

FCC DTS RF TEST REPORT



Test Report Number.....	GBX-19011401-LC-RF-FCC-DTS Rev1.0
Applicant.....	MyGnar, Inc.
Applicant Address.....	2525 MAIN ST, SUITE 300, Santa Monica, CA 90405 US
Product Name.....	GNARBOX 2.0 SSD
Model Number.....	GBXV2
Family Product/Model.....	GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2
FCC ID.....	2AJLWGBX2
Date of EUT received.....	01/21/2019
Date of Test.....	01/23/2019 – 02/12/2019
Report Issue Date.....	03/12/2019
Test Standards.....	47CFR Part 15.247: 2018
Test Result.....	Pass

Issued By:

Vista Laboratories
1261 Puerta Del Sol, San Clemente, CA 92673 USA
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Tested by:

Sherwin Lee/Test Engineer

Approved By:

David Zhang/Technical Manager

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Laboratory Introduction

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REVISION HISTORY

Revision	Issue Date	Description	Note
Original	02/13/2019	Original release	N/A
Rev1.0	03/12/2019	Update EUT model	N/A



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1 General Information

1.1 Applicant

Applicant:	MyGnar, Inc.
Applicant address:	2525 MAIN ST, SUITE 300, Santa Monica, CA 90405 US
Manufacturer:	MyGnar, Inc.
Manufacturer Address:	2525 MAIN ST, SUITE 300, Santa Monica, CA 90405 US

1.2 Product information

Product Name	GNARBOX 2.0 SSD
Model Number	GBXV2
Family Model Number	GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2
Serial Number	N/A
Frequency Band	FCC: - 802.11b/g/n-20MHz: 2412-2462MHz - 802.11n-40MHz: 2422-2452MHz - 802.11a/n-20MHz: 5180-5320MHz, 5500-5720MHz, 5725-5825MHz - 802.11n-40MHz: 5190-5310MHz, 5510-5710MHz, 5755-5795MHz - 802.11ac: 5210-5290MHz, 5530-5690MHz, 5775MHz
Type of modulation	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM) 802.11a/n/ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Equipment Class/ Category	DTS, UNII
Maximum output power	See test result
Antenna Information	PCB antenna (-10 dBi – 2.4GHz, -5 dBi – 5GHz)
Clock Frequencies	2.40GHZ (CPU)
Port/Connectors	2x USB-C, SD & Micro HDMI ports
Input Power	Battery powered: DC 7.8V, 2.5A
Power Adapter Manu/Model	KYTW40P01
Power Adapter SN	N/A
Hardware version	GBXV2, GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2
Software version	v2.0.0
Simultaneous Transmission	N/A
Additional Info	1. EUT is DFS client device without radar detection capability. 2. The family models include GBXV2, GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2. The only difference between these models are the capacity of the SSD which varies from 128GB to 2048GB while the electrical parameters of the SSD including read/write speed, etc, are identical in different models. Hence the difference on SSD capacity does not affect any product Radio or EMC performance. Only the worst case representative testing result on model GBXV2 is presented in current report.



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1.3 Test standard and method

Test standard	47CFR Part 15.247: 2018
Test method	ANSI C63.10: 2013 558074 D01 15.247 Meas Guidance v05r01

1.4 Test Purpose and statement

The purpose of this test report is intended to demonstrate the compliance of product listed in section 1.2, received from company listed in section 1.1, to the requirements of standard and method listed in section 1.3. Based on our test results, we conclude that the product tested complies with the requirements of the standards indicated.



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2 Test site information

Lab performing tests	Vista Laboratories
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www.Vista-compliance.com

Test condition	Test Engineer	Test Environment	Test Date
RF conducted	Sherwin Lee	23.5°C / 58.2%/996 mbar	01/23/2019 – 02/12/2019
Radiated	Sherwin Lee	23.5°C / 58.2%/996 mbar	01/23/2019 – 02/12/2019

3 Modification of EUT

The EUT is an engineering test sample loaded with RF testing software specifically designed to support the RF TX/RX measurement in different aspects.

4 Test configuration and operation

4.1 EUT test configuration

EUT is powered by external DC power supply through standard banana plug cables with mini-grabbers. EUT's Rf antenna port is connected to spectrum analyzer or signal generator through IPEX MHF4 RF cable. The operation, control and display are done by the built-in buttons and OLED display.

4.2 EUT test mode

Radio	Channel	Frequency (MHz)
802.11-b	1	2412
802.11-b	6	2437
802.11-b	11	2462
802.11-g	1	2412
802.11-g	6	2437
802.11-g	11	2462
802.11-n-20	1	2412
802.11-n-20	6	2437
802.11-n-20	11	2462
802.11-n-40	3	2422
802.11-n-40	6	2437
802.11-n-40	9	2452



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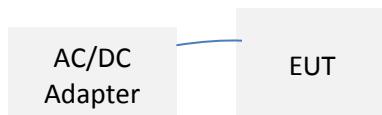


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4.3 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
1	AC/DC adapter	KYTW40P01	N/A	Keyuantai	N/A

4.4 EUT setup diagram



4.5 EUT operation

The operation, control and display are done by the built-in buttons and OLED display.

4.6 Test software

Index	Description	Remark
1	Built-in RF test software	To set EUT into continuous TX and RX mode under different modulation, data rate and channel, etc.
2	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing

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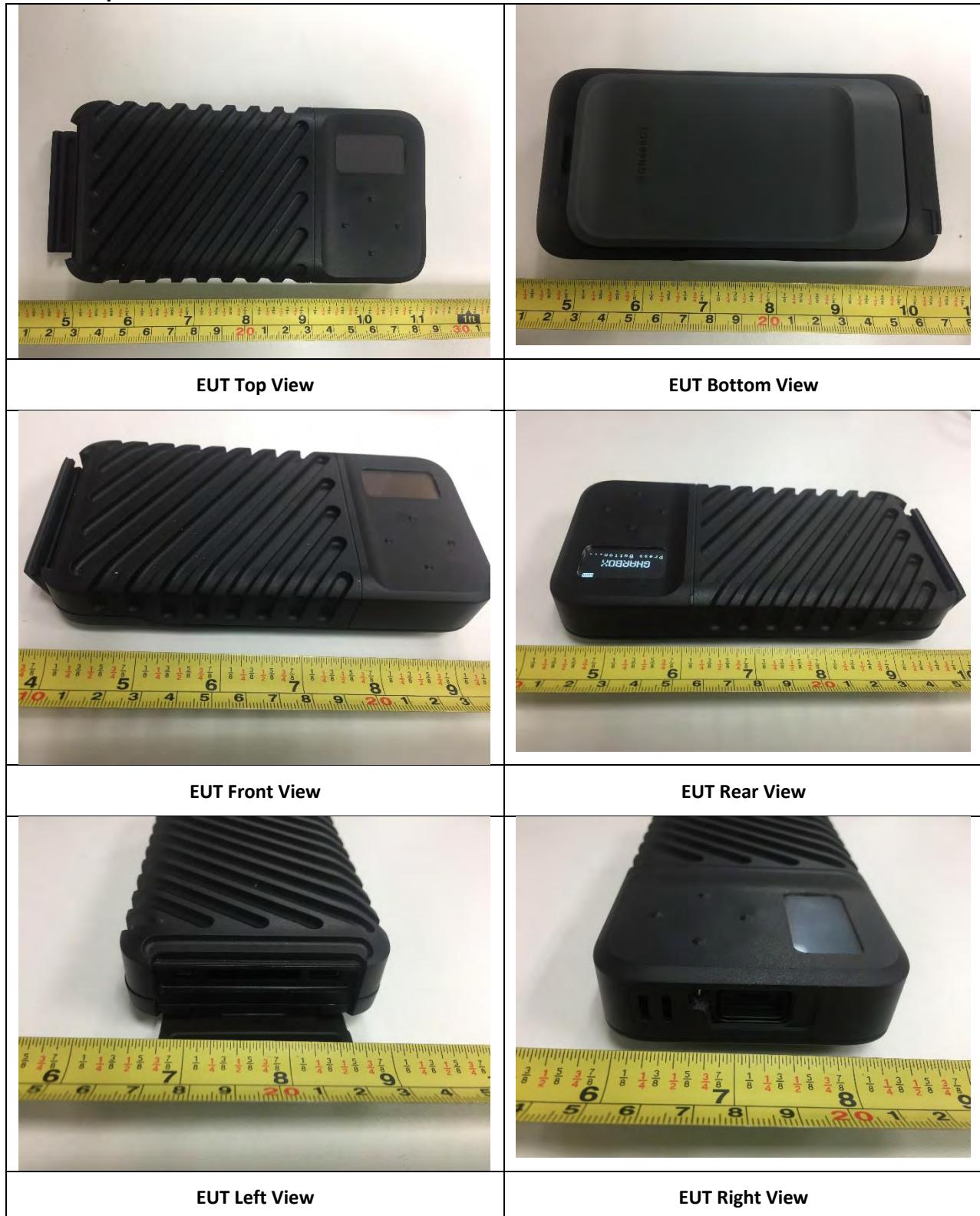


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5 EUT and test setup pictures

5.1 EUT pictures



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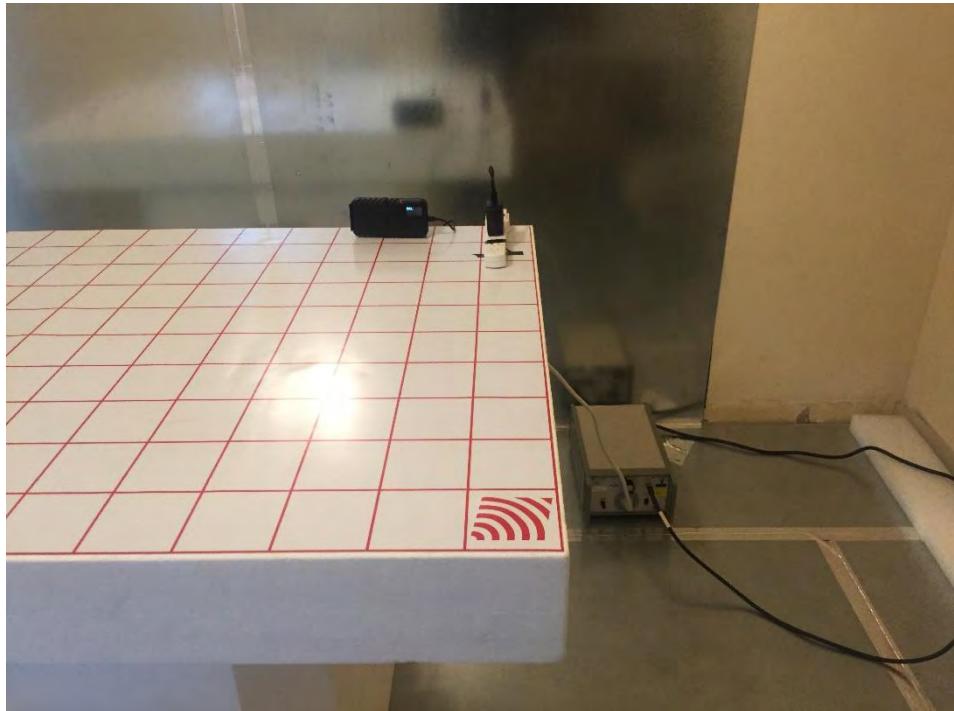
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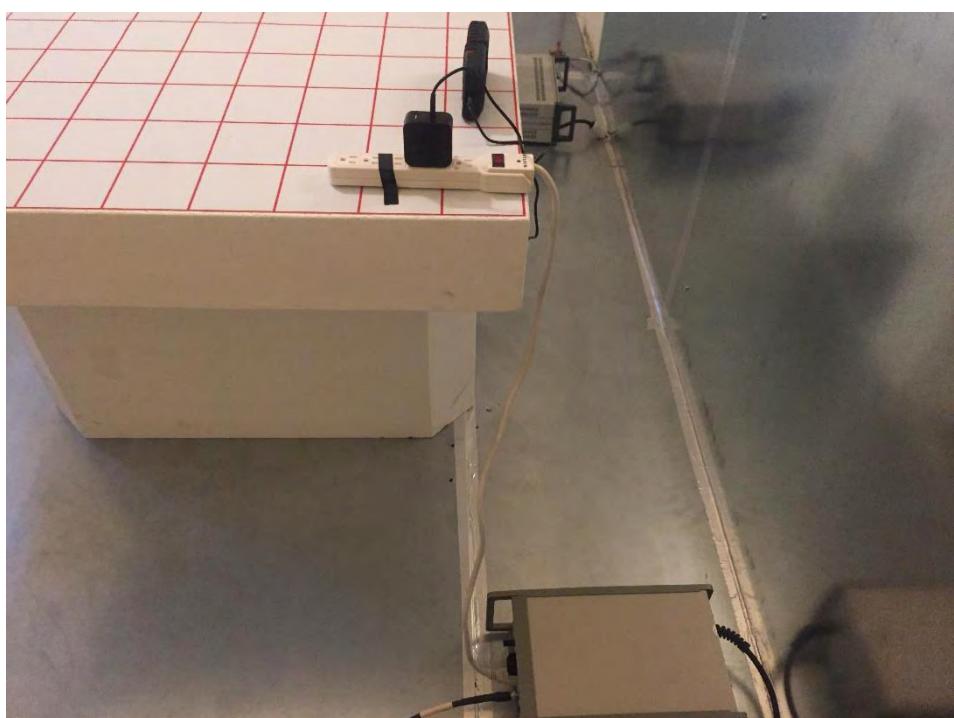
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5.2 EUT test setup pictures



AC Line Conducted Emission setup – Front



AC Line Conducted Emission setup – Rear



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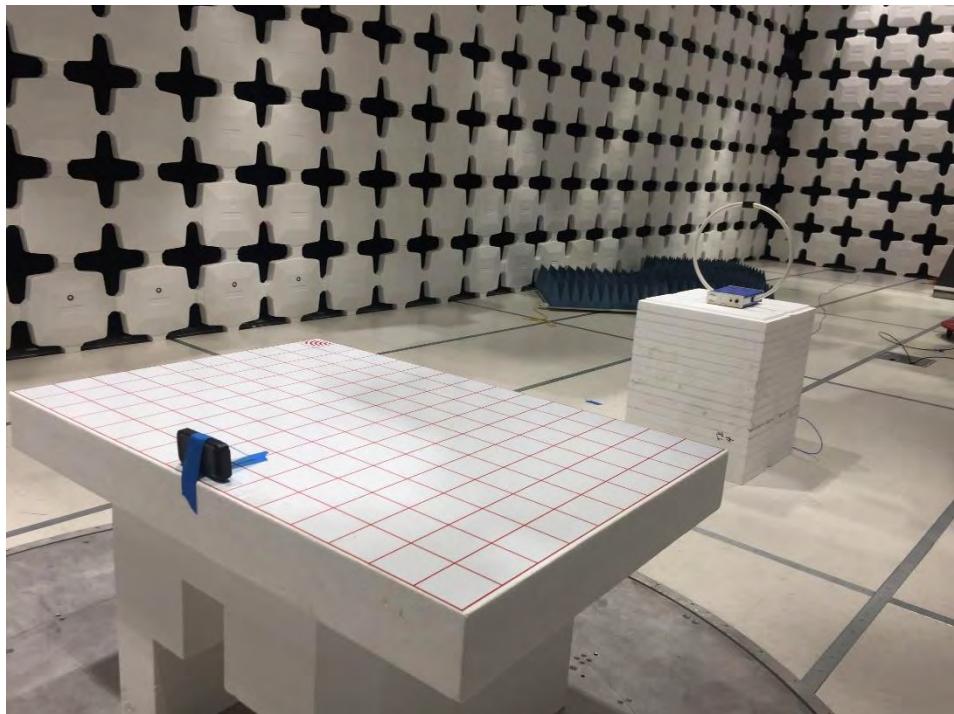


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Radiated Emissions Below 30MHz setup – Front



Radiated Emissions Below 30MHz setup – Rear



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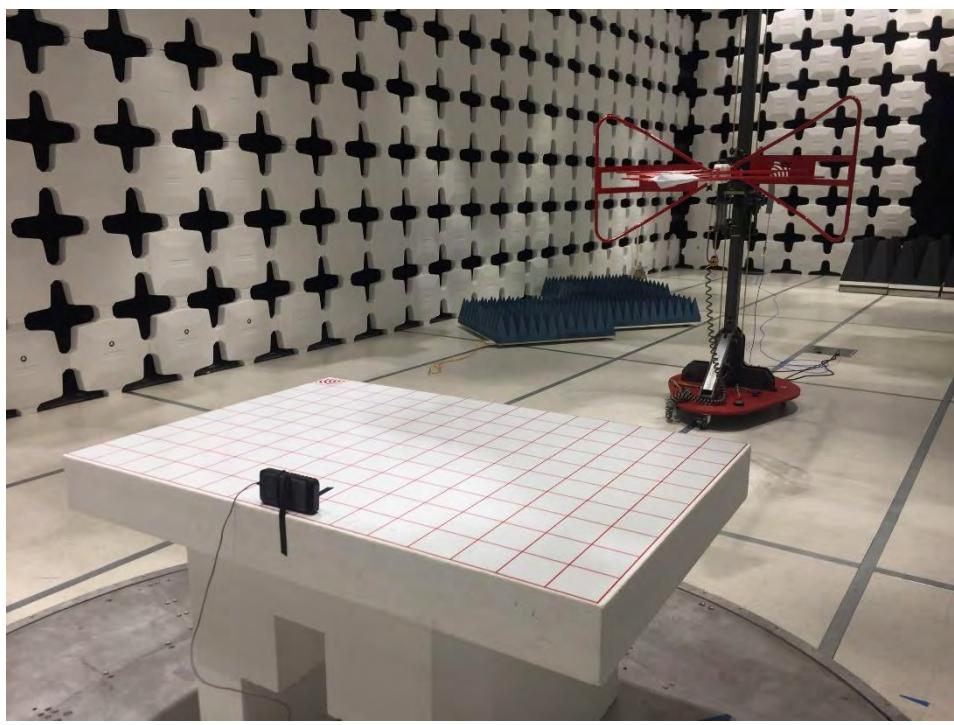


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Radiated Emissions Below 1GHz setup – Front



Radiated Emissions Below 1GHz setup – Rear



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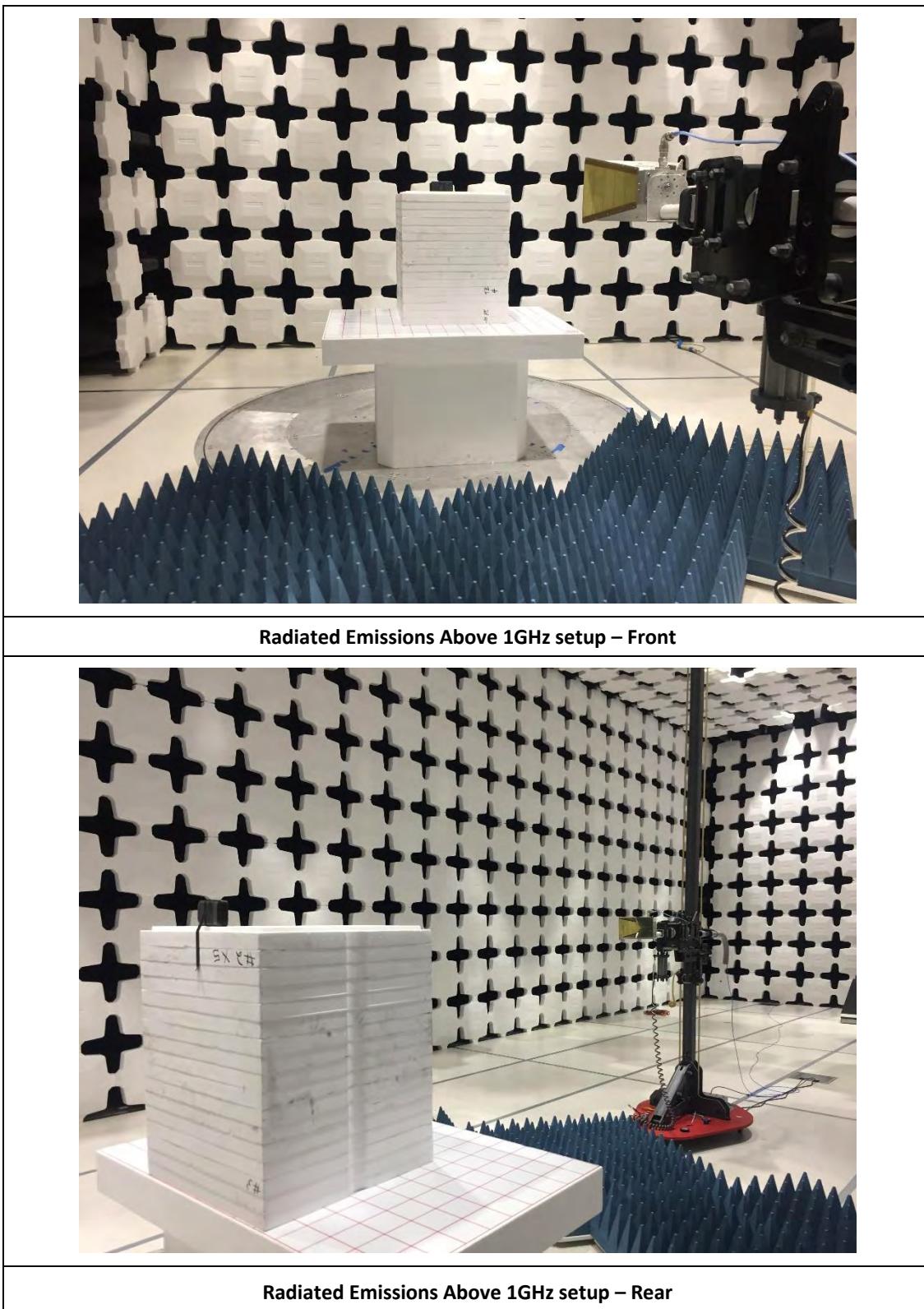
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Radiated Emissions Above 1GHz setup – Front

Radiated Emissions Above 1GHz setup – Rear



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6 Test Summary

FCC Rules	Test Item	Section	Verdict
§15.203	Antenna Requirement	8.1	Pass
§15.247 (a)(2)	DTS (6 dB) Channel Bandwidth	8.2	Pass
§15.247(b)(3)	Conducted Maximum Output Power	8.3	Pass
§15.247(e)	Power Spectral Density	8.4	Pass
§15.247(d)	Conducted Band-Edge & Unwanted Emissions	8.5	Pass
§15.205, §15.209, §15.247(d)	Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	8.6	Pass
§15.207 (a)	AC Power Line Conducted Emissions	8.7	Pass



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7 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB



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8 Test summary and result

8.1 Antenna Requirement

8.1.1 Requirement

Per § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

8.1.2 Result

Analysis:

- EUT has two removable PCB trace antennas which connect to the main board through unique IPEX MHF4 RF connectors.
- Both main board and antenna are equipped with IPEX MHF4 connector. No standard RF connector is used.

Conclusion:

EUT complies with antenna requirement in § 15.203.



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8.2 DTS (6 dB) Bandwidth

8.2.1 Requirement

§ 15.247 (a)(2)

Systems using digital modulation techniques may operate in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands. The minimum 6 dB bandwidth shall be at least 500 KHz.

8.2.2 Test setup



8.2.3 Test Procedure

According to section 8.2, option 2, in KDB 558074 D01 DTS Meas Guidance v05r01 and subclause 11.8 of ANSI C63.10-2013:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq 3 \times$ RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Use automatic bandwidth measurement capability on instrument to obtain BW result.

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8.2.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11b	2412	1Mbps	10090	500	Pass
11b	2437	1Mbps	10090	500	Pass
11b	2462	1Mbps	10080	500	Pass
11g	2412	6Mbps	16450	500	Pass
11g	2437	6Mbps	17100	500	Pass
11g	2462	6Mbps	16560	500	Pass
11n-20M	2412	MCS1	17760	500	Pass
11n-20M	2437	MCS1	17770	500	Pass
11n-20M	2462	MCS1	17000	500	Pass
11n-40M	2422	MCS1	36160	500	Pass
11n-40M	2437	MCS1	36330	500	Pass
11n-40M	2452	MCS1	36400	500	Pass



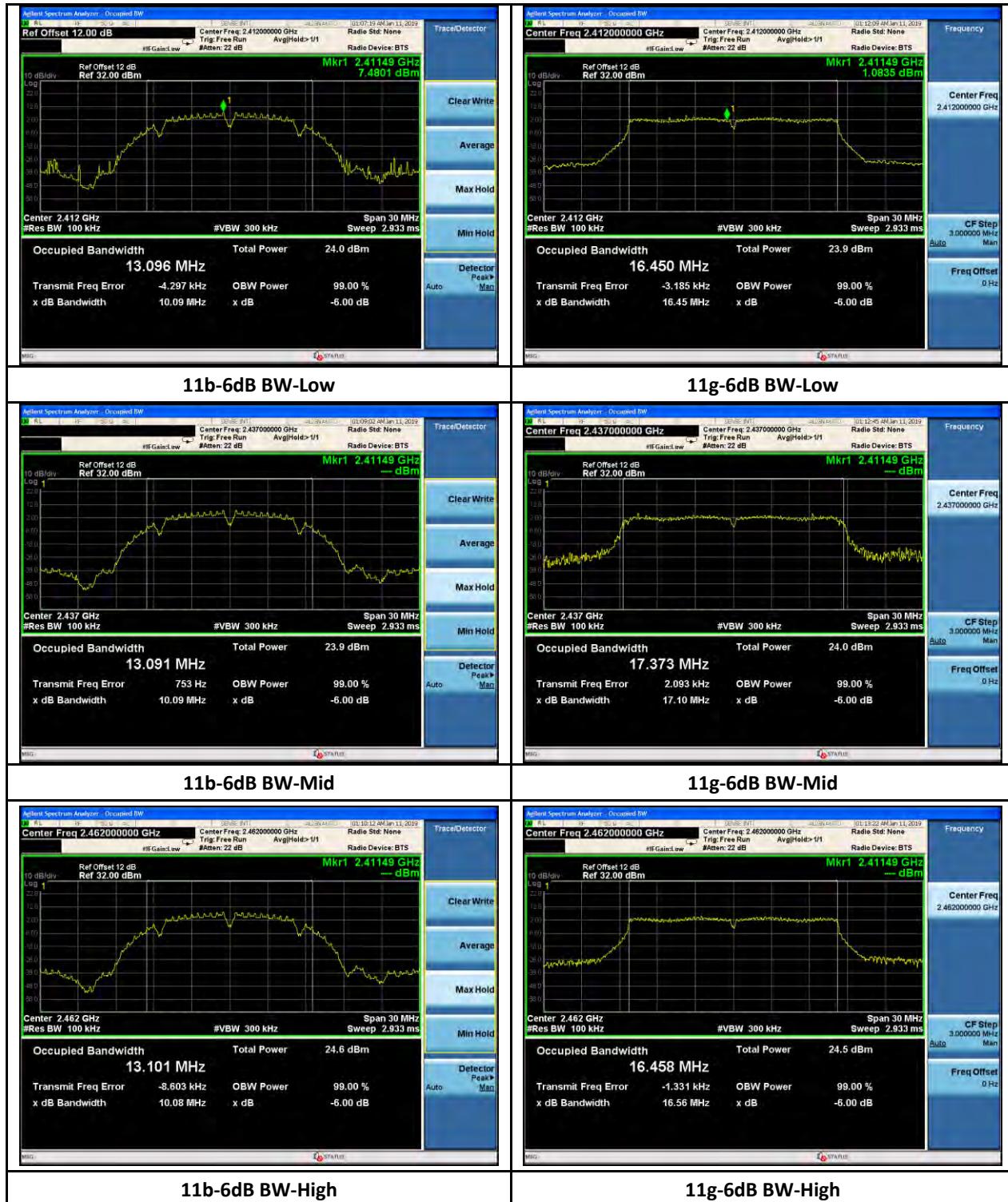
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8.2.5 Test Plots



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8.3 Maximum Output Power

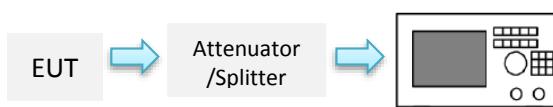
8.3.1 Requirement

§ 15.247 (b)(3)

or systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: the maximum output power is 1 Watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.3.2 Test setup



8.3.3 Test Procedure

According to subclause 11.9.2.2.2 of ANSI C63.10-2013:

1. Set span to at least 1.5 times of the OBW.
2. Set the RBW = 1% to 5% of the OBW, not to exceed 1 MHz.
2. Set VBW $\geq 3 \times$ RBW.
3. Set number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$
4. Sweep time = auto couple.
5. Detector = RMS
6. If transmit duty cycle < 98%, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at the maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no OFF intervals) or at duty cycle 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."
7. Trace average at least 100 traces in power averaging (rms) mode.
8. Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

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8.3.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	TX1 power (dBm)	TX2 power (dBm)	Highest or Total power (dBm)	Max Output Power (dBm)	Result
11b	2412	1Mbps	15.40	15.85	15.85	30	Pass
11b	2437	1Mbps	15.34	15.77	15.77	30	Pass
11b	2462	1Mbps	15.49	16.75	16.75	30	Pass
11g	2412	6Mbps	11.51	11.49	11.49	30	Pass
11g	2437	6Mbps	10.89	11.24	11.24	30	Pass
11g	2462	6Mbps	11.44	12.28	12.28	30	Pass
11n-20M	2412	MCS1	15.91	15.77	18.85	30	Pass
11n-20M	2437	MCS1	15.29	15.89	18.61	30	Pass
11n-20M	2462	MCS1	15.81	16.83	19.36	30	Pass
11n-40M	2422	MCS1	14.82	14.95	17.90	30	Pass
11n-40M	2437	MCS1	15.19	15.29	18.25	30	Pass
11n-40M	2452	MCS1	14.93	15.74	18.36	30	Pass

Note:

- 1) For 802.11b/g, the highest output power is recorded.
- 2) For 802.11n mode, it's under 2x2 MIMO mode, the output power is combined together to compare to limit.
- 3) For 2.4GHz, antenna gain = -10 dBi, directional gain = 3 dB, total gain = -7 dBi. Highest of total gain is -7 dBi.

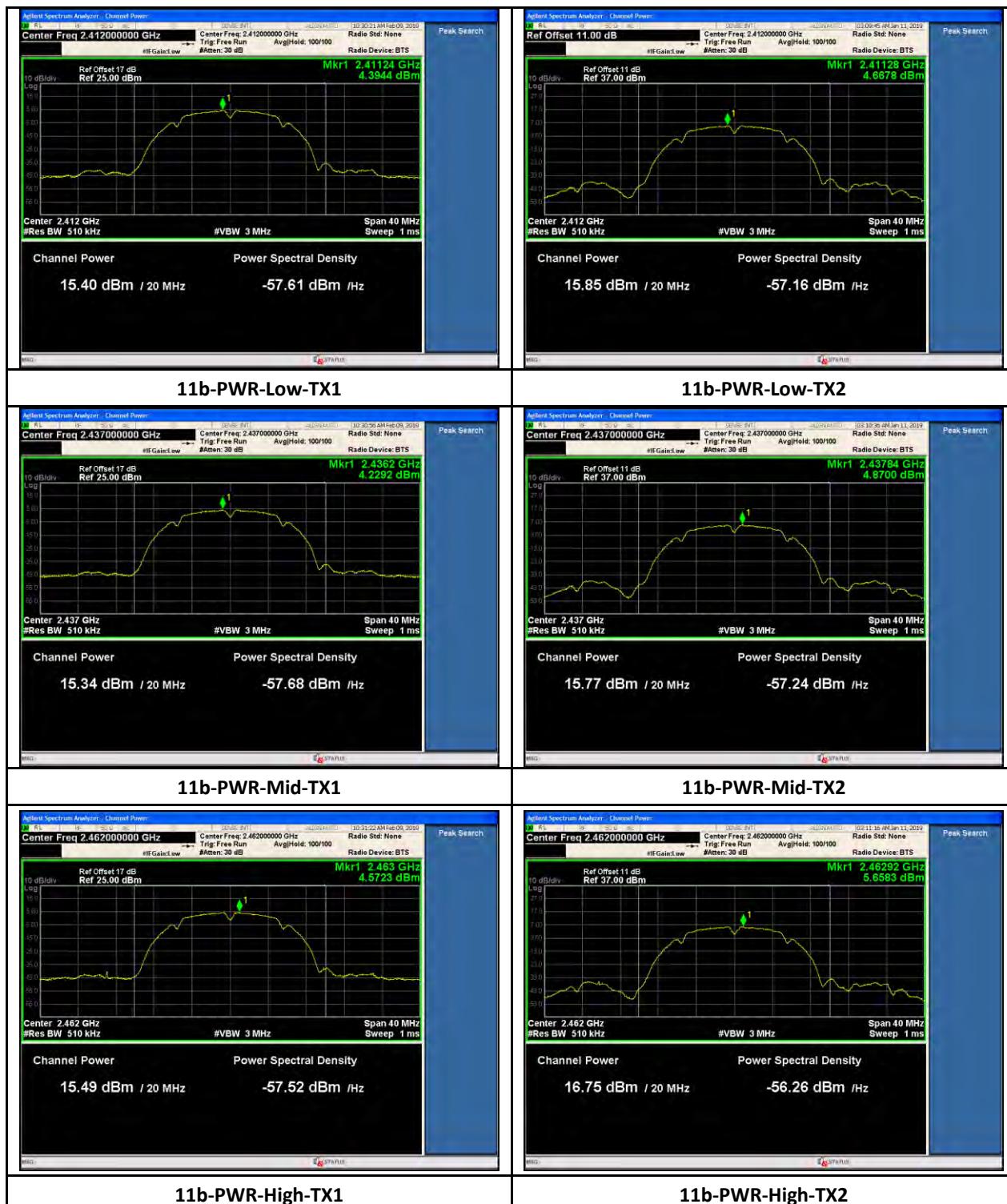


Report Number:	GBX-19011401-LC-RF-FCC-DTS Rev1.0
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Model Number:	GBXV
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8.3.5 Test Plots



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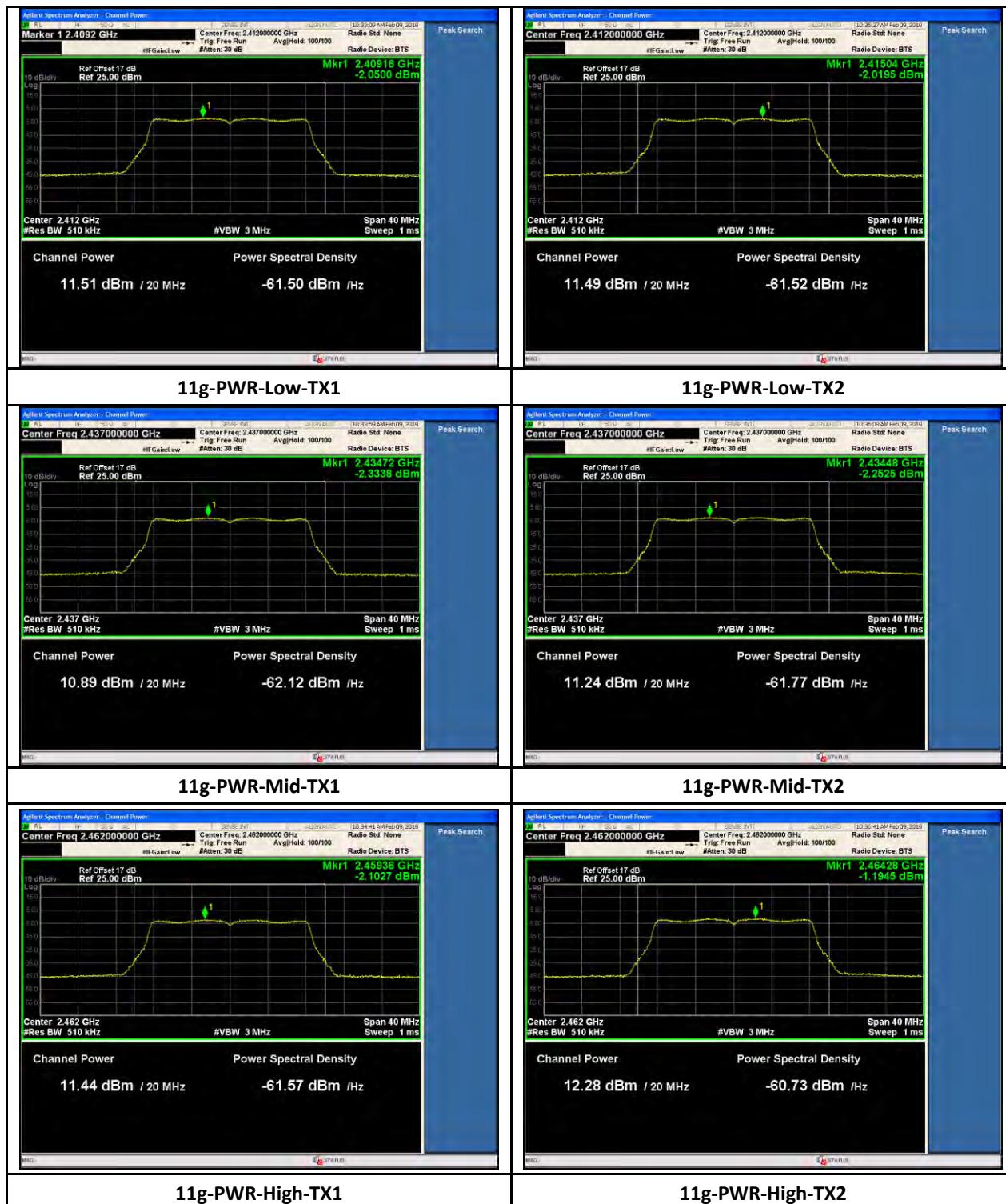
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Product: GNARBOX 2.0 SSD
Model Number: GBXV
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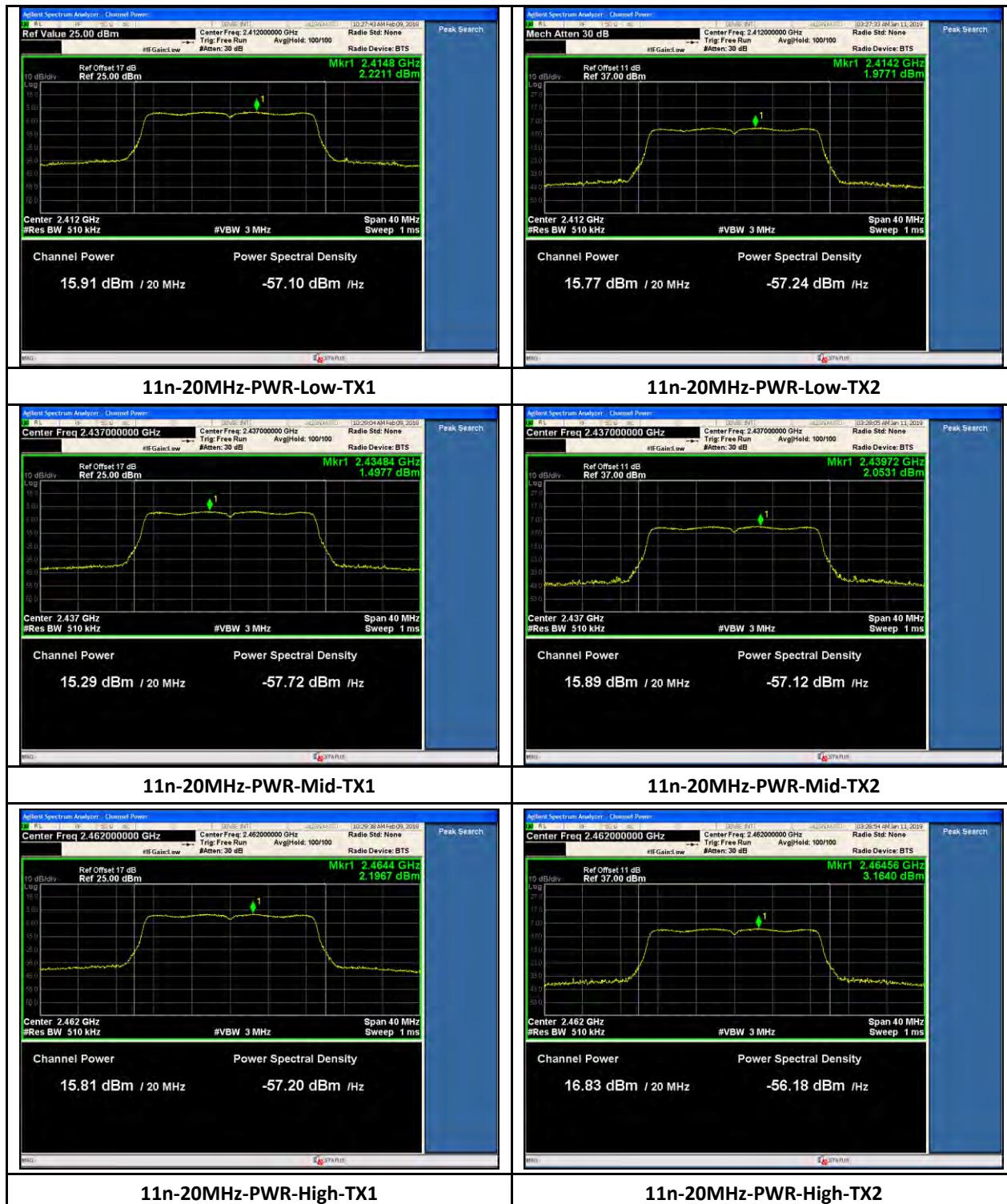
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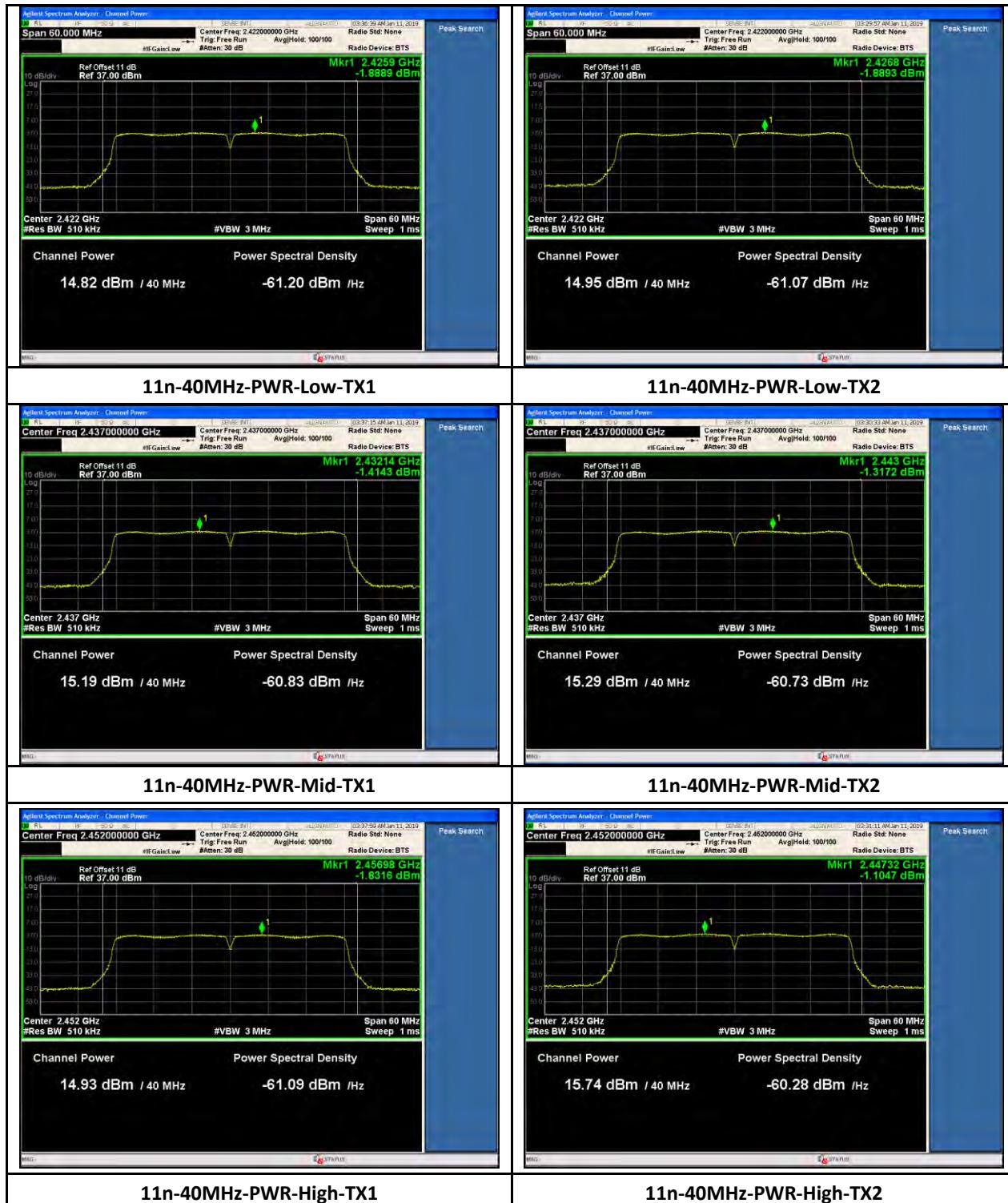
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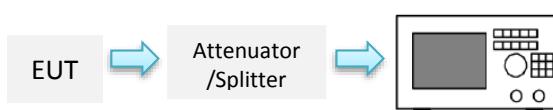
8.4 Power Spectral Density

8.4.1 Requirement

§ 15.247 (e)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power is used to determine the power spectral density.

8.4.2 Test setup



8.4.3 Test Procedure

According to section 8.4 in KDB 558074 D01 DTS Meas Guidance v05r01 and subclause 11.10.2 PKPSD of ANSI C63.10-2013:

1. Set analyser centre frequency to DTS channel centre frequency.
2. Set the span to 1.5 X DTS bandwidth.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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8.4.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	TX1 PSD (dBm/3KHz)	TX2 PSD (dBm/3KHz)	Highest or Total PSD (dBm/3KHz)	Max PSD (dBm/3KHz)	Result
11b	2412	1Mbps	-1.8862	-1.7536	-1.7536	8	Pass
11b	2437	1Mbps	-1.7419	-1.3548	-1.3548	8	Pass
11b	2462	1Mbps	-1.9068	-0.3675	-0.3675	8	Pass
11g	2412	6Mbps	-8.5961	-8.3422	-8.3422	8	Pass
11g	2437	6Mbps	-9.0609	-8.5478	-8.5478	8	Pass
11g	2462	6Mbps	-8.5216	-7.6627	-7.6627	8	Pass
11n-20M	2412	MCS1	-4.3244	-4.4566	-1.3797	8	Pass
11n-20M	2437	MCS1	-4.5450	-4.2697	-1.3949	8	Pass
11n-20M	2462	MCS1	-3.8069	-3.2202	-0.4934	8	Pass
11n-40M	2422	MCS1	-7.9644	-7.4888	-4.7098	8	Pass
11n-40M	2437	MCS1	-8.0174	-7.4296	-4.7033	8	Pass
11n-40M	2452	MCS1	-8.6153	-7.4983	-5.0107	8	Pass



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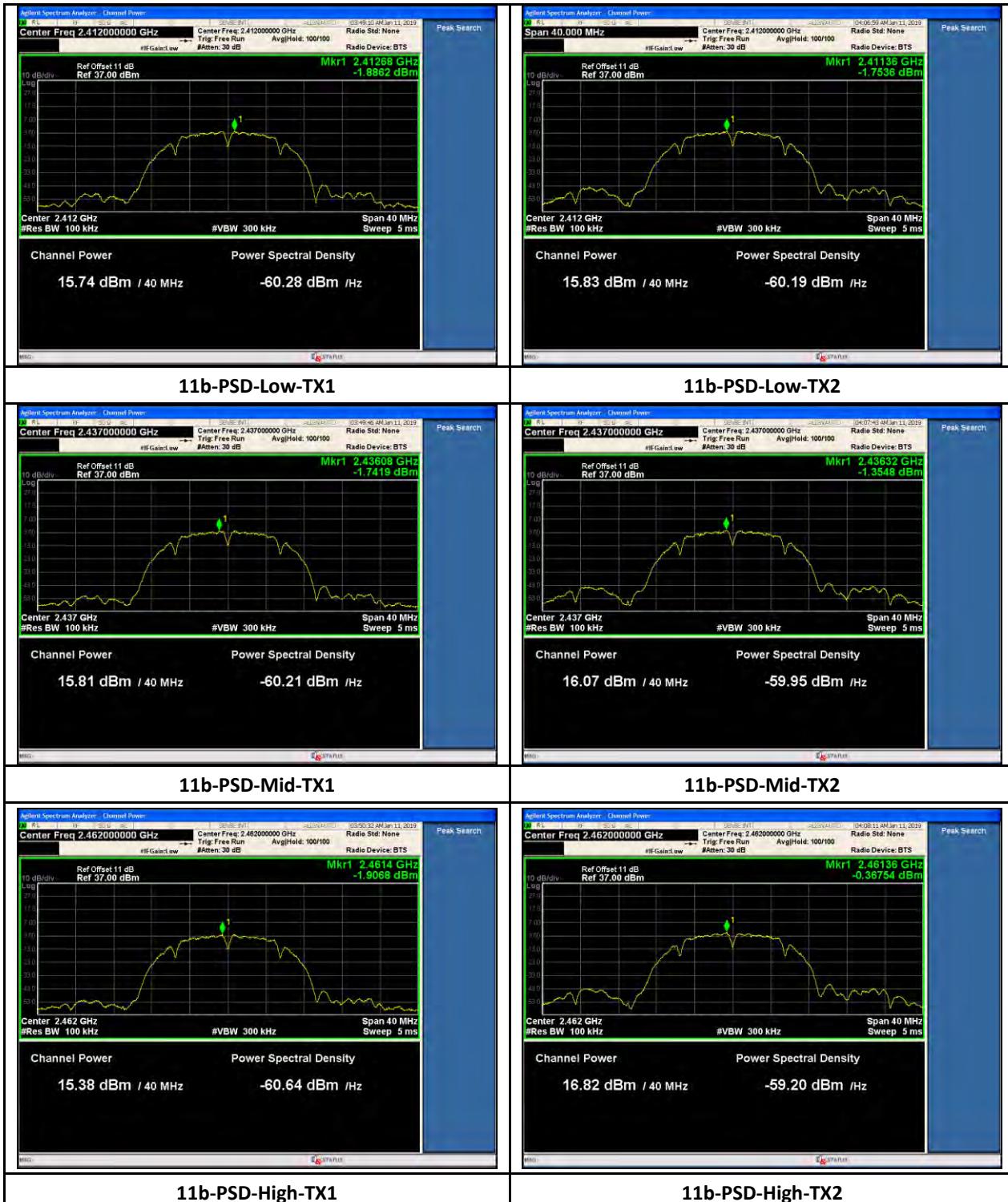
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8.4.5 Test Plots



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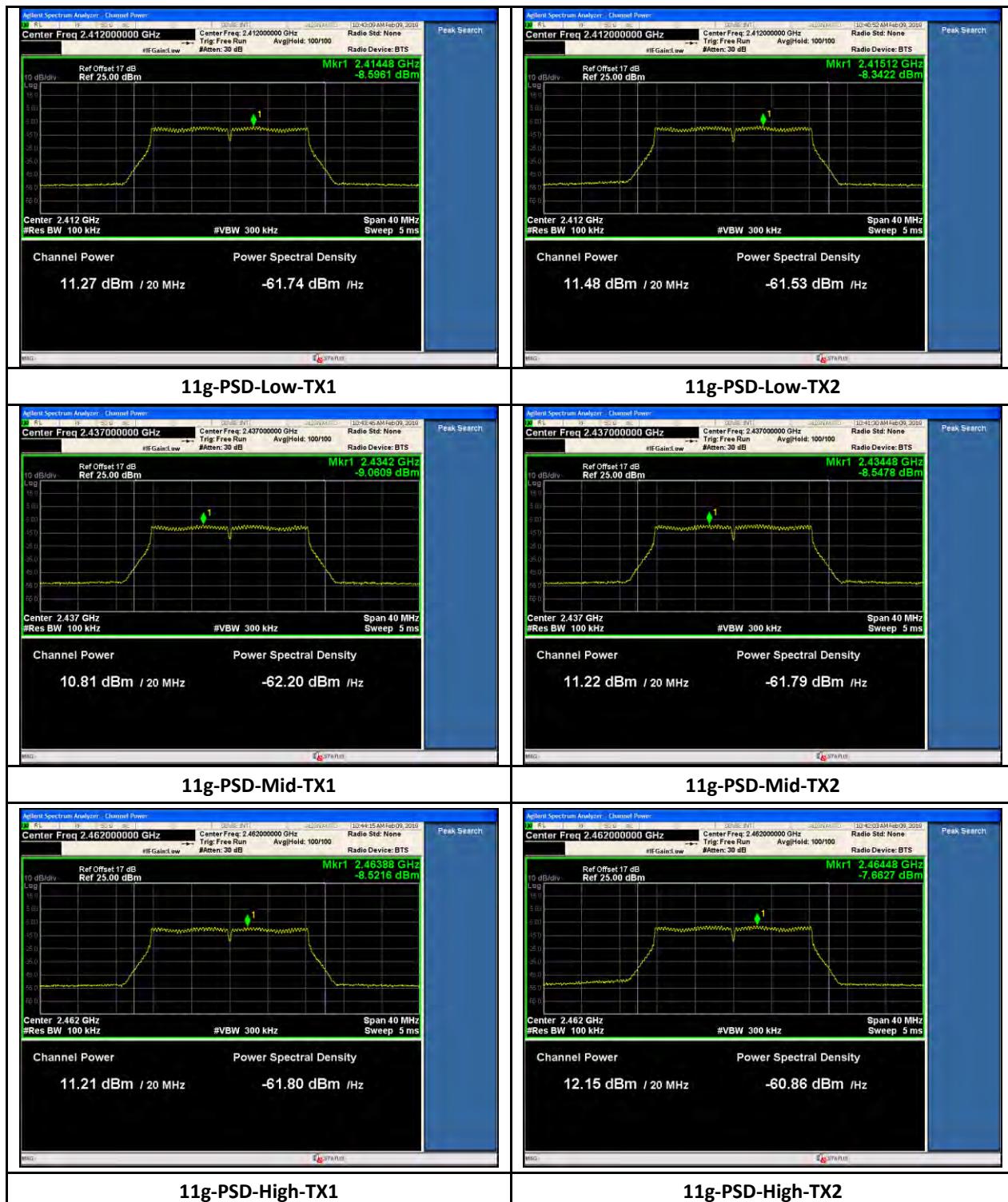
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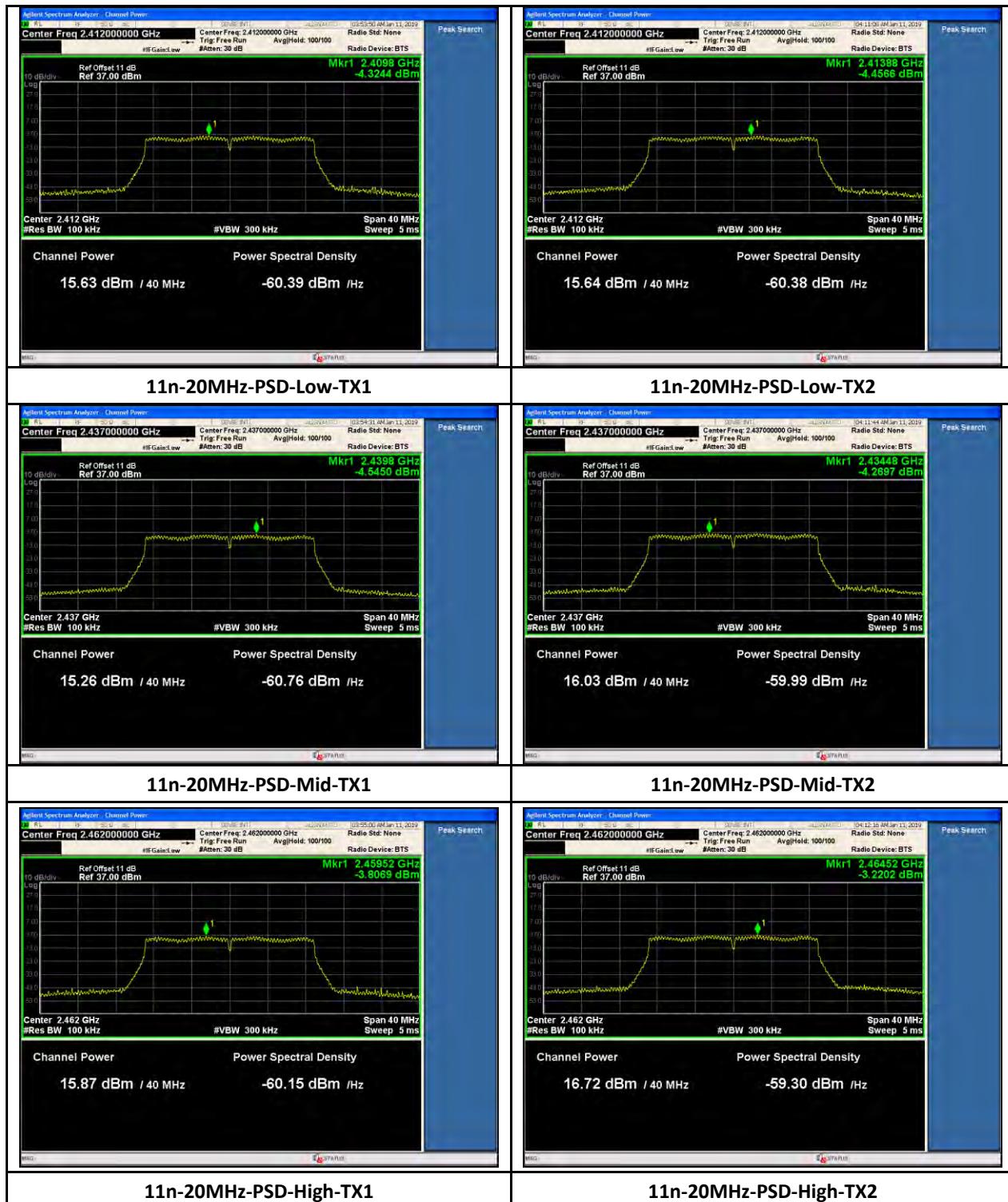
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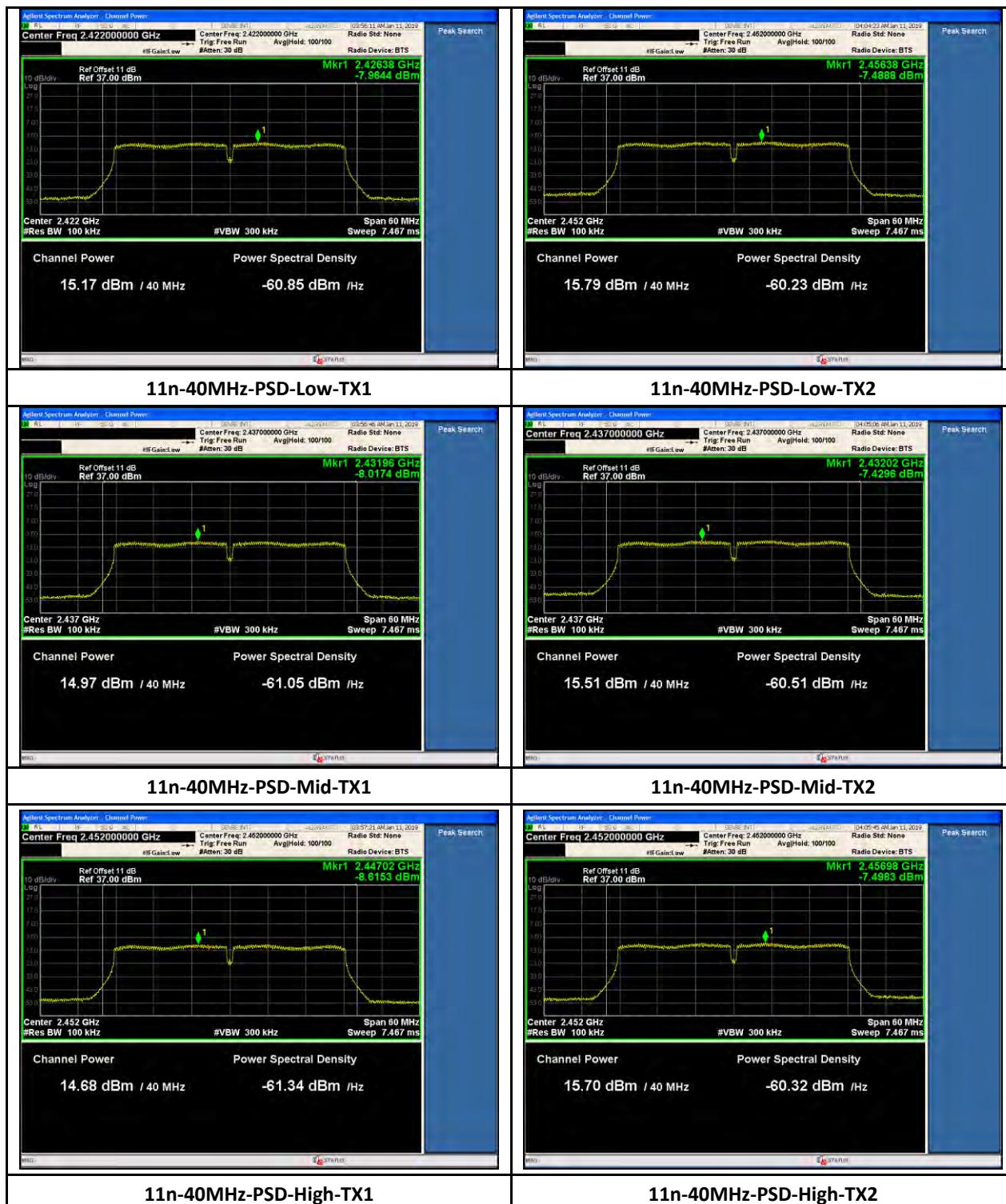
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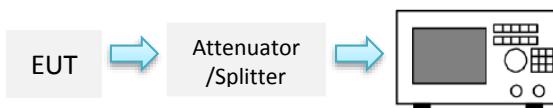
8.5 Conducted Band-Edge & Unwanted Emissions Measurement

8.5.1 Requirement

§ 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

8.5.2 Test setup



8.5.3 Test Procedure

According to section 8.5 Emission level measurement, in KDB 558074 D01 DTS Meas Guidance v05r01 and subclause 11.11.3 in ANSI C63.10-2013:

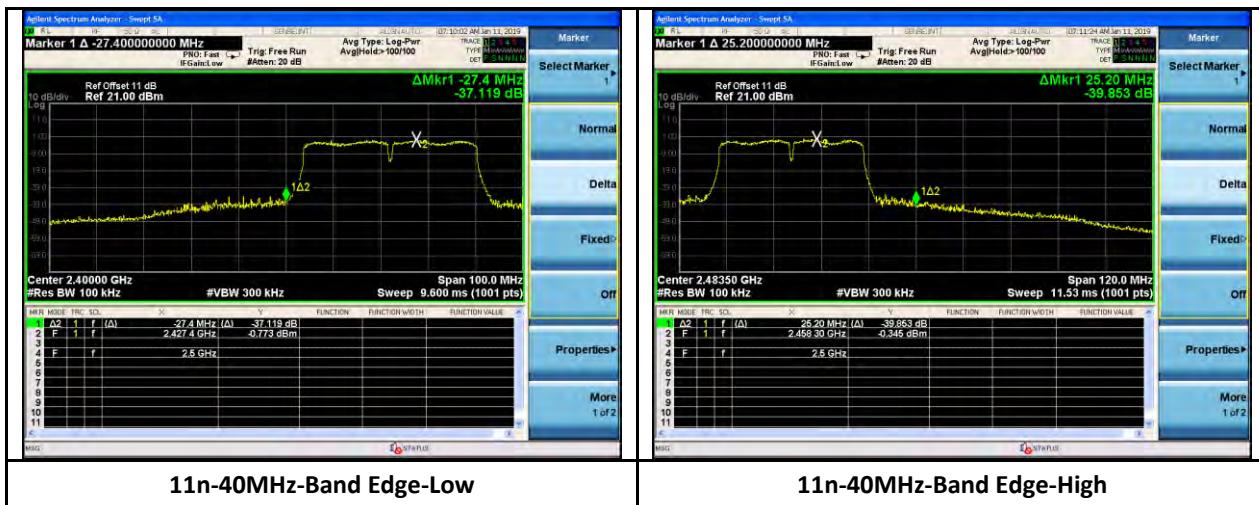
1. Set the centre frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

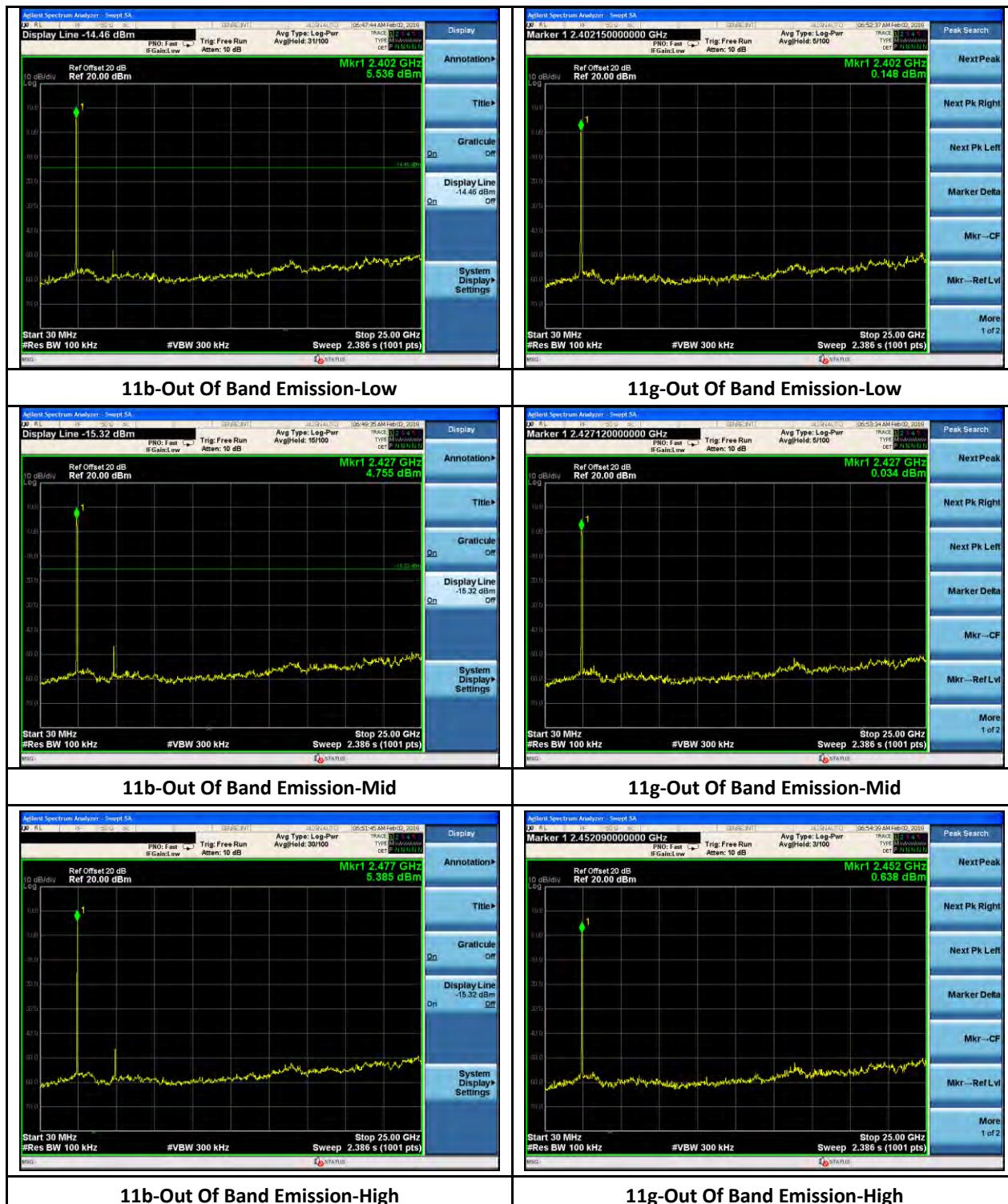
8.5.4 Test Result

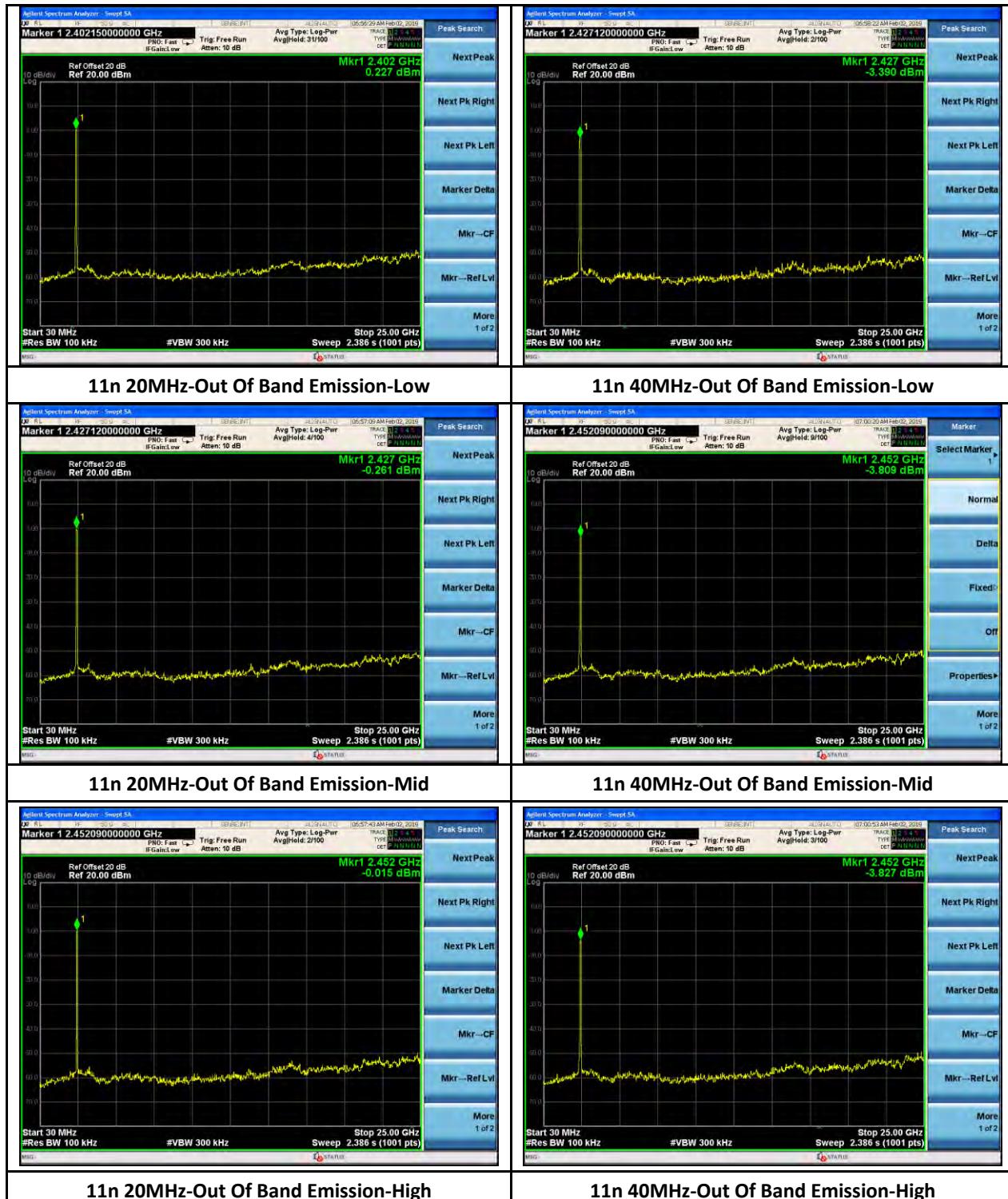
See test plots

8.5.5 Test Plots









8.6 Radiated Band-Edge & Spurious Emissions into Restricted Frequency Bands

8.6.1 Requirement

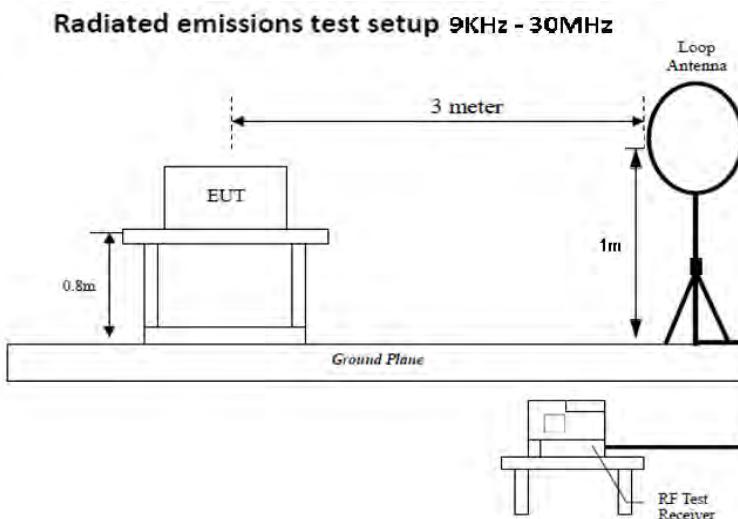
§ 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

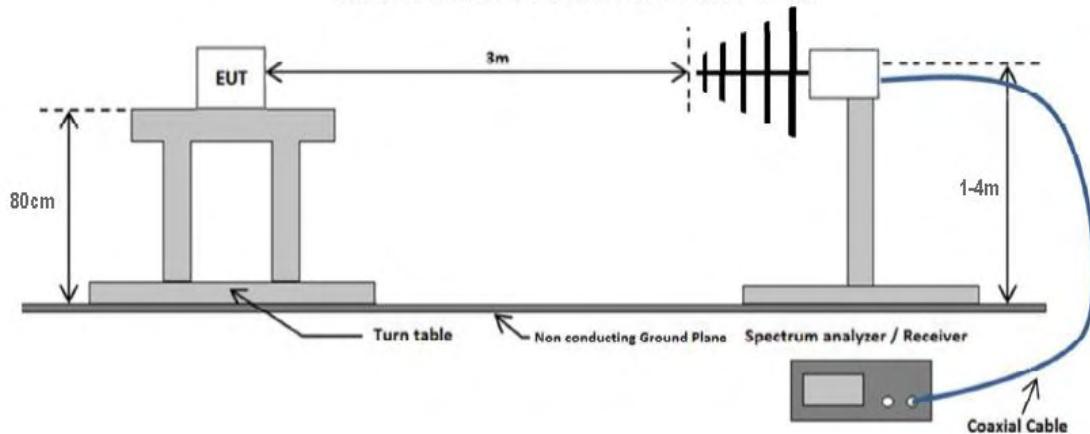
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency range (MHz)	Field Strength (μ V/m)
0.009~0.490	2400/F(KHz)
0.490~1.705	24000/F(KHz)
1.705~30.0	30
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

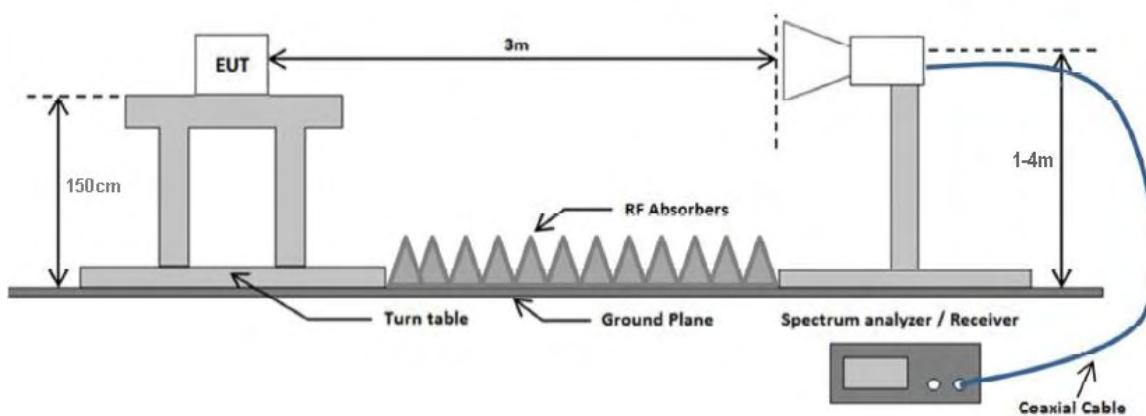
8.6.2 Test setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



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8.6.3 Test Procedure

According to section 8.6 in KDB 558074 D01 DTS Meas Guidance v05r01 and subclause 11.12.2.7 Radiated spurious emission measurements in ANSI C62.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.



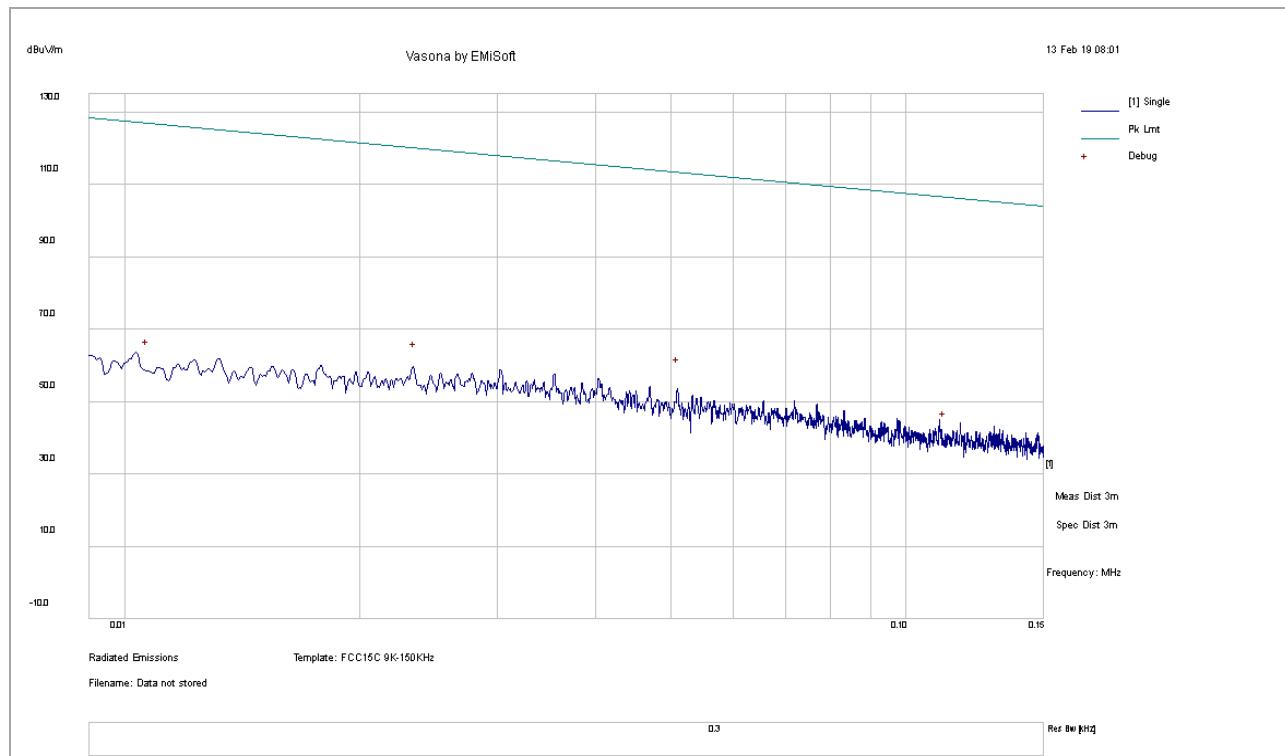
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Product:	GNARBOX 2.0 SSD
Model Number:	GBXV2
Family Model:	GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2



8.6.4 Test Result

9KHz – 150KHz test result

Test Standard:	15.209	Mode:	2437MHz
Frequency Range:	Below 150KHz	Test Date:	02/12/2019
Antenna Type/Polarity:	Loop / 0 deg & 90 deg	Test Personnel:	Sherwin Lee
Remark:	Internal antenna	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
0.015	49.85	0.35	10.83	61.03	PK	0	100	28	124.07	-63.04
0.070	37.99	0.51	12.50	51.00	PK	0	100	110	110.68	-59.68
0.026	44.81	0.41	12.99	58.20	PK	0	100	101	119.38	-61.18
0.010	52.84	0.31	10.15	63.30	PK	0	100	139	127.74	-64.44
0.127	28.20	0.56	11.00	39.76	PK	0	100	0	105.55	-65.79
0.015	49.85	0.35	10.83	61.03	PK	0	100	0	124.07	-63.04

Note: 1) Both 0 deg and 90 deg setup of the loop antenna have been verified and the worst case result is presented here.

2) EUT was tested in 3 orientations.



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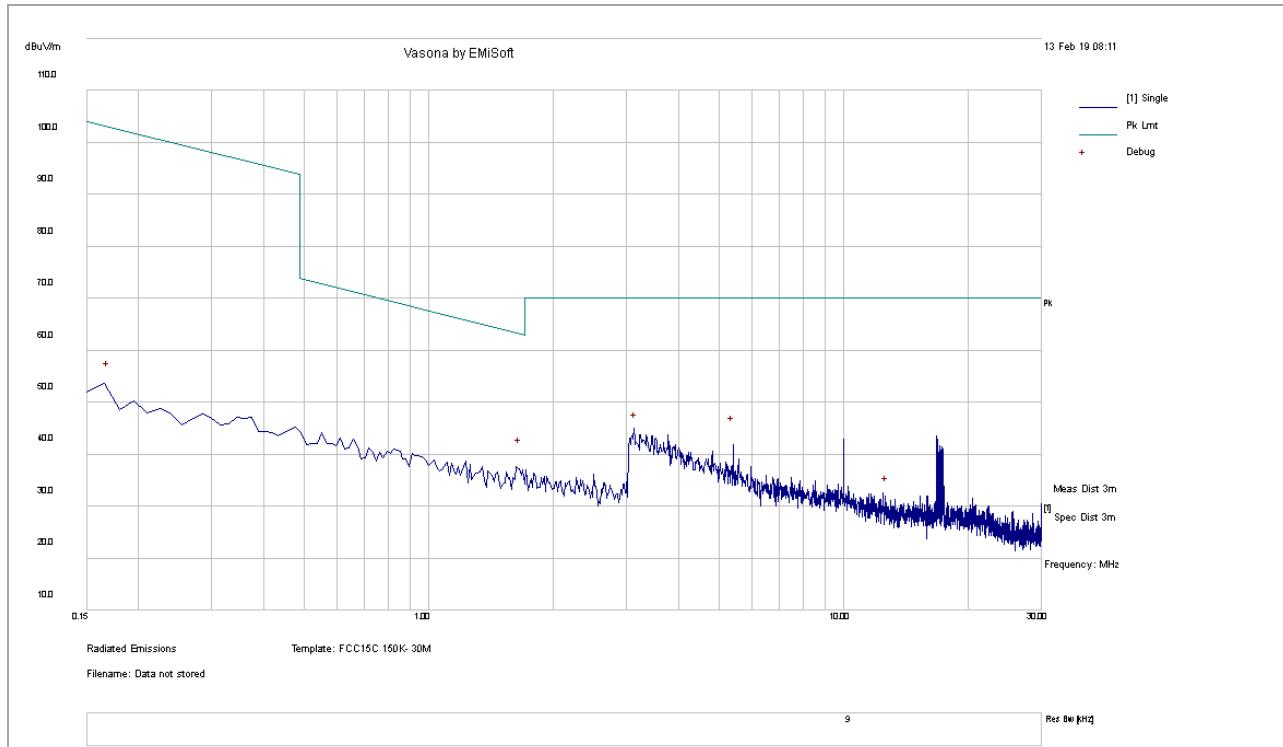
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150KHz – 30MHz test result

Test Standard:	15.209-247	Mode:	2440MHz
Frequency Range:	150KHz – 30MHz	Test Date:	11/14/2018
Antenna Type/Polarity:	Loop / 0 deg & 90 deg	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
0.169	40.38	0.59	11.00	51.97	PK	0	100	62	0.169	40.38
1.654	23.27	0.82	13.12	37.21	PK	0	100	88	1.654	23.27
5.406	27.31	0.94	13.21	41.46	PK	0	100	13	5.406	27.31
12.649	15.36	1.26	13.21	29.83	PK	0	100	102	12.649	15.36
3.156	27.99	0.88	13.08	41.96	PK	0	100	9	3.156	27.99

Note: 1) Both 0 deg and 90 deg setup of the loop antenna have been verified and the worst case result is presented here.

2) EUT was tested in 3 orientations.

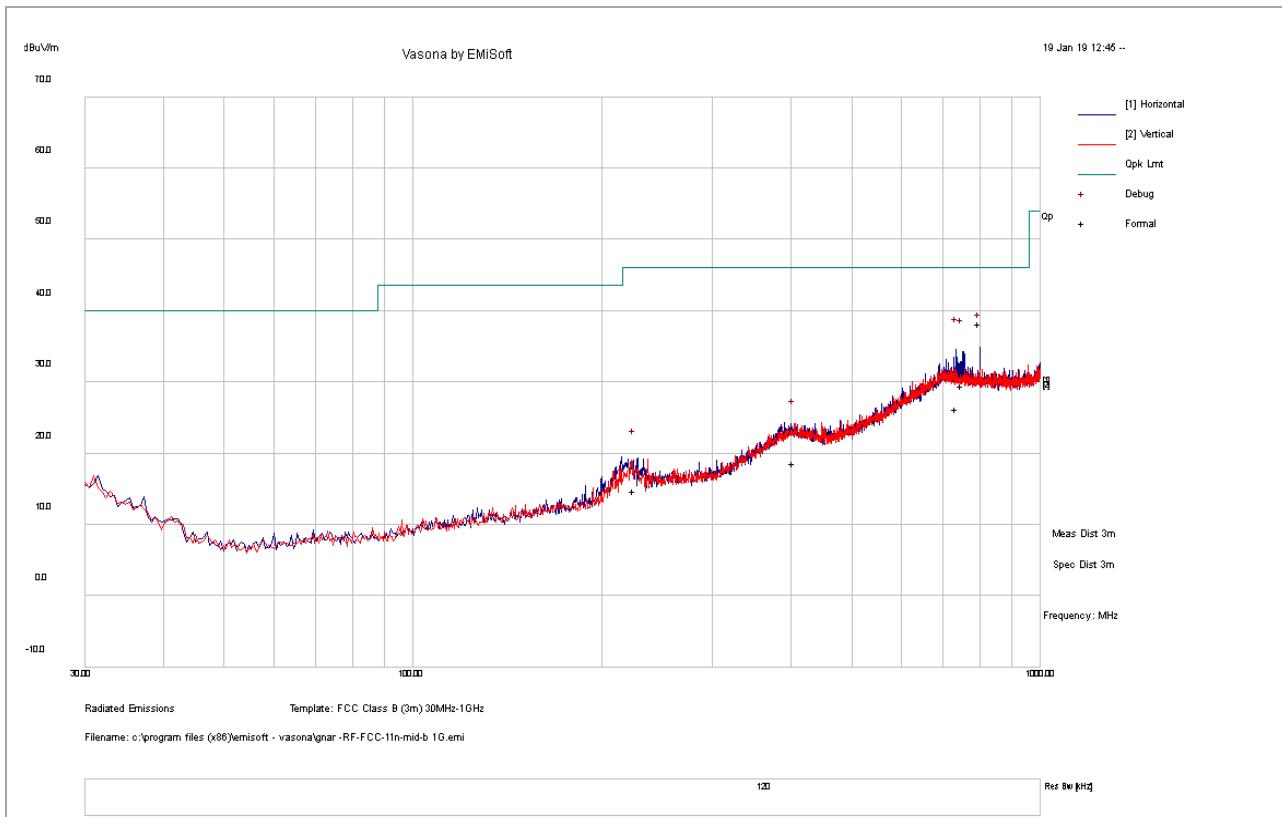


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Product:	GNARBOX 2.0 SSD
Model Number:	GBXV2
Family Model:	GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2



30-1000MHz test result

Test Standard:	15.209-247	Mode:	802.11n-2437MHz
Frequency Range:	30-1000MHz	Test Date:	01/19/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
800.00	37.69	7.24	-6.76	38.17	QP	H	104	344	46.00	-7.83
733.37	25.52	7.29	-6.55	26.26	QP	H	350	287	46.00	-19.74
750.05	28.82	7.28	-6.60	29.50	QP	H	120	164	46.00	-16.50
404.45	25.80	6.35	-13.49	18.67	QP	V	249	254	46.00	-27.33
224.59	30.33	5.00	-20.48	14.85	QP	H	363	111	46.00	-31.15

Note:

- 1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.



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Product: GNARBOX 2.0 SSD
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Family Model: GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2

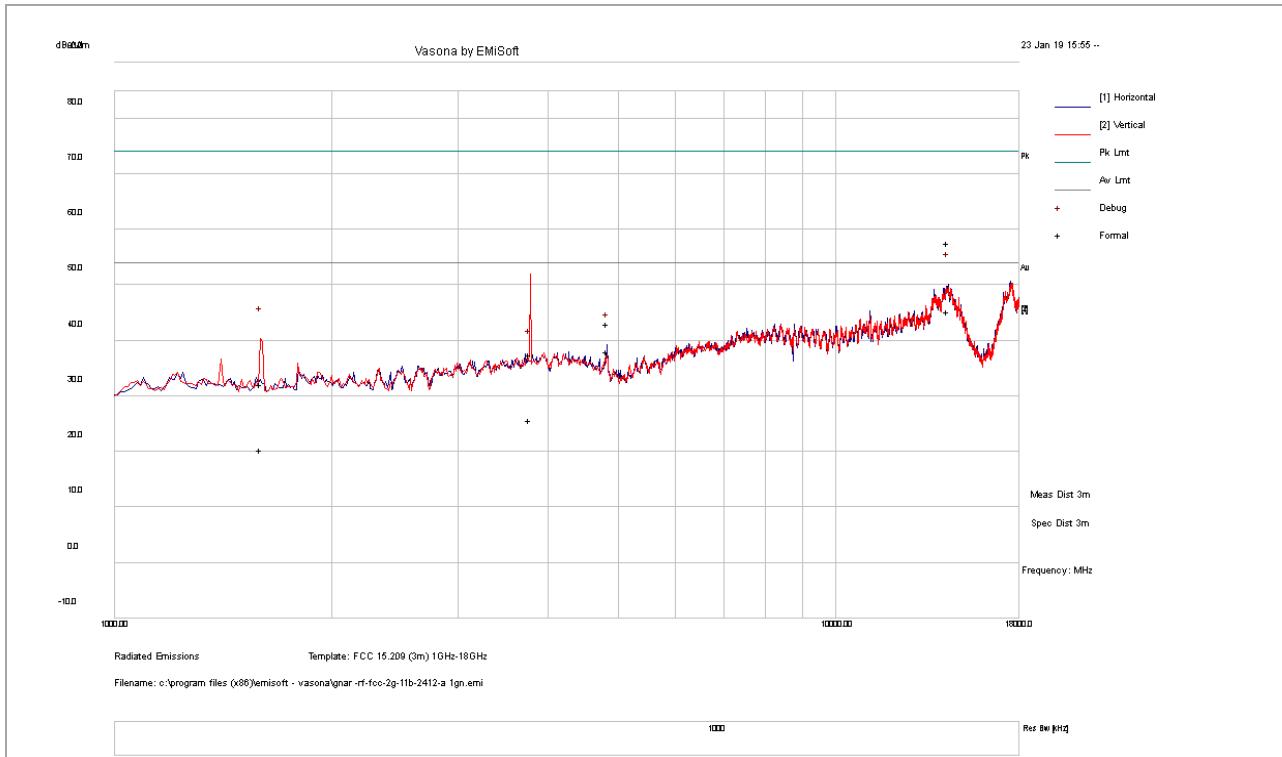


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11b-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1594.59	33.54	10.45	-11.80	32.20	PK	V	211	44	74.00	-41.80
3772.92	31.78	12.19	-6.50	37.47	PK	V	288	0	74.00	-36.53
4824.11	35.73	12.88	-5.52	43.09	PK	H	165	202	74.00	-30.91
14345.96	28.78	20.51	8.38	57.67	PK	H	224	219	74.00	-16.33
1594.59	21.64	10.45	-11.80	20.29	AV	V	211	44	54.00	-33.71
3772.92	19.95	12.19	-6.50	25.64	AV	V	288	0	54.00	-28.36
4824.11	30.77	12.88	-5.52	38.13	AV	H	165	202	54.00	-15.87
14345.96	16.39	20.51	8.38	45.28	AV	H	224	219	54.00	-8.72



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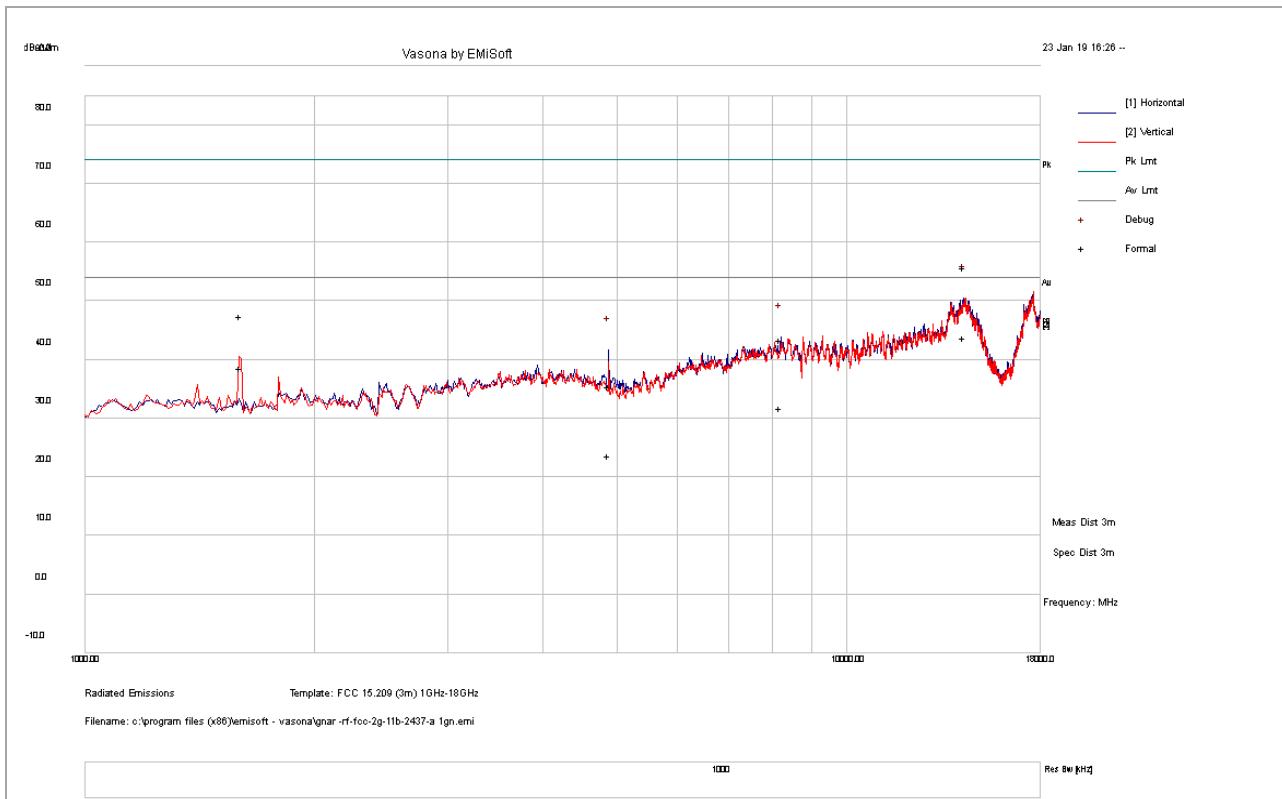
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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11b-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1600.00	48.85	10.45	-11.79	47.51	PK	V	125	158	74.00	-26.49
4877.17	28.16	12.89	-5.54	35.50	PK	H	147	360	74.00	-38.50
8205.32	27.98	15.82	-0.43	43.36	PK	H	189	35	74.00	-30.64
14279.85	27.19	20.35	8.18	55.71	PK	H	194	304	74.00	-18.29
1600.00	39.96	10.45	-11.79	38.62	AV	V	125	158	54.00	-15.38
4877.17	16.39	12.89	-5.54	23.74	AV	H	147	360	54.00	-30.26
8205.32	16.35	15.82	-0.43	31.73	AV	H	189	35	54.00	-22.27
14279.85	15.18	20.35	8.18	43.70	AV	H	194	304	54.00	-10.30



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Product: GNARBOX 2.0 SSD
Model Number: GBXV2
Family Model: GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2

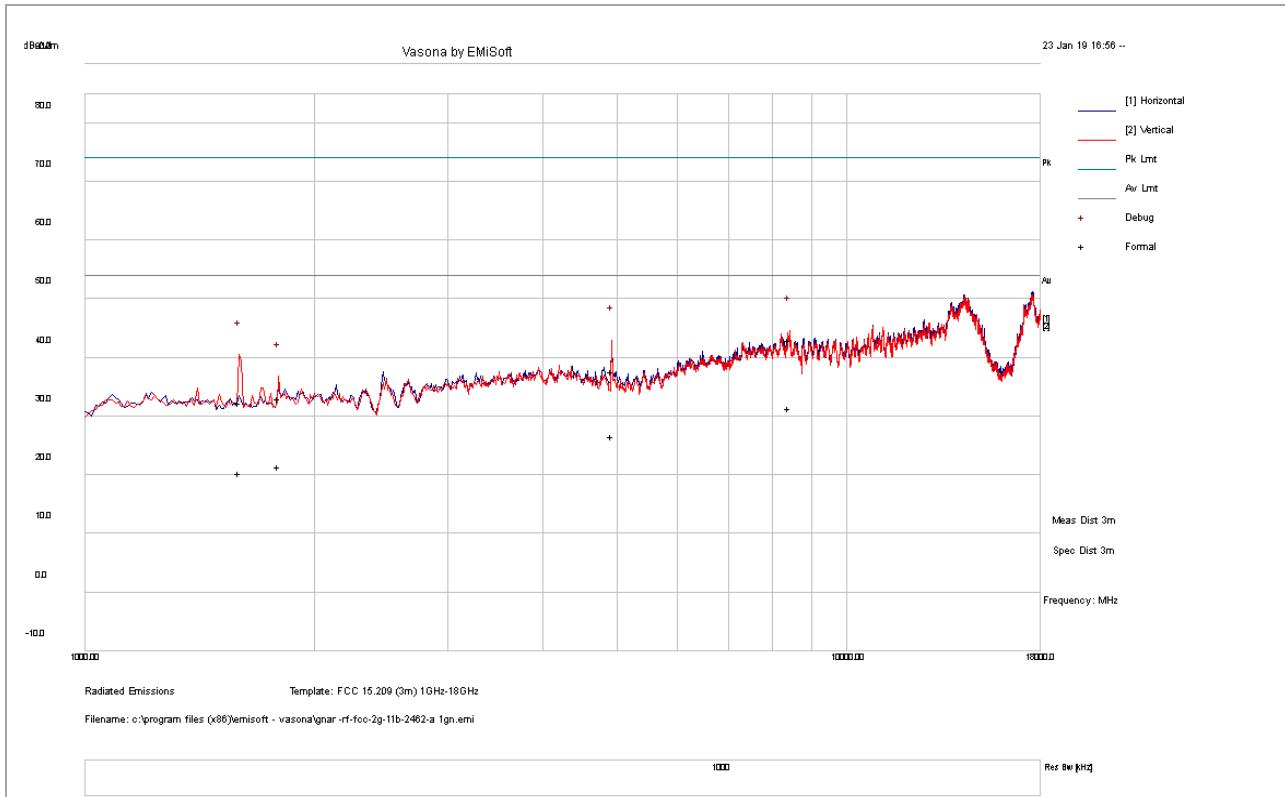


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Testing Cert #4848-01

1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11b-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1594.96	33.76	10.45	-11.80	32.42	PK	V	318	350	74.00	-41.58
1796.80	33.52	10.45	-10.94	33.03	PK	V	222	340	74.00	-40.97
4921.07	30.38	12.90	-5.64	37.63	PK	H	114	202	74.00	-36.37
8425.05	27.30	15.85	-0.06	43.10	PK	V	400	134	74.00	-30.90
1594.96	21.68	10.45	-11.80	20.34	AV	V	318	350	54.00	-33.66
1796.80	21.91	10.45	-10.94	21.42	AV	V	222	340	54.00	-32.58
4921.07	19.40	12.90	-5.64	26.65	AV	H	114	202	54.00	-27.35
8425.05	15.63	15.85	-0.06	31.43	AV	V	400	134	54.00	-22.57



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Family Model: GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2

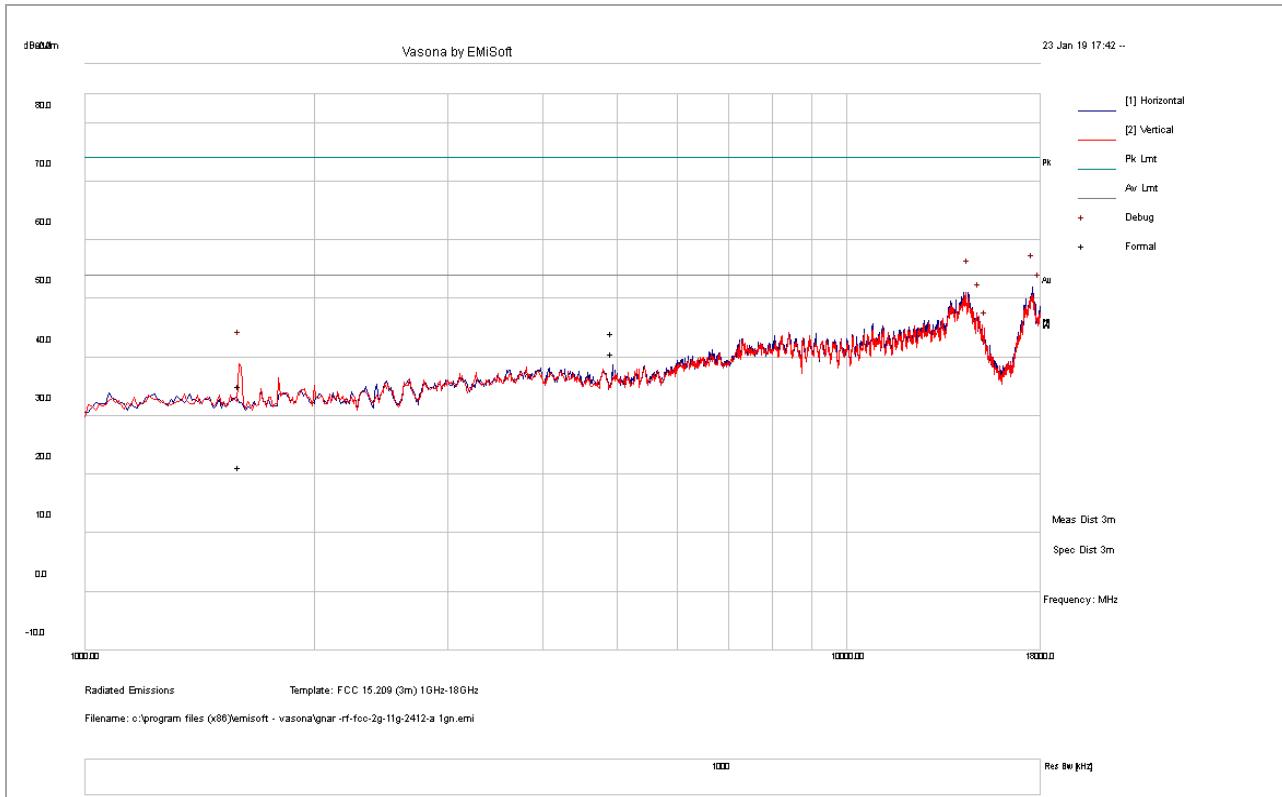


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Testing Cert #4848-01

1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11g-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1600.07	58.30	10.45	-11.79	56.96	PK	V	137	182	74.00	-17.04
1799.97	50.16	10.45	-10.90	49.71	PK	V	160	196	74.00	-24.29
4824.01	47.00	12.89	-5.54	54.35	PK	H	107	205	74.00	-19.65
1600.07	52.06	10.45	-11.79	50.72	AV	V	137	182	54.00	-3.28
1799.97	42.72	10.45	-10.90	42.27	AV	V	160	196	54.00	-11.73
4824.01	43.21	12.89	-5.54	50.56	AV	H	107	205	54.00	-3.44



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Model Number: GBXV2
Family Model: GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2

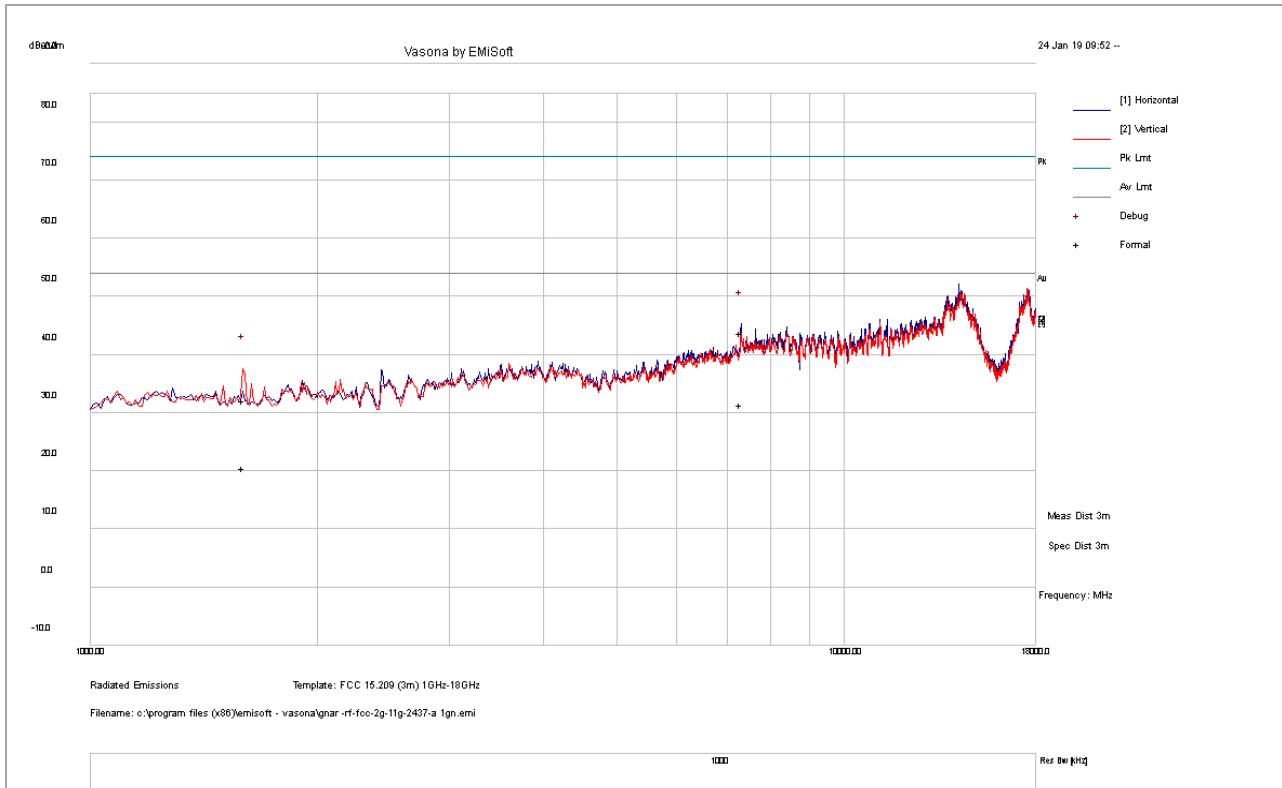


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11g-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1594.96	33.57	10.45	-11.80	32.22	PK	V	258	357	74.00	-41.78
7309.83	29.58	15.40	-1.20	43.78	PK	H	131	324	74.00	-30.22
1594.96	21.84	10.45	-11.80	20.49	AV	V	258	357	54.00	-33.51
7309.83	17.28	15.40	-1.20	31.48	AV	H	131	324	54.00	-22.52



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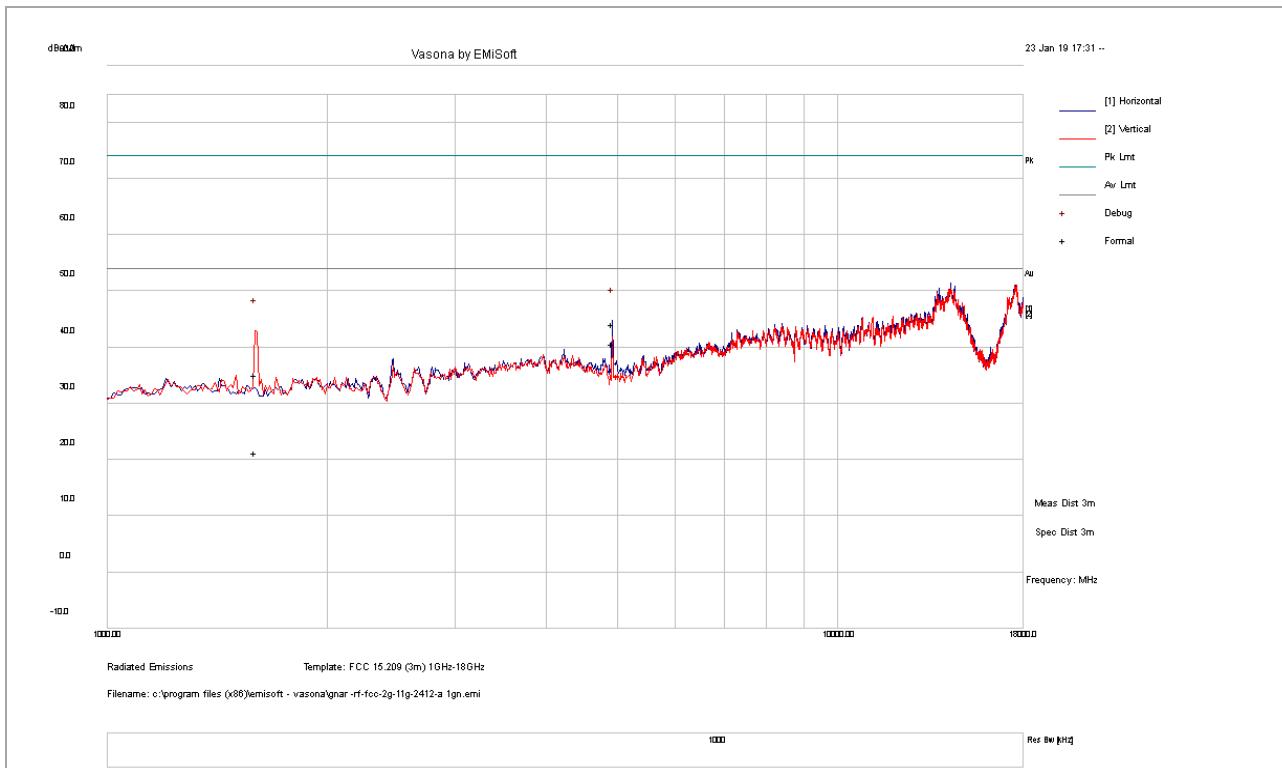


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11g-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1604.13	36.51	10.45	-11.80	35.16	PK	V	124	185	74.00	-38.84
4921.00	36.98	12.90	-5.65	44.22	PK	H	229	114	74.00	-29.78
1604.13	22.62	10.45	-11.80	21.27	AV	V	124	185	54.00	-32.73
4921.00	33.36	12.90	-5.65	40.60	AV	H	229	114	54.00	-13.40



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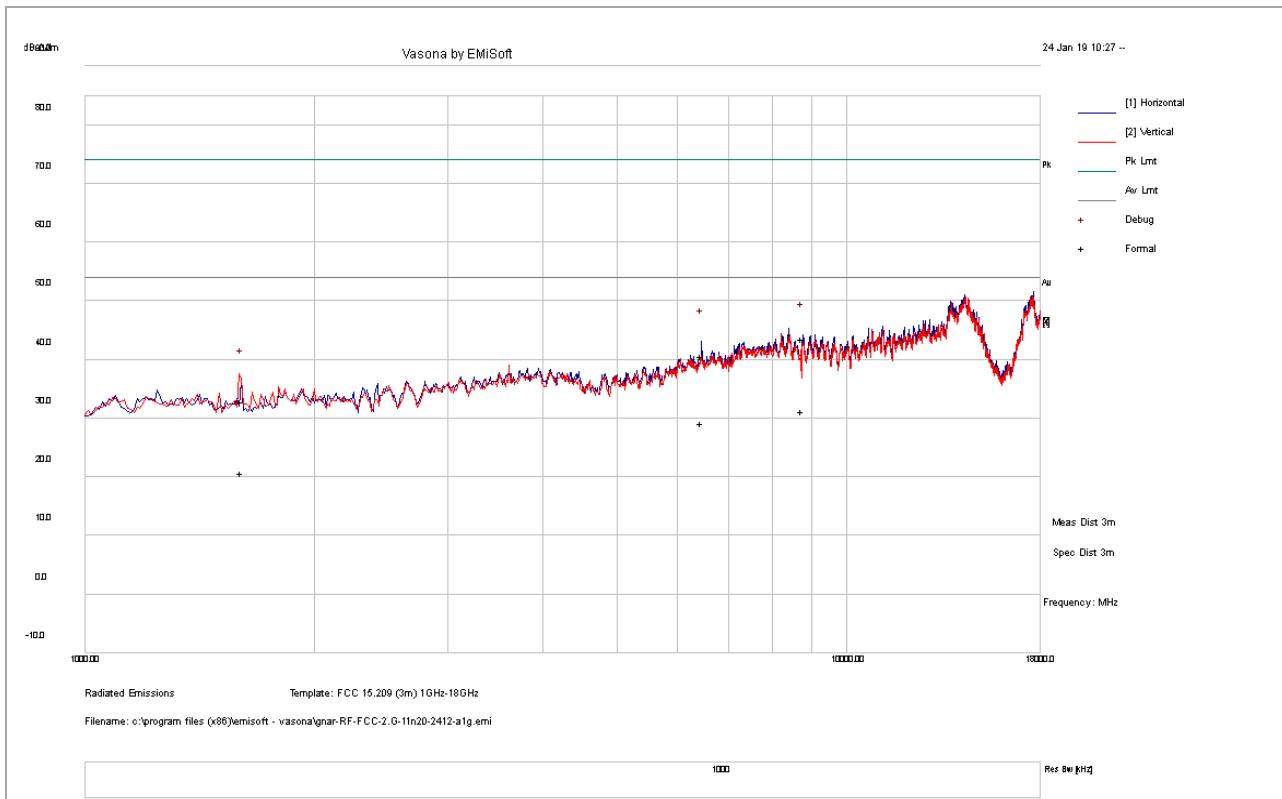


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11n-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1604.13	34.29	10.45	-11.81	32.94	PK	V	115	257	74.00	-41.06
6459.76	29.44	13.86	-2.68	40.62	PK	V	279	118	74.00	-33.38
8765.54	27.52	15.91	0.14	43.57	PK	H	356	37	74.00	-30.43
1604.13	22.09	10.45	-11.81	20.74	AV	V	115	257	54.00	-33.26
6459.76	18.00	13.86	-2.68	29.18	AV	V	279	118	54.00	-24.82
8765.54	15.15	15.91	0.14	31.20	AV	H	356	37	54.00	-22.80



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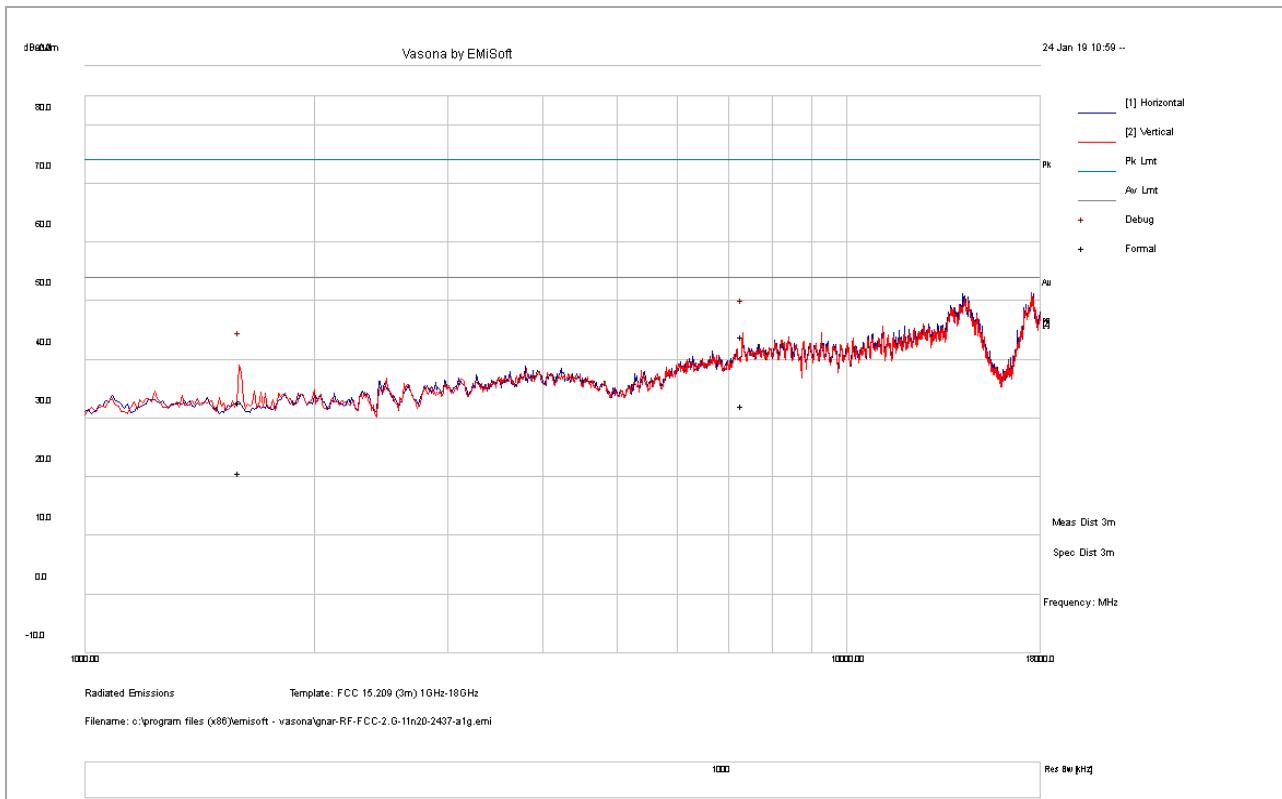


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11n-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1593.60	34.15	10.45	-11.80	32.80	PK	V	362	142	74.00	-41.20
7311.03	29.72	15.40	-1.20	43.93	PK	V	248	212	74.00	-30.07
1593.60	22.08	10.45	-11.80	20.73	AV	V	362	142	54.00	-33.27
7311.03	17.91	15.40	-1.20	32.12	AV	V	248	212	54.00	-21.88



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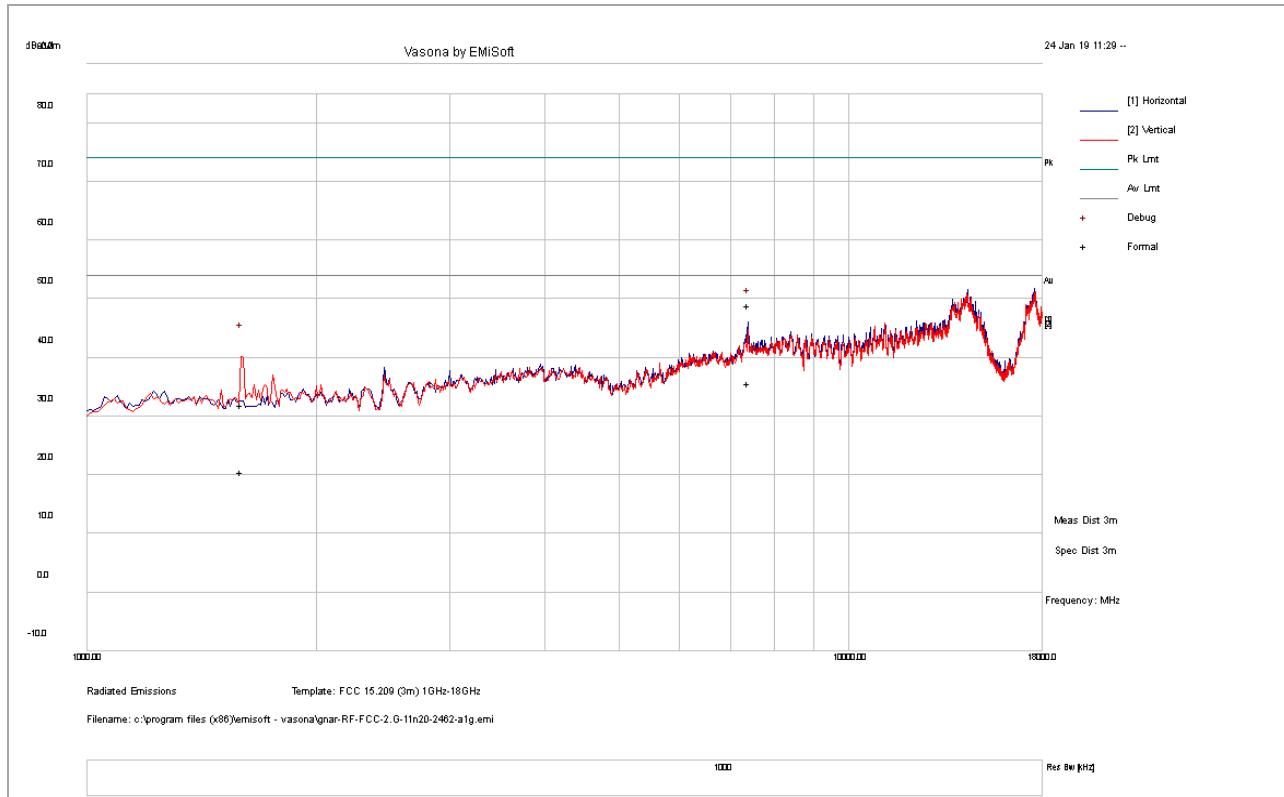


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11n-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1594.89	33.34	10.45	-11.80	32.00	PK	V	341	238	74.00	-42.01
7384.76	34.56	15.56	-1.12	48.99	PK	H	205	166	74.00	-25.01
1594.89	21.95	10.45	-11.80	20.60	AV	V	341	238	54.00	-33.40
7384.76	21.21	15.56	-1.12	35.64	AV	H	205	166	54.00	-18.36



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Family Model: GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2

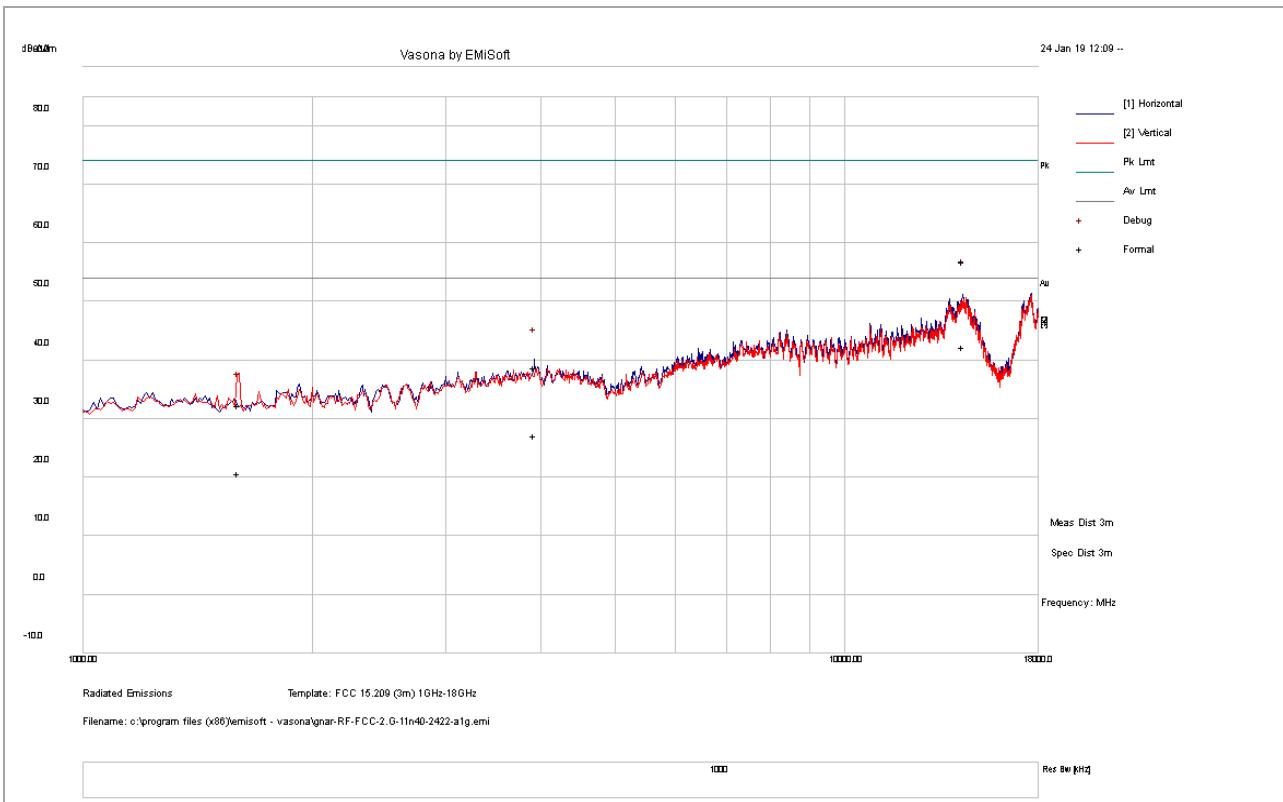


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11n40-2422MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1601.11	33.64	10.45	-11.80	32.29	PK	V	334	282	74.00	-41.71
3922.89	32.58	12.34	-6.11	38.80	PK	V	304	266	74.00	-35.20
14323.79	28.09	20.46	8.31	56.86	PK	H	374	125	74.00	-17.14
1601.11	21.99	10.45	-11.80	20.65	AV	V	334	282	54.00	-33.35
3922.89	20.86	12.34	-6.11	27.09	AV	V	304	266	54.00	-26.91
14323.79	13.51	20.46	8.31	42.28	AV	H	374	125	54.00	-11.72



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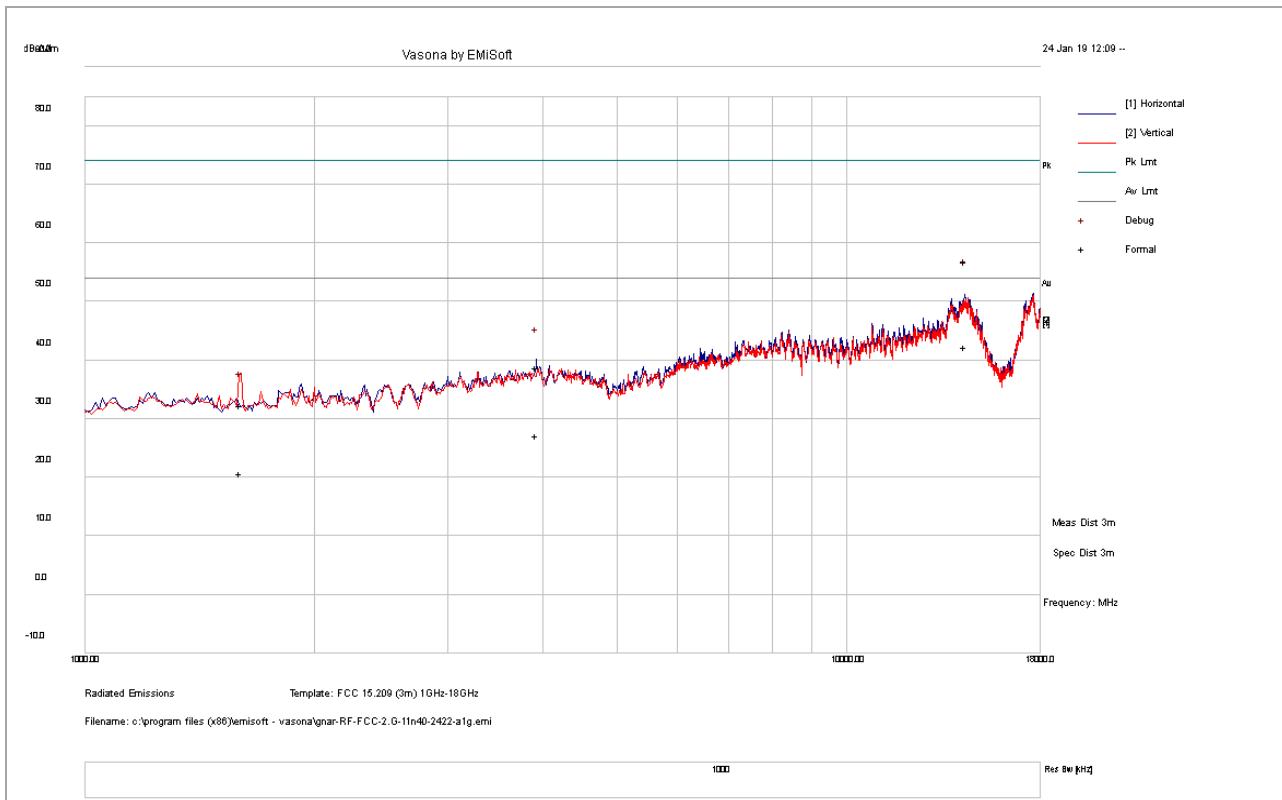


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11n40-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1595.67	33.97	10.45	-11.80	32.62	PK	V	297	276	74.00	-41.38
3928.04	32.78	12.34	-6.12	39.00	PK	V	281	45	74.00	-35.00
8383.93	28.76	15.85	-0.10	44.51	PK	H	352	231	74.00	-29.49
1595.67	21.91	10.45	-11.80	20.56	AV	V	297	276	54.00	-33.44
3928.04	20.84	12.34	-6.12	27.07	AV	V	281	45	54.00	-26.94
8383.93	16.86	15.85	-0.10	32.61	AV	H	352	231	54.00	-21.39



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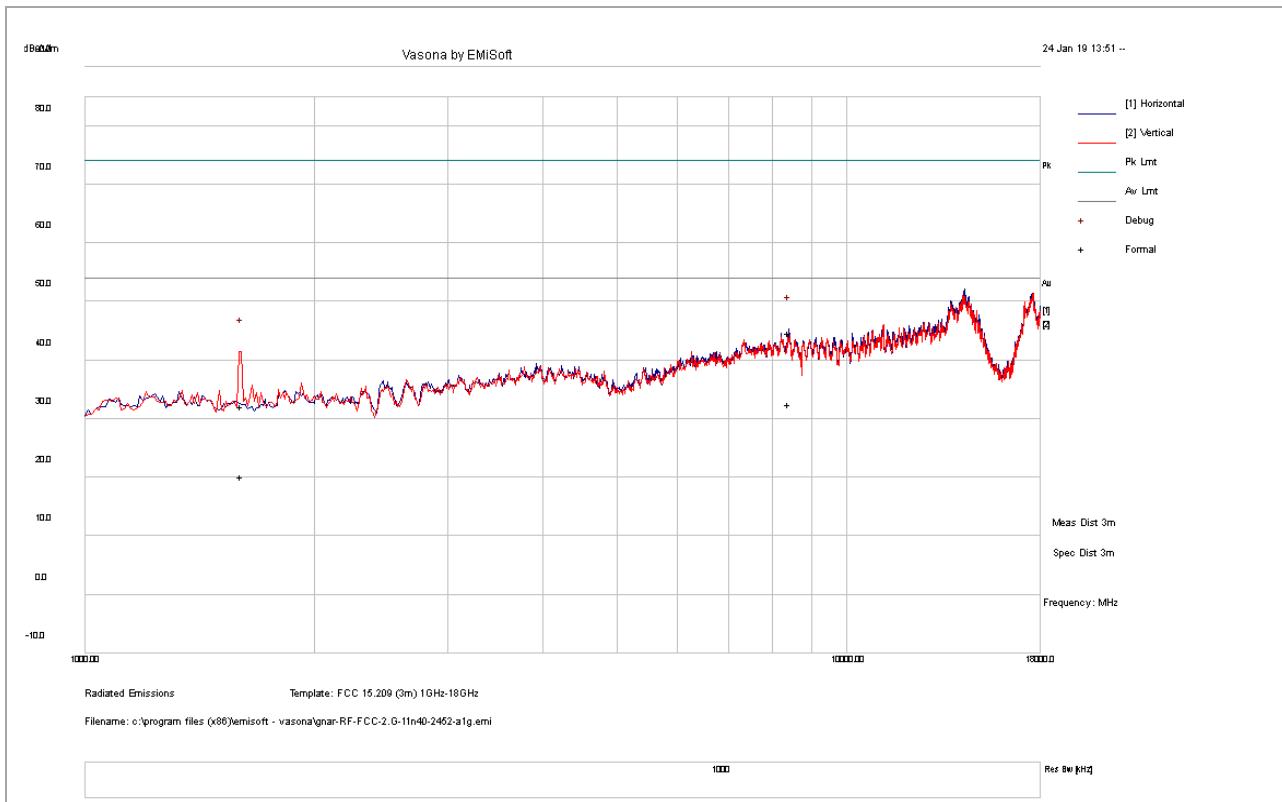


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1GHz – 18GHz test result

Test Standard:	15.209-247	Mode:	11n40-2452MHz
Frequency Range:	1GHz-18GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table cm	Limit dBuV/m	Margin dB
1606.37	33.60	10.45	-11.82	32.23	PK	V	164	70	74.00	-41.77
8414.62	28.99	15.85	-0.07	44.77	PK	H	351	0	74.00	-29.23
1606.37	21.57	10.45	-11.82	20.20	AV	V	164	70	54.00	-33.80
8414.62	16.66	15.85	-0.07	32.44	AV	H	351	0	54.00	-21.56



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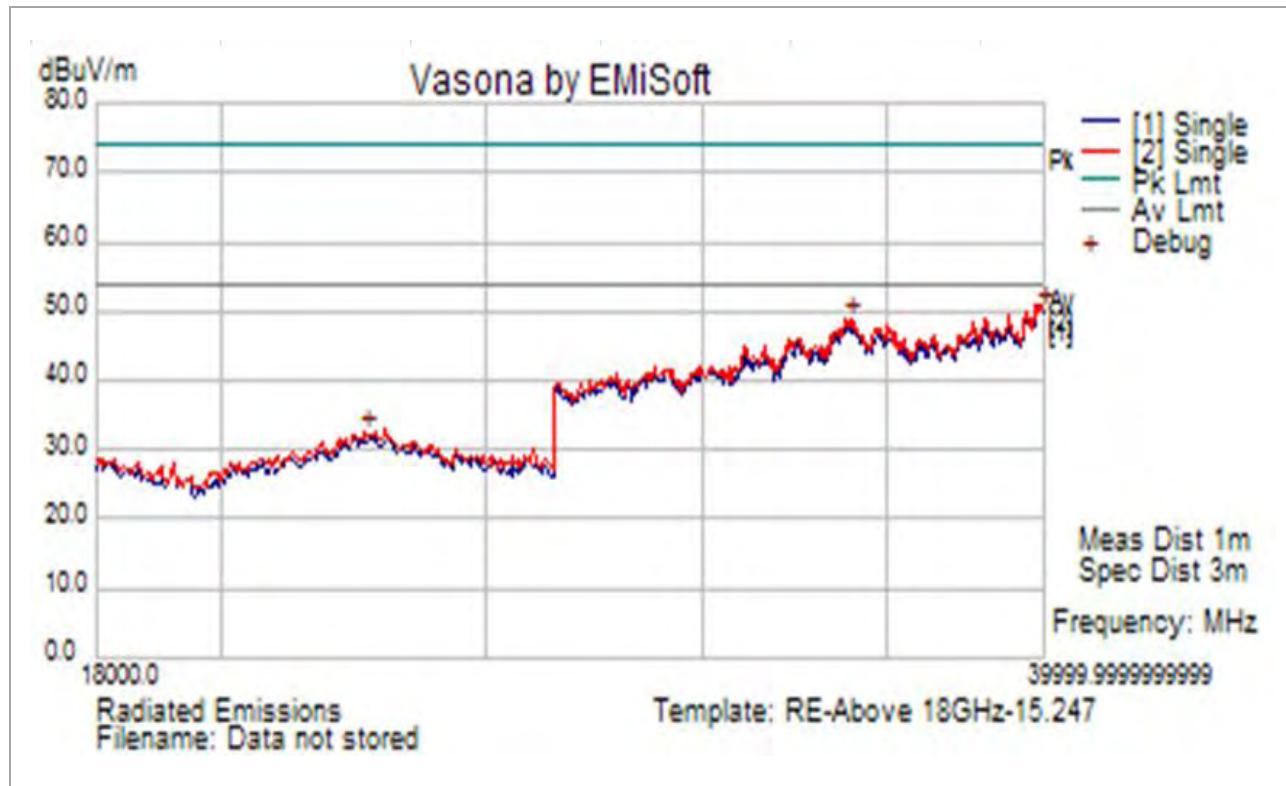


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18GHz – 40GHz test result

Test Standard:	15.209-247	Mode:	11g-2437MHz
Frequency Range:	18GHz-40GHz	Test Date:	01/23/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Note: no substantial emission is found other than the noise floor. Different modes have been verified and the worse case one is presented here.



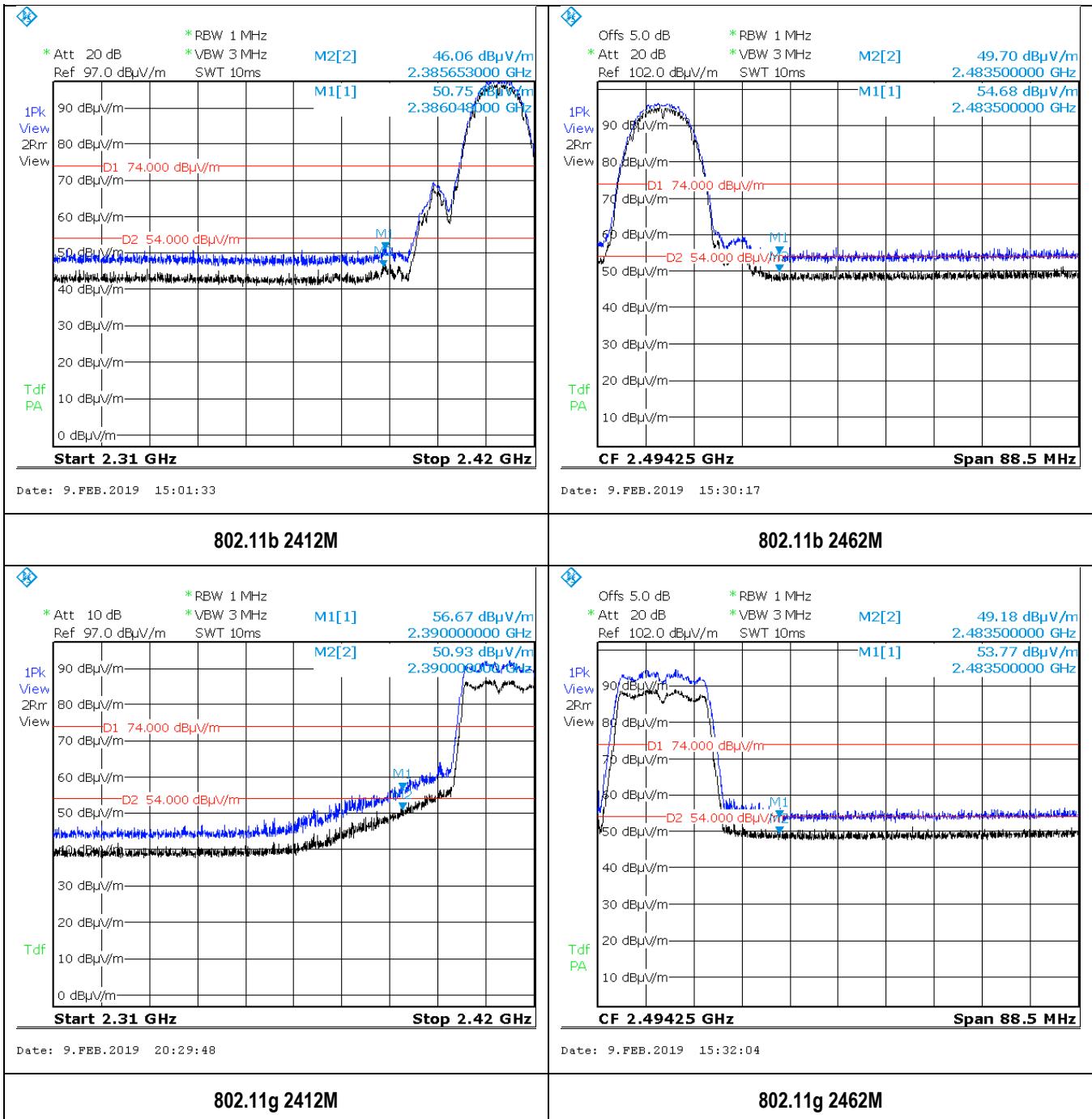
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Restricted Band Measurement Plots:

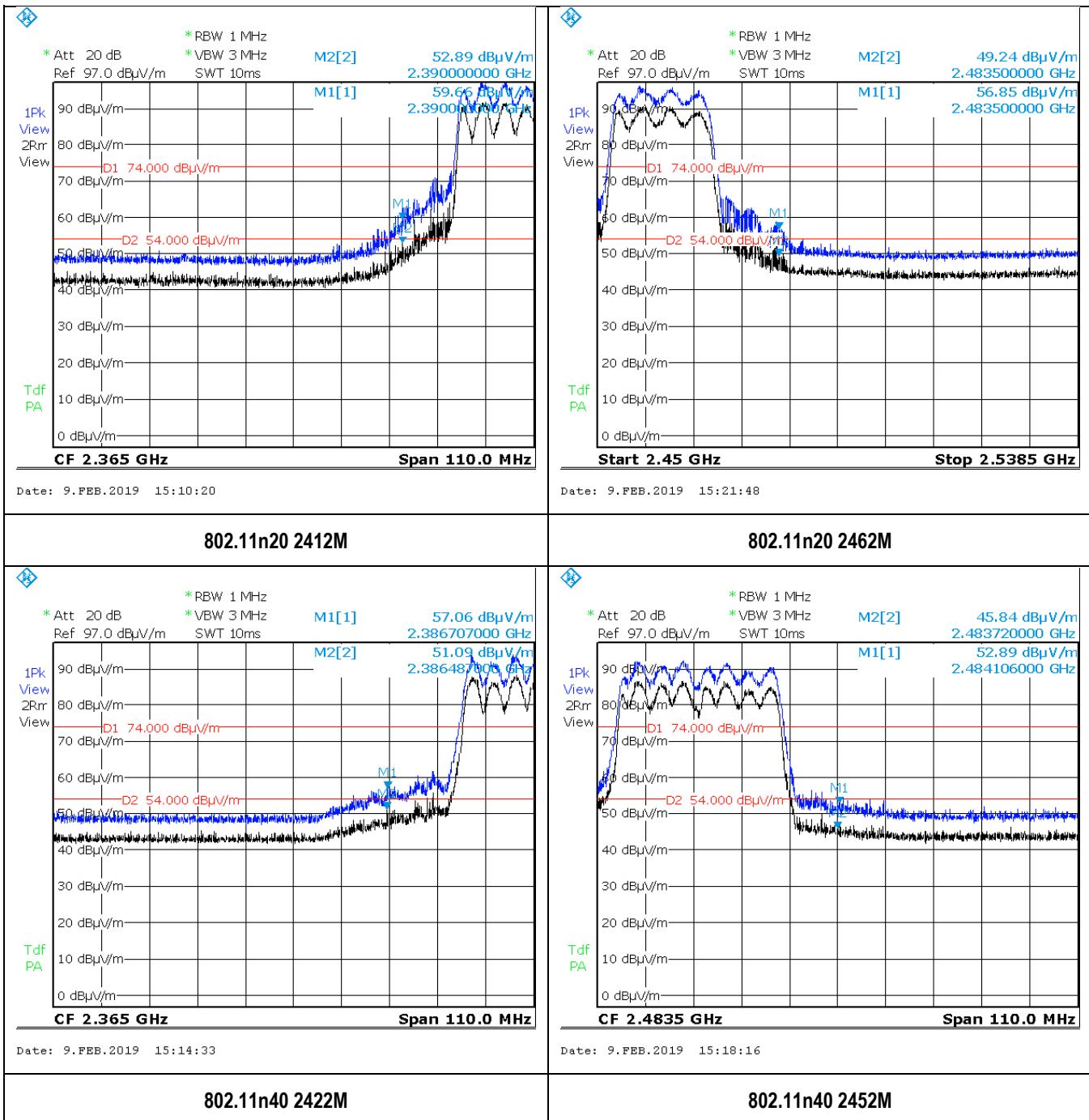


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Product: GNARBOX 2.0 SSD
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8.7 Conducted Emissions

8.7.1 Requirement

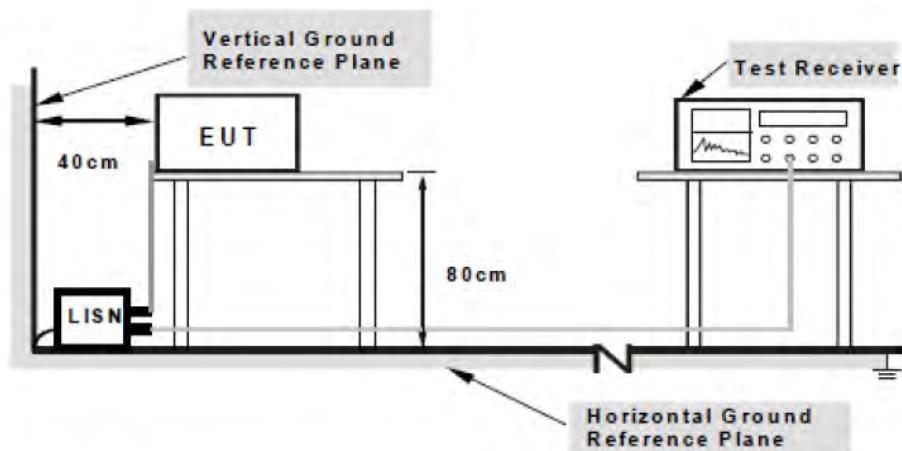
Per § 15.207 (a), an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limits for Conducted Emissions at the Mains Ports

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
Class B devices	0.15 – 0.5	66 – 56	56 – 46
	0.5 – 5	56	46
	5 - 30	60	50

NOTE 1 The lower limit shall apply at the transition frequencies.

8.7.2 Test setup



Note:

1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

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Family Model:	GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2



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8.7.3 Test Procedure

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a $50\Omega/50\mu\text{H}$ EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment was powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, were then selected.
8. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made
9. All possible modes of operation were investigated. Only the worst case emissions were measured and reported. All other emissions were relatively insignificant.



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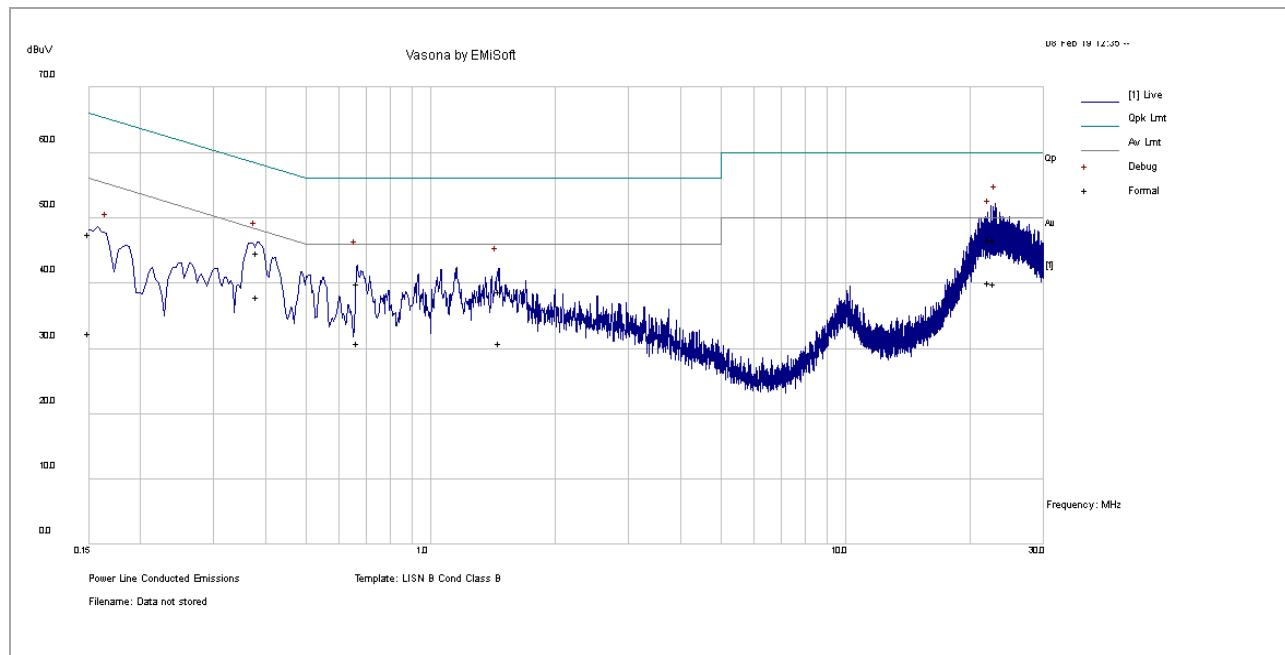


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8.7.4 Test Result

Live Line

Test Standard:	47CFR 15.207	Mode:	Line
Frequency Range:	0.15-30MHz	Test Date:	02/08/2019
Antenna Type/Polarity:	N/A	Test Personnel:	Sherwin Lee
Remark:	120VAC, 60Hz	Test Result:	Pass



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV/m)	Meas. Type	Line	Limit (dBuV/m)	Margin (dB)	Pass /Fail
0.15	36.89	10.32	0.24	47.45	QP	Live	66.00	-18.55	Pass
0.38	33.98	10.37	0.25	44.59	QP	Live	58.24	-13.64	Pass
0.67	29.21	10.45	0.30	39.96	QP	Live	56.00	-16.04	Pass
1.46	27.75	10.57	0.49	38.81	QP	Live	56.00	-17.19	Pass
22.12	16.10	11.17	19.34	46.60	QP	Live	60.00	-13.40	Pass
22.90	16.37	11.20	19.15	46.72	QP	Live	60.00	-13.28	Pass
0.15	21.71	10.32	0.24	32.26	AV	Live	56	-23.74	Pass
0.38	27.35	10.37	0.25	37.97	AV	Live	48.24	-10.27	Pass
0.67	20.09	10.45	0.30	30.84	AV	Live	46.00	-15.16	Pass
1.46	19.79	10.57	0.49	30.85	AV	Live	46.00	-15.15	Pass
22.12	9.57	11.17	19.34	40.08	AV	Live	50.00	-9.92	Pass
22.90	9.62	11.20	19.15	39.97	AV	Live	50.00	-10.03	Pass



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Radio Frequency
Product Certification
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Report Number:	GBX-19011401-LC-RF-FCC-DTS Rev1.0
Product:	GNARBOX 2.0 SSD
Model Number:	GBXV2
Family Model:	GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2

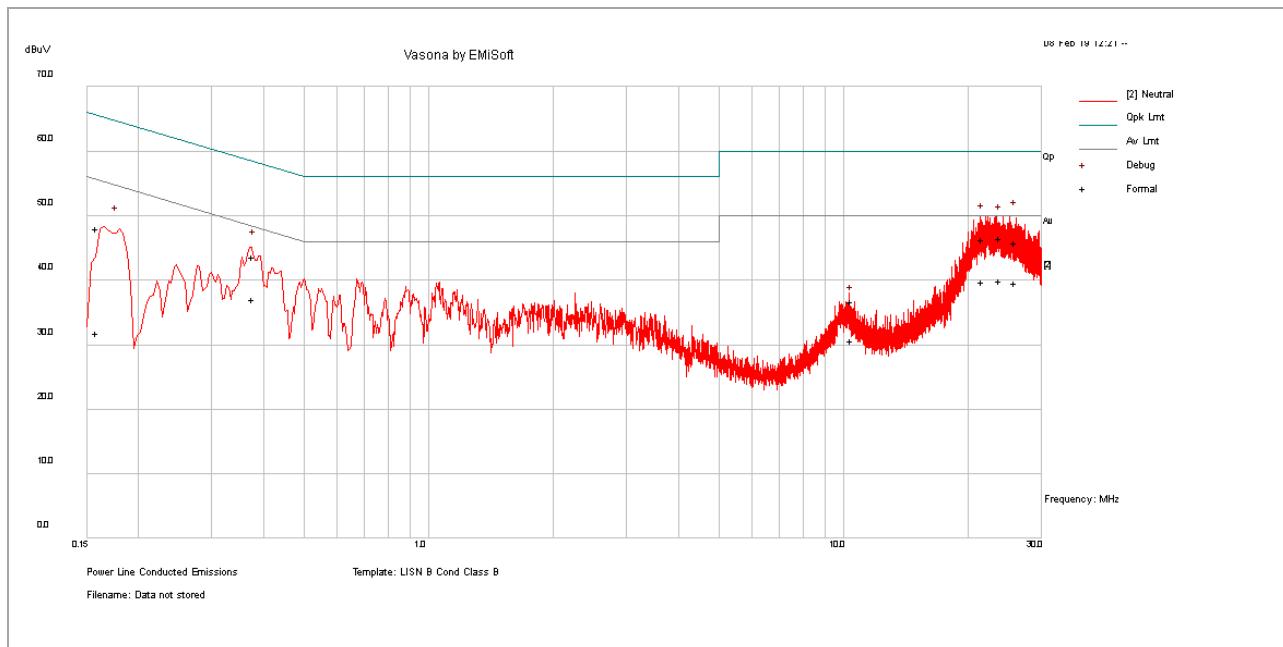


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Testing Cert #4848-01

Neutral Line

Test Standard:	47CFR 15.207	Mode:	Neutral
Frequency Range:	0.15-30MHz	Test Date:	02/08/2019
Antenna Type/Polarity:	N/A	Test Personnel:	Sherwin Lee
Remark:	120VAC, 60Hz	Test Result:	Pass



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV/m)	Meas. Type	Line	Limit (dBuV/m)	Margin (dB)	Pass /Fail
0.16	37.46	10.32	0.24	48.02	QP	Neutral	65.51	-17.49	Pass
0.38	33.07	10.37	0.25	43.69	QP	Neutral	58.32	-14.63	Pass
10.47	17.62	10.78	8.40	36.80	QP	Neutral	60.00	-23.20	Pass
21.59	16.20	11.14	19.03	46.38	QP	Neutral	60.00	-13.62	Pass
23.77	16.20	11.23	19.05	46.48	QP	Neutral	60.00	-13.52	Pass
25.87	15.80	11.30	18.76	45.87	QP	Neutral	60.00	-14.13	Pass
0.16	21.22	10.32	0.24	31.78	AV	Neutral	55.51	-23.73	Pass
0.38	26.41	10.37	0.25	37.02	AV	Neutral	48.32	-11.30	Pass
10.47	11.54	10.78	8.40	30.71	AV	Neutral	50.00	-19.29	Pass
21.59	9.54	11.14	19.03	39.72	AV	Neutral	50.00	-10.28	Pass
23.77	9.66	11.23	19.05	39.95	AV	Neutral	50.00	-10.05	Pass
25.87	9.48	11.30	18.76	39.55	AV	Neutral	50.00	-10.45	Pass



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Report Number: GBX-19011401-LC-RF-FCC-DTS Rev1.0
Product: GNARBOX 2.0 SSD
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Family Model: GNAR128V2, GNAR256V2, GNAR512V2, GNAR1024V2, GNAR2048V2



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9 Test instrument list

Equipment	Manufacturer	Model	Serial Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	5/11/2018	5/11/2019
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	5/4/2018	5/4/2019
EMC Test Receiver	R&S	ESL6	100230	5/7/2018	5/7/2019
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/2018	5/4/2019
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2018	11/15/2019
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/2/2018	5/2/2019
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	5/2/2018	5/2/2019
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	5/10/2018	5/10/2019
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/10/2018	5/10/2019
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/9/2018	5/9/2019
RF Attenuator	Pasternack	PE7005-3	VL061	5/10/2018	5/10/2019
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	5/10/2018	5/10/2019
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/9/2018	5/9/2019
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	5/10/2018	5/10/2019
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	5/10/2018	5/10/2019
RE test cable (>18GHz)	Sucoflex	104	344903/4	5/10/2018	5/10/2019
Pulse limiter	Com-Power	LIT-930A	531727	5/15/2018	5/15/2019
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	5/10/2018	5/10/2019
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	5/9/2018	5/9/2019



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