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FCC RADIO TEST REPORT

Applicant's company	ASUSTeK COMPUTER INC.
Applicant Address	4F, No. 150, Li-Te Rd., Peitou, Taipei 112, Taiwan
FCC ID	MSQ-RTAC53U
Manufacturer's company	Compal Networking (KunShan) Co., LTD.
Manufacturer Address	No. 520, Nabbang Rd., Economic & Technical Development Zone Kunshan, Jiangsu Province China

Product Name	Dual-band Wireless-AC Router
Brand Name	ASUS
Model No.	RT-AC53U
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5150 ~ 5250MHz
Received Date	Dec. 04, 2013
Final Test Date	Jul. 16, 2014
Submission Type	Original Equipment
Operating Mode	Master

Statement

Test result included is for the IEEE 802.11n and IEEE 802.11 a/ac of the product.

The test result in this report refers exclusively to the presented test model / sample.

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The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2009, 47 CFR FCC Part 15 Subpart E, KDB789033 D02 v01, KDB662911 D01 v02r01, KDB644545 D01 v01r02.**

The test equipment used to perform the test is calibrated and traceable to NML/ROC.



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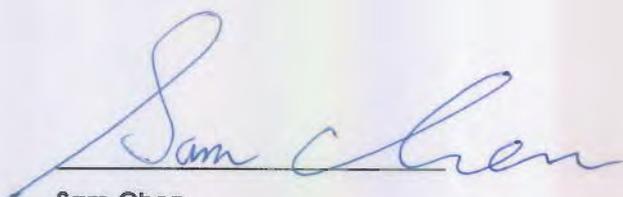
History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3D0427AB	Rev. 01	Initial issue of report	Oct. 14, 2014

1. CERTIFICATE OF COMPLIANCE

Product Name : Dual-band Wireless-AC Router
Brand Name : ASUS
Model No. : RT-AC53U
Applicant : ASUSTeK COMPUTER INC.
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart E § 15.407

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Dec. 04, 2013 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.



Sam Chen

SPORTON INTERNATIONAL INC.

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart E				
Part	Rule Section	Description of Test	Result	Under Limit
4.1	15.207	AC Power Line Conducted Emissions	Complies	13.56 dB
4.2	15.407(a)	26dB Spectrum Bandwidth and 99% Occupied Bandwidth	Complies	-
4.3	15.407(a)	Maximum Conducted Output Power	Complies	5.30 dB
4.4	15.407(a)	Power Spectral Density	Complies	4.85 dB
4.5	15.407(b)	Radiated Emissions	Complies	4.12 dB
4.6	15.407(b)	Band Edge Emissions	Complies	1.01 dB
4.7	15.407(g)	Frequency Stability	Complies	-
4.8	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

IEEE 802.11n/ac

Items	Description
Product Type	WLAN (2TX, 2RX)
Radio Type	Intentional Transceiver
Power Type	From power adapter
Modulation	see the below table for IEEE 802.11n/ac
Data Modulation	For 802.11n: OFDM (BPSK / QPSK / 16QAM / 64QAM) For 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
Data Rate (Mbps)	see the below table for IEEE 802.11n/ac
Frequency Range	5150 ~ 5250MHz
Channel Number	4 for 20MHz bandwidth ; 2 for 40MHz bandwidth 1 for 80MHz bandwidth
Channel Band Width (99%)	For non-beamforming mode: 802.11ac MCS0/Nss1 (VHT20): 18.56 MHz ; 802.11ac MCS0/Nss1 (VHT40): 38.40 MHz ; 802.11ac MCS0/Nss1 (VHT80): 76.16 MHz For beamforming mode: 802.11ac MCS0/Nss1 (VHT20): 17.92 MHz ; 802.11ac MCS0/Nss1 (VHT40): 36.48 MHz ; 802.11ac MCS0/Nss1 (VHT80): 76.16 MHz
Maximum Conducted Output Power	For non-beamforming mode: 802.11ac MCS0/Nss1 (VHT20): 23.92 dBm ; 802.11ac MCS0/Nss1 (VHT40): 24.70 dBm ; 802.11ac MCS0/Nss1 (VHT80): 16.31 dBm For beamforming mode: 802.11ac MCS0/Nss1 (VHT20): 22.96 dBm ; 802.11ac MCS0/Nss1 (VHT40): 21.69 dBm ; 802.11ac MCS0/Nss1 (VHT80): 15.85 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

IEEE 802.11a

Items	Description
Product Type	WLAN (2TX, 2RX)
Radio Type	Intentional Transceiver
Power Type	From power adapter
Modulation	OFDM for IEEE 802.11a
Data Modulation	OFDM (BPSK / QPSK / 16QAM / 64QAM)
Data Rate (Mbps)	OFDM (6/9/12/18/24/36/48/54)
Frequency Range	5150 ~ 5250MHz
Channel Number	4
Channel Band Width (99%)	18.40 MHz
Maximum Conducted Output Power	23.97 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

Items	Description	
Communication Mode	<input checked="" type="checkbox"/> IP Based (Load Based)	<input type="checkbox"/> Frame Based
Beamforming Function	<input checked="" type="checkbox"/> With beamforming	<input type="checkbox"/> Without beamforming

Note: The product has beamforming function for 802.11n HT20/40 and 802.11ac VHT20/40/80 in 5150-5250MHz and 5725-5850MHz.

Antenna and Band width

Antenna	Single (TX)			Two (TX)		
	20 MHz	40 MHz	80 MHz	20 MHz	40 MHz	80 MHz
IEEE 802.11a	X	X	X	V	X	X
IEEE 802.11n	X	X	X	V	V	X
IEEE 802.11ac	X	X	X	V	V	V

IEEE 11n/ac Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	2	MCS 0-15
802.11n (HT40)	2	MCS 0-15
802.11ac (VHT20)	2	MCS 0-9/Nss1-2
802.11ac (VHT40)	2	MCS 0-9/Nss1-2
802.11ac (VHT80)	2	MCS 0-9/Nss1-2

Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput).
Then EUT support HT20 and HT40.

Note 2: IEEE Std. 802.11ac modulation consists of VHT20, VHT40, VHT80 and VHT160 (VHT: Very High Throughput). Then EUT support VHT20, VHT40 and VHT80.

Note 3: Modulation modes consist of below configuration:
HT20/HT40: IEEE 802.11n, VHT20/VHT40/VHT80: IEEE 802.11ac

3.2. Accessories

Power	Brand	Model	Rating
Adapter	LEI	MU18-R120150-A1	INPUT: 100-240Vac, 50/60Hz, 0.6A OUTPUT: 12Vdc, 1.5A
Other			
RJ-45 cable*1: Non-shielded, 1.5m			

3.3. Table for Filed Antenna

Ant.	Brand	P/N	Antenna Type	Connector	Gain (dBi)	
					2.4GHz	5GHz
1	M.gear	C660-510303-A (SRF2014062)	Dipole Antenna	Reversed-SMA	3.79	4.52
2	M.gear	C660-510302-A (SRF2014026)	Dipole Antenna	Reversed-SMA	3.51	4.25
3	PSA	RFDPA141000SBLB805	Dipole Antenna	Reversed-SMA	3.31	4.51
4	MAG.LAYERS	RT-AC53U	Dipole Antenna	Reversed-SMA	3.11	4.48

Note: The EUT has four sets of antenna, and each set contains two antennas.

Ant. 1 ~ 4 are the same type antennas. Only the higher gain antennas "Ant. 1" were tested and recorded in the report.

For 2.4GHz function:

For IEEE 802.11b mode (1TX/1RX)

The EUT supports the antenna with TX and RX diversity functions.

Both Chain 1 and Chain 2 support transmit and receive functions, but only one of them will be used at one time.

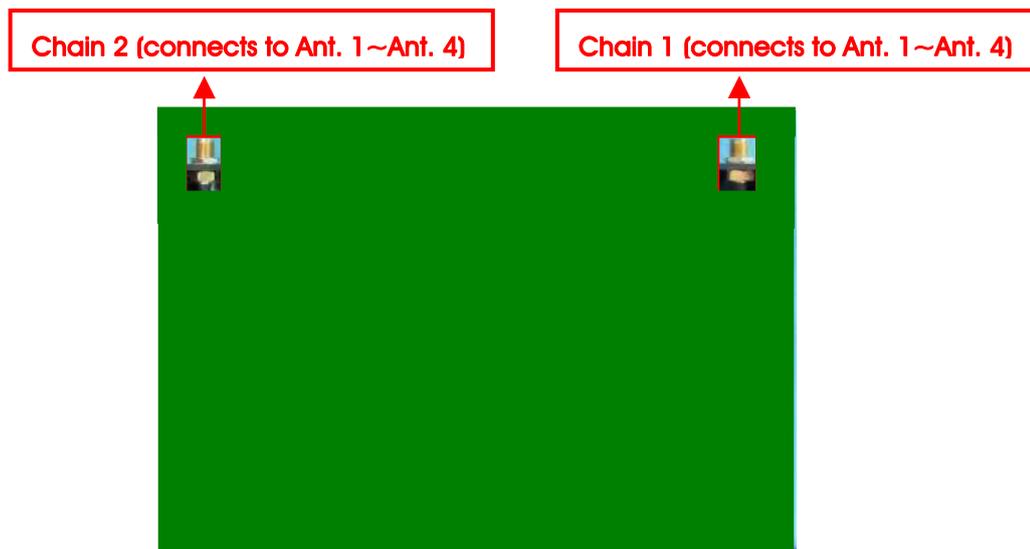
For IEEE 802.11g/n mode (2TX/2RX)

Chain 1 and Chain 2 could transmit/receive simultaneously.

For 5GHz function:

For IEEE 802.11a/n/ac mode (2TX/2RX)

Chain 1 and Chain 2 could transmit/receive simultaneously.



3.4. Table for Carrier Frequencies

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 36, 40, 44, 48.

For 40MHz bandwidth systems, use Channel 38, 46.

For 80MHz bandwidth systems, use Channel 42.

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
5150~5250 MHz Band 1	36	5180 MHz	44	5220 MHz
	38	5190 MHz	46	5230 MHz
	40	5200 MHz	48	5240 MHz
	42	5210 MHz	-	-

3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode		Data Rate	Channel	Chain
AC Power Conducted Emission	Normal Link		-	-	-
Max. Conducted Output Power	11ac VHT20	Band 1	MCS0/Nss1	36/40/48	1+2
	11ac VHT40	Band 1	MCS0/Nss1	38/46	1+2
	11ac VHT80	Band 1	MCS0/Nss1	42	1+2
	11a/BPSK	Band 1	6Mbps	36/40/48	1+2
Power Spectral Density	11ac VHT20	Band 1	MCS0/Nss1	36/40/48	1+2
	11ac VHT40	Band 1	MCS0/Nss1	38/46	1+2
	11ac VHT80	Band 1	MCS0/Nss1	42	1+2
	11a/BPSK	Band 1	6Mbps	36/40/48	1+2
26dB Spectrum Bandwidth 99% Occupied Bandwidth Measurement	11ac VHT20	Band 1	MCS0/Nss1	36/40/48	1+2
	11ac VHT40	Band 1	MCS0/Nss1	38/46	1+2
	11ac VHT80	Band 1	MCS0/Nss1	42	1+2
	11a/BPSK	Band 1	6Mbps	36/40/48	1+2
Radiated Emission Below 1GHz	Normal Link		-	-	-
Radiated Emission Above 1GHz	11ac VHT20	Band 1	MCS0/Nss1	36/40/48	1+2
	11ac VHT40	Band 1	MCS0/Nss1	38/46	1+2
	11ac VHT80	Band 1	MCS0/Nss1	42	1+2
	11a/BPSK	Band 1	6Mbps	36/40/48	1+2
Band Edge Emission	11ac VHT20	Band 1	MCS0/Nss1	36/40/48	1+2
	11ac VHT40	Band 1	MCS0/Nss1	38/46	1+2
	11ac VHT80	Band 1	MCS0/Nss1	42	1+2
	11a/BPSK	Band 1	6Mbps	36/40/48	1+2
Frequency Stability	Un-modulation		-	40	1+2

Note: VHT20/VHT40 covers HT20/HT40, due to same modulation.

The following test modes were performed for all tests:

For Conducted Emission test:

Mode 1. Normal Link - EUT with AC Adapter

For Radiated Emission below 1GHz test:

Mode 1. Normal Link - EUT laying with AC Adapter

Mode 2. Normal Link - EUT standing with AC Adapter

Mode 1 is the worst case, so it was selected to record in this test report.

For Radiated Emission above 1GHz test:

There are two modes of EUT, one is standing, the other one is Laying position.

Standing has been evaluated to be the worst case after evaluating.

Consequently, measurement for Radiated Emission above 1GHz test will follow this same test mode.

Mode 1. EUT standing

For Co-location MPE and Radiated Emission Co-location Test:

The EUT could be applied with 2.4GHz WLAN function and 5GHz WLAN function; therefore Co-location Maximum Permissible Exposure (Please refer to Appendix C) and Radiated Emission Co-location (please refer to Appendix D) tests are added for simultaneously transmit between 2.4GHz WLAN function and 5GHz WLAN function.

3.6. Table for Testing Locations

Test Site Location					
Address:	No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C.				
TEL:	886-3-656-9065				
FAX:	886-3-656-9085				
Test Site No.	Site Category	Location	FCC Reg. No.	IC File No.	VCCI Reg. No
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D	-
CO01-CB	Conduction	Hsin Chu	262045	IC 4086D	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

3.7. Table for Supporting Units

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
Notebook*4	DELL	E6430	DoC
Flash Disk	Transcend	604108 8255	DoC

For Test Site No: 03CH01-CB

For Radiated Emission 30MHz~1GHz test

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
Notebook	Apple	Mac Book	DoC
Notebook	DELL	E6220	DoC
Notebook	DELL	D420	DoC
Flash Disk	Silicon	D33B01	DoC

For Radiated Emission above 1GHz test
For Non-Beamforming Mode

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC

For Beamforming Mode

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6220	DoC
Notebook	DELL	D420	DoC
WLAN ac Dongle	Netgear	A6200	PY31220200

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	QDS-BRCM1049LE

3.8. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

For non-beamforming mode:
Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT20

Test Software Version	Mtool 2.0.0.9		
Frequency	5180 MHz	5200 MHz	5240 MHz
MCS0/Nss1 VHT20	62	75	84

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT40

Test Software Version	Mtool 2.0.0.9	
Frequency	5190 MHz	5230 MHz
MCS0/Nss1 VHT40	57	84

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT80

Test Software Version	Mtool 2.0.0.9
Frequency	5210 MHz
MCS0/Nss1 VHT80	53

Power Parameters of IEEE 802.11a

Test Software Version	Mtool 2.0.0.9		
Frequency	5180 MHz	5200 MHz	5240 MHz
802.11a	57	71	84

For beamforming mode:

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT20

Test Software Version	Mtool 2.0.0.9		
Frequency	5180 MHz	5200 MHz	5240 MHz
MCS0/Nss1 VHT20	55	59	80

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT40

Test Software Version	Mtool 2.0.0.9	
Frequency	5190 MHz	5230 MHz
MCS0/Nss1 VHT40	61	72

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT80

Test Software Version	Mtool 2.0.0.9
Frequency	5210 MHz
MCS0/Nss1 VHT80	51

3.9. EUT Operation during Test

For non-beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

For beamforming mode:

For Conducted Mode:

The EUT was programmed to be in continuously transmitting mode.

For Radiated Mode:

During the test, the following programs under WIN XP were executed.

The program was executed as follows:

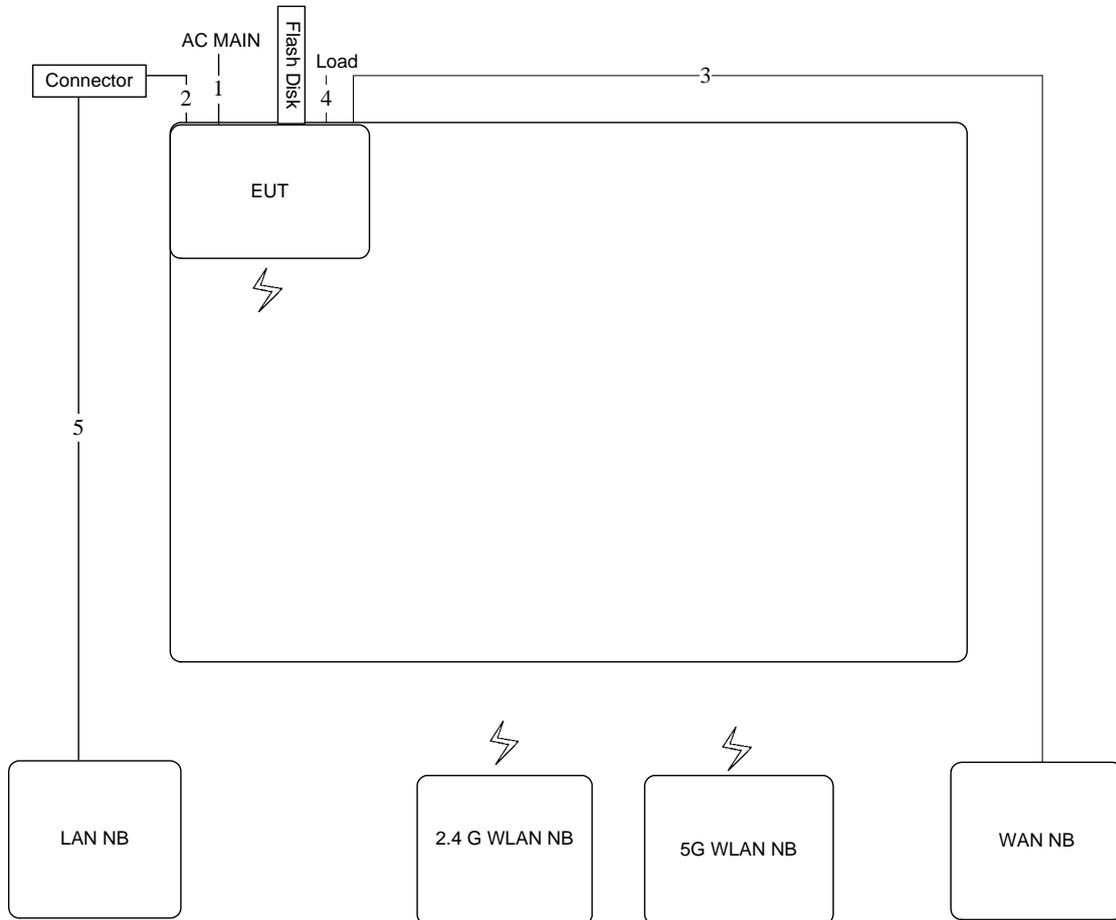
1. During the test, the EUT operation to normal function.
2. Executed command fixed test channel under DOS.
3. Executed "Lantest.exe " to link with the remote workstation to receive and transmit packet by WLAN ac Dongle and transmit duty cycle no less 98%

3.10. Duty Cycle

Mode	On Time(ms)	On+Off Time(ms)	Duty Cycle(%)	1/T Minimum VBW (kHz)
802.11ac MCS0/Nss1 VHT20	1.932	1.956	98.77	0.01
802.11ac MCS0/Nss1 VHT40	0.930	0.960	96.88	0.01
802.11ac MCS0/Nss1 VHT80	0.450	0.480	93.75	1.08
802.11a	2.064	2.088	98.85	0.01

3.11. Test Configurations

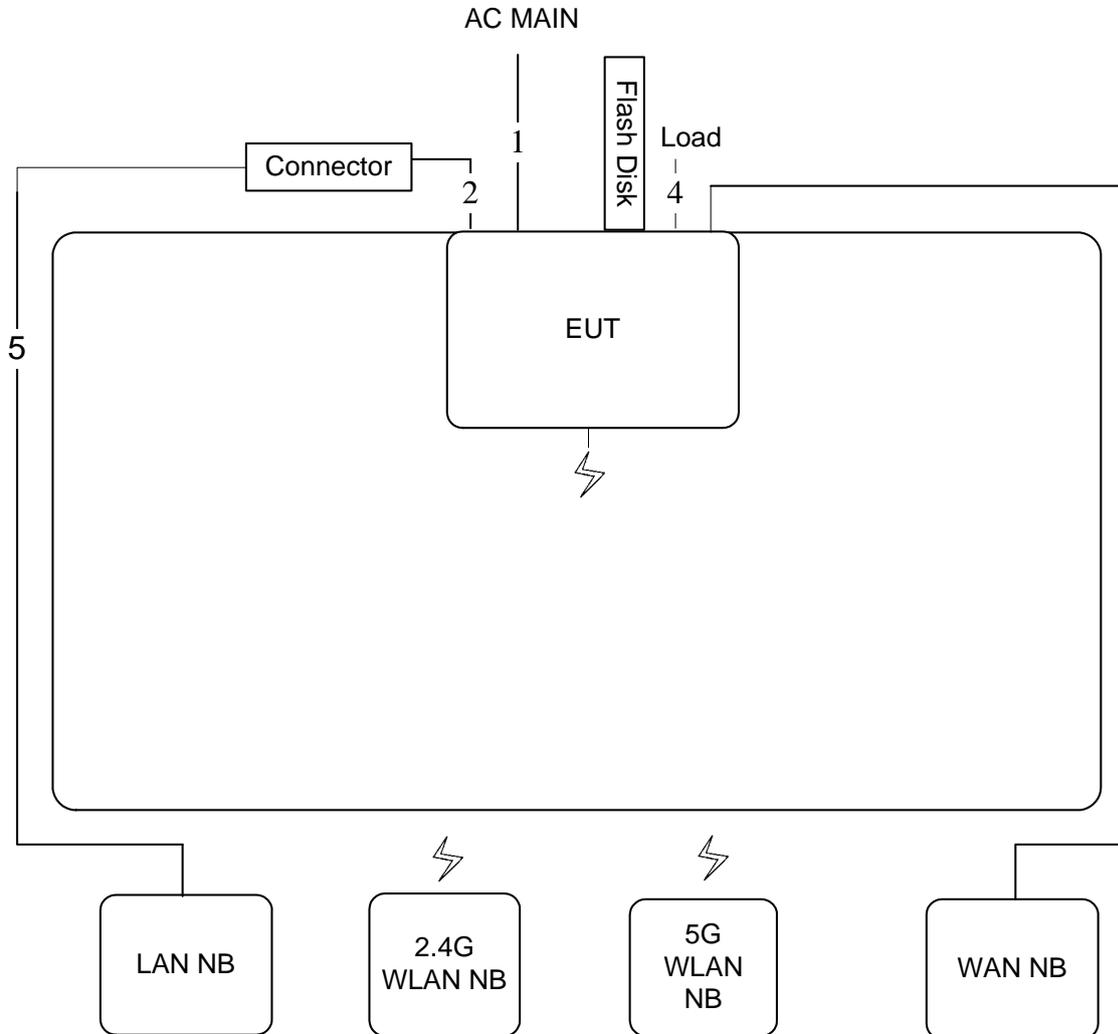
3.11.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length(m)	Remark
1	Power cable	No	1.5m	-
2	RJ-45 cable	No	1.5m	-
3	RJ-45 cable	No	10m	-
4	RJ-45 cable*3	No	3m	Load
5	RJ-45 cable	No	10m	-

3.11.2. Radiation Emissions Test Configuration

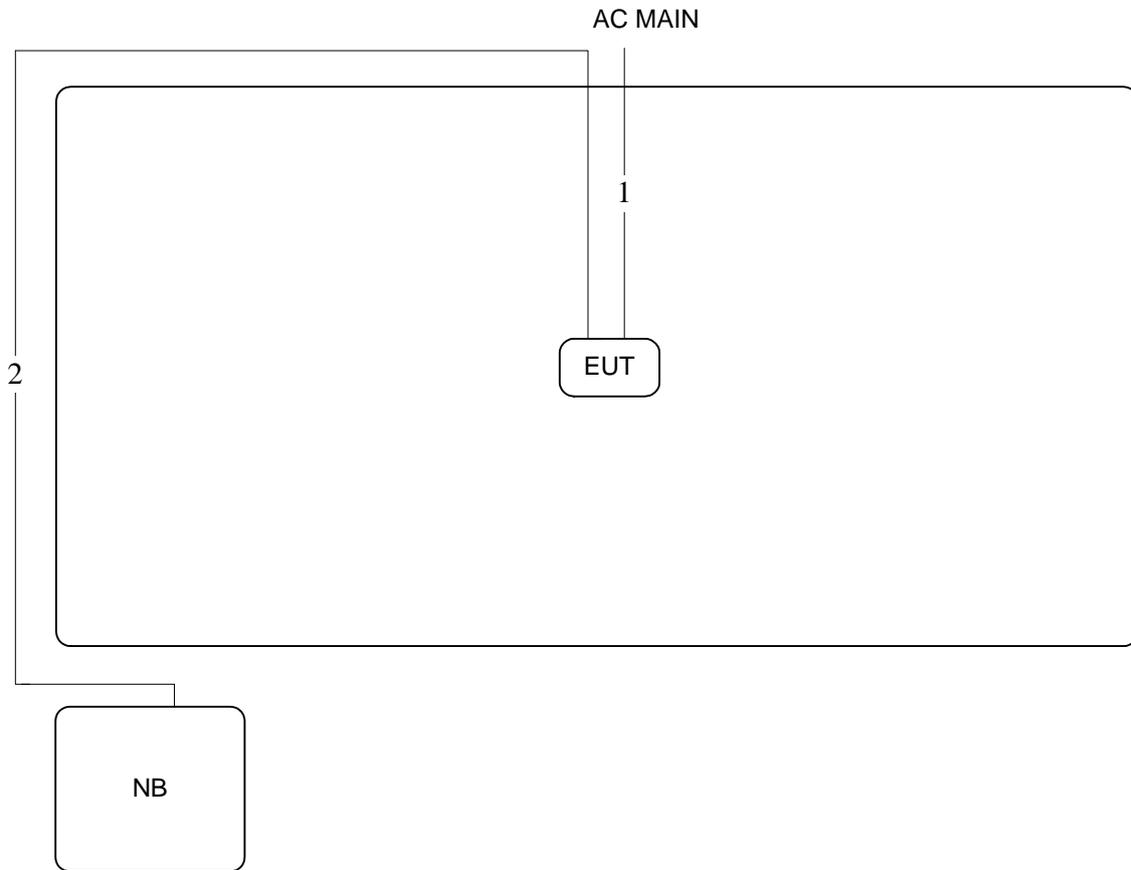
Test Configuration: 30MHz~1GHz



Item	Connection	Shielded	Length(m)	Remark
1	Power cable	No	1.5m	-
2	RJ-45 cable	No	1.5m	-
3	RJ-45 cable	No	10m	-
4	RJ-45 cable*3	No	3m	Load
5	RJ-45 cable	No	10m	-

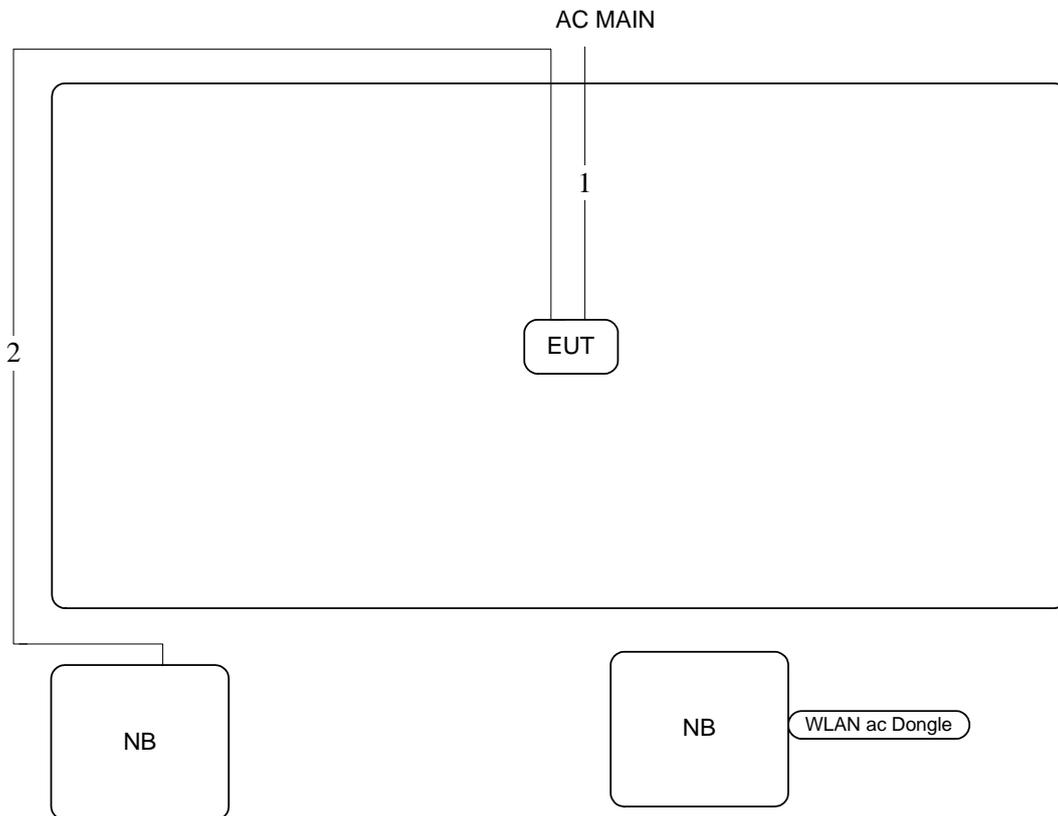
Test Configuration: above 1GHz

For non-beamforming mode:



Item	Connection	Shielded	Length(m)	Remark
1	Power cable	No	1.5m	-
2	RJ-45 cable	No	10m	-

For beamforming mode:



Item	Connection	Shielded	Length(m)	Remark
1	Power cable	No	1.5m	-
2	RJ-45 cable	No	10m	-

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For this product that is designed to connect to the 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 below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.1.2. Measuring Instruments and Setting

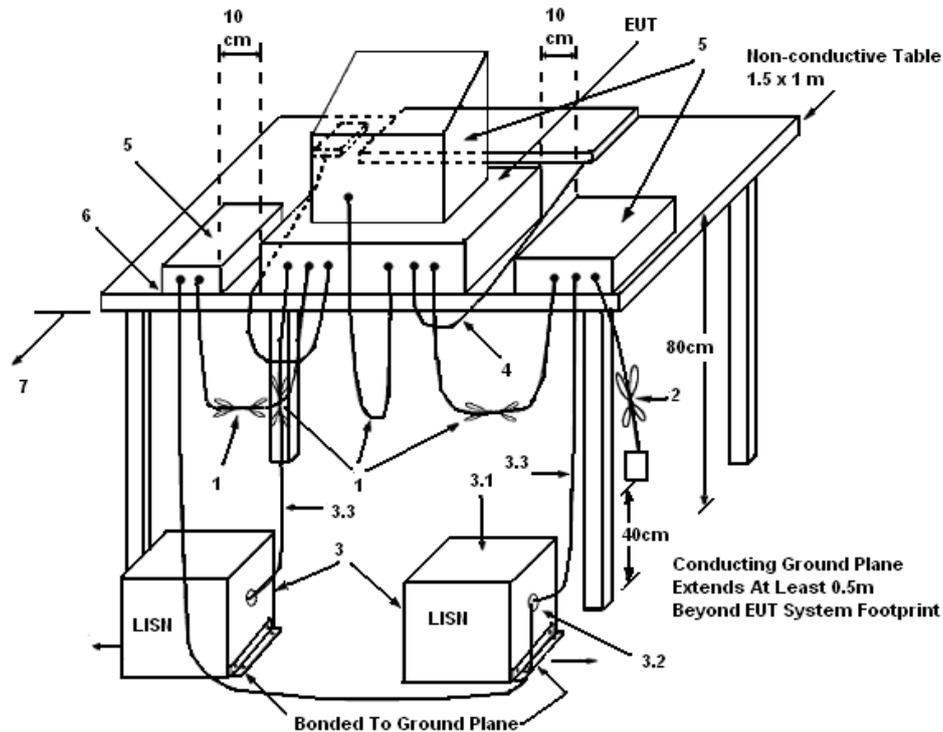
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

4.1.4. Test Setup Layout



LEGEND:

- (1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- (2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- (3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω . LISN can be placed on top of, or immediately beneath, reference ground plane.
 - (3.1) All other equipment powered from additional LISN(s).
 - (3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
 - (3.3) LISN at least 80 cm from nearest part of EUT chassis.
- (4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.
- (5) Non-EUT components of EUT system being tested.
- (6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
- (7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

4.1.5. Test Deviation

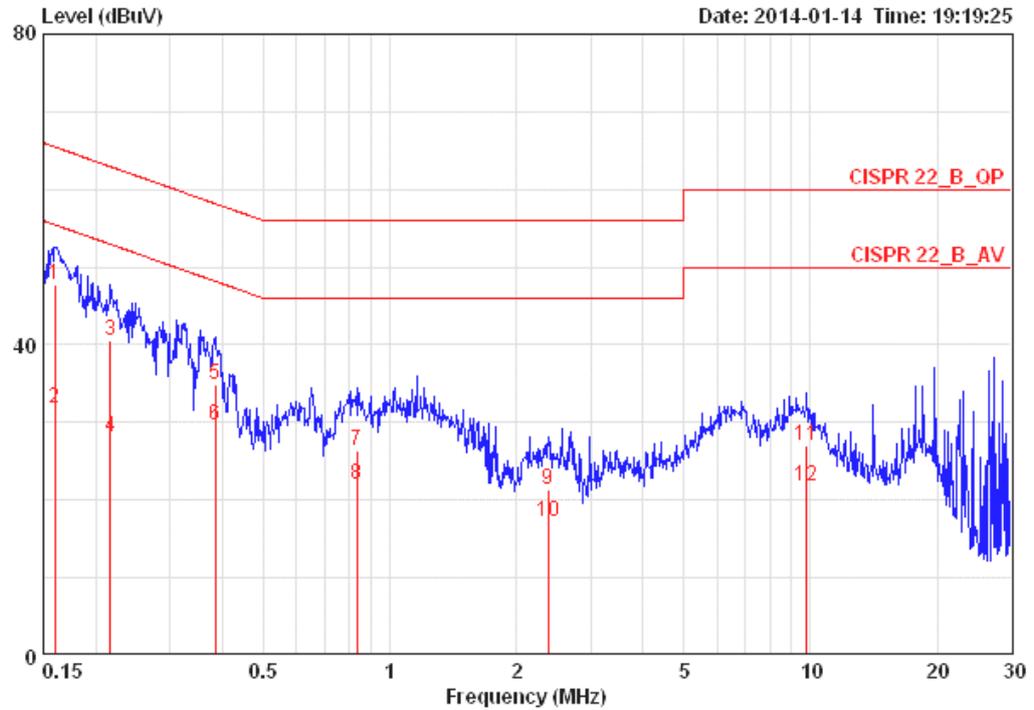
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

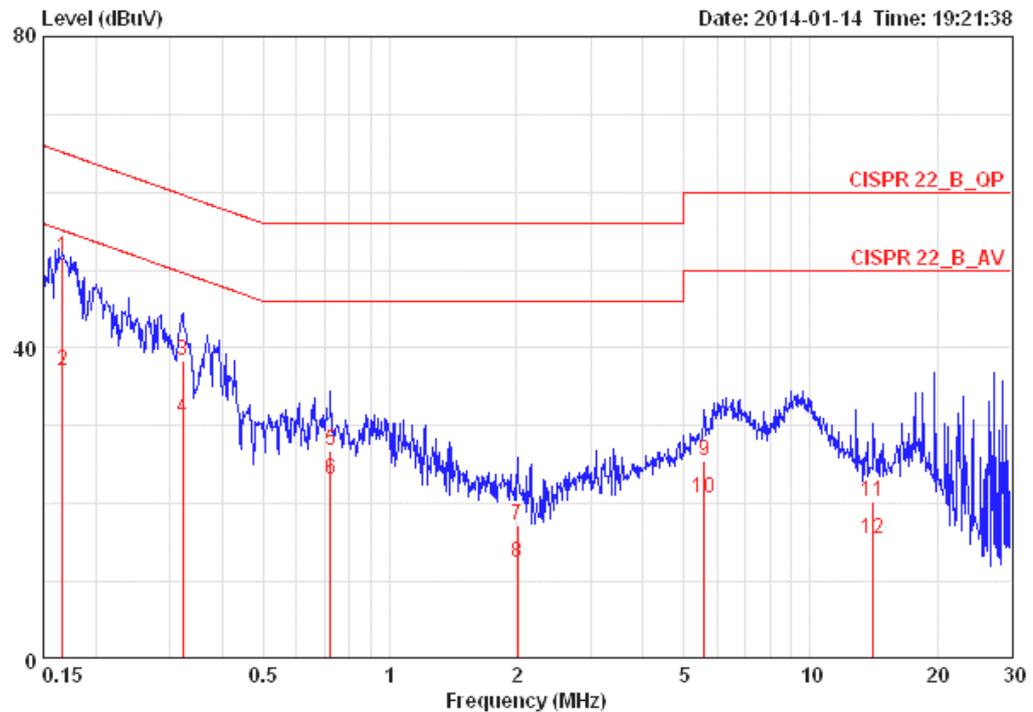
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	24°C	Humidity	55%
Test Engineer	Parody Lin	Phase	Line
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1	0.15985	47.81	-17.66	65.47	0.15	47.48	0.18	LINE	QP
2	0.15985	31.91	-23.56	55.47	0.15	31.58	0.18	LINE	AVERAGE
3	0.21620	40.45	-22.51	62.96	0.15	40.10	0.20	LINE	QP
4	0.21620	28.06	-24.90	52.96	0.15	27.71	0.20	LINE	AVERAGE
5	0.38519	34.88	-23.29	58.17	0.15	34.53	0.20	LINE	QP
6	0.38519	29.59	-18.58	48.17	0.15	29.24	0.20	LINE	AVERAGE
7	0.83488	26.43	-29.57	56.00	0.16	26.07	0.20	LINE	QP
8	0.83488	21.98	-24.02	46.00	0.16	21.62	0.20	LINE	AVERAGE
9	2.384	21.35	-34.65	56.00	0.21	20.90	0.24	LINE	QP
10	2.384	17.24	-28.76	46.00	0.21	16.79	0.24	LINE	AVERAGE
11	9.809	27.04	-32.96	60.00	0.37	26.33	0.34	LINE	QP
12	9.809	21.77	-28.23	50.00	0.37	21.06	0.34	LINE	AVERAGE

Temperature	24°C	Humidity	55%
Test Engineer	Parody Lin	Phase	Neutral
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit	LISN Line	Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dB	dBuV	dB		
1	0.16677	51.56	-13.56	65.12	0.07	51.30	0.19	NEUTRAL	QP	
2	0.16677	37.01	-18.11	55.12	0.07	36.75	0.19	NEUTRAL	AVERAGE	
3	0.32169	38.35	-21.31	59.66	0.07	38.08	0.20	NEUTRAL	QP	
4	0.32169	30.97	-18.69	49.66	0.07	30.70	0.20	NEUTRAL	AVERAGE	
5	0.72360	26.76	-29.24	56.00	0.08	26.48	0.20	NEUTRAL	QP	
6	0.72360	23.13	-22.87	46.00	0.08	22.85	0.20	NEUTRAL	AVERAGE	
7	2.012	17.15	-38.85	56.00	0.11	16.81	0.23	NEUTRAL	QP	
8	2.012	12.42	-33.58	46.00	0.11	12.08	0.23	NEUTRAL	AVERAGE	
9	5.594	25.46	-34.54	60.00	0.17	24.97	0.33	NEUTRAL	QP	
10	5.594	20.73	-29.27	50.00	0.17	20.24	0.33	NEUTRAL	AVERAGE	
11	14.138	20.28	-39.72	60.00	0.34	19.53	0.40	NEUTRAL	QP	
12	14.138	15.51	-34.49	50.00	0.34	14.76	0.40	NEUTRAL	AVERAGE	

Note:

Level = Read Level + LISN Factor + Cable Loss

4.2. 26dB Bandwidth and 99% Occupied Bandwidth Measurement

4.2.1. Limit

No restriction limits.

4.2.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

26dB Bandwidth	
Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 26dB Bandwidth
RBW	Approximately 1% of the emission bandwidth
VBW	VBW > RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto
99% Occupied Bandwidth	
Spectrum Parameters	Setting
Span	1.5 times to 5.0 times the OBW
RBW	1 % to 5 % of the OBW
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold

4.2.3. Test Procedures

For Radiated 26dB Bandwidth and 99% Occupied Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

4.2.4. Test Setup Layout

For Radiated 26dB Bandwidth and 99% Occupied Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.5.4.

4.2.5. Test Deviation

There is no deviation with the original standard.

4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

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

Temperature	22°C	Humidity	58%
Test Engineer	Benson Peng	Configurations	IEEE 802.11ac

For non-beamforming mode:

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
36	5180 MHz	20.32	18.08
40	5200 MHz	21.44	18.24
48	5240 MHz	35.20	18.56

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
38	5190 MHz	39.04	36.16
46	5230 MHz	76.16	38.40

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
42	5210 MHz	81.92	76.16

For beamforming mode:

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
36	5180 MHz	20.48	17.92
40	5200 MHz	20.48	17.92
48	5240 MHz	22.08	17.92

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
38	5190 MHz	39.36	36.48
46	5230 MHz	39.04	36.48

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
42	5210 MHz	81.28	76.16

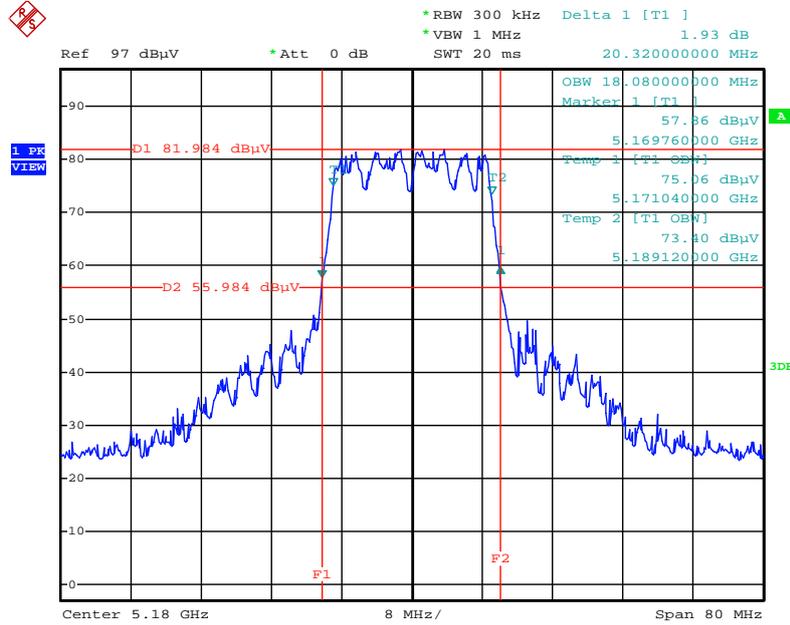
Temperature	22°C	Humidity	58%
Test Engineer	Benson Peng	Configurations	IEEE 802.11a

Configuration IEEE 802.11a / Chain 1 + Chain 2

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
36	5180 MHz	20.32	17.92
40	5200 MHz	20.32	18.08
48	5240 MHz	35.84	18.40

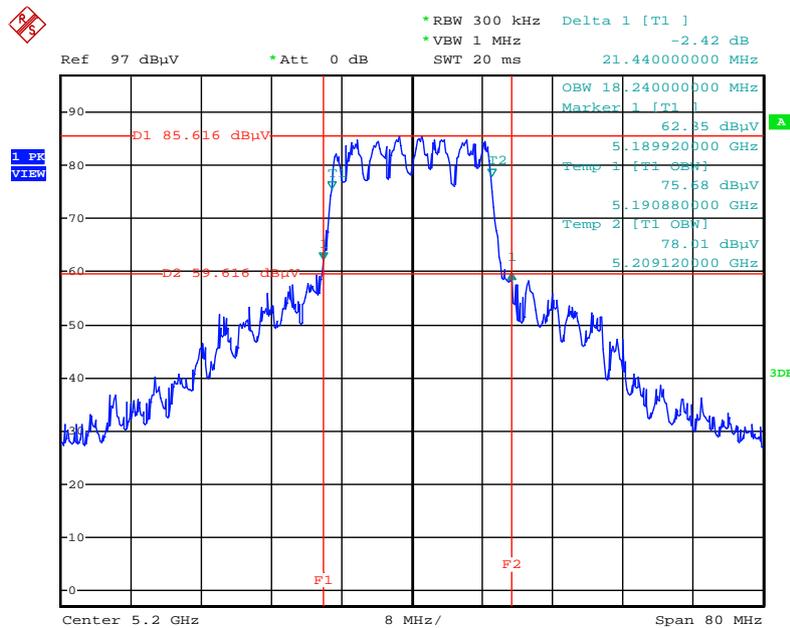
For non-beamforming mode:

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5180 MHz



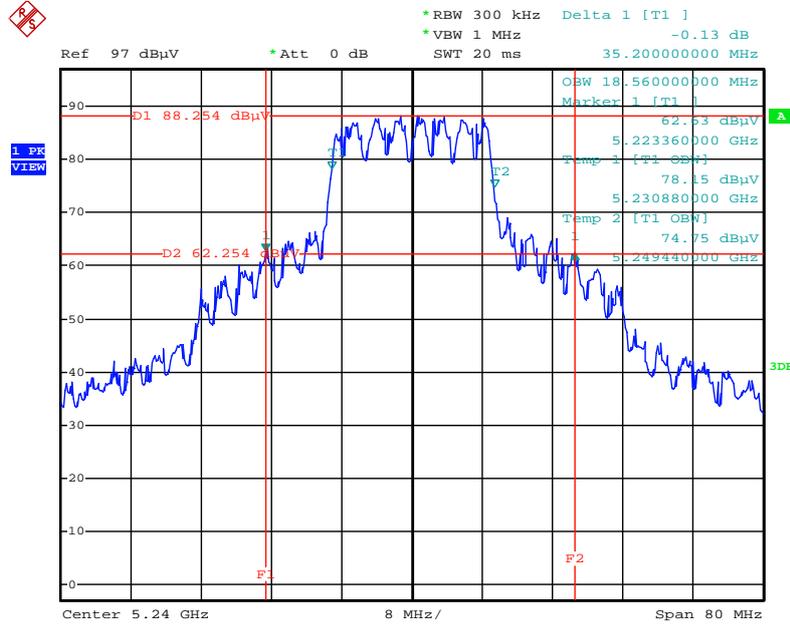
Date: 16.JUL.2014 18:18:45

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5200 MHz



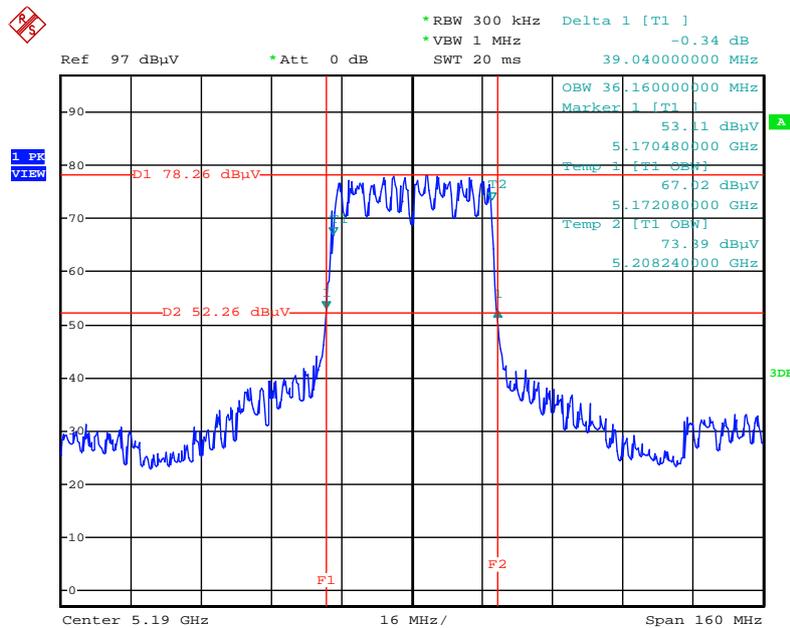
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26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5240 MHz



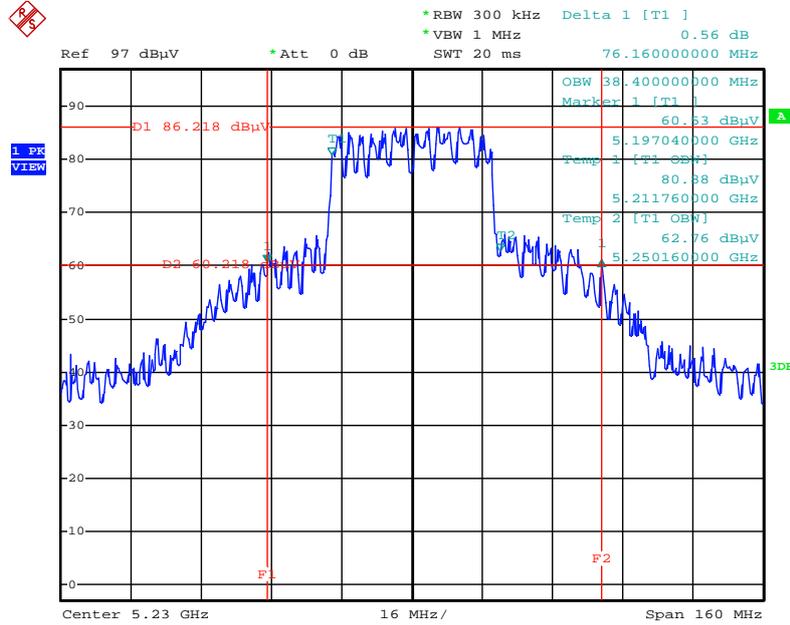
Date: 16.JUL.2014 18:18:05

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 / 5190 MHz



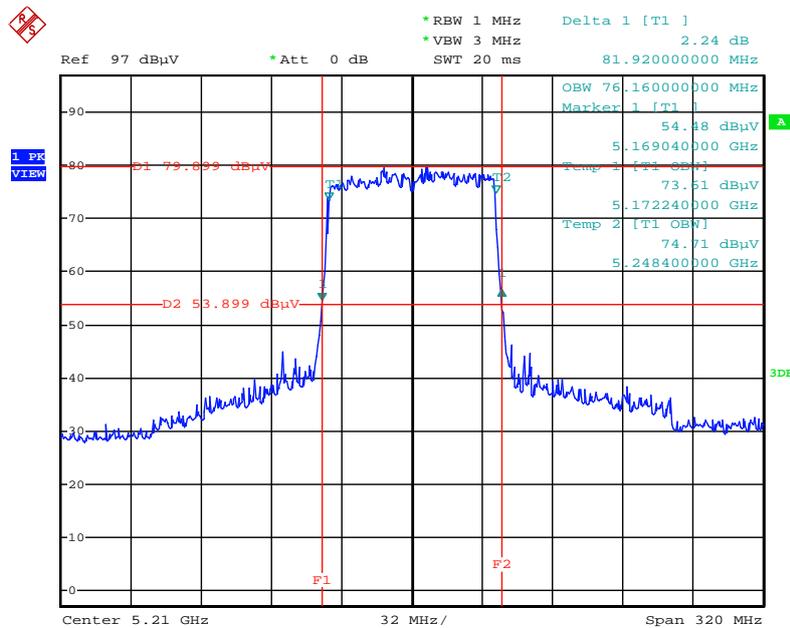
Date: 16.JUL.2014 18:19:20

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 / 5230 MHz



Date: 16.JUL.2014 18:19:40

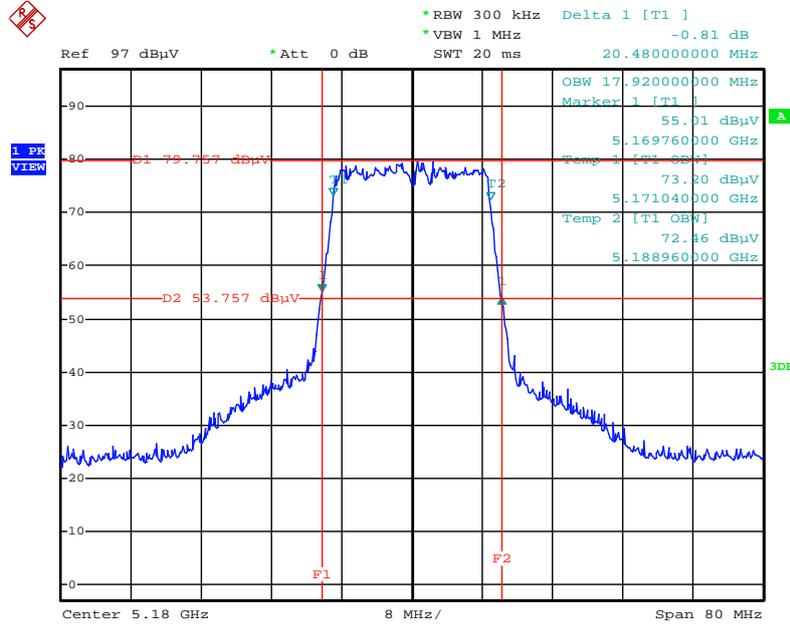
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 / 5210 MHz



Date: 16.JUL.2014 18:20:14

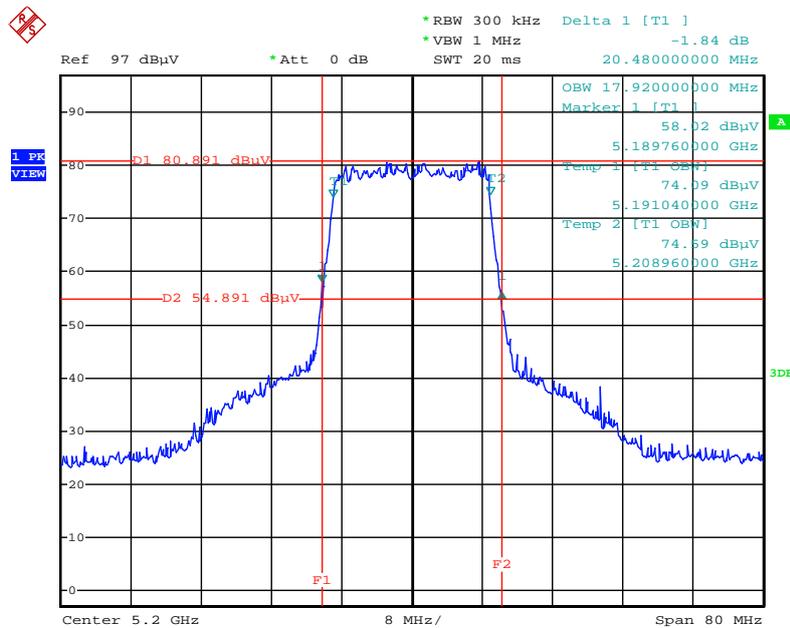
For beamforming mode:

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5180 MHz



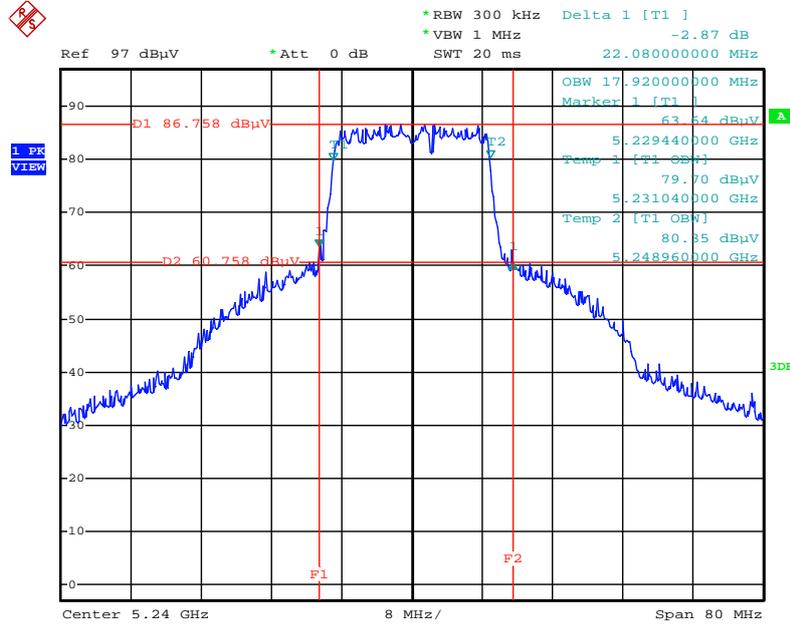
Date: 16.JUL.2014 18:24:46

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5200 MHz



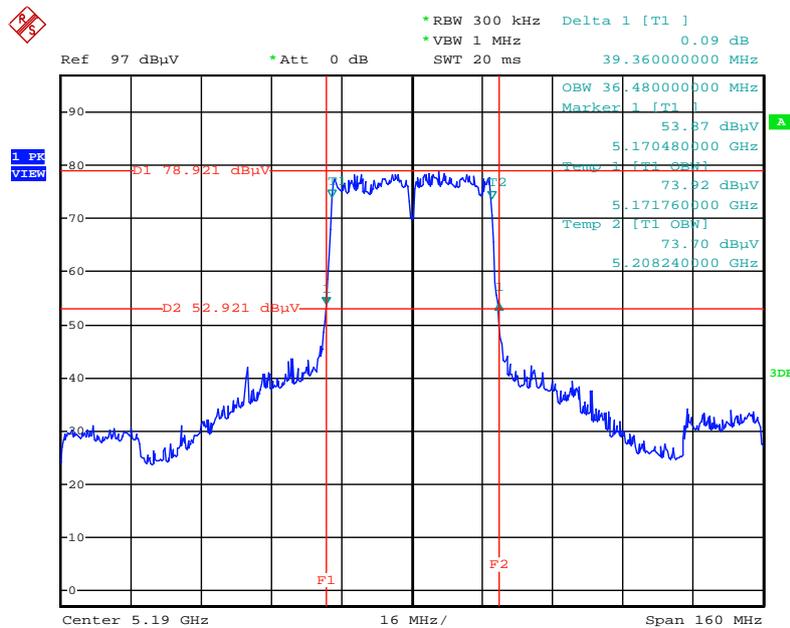
Date: 16.JUL.2014 18:25:07

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5240 MHz



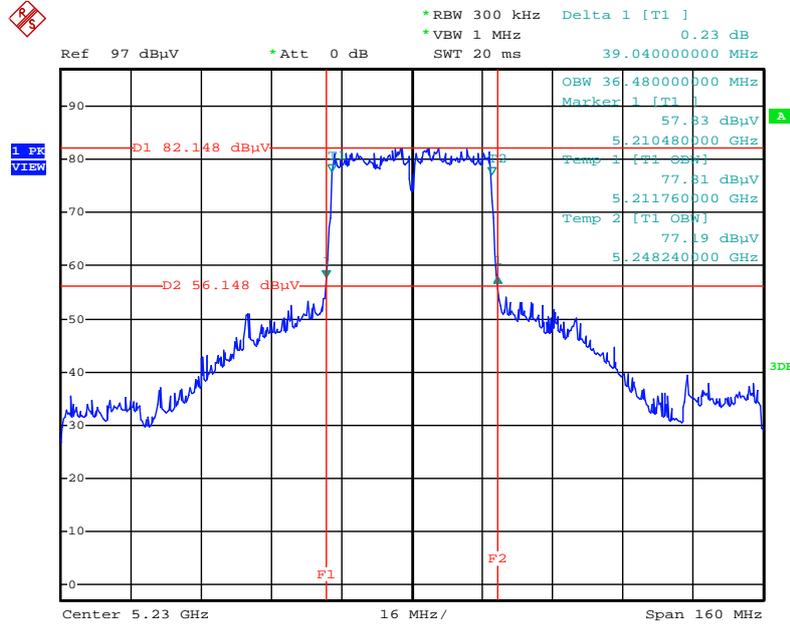
Date: 16.JUL.2014 18:25:28

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 / 5190 MHz



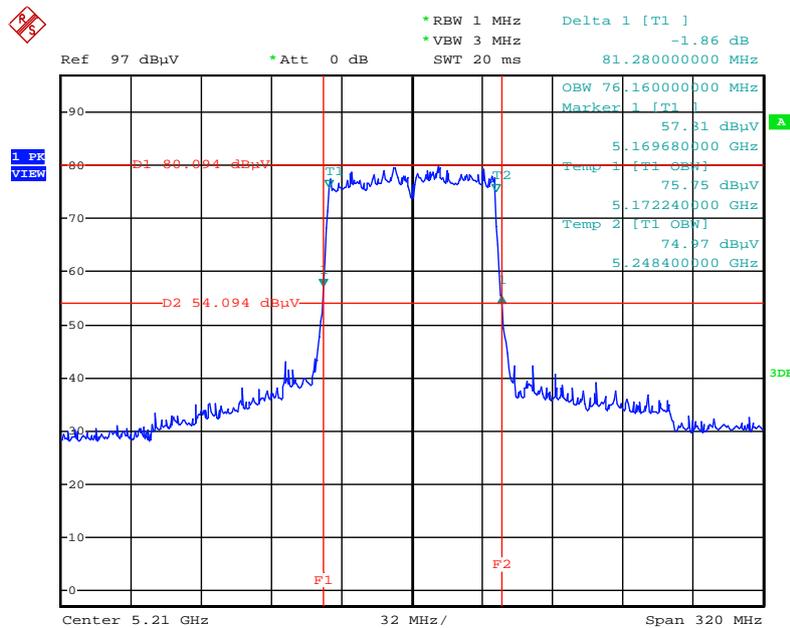
Date: 16.JUL.2014 18:23:44

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 / 5230 MHz



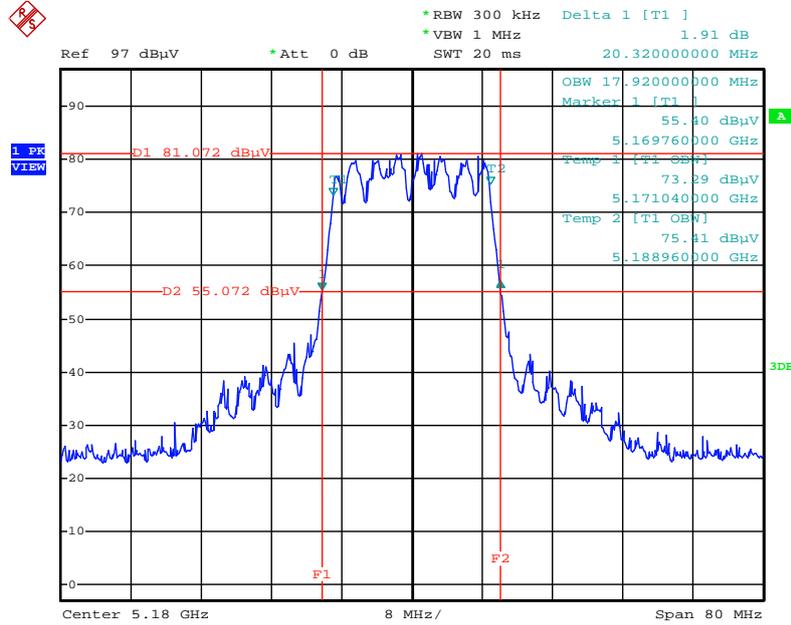
Date: 16.JUL.2014 18:24:04

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 / 5210 MHz



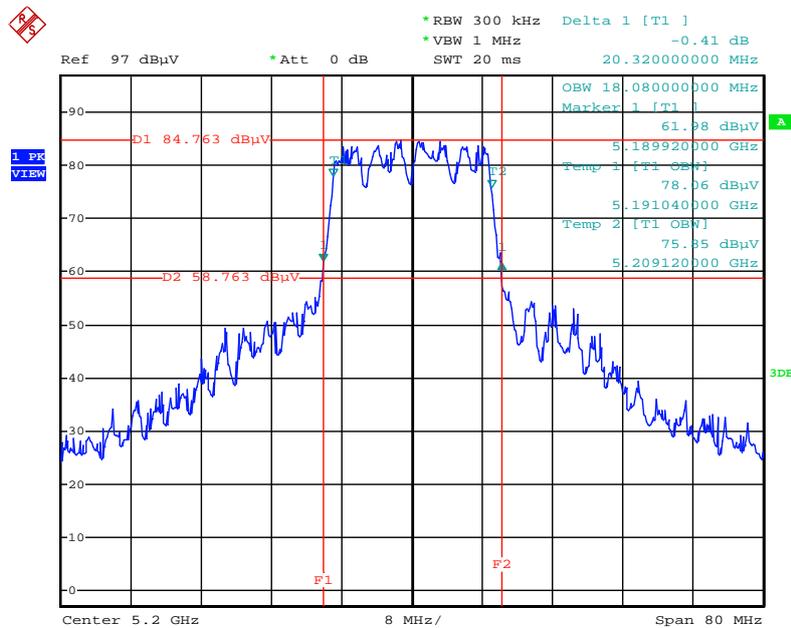
Date: 16.JUL.2014 18:22:04

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5180 MHz



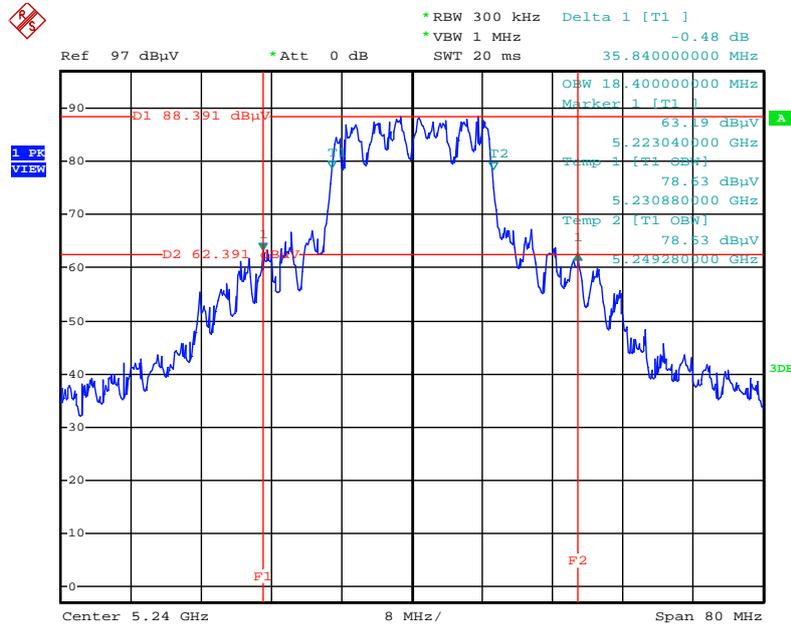
Date: 16.JUL.2014 18:16:41

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5200 MHz



Date: 16.JUL.2014 18:17:15

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5240 MHz



Date: 16.JUL.2014 18:17:38

4.3. Maximum Conducted Output Power Measurement

4.3.1. Limit

For the band 5.15~5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm) provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.3.2. Measuring Instruments and Setting

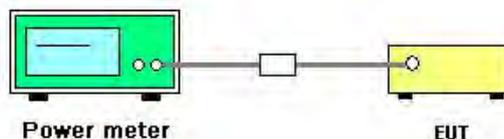
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Detector	AVERAGE

4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the power meter.
2. Test was performed in accordance with KDB789033 D02 v01 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (E) Maximum conducted output power =>3. Measurement using a Power Meter (PM) =>b) Method PM-G (Measurement using a gated RF average power meter).
3. Multiple antenna systems was performed in accordance with KDB662911 D01 v02r01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
4. When measuring maximum conducted output power with multiple antenna systems, add every result of the values by mathematic formula.

4.3.4. Test Setup Layout



4.3.5. Test Deviation

There is no deviation with the original standard.

4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of Maximum Conducted Output Power

Temperature	22°C	Humidity	58%
Test Engineer	Benson Peng	Configurations	IEEE 802.11ac
Test Date	Jul. 16, 2014		

For non-beamforming mode:

Configuration IEEE 802.11ac MCS0/Nss1 VHT20

Channel	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
36	5180 MHz	15.22	15.15	18.20	30.00	Complies
40	5200 MHz	18.59	18.51	21.56	30.00	Complies
48	5240 MHz	20.96	20.86	23.92	30.00	Complies

Configuration IEEE 802.11ac MCS0/Nss1 VHT40

Channel	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
38	5190 MHz	14.52	14.41	17.48	30.00	Complies
46	5230 MHz	21.78	21.59	24.70	30.00	Complies

Configuration IEEE 802.11ac MCS0/Nss1 VHT80

Channel	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
42	5210 MHz	13.33	13.27	16.31	30.00	Complies

For beamforming mode:

Configuration IEEE 802.11ac MCS0/Nss1 VHT20

Channel	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
36	5180 MHz	13.52	13.43	16.49	28.47	Complies
40	5200 MHz	14.62	14.51	17.58	28.47	Complies
48	5240 MHz	20.01	19.89	22.96	28.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ch}} \left\{ \sum_{k=1}^{N_{ant}} S_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power limit = $30 - (7.53 - 6) = 28.47\text{dBm}$

Configuration IEEE 802.11ac MCS0/Nss1 VHT40

Channel	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
38	5190 MHz	15.51	15.49	18.51	28.47	Complies
46	5230 MHz	18.72	18.63	21.69	28.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ch}} \left\{ \sum_{k=1}^{N_{ant}} S_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power limit = $30 - (7.53 - 6) = 28.47\text{dBm}$

Configuration IEEE 802.11ac MCS0/Nss1 VHT80

Channel	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
42	5210 MHz	12.86	12.81	15.85	28.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ch}} \left\{ \sum_{k=1}^{N_{ant}} S_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power limit = $30 - (7.53 - 6) = 28.47\text{dBm}$

Temperature	22°C	Humidity	58%
Test Engineer	Benson Peng	Configurations	IEEE 802.11a
Test Date	Jul. 16, 2014		

Configuration IEEE 802.11a

Channel	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
36	5180 MHz	14.02	13.92	16.98	30.00	Complies
40	5200 MHz	17.62	17.49	20.57	30.00	Complies
48	5240 MHz	21.02	20.89	23.97	30.00	Complies

4.4. Power Spectral Density Measurement

4.4.1. Limit

The power spectral density is defined as the highest level of power in dBm per MHz generated by the transmitter within the power envelope. The following table is power spectral density limits and decrease power density limit rule refer to section 4.3.1.

Frequency Range	Power Spectral Density limit (dBm/MHz)
5.15~5.25 GHz	17

4.4.2. Measuring Instruments and Setting

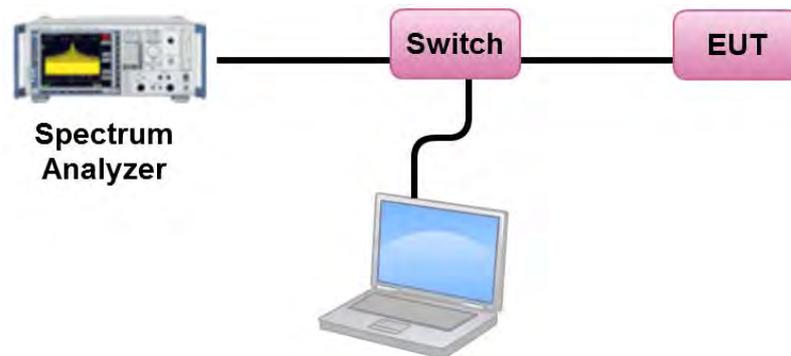
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Encompass the entire emissions bandwidth (EBW) of the signal
RBW	1000 kHz
VBW	3000 kHz
Detector	RMS
Trace	AVERAGE
Sweep Time	Auto
Trace Average	100 times

4.4.3. Test Procedures

1. The transmitter output (antenna port) was connected RF switch to the spectrum analyzer.
2. Test was performed in accordance with KDB789033 D02 v01 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (F) Maximum Power Spectral Density (PSD).
3. Multiple antenna systems was performed in accordance KDB662911 D01 v02r01 in-Band Power Spectral Density (PSD) Measurements (a) Measure and sum the spectra across the outputs.
4. When measuring first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3 and so on up to the Nth output to obtain the value for the first frequency bin of the summed spectrum. The summed spectrum value for each of the other frequency bins is computed in the same way.

4.4.4. Test Setup Layout



4.4.5. Test Deviation

There is no deviation with the original standard.

4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.4.7. Test Result of Power Spectral Density

Temperature	22°C	Humidity	58%
Test Engineer	Benson Peng	Configurations	IEEE 802.11ac
Test Date	Jul. 16, 2014		

For non-beamforming mode:

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
36	5180 MHz	4.64	15.47	Complies
40	5200 MHz	8.09	15.47	Complies
48	5240 MHz	10.46	15.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} S_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power density limit = $17 - (7.53 - 6) = 15.47\text{dBm/MHz}$

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
38	5190 MHz	0.99	15.47	Complies
46	5230 MHz	8.46	15.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} S_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power density limit = $17 - (7.53 - 6) = 15.47\text{dBm/MHz}$

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
42	5210 MHz	-3.27	15.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} S_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power density limit = $17 - (7.53 - 6) = 15.47\text{dBm/MHz}$

For beamforming mode:

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
36	5180 MHz	3.05	15.47	Complies
40	5200 MHz	4.12	15.47	Complies
48	5240 MHz	9.52	15.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power density limit = $17 - (7.53 - 6) = 15.47\text{dBm/MHz}$

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
38	5190 MHz	2.10	15.47	Complies
46	5230 MHz	5.46	15.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power density limit = $17 - (7.53 - 6) = 15.47\text{dBm/MHz}$

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
42	5210 MHz	-3.87	15.47	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power density limit = $17 - (7.53 - 6) = 15.47\text{dBm/MHz}$

Temperature	22°C	Humidity	58%
Test Engineer	Benson Peng	Configurations	IEEE 802.11a
Test Date	Jul. 16, 2014		

Configuration IEEE 802.11a / Chain 1 + Chain 2

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
36	5180 MHz	3.44	15.47	Complies
40	5200 MHz	7.05	15.47	Complies
48	5240 MHz	10.62	15.47	Complies

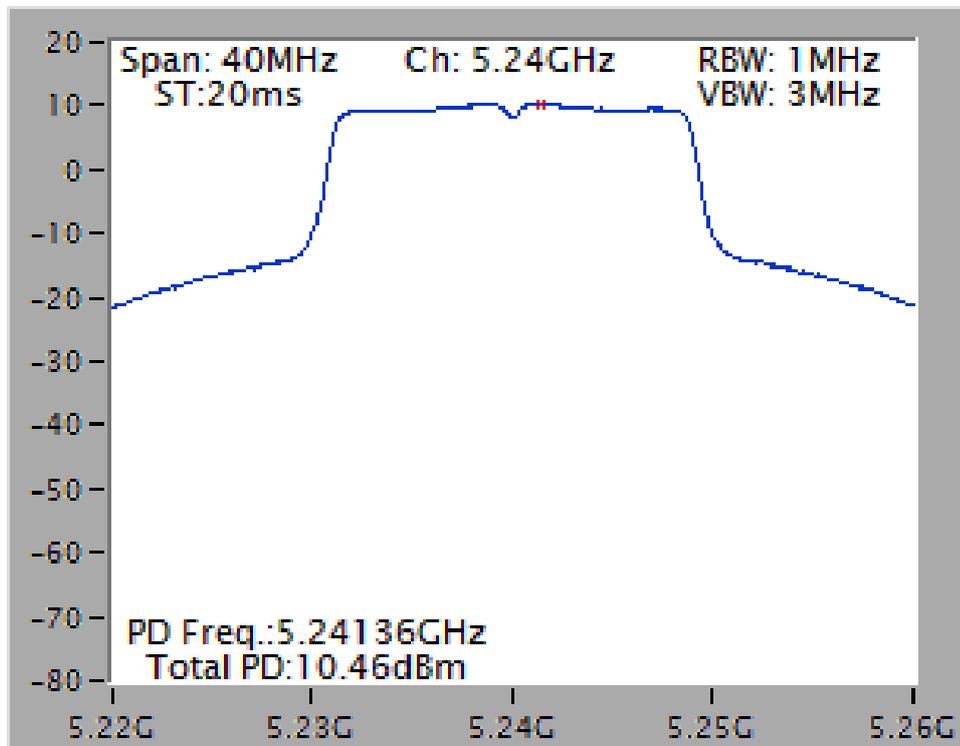
Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left\{ \sum_{j=1}^{N_{ELEM}} |S_{i,j,k}|^2 \right\}}{N_{ANT}} \right] = 7.53\text{dBi} > 6\text{dBi}$, so power density limit = $17 - (7.53 - 6) = 15.47\text{dBm/MHz}$

Note: All the test values were listed in the report.

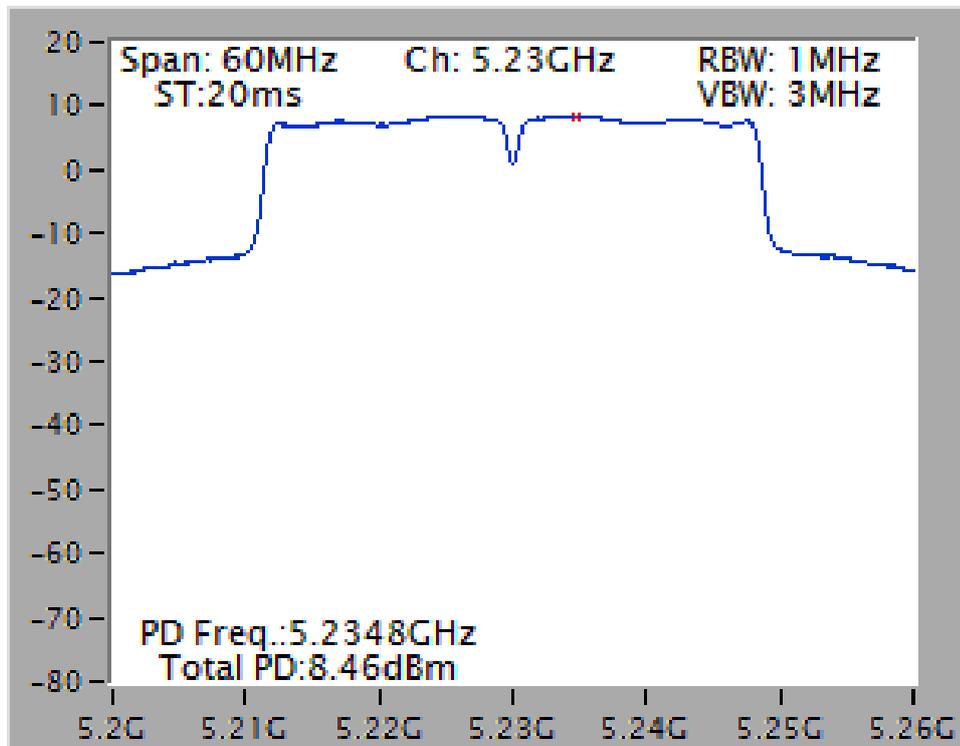
For plots, only the channel with worse result was shown.

For non-beamforming mode:

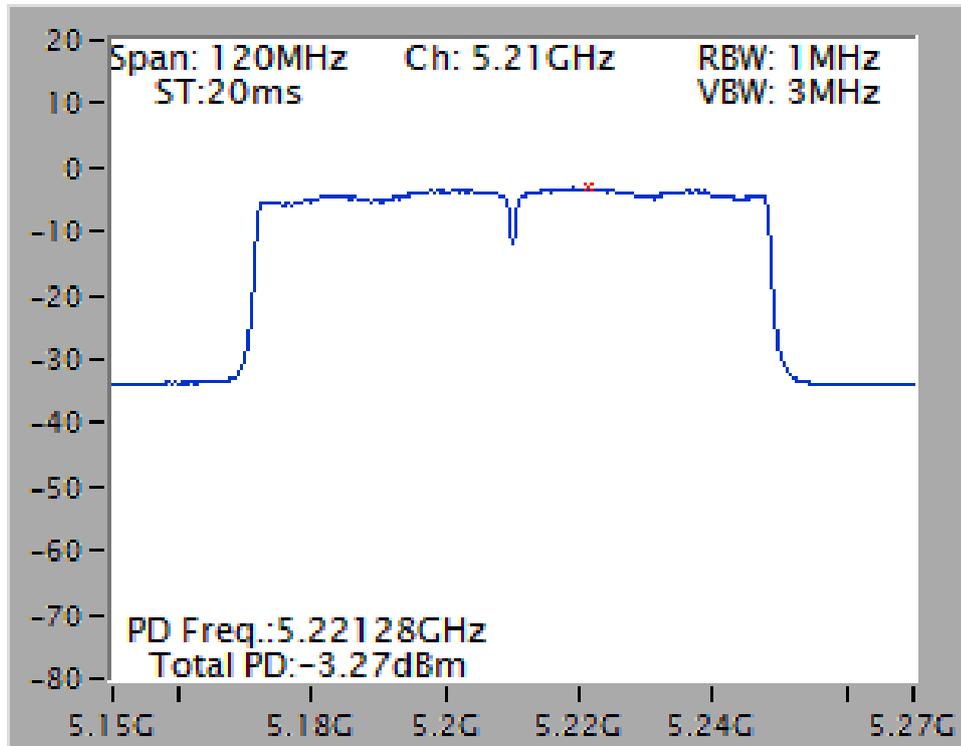
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5240 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 / 5230 MHz

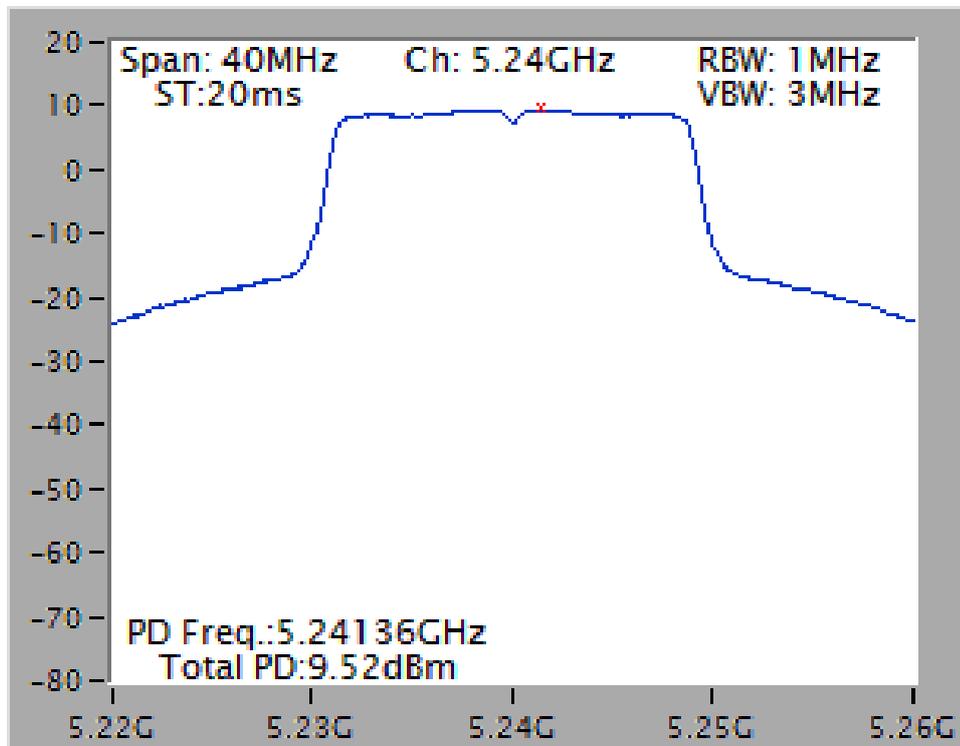


Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 / 5210 MHz

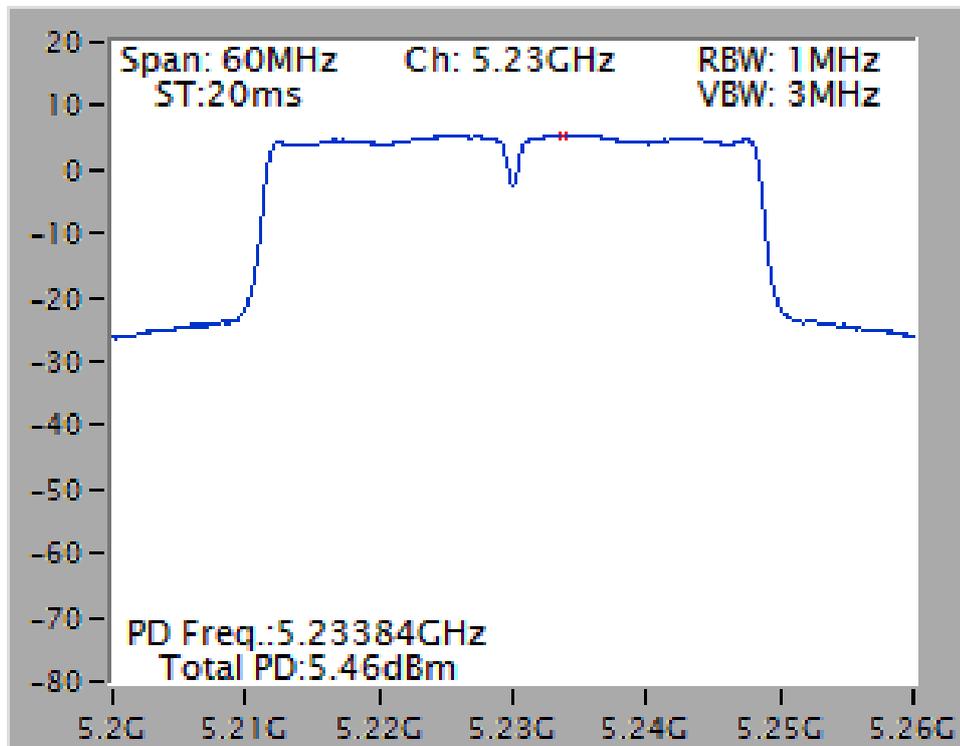


For beamforming mode:

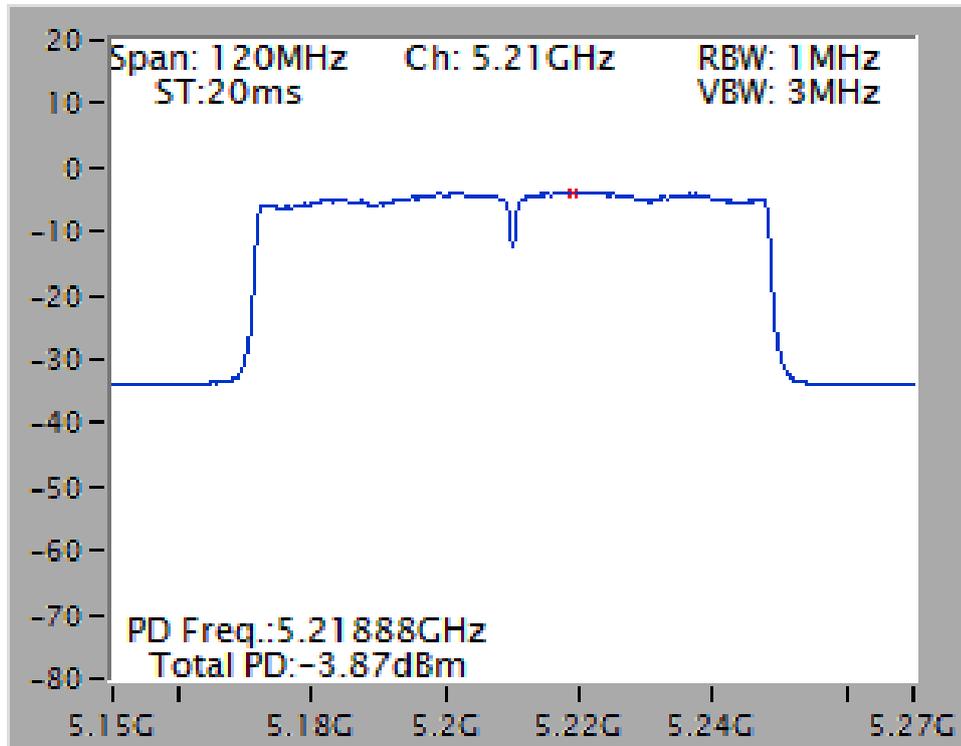
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5240 MHz



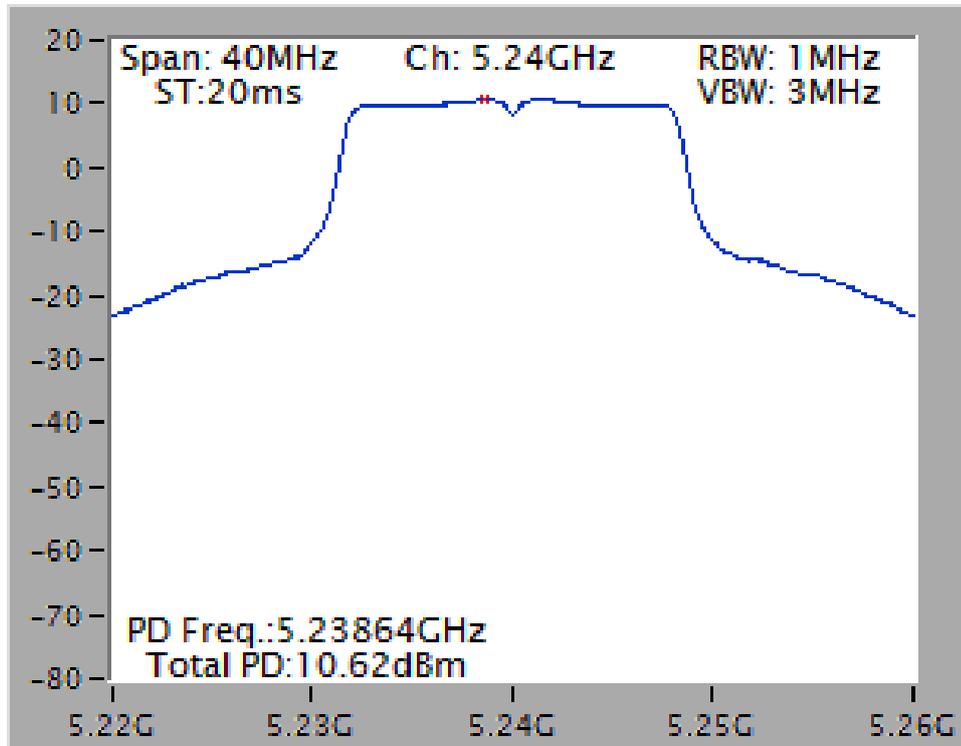
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 / 5230 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 / 5210 MHz



Power Density Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5240 MHz



4.5. Radiated Emissions Measurement

4.5.1. Limit

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.

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 (micorvolts/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

4.5.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	40 GHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, Please refer to section 3.10 for Average
RBW / VBW (Emission in non-restricted band)	1MHz / 3MHz for peak

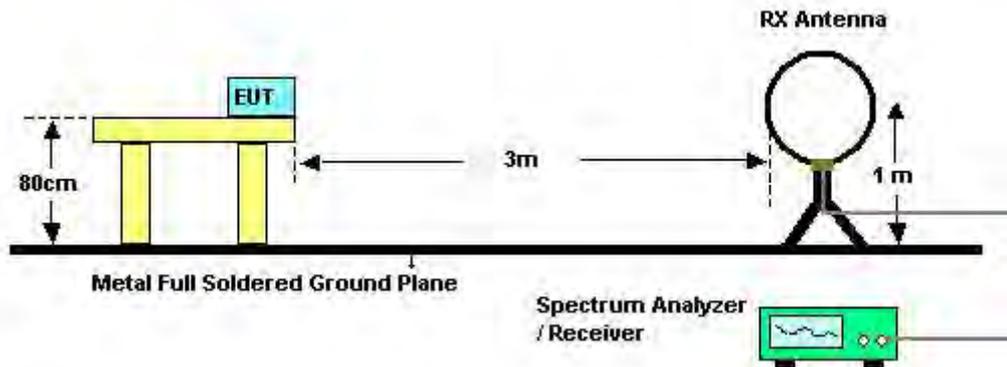
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.5.3. Test Procedures

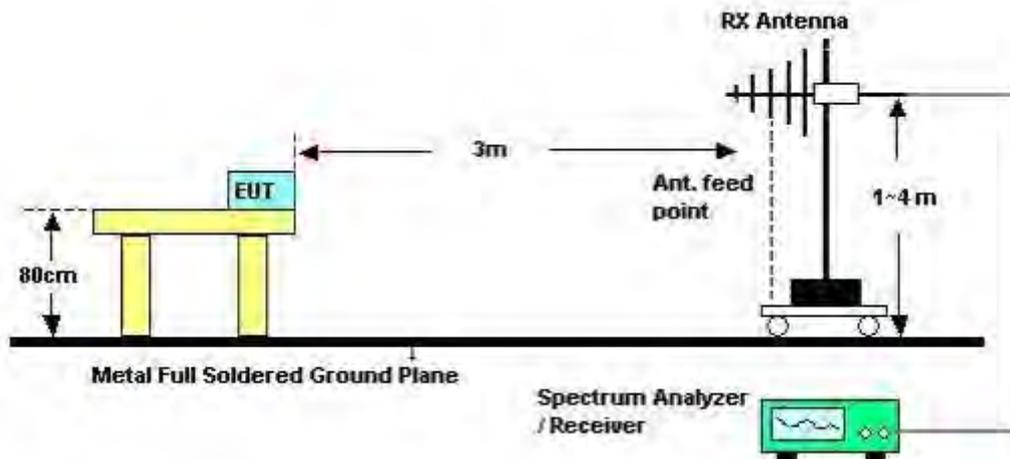
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

4.5.4. Test Setup Layout

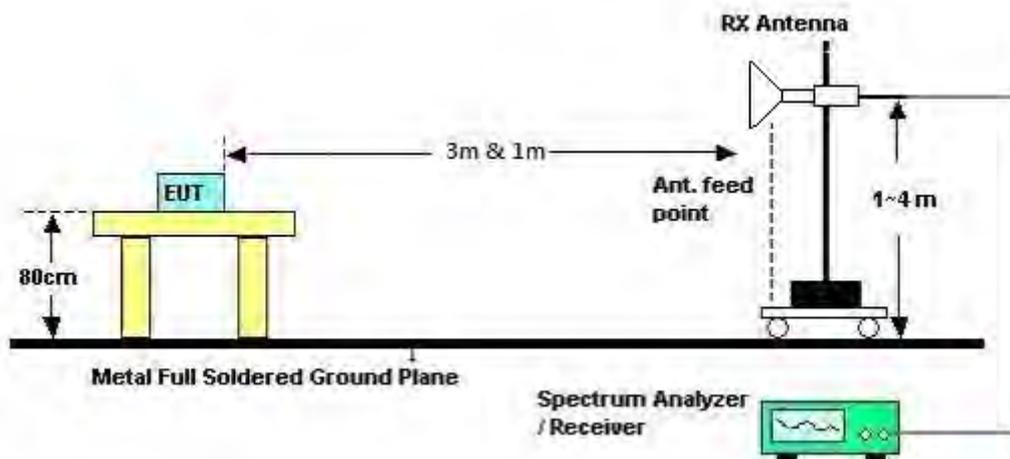
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



4.5.5. Test Deviation

There is no deviation with the original standard.

4.5.6. EUT Operation during Test

For Non-beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

For beamforming mode:

The EUT was programmed to be in beamforming transmitting mode.

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

Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	Normal Link
Test Date	Jan. 29, 2014	Test Mode	Mode 1

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

Note:

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

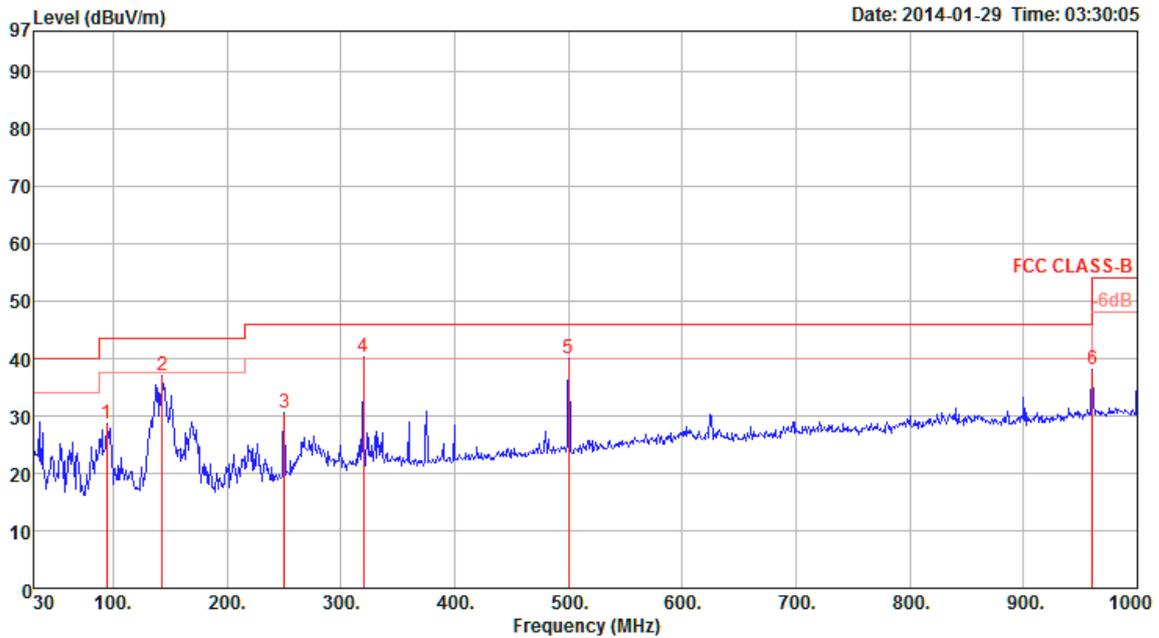
Distance extrapolation factor = $40 \log(\text{specific distance} / \text{test distance})$ (dB);

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

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

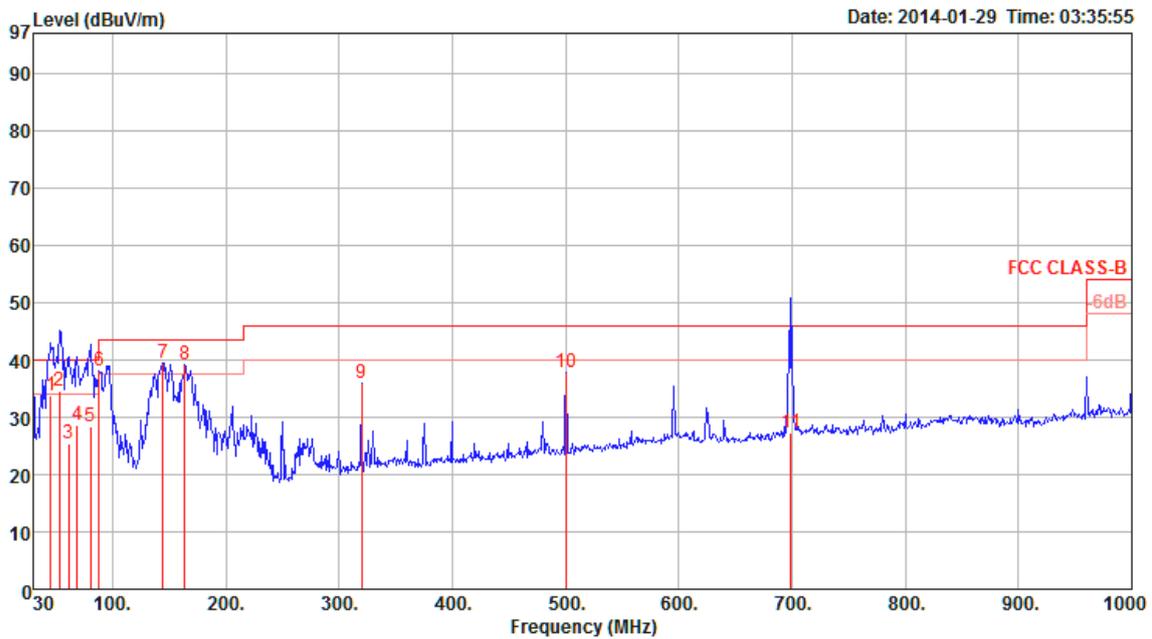
Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	Normal Link
Test Mode	Mode 1		

Horizontal



	Freq	Level	Limit	Over	Read	Cable	Preamp		Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	94.02	28.51	43.50	-14.99	44.79	1.43	27.85	-16.28	Peak	0	400	HORIZONTAL
2	143.49	37.11	43.50	-6.39	51.14	1.74	27.54	-14.03	Peak	0	400	HORIZONTAL
3	250.19	30.47	46.00	-15.53	42.14	2.38	26.95	-11.67	Peak	0	400	HORIZONTAL
4	320.03	40.15	46.00	-5.85	50.02	2.63	26.91	-9.87	Peak	0	400	HORIZONTAL
5	500.45	39.88	46.00	-6.12	46.63	3.38	27.93	-6.75	Peak	0	400	HORIZONTAL
6	960.23	38.14	54.00	-15.86	37.77	4.86	26.45	0.37	Peak	0	400	HORIZONTAL

Vertical



	Freq	Level	Limit	Over	Read	Cable	Preamp			T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	Remark	deg	cm	
1	45.52	33.71	40.00	-6.29	50.20	1.00	27.94	-16.49	QP	177	100	VERTICAL
2	53.28	34.55	40.00	-5.45	53.20	1.10	27.91	-18.65	QP	272	100	VERTICAL
3	61.04	25.39	40.00	-14.61	45.30	1.18	27.98	-19.91	QP	114	217	VERTICAL
4	68.80	28.73	40.00	-11.27	48.60	1.26	27.94	-19.87	QP	64	149	VERTICAL
5	80.44	28.25	40.00	-11.75	47.30	1.35	27.90	-19.05	QP	84	159	VERTICAL
6	88.20	37.97	43.50	-5.53	55.51	1.40	27.88	-17.54	Peak	0	100	VERTICAL
7	144.46	39.38	43.50	-4.12	53.47	1.75	27.53	-14.09	Peak	0	100	VERTICAL
8	163.86	39.19	43.50	-4.31	54.22	1.90	27.41	-15.03	Peak	0	100	VERTICAL
9	320.03	35.81	46.00	-10.19	45.68	2.63	26.91	-9.87	Peak	0	100	VERTICAL
10	500.45	37.74	46.00	-8.26	44.49	3.38	27.93	-6.75	Peak	0	100	VERTICAL
11	699.30	27.36	46.00	-18.64	30.30	4.16	27.09	-2.94	QP	353	100	VERTICAL

Note:

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

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.5.9. Results for Radiated Emissions (1GHz~40GHz)

For non-beamforming mode:

Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 36 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15539.88	51.24	74.00	-22.76	42.77	6.13	37.65	35.31	Peak	100	356	HORIZONTAL
2	15541.04	38.68	54.00	-15.32	30.21	6.13	37.65	35.31	Average	100	356	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15534.00	50.53	74.00	-23.47	41.96	6.13	37.73	35.29	Peak	100	293	VERTICAL
2	15537.12	38.18	54.00	-15.82	29.61	6.13	37.73	35.29	Average	100	293	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 40 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15600.32	50.96	74.00	-23.04	42.57	6.13	37.60	35.34	Peak	100	215	HORIZONTAL
2	15602.24	42.71	54.00	-11.29	34.32	6.13	37.60	35.34	Average	100	215	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15604.28	52.63	74.00	-21.37	44.24	6.13	37.60	35.34	Peak	100	337	VERTICAL
2	15604.60	41.92	54.00	-12.08	33.53	6.13	37.60	35.34	Average	100	337	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 48 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor		cm	deg	
1	15717.72	45.25	54.00	-8.75	37.02	6.14	37.48	35.39	Average	101	319	HORIZONTAL
2	15720.32	57.23	74.00	-16.77	49.00	6.14	37.48	35.39	Peak	101	319	HORIZONTAL

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor		cm	deg	
1	15718.20	41.98	54.00	-12.02	33.75	6.14	37.48	35.39	Average	100	256	VERTICAL
2	15723.44	53.31	74.00	-20.69	45.08	6.14	37.48	35.39	Peak	100	256	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 38 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15569.91	51.11	74.00	-22.89	42.68	6.13	37.63	35.33	Peak	101	210	HORIZONTAL
2	15570.44	38.10	54.00	-15.90	29.67	6.13	37.63	35.33	Average	101	210	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15562.24	50.09	74.00	-23.91	41.62	6.13	37.65	35.31	Peak	101	303	VERTICAL
2	15573.12	37.36	54.00	-16.64	28.95	6.13	37.61	35.33	Average	101	303	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 46 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15680.72	44.61	54.00	-9.39	36.33	6.14	37.51	35.37	Average	100	311	HORIZONTAL
2	15704.40	55.63	74.00	-18.37	47.38	6.14	37.49	35.38	Peak	100	311	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15569.76	50.39	74.00	-23.61	41.94	6.13	37.65	35.33	Peak	100	246	VERTICAL
2	15570.22	39.65	54.00	-14.35	31.20	6.13	37.65	35.33	Average	100	246	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 42 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	4630.62	41.97	54.00	-12.03	41.19	3.21	32.64	35.07	Average	100	197	HORIZONTAL
2	4631.08	33.40	54.00	-20.60	32.62	3.21	32.64	35.07	Average	100	197	HORIZONTAL
3	15599.92	38.08	54.00	-15.92	29.69	6.13	37.60	35.34	Average	100	293	HORIZONTAL
4	15637.68	50.27	74.00	-23.73	41.92	6.14	37.56	35.35	Peak	100	293	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	4631.10	46.87	74.00	-27.13	46.09	3.21	32.64	35.07	Peak	100	266	VERTICAL
2	4631.14	41.18	54.00	-12.82	40.40	3.21	32.64	35.07	Average	100	266	VERTICAL
3	15605.90	38.99	54.00	-15.01	30.62	6.13	37.58	35.34	Average	100	222	VERTICAL
4	15616.40	50.26	74.00	-23.74	41.90	6.13	37.58	35.35	Peak	100	222	VERTICAL

Note:

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

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.



For beamforming mode:

Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 36 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15538.84	51.82	74.00	-22.18	43.35	6.13	37.65	35.31	Peak	100	235	HORIZONTAL
2	15543.86	39.50	54.00	-14.50	31.03	6.13	37.65	35.31	Average	100	235	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15535.48	52.27	74.00	-21.73	43.70	6.13	37.73	35.29	Peak	100	24	VERTICAL
2	15541.30	39.44	54.00	-14.56	30.93	6.13	37.69	35.31	Average	100	24	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 40 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15556.22	52.15	74.00	-21.85	43.70	6.13	37.63	35.31	Peak	100	98	HORIZONTAL
2	15557.26	39.13	54.00	-14.87	30.68	6.13	37.63	35.31	Average	100	98	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15556.48	51.48	74.00	-22.52	43.01	6.13	37.65	35.31	Peak	100	289	VERTICAL
2	15562.06	39.09	54.00	-14.91	30.62	6.13	37.65	35.31	Average	100	289	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 48 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15717.50	55.60	74.00	-18.40	47.37	6.14	37.48	35.39	Peak	100	315	HORIZONTAL
2	15722.94	43.42	54.00	-10.58	35.19	6.14	37.48	35.39	Average	100	315	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15717.40	40.74	54.00	-13.26	32.51	6.14	37.48	35.39	Average	100	358	VERTICAL
2	15720.96	54.09	74.00	-19.91	45.86	6.14	37.48	35.39	Peak	100	358	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 38 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15567.28	50.97	74.00	-23.03	42.54	6.13	37.63	35.33	Peak	100	112	HORIZONTAL
2	15573.34	39.20	54.00	-14.80	30.79	6.13	37.61	35.33	Average	100	112	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15572.04	51.35	74.00	-22.65	42.94	6.13	37.61	35.33	Peak	100	351	VERTICAL
2	15573.18	38.79	54.00	-15.21	30.38	6.13	37.61	35.33	Average	100	351	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 46 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15690.78	40.17	54.00	-13.83	31.90	6.14	37.51	35.38	Average	100	65	HORIZONTAL
2	15693.48	52.74	74.00	-21.26	44.49	6.14	37.49	35.38	Peak	100	65	HORIZONTAL

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15690.96	50.93	74.00	-23.07	42.66	6.14	37.51	35.38	Peak	100	21	VERTICAL
2	15693.96	39.06	54.00	-14.94	30.81	6.14	37.49	35.38	Average	100	21	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 42 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15631.78	38.56	54.00	-15.44	30.21	6.14	37.56	35.35	Average	100	257	HORIZONTAL
2	15634.22	51.38	74.00	-22.62	43.03	6.14	37.56	35.35	Peak	100	257	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15625.00	38.68	54.00	-15.32	30.33	6.14	37.56	35.35	Average	100	6	VERTICAL
2	15634.46	51.26	74.00	-22.74	42.91	6.14	37.56	35.35	Peak	100	6	VERTICAL

Note:

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

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11a CH 36 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor		cm	deg	
1	15536.12	40.44	54.00	-13.56	31.93	6.13	37.67	35.29	Average	100	268	HORIZONTAL
2	15539.24	50.48	74.00	-23.52	42.01	6.13	37.65	35.31	Peak	100	268	HORIZONTAL

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor		cm	deg	
1	15534.96	37.86	54.00	-16.14	29.29	6.13	37.73	35.29	Average	100	322	VERTICAL
2	15544.00	50.41	74.00	-23.59	41.90	6.13	37.69	35.31	Peak	100	322	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11a CH 40 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15600.04	42.59	54.00	-11.41	34.20	6.13	37.60	35.34	Average	100	320	HORIZONTAL
2	15601.68	54.50	74.00	-19.50	46.11	6.13	37.60	35.34	Peak	100	320	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15597.36	51.07	74.00	-22.93	42.68	6.13	37.60	35.34	Peak	100	285	VERTICAL
2	15600.40	40.35	54.00	-13.65	31.96	6.13	37.60	35.34	Average	100	285	VERTICAL



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11a CH 48 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15714.08	57.57	74.00	-16.43	49.33	6.14	37.48	35.38	Peak	100	318	HORIZONTAL
2	15720.08	45.25	54.00	-8.75	37.02	6.14	37.48	35.39	Average	100	318	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	15716.52	41.50	54.00	-12.50	33.27	6.14	37.48	35.39	Average	100	250	VERTICAL
2	15717.56	53.66	74.00	-20.34	45.43	6.14	37.48	35.39	Peak	100	250	VERTICAL

Note:

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

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.6. Band Edge Emissions Measurement

4.6.1. Limit

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.

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 (micovolts/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

4.6.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1 MHz / 3MHz for Peak, Please refer to section 3.10 for Average
RBW / VBW (Emission in non-restricted band)	1 MHz / 3MHz for Peak

4.6.3. Test Procedures

- The test procedure is the same as section 4.5.3, only the frequency range investigated is limited to 100MHz around bandedges.

4.6.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.5.4.

4.6.5. Test Deviation

There is no deviation with the original standard.

4.6.6. EUT Operation during Test

For Non-beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

For beamforming mode:

The EUT was programmed to be in beamforming transmitting mode.

4.6.7. Test Result of Band Edge and Fundamental Emissions

For non-beamforming mode:

Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 36, 40, 48 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Channel 36

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp		A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5099.20	52.95	54.00	-1.05	15.95	3.42	33.58	0.00	100	289	VERTICAL
2	5099.20	63.90	74.00	-10.10	26.90	3.42	33.58	0.00	100	289	VERTICAL
3	5173.60	100.67			63.53	3.44	33.70	0.00	100	289	VERTICAL
4	5174.00	111.53			74.39	3.44	33.70	0.00	100	289	VERTICAL

Item 3, 4 are the fundamental frequency at 5180 MHz.

Channel 40

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp		A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5111.60	52.82	54.00	-1.18	15.79	3.42	33.61	0.00	100	299	VERTICAL
2	5112.00	62.89	74.00	-11.11	25.86	3.42	33.61	0.00	100	299	VERTICAL
3	5198.80	115.90			78.69	3.45	33.76	0.00	100	299	VERTICAL
4	5201.60	104.13			66.92	3.45	33.76	0.00	100	299	VERTICAL

Item 3, 4 are the fundamental frequency at 5200 MHz.

Channel 48

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp		A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5126.60	44.46	54.00	-9.54	7.39	3.43	33.64	0.00	100	300	VERTICAL
2	5127.20	57.19	74.00	-16.81	20.12	3.43	33.64	0.00	100	300	VERTICAL
3	5239.40	118.05			80.77	3.46	33.82	0.00	100	300	VERTICAL
4	5241.80	107.32			70.04	3.46	33.82	0.00	100	300	VERTICAL
5	5365.00	47.86	54.00	-6.14	10.31	3.49	34.06	0.00	100	300	VERTICAL
6	5367.40	60.02	74.00	-13.98	22.47	3.49	34.06	0.00	100	300	VERTICAL

Item 3, 4 are the fundamental frequency at 5240 MHz.

Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 38, 46 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Channel 38

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5149.20	70.42	74.00	-3.58	33.32	3.43	33.67	0.00 Peak	100	302	VERTICAL
2	5149.60	52.97	54.00	-1.03	15.87	3.43	33.67	0.00 Average	100	302	VERTICAL
3	5186.80	96.06			58.89	3.44	33.73	0.00 Average	100	302	VERTICAL
4	5186.80	108.89			71.72	3.44	33.73	0.00 Peak	100	302	VERTICAL

Item 3, 4 are the fundamental frequency at 5190 MHz.

Channel 46

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5148.80	52.69	54.00	-1.31	15.59	3.43	33.67	0.00 Average	100	11	VERTICAL
2	5148.80	65.90	74.00	-8.10	28.80	3.43	33.67	0.00 Peak	100	11	VERTICAL
3	5233.60	104.07			66.79	3.46	33.82	0.00 Average	100	11	VERTICAL
4	5233.60	114.61			77.33	3.46	33.82	0.00 Peak	100	11	VERTICAL

Item 3, 4 are the fundamental frequency at 5230 MHz.



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 42 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Channel 42

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	5146.00	52.97	54.00	-1.03	15.87	3.43	33.67	0.00	Average	100	287	VERTICAL
2	5146.00	68.37	74.00	-5.63	31.27	3.43	33.67	0.00	Peak	100	287	VERTICAL
3	5221.00	91.18			53.93	3.46	33.79	0.00	Average	100	287	VERTICAL
4	5221.00	104.65			67.40	3.46	33.79	0.00	Peak	100	287	VERTICAL

Item 3, 4 are the fundamental frequency at 5210 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m)

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

For beamforming mode:

Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 36, 40, 48 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Channel 36

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	5099.00	63.56	74.00	-10.44	26.56	3.42	33.58	0.00	Peak	100	75	VERTICAL
2	5101.00	52.82	54.00	-1.18	15.82	3.42	33.58	0.00	Average	100	75	VERTICAL
3	5172.00	98.56			61.42	3.44	33.70	0.00	Average	100	75	VERTICAL
4	5172.00	111.18			74.04	3.44	33.70	0.00	Peak	100	75	VERTICAL

Item 3, 4 are the fundamental frequency at 5180 MHz.

Channel 40

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	5128.00	52.94	54.00	-1.06	15.87	3.43	33.64	0.00	Average	100	65	VERTICAL
2	5128.00	63.52	74.00	-10.48	26.45	3.43	33.64	0.00	Peak	100	65	VERTICAL
3	5208.00	100.52			63.31	3.45	33.76	0.00	Average	100	65	VERTICAL
4	5208.00	112.71			75.50	3.45	33.76	0.00	Peak	100	65	VERTICAL

Item 3, 4 are the fundamental frequency at 5200 MHz.

Channel 48

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	5073.00	50.51	54.00	-3.49	13.58	3.41	33.52	0.00	Average	100	264	VERTICAL
2	5074.00	62.21	74.00	-11.79	25.28	3.41	33.52	0.00	Peak	100	264	VERTICAL
3	5241.00	118.41			81.13	3.46	33.82	0.00	Peak	100	264	VERTICAL
4	5243.00	106.11			68.83	3.46	33.82	0.00	Average	100	264	VERTICAL
5	5401.00	65.25	74.00	-8.75	27.62	3.51	34.12	0.00	Peak	100	264	VERTICAL
6	5402.00	52.99	54.00	-1.01	15.36	3.51	34.12	0.00	Average	100	264	VERTICAL

Item 3, 4 are the fundamental frequency at 5240 MHz.



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 38, 46 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Channel 38

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5150.00	52.23	54.00	-1.77	15.13	3.43	33.67	0.00 Average	100	357	VERTICAL
2	5150.00	67.47	74.00	-6.53	30.37	3.43	33.67	0.00 Peak	100	357	VERTICAL
3	5194.00	98.88			61.71	3.44	33.73	0.00 Average	100	357	VERTICAL
4	5194.00	110.06			72.89	3.44	33.73	0.00 Peak	100	357	VERTICAL

Item 3, 4 are the fundamental frequency at 5190 MHz.

Channel 46

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5137.00	64.32	74.00	-9.68	27.25	3.43	33.64	0.00 Peak	100	82	VERTICAL
2	5147.00	52.66	54.00	-1.34	15.56	3.43	33.67	0.00 Average	100	82	VERTICAL
3	5235.00	115.40			78.12	3.46	33.82	0.00 Peak	100	82	VERTICAL
4	5236.00	103.18			65.90	3.46	33.82	0.00 Average	100	82	VERTICAL

Item 3, 4 are the fundamental frequency at 5230 MHz.



Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 42 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Channel 42

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	5140.00	68.23	74.00	-5.77	31.16	3.43	33.64	0.00	Peak	104	75	VERTICAL
2	5144.00	52.93	54.00	-1.07	15.83	3.43	33.67	0.00	Average	104	75	VERTICAL
3	5225.00	94.63			57.38	3.46	33.79	0.00	Average	104	75	VERTICAL
4	5228.00	106.46			69.21	3.46	33.79	0.00	Peak	104	75	VERTICAL
5	5350.00	43.66	54.00	-10.34	6.14	3.49	34.03	0.00	Average	104	75	VERTICAL
6	5350.00	56.65	74.00	-17.35	19.13	3.49	34.03	0.00	Peak	104	75	VERTICAL

Item 3, 4 are the fundamental frequency at 5210 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m)

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

Temperature	25°C	Humidity	54%
Test Engineer	Jim Huang	Configurations	IEEE 802.11a CH 36, 40, 48 / Chain 1 + Chain 2
Test Date	Jan. 07, 2014		

Channel 36

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	5098.00	52.97	54.00	-1.03	15.97	3.42	33.58	0.00	Average	100	289	VERTICAL
2	5098.40	64.03	74.00	-9.97	27.03	3.42	33.58	0.00	Peak	100	289	VERTICAL
3	5172.40	100.88			63.74	3.44	33.70	0.00	Average	100	289	VERTICAL
4	5173.20	111.02			73.88	3.44	33.70	0.00	Peak	100	289	VERTICAL

Item 3, 4 are the fundamental frequency at 5180 MHz.

Channel 40

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	5118.40	52.86	54.00	-1.14	15.82	3.43	33.61	0.00	Average	100	301	VERTICAL
2	5124.40	63.64	74.00	-10.36	26.60	3.43	33.61	0.00	Peak	100	301	VERTICAL
3	5198.40	103.89			66.68	3.45	33.76	0.00	Average	100	301	VERTICAL
4	5198.40	114.52			77.31	3.45	33.76	0.00	Peak	100	301	VERTICAL

Item 3, 4 are the fundamental frequency at 5200 MHz.

Channel 48

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	5125.40	56.17	74.00	-17.83	19.13	3.43	33.61	0.00	Peak	100	300	VERTICAL
2	5127.80	44.67	54.00	-9.33	7.60	3.43	33.64	0.00	Average	100	300	VERTICAL
3	5238.80	108.15			70.87	3.46	33.82	0.00	Average	100	300	VERTICAL
4	5243.60	119.21			81.93	3.46	33.82	0.00	Peak	100	300	VERTICAL
5	5363.80	48.04	54.00	-5.96	10.52	3.49	34.03	0.00	Average	100	300	VERTICAL
6	5363.80	59.78	74.00	-14.22	22.26	3.49	34.03	0.00	Peak	100	300	VERTICAL

Item 3, 4 are the fundamental frequency at 5240 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m)

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

4.7. Frequency Stability Measurement

4.7.1. Limit

In-band emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification).

4.7.2. Measuring Instruments and Setting

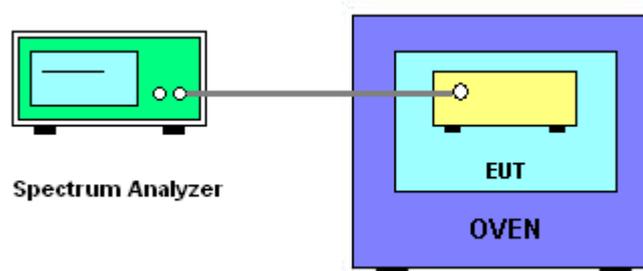
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Entire absence of modulation emissions bandwidth
RBW	10 kHz
VBW	10 kHz
Sweep Time	Auto

4.7.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5. f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f)/f_c \times 10^6$ ppm and the limit is less than ± 20 ppm (IEEE 802.11n specification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is $-30^\circ\text{C} \sim 50^\circ\text{C}$.

4.7.4. Test Setup Layout



4.7.5. Test Deviation

There is no deviation with the original standard.

4.7.6. EUT Operation during Test

The EUT was programmed to be in continuously un-modulation transmitting mode.

4.7.7. Test Result of Frequency Stability

Temperature	22°C	Humidity	58%
Test Engineer	Benson Peng	Test Date	Jul. 16, 2014

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)
(V)	5200 MHz
126.50	5200.0306
110.00	5200.0324
93.50	5200.0348
Max. Deviation (MHz)	0.034800
Max. Deviation (ppm)	6.69

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)
(°C)	5200 MHz
-30	5200.0336
-20	5200.0324
-10	5200.0348
0	5200.0348
10	5200.0352
20	5200.0352
30	5200.0214
40	5200.0284
50	5200.0118
Max. Deviation (MHz)	0.035200
Max. Deviation (ppm)	6.77

4.8. Antenna Requirements

4.8.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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 the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

4.8.2. Antenna Connector Construction

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Test Receiver	R&S	ESCS 30	100355	9 kHz ~ 2.75 GHz	Apr. 12, 2013	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150 kHz ~ 100 MHz	Nov. 23, 2013	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Nov. 23, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150 kHz ~ 30 MHz	Dec. 04, 2013	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	22021	20MHz ~ 2GHz	Apr. 16, 2013	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9 kHz - 30 MHz	Nov. 05, 2012*	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBEAK	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Dec. 17, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 12, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Dec. 16, 2013	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Oct. 23, 2013	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100019	9kHz~40GHz	Dec. 02, 2013	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Dec. 12, 2013	Radiation (03CH01-CB)
Turn Table	INN CO	CO 2000	N/A	0 ~ 360 degree	N.C.R.	Radiation (03CH01-CB)
Antenna Mast	INN CO	CO2000	N/A	1 m - 4 m	N.C.R.	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz - 1 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-3	N/A	1 GHz - 40 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-4	N/A	1 GHz - 40 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
Signal analyzer	R&S	FSV40	100979	9kHz~40GHz	Nov. 29, 2013	Conducted (TH01-CB)
Temp. and Humidity Chamber	Ten Billion	TTH-D3SP	TBN-931011	-30~100 degree	Jun. 03, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-7	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-8	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-9	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-10	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-11	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
Power Sensor	Anritsu	MA2411B	0917223	300MHz~40GHz	Sep. 18, 2013	Conducted (TH01-CB)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Power Meter	Anritsu	ML2495A	1035008	300MHz~40GHz	Sep. 18, 2013	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.

“*” Calibration Interval of instruments listed above is two years.

NCR means Non-Calibration required.

6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	2.4 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%