

TEST REPORT

ACCORDING TO: FCC 47 CFR part 15 section 15.255;
RSS-210 issue 10 Annex J, RSS-Gen issue 5

FOR:

Radwin Ltd.

PtP/PtMP 57-71 GHz Radio Transceiver

RW6000/TB/6C00/F60

Trade Mark: TerraBridge™

Model: RADWIN 6000 6C00

FCC ID: Q3KTRBR600G

IC:5100A-TRBR600G

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

Table of contents

1	Applicant information	3
2	Equipment under test attributes	3
3	Manufacturer information	3
4	Test details	3
5	Tests summary	4
6	EUT description	5
6.1	General information	5
6.2	Ports and lines	5
6.3	Auxiliary equipment	5
6.4	Changes made in the EUT	5
6.5	Test configuration	6
6.6	Transmitter characteristics	7
7	Transmitter tests	8
7.1	Transmitter power test	8
7.2	Occupied bandwidth test	15
7.3	Field strength of emissions	20
7.4	Out of band radiated emissions above 40 GHz up to 200 GHz	31
7.5	Frequency stability test	108
7.6	Conducted emissions	110
7.7	Antenna requirements	113
8	APPENDIX A Test equipment and ancillaries used for tests	114
9	APPENDIX B Measurement uncertainties	117
10	APPENDIX C Test facility description	118
11	APPENDIX D Specification references	118
12	APPENDIX E Test equipment correction factors	119
13	APPENDIX F Abbreviations and acronyms	129

1 Applicant information

Client name: Radwin Ltd.
Address: 27 HaBarzel St., Ramat Hahayal, Tel Aviv, 6971039, Israel
Telephone: +972 (3) 766 2900
Fax: +972 (3) 766 2902
E-mail: slava_la@radwin.com
Contact name: Mr. Slava Lagaev

2 Equipment under test attributes

Product description: PtP/PtMP 57-71 GHz Radio Transceiver
Product name: RW6000/TB/6C00/F60
Trade Mark: TerraBridge™
Model: RADWIN 6000 6C00
Serial number: Sample
Hardware version: 2
Software release: 1.0.0.518
Receipt date: 31-May-20

3 Manufacturer information

Manufacturer name: Radwin Ltd.
Address: 27 HaBarzel St., Ramat Hahayal, Tel Aviv, 6971039, Israel
Telephone: +972 (3) 766 2900
Fax: +972 (3) 766 2902
E-Mail: slava_la@radwin.com
Contact name: Mr. Slava Lagaev

4 Test details




Project ID: 37852
Location: Primary: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Satellite: Hermon Laboratories Ltd. Hefetz-Haim 10, Tel Aviv 6744124, Israel
Test started: 19-Apr-20
Test completed: 15-Jun-20
Test specification(s): FCC 47 CFR part 15 section 15.255; RSS-210 issue 10 Annex J; RSS-Gen issue 5 with Am.1

5 Tests summary

Test	Status
Transmitter characteristics	
FCC section 15.255(c)(1) (ii),(d)(1) / RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density	Pass
FCC section 15.215(c)/ RSS-210 section J.4(c), RSS-Gen, Section 6.7, Occupied bandwidth	Pass
FCC section 15.255(d)(2)/ RSS-210 section J.3, Radiated spurious emissions below 40 GHz	Pass
FCC section 15.255(d)(3)/ RSS-210 section J.3, Radiated emissions outside assigned band and above 40 GHz up to 200 GHz	Pass
FCC section 15.255(f)/ RSS-210 section J.6, Frequency stability	Pass
FCC section 15.203 / RSS-Gen section 6.8, Antenna requirement	Pass
FCC Section 15.207(a)/ RSS-Gen, section 8.8, Conducted emission	Pass
FCC section 15.255(g)/ RSS-Gen, section 3.4, RF exposure	Pass, exhibit included in Application for certification
RSS-Gen section 7.3, Receiver spurious emission	Pass*

*Note: tested during the transmitter radiated spurious emissions below 40 GHz.

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

	Name and Title	Date	Signature
Tested by:	Mr. A. Morozov, test engineer	June 15, 2020	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	July 12, 2020	
Approved by:	Mr. S. Samokha, Technical Manager, EMC and Radio	July 27, 2020	

6 EUT description

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

6.1 General information

The EUT is an outdoor radio transceiver operating in 57-71 GHz frequency band. The EUT provides up to 1Gbps full duplex wireless connectivity between train cars. The product is designed to enable Gbps Ethernet network throughout the train, seamlessly supporting dynamic consist.

The EUT was powered from 55 VDC obtained via auxiliary PoE.

6.2 Ports and lines

Port type	Port description	Connected		Qty.	Cable type	Cable length	Indoor / outdoor
		From	To				
Telecom and power	PoE	EUT	PoE	1	FTP	10 m*	Outdoor
GND	GND	EUT	GND	1	Unshielded	2 m	Outdoor

* May be up to 100 m long.

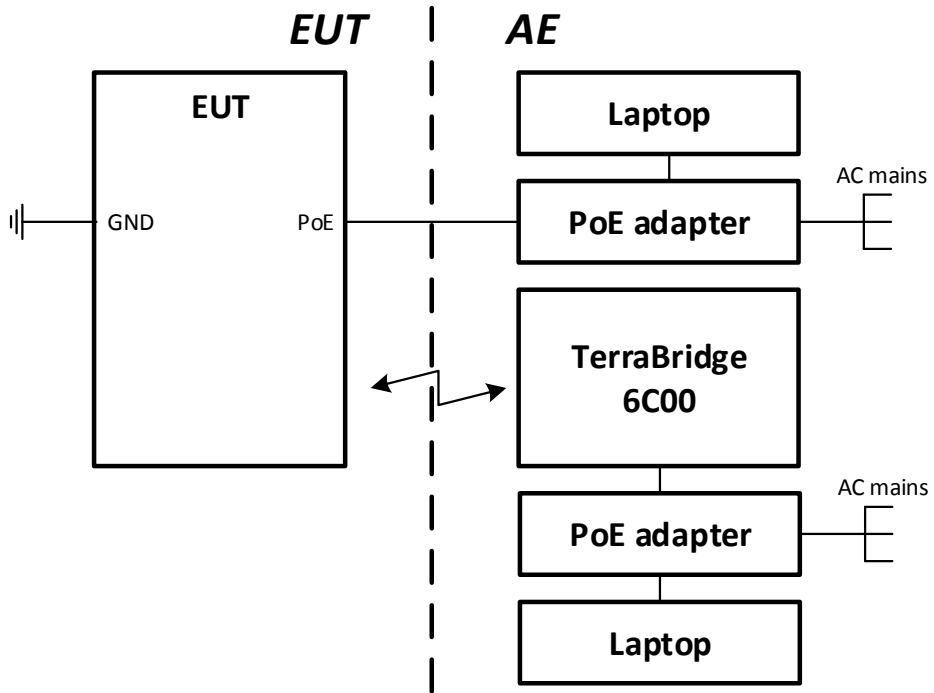
6.3 Auxiliary equipment

Description	Manufacturer	Model number
Laptop x 2	Dell	VOSTRO
PtP/PtMP 57-71 GHz Radio Transceiver	Radwin	RADWIN 6000 6C00
PoE Adapter x 2	SinPro	CPU55A 270-1

6.4 Changes made in the EUT

No changes were performed in the EUT during testing.

6.5 Test configuration





6.6 Transmitter characteristics

Type of equipment			
V	Stand-alone (Equipment with or without its own control provisions)		
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)		
	Plug-in card (Equipment intended for a variety of host systems)		
Intended use		Condition of use	
	fixed	Always at a distance more than 2 m from all people	
V	mobile	Always at a distance more than 20 cm from all people	
	portable	May operate at a distance closer than 20 cm to human body	
Assigned frequency range		57.0 GHz – 71.0 GHz	
Operating frequency range		57240 -65880 MHz	
Test frequencies		58320 MHz, 60480 MHz, 64800 MHz	
Maximum rated output power		EIRP	26.72 dBm
		Peak conducted power	7.72 dBm
Is transmitter output power variable?		V	No
			Yes
			continuous variable
			stepped variable with stepsize
	minimum RF power	dBm	
	maximum RF power		
Antenna connection			
unique coupling	standard connector	V	Integral
			with temporary RF connector
			without temporary RF connector
Antenna/s technical characteristics			
Type	Manufacturer	Model number	Antenna array gain
Integrated	Semco	SWL-W14, tile combination 1x1	19 dBi
Transmitter 99% power bandwidth, MHz	Transmitter aggregate data rate/s, Mbps		Type of modulation
2160	385, 770, 962.5, 1155, 1251.25		BPSK
2160	1540, 1925, 2310		QPSK
Type of multiplexing		TDD	
Transmitter power source			
		Nominal rated voltage	Battery type
V	DC	Nominal rated voltage	55 V via POE
		Voltage range	
	AC mains	Nominal rated voltage	120 V
		Frequency	60 Hz
Common power source for transmitter and receiver		V	yes no



Test specification: FCC Section 15.255(c)(1)(ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict:	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: 55 VDC
Remarks:			

7 Transmitter tests

7.1 Transmitter power test

7.1.1 General

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

Table 7.1.1 Output power limits

Assigned frequency range, MHz	Maximum output power			
	Peak conducted output power		EIRP, dBm	
	mW	dBm	Peak	Average
57000 – 71000	500	27.0	43	40

7.1.2 Test procedure

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

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

7.1.2.3 The average and peak voltage was measured at the low and high frequency channels with oscilloscope connected to RF detector and provided in the associated plots.

7.1.2.4 The unmodulated signal was applied to Zero-Biased Detector via variable attenuator as shown in Figure 7.1.2.

7.1.2.5 The variable attenuator was adjusted such that the oscilloscope indicated a voltage equal to the peak voltage recorded in the step 7.1.2.3.

7.1.2.6 The variable attenuator was disconnected from the Zero-Biased Detector.

7.1.2.7 Without changing any settings, the variable attenuator was connected to a power meter as shown in Figure 7.1.3.

7.1.2.8 The power was measured and result was recorded in Table 7.1.2 and Table 7.1.3.

7.1.2.9 The steps 7.1.2.4 through 7.1.2.8 were repeated for the average voltage recorded in the step 7.1.2.3 and 7.1.2.4.



Test specification: FCC Section 15.255(c)(1)(ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict:	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: 55 VDC
Remarks:			

Figure 7.1.1 Peak output power test setup

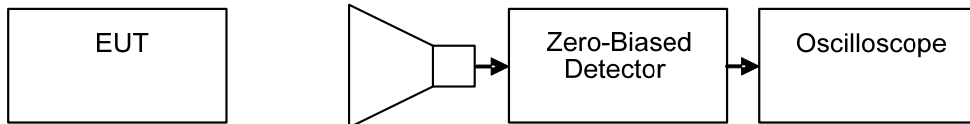


Figure 7.1.2 Peak output power test setup

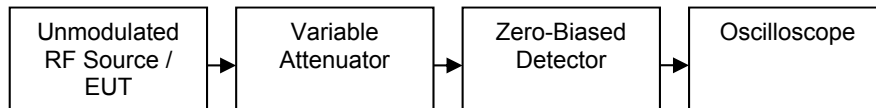
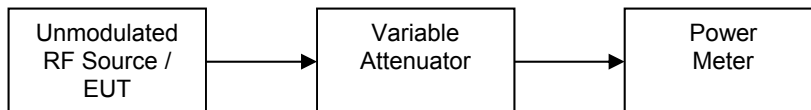


Figure 7.1.3 Peak output power test setup





Test specification: FCC Section 15.255(c)(1)(ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict:	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: 55 VDC
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 57.0 – 71.0 GHz
DETECTOR USED: Peak
MEASUREMENTS DISTANCE: 0.6 m
VIDEO BANDWIDTH: >10 MHz
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
EUT ANTENNA GAIN: 19 dBi
MODULATION: BPSK

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	-33.76	-13.55	24.0	135.42	26.29	43.0	-16.71	Pass
60480	0.004960	-37.84	-13.03	24.0	135.86	26.72	43.0	-16.28	Pass
64800	0.004630	-19.02	-18.36	24.0	131.13	21.99	43.0	-21.01	Pass

MODULATION: QPSK

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	-32.20	-13.36	24.0	135.21	26.08	43.0	-16.92	Pass
60480	0.004960	-36.12	-13.23	24.0	135.66	26.52	43.0	-16.48	Pass
64800	0.004630	-18.55	-18.79	24.0	130.70	21.56	43.0	-21.44	Pass

Note: Max peak conducted power is 26.72 dBm – 19 dBi = 7.72 dBm

* - $\lambda = 300/\text{Frequency(MHz)}$

** - $E_{meas} = 126.8 - 20\log(\lambda) + \text{Power measured} - \text{Measurement Antenna Gain (24 dBi)}$

*** - $EIRP = E_{meas} + 20\log(\text{Measurements distance}) - 104.7$

**** - $\text{Margin} = EIRP - \text{Limit}$



Test specification: FCC Section 15.255(c)(1)(ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict:	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: 55 VDC
Remarks:			

Table 7.1.3 Average output power test results

ASSIGNED FREQUENCY RANGE: 57.0 – 71.0 GHz
 DETECTOR USED: Average
 MEASUREMENTS DISTANCE: 0.6 m
 VIDEO BANDWIDTH: >10 MHz
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 EUT ANTENNA GAIN: 19 dBi
 MODULATION: BPSK

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	32.55	-13.51	24.0	135.06	25.93	40.0	-14.07	Pass
60480	0.004960	36.26	-13.23	24.0	135.66	26.52	40.0	-13.48	Pass
64800	0.004630	17.91	-18.72	24.0	130.77	21.63	40.0	-18.37	Pass

MODULATION: QPSK

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	30.85	-13.43	24.0	135.14	26.01	40.0	-13.99	Pass
60480	0.004960	34.41	-13.42	24.0	135.47	26.33	40.0	-13.67	Pass
64800	0.004630	17.53	-18.94	24.0	130.55	21.41	40.0	-18.59	Pass

* - $\lambda = 300/\text{Frequency(MHz)}$
 ** - $E_{meas} = 126.8 - 20\log(\lambda) + \text{Power measured} - \text{Measurement Antenna Gain (24 dBi)}$
 *** - $EIRP = E_{meas} + 20\log(\text{Measurements distance}) - 104.7$
 **** - $\text{Margin} = EIRP - \text{Limit}$

Reference numbers of test equipment used

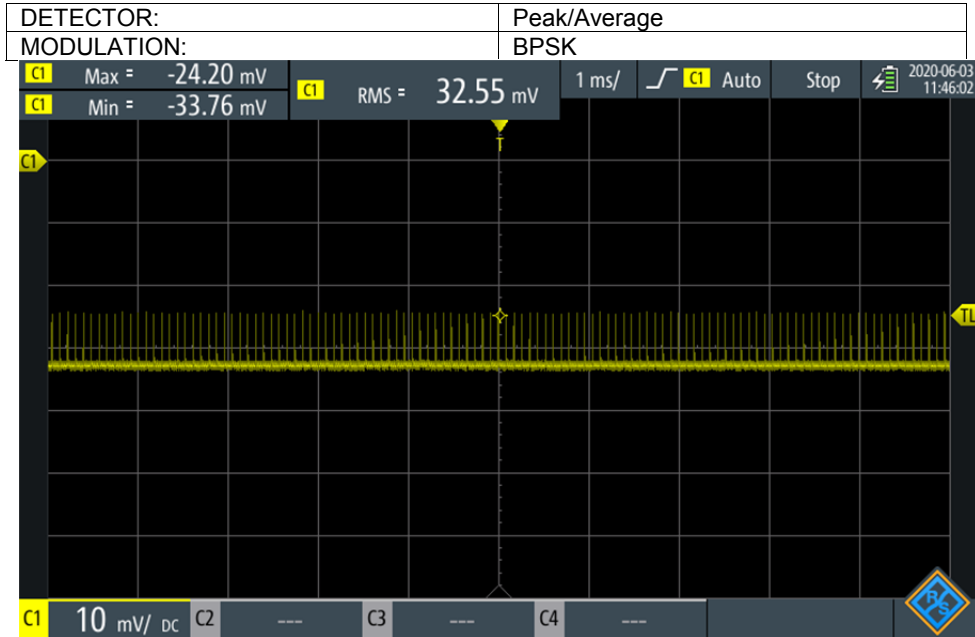
HL 0770	HL 0771	HL 3291	HL 3293	HL 3901	HL 4856	HL 5360	HL 5377
HL 5379	HL 5710						

Full description is given in Appendix A.

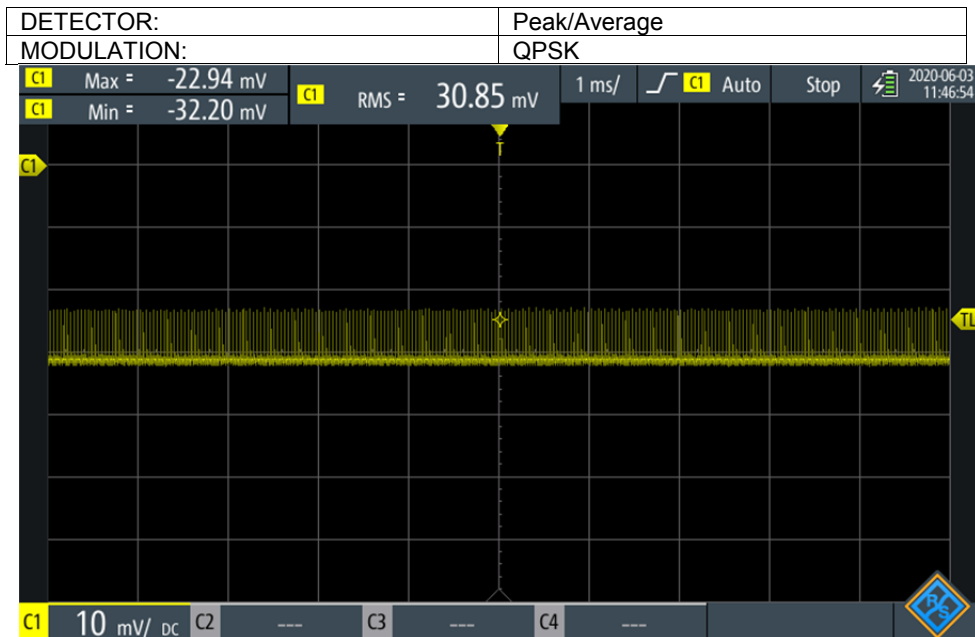


Test specification: FCC Section 15.255(c)(1)(ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict:	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: 55 VDC
Remarks:			

Plot 7.1.1 Output power test result at the 58.32 GHz frequency



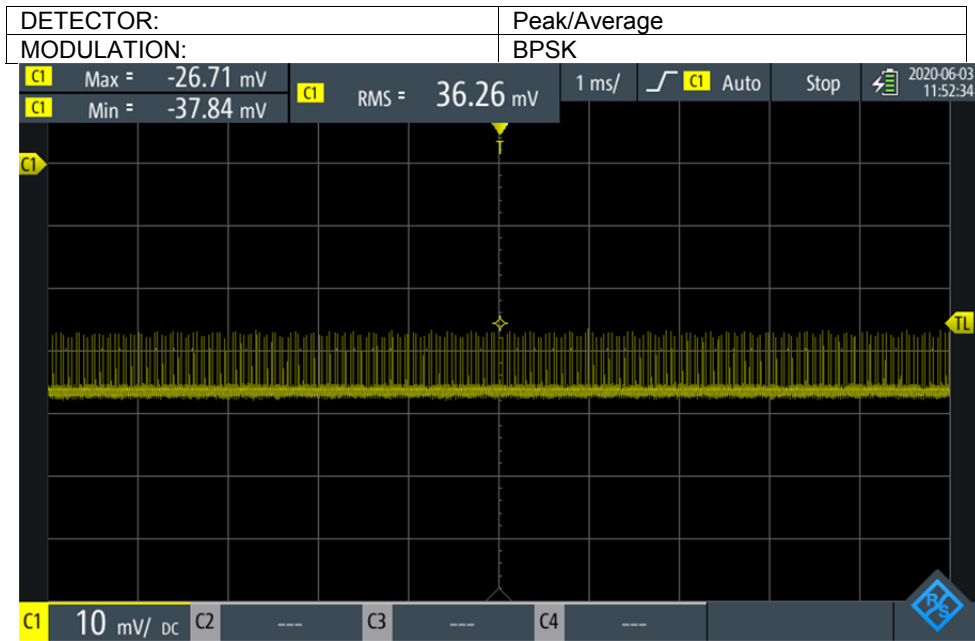
Plot 7.1.2 Output power test result at the 58.32 GHz frequency



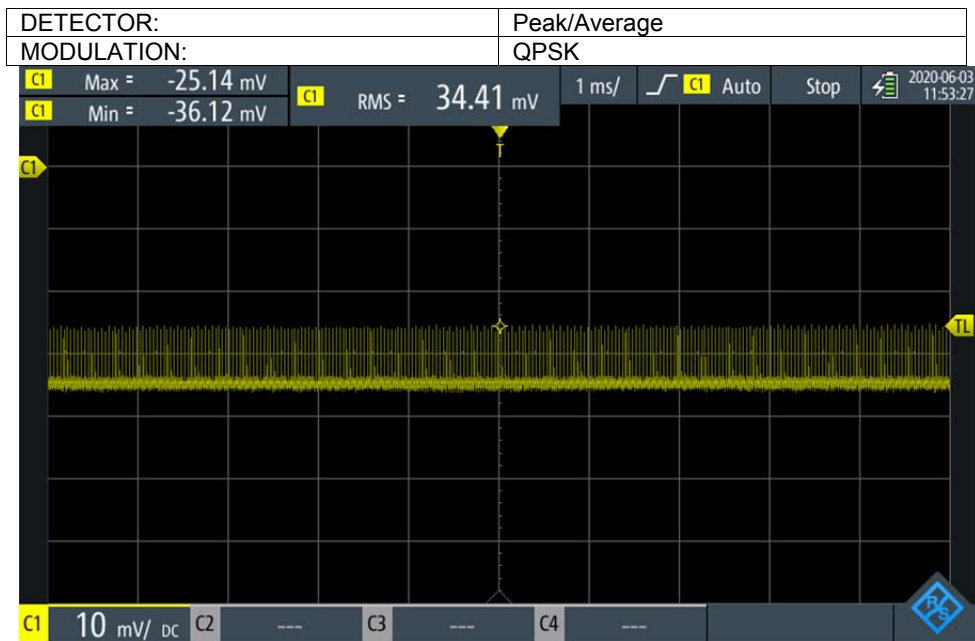


Test specification: FCC Section 15.255(c)(1)(ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict:	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: 55 VDC
Remarks:			

Plot 7.1.3 Output power test result at the 60.48 GHz frequency



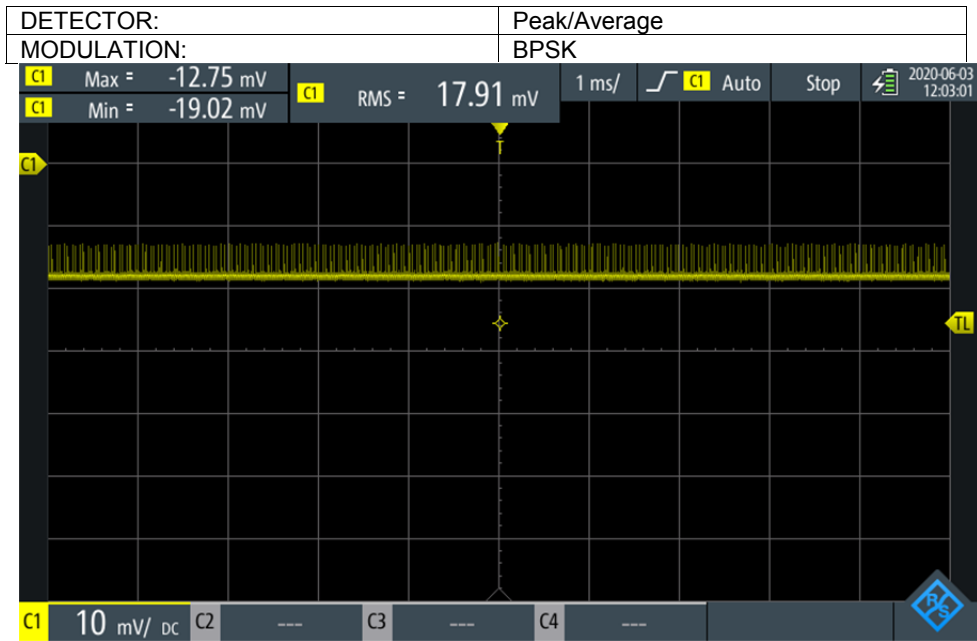
Plot 7.1.4 Output power test result at the 60.48 GHz frequency



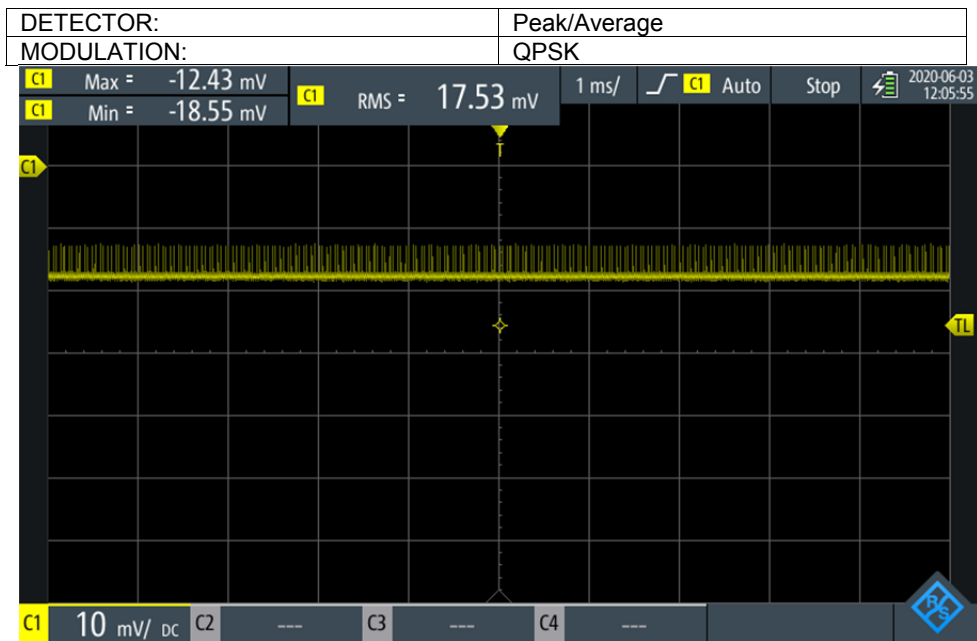


Test specification: FCC Section 15.255(c)(1)(ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict:	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: 55 VDC
Remarks:			

Plot 7.1.5 Output power test result at the 64.80 GHz frequency



Plot 7.1.6 Output power test result at the 64.80 GHz frequency





Test specification: FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Jun-20			
Temperature: 28 °C	Relative Humidity: 47 %	Air Pressure: 1003 hPa	Power: 55 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency range, MHz	Modulation envelope reference points	
57000 - 71000	6 dBc	99%

NOTE: Modulation envelope reference points provided in terms of attenuation below unmodulated carrier.

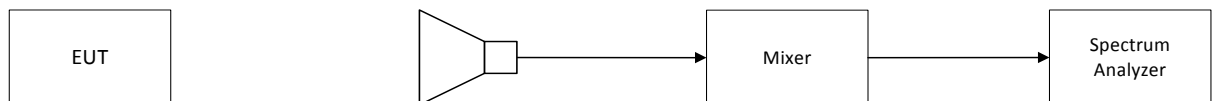
7.2.2 Test procedure

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

7.2.2.2 The EUT was set to transmit modulated carrier as provided in Table 7.2.2.

7.2.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope. The test results are provided in Table 7.2.2 and the associated plots.

Figure 7.2.1 Occupied bandwidth test setup





Test specification: FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Jun-20			
Temperature: 28 °C	Relative Humidity: 47 %	Air Pressure: 1003 hPa	Power: 55 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

ASSIGNED FREQUENCY RANGE: 57000 –71000 MHz
DETECTOR USED: Peak

Frequency, GHz	Modulation	Occupied bandwidth 6 dBc, MHz	Occupied bandwidth 99%, MHz	Verdict
58.32	QPSK	1347.0	1893.7	Pass
	BPSK	1285.0	1838.7	Pass
60.48	QPSK	1059.0	1914.9	Pass
	BPSK	1104.0	1868.7	Pass
64.80	QPSK	1530.0	2069.2	Pass
	BPSK	1534.0	2084.9	Pass

Reference numbers of test equipment used

HL 0771	HL 5376	HL 5380				
---------	---------	---------	--	--	--	--

Full description is given in Appendix A.

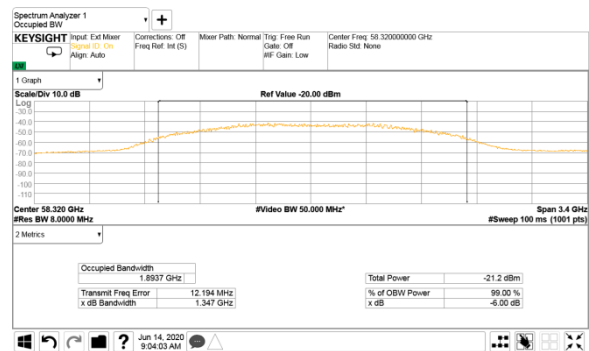
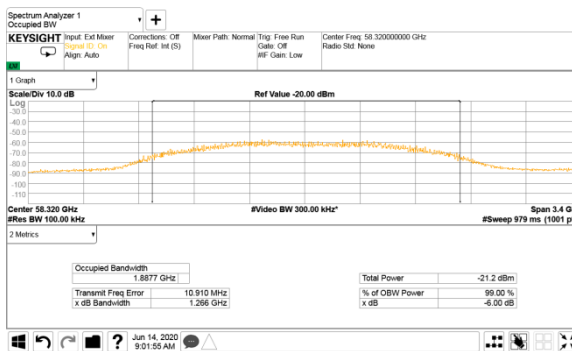


HERMON LABORATORIES

Test specification: FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure: 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode: Compliance	Verdict: PASS
Date(s): 14-Jun-20	
Temperature: 28 °C	Relative Humidity: 47 %
Air Pressure: 1003 hPa	Power: 55 VDC
Remarks:	

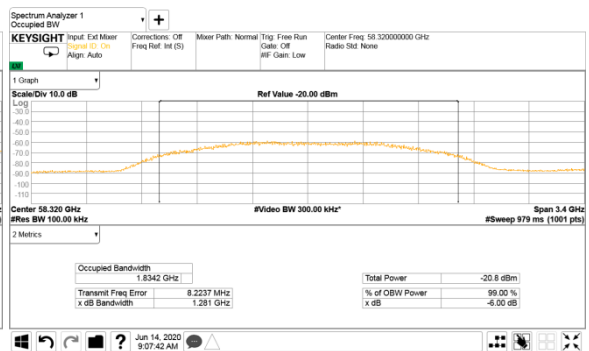
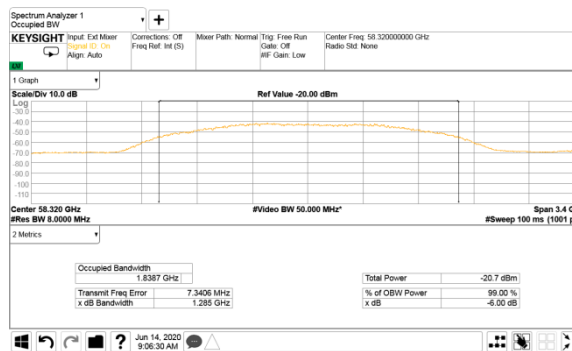
Plot 7.2.1 The 6dBc and 99% occupied bandwidth

FREQUENCY:	58.32 GHz
MODULATION:	QPSK
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%



Plot 7.2.2 The 6dBc and 99% occupied bandwidth

FREQUENCY:	58.32 GHz
MODULATION:	BPSK
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%

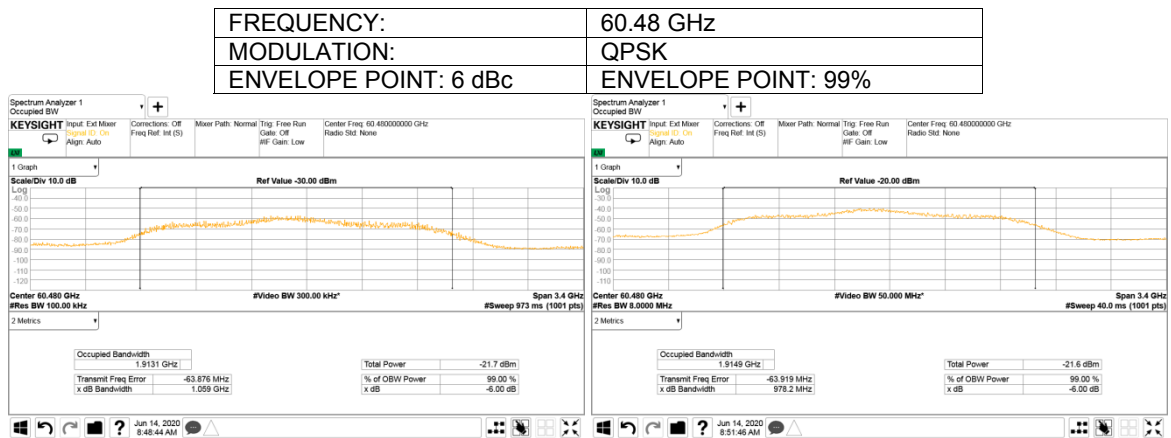




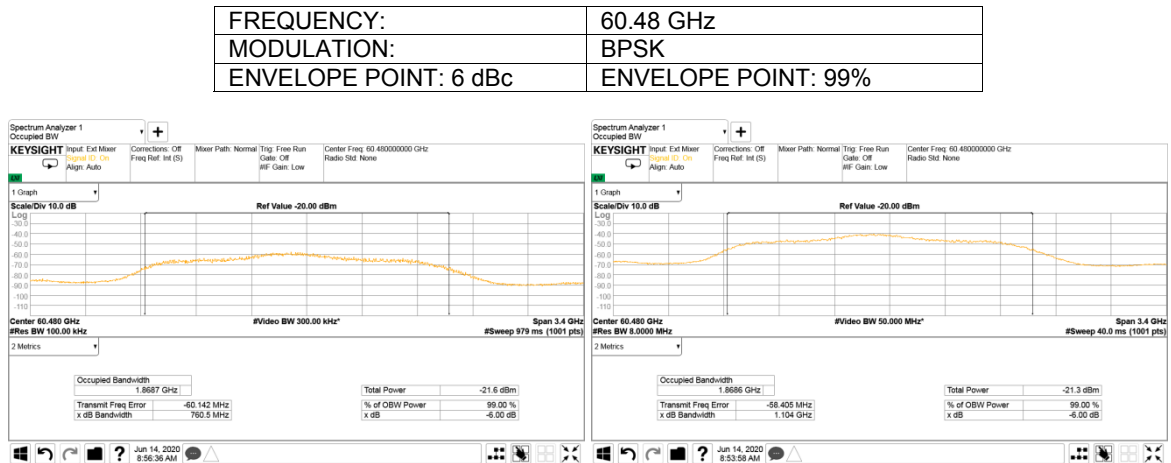
HERMON LABORATORIES

Test specification: FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure: 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode: Compliance	Verdict: PASS
Date(s): 14-Jun-20	
Temperature: 28 °C	Relative Humidity: 47 %
Air Pressure: 1003 hPa	Power: 55 VDC
Remarks:	

Plot 7.2.3 The 6dBc and 99% occupied bandwidth



Plot 7.2.4 The 6dBc and 99% occupied bandwidth



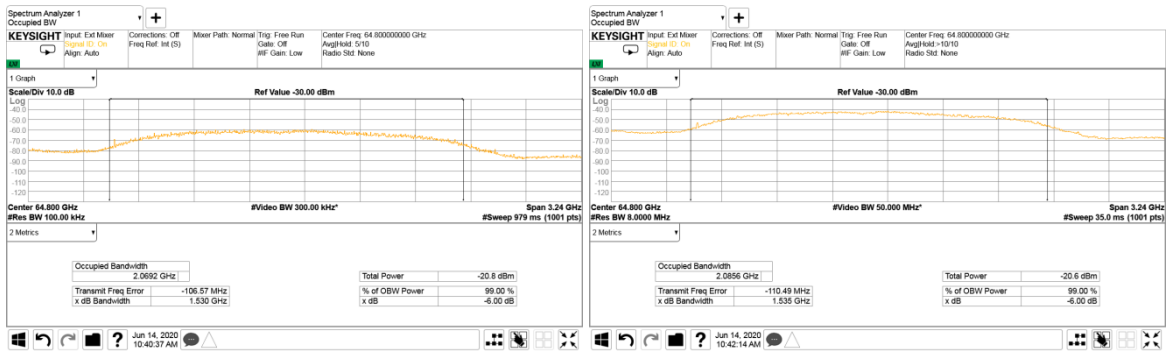


HERMON LABORATORIES

Test specification: FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure: 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode: Compliance	Verdict: PASS
Date(s): 14-Jun-20	
Temperature: 28 °C	Relative Humidity: 47 %
Air Pressure: 1003 hPa	Power: 55 VDC
Remarks:	

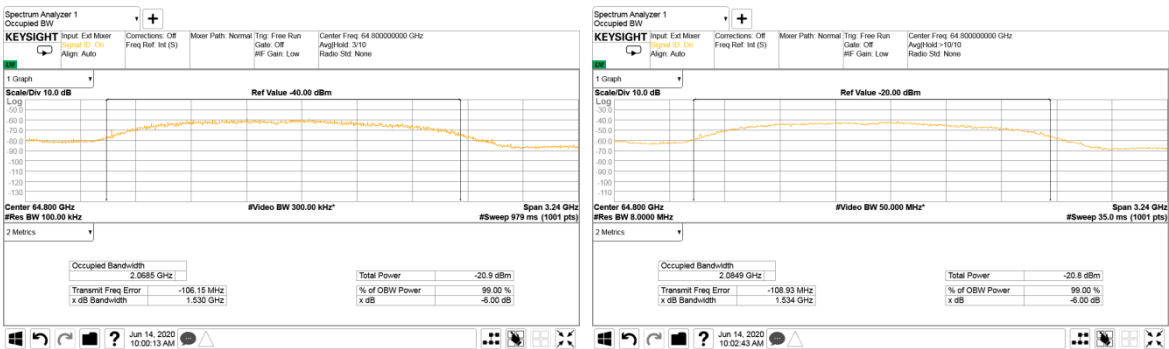
Plot 7.2.5 The 6dBc and 99% occupied bandwidth

FREQUENCY:	64.80 GHz
MODULATION:	QPSK
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%



Plot 7.2.6 The 6dBc and 99% occupied bandwidth

FREQUENCY:	64.80 GHz
MODULATION:	BPSK
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%





Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

7.3 Field strength of emissions

7.3.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated spurious emissions limits

Frequency range, MHz	Field strength at 3 m, dB(μV/m)*		
	Within restricted bands		
	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	

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

$$\text{Lim}_{S_2} = \text{Lim}_{S_1} + 40 \log(S_1/S_2),$$

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

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

Note: The above 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 but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 100 GHz for intentional radiators operated above 10 GHz.



Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

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

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

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

7.3.2.3 The worst test results (the lowest margins) were recorded in Table 7.3.3 and shown in the associated plots.

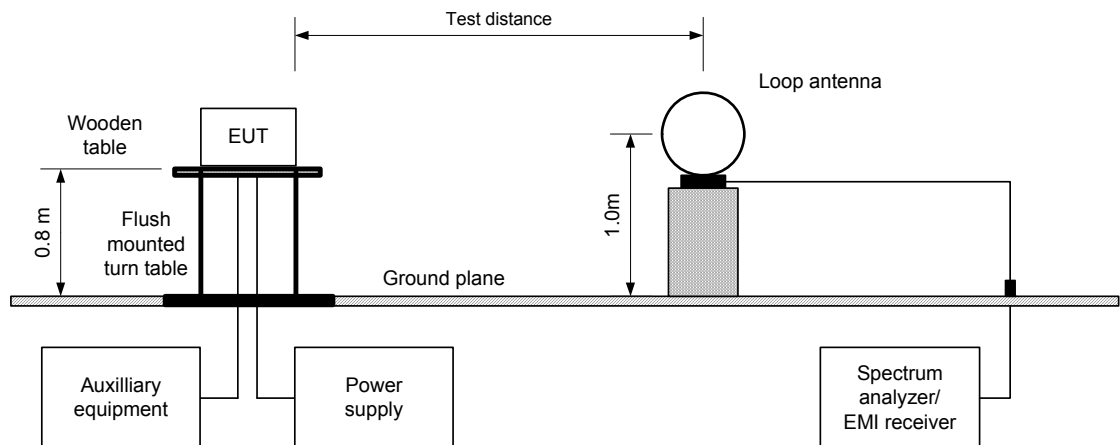
7.3.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.3.3.1 The EUT was set up as shown in Figure 7.3.2, Figure 7.3.3, energized and the performance check was conducted.

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

7.3.3.3 The worst test results (the lowest margins) were recorded in Table 7.3.2 and shown in the associated plots.

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz





Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict:	PASS
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

Figure 7.3.2 Setup for spurious emission field strength measurements in 30 – 1000 MHz

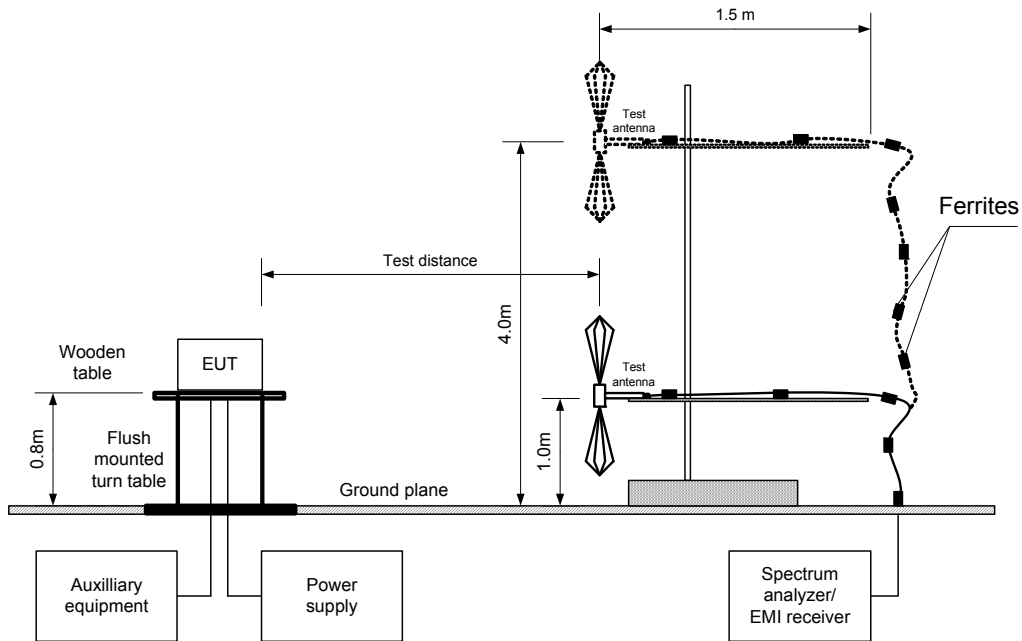
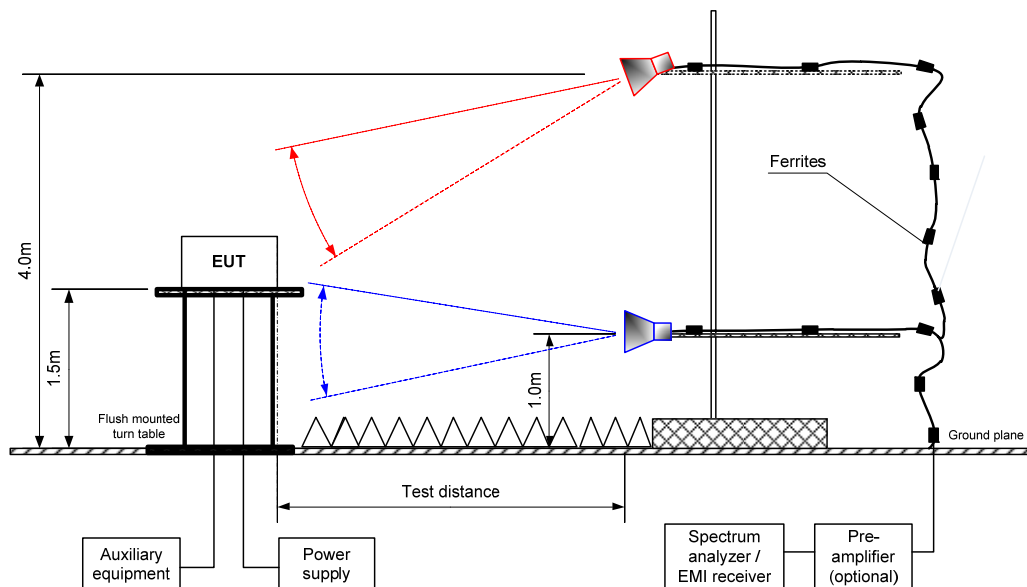


Figure 7.3.3 Setup for spurious emission field strength measurements above 1000 MHz





Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

Table 7.3.2 Field strength of spurious emissions at frequencies above 1 GHz

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: BPSK
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 - 40000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1.0 MHz
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
Low frequency 58320 MHz											
3183.7	V	2.58	23.0	61.08	74.0	-12.92	0.0	29.91	54.0	-24.09	Pass
7290.2	V	1.02	-7.00	56.82	74.0	-17.18	0.0	53.97	54.0	-0.03	
Mid frequency 60480 MHz											
3175.8	H	1.53	16.00	56.54	74.0	-17.46	0.0	27.42	54.0	-26.58	Pass
7559.8	V	2.05	-2.00	55.09	74.0	-18.91	0.0	51.08	54.0	-2.92	
High frequency 64800 MHz											
1984.5	V	1.27	35.00	51.97	74.0	-22.03	0.0	24.98	54.0	-29.02	Pass
8099.8	H	2.06	17.00	53.77	74.0	-20.23	0.0	47.92	54.0	-6.08	

*- EUT front panel refers to 0 degrees position of turntable.
 **- Margin = dB below (negative if above) specification limit.



Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

Table 7.3.3 Field strength of emissions below 1 GHz

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: BPSK
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 DETECTOR USED: Peak
 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*				
Low frequency 58320 MHz								
30.011	33.14	27.32	40.0	-12.68	Vertical	1.00	-960.00	Pass
31.267	27.82	20.68	40.0	-19.32	Vertical	2.66	-112.00	
42.454	31.12	24.28	40.0	-15.72	Vertical	1.02	106.00	
862.192	32.95	26.61	46.0	-19.39	Vertical	3.63	4.00	
Mid frequency 60480 MHz								
30.416	29.13	22.81	40.0	-17.19	Vertical	2.32	-98.00	Pass
33.493	30.61	24.26	40.0	-15.74	Vertical	1.00	-112.00	
42.369	33.58	27.24	40.0	-12.76	Vertical	1.02	180.00	
High frequency 64800 MHz								
30.040	30.04	23.92	40.0	-16.08	Vertical	1.02	-112.00	Pass
41.962	30.27	24.02	40.0	-15.98	Vertical	1.02	21.00	
44.755	28.02	21.41	40.0	-18.59	Vertical	1.04	-102.00	

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

Reference numbers of test equipment used

HL 0446	HL 3818	HL 3901	HL 3903	HL 4360	HL 4933	HL 4956	HL 5288
HL 5404							

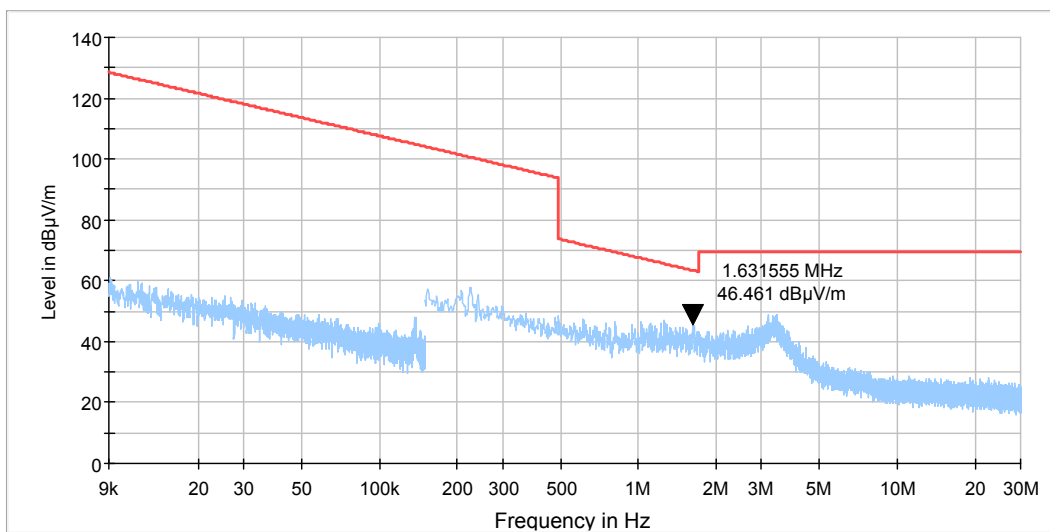
Full description is given in Appendix A.



Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

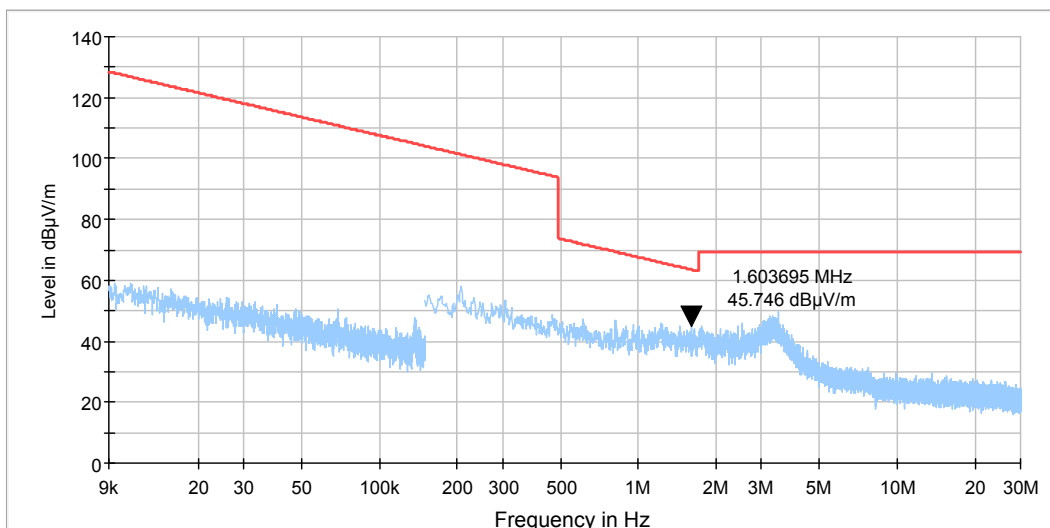
Plot 7.3.1 Radiated emission measurements from 9 KHz to 30 MHz at low frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and horizontal
 EUT POSITION: Typical (Vertical)



Plot 7.3.2 Radiated emission measurements from 9 KHz to 30 MHz at mid frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and horizontal
 EUT POSITION: Typical (Vertical)

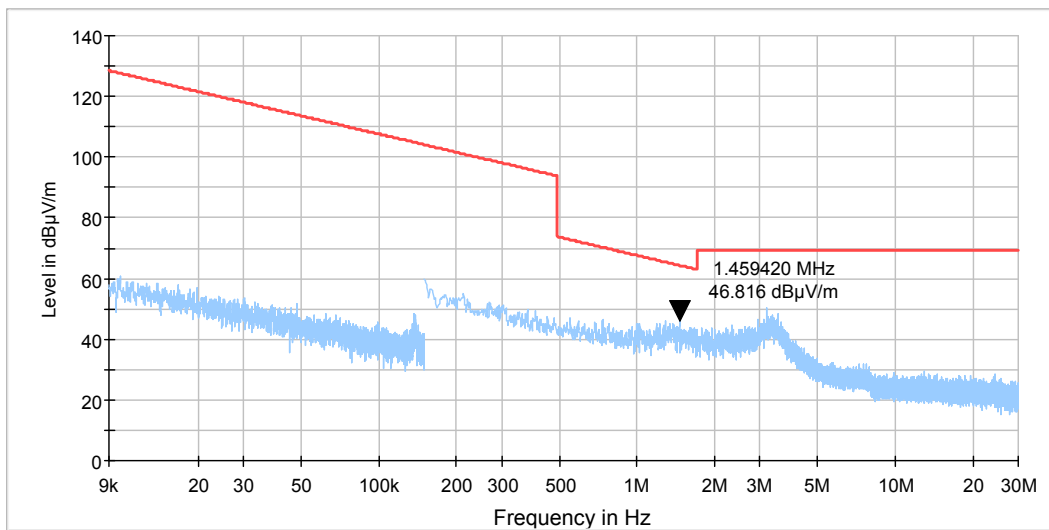




Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

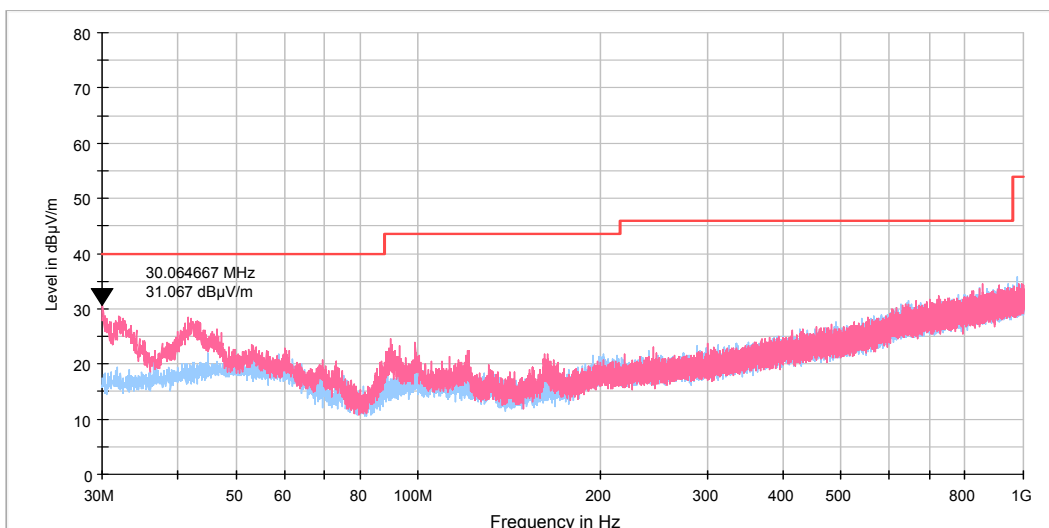
Plot 7.3.3 Radiated emission measurements from 9 KHz to 30 MHz at high frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and horizontal
 EUT POSITION: Typical (Vertical)



Plot 7.3.4 Radiated emission measurements from 30 to 1000 MHz at low frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)

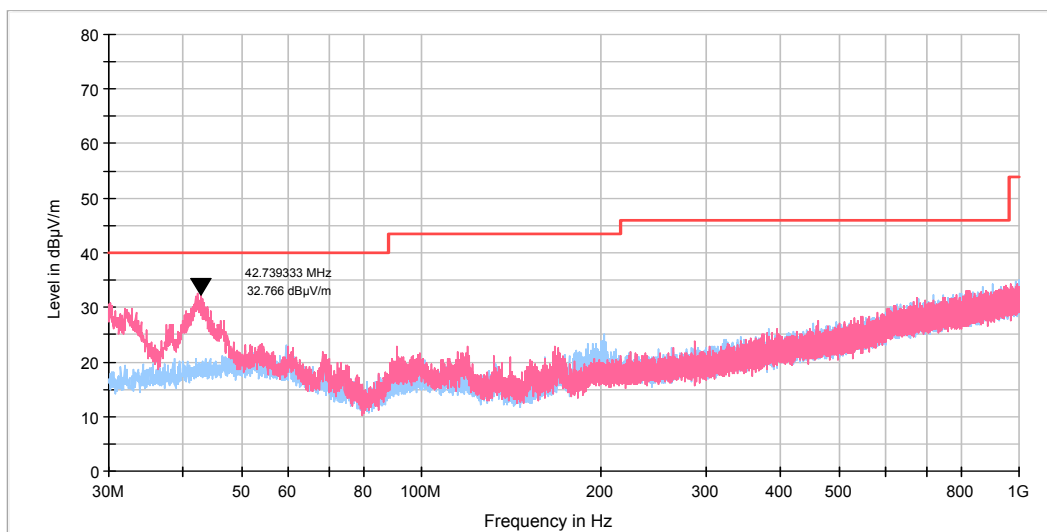




Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

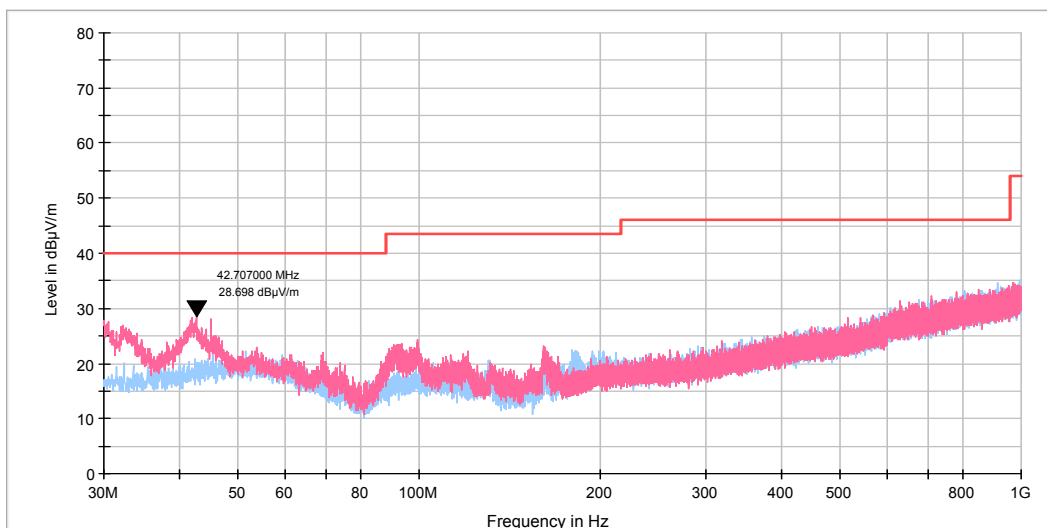
Plot 7.3.5 Radiated emission measurements from 30 to 1000 MHz at mid frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Plot 7.3.6 Radiated emission measurements from 30 to 1000 MHz at high frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)

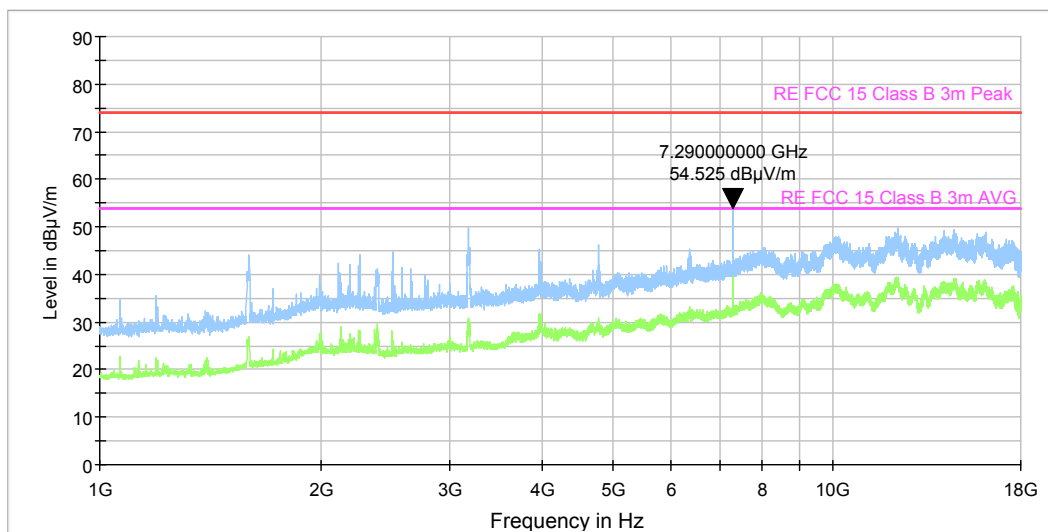




Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

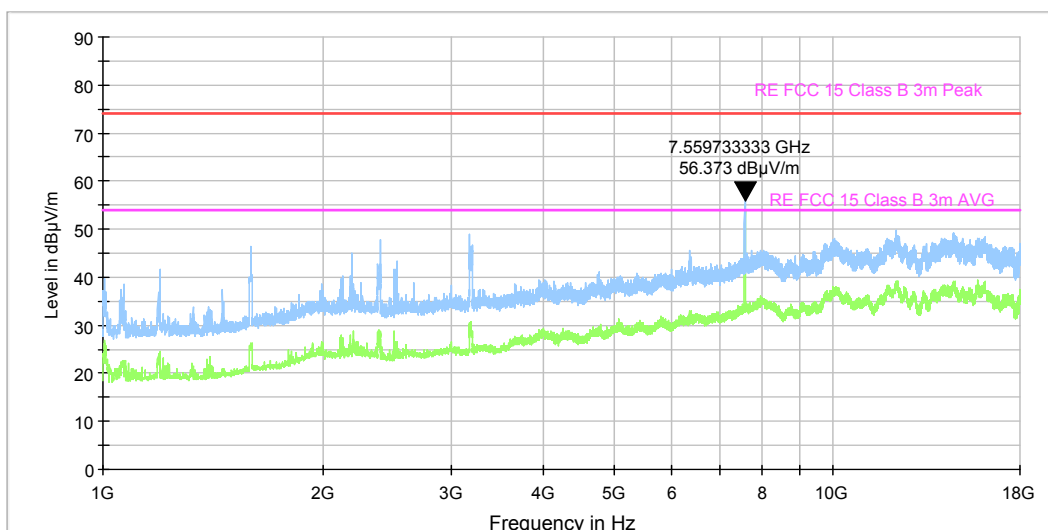
Plot 7.3.7 Radiated emission measurements from 1.0 to 18 MHz at low frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Plot 7.3.8 Radiated emission measurements from 1.0 to 18 MHz at mid frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



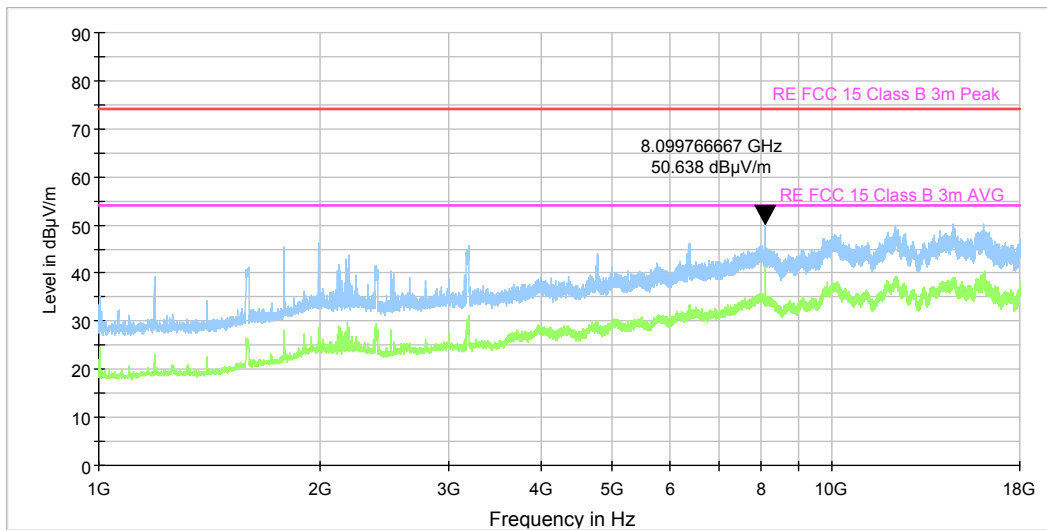


HERMON LABORATORIES

Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

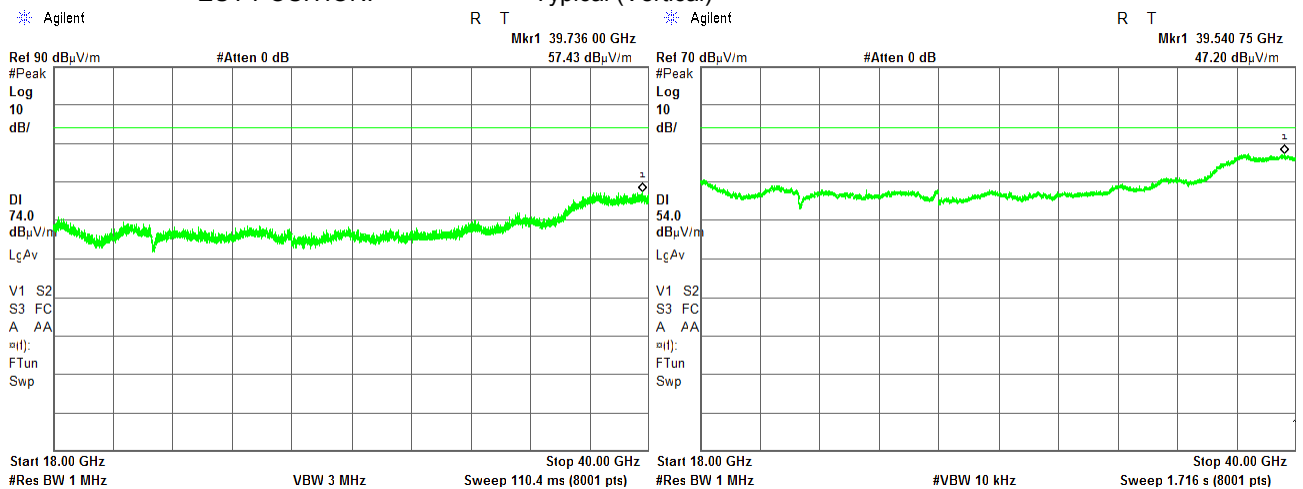
Plot 7.3.9 Radiated emission measurements from 1.0 to 18 MHz at high frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Plot 7.3.10 Radiated emission measurements from 18.0 to 40 GHz at low frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



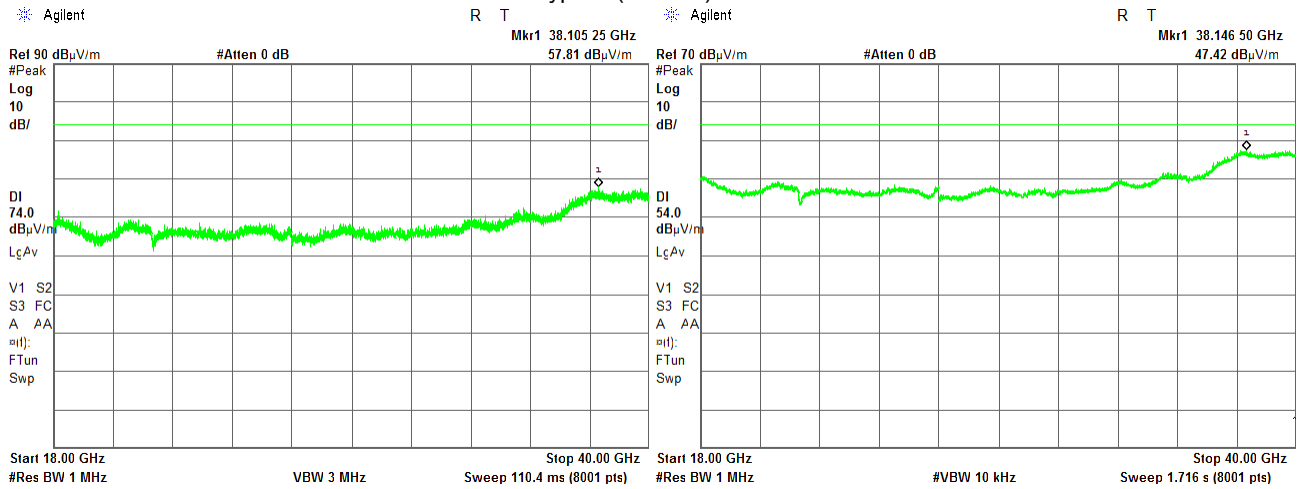


HERMON LABORATORIES

Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 10-Jun-20			
Temperature: 26 °C	Relative Humidity: 35 %	Air Pressure: 1006 hPa	Power: 55 VDC
Remarks:			

Plot 7.3.11 Radiated emission measurements from 18.0 to 40 GHz at mid frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



Plot 7.3.12 Radiated emission measurements from 18.0 to 40 GHz at high frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)

