



SPORTON International Inc.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

FCC RADIO TEST REPORT

Applicant's company	PEGATRON CORPORATION
Applicant Address	5F No. 76, Ligong St., Beitou District, Taipei City 112, Taiwan
FCC ID	VUI-ITV790X
Manufacturer's company	PEGATRON CORPORATION
Manufacturer Address	5F No. 76, Ligong St., Beitou District, Taipei City 112, Taiwan

Product Name	STB Product
Brand Name	CISCO
Model No.	ITV790X(The "X" in model name can be 0 to 9, A to Z or blank, for marketing purpose.)
Test Rule Part(s)	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	5725 ~ 5850MHz
Received Date	Jan. 23, 2014
Final Test Date	May 15, 2014
Submission Type	Original Equipment

Statement

Test result included is only for the IEEE 802.11n and IEEE 802.11a/ac (5725 ~ 5850MHz) 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 C, KDB 558074 D01 v03r01, KDB 662911 D01 v02r01, KDB644545 D01v01r02.**

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



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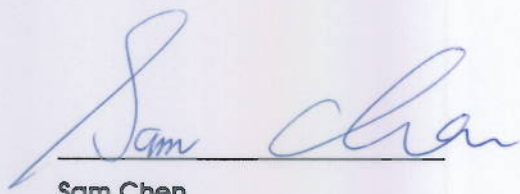
History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR432003AA	Rev. 01	Initial issue of report	Jun. 11, 2014

1. CERTIFICATE OF COMPLIANCE

Product Name : STB Product
Brand Name : CISCO
Model No. : ITV790X(The "X" in model name can be 0 to 9, A to Z or blank, for marketing purpose.)
Applicant : PEGATRON CORPORATION
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Jan. 23, 2014 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 C				
Part	Rule Section	Description of Test	Result	Under Limit
4.1	15.207	AC Power Line Conducted Emissions	Complies	13.06 dB
4.2	15.247(b)(3)	Maximum Conducted Output Power	Complies	0.02 dB
4.3	15.247(e)	Power Spectral Density	Complies	2.78 dB
4.4	15.247(a)(2)	6dB Spectrum Bandwidth	Complies	-
4.5	15.247(d)	Radiated Emissions	Complies	0.79 dB
4.6	15.247(d)	Band Edge Emissions	Complies	-
4.7	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

IEEE 802.11n/ac

Items	Description
Product Type	WLAN (3TX, 3RX)
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	5725 ~ 5850MHz
Channel Number	5 for 20MHz bandwidth ; 2 for 40MHz bandwidth ; 1 for 80MHz bandwidth
Channel Band Width (99%)	802.11ac MCS0/Nss1 (VHT20): 23.36 MHz ; 802.11ac MCS0/Nss1 (VHT40): 45.92 MHz ; 802.11ac MCS0/Nss1 (VHT80): 76.48 MHz
Maximum Conducted Output Power	802.11ac MCS0/Nss1 (VHT20): 29.98 dBm ; 802.11ac MCS0/Nss1 (VHT40): 29.86 dBm ; 802.11ac MCS0/Nss1 (VHT80): 25.98 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

IEEE 802.11a

Items	Description
Product Type	WLAN (3TX, 3RX)
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	5725 ~ 5850MHz
Channel Number	5
Channel Band Width (99%)	25.84 MHz
Maximum Conducted Output Power	29.98 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

Items	Description
Beamforming Function	<input type="checkbox"/> With beamforming <input checked="" type="checkbox"/> Without beamforming

Antenna and Band width

Antenna	Three (TX)		
Band width Mode	20 MHz	40 MHz	80 MHz
IEEE 802.11a	V	X	X
IEEE 802.11n	V	V	X
IEEE 802.11ac	V	V	V

IEEE 11n/ac Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	3	MCS0-23
802.11n (HT40)	3	MCS0-23
802.11ac (VHT20)	3	MCS 0-9/Nss1-3
802.11ac (VHT40)	3	MCS 0-9/Nss1-3
802.11ac (VHT80)	3	MCS 0-9/Nss1-3
<p>Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput). Then EUT support HT20 and HT40.</p> <p>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.</p> <p>Note 3: Modulation modes consist of below configuration: HT20/HT40: IEEE 802.11n, VHT20/VHT40/VHT80: IEEE 802.11ac</p>		

3.2. Accessories

Power	Brand	Model	Rating
Adapter 1	ENG	3A-183WU12	Input:100-120V~50-60Hz, 0.5A Output:12V, 1.5A
Adapter 2	APD	WB-18B12FU	Input:100-120V~ , 60Hz, 0.4A Max. Output:12V, 1.5A

3.3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	Airgain	N5x20B	Embedded Antenna	U.FL	1.70
2	Airgain	N5x20B	Embedded Antenna	U.FL	1.70
3	Airgain	N5x20B	Embedded Antenna	U.FL	1.70
4	Hong Lin	N/A	Printed Antenna	N/A	3.39

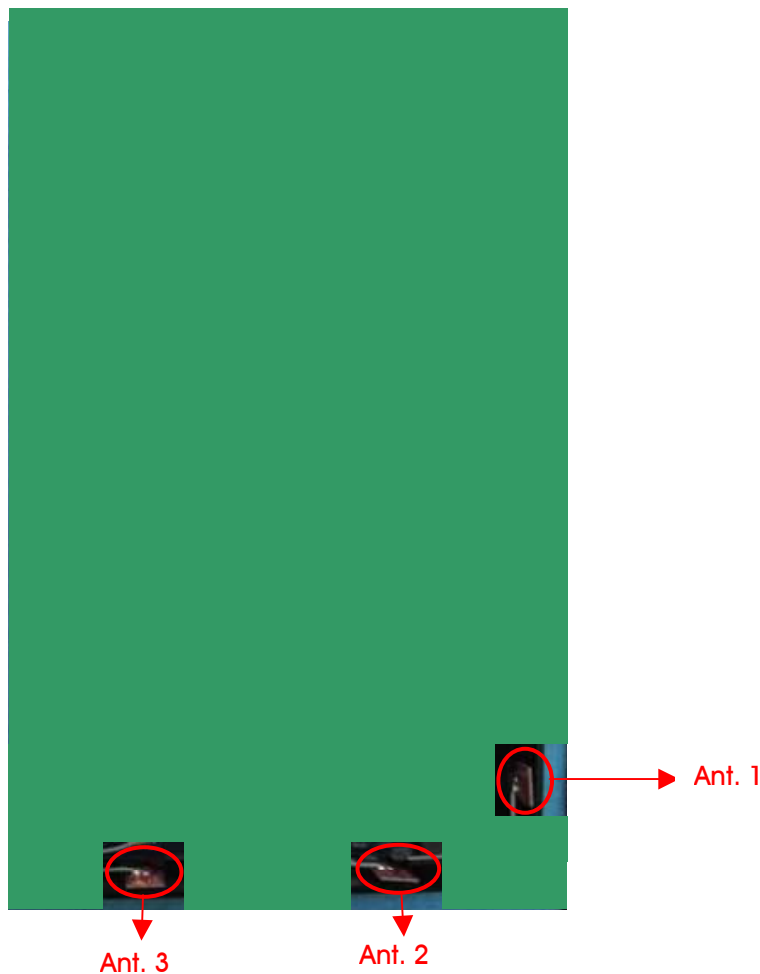
Note: The EUT has four antennas.

For IEEE 802.11a/n/ac mode (3TX/3RX)

Ant. 1, Ant. 2 and Ant. 3 could transmit/receive simultaneously.

For IEEE 802.15.4 ZigBee RF4CE mode: (1TX/1RX)

Ant. 4 can be use as transmit and receive antenna.



Ant. 4



3.4. Table for Carrier Frequencies

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 149, 153, 157, 161, 165.

For 40MHz bandwidth systems, use Channel 151, 159.

For 80MHz bandwidth systems, use Channel 155.

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
5725~5850 MHz Band 4	149	5745 MHz	157	5785 MHz
	151	5755 MHz	159	5795 MHz
	153	5765 MHz	161	5805 MHz
	155	5775 MHz	165	5825 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	Antenna
AC Power Line Conducted Emissions	CTX	-	-	-
Maximum Conducted Output Power	11ac VHT20	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	MCS0/Nss1	155	1+2+3
	11a/BPSK	6 Mbps	149/157/165	1+2+3
Power Spectral Density	11ac VHT20	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	MCS0/Nss1	155	1+2+3
	11a/BPSK	6 Mbps	149/157/165	1+2+3
6dB Spectrum Bandwidth	11ac VHT20	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	MCS0/Nss1	155	1+2+3
	11a/BPSK	6 Mbps	149/157/165	1+2+3
Radiated Emissions Below 1GHz	CTX	-	-	-
Radiated Emissions Above 1GHz	11ac VHT20	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	MCS0/Nss1	155	1+2+3
	11a/BPSK	6 Mbps	149/157/165	1+2+3
Band Edge Emissions	11ac VHT20	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	MCS0/Nss1	155	1+2+3
	11a/BPSK	6 Mbps	149/157/165	1+2+3

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. Laying of EUT + Adapter 1

Mode 2. Laying of EUT + Adapter 2

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

For Radiated Emission test:

Mode 1. Laying of EUT + Adapter 1

Mode 2. Laying of EUT + Adapter 2

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

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.
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

Support Unit	Brand	Model	FCC ID
NB	DELL	E6430	DoC

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.

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT20

Test Software Version	Mtool 2.0.0.7		
Frequency	5745 MHz	5785 MHz	5825 MHz
MCS0/Nss1 VHT20	100	100	100

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT40

Test Software Version	Mtool 2.0.0.7	
Frequency	5755 MHz	5795 MHz
MCS0/Nss1 VHT40	90	100

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT80

Test Software Version	Mtool 2.0.0.7
Frequency	5775 MHz
MCS0/Nss1 VHT80	86

Power Parameters of IEEE 802.11a

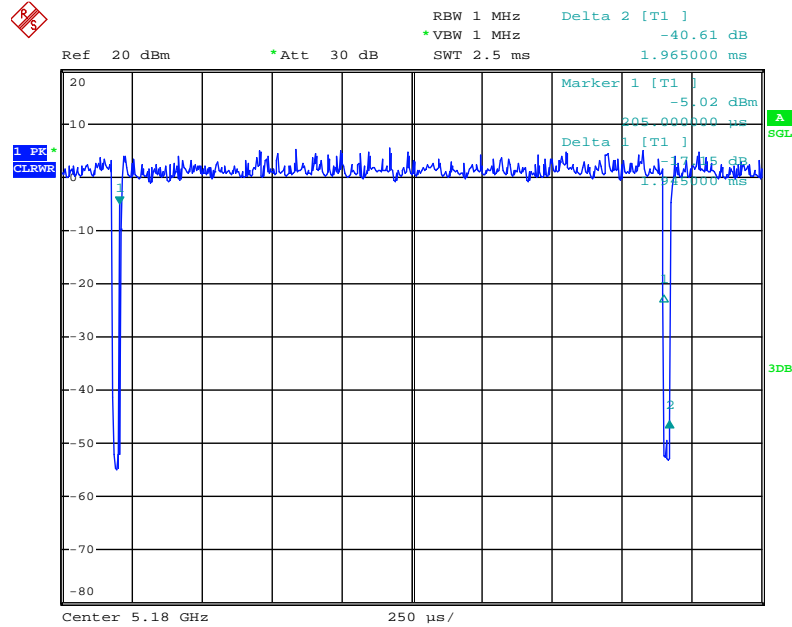
Test Software Version	Mtool 2.0.0.7		
Frequency	5745 MHz	5785 MHz	5825 MHz
IEEE 802.11a	100	100	100

3.9. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

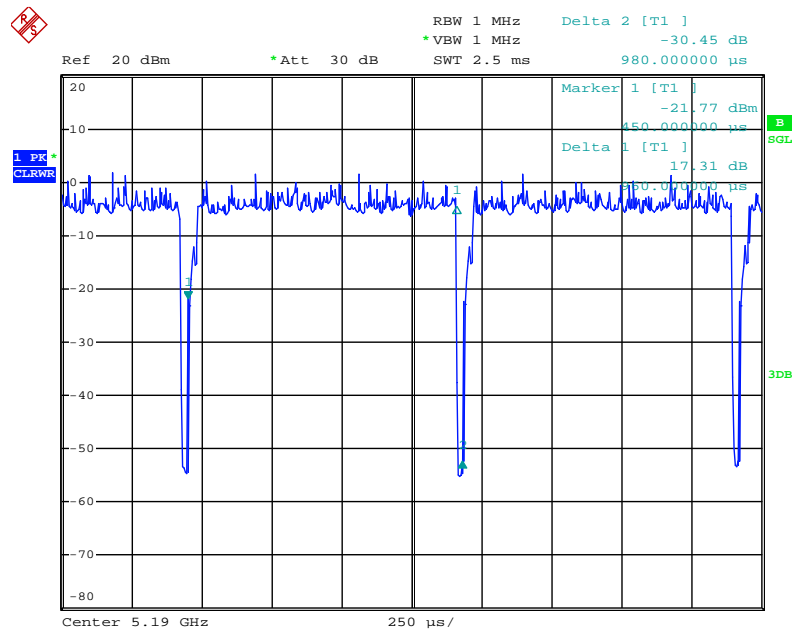
3.10. Duty Cycle

IEEE 802.11ac MCS0/Nss1 VHT20



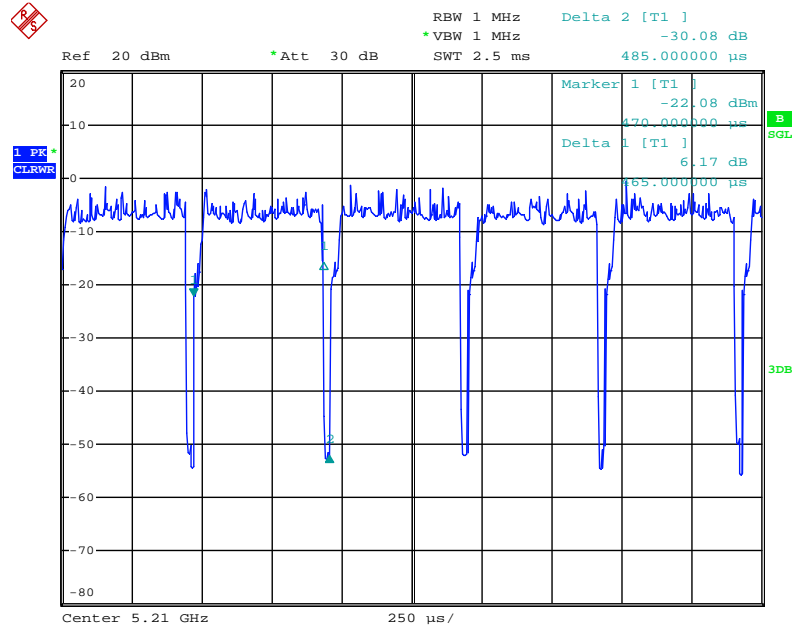
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IEEE 802.11ac MCS0/Nss1 VHT40



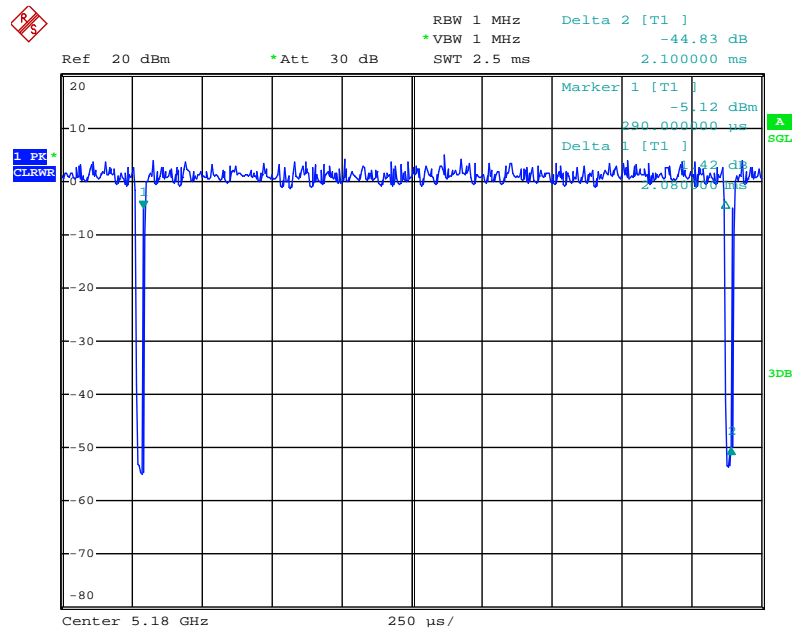
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IEEE 802.11ac MCS0/Nss1 VHT80



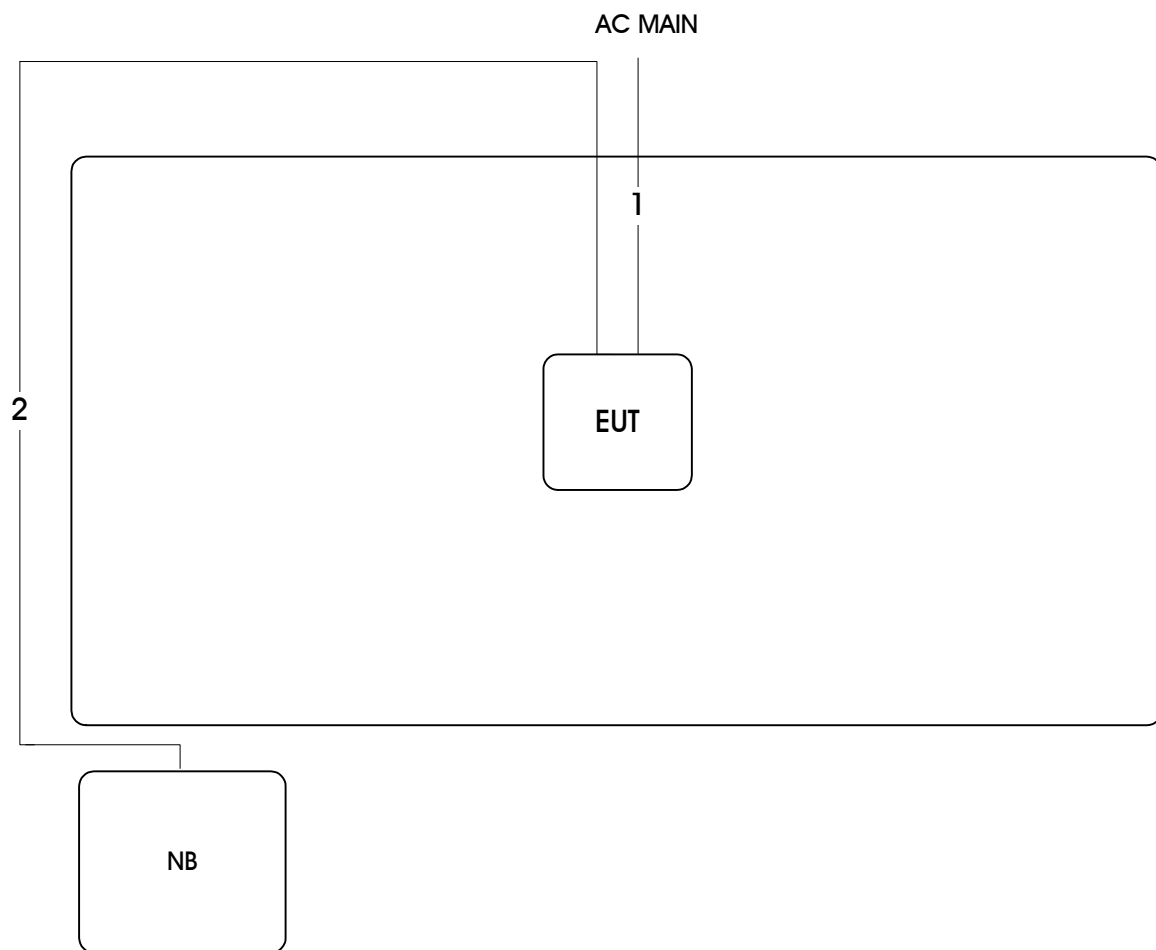
Date: 20.FEB.2014 23:08:51

IEEE 802.11a



Date: 20.FEB.2014 23:05:58

3.11. Test Configurations



Item	Connection	Shielded	Length(m)
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 which is designed to be connected 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

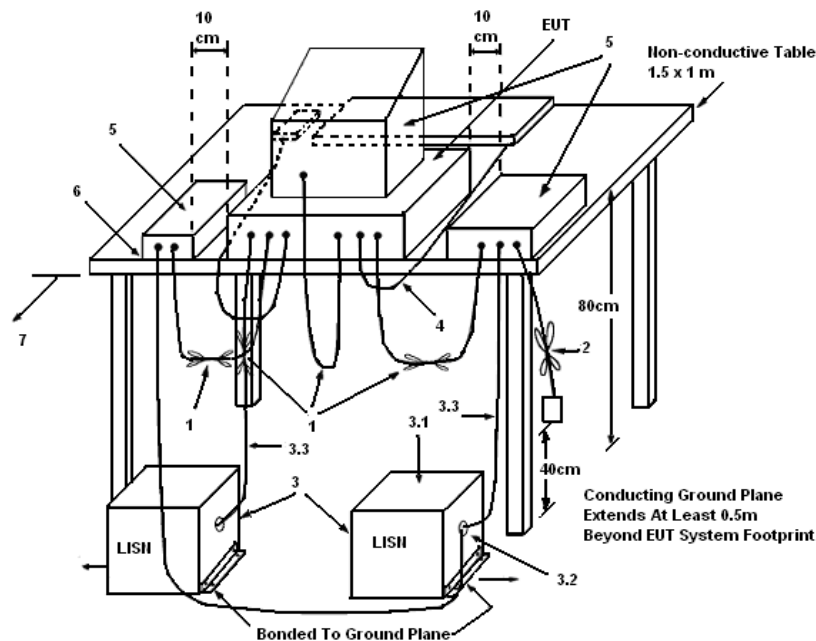
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

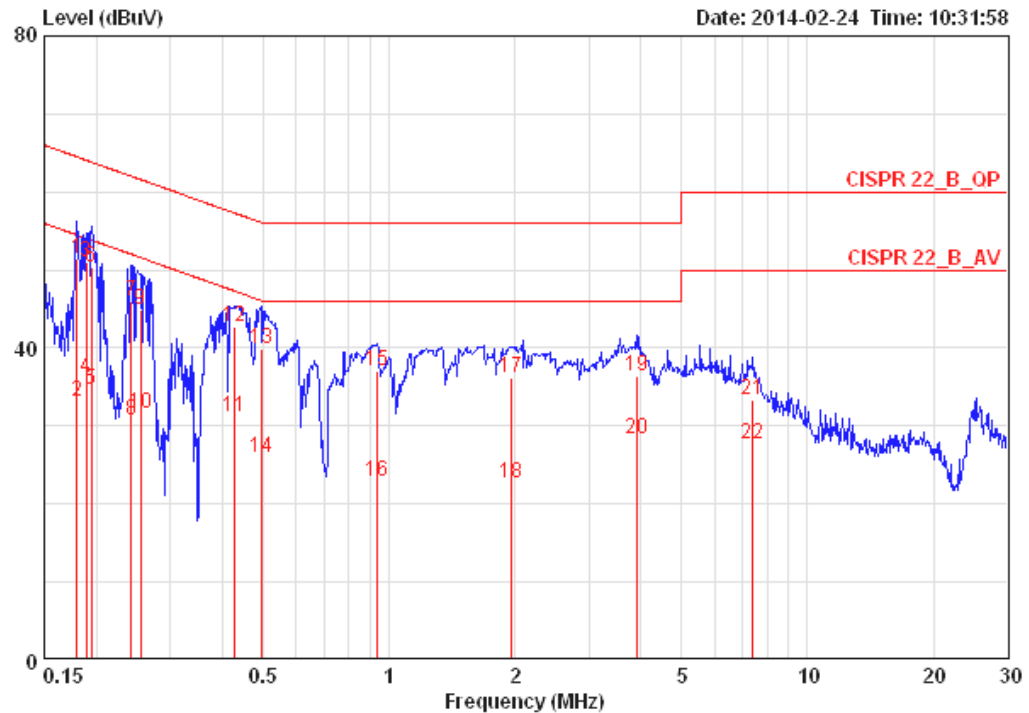
There is no deviation with the original standard.

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

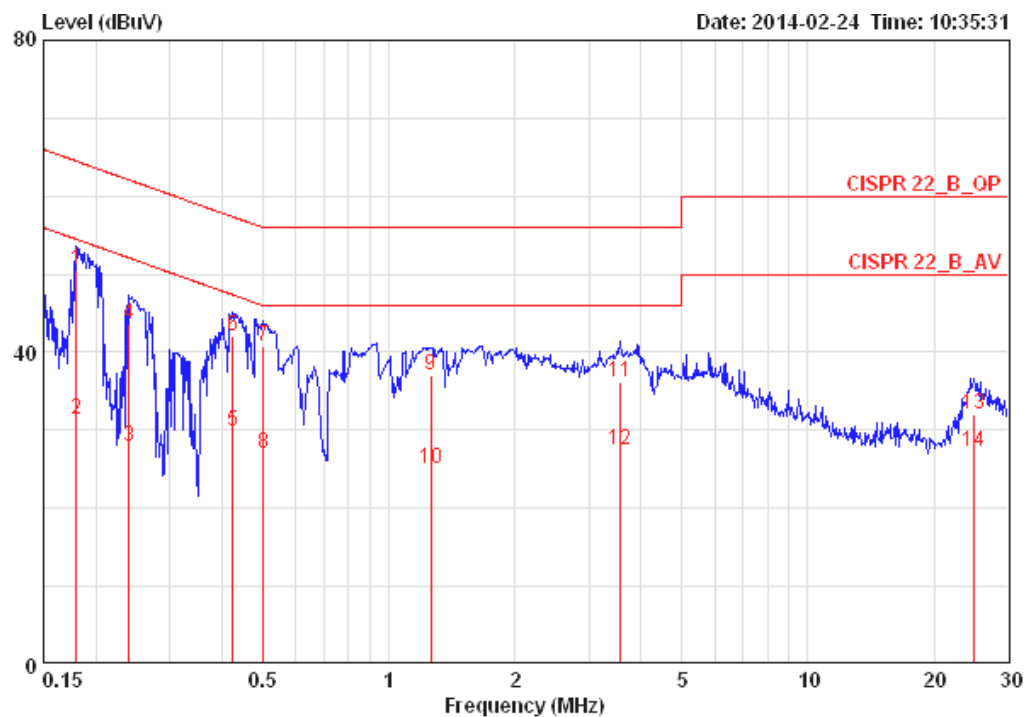
Temperature	24°C	Humidity	52%
Test Engineer	Justin Chiu	Phase	Line
Configuration	CTX	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1 @	0.17961	51.35	-13.15	64.50	0.15	51.04	0.16	LINE	QP
2	0.17961	33.11	-21.39	54.50	0.15	32.80	0.16	LINE	AVERAGE
3 @	0.18938	51.00	-13.06	64.06	0.15	50.69	0.16	LINE	QP
4	0.18938	36.13	-17.93	54.06	0.15	35.82	0.16	LINE	AVERAGE
5	0.19447	34.60	-19.24	53.84	0.15	34.29	0.16	LINE	AVERAGE
6 @	0.19447	50.38	-13.46	63.84	0.15	50.07	0.16	LINE	QP
7	0.24165	46.02	-16.02	62.04	0.15	45.70	0.17	LINE	QP
8	0.24165	30.74	-21.30	52.04	0.15	30.42	0.17	LINE	AVERAGE
9	0.25480	44.80	-16.80	61.60	0.15	44.48	0.17	LINE	QP
10	0.25480	31.68	-19.92	51.60	0.15	31.36	0.17	LINE	AVERAGE
11	0.42825	31.25	-16.03	47.29	0.15	30.92	0.18	LINE	AVERAGE
12	0.42825	42.81	-14.47	57.29	0.15	42.48	0.18	LINE	QP
13	0.49411	39.98	-16.12	56.10	0.15	39.64	0.18	LINE	QP
14	0.49411	25.99	-20.11	46.10	0.15	25.65	0.18	LINE	AVERAGE
15	0.93314	36.98	-19.02	56.00	0.16	36.62	0.20	LINE	QP

16	0.93314	22.79	-23.21	46.00	0.16	22.43	0.20	LINE	AVERAGE
17	1.959	36.13	-19.87	56.00	0.19	35.69	0.25	LINE	QP
18	1.959	22.74	-23.26	46.00	0.19	22.30	0.25	LINE	AVERAGE
19	3.901	36.40	-19.60	56.00	0.28	35.83	0.30	LINE	QP
20	3.901	28.39	-17.61	46.00	0.28	27.82	0.30	LINE	AVERAGE
21	7.407	33.45	-26.55	60.00	0.33	32.76	0.36	LINE	QP
22	7.407	27.75	-22.25	50.00	0.33	27.06	0.36	LINE	AVERAGE

Temperature	24°C	Humidity	52%
Test Engineer	Justin Chiu	Phase	Neutral
Configuration	CTX	Test Mode	Mode 1



	Freq	Level	Over	Limit	LISN	Read	Cable		
	MHz	dBuV	Limit	Line	Factor	Level	Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1	0.17961	50.53	-13.97	64.50	0.07	50.30	0.16	NEUTRAL	QP
2	0.17961	31.34	-23.16	54.50	0.07	31.11	0.16	NEUTRAL	AVERAGE
3	0.24037	27.97	-24.11	52.08	0.07	27.73	0.17	NEUTRAL	AVERAGE
4	0.24037	43.51	-18.57	62.08	0.07	43.27	0.17	NEUTRAL	QP
5	0.42373	29.94	-17.43	47.37	0.07	29.69	0.18	NEUTRAL	AVERAGE
6	0.42373	42.08	-15.29	57.37	0.07	41.83	0.18	NEUTRAL	QP
7	0.50203	40.68	-15.32	56.00	0.07	40.42	0.19	NEUTRAL	QP
8	0.50203	26.95	-19.05	46.00	0.07	26.69	0.19	NEUTRAL	AVERAGE
9	1.262	36.96	-19.04	56.00	0.09	36.66	0.22	NEUTRAL	QP
10	1.262	25.17	-20.83	46.00	0.09	24.87	0.22	NEUTRAL	AVERAGE
11	3.565	36.18	-19.82	56.00	0.13	35.76	0.29	NEUTRAL	QP
12	3.565	27.52	-18.48	46.00	0.13	27.10	0.29	NEUTRAL	AVERAGE
13	24.790	32.08	-27.92	60.00	0.65	30.87	0.57	NEUTRAL	QP
14	24.790	27.21	-22.79	50.00	0.65	26.00	0.57	NEUTRAL	AVERAGE

Note:

Level = Read Level + LISN Factor + Cable Loss

4.2. Maximum Conducted Output Power Measurement

4.2.1. Limit

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter output power.

4.2.2. Measuring Instruments and Setting

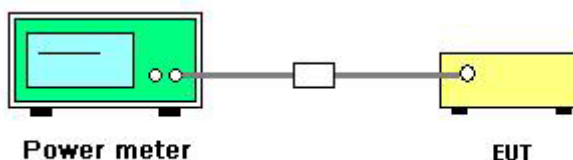
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Detector	Average

4.2.3. Test Procedures

1. Test procedures refer KDB 558074 D01 v03r01 section 9.2.2 Measurement using a power meter (PM).
2. This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector.

4.2.4. Test Setup Layout



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 Maximum Conducted Output Power

Temperature	26°C	Humidity	63%
Test Engineer	Wen Chao	Configurations	IEEE 802.11ac
Test Date	Feb. 20, 2014		

Configuration IEEE 802.11ac MCS0/Nss1 VHT20

Channel	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Ant. 1	Ant. 2	Ant. 3	Total		
149	5745 MHz	26.31	24.61	24.45	29.98	30.00	Complies
157	5785 MHz	26.23	24.22	24.09	29.73	30.00	Complies
165	5825 MHz	26.29	23.92	23.88	29.62	30.00	Complies

Configuration IEEE 802.11ac MCS0/Nss1 VHT40

Channel	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Ant. 1	Ant. 2	Ant. 3	Total		
151	5755 MHz	24.01	23.61	21.72	27.99	30.00	Complies
159	5795 MHz	26.35	24.38	24.18	29.86	30.00	Complies

Configuration IEEE 802.11ac MCS0/Nss1 VHT80

Channel	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Ant. 1	Ant. 2	Ant. 3	Total		
155	5775 MHz	21.79	21.53	20.13	25.98	30.00	Complies

Temperature	26°C	Humidity	63%
Test Engineer	Wen Chao	Configurations	IEEE 802.11a
Test Date	Feb. 20, 2014		

Configuration IEEE 802.11a

Channel	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Ant. 1	Ant. 2	Ant. 3	Total		
149	5745 MHz	26.29	24.61	24.48	29.98	30.00	Complies
157	5785 MHz	26.03	24.16	24.19	29.66	30.00	Complies
165	5825 MHz	26.26	23.95	23.92	29.63	30.00	Complies

4.3. Power Spectral Density Measurement

4.3.1. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2. Measuring Instruments and Setting

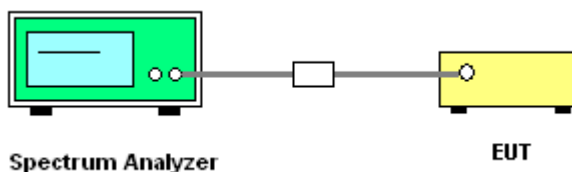
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Set the span to 1.5 times the DTS channel bandwidth.
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100\text{kHz}$
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold
Sweep Time	Auto couple

4.3.3. Test Procedures

1. Test procedures refer KDB 558074 D01 v03r01 section 10.2 Method PKPSD (peak PSD) and KDB 662911 D01 v02r01 section In-Band Power Spectral Density (PSD) Measurements option (b) Measure and sum spectral maximal across the outputs.
2. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$ (use of a greater number of measurement points than this minimum requirement is recommended).
4. Use the peak marker function to determine the maximum level in any 3 kHz band segment within the fundamental EBW.
5. The resulting PSD level must be $\leq 8 \text{ dBm}$.

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 Power Spectral Density

Temperature	26°C	Humidity	63%
Test Engineer	Wen Chao	Configurations	IEEE 802.11ac

Configuration IEEE 802.11ac MCS0/Nss1 VHT20

Channel	Frequency	Power Density (dBm/3kHz)				Power Density Limit (dBm/3kHz)	Result
		Ant. 1	Ant. 2	Ant. 3	Total		
149	5745 MHz	0.92	-0.80	-0.76	4.63	8.00	Complies
157	5785 MHz	0.89	-0.28	0.66	5.22	8.00	Complies
165	5825 MHz	-1.99	-0.57	-1.40	3.49	8.00	Complies

Configuration IEEE 802.11ac MCS0/Nss1 VHT40

Channel	Frequency	Power Density (dBm/3kHz)				Power Density Limit (dBm/3kHz)	Result
		Ant. 1	Ant. 2	Ant. 3	Total		
151	5755 MHz	-4.94	-4.96	-6.57	-0.65	8.00	Complies
159	5795 MHz	-5.89	-5.66	-8.46	-1.73	8.00	Complies

Configuration IEEE 802.11ac MCS0/Nss1 VHT80

Channel	Frequency	Power Density (dBm/3kHz)				Power Density Limit (dBm/3kHz)	Result
		Ant. 1	Ant. 2	Ant. 3	Total		
155	5775 MHz	-10.23	-10.58	-12.87	-6.31	8.00	Complies

Temperature	26°C	Humidity	63%
Test Engineer	Wen Chao	Configurations	IEEE 802.11a

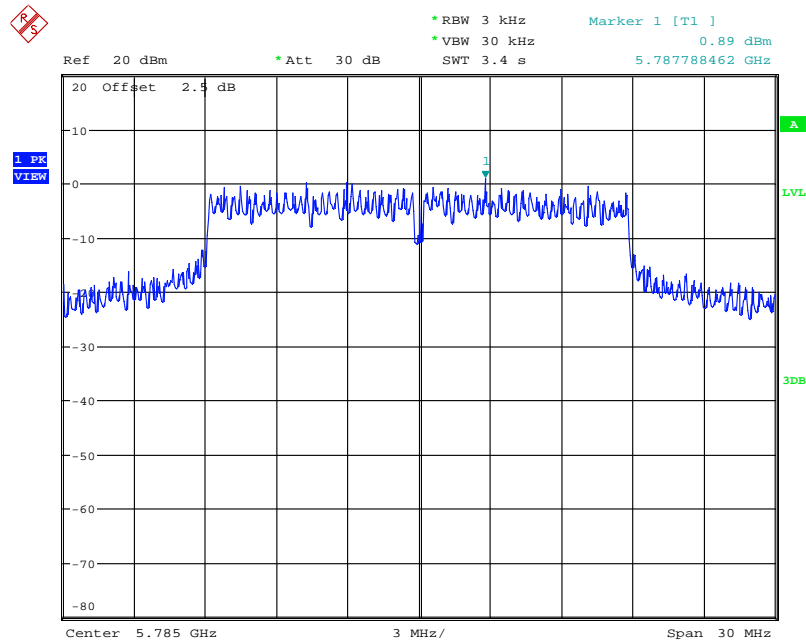
Configuration IEEE 802.11a

Channel	Frequency	Power Density (dBm/3kHz)				Power Density Limit (dBm/3kHz)	Result
		Ant. 1	Ant. 2	Ant. 3	Total		
149	5745 MHz	-0.58	-0.97	-2.01	3.63	8.00	Complies
157	5785 MHz	-0.51	-0.97	-2.85	3.44	8.00	Complies
165	5825 MHz	-1.76	-0.71	-3.82	2.86	8.00	Complies

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

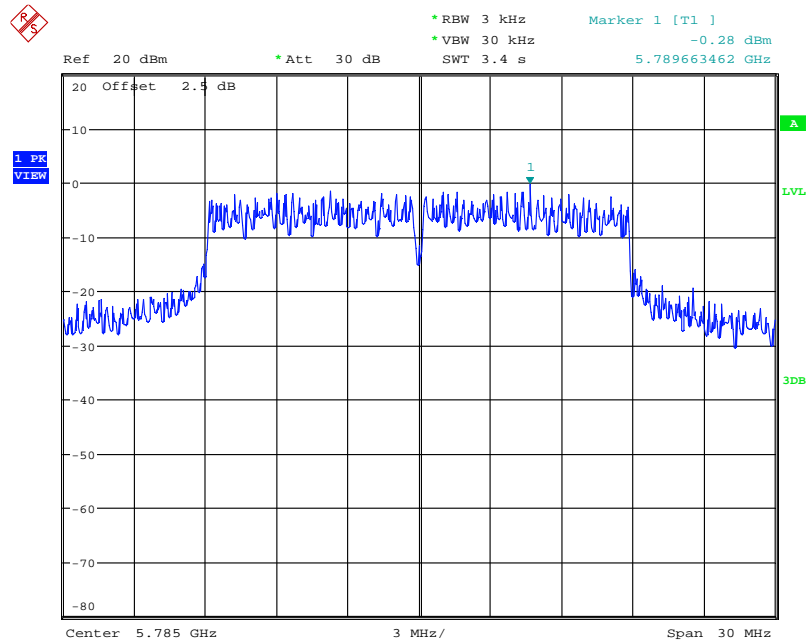
For plots, only the channel with worse result was shown.

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / 5785 MHz / Ant. 1



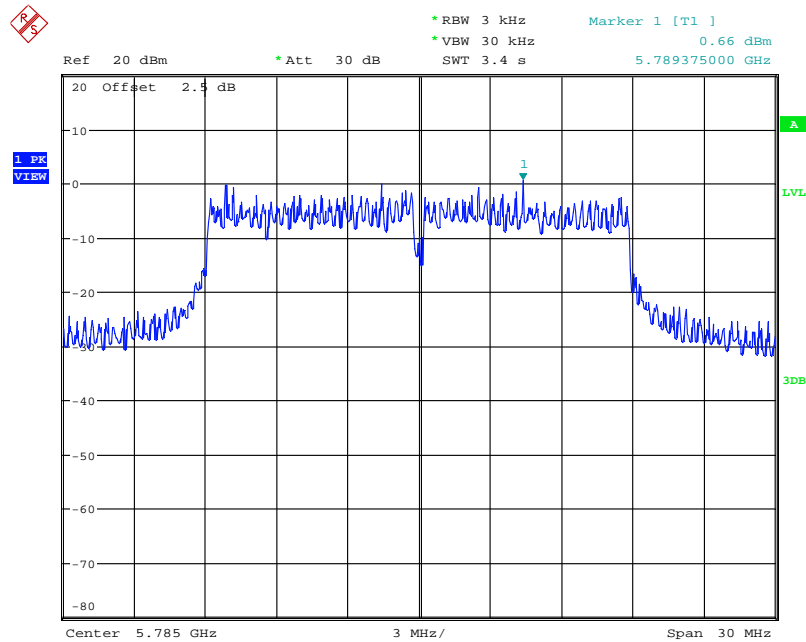
Date: 20.FEB.2014 21:40:46

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / 5785 MHz / Ant. 2



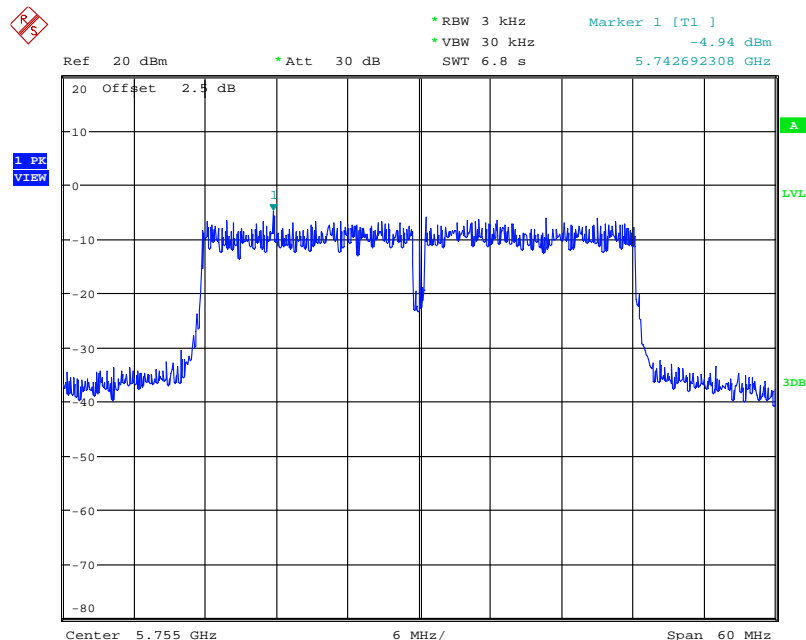
Date: 20.FEB.2014 22:07:34

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / 5785 MHz / Ant. 3



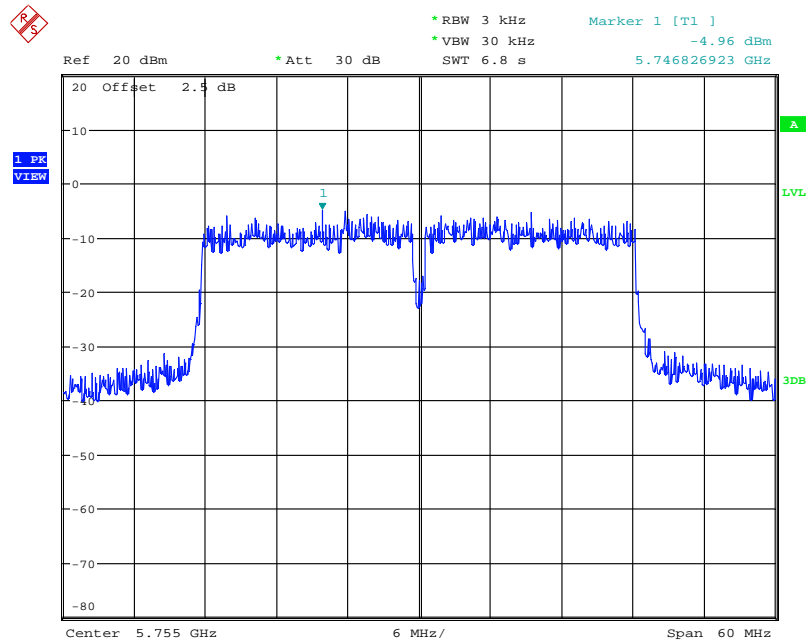
Date: 20.FEB.2014 22:00:21

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / 5755 MHz / Ant. 1



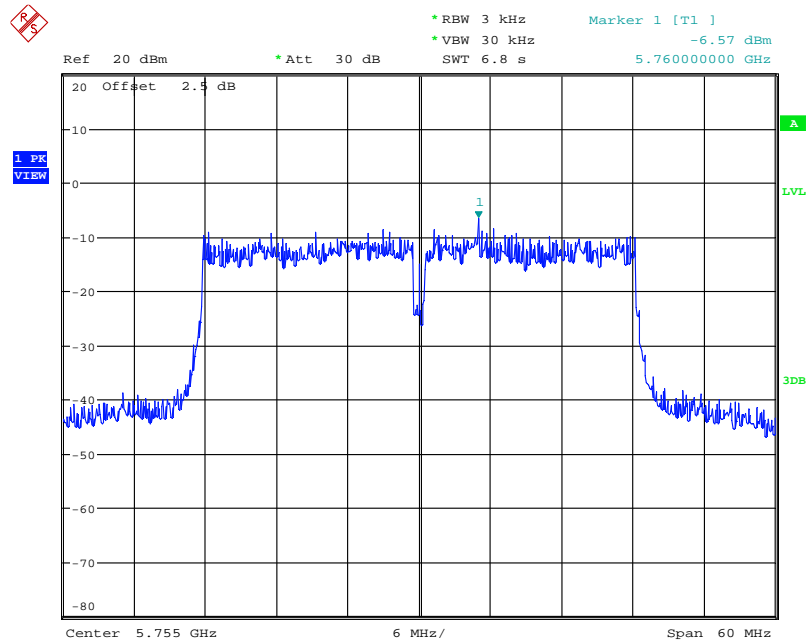
Date: 20.FEB.2014 22:32:47

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / 5755 MHz / Ant. 2



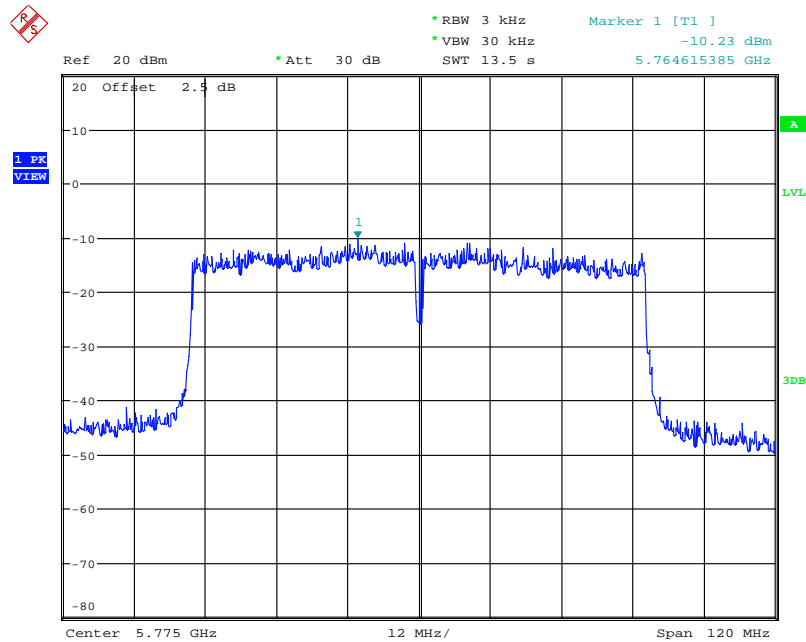
Date: 20.FEB.2014 22:37:49

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / 5755 MHz / Ant. 3



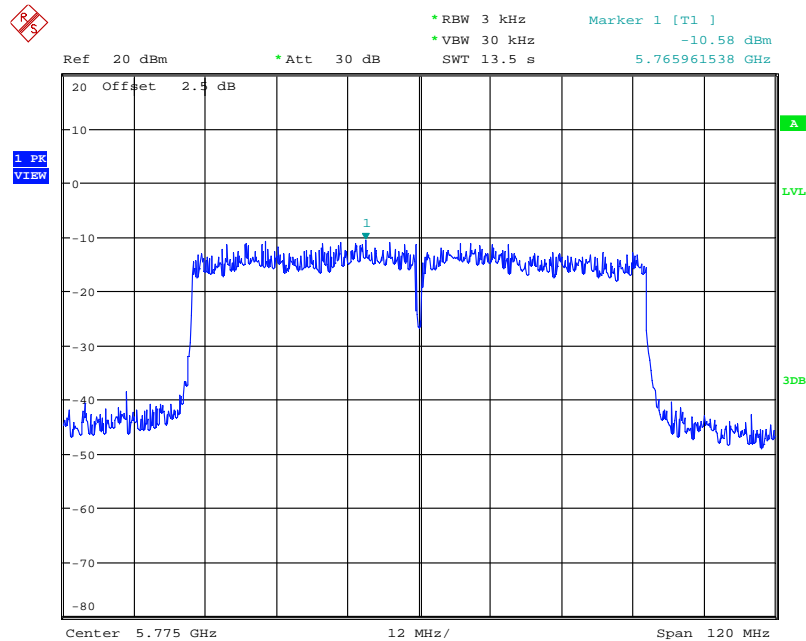
Date: 20.FEB.2014 22:36:44

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / 5775 MHz / Ant. 1



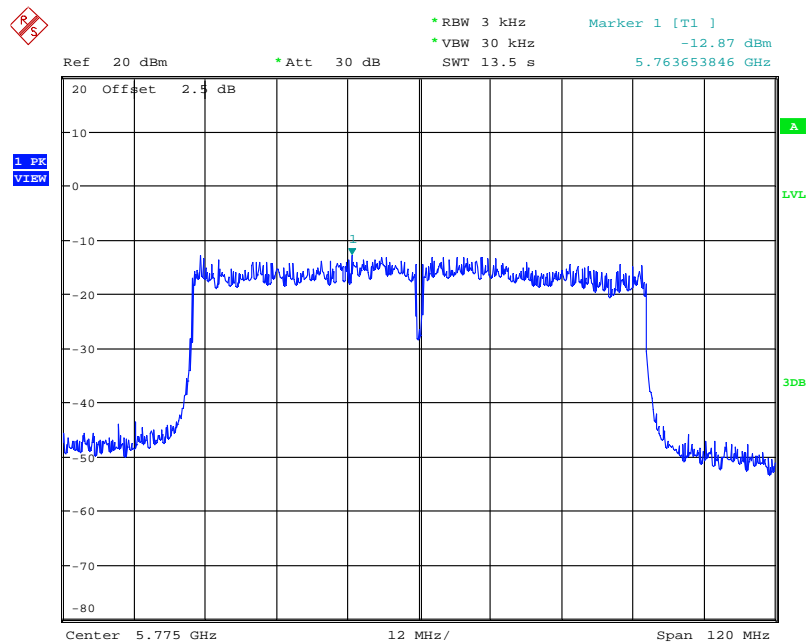
Date: 20.FEB.2014 22:43:05

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / 5775 MHz / Ant. 2



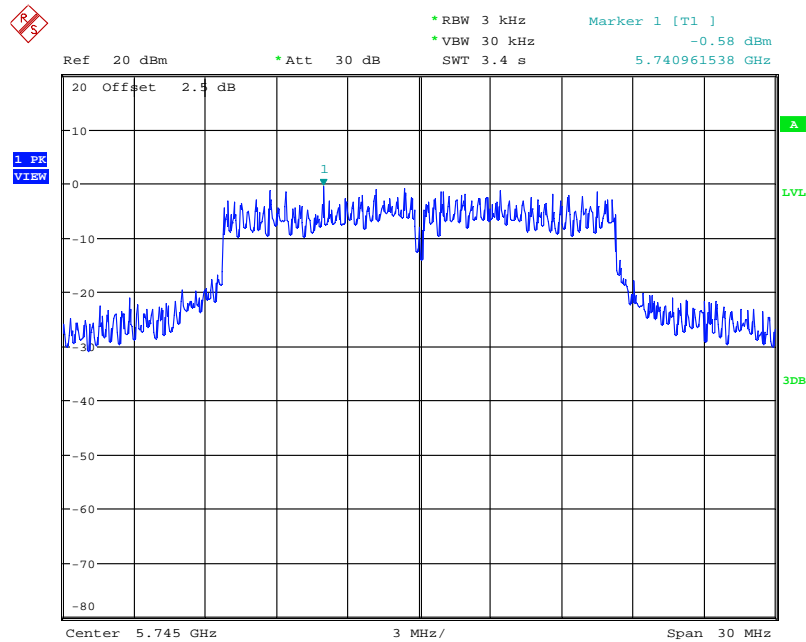
Date: 20.FEB.2014 22:40:42

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / 5775 MHz / Ant. 3



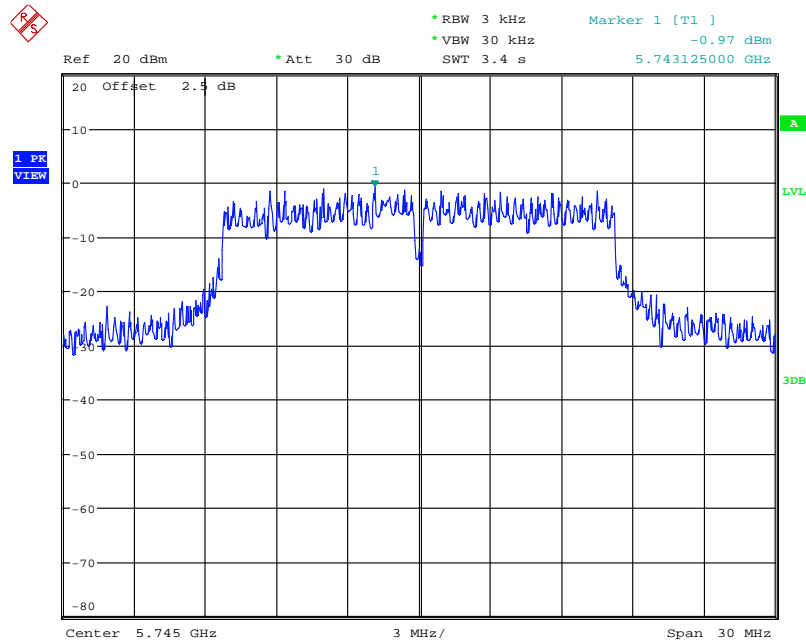
Date: 20.FEB.2014 22:41:44

Power Density Plot on Configuration IEEE 802.11a / 5745 MHz / Ant. 1



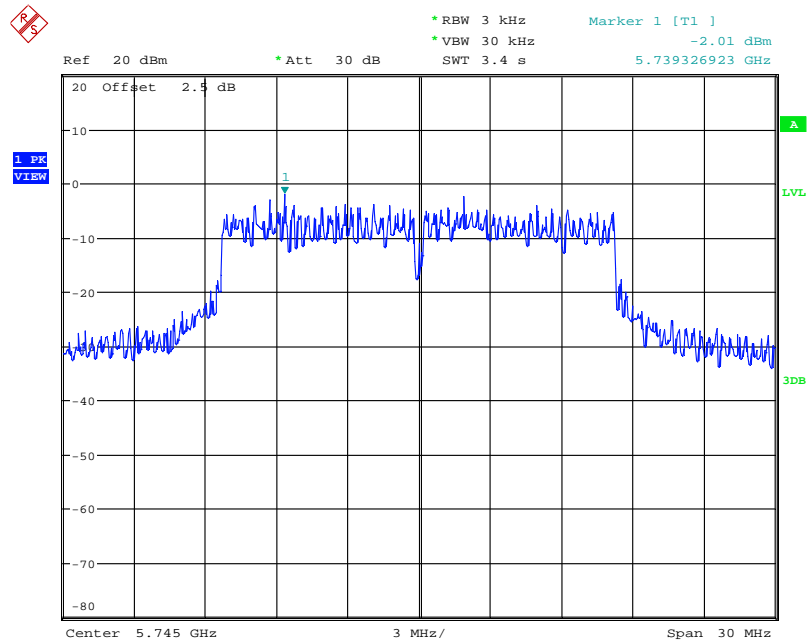
Date: 20.FEB.2014 22:26:54

Power Density Plot on Configuration IEEE 802.11a / 5745 MHz / Ant. 2



Date: 20.FEB.2014 22:17:21

Power Density Plot on Configuration IEEE 802.11a / 5745 MHz / Ant. 3



Date: 20.FEB.2014 22:21:12

4.4. 6dB Spectrum Bandwidth Measurement

4.4.1. Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

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 spectrum analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 6dB Bandwidth
RBW	100kHz
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.4.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB 558074 D01 v03r01 for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8.0 DTS 6-dB signal bandwidth option 1.
3. Multiple antenna system was performed in accordance with KDB 662911 D01 v02r01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
4. Measured the spectrum width with power higher than 6dB below carrier.

4.4.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

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

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 6dB Spectrum Bandwidth

Temperature	26°C	Humidity	63%
Test Engineer	Wen Chao	Configurations	IEEE 802.11ac

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Ant. 1 + Ant. 2 + Ant. 3

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
149	5745 MHz	16.96	22.96	500	Complies
157	5785 MHz	16.96	22.48	500	Complies
165	5825 MHz	16.40	23.36	500	Complies

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Ant. 1 + Ant. 2 + Ant. 3

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
151	5755 MHz	35.68	36.48	500	Complies
159	5795 MHz	35.36	45.92	500	Complies

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Ant. 1 + Ant. 2 + Ant. 3

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
155	5775 MHz	71.04	76.48	500	Complies

Temperature	26°C	Humidity	63%
Test Engineer	Wen Chao	Configurations	IEEE 802.11

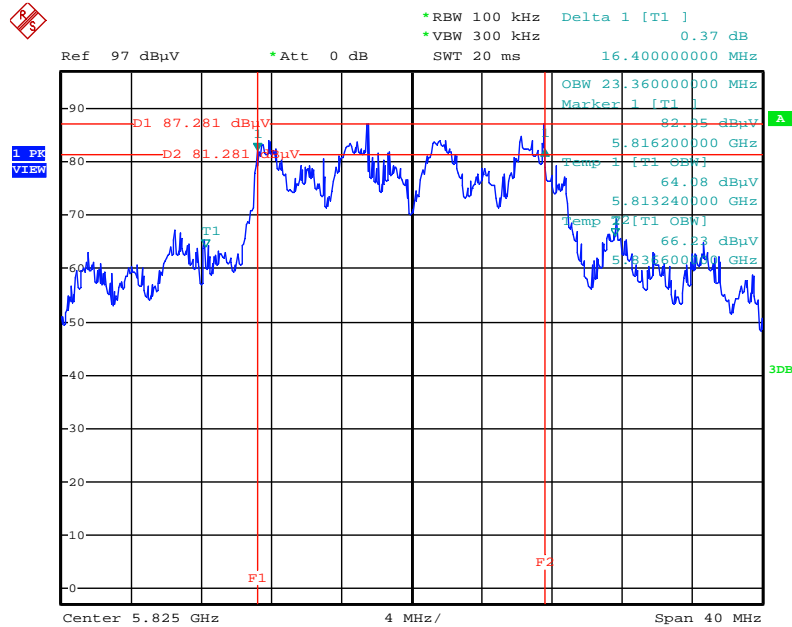
Configuration IEEE 802.11a / Ant. 1 + Ant. 2 + Ant. 3

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
149	5745 MHz	13.20	25.84	500	Complies
157	5785 MHz	12.32	22.48	500	Complies
165	5825 MHz	12.32	21.52	500	Complies

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

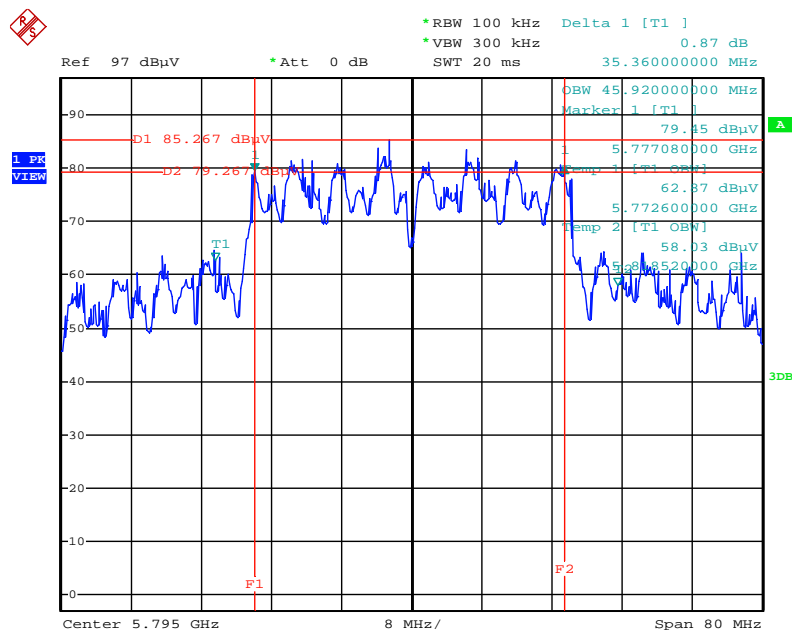
For plots, only the channel with worse result was shown.

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / 5825 MHz / Ant. 1 + Ant. 2 + Ant. 3



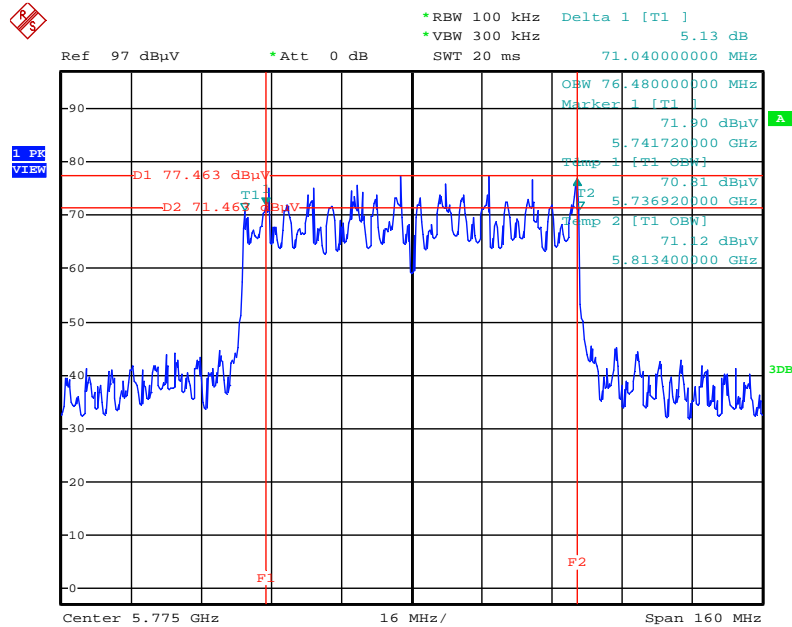
Date: 20.FEB.2014 20:46:32

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / 5795MHz / Ant. 1 + Ant. 2 + Ant. 3



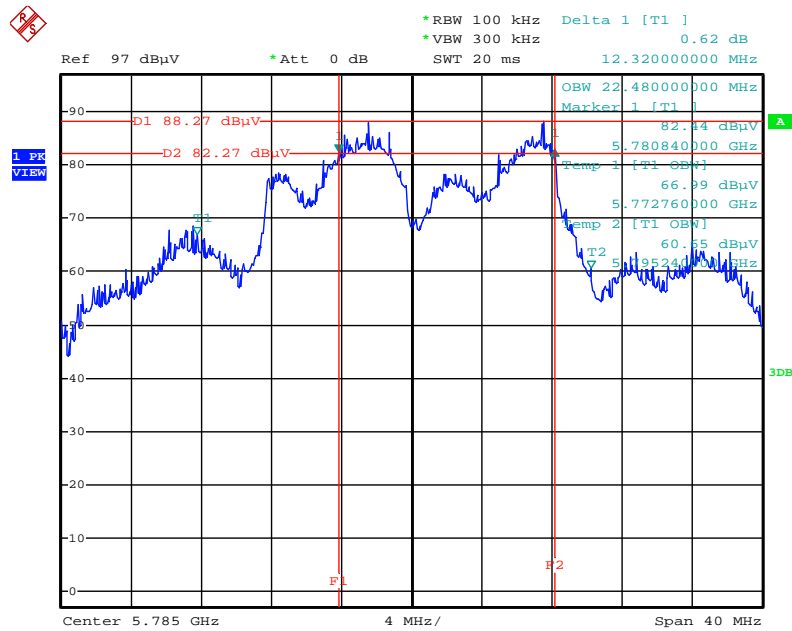
Date: 20.FEB.2014 20:48:47

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / 5775 MHz / Ant. 1 + Ant. 2 + Ant. 3



Date: 20.FEB.2014 20:49:26

6 dB Bandwidth Plot on Configuration IEEE 802.11a / 5785 MHz / Ant. 1 + Ant. 2 + Ant. 3



Date: 20.FEB.2014 20:45:02

4.5. Radiated Emissions Measurement

4.5.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. 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	1 GHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

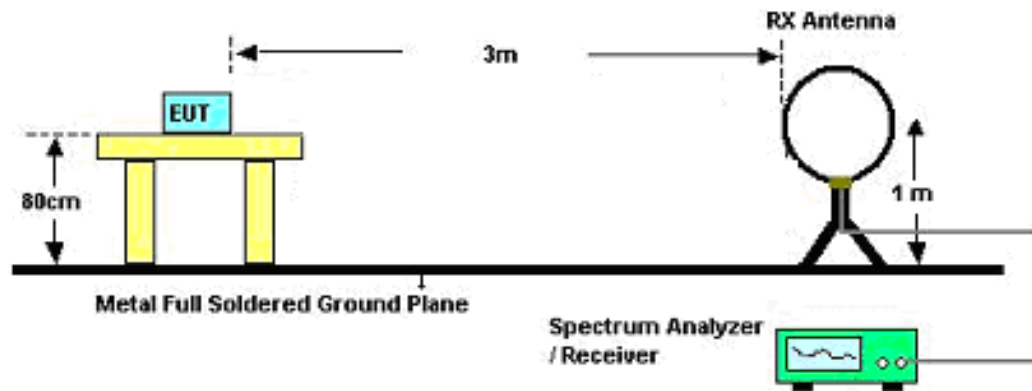
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1GHz / RBW 120kHz for QP

4.5.3. Test Procedures

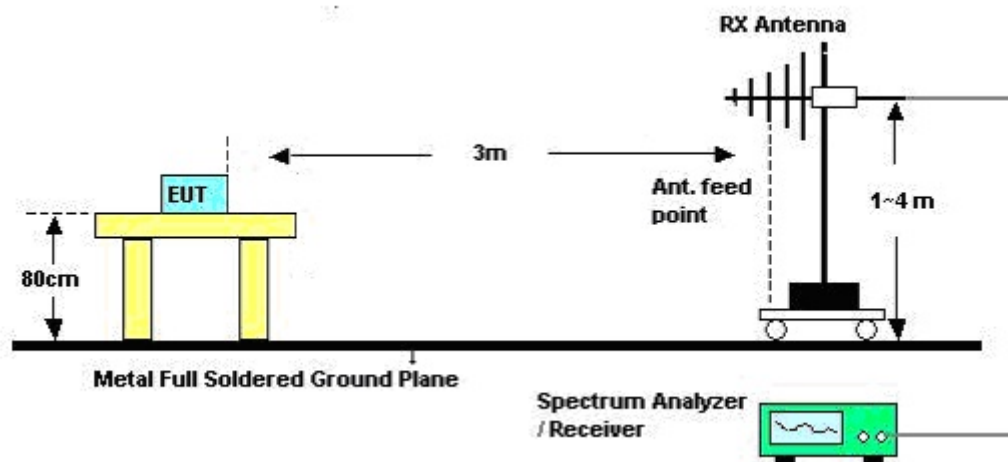
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting 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 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
8. 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.
9. 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.
10. 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

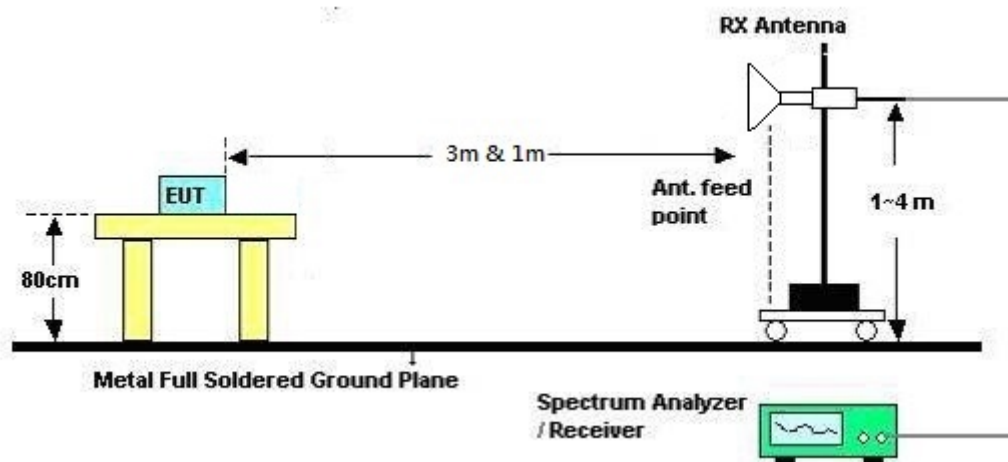
For Radiated Emissions: 9kHz ~30MHz



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

The EUT was programmed to be in continuously transmitting mode.

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

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	CTX
Test Date	Feb. 21, 2014		

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 20 dB below the permissible value has no need to be reported.

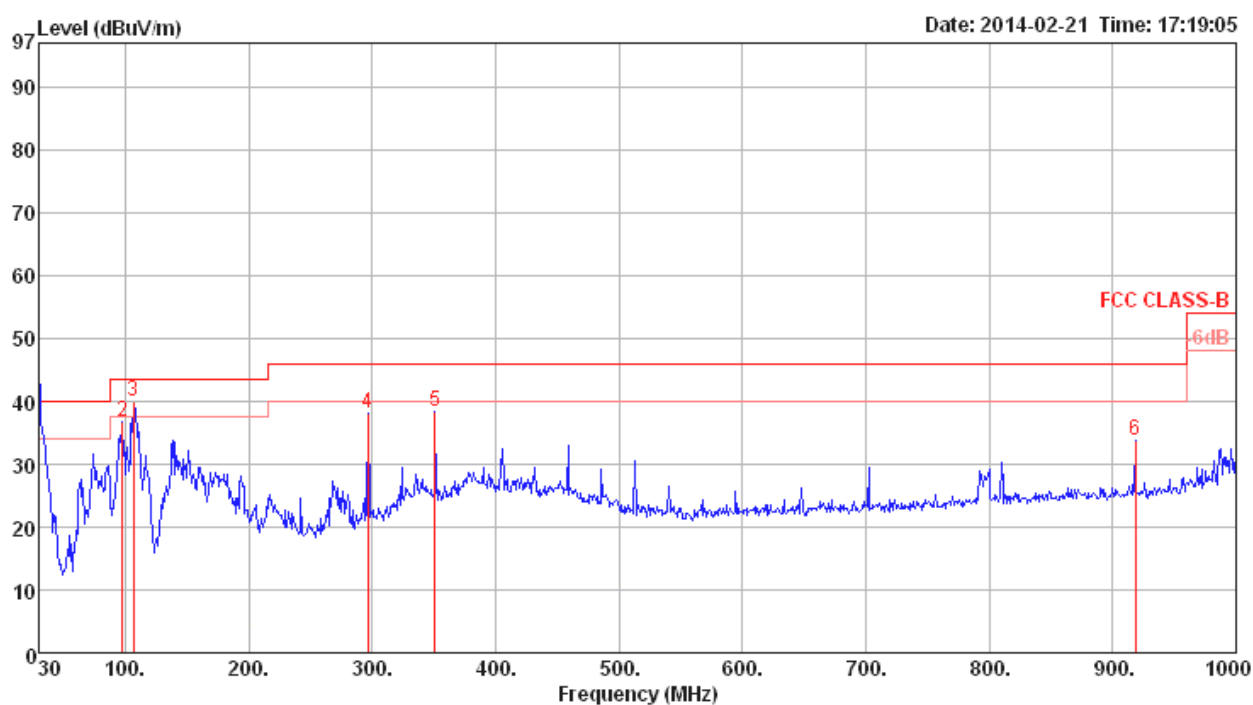
Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

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

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

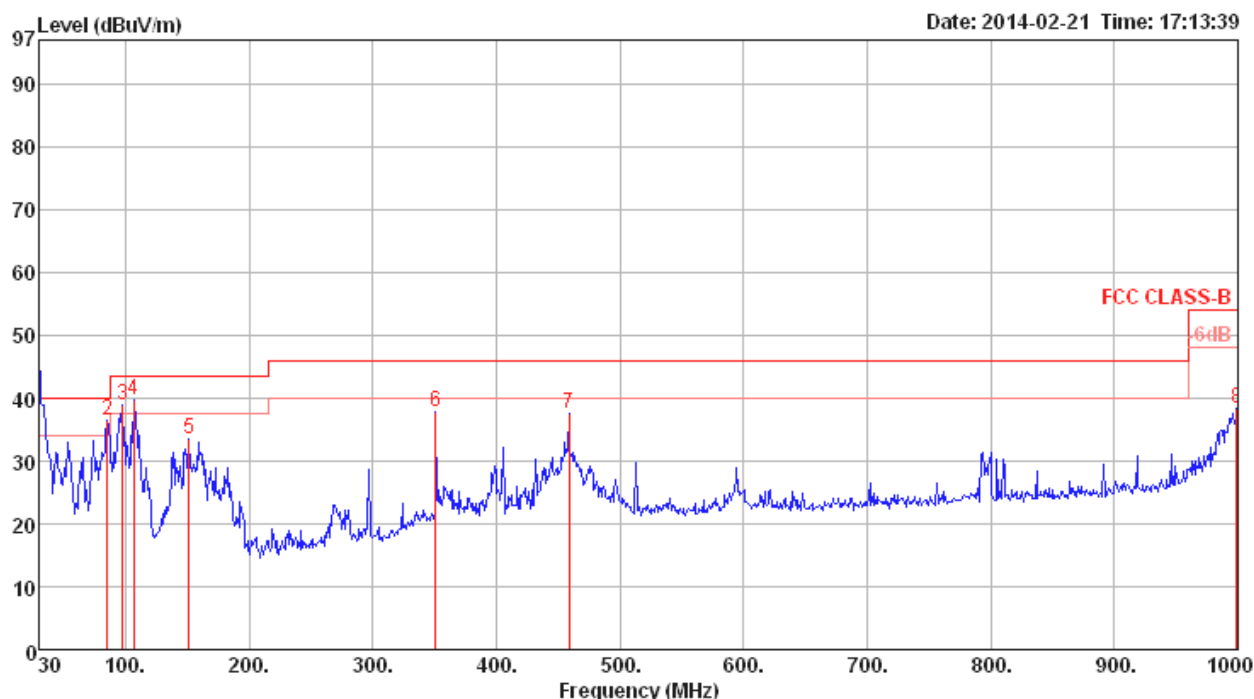
Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	CTX
Test Mode	Mode 1		

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	30.00	37.00	40.00	-3.00	45.43	0.61	18.76	27.80	QP	289	0	HORIZONTAL
2	97.90	36.68	43.50	-6.82	52.52	1.18	10.59	27.61	Peak	100	0	HORIZONTAL
3	106.63	39.90	43.50	-3.60	54.76	1.21	11.50	27.57	Peak	100	0	HORIZONTAL
4	296.75	37.96	46.00	-8.04	49.52	2.02	13.33	26.91	Peak	100	0	HORIZONTAL
5	351.07	38.34	46.00	-7.66	48.75	2.10	14.75	27.26	Peak	100	0	HORIZONTAL
6	918.52	33.68	46.00	-12.32	36.79	3.54	20.67	27.32	Peak	100	0	HORIZONTAL

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	30.00	34.71	40.00	-5.29	43.14	0.61	18.76	27.80	224	0	VERTICAL
2	85.29	36.35	40.00	-3.65	54.81	1.13	8.07	27.66	400	0	VERTICAL
3	97.90	38.94	43.50	-4.56	54.78	1.18	10.59	27.61	400	0	VERTICAL
4	106.63	39.60	43.50	-3.90	54.46	1.21	11.50	27.57	400	0	VERTICAL
5	151.25	33.43	43.50	-10.07	47.49	1.41	11.87	27.34	400	0	VERTICAL
6	351.07	37.88	46.00	-8.12	48.29	2.10	14.75	27.26	400	0	VERTICAL
7	458.74	37.67	46.00	-8.33	46.08	2.50	16.98	27.89	400	0	VERTICAL
8	999.03	38.50	54.00	-15.50	40.53	3.70	21.28	27.01	400	0	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~10th Harmonic)

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg	
1	11488.58	44.44	54.00	-9.56	31.10	9.09	39.10	34.85	100	51 HORIZONTAL	Average
2	11491.12	54.43	74.00	-19.57	41.09	9.09	39.10	34.85	100	51 HORIZONTAL	Peak

Vertical

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg	
1	11489.83	51.07	54.00	-2.93	37.73	9.09	39.10	34.85	100	333 VERTICAL	Average
2	11490.10	61.90	74.00	-12.10	48.56	9.09	39.10	34.85	100	333 VERTICAL	Peak

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 157 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11569.86	44.29	54.00	-9.71	31.02	9.11	39.01	34.85	100	286	HORIZONTAL	Average
2	11570.15	54.63	74.00	-19.37	41.36	9.11	39.01	34.85	100	286	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11571.69	52.75	54.00	-1.25	39.48	9.11	39.01	34.85	126	149	VERTICAL	Average
2	11572.21	63.86	74.00	-10.14	50.59	9.11	39.01	34.85	126	149	VERTICAL	Peak

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 165 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg		
1	11641.52	54.01	74.00	-19.99	40.82	9.11	38.93	34.85	100	28	HORIZONTAL	Peak
2	11649.42	44.88	54.00	-9.12	31.69	9.11	38.93	34.85	100	28	HORIZONTAL	Average

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg		
1	11651.01	64.05	74.00	-9.95	50.90	9.11	38.89	34.85	145	151	VERTICAL	Peak
2	11651.81	53.21	54.00	-0.79	40.06	9.11	38.89	34.85	145	151	VERTICAL	Average

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg	
1	11511.46	53.41	74.00	-20.59	40.06	9.10	39.10	34.85	100	302	HORIZONTAL Peak
2	11515.08	42.53	54.00	-11.47	29.18	9.10	39.10	34.85	100	302	HORIZONTAL Average

Vertical

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg	
1	11509.06	60.11	74.00	-13.89	46.76	9.10	39.10	34.85	153	332	VERTICAL Peak
2	11510.08	48.61	54.00	-5.39	35.26	9.10	39.10	34.85	153	332	VERTICAL Average

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 159 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos		
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg	Pol/Phase	Remark
1	11586.48	54.61	74.00	-19.39	41.38	9.11	38.97	34.85	100	342	HORIZONTAL	Peak
2	11593.30	43.81	54.00	-10.19	30.58	9.11	38.97	34.85	100	342	HORIZONTAL	Average

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos		
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg	Pol/Phase	Remark
1	11592.06	52.03	54.00	-1.97	38.80	9.11	38.97	34.85	148	155	VERTICAL	Average
2	11592.49	63.45	74.00	-10.55	50.22	9.11	38.97	34.85	148	155	VERTICAL	Peak

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5133.20	48.05	74.00	-25.95	44.47	5.98	33.01	35.41	175	119 HORIZONTAL	Peak
2	5133.52	40.34	54.00	-13.66	36.76	5.98	33.01	35.41	175	119 HORIZONTAL	Average
3	11550.46	53.75	74.00	-20.25	40.49	9.10	39.01	34.85	100	39 HORIZONTAL	Peak
4	11550.96	42.24	54.00	-11.76	28.98	9.10	39.01	34.85	100	39 HORIZONTAL	Average

Vertical

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	5133.47	50.92	54.00	-3.08	47.34	5.98	33.01	35.41	100	84 VERTICAL	Average
2	5133.58	55.92	74.00	-18.08	52.34	5.98	33.01	35.41	100	84 VERTICAL	Peak
3	11547.30	47.05	54.00	-6.95	33.74	9.10	39.06	34.85	114	150 VERTICAL	Average
4	11552.00	57.69	74.00	-16.31	44.43	9.10	39.01	34.85	114	150 VERTICAL	Peak

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11a CH 149 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg		
1	11488.29	44.48	54.00	-9.52	31.14	9.09	39.10	34.85	100	296	HORIZONTAL	Average
2	11493.01	55.45	74.00	-18.55	42.11	9.09	39.10	34.85	100	296	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg		
1	11489.59	62.82	74.00	-11.18	49.48	9.09	39.10	34.85	100	333	VERTICAL	Peak
2	11489.84	50.64	54.00	-3.36	37.30	9.09	39.10	34.85	100	333	VERTICAL	Average

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11a CH 157 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11568.38	54.81	74.00	-19.19	41.54	9.11	39.01	34.85	100	296	HORIZONTAL	Peak
2	11573.04	43.88	54.00	-10.12	30.61	9.11	39.01	34.85	100	296	HORIZONTAL	Average

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11569.20	60.52	74.00	-13.48	47.25	9.11	39.01	34.85	100	332	VERTICAL	Peak
2	11569.44	50.81	54.00	-3.19	37.54	9.11	39.01	34.85	100	332	VERTICAL	Average

Temperature	24°C	Humidity	53%
Test Engineer	Nick Peng	Configurations	IEEE 802.11a CH 165 / Ant. 1 + Ant. 2 + Ant. 3
Test Date	Jan. 24, 2014		

Horizontal

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg		
1	11648.82	44.58	54.00	-9.42	31.39	9.11	38.93	34.85	100	294	HORIZONTAL	Average
2	11653.92	54.91	74.00	-19.09	41.76	9.11	38.89	34.85	100	294	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	Loss	Factor	Factor	cm	deg		
1	11648.16	60.08	74.00	-13.92	46.89	9.11	38.93	34.85	100	342	VERTICAL	Peak
2	11648.50	49.33	54.00	-4.67	36.14	9.11	38.93	34.85	100	342	VERTICAL	Average

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. Emissions Measurement

4.6.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. 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

4.6.2. 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)	1MHz / 3MHz for Peak, 1 MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100 kHz / 300 kHz for Peak

4.6.3. Test Procedures

For Radiated band edges Measurement:

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

For Radiated Out of Band Emission Measurement:

1. Test was performed in accordance with KDB 558074 D01 v03r01 for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10.1 Unwanted Emissions into Non-Restricted Frequency Bands Measurement Procedure
2. The radiated emission test is performed on each TX port of operating mode without summing or adding $10\log(N)$ since the limit is relative emission limit.
Only worst data of each operating mode is presented.

4.6.4. Test Setup Layout

For Radiated band edges Measurement:

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

For Radiated Out of Band Emission Measurement:

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

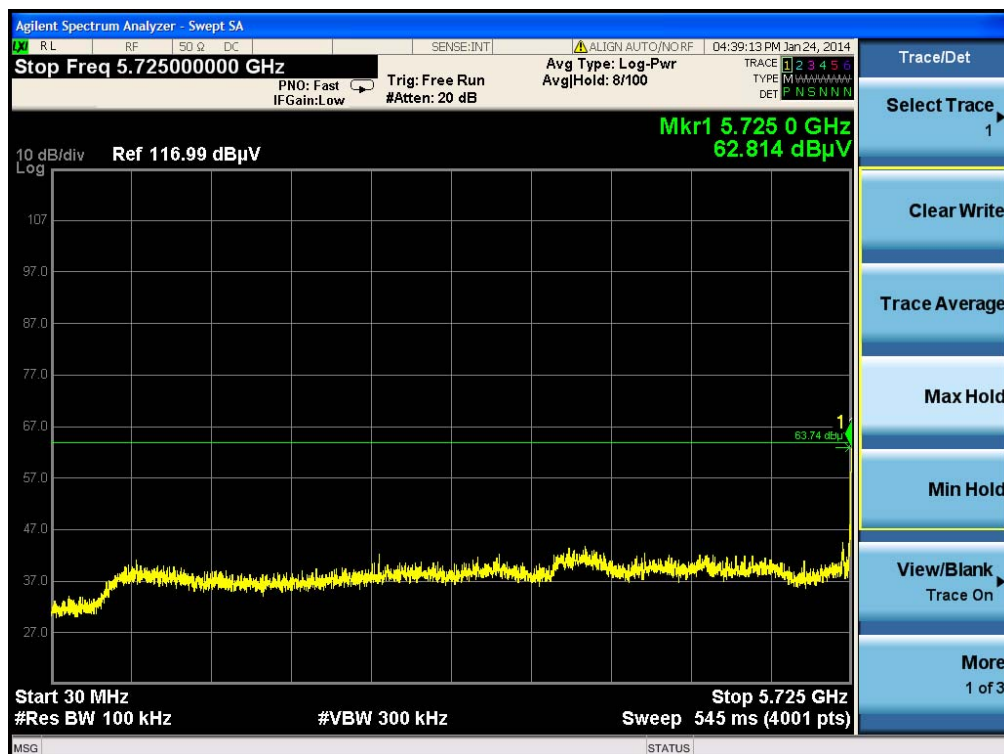
The EUT was programmed to be in continuously transmitting mode.

4.6.7. Test Result of Band Edge and Fundamental Emissions

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Reference Level



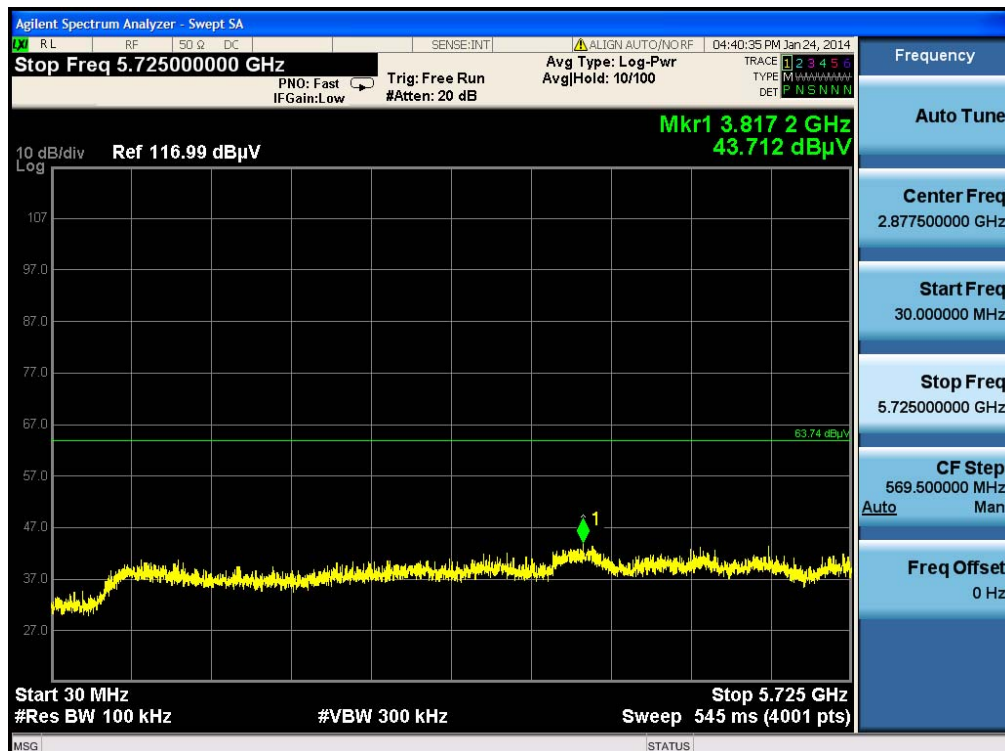
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 149 / 30MHz~5725MHz (down 30dBc)



Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 149 / 5850MHz~40000MHz (down 30dBc)



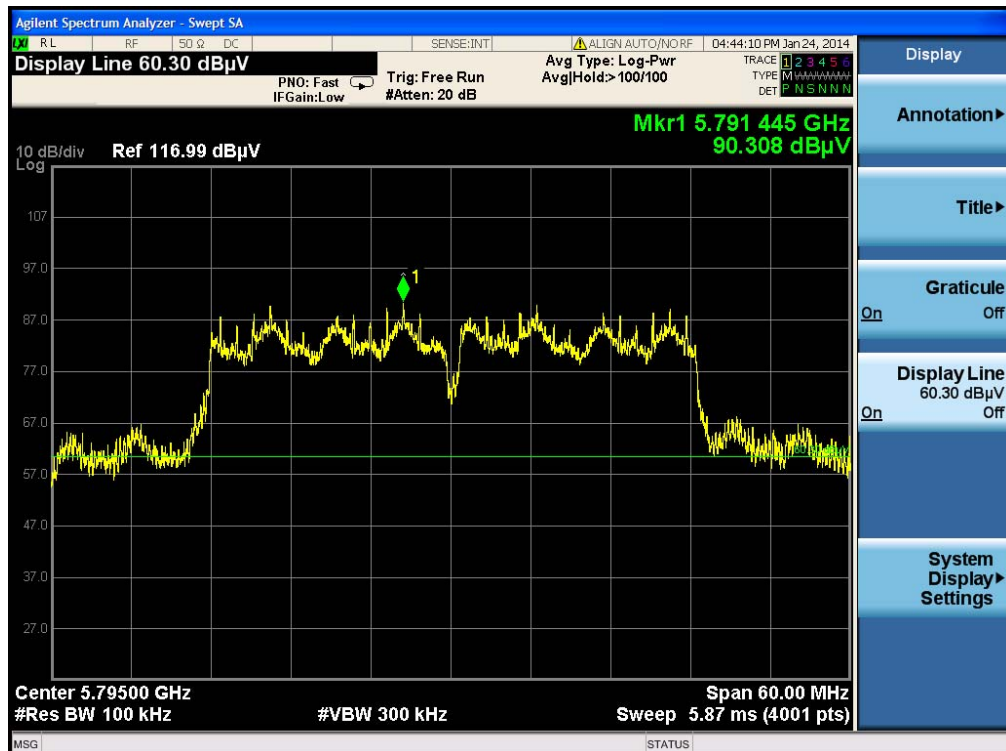
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 165 / 30MHz~5725MHz (down 30dBc)



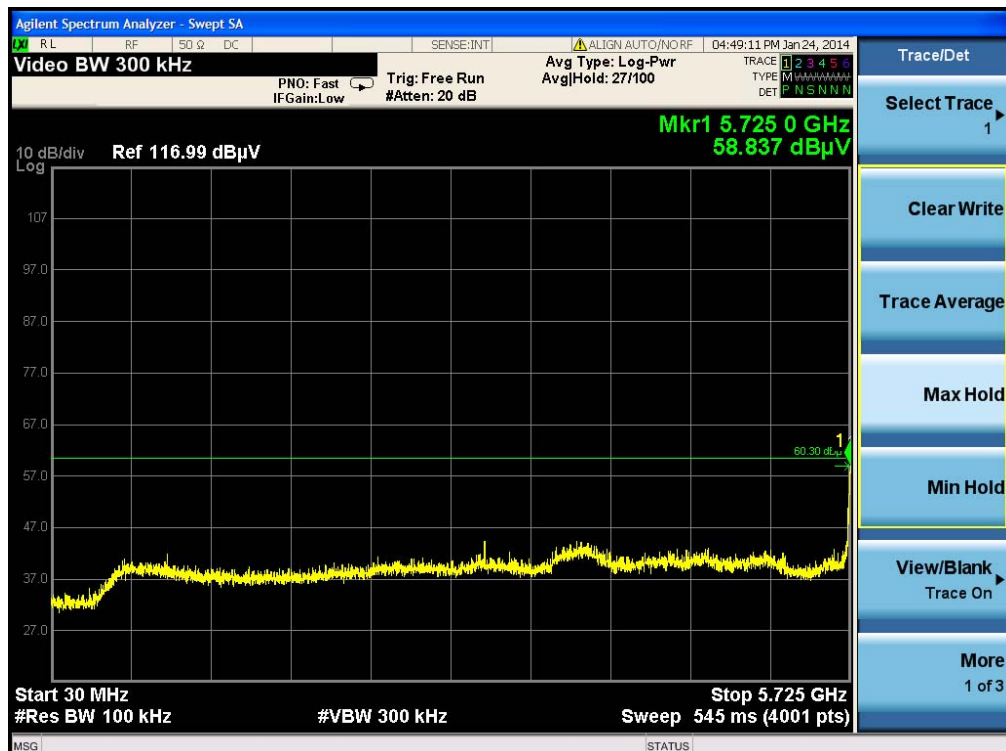
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 165 / 5850MHz~40000MHz (down 30dBc)



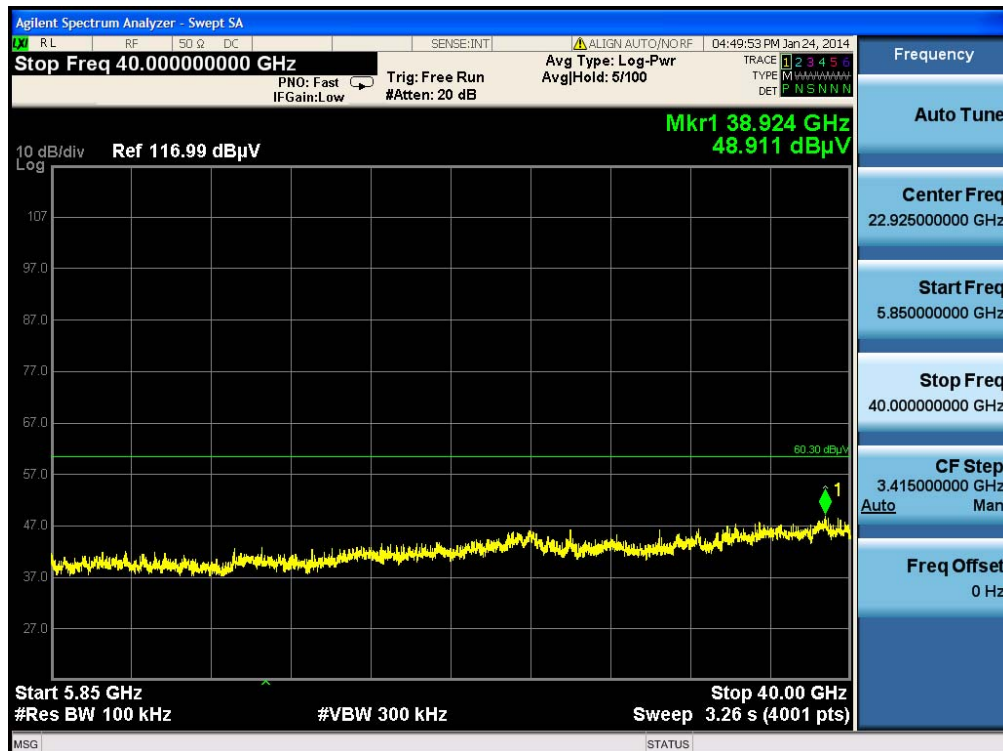
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Reference Level



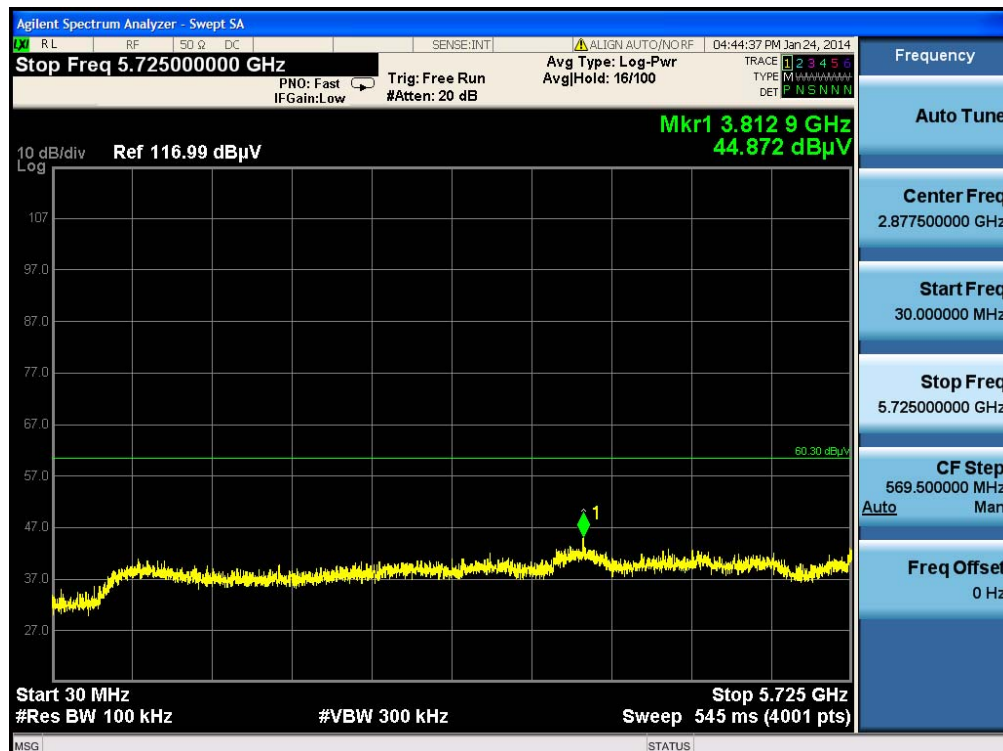
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 151 / 30MHz~5725MHz (down 30dBc)



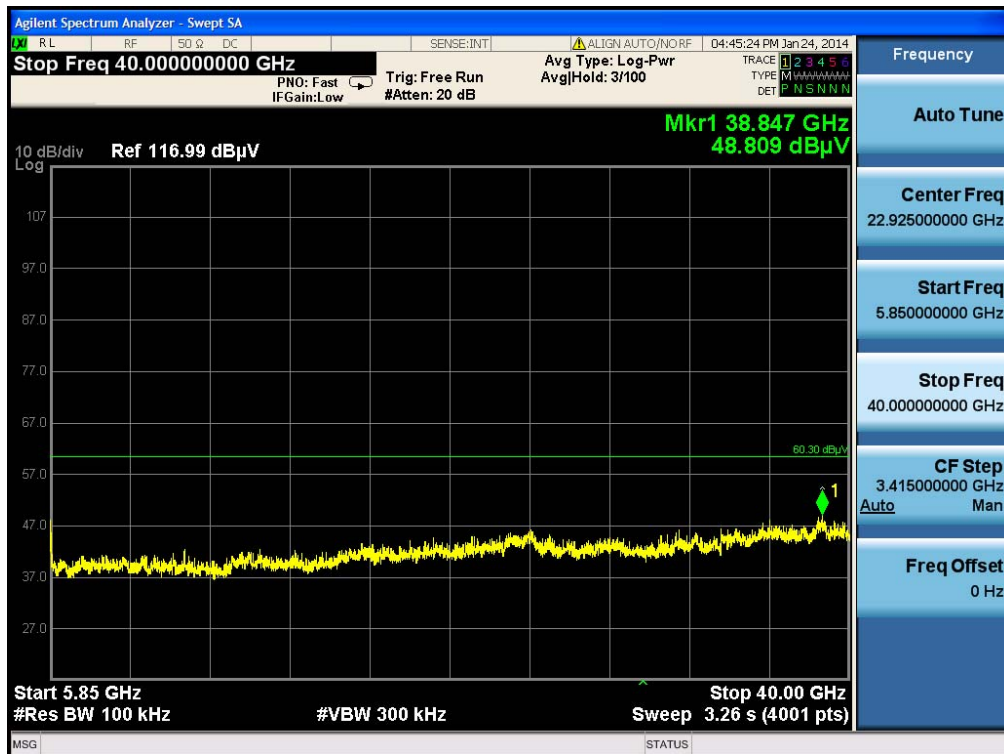
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 151 / 5850MHz~40000MHz (down 30dBc)



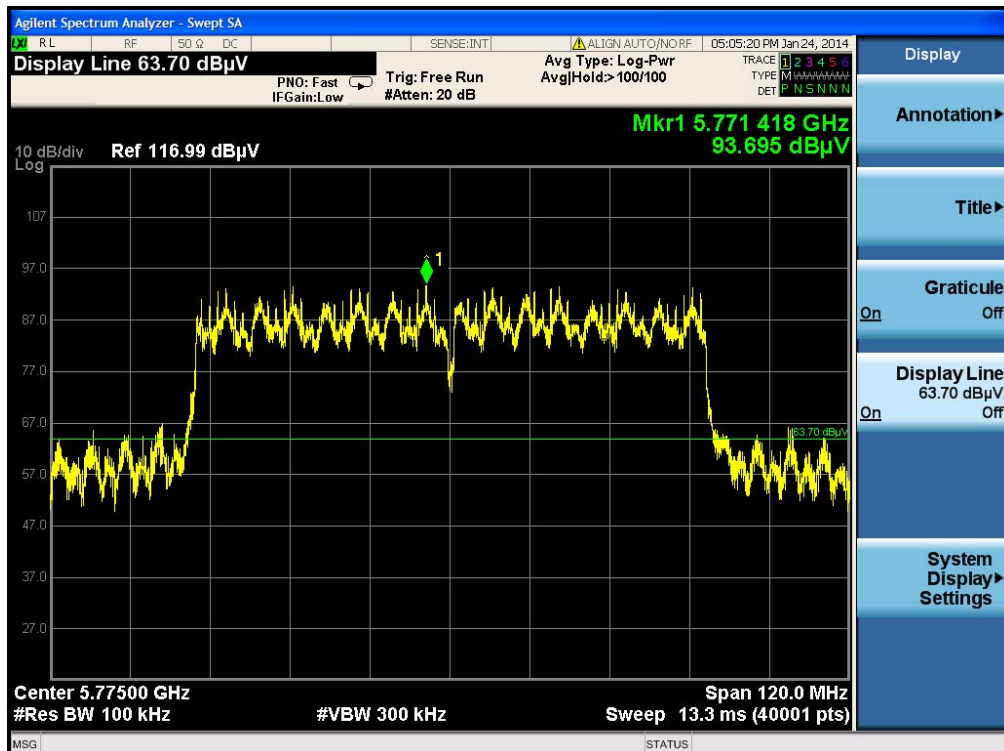
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 159 / 30MHz~5725MHz (down 30dBc)



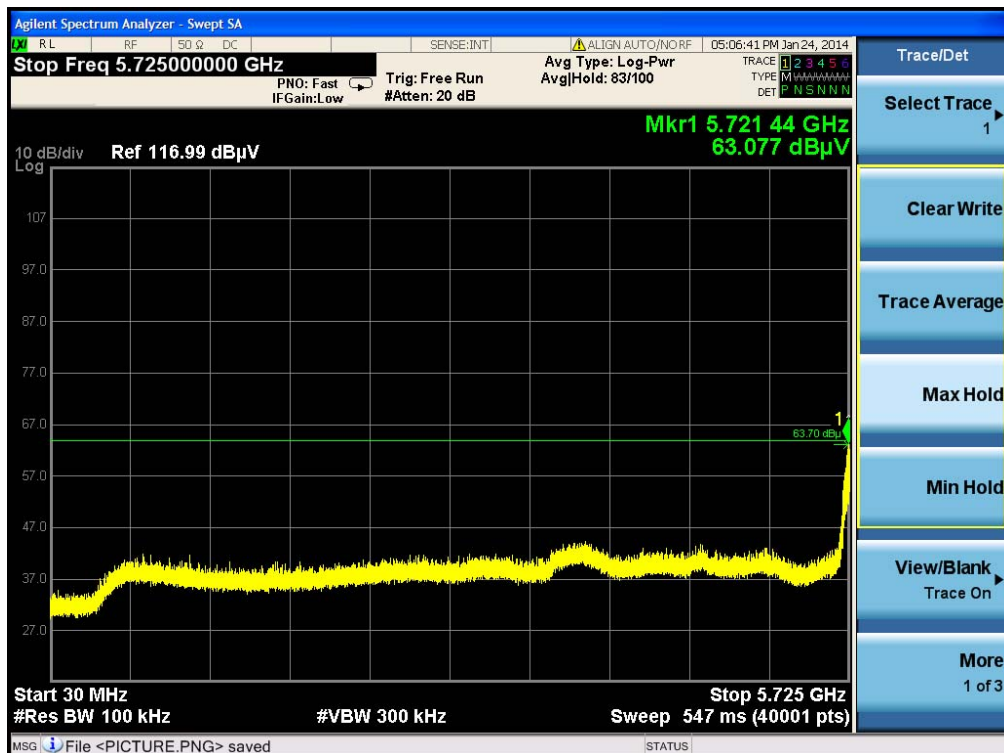
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 159 / 5850MHz~40000MHz (down 30dBc)



Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Reference Level



Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / CH 155 / 30MHz~5725MHz (down 30dBc)





Agilent Spectrum Analyzer - Swept SA

RL RF 50 Ω DC SENSE:INT Δ ALIGN AUTO/NORF 05:07:49 PM Jan 24, 2014

Marker 1 5.850853750000 GHz PNO: Fast IF Gain: Low Trig: Free Run #Atten: 20 dB Avg Type: Log-Pwr Avg/Hold: 15/100 TRACE 1 2 3 4 5 6 TYPE M N S N N N DET P N S N N N

10 dB/div Log Ref 116.99 dB μ V Mkr1 5.850 9 GHz 56.896 dB μ V

Start 5.85 GHz #Res BW 100 kHz #VBW 300 kHz Stop 40.00 GHz Sweep 3.26 s (40001 pts)

MSG STATUS

Peak Search

Next Peak

Next Pk Right

Next Pk Left

Marker Delta

Mkr→CF

Mkr→Ref Lvl

More

1 of 2

[illegible]

Agilent Spectrum Analyzer - Swept SA

RL RF 50 Ω DC SENSE:INT

Stop Freq 5.72500000 GHz

PNO: Fast IF Gain: Low Trig: Free Run #Atten: 20 dB

Avg Type: Log-Pwr AvgHld: >100/100

04:34:22 PM Jan 24, 2014

TRACE 1 2 3 4 5 6

TYPE M M M M M M M M

DET P N S N N N

Frequency

Auto Tune

Center Freq 2.877500000 GHz

Start Freq 30.000000 MHz

Stop Freq 5.72500000 GHz

CF Step 569.500000 MHz

Auto Man

Freq Offset 0 Hz

10 dB/div Ref 116.99 dB μ V

Log

107

97.0

87.0

77.0

67.0

57.0

47.0

37.0

27.0

Mkr1 5.725 0 GHz

58.995 dB μ V

62.58 dB

Start 30 MHz

#Res BW 100 kHz

#VBW 300 kHz

Stop 5.725 GHz

Sweep 545 ms (4001 pts)

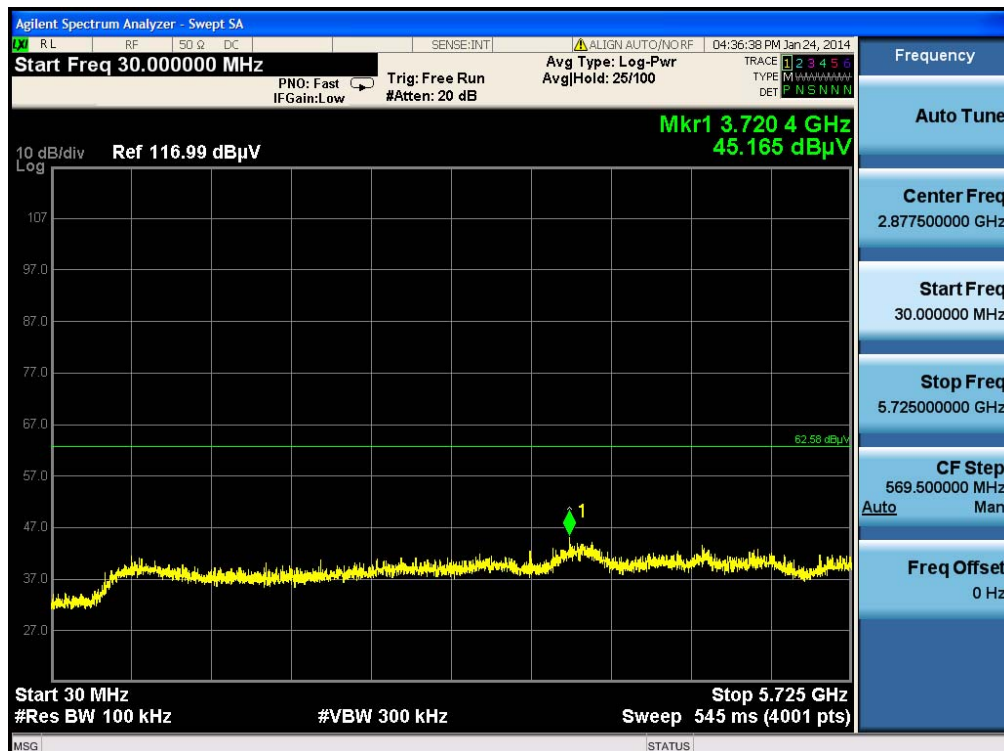
MSG Alignment Completed

STATUS

Plot on Configuration IEEE 802.11a / CH 149 / 5850MHz~40000MHz (down 30dBc)



Plot on Configuration IEEE 802.11a / CH 165 / 30MHz~5725MHz (down 30dBc)



Plot on Configuration IEEE 802.11a / CH 165 / 5850MHz~40000MHz (down 30dBc)



4.7. Antenna Requirements

4.7.1. 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.

4.7.2. 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	9kHz ~ 2.75GHz	Apr. 12, 2013	Conduction (CO01-CB)
EMI Test Receiver	R&S	ESCS 30	100355	9 kHz ~ 2.75 GHz	Apr. 23, 2014	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Nov. 23, 2013	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Nov. 23, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	Dec. 04, 2013	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	N.C.R	Conduction (CO01-CB)
Bilog Antenna	SCHAFFNER	CBL61112B	2894	30MHz - 1GHz	Nov. 14, 2013	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz ~ 30MHz	Nov. 05, 2012*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz~18GHz	Nov. 01, 2013	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	30MHz - 1GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-3	N/A	1GHz - 40GHz	Nov. 17, 2013	Radiation (03CH01-CB)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
RF Cable-high	Woken	High Cable-4	N/A	1GHz – 40GHz	Nov. 17, 2013	Radiation (03CH01-CB)
Signal analyzer	R&S	FSV40	100979	9kHz~40GHz	Nov. 29, 2013	Conducted (TH01-CB)
RF Power Divider	Woken	2 Way	0120A02056002D	2GHz ~ 18GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Power Divider	Woken	3 Way	MDC2366	2GHz ~ 18GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Power Divider	Woken	4 Way	0120A04056002D	2GHz ~ 18GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-7	-	1GHz – 26.5GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-8	-	1GHz – 26.5GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-9	-	1GHz – 26.5GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-10	-	1GHz – 26.5GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-11	-	1GHz – 26.5GHz	Nov. 17, 2013	Conducted (TH01-CB)
Power Sensor	Anritsu	MA2411B	0917223	300MHz~40GHz	Sep. 18, 2013	Conducted (TH01-CB)
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.

N.C.R. means Non-Calibration required.

6. MEASUREMENT UNCERTAINTY

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

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	0.026	dB	normal(k=2)	0.013
Cable loss	0.002	dB	normal(k=2)	0.001
AMN/LISN specification	1.200	dB	normal(k=2)	0.600
Mismatch Receiver VSWR 1 = AMN/LISN VSWR 2 =	-0.080	dB	U-shaped	0.060
Combined standard uncertainty $U_c(y)$				1.2
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				2.4

Uncertainty of Radiated Emission Measurement (30MHz ~ 1,000MHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	± 0.173	dB	K=1	0.086
Cable loss	± 0.174	dB	K=2	0.087
Antenna gain	± 0.169	dB	K=2	0.084
Site imperfection	± 0.433	dB	Triangular	0.214
Pre-amplifier gain	± 0.366	dB	K=2	0.183
Transmitter antenna	± 1.200	dB	Rectangular	0.600
Signal generator	± 0.461	dB	Rectangular	0.231
Mismatch	± 0.080	dB	U-shape	0.040
Spectrum analyzer	± 0.500	dB	Rectangular	0.250
Combined standard uncertainty $U_c(y)$				1.778
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				3.555

Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	± 0.191	dB	K=1	0.095
Cable loss	± 0.169	dB	K=2	0.084
Antenna gain	± 0.191	dB	K=2	0.096
Site imperfection	± 0.582	dB	Triangular	0.291
Pre-amplifier gain	± 0.304	dB	K=2	0.152
Transmitter antenna	± 1.200	dB	Rectangular	0.600
Signal generator	± 0.461	dB	Rectangular	0.231
Mismatch	± 0.080	dB	U-shape	0.040
Spectrum analyzer	± 0.500	dB	Rectangular	0.250
Combined standard uncertainty $U_c(y)$				1.839
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				3.678

Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	± 0.186	dB	K=1	0.093
Cable loss	± 0.167	dB	K=2	0.083
Antenna gain	± 0.190	dB	K=2	0.095
Site imperfection	± 0.488	dB	Triangular	0.244
Pre-amplifier gain	± 0.269	dB	K=2	0.134
Transmitter antenna	± 1.200	dB	Rectangular	0.600
Signal generator	± 0.461	dB	Rectangular	0.231
Mismatch	± 0.080	dB	U-shape	0.040
Spectrum analyzer	± 0.500	dB	Rectangular	0.250
Combined standard uncertainty $U_c(y)$				1.771
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				3.541

Uncertainty of Conducted Emission Measurement

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Cable loss	± 0.038	dB	K=2	0.019
Attenuator	± 0.047	dB	K=2	0.024
Power Meter specification	± 0.300	dB	Triangular	0.150
Power Sensor specification	± 0.300	dB	Rectangular	0.150
Signal generator	± 0.461	dB	Rectangular	0.231
Mismatch	± 0.080	dB	U-shape	0.040
Spectrum analyzer	± 0.500	dB	Rectangular	0.250
Combined standard uncertainty $U_c(y)$				0.863
Measuring uncertainty for a level of confidence of 95% $U = 2U_c(y)$				1.726