FCC/ISED RF TEST REPORT

Test Report Number……	**MTK-19111321-LC-FCC-IC-UNII**
Applicant……	**Mikrotikls SIA**
Applicant Address……	**Brivibas gatve 214i, Riga, LV-1039 LATVIA**
Product Name……	wAP R ac
Model Number……	RBwAPGR-5HacD2HnD-US
Family Product/Model……	N/A
FCC ID……	TV7WAPGR5AC2D
ISED ID……	7442A-WAPGR5AC2D
Date of EUT received……	12/04/2019
Date of Test……	12/04/2019 – 12/31/2019
Report Issue Date……	12/31/2019
Test Standards……	**47CFR Part 15.407** **RSS-247 Issue 2.0: Feb 2017**
Test Result……	Pass

Issued By:

Vista Laboratories

1261 Puerta Del Sol, San Clemente, CA 92673 USA

www.vista-compliance.com

Tested by:	**Approved By:**
Bruce Li	
Bruce Li/Test Engineer	**David Zhang/Technical Manager**

Laboratory Introduction

Vista Labs is an A2LA accredited 17025 compliant regulatory compliance testing laboratories (Cert. number: 4848-01) strategically located in Orange County, providing services in the electrical and telecommunication industries. Vista labs is also recognized testing facility for Australia (ACMA), Chinese Taipei (BSMI), Chinese Taipei (NCC), Hong Kong (OFCA), Israel (MOC), Korea (RRA), Singapore (IMDA), Vietnam (MIC), etc.

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VISTA LABORATORIES, INC.

San Clemente, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 21st day of June 2018.

President and CEO
For the Accreditation Council
Certificate Number 4848.01
Valid to July 31, 2020

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

17025 Product Testing Accreditation Certificate

Accredited Product Certification Body

A2LA has accredited

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San Clemente, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This product certification body also meets the A2LA R308 – Specific Requirements – ISO-IEC 17065 – Telecommunication Certification Body Accreditation Program and R322 – Specific Requirements – Notified Body Accreditation Requirements. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 1st day of October 2018.

President and CEO
For the Accreditation Council
Certificate Number 4848.02
Valid to July 31, 2020

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

17065 Product Certification Accreditation Certificate

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REVISION HISTORY

Revision	Issue Date	Description	Note
Original	12/31/2019	Original release	N/A

1 General Information

1.1 Applicant

Applicant:	Mikrotikls SIA
Applicant address:	Brivibas gatve 214i, Riga, LV-1039 LATVIA
Manufacturer:	Mikrotikls SIA
Manufacturer Address:	Brivibas gatve 214i, Riga, LV-1039 LATVIA

1.2 Product information

Product Name	wAP R ac
Model Number	RBwAPGR-5HacD2HnD-US
Family Model Number	N/A
HVIN	RBwAPGR-5HacD2HnD-US
FVIN	V6.45.7
Serial Number	AEEA0A452D59/928/r2
Frequency Band	**For United states:** 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 **For Canada (5600-5650MHz blocked):** 802.11b/g/n-20MHz: 2412-2462MHz 802.11n-40MHz: 2422-2452MHz 802.11a/n-20MHz: 5180-5320MHz, 5500-5580MHz, 5660-5720MHz, 5725-5825MHz 802.11n-40MHz: 5190-5310MHz, 5510-5550MHz, 5630-5710MHz, 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	2 x Integral antenna, 2.5 dBi gain Directional Gain: WiFi1 & WiFi2 Antenna: 5.5 dBi
Clock Frequencies	N/A
Port/Connectors	DC In, PoE, Ethernet
Input Power	DC 10-57V
Power Adapter Manu/Model	FullPower / SAW30-240-0800U
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	N/A
Additional Info	EUT is DFS master device.

1.3 Test standard and method

Test standard	RSS-247 Issue 2.0: Feb 2017
Test method	ANSI C63.10: 2013 789033 D02 General UNII Test Procedures New Rules v02r01 RSS-Gen Issue 5: Mar 2019

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.

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	Bruce Li	23.5°C / 58.2%/996 mbar	12/04/2019 – 12/31/2019
Radiated	Bruce Li	23.5°C / 58.2%/996 mbar	12/04/2019 – 12/31/2019

3 Modification of EUT

The EUT is a normal operational sample loaded with test firmware to set the EUT into continuous transmission mode under different modulation and data rate.

4 Test configuration and operation

4.1 EUT test configuration

EUT is powered by external DC power supply for testing purpose. EUT's RF antenna port is connected to spectrum analyzer through RF test cable for measurement. The test software is used to set EUT to different transmission mode in terms of radio mode (11a/n/ac), test channel, data rate, etc.

4.2 EUT test channel

Radio	Channel	Radio	Channel
802.11-a	5500	802.11-a	5720
802.11-a	5580	802.11-n-20	5720
802.11-a	5700	802.11-n-40	5710
802.11-n-20	5500	802.11-ac-80	5690
802.11-n-20	5580		
802.11-n-20	5700		
802.11-n-40	5510		
802.11-n-40	5550		
802.11-n-40	5670		
802.11-ac-80	5530		

4.3 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
1	Notebook	W540	427638U	Lenovo	DFS client
2	AC/DC Adapter	SAW30-240-0800U	N/A	FullPower	-
3	AC/DC Adapter	HA45NM140	00285K	DELL	-
4	Laptop	Inspiron 15	245S2F2	DELL	-

4.4 EUT setup diagram

4.5 EUT operation

The test software is used to set EUT to different transmission mode in terms of radio mode (11a/n/ac), test channel, data rate, etc.

4.6 Test software

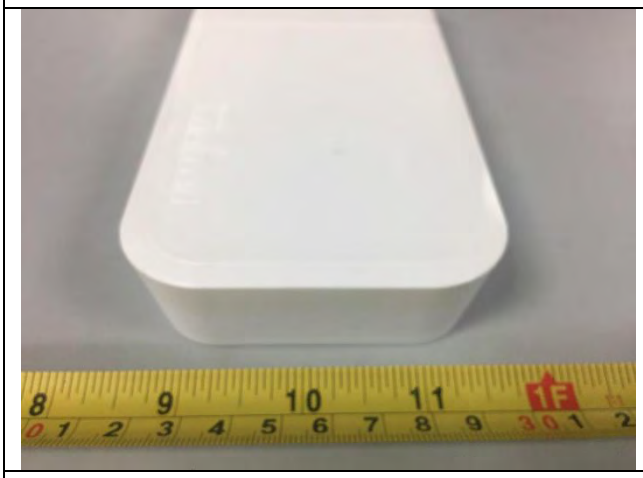
Index	Description	Remark
1	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing

5 EUT and test setup pictures

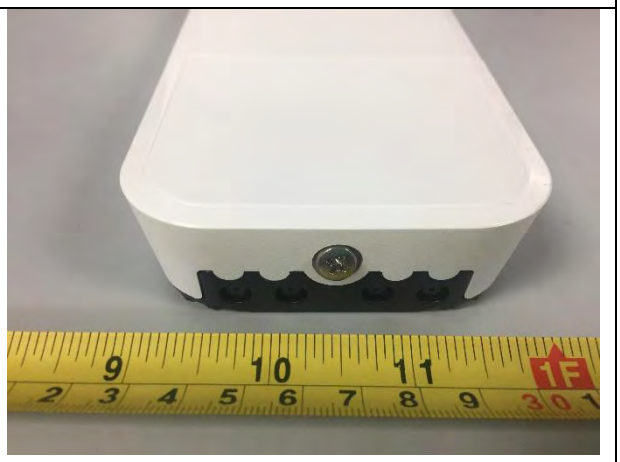
5.1 EUT pictures

EUT Top View

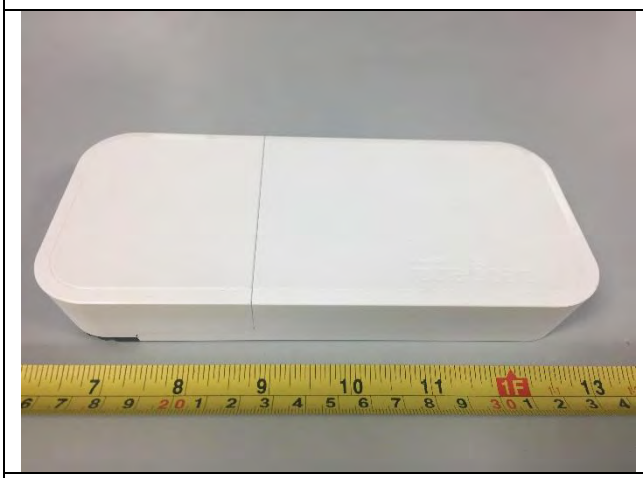
EUT Bottom View



EUT Front View



EUT Rear View



EUT Left View

EUT Right View

6 Test Summary

FCC Rules	ISED Rules	Test Item	Section	Verdict
§15.203	-	Antenna Requirement	8.1	Pass
§15.407(a)	-	26 dB Bandwidth	8.2	Pass
-	RSS-Gen §6.7	99% Occupied Bandwidth	8.3	Pass
§15.407(a)	RSS-247 §6.2	Conducted Maximum Output Power & E.I.R.P	8.4	Pass
§15.407(a)	RSS-247 §6.2	Power Spectral Density& E.I.R.Psd	8.5	Pass
§15.407(c)	RSS-247 §6.4 (a)	Automatically Discontinue Transmission	8.6	Pass
§15.205, §15.209, §15.407(b)	RSS-247 §6.2	Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	8.7	Pass
§15.207 (a)	RSS-Gen §8.8	AC Power Line Conducted Emissions	8.8	Pass
-	RSS-Gen §7.3	Receiver Spurious Emission	N/A	N/A 1)

Note

1) Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.

7 Uncertainly 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

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 uses internal PIFA antenna with U. FL connector glued onto PCB. No standard RF connector or coupling is used.

Conclusion:

EUT complies with antenna requirement in § 15.203.

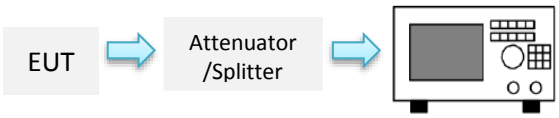
8.2 26 d Bandwidth

8.2.1 Requirement

§ 15.407 (a)

This section is for reporting purpose only. There are no restriction limits for bandwidth.

8.2.2 Test setup



8.2.3 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01, Section C) Emission bandwidth.

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 26 dB, if the functionality described above (i.e., RBW , VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function.

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the video bandwidth (VBW) ≥ 3 x 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.

8.2.4 Test Result

For U-NII-2A band

Mode/ Bandwidth	Channel	Frequency (MHz)	Data rate	Measured 26 dB Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11a	52	5260	6Mbps	24480	N/A	N/A
11a	60	5300	6Mbps	25650	N/A	N/A
11a	64	5320	6Mbps	27990	N/A	N/A
11n-20M	52	5260	MCS0	22150	N/A	N/A
11n-20M	60	5300	MCS0	27220	N/A	N/A
11n-20M	64	5320	MCS0	26310	N/A	N/A
11n-40M	54	5270	MCS0	77430	N/A	N/A
11n-40M	62	5310	MCS0	82110	N/A	N/A
11ac-80M	58	5290	VHC-MCS0	84450	N/A	N/A

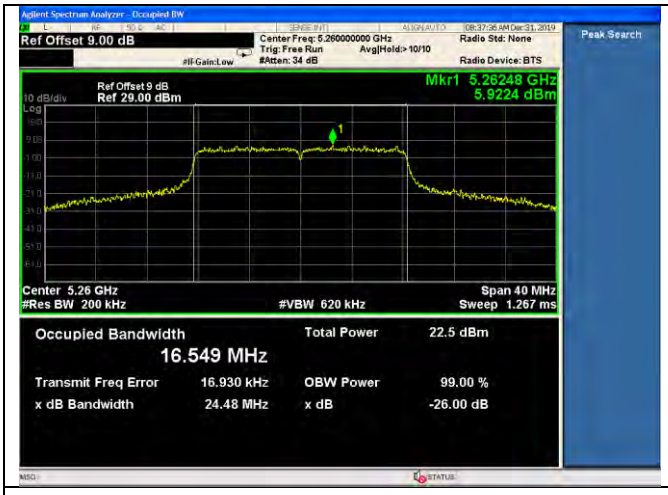
For U-NII-2C band

Mode/ Bandwidth	Channel	Frequency (MHz)	Data rate	Measured 26 dB Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11a	100	5500	6Mbps	24140	N/A	N/A
11a	116	5580	6Mbps	22980	N/A	N/A
11a	140	5700	6Mbps	19630	N/A	N/A
11n-20M	100	5500	MCS0	21990	N/A	N/A
11n-20M	116	5580	MCS0	23990	N/A	N/A
11n-20M	140	5700	MCS0	20500	N/A	N/A
11n-40M	102	5510	MCS0	39170	N/A	N/A
11n-40M	110	5550	MCS0	67610	N/A	N/A
11n-40M	134	5670	MCS0	39280	N/A	N/A
11ac-80M	106	5530	VHC-MCS0	83740	N/A	N/A

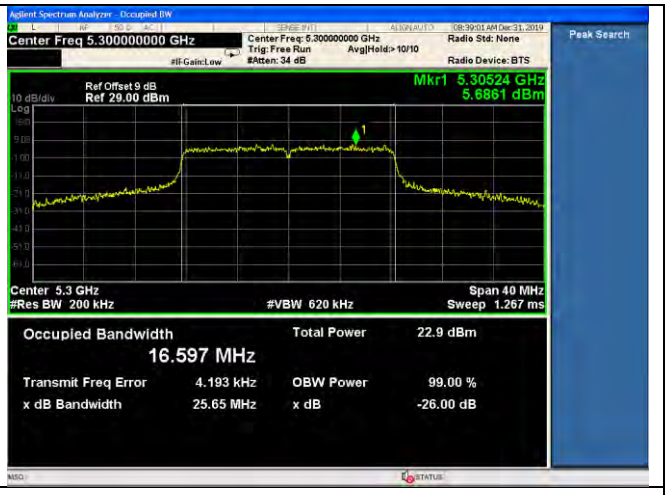
For U-NII-2C band Cross-band channel

Mode/ Bandwidth	Channel	Frequency (MHz)	Data rate	Measured 26 dB Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11a	144	5720	6Mbps	19200	N/A	N/A
11n	144	5720	MCS0	20240	N/A	N/A
11n-40M	144	5710	MCS0	53270	N/A	N/A
11ac-80M	136	5690	VHC-MCS0	89110	N/A	N/A

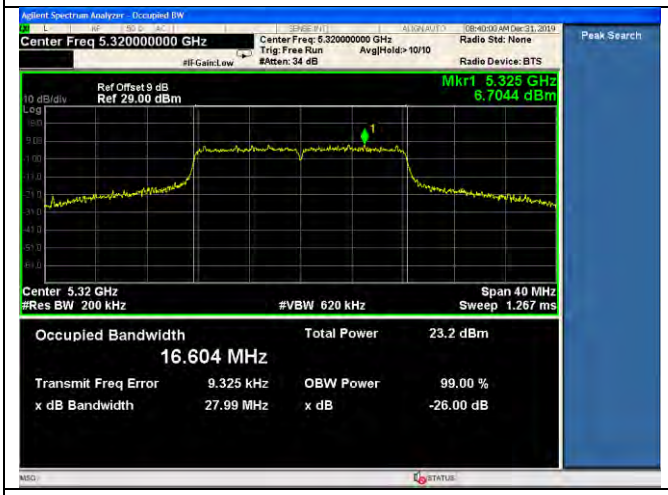
8.2.5 Test Plots



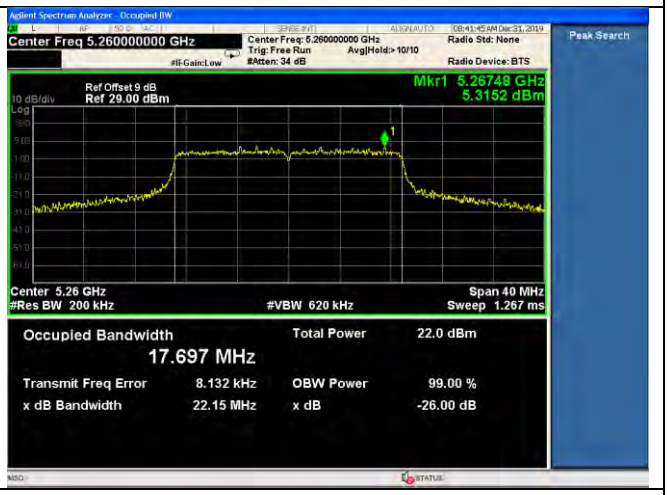
26dB BW -802.11a 5260MHz



26dB BW -802.11a 5300MHz



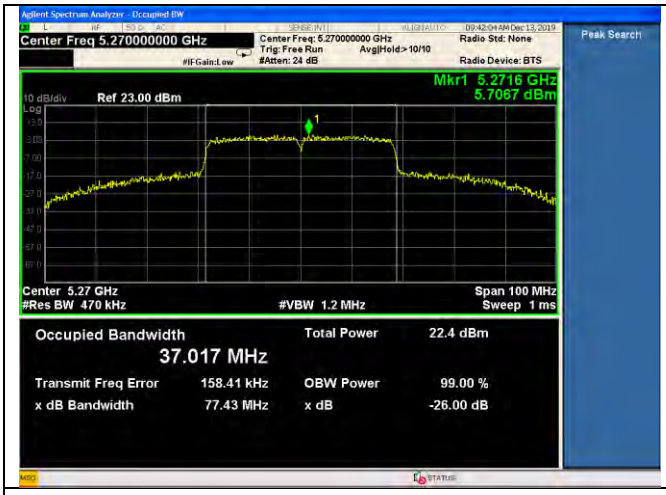
26dB BW -802.11a 5320MHz



26dB BW -802.11n-20M 5260MHz

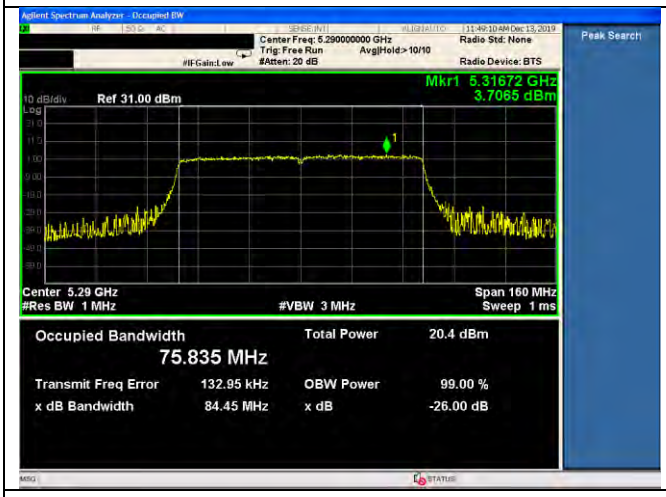
26dB BW -802.11n-20M 5300MHz

26dB BW -802.11n-20M 5320MHz

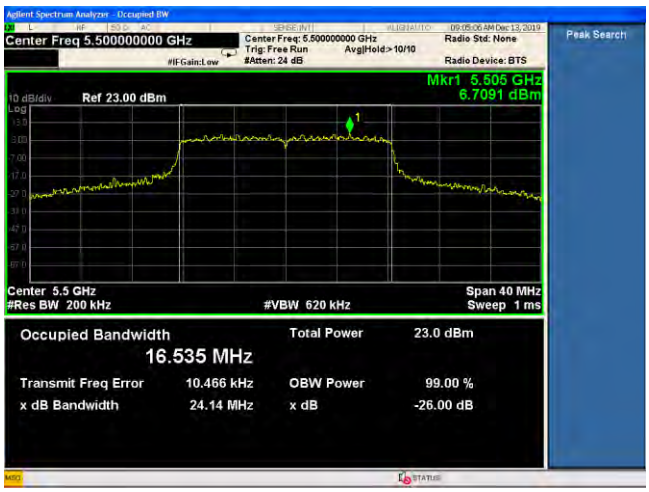


26dB BW -802.11n-40M 5270MHz

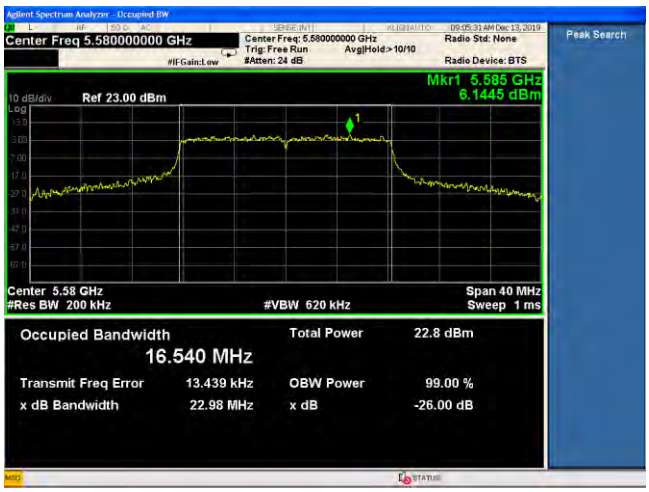
26dB BW -802.11n-40M 5310MHz



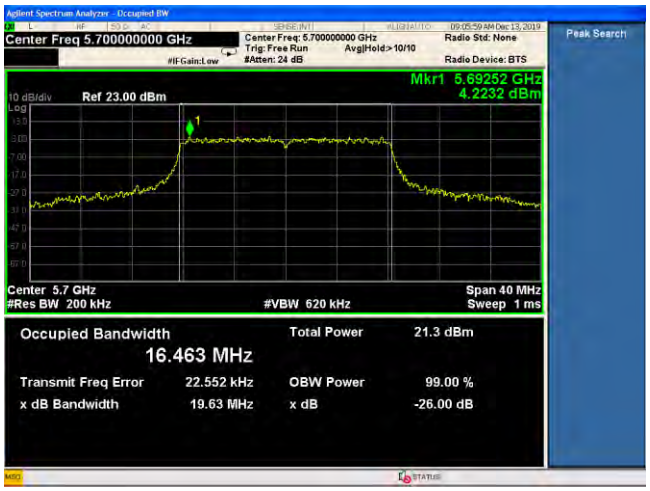
26dB BW -802.11ac-80M 5290MHz



26dB BW -802.11a 5500MHz

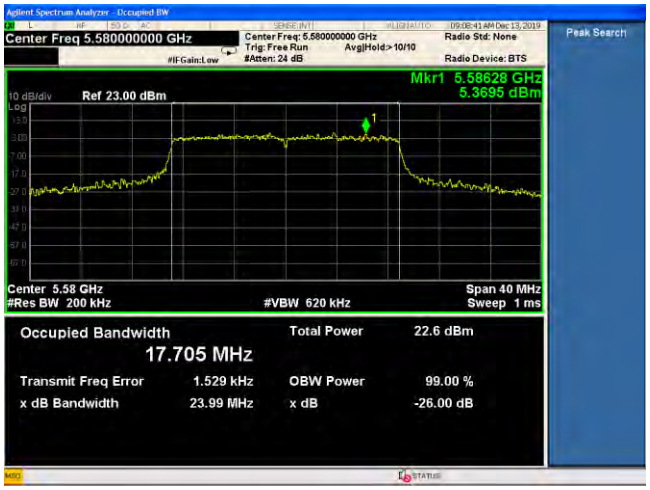


26dB BW -802.11a 5580MHz

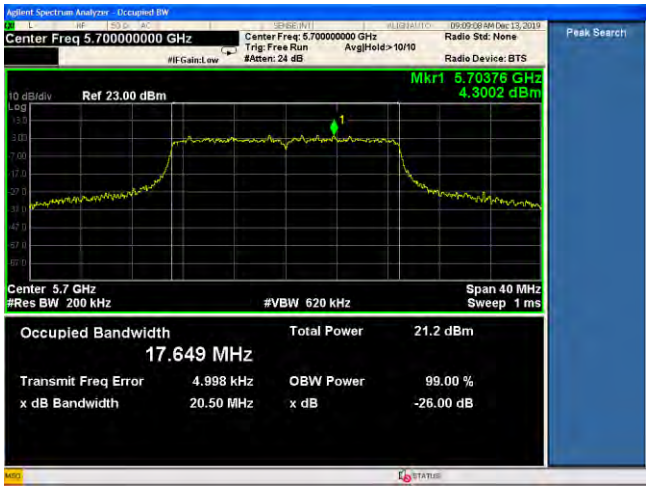


26dB BW -802.11a 5700MHz

26dB BW -802.11n-20M 5500MHz



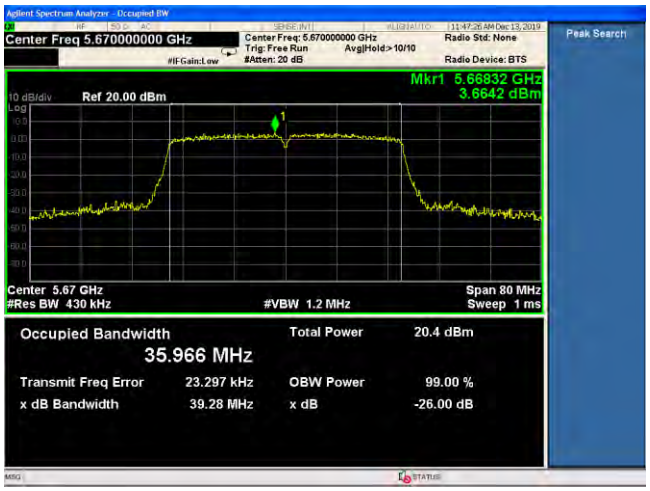
26dB BW -802.11n-20M 5580MHz



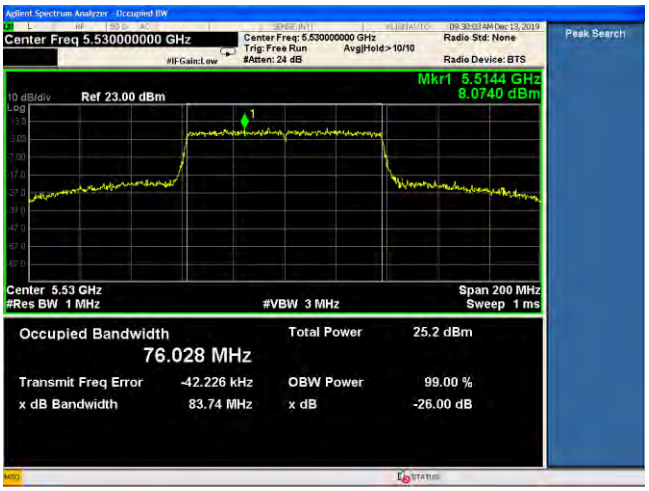
26dB BW -802.11n-20M 5700MHz

26dB BW -802.11n-40M 5510MHz

26dB BW -802.11n-40M 5550MHz

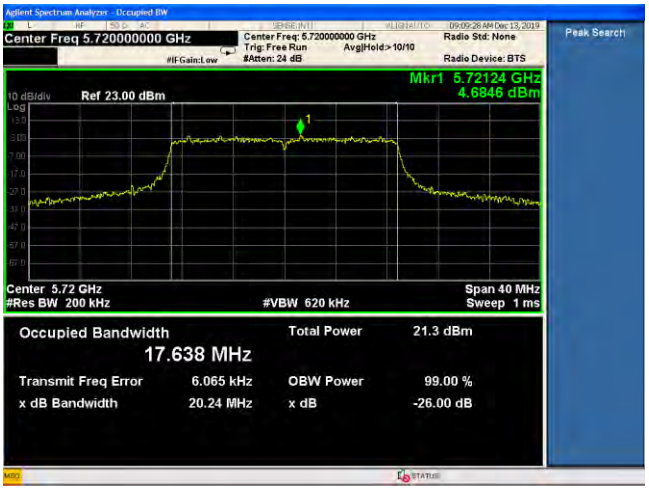


26dB BW -802.11n-40M 5670MHz



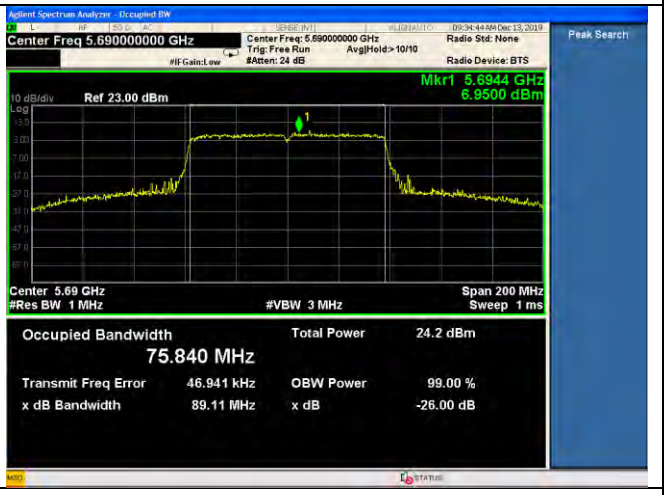
26dB BW -802.11ac-80M 5530MHz

26dB BW -802.11a-20M 5720MHz



26dB BW -802.11n-20M 5720MHz

26dB BW -802.11n-40M 5710MHz



26dB BW -802.11ac-80M 5690MHz

8.3 Occupied Bandwidth (99%)

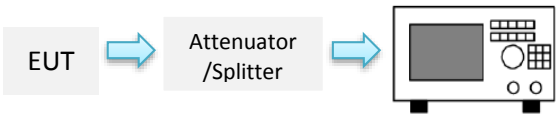
8.3.1 Requirement

RSS-Gen §6.7

This section is for reporting purpose only. There are no restriction limits for bandwidth.

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

8.3.2 Test setup



8.3.3 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01, Section C) Emission bandwidth.

The automatic bandwidth measurement capability of an instrument is used for this measurement.

1. Set RBW = 1% to 5% of the actual occupied BW.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Span = 1.5 times to 5.0 times the OBW
7. Allow the trace to stabilize.
8. Use automatic bandwidth measurement capability on instrument to obtain BW result.

8.3.4 Test Result

For U-NII-2A band

Mode/ Bandwidth	Channel	Frequency (MHz)	Data rate	Measured 99% Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11a	52	5260	6Mbps	16930	N/A	N/A
11a	60	5300	6Mbps	16597	N/A	N/A
11a	64	5320	6Mbps	16604	N/A	N/A
11n-20M	52	5260	MCS0	17697	N/A	N/A
11n-20M	60	5300	MCS0	17745	N/A	N/A
11n-20M	64	5320	MCS0	17742	N/A	N/A
11n-40M	54	5270	MCS0	37017	N/A	N/A
11n-40M	62	5310	MCS0	37936	N/A	N/A
11ac-80M	58	5290	VHC-MCS0	75835	N/A	N/A

For U-NII-2C band

Mode/ Bandwidth	Channel	Frequency (MHz)	Data rate	Measured 99% Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11a	100	5500	6Mbps	16535	N/A	N/A
11a	120	5580	6Mbps	16540	N/A	N/A
11a	140	5700	6Mbps	16463	N/A	N/A
11n-20M	100	5500	MCS0	17696	N/A	N/A
11n-20M	120	5580	MCS0	17705	N/A	N/A
11n-20M	140	5700	MCS0	17649	N/A	N/A
11n-40M	102	5510	MCS0	35950	N/A	N/A
11n-40M	110	5550	MCS0	36874	N/A	N/A
11n-40M	134	5670	MCS0	35966	N/A	N/A
11ac-80M	106	5530	VHC-MCS0	76028	N/A	N/A

For U-NII-2C band Cross-band channel

Mode/ Bandwidth	Channel	Frequency (MHz)	Data rate	Measured 99% Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11a	144	5720	6Mbps	16463	N/A	N/A
11n	144	5720	MCS0	17638	N/A	N/A
11n-40M	144	5710	MCS0	36241	N/A	N/A
11ac-80M	136	5690	VHC-MCS0	75840	N/A	N/A

8.4 Maximum Output Power

8.4.1 Requirement

Per § 15.407 (a),

For the 5.25–5.725 GHz bands:
The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm+10 log B, where B is the 26 dB emission bandwidth in megahertz.

For Straddle Channel, according to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, if the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Per RSS-247 §6.2

For the 5.25–5.350 GHz bands:
For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

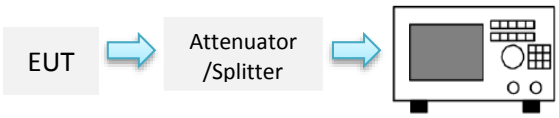
a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;

b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

For the 5.47–5.600GHz and 5.65-5.725GHz bands:
The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order

8.4.2 Test setup



8.4.3 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01, Section E) Maximum conducted output power, 2, b), method SA-1

1. Set span to encompass the entireemission bandwidth (EBW)(or, alternatively, the entire 99% occupied bandwidth)of the signal.
2. Set RBW=1MHz
3. Set VBW ≥ 3 X RBW
4. Number of points in sweep ≥ 2 × span/ RBW. (This ensures that bin-to-bin spacing is ≤RBW/2, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto couple.
6. Detector = Power averaging (RMS)
7. Trace average at least 100 traces in power averaging(rms)mode.
8. Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges.

8.4.4 Test Result

For U-NII-2A band

Mode/ Bandwidth	Frequency (MHz)	Data rate	TX1 power (dBm)	TX2 power (dBm)	Highest or Total power (dBm)	Max Output Power (dBm)	Result
11a	5260	6Mbps	16.45	13.30	16.45	24.00	Pass
11a	5300	6Mbps	16.96	14.25	16.96	24.00	Pass
11a	5320	6Mbps	17.24	14.66	17.24	24.00	Pass
11n-20M	5260	MCS0	16.35	13.31	18.10	24.00	Pass
11n-20M	5300	MCS0	16.84	14.16	18.71	24.00	Pass
11n-20M	5320	MCS0	17.14	14.60	19.06	24.00	Pass
11n-40M	5270	MCS0	16.08	14.26	18.27	24.00	Pass
11n-40M	5310	MCS0	16.52	15.18	18.91	24.00	Pass
11ac-80M	5290	VHC-MCS0	11.59	8.95	13.48	24.00	Pass

For U-NII-2C band

Mode/ Bandwidth	Frequency (MHz)	Data rate	TX1 power (dBm)	TX2 power (dBm)	Highest or Total power (dBm)	Max Output Power (dBm)	Result
11a	5500	6Mbps	17.15	14.72	17.15	24.00	Pass
11a	5580	6Mbps	17.09	15.16	17.09	24.00	Pass
11a	5700	6Mbps	15.68	13.44	15.68	23.93	Pass
11n-20M	5500	MCS0	16.95	14.89	19.05	24.00	Pass
11n-20M	5580	MCS0	17.07	15.23	19.26	24.00	Pass
11n-20M	5700	MCS0	15.70	13.45	17.73	24.00	Pass
11n-40M	5510	MCS0	14.17	11.76	16.14	24.00	Pass
11n-40M	5550	MCS0	19.94	17.99	22.08	24.00	Pass
11n-40M	5670	MCS0	13.27	10.96	15.28	24.00	Pass
11ac-80M	5530	VHC-MCS0	12.00	9.14	13.81	24.00	Pass

For U-NII-2C band Cross-band channel

Mode/ Bandwidth	Frequency (MHz)	Data rate	TX1 power (dBm)	TX2 power (dBm)	Highest or Total power (dBm)	Max Output Power (dBm)	Result
11a	5720	6Mbps	15.95	14.69	15.95	23.83	Pass
11n	5720	MCS0	15.85	14.58	18.27	24.00	Pass
11n-40M	5710	MCS0	18.48	17.34	20.96	24.00	Pass
11ac-80M	5690	VHC-MCS0	16.27	14.86	18.63	24.00	Pass

Note:

1) For 802.11a, the highest output power is recorded.
2) For 5GHz non-11a mode, it's under 2x2 MIMO mode, the output power is combined together to compare to limit.

8.4.5 Test Result for e.i.r.p

For U-NII-2A band

Mode/ Bandwidth	Frequency (MHz)	Data rate	Highest or Total power (dBm)	Directional Ant Gain (dBi)	Highest or Total E.I.R.P (dBm)	Max E.I.R.P (dBm)	Result
11a	5260	6Mbps	16.45	2.5	18.95	29.29	Pass
11a	5300	6Mbps	16.96	2.5	19.46	29.20	Pass
11a	5320	6Mbps	17.24	2.5	19.74	29.20	Pass
11n-20M	5260	MCS0	18.10	5.5	23.60	29.48	Pass
11n-20M	5300	MCS0	18.71	5.5	24.21	29.49	Pass
11n-20M	5320	MCS0	19.06	5.5	24.56	29.49	Pass
11n-40M	5270	MCS0	18.27	5.5	23.77	30.00	Pass
11n-40M	5310	MCS0	18.91	5.5	24.41	30.00	Pass
11ac-80M	5290	VHC-MCS0	13.48	5.5	18.98	30.00	Pass

For U-NII-2C band

Mode/ Bandwidth	Frequency (MHz)	Data rate	Highest or Total power (dBm)	Directional Ant Gain (dBi)	Highest or Total E.I.R.P (dBm)	Max E.I.R.P (dBm)	Result
11a	5500	6Mbps	17.15	2.5	19.65	29.18	Pass
11a	5580	6Mbps	17.09	2.5	19.59	29.19	Pass
11a	5700	6Mbps	15.68	2.5	18.18	29.17	Pass
11n-20M	5500	MCS0	19.05	5.5	24.55	29.48	Pass
11n-20M	5580	MCS0	19.26	5.5	24.76	29.48	Pass
11n-20M	5700	MCS0	17.73	5.5	23.23	29.47	Pass
11n-40M	5510	MCS0	16.14	5.5	21.64	30.00	Pass
11n-40M	5550	MCS0	22.08	5.5	27.58	30.00	Pass
11n-40M	5670	MCS0	15.28	5.5	20.78	30.00	Pass
11ac-80M	5530	VHC-MCS0	13.81	5.5	19.31	30.00	Pass

For U-NII-2C band Cross-band channel

Mode/ Bandwidth	Frequency (MHz)	Data rate	Highest or Total power (dBm)	Directional Ant Gain (dBi)	Highest or Total E.I.R.P (dBm)	Max E.I.R.P (dBm)	Result
11a	5720	6Mbps	15.95	2.5	18.45	29.17	Pass
11n	5720	MCS0	18.27	5.5	23.77	29.46	Pass
11n-40M	5710	MCS0	20.96	5.5	26.46	30.00	Pass
11ac-80M	5690	VHC-MCS0	18.63	5.5	24.13	30.00	Pass

8.4.6 Test Plots

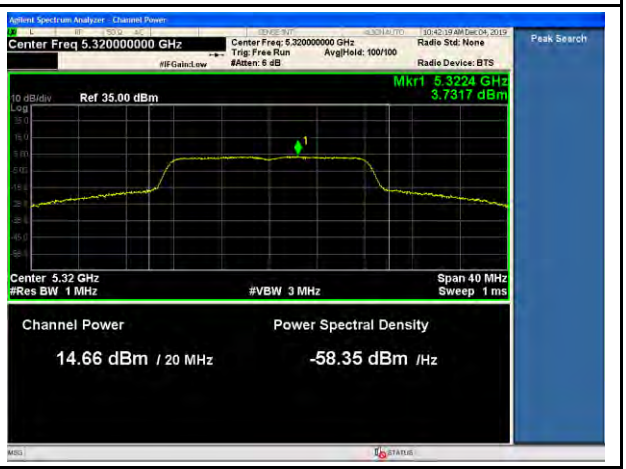
802.11a 5260MHz-PWR-TX1

802.11a 5260MHz-PWR-TX2

802.11a 5300MHz-PWR-TX1

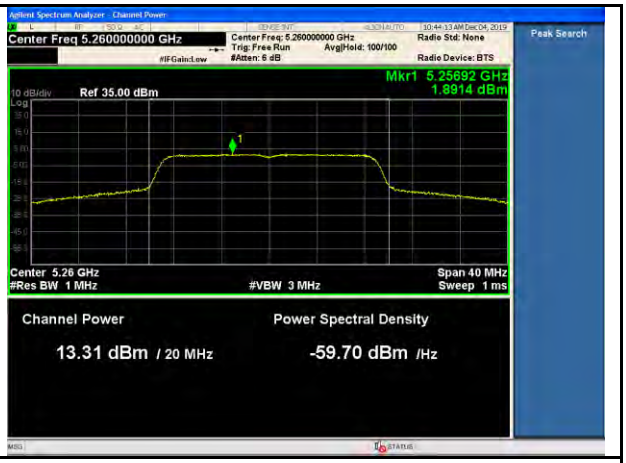
802.11a 5300MHz-PWR-TX2

802.11a 5320MHz-PWR-TX1



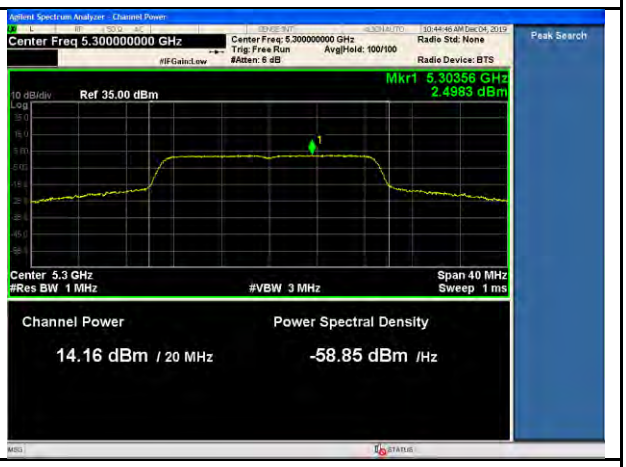
802.11a 5320MHz-PWR-TX2

802.11n-20MHz- 5260MHz-PWR-TX1



802.11n-20MHz- 5260MHz-PWR-TX2

802.11n-20MHz- 5300MHz-PWR-TX1



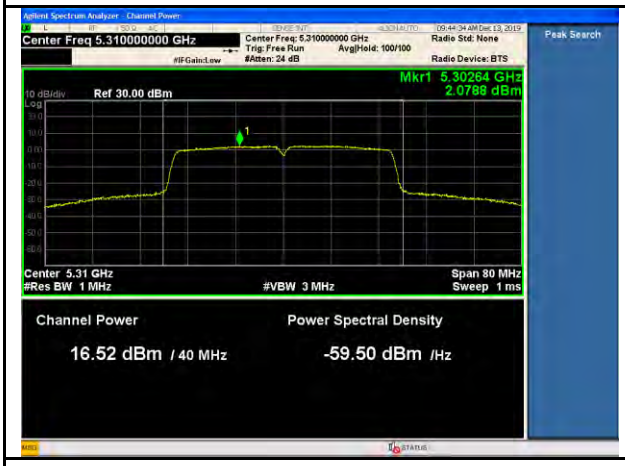
802.11n-20MHz- 5300MHz-PWR-TX2

802.11n-20MHz- 5320MHz-PWR-TX1

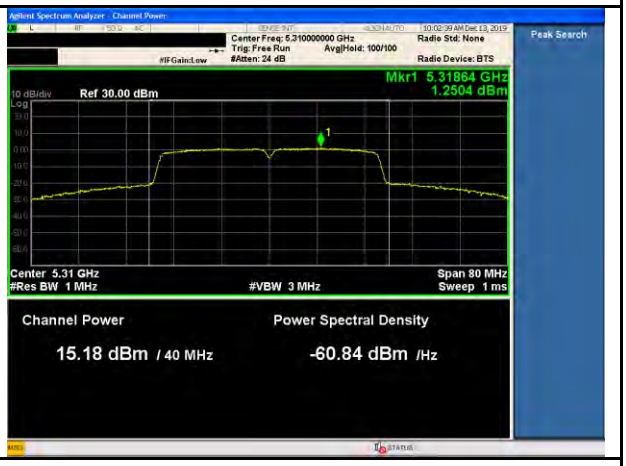
802.11n-20MHz- 5320MHz-PWR-TX2

802.11n-40MHz- 5270MHz-PWR-TX1

802.11n-40MHz- 5270MHz-PWR-TX2

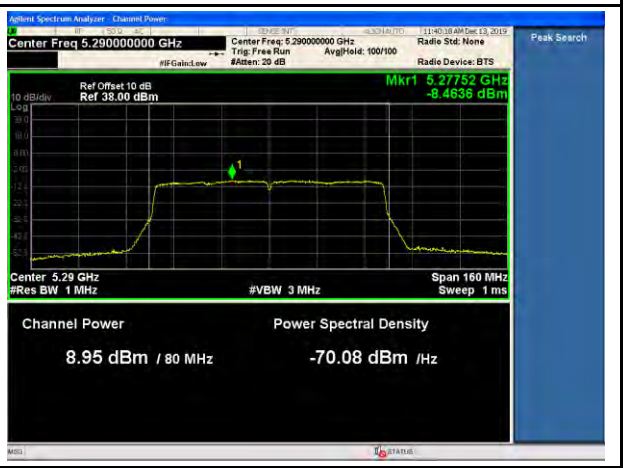


802.11n-40MHz- 5310MHz-PWR-TX1

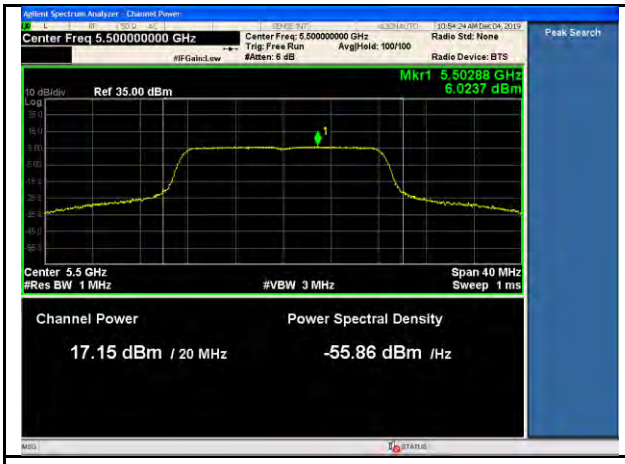


802.11n-40MHz- 5310MHz-PWR-TX2

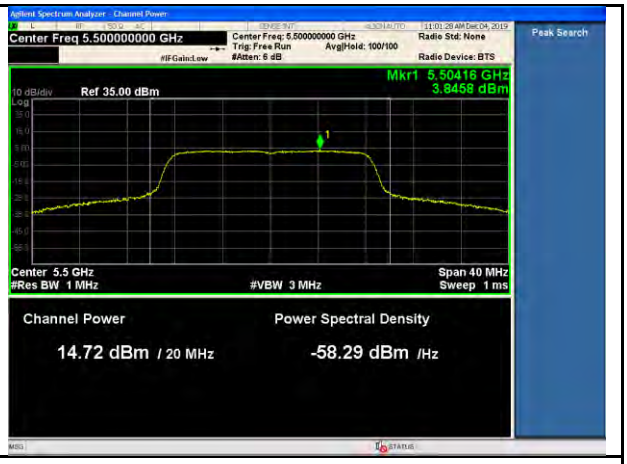
802.11ac-80MHz- 5290MHz-PWR-TX1



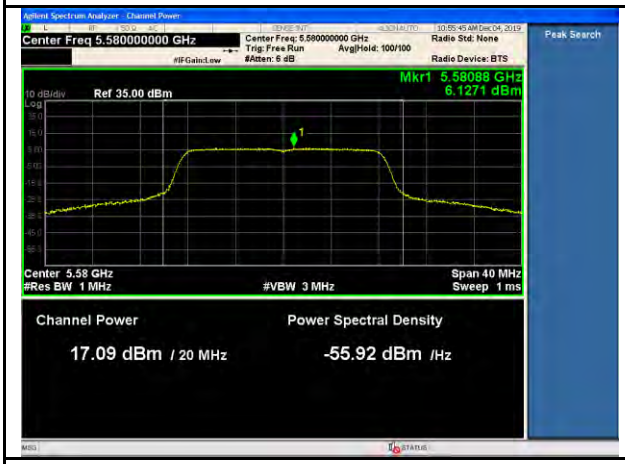
802.11ac-80MHz- 5290MHz-PWR-TX2



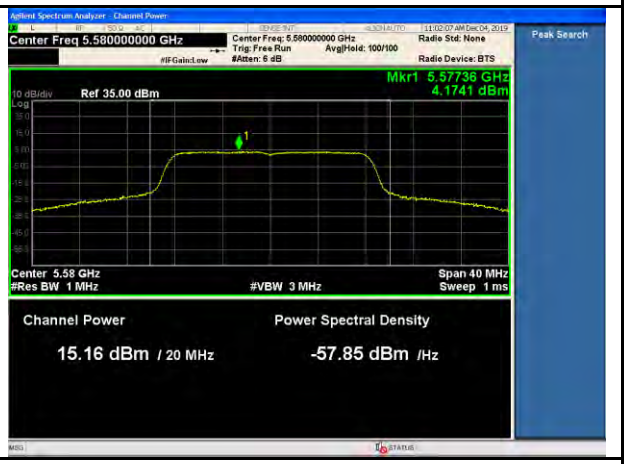
802.11a 5500MHz-PWR-TX1



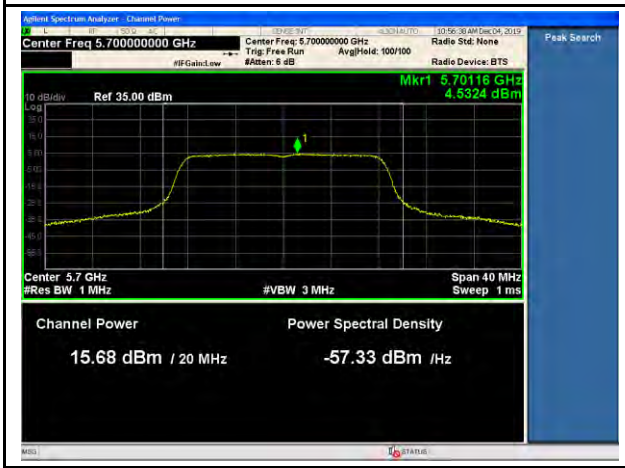
802.11a 5500MHz-PWR-TX2



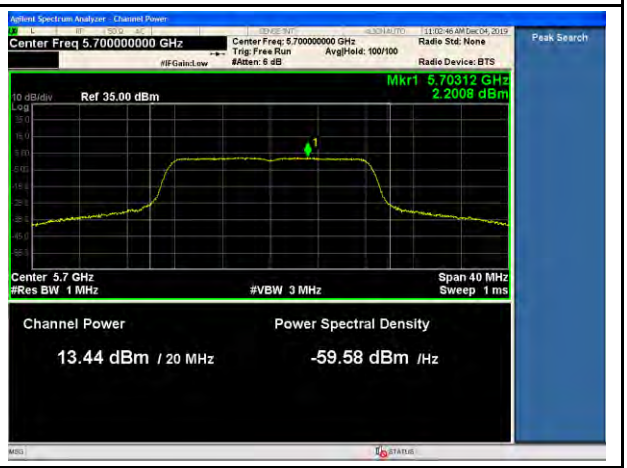
802.11a 5580MHz-PWR-TX1



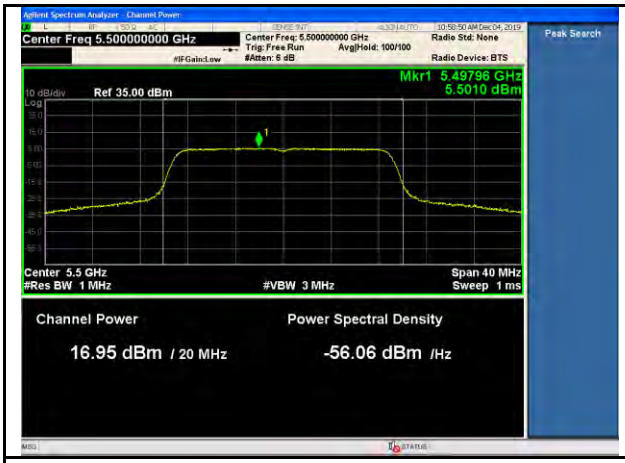
802.11a 5580MHz-PWR-TX2



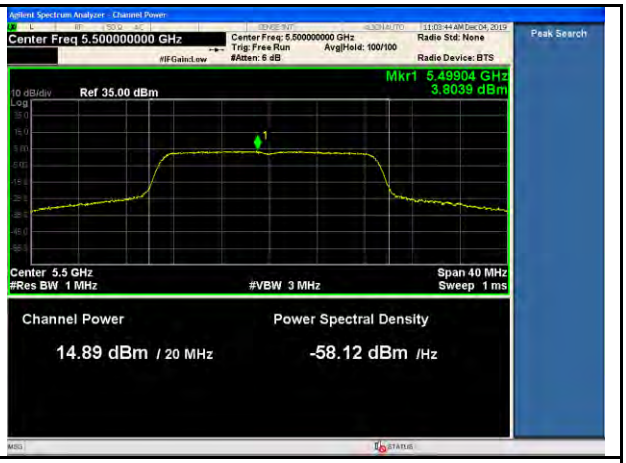
802.11a 5700MHz-PWR-TX1



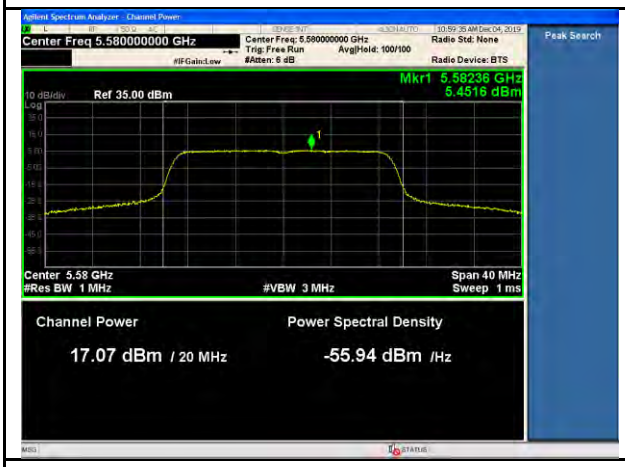
802.11a 5700MHz-PWR-TX2



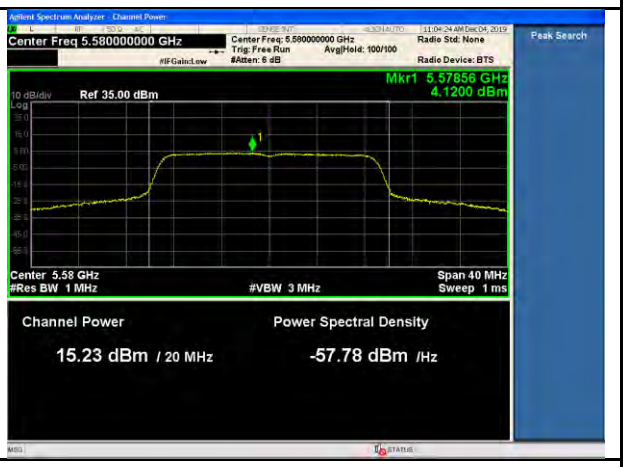
802.11n-20MHz- 5500MHz-PWR-TX1



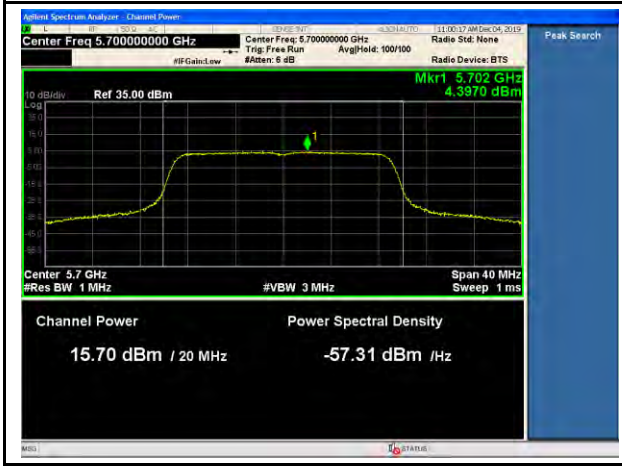
802.11n-20MHz- 5500MHz-PWR-TX2



802.11n-20MHz- 5580MHz-PWR-TX1

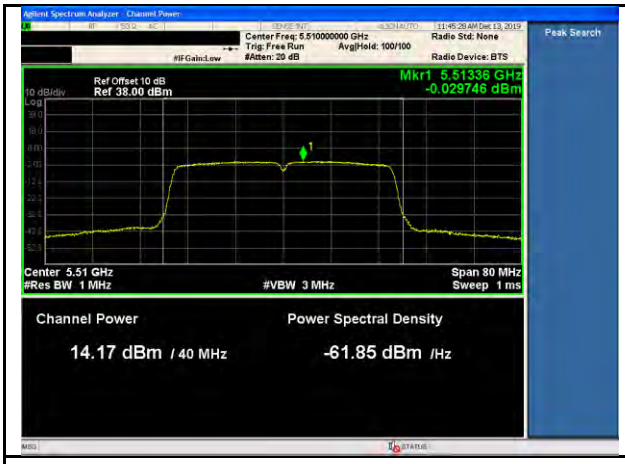


802.11n-20MHz- 5580MHz-PWR-TX2

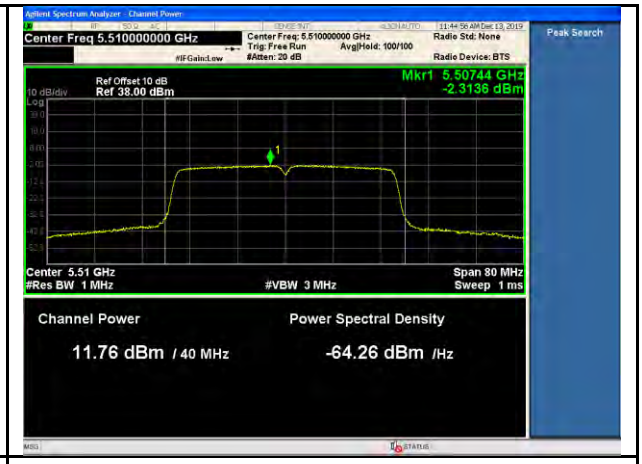


802.11n-20MHz- 5700MHz-PWR-TX1

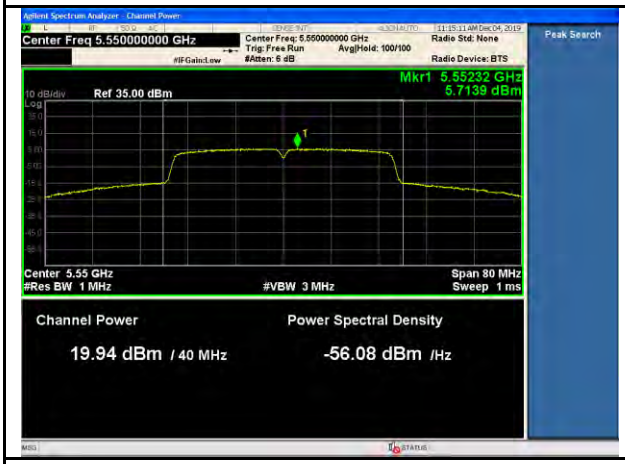
802.11n-20MHz- 5700MHz-PWR-TX2



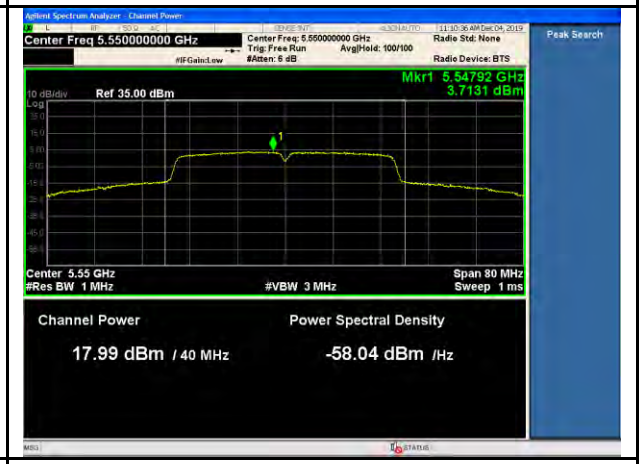
802.11n-40MHz- 5510MHz-PWR-TX1



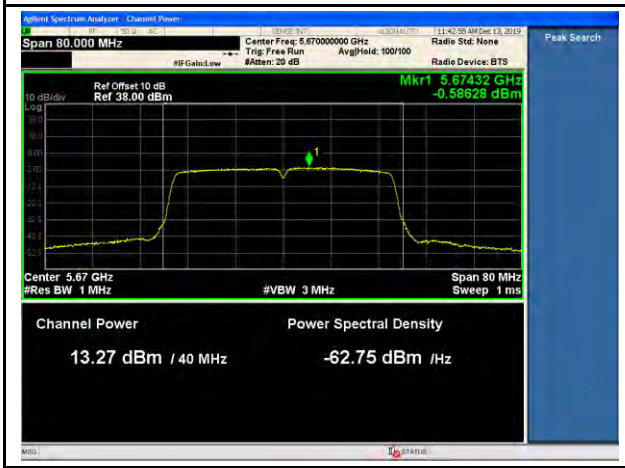
802.11n-40MHz- 5510MHz-PWR-TX2



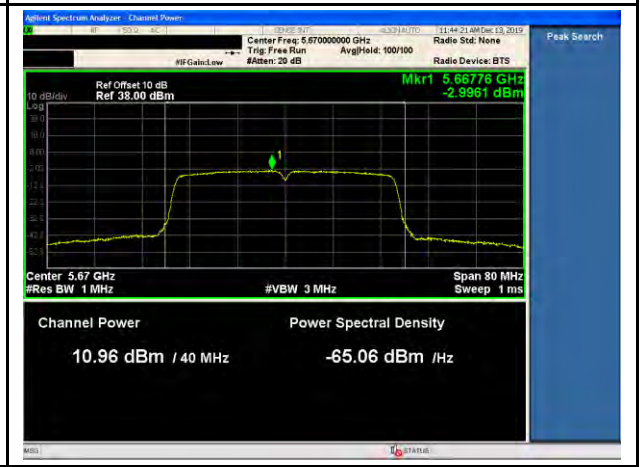
802.11n-40MHz- 5550MHz-PWR-TX1



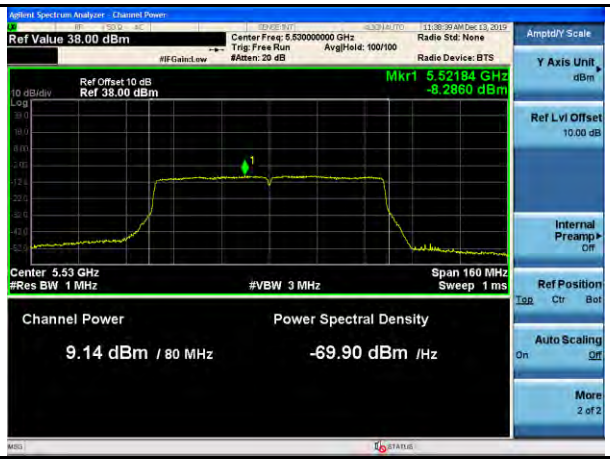
802.11n-40MHz- 5550MHz-PWR-TX2



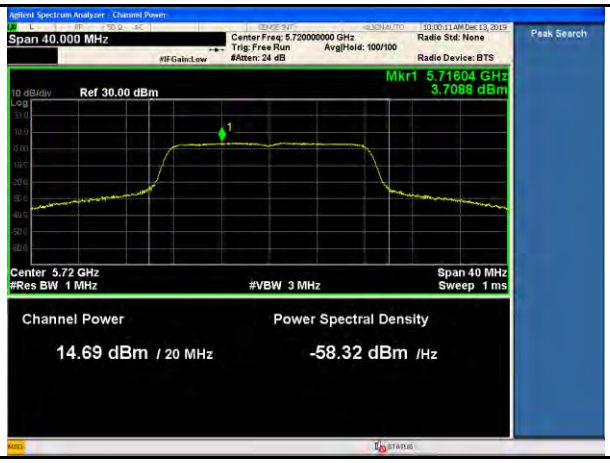
802.11n-40MHz- 5670MHz-PWR-TX1



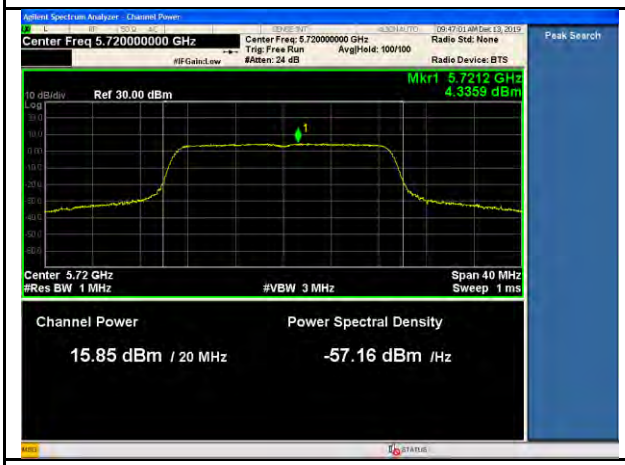
802.11n-40MHz- 5670MHz-PWR-TX2

	
802.11ac-80MHz- 5530MHz-PWR-TX1	**802.11ac-80MHz - 5530MHz-PWR-TX2**

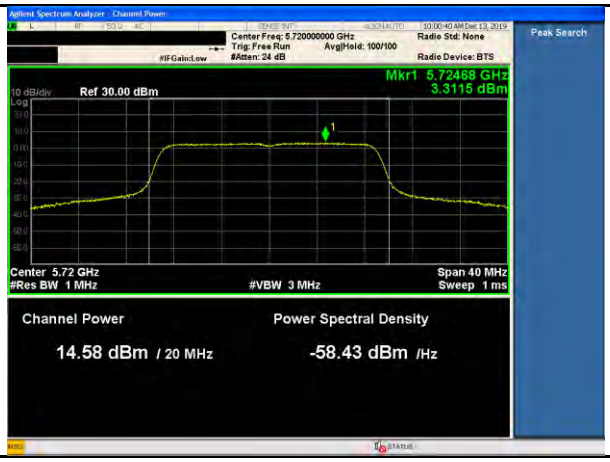
802.11a-20MHz- 5720MHz-PWR-TX1



802.11a-20MHz- 5720MHz-PWR-TX2



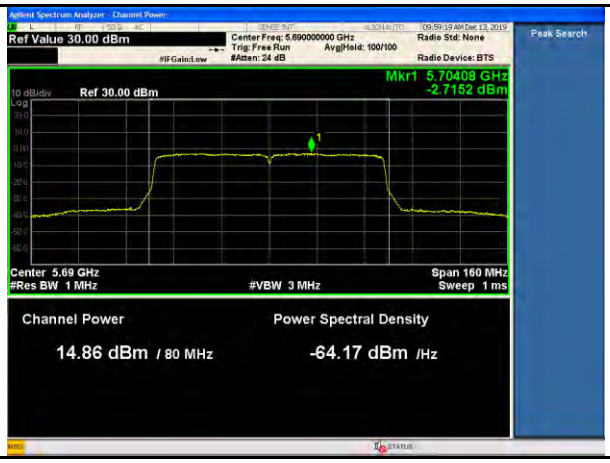
802.11n-20MHz- 5720MHz-PWR-TX1



802.11n-20MHz- 5720MHz-PWR-TX2

802.11n-40MHz- 5710MHz-PWR-TX1

802.11n-40MHz- 5710MHz-PWR-TX2

	
802.11ac-80MHz- 5690MHz-PWR-TX1	**802.11ac-80MHz- 5690MHz-PWR-TX2**

8.5 Power Spectral Density

8.5.1 Requirement

Per § 15.407 (a),

For the 5.25–5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

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

Per RSS-247 §6.2

For the 5.25–5.350 GHz bands:
Devices, other than devices installed in vehicles, shall comply with the following:

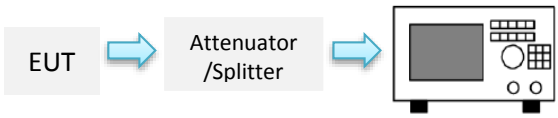
a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;

b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

For the 5.47–5.600GHz and 5.65-5.725GHz bands:
The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order

8.5.2 Test setup



8.5.3 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, section F) Maximum power spectral density. Method SA-1

1. Set span to encompass the entireemission bandwidth (EBW)(or, alternatively, the entire 99% occupied bandwidth)of the signal.
2. Set RBW=1MHz
3. Set VBW ≥ 3 X RBW
4. Number of points in sweep ≥ 2 × span/ RBW. (This ensures that bin-to-bin spacing is ≤RBW/2, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto couple.
6. Detector = Power averaging (RMS)
7. Trace average at least 100 traces in power averaging(rms)mode.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.

8.5.4 Test Result

For U-NII-2A band

Mode/ Bandwidth	Frequency (MHz)	Data rate	TX1 PSD (dBm/MHz)	TX2 PSD (dBm/MHz)	Highest or Total PSD (dBm/MHz)	Max PSD (dBm/MHz)	Result
11a	5260	6Mbps	5.47	2.37	5.47	11	Pass
11a	5300	6Mbps	5.86	3.33	5.86	11	Pass
11a	5320	6Mbps	6.07	3.73	6.07	11	Pass
11n-20M	5260	MCS0	5.12	1.89	6.81	11	Pass
11n-20M	5300	MCS0	5.44	2.50	7.22	11	Pass
11n-20M	5320	MCS0	5.64	3.11	7.57	11	Pass
11n-40M	5270	MCS0	1.90	0.38	4.22	11	Pass
11n-40M	5310	MCS0	2.08	1.25	4.69	11	Pass
11ac-80M	5290	VHC-MCS0	-5.60	-8.46	-3.79	11	Pass

For U-NII-2C band

Mode/ Bandwidth	Frequency (MHz)	Data rate	TX1 PSD (dBm/MHz)	TX2 PSD (dBm/MHz)	Highest or Total PSD (dBm/MHz)	Max PSD (dBm/MHz)	Result
11a	5500	6Mbps	6.02	3.85	6.02	11	Pass
11a	5580	6Mbps	6.13	4.17	6.13	11	Pass
11a	5700	6Mbps	4.53	2.20	4.53	11	Pass
11n-20M	5500	MCS0	5.50	3.80	7.75	11	Pass
11n-20M	5580	MCS0	5.45	4.12	7.85	11	Pass
11n-20M	5700	MCS0	4.40	2.04	6.39	11	Pass
11n-40M	5510	MCS0	-0.03	-2.31	1.99	11	Pass
11n-40M	5550	MCS0	5.71	3.71	7.84	11	Pass
11n-40M	5670	MCS0	-5.34	-8.29	-3.56	11	Pass
11ac-80M	5530	VHC-MCS0	0.06	-1.39	2.41	11	Pass

For U-NII-2C band Cross-band channel

Mode/ Bandwidth	Frequency (MHz)	Data rate	TX1 PSD (dBm/MHz)	TX2 PSD (dBm/MHz)	Highest or Total PSD (dBm/MHz)	Max PSD (dBm/MHz)	Result
11a	5720	6Mbps	4.92	3.71	4.92	11	Pass
11n	5720	MCS0	4.34	3.31	6.86	11	Pass
11n-40M	5710	MCS0	4.73	3.21	7.04	11	Pass
11ac-80M	5690	VHC-MCS0	-1.34	-2.72	1.04	11	Pass

Note:

1) For 802.11a, the highest PSD is recorded.
2) For 5GHz non-11a mode, it's under 2x2 MIMO mode, the PSD is combined together to compare to limit.

8.5.5 Test Plots

Refer to test plots in conducted peak output power

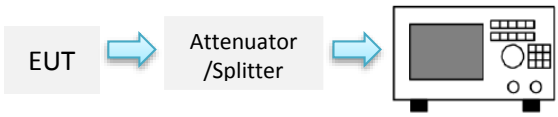
8.6 Automatically Discontinue Transmission

8.6.1 Requirement

§ 15.407 (c), RSS-247 §6 (a)

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signalling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

8.6.2 Test setup



8.6.3 Test Result

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

8.7 Radiated Spurious Emissions into Restricted Frequency Bands

8.7.1 Requirement

§ 15.205, 15.209, 15.407(b), RSS-Gen §8.10, RSS-247

(1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

(3) For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

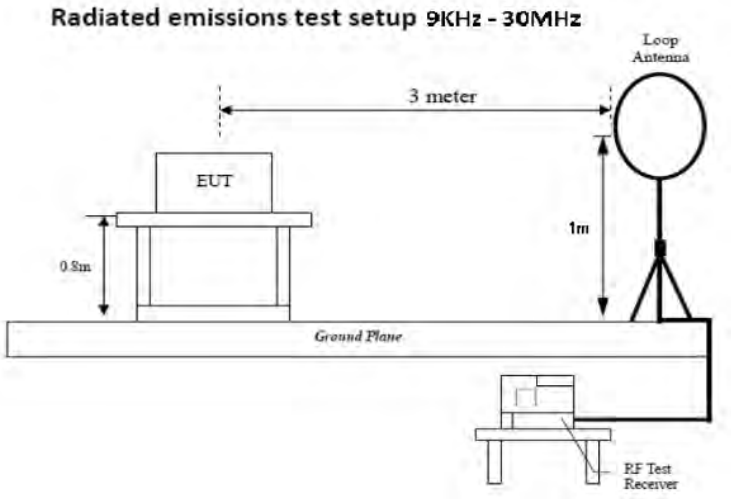
(4) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

(5) Restricted band, emission must also comply with the radiated emission limits specified in 15.209

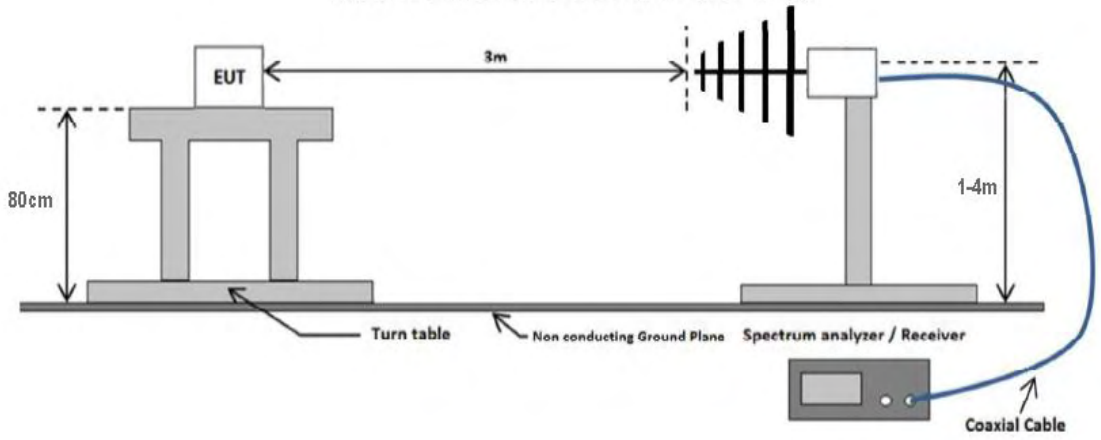
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency range (MHz)	Field Strength (µV/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

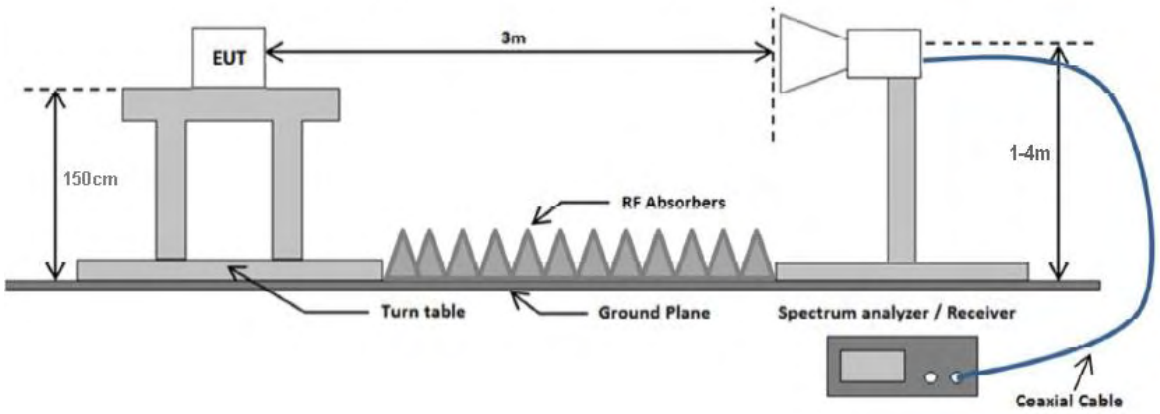
8.7.2 Test setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



8.7.3 ***Test Procedure***

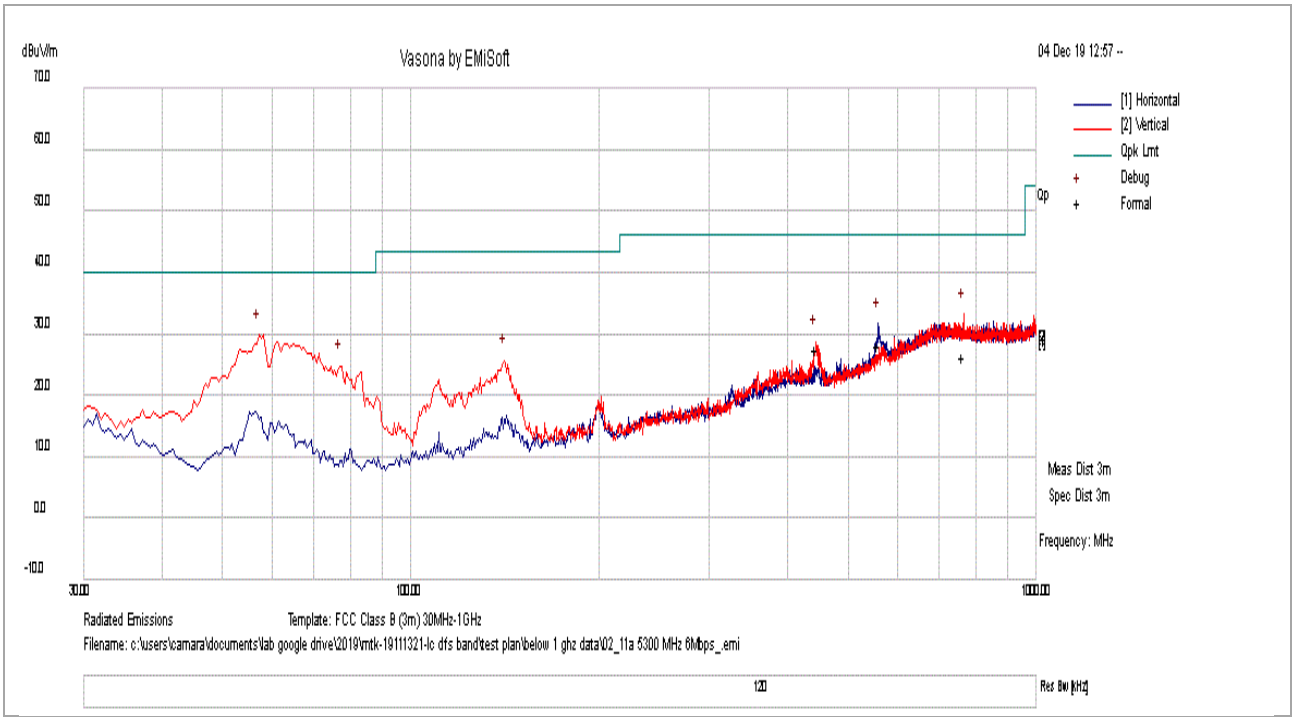
According to FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement. And subclause 12.7 Radiated spurious emission measurements in ANSI C62.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI 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.

8.7.4 Test Result

30-1000MHz test result

Test Standard:	**15.209, RSS-247**	**Mode:**	**11a-5300MHz**
Frequency Range:	**30-1000MHz**	**Test Date:**	**12/04/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



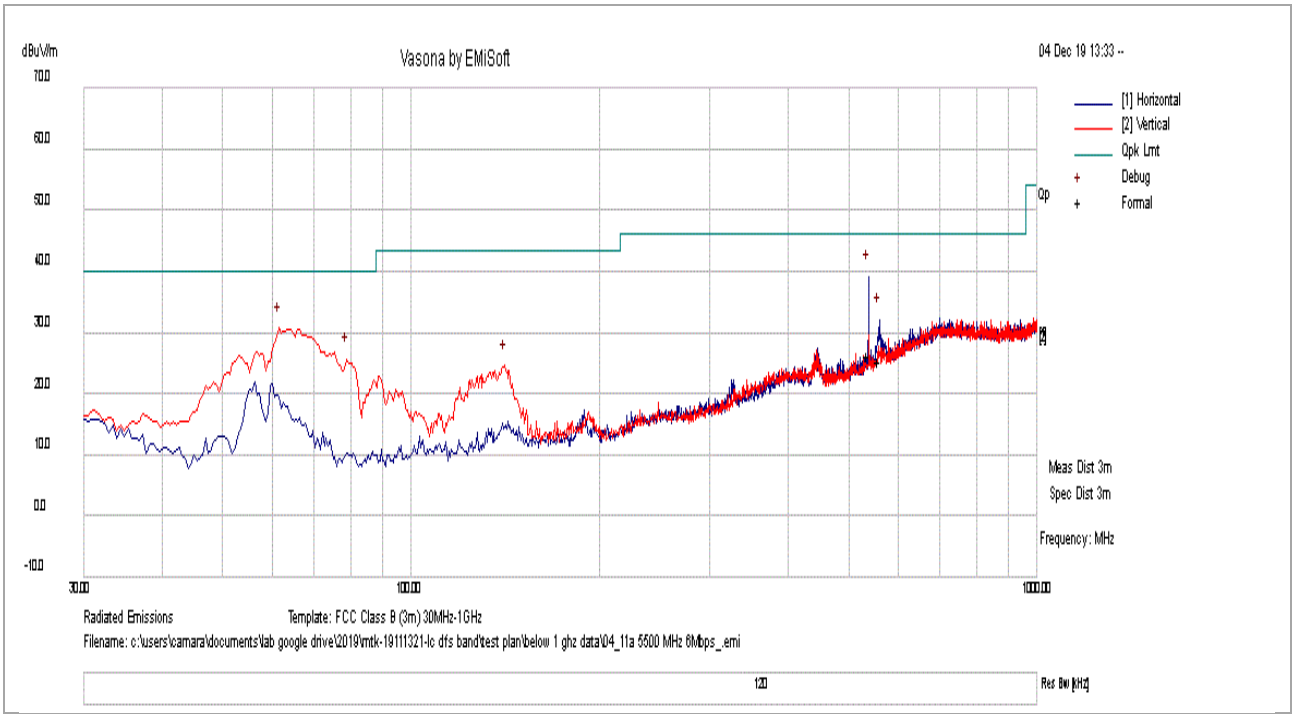
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
765.71	25.90	7.30	-6.70	26.50	QP	V	174	223	46	-19.50
558.25	32.50	6.70	-11.00	28.20	QP	H	155	232	46	-17.80
443.93	35.30	6.20	-14.00	27.50	QP	V	100	287	46	-18.50

Note:

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

30-1000MHz test result

Test Standard:	**15.209, RSS-247**	**Mode:**	**11a-5500MHz**
Frequency Range:	**30-1000MHz**	**Test Date:**	**12/04/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



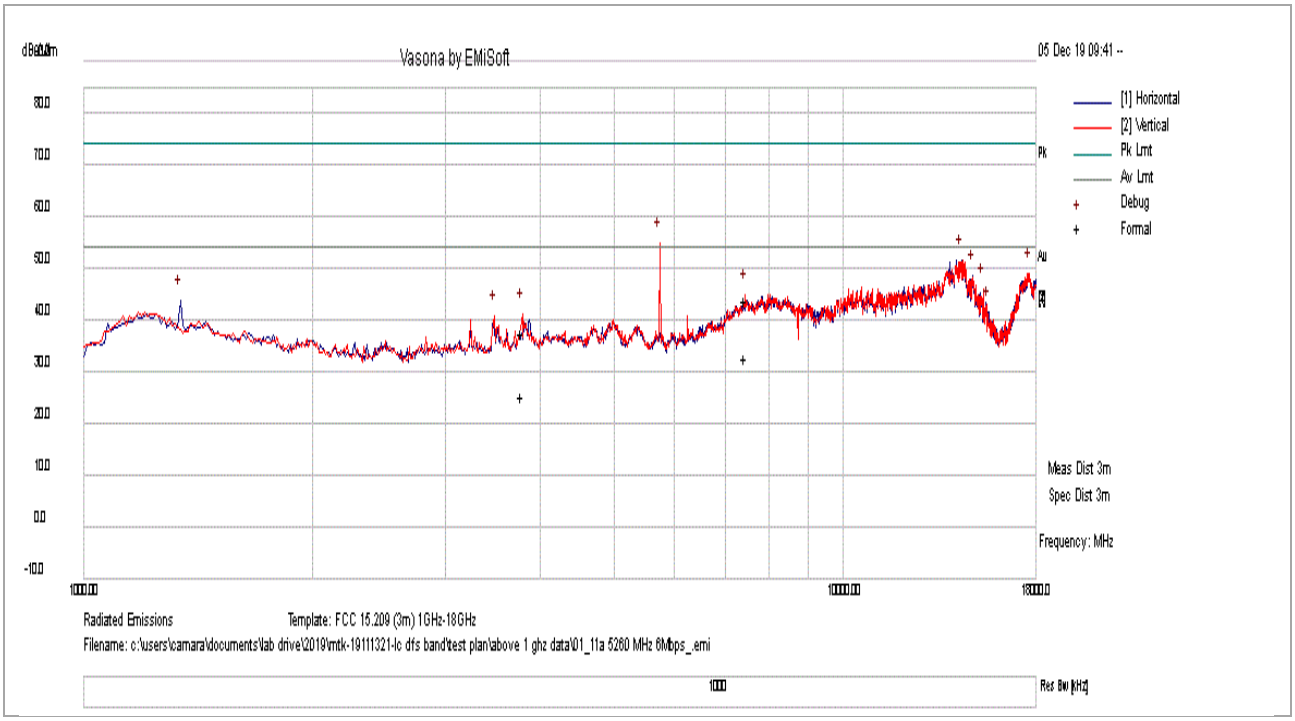
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
537.63	31.30	6.50	-11.60	26.30	QP	H	145	234	46	-19.70
559.87	29.50	6.80	-11.00	25.30	QP	H	111	258	46	-20.70

Note:

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

1GHz – 18GHz test result

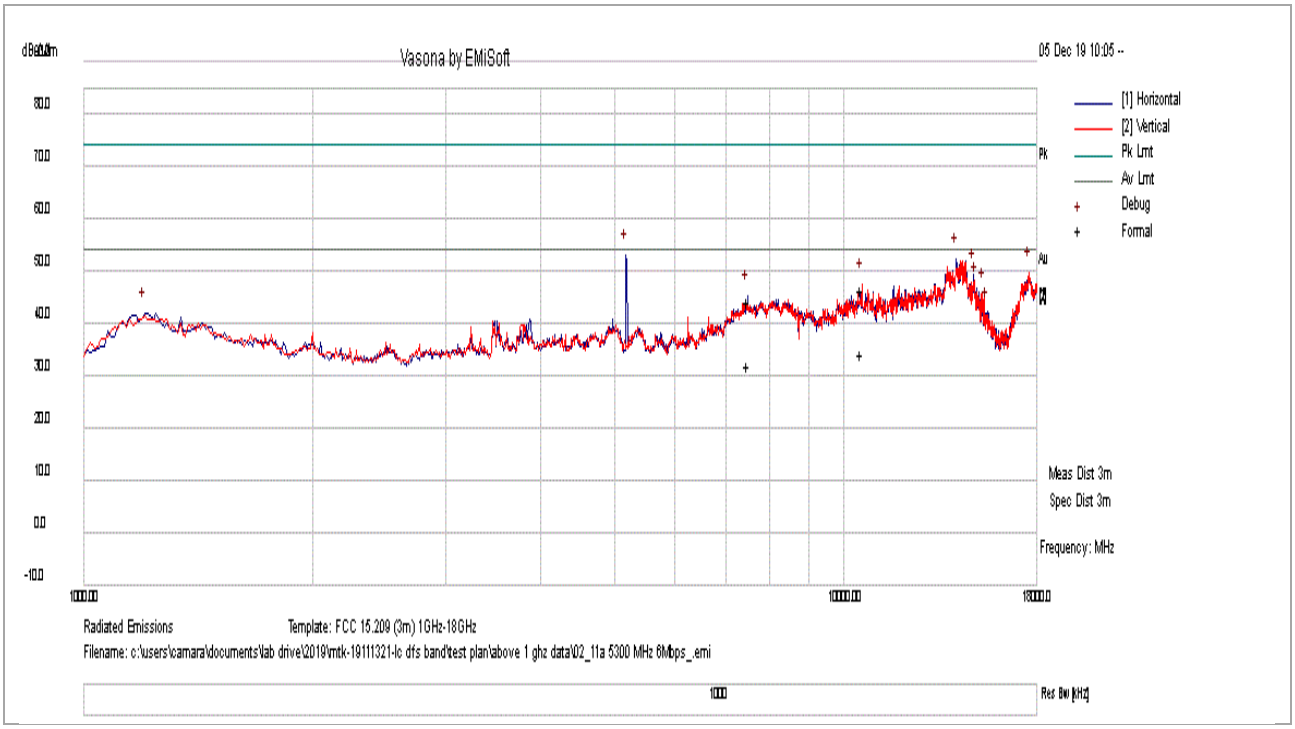
Test Standard:	**15.209, RSS-247**	**Mode:**	**11a-5260MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7439.65	30.60	20.90	-7.60	43.90	PK	V	329	154	74	-30.10
3781.90	37.70	16.40	-16.30	37.70	PK	V	128	336	74	-36.30
7439.65	19.50	20.90	-7.60	32.70	AV	V	329	154	54	-21.30
3781.90	25.50	16.40	-16.30	25.60	AV	V	128	336	54	-28.40

1GHz – 18GHz test result

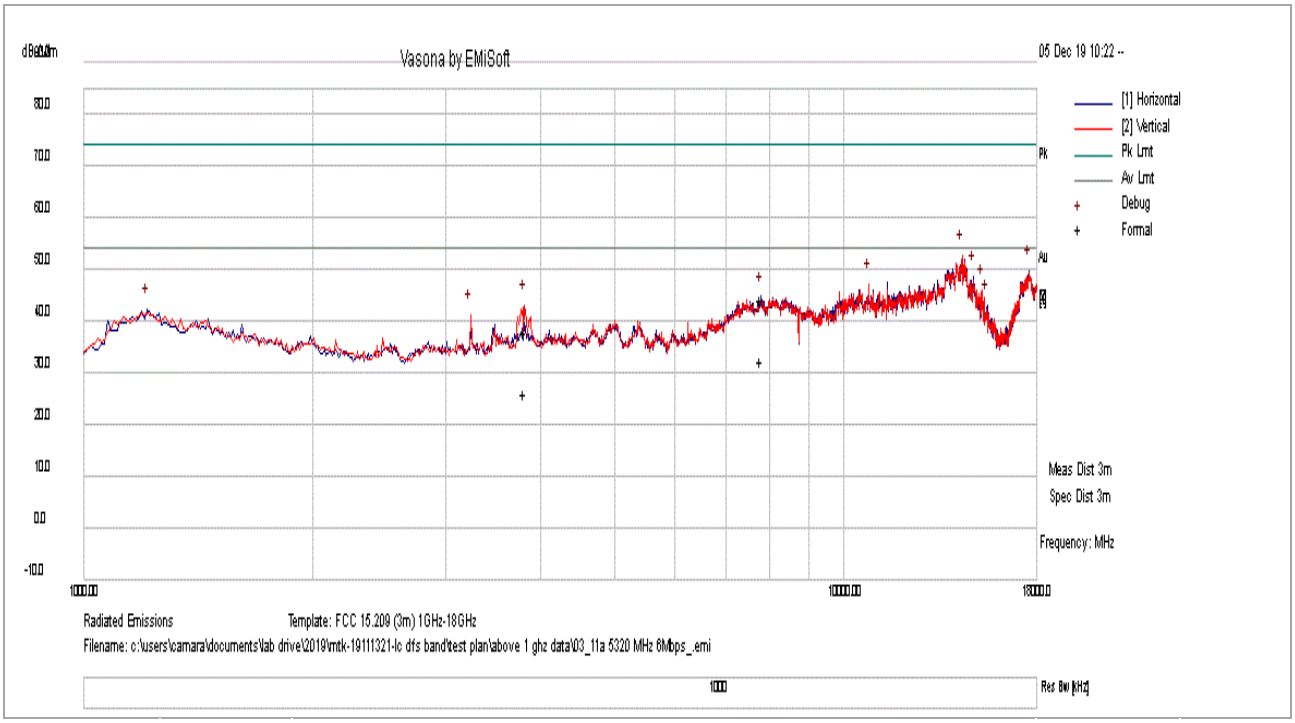
Test Standard:	**15.209, RSS-247**	**Mode:**	**11a-5300MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**12/05/2019**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
10582.72	27.00	23.30	-3.50	46.70	PK	V	184	82	74	-27.30
7483.10	30.80	21.00	-7.60	44.20	PK	H	240	45	74	-29.80
10582.72	14.70	23.30	-3.50	34.40	AV	V	184	82	54	-19.60
7483.10	18.90	21.00	-7.60	32.30	AV	H	240	45	54	-21.70

1GHz – 18GHz test result

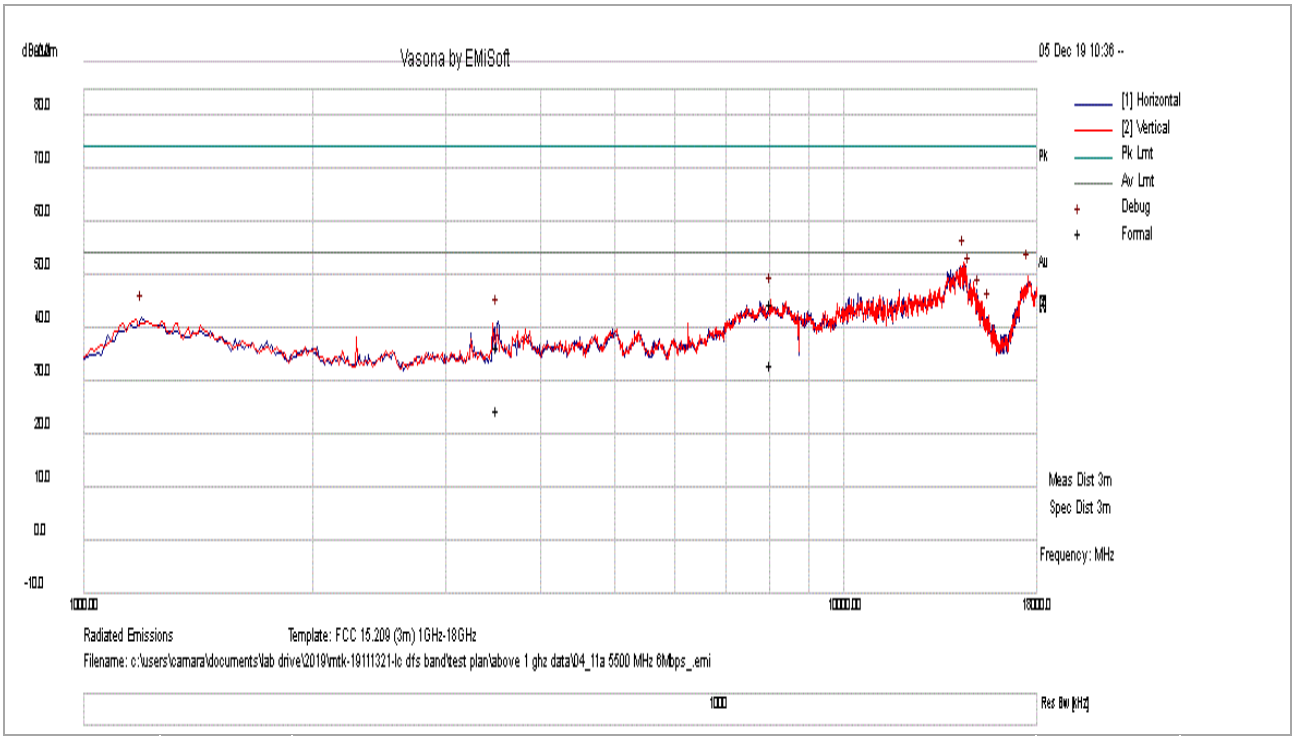
Test Standard:	**15.209, RSS-247**	**Mode:**	**11a-5320MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7797.35	30.30	21.20	-7.00	44.50	PK	V	309	228	74	-29.50
3805.25	37.50	16.40	-16.10	37.90	PK	V	152	339	74	-36.10
7797.35	18.20	21.20	-7.00	32.40	AV	V	309	228	54	-21.60
3805.25	25.70	16.40	-16.10	26.00	AV	V	152	339	54	-28.00

1GHz – 18GHz test result

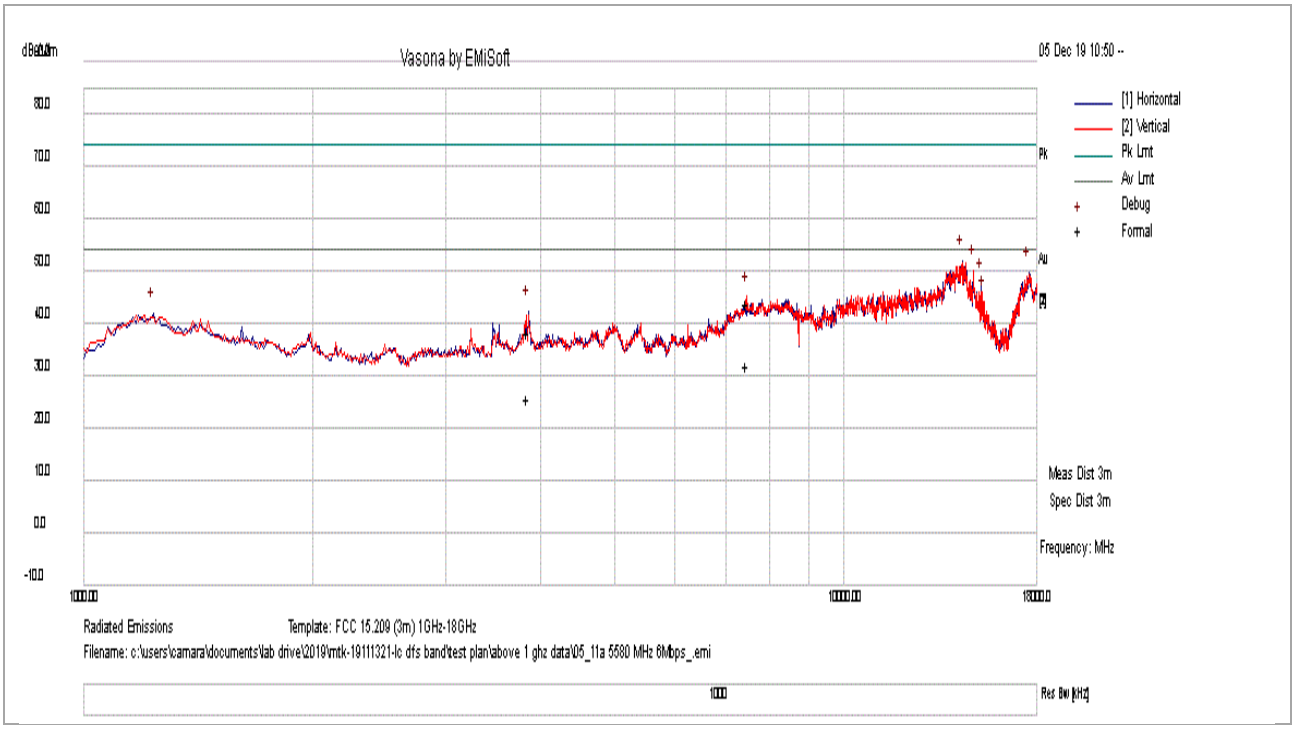
Test Standard:	**15.209, RSS-247**	**Mode:**	**11a-5500MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8032.81	29.50	21.30	-6.20	44.60	PK	V	187	160	74	-29.40
3509.16	38.50	15.90	-17.80	36.70	PK	H	188	53	74	-37.30
8032.81	18.10	21.30	-6.20	33.20	AV	V	187	160	54	-20.80
3509.16	26.60	15.90	-17.80	24.80	AV	H	188	53	54	-29.20

1GHz – 18GHz test result

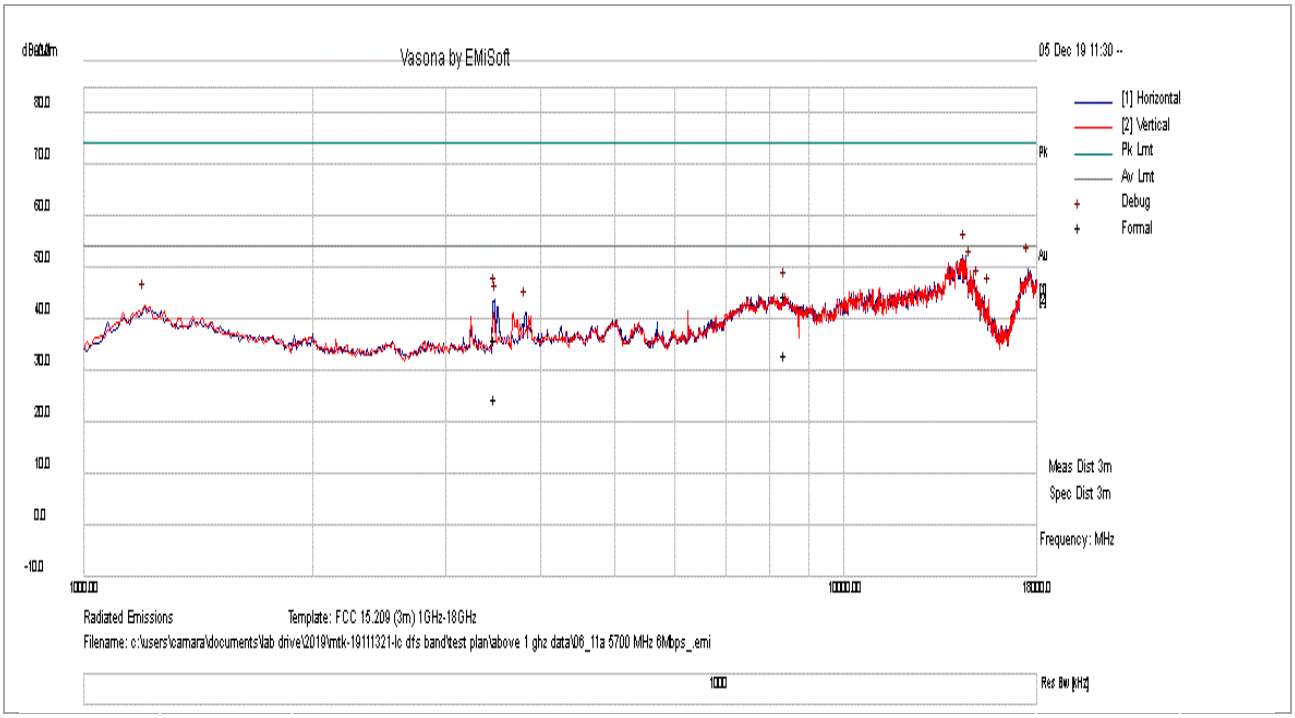
Test Standard:	**15.209, RSS-247**	**Mode:**	**11a-5580MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7469.39	30.70	21.00	-7.60	44.10	PK	V	137	219	74	-29.90
3846.40	37.60	16.50	-15.90	38.20	PK	H	140	265	74	-35.80
7469.39	18.90	21.00	-7.60	32.20	AV	V	137	219	54	-21.80
3846.40	25.20	16.50	-15.90	25.90	AV	H	140	265	54	-28.10

1GHz – 18GHz test result

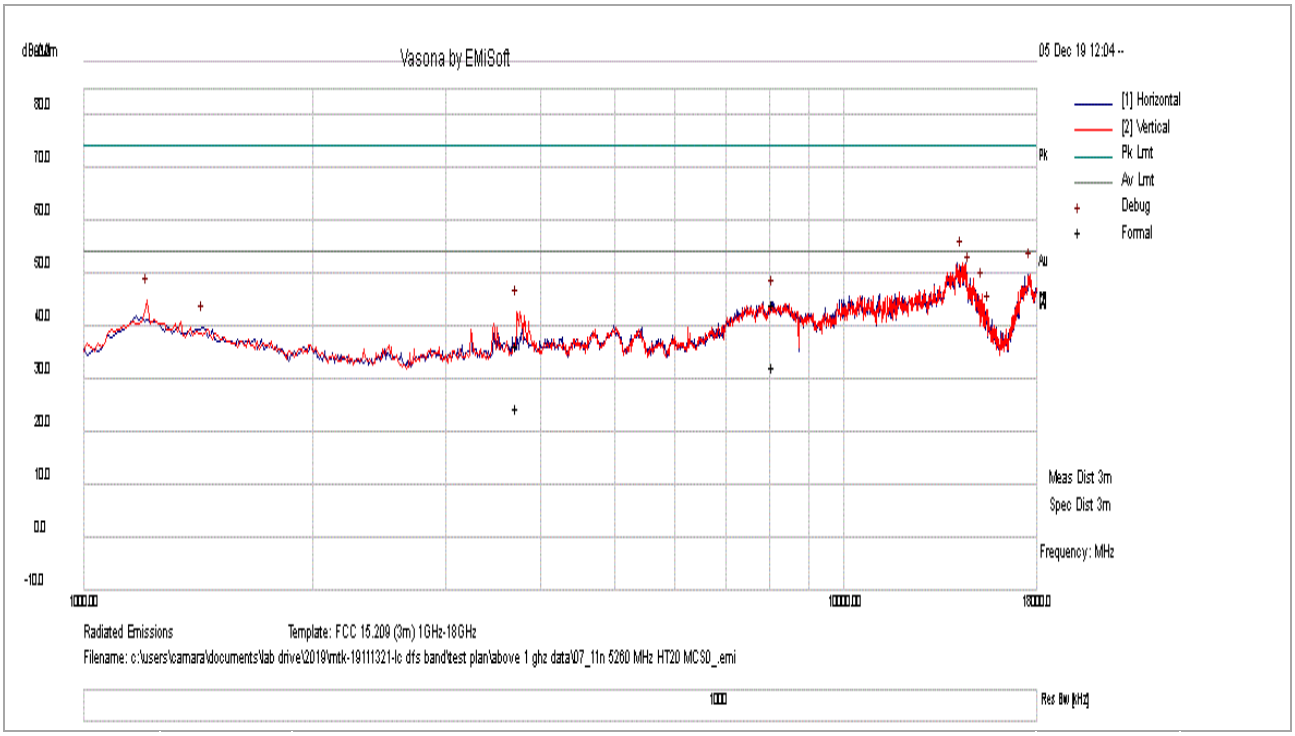
Test Standard:	**15.209, RSS-247**	**Mode:**	**11a-5700MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8386.26	29.00	21.20	-5.60	44.60	PK	V	358	10	74	-29.40
3476.29	38.10	15.90	-17.90	36.00	PK	H	154	213	74	-38.00
8386.26	17.50	21.20	-5.60	33.10	AV	V	358	10	54	-20.90
3476.29	26.60	15.90	-17.90	24.50	AV	H	154	213	54	-29.50

1GHz – 18GHz test result

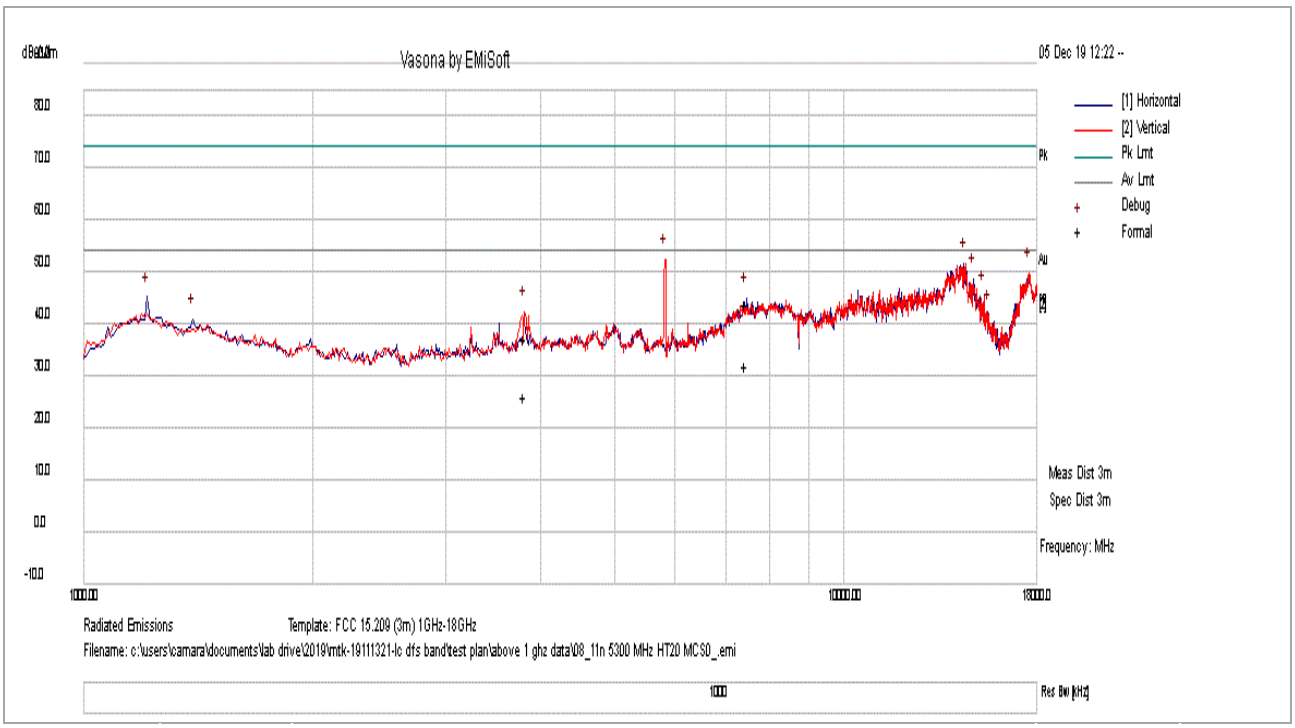
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n-5260MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8075.37	29.10	21.20	-6.10	44.20	PK	H	264	148	74	-29.80
3720.58	36.80	16.30	-16.80	36.40	PK	V	175	72	74	-37.60
8075.37	17.40	21.20	-6.10	32.50	AV	H	264	148	54	-21.50
3720.58	25.30	16.30	-16.80	24.90	AV	V	175	72	54	-29.10

1GHz – 18GHz test result

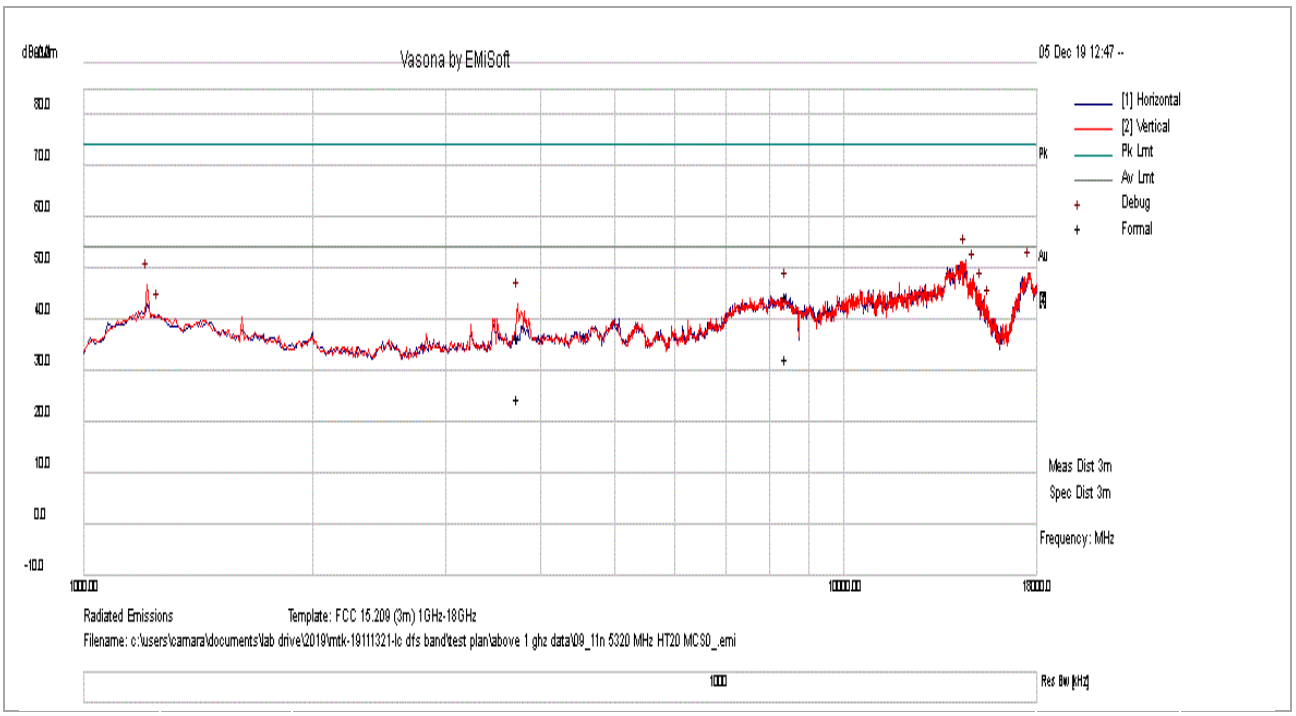
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n-5300MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7448.27	30.50	20.90	-7.60	43.80	PK	H	192	201	74	-30.20
3805.00	37.10	16.40	-16.10	37.50	PK	V	276	206	74	-36.50
7448.27	18.90	20.90	-7.60	32.20	AV	H	192	201	54	-21.80
3805.00	25.70	16.40	-16.10	26.10	AV	V	276	206	54	-27.90

1GHz – 18GHz test result

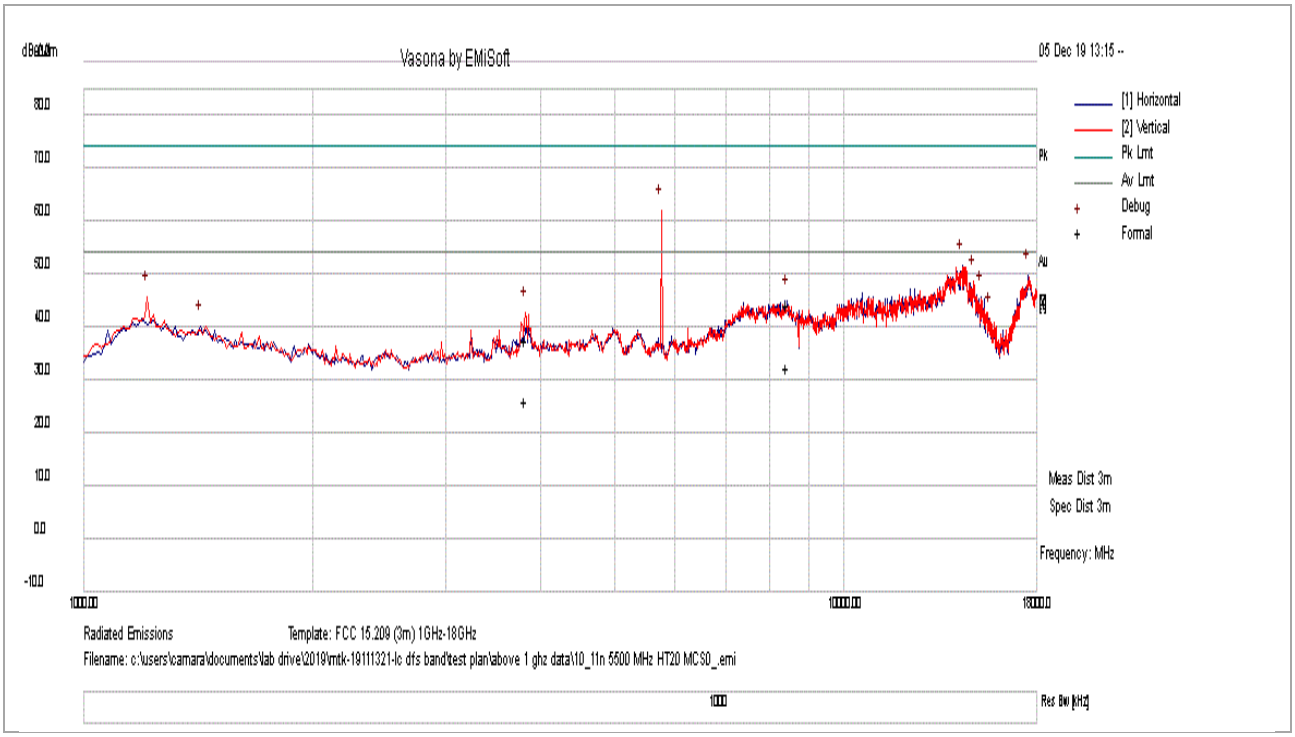
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n-5320MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8416.27	29.20	21.20	-5.60	44.90	PK	H	169	294	74	-29.10
3731.54	36.90	16.30	-16.70	36.50	PK	V	179	212	74	-37.50
8416.27	17.00	21.20	-5.60	32.60	AV	H	169	294	54	-21.40
3731.54	25.20	16.30	-16.70	24.80	AV	V	179	212	54	-29.20

1GHz – 18GHz test result

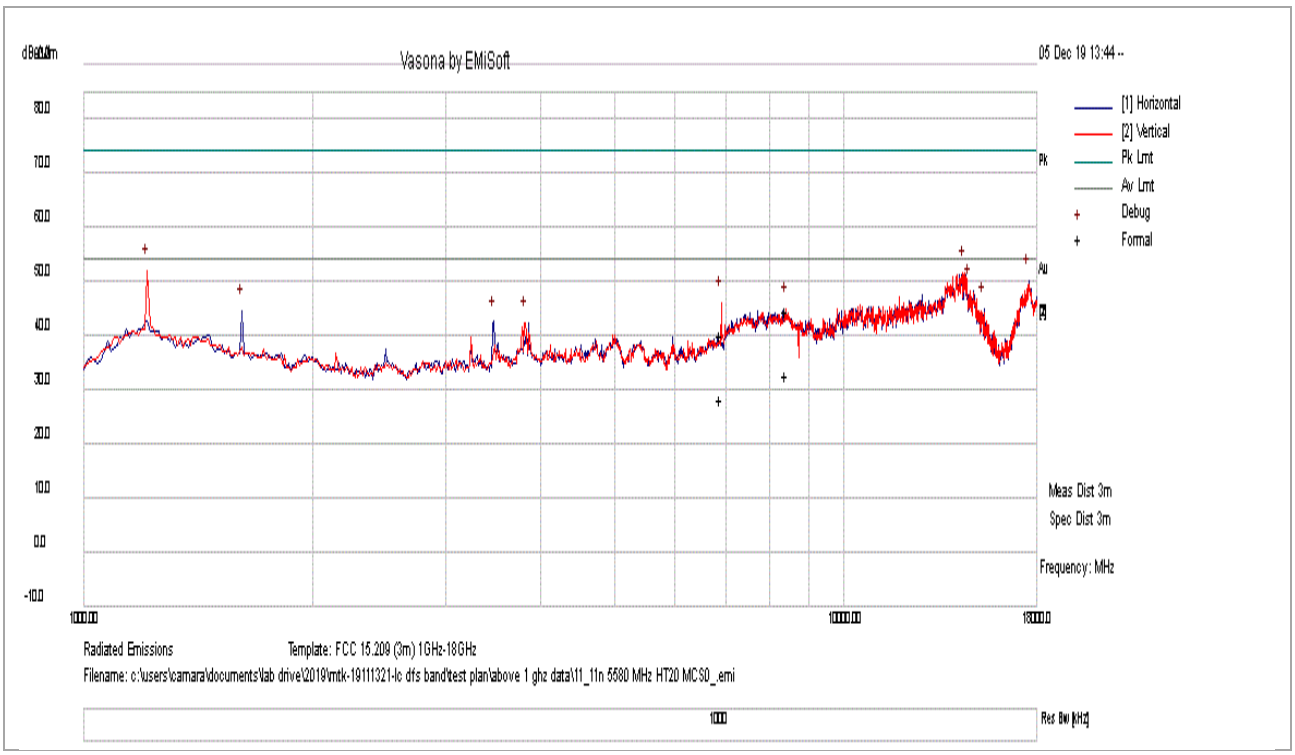
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n-5500MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8435.74	28.70	21.20	-5.60	44.40	PK	H	114	0	74	-29.70
3814.83	37.20	16.40	-16.00	37.60	PK	V	341	161	74	-36.40
8435.74	16.80	21.20	-5.60	32.40	AV	H	114	0	54	-21.60
3814.83	25.70	16.40	-16.00	26.10	AV	V	341	161	54	-27.90

1GHz – 18GHz test result

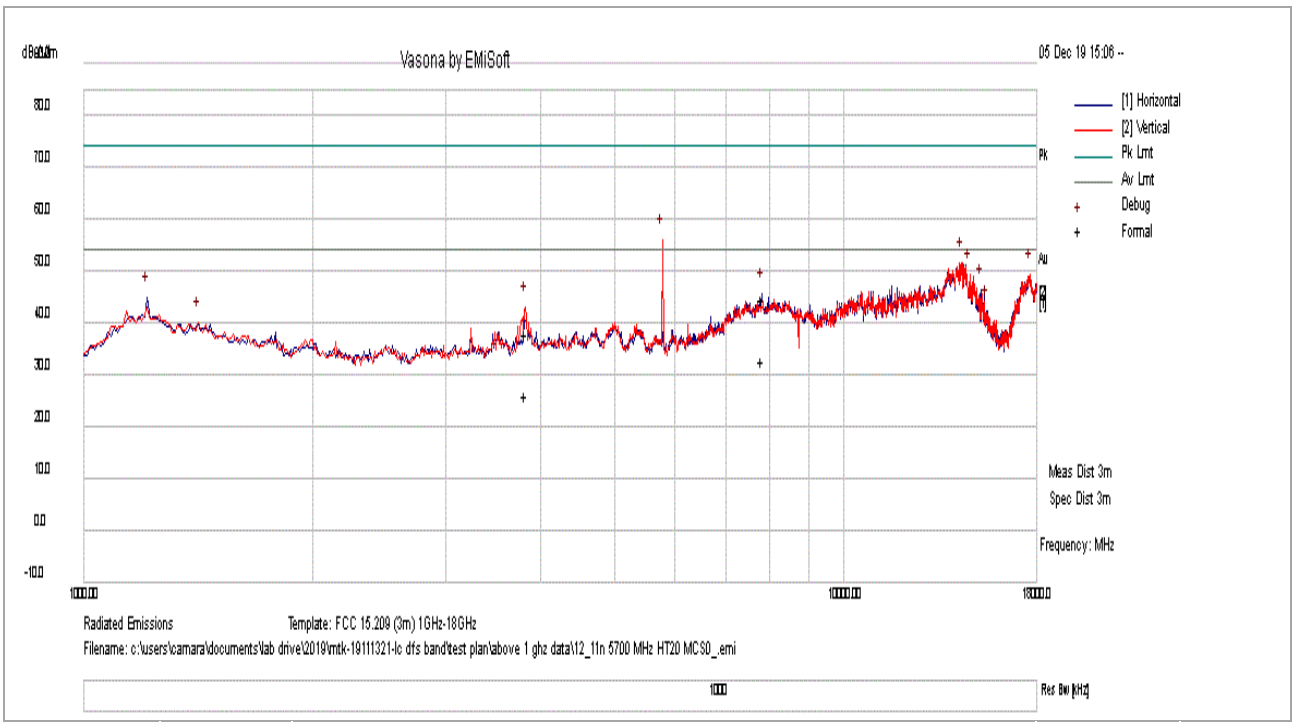
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n-5580MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
6908.07	30.10	19.90	-9.80	40.10	PK	V	266	100	74	-33.90
8407.24	28.90	21.20	-5.60	44.60	PK	V	190	236	74	-29.40
6908.07	18.20	19.90	-9.80	28.30	AV	V	266	100	54	-25.70
8407.24	17.10	21.20	-5.60	32.70	AV	V	190	236	54	-21.30

1GHz – 18GHz test result

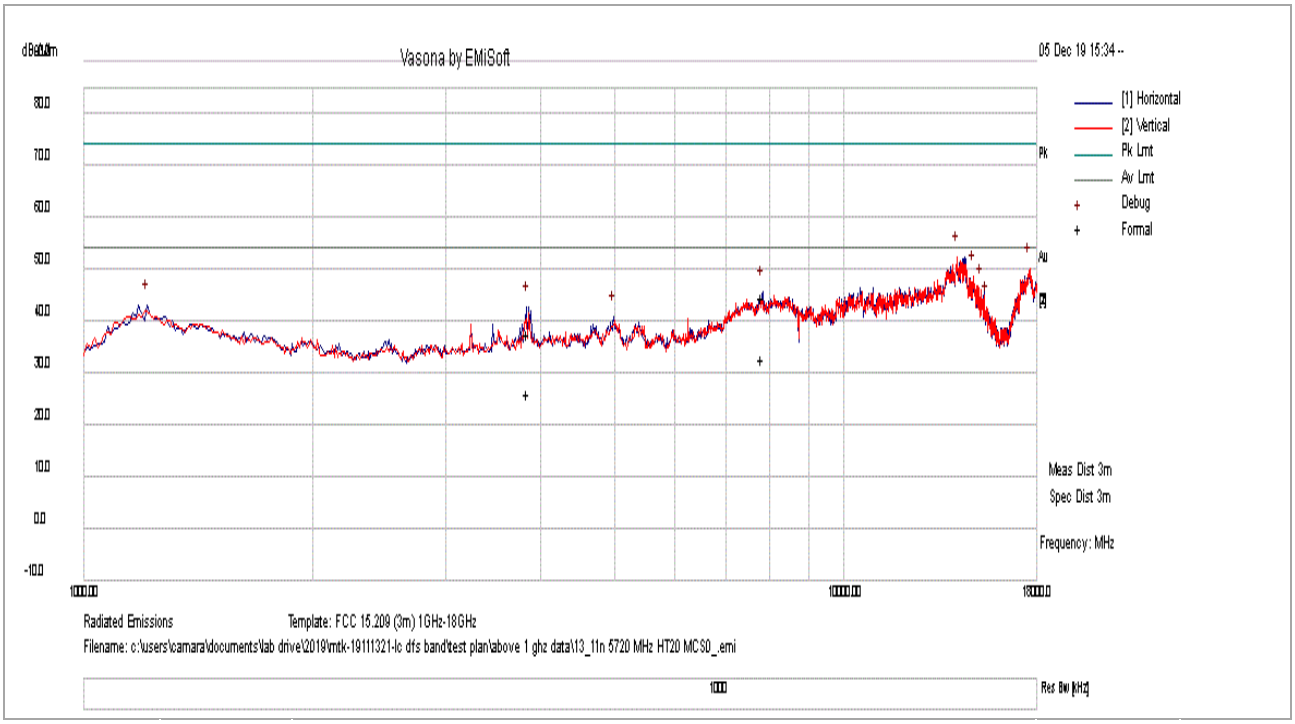
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n-5700MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7819.51	30.50	21.20	-6.90	44.80	PK	H	343	199	74	-29.20
3815.77	37.80	16.40	-16.00	38.20	PK	V	357	136	74	-35.80
7819.51	18.60	21.20	-6.90	32.90	AV	H	343	199	54	-21.10
3815.77	25.60	16.40	-16.00	26.10	AV	V	357	136	54	-27.90

1GHz – 18GHz test result

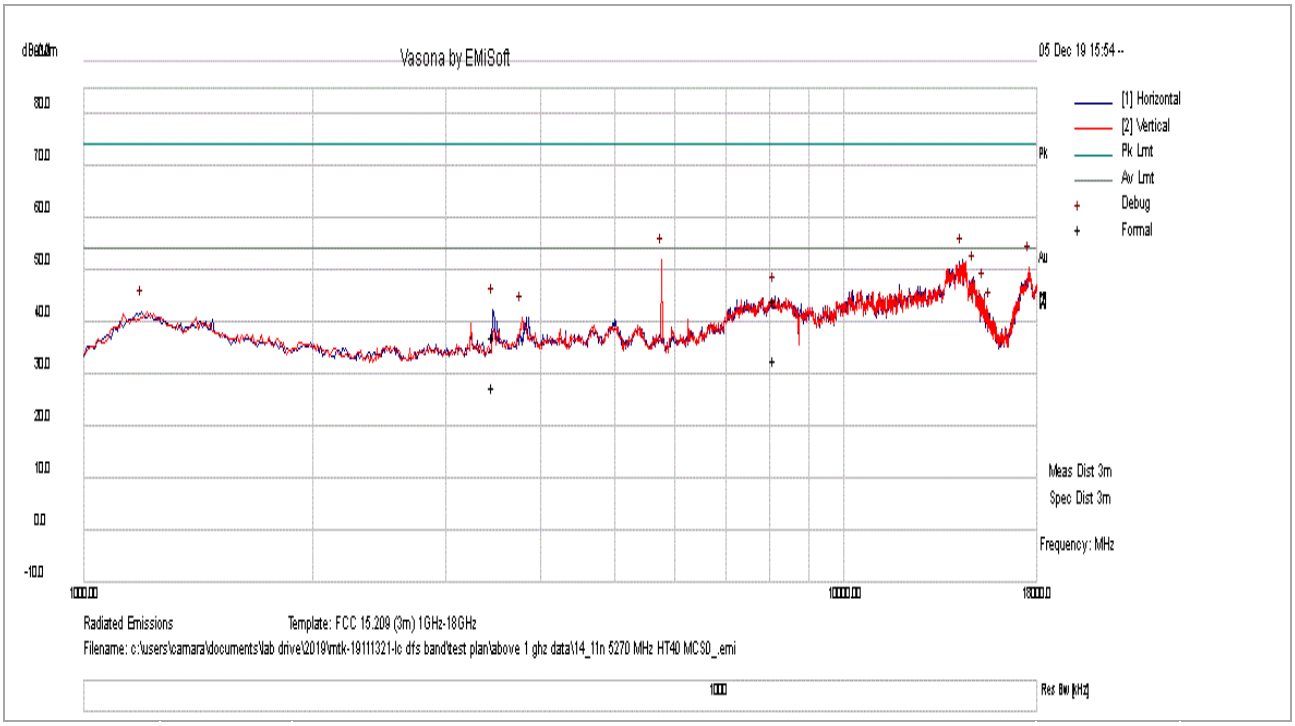
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n20-5720MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7833.71	30.30	21.20	-6.80	44.60	PK	H	280	226	74	-29.40
3846.62	36.90	16.50	-15.90	37.60	PK	H	100	171	74	-36.40
7833.71	18.50	21.20	-6.80	32.90	AV	H	280	226	54	-21.10
3846.62	25.40	16.50	-15.90	26.00	AV	H	100	171	54	-28.00

1GHz – 18GHz test result

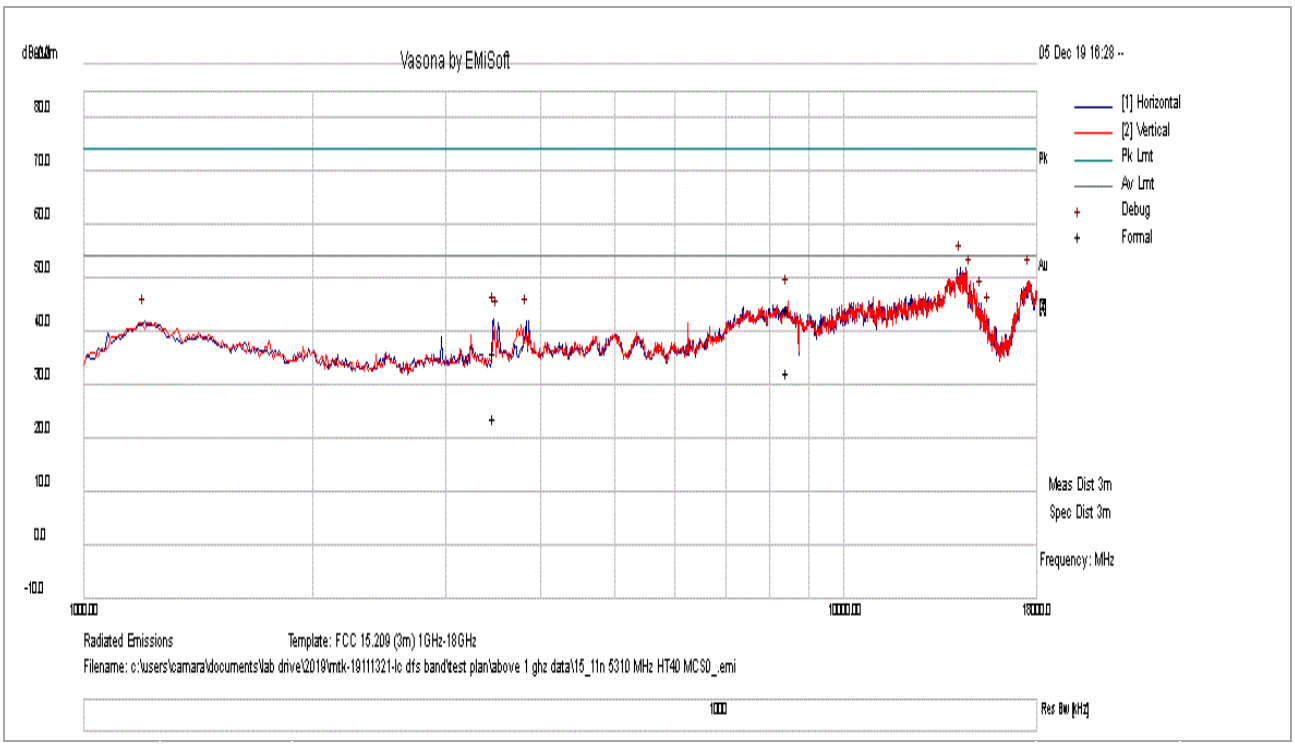
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n40-5270MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8117.41	29.00	21.20	-6.10	44.10	PK	H	134	28	74	-29.90
3453.37	39.60	15.80	-18.10	37.40	PK	H	128	286	74	-36.60
8117.41	17.50	21.20	-6.10	32.70	AV	H	134	28	54	-21.30
3453.37	29.70	15.80	-18.10	27.50	AV	H	128	286	54	-26.50

1GHz – 18GHz test result

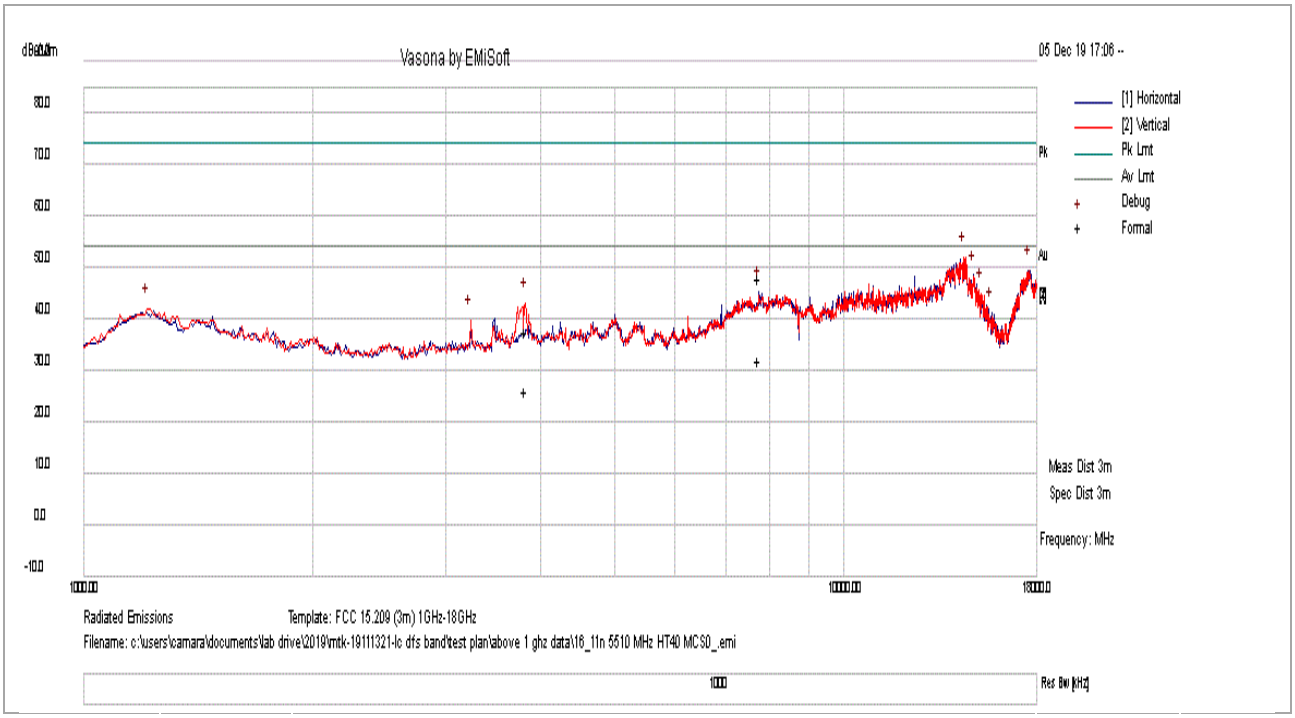
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n40-5310MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8446.96	28.90	21.20	-5.50	44.50	PK	V	296	72	74	-29.50
3464.61	38.40	15.90	-18.00	36.30	PK	H	259	194	74	-37.70
8446.96	16.90	21.20	-5.50	32.50	AV	V	296	72	54	-21.50
3464.61	26.20	15.90	-18.00	24.10	AV	H	259	194	54	-29.90

1GHz – 18GHz test result

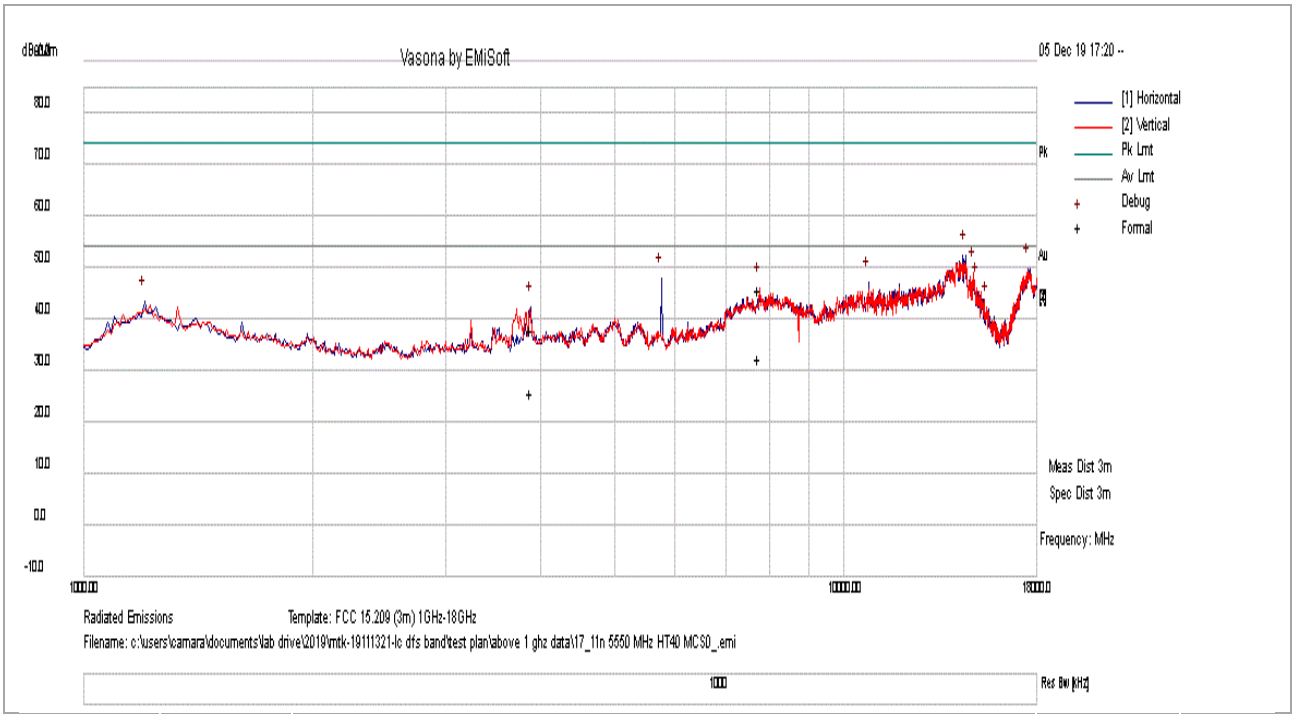
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n40-5510MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7746.56	33.90	21.10	-7.10	48.00	PK	H	376	337	74	-26.10
3814.49	37.30	16.40	-16.00	37.70	PK	V	292	237	74	-36.30
7746.56	18.20	21.10	-7.10	32.20	AV	H	376	337	54	-21.80
3814.49	25.70	16.40	-16.00	26.10	AV	V	292	237	54	-27.90

1GHz – 18GHz test result

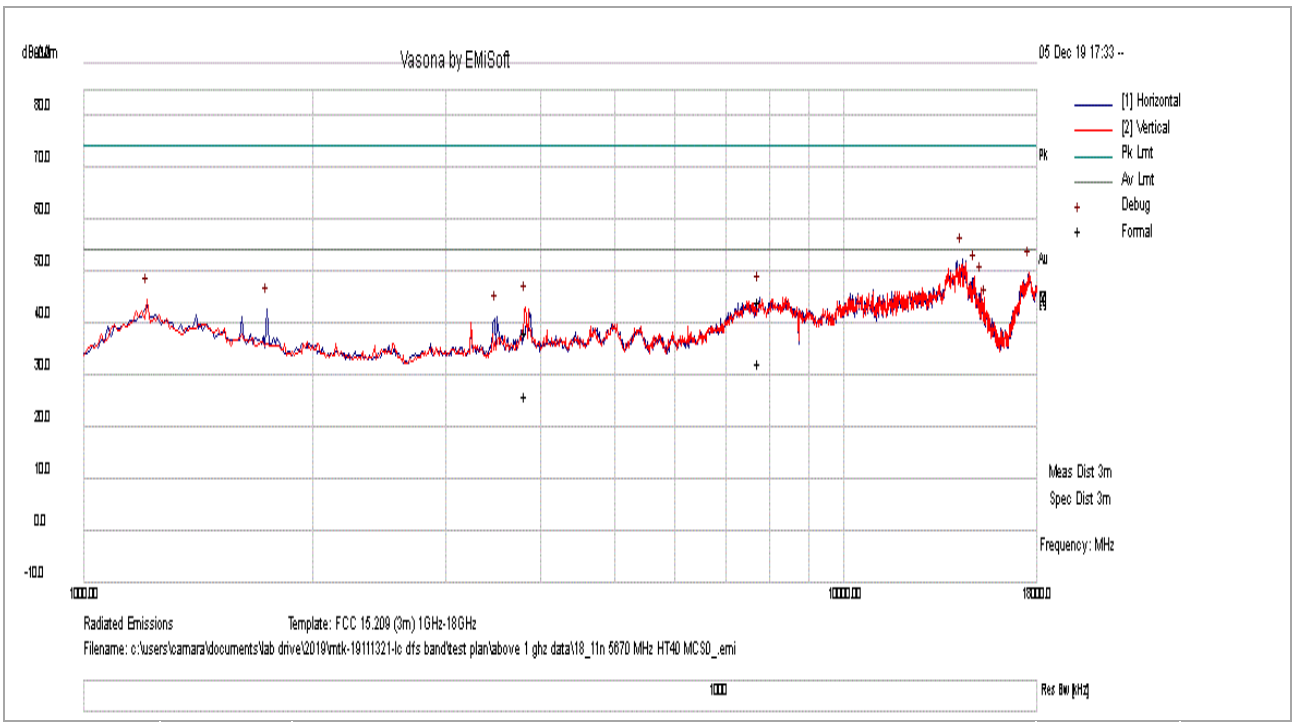
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n40-5550MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7756.70	31.60	21.10	-7.10	45.70	PK	V	400	244	74	-28.30
3878.45	37.20	16.50	-15.80	38.00	PK	H	250	58	74	-36.00
7756.70	18.40	21.10	-7.10	32.50	AV	V	400	244	54	-21.50
3878.45	25.00	16.50	-15.80	25.80	AV	H	250	58	54	-28.20

1GHz – 18GHz test result

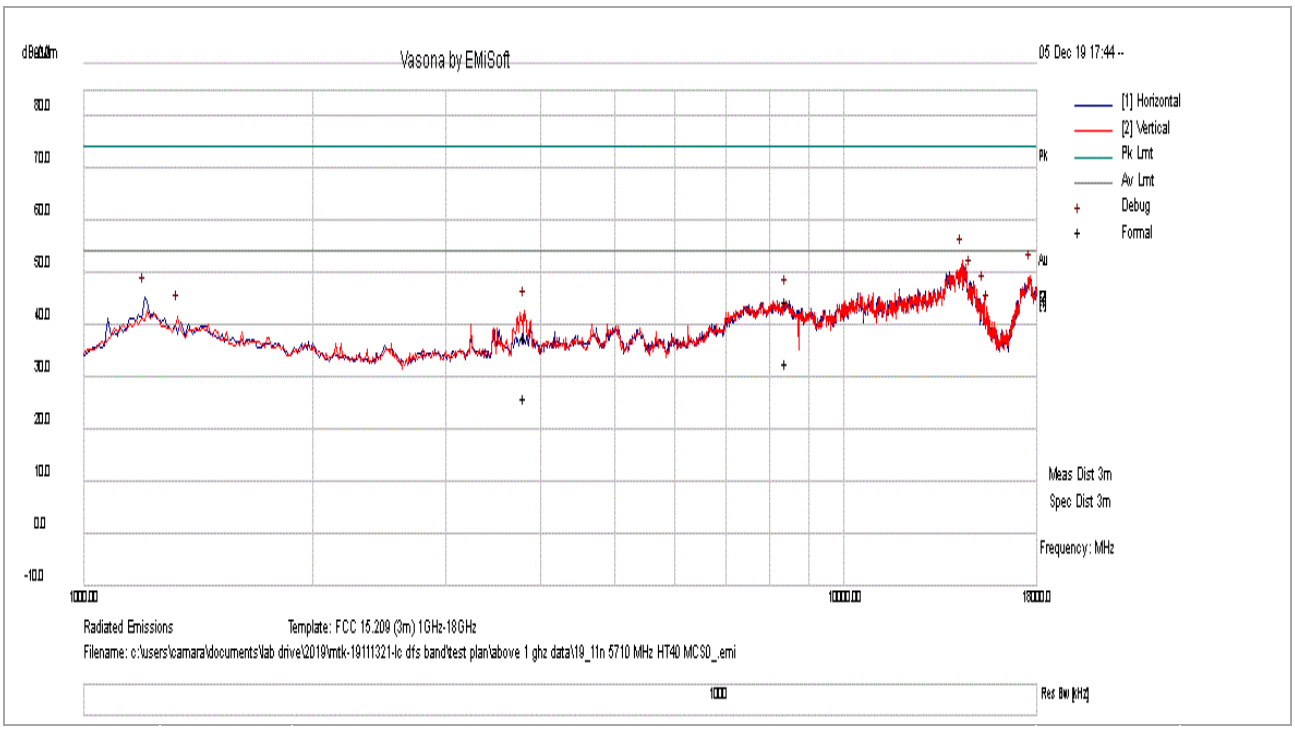
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n40-5670MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**12/05/2019**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7758.88	30.20	21.10	-7.10	44.30	PK	H	119	253	74	-29.70
3816.48	37.90	16.40	-16.00	38.30	PK	V	326	327	74	-35.70
7758.88	18.30	21.10	-7.10	32.40	AV	H	119	253	54	-21.60
3816.48	25.70	16.40	-16.00	26.10	AV	V	326	327	54	-27.90

1GHz – 18GHz test result

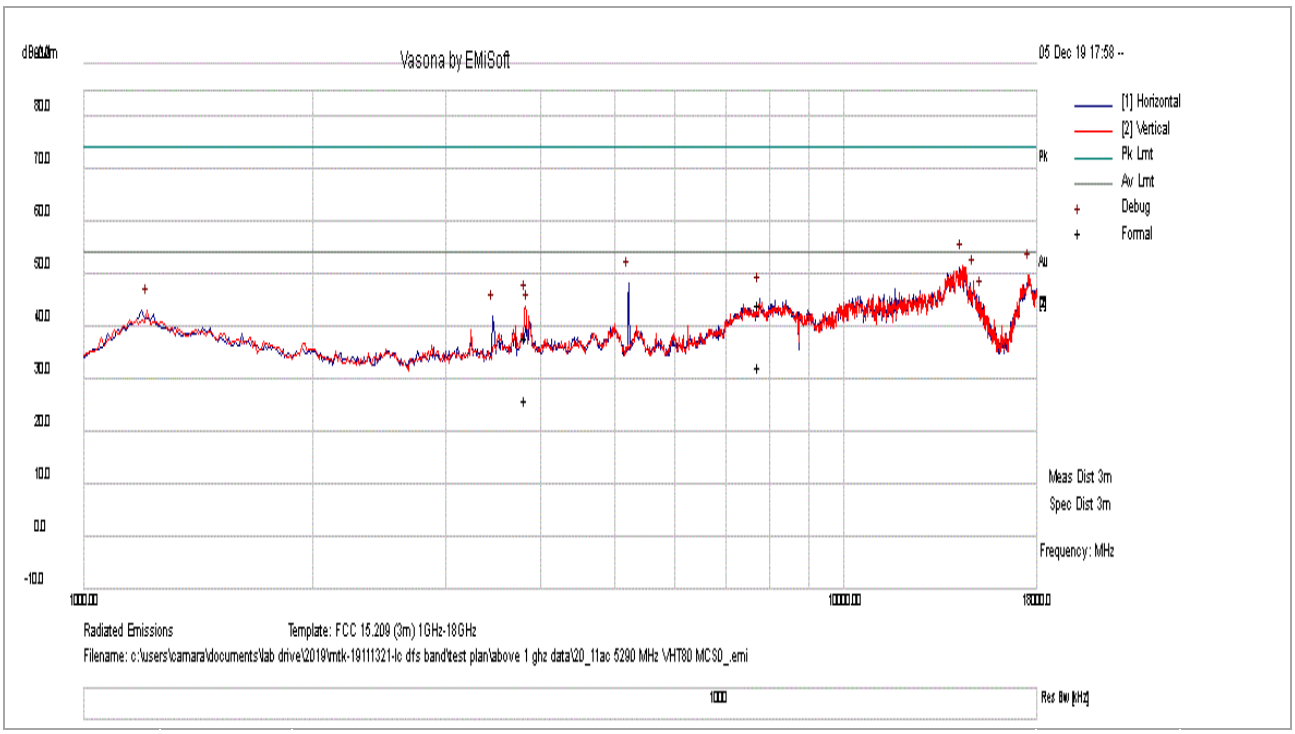
Test Standard:	**15.209, RSS-247**	**Mode:**	**11n40-5710MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8406.05	29.00	21.20	-5.60	44.60	PK	V	194	18	74	-29.40
3803.93	37.30	16.40	-16.10	37.60	PK	V	260	3	74	-36.40
8406.05	17.20	21.20	-5.60	32.80	AV	V	194	18	54	-21.20
3803.93	25.80	16.40	-16.10	26.10	AV	V	260	3	54	-27.90

1GHz – 18GHz test result

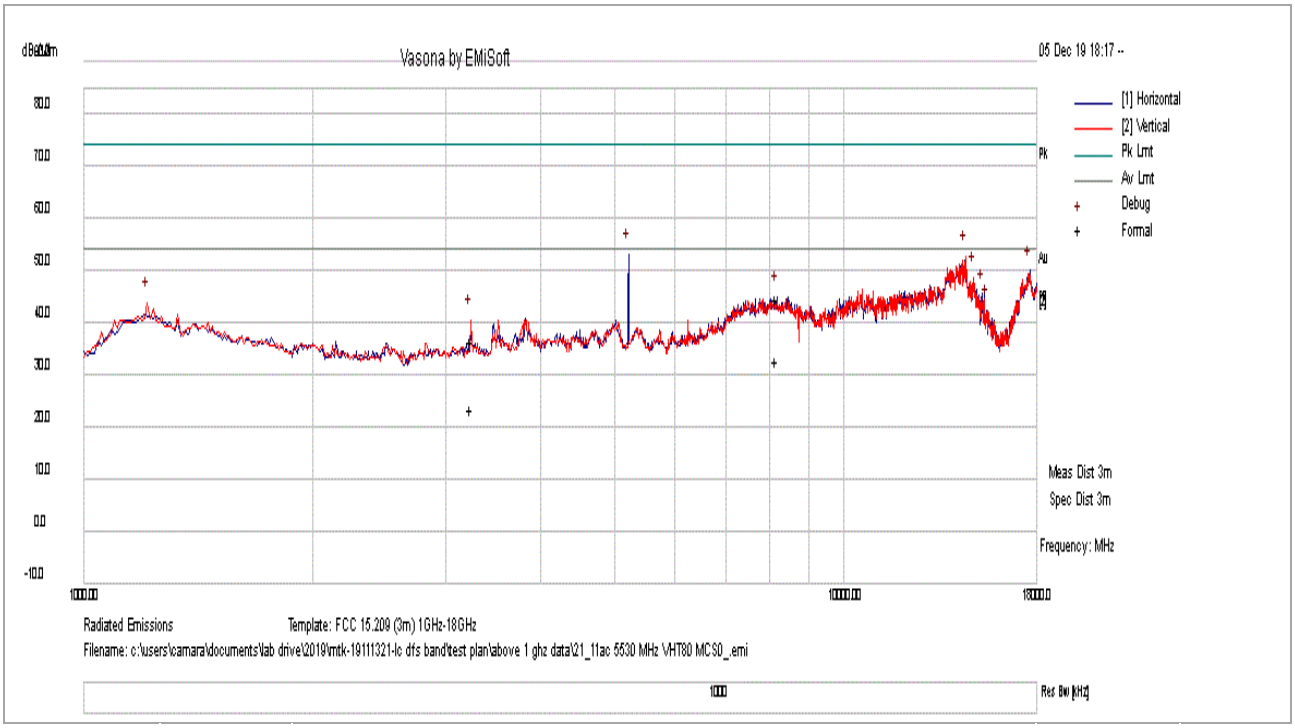
Test Standard:	**15.209, RSS-247**	**Mode:**	**11ac80-5290MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7756.61	30.30	21.10	-7.10	44.40	PK	H	206	198	74	-29.60
3814.78	37.50	16.40	-16.00	37.90	PK	V	280	0	74	-36.10
7756.61	18.30	21.10	-7.10	32.40	AV	H	206	198	54	-21.60
3814.78	25.70	16.40	-16.00	26.10	AV	V	280	0	54	-27.90

1GHz – 18GHz test result

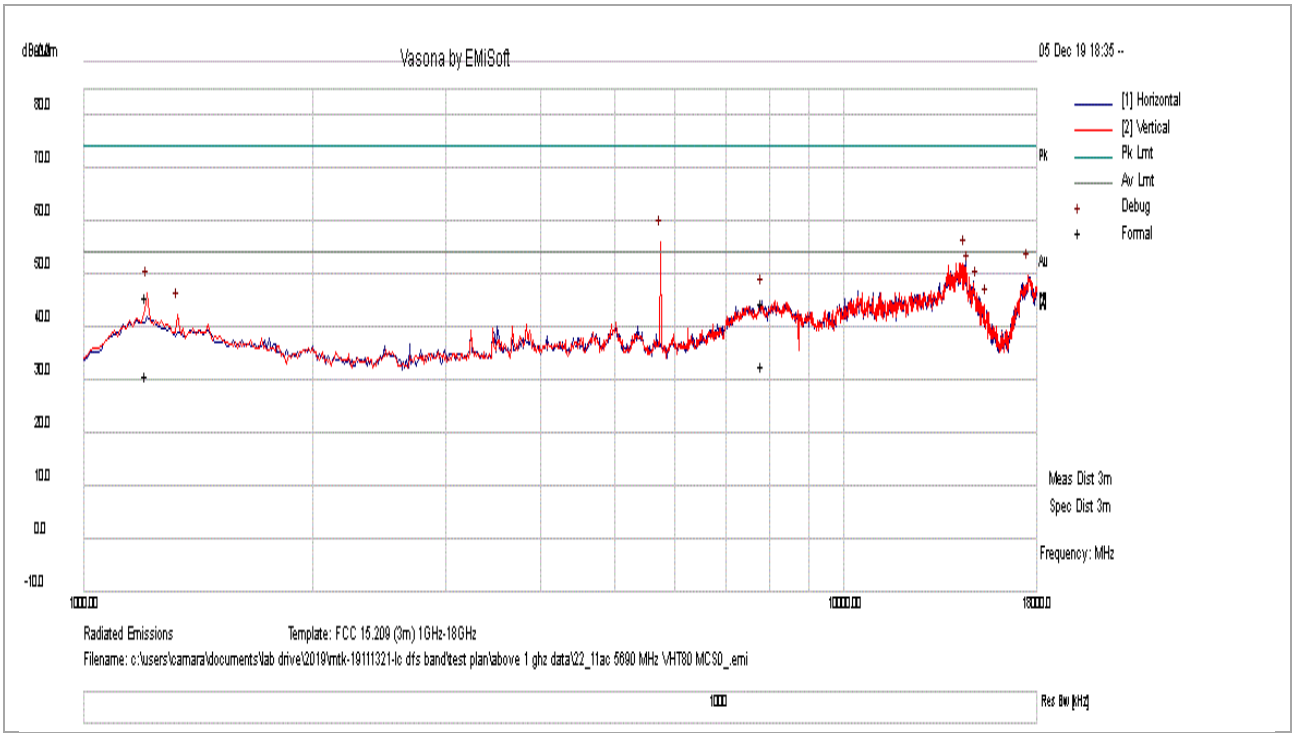
Test Standard:	**15.209, RSS-247**	**Mode:**	**11ac80-5530MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
8170.01	29.40	21.20	-6.00	44.70	PK	H	232	288	74	-29.30
3232.91	40.10	15.60	-19.30	36.40	PK	V	150	309	74	-37.60
8170.01	17.40	21.20	-6.00	32.70	AV	H	232	288	54	-21.30
3232.91	27.50	15.60	-19.30	23.80	AV	V	150	309	54	-30.20

1GHz – 18GHz test result

Test Standard:	**15.209, RSS-247**	**Mode:**	**11ac80-5690MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**12/05/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Bruce Li**
Remark:	**N/A**	**Test Result:**	**Pass**

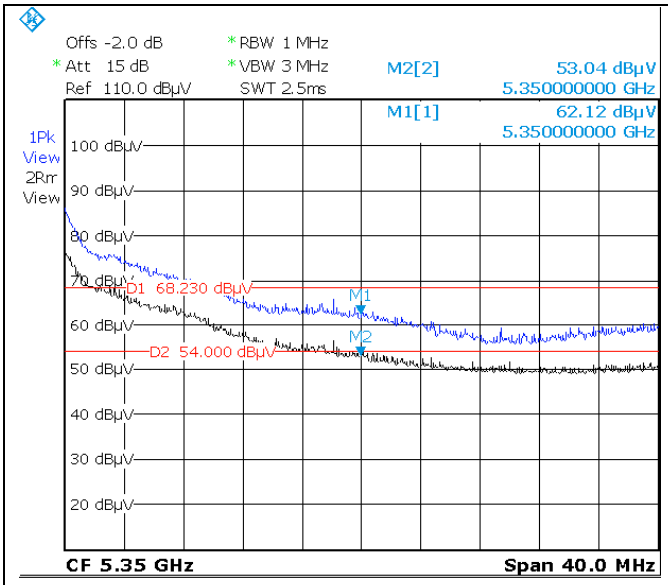


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
1210.55	50.70	14.30	-19.30	45.80	PK	V	100	153	74	-28.20
7822.04	30.20	21.20	-6.90	44.60	PK	H	202	0	74	-29.40
1210.55	36.00	14.30	-19.30	31.00	AV	V	100	153	54	-23.00
7822.04	18.50	21.20	-6.90	32.90	AV	H	202	0	54	-21.10

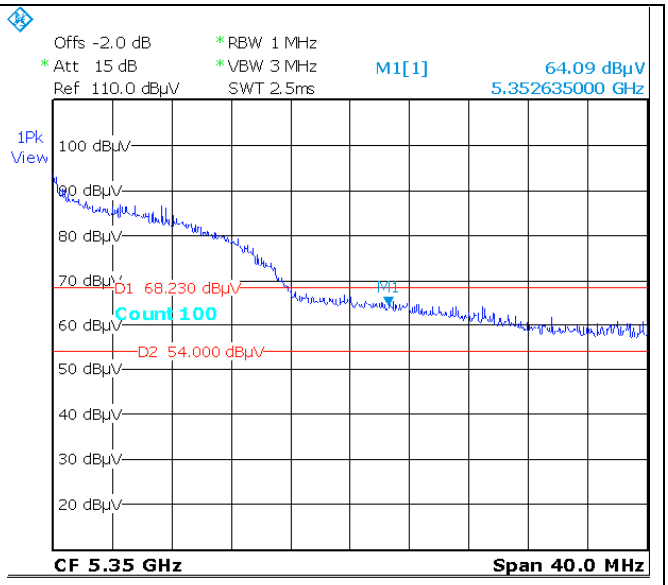
18GHz – 40GHz test result

Note: no substantial emission is found other than the noise floor.

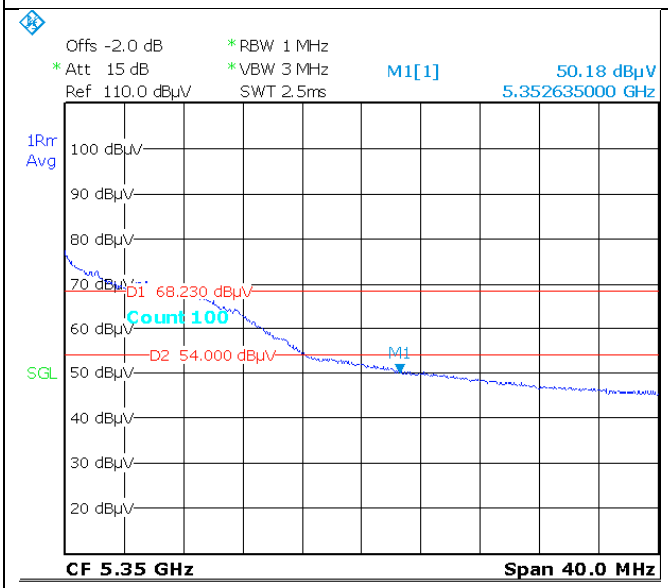
Radiated Band Edge measurement result



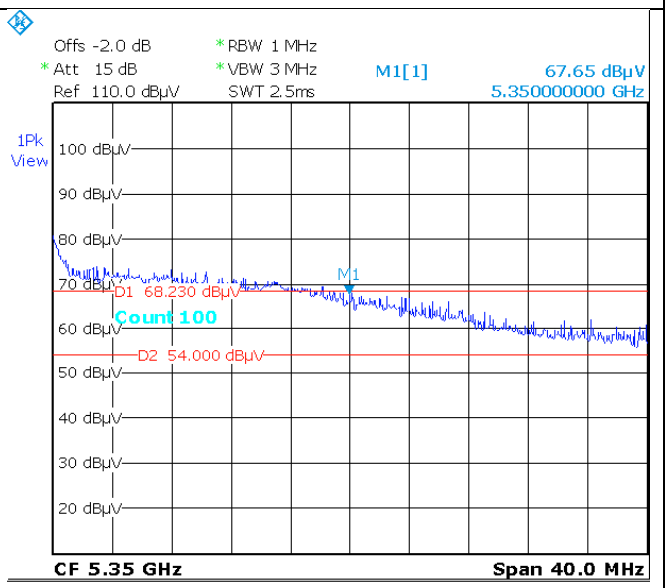
802.11a 5320M– Edge 5350MHz



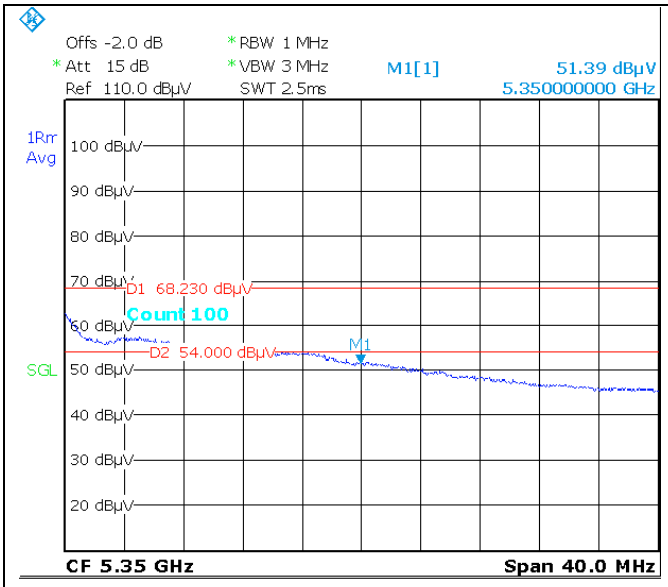
802.11n 5320M– Edge 5350MHz (Peak)



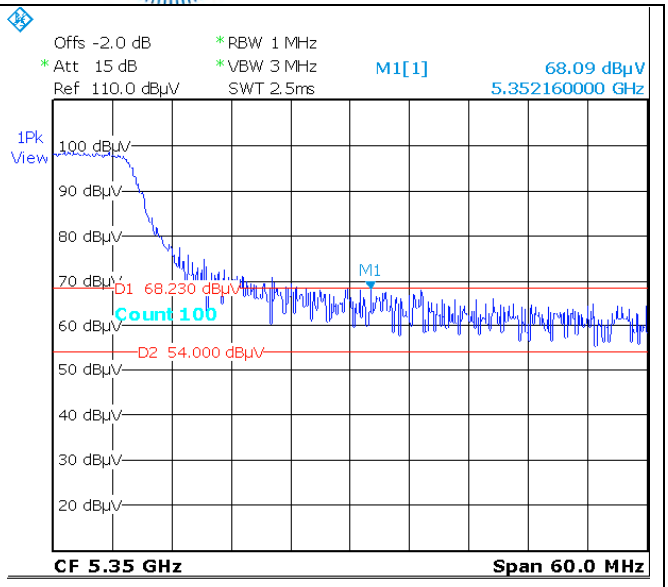
802.11n 5320M– Edge 5350MHz (Average)



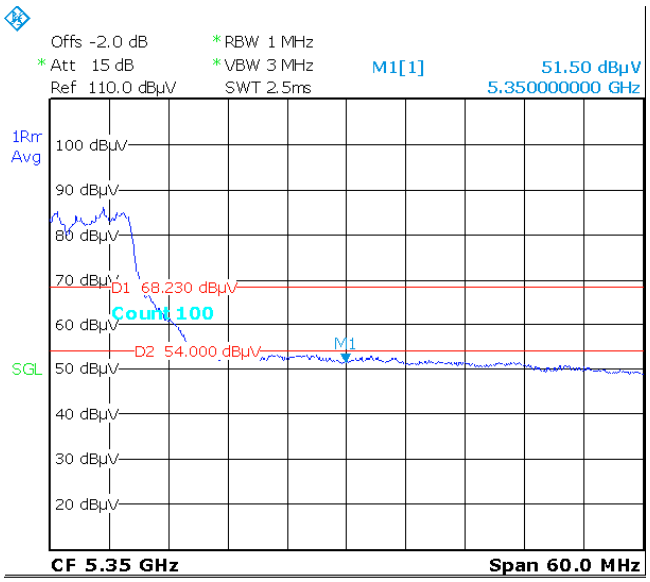
802.11n40MHz 5310M– Edge 5350MHz (Peak)



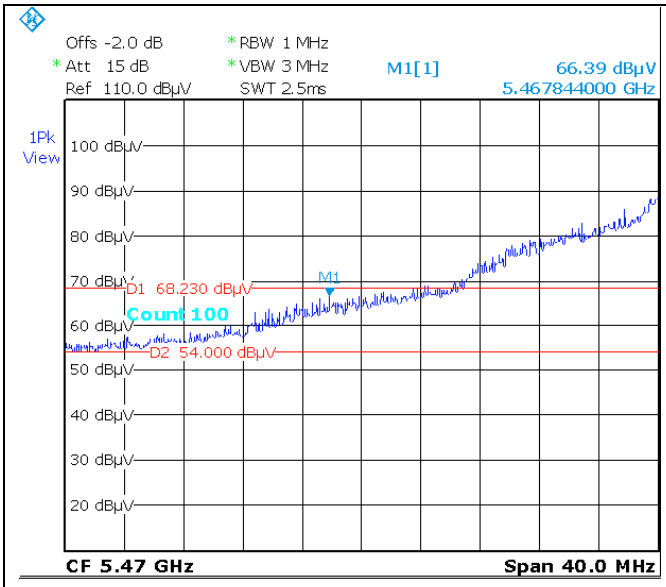
802.11n40MHz 5310M– Edge 5350MHz (Average)



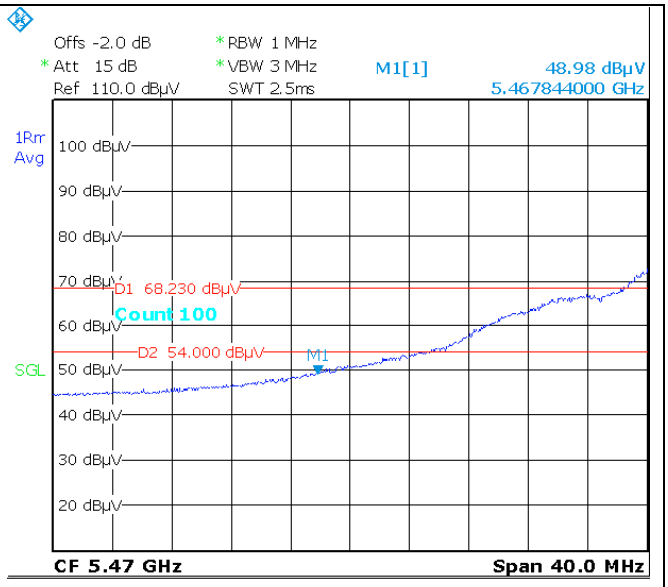
802.11ac80MHz 5290M– Edge 5350MHz (Peak)



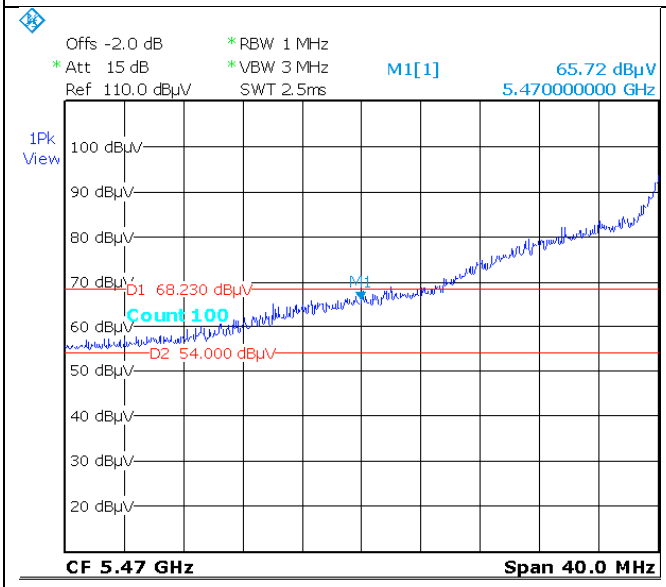
802.11ac80MHz 5290M– Edge 5350MHz (Average)



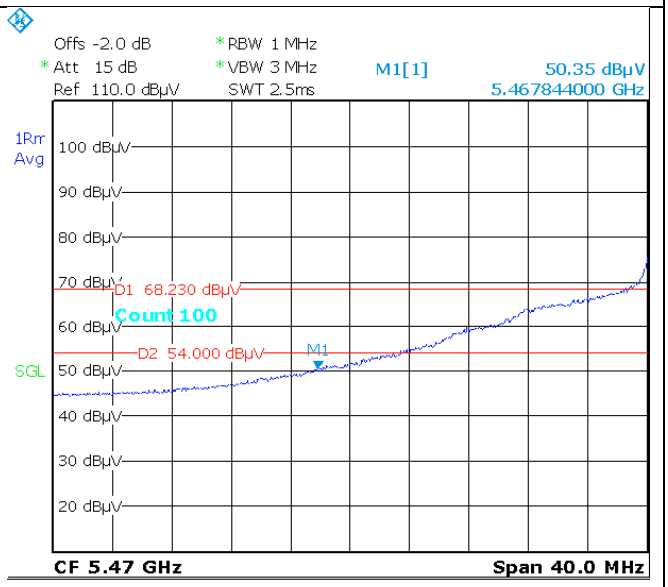
802.11a 5500M– Edge 5470MHz (Peak)



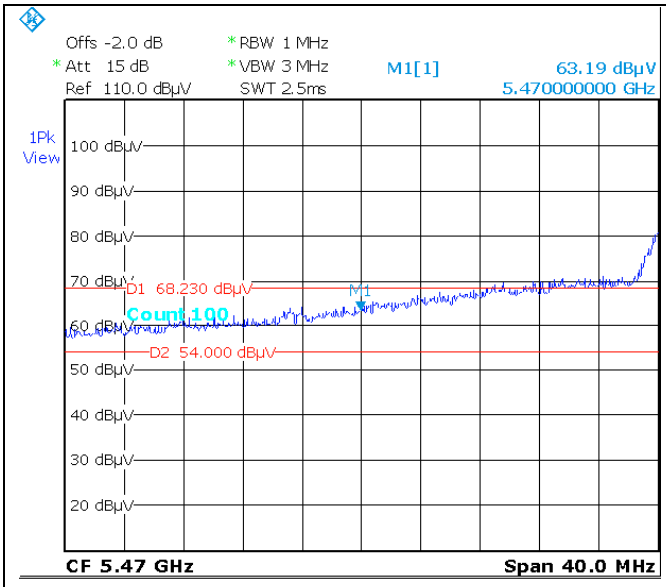
802.11a 5500M– Edge 5470MHz (Average)



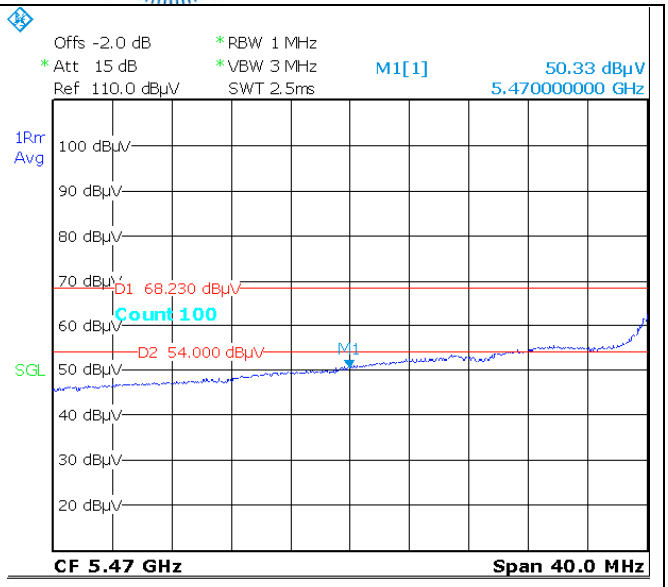
802.11n 5500M– Edge 5470MHz (Peak)



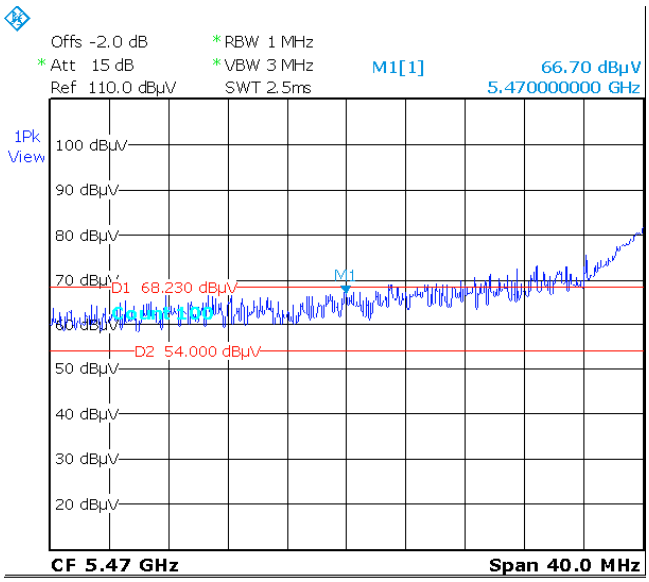
802.11n 5500M– Edge 5470MHz (Average)



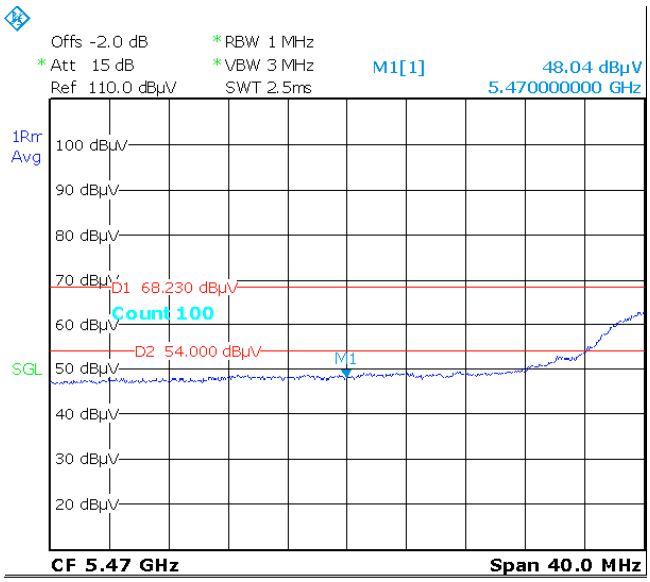
802.11n40MHz 5510M– Edge 5470MHz (Peak)



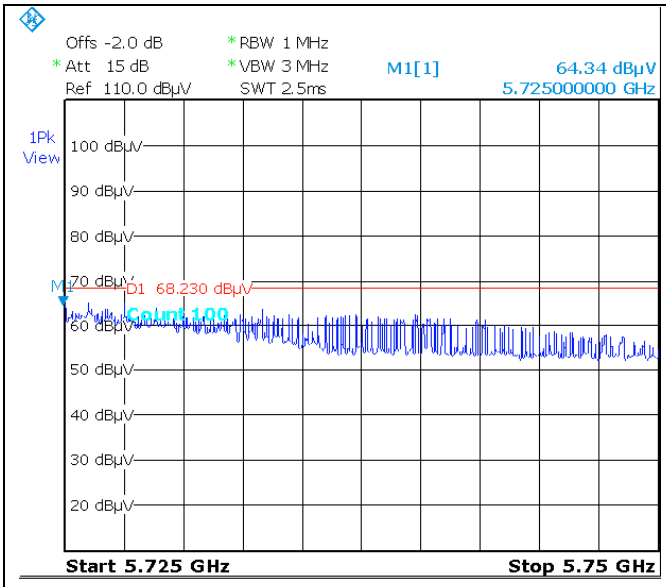
802.11n40MHz 5510M– Edge 5470MHz (Average)



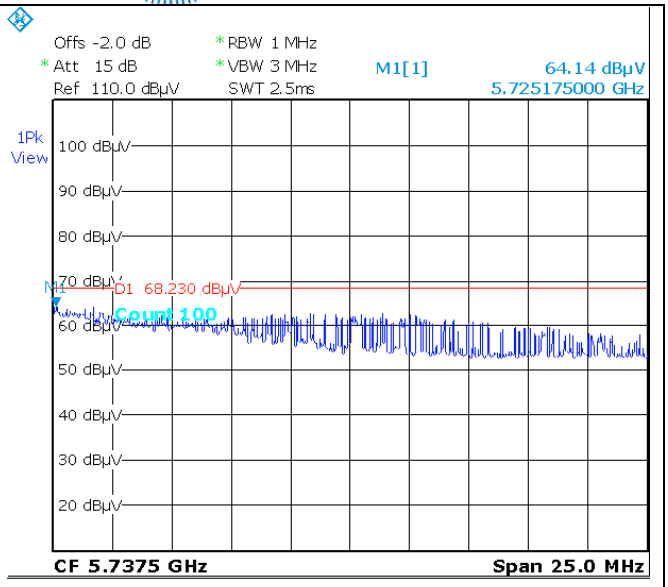
802.11ac80MHz 5530M– Edge 5470MHz (Peak)



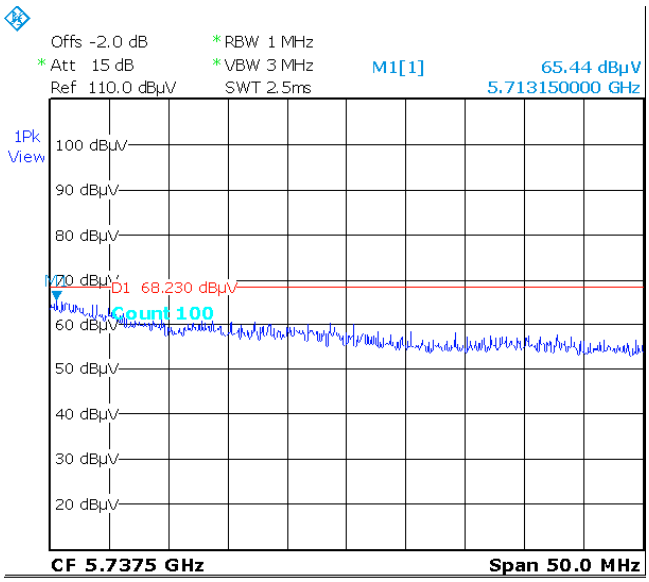
802.11ac80MHz 5530M– Edge 5470MHz (Average)



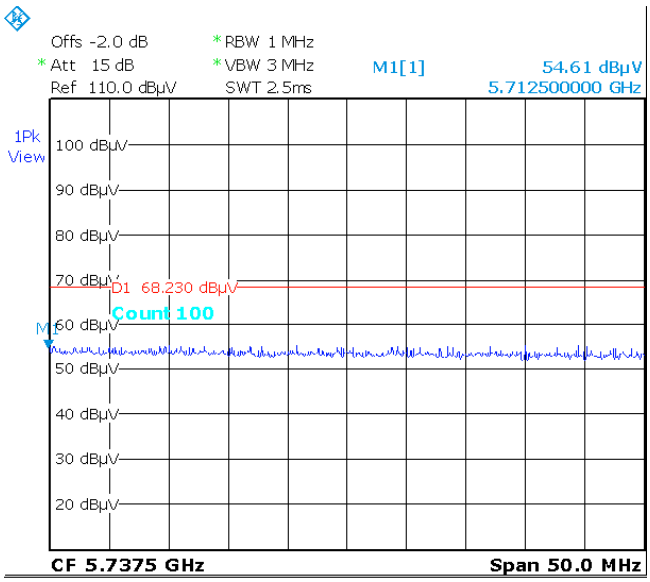
802.11a 5700M– Edge 5725MHz



802.11n 5700M– Edge 5725MHz



802.11n40MHz 5670M– Edge 5725MHz



802.11ac80MHz 5530M– Edge 5725MHz

8.8 Conducted Emissions

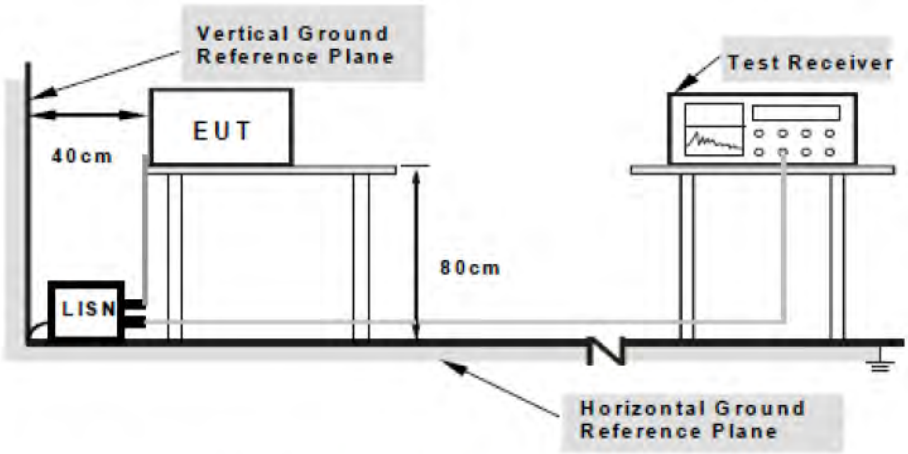
8.8.1 Requirement

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 µH/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.			

8.8.2 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.

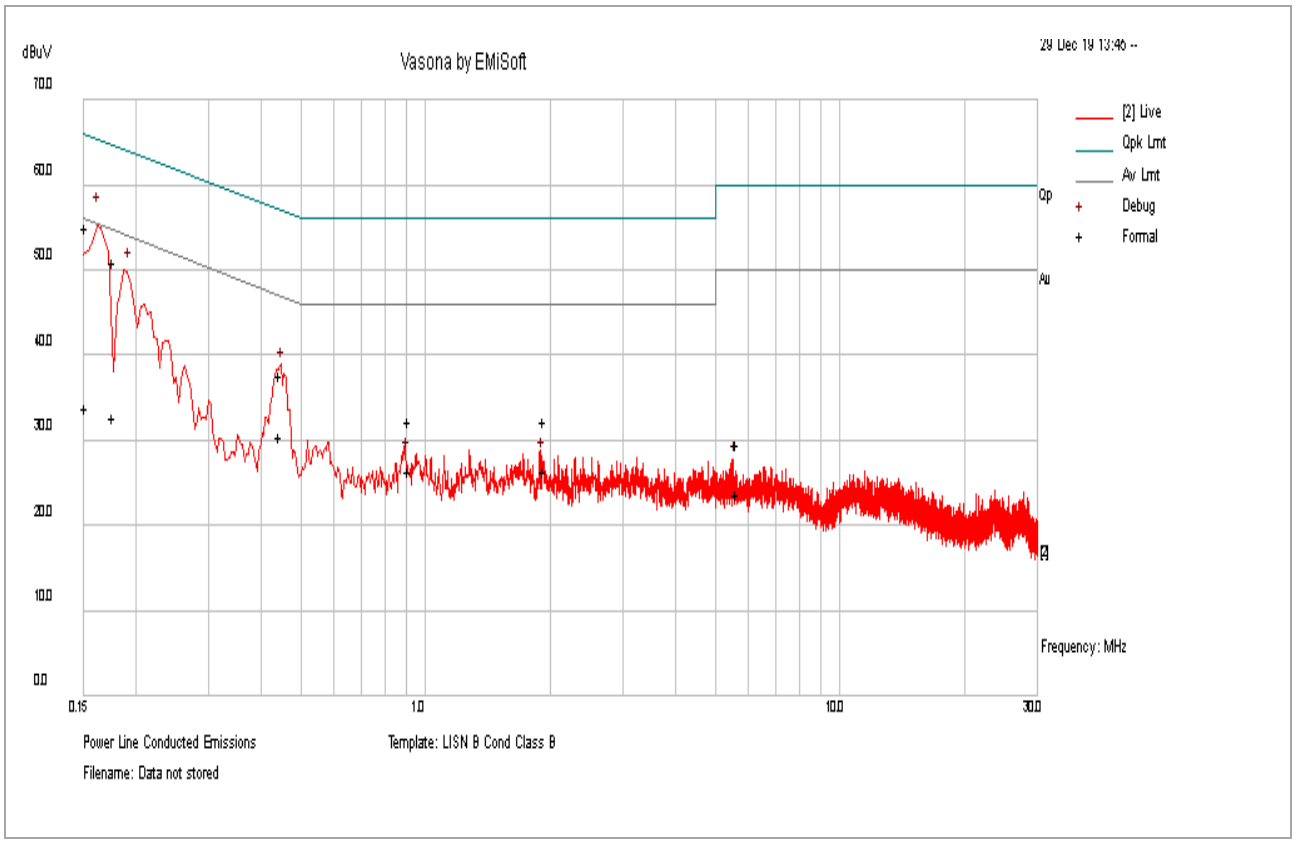
8.8.3 Test Procedure

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 50Ω/50µH 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.

8.8.4 Test Result

Live Line

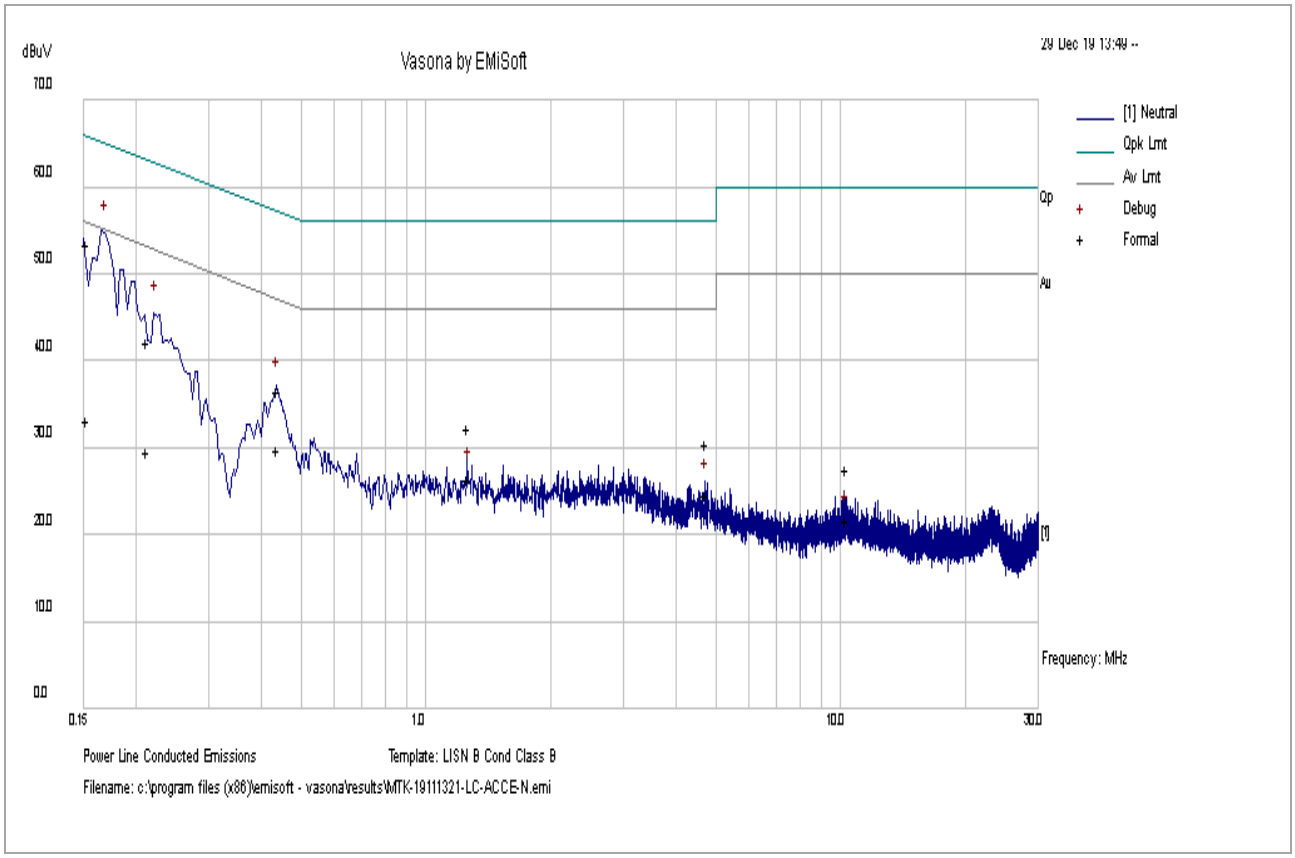
Test Standard:	**47CFR 15.207**	**Mode:**	**Line**
Frequency Range:	**0.15-30MHz**	**Test Date:**	**12/29/2019**
Antenna Type/Polarity:	**N/A**	**Test Personnel:**	**Bruce Li**
Remark:	**120VAC, 60Hz**	**Test Result:**	**Pass**



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV/m)	Meas. Type	Line	Limit (dBuV/m)	Margin (dB)	Pass /Fail
0.15	44.64	10.07	0.24	54.96	QP	Live	65.92	-10.96	Pass
0.18	40.55	10.07	0.21	50.84	QP	Live	64.67	-13.84	Pass
0.45	27.51	10.10	0.12	37.73	QP	Live	56.95	-19.22	Pass
0.91	22.09	10.14	0.10	32.34	QP	Live	56.00	-23.66	Pass
1.93	21.80	10.22	0.11	32.13	QP	Live	56.00	-23.87	Pass
5.61	18.97	10.42	0.16	29.55	QP	Live	60.00	-30.45	Pass
0.15	23.39	10.07	0.24	33.70	AV	Live	55.92	-22.22	Pass
0.18	22.38	10.07	0.21	32.66	AV	Live	54.67	-22.01	Pass
0.45	20.14	10.10	0.12	30.36	AV	Live	46.95	-16.59	Pass
0.91	16.24	10.14	0.10	26.48	AV	Live	46.00	-19.52	Pass
1.93	16.01	10.22	0.11	26.34	AV	Live	46.00	-19.66	Pass
5.61	13.10	10.42	0.16	23.69	AV	Live	50.00	-26.31	Pass

Neutral Line

Test Standard:	**47CFR 15.207**	**Mode:**	**Neutral**
Frequency Range:	**0.15-30MHz**	**Test Date:**	**12/29/2019**
Antenna Type/Polarity:	**N/A**	**Test Personnel:**	**Bruce Li**
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	43.00	10.07	0.24	53.32	QP	Neutral	65.87	-12.55	Pass
0.21	31.90	10.08	0.18	42.15	QP	Neutral	63.12	-20.97	Pass
0.44	26.32	10.10	0.12	36.54	QP	Neutral	57.09	-20.55	Pass
1.26	21.98	10.17	0.11	32.26	QP	Neutral	56.00	-23.74	Pass
4.75	19.90	10.38	0.14	30.42	QP	Neutral	56.00	-25.58	Pass
10.32	16.65	10.54	0.24	27.43	QP	Neutral	60.00	-32.57	Pass
0.15	22.77	10.07	0.24	33.09	AV	Neutral	55.87	-22.78	Pass
0.21	19.33	10.08	0.18	29.58	AV	Neutral	53.12	-23.54	Pass
0.44	19.59	10.10	0.12	29.81	AV	Neutral	47.09	-17.28	Pass
1.26	16.15	10.17	0.11	26.43	AV	Neutral	46.00	-19.57	Pass
4.75	14.02	10.38	0.14	24.54	AV	Neutral	46.00	-21.46	Pass
10.32	10.85	10.54	0.24	21.63	AV	Neutral	50.00	-28.37	Pass

9 Test instrument list

Equipment	Manufacturer	Model	Serial Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	5/11/2019	5/11/2020
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	5/4/2019	5/4/2020
EMC Test Receiver	R&S	ESL6	100230	5/7/2019	5/7/2020
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/2019	5/4/2020
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2019	11/15/2020
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/2/2019	5/2/2020
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	5/2/2019	5/2/2020
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	5/10/2019	5/10/2020
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/10/2019	5/10/2020
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/9/2019	5/9/2020
RF Attenuator	Pasternack	PE7005-3	VL061	5/10/2019	5/10/2020
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	5/10/2019	5/10/2020
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	5/9/2019	5/9/2020
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	5/10/2019	5/10/2020
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	5/10/2019	5/10/2020
RE test cable (>18GHz)	Sucoflex	104	344903/4	5/10/2019	5/10/2020
Pulse limiter	Com-Power	LIT-930A	531727	5/15/2019	5/15/2020
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	5/10/2019	5/10/2020
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	5/9/2019	5/9/2020
Wideband Communication	R&S	CMW500	147508	5/8/2019	5/8/2020