



FCC RF Test Report

APPLICANT : Lenovo(Shanghai) Electronics Technology Co., Ltd.
EQUIPMENT : Portable Tablet Computer
BRAND NAME : Lenovo
MODEL NAME : Lenovo YB1-X90L
FCC ID : O57YB1X90L
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure

The product was received on Jun. 20, 2016 and testing was completed on Aug. 11, 2016. We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL (KUNSHAN) INC., the test report shall not be reproduced except in full.

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**REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR662015E	Rev. 01	Initial issue of report	Aug. 17, 2016



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.403(i)	6dB, 26dB and 99% Occupied Bandwidth	> 500kHz	Pass	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 30 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 30 dBm/500kHz	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b)(4)(i) & 15.209(a)	Pass	Under limit 4.23 dB at 35.820 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 5.38 dB at 5.870 MHz
3.6	15.407(g)	Frequency Stability	Within Operation Band	Pass	-
3.7	15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.8	15.203 & 15.407(a)	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

Lenovo(Shanghai) Electronics Technology Co., Ltd.

NO.68 BUILDING, 199 FENJU RD, China (Shanghai) Pilot Free Trade Zone, 200131, CHINA

1.2 Manufacturer

Lenovo PC HK Limited

23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Portable Tablet Computer
Brand Name	Lenovo
Model Name	Lenovo YB1-X90L
FCC ID	O57YB1X90L
EUT supports Radios application	GPRS/EGPRS/WCDMA/HSPA/DC-HSDPA/ HSPA+(16QAM uplink is not supported)/LTE/ WLAN2.4GHz 802.11b/g/n HT20/ WLAN5GHz 802.11a/n HT20/HT40/ WLAN5GHz 802.11ac VHT20/VHT40/VHT80/ Bluetooth v3.0+EDR/Bluetooth v4.0 LE
IMEI Code	Conducted: 868672020019995 Radiation: 868672020020027 Conduction: 868672020020035
HW Version	Lenovo YB1-X90L
SW Version	YB1-X90L_160707
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



1.4 Product Specification of Equipment Under Test

Standards-related Product Specification				
Tx/Rx Channel Frequency Range		5745 MHz ~ 5825 MHz		
Maximum Output Power		802.11a : 16.24 dBm / 0.0421 W 802.11n HT20 : 19.08 dBm / 0.0809 W 802.11n HT40 : 18.15 dBm / 0.0653 W 802.11ac VHT20: 17.60 dBm / 0.0575 W 802.11ac VHT40: 18.11 dBm / 0.0647 W 802.11ac VHT80: 17.31 dBm / 0.0538 W		
99% Occupied Bandwidth		802.11a : 18.48 MHz 802.11n HT20 : 19.18 MHz 802.11n HT40 : 36.86 MHz 802.11ac VHT20 : 19.33 MHz 802.11ac VHT40 : 36.86 MHz 802.11ac VHT80 : 75.76 MHz		
Antenna Type		PIFA Antenna		
Antenna Gain		Chain Port 1 : -0.70 dBi Chain Port 2 : -3.80 dBi		
Type of Modulation		802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)		
Antenna Function Description			Chain Port 1	Chain Port 2
		802.11 a	V	V
		802.11 n/ac SISO	V	V
		802.11 n/ac MIMO	V	V



1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Test Site	SPORTON INTERNATIONAL (KUNSHAN) INC.			
Test Site Location	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958			
Test Site No.	Sporton Site No.			FCC Registration No.
	TH01-KS	CO01-KS	03CH03-KS	306251

Note: The test site complies with ANSI C63.4 2014 requirement.

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conducted emission (150 kHz to 30 MHz) and radiated emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X/Y plane) were recorded in this report.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5725-5850 MHz Band 4 (U-NII-3)	149	5745	157	5785
	151	5755	159	5795
	153	5765	161	5805
	155	5775	165	5825

Note: The above Frequency and Channel in boldface were 802.11n HT40.

2.2 Test Mode

Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

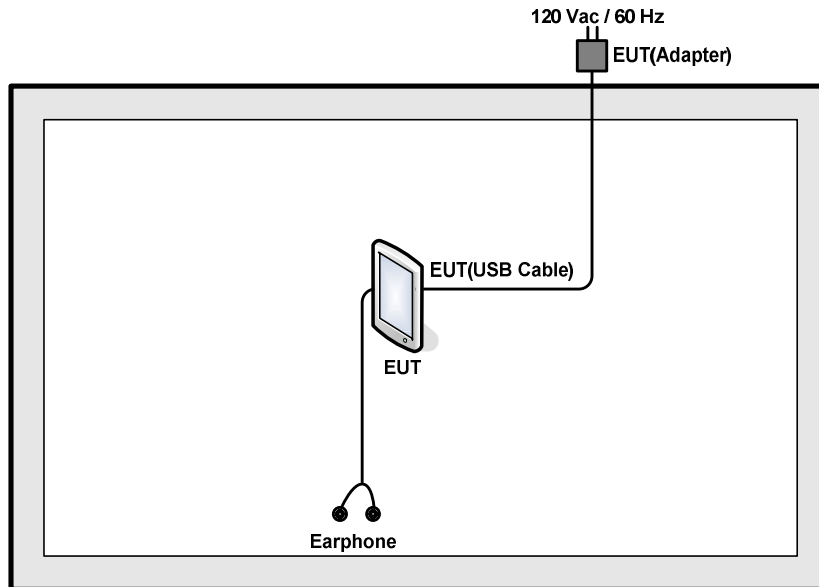
AC Conducted Emission	Mode 1 : GSM850 Idle + Bluetooth Link + WLAN (5GHz) Link + Earphone + USB Cable (Charging from Adapter)
Remark: For Radiated TCs, the tests were performed with adapter, earphone and USB cable.	

Ch. #		Band IV : 5745 ~ 5825 MHz		
		802.11a	802.11n HT20	802.11n HT40
L	Low	149	149	151
M	Middle	157	157	-
H	High	165	165	159

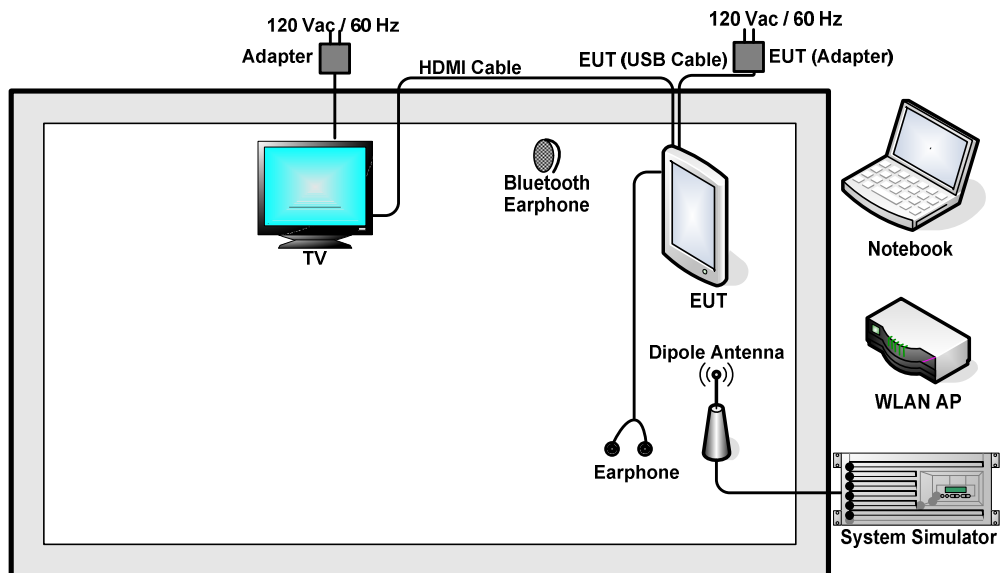
Ch. #		Band IV : 5745 ~ 5825 MHz		
		802.11ac VHT20	802.11ac VHT40	802.11ac VHT80
L	Low	149	151	-
M	Middle	157	-	155
H	High	165	159	-

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	G480	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
2.	WLAN AP	LINKSYS	WRT600N	Q87-WRT600NV11	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
4.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
5.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
6.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
7.	Bluetooth Earphone	Nokia	BH-102	PYAHS-107W	N/A	N/A
8.	Earphone	Lenovo	LH102	N/A	N/A	Unshielded, 1.2 m
9.	TV	Sony	KLV32V300A	FCC Doc	N/A	Unshielded, 1.8 m
10.	HDMI Cable	N/A	N/A	N/A	N/A	N/A
11.	DC Power Supply	GW INSTEK	GPD-2303S	N/A	N/A	Unshielded, 1.8 m

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the Notebook under large package sizes transmission.



2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 7.0 dB.

Offset (dB) = RF cable loss(dB).
= 7.0 (dB)

3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

26dB and 99% Occupied bandwidth are reporting only.

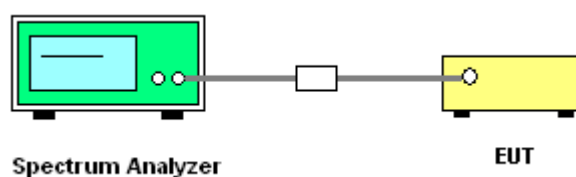
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

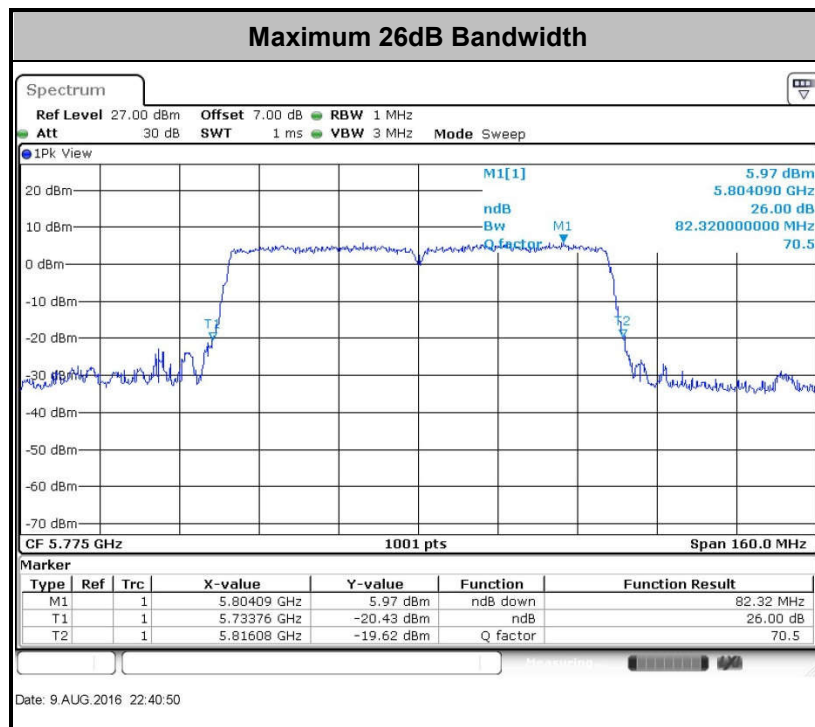
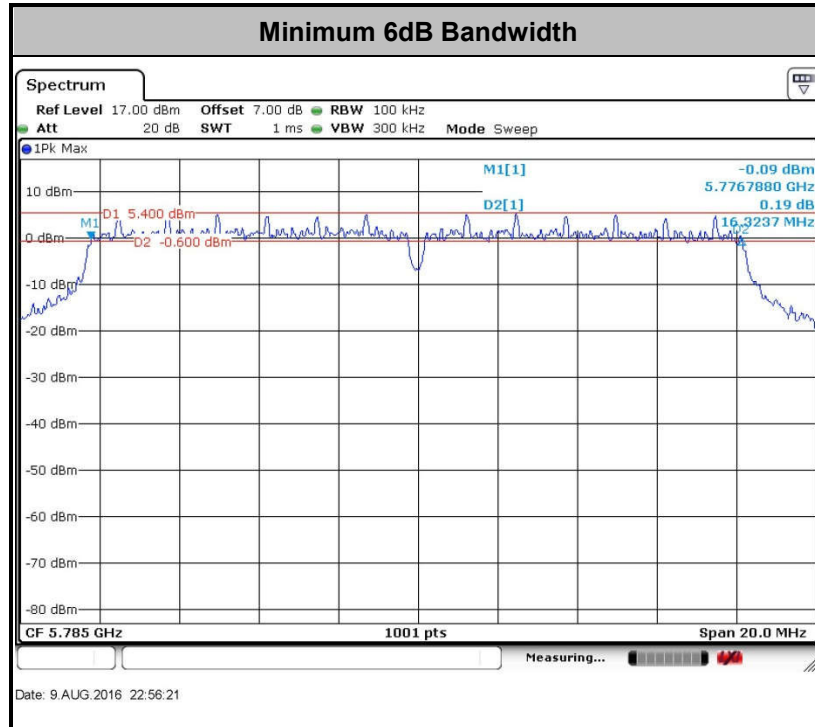
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02.
Section C) Emission bandwidth for the band 5.725-5.85GHz
2. Set RBW = 100kHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.
7. Measure and record the results in the test report.

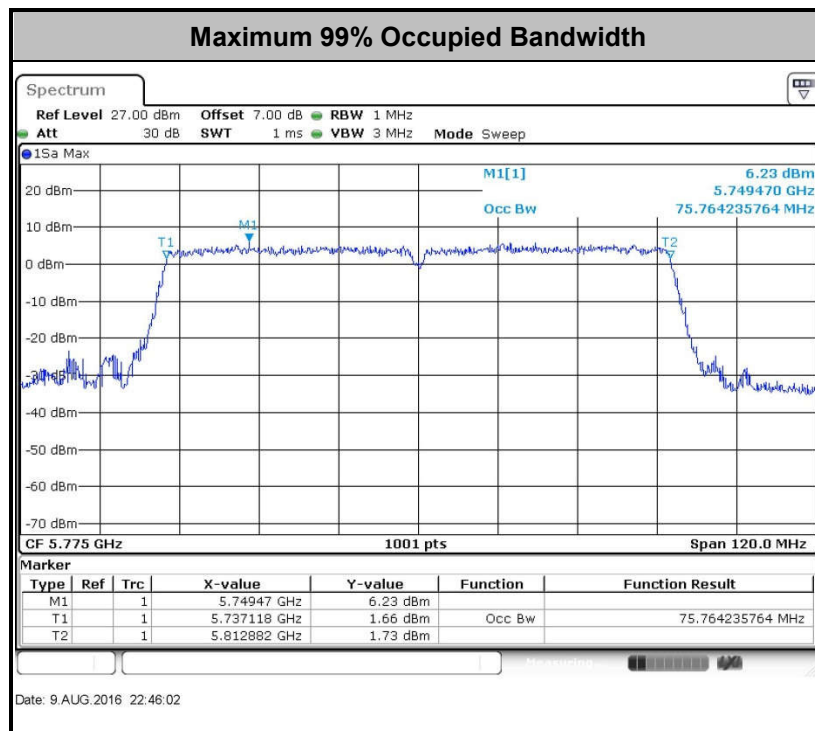
3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.





Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

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

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

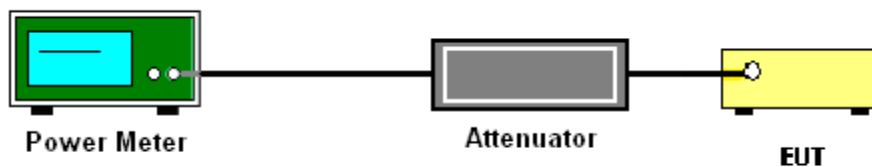
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, $10 \log(1/x)$, where x is the duty cycle.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

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

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02.
Section F) Maximum power spectral density.

Method SA-2

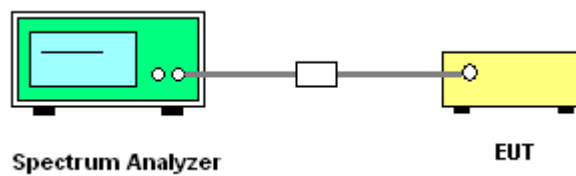
(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

1. The testing follows Method SA-2 of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02.
 - Measure the duty cycle.
 - Set span to encompass the entire emission bandwidth (EBW) of the signal.
 - Set RBW = 300 kHz.
 - Set VBW $\geq$ 1 MHz.
 - Number of points in sweep $\geq$ 2 Span / RBW.
 - Sweep time = auto.
 - Detector = RMS
 - Trace average at least 100 traces in power averaging mode.
 - Add $10 \log(500\text{kHz}/\text{RBW})$ to the test result.
 - 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. For example, add $10 \log(1/0.25) = 6$ dB if the duty cycle is 25 percent.

2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
4. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (c): Measure and add $10 \log(\text{NANT})$ dB, where NANT is the number of outputs.

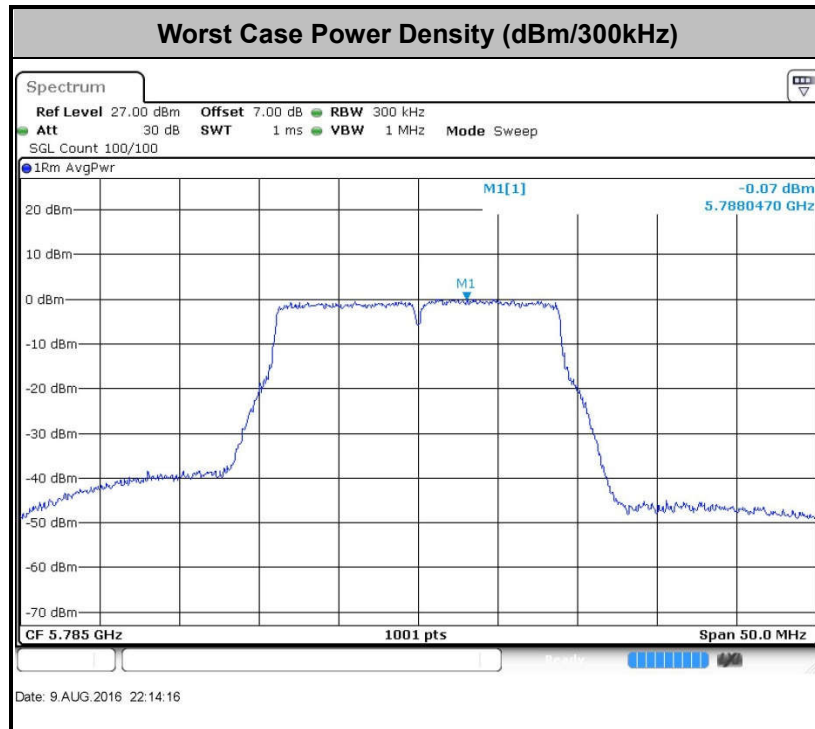
3.3.4 Test Setup





3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



3.4 Unwanted Emissions Measurement

This section as specified in FCC Part 15.407(b) is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement. The unwanted emissions shall comply with 15.407(b)(1) to (6), and restricted bands per FCC Part 15.205.

3.4.1 Limit of Unwanted Emissions

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

15.407(b)(4)(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.

- (2) Unwanted spurious emissions fallen in restricted bands per FCC Part 15.205 shall comply with the general field strength limits set forth in § 15.209 as below table,

Frequency (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

Note: The following formula is used to convert the EIRP to field strength.

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts)}$$

EIRP (dBm)	Field Strength at 3m (dBμV/m)
-17	78.3
-27	68.3

- (3) KDB 789033 D02 General UNII Test Procedures New Rules v01r02 G)2)c) As specified in 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in 15.407(b)(4)). However, an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.



3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02.

Section G) Unwanted emissions measurement.

(1) Procedure for Unwanted Emissions Measurements Below 1000MHz

- RBW = 120 kHz
- VBW = 300 kHz
- Detector = Peak
- Trace mode = max hold

(2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

- RBW = 1 MHz
- VBW $\geq$ 3 MHz
- Detector = Peak
- Sweep time = auto
- Trace mode = max hold

(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

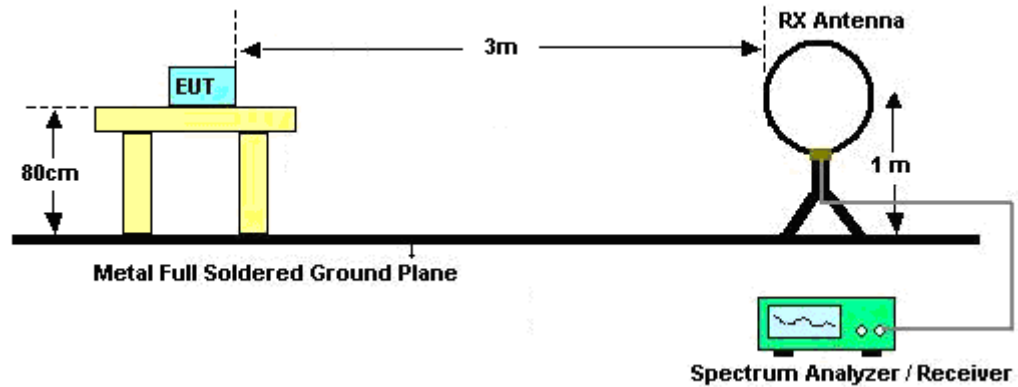
- RBW = 1 MHz
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.



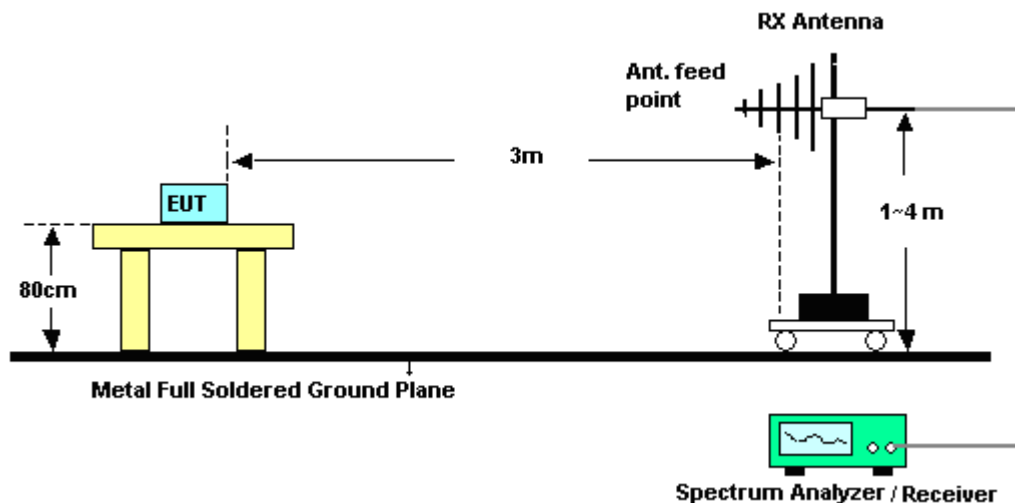
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.4.4 Test Setup

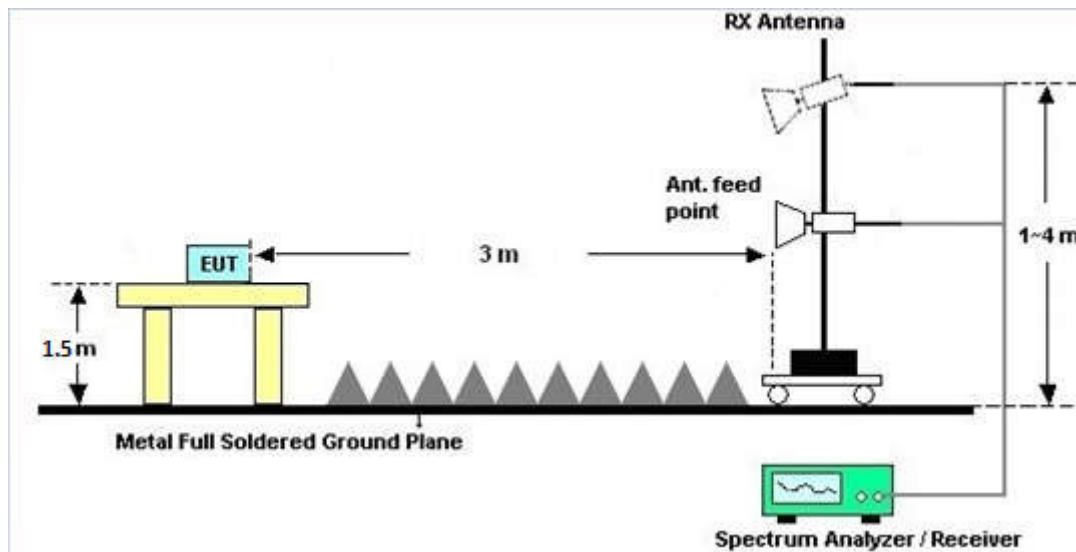
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.4.6 Test Result of Radiated Band Edges

Please refer to Appendix B.

3.4.7 Duty Cycle

Please refer to Appendix C.

3.4.8 Test Result of Unwanted Radiated Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B.

3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

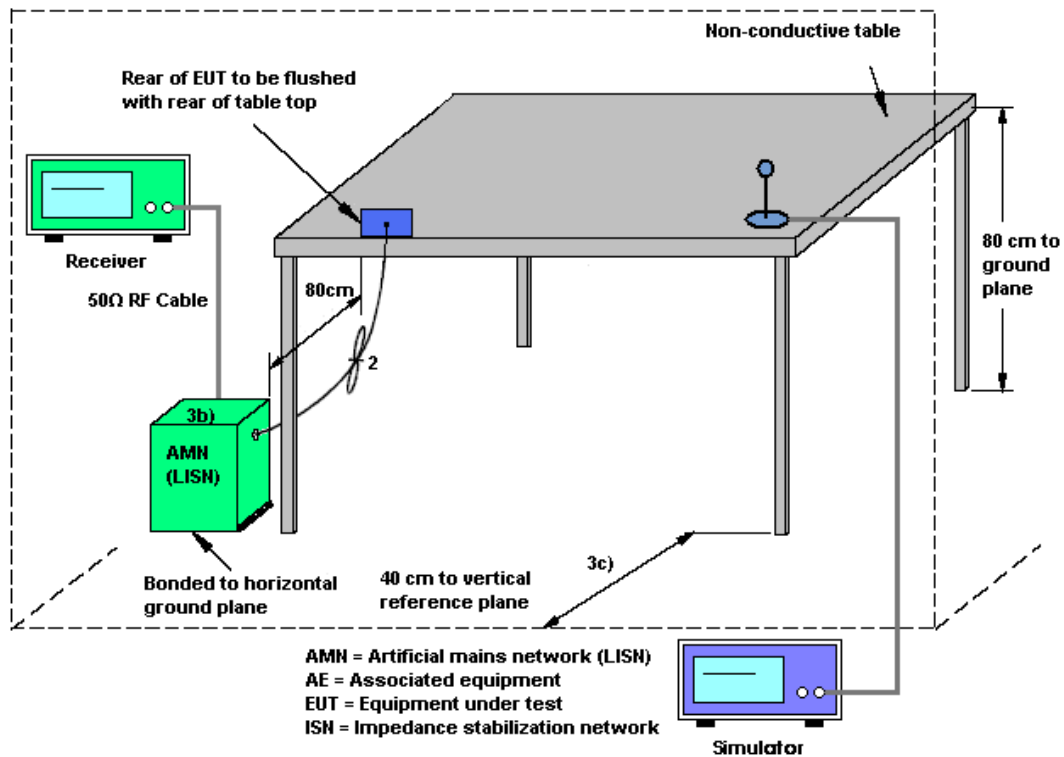
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

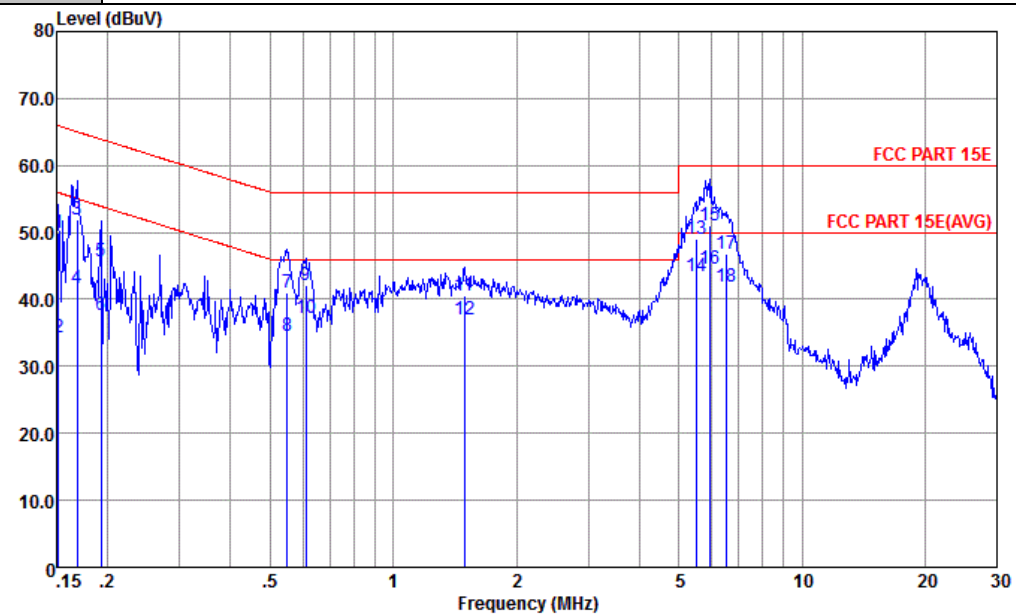
3.5.4 Test Setup





3.5.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	22~24℃
Test Engineer :	Amos Zhang	Relative Humidity :	44~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (5GHz) Link + Earphone + USB Cable (Charging from Adapter)		



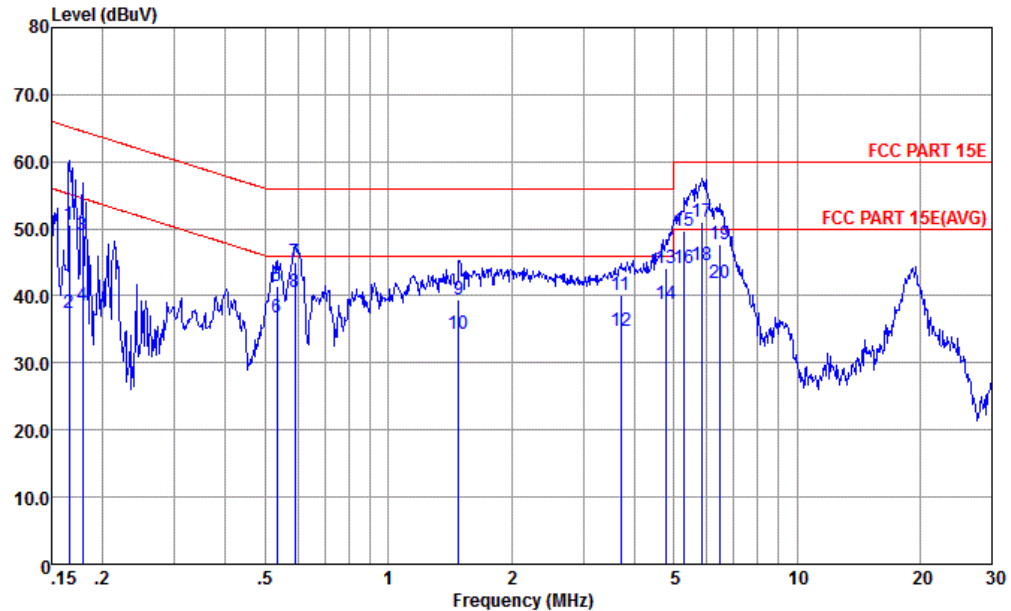
Site : CO01-KS
Condition : FCC PART 15E LISN-L-20151024 LINE

mode : Mode 1
: 868672020020035 #3

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.15	49.93	-15.98	65.91	39.30	0.52	10.11	QP
2	0.15	34.23	-21.68	55.91	23.60	0.52	10.11	Average
3	0.17	51.83	-13.20	65.03	41.30	0.41	10.12	QP
4	0.17	41.73	-13.30	55.03	31.20	0.41	10.12	Average
5	0.19	45.58	-18.35	63.93	35.20	0.26	10.12	QP
6	0.19	37.68	-16.25	53.93	27.30	0.26	10.12	Average
7	0.55	40.99	-15.01	56.00	30.60	0.23	10.16	QP
8	0.55	34.59	-11.41	46.00	24.20	0.23	10.16	Average
9	0.61	42.19	-13.81	56.00	31.79	0.24	10.16	QP
10	0.61	37.29	-8.71	46.00	26.89	0.24	10.16	Average
11	1.50	40.65	-15.35	56.00	30.30	0.21	10.14	QP
12	1.50	36.95	-9.05	46.00	26.60	0.21	10.14	Average
13	5.51	48.99	-11.01	60.00	38.60	0.20	10.19	QP
14	5.51	43.49	-6.51	50.00	33.10	0.20	10.19	Average
15	5.96	51.01	-8.99	60.00	40.60	0.21	10.20	QP
16 *	5.96	44.61	-5.39	50.00	34.20	0.21	10.20	Average
17	6.56	46.73	-13.27	60.00	36.30	0.22	10.21	QP
18	6.56	41.93	-8.07	50.00	31.50	0.22	10.21	Average



Test Mode :	Mode 1	Temperature :	22~24℃
Test Engineer :	Amos Zhang	Relative Humidity :	44~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (5GHz) Link + Earphone + USB Cable (Charging from Adapter)		



Site : CO01-KS
Condition : FCC PART 15E LISN-N-20151024 NEUTRAL

mode : Mode 1
: 868672020020035 #3

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.17	50.62	-14.54	65.16	40.20	0.30	10.12	QP
2	0.17	37.52	-17.64	55.16	27.10	0.30	10.12	Average
3	0.18	49.03	-15.52	64.55	38.60	0.31	10.12	QP
4	0.18	38.53	-16.02	54.55	28.10	0.31	10.12	Average
5	0.53	41.39	-14.61	56.00	30.91	0.32	10.16	QP
6	0.53	36.79	-9.21	46.00	26.31	0.32	10.16	Average
7	0.59	45.09	-10.91	56.00	34.60	0.33	10.16	QP
8	0.59	40.59	-5.41	46.00	30.10	0.33	10.16	Average
9	1.49	39.41	-16.59	56.00	28.89	0.38	10.14	QP
10	1.49	34.31	-11.69	46.00	23.79	0.38	10.14	Average
11	3.70	40.13	-15.87	56.00	29.60	0.37	10.16	QP
12	3.70	34.73	-11.27	46.00	24.20	0.37	10.16	Average
13	4.77	44.14	-11.86	56.00	33.60	0.36	10.18	QP
14	4.77	38.84	-7.16	46.00	28.30	0.36	10.18	Average
15	5.30	49.64	-10.36	60.00	39.10	0.35	10.19	QP
16	5.30	44.14	-5.86	50.00	33.60	0.35	10.19	Average
17	5.87	51.02	-8.98	60.00	40.49	0.33	10.20	QP
18 *	5.87	44.62	-5.38	50.00	34.09	0.33	10.20	Average
19	6.45	47.61	-12.39	60.00	37.09	0.31	10.21	QP
20	6.45	41.81	-8.19	50.00	31.29	0.31	10.21	Average

3.6 Frequency Stability Measurement

3.6.1 Limit of Frequency Stability

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

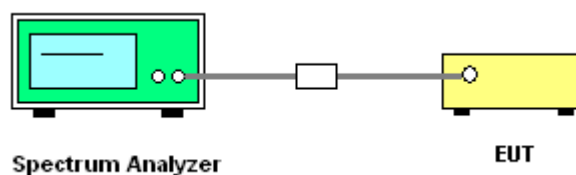
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

1. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.
2. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.
3. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

3.6.4 Test Setup



3.6.5 Test Result of Frequency Stability

Please refer to Appendix A.



3.7 Automatically Discontinue Transmission

3.7.1 Limit of Automatically Discontinue Transmission

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

3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Result of Automatically Discontinue Transmission

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

3.8 Antenna Requirements

3.8.1 Standard Applicable

According to FCC 47 CFR Section 15.407(a)(1)(2) ,if transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.8.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.8.3 Antenna Gain

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = $10 \log(N_{ANT}/N_{SS}=1)$ dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

For power, the directional gain G_{ANT} is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain "DG" is calculated as following table.

	Chain Port 0 Ant 1 (dBi)	Chain Port 1 Ant 2 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
5.8G Band	-0.70	-3.80	-0.70	0.90	0.00	0.00

Power Limit Reduction = $DG(\text{Power}) - 6\text{dBi}$, (min = 0)

PSD Limit Reduction = $DG(\text{PSD}) - 6\text{dBi}$, (min = 0)



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Sep. 10, 2015	Aug. 09, 2016	Sep. 09, 2016	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 20, 2016	Aug. 09, 2016	Jan. 19, 2017	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 20, 2016	Aug. 09, 2016	Jan. 19, 2017	Conducted (TH01-KS)
Thermal Chamber	Ten Billion	TTC-B3S	TBN-960502	-40~+150°C	Oct. 24, 2015	Aug. 09, 2016	Oct. 23, 2016	Conducted (TH01-KS)
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz; Max 30dBm	Sep. 10, 2015	Jul. 05, 2016~ Aug. 11, 2016	Sep. 09, 2016	Radiation (03CH03-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz~44GHz	Apr. 22, 2016	Jul. 05, 2016~ Aug. 11, 2016	Apr. 21, 2017	Radiation (03CH03-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 07, 2015	Jul. 05, 2016~ Aug. 11, 2016	Nov. 06, 2016	Radiation (03CH03-KS)
Bilog Antenna	TeseQ	CBL6112D	35406	25MHz-2GHz	Apr. 16, 2016	Jul. 05, 2016~ Aug. 11, 2016	Apr. 15, 2017	Radiation (03CH03-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1356	1GHz~18GHz	Apr. 16, 2016	Jul. 05, 2016~ Aug. 11, 2016	Apr. 15, 2017	Radiation (03CH03-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz ~40GHz	Mar. 03, 2016	Jul. 05, 2016~ Aug. 11, 2016	Mar. 02, 2017	Radiation (03CH03-KS)
Amplifier	SONOMA	310N	187289	9KHz-1GHz	Jun. 09, 2016	Jul. 05, 2016~ Aug. 11, 2016	Jun. 08, 2017	Radiation (03CH03-KS)
Amplifier	MITEQ	TTA1840 -35-HG	1887435	18~40GHz	Aug. 27, 2015	Jul. 05, 2016~ Aug. 11, 2016	Aug. 26, 2016	Radiation (03CH03-KS)
Amplifier	Agilent	8449B	3008A02370	1GHz~26.5GHz	Oct. 24, 2015	Jul. 05, 2016~ Aug. 11, 2016	Oct. 23, 2016	Radiation (03CH03-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Jul. 05, 2016~ Aug. 11, 2016	NCR	Radiation (03CH03-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jul. 05, 2016~ Aug. 11, 2016	NCR	Radiation (03CH03-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jul. 05, 2016~ Aug. 11, 2016	NCR	Radiation (03CH03-KS)
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz; Max 30dBm	Sep. 10, 2015	Jul. 09, 2016	Sep. 09, 2016	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 24, 2015	Jul. 09, 2016	Oct. 23, 2016	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Oct. 24, 2015	Jul. 09, 2016	Oct. 23, 2016	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP0000008 11	AC 0V~300V, 45Hz~1000Hz	Oct. 24, 2015	Jul. 09, 2016	Oct. 23, 2016	Conduction (CO01-KS)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.3
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.5dB
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Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.5dB
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Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.6dB
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Appendix A. Conducted Test Results

Report Number : FR662015E

Test Engineer:	Ivan Zhang	Temperature:	24~25	°C
Test Date:	2016/8/9	Relative Humidity:	54~55	%

TEST RESULTS DATA
6dB and 26dB EBW and 99% OBW

Band IV													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)		26dB Bandwidth (MHz)		6 dB Bandwidth (MHz)		6 dB Bandwidth Min. Limit (MHz)		Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	-	18.48	-	22.88	-	16.34	0.5	0.5	Pass
11a	6Mbps	1	157	5785	-	18.43	-	22.73	-	16.32	0.5	0.5	Pass
11a	6Mbps	1	165	5825	-	18.48	-	22.68	-	16.34	0.5	0.5	Pass
HT20	MCS0	2	149	5745	19.18	18.93	22.93	22.88	17.58	17.58	0.5		Pass
HT20	MCS0	2	157	5785	19.18	18.88	22.93	22.78	17.58	17.58	0.5		Pass
HT20	MCS0	2	165	5825	19.08	18.93	22.83	22.63	17.58	17.58	0.5		Pass
HT40	MCS0	2	151	5755	36.86	36.76	41.09	40.91	36.28	36.32	0.5		Pass
HT40	MCS0	2	159	5795	36.86	36.76	41.00	40.91	36.28	36.32	0.5		Pass
VHT20	MCS0	2	149	5745	19.33	18.83	22.93	22.83	17.58	17.58	0.5		Pass
VHT20	MCS0	2	157	5785	19.33	18.93	22.88	22.83	17.58	17.58	0.5		Pass
VHT20	MCS0	2	165	5825	19.23	18.93	22.93	22.73	17.58	17.58	0.5		Pass
VHT40	MCS0	2	151	5755	36.66	36.66	41.09	40.91	36.28	36.32	0.5		Pass
VHT40	MCS0	2	159	5795	36.86	36.66	41.00	41.00	36.28	36.32	0.5		Pass
VHT80	MCS0	2	155	5775	75.76	75.64	82.32	81.52	76.32	76.32	0.5		Pass

TEST RESULTS DATA
Average Power Table

Band IV														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	0.28	0.29	15.46	15.96		30.00	30.00	-0.70	-3.80	Pass
11a	6Mbps	1	157	5785	0.28	0.29	15.54	15.97		30.00	30.00	-0.70	-3.80	Pass
11a	6Mbps	1	165	5825	0.28	0.29	15.82	16.24		30.00	30.00	-0.70	-3.80	Pass
HT20	MCS0	2	149	5745	0.42	0.42	16.05	15.80	18.94	30.00		-0.70		Pass
HT20	MCS0	2	157	5785	0.42	0.42	16.13	15.82	18.99	30.00		-0.70		Pass
HT20	MCS0	2	165	5825	0.42	0.42	16.17	15.97	19.08	30.00		-0.70		Pass
HT40	MCS0	2	151	5755	0.80	0.79	15.16	14.41	17.81	30.00		-0.70		Pass
HT40	MCS0	2	159	5795	0.80	0.79	15.35	14.91	18.15	30.00		-0.70		Pass
VHT20	MCS0	2	149	5745	0.58	0.62	14.66	14.08	17.39	30.00		-0.70		Pass
VHT20	MCS0	2	157	5785	0.58	0.62	14.70	14.05	17.40	30.00		-0.70		Pass
VHT20	MCS0	2	165	5825	0.58	0.62	14.83	14.33	17.60	30.00		-0.70		Pass
VHT40	MCS0	2	151	5755	1.06	1.07	15.27	14.61	17.96	30.00		-0.70		Pass
VHT40	MCS0	2	159	5795	1.06	1.07	15.27	14.92	18.11	30.00		-0.70		Pass
VHT80	MCS0	2	155	5775	1.82	1.83	14.44	14.16	17.31	30.00		-0.70		Pass

TEST RESULTS DATA
Power Spectral Density

Band IV																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		10log (500kHz /RBW) Factor (dB)		Average Power Density (dBm/500kHz)			Average PSD Limit (dBm/500kHz)		DG (dBi)		Pass /Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	0.28	0.29	2.22	2.22	-	2.25		30.00	30.00	-0.70	-3.80	Pass
11a	6Mbps	1	157	5785	0.28	0.29	2.22	2.22	-	2.34		30.00	30.00	-0.70	-3.80	Pass
11a	6Mbps	1	165	5825	0.28	0.29	2.22	2.22	-	2.30		30.00	30.00	-0.70	-3.80	Pass
HT20	MCS0	2	149	5745	0.42	0.42	2.22					5.26	30.00	0.90		Pass
HT20	MCS0	2	157	5785	0.42	0.42	2.22					5.58	30.00	0.90		Pass
HT20	MCS0	2	165	5825	0.42	0.42	2.22					5.34	30.00	0.90		Pass
HT40	MCS0	2	151	5755	0.80	0.79	2.22					1.22	30.00	0.90		Pass
HT40	MCS0	2	159	5795	0.80	0.79	2.22					1.80	30.00	0.90		Pass
VHT20	MCS0	2	149	5745	0.58	0.62	2.22					3.45	30.00	0.90		Pass
VHT20	MCS0	2	157	5785	0.58	0.62	2.22					3.88	30.00	0.90		Pass
VHT20	MCS0	2	165	5825	0.58	0.62	2.22					3.78	30.00	0.90		Pass
VHT40	MCS0	2	151	5755	1.06	1.07	2.22					1.81	30.00	0.90		Pass
VHT40	MCS0	2	159	5795	1.06	1.07	2.22					1.92	30.00	0.90		Pass
VHT80	MCS0	2	155	5775	1.82	1.83	2.22					-1.72	30.00	0.90		Pass

TEST RESULTS DATA
Frequency Stability

Band IV										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)	Temperature (°C)	Voltage (V)	Note
11a	6Mbps	1	149	5745	5744.950	-0.050	-8.70	20	3.6	
11a	6Mbps	1	149	5745	5744.950	-0.050	-8.70	20	4.35	
11a	6Mbps	1	149	5745	5744.950	-0.050	-8.70	20	3.8	
11a	6Mbps	1	149	5745	5745.025	0.025	4.35	-30	3.8	
11a	6Mbps	1	149	5745	5744.950	-0.050	-8.70	55	3.8	



Appendix B. Radiated Spurious Emission

Band 4 - 5725~5850MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5699.6	52.74	-52.27	105.01	48.72	32.02	8.25	36.25	102	354	P	H
		5719.6	59.85	-50.94	110.79	55.78	32.04	8.31	36.28	102	354	P	H
		5724.2	61.81	-58.67	120.48	57.74	32.04	8.31	36.28	102	354	P	H
	*	5738	104.41	-	-	100.31	32.05	8.34	36.29	102	354	P	H
	*	5744	96.77	-	-	92.67	32.05	8.34	36.29	102	354	A	H
		5699.9	48.47	-56.76	105.23	44.45	32.02	8.25	36.25	100	181	P	V
		5713.7	50.83	-58.31	109.14	46.79	32.03	8.28	36.27	100	181	P	V
		5725	55.42	-66.88	122.3	51.35	32.04	8.31	36.28	100	181	P	V
	*	5740	97.09	-	-	92.99	32.05	8.34	36.29	100	181	P	V
	*	5744	89.76	-	-	85.66	32.05	8.34	36.29	100	181	A	V
802.11a CH 157 5785MHz	*	5780	103.77	-	-	99.62	32.06	8.4	36.31	104	358	P	H
	*	5780	96.23	-	-	92.08	32.06	8.4	36.31	104	358	A	H
	*	5780	96.35	-	-	92.2	32.06	8.4	36.31	100	183	P	V
	*	5782	89.11	-	-	84.96	32.06	8.4	36.31	100	183	A	V
802.11a CH 165 5825MHz	*	5822	102.69	-	-	98.49	32.08	8.47	36.35	102	1	P	H
	*	5822	95.3	-	-	91.1	32.08	8.47	36.35	102	1	A	H
		5850.67	59.52	-61.25	120.77	55.3	32.09	8.49	36.36	102	1	P	H
		5855.04	55.18	-55.71	110.89	50.94	32.1	8.51	36.37	102	1	P	H
		5879.55	50.51	-51.41	101.92	46.26	32.1	8.53	36.38	102	1	P	H
	*	5824	95.86	-	-	91.66	32.08	8.47	36.35	100	183	P	V
	*	5824	88.02	-	-	83.82	32.08	8.47	36.35	100	183	A	V
		5853.9	48.64	-64.77	113.41	44.4	32.1	8.51	36.37	100	183	P	V
		5864.73	47.57	-60.6	108.17	43.33	32.1	8.51	36.37	100	183	P	V
		5877.27	46.22	-57.39	103.61	41.97	32.1	8.53	36.38	100	183	P	V
Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a		11490	44.56	-29.44	74	52.81	38.59	10.14	56.98	100	360	P	H
CH 149		11490	43.64	-30.36	74	51.89	38.59	10.14	56.98	100	360	P	V
5745MHz													
802.11a		11570	44.03	-29.97	74	52.14	38.75	10.29	57.15	100	360	P	H
CH 157		11570	44.22	-29.78	74	52.33	38.75	10.29	57.15	100	360	P	V
5785MHz													
802.11a		11650	44.85	-29.15	74	52.82	38.9	10.42	57.29	100	360	P	H
CH 165		11650	45.19	-28.81	74	53.16	38.9	10.42	57.29	100	360	P	V
5825MHz													
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 - 5725~5850MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5697.7	47.32	-56.29	103.61	43.3	32.02	8.25	36.25	100	199	P	H
		5719.2	50.74	-59.94	110.68	46.67	32.04	8.31	36.28	100	199	P	H
		5724.9	56.26	-65.81	122.07	52.19	32.04	8.31	36.28	100	199	P	H
	*	5748	94.76	-	-	90.66	32.05	8.34	36.29	100	199	P	H
	*	5742	87.34	-	-	83.24	32.05	8.34	36.29	100	199	A	H
		5696.5	49.35	-53.37	102.72	45.33	32.02	8.25	36.25	400	254	P	V
		5715.5	55.17	-54.47	109.64	51.13	32.03	8.28	36.27	400	254	P	V
		5724.8	60.23	-61.61	121.84	56.16	32.04	8.31	36.28	400	254	P	V
	*	5752	98.11	-	-	93.99	32.05	8.37	36.3	400	254	P	V
	*	5750	90.97	-	-	86.87	32.05	8.34	36.29	400	254	A	V
802.11a CH 157 5785MHz	*	5788	96.15	-	-	91.97	32.07	8.43	36.32	254	190	P	H
	*	5782	88.62	-	-	84.47	32.06	8.4	36.31	254	190	A	H
	*	5780	98.07	-	-	93.92	32.06	8.4	36.31	398	252	P	V
	*	5782	90.58	-	-	86.43	32.06	8.4	36.31	398	252	A	V
802.11a CH 165 5825MHz	*	5828	96.78	-	-	92.58	32.08	8.47	36.35	283	168	P	H
	*	5828	89.17	-	-	84.97	32.08	8.47	36.35	283	168	A	H
		5851.81	52.96	-65.21	118.17	48.74	32.09	8.49	36.36	283	168	P	H
		5857.7	51.42	-58.72	110.14	47.18	32.1	8.51	36.37	283	168	P	H
		5876.89	48.3	-55.6	103.9	44.05	32.1	8.53	36.38	283	168	P	H
	*	5830	98.01	-	-	93.81	32.08	8.47	36.35	400	296	P	V
	*	5830	90.65	-	-	86.45	32.08	8.47	36.35	400	296	A	V
		5850.29	54.63	-67.01	121.64	50.41	32.09	8.49	36.36	400	296	P	V
		5856.75	51.01	-59.4	110.41	46.77	32.1	8.51	36.37	400	296	P	V
		5878.6	47.22	-55.41	102.63	42.97	32.1	8.53	36.38	400	296	P	V
Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a		11490	44.74	-29.26	74	52.99	38.59	10.14	56.98	100	360	P	H
CH 149		11490	43.89	-30.11	74	52.14	38.59	10.14	56.98	100	360	P	V
5745MHz													
802.11a		11570	44.53	-29.47	74	52.64	38.75	10.29	57.15	100	360	P	H
CH 157		11570	44.78	-29.22	74	52.89	38.75	10.29	57.15	100	360	P	V
5785MHz													
802.11a		11650	45.03	-28.97	74	53	38.9	10.42	57.29	100	360	P	H
CH 165		11650	44.62	-29.38	74	52.59	38.9	10.42	57.29	100	0	P	V
5825MHz													
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 - 5725~5850MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT20 CH 149 5745MHz		5695.32	49.62	-52.23	101.85	45.6	32.02	8.25	36.25	303	170	P	H
		5719.56	59.73	-51.05	110.78	55.66	32.04	8.31	36.28	303	170	P	H
		5724.12	62.06	-58.23	120.29	57.99	32.04	8.31	36.28	303	170	P	H
	*	5750	100.21	-	-	96.11	32.05	8.34	36.29	303	170	P	H
	*	5742	91.4	-	-	87.3	32.05	8.34	36.29	303	170	A	H
		5699.16	49.87	-54.81	104.68	45.85	32.02	8.25	36.25	375	150	P	V
		5719.24	62.29	-48.4	110.69	58.22	32.04	8.31	36.28	375	150	P	V
		5724.12	62.7	-57.59	120.29	58.63	32.04	8.31	36.28	375	150	P	V
	*	5750	98.43	-	-	94.33	32.05	8.34	36.29	375	150	P	V
	*	5742	89.3	-	-	85.2	32.05	8.34	36.29	375	150	A	V
802.11n HT20 CH 157 5785MHz	*	5790	100.46	-	-	96.28	32.07	8.43	36.32	301	168	P	H
	*	5788	91.05	-	-	86.87	32.07	8.43	36.32	301	168	A	H
	*	5782	102.9	-	-	98.75	32.06	8.4	36.31	105	298	P	V
	*	5786	95.97	-	-	91.79	32.07	8.43	36.32	105	298	A	V
802.11n HT20 CH 165 5825MHz	*	5830	98.49	-	-	94.29	32.08	8.47	36.35	273	179	P	H
	*	5820	91.28	-	-	87.08	32.08	8.47	36.35	273	179	A	H
		5850.56	58.05	-62.97	121.02	53.83	32.09	8.49	36.36	273	179	P	H
		5858.64	53.79	-56.09	109.88	49.55	32.1	8.51	36.37	273	179	P	H
		5882.88	47.29	-52.16	99.45	43.04	32.1	8.53	36.38	273	179	P	H
	*	5818	103.4	-	-	99.2	32.08	8.45	36.33	142	239	P	V
	*	5824	96.01	-	-	91.81	32.08	8.47	36.35	142	239	A	V
		5850.32	59.91	-61.66	121.57	55.69	32.09	8.49	36.36	142	239	P	V
		5857.44	56.74	-53.48	110.22	52.5	32.1	8.51	36.37	142	239	P	V
		5886.24	49.73	-47.22	96.95	45.48	32.1	8.53	36.38	142	239	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 149 5745MHz		11490	44.85	-29.15	74	53.1	38.59	10.14	56.98	100	360	P	H
		11490	44.68	-29.32	74	52.93	38.59	10.14	56.98	100	360	P	V
802.11n HT20 CH 157 5785MHz		11570	46.04	-27.96	74	54.15	38.75	10.29	57.15	100	360	P	H
		11570	44.91	-29.09	74	53.02	38.75	10.29	57.15	100	360	P	V
802.11n HT20 CH 165 5825MHz		11650	44.16	-29.84	74	52.13	38.9	10.42	57.29	100	360	P	H
		11650	44.52	-29.48	74	52.49	38.9	10.42	57.29	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 151 5755MHz		5699.64	60.42	-44.61	105.03	56.4	32.02	8.25	36.25	103	347	P	H
		5719.72	70.39	-40.43	110.82	66.32	32.04	8.31	36.28	103	347	P	H
		5720.04	69	-41.99	110.99	64.93	32.04	8.31	36.28	103	347	P	H
	*	5744	100.5	-	-	96.4	32.05	8.34	36.29	103	347	P	H
	*	5750	93.66	-	-	89.56	32.05	8.34	36.29	103	347	A	H
		5691.8	53.87	-45.38	99.25	49.85	32.02	8.25	36.25	101	97	P	V
		5719.96	63.95	-46.94	110.89	59.88	32.04	8.31	36.28	101	97	P	V
		5724.36	64.95	-55.89	120.84	60.88	32.04	8.31	36.28	101	97	P	V
	*	5752	95.9	-	-	91.78	32.05	8.37	36.3	101	97	P	V
	*	5746	88.04	-	-	83.94	32.05	8.34	36.29	101	97	A	V
802.11n HT40 CH 159 5795MHz	*	5788	100.36	-	-	96.18	32.07	8.43	36.32	104	352	P	H
	*	5782	93.24	-	-	89.09	32.06	8.4	36.31	104	352	A	H
		5852.16	55.06	-62.31	117.37	50.84	32.09	8.49	36.36	104	352	P	H
		5858.64	53.2	-56.68	109.88	48.96	32.1	8.51	36.37	104	352	P	H
		5875.04	50.07	-55.2	105.27	45.82	32.1	8.53	36.38	104	352	P	H
	*	5792	94.64	-	-	90.46	32.07	8.43	36.32	349	345	P	V
	*	5802	87.13	-	-	82.95	32.07	8.43	36.32	349	345	A	V
		5852.48	47.52	-69.12	116.64	43.3	32.09	8.49	36.36	349	345	P	V
		5863.44	48.42	-60.11	108.53	44.18	32.1	8.51	36.37	349	345	P	V
		5876.4	47.08	-57.18	104.26	42.83	32.1	8.53	36.38	349	345	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 151 5755MHz		11510	42.86	-31.14	74	51.11	38.6	10.17	57.02	100	360	P	H
		11510	42.43	-31.57	74	50.68	38.6	10.17	57.02	100	360	P	V
802.11n HT40 CH 159 5795MHz		11590	43.41	-30.59	74	51.49	38.79	10.32	57.19	100	360	P	H
		11590	45.24	-28.76	74	53.32	38.79	10.32	57.19	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11ac VHT20 (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT20 CH 149 5745MHz		5693.16	47.74	-52.52	100.26	43.72	32.02	8.25	36.25	311	204	P	H
		5719.4	49.77	-60.96	110.73	45.7	32.04	8.31	36.28	311	204	P	H
		5724.44	57.26	-63.76	121.02	53.19	32.04	8.31	36.28	311	204	P	H
	*	5752	99.16	-	-	95.04	32.05	8.37	36.3	311	204	P	H
	*	5742	91.32	-	-	87.22	32.05	8.34	36.29	311	204	A	H
		5694.68	51.16	-50.22	101.38	47.14	32.02	8.25	36.25	298	259	P	V
		5719.88	56.75	-54.12	110.87	52.68	32.04	8.31	36.28	298	259	P	V
		5724.76	60.75	-61	121.75	56.68	32.04	8.31	36.28	298	259	P	V
	*	5742	102.3	-	-	98.2	32.05	8.34	36.29	298	259	P	V
	*	5740	95.47	-	-	91.37	32.05	8.34	36.29	298	259	A	V
802.11ac VHT20 CH 157 5785MHz	*	5782	98.59	-	-	94.44	32.06	8.4	36.31	306	207	P	H
	*	5782	91.56	-	-	87.41	32.06	8.4	36.31	306	207	A	H
	*	5788	101.07	-	-	96.89	32.07	8.43	36.32	294	278	P	V
	*	5788	94.4	-	-	90.22	32.07	8.43	36.32	294	278	A	V
802.11ac VHT20 CH 165 5825MHz	*	5820	98.39	-	-	94.19	32.08	8.47	36.35	298	203	P	H
	*	5822	91.46	-	-	87.26	32.08	8.47	36.35	298	203	A	H
		5851.6	48.92	-69.73	118.65	44.7	32.09	8.49	36.36	298	203	P	H
		5857.68	48.56	-61.59	110.15	44.32	32.1	8.51	36.37	298	203	P	H
		5876.4	47.45	-56.81	104.26	43.2	32.1	8.53	36.38	298	203	P	H
	*	5832	101.61	-	-	97.41	32.08	8.47	36.35	142	244	P	V
	*	5830	94.15	-	-	89.95	32.08	8.47	36.35	142	244	A	V
		5850.16	52.02	-69.91	121.93	47.8	32.09	8.49	36.36	142	244	P	V
		5865.12	51.38	-56.68	108.06	47.14	32.1	8.51	36.37	142	244	P	V
		5877.68	49.63	-53.68	103.31	45.38	32.1	8.53	36.38	142	244	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11ac VHT20 (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT20 CH 149 5745MHz		11490	43.83	-30.17	74	52.08	38.59	10.14	56.98	100	360	P	H
		11490	44.42	-29.58	74	52.67	38.59	10.14	56.98	100	0	P	V
802.11ac VHT20 CH 157 5785MHz		11570	44.49	-29.51	74	52.6	38.75	10.29	57.15	100	0	P	H
		11570	44.66	-29.34	74	52.77	38.75	10.29	57.15	100	360	P	V
802.11ac VHT20 CH 165 5825MHz		11650	44.02	-29.98	74	51.99	38.9	10.42	57.29	100	360	P	H
		11650	44.33	-29.67	74	52.3	38.9	10.42	57.29	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11ac VHT40 (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT40 CH 151 5755MHz		5699.96	59.09	-46.18	105.27	55.07	32.02	8.25	36.25	100	360	P	H
		5719.96	67.04	-43.85	110.89	62.97	32.04	8.31	36.28	100	360	P	H
		5724.76	67.96	-53.79	121.75	63.89	32.04	8.31	36.28	100	360	P	H
	*	5762	100.57	-	-	96.45	32.05	8.37	36.3	100	360	P	H
	*	5748	93.23	-	-	89.13	32.05	8.34	36.29	100	360	A	H
		5695.4	54.37	-47.54	101.91	50.35	32.02	8.25	36.25	100	93	P	V
		5713	60.29	-48.65	108.94	56.25	32.03	8.28	36.27	100	93	P	V
		5721.16	61.54	-52.01	113.55	57.47	32.04	8.31	36.28	100	93	P	V
	*	5748	93.84	-	-	89.74	32.05	8.34	36.29	100	93	P	V
	*	5738	87.3	-	-	83.2	32.05	8.34	36.29	100	93	A	V
802.11ac VHT40 CH 159 5795MHz	*	5780	99.26	-	-	95.11	32.06	8.4	36.31	100	360	P	H
	*	5782	92.37	-	-	88.22	32.06	8.4	36.31	100	360	A	H
		5851.12	52.58	-67.17	119.75	48.36	32.09	8.49	36.36	100	360	P	H
		5855.04	52.67	-58.22	110.89	48.43	32.1	8.51	36.37	100	360	P	H
		5877.6	50.56	-52.81	103.37	46.31	32.1	8.53	36.38	100	360	P	H
	*	5800	93.63	-	-	89.45	32.07	8.43	36.32	100	145	P	V
	*	5792	86.86	-	-	82.68	32.07	8.43	36.32	100	145	A	V
		5852.64	48.29	-67.99	116.28	44.07	32.09	8.49	36.36	100	145	P	V
		5855.28	47.9	-62.92	110.82	43.66	32.1	8.51	36.37	100	145	P	V
		5880.16	47.22	-54.25	101.47	42.97	32.1	8.53	36.38	100	145	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11ac VHT40 (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT40 CH 151 5755MHz		11510	43.71	-30.29	74	51.96	38.6	10.17	57.02	100	0	P	H
		11510	44.63	-29.37	74	52.88	38.6	10.17	57.02	100	360	P	V
802.11ac VHT40 CH 159 5795MHz		11590	44.3	-29.7	74	52.38	38.79	10.32	57.19	100	0	P	H
		11590	44.63	-29.37	74	52.71	38.79	10.32	57.19	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 155 5775MHz		5687.16	62.66	-33.17	95.83	58.64	32.02	8.25	36.25	105	345	P	H
		5706.12	63.08	-43.94	107.02	59.04	32.03	8.28	36.27	105	345	P	H
		5722.6	65.72	-51.11	116.83	61.65	32.04	8.31	36.28	105	345	P	H
	*	5748	97.39	-	-	93.29	32.05	8.34	36.29	105	345	P	H
	*	5758	90.81	-	-	86.69	32.05	8.37	36.3	105	345	A	H
		5850.72	54.08	-66.58	120.66	49.86	32.09	8.49	36.36	105	345	P	H
		5868	55.82	-51.44	107.26	51.58	32.1	8.51	36.37	105	345	P	H
		5878.64	52.09	-50.51	102.6	47.84	32.1	8.53	36.38	105	345	P	H
		5686.6	56.59	-38.83	95.42	52.57	32.02	8.25	36.25	302	247	P	V
		5719.08	55.97	-54.67	110.64	51.9	32.04	8.31	36.28	302	247	P	V
		5721.8	55.56	-59.44	115	51.49	32.04	8.31	36.28	302	247	P	V
	*	5768	90.81	-	-	86.69	32.05	8.37	36.3	302	247	P	V
	*	5748	84.54	-	-	80.44	32.05	8.34	36.29	302	247	A	V
		5851.12	47.12	-72.63	119.75	42.9	32.09	8.49	36.36	302	247	P	V
		5872.88	50.22	-55.67	105.89	45.97	32.1	8.53	36.38	302	247	P	V
		5877.92	47.36	-55.77	103.13	43.11	32.1	8.53	36.38	302	247	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

**Band 4 5725~5850MHz****WIFI 802.11ac VHT80 (Harmonic @ 3m)**

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 155 5775MHz		11550	45.67	-28.33	74	53.82	38.71	10.26	57.12	100	360	P	H
		11550	44.68	-29.32	74	52.83	38.71	10.26	57.12	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

5GHz WIFI 802.11n HT20 (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
5GHz 802.11n HT20 LF		152.22	35.52	-7.98	43.5	51.9	13.68	1.49	31.55	-	-	P	H
		171.62	37.41	-6.09	43.5	54.89	12.46	1.59	31.53	100	0	P	H
		234.67	38.64	-7.36	46	55.94	12.43	1.73	31.46	-	-	P	H
		288.99	38.27	-7.73	46	53.08	14.53	2.05	31.39	-	-	P	H
		314.21	36.37	-9.63	46	50.36	15.16	2.18	31.33	-	-	P	H
		468.44	37.53	-8.47	46	48.35	17.73	2.7	31.25	-	-	P	H
		35.82	35.77	-4.23	40	49.24	17.16	0.72	31.35	100	360	P	V
		45.52	35.33	-4.67	40	53.7	12.22	0.83	31.42	-	-	P	V
		60.07	34.73	-5.27	40	58.44	6.8	0.92	31.43	-	-	P	V
		151.25	39.13	-4.37	43.5	55.45	13.74	1.49	31.55	-	-	P	V
		234.67	36.17	-9.83	46	53.47	12.43	1.73	31.46	-	-	P	V
		288.99	37.24	-8.76	46	52.05	14.53	2.05	31.39	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

**Note symbol**

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	P eak or A verage
H/V	H orizontal or V ertical



A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

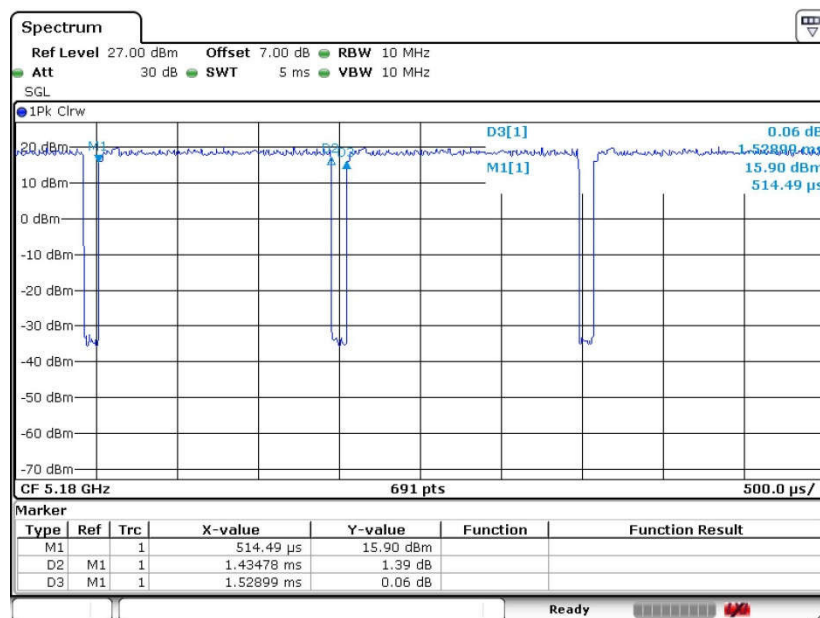
= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix C. Duty Cycle Plots

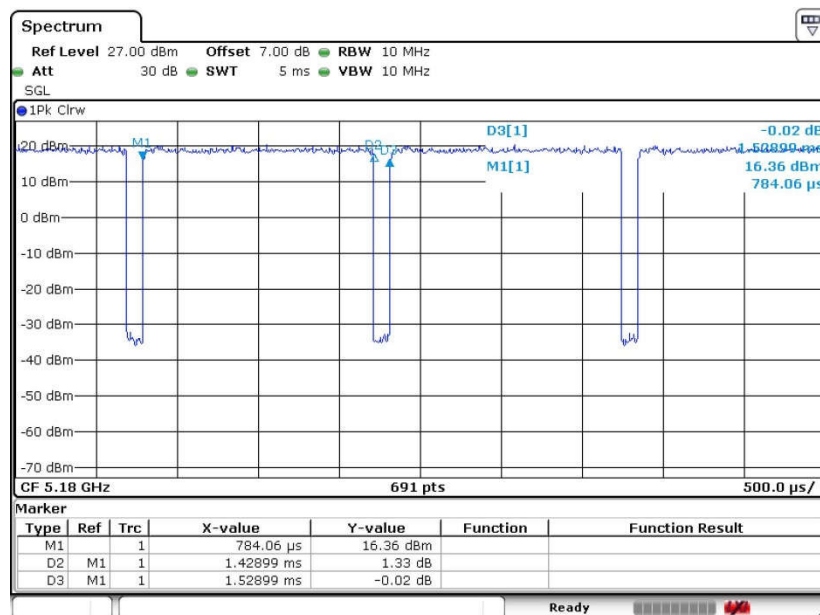
Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1	802.11a	93.84	1.43	0.70	1kHz
2	802.11a	93.46	1.43	0.70	1kHz
1+2	802.11n HT20	90.78	0.98	1.02	3kHz
1+2	802.11n HT40	83.29	0.50	2.01	3kHz
1+2	802.11ac VHT20	86.73	0.69	1.45	3kHz
1+2	802.11ac VHT40	78.30	0.36	2.77	3kHz
1+2	802.11ac VHT80	65.67	0.19	5.23	10kHz

802.11a Antenna 1


Date: 5.JUL.2016 03:35:25

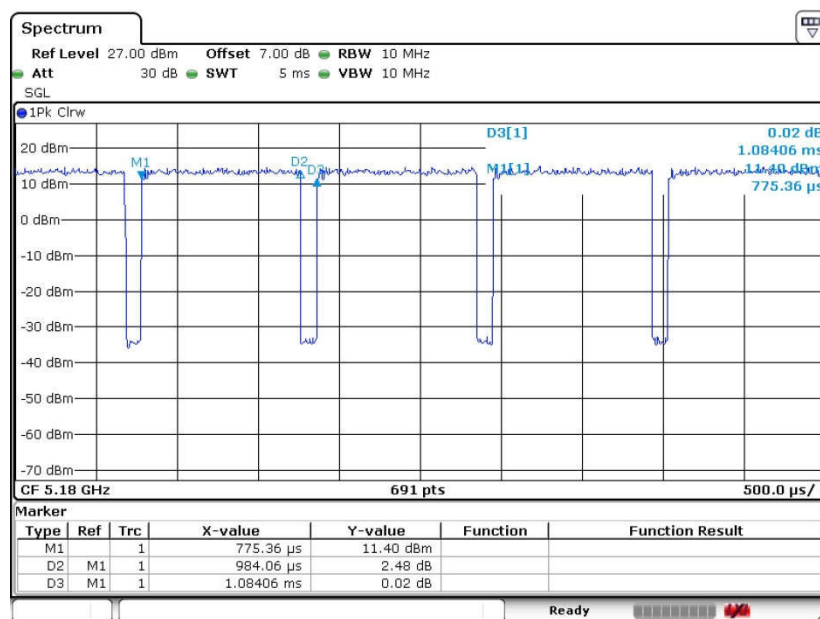


802.11a Antenna 1



Date: 5.JUL.2016 05:53:06

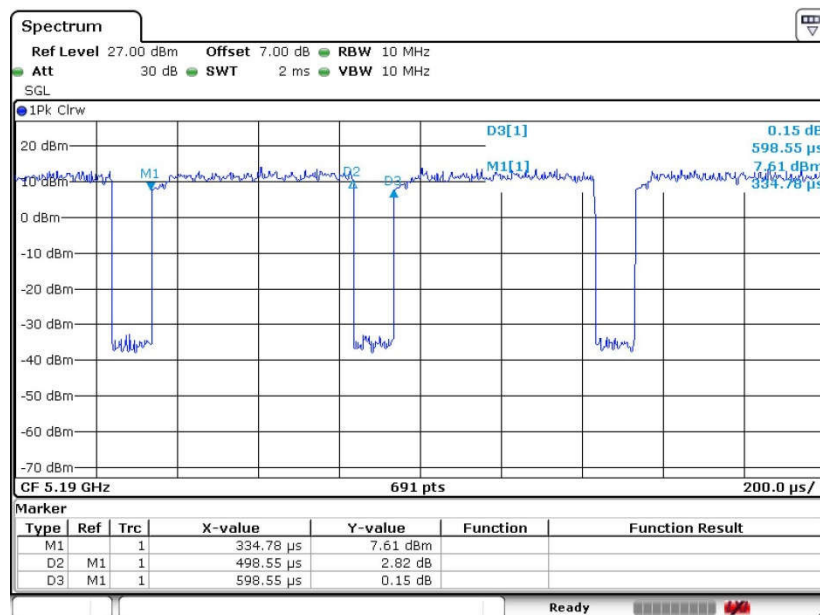
802.11n HT20 Antenna 1+2



Date: 5.JUL.2016 04:27:26

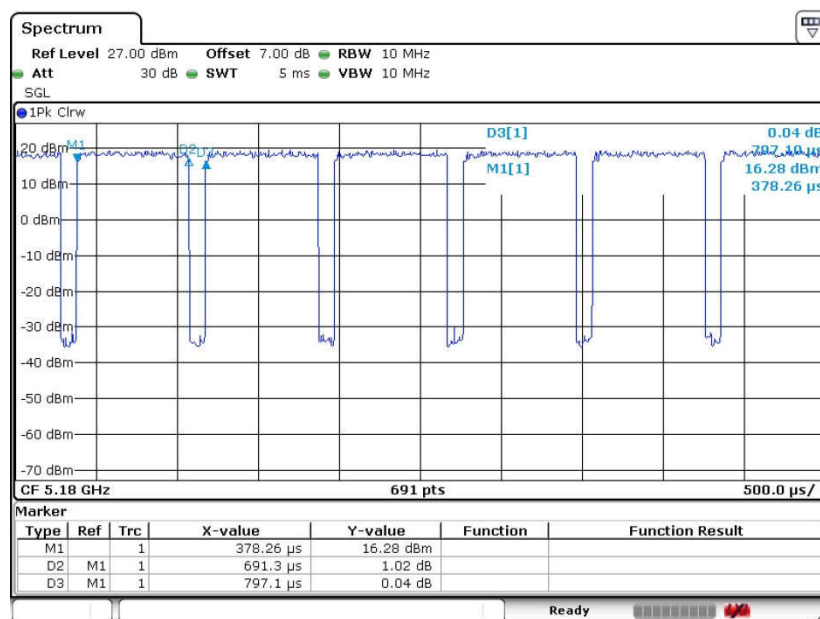


802.11n HT40 Antenna 1+2



Date: 5 JUL 2016 05:35:50

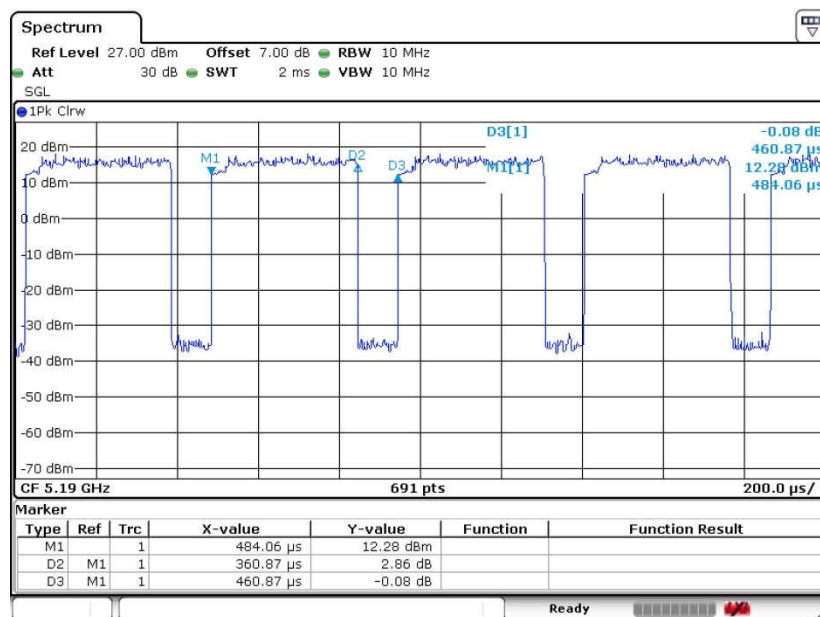
802.11ac VHT20 Antenna 1+2



Date: 5 JUL 2016 05:22:07

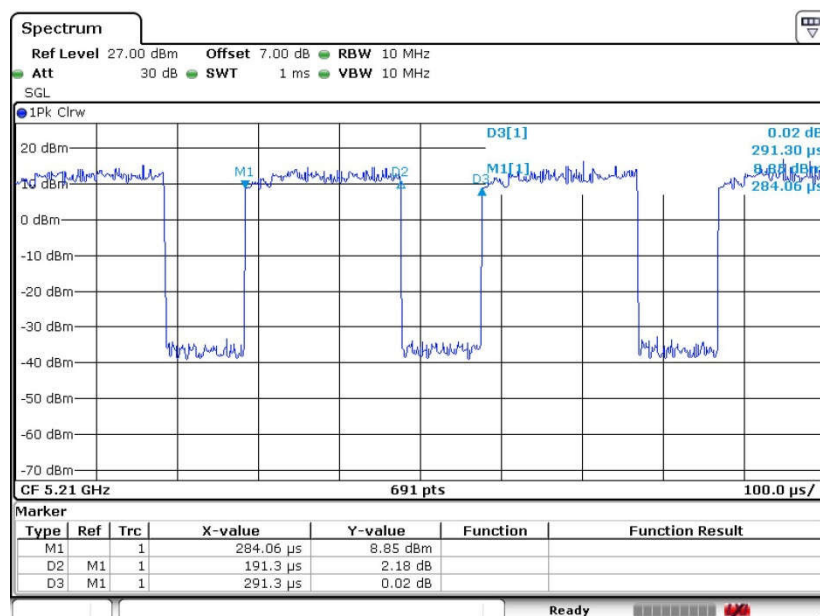


802.11ac VH40 Antenna 1+2



Date: 5 JUL 2016 04:53:24

802.11ac VHT80 Antenna 1+2



Date: 5 JUL 2016 05:14:11