FCC TEST REPORT

For

Hena Digital Technology (Shenzhen) Co., Ltd.

Tablet PC with DVD player

Model No.: MD93

Additional Model No.: MD-93, MD92, MD-92, MD91, MD-91, PDT9000

Prepared for	:	Hena Digital Technology (Shenzhen) Co., Ltd.
Address	:	3F, South Tower, Jiuzhou Electric Building, Southern No, 12Rd, High-tech Industrial Park, Nanshan District, Shenzhen, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Mail	:	webmaster@LCS-cert.com
Date of receipt of test sample	:	March 09, 2017
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	March 09, 2017~March 24, 2017
Date of Report	:	March 24, 2017

FCC TEST REPORT
FCC CFR 47 PART 15 E(15.407): 2016

Report Reference No.	**:**	**LCS1703243376E**
Date of Issue.....	:	March 24, 2017
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	1F., Xingyuan Industrial Park, Tongda Road, Bao'an Blvd., Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**:**	**Hena Digital Technology (Shenzhen) Co., Ltd.**
Address.....	:	3F, South Tower, Jiuzhou Electric Building, Southern No, 12Rd, High-tech Industrial Park, Nanshan District, Shenzhen, China
Test Specification		
Standard	:	FCC CFR 47 PART 15 E(15.407): 2016
Test Report Form No.	**:**	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

EUT Description.	**:**	**Tablet PC with DVD player**
Trade Mark.....	:	HENA, Polaroid
Model/ Type reference	:	MD93
Ratings.....	:	DC 3.7V by Lithium ion polymer battery (4000mAh) Recharge Voltage: DC 5V/2A
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Aking Jin		Gavin Liang
Aking Jin/ File administrators	Glin Lu/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS1703243376E	March 24, 2017 Date of issue

EUT.....	: Tablet PC with DVD player
Type / Model.....	: MD93
Applicant.....	**: Hena Digital Technology (Shenzhen) Co., Ltd.**
Address.....	: 3F, South Tower, Jiuzhou Electric Building, Southern No, 12Rd, High-tech Industrial Park, Nanshan District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Hena Digital Technology (Shenzhen) Co., Ltd.**
Address.....	: 3F, South Tower, Jiuzhou Electric Building, Southern No, 12Rd, High-tech Industrial Park, Nanshan District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Factory.....	**: Hena Digital Technology (Shenzhen) Co., Ltd.**
Address.....	: 3F, South Tower, Jiuzhou Electric Building, Southern No, 12Rd, High-tech Industrial Park, Nanshan District, Shenzhen, China
Telephone.....	: /
Fax.....	: /

Test Result:	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
00	March 24, 2017	Initial Issue	Gavin Liang

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	: Tablet PC with DVD player
Model Number	: MD93, MD-93, MD92, MD-92, MD91, MD-91, PDT9000
Model Declaration	: PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Test Model	: MD93
Hardware version	: 7500-MD7100-03R
Software version	: Ver.Wed Mar 15 11:56:56 CST 2017
Power Supply	: DC 3.7V by Lithium ion polymer battery (4000mAh) Recharge Voltage: DC 5V/2A
Bluetooth	: Supported BT 4.0
Operation frequency	: 2402MHz-2480MHz
Channel Spacing	: 1MHz for Bluetooth 4.0(DSS); 2MHz for Bluetooth 4.0(DTS);
Modulation Type	: GFSK,π/4DQPSK, 8DPSK for Bluetooth 4.0(DSS); GFSK for Bluetooth 4.0(DTS)
Bluetooth Version	: 4.0
Channel Number	: 79 Channels for Bluetooth 4.0(DSS);40 Channels for Bluetooth 4.0(DTS)
WLAN	: Supported 802.11b/802.11g/802.11n/802.11a
Operation frequency	: IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz/5150-5250MHz/5745-5850MHz IEEE 802.11n HT40:2422-2452MHz/5150-5250MHz/5745-5850MHz IEEE 802.11a:5150-5250MHz/5745-5850MHz
Modulation Type	: IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM,QPSK,BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM,QPSK,BPSK)
Channel Number	: 11 Channels for WIFI 20MHz Bandwidth(802.11b/g/n-HT20) 7 Channels for WIFI 40MHz Bandwidth(802.11n-HT40) 4 Channels for 5180.00-5240.00MHz(802.11a/n-HT20) 5 Channels for 5745.00-5825.00MHz(802.11a/n-HT20) 2 Channels for 5190.00-5230.00MHz(802.11n-HT40) 2 Channels for 5755.00-5795.00MHz(802.11n-HT40)
Antenna Type	: PIFA Antenna
Antenna Gain	: 2.0dBi (Max.) For WIFI/BT
Extreme temp. Tolerance	: -15°C to +45°C
Extreme vol. Limits	: 3.30VDC to 4.20VDC (nominal: 3.70VDC)
GPS Function	: Supported and only RX

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
Mass Power Electronic Limited	AC Adapter	NBS12E050200 HU	--	CE

1.3. External I/O Port

I/O Port Description	Quantity	Cable
Micro USB Port	1	1.2m, unshielded
TF Card Slot	1	N/A
Earphone Jack	1	N/A

1.4. Description of Test Facility

CNAS Registration Number. is L4595.
FCC Registration Number. is 899208.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of The Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:
IEEE 802.11a Mode: 6 Mbps, OFDM.
IEEE 802.11n-HT20 Mode: MCS0, OFDM.
IEEE 802.11n-HT40 Mode: MCS0, OFDM.

Antenna & Bandwidth

Antenna	Single (Port.1)			Two (Port.1 + Port.2)		
Bandwidth Mode	20MHz	40MHz	80MHz	20MHz	40MHz	80MHz
802.11a	☑	☐	☐	☐	☐	☐
802.11n	☑	☑	☐	☐	☐	☐

1.8. Frequency of Channels

IEEE 802.11a/n-HT20

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
5150~5250MHz	36	5180	44	5220
	40	5200	48	5240

IEEE 802.11n-HT40

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
5150~5250MHz	38	5190	46	5230

The test configuration of the test software shows as below:

Test mode	Channel No.	Frequency(MHz)	Software setting value
IEEE 802.11a	36	5180	4
	44	5220	4
	48	5240	4
IEEE 802.11n-HT20	36	5180	4
	44	5200	4
	48	5240	4
IEEE 802.11n-HT40	38	5190	4
	46	5230	4

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure 789033 D02 General UNII Test Procedures New Rules v01r03 is required to be used for this kind of FCC 15.407 UII device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013.

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmit condition.

3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (Installed in the tablet PC) provided by application.

3.3. Special Accessories

N/A

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart E		
FCC Rules	Description of Test	Result
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.407(a)	26dB Bandwidth	Compliant
§15.407(a)	99% Occupied Bandwidth	Compliant
§15.407(b)	Radiated Emissions	Compliant
§15.407(b)	Band edge Emissions	Compliant
§15.205	Emissions at Restricted Band	Compliant
§15.407(g)	Frequency Stability	N/A
§15.207(a)	Line Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant
§2.1093	RF Exposure	Compliant

Note: The customer declared frequency stability is better than 20ppm which ensures that the signal remains in the allocated bands under all operational conditions stated in the user manual.

5. TEST RESULT

5.1. On Time and Duty Cycle

5.1.1. Standard Applicable

None; for reporting purpose only.

5.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the spectrum analyse.

5.1.3. Test Procedures

1). Set the centre frequency of the spectrum analyse to the transmiting frequency;

2). Set the span=0MHz, RBW=8MHz, VBW=50MHz, Sweep time=5ms;

3). Detector = peak;

4). Trace mode = Single hold.

5.1.4. Test Setup Layout

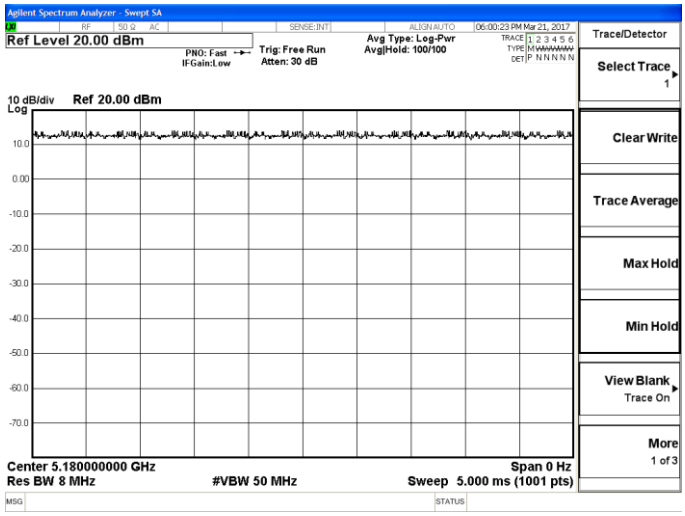
5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

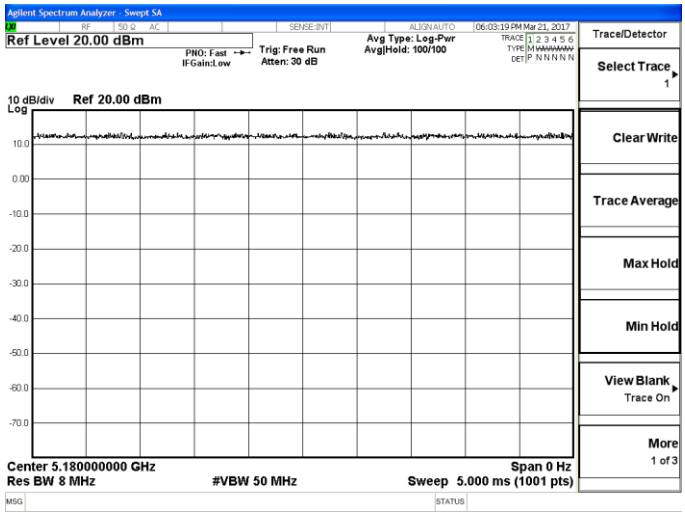
5.1.6. Test result

Mode	On Time B (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW(KHz)
IEEE 802.11a	/	0.0	1	100	0.000	0.010
IEEE 802.11n-HT20	/	0.0	1	100	0.000	0.010
IEEE 802.11n-HT40	/	0.0	1	100	0.000	0.010
Note: Duty Cycle Correction Factor=10log(1/Duty cycle)						

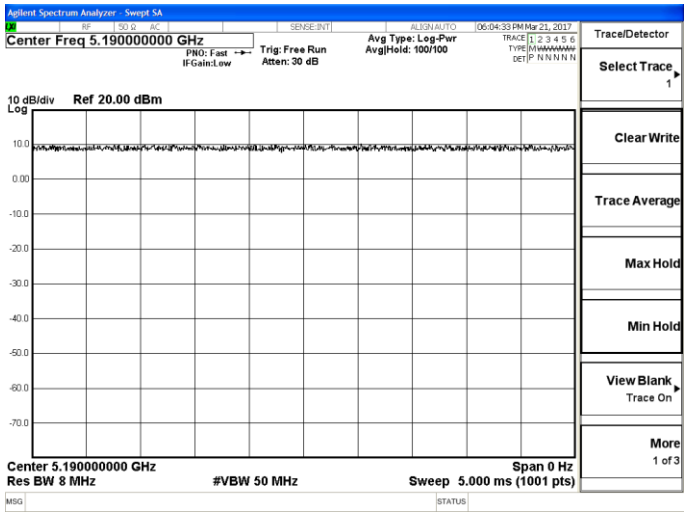
Test plot of On Time and Duty Cycle



IEEE 802.11a



IEEE 802.11n-HT20



IEEE 802.11n-HT40

/

/

5.2. Maximum Conducted Output Power Measurement

5.2.1. Standard Applicable

(1) For the band 5.15~5.25GHz

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the power meter.

5.2.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

According to KDB 789033 D02 Section 3 (a) Method PM (Measurement using an RF average power meter):

(i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

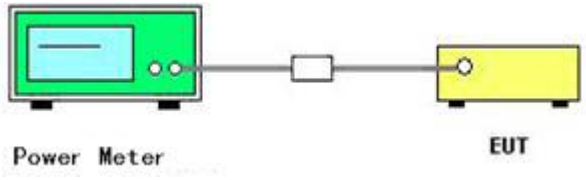
- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

(ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.

(iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

(iv) Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25%).

5.2.4. Test Setup Layout



5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.2.6. Test Result of Maximum Conducted Output Power

Temperature	25℃	Humidty	60%
Test Engineer	Jayden Zhuo	Configurations	IEEE 802.11a/n

Test Mode	Channel	Frequency (MHz)	AVG Conducted Power (dBm)	Duty Cycle Factor (dB)	Sum Power (dBm)	Max. Limit (dBm)	Result
IEEE 802.11a	36	5180	7.32	0.000	7.32	24	Complies
	44	5220	7.25	0.000	7.25	24	Complies
	48	5240	7.36	0.000	7.36	24	Complies

Test Mode	Channel	Frequency (MHz)	AVG Conducted Power (dBm)	Duty Cycle Factor (dB)	Sum Power (dBm)	Max. Limit (dBm)	Result
IEEE 802.11n-HT20	36	5180	7.03	0.000	7.03	24	Complies
	44	5220	7.10	0.000	7.10	24	Complies
	48	5240	7.09	0.000	7.09	24	Complies

Test Mode	Channel	Frequency (MHz)	AVG Conducted Power (dBm)	Duty Cycle Factor (dB)	Sum Power (dBm)	Max. Limit (dBm)	Result
IEEE 802.11n-HT40	38	5190	6.99	0.000	6.99	24	Complies
	46	5230	6.89	0.000	6.89	24	Complies

Remark:

1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40;*
4. *Report conducted power = Measured conducted average power + Duty Cycle factor;*

5.3. Power Spectral Density Measurement

5.3.1. Standard Applicable

For 5.15~5.25GHz

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.note1
(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.note1
(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.
(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. note1
Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

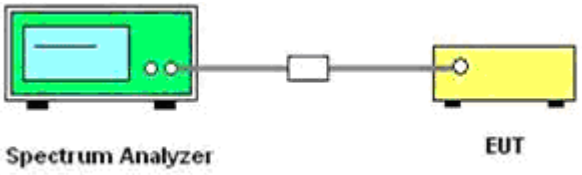
5.3.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

5.3.3. Test Procedures

1). The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2). The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3). Set the RBW = 1MHz.
4). Set the VBW ≥ 3MHz
5). Span=Encompass the entire emissions bandwidth (EBW) of the signal (or, alternatively, the entire 99% occupied bandwidth) of the signal.
6). Number of points in sweep $\geqslant$ 2 $\times$ span / RBW. (This ensures that bin-to-bin spacing is $\leqslant$ RBW/2, so that narrowband signals are not lost between frequency bins.)
7). Manually set sweep time $\geqslant$ 10 $\times$ (number of points in sweep) $\times$ (total on/off period of the transmitted signal).
8). Set detector = power averaging (rms).
9). Sweep time = auto couple.
10). Trace mode = max hold.
11). Allow trace to fully stabilize.
12). 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. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively.
13). Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25%.
14). Use the peak marker function to determine the maximum power level in any 1MHz band segment within the fundamental EBW.

5.3.4. Test Setup Layout



5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.3.6. Test Result of Power Spectral Density

Temperature	25℃	Humidity	60%
Test Engineer	Jayden Zhuo	Configurations	IEEE 802.11a/n

Test Mode	Channel	Frequency (MHz)	Power Density (dBm/MHz)	Duty cycle factor (dB)	Sum PSD (dBm/MHz)	Max. Limit (dBm/MHz)	Result
IEEE 802.11a	36	5180	-4.683	0.000	-4.683	11	Complies
	44	5220	-4.181	0.000	-4.181	11	Complies
	48	5240	-3.870	0.000	-3.870	11	Complies

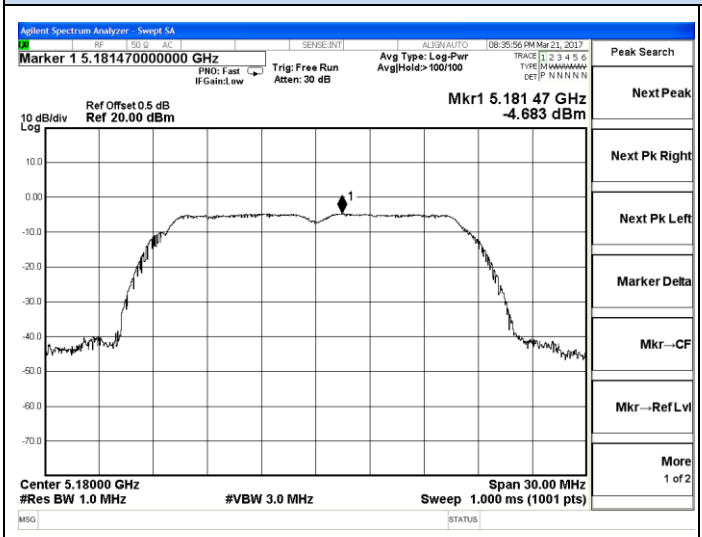
Test Mode	Channel	Frequency (MHz)	Power Density (dBm/MHz)	Duty cycle factor (dB)	Sum PSD (dBm/MHz)	Max. Limit (dBm/MHz)	Result
IEEE 802.11n-HT20	36	5180	-4.799	0.000	-4.799	11	Complies
	44	5220	-4.352	0.000	-4.352	11	Complies
	48	5240	-3.807	0.000	-3.807	11	Complies

Test Mode	Channel	Frequency (MHz)	Power Density (dBm/MHz)	Duty cycle factor (dB)	Sum PSD (dBm/MHz)	Max. Limit (dBm/MHz)	Result
IEEE 802.11n-HT40	38	5190	-7.553	0.000	-7.553	11	Complies
	46	5230	-7.070	0.000	-7.070	11	Complies

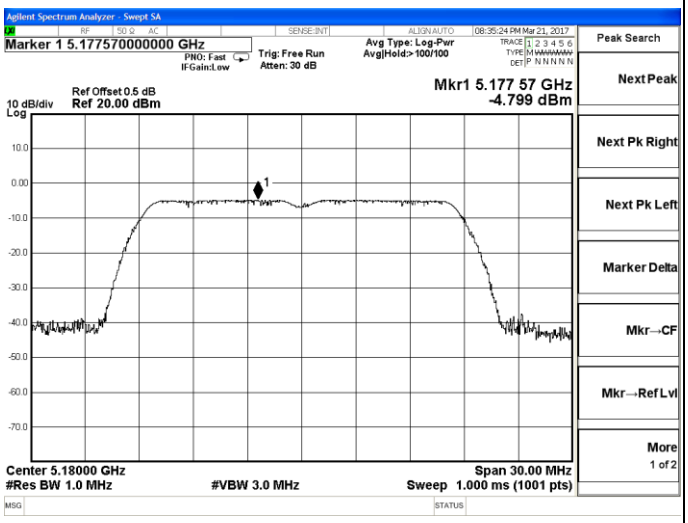
Remark:

1. *Measured power spectrum density at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40;*
4. *Report conducted PSD = Measured conducted average power + Duty Cycle factor;*
5. *Please refer to following test plots;*

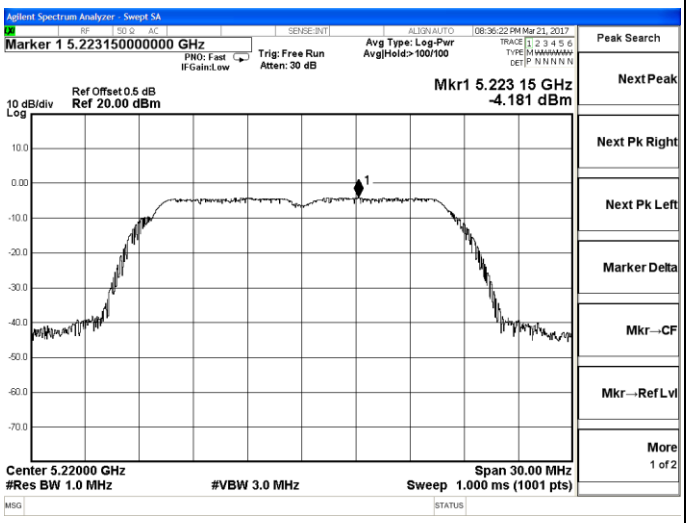
Test Plot of Power Spectral Density



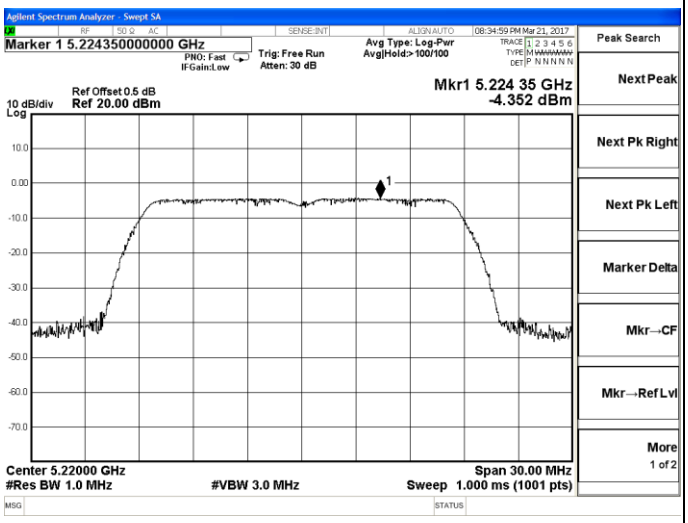
IEEE 802.11a-5180MHz



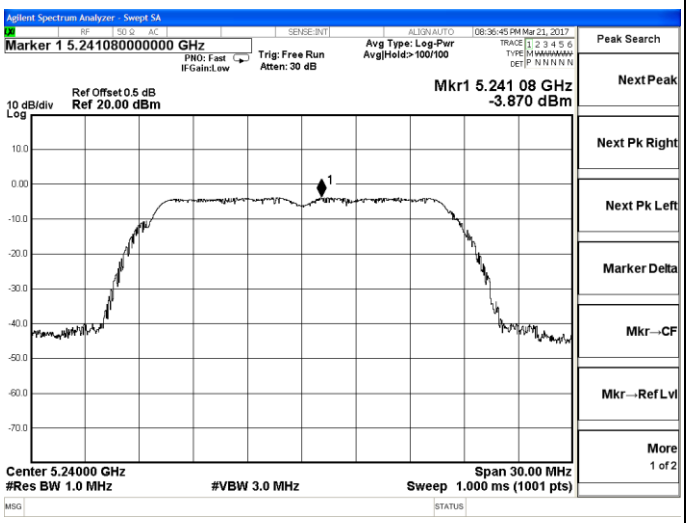
IEEE 802.11n-HT20-5180MHz



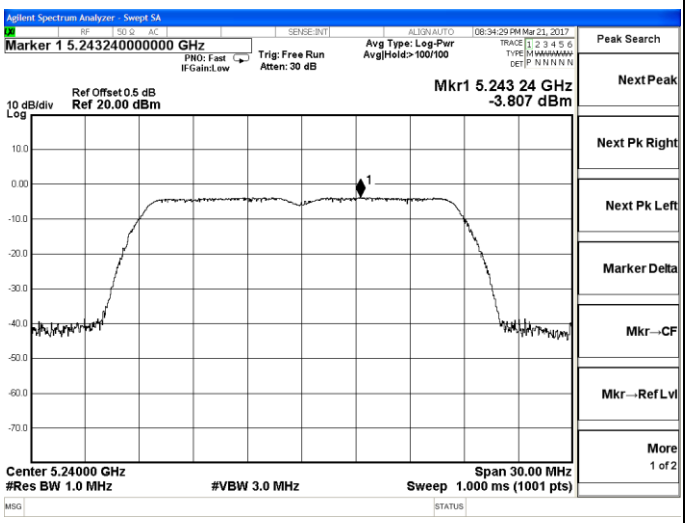
IEEE 802.11a-5220MHz



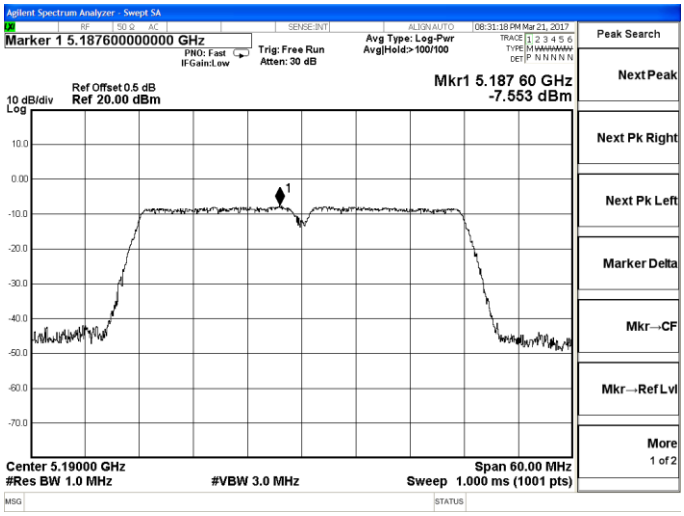
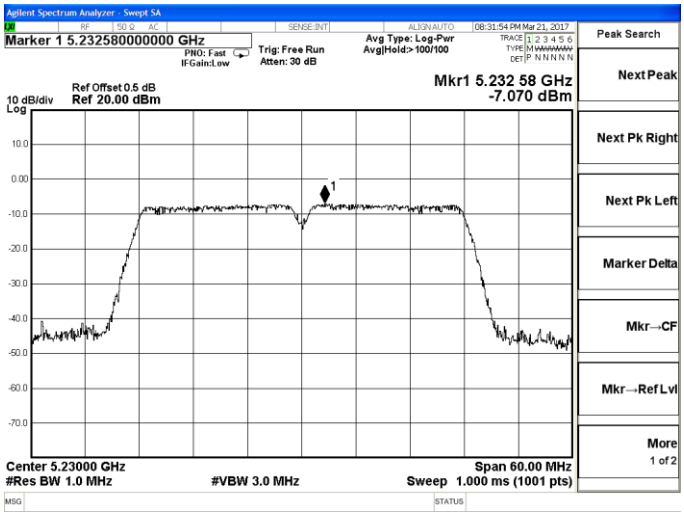
IEEE 802.11n-HT20-5220MHz



IEEE 802.11a-5240MHz



IEEE 802.11n-HT20-5240MHz

Test Plot of Power Spectral Density	
	
IEEE 802.11n-HT40-5190MHz	
	
IEEE 802.11n-HT40-5230MHz	

5.4. 99% and 26dB Occupied Bandwidth Measurement

5.4.1. Standard Applicable

No restriction limits. But resolution bandwidth within band edge measurement is 1% of the 99% occupied bandwidth.

5.4.2. Measuring Instruments and Setting

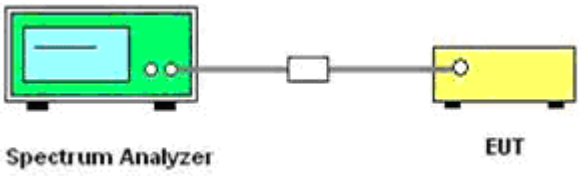
Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span	> 26dB Bandwidth
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

5.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 300 kHz and the video bandwidth of 1000 kHz were used.
3. Measured the spectrum width with power higher than 26dB below carrier.

5.4.4. Test Setup Layout



5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.4.6. Test Result of 99% and 26dB Occupied Bandwidth

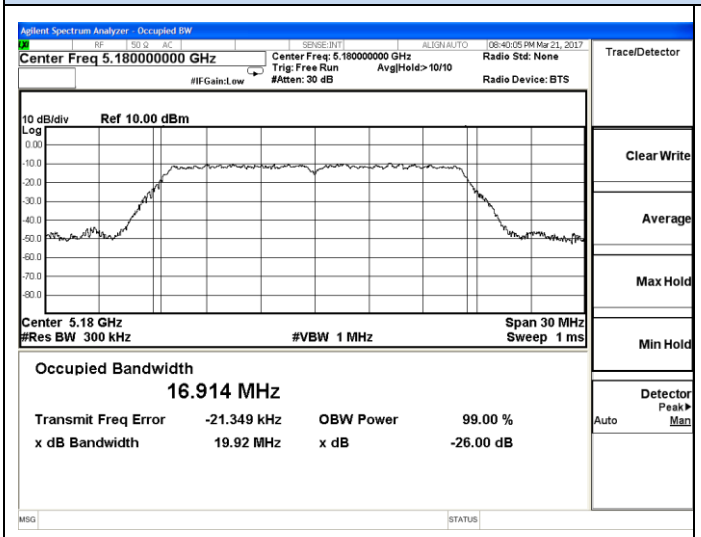
Temperature	25℃	Humidity	60%
Test Engineer	Jayden Zhuo	Configurations	IEEE 802.11a/n

Test Mode	Channel	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
IEEE 802.11a	36	5180	19.92	16.914
	44	5220	20.17	17.149
	48	5240	19.95	16.960
IEEE 802.11n-HT20	36	5180	20.02	17.798
	44	5220	20.07	17.803
	48	5240	20.13	17.794
IEEE 802.11n-HT40	38	5190	40.01	36.192
	46	5230	40.04	36.165

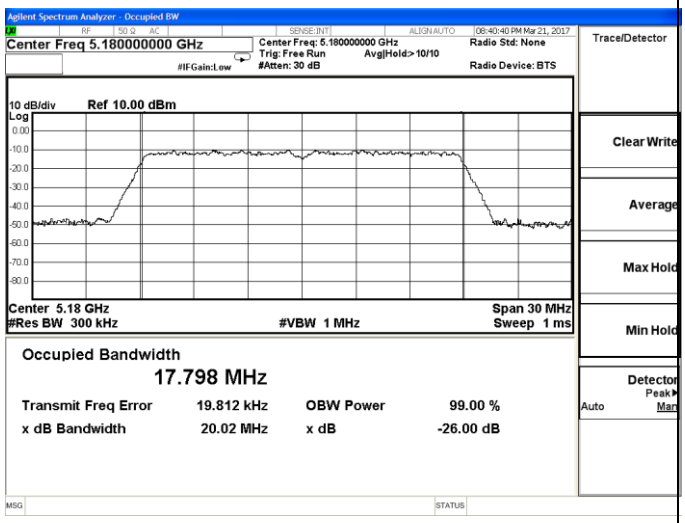
Remark:

1. *Measured 99% and 26dB bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40;*
4. *Please refer to following test plots;*

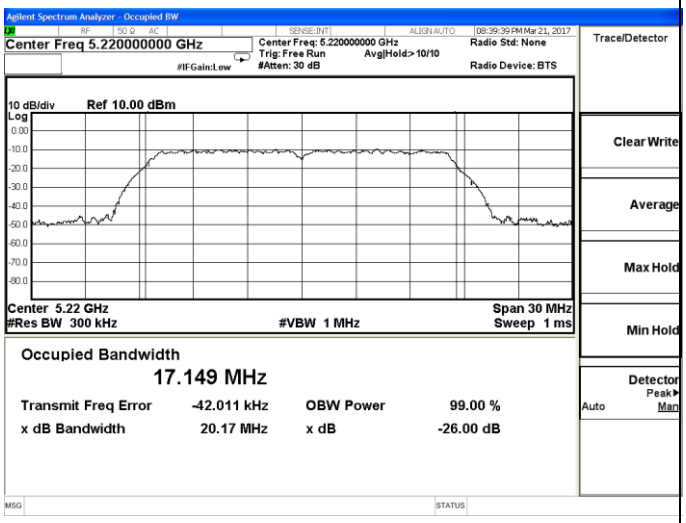
Test Plot of 99% and 26dB Occupied Bandwidth



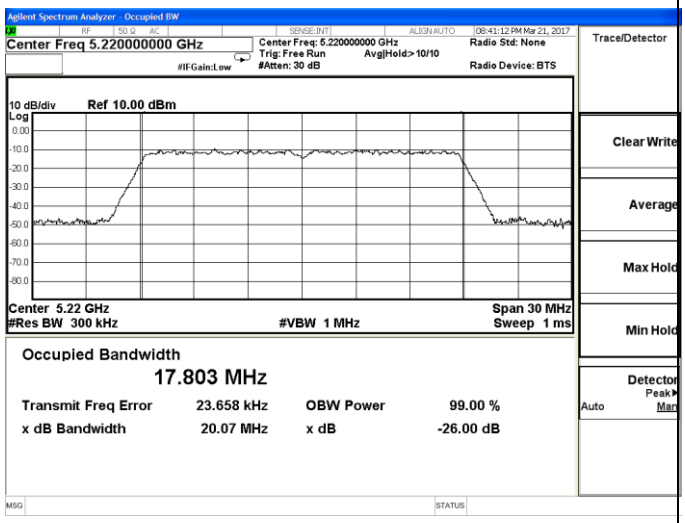
IEEE 802.11a-5180MHz



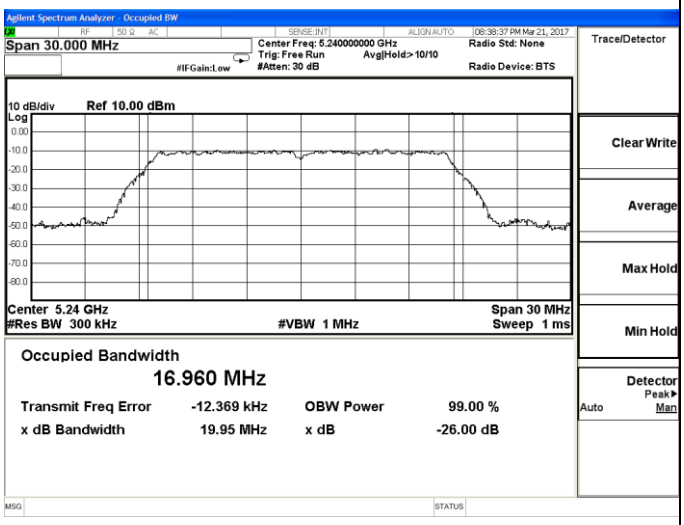
IEEE 802.11n-HT20-5180MHz



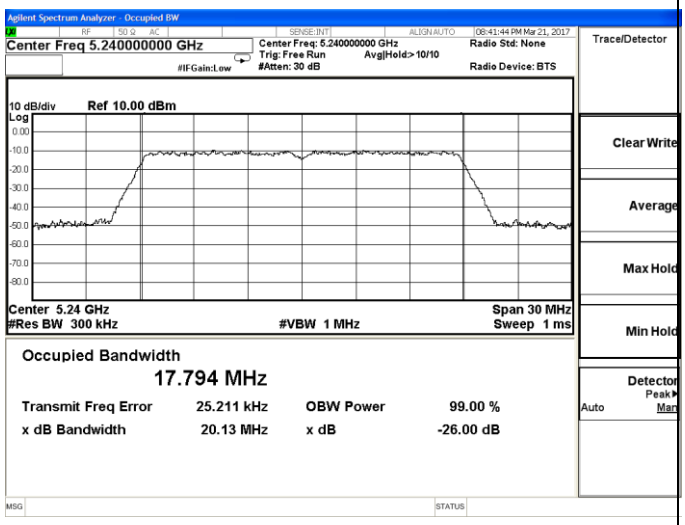
IEEE 802.11a-5220MHz



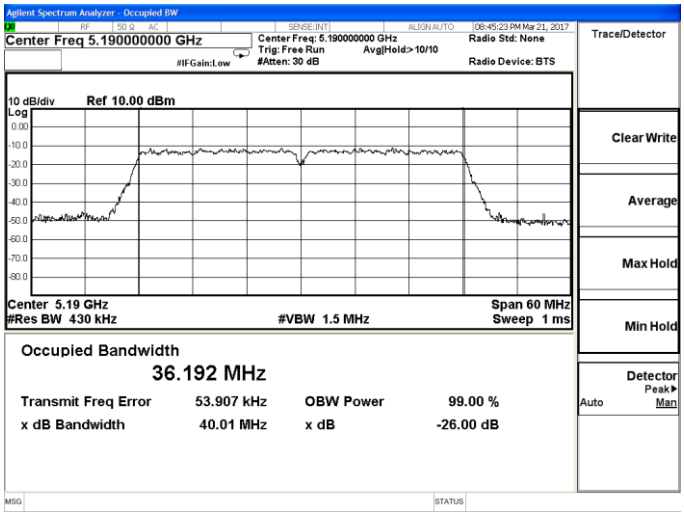
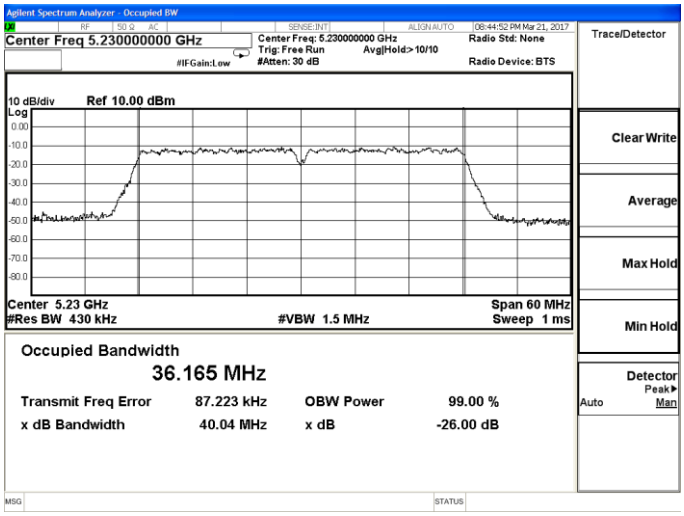
IEEE 802.11n-HT20-5220MHz



IEEE 802.11a-5240MHz



IEEE 802.11n-HT20-5240MHz

Test Plot of 99% and 26dB Occupied Bandwidth	
	
IEEE 802.11n-HT40-5190MHz	
	
IEEE 802.11n-HT40-5230MHz	

5.5. Radiated Emissions Measurement

5.5.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
\2\ Above 38.6

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 e.i.r.p. of −27 dBm/MHz(68.2dBuV/m at 3m).

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB 100kHz for QP

5.5.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

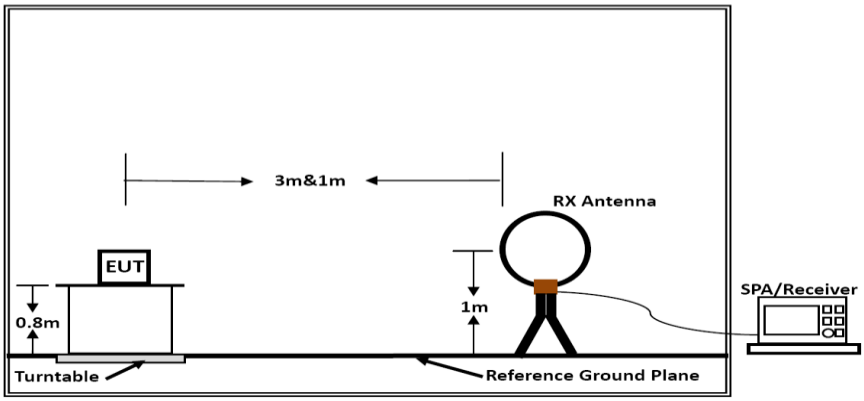
Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

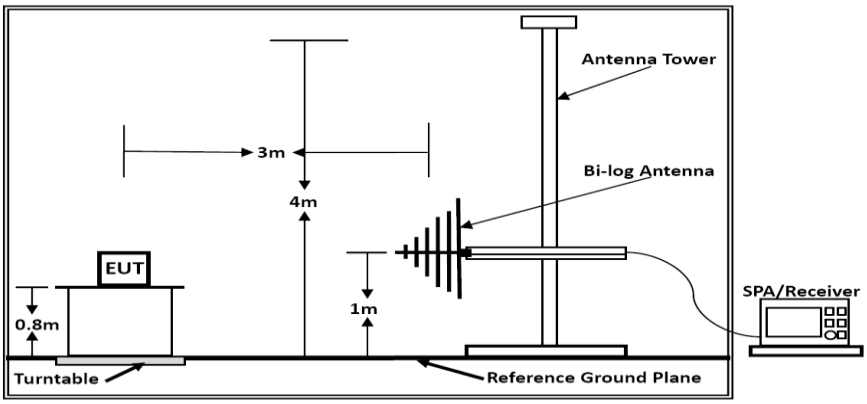
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

5.5.4. Test Setup Layout

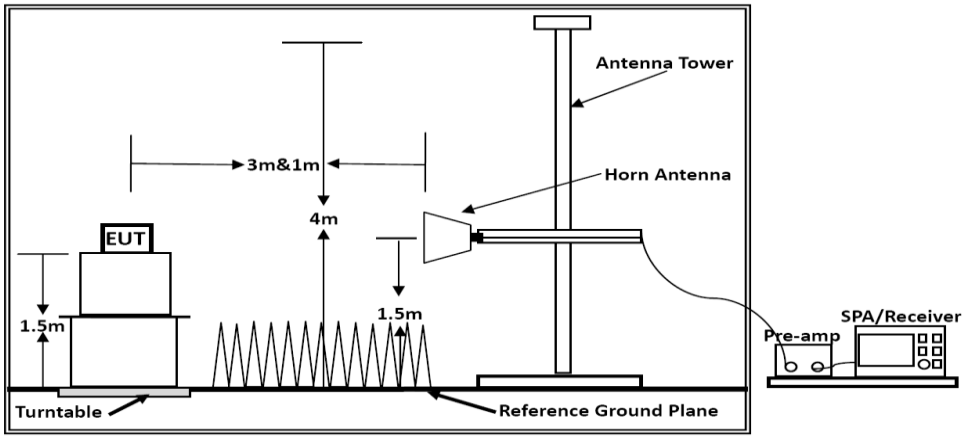
For radiated emissions below 30MHz



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1.5m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.5.6. Results of Radiated Emissions (9kHz~30MHz)

Temperature	25℃	Humidty	60%
Test Engineer	Jayden Zhuo	Configurations	IEEE 802.11a/n

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

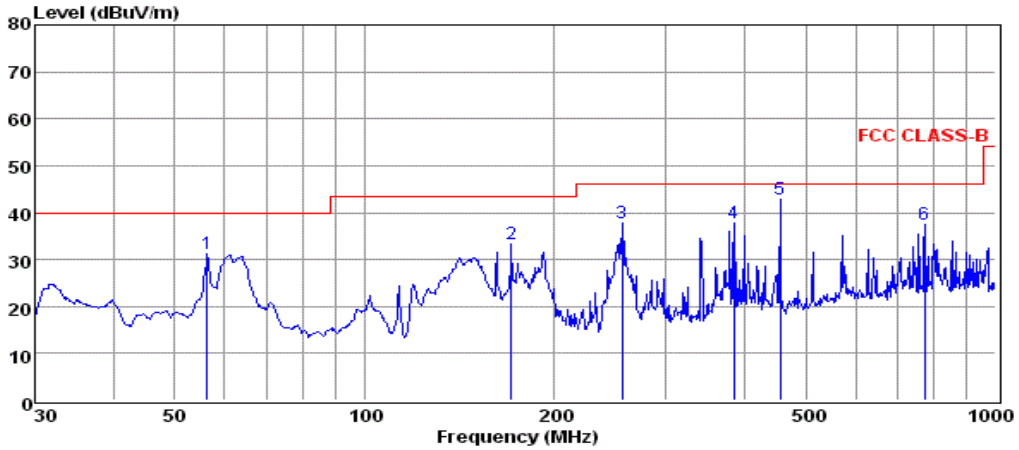
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

5.5.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	25℃	Humidty	60%
Test Engineer	Jayden Zhuo	Configurations	IEEE 802.11a, 5180MHz

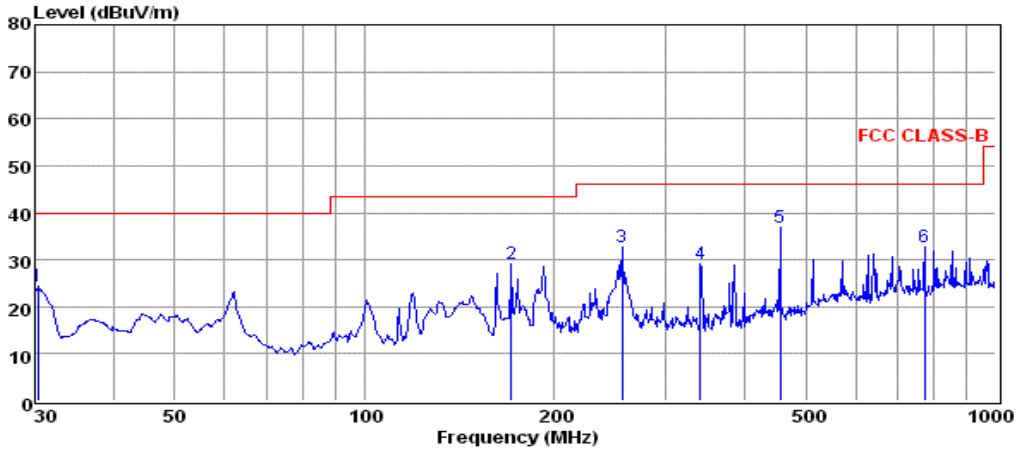
Test result for IEEE 802.11a-5180MHz



pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	56.20	17.71	0.47	12.94	31.12	40.00	-8.88	QP
2	170.79	23.37	0.80	9.03	33.20	43.50	-10.30	QP
3	255.62	24.73	1.02	12.06	37.81	46.00	-8.19	QP
4	385.28	21.84	1.32	14.71	37.87	46.00	-8.13	QP
5	455.91	25.90	1.39	15.58	42.87	46.00	-3.13	QP
6	771.45	16.27	1.63	19.70	37.60	46.00	-8.40	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported



pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	30.32	11.59	0.39	12.33	24.31	40.00	-15.69	QP
2	170.79	19.29	0.80	9.03	29.12	43.50	-14.38	QP
3	255.62	19.63	1.02	12.06	32.71	46.00	-13.29	QP
4	340.78	13.82	1.12	14.13	29.07	46.00	-16.93	QP
5	455.91	19.77	1.39	15.58	36.74	46.00	-9.26	QP
6	771.45	11.25	1.63	19.70	32.58	46.00	-13.42	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported

Note:

Pre-scan all mode and recorded the worst case results in this report (802.11a-5180MHz).
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

5.5.8. Results for Radiated Emissions (Above 1GHz)

IEEE 802.11a

Channel 36

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.54	45.92	38.82	36.04	10.40	59.10	74.0	-14.90	Peak	Horizontal
15.54	29.22	38.82	36.04	10.40	42.40	54.0	-11.60	Average	Horizontal
15.54	45.30	38.75	36.04	10.40	58.41	74.0	-15.59	Peak	Vertical
15.54	29.64	38.75	36.04	10.40	42.75	54.0	-11.25	Average	Vertical

Channel 40

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.60	45.20	38.82	36.04	10.40	58.38	74.0	-15.62	Peak	Horizontal
15.60	29.41	38.82	36.04	10.40	42.59	54.0	-11.41	Average	Horizontal
15.60	45.53	38.79	36.04	10.40	58.68	74.0	-15.32	Peak	Vertical
15.60	30.04	38.79	36.04	10.40	43.19	54.0	-10.81	Average	Vertical

Channel 48

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.72	44.38	38.82	36.04	10.40	57.56	74.0	-16.44	Peak	Horizontal
15.72	30.42	38.82	36.04	10.40	43.60	54.0	-10.40	Average	Horizontal
15.72	45.28	38.53	36.04	10.40	58.17	74.0	-15.83	Peak	Vertical
15.72	29.75	38.53	36.04	10.40	42.64	54.0	-11.36	Average	Vertical

IEEE 802.11n-HT20

Channel 36

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.54	44.64	38.82	36.04	10.40	57.82	74.0	-16.18	Peak	Horizontal
15.54	30.85	38.82	36.04	10.40	44.03	54.0	-9.97	Average	Horizontal
15.54	45.95	38.75	36.04	10.40	59.06	74.0	-14.94	Peak	Vertical
15.54	29.25	38.75	36.04	10.40	42.36	54.0	-11.64	Average	Vertical

Channel 40

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.60	45.60	38.82	36.04	10.40	58.78	74.0	-15.22	Peak	Horizontal
15.60	29.56	38.82	36.04	10.40	42.74	54.0	-11.26	Average	Horizontal
15.60	44.94	38.79	36.04	10.40	58.09	74.0	-15.91	Peak	Vertical
15.60	29.38	38.79	36.04	10.40	42.53	54.0	-11.47	Average	Vertical

Channel 48

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.72	45.55	38.82	36.04	10.40	58.73	74.0	-15.27	Peak	Horizontal
15.72	30.51	38.82	36.04	10.40	43.69	54.0	-10.31	Average	Horizontal
15.72	44.89	38.53	36.04	10.40	57.78	74.0	-16.22	Peak	Vertical
15.72	30.80	38.53	36.04	10.40	43.69	54.0	-10.31	Average	Vertical

IEEE 802.11n-HT40

Channel 38

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.57	45.29	38.82	36.04	10.40	58.47	74.0	-15.53	Peak	Horizontal
15.57	29.91	38.82	36.04	10.40	43.09	54.0	-10.91	Average	Horizontal
15.57	45.99	38.79	36.04	10.40	59.14	74.0	-14.86	Peak	Vertical
15.57	30.22	38.79	36.04	10.40	43.37	54.0	-10.63	Average	Vertical

Channel 46

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.69	45.36	38.82	36.04	10.40	58.54	74.0	-15.46	Peak	Horizontal
15.69	30.39	38.82	36.04	10.40	43.57	54.0	-10.43	Average	Horizontal
15.69	45.46	38.53	36.04	10.40	58.35	74.0	-15.65	Peak	Vertical
15.69	29.95	38.53	36.04	10.40	42.84	54.0	-11.16	Average	Vertical

Notes:

1). Measuring frequencies from 9k~40GHz, No emission found between lowest internal used/generated frequency to 30MHz.
2). Radiated emissions measured in frequency range from 9k~40GHz were made with an instrument using Peak detector mode.
3). 18~40GHz at least have 20dB margin. No recording in the test report.
4). Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40;

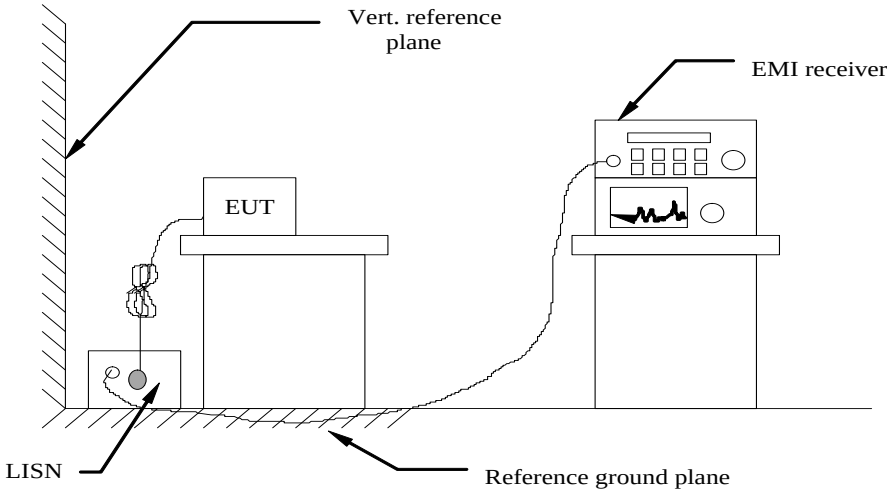
5.6. Power line conducted emissions

5.6.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

5.6.2 Block Diagram of Test Setup

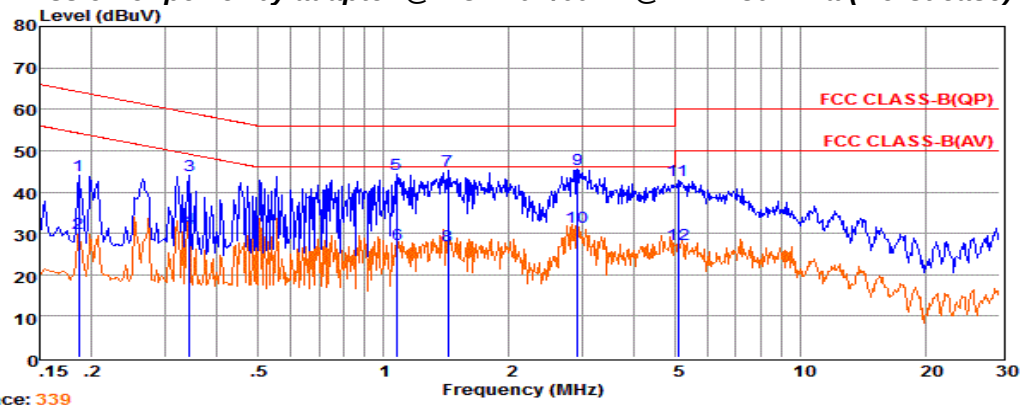


5.6.3 Test Results

PASS.

The test data please refer to following page.

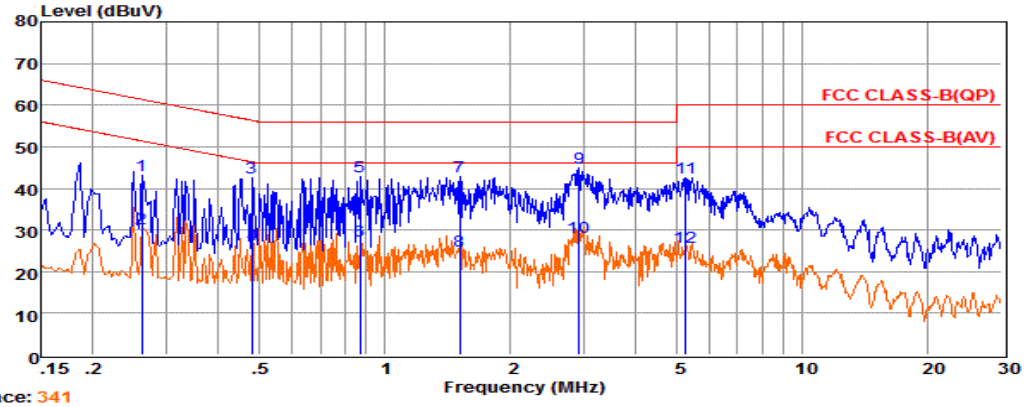
AC Conducted Emission of power by adapter @ AC 120V/60Hz @ IEEE 802.11a (worst case)



Trace: 339
Power Rating: AC 120V/60Hz
Pol: NEUTRAL

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.19	24.48	9.62	0.02	10.00	44.12	64.20	-20.08	QP
2	0.19	10.46	9.62	0.02	10.00	30.10	54.19	-24.09	Average
3	0.34	24.25	9.61	0.03	10.00	43.89	59.13	-15.24	QP
4	0.34	11.44	9.61	0.03	10.00	31.08	49.13	-18.05	Average
5	1.08	24.74	9.63	0.05	10.00	44.42	56.00	-11.58	QP
6	1.08	7.68	9.63	0.05	10.00	27.36	46.00	-18.64	Average
7	1.43	25.54	9.63	0.05	10.00	45.22	56.00	-10.78	QP
8	1.43	7.41	9.63	0.05	10.00	27.09	46.00	-18.91	Average
9	2.92	25.82	9.64	0.06	10.00	45.52	56.00	-10.48	QP
10	2.92	11.75	9.64	0.06	10.00	31.45	46.00	-14.55	Average
11	5.08	23.04	9.66	0.06	10.00	42.76	60.00	-17.24	QP
12	5.09	7.75	9.66	0.06	10.00	27.47	50.00	-22.53	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

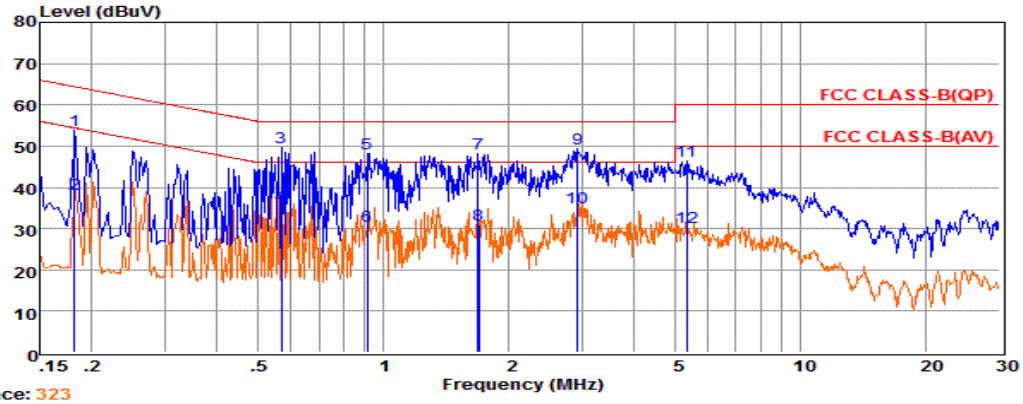


Trace: 341
Power Rating: AC 120V/60Hz
Pol: LINE

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.26	23.33	9.63	0.03	10.00	42.99	61.38	-18.39	QP
2	0.26	10.59	9.63	0.03	10.00	30.25	51.38	-21.13	Average
3	0.48	22.93	9.62	0.04	10.00	42.59	56.32	-13.73	QP
4	0.48	6.80	9.62	0.04	10.00	26.46	46.32	-19.86	Average
5	0.87	23.05	9.63	0.04	10.00	42.72	56.00	-13.28	QP
6	0.87	7.61	9.63	0.04	10.00	27.28	46.00	-18.72	Average
7	1.51	23.03	9.64	0.05	10.00	42.72	56.00	-13.28	QP
8	1.51	5.20	9.64	0.05	10.00	24.89	46.00	-21.11	Average
9	2.92	25.27	9.64	0.06	10.00	44.97	56.00	-11.03	QP
10	2.92	8.40	9.64	0.06	10.00	28.10	46.00	-17.90	Average
11	5.25	22.86	9.65	0.06	10.00	42.57	60.00	-17.43	QP
12	5.25	6.25	9.65	0.06	10.00	25.96	50.00	-24.04	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

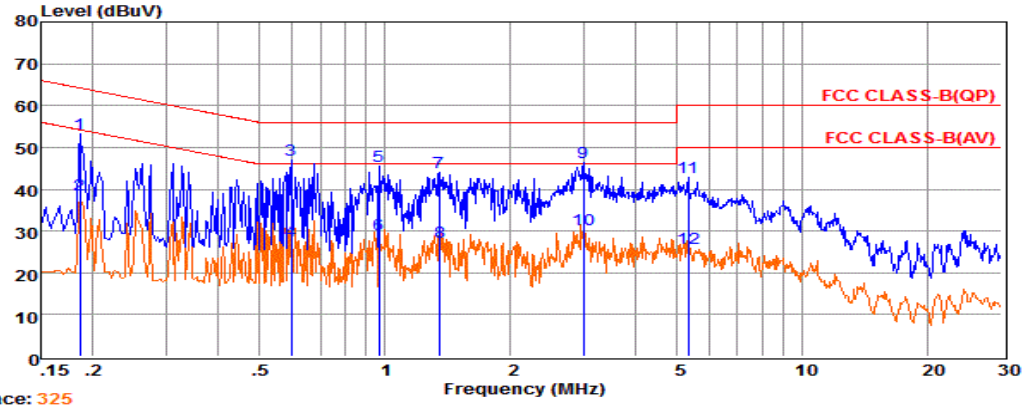
AC Conducted Emission of power by adapter @ AC 240V/60Hz @ IEEE 802.11a (worst case)



Trace: 323
Power Rating: AC 240V/60Hz
Pol: NEUTRAL

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.18	34.09	9.63	0.02	10.00	53.74	64.42	-10.68	QP
2	0.18	18.85	9.63	0.02	10.00	38.50	54.41	-15.91	Average
3	0.57	29.88	9.62	0.04	10.00	49.54	56.00	-6.46	QP
4	0.57	15.91	9.62	0.04	10.00	35.57	46.00	-10.43	Average
5	0.91	28.43	9.63	0.05	10.00	48.11	56.00	-7.89	QP
6	0.91	11.05	9.63	0.05	10.00	30.73	46.00	-15.27	Average
7	1.69	28.37	9.63	0.05	10.00	48.05	56.00	-7.95	QP
8	1.69	11.25	9.63	0.05	10.00	30.93	46.00	-15.07	Average
9	2.92	29.55	9.64	0.06	10.00	49.25	56.00	-6.75	QP
10	2.92	15.52	9.64	0.06	10.00	35.22	46.00	-10.78	Average
11	5.33	26.56	9.67	0.06	10.00	46.29	60.00	-13.71	QP
12	5.33	10.69	9.67	0.06	10.00	30.42	50.00	-19.58	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.



Trace: 325
Power Rating: AC 240V/60Hz
Pol: LINE

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.19	33.54	9.62	0.02	10.00	53.18	64.20	-11.02	QP
2	0.19	18.90	9.62	0.02	10.00	38.54	54.19	-15.65	Average
3	0.60	27.37	9.63	0.04	10.00	47.04	56.00	-8.96	QP
4	0.60	8.02	9.63	0.04	10.00	27.69	46.00	-18.31	Average
5	0.97	25.68	9.63	0.05	10.00	45.36	56.00	-10.64	QP
6	0.97	9.38	9.63	0.05	10.00	29.06	46.00	-16.94	Average
7	1.35	24.29	9.63	0.05	10.00	43.97	56.00	-12.03	QP
8	1.35	7.69	9.63	0.05	10.00	27.37	46.00	-18.63	Average
9	2.99	26.78	9.64	0.06	10.00	46.48	56.00	-9.52	QP
10	2.99	10.51	9.64	0.06	10.00	30.21	46.00	-15.79	Average
11	5.33	22.96	9.66	0.06	10.00	42.68	60.00	-17.32	QP
12	5.33	6.27	9.66	0.06	10.00	25.99	50.00	-24.01	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

***Note: Pre-scan all mode and recorded the worst case results in this report (802.11a).

5.7 Undesirable Emissions Measurement

5.7.1 Limit

According to ξ15.407 (b) Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(a) 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 e.i.r.p. of −27 dBm/MHz.

(b) 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 e.i.r.p. of −27 dBm/MHz.

(c) 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 e.i.r.p. of −27 dBm/MHz.

(d) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

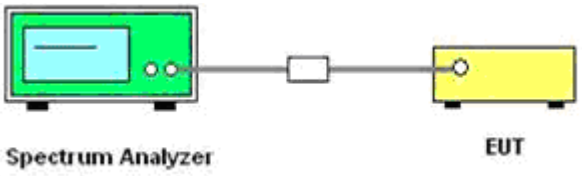
(e) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(f) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(g) The provisions of §15.205 apply to intentional radiators operating under this section.

(h) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

5.7.2 Test Configuration



5.7.3 Test Procedure

According to KDB789033 D02 General UNII Test Procedures New Rules v01 Section G: Unwanted Emission Measurement

1. Unwanted Emissions in the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”

b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements below 1000 MHz.”

c) At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.

d) For conducted measurements above 1000 MHz, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KDB Publication 412172):

i) E[dBμV/m] = EIRP[dBm] - 20 log (d[meters]) + 104.77, where E = field strength and d = distance at which field strength limit is specified in the rules;

ii) E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters

e) For conducted measurements below 1000 MHz, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

2. Unwanted Emissions that fall Outside of the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”

b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements below 1000 MHz.”

c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., “Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 MHz.”

d) Section 15.407(b) (1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.

i) Section 15.407(b) (4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b) (4) (i). An alternative to the band emissions mask is specified in Section 15.407(b) (4) (ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.

e) If radiated measurements are performed, field strength is then converted to EIRP as follows:

i) EIRP = ((E×d) ^2) / 30

Where:

- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotopically radiated power in watts;

ii) Working in dB units, the above equation is equivalent to:

EIRP [dBm] = E [dBμV/m] + 20 log (d [meters]) - 104.77

iii) Or, if d is 3 meters:

EIRP [dBm] = E [dBμV/m] - 95.23

3) Radiated versus Conducted Measurements.

The unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance provided that the following steps are performed:

(i) Cabinet emissions measurements. A radiated test shall be performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna may be replaced by a termination matching the nominal impedance of the antenna.

(ii) Impedance matching. Conducted tests shall be performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT.

(iii) EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater.3 However, for devices that operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20% of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 dBi be selected.

(iv) EIRP adjustments for multiple outputs. For devices with multiple outputs occupying the same or overlapping frequency ranges in the same band (e.g., MIMO or beamforming devices), compute the total EIRP as follows:

- Compute EIRP for each output, as described in (iii), above.
- Follow the procedures specified in KDB Publication 662911 for summing emissions across the outputs or adjusting emission levels measured on individual outputs by 10 log (N_{ANT}), where N_{ANT} is the number of outputs.
- Add the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.

(v) Direction of maximum emission.

For all radiated emissions tests, measurements shall correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

5.7.4 Test Results

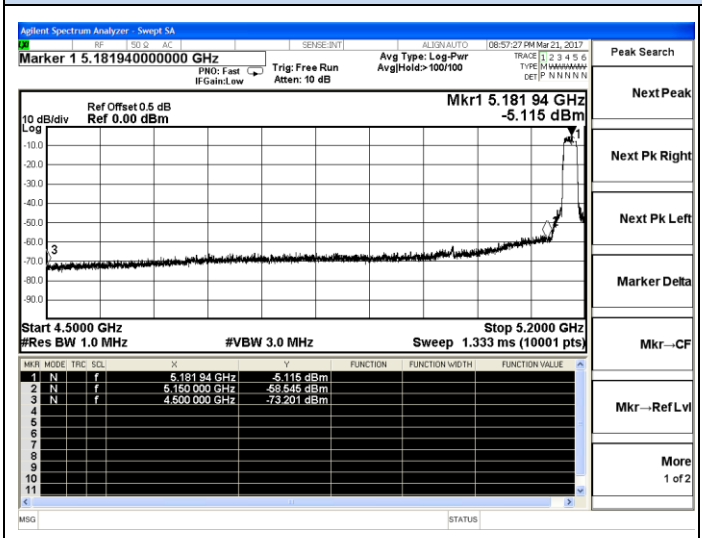
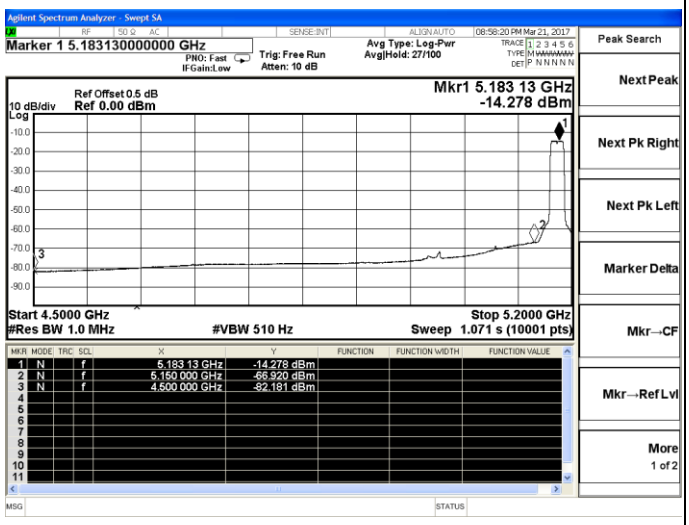
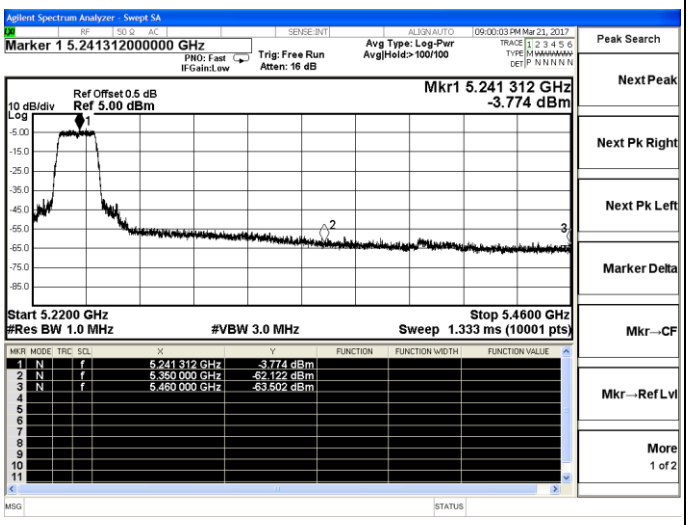
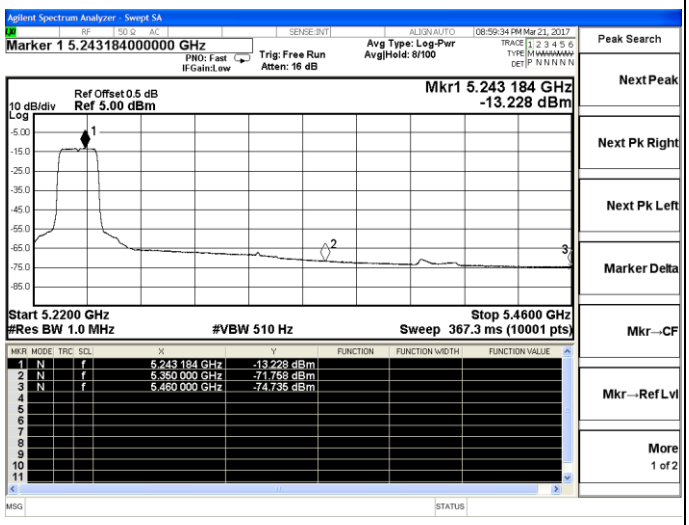
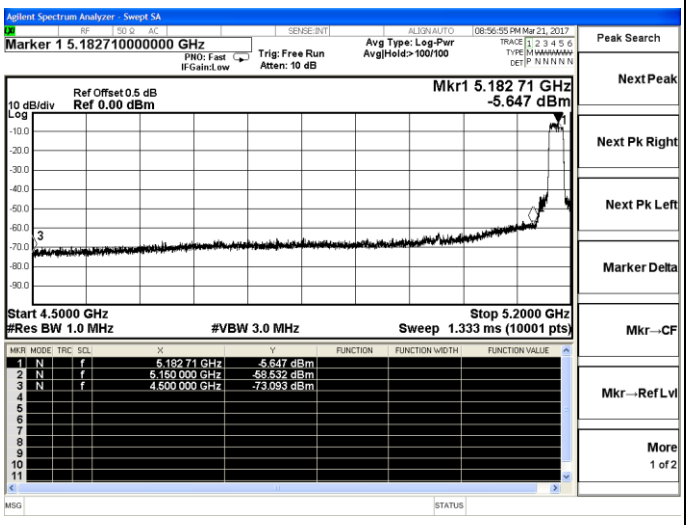
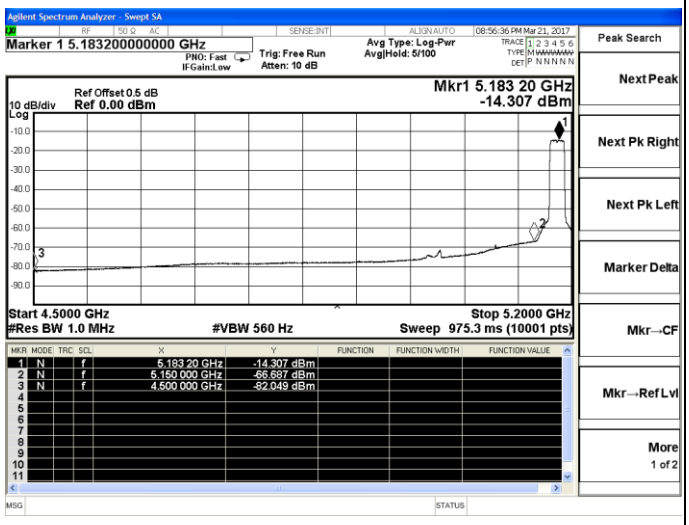
IEEE 802.11a						
Freq. MHz	Reading Level dBm	Antenna Gain dBi	Measured E dBuV/m	Limit dBuV/m	Margin dB	Remark
4500.000	-73.201	2.0	24.029	68.2	-44.171	Peak
4500.000	-82.181	2.0	15.049	54.0	-38.951	Average
5150.000	-58.545	2.0	38.685	68.2	-29.515	Peak
5150.000	-66.920	2.0	30.310	54.0	-23.690	Average
5350.000	-62.122	2.0	35.108	68.2	-33.092	Peak
5350.000	-71.758	2.0	25.472	54.0	-28.528	Average
5460.000	-63.502	2.0	33.728	68.2	-34.472	Peak
5460.000	-74.735	2.0	22.495	54.0	-31.505	Average

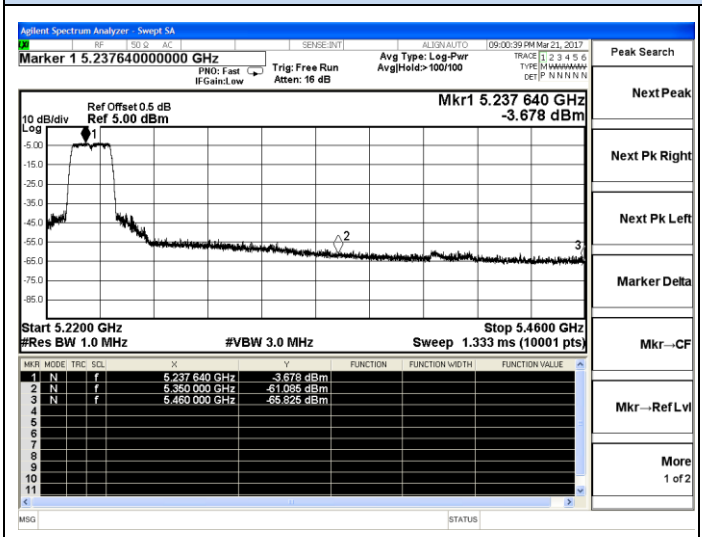
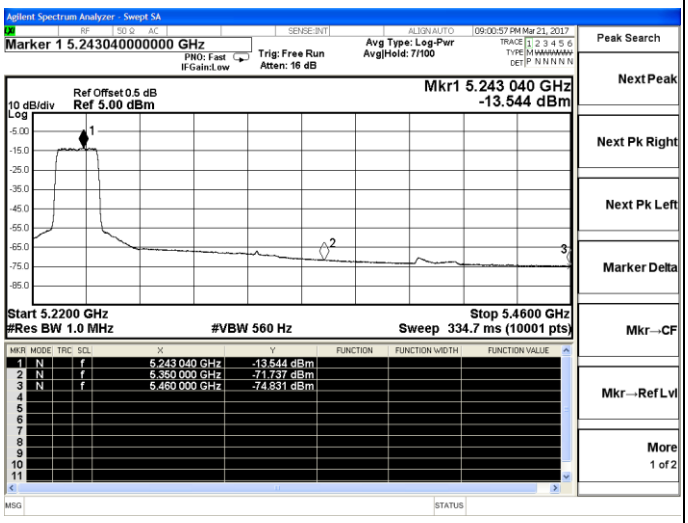
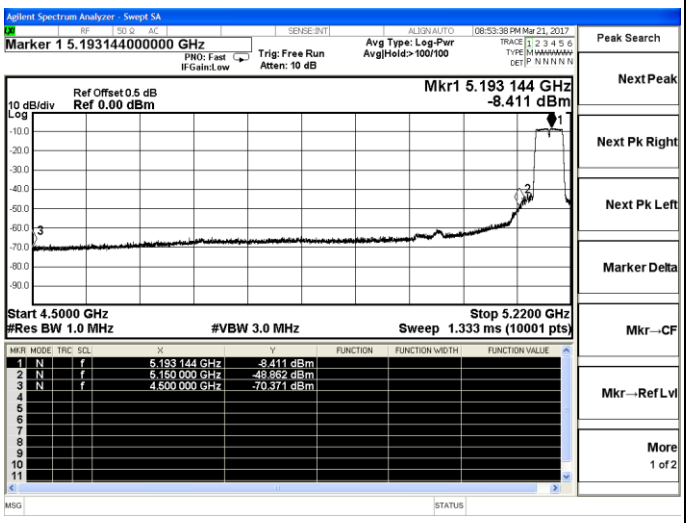
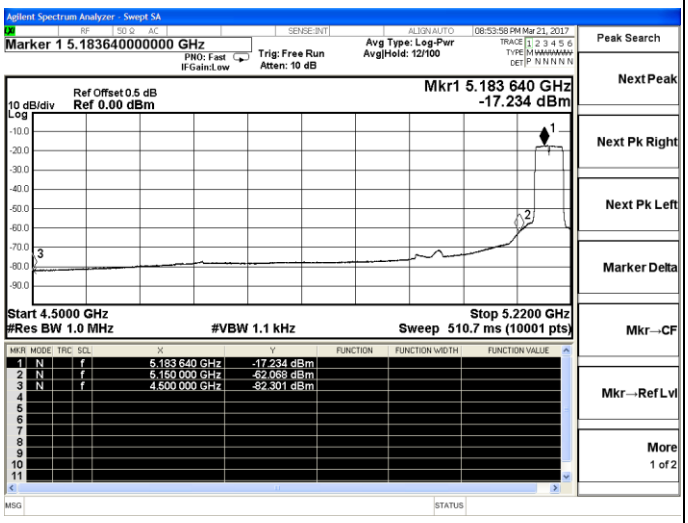
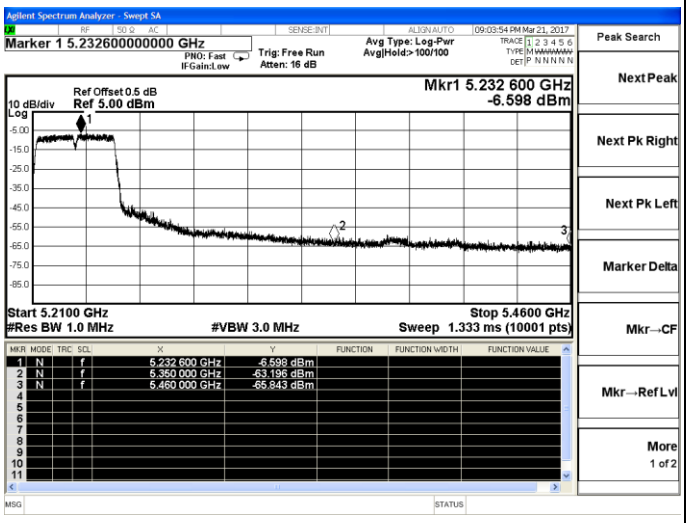
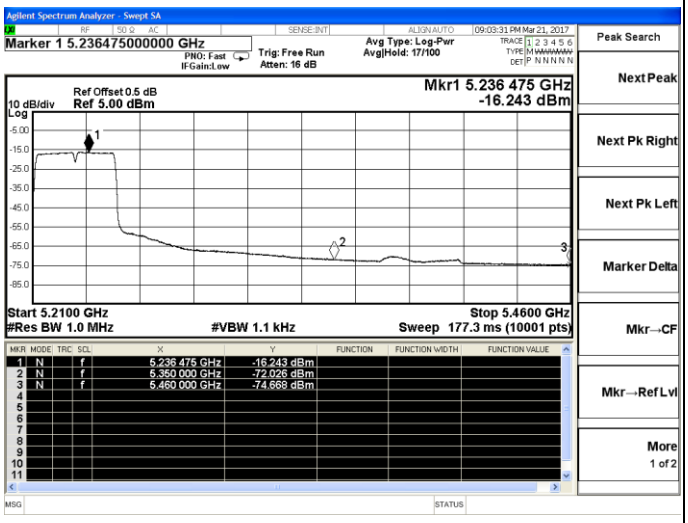
IEEE 802.11n-HT20						
Freq. MHz	Reading Level dBm	Antenna Gain dBi	Measured E dBuV/m	Limit dBuV/m	Margin dB	Remark
4500.000	-73.093	2.0	24.137	68.2	-44.063	Peak
4500.000	-82.049	2.0	15.181	54.0	-38.819	Average
5150.000	-58.532	2.0	38.698	68.2	-29.502	Peak
5150.000	-66.687	2.0	30.543	54.0	-23.457	Average
5350.000	-61.085	2.0	36.145	68.2	-32.055	Peak
5350.000	-71.737	2.0	25.493	54.0	-28.507	Average
5460.000	-65.825	2.0	31.405	68.2	-36.795	Peak
5460.000	-74.831	2.0	22.399	54.0	-31.601	Average

IEEE 802.11n-HT40						
Freq. MHz	Reading Level dBm	Antenna Gain dBi	Measured E dBuV/m	Limit dBuV/m	Margin dB	Remark
4500.000	-70.371	2.0	26.859	68.2	-41.341	Peak
4500.000	-82.301	2.0	14.929	54.0	-39.071	Average
5150.000	-48.862	2.0	48.368	68.2	-19.832	Peak
5150.000	-62.068	2.0	35.162	54.0	-18.838	Average
5350.000	-63.196	2.0	34.034	68.2	-34.166	Peak
5350.000	-72.026	2.0	25.204	54.0	-28.796	Average
5460.000	-65.843	2.0	31.387	68.2	-36.813	Peak
5460.000	-74.668	2.0	22.562	54.0	-31.438	Average

Remark:

1. *Measured Undesirable emission at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40;*
4. *Covert Radiated E Level At 3m = Conducted average power + Directional Gain + 104.77-20*log(3);*
5. *Please refer to following test plots;*

Test plot of Undesirable emission	
	
IEEE 802.11a-Low channel(Peak)	IEEE 802.11a-Low channel(Average)
	
IEEE 802.11a-High channel(Peak)	IEEE 802.11a-High channel(Average)
	
IEEE 802.11n-HT20-Low channel(Peak)	IEEE 802.11n-HT20-Low channel(Average)

Test plot of Undesirable emission	
	
IEEE 802.11n-HT20-High channel(Peak)	IEEE 802.11n-HT20-High channel(Average)
	
IEEE 802.11n-HT40-Low channel(Peak)	IEEE 802.11n-HT40-Low channel(Average)
	
IEEE 802.11n-HT40-High channel(Peak)	IEEE 802.11n-HT40-High channel(Average)

5.8. Antenna Requirements

5.8.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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 re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

5.8.2 Antenna Connected Construction

5.8.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, 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.

5.8.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 2.0dBi, and the antenna is a PIFA antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

The WLAN and Bluetooth share same antenna.

5.8.2.3. Results: Compliance.

6. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal Date	Due Date
EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	June 18, 2016	June 17, 2017
Signal analyzer	Agilent	E4448A(External mixers to	US44300469	9kHz~40GHz	July 16, 2016	July 15, 2017
Signal analyzer	Agilent	N9020A	MY50510140	9kHz~26.5GHz	October 27, 2016	October 27, 2017
LISN	MESS Tec	NNB-2/16Z	99079	9KHz-30MHz	June 18, 2016	June 17, 2017
LISN (Support Unit)	EMCO	3819/2NM	9703-1839	9KHz-30MHz	June 18, 2016	June 17, 2017
RF Cable-CON	UTIFLEX	3102-26886-4	CB049	9KHz-30MHz	June 18, 2016	June 17, 2017
ISN	SCHAFFNER	ISN ST08	21653	9KHz-30MHz	June 18, 2016	June 17, 2017
3m Semi Anechoic	SIDT FRANKONIA	SAC-3M	03CH03-HY	30M-18GHz 3m	June 18, 2016	June 17, 2017
Amplifier	SCHAFFNER	COA9231A	18667	9kHz-2GHzz	June 18, 2016	June 17, 2017
Amplifier	Agilent	8449B	3008A02120	1GHz-26.5GHz	July 16, 2016	July 15, 2017
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5GHz-40GHz	July 16, 2016	July 15, 2017
Loop Antenna	R&S	HFH2-Z2	860004/001	9k-30MHz	June 18, 2016	June 17, 2017
By-log Antenna	SCHWARZBECK	VULB9163	9163-470	30MHz-1GHz	June 10, 2016	June 09, 2017
Horn Antenna	EMCO	3115	6741	1GHz-18GHz	June 10, 2016	June 09, 2017
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz-40GHz	June 10, 2016	June 09, 2017
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz-1GHz	June 18, 2016	June 17, 2017
RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz-40GHz	June 18, 2016	June 17, 2017
Power Meter	R&S	NRVS	100444	DC-40GHz	June 18, 2016	June 17, 2017
Power Sensor	R&S	NRV-Z51	100458	DC-30GHz	June 18, 2016	June 17, 2017
Power Sensor	R&S	NRV-Z32	10057	30MHz-6GHz	June 18, 2016	June 17, 2017
AC Power Source	HPC	HPA-500E	HPA-9100024	AC 0~300V	June 18, 2016	June 17, 2017
DC power Soure	GW	GPC-6030D	C671845	DC 1V-60V	June 18, 2016	June 17, 2017
Temp. and Humidigy	Giant Force	GTH-225-20-S	MAB0103-00	N/A	June 18, 2016	June 17, 2017
RF CABLE-1m	JYE Bao	RG142	CB034-1m	20MHz-7GHz	June 18, 2016	June 17, 2017
RF CABLE-2m	JYE Bao	RG142	CB)35-2m	20MHz-1GHz	June 18, 2016	June 17, 2017
Note: All equipment through GRGT EST calibration						

7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

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