier frequency 5825 MHz								
120.014784	41.09	39.37	43.50	-4.13	V	1.06	-86	Pass
960.094159	41.27	38.29	54.00	-15.71	H	1.00	178	

*****- 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 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1008 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

Table 11.3.4 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY BAND:	5725 - 5825 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 5745 MHz							
All emissions are more than 20 dB below the limit							Pass
Mid carrier frequency 5785 MHz							
All emissions are more than 20 dB below the limit							Pass
High carrier frequency 5825 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 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1008 hPa	**Power:** 230 VAC, 50 Hz
Remarks:			

Table 11.3.5 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY:	5725 - 5825 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

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 5745 MHz											
All emissions are more than 20 dB below the limit											Pass
Mid carrier frequency 5785 MHz											
All emissions are more than 20 dB below the limit											Pass
High carrier frequency 5825 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.

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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Table 11.3.6 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	

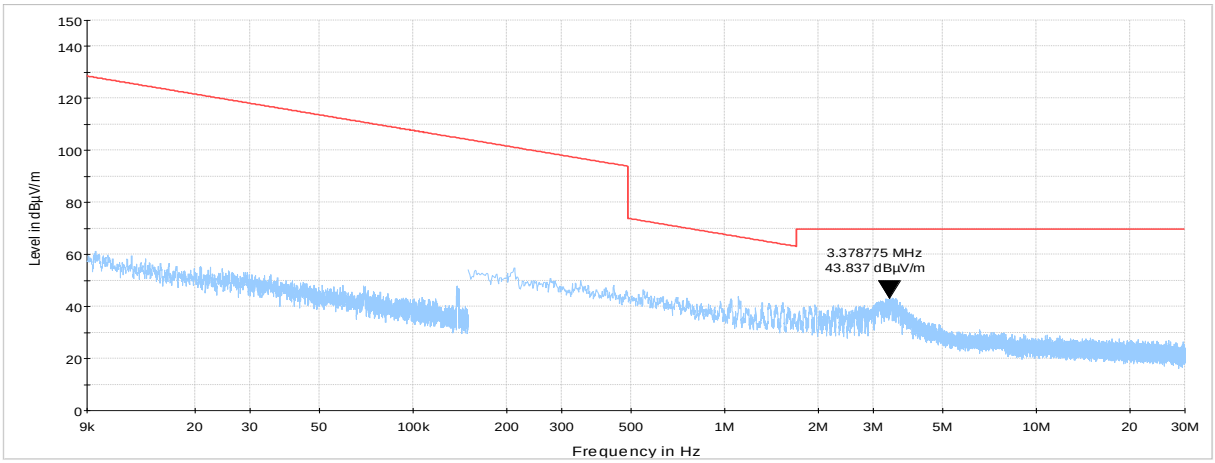
Table 11.3.7 Restricted bands according to RSS-Gen

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

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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

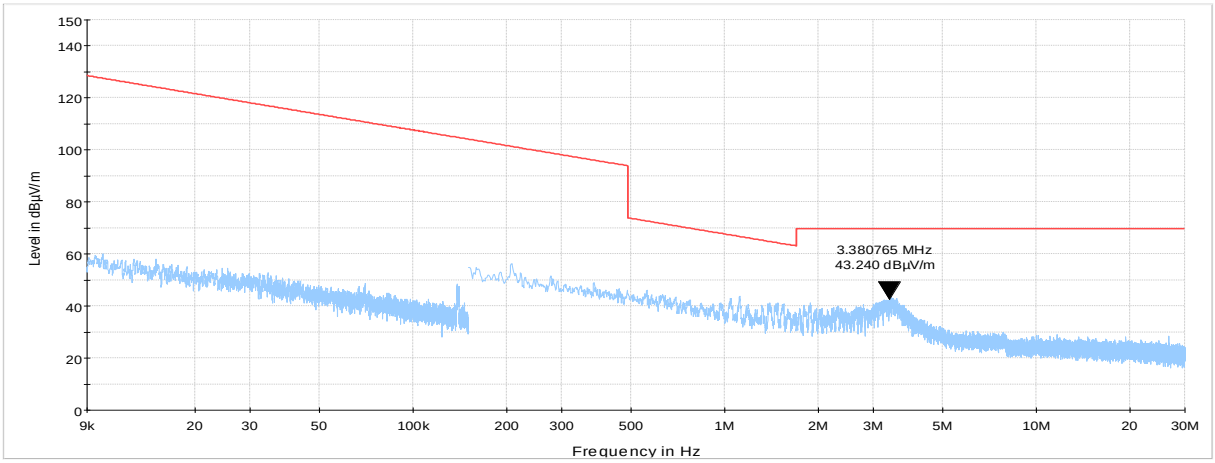
Plot 11.3.1 Radiated emission measurements from 9 kHz to 30 MHz at the low carrier frequency

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



Plot 11.3.2 Radiated emission measurements from 9 kHz to 30 MHz at the mid carrier frequency

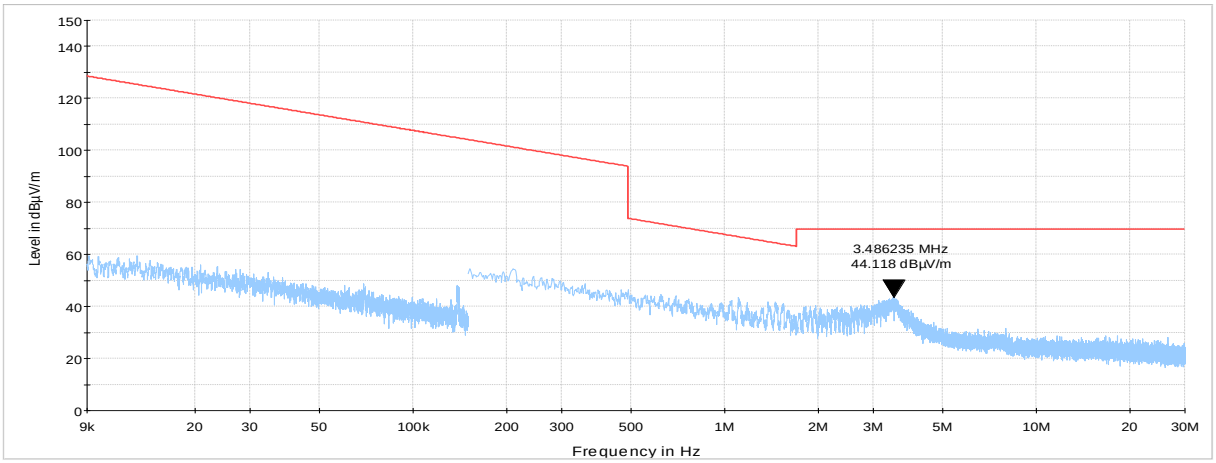
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 11.3.3 Radiated emission measurements from 9 kHz to 30 MHz at the high carrier frequency

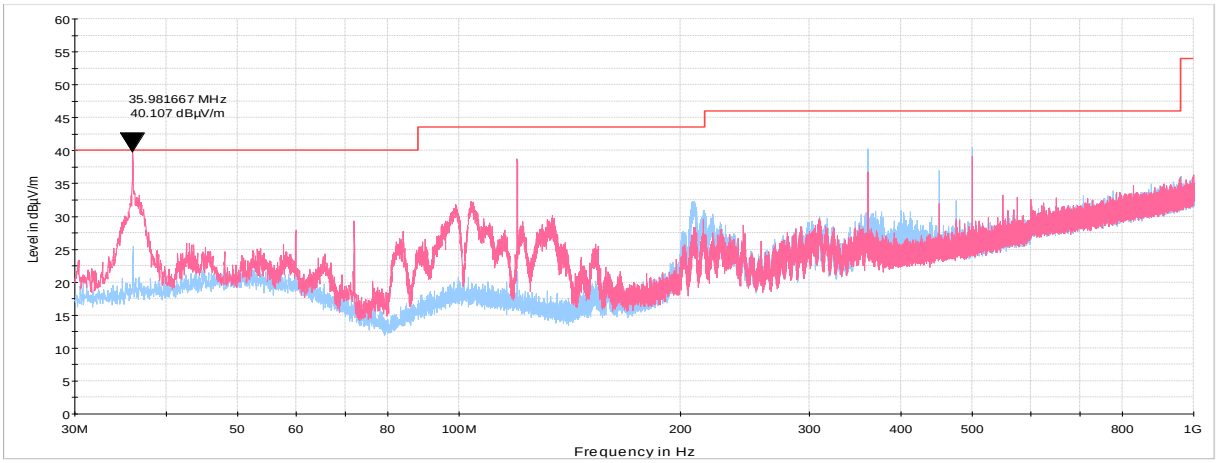
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

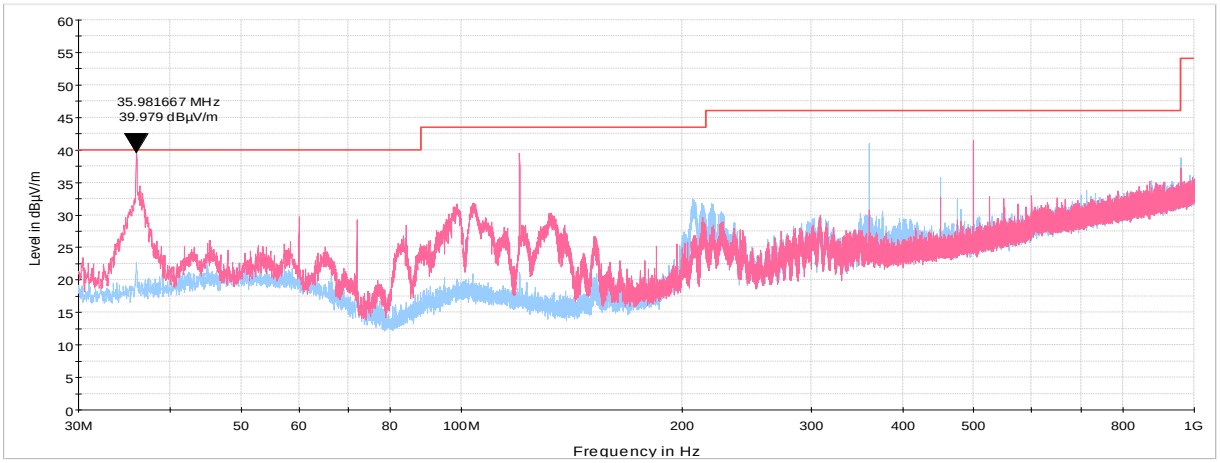
Plot 11.3.4 Radiated emission measurements from 30 MHz to 1000 MHz at the low carrier frequency

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



Plot 11.3.5 Radiated emission measurements from 30 MHz to 1000 MHz at the mid carrier frequency

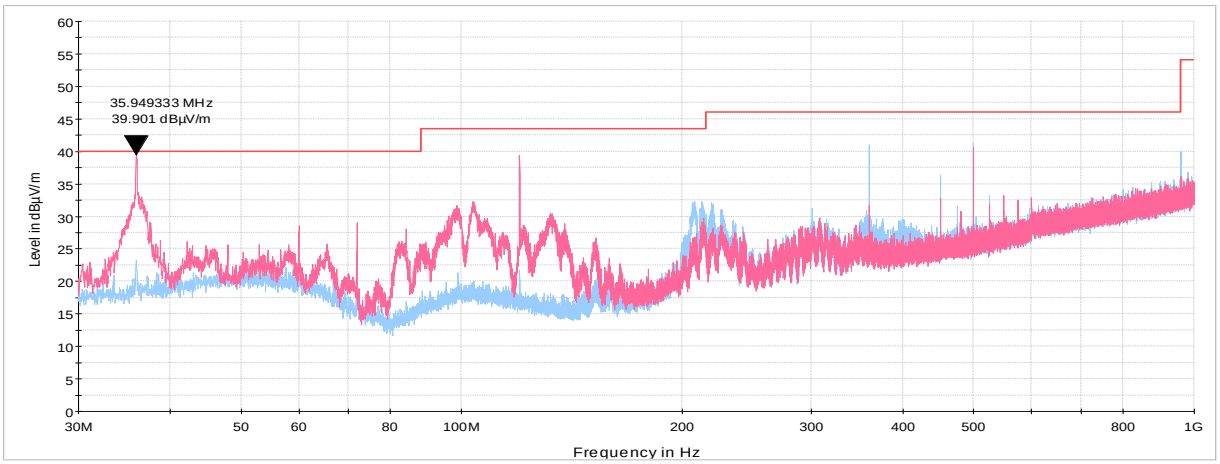
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 11.3.6 Radiated emission measurements from 30 MHz to 1000 MHz at the high carrier frequency

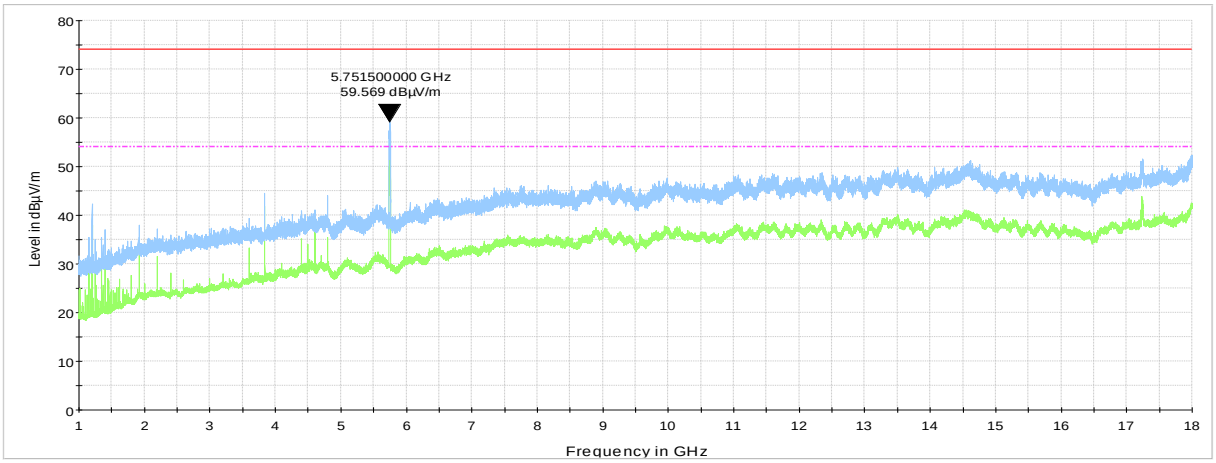
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

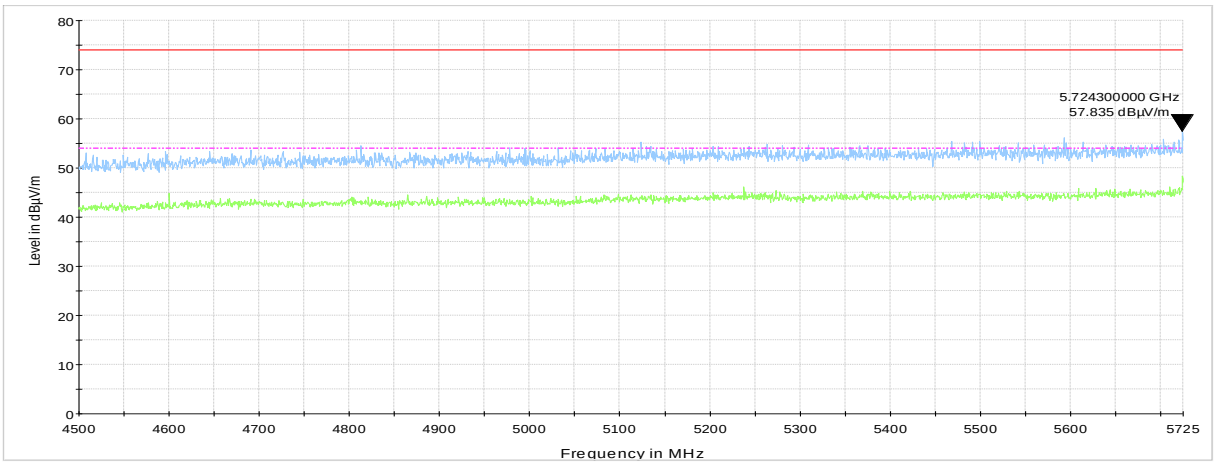


Test specification:	FCC section 15.407(b)1, Field strength of undesirable emissions		
Test procedure:	KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC,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

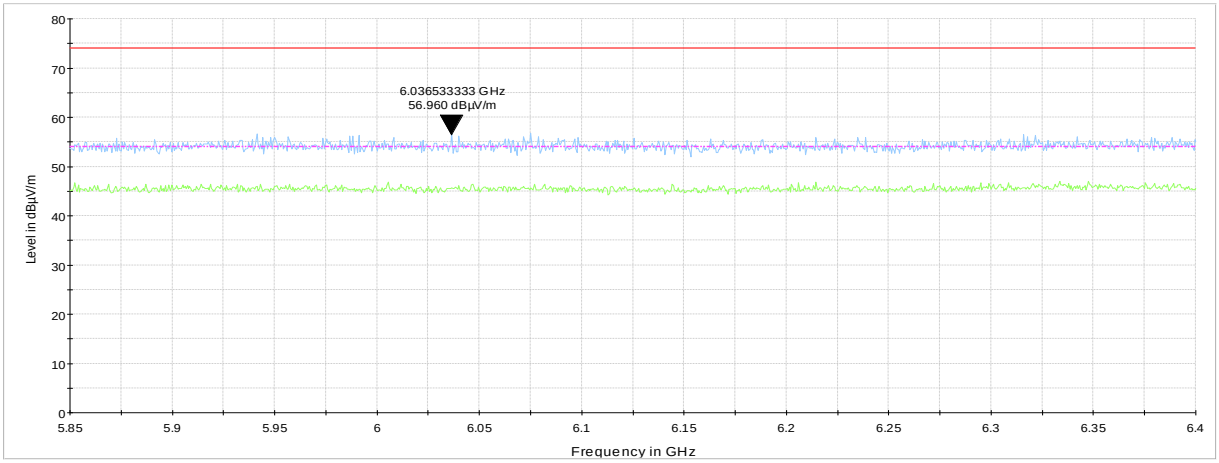
Plot 11.3.7 Radiated emission measurements from 1.0 to 18 GHz at the low carrier frequency

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





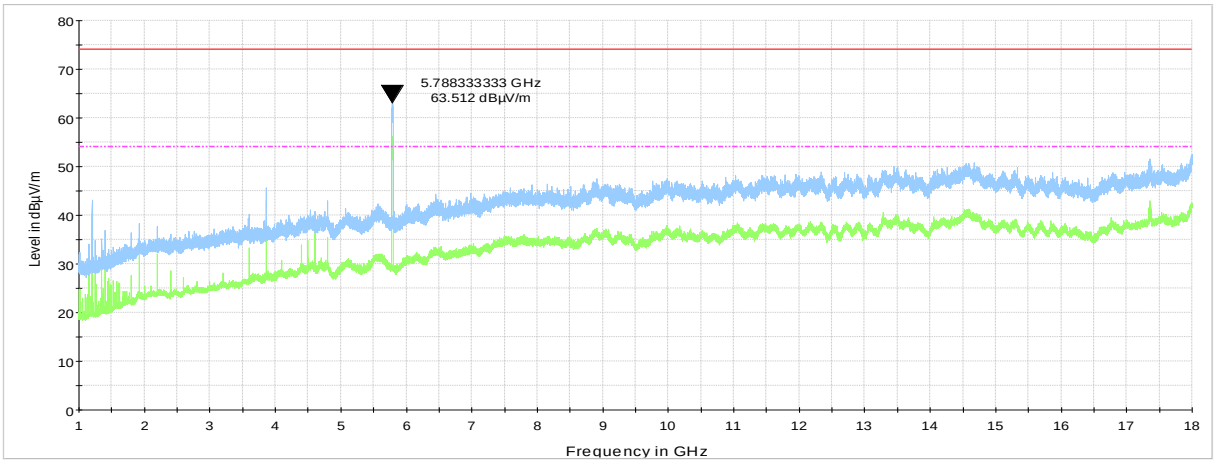
Test specification:	FCC section 15.407(b)1, Field strength of undesirable emissions		
Test procedure:	KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC,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

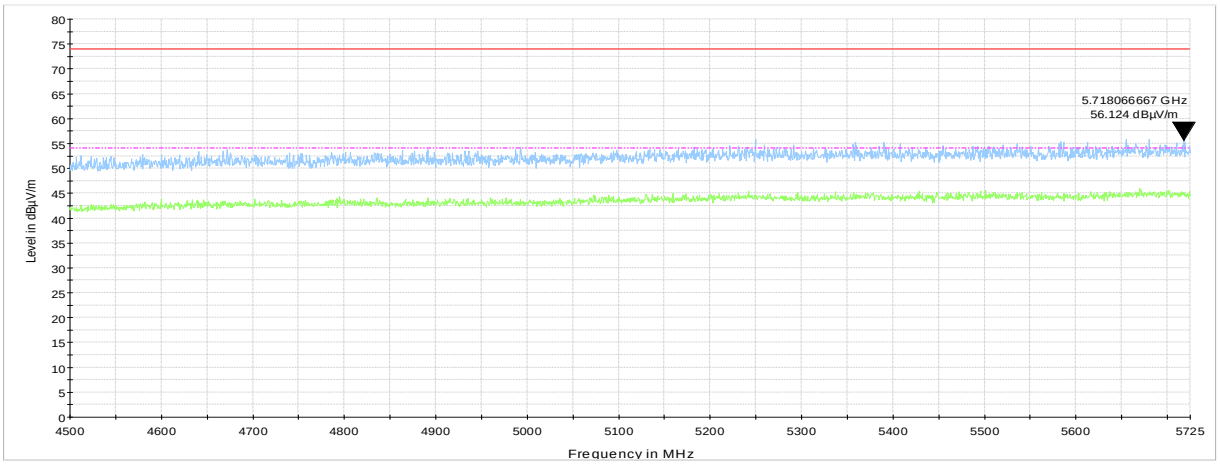


Test specification:	FCC section 15.407(b)1, Field strength of undesirable emissions		
Test procedure:	KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC,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

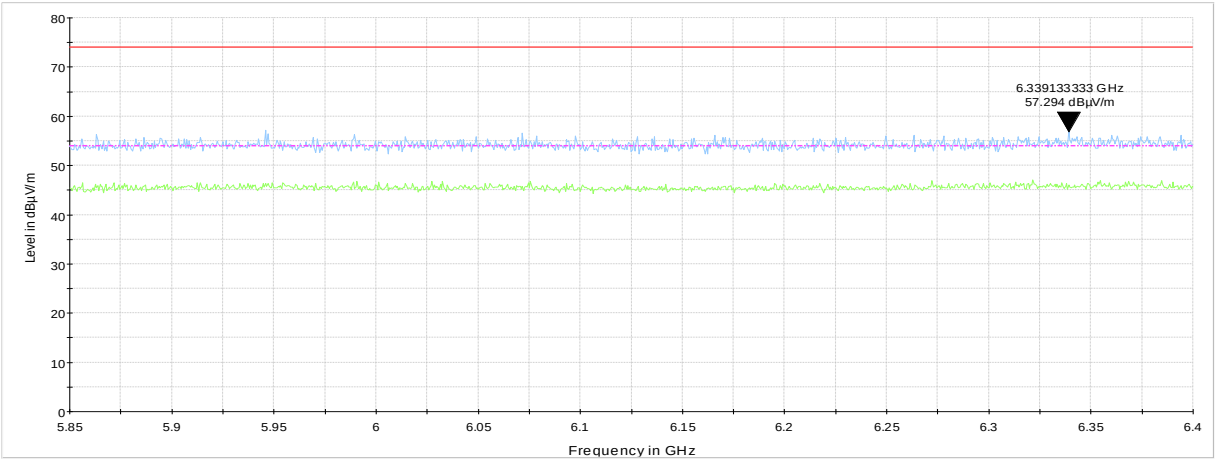
Plot 11.3.8 Radiated emission measurements from 1.0 to 18 GHz at the mid carrier frequency

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





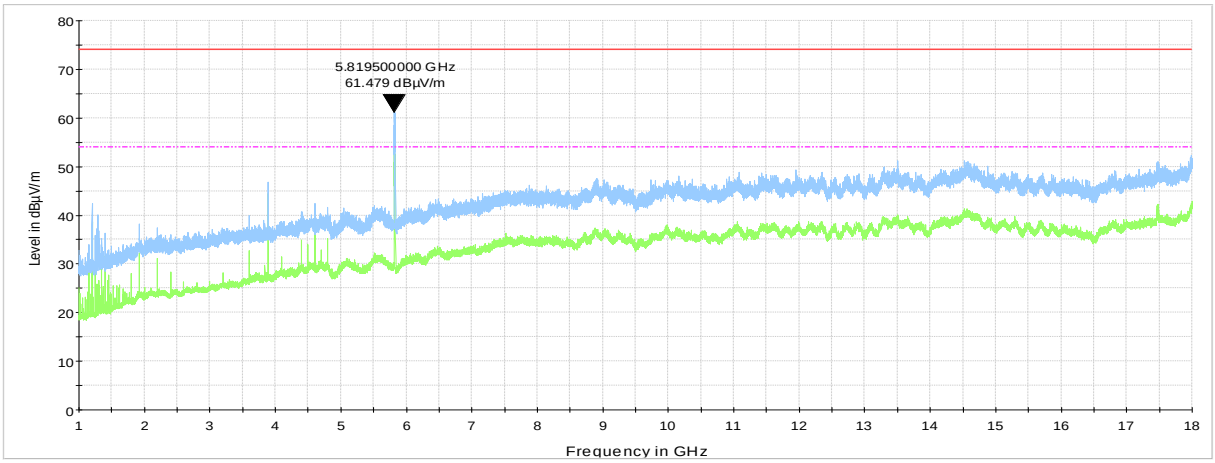
Test specification:	FCC section 15.407(b)1, Field strength of undesirable emissions		
Test procedure:	KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC,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

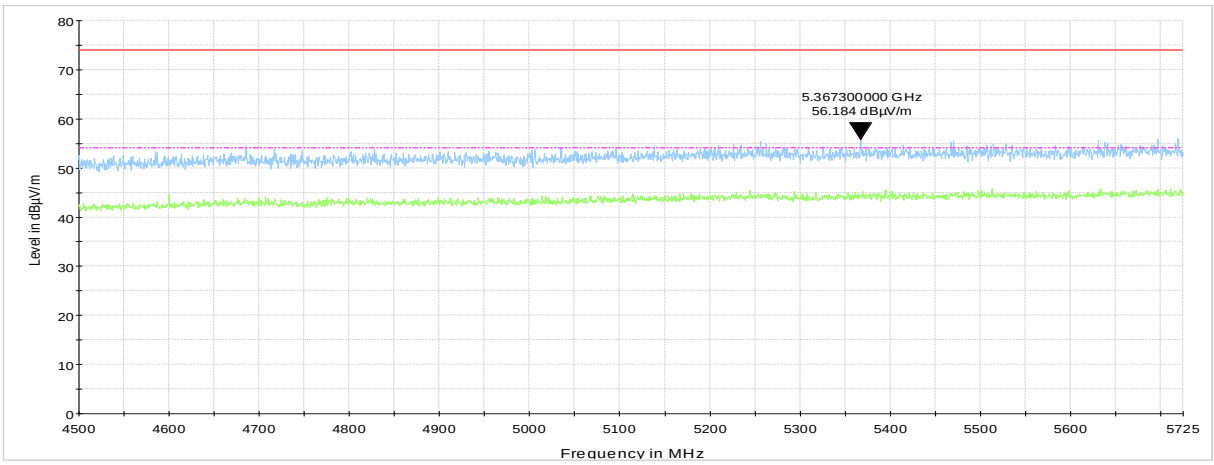


Test specification:	FCC section 15.407(b)1, Field strength of undesirable emissions		
Test procedure:	KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC,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

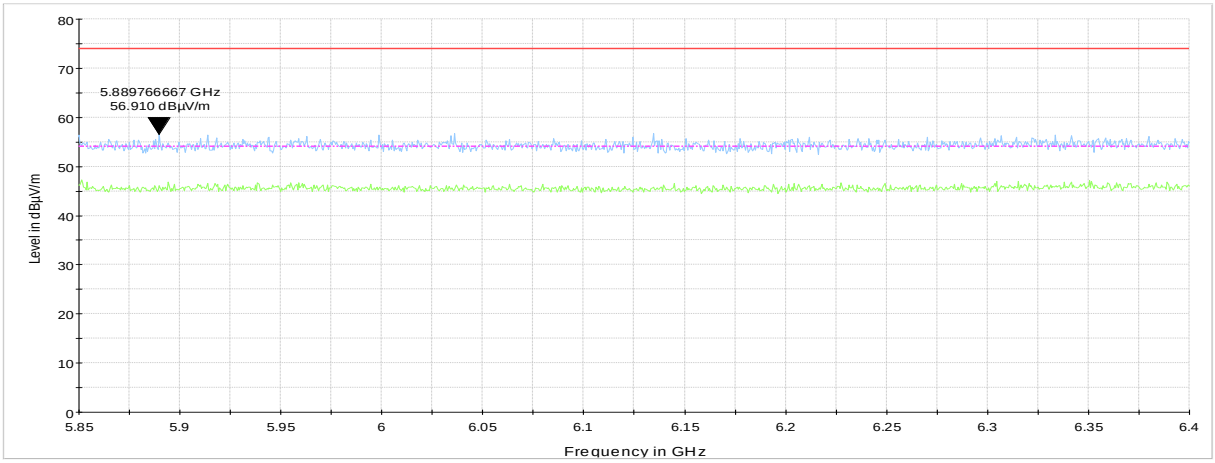
Plot 11.3.9 Radiated emission measurements from 1.0 to 18 GHz at the high carrier frequency

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





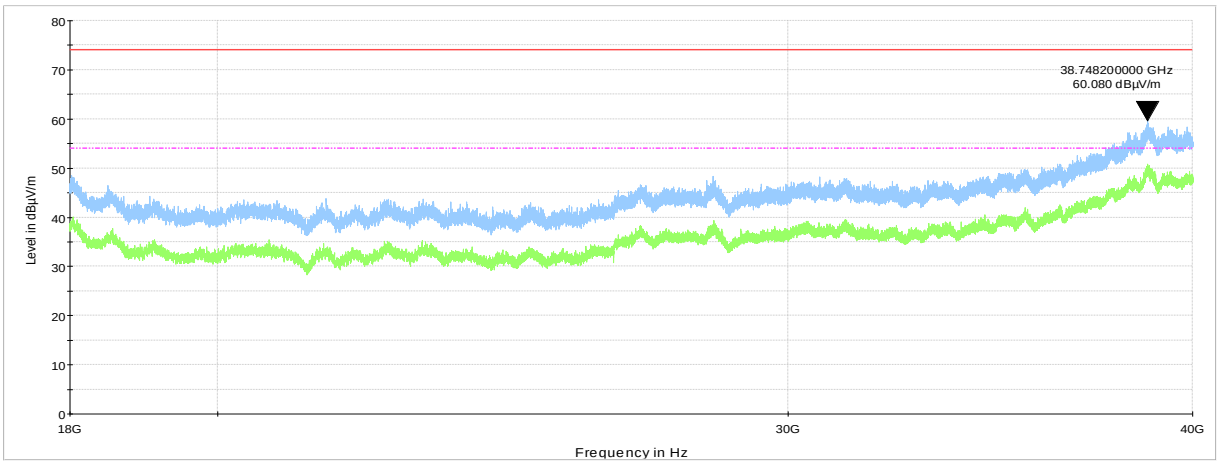
Test specification:	FCC section 15.407(b)1, Field strength of undesirable emissions		
Test procedure:	KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC,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



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

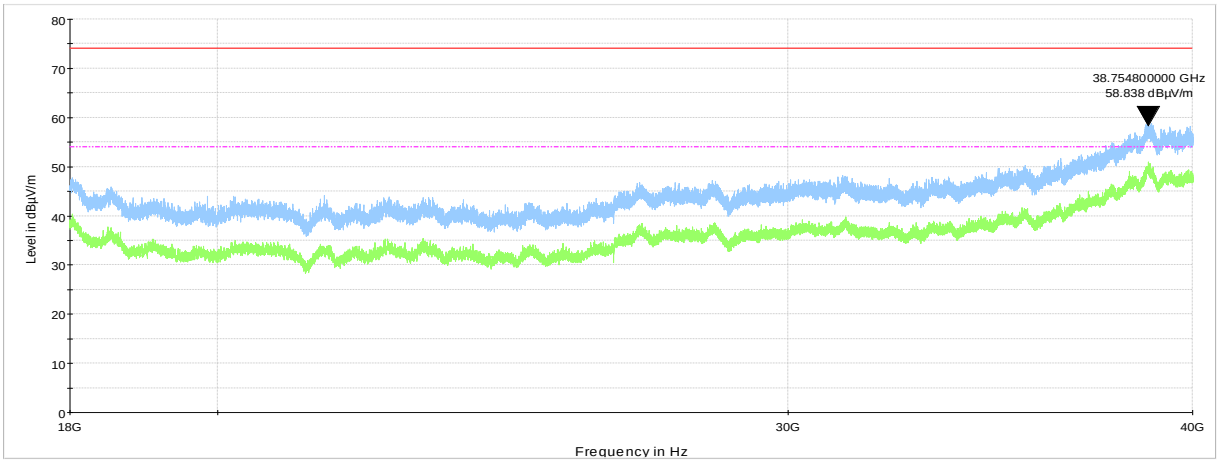
Plot 11.3.10 Radiated emission measurements from 18 to 40 GHz at the low carrier frequency

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



Plot 11.3.11 Radiated emission measurements from 18 to 40 GHz at the mid carrier frequency

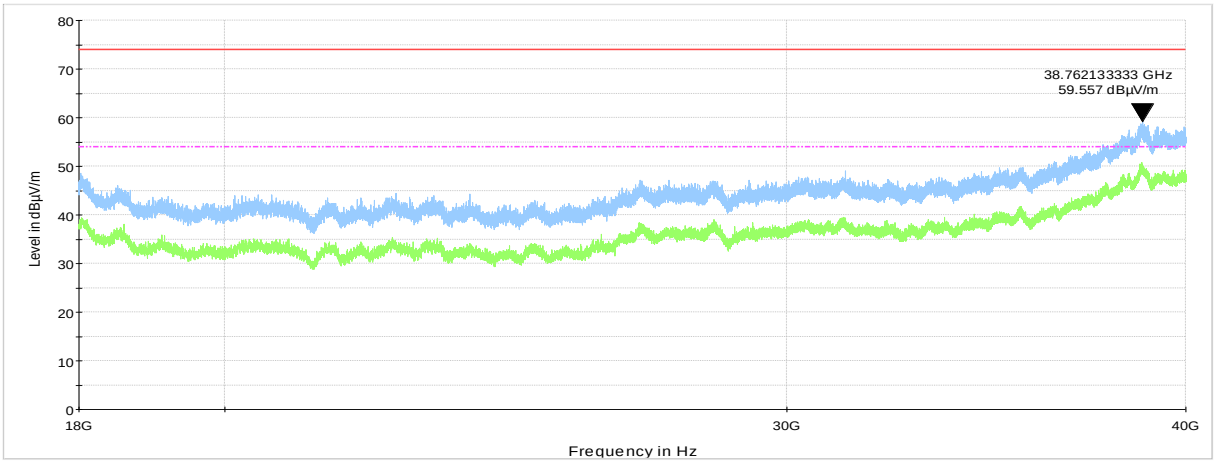
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



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 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

Plot 11.3.12 Radiated emission measurements from 18 to 40 GHz at the high carrier frequency

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



Test specification:	Section 15.203, Antenna requirements		
Test procedure:	Visual inspection		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Apr-21 - 20-May-21		
Temperature: 25 ºC	Relative Humidity: 49 %	Air Pressure: 1008 hPa	Power: 230 VAC, 50 Hz
Remarks:			

11.4 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 11.4.1.

Table 11.4.1 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 11.4.1 Antenna assembly

3. APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 (9) kHz - 30 MHz	EMCO	6502	2857	28-Feb-21	28-Feb-22
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A01877	06-Oct-20	06-Oct-21
1501	Cable RF, 6 m, BNC/BNC	Belden	M17/167 MIL-C-17	1501	13-Sep-20	13-Sep-21
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	14-Mar-21	14-Mar-22
3442	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	25-Feb-21	25-Feb-22
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	11-Apr-21	11-Apr-22
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	06-Apr-21	06-Apr-22
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	101630	09-Sep-20	09-Sep-21
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	19-Jan-21	19-Jan-22
4378	Reject Band Filter. Pass band from 0 to 4550 and from 6400 to 18000 MHz,SMA-FM / SMA-M	Micro-Tronics	BRM50716-02	001	05-Jun-19	05-Jun-21
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	26-Jan-21	26-Jan-22
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	26-Jan-21	26-Jan-22
5085	Attenuator, 4 dB, DC - 6 GHz, 1 W	Mini-Circuits	UNAT-4+	NA	22-May-20	22-May-21
5112	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/11SK/11SK/5500MM	502494/2EA	19-Apr-20	19-Apr-21
5286	Band Pass Filter, 50 Ohm, 4.4 to 18 GHz, SMA/M-SMA/F	A-INFOMW	WBLB-T-HP-4.4-18-S	J108000000305	05-Jun-19	05-Jun-21
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	08-Feb-19	08-Feb-22
5606	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18000 MHz	Mini Circuits	BW-N10W5+	NA	16-Sep-20	16-Sep-21
5707	EMI receiver	PMM / Narda	PMM 9010F	060WW91101	01-Feb-21	01-Feb-22
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/11N/11N/6000		01-Dec-20	01-Dec-21

4. 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 dBμV to obtain field strength in dBμA/m.

HL 2888 LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A
Rolf Heine, model: NNB-2/16Z, s/n 02/10018, HL 2888

Voltage division factor (insertion loss)

Frequency,	L1, dB	L2, dB	Uncertainty, dB
150	0.09	0.07	±0.09
170	0.08	0.07	±0.09
200	0.08	0.06	±0.09
250	0.09	0.06	±0.09
300	0.09	0.06	±0.09
350	0.09	0.07	±0.09
400	0.09	0.07	±0.09
500	0.09	0.07	±0.09
600	0.09	0.07	±0.09
700	0.10	0.08	±0.09
800	0.10	0.08	±0.09
900	0.11	0.08	±0.09
1000	0.11	0.08	±0.09
1200	0.11	0.09	±0.16
1500	0.12	0.10	±0.16
2000	0.14	0.12	±0.16
2500	0.15	0.12	±0.16
3000	0.16	0.14	±0.16
4000	0.19	0.16	±0.16
5000	0.23	0.19	±0.16
7000	0.30	0.25	±0.16
10000	0.46	0.40	±0.16
15000	0.71	0.62	±0.16
20000	0.94	0.85	±0.16
30000	1.41	1.33	±0.32

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

Frequency, MHz	Antenna factor, dB/m	Frequency, MHz	Antenna factor, dB/m
30	14.96	160	12.67
35	15.33	180	13.34
40	16.37	200	15.40
45	17.56	250	16.42
50	17.95	300	17.28
60	16.87	400	19.98
70	13.22	500	21.11
80	10.56	600	22.90
90	13.61	700	24.13
100	15.46	800	25.25
120	14.03	900	26.35
140	12.23	1000	27.18

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

above 1000 MHz

Frequency, MHz	Antenna factor, dB/m	Frequency, MHz	Antenna factor, dB/m
1000	26.9	3600	38.9
1100	28.1	3700	39.4
1200	28.4	3800	39.4
1300	29.6	3900	39.6
1400	29.1	4000	39.7
1500	30.4	4100	39.8
1600	30.7	4200	40.5
1700	31.5	4300	40.9
1800	32.3	4400	41.1
1900	32.6	4500	41.4
2000	32.5	4600	41.3
2100	32.9	4700	41.6
2200	33.5	4800	41.9
2300	33.2	4900	42.3
2400	33.7	5000	42.7
2500	34.6	5100	43.0
2600	34.7	5200	42.9
2700	34.6	5300	43.5
2800	35.0	5400	43.6
2900	35.5	5500	44.3
3000	36.2	5600	44.7
3100	36.8	5700	45.0
3200	36.8	5800	45.0
3300	37.0	5900	45.3
3400	37.5	6000	45.9
3500	38.2		

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

HL 4933 Active Horn Antenna, 1 GHz to 18 GHz

COM-POWER CORPORATION AHA-118 , s/n 701046 HL 4933

Frequency, MHz	Measured antenna factor, dB/m
1000	-16.1
1050	-16.0
1100	-15.1
1150	-16.4
1200	-16.0
1250	-15.6
1300	-15.1
1350	-14.8
1400	-15.1
1450	-15.1
1500	-15.5
1550	-15.2
1600	-14.7
1650	-14.4
1700	-14.4
1750	-14.0
1800	-13.6
1850	-12.7
1900	-11.9
1950	-11.9
2000	-11.8
2050	-11.3
2100	-11.3
2150	-11.7
2200	-12.3
2250	-12.3
2300	-12.4
2350	-12.2
2400	-11.7
2450	-11.5
2500	-11.5
2550	-11.5
2600	-11.5
2650	-11.3
2700	-11.3
2750	-11.1
2800	-11.1
2850	-11.3
2900	-11.1
2950	-11.0
3000	-11.1
3050	-10.9
3100	-10.7
3150	-10.6

Frequency, MHz	Measured antenna factor, dB/m
3200	-11.2
3250	-10.8
3300	-10.8
3350	-10.7
3400	-10.3
3450	-10.2
3500	-10.1
3550	-10.4
3600	-10.5
3650	-10.4
3700	-10.4
3750	-10.3
3800	-10.1
3850	-10.0
3900	-9.9
3950	-9.8
4000	-9.7
4050	-9.3
4100	-8.6
4150	-8.2
4200	-8.3
4250	-8.5
4300	-8.5
4350	-8.3
4400	-8.0
4450	-7.7
4500	-7.6
4550	-7.4
4600	-7.5
4650	-7.8
4700	-7.6
4750	-6.8
4800	-6.1
4850	-5.7
4900	-5.8
4950	-5.8
5000	-6.0
5050	-5.7
5100	-5.4
5150	-5.1
5200	-4.6
5250	-4.6
5300	-4.8
5350	-5.1

Frequency, MHz	Measured antenna factor, dB/m
5400	-5.1
5450	-4.6
5500	-4.0
5550	-3.5
5600	-3.1
5650	-3.3
5700	-3.8
5750	-4.3
5800	-4.3
5850	-4.0
5900	-3.5
5950	-3.2
6000	-3.2
6050	-3.2
6100	-3.3
6150	-3.3
6200	-3.1
6250	-2.9
6300	-2.8
6350	-3.0
6400	-3.2
6450	-3.4
6500	-3.7
6550	-3.6
6600	-3.4
6650	-2.9
6700	-2.6
6750	-2.5
6800	-2.6
6850	-2.8
6900	-2.7
6950	-2.3
7000	-2.0
7050	-1.9
7100	-1.8
7150	-1.8
7200	-1.7
7250	-1.7
7300	-1.6
7350	-1.5
7400	-1.5
7450	-1.3
7500	-1.4
7550	-1.3
7600	-1.0
7650	-0.7
7700	-0.3
7750	0.1
7800	0.3
7850	0.4
7900	0.2
7950	0.1
8000	0.2
8050	0.3
8100	0.8
8150	1.1
8200	1.1
8250	1.0
12400	2.1
12500	1.2
12600	1.3
12700	2.4
12800	1.8

Frequency, MHz	Measured antenna factor, dB/m
8300	0.8
8350	0.5
8400	0.3
8450	0.5
8500	0.8
8550	0.9
8600	0.9
8650	0.6
8700	0.0
8750	-0.3
8800	0.0
8850	0.5
8900	0.6
8950	0.4
9000	-0.3
9050	-1.0
9100	-1.2
9150	-0.6
9200	-0.1
9250	0.0
9300	-0.1
9350	-0.5
9400	-0.7
9450	-0.4
9500	0.2
9550	0.5
9600	0.5
9650	0.3
9700	0.0
9750	0.0
9800	0.6
9850	1.4
9900	1.8
9950	1.7
10000	1.4
10100	0.8
10200	1.2
10300	1.5
10400	1.1
10500	1.6
10600	3.0
10700	2.9
10800	1.3
10900	1.0
11000	1.1
11100	0.7
11200	1.1
11300	1.5
11400	1.4
11500	0.6
11600	1.0
11700	1.4
11800	0.7
11900	0.9
12000	2.1
12100	2.1
12200	0.9
12300	1.6

12900	0.6
13000	0.9
13100	1.1
13200	0.7
13300	0.9
13400	1.8
13500	2.1
13600	1.2
13700	0.8
13800	1.2
13900	1.5
14000	1.7
14100	2.2
14200	2.8
14300	3.0
14400	3.0
14500	3.3
14600	4.0
14700	5.4
14800	5.4
14900	4.7
15000	3.1
15100	2.0
15200	1.5
15300	1.4
15400	1.7
15500	1.9
15600	1.2
15700	0.2
15800	0.6
15900	1.2
16000	0.6
16100	0.6
16200	1.9
16300	2.2
16400	0.9
16500	0.7
16600	1.7
16700	1.3
16800	1.0
16900	2.0
17000	2.4
17100	1.8
17200	1.8
17300	2.5
17400	2.7
17500	3.1
17600	3.7
17700	4.3
17800	4.8
17900	5.7
18000	5.1

HL 5112 RF cable, 40 GHz, 5.5 m, K-type,
Huber-Suhner, SF102EA/11SK/11SK/5500MM, s/n 502494/2EA, HL 5112

Insertion loss

Set / Applied, MHz	Measured, dB	Uncertainty, dB
100	0.70	±0.07
200	0.99	±0.08
300	1.21	±0.08
500	1.55	±0.08
1000	2.18	±0.08
1500	2.67	±0.08
2000	3.09	±0.08
2500	3.46	±0.10
3000	3.80	±0.10
3500	4.12	±0.10
4000	4.41	±0.10
4500	4.69	±0.10
5000	4.95	±0.10
5500	5.20	±0.10
6000	5.45	±0.10
6500	5.68	±0.10
7000	5.91	±0.10
7500	6.13	±0.10
8000	6.34	±0.10
8500	6.56	±0.10
9000	6.76	±0.10
9500	6.95	±0.10
10000	7.16	±0.10
10500	7.33	±0.10
11000	7.51	±0.10
11500	7.68	±0.10
12000	7.85	±0.10
12500	8.02	±0.13
13000	8.17	±0.13
13500	8.31	±0.13
14000	8.46	±0.13
14500	8.61	±0.18
15000	8.76	±0.18
15500	8.91	±0.18
16000	9.07	±0.18
16500	9.22	±0.18
17000	9.36	±0.18
17500	9.51	±0.18
18000	9.66	±0.18
18500	9.81	±0.23
19000	9.95	±0.23
19500	10.10	±0.23

Set / Applied, MHz	Measured, dB	Uncertainty, dB
20000	10.25	±0.23
20500	10.38	±0.23
21000	10.52	±0.23
21500	10.67	±0.23
22000	10.84	±0.23
22500	11.00	±0.29
23000	11.10	±0.29
23500	11.20	±0.29
24000	11.32	±0.29
24500	11.42	±0.29
25000	11.59	±0.23
25500	11.70	±0.23
26000	11.85	±0.23
26500	11.97	±0.23
27000	12.07	±0.33
27500	12.17	±0.33
28000	12.26	±0.40
28500	12.38	±0.40
29000	12.50	±0.40
29500	12.63	±0.40
30000	12.75	±0.40
30500	12.82	±0.33
31000	12.93	±0.33
31500	13.09	±0.33
32000	13.22	±0.33
32500	13.35	±0.33
33000	13.48	±0.33
33500	13.60	±0.33
34000	13.72	±0.33
34500	13.80	±0.40
35000	13.92	±0.40
35500	14.01	±0.40
36000	14.12	±0.40
36500	14.23	±0.40
37000	14.34	±0.33
37500	14.44	±0.33
38000	14.57	±0.33
38500	14.72	±0.33
39000	14.82	±0.33
39500	14.94	±0.33
40000	15.08	±0.47

5. 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

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

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

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

6. APPENDIX D Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.
Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).
The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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7. APPENDIX E Specification references

FCC 47CFR part 15:2020	Radio Frequency Devices.
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.4:2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
KDB 789033:2018	Guidance for compliance testing of unlicensed national information infrastructure (U-NII) devices Part 15, Subpart E

12 APPENDIX F Abbreviations and acronyms

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

END OF DOCUMENT