TCT 通测检测
TESTING CENTRE TECHNOLOGY

TEST REPORT

FCC ID: 2AQPYIMOQ2PLUS

Product: smartphone

Model No.: IMO Q2 Plus

Additional Model No.: N/A

Trade Mark: IMO

Report No.: TCT180712E029

Issued Date: Jul. 26, 2018

Issued for:

Verve Connect Ltd.

59 Church Street, Staines, TW18 4XS, United Kingdom

Issued By:

Shenzhen Tongce Testing Lab.

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TABLE OF CONTENTS

1. Test Certification 3
2. Test Result Summary 4
3. EUT Description 5
4. Genera Information 7
4.1. Test environment and mode 7
4.2. Description of Support Units 8
5. Facilities and Accreditations 9
5.1. Facilities 9
5.2. Location 9
5.3. Measurement Uncertainty 9
6. Test Results and Measurement Data 10
6.1. Antenna requirement 10
6.2. Conducted Emission 11
6.3. Maximum Conducted (Average) Output Power 15
6.4. Emission Bandwidth 16
6.5. Power Spectral Density 17
6.6. Conducted Band Edge and Spurious Emission Measurement 18
6.7. Radiated Spurious Emission Measurement 20
Appendix A: Test Result of Conducted Test
Appendix B: Photographs of Test Setup
Appendix C: Photographs of EUT

1. Test Certification

Product:	smartphone
Model No.:	IMO Q2 Plus
Additional Model:	N/A
Trade Mark:	**IMO**
Applicant:	Verve Connect Ltd.
Address:	59 Church Street, Staines, TW18 4XS, United Kingdom
Manufacturer:	Verve Connect Ltd.
Address:	59 Church Street, Staines, TW18 4XS, United Kingdom
Date of Test:	Jul. 13, 2018 - Jul. 25, 2018
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247 KDB 558074 D01 DTS Meas Guidance v04

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By: Jin Wang ***Date:*** ***Jul. 25, 2018***

Jin Wang

Reviewed By: Beryl zhao ***Date:*** ***Jul. 26, 2018***

Beryl Zhao

Approved By: Tomsin ***Date:*** ***Jul. 26, 2018***

Tomsin

SHENZHEN TONGCE TESTING LAB TCT

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247 (b)(3) §2.1046	PASS
6dB Emission Bandwidth	§15.247 (a)(2) §2.1049	PASS
Power Spectral Density	§15.247 (e)	PASS
Band Edge	1§5.247(d) §2.1051, §2.1057	PASS
Spurious Emission	§15.205/§15.209 §2.1053, §2.1057	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

3. EUT Description

Product:	smartphone
Model No.:	IMO Q2 Plus
Additional Model:	N/A
Trade Mark:	**IMO**
Hardware Version:	C55B_V2.0K
Software Version:	c55_xx08_ruiou_imo_q2_puls_V1.0.0_180619
Operation Frequency:	2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20))
Channel Separation:	5MHz
Number of Channel:	11 for 802.11b/802.11g/802.11n(HT20)
Modulation Technology: (IEEE 802.11b)	Direct Sequence Spread Spectrum (DSSS)
Modulation Technology: (IEEE 802.11g/802.11n)	Orthogonal Frequency Division Multiplexing(OFDM)
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data speed (IEEE 802.11g):	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps
Data speed (IEEE 802.11n):	Up to 150Mbps
Antenna Type:	PIFA Antenna
Antenna Gain:	2.9dBi
Power Supply:	Rechargeable Li-ion Battery DC 3.7V
AC adapter:	Adapter Information: MODEL: HL-0507C INPUT: 100-240V~50/60Hz, 0.2A OUTPUT: 5.0V, 700mA

Operation Frequency each of channel For 802.11b/g/n(HT20)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

802.11b/802.11g/802.11n (HT20)

Channel	Frequency
The lowest channel	2412MHz
The middle channel	2437MHz
The Highest channel	2462MHz

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4. Genera Information

4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 98.46%)
The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. For the full battery state and The output power to the maximum state.	

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate
802.11b	1Mbps
802.11g	6Mbps
802.11n(H20)	6.5Mbps

Final Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation

1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

2.According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup” 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20). Duty cycle setting during the transmission is 98.5% with maximum power setting for all modulations.

4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

5. Facilities and Accreditations

5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098
  Shenzhen Tongce Testing Lab
  The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.
- IC - Registration No.: 10668A-1
  The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

5.2. Location

Shenzhen Tongce Testing Lab
Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China
TEL: +86-755-27673339

5.3. Measurement Uncertainty

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	±2.56dB
2	RF power, conducted	±0.12dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1G)	±3.92dB
5	All emissions, radiated(>1G)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%

6. Test Results and Measurement Data

6.1. Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 requirement: 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, 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. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
E.U.T Antenna:	
The WIFI antenna is PIFA antenna which permanently attached, and the best case gain of the antenna is 2.9dBi.	

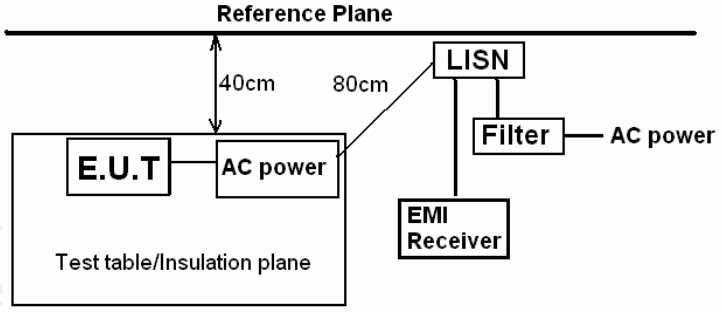
6.2. Conducted Emission

6.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Frequency Range:	150 kHz to 30 MHz
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto
Limits:	

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Test Setup:



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

Test Mode:	Charging + transmitting with modulation
Test Procedure:	1. The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.
Test Result:	PASS

6.2.2. Test Instruments

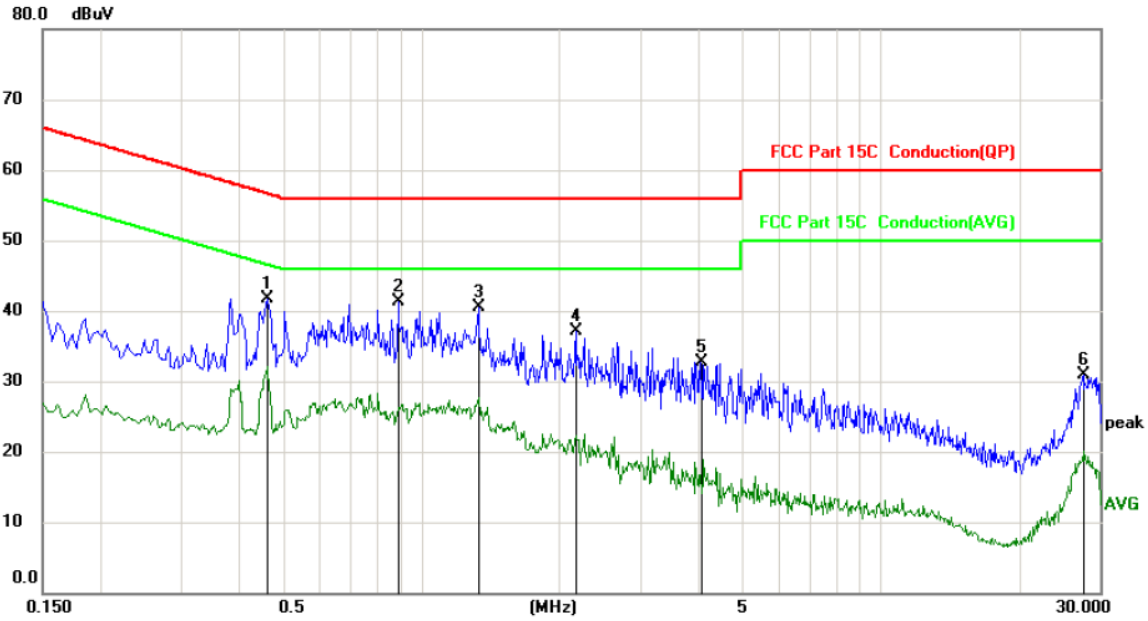
Conducted Emission Shielding Room Test Site (843)				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Test Receiver	R&S	ESPI	101401	Sep. 27, 2018
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 27, 2018
Coax cable (9KHz-30MHz)	TCT	CE-05	N/A	Sep. 27, 2018
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.2.3. Test data

Please refer to following diagram for individual

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



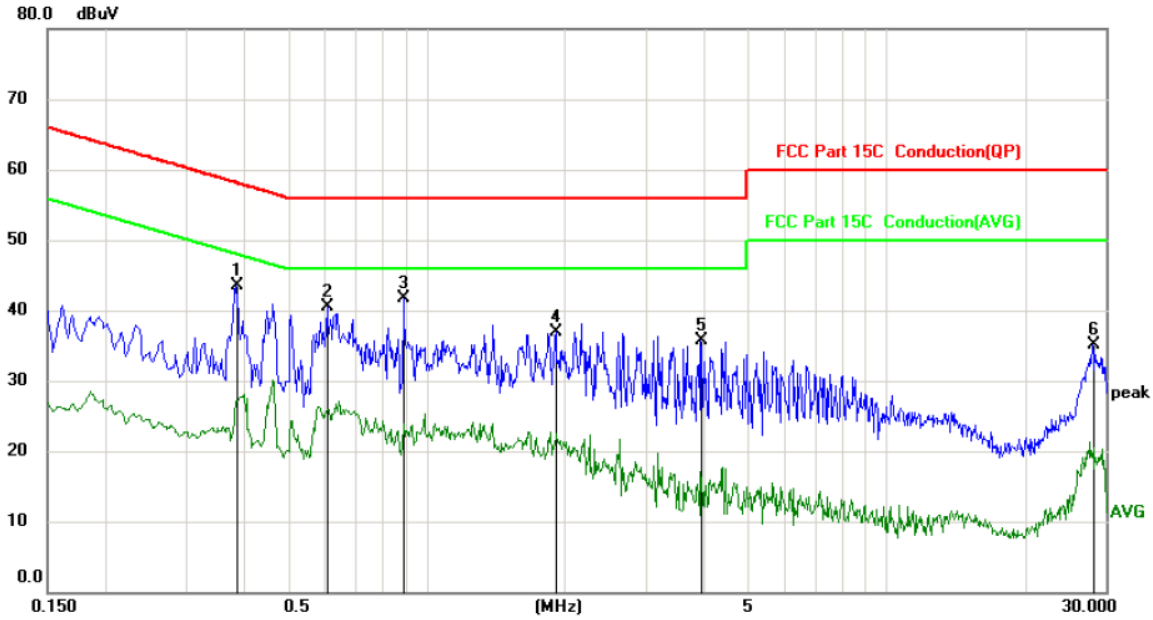
Site	Phase: *L1*	Temperature:	25
Limit: FCC Part 15C Conduction(QP)	Power: AC 120V/60Hz	Humidity:	55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.4620	40.51	1.24	41.75	56.66	-14.91	peak	
2	*	0.8940	40.24	1.02	41.26	56.00	-14.74	peak	
3		1.3340	39.34	1.10	40.44	56.00	-15.56	peak	
4		2.1779	35.77	1.30	37.07	56.00	-18.93	peak	
5		4.0700	32.18	0.61	32.79	56.00	-23.21	peak	
6		27.6859	30.95	-0.10	30.85	60.00	-29.15	peak	

Note:

Freq. = Emission frequency in MHz
Reading level (dBµV) = Receiver reading
Corr. Factor (dB) = Antenna factor + Cable loss
Measurement (dBµV) = Reading level (dBµV) + Corr. Factor (dB)
Limit (dBµV) = Limit stated in standard
Margin (dB) = Measurement (dBµV) – Limits (dBµV)
Q.P. =Quasi-Peak
AVG =average
** is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.*

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site	Phase: N	Temperature:	25
Limit: FCC Part 15C Conduction(QP)	Power: AC 120V/60Hz	Humidity:	55 %

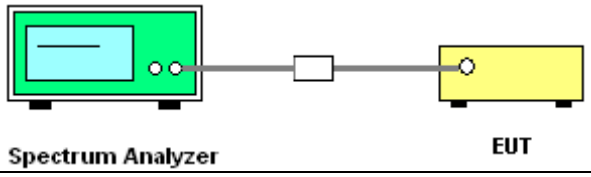
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3860	42.21	1.28	43.49	58.15	-14.66	peak	
2		0.6100	39.26	1.16	40.42	56.00	-15.58	peak	
3	*	0.8940	40.65	1.02	41.67	56.00	-14.33	peak	
4		1.9100	35.65	1.33	36.98	56.00	-19.02	peak	
5		3.9620	35.07	0.65	35.72	56.00	-20.28	peak	
6		28.0777	35.15	-0.10	35.05	60.00	-24.95	peak	

Note:

Freq. = Emission frequency in MHz
Reading level (dBµV) = Receiver reading
Corr. Factor (dB) = Antenna factor + Cable loss
Measurement (dBµV) = Reading level (dBµV) + Corr. Factor (dB)
Limit (dBµV) = Limit stated in standard
Margin (dB) = Measurement (dBµV) – Limits (dBµV)
Q.P. =Quasi-Peak
AVG =average
** is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.*

6.3. Maximum Conducted (Average) Output Power

6.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB 558074
Limit:	30dBm
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Measure the conducted output power and record the results in the test report.
Test Result:	PASS

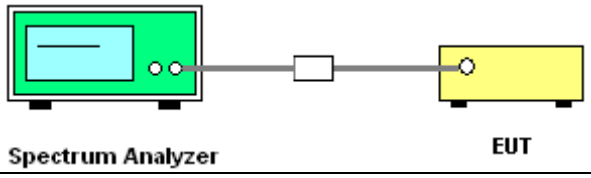
6.3.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-01	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.4. Emission Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB 558074
Limit:	>500kHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 4. Measure and record the results in the test report.
Test Result:	PASS

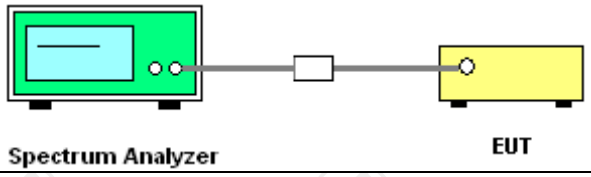
6.4.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-01	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.5. Power Spectral Density

6.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB 558074
Limit:	The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows Measurement Procedure 10.3 Method AVGPSD of FCC KDB Publication No.558074 D01 DTS Meas. Guidance v04 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): 3 kHz ≤ RBW ≤ 100 kHz. Video bandwidth VBW ≥ 3 x RBW. Set the span to at least 1.5 times the OBW. 5. Detector = RMS, Sweep time = auto couple. 6. Employ trace averaging (RMS) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level. 6. Measure and record the results in the test report.
Test Result:	PASS

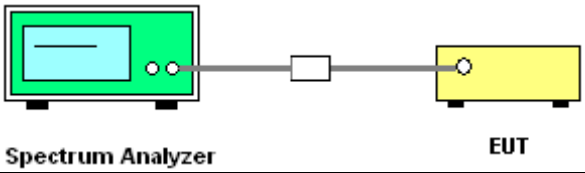
6.5.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-01	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.6. Conducted Band Edge and Spurious Emission Measurement

6.6.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074
Limit:	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. 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 per 15.247(d). 5. Measure and record the results in the test report. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

6.6.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-01	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.7. Radiated Spurious Emission Measurement

6.7.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209
Test Method:	ANSI C63.10: 2013
Frequency Range:	9 kHz to 25 GHz
Measurement Distance:	3 m
Antenna Polarization:	Horizontal & Vertical
Operation mode:	Transmitting mode with modulation

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value

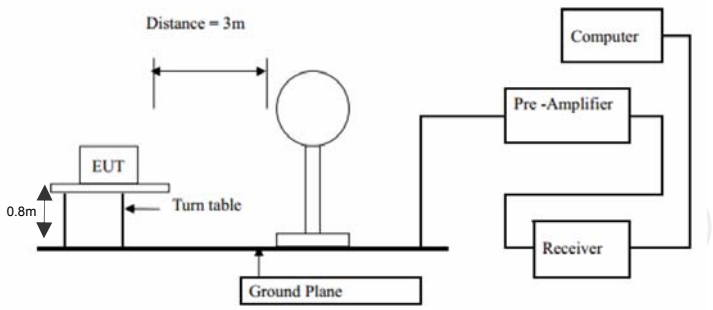
Limit:

Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(KHz)	300
0.490-1.705	24000/F(KHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector
Above 1GHz	500	3	Average
	5000	3	Peak

Test setup:

For radiated emissions below 30MHz



30MHz to 1GHz

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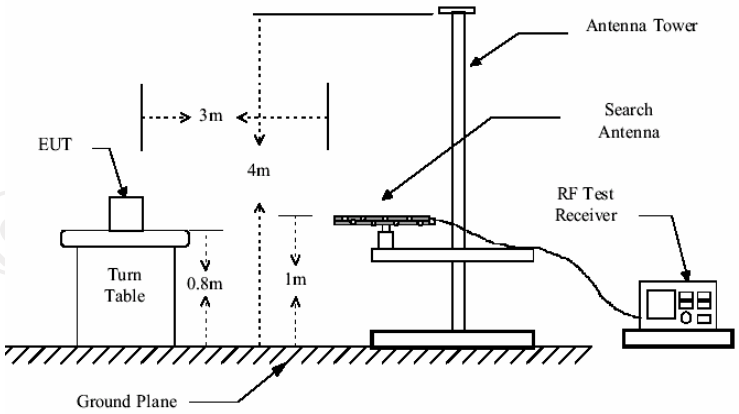
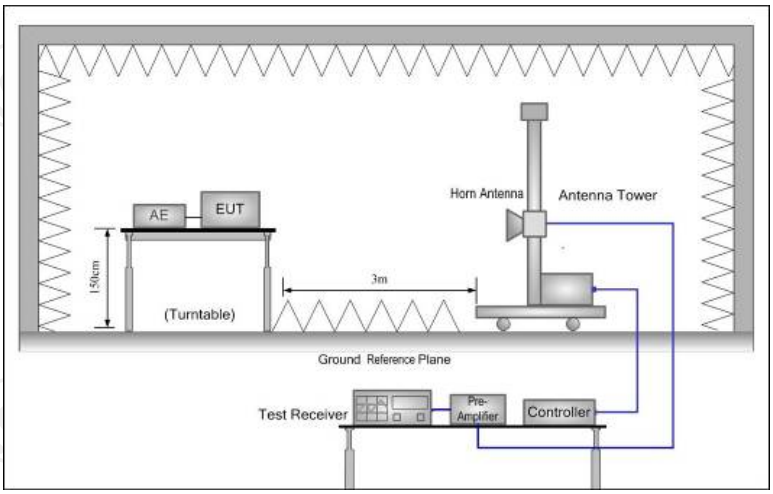


Above 1GHz


</td>
</tr>
<tr>
<td>Test Procedure:</td>
<td>1. For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for</td>
</tr>
</table>

	receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. 3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level 4. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported. 5. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥RBW; Sweep = auto; Detector function = peak; Trace = max hold; (3) Set RBW = 1 MHz, VBW= 3MHz for f 1 GHz for peak measurement. For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Test results:	PASS

6.7.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Test Receiver	ROHDE&SCHWARZ	ESVD	100008	Sep. 27, 2018
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ	200061	Sep. 27, 2018
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 27, 2018
Pre-amplifier	HP	8447D	2727A05017	Sep. 27, 2018
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 27, 2018
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 27, 2018
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 27, 2018
Horn Antenna	Schwarzbeck	BBH 9170	582	Sep. 27, 2018
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
Coax cable (9KHz-1GHz)	TCT	RE-low-01	N/A	Sep. 27, 2018
Coax cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 27, 2018
Coax cable (9KHz-1GHz)	TCT	RE-low-03	N/A	Sep. 27, 2018
Coax cable (9KHz-40GHz)	TCT	RE-high-04	N/A	Sep. 27, 2018
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

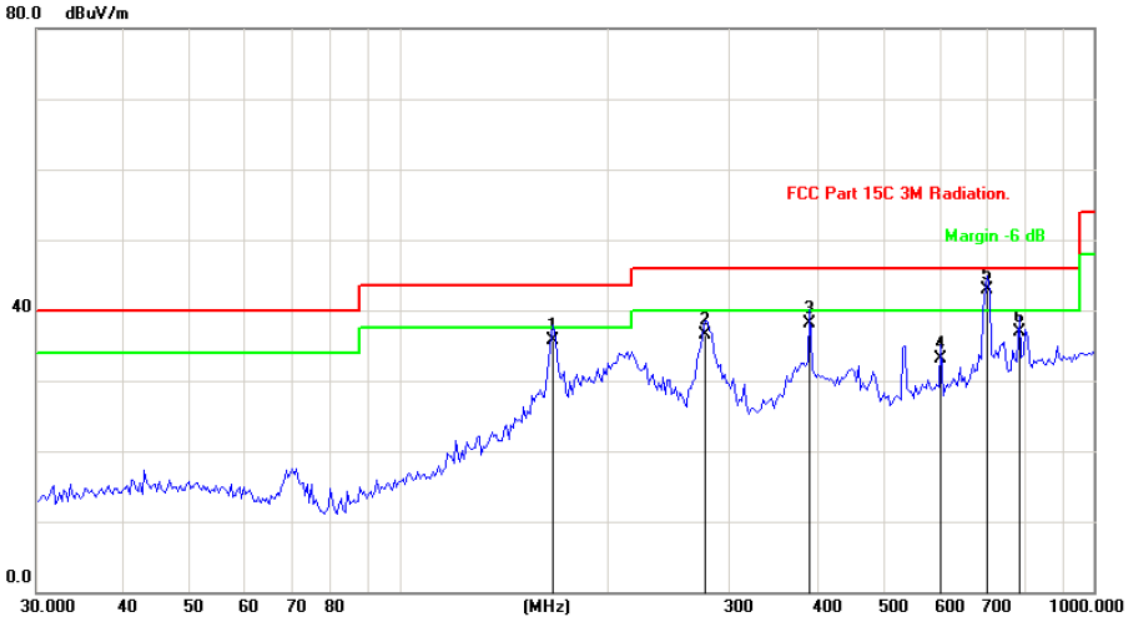
Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.7.3. Test Data

Please refer to following diagram for individual

Below 1GHz

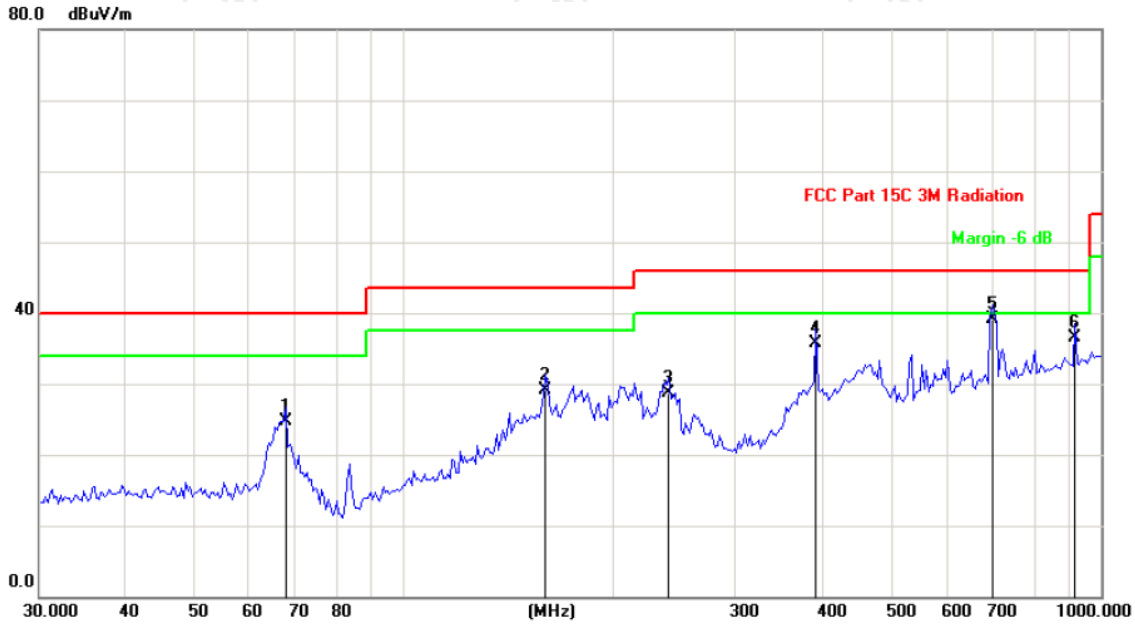
Horizontal:



Site	Polarization: *Horizontal*	Temperature:	25
Limit: FCC Part 15C 3M Radiation.	Power:	Humidity:	55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1		166.6385	50.50	-14.78	35.72	43.50	-7.78	QP			
2		276.3818	46.10	-9.69	36.41	46.00	-9.59	QP			
3		389.9874	44.20	-6.09	38.11	46.00	-7.89	QP			
4		602.9287	33.90	-0.75	33.15	46.00	-12.85	QP			
5	*	703.7314	42.80	0.05	42.85	46.00	-3.15	QP			
6		781.9606	35.40	1.57	36.97	46.00	-9.03	QP			

Vertical:



Site	Polarization: *Vertical*	Temperature:	25
Limit: FCC Part 15C 3M Radiation	Power:	Humidity:	55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1		67.7856	41.10	-16.40	24.70	40.00	-15.30	QP			
2		159.7586	44.40	-15.20	29.20	43.50	-14.30	QP			
3		240.1442	40.00	-11.20	28.80	46.00	-17.20	QP			
4		389.9874	41.70	-6.09	35.61	46.00	-10.39	QP			
5	*	698.8035	39.10	-0.03	39.07	46.00	-6.93	QP			
6		919.1315	33.00	3.50	36.50	46.00	-9.50	QP			

Note: *1.The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported*

2. Measurements were conducted in all three channels (high, middle, low) and all modulation(802.11b, 802.11g, 802.11n(HT20)), and the worst case Mode (Highest channel and 802.11b) was submitted only.

Test Result of Radiated Spurious at Band edges

Modulation Type: 802.11b

Low channel: 2412 MHz						
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	Correction Factor (dB/m)	Peak Final Emission Level	Peak limit (dBμV/m)	AV limit (dBμV/m)
2310	H	45.35	-4.20	41.15	74.00	54.00
2377.38	H	48.03	-4.10	43.93	74.00	54.00
2390	H	53.68	-3.94	49.74	74.00	54.00
2310	V	44.71	-4.20	40.51	74.00	54.00
2377.38	V	54.25	-4.10	50.15	74.00	54.00
2390	V	55.14	-3.94	51.20	74.00	54.00

Modulation Type: 802.11b

High channel: 2462 MHz						
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	Correction Factor (dB/m)	Peak Final Emission Level	Peak limit (dBμV/m)	AV limit (dBμV/m)
2483.5	H	50.32	-3.60	46.72	74.00	54.00
2487.09	H	47.41	-3.50	43.91	74.00	54.00
2500	H	45.09	-3.34	41.75	74.00	54.00
2483.5	V	54.78	-3.60	51.18	74.00	54.00
2487.09	V	47.23	-3.50	43.73	74.00	54.00
2500	V	42.35	-3.34	39.01	74.00	54.00

Modulation Type: 802.11g

Low channel: 2412 MHz						
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	Correction Factor (dB/m)	Peak Final Emission Level	Peak limit (dBμV/m)	AV limit (dBμV/m)
2310	H	43.48	-4.20	39.28	74.00	54.00
2388.96	H	50.25	-4.12	46.13	74.00	54.00
2390	H	53.02	-3.94	49.08	74.00	54.00
2310	V	45.83	-4.20	41.63	74.00	54.00
2388.96	V	49.65	-4.12	45.53	74.00	54.00
2390	V	54.54	-3.94	50.60	74.00	54.00

Modulation Type: 802.11g

High channel: 2462 MHz						
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	Correction Factor (dB/m)	Peak Final Emission Level	Peak limit (dBμV/m)	AV limit (dBμV/m)
2483.5	H	52.07	-3.60	48.47	74.00	54.00
2487.59	H	50.41	-3.52	46.89	74.00	54.00
2500	H	46.36	-3.34	43.02	74.00	54.00
2483. 5	V	51.17	-3.60	47.57	74.00	54.00
2487.59	V	47.62	-3.52	44.10	74.00	54.00
2500	V	47.58	-3.34	44.24	74.00	54.00

Modulation Type: 802.11n(20MHz)

Low channel: 2412 MHz						
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	Correction Factor (dB/m)	Peak Final Emission Level	Peak limit (dBμV/m)	AV limit (dBμV/m)
2310	H	46.42	-4.20	42.22	74.00	54.00
2388.01	H	53.38	-4.10	49.28	74.00	54.00
2390	H	54.15	-3.94	50.21	74.00	54.00
2310	V	48.02	-4.20	43.82	74.00	54.00
2388.01	V	54.24	-4.10	50.14	74.00	54.00
2390	V	55.98	-3.94	52.04	74.00	54.00

Modulation Type: 802.11n(20MHz)

High channel: 2462 MHz						
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	Correction Factor (dB/m)	Peak Final Emission Level	Peak limit (dBμV/m)	AV limit (dBμV/m)
2483.5	H	52.75	-3.60	49.15	74.00	54.00
2392.55	H	51.32	-3.50	47.82	74.00	54.00
2500	H	47.61	-3.34	44.27	74.00	54.00
2483. 5	V	53.24	-3.60	49.64	74.00	54.00
2392.55	V	50.38	-3.50	46.88	74.00	54.00
2500	V	48.05	-3.34	44.71	74.00	54.00

Note:

1. *Peak Final Emission Level=Peak Reading + Correction Factor;*
2. *Correction Factor= Antenna Factor + Cable loss – Pre-amplifier*

Above 1GHz

Modulation Type: 802.11b

Low channel: 2412 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4824	H	49.26	---	0.75	50.01	---	74	54	-3.99
7236	H	40.19	---	9.87	50.06	---	74	54	-3.94
---	H	---	---	---	---	---	---	---	---
4824	V	48.31	---	0.75	49.06	---	74	54	-4.94
7236	V	41.02	---	9.87	50.89	---	74	54	-3.11
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	49.23	---	0.97	50.20	---	74	54	-3.80
7311	H	41.15	---	9.83	50.98	---	74	54	-3.02
---	H	---	---	---	---	---	---	---	---
4874	V	48.47	---	0.97	49.44	---	74	54	-4.56
7311	V	40.06	---	9.83	49.89	---	74	54	-4.11
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4924	H	49.24	---	1.18	50.42	---	74	54	-3.58
7386	H	39.31	---	10.07	49.38	---	74	54	-4.62
---	H	---	---	---	---	---	---	---	---
4924	V	49.46	---	1.18	50.64	---	74	54	-3.36
7386	V	40.18	---	10.07	50.25	---	74	54	-3.75
---	V	---	---	---	---	---	---	---	---

Note:

1. *Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier*
2. *Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
4. *Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.*
5. *Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.*

Modulation Type: 802.11g

Low channel: 2412 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4824	H	48.16	---	0.75	48.91	---	74	54	-5.09
7236	H	39.87	---	9.87	49.74	---	74	54	-4.26
---	H	---	---	---	---	---	---	---	---
4824	V	47.51	---	0.75	48.26	---	74	54	-5.74
7236	V	41.33	---	9.87	51.20	---	74	54	-2.80
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	49.06	---	0.97	50.03	---	74	54	-3.97
7311	H	41.51	---	9.83	51.34	---	74	54	-2.66
---	H	---	---	---	---	---	---	---	---
4874	V	48.82	---	0.97	49.79	---	74	54	-4.21
7311	V	40.45	---	9.83	50.28	---	74	54	-3.72
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4924	H	49.09	---	1.18	50.27	---	74	54	-3.73
7386	H	39.27	---	10.07	49.34	---	74	54	-4.66
---	H	---	---	---	---	---	---	---	---
4924	V	49.53	---	1.18	50.71	---	74	54	-3.29
7386	V	40.37	---	10.07	50.44	---	74	54	-3.56
---	V	---	---	---	---	---	---	---	---

Note:

1. *Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier*
2. *Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
4. *Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.*
5. *Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.*

Modulation Type: 802.11n (HT20)

Low channel: 2412 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4824	H	47.98	---	0.75	48.73	---	74	54	-5.27
7236	H	38.75	---	9.87	48.62	---	74	54	-5.38
---	H	---	---	---	---	---	---	---	---
4824	V	48.26	---	0.75	49.01	---	74	54	-4.99
7236	V	40.54	---	9.87	50.41	---	74	54	-3.59
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	49.23	---	0.97	50.20	---	74	54	-3.80
7311	H	40.19	---	9.83	50.02	---	74	54	-3.98
---	H	---	---	---	---	---	---	---	---
4874	V	48.12	---	0.97	49.09	---	74	54	-4.91
7311	V	39.56	---	9.83	49.39	---	74	54	-4.61
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4924	H	49.63	---	1.18	50.81	---	74	54	-3.19
7386	H	39.94	---	10.07	50.01	---	74	54	-3.99
---	H	---	---	---	---	---	---	---	---
4924	V	48.51	---	1.18	49.69	---	74	54	-4.31
7386	V	41.04	---	10.07	51.11	---	74	54	-2.89
---	V	---	---	---	---	---	---	---	---

Note:

1. *Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier*
2. *Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
4. *Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.*
5. *Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.*

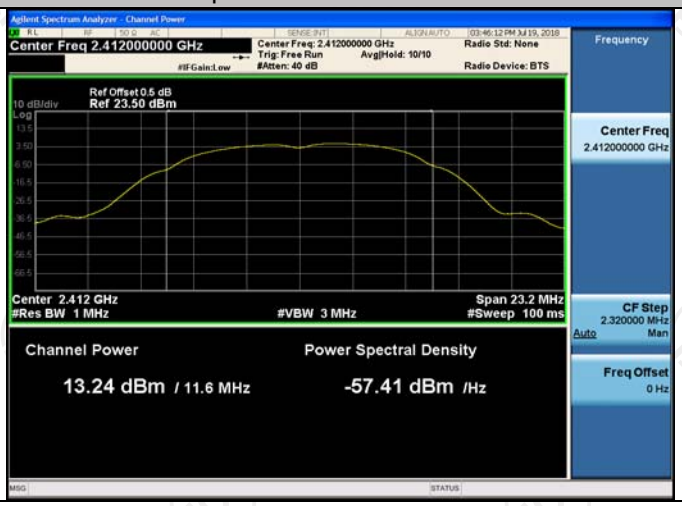
Appendix A: Test Result of Conducted Test

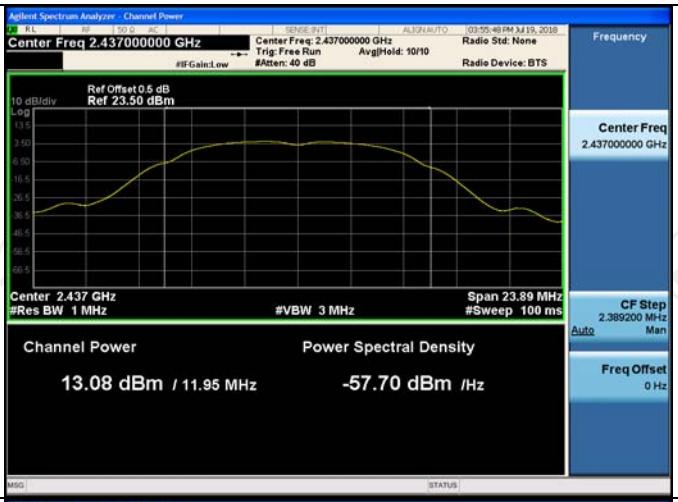
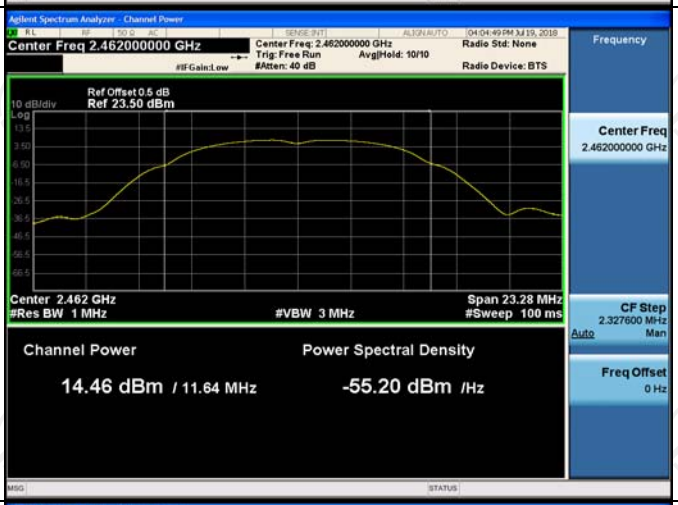
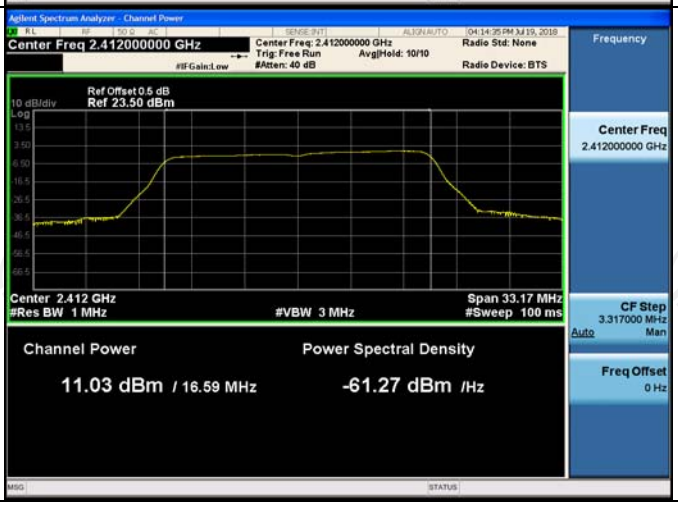
Conducted Average Output Power

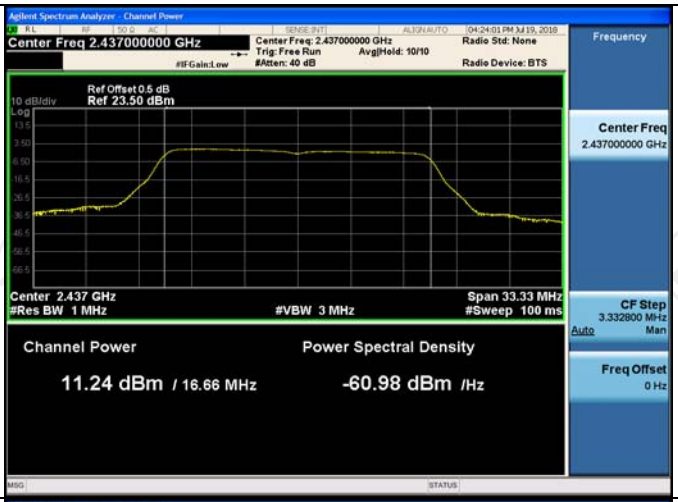
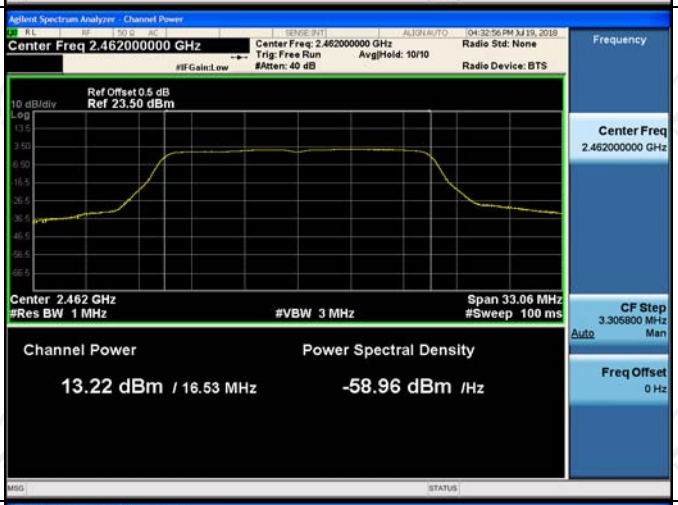
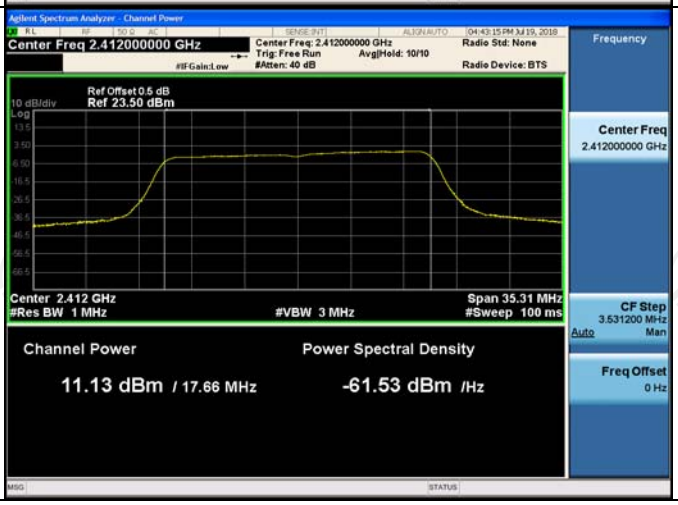
Result Table

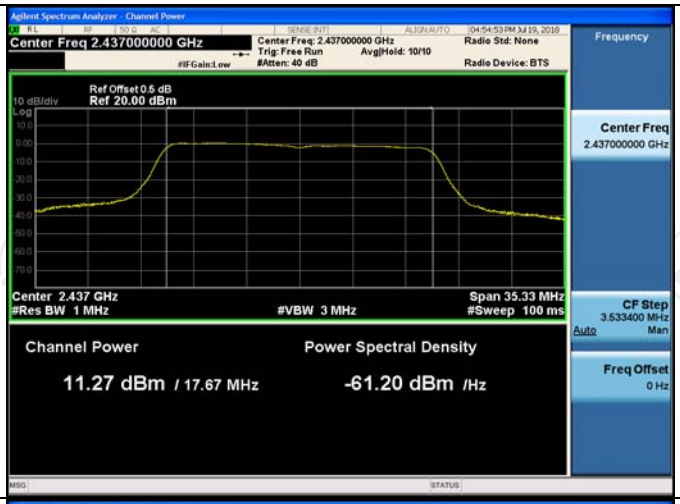
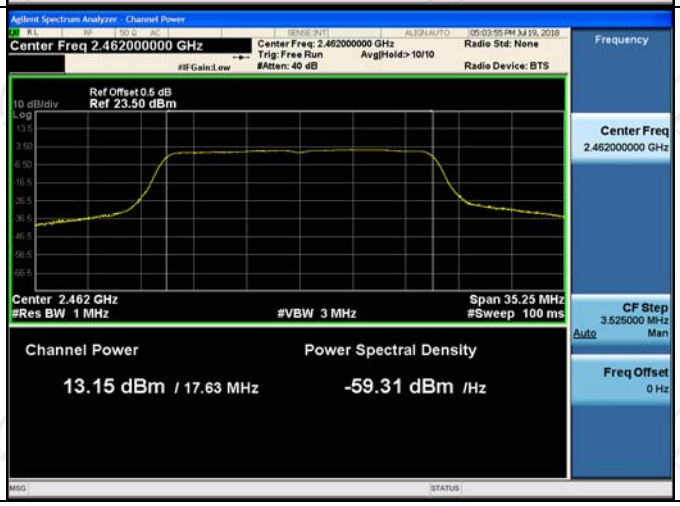
Mode	Channel	Meas.Level [dBm]	Verdict
11B	LCH	13.24	PASS
11B	MCH	13.08	PASS
11B	HCH	14.46	PASS
11G	LCH	11.03	PASS
11G	MCH	11.24	PASS
11G	HCH	13.22	PASS
11N20SISO	LCH	11.13	PASS
11N20SISO	MCH	11.27	PASS
11N20SISO	HCH	13.15	PASS

Test Graph

Graphs			
11B/LCH			

11B/MCH			
11B/HCH			
11G/LCH			

11G/MCH			
11G/HCH			
11N20SISO/LCH			

11N20SISO/MCH			
11N20SISO/HCH			

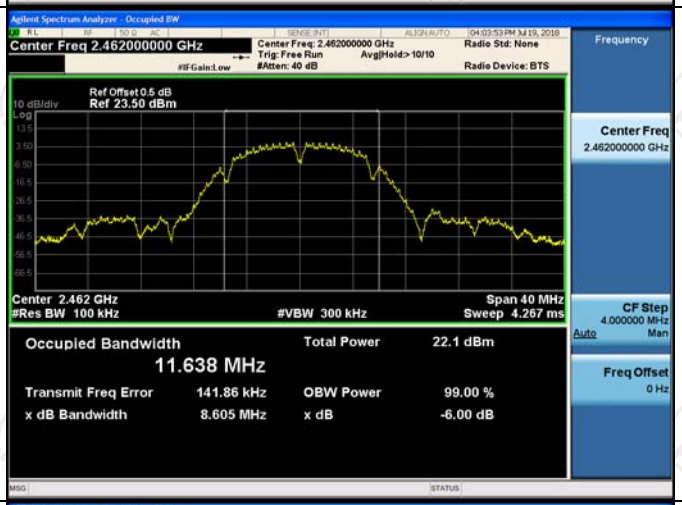
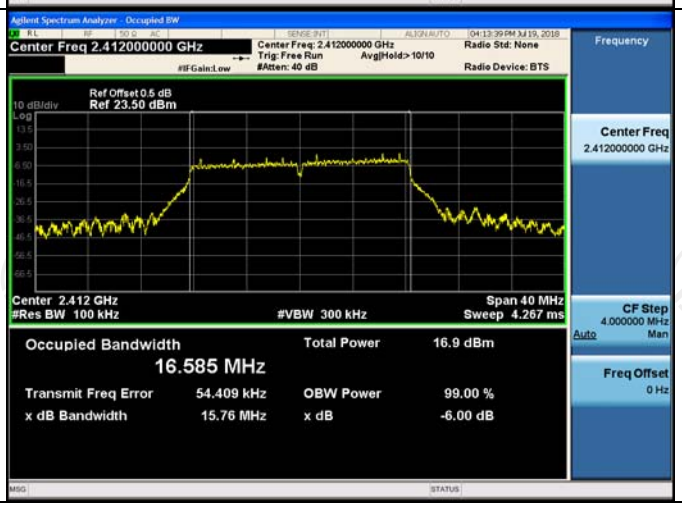
6dB Occupied Bandwidth

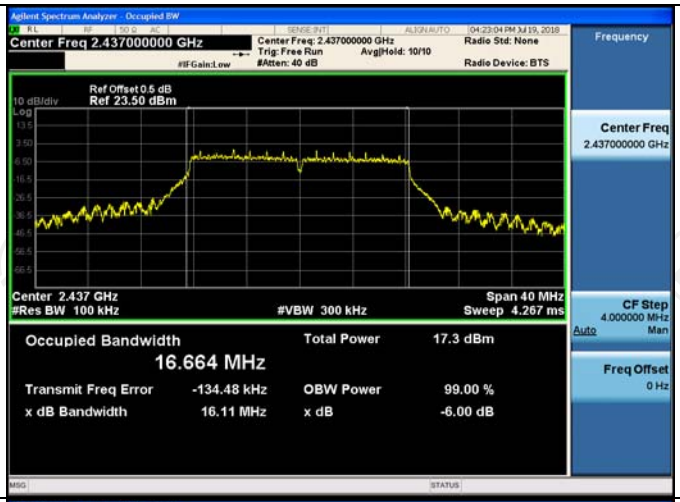
Result Table

Mode	Channel	6dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
11B	LCH	8.614	11.600	PASS
11B	MCH	9.101	11.946	PASS
11B	HCH	8.605	11.638	PASS
11G	LCH	15.76	16.585	PASS
11G	MCH	16.11	16.664	PASS
11G	HCH	16.30	16.529	PASS
11N20SISO	LCH	16.38	17.656	PASS
11N20SISO	MCH	16.39	17.667	PASS
11N20SISO	HCH	17.29	17.625	PASS

Test Graph

Graphs			
11B/LCH			

11B/MCH			
11B/HCH			
11G/LCH			

11G/MCH			
11G/HCH			
11N20SISO/LCH			

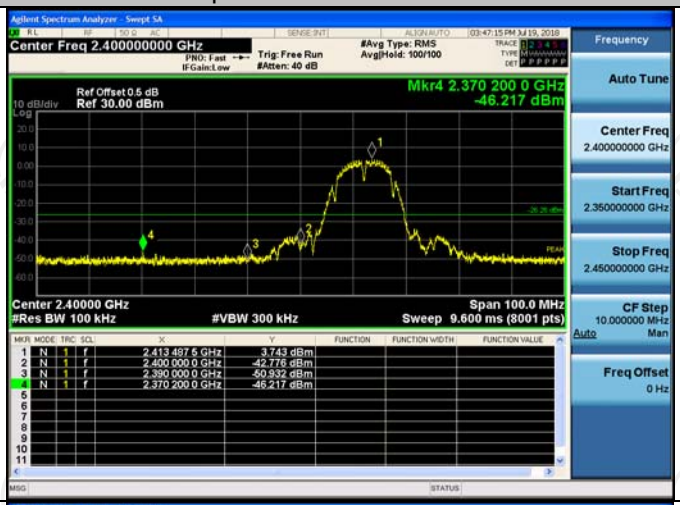
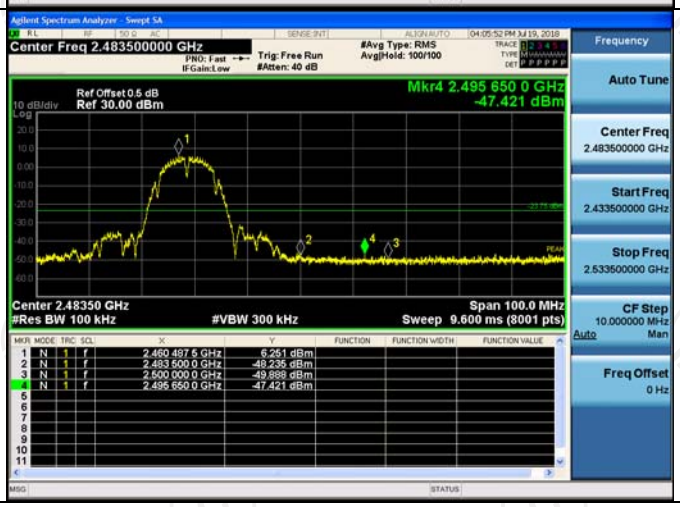
11N20SISO/MCH			
11N20SISO/HCH			

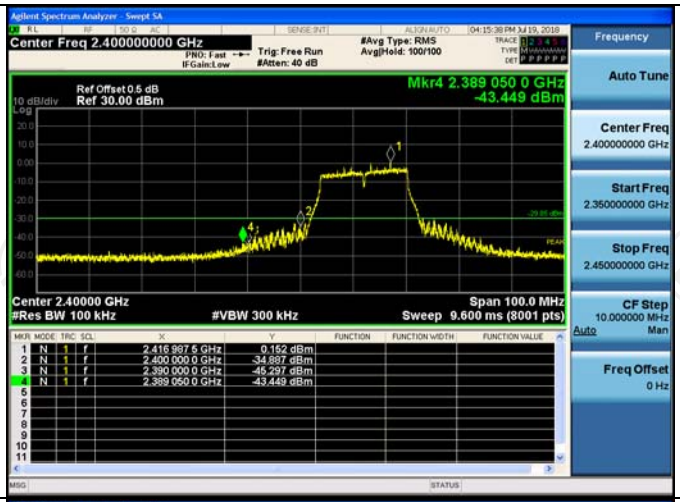
Band-edge for RF Conducted Emissions

Result Table

Mode	Channel	Carrier Power [dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
11B	LCH	3.743	-46.217	-26.26	PASS
11B	HCH	6.251	-47.421	-23.75	PASS
11G	LCH	0.152	-43.449	-29.85	PASS
11G	HCH	1.028	-42.301	-28.97	PASS
11N20SISO	LCH	0.049	-43.127	-29.95	PASS
11N20SISO	HCH	1.275	-40.549	-28.73	PASS

Test Graph

Graphs			
11B/LCH			
11B/HCH			

11G/LCH			
11G/HCH			
11N20SISO/LCH			

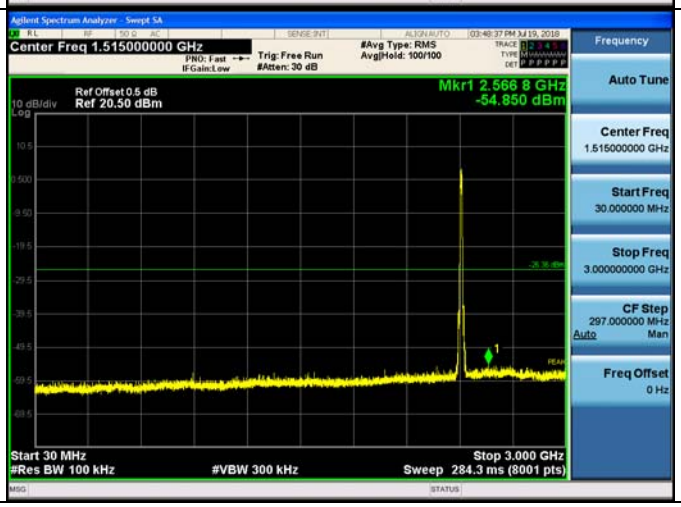
11N20SISO/HCH			

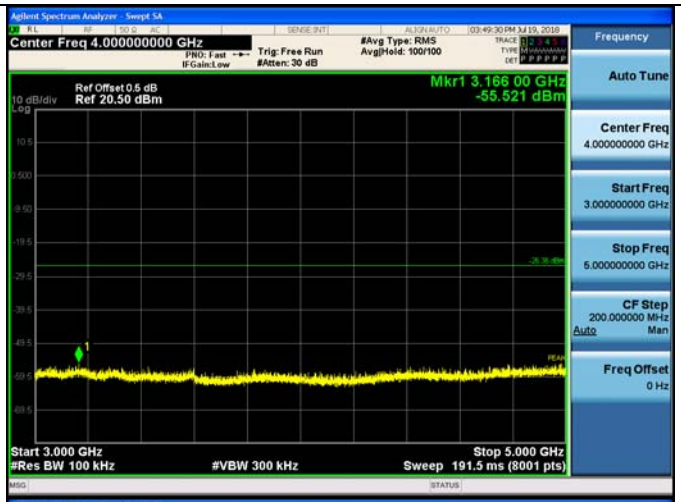
RF Conducted Spurious Emissions

Result Table

Mode	Channel	Pref [dBm]	Puw [dBm]	Verdict
11B	LCH	3.637	<Limit	PASS
11B	MCH	3.323	<Limit	PASS
11B	HCH	5.745	<Limit	PASS
11G	LCH	0.194	<Limit	PASS
11G	MCH	0.467	<Limit	PASS
11G	HCH	0.971	<Limit	PASS
11N20SISO	LCH	0.218	<Limit	PASS
11N20SISO	MCH	0.669	<Limit	PASS
11N20SISO	HCH	2.216	<Limit	PASS

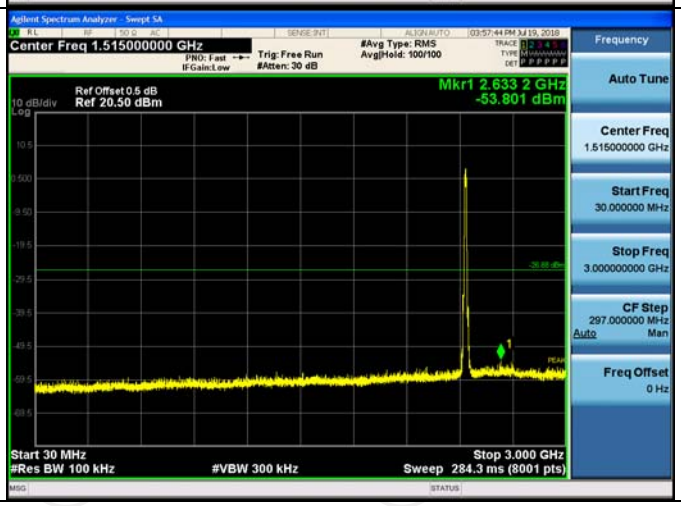
Test Graph

11B_LCH_Graphs			
Pref/11B/LCH			
Puw/11B/LCH			

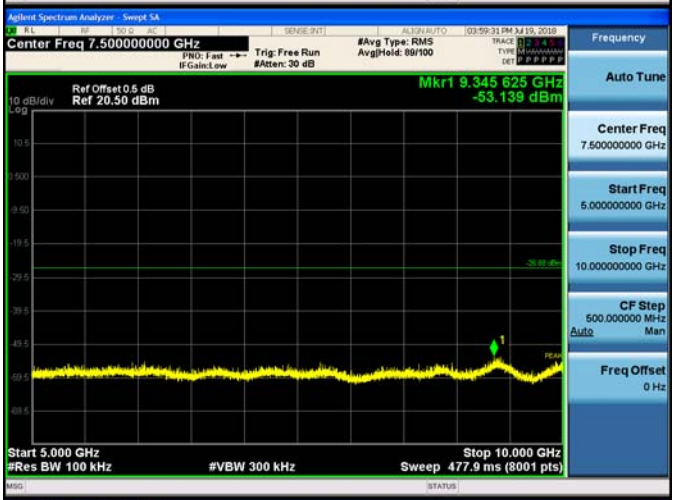

Agilent Spectrum Analyzer - Swept SA
Center Freq 4.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 0.5 dB
10 dB/div Ref 20.50 dBm
Mkr1 3.166 00 GHz
-55.521 dBm
Start 3.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 5.000 GHz
Sweep 191.5 ms (8001 pts)
Frequency
Auto Tune
Center Freq
4.000000000 GHz
Start Freq
3.000000000 GHz
Stop Freq
5.000000000 GHz
CF Step
200.000000 MHz
Auto Man
Freq Offset
0 Hz

Agilent Spectrum Analyzer - Swept SA
Center Freq 7.500000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 89/100
Ref Offset 0.5 dB
10 dB/div Ref 20.50 dBm
Mkr1 9.382 500 GHz
-53.521 dBm
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 477.9 ms (8001 pts)
Frequency
Auto Tune
Center Freq
7.500000000 GHz
Start Freq
5.000000000 GHz
Stop Freq
10.000000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0 Hz

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.500000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 0.5 dB
10 dB/div Ref 20.50 dBm
Mkr1 14.910 000 GHz
-51.384 dBm
Start 10.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 15.000 GHz
Sweep 477.9 ms (8001 pts)
Frequency
Auto Tune
Center Freq
12.500000000 GHz
Start Freq
10.000000000 GHz
Stop Freq
15.000000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0 Hz

11B_MCH_Graphs			
Pref/11B/MCH			
Puw/11B/MCH			

Agilent Spectrum Analyzer - Swept SA
Center Freq 4.000000000 GHz
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 0.5 dB
10 dB/div Ref 20.50 dBm
Mkr1 4.956 25 GHz
-54.760 dBm
Start 3.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 5.000 GHz
Sweep 191.5 ms (8001 pts)
Frequency
Auto Tune
Center Freq 4.000000000 GHz
Start Freq 3.000000000 GHz
Stop Freq 5.000000000 GHz
CF Step 200.000000 MHz
Freq Offset 0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 7.500000000 GHz
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 89/100
Ref Offset 0.5 dB
10 dB/div Ref 20.50 dBm
Mkr1 9.345 625 GHz
-53.139 dBm
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 477.9 ms (8001 pts)
Frequency
Auto Tune
Center Freq 7.500000000 GHz
Start Freq 5.000000000 GHz
Stop Freq 10.000000000 GHz
CF Step 500.000000 MHz
Freq Offset 0 Hz

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.500000000 GHz
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 0.5 dB
10 dB/div Ref 20.50 dBm
Mkr1 14.986 875 GHz
-52.016 dBm
Start 10.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 15.000 GHz
Sweep 477.9 ms (8001 pts)
Frequency
Auto Tune
Center Freq 12.500000000 GHz
Start Freq 10.000000000 GHz
Stop Freq 15.000000000 GHz
CF Step 500.000000 MHz
Freq Offset 0 Hz