FCC TEST REPORT

For

Hena Digital Technology (Shenzhen) Co., Ltd.

Tablet PC

Test Model: MID-16Q1E

List Model No.: MD-16Q1E, MW-16Q1E, TM101A730M

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.
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Tel	:	(+86)755-82591330
Fax	:	(+86)755-82591332
Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com

Date of receipt of test sample	:	April 27, 2017
Number of tested samples	:	1
Serial number	:	20170104010
Date of Test	:	April 27,2017~May 17, 2017
Date of Report	:	May 17, 2017

FCC TEST REPORT **FCC CFR 47 PART 15 E(15.407)**	
Report Reference No. ..... :	**LCS170427165AE**
Date of Issue..... :	May 17, 2017
Testing Laboratory Name ..... :	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address..... :	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, 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) / ANSI C63.10: 2013
Test Report Form No. ..... :	LCSEMC-1.0
TRF Originator..... :	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF ..... :	Dated 2011-03

Test Item Description..... :	**Tablet PC**
Trade Mark..... :	HENA , NuVision
Test Model ..... :	MID-16Q1E
Ratings ..... :	DC 3.7V by Li-ion Battery(5000mAh) Input:100~240V, 0.3A, Output: 5V,2A
Result ..... :	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Calvin Weng		
Calvin Weng/ Administrators	Glin Lu/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS170427165AE	May 17, 2017 Date of issue

Test Model.....	: MID-16Q1E
EUT.....	: Tablet PC
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	May 17, 2017	Initial Issue	Gavin Liang

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

The **Hena Digital Technology (Shenzhen) Co., Ltd**'s Model: MID16Q1E or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Tablet PC
Model Number	MID-16Q1E, MD-16Q1E, MW-16Q1E, TM101A730M
Antenna Type	PIFA Antenna
Antenna Gain	2.0dBi (max.) for BT and WLAN
WLAN FCC Operation frequency	IEEE 802.11a: 5180-5240MHz/5745-5825MHz IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz/5180-5240MHz/5745-5825MHz IEEE 802.11n HT40:2422-2452MHz/5190-5210MHz/5755-5795MHz
BT FCC Operation frequency	2402MHz-2480MHz
WLAN FCC Modulation Type	IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
BT Modulation Type	GFSK,8DPSK,π/4DQPSK(BT V4.0)
Hardware version	7500-M16Q1E-01R
Software version	TM101A730M
WLAN	Supported 802.11a/b/g/n20/n40
Bluetooth	Supported BT V4.0
Extreme temp. Tolerance	-30°C to +50°C
Extreme vol. Limits	3.40VDC to 4.20VDC (nominal: 3.70VDC)

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
Mass Power Electronic Limited	Power Adapter	NBS10B050200VUU	---	FCC VoC

1.3. External I/O Cable

I/O Port Description	Quantity	Cable
Earphone Port	1	1.2m
USB Port	1	1.5m unshielded cable

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 C63.10:2013 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. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal Date	Due Date
EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	Jun 18, 2016	Jun 17, 2017
Signal analyzer	Agilent	E4448A(External mixers to 40GHz)	US44300469	9kHz~40GHz	Jul 16, 2016	Jul 15, 2017
LISN	MESS Tec	NNB-2/16Z	99079	9KHz-30MHz	Jun 18, 2016	Jun 17, 2017
LISN	EMCO	3819/2NM	9703-1839	9KHz-30MHz	Jun 18, 2016	Jun 17, 2017
RF Cable-CON	UTIFLEX	3102-26886-4	CB049	9KHz-30MHz	Jun 18, 2016	Jun 17, 2017
ISN	SCHAFFNER	ISN ST08	21653	9KHz-30MHz	Jun 18, 2016	Jun 17, 2017
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30M-18GHz	Jun 18, 2016	Jun 17, 2017
Amplifier	SCHAFFNER	COA9231A	18667	9kHz-2GHzz	Apr 18, 2016	Apr 17, 2017
Amplifier	Agilent	8449B	3008A02120	1GHz-26.5GHz	Apr 18, 2016	Apr 17, 2017
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5GHz-40GHz	Apr 18, 2016	Apr 17, 2017
Loop Antenna	R&S	HFH2-Z2	860004/001	9k-30MHz	Apr 18, 2016	Apr 17, 2017
By-log Antenna	SCHWARZBECK	VULB9163	9163-470	30MHz-1GHz	Apr 18, 2016	Apr 17, 2017
Horn Antenna	EMCO	3115	6741	1GHz-18GHz	Apr 18, 2016	Apr 17, 2017
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA917015	15GHz-40GHz	Apr 18, 2016	Apr 17, 2017
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz-1GHz	Jun 18, 2016	Jun 17, 2017
RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz-40GHz	Jun 18, 2016	Jun 17, 2017
Power Meter	R&S	NRVS	100444	DC-40GHz	Jun 18, 2016	Jun 17, 2017
Power Sensor	R&S	NRV-Z81	100458	DC-30GHz	Jun 18, 2016	Jun 17, 2017
Power Sensor	R&S	NRV-Z32	10057	30MHz-6GHz	Jun 18, 2016	Jun 17, 2017
DC power Source	GW	GPC-6030D	C671845	DC 1V-60V	Jun 18, 2016	Jun 17, 2017
RF CABLE-1m	JYE Bao	RG142	CB034-1m	20MHz-7GHz	Jun 18, 2016	Jun 17, 2017
RF CABLE-2m	JYE Bao	RG142	CB035-2m	20MHz-1GHz	Jun 18, 2016	Jun 17, 2017
Signal Generator	R&S	SMR40	10016	10MHz~40GHz	Jul 16, 2016	Jul 15, 2017
MXA Signal Analyzer	Agilent	N9020A	MY50510140	10Hz~26.5GHz	Oct 27, 2016	Oct 26, 2017
RF Control Unit	Tonscend	JS0806-1	/	/	Nov 19,	Nov 18, 2017
Test Software	Ascentest	AT890-SW	20141230	Version:	N/A	N/A
Splitter/Combiner(Qty: 2)	Mini-Circuits	ZAPD-50W 4.2-6.0 GHz	NN256400424	/	Oct 27, 2016	Oct 26, 2017
Splitter/Combine (Qty: 2)	MCLI	PS3-7	4463/4464	/	Oct 27, 2016	Oct 26, 2017
ATT (Qty: 1)	Mini-Circuits	VAT-30+	30912	/	Oct 27, 2016	Oct 26, 2017
EMC Test Software	Audix	E3	/	/	/	/

1.8. 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 mode and channel used for 150 KHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be IEEE 802.11a mode (Low Channel).

AC conducted emission pre-test at both at AC 120V/60Hz and AC 240V/50Hz modes, recorded worst case;

AC conducted emission pre-test at both at power adapter and power from PC modes, recorded worst case;

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be IEEE 80211.a mode(Low Channel).

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.

Support Bandwidth For 5G WIFI Part:

Bandwidth Mode	20MHz	40MHz	80MHz
IEEE 802.11a	☑	☐	☐
IEEE 802.11n HT20	☑	☐	☐
IEEE 802.11n HT40	☐	☑	☐

Channel & Frequency:

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
5180~5240MHz	36	5180	44	5220
	38	5190	46	5230
	40	5200	48	5240
	42	5210	/	/
For IEEE 802.11a/n HT20, Channel 36, 40 and 48 were tested. For IEEE 802.11n HT40, Channel 38 and 46 were tested.				
5745~5825MHz	149	5745	155	5775
	151	5755	159	5795
	153	5765	161	5805
	157	5785	165	5825
For IEEE 802.11a/n HT20, Channel 149, 157 and 165 were tested. For IEEE 802.11n HT40, Channel 151 and 159 were tested.				

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz

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 v01 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

According to the requirements in Section 6.2 of ANSI C63.10: 2013, AC power-line conducted emissions shall be 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 and 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 transmits condition by engineer mode (*#*#63646633#*#*) enter engineer mode provided by application.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	PC	Lenovo	Ideapad	A131101550	/	/	DOC
2	Power adapter	Lenovo	CPA-A090	36200414	1.00m	unshielded	DOC

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(e)	6dB and 26dB Bandwidth	Compliant
§15.205, §15.407(b)	Radiated Spurious Emissions and Band Edge	Compliant
§15.407(g)	Frequency Stability	N/A
§15.407(h)	Transmit Power Control (TPC)	N/A
§15.207(a)	Line Conducted Emissions	Compliant
§15.203	Antenna Requirements	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 equipment list in this report. The following table is the setting of the spectrum analyzer.

5.1.3. Test Procedures

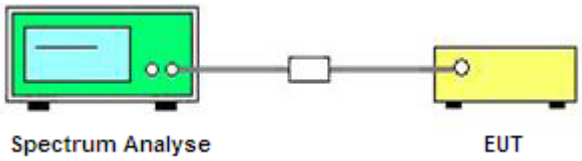
1). Set the centre frequency of the spectrum analyzer to the transmitting frequency;

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



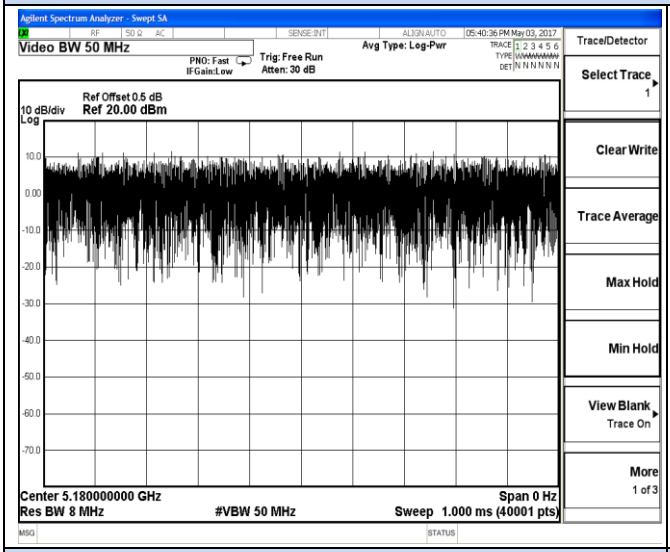
5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

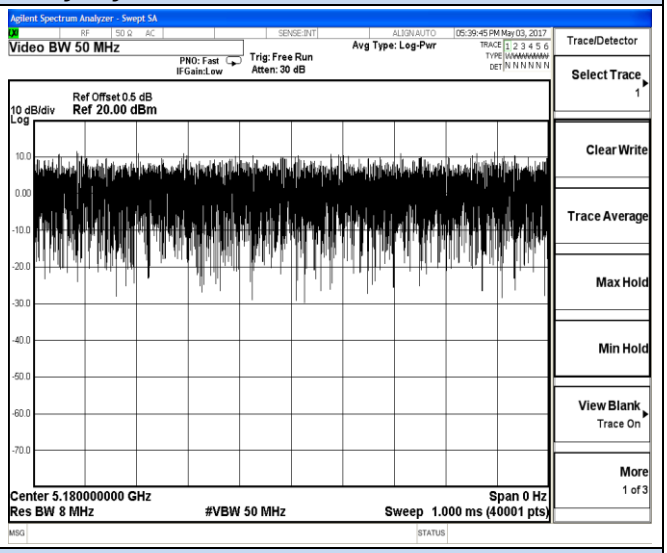
5.1.6. Test result

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	5.0	5.0	1	100	0.0	0.01
IEEE 802.11n HT20	5.0	5.0	1	100	0.0	0.01
IEEE 802.11n HT40	5.0	5.0	1	100	0.0	0.01

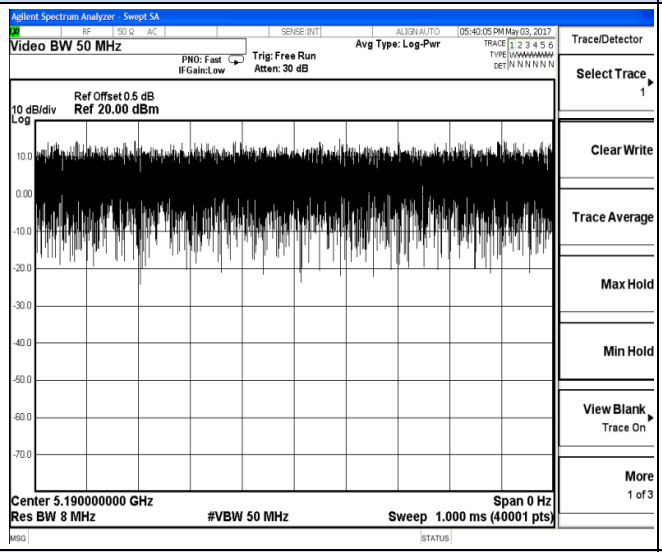
On Time and Duty Cycle



IEEE 802.11a



IEEE 802.11n-HT20



IEEE 802.11n-HT40

5.2. Maximum Conducted Output Power Measurement

5. 2.1. Standard Applicable

According to §15.407(a)(1)(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. 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).

According to §15.407(a)(1)(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.

According to §15.407(a)(1)(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.

According to §15.407(a) (3), for the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

5.2.2. Measuring Instruments and Setting

Please refer to equipment 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.

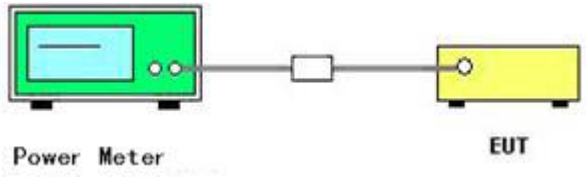
- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at 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. 2.5. 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℃	Humidity	60%
Test Engineer	Kyle Yin	Configurations	IEEE 802.11a/n

Test Mode	Channel	Frequency (MHz)	Measured Output Average Power (dBm)	Duty Cycle factor (dB)	Limits (dBm)	Verdict
IEEE 802.11a	36	5180	6.07	0.00	24	PASS
	40	5200	6.24	0.00		
	48	5240	6.15	0.00		
IEEE 802.11n HT20	36	5180	6.13	0.00	24	PASS
	40	5200	6.27	0.00		
	48	5240	6.42	0.00		
IEEE 802.11n HT40	38	5190	6.26	0.00	24	PASS
	46	5230	6.34	0.00		

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; 13Mbps at IEEE 802.11n HT20; 27Mbps at IEEE 802.11n HT40;*

5.3. Power Spectral Density Measurement

5. 3.1. Standard Applicable

According to §15.407(a)(1)(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 megahertz band.

According to §15.407(a)(1)(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 megahertz band.

According to §15.407(a) (1) (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 megahertz band.

According to §15.407(a) (3), for the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

5. 3.2. 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/VBW = 1MHz/3MHz For the 5.15-5.25GHz band;

Set the RBW/VBW = 100 KHz/300KHz For the 5.725-5.85GHz band.

4) Set the span to encompass the entire emission bandwidth of the signal.

5) Detector = RMS.

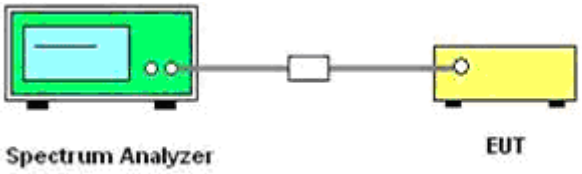
6) Sweep time = auto couple.

7) Trace mode = max hold.

8) Allow trace to fully stabilize.

9) Use the peak marker function to determine the maximum amplitude level.

5. 3.3. Test Setup Layout



5. 3.4. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5. 3.5. Test Result of Power Spectral Density

Temperature	25℃	Humidity	60%
Test Engineer	Kyle Yin	Configurations	IEEE 802.11a/n

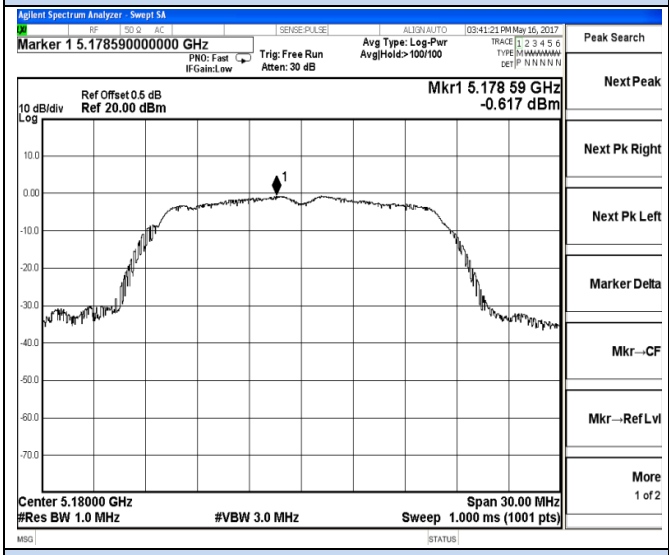
Test Mode	Channel	Frequency (MHz)	Measured Peak Power Spectral Density (dBm/1MHz)	Duty Cycle factor (dB)	RBW factor (dB)	Limits (dBm/1MHz)	Verdict
IEEE 802.11a	36	5180	-0.617	0.000	0.000	11	PASS
	40	5200	-0.657	0.000	0.000		
	48	5240	-0.961	0.000	0.000		
IEEE 802.11n HT20	36	5180	-1.503	0.000	0.000	11	PASS
	40	5200	-1.031	0.000	0.000		
	48	5240	-0.719	0.000	0.000		
IEEE 802.11n HT40	38	5190	-2.971	0.000	0.000	11	PASS
	46	5230	-3.631	0.000	0.000		

Remark:

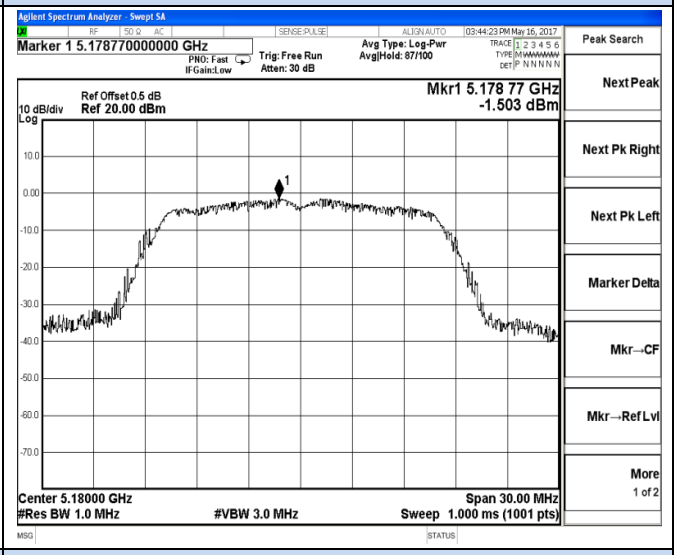
1. *Measured power spectrum density at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; 13Mbps at IEEE 802.11n HT20; 27Mbps at IEEE 802.11n HT40;*
4. *RBW factor* = 10 log (1 *MHz/RBW) = 10*log (1000KHz/1000KHz) = 0 dB;*
5. *Report peak power spectral density = Measure peak power spectral density + RBW factor + Duty Cycle factor*
6. *Please refer to following plots;*

Peak Power Spectral Density

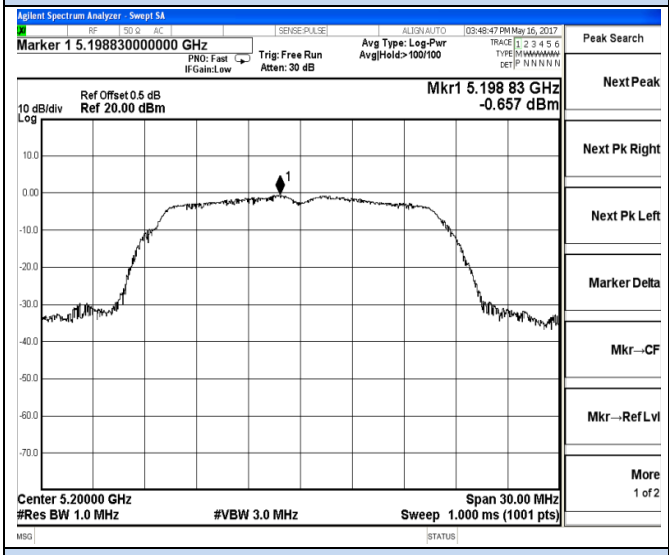
IEEE 802.11a



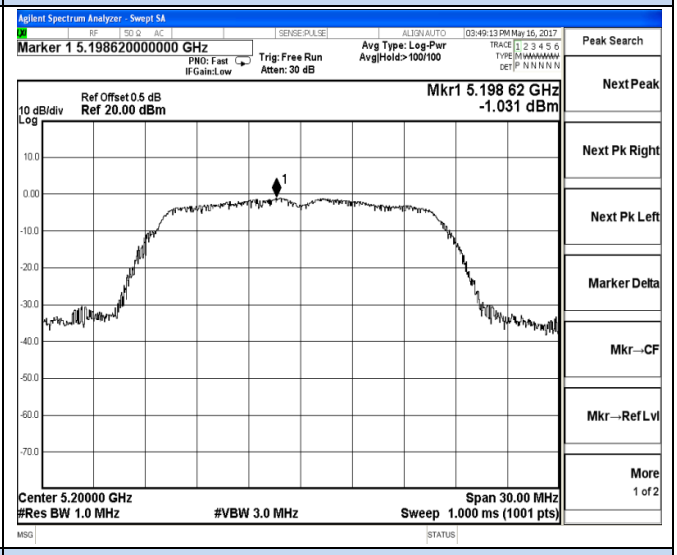
IEEE 802.11n HT20



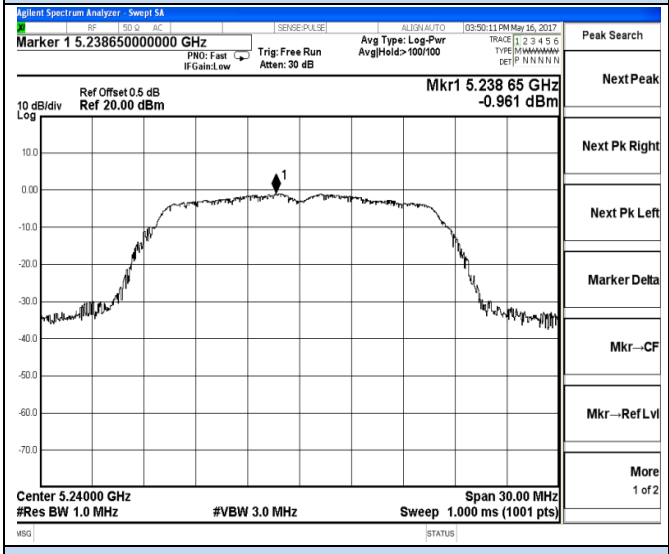
Channel 36 / 5180 MHz



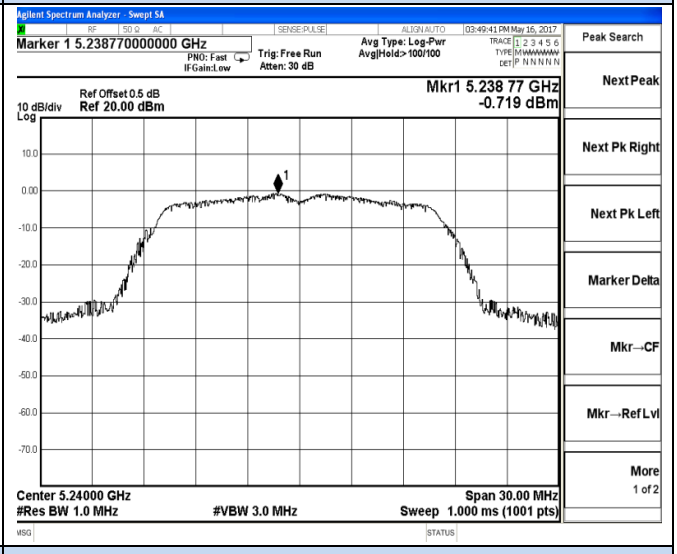
Channel 36 / 5180 MHz



Channel 40 / 5200 MHz

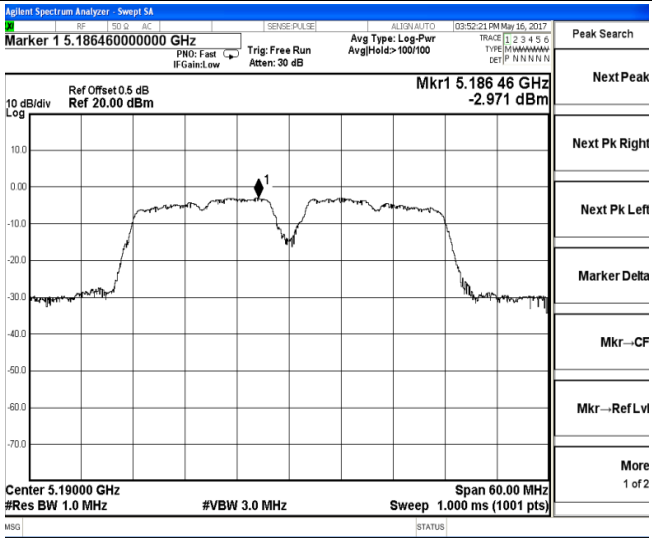
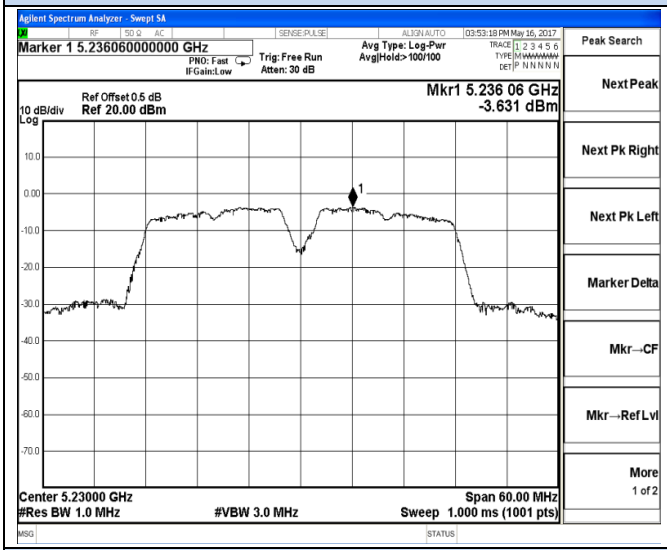


Channel 40 / 5200 MHz



Channel 48 / 5240 MHz

Channel 48 / 5240 MHz

Peak Power Spectral Density	
IEEE 802.11n HT40	
	
Channel 38 / 5190 MHz	
	
Channel 46 / 5230 MHz	

5.4. 99% & 26dB 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.

26dB & 99%Bandwidth Measurement (Only For 5180~5240MHz Band)	
Attenuation	Auto
Span	> 26dB Bandwidth
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

55. 4.3. Test Procedures

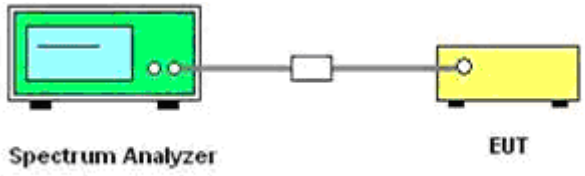
1) The transmitter output (antenna port) was connected to the spectrum analyses in peak hold mode.

2) The resolution bandwidth and the video bandwidth were set according to KDB 789033 D02 General UNII Test Procedures New Rules v01

3) For 5745~5825MHz Band, Measured the maximum width of the emission that is 6dB down from the peak of the emission.

4) For 5180~5240MHz Band, Measured the maximum width of the emission that is 26dB down from the peak of the emission. Record the 26dB & 99% Bandwidth.

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 Spectrum Bandwidth

Temperature	25℃	Humidity	60%
Test Engineer	Kyle Yin	Configurations	IEEE 802.11a/n

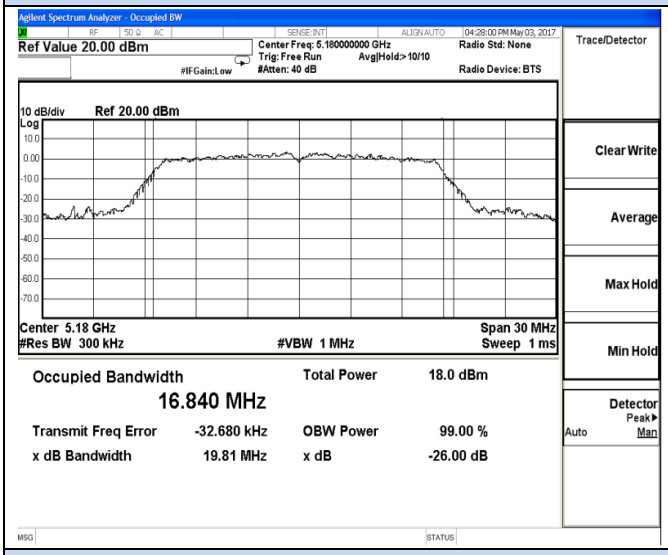
Test Mode	Channel	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limits (MHz)	Verdict
IEEE 802.11a	36	5180	19.810	16.840	No Limit	PASS
	40	5200	20.280	16.730		
	48	5240	19.790	16.848		
IEEE 802.11n HT20	36	5180	20.020	17.682	No Limit	PASS
	40	5200	20.030	17.702		
	48	5240	19.930	17.636		
IEEE 802.11n HT40	38	5190	41.450	36.019	No Limit	PASS
	46	5230	43.990	36.025		

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 802.11 a; 13Mbps at IEEE 802.11 n HT20; 27Mbps at IEEE 802.11 n HT40;*
4. *Please refer to following plots;*

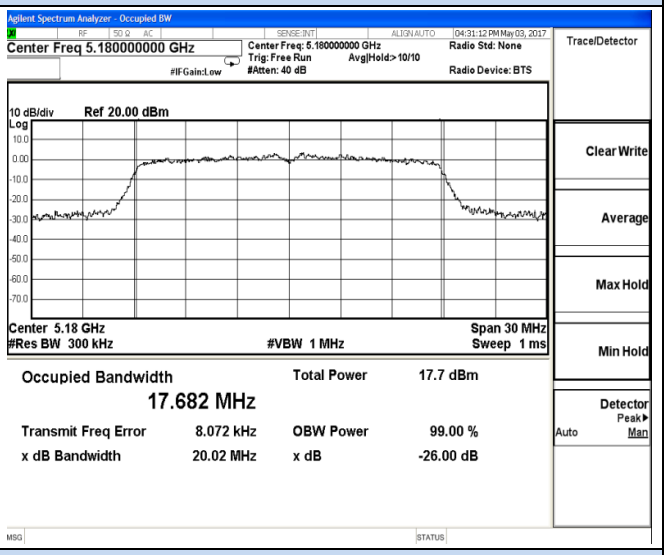
99% and 26dB Occupied Bandwidth

IEEE 802.11a

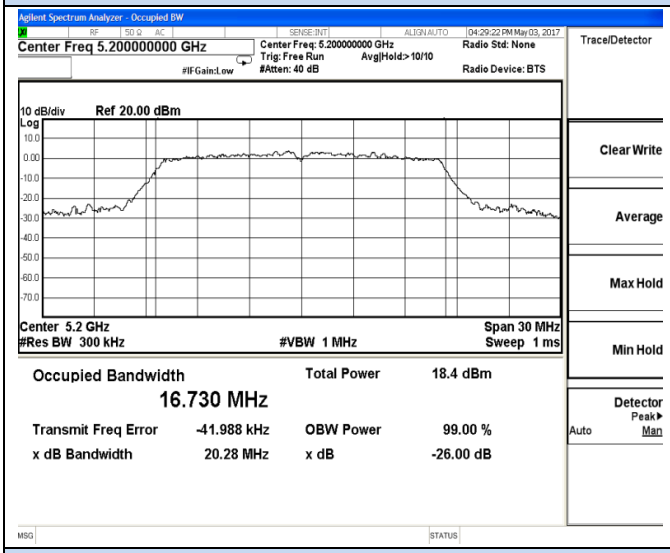


Channel 36 / 5180 MHz

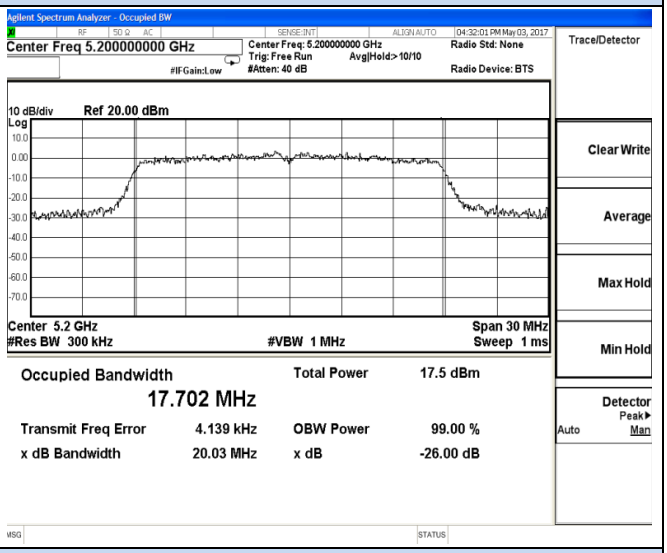
IEEE 802.11n HT20



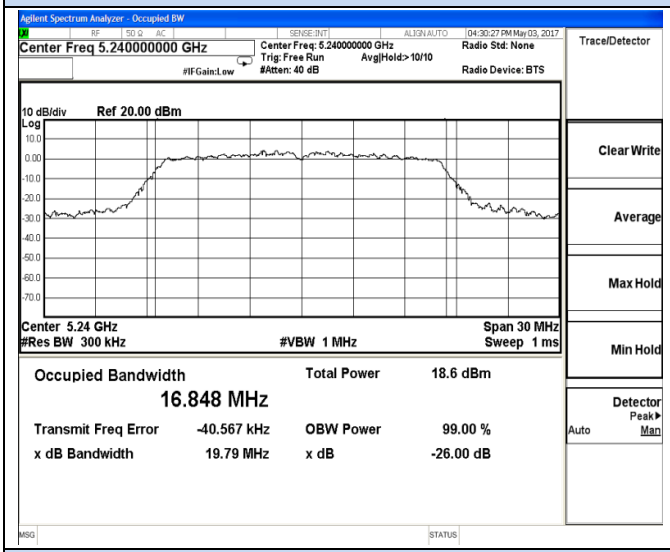
Channel 36 / 5180 MHz



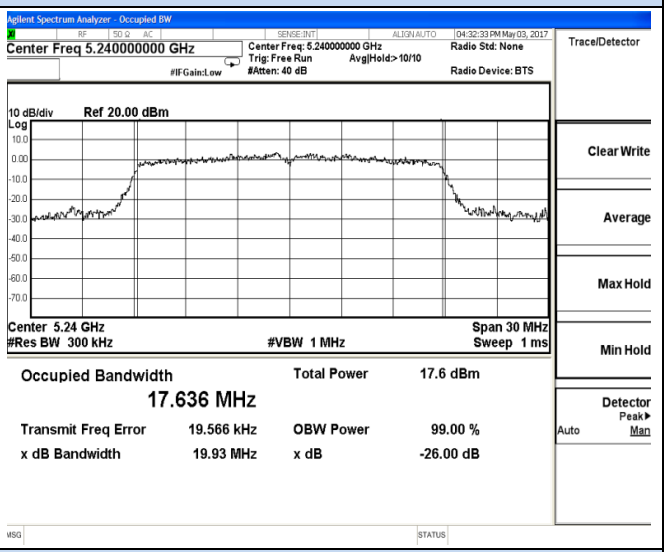
Channel 40 / 5200 MHz



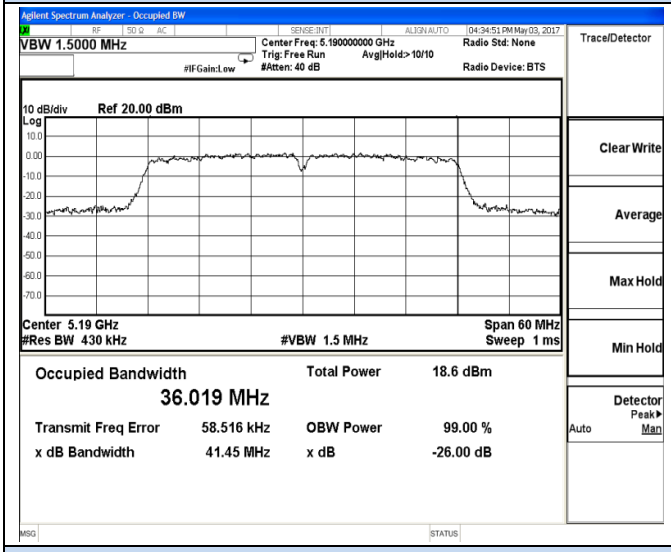
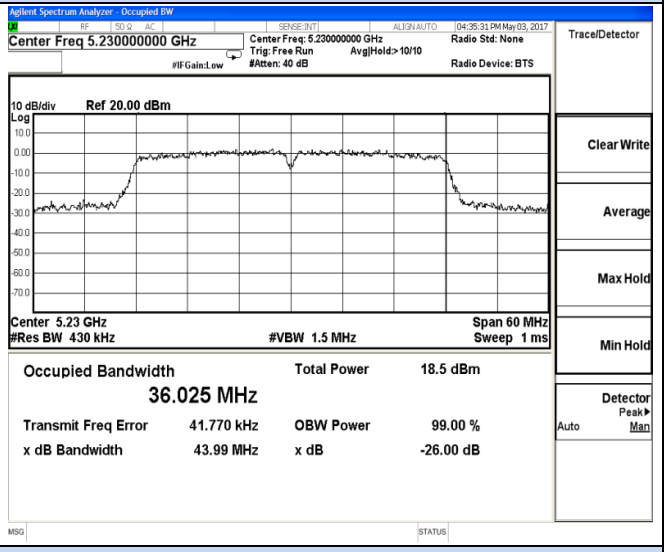
Channel 40 / 5200 MHz



Channel 48 / 5240 MHz



Channel 48 / 5240 MHz

99% and 26dB Occupied Bandwidth	
IEEE 802.11n HT40	IEEE 802.11n HT40
	
Channel 38 / 5190 MHz	Channel 46 / 5230 MHz

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).

For transmitters operating in the 5.725-5.85 GHz band:

All emissions shall be limited to a level of −27 dBm/MHz(68.2dBuV/m at 3m) at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz(105.2dBuV/m at 3m) 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(110.8dBuV/m at 3m) 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(122.2dBuV/m at 3m) at the band edge.

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 equipment 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/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz 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:

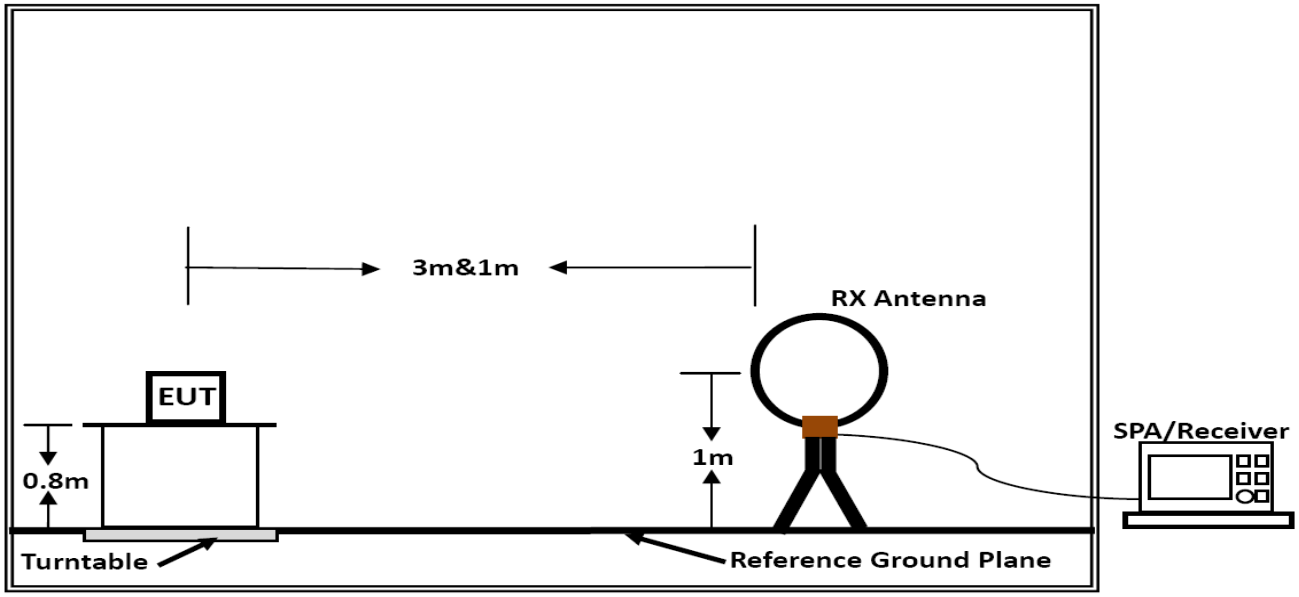
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

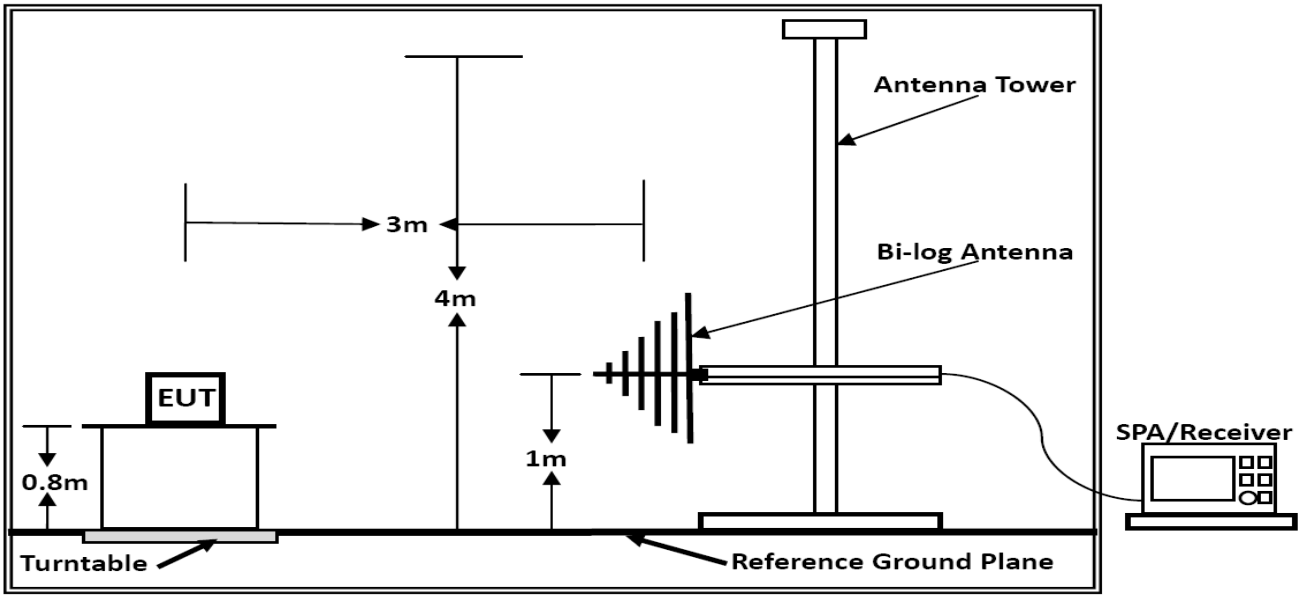
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- 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.

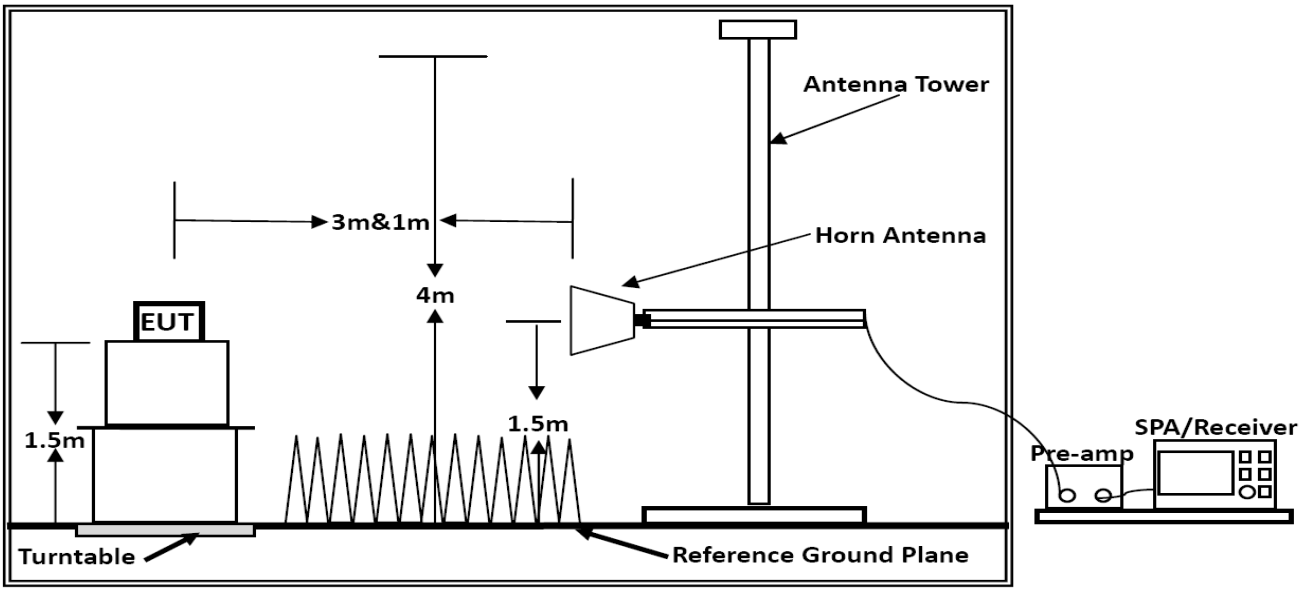
5. 5.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distance [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 (9 KHz~30 MHz)

Temperature	25℃	Humidity	60%
Test Engineer	Kyle Yin	Configurations	IEEE 802.11a/n

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

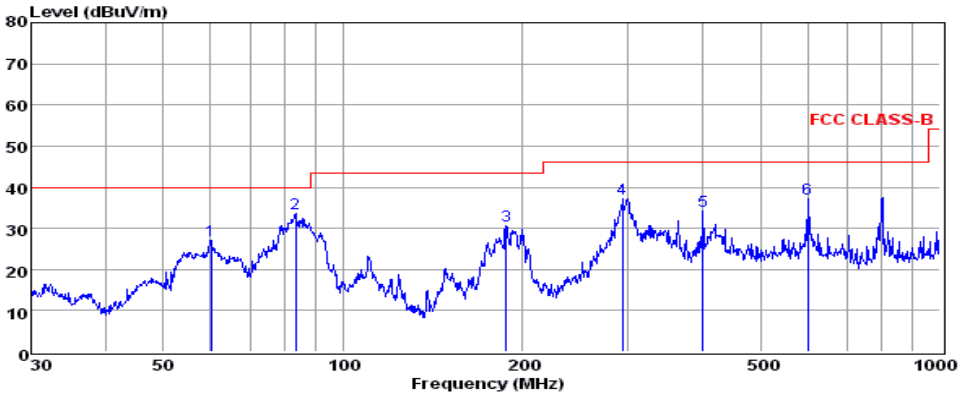
Note:

The radiated emissions from 9 KHz to 30MHz are at least 20dB below the official limit and no need to report.

5. 5.7. Results of Radiated Emissions (30MHz~1GHz)

Note: Only record the worst test result in this report.

Vertical:

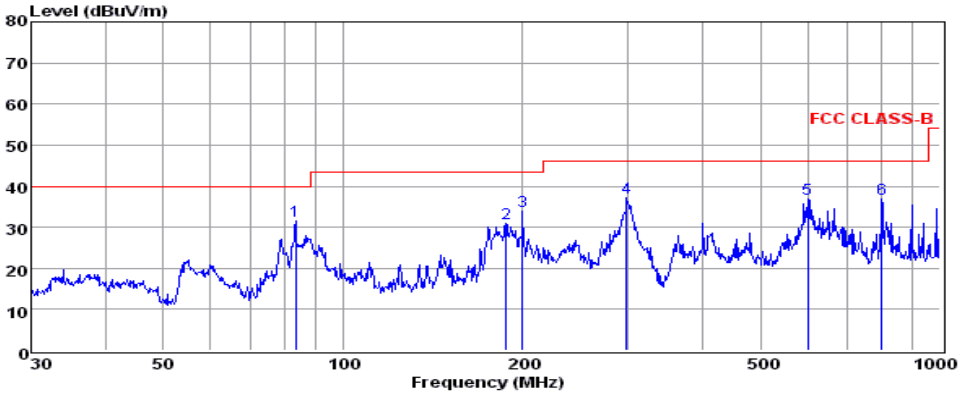


Env./Ins: 24℃/56%
pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	60.07	13.99	0.49	12.66	27.14	40.00	-12.86	QP
2	83.23	23.29	0.54	9.68	33.51	40.00	-6.49	QP
3	187.75	19.16	0.98	10.36	30.50	43.50	-13.00	QP
4	294.11	23.13	1.08	12.95	37.16	46.00	-8.84	QP
5	400.43	17.79	1.20	15.07	34.06	46.00	-11.94	QP
6	601.43	17.36	1.43	18.46	37.25	46.00	-8.75	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

Horizontal:



Env./Ins: 24℃/56%
pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	83.23	21.20	0.54	9.68	31.42	40.00	-8.58	QP
2	187.75	19.58	0.98	10.36	30.92	43.50	-12.58	QP
3	199.99	22.38	0.84	10.57	33.79	43.50	-9.71	QP
4	298.27	22.93	1.12	13.03	37.08	46.00	-8.92	QP
5	601.43	16.97	1.43	18.46	36.86	46.00	-9.14	QP
6	798.98	15.10	1.68	20.05	36.83	46.00	-9.17	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 modes and recorded the worst case results in this report (IEEE 802.11a mode (Low Channel).
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.
Only recorded the worst test case in this report.

5.5.8. Results for Radiated Emissions (Above 1GHz)

Note: Only recorded the worst test result in this report.

IEEE 802.11a

Channel 36 / 5180 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.36	45.02	33.21	35.82	9.52	51.93	68.20	-16.27	Peak	Horizontal
10.36	34.64	33.21	35.82	9.52	41.55	54.00	-12.45	Average	Horizontal
10.36	47.73	32.82	35.82	9.52	54.25	68.20	-13.95	Peak	Vertical
10.36	35.04	32.82	35.82	9.52	41.56	54.00	-12.44	Average	Vertical

Channel 40 / 5200 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.44	46.41	33.21	35.82	9.52	53.32	68.20	-14.88	Peak	Horizontal
10.44	34.63	33.21	35.82	9.52	41.54	54.00	-12.46	Average	Horizontal
10.44	47.18	32.82	35.82	9.52	53.70	68.20	-14.50	Peak	Vertical
10.44	35.74	32.82	35.82	9.52	42.26	54.00	-11.74	Average	Vertical

Channel 48 / 5240 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.48	47.06	33.21	35.82	9.52	53.97	68.20	-14.23	Peak	Horizontal
10.48	35.36	33.21	35.82	9.52	42.27	54.00	-11.73	Average	Horizontal
10.48	47.88	32.82	35.82	9.52	54.40	68.20	-13.80	Peak	Vertical
10.48	35.63	32.82	35.82	9.52	42.15	54.00	-11.85	Average	Vertical

IEEE 802.11n HT20

Channel 36 / 5180 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.36	46.22	33.21	35.82	9.52	53.13	68.20	-15.07	Peak	Horizontal
10.36	34.68	33.21	35.82	9.52	41.59	54.00	-12.41	Average	Horizontal
10.36	46.81	32.82	35.82	9.52	53.33	68.20	-14.87	Peak	Vertical
10.36	35.13	32.82	35.82	9.52	41.65	54.00	-12.35	Average	Vertical

Channel 40 / 5200 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.44	46.35	33.21	35.82	9.52	53.26	68.20	-14.94	Peak	Horizontal
10.44	34.20	33.21	35.82	9.52	41.11	54.00	-12.89	Average	Horizontal
10.44	48.09	32.82	35.82	9.52	54.61	68.20	-13.59	Peak	Vertical
10.44	34.82	32.82	35.82	9.52	41.34	54.00	-12.66	Average	Vertical

Channel 48 / 5240 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.48	46.15	33.21	35.82	9.52	53.06	68.20	-15.14	Peak	Horizontal
10.48	34.40	33.21	35.82	9.52	41.31	54.00	-12.69	Average	Horizontal
10.48	47.85	32.82	35.82	9.52	54.37	68.20	-13.83	Peak	Vertical
10.48	35.01	32.82	35.82	9.52	41.53	54.00	-12.47	Average	Vertical

IEEE 802.11n HT40

Channel 38 / 5190 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.38	45.29	33.21	35.82	9.52	52.20	68.20	-16.00	Peak	Horizontal
10.38	35.96	33.21	35.82	9.52	42.87	54.00	-11.13	Average	Horizontal
10.38	46.85	32.82	35.82	9.52	53.37	68.20	-14.83	Peak	Vertical
10.38	35.96	32.82	35.82	9.52	42.48	54.00	-11.52	Average	Vertical

Channel 46 / 5230 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.46	45.49	33.21	35.82	9.52	52.40	68.20	-15.80	Peak	Horizontal
10.46	36.40	33.21	35.82	9.52	43.31	54.00	-10.69	Average	Horizontal
10.46	46.29	32.82	35.82	9.52	52.81	68.20	-15.39	Peak	Vertical
10.46	35.99	32.82	35.82	9.52	42.51	54.00	-11.49	Average	Vertical

Notes:

1). Measuring frequencies from 9KHz~40GHz, No emission found between lowest internal used/generated frequency to 30MHz.
2). Radiated emissions measured in frequency range from 9KHz~40GHz were made with an instrument using Peak detector mode.
3). Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

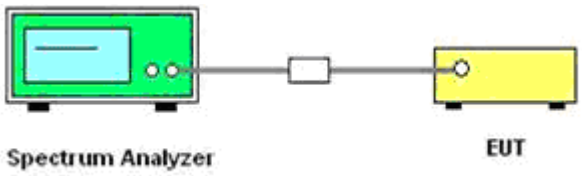
5.6. Undesirable Emissions Measurement

5. 6.1 Test Requirements

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:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) 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.
(5) 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.
(6) 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.
(7) The provisions of §15.205 apply to intentional radiators operating under this section.
(8) 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. 6.2 Test Configuration



5. 6.3 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.”

(i) 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.

(ii) 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.

d) 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

5. 6.4. Test Results

IEEE 802.11a							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-50.640	2.000	0.000	46.618	Peak	74.00	PASS
4500.000	-63.133	2.000	0.000	34.125	Average	54.00	PASS
5150.000	-47.530	2.000	0.000	49.728	Peak	74.00	PASS
5150.000	-59.800	2.000	0.000	37.458	Average	54.00	PASS
5350.000	-50.964	2.000	0.000	46.294	Peak	74.00	PASS
5350.000	-62.296	2.000	0.000	34.962	Average	54.00	PASS
5460.000	-50.997	2.000	0.000	46.261	Peak	74.00	PASS
5460.000	-62.660	2.000	0.000	34.598	Average	54.00	PASS

IEEE 802.11n HT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-53.030	2.000	0.000	44.228	Peak	74.00	PASS
4500.000	-63.150	2.000	0.000	34.108	Average	54.00	PASS
5150.000	-49.366	2.000	0.000	47.892	Peak	74.00	PASS
5150.000	-59.161	2.000	0.000	38.097	Average	54.00	PASS
5350.000	-51.873	2.000	0.000	45.385	Peak	74.00	PASS
5350.000	-62.252	2.000	0.000	35.006	Average	54.00	PASS
5460.000	-52.496	2.000	0.000	44.762	Peak	74.00	PASS
5460.000	-62.682	2.000	0.000	34.576	Average	54.00	PASS

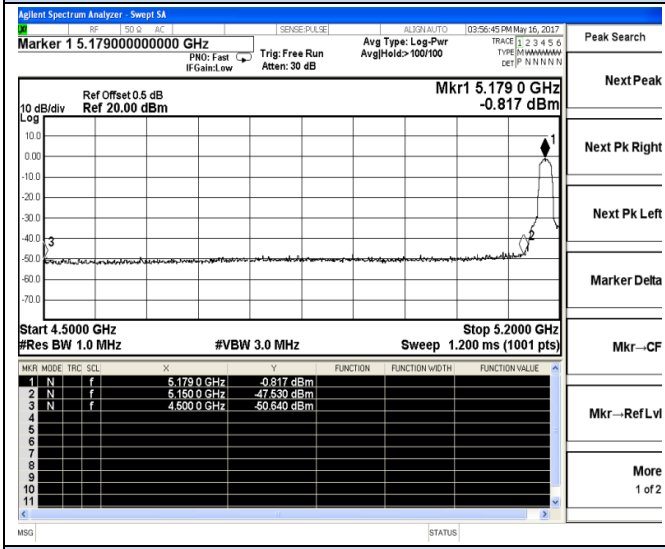
IEEE 802.11n HT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-52.675	2.000	0.000	44.583	Peak	74.00	PASS
4500.000	-63.131	2.000	0.000	34.127	Average	54.00	PASS
5150.000	-42.127	2.000	0.000	55.131	Peak	74.00	PASS
5150.000	-51.949	2.000	0.000	45.309	Average	54.00	PASS
5350.000	-51.745	2.000	0.000	45.513	Peak	74.00	PASS
5350.000	-62.353	2.000	0.000	34.905	Average	54.00	PASS
5460.000	-51.529	2.000	0.000	45.729	Peak	74.00	PASS
5460.000	-62.675	2.000	0.000	34.583	Average	54.00	PASS

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; 13Mbps at IEEE 802.11n HT20; 27Mbps at IEEE 802.11n HT40;*
4. *please refer to following plots;*
5. *The average measurement was not performed when the peak measured data under the limit of average detection.*
6. *"---"means that the fundamental frequency not for 15.209 limits requirement.*

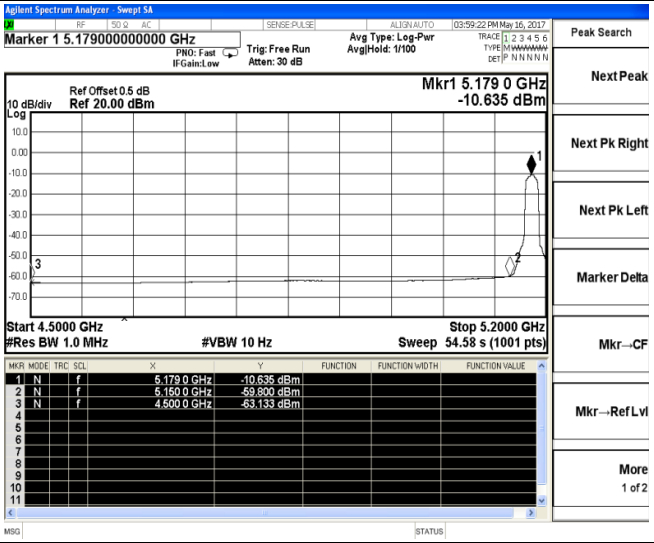
Band-edge Measurements for Radiated Emissions

IEEE 802.11a

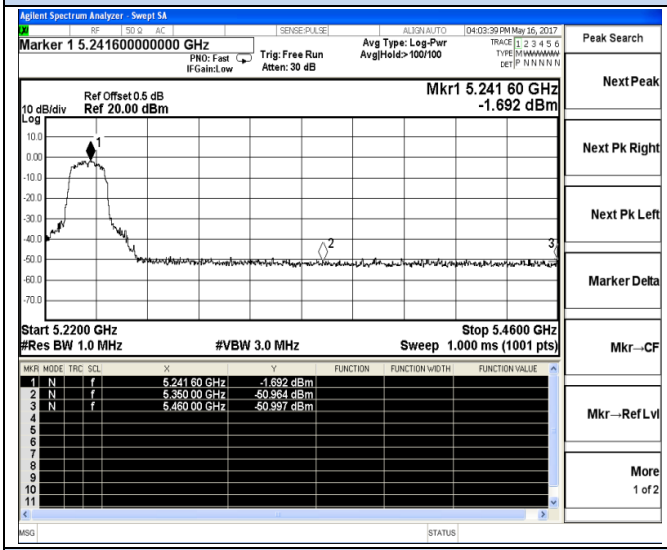


Channel 36 / 5180 MHz – Peak

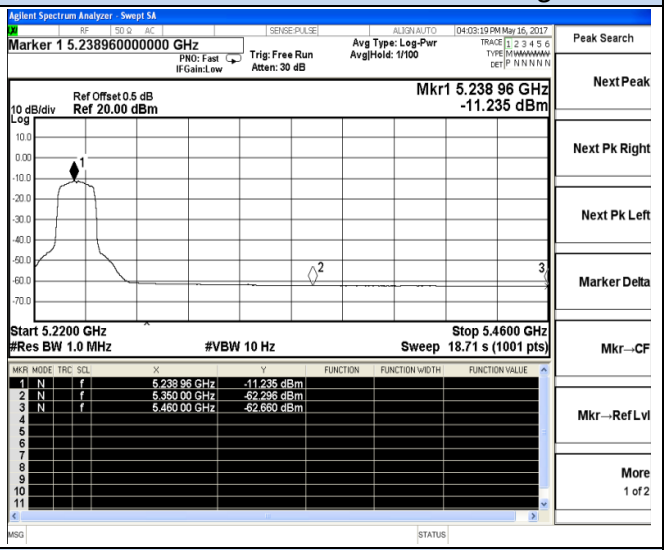
IEEE 802.11a



Channel 36 / 5180 MHz – Average

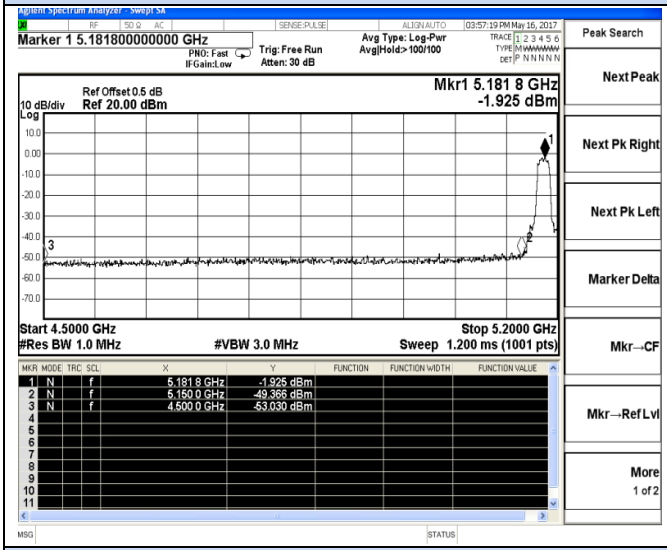


Channel 48 / 5240 MHz – Peak



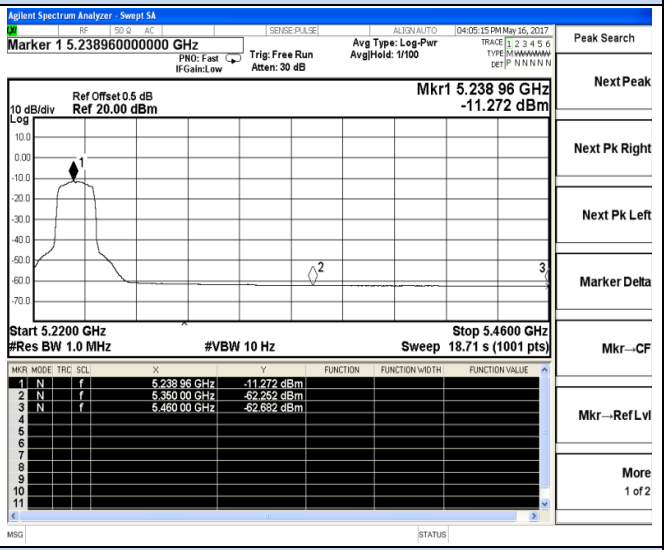
Channel 48 / 5240 MHz –Average

IEEE 802.11n HT20



Channel 36 / 5180 MHz – Peak

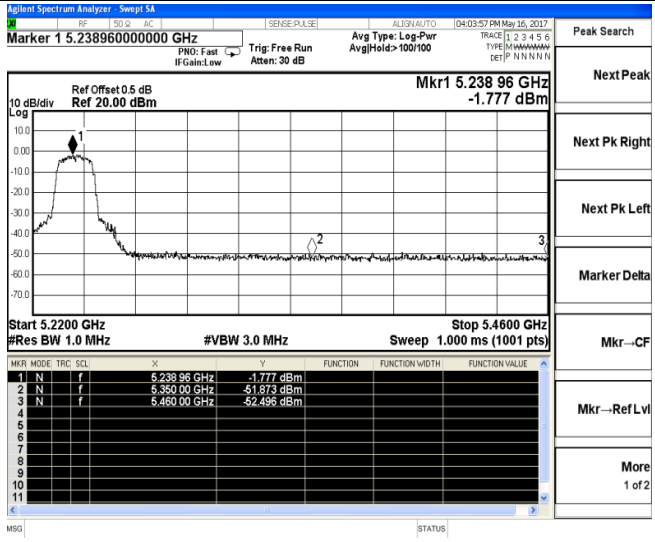
IEEE 802.11n HT20



Channel 36 / 5180 MHz –Average

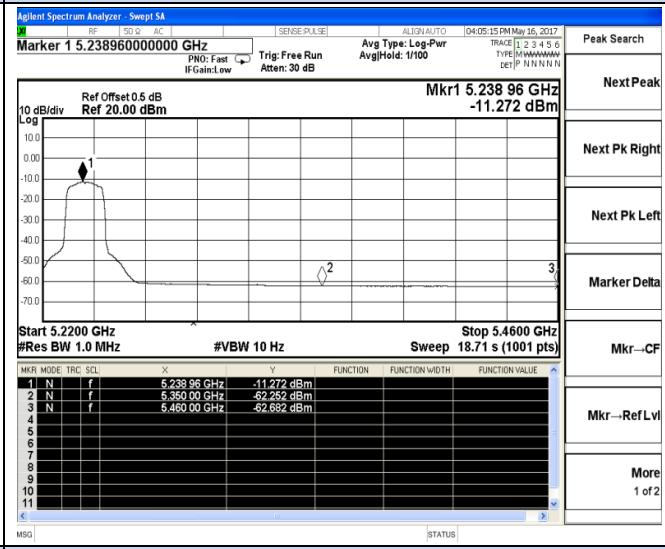
Undesirable Emissions

IEEE 802.11a



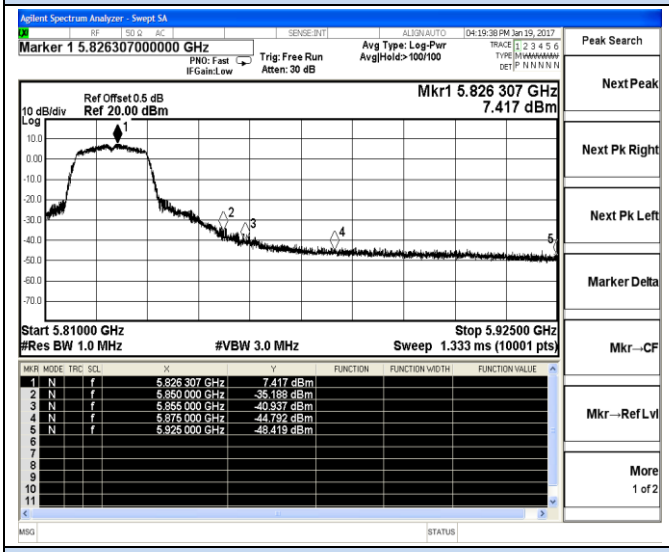
Channel 48 / 5240 MHz –Peak

IEEE 802.11n HT20



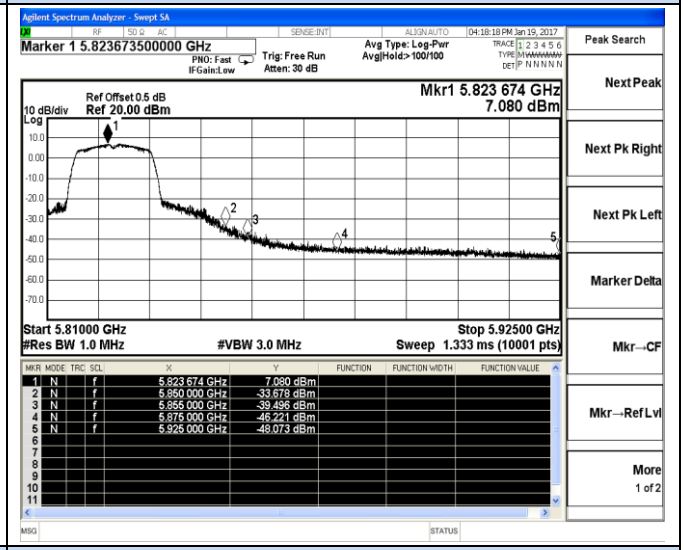
Channel 48 / 5240 MHz –Average

IEEE 802.11n HT40

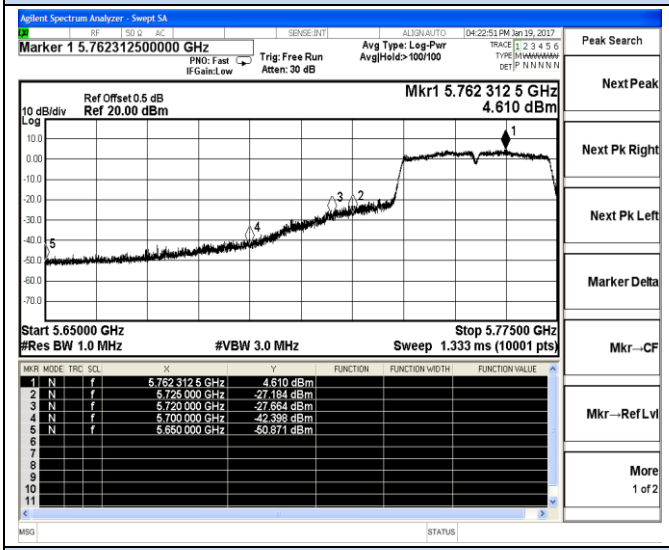


Channel 38 / 5190 MHz – Peak

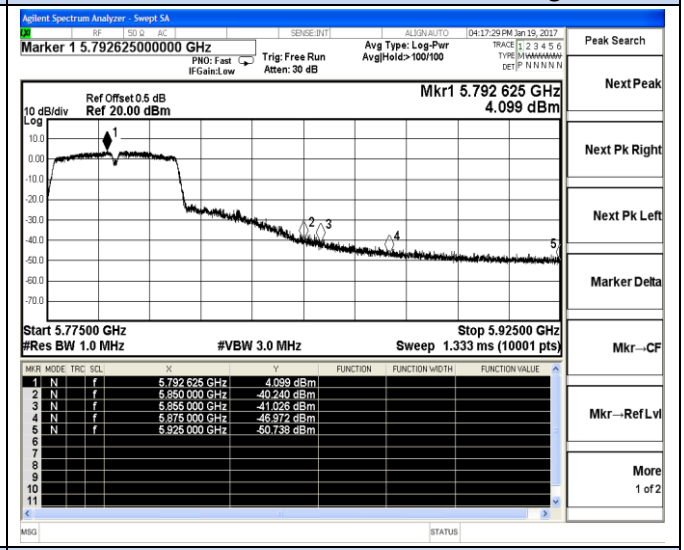
IEEE 802.11n HT40



Channel 38 / 5190 MHz –Average



Channel 46 / 5230 MHz –Peak



Channel 46 / 5230 MHz –Average

5.7. Power line conducted emissions

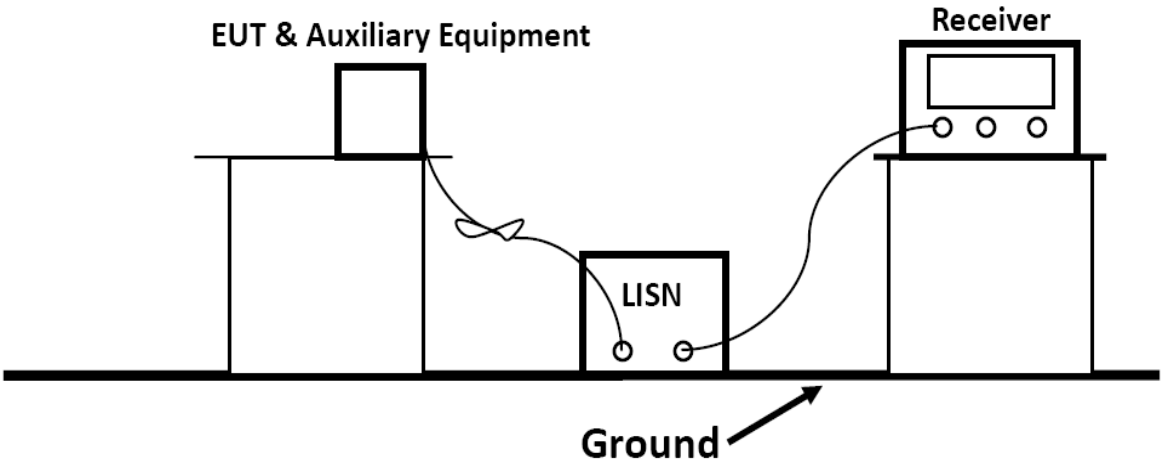
5. 7.1 Standard Applicable

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 are 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

* Decreasing linearly with the logarithm of the frequency

5. 7.2 Block Diagram of Test Setup



5. 7.3 Test Results

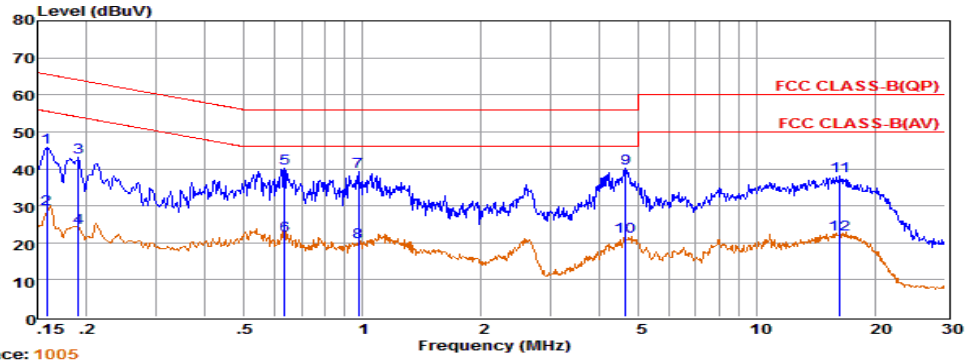
PASS.

Only recorded the worst test case in this report.

The test data please refer to following page.

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

Line:

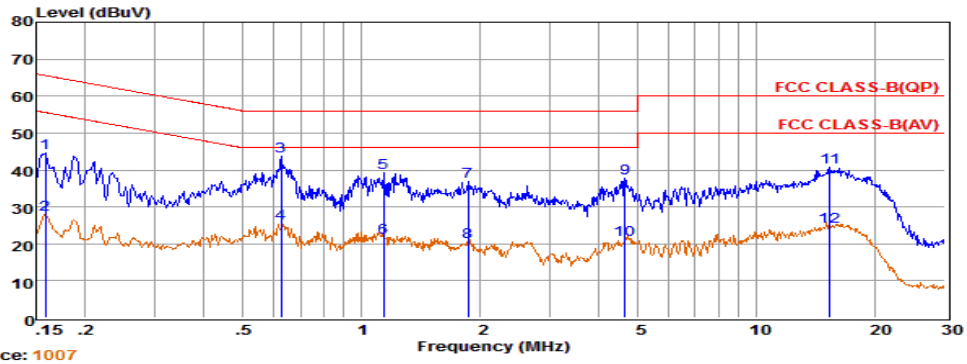


Trace: 1005
Env. Ins: 24*/56%
Pol: NEUTRAL

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.16	26.15	9.68	0.02	10.00	45.85	65.56	-19.71	QP
2	0.16	9.32	9.68	0.02	10.00	29.02	55.55	-26.53	Average
3	0.19	23.37	9.61	0.02	10.00	43.00	64.02	-21.02	QP
4	0.19	4.58	9.61	0.02	10.00	24.21	54.02	-29.81	Average
5	0.63	20.48	9.63	0.04	10.00	40.15	56.00	-15.85	QP
6	0.63	2.38	9.63	0.04	10.00	22.05	46.00	-23.95	Average
7	0.98	19.58	9.63	0.05	10.00	39.26	56.00	-16.74	QP
8	0.98	0.55	9.63	0.05	10.00	20.23	46.00	-25.77	Average
9	4.65	20.49	9.66	0.06	10.00	40.21	56.00	-15.79	QP
10	4.65	1.93	9.66	0.06	10.00	21.65	46.00	-24.35	Average
11	16.23	18.29	9.75	0.11	10.00	38.15	60.00	-21.85	QP
12	16.23	2.45	9.75	0.11	10.00	22.31	50.00	-27.69	Average

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

Neutral:



Trace: 1007
Env. Ins: 24*/56%
Pol: LINE

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.16	24.92	9.58	0.02	10.00	44.52	65.56	-21.04	QP
2	0.16	8.32	9.58	0.02	10.00	27.92	55.55	-27.63	Average
3	0.63	24.03	9.63	0.04	10.00	43.70	56.00	-12.30	QP
4	0.63	6.05	9.63	0.04	10.00	25.72	46.00	-20.28	Average
5	1.14	19.65	9.63	0.05	10.00	39.33	56.00	-16.67	QP
6	1.14	2.02	9.63	0.05	10.00	21.70	46.00	-24.30	Average
7	1.86	17.21	9.64	0.05	10.00	36.90	56.00	-19.10	QP
8	1.86	0.93	9.64	0.05	10.00	20.62	46.00	-25.38	Average
9	4.65	18.07	9.65	0.06	10.00	37.78	56.00	-18.22	QP
10	4.65	1.44	9.65	0.06	10.00	21.15	46.00	-24.85	Average
11	15.31	20.91	9.71	0.10	10.00	40.72	60.00	-19.28	QP
12	15.31	4.92	9.71	0.10	10.00	24.73	50.00	-25.27	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 modes and recorded the worst case results in this report (IEEE 802.11a).*

5.8. Antenna Requirements

5. 8.1. Standard Applicable

According to antenna requirement of §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.

5. 8.2. Antenna Connector Construction

The antenna used for transmitting is permanently attached and no consideration of replacement. Please see EUT photo for details.

The BT and WLAN share same PIFA antenna, the maximum gain is 2.0dBi; more information as follows.

5. 8.3. Results: Compliance.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Conducted power refers ANSI C63.10:2013 Output power test procedure for U-NII devices.

Radiated power refers to ANSI C63.10:2013 Radiated emissions tests.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep Time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

FCC	IC
Antenna Gain	
6 dBi	

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For WLAN devices, the OFDM (IEEE 802.11a) mode is used;

T_{nom}	V_{nom}	Lowest Channel 5180 MHz	Middle Channel 5200 MHz	Highest Channel 5240 MHz
Conducted power [dBm] Measured with OFDM modulation		4.387	4.364	4.354
Radiated power [dBm] Measured with OFDM modulation		5.910	5.992	5.958
Gain [dBi] Calculated		1.523	1.628	1.604
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)	

6. PHOTOGRAPHS OF TEST SETUP

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

7. EXTERIOR PHOTOGRAPHS OF THE EUT

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

8. INTERIOR PHOTOGRAPHS OF THE EUT

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

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