Nemko Korea Co., Ltd.

155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-852 KOREA, REPUBLIC OF
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FCC and IC EVALUATION REPORT FOR CLASS II PERMISSIVE CHANGE

Applicant :

Samsung Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, Korea.
(Post code : 443-742)
Attn. : Mr. Dongwook. Shin

Dates of Issue : September 11, 2013
Test Report No. : NK-13-R-107-2
Test Site : Nemko Korea Co., Ltd.

FCC ID	**A3LWIDT30Q**
IC	**649E-WIDT30Q**
Brand Name	**SAMSUNG**
Contact Person	**Samsung Electronics Co., Ltd.** **129, Samsung-ro, Yeongtong-gu,** **Suwon-si, Gyeonggi-do, Korea, 443-742.** **Mr. Dongwook. Shin** **Telephone No. : +82-31-200-5698**

Applied Standard:	FCC 47 CFR Part 15.407 and IC RSS-210 Issue 8
Classification:	Unlicensed National Information Infrastructure (UNII)
EUT Type:	WiFi module

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2009, ANSI C63.10-2009. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Sep. 11. 2013
Tested By : Jin-ha Ko
Engineer

Sep 11. 2013
Reviewed By : Deokha Ryu
Technical Manager

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1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.407 and IC RSS-210 Issue 8.

Responsible Party :	Samsung Electronics Co., Ltd.
Contact Person :	Mr. Dongwook. Shin
Manufacturer :	Samsung Electronics Co., Ltd. 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 443-742

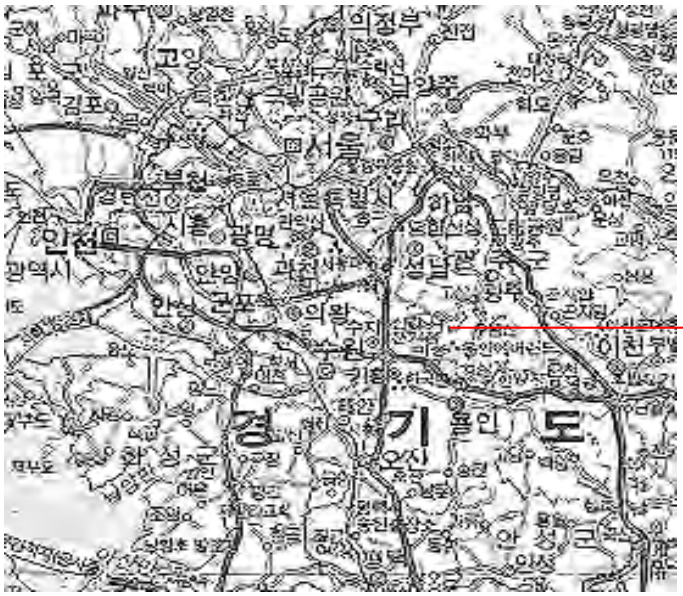
- FCC ID: A3LWIDT30Q
- IC : 649E-WIDT30Q
- Model: WIDT30Q
- Brand Name: SAMSUNG
- EUT Type: WiFi module
- Classification: Unlicensed National Information Infrastructure (UNII)
- Applied Standard: FCC 47 CFR Part 15.407 and IC RSS-210 Issue 8
- Test Procedure(s): ANSI C63.4-2009, ANSI C63.10-2009 and FCC guidance of General UNII Test Procedures 789033 D01 v01r02 and 789033 D01 v01r03
- Dates of Test: June 23, 2013 ~ July 18, 2013
- Place of Tests: Nemko Korea Co., Ltd.

2. INTRODUCTION

2.1 Test facility

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.**
FCC ID : A3LWIDT30Q and **IC : 649E-WIDT30Q**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory*** .
The site address 155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-852 KOREA, REPULIC OF.
The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 km (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 km (18miles) south-southeast from central Seoul.
It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.
The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 2009.



Nemko Korea Co., Ltd.
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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

2.2 Accreditation and listing

Accreditation type		Accreditation number
FC	FCC part 15/18 Filing site	Registration No. 97992
	CAB Accreditation for DOC	Designation No. KR0026
KOLAS	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
Industry Canada	Canada IC Registered site	Site No. 2040E
VCCI	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
IECEE CB SCHEME	EMC CBTL	-
방송통신위원회	KCC(RRL)Designated Lab.	Registration No. KR0026
	SASO registered Lab and Certification Body	Registration No. 2008-15

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT is the MIMO transceiver which is module supporting the 802.11a/b/g/n mode (802.11a/b/g :1TX/1RX, 802.11n: 2TX/2RX).
During the test, the EUT was connected to laptop PC and then a test program was executed to operate EUT continuously. The operating voltage of EUT was 5 Vdc supplied from a USB port on Laptop PC. The EUT was tested at the lowest channel, middle channel and the highest channel with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

3.1.1 Table of test channels

Frequency band	Mode	Test Channel (CH)	Frequency (MHz)
Band I	802.11a	36	5180
		40	5200
		48	5240
	802.11n(20 MHz)	36	5180
		40	5200
		48	5240
	802.11n(40 MHz)	38	5190
		46	5230
Band II	802.11a	52	5260
		56	5280
		64	5320
	802.11n(20 MHz)	52	5260
		56	5280
		64	5320
	802.11n(40 MHz)	54	5270
		62	5310
Band III	802.11a	100	5500
		116	5580
		140	5700
	802.11n(20 MHz)	100	5500
		116	5580
		140	5700
	802.11n(40 MHz)	102	5510
		118	5590
		134	5670

3.1.2 Table of test modes

Test Items	Mode	Data rate (Mbps)	Test Channel (CH)
Conducted Emissions	802.11n(20 MHz)	MCS0	56
Radiated Emissions	802.11n(20 MHz)	MCS0	56
Radiated Spurious Emissions, Band edge Emissions	802.11a	6	36/40/48 52/56/64 100/116/140
	802.11n(20 MHz)	MCS0	36/40/48 52/56/64 100/116/140
	802.11n(40 MHz)	MCS0	38/46 54/62 102/118/134

3.1.3 Antenna TX mode information:

Frequency band	Mode	Antenna TX mode	Support MIMO
5 GHz	802.11a	■ 1TX, □ 2TX	□ Yes, ■ No
	802.11n(20 MHz) 802.11n(40 MHz)	□ 1TX, ■ 2TX	■ Yes, □ No

Note(s) :
1. The EUT support both chains transmit and receive simultaneously for 802.11n(20 MHz/40 MHz).
2. The EUT support the antenna with TX diversity function for 802.11a.

3.1.4 Description of available antennas

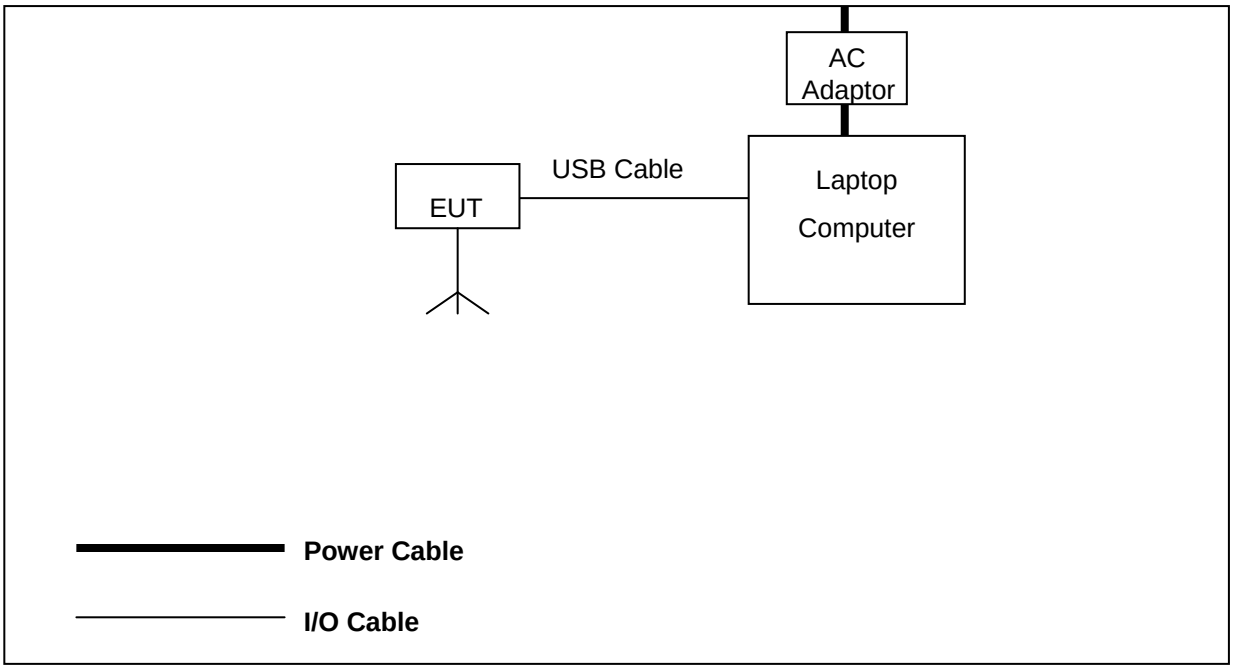
The radio utilized two external omni directional antennas. The following is the list of the antennas to be added to WIDT30Q certifications.

Antenna Part Number (main & aux)	Antenna Type	Peak Gain include Cable Loss(dBi)	Frequency band
WIFI-SAMUSNG-002	PIFA	-2.28	Band I
		-2.28	Band II
		-4.04	Band III
WIFI-SAMSUNG-003	PIFA	-7.77	Band I
		-4.80	Band II
		-8.42	Band III

3.2 Support Equipment

EUT	Samsung Electronics Co., Ltd. FCC ID: A3LWIDT30Q	S/N: N/A
Laptop Computer	Samsung Electronics Co., Ltd. Model : NT-R55 0.3 m unshielded pin connector cable	FCC DOC S/N : 408L93AP400115W
AC/DC Adapter	Chicony Power Technology Co., Ltd. Model : AD-9019S 1.5 m unshielded power cable	FCC DOC S/N : CNBA4400215ADON81BT01V8

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung WiFi module FCC ID: A3LWIDT30Q, IC: 649E-WIDT30Q.**

Specifications:

Category	WiFi module
Model Name	WIDT30Q
Brand Name	SAMSUNG
Frequency of Operation	For Band I 802.11a,n(20 MHz): 5180 MHz ~ 5240 MHz 802.11n(40 MHz) : 5190 MHz ~ 5230 MHz For Band II 802.11a,n(20 MHz): 5260 MHz ~ 5320 MHz 802.11n(40 MHz) : 5270 MHz ~ 5310 MHz For Band III 802.11a,n(20 MHz): 5500 MHz ~ 5700 MHz 802.11n(40 MHz) : 5510 MHz ~ 5670 MHz
Power Output (Conducted)	For Band I 802.11a : 12.89 dBm 802.11n(20 MHz) : 13.42 dBm 802.11n(40 MHz) : 13.33 dBm For Band II 802.11a : 15.12 dBm 802.11n(20 MHz) : 15.22 dBm 802.11n(40 MHz) : 14.44 dBm For Band III 802.11a : 15.40 dBm 802.11n(20 MHz) : 16.17 dBm 802.11n(40 MHz) : 12.56 dBm
Channels	For Band I 802.11a, n(20 MHz) : 4 CH 802.11n(40 MHz): 2 CH For Band II 802.11a, n(20 MHz) : 4 CH 802.11n(40 MHz): 2 CH For Band III 802.11a, n(20 MHz) : 11 CH 802.11n(40 MHz): 5 CH
Antenna Gain (peak)	For Band I Ant 0 : -2.28 dBi, Ant1 : -7.77 dBi For Band II Ant 0 : -2.28 dBi, Ant1 : -4.80 dBi

	For Band III Ant 0 : -4.04 dBi, Ant1 : -8.42 dBi
Antenna setup	802.11a : 1TX / 1RX 802.11n(20 MHz), 802.11n(40 MHz) : 2TX / 2RX
Modulations	OFDM(BPSK,QPSK,16QAM,64QAM) for 802.11a,g,n
Temperature Range	-20 ℃ ~ +50 ℃
Voltage	5.0 Vdc
Dimensions (D x W x H)	55 mm x 24 mm x 6 mm (Module only)
Weight	6 g
Remarks	-

IEEE 802.11n specification :

CS Index	Spatial Streams	Modulation Type	Coding Rate	Data Rate Mb/s			
				20 MHz		40 MHz	
				800ns GI	400ns GI	800ns GI	400ns GI
0	1	BPSK	1/2	6.5	7.2	13.5	15.0
1	1	QPSK	1/2	13.0	14.4	27.0	30.0
2	1	QPSK	3/4	19.5	21.7	40.5	45.0
3	1	16-QAM	1/2	26.0	28.9	54.0	60.0
4	1	16-QAM	3/4	39.0	43.3	81.0	90.0
5	1	64-QAM	2/3	52.0	57.8	108.0	120.0
6	1	64-QAM	3/4	58.5	65.0	121.5	135.0
7	1	64-QAM	5/6	65.0	72.2	135.0	150.0
8	2	BPSK	1/2	13.0	14.4	27.0	30.0
9	2	QPSK	1/2	26.0	28.9	54.0	60.0
10	2	QPSK	3/4	39.0	43.3	81.0	90.0
11	2	16-QAM	1/2	52.0	57.8	108.0	120.0
12	2	16-QAM	3/4	78.0	86.7	162.0	180.0
13	2	64-QAM	2/3	104.0	115.6	216.0	240.0
14	2	64-QAM	3/4	117.0	130.0	243.0	270.0
15	2	64-QAM	5/6	130.0	144.4	270.0	300.0

3.5 Description of change

- Enclosure of the module was removed.
- Antennas were changed.
- Antenna gain was changed.

	Before	After
Antenna Type	Integrated type antenna	External type antenna
Antenna Gain	For Band I and II: Ant 0 : 2.69 dBi, Ant1 :2.50 dBi For Band III: Ant 0 : 1.30 dBi, Ant1 : -0.25 dBi	For Band I: Ant 0 : -2.28 dBi, Ant1 : -7.77 dBi For Band II: Ant 0 : -2.28 dBi, Ant1 : -4.80 dBi For 5 GHz Higher sub-band: Ant 0 : -4.04 dBi, Ant1 : -8.42 dBi

- Printed circuit board, component lay out and frequency bands are the same as previous model. Therefore radiated emissions test was performed only.

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	IC Paragraph No.	Result	Remark
Conducted Emission	15.207	RSS-GEN 7.2.4	Complies	*Tested
Radiated Emission	15.209	RSS-210 Issue 8 A9.2	Complies	*Tested
26 dB Spectrum Bandwidth	15.407(a)	RSS-210 Issue 8 A9.2	Complies	Excluded
Maximum Conducted Output Power	15.407(a)	RSS-210 Issue 8 A9.2	Complies	Excluded
Power Spectral Density	15.407(a)	RSS-210 Issue 8 A9.2	Complies	Excluded
Peak Excursion Measurement	15.407(a)	-	Complies	Excluded
Radiated Spurious Emission	15.407(b)	RSS-210 Issue 8 A9.2	Complies	*Tested
Frequency Stability	15.407(g)	-	Complies	Excluded
Maximum Permissible Exposure	1.1307(b)	RSS-102	Complies	*Tested

Note(s):

** Printed circuit board, component lay out and frequency bands are the same as previous model. Therefore radiated emissions test was performed only.*

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung WiFi module FCC ID: A3LWIDT30Q, IC : 649E-WIDT30Q** is in compliance with Part 15.407 of the FCC Rule and RSS-210 Issue 8 of the IC Specification.

6. ANTENNA REQUIREMENTS

§15.203 of the FCC Rules part 15 Subpart C

: 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 antenna of the **Samsung WiFi module FCC ID: A3LWIDT30Q, IC: 649E-WIDT30Q** is **external antenna** that is connected with a unique coupling to the module. It complies with the requirement of §15.203.

According to "**662911 D01 Multiple Transmitter Output v01r02**", if two antennas are unequal antenna gains and transmit signals are correlated, then the **Directional gain = 10 log[($10^{G1/20}$+$10^{G2/20}$)^2/N_{ANT}] dBi**. The directional gain of Samsung WiFi module is **-1.59 dBi** for **Band I, II** and **-2.95 dBi** for **Band III**.

7. DESCRIPTION OF TESTS

7.1 Conducted Emissions

The Line conducted emission test facility is located inside a 4 x 7 x 2.5 m shielded enclosure.
It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6. A 1 m x 1.5 m wooden table 0.8 m height is placed 0.4 m away from the vertical wall and 1.5 m away from the side of wall of the shielded room Rohde & Schwarz (ESH3-Z5) and (ESH2-Z5) of the 50 ohm/50 µH Line Impedance Stabilization Network (LISN) are bonded to the shielded room. The EUT is powered from the Rohde & Schwarz LISN (ESH3-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH2-Z5). Power to the LISNs are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1 / 2 ".
If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs, All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentinefashion) to a 1 m length.
Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT.
The spectrum was scanned from 150 kHz to 30 MHz with 200 ms sweep time.
The frequency producing the maximum level was re-examined using the EMI test receiver.
(Rohde & Schwarz ESCS30). The detector functions were set to CISPR quasi-peak mode & average mode. The bandwidth of receiver was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.
Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; whichever determined the worst case emission.
Each EME reported was calibrated using the R&S signal generator.

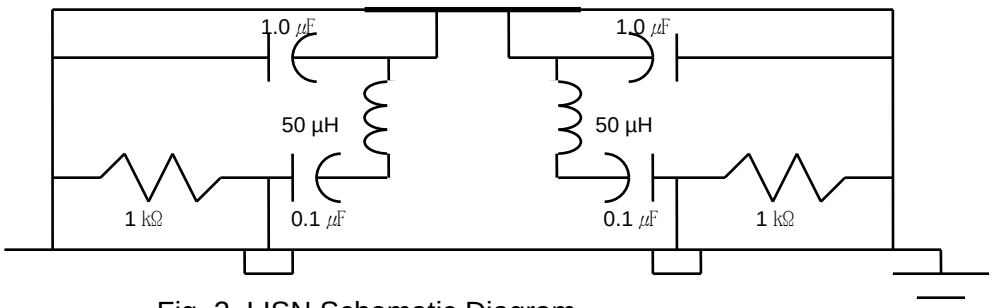


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.4-2009 and ANCI C63.10-2009.
The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Trilog broadband test antenna(Schwarzbeck, VULB 9163). Above 1 GHz, Horn antenna (Schwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz) was used.
The test equipment was placed on turntable with 0.8 m above ground. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0˚ to 360˚ and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

Unwanted emissions in the restricted bands

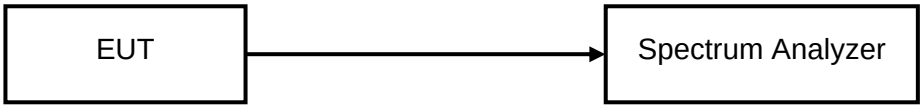
At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection.
At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in KDB “789033 D01 General UNII Test Procedures v01r03”in section H)5) and H)6). Peak emission levels was measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold. Average emission levels was measured using the “Method VB” by setting the analyzer RBW = 1 MHz, VBW = 1 kHz (VBW ≤ RBW/100), Detector = Peak if, if the EUT is configured to transmit with duty cycle ≥ 98 percent. When the duty cycle ≤ 98 percent, VBW ≥ 1/T(T = minimum transmission duration over which the transmitter is on) was used.

Unwanted emissions outside of the restricted bands

At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection.
At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in KDB “789033 D01 General UNII Test Procedures v01r02”in section G)5). Peak emission levels was measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold.

7.3 26 dB Bandwidth and 99% Occupied bandwidth

Test Setup

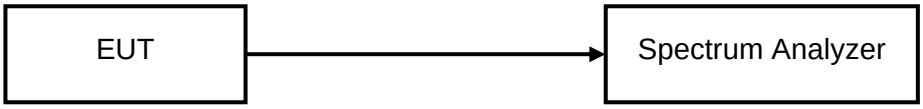


Test Procedure

EUTs 26 dB bandwidth is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.
RBW = approximately 1 % of the emission bandwidth
VBW > RBW
Detector = Peak
Trace mode = max hold
The bandwidth measurement function on the spectrum analyzer is used to measure the 26 dB bandwidth and 99% occupied bandwidth.

7.4 Maximum Peak Output Power

Test Setup



Test Procedure

EUTs Maximum Conducted Output Power is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.

The spectrum analyzer setting is as follows.

RBW = 1 MHz

VBW ≥ 3 MHz

Number of points in sweep ≥ 2 Span / RBW

Sweep time = auto

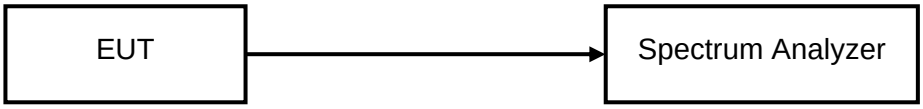
Detector = RMS

Trace average at least 100 traces in power averaging mode

The band power measurement function on the spectrum analyzer is used to measure the Maximum conducted output power.

7.5 Peak Power Spectral Density

Test Setup



Test Procedure

EUTs Peak Power Spectral Density is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.

The spectrum analyzer setting is as follows.

RBW = 1 MHz

VBW ≥ 3 MHz

Number of points in sweep ≥ 2 Span / RBW

Sweep time = auto

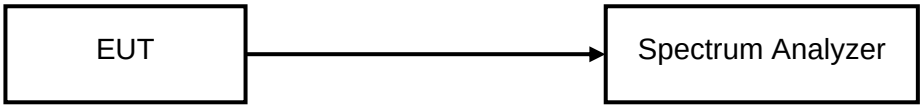
Detector = RMS

Trace average at least 100 traces in power averaging mode

The peak search function on the spectrum analyzer is used to find the peak of the spectrum.

7.6 Peak Excursion Measurement

Test Setup



Test Procedure

EUTs Peak Excursion is measured at middle channel with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.

The spectrum analyzer setting is as follows.

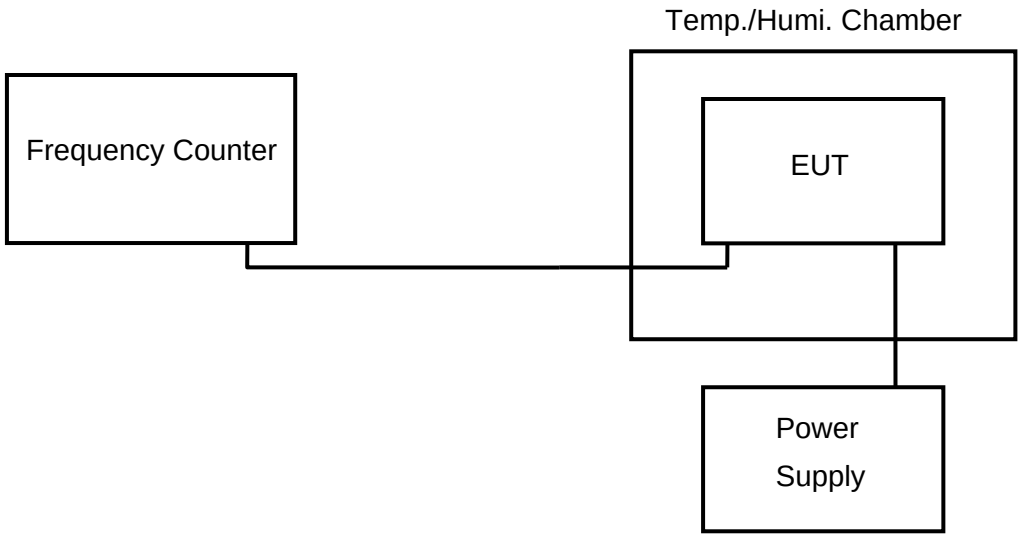
Trace 1)
RBW = 1 MHz
VBW ≥ 3 MHz
Detector = peak
Trace mode = max-hold
The sweeps is set to continue until the trace stabilizes.
The peak search function on the spectrum analyzer is used to find the peak of the spectrum.

Trace 2)
RBW = 1 MHz
VBW ≥ 3 MHz
Number of points in sweep ≥ 2 Span / RBW
Sweep time = auto
Detector = RMS
Trace average at least 100 traces in power averaging mode

The ratio of the maximum of the peak max hold spectrum to the PPSD is computed.

7.7 Frequency Stability

Test Set-up:



Test Procedure

EUTs Frequency Stability is measured at center channel with a Frequency Counter connected to the antenna terminal while the EUTs operating at its non-modulated signal.
fc is declaring of channel frequency. Then the frequency error formula is (fc - f) / fc x 10^6 ppm.
The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value. Extreme temperature rule is - 30 ℃ ~ 50 ℃.

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207, RSS-Gen 7.2.4

Frequency	Level(dBµV)		*)Factor	**) Line	Limit(dBµV)		Margin(dB)	
(MHz)	Q-Peak	Average	(dB)		Q-Peak	Average	Q-Peak	Average
0.17	55.3	36.1	0.2	L	65.0	55.0	9.7	18.9
0.23	47.2	30.1	0.2	L	62.4	52.4	15.2	22.3
0.29	39.0	21.1	0.2	L	60.5	50.5	21.5	29.4
0.44	36.1	20.9	0.2	N	57.1	47.1	21.0	26.2
0.52	35.8	22.3	0.2	N	56.0	46.0	20.2	23.7
14.51	26.6	22.6	0.9	N	60.0	50.0	33.4	27.4

Line Conducted Emissions Tabulated Data

Note(s):

1. Measurements using CISPR quasi-peak mode & average mode.

2. All modes of operation were investigated and the worst -case emission are reported. See attached Plots.

*3. *) Factor = LISN + Cable Loss*

*4. **) LINE : L = Line , N = Neutral*

5. The limit is on the FCC Part section 15.207(a).

PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line)***

NEMKO KOREA (NK-13-R-107) 18 Jul 2013 10:23

Conducted Emissions

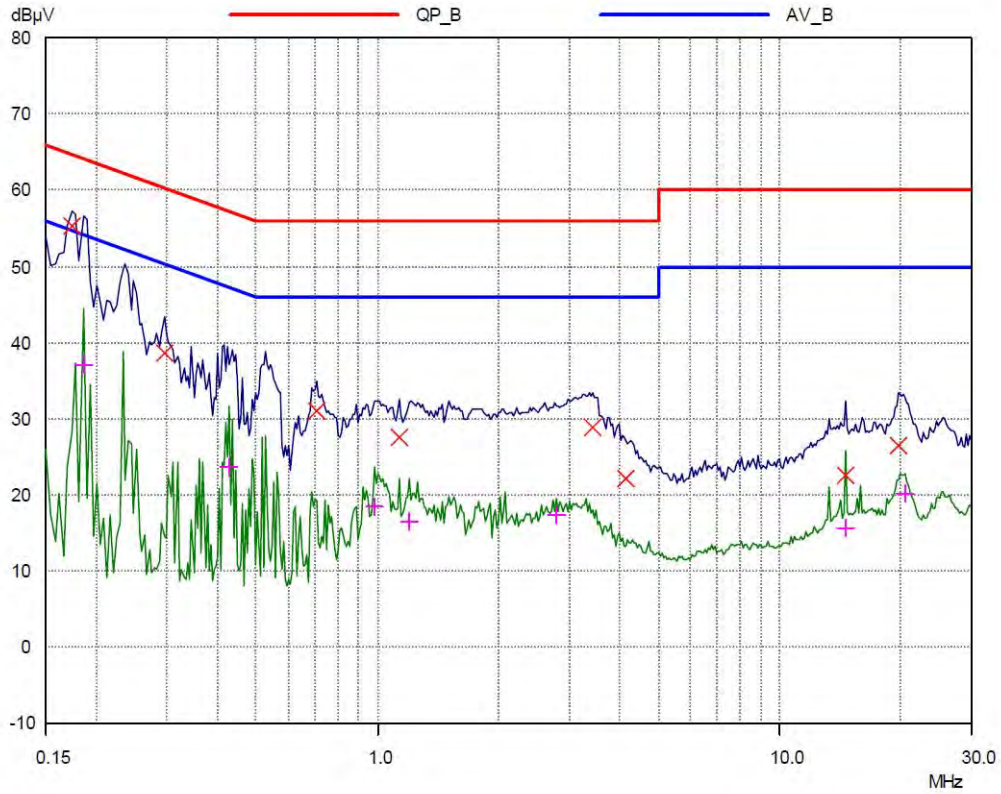
EUT:	Wifi Module
Manuf:	Samsung Electronics
Op Cond:	a.c. 120 V / 60 Hz (802.11n HT20 5500 MHz TX mode)
Operator:	Jinha. Ko
Test Spec:	FCC Part 15.207
Comment:	MODEL : WIDT30Q
	LINE : L1

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Line

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	8
	Acc Margin:	30 dB



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral)***

NEMKO KOREA (NK-13-R-107) 18 Jul 2013 10:35

Conducted Emissions

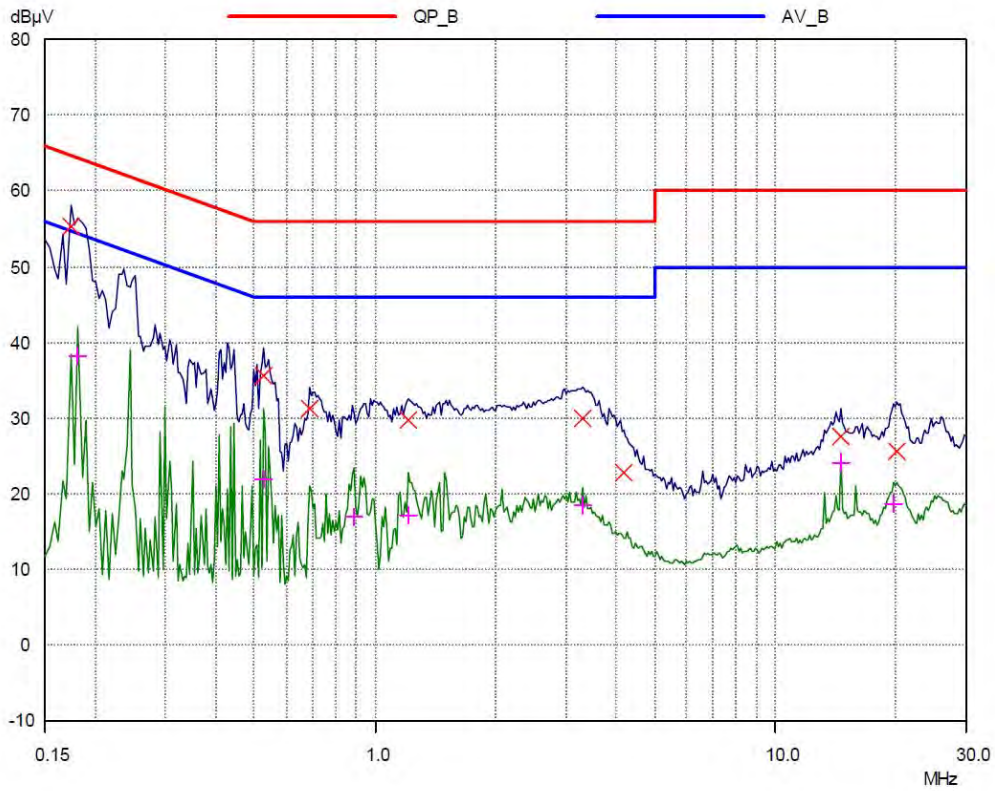
EUT:	Wifi Module
Manuf:	Samsung Electronics
Op Cond:	a.c. 120 V / 60 Hz (802.11n HT20 5500 MHz TX mode)
Operator:	Jinha. Ko
Test Spec:	FCC Part 15.207
Comment:	MODEL : WIDT30Q
	LINE : Neutral

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Neutral

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	8
	Acc Margin:	30 dB



8.2 Radiated Emissions

FCC §15.209, RSS-210 Issue 8, A8.5

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
75.68	50.90	H	340	270	-18.9	32.0	40.0	8.0
80.01	53.60	H	392	90	-20.8	32.8	40.0	7.2
83.73	52.40	H	382	86	-20.8	31.6	40.0	8.4
229.34	51.71	H	150	155	-19.1	32.6	46.0	13.4
240.01	54.91	H	135	197	-19.1	35.8	46.0	10.2
666.14	37.50	V	110	40	-6.5	31.0	46.0	15.0

Radiated Measurements at 3meters

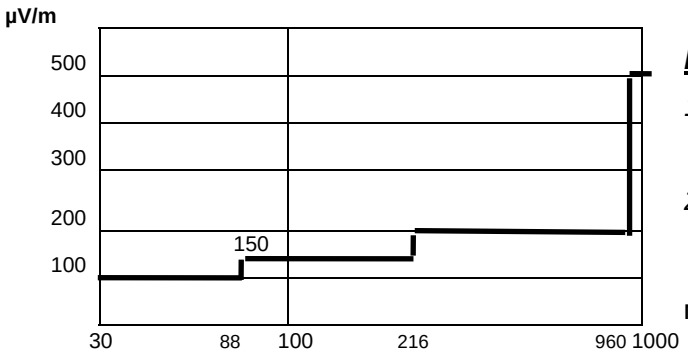


Fig. 3. Limits at 3 meters

Note(s)s:

1. All modes were measured and the worst-case emission was reported.

2 The radiated limits are shown on Figure 3.

Above 1 GHz the limit is 500 µV/m.

*3. *Pol. H = Horizontal, V = Vertical*

*4. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*

5. Measurements using CISPR quasi-peak mode.

6. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.

7. The limit is on the FCC Part section 15.209(a).

8.3 Radiated Spurious Emissions

8.3.1 Radiated Spurious Emissions – Band I

FCC §15.407(b), RSS-210 Issue 8, A9.2

Test Mode : Set to Lowest channel, Middle channel and Highest channel

802.11a mode

Chain 0

Lowest Channel (5180 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.36	59.86	H	peak	5.38	-6.02	59.22	68.2	8.98
15.54	55.55	H	peak	5.27	-6.02	54.80	74.0	19.20
15.54	42.65	H	average	5.27	-6.02	41.90	54.0	12.10

Middle Channel (5200 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.40	59.00	H	peak	4.90	-6.02	57.88	68.2	10.32
15.60	54.51	H	peak	5.29	-6.02	53.78	74.0	20.22
15.60	41.56	H	average	5.29	-6.02	40.83	54.0	13.17

Highest Channel (5240 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.48	58.47	H	peak	5.31	-6.02	57.76	68.2	10.44
15.72	53.64	H	peak	4.15	-6.02	51.77	74.0	22.23
15.72	40.14	H	average	4.15	-6.02	38.27	54.0	15.73

TEST DATA

802.11a mode

Chain 1

Lowest Channel (5180 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.36	62.33	H	peak	5.38	-6.02	61.69	68.2	6.51
15.54	65.23	H	peak	5.27	-6.02	64.48	74.0	9.52
15.54	50.10	H	average	5.27	-6.02	49.35	54.0	4.65

Middle Channel (5200 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.40	63.03	H	peak	4.90	-6.02	61.91	68.2	6.29
15.60	61.42	H	peak	5.29	-6.02	60.69	74.0	13.31
15.60	45.88	H	average	5.29	-6.02	45.15	54.0	8.85

Highest Channel (5240 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.48	62.34	H	peak	5.31	-6.02	61.63	68.2	6.57
15.72	57.44	H	peak	4.15	-6.02	55.57	74.0	18.43
15.72	44.17	H	average	4.15	-6.02	42.30	54.0	11.70

802.11n(20 MHz) mode

Chain 0 + Chain 1

Lowest Channel (5180 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.36	56.38	H	peak	5.38	-6.02	55.74	68.2	12.46
15.54	55.20	H	peak	5.27	-6.02	54.45	74.0	19.55
15.54	40.80	H	average	5.27	-6.02	40.05	54.0	13.95

Middle Channel (5200 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.40	59.42	H	peak	4.90	-6.02	58.30	68.2	9.90
15.60	57.76	H	peak	5.29	-6.02	57.03	74.0	16.97
15.60	43.93	H	average	5.29	-6.02	43.20	54.0	10.80

Highest Channel (5240 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.48	60.20	V	peak	5.31	-6.02	59.49	68.2	8.71
15.72	57.38	V	peak	4.15	-6.02	55.51	74.0	18.49
15.72	43.74	H	average	4.15	-6.02	41.87	54.0	12.13

802.11n(40 MHz) mode

Chain 0 + Chain 1

Lowest Channel (5190 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.38	54.03	H	peak	5.27	-6.02	53.28	68.2	14.92
15.57	50.25	H	peak	5.33	-6.02	49.56	74.0	24.44
15.57	38.21	H	average	5.33	-6.02	37.52	54.0	16.48

Highest Channel (5230 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.46	55.55	H	peak	5.62	-6.02	55.15	68.2	13.05
15.69	51.07	H	peak	4.95	-6.02	50.00	74.0	24.00
15.69	37.17	H	average	4.95	-6.02	36.10	54.0	17.90

Note(s):

*1. *Pol. H = Horizontal V = Vertical*

*2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*

*3. ***Distance factor = 20 log (test distance/specific distance) = 20 log (1.5 / 3)*

4. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.

5. At frequencies above 1 GHz, peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.

6. As the EUT was configured to transmit with duty cycles ≥ 98 percent, at frequencies above 1 GHz, average emission levels were measured using the "Method VB" by setting the analyzer RBW = 1 MHz, VBW = 1 kHz (VBW ≤ RBW/100), Detector = Peak.

7. The spectrum is measured from 9 kHz to 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the third harmonic for this device.

8. The peak limit of non-restricted band is -27 dBm/MHz can be converted 68.2 dBµV/m per KDB789033.

9. For restricted band, the peak limit is 74 dBµV/m and the average limit is 54 dBµV/m per § 15.209.

8.3.2 Radiated Spurious Emissions – Band II

FCC §15.407(b), RSS-210 Issue 8, A9.2

Test Mode : Set to Lowest channel, Middle channel and Highest channel

802.11a mode

Chain 0

Lowest Channel (5260 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.52	58.02	V	peak	5.83	-6.02	57.83	68.2	10.37
15.78	51.71	H	peak	4.28	-6.02	49.97	74.0	24.03
15.78	38.94	H	average	4.28	-6.02	37.20	54.0	16.80

Middle Channel (5280 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.56	57.74	H	peak	5.98	-6.02	57.70	68.2	10.50
15.84	51.50	H	peak	4.44	-6.02	49.92	74.0	24.08
15.84	39.10	H	average	4.44	-6.02	37.52	54.0	16.48

Highest Channel (5320 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.64	53.35	H	peak	6.60	-6.02	53.93	74.0	20.07
10.64	40.78	H	average	6.60	-6.02	41.36	54.0	12.64
15.96	53.90	H	peak	4.53	-6.02	52.41	74.0	21.59
15.96	40.30	H	average	4.53	-6.02	38.81	54.0	15.19

802.11a mode

Chain 1

Lowest Channel (5260 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.52	60.23	H	peak	5.83	-6.02	60.04	68.2	8.16
15.78	58.19	H	peak	4.28	-6.02	56.45	74.0	17.55
15.78	43.72	H	average	4.28	-6.02	41.98	54.0	12.02

Middle Channel (5280 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.56	54.48	V	peak	5.98	-6.02	54.44	68.2	13.76
15.84	56.13	V	peak	4.44	-6.02	54.55	74.0	19.45
15.84	42.35	V	average	4.44	-6.02	40.77	54.0	13.23

Highest Channel (5320 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.64	55.76	H	peak	6.60	-6.02	56.34	74.0	17.66
10.64	42.49	H	average	6.60	-6.02	43.07	54.0	10.93
15.96	52.66	H	peak	4.53	-6.02	51.17	74.0	22.83
15.96	39.15	H	average	4.53	-6.02	37.66	54.0	16.34

802.11n(20 MHz) mode

Chain 0 + Chain 1

Lowest Channel (5260 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.52	58.83	H	peak	5.83	-6.02	58.64	68.2	9.56
15.78	55.88	H	peak	4.28	-6.02	54.14	74.0	19.86
15.78	42.33	H	average	4.28	-6.02	40.59	54.0	13.41

Middle Channel (5280 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.56	58.40	H	peak	5.98	-6.02	58.36	68.2	9.84
15.84	56.87	H	peak	4.44	-6.02	55.29	74.0	18.71
15.84	44.33	H	average	4.44	-6.02	42.75	54.0	11.25

Highest Channel (5320 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.64	55.25	H	peak	6.60	-6.02	55.83	74.0	18.17
10.64	43.22	H	average	6.60	-6.02	43.80	54.0	10.20
15.96	51.17	H	peak	4.53	-6.02	49.68	74.0	24.32
15.96	38.10	H	average	4.53	-6.02	36.61	54.0	17.39

802.11n(40 MHz) mode

Chain 0 + Chain 1

Lowest Channel (5270 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.54	53.89	H	peak	6.38	-6.02	54.25	68.2	13.95
15.81	49.45	H	peak	4.54	-6.02	47.97	74.0	26.03
15.81	36.05	H	average	4.54	-6.02	34.57	54.0	19.43

Highest Channel (5310 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.62	51.52	H	peak	7.13	-6.02	52.63	74.0	21.37
10.62	37.12	H	average	7.13	-6.02	38.23	54.0	15.77
15.93	48.21	H	peak	3.93	-6.02	46.12	74.0	27.88
15.93	34.73	H	average	3.93	-6.02	32.64	54.0	21.36

Note(s):

*1. *Pol. H = Horizontal V = Vertical*

*2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*

*3. ***Distance factor = 20 log (test distance/specific distance) = 20 log (1.5 / 3)*

4. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.

5. At frequencies above 1 GHz, peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.

6. As the EUT was configured to transmit with duty cycles ≥ 98 percent, at frequencies above 1 GHz, average emission levels were measured using the "Method VB" by setting the analyzer RBW = 1 MHz, VBW = 1 kHz (VBW ≤ RBW/100), Detector = Peak.

7. The spectrum is measured from 9 kHz to 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the third harmonic for this device.

8. The peak limit of non-restricted band is -27 dBm/MHz can be converted 68.2 dBµV/m per KDB789033.

9. For restricted band, the peak limit is 74 dBµV/m and the average limit is 54 dBµV/m per § 15.209.

8.3.3 Radiated Spurious Emissions – Band III

FCC §15.407(b), RSS-210 Issue 8, A9.2

Test Mode : Set to Lowest channel, Middle channel and Highest channel

802.11a mode

Chain 0

Lowest Channel (5500 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.00	54.47	H	peak	7.02	-6.02	55.47	74.0	18.53
11.00	41.88	H	average	7.02	-6.02	42.88	54.0	11.12
16.50	50.09	H	peak	5.96	-6.02	50.03	68.2	18.17

Middle Channel (5580 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.16	55.31	H	peak	6.02	-6.02	55.31	74.0	18.69
11.16	43.40	H	average	6.02	-6.02	43.40	54.0	10.60
16.74	54.42	H	peak	5.94	-6.02	54.34	68.2	13.86

Highest Channel (5700 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.40	58.27	H	peak	6.67	-6.02	58.92	74.0	15.08
11.40	40.93	H	average	6.67	-6.02	41.58	54.0	12.42
17.10	55.12	H	peak	7.00	-6.02	56.10	68.2	12.10

802.11a mode

Chain 1

Lowest Channel (5500 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.00	60.04	H	peak	7.02	-6.02	61.04	74.0	12.96
11.00	47.90	H	average	7.02	-6.02	48.90	54.0	5.10
16.50	54.48	H	peak	5.96	-6.02	54.42	68.2	13.78

Middle Channel (5580 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.16	62.55	H	peak	6.02	-6.02	62.55	74.0	11.45
11.16	48.76	H	average	6.02	-6.02	48.76	54.0	5.24
16.74	60.11	H	peak	5.94	-6.02	60.03	68.2	8.17

Highest Channel (5700 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.40	59.82	V	peak	6.67	-6.02	60.47	74.0	13.53
11.40	45.88	V	average	6.67	-6.02	46.53	54.0	7.47
17.10	59.78	H	peak	7.00	-6.02	60.76	68.2	7.44

802.11n(20 MHz) mode

Chain 0 + Chain 1

Lowest Channel (5500 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.00	58.85	H	peak	7.02	-6.02	59.85	74.0	14.15
11.00	46.26	H	average	7.02	-6.02	47.26	54.0	6.74
16.50	55.76	H	peak	5.96	-6.02	55.70	68.2	12.50

Middle Channel (5580 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.16	60.89	H	peak	6.02	-6.02	60.89	74.0	13.11
11.16	46.32	H	average	6.02	-6.02	46.32	54.0	7.68
16.74	58.67	V	peak	5.94	-6.02	58.59	68.2	9.61

Highest Channel (5700 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.40	59.29	V	peak	6.67	-6.02	59.94	74.0	14.06
11.40	47.07	V	average	6.67	-6.02	47.72	54.0	6.28
17.10	58.13	H	peak	7.00	-6.02	59.11	68.2	9.09

802.11n(40 MHz) mode

Chain 0 + Chain 1

Lowest Channel (5510 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.02	52.97	H	peak	7.29	-6.02	54.24	74.0	19.76
11.02	39.41	H	average	7.29	-6.02	40.68	54.0	13.32
16.53	49.42	H	peak	5.78	-6.02	49.18	68.2	19.02

Middle Channel (5590 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.18	51.94	H	peak	7.02	-6.02	52.94	74.0	21.06
11.18	39.08	H	average	7.02	-6.02	40.08	54.0	13.92
16.77	51.19	H	peak	6.69	-6.02	51.86	68.2	16.34

Highest Channel (5670 MHz)

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.34	54.05	H	peak	6.76	-6.02	54.79	74.0	19.21
11.34	40.43	H	average	6.76	-6.02	41.17	54.0	12.83
17.01	53.14	H	peak	6.38	-6.02	53.50	68.2	14.70

Note(s):

*1. *Pol. H = Horizontal V = Vertical*

*2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*

*3. ***Distance factor = 20 log (test distance/specific distance) = 20 log (1.5 / 3)*

4. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.

5. At frequencies above 1 GHz, peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz,

Detector = Peak.

6. *As the EUT was configured to transmit with duty cycles ≥ 98 percent, at frequencies above 1 GHz, average emission levels were measured using the "Method VB" by setting the analyzer RBW = 1 MHz, VBW = 1 kHz (VBW ≤ RBW/100), Detector = Peak.*
7. *The spectrum is measured from 9 kHz to 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the third harmonic for this device.*
8. *The peak limit of non-restricted band is -27 dBm/MHz can be converted 68.2 dBμV/m per KDB789033.*
9. *For restricted band, the peak limit is 74 dBμV/m and the average limit is 54 dBμV/m per § 15.209.*

8.4 Radiated Band Edge

8.4.1 Radiated Band Edge – Band I and II

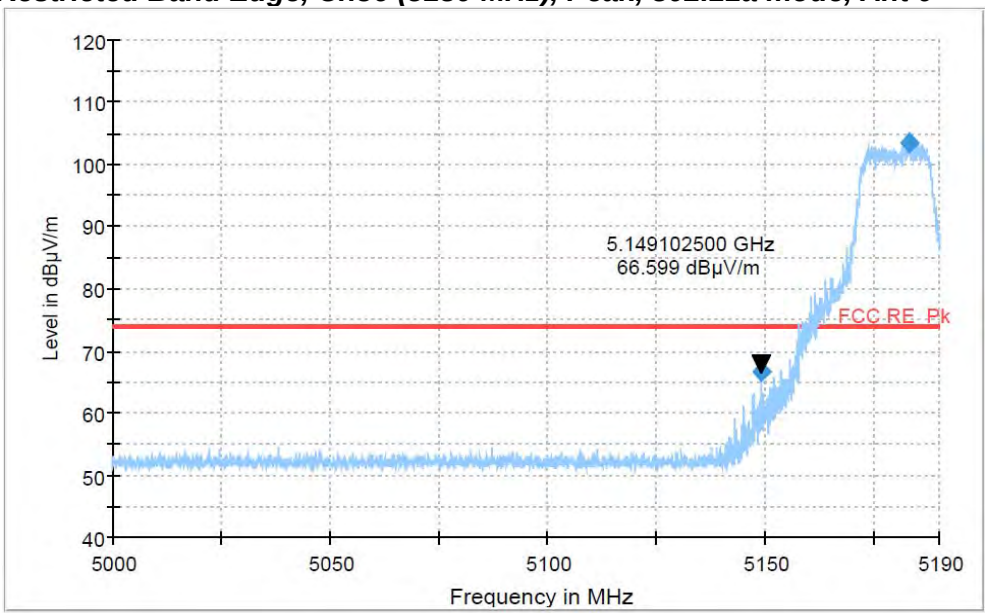
FCC §15.407(b), RSS-210 Issue 8, A9.2

Test Mode : Set to Band Edge Channels

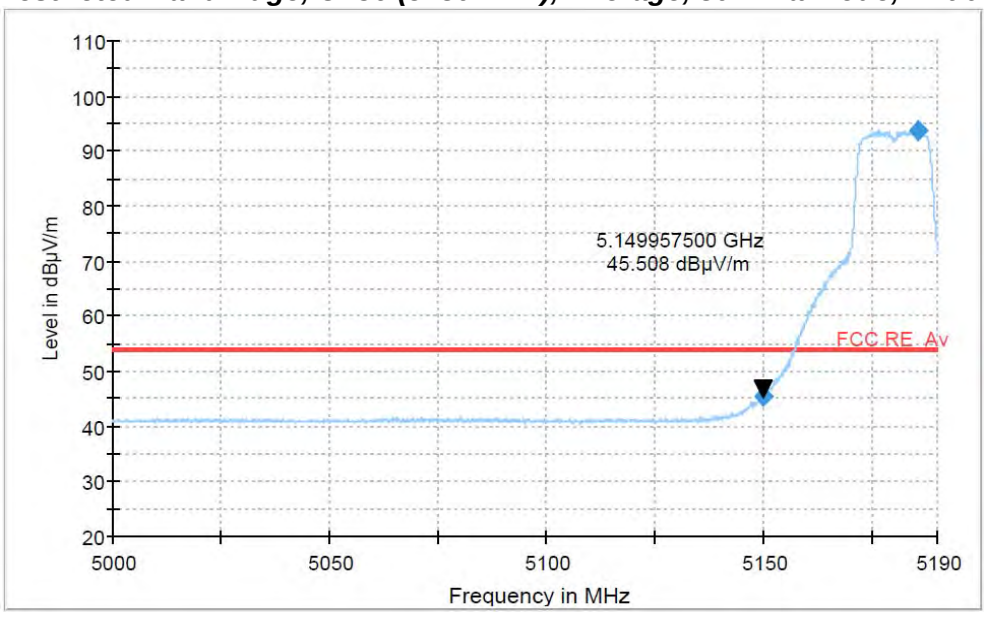
802.11a mode

Chain 0

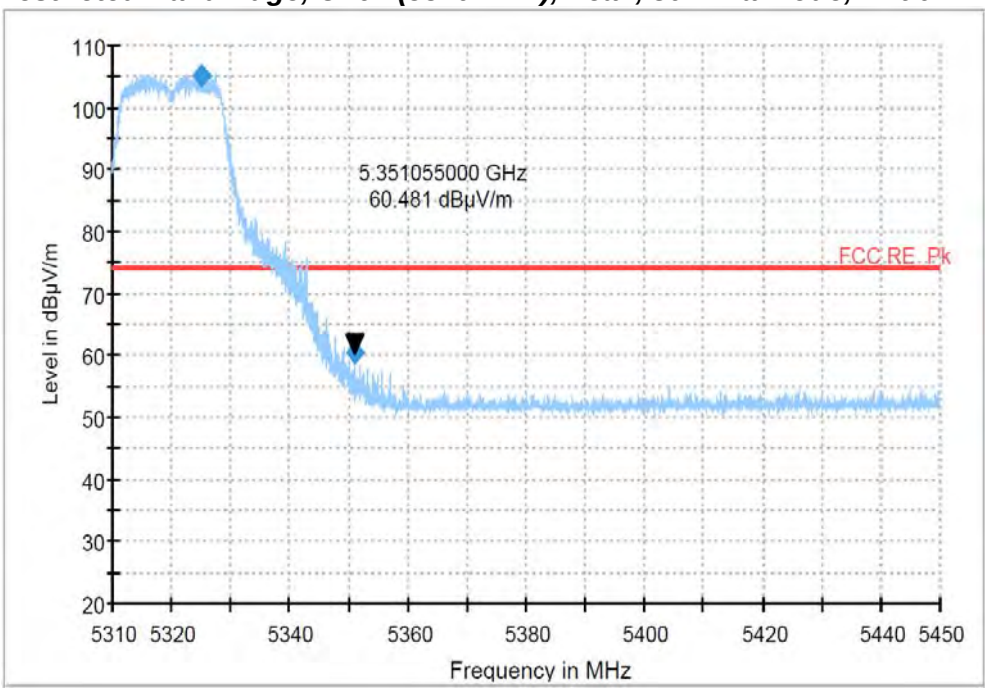
Restricted Band Edge, Ch36 (5180 MHz), Peak, 802.11a mode, Ant 0



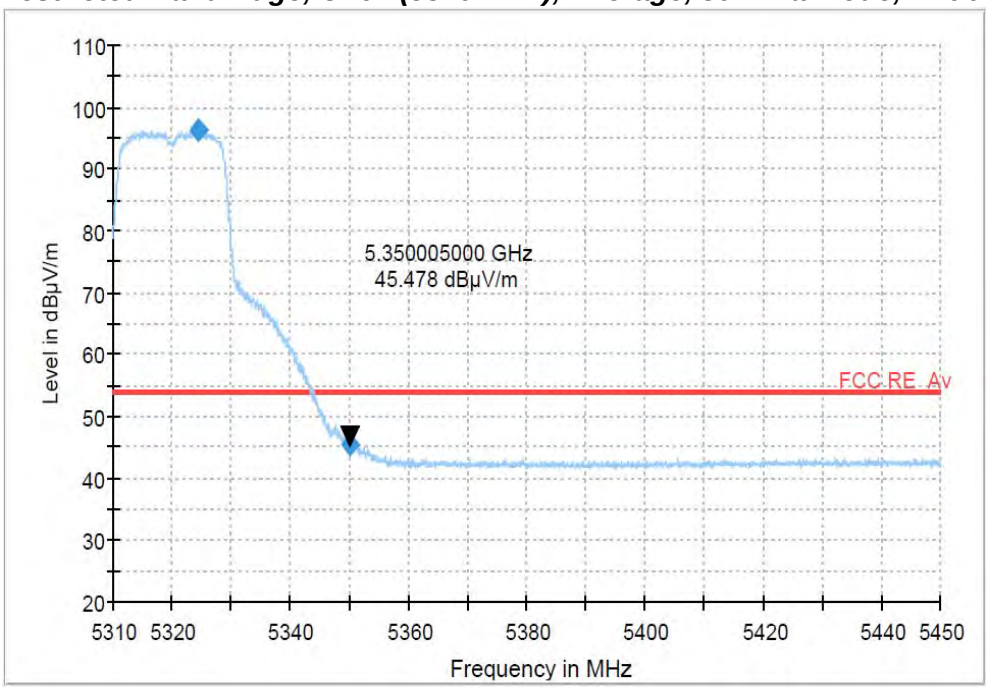
Restricted Band Edge, Ch36 (5180 MHz), Average, 802.11a mode, Ant 0



Restricted Band Edge, Ch64 (5320 MHz), Peak, 802.11a mode, Ant 0



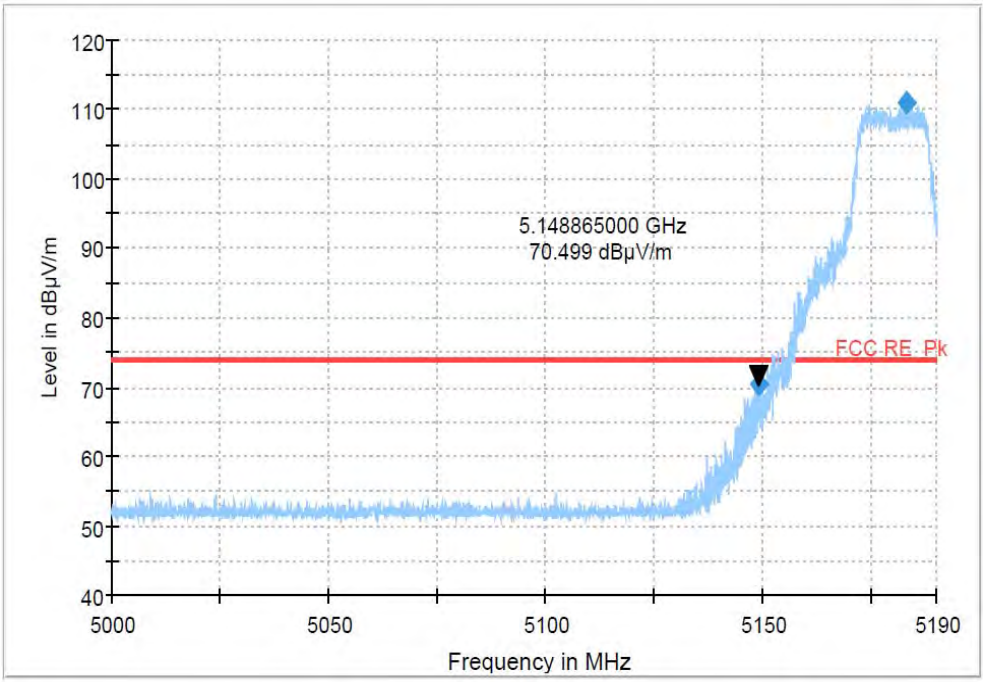
Restricted Band Edge, Ch64 (5320 MHz), Average, 802.11a mode, Ant 0



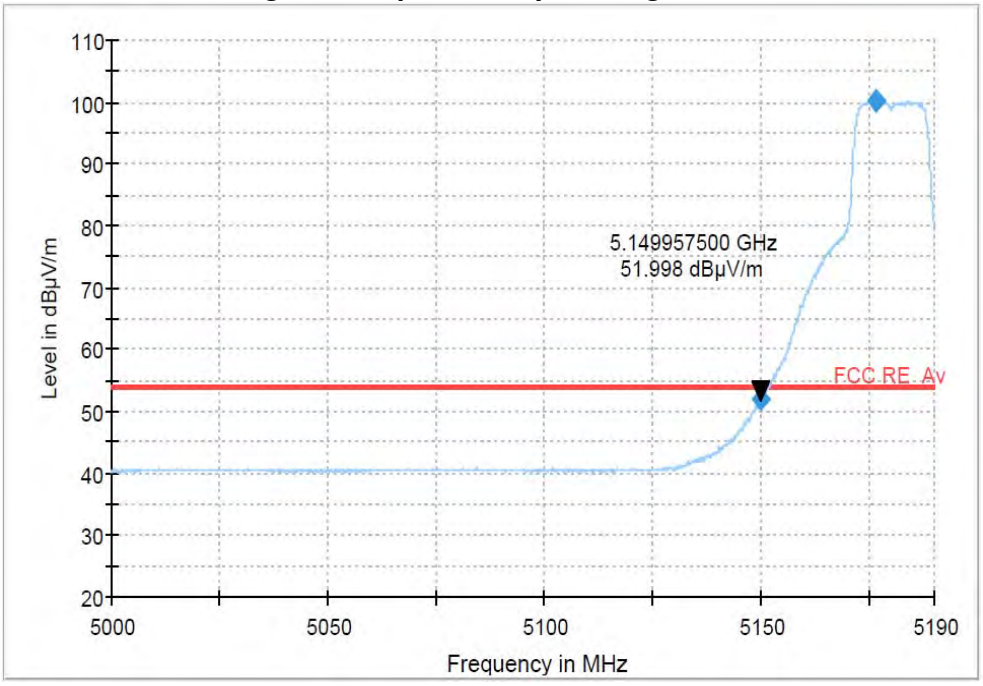
802.11a Mode

Chain 1

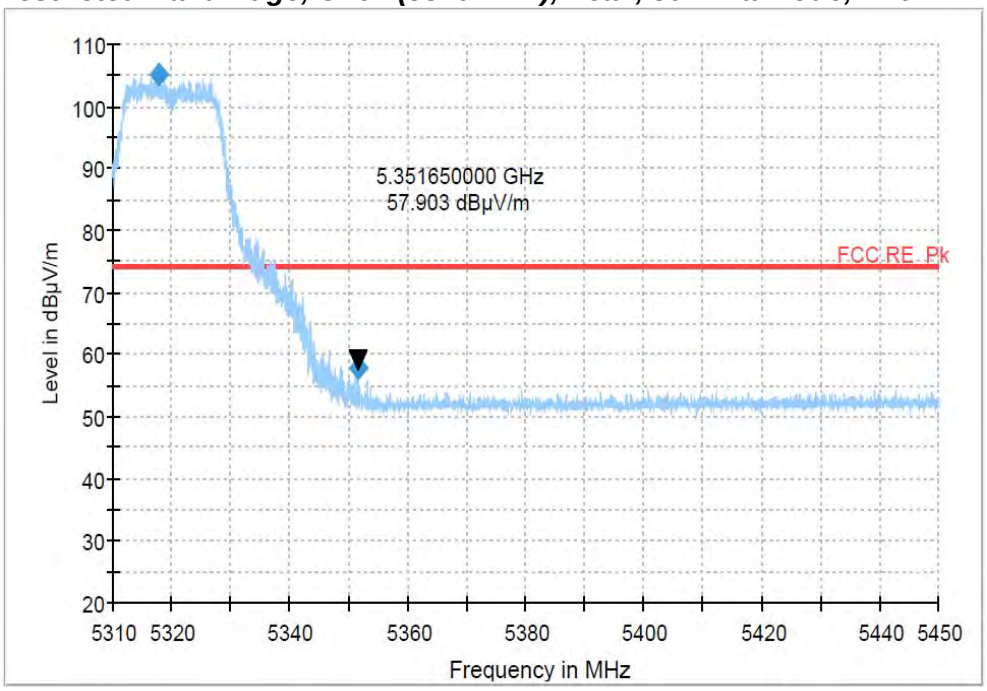
Restricted Band Edge, Ch36 (5180 MHz), Peak, 802.11a mode, Ant 1



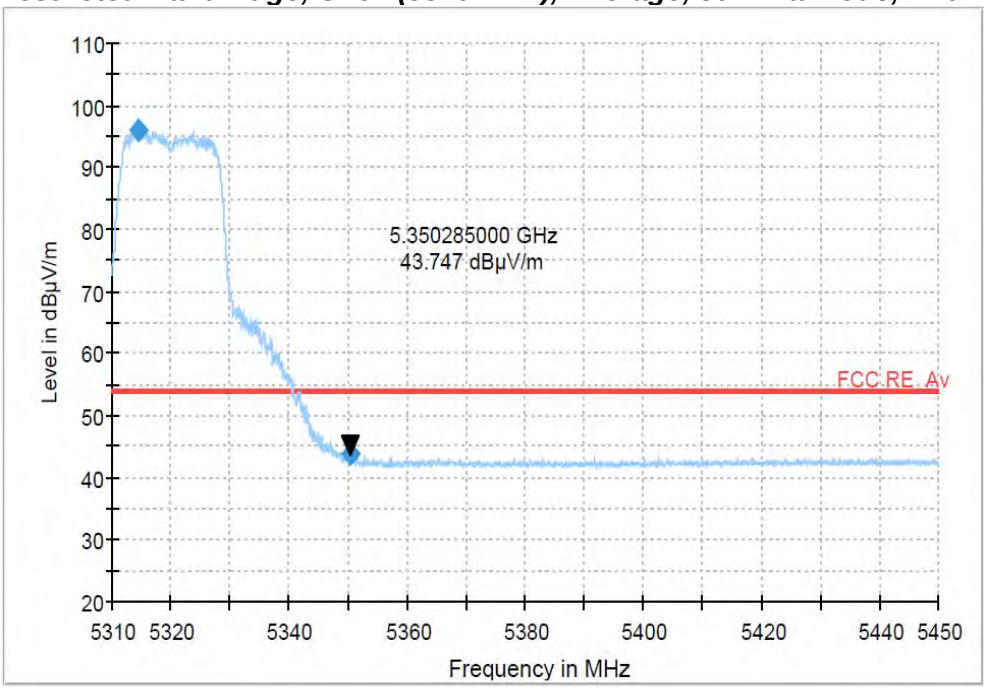
Restricted Band Edge, Ch36 (5180 MHz), Average, 802.11a mode, Ant 1



Restricted Band Edge, Ch64 (5320 MHz), Peak, 802.11a mode, Ant 1



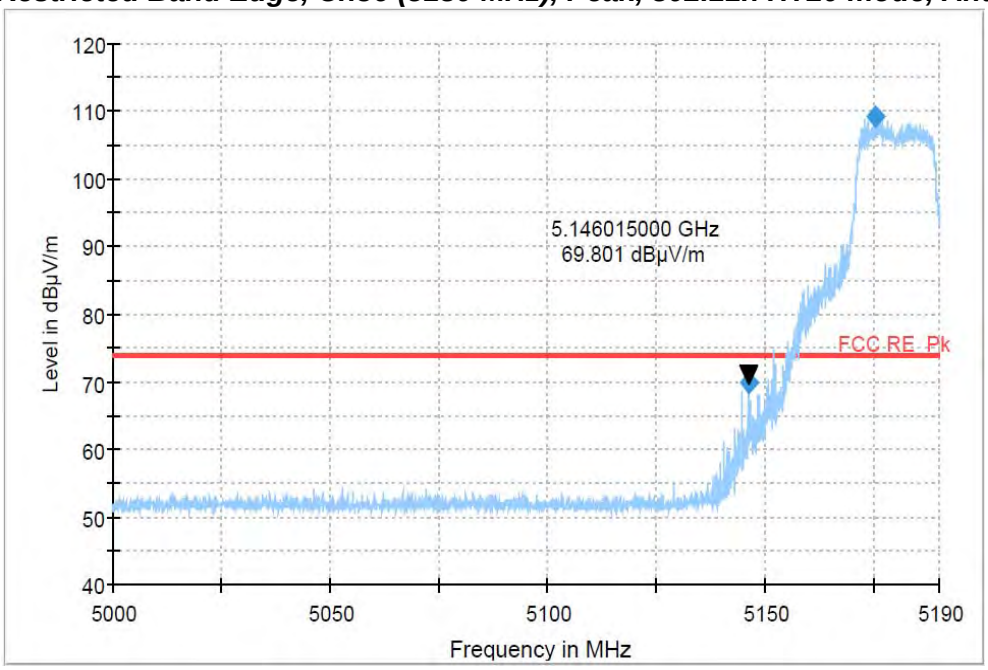
Restricted Band Edge, Ch64 (5320 MHz), Average, 802.11a mode, Ant 1



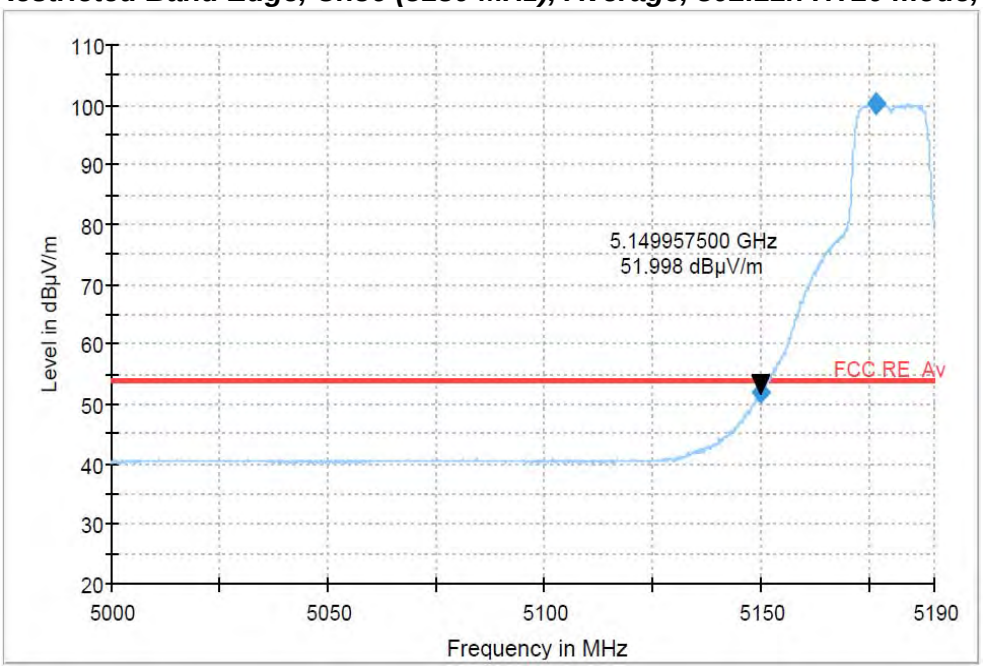
802.11n HT20

Chain 0 + Chain 1

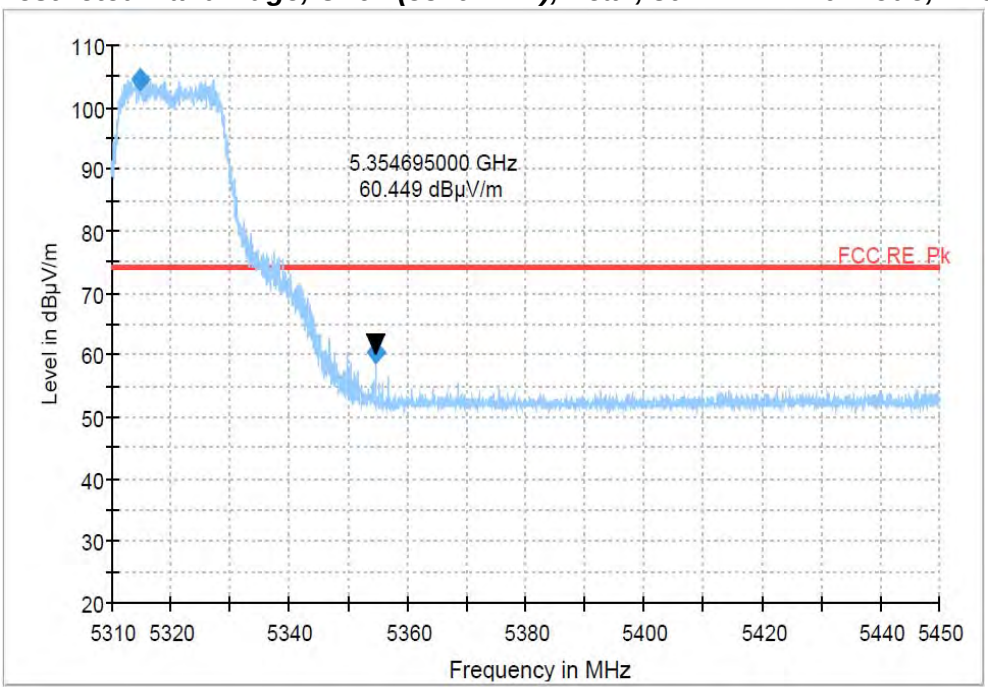
Restricted Band Edge, Ch36 (5180 MHz), Peak, 802.11n HT20 mode, Ant MIMO



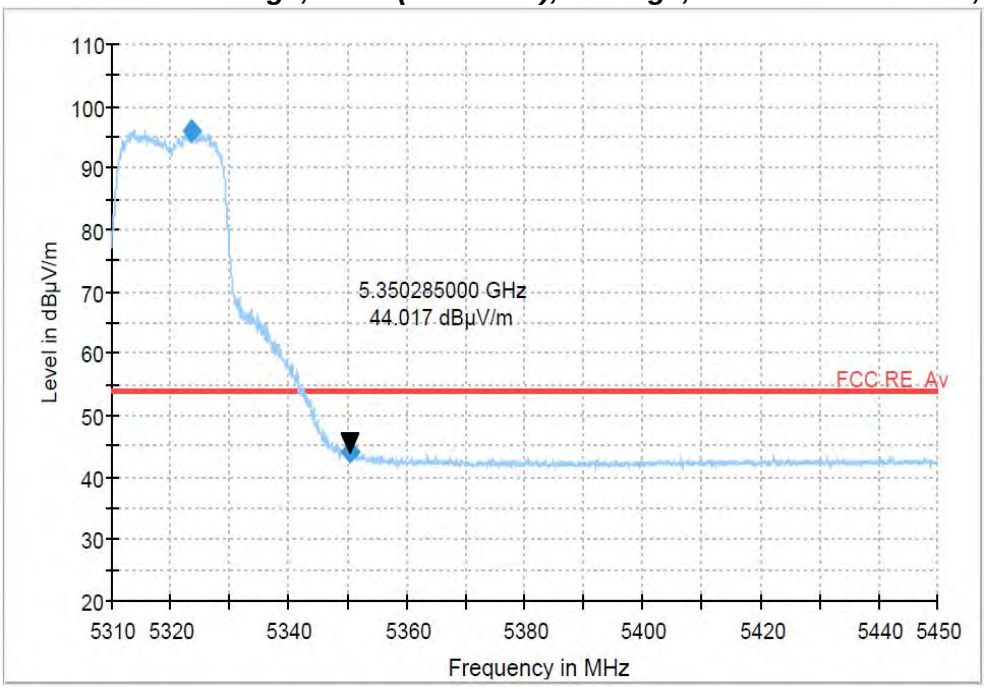
Restricted Band Edge, Ch36 (5180 MHz), Average, 802.11n HT20 mode, Ant MIMO



Restricted Band Edge, Ch64 (5320 MHz), Peak, 802.11n HT20 mode, Ant MIMO



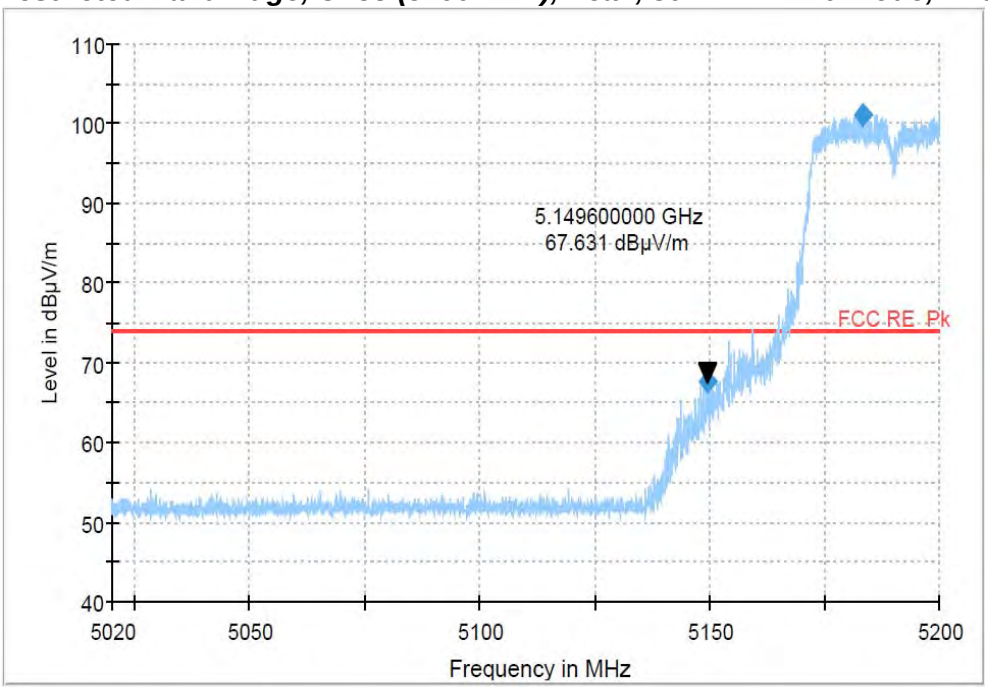
Restricted Band Edge, Ch64 (5320 MHz), Average, 802.11n HT20 mode, Ant MIMO



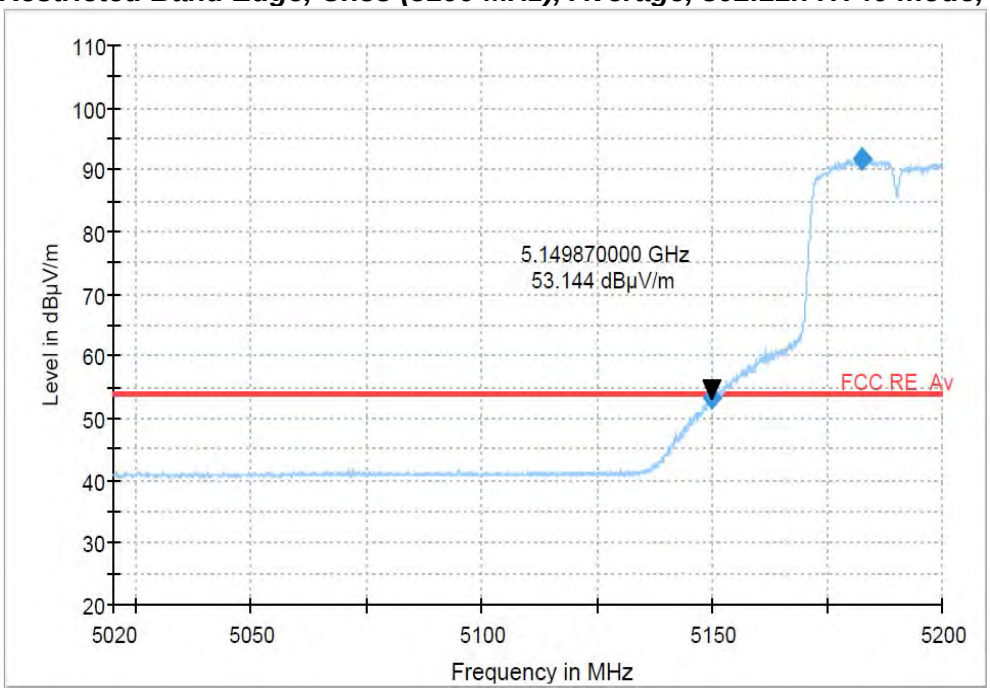
802.11n HT40

Chain 0 + Chain 1

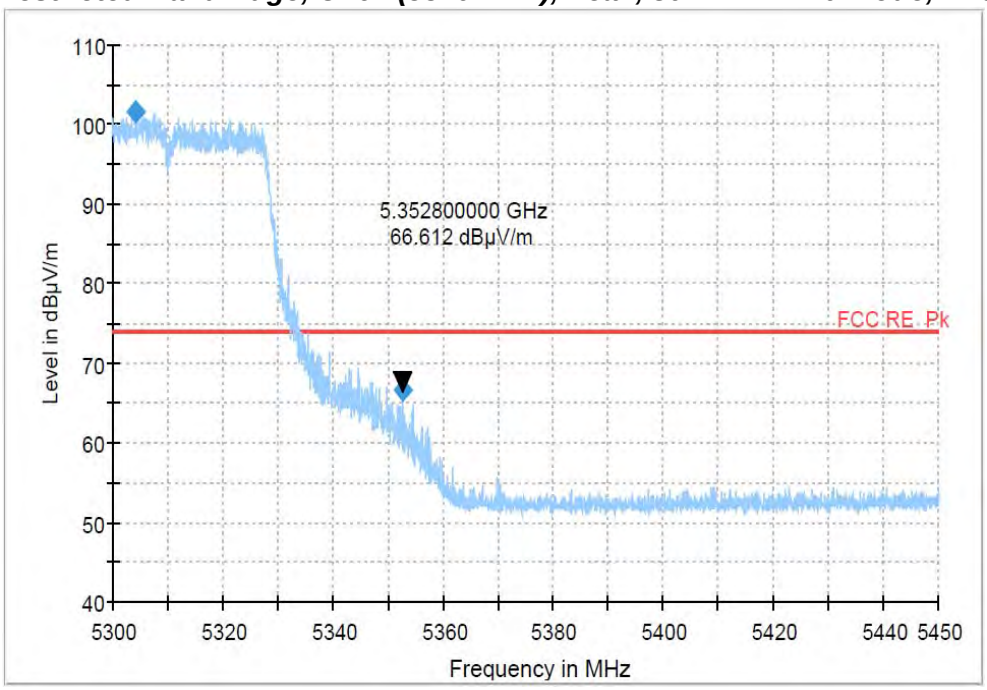
Restricted Band Edge, Ch38 (5190 MHz), Peak, 802.11n HT40 mode, Ant MIMO



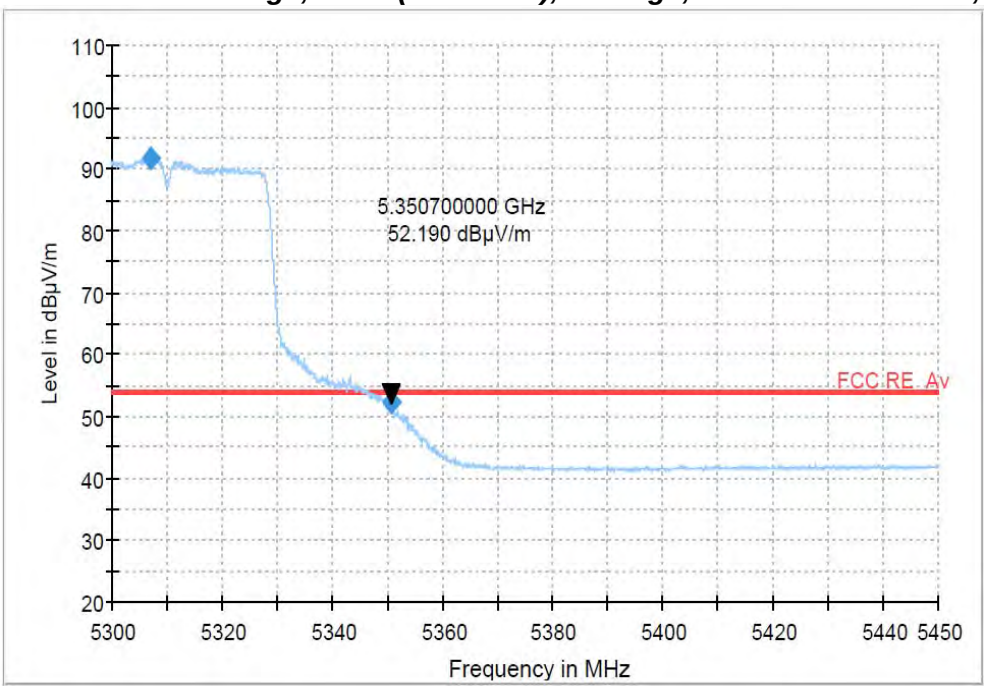
Restricted Band Edge, Ch38 (5190 MHz), Average, 802.11n HT40 mode, Ant MIMO



Restricted Band Edge, Ch62 (5310 MHz), Peak, 802.11n HT40 mode, Ant MIMO



Restricted Band Edge, Ch62 (5310 MHz), Average, 802.11n HT40 mode, Ant MIMO



Note(s):

1. *The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.*
2. *For the radiated band edge test, the EUT was investigated in all available data rates for 802.11a,n modes. The worst case band edge emissions were found while EUT was transmitting in 802.11a mode at 6 Mbps and 802.11n mode at MCS0*
3. *Peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.*
4. *As the EUT was configured to transmit with duty cycles ≥ 98 percent, average emission levels were measured using the "Method VB" by setting the analyzer RBW = 1 MHz, VBW = 1 kHz (VBW ≤ RBW/100), Detector = Peak.*
5. *For non-restricted band, the peak limit is 68.2 dBμV/m.*
6. *For restricted band, the peak limit is 74 dBμV/m and the average limit is 54 dBμV/m per § 15.209.*

8.4.2 Radiated Band Edge – Band III

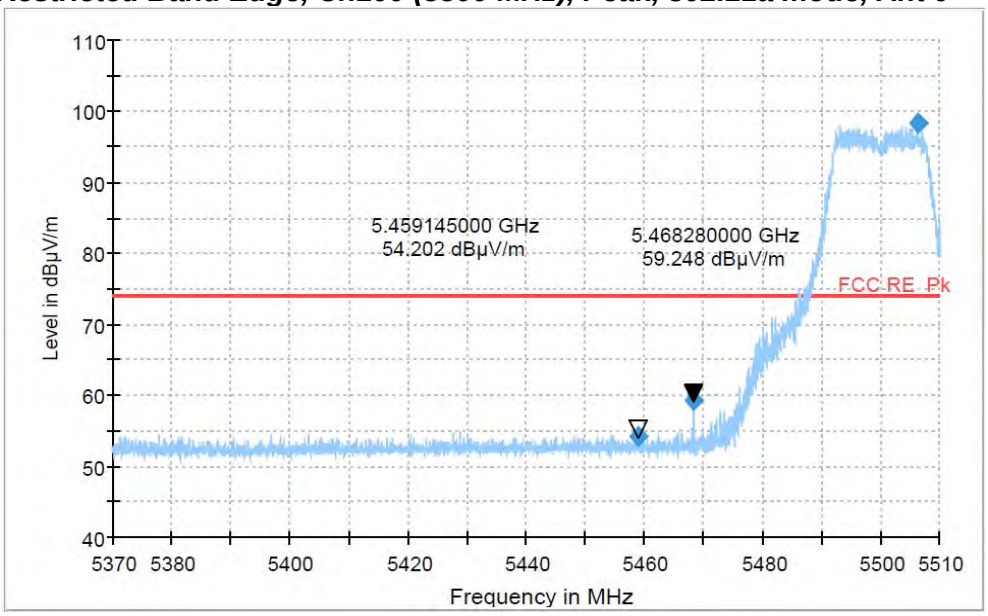
FCC §15.407(b), RSS-210 Issue 8, A9.2

Test Mode : Set to Band Edge Channels

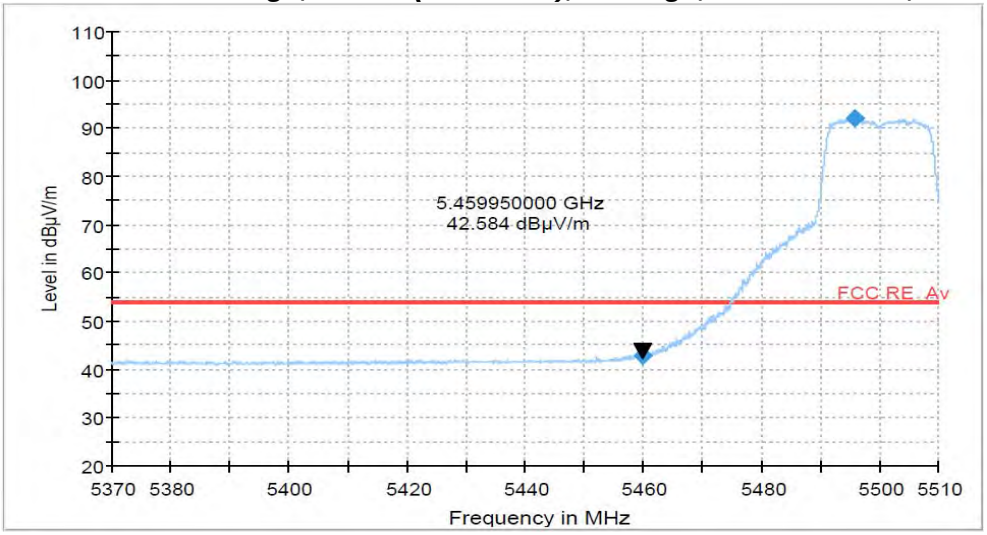
802.11a mode

Chain 0

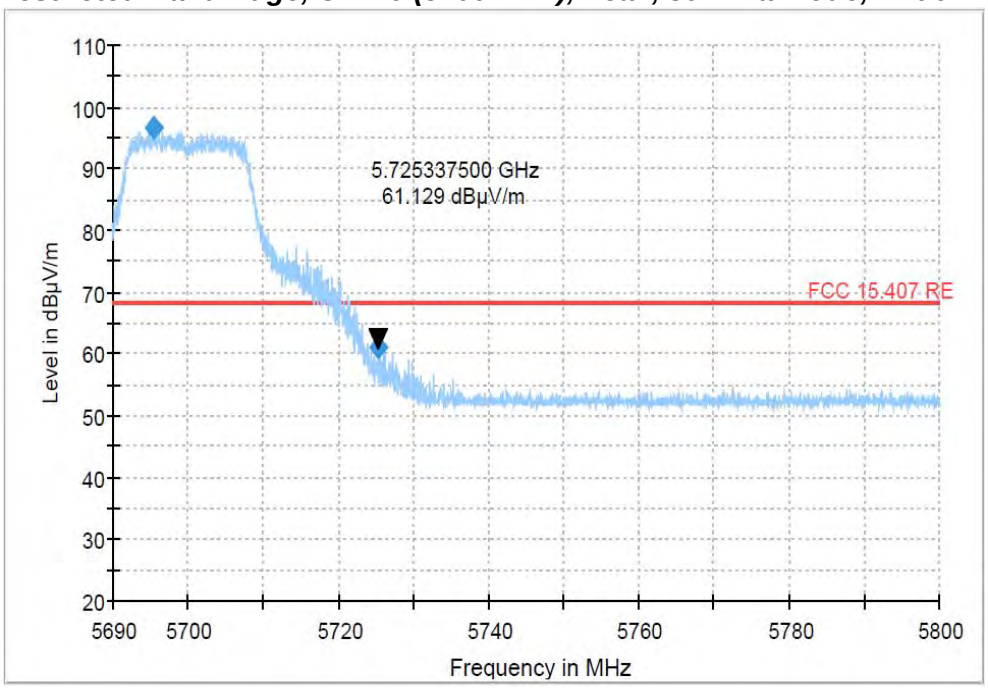
Restricted Band Edge, Ch100 (5500 MHz), Peak, 802.11a mode, Ant 0



Restricted Band Edge, Ch100 (5500 MHz), Average, 802.11a mode, Ant 0



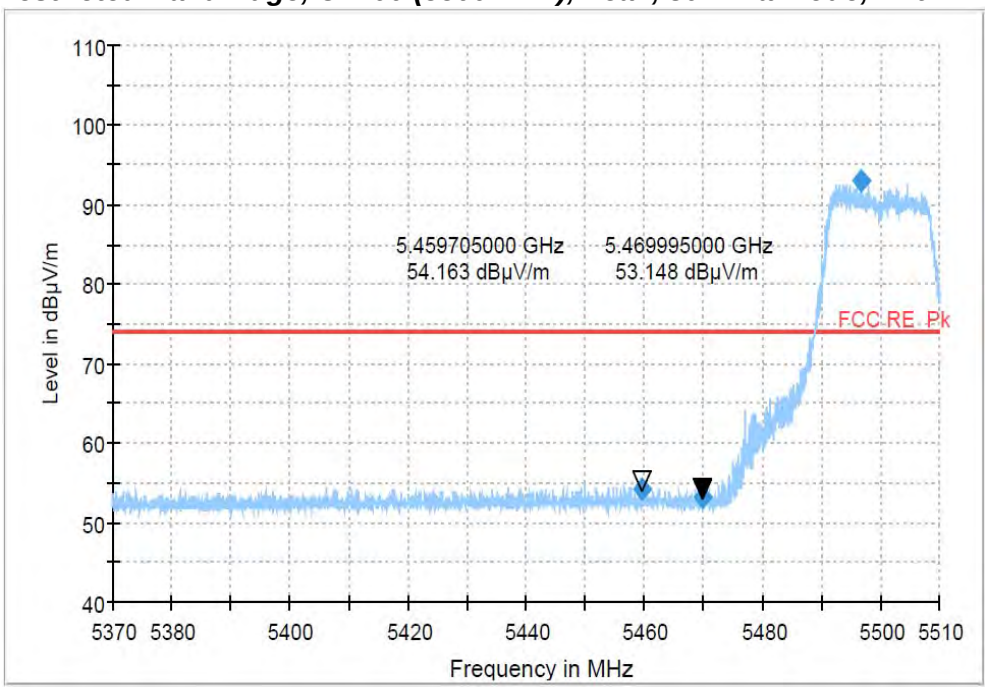
Restricted Band Edge, Ch140 (5700 MHz), Peak, 802.11a mode, Ant 0



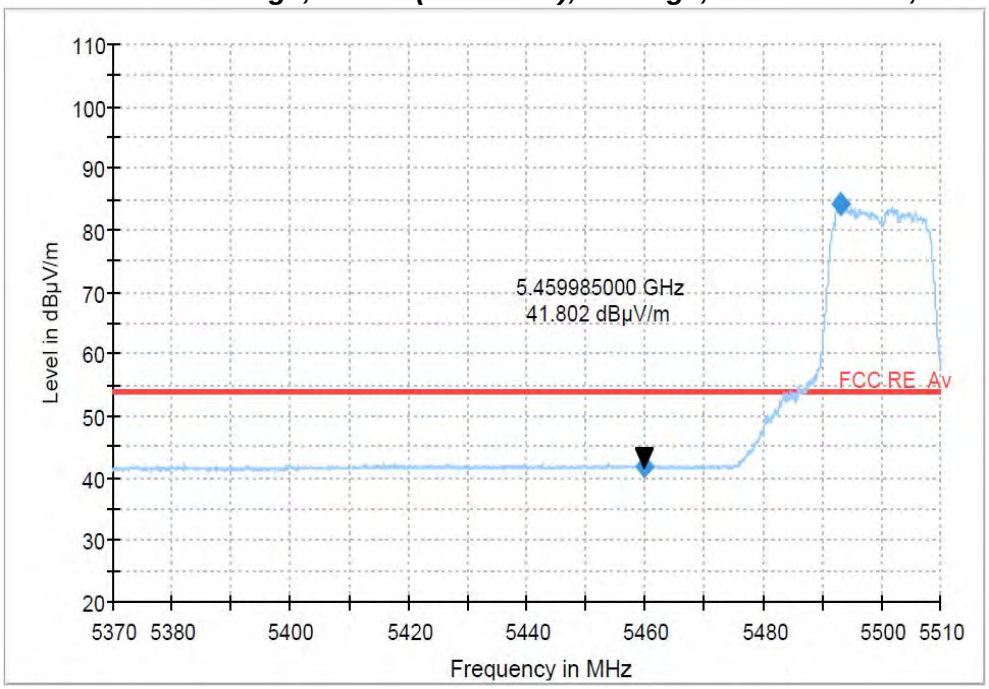
802.11a Mode

Chain 1

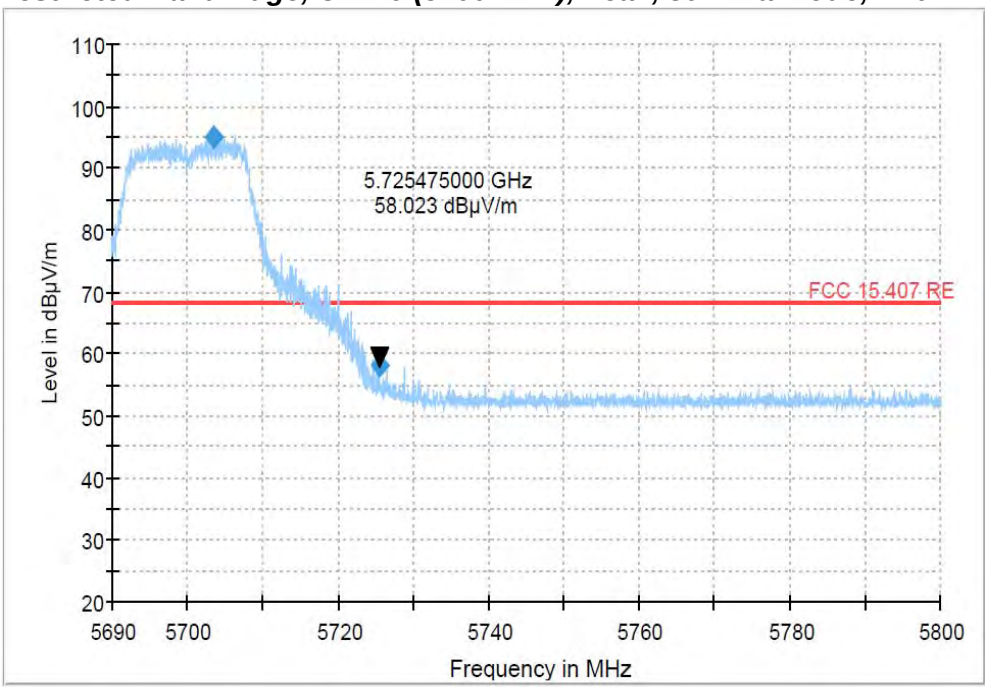
Restricted Band Edge, Ch100 (5500 MHz), Peak, 802.11a mode, Ant 1



Restricted Band Edge, Ch100 (5500 MHz), Average, 802.11a mode, Ant 1



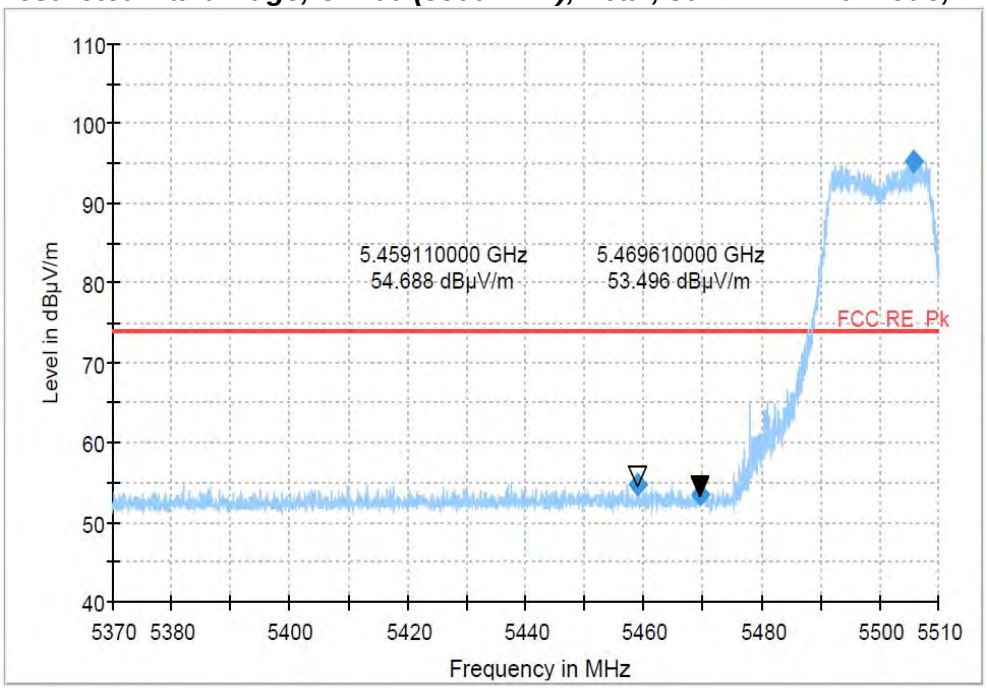
Restricted Band Edge, Ch140 (5700 MHz), Peak, 802.11a mode, Ant 1



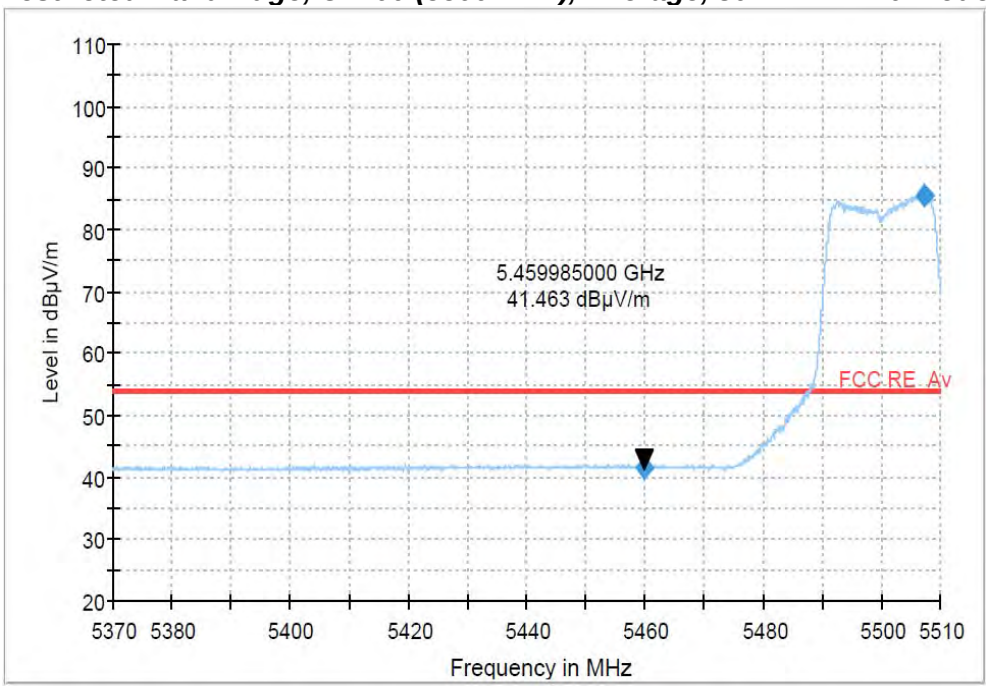
802.11n HT20 Mode

Chain 0 + Chain 1

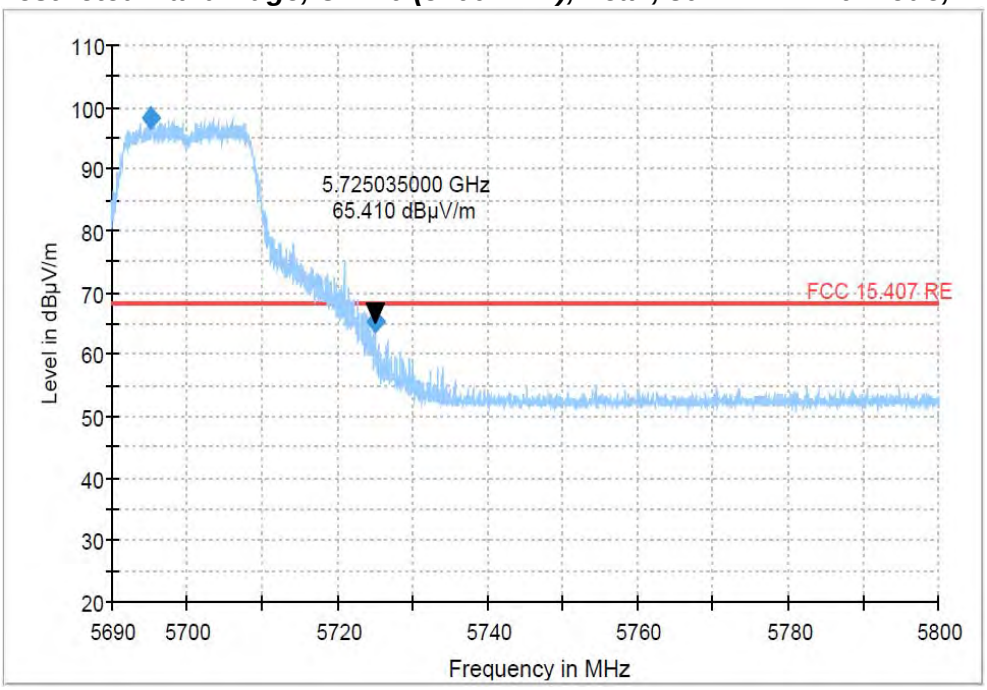
Restricted Band Edge, Ch100 (5500 MHz), Peak, 802.11n HT20 mode, Ant MIMO



Restricted Band Edge, Ch100 (5500 MHz), Average, 802.11n HT20 mode, Ant MIMO



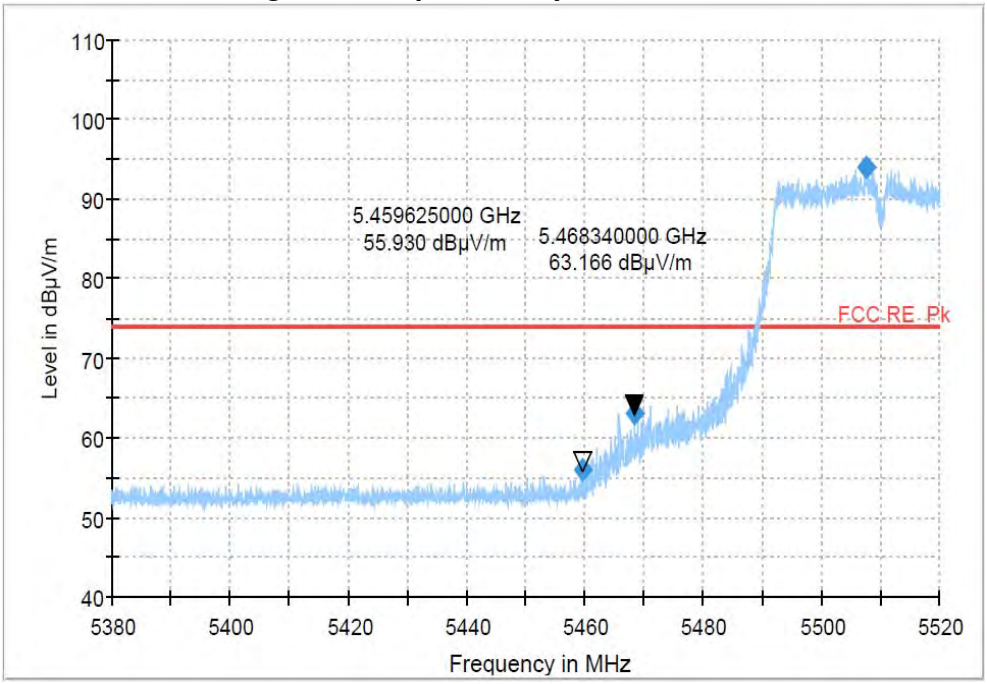
Restricted Band Edge, Ch140 (5700 MHz), Peak, 802.11n HT20 mode, Ant MIMO



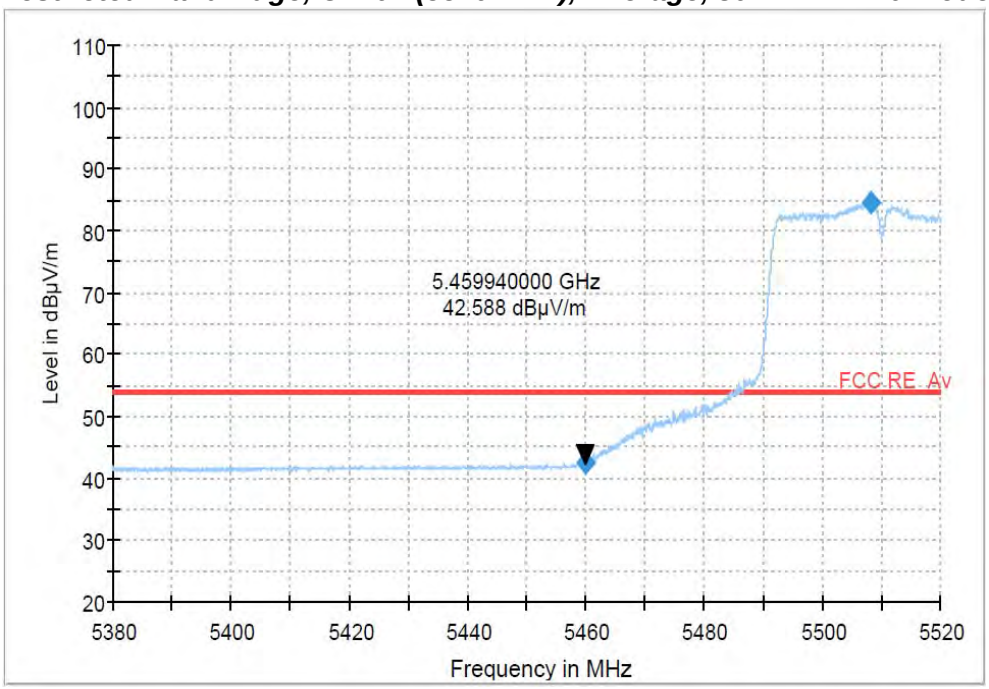
802.11n HT40 Mode

Chain 0 + Chain 1

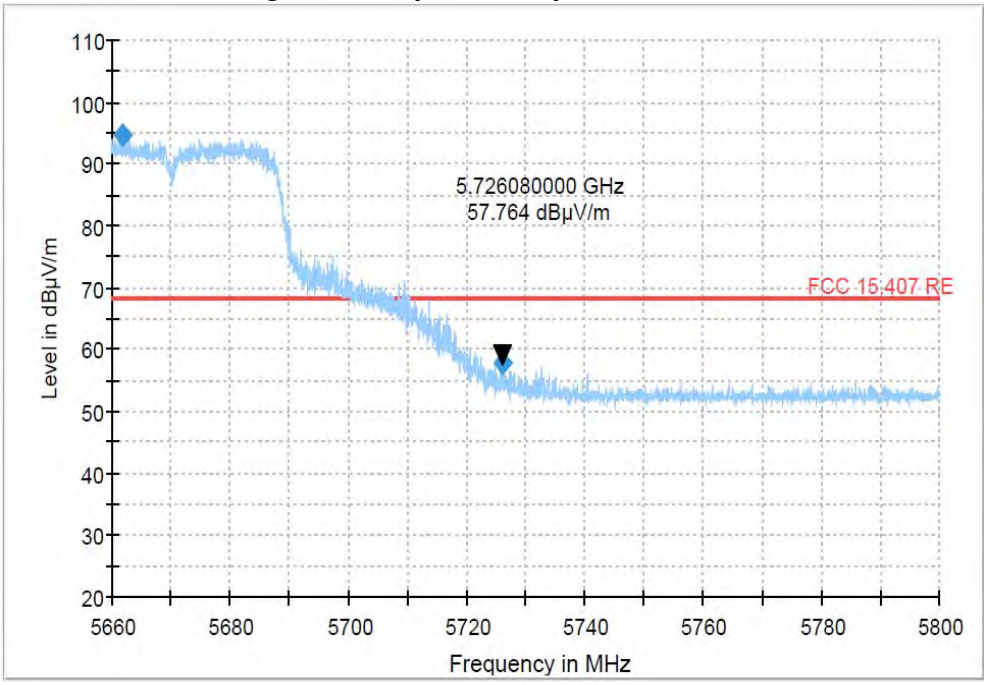
Restricted Band Edge, Ch102 (5510 MHz), Peak, 802.11n HT40 mode, Ant MIMO



Restricted Band Edge, Ch102 (5510 MHz), Average, 802.11n HT40 mode, Ant MIMO



Restricted Band Edge, Ch134 (5670 MHz), Peak, 802.11n HT40 mode, Ant MIMO



Note(s):

1. *The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.*
2. *For the radiated band edge test, the EUT was investigated in all available data rates for 802.11a,n modes. The worst case band edge emissions were found while EUT was transmitting in 802.11a mode at 6 Mbps and 802.11n mode at MCS0*
3. *Peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.*
4. *As the EUT was configured to transmit with duty cycles ≥ 98 percent, average emission levels were measured using the "Method VB" by setting the analyzer RBW = 1 MHz, VBW = 1 kHz (VBW ≤ RBW/100), Detector = Peak.*
5. *For non-restricted band, the peak limit is 68.2 dBµV/m.*
6. *For restricted band, the peak limit is 74 dBµV/m and the average limit is 54 dBµV/m per § 15.209.*

9. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 09 2013	1 year
2	*Test Receiver	R & S	ESCS 30	100302	Oct. 08 2012	1 year
3	*Amplifier	R & S	SCU 01	10029	Apr. 05 2013	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	**Jul. 16 2013	1 year
5	*Amplifier	R & S	SCU18	10065	Apr. 05 2013	1 year
6	*Amplifier	R & S	SCU26	10011	***Jul. 08 2013	1 year
7	*Amplifier	R & S	SCU40	10008	***Jul. 08 2013	1 year
8	*Pre Amplifier	HP	8449B	3008A00107	Jan. 09 2013	1 year
9	*Spectrum Analyzer	Agilent	E4440A	MY44303257	**Jul. 16 2013	1 year
10	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Apr. 05 2013	1 year
11	*Spectrum Analyzer	R & S	FSP40	100361	**Jul. 16 2013	1 year
12	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 21 2012	2 year
13	Wideband Power Sensor	R & S	NRP-Z81	100634	**Jul. 16 2013	1 year
14	*Biconical Log Antenna	ARA	LPB-2520/A	1180	Apr. 26 2012	2 year
15	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-474	Aug. 13 2012	2 year
16	*Horn Antenna	Q-par Angus	QSH20S20	8179	Mar. 20 2013	2 year
17	*Horn Antenna	Q-par Angus	QSH22K20	8180	Mar. 20 2013	2 year
18	Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 24 2012	2 year
19	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Mar. 06 2013	2 year
20	*LISN	R & S	ESH3-Z5	833874/006	Oct. 08 2012	1 year
21	*LISN	R & S	ESH2-Z5	100227	Apr. 04 2013	1 year
22	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
23	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
24	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
25	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
26	*Position Controller	INNCO	CO2000	1480406/L	N/A	N/A
27	*Turn Table	INNCO	DS1200S	N/A	N/A	N/A
28	*Antenna Mast	INNCO	MA4000	N/A	N/A	N/A
29	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A

Note(s)

1. * Test equipment used during the test.
2. ** The calibrations of these equipment were performed for 2 day (7/15~7/16) and they were not used to test during this period.
3. *** The calibrations of these equipment were performed for a day (7/8) and they were not used to test during this period.

10. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

1. Conducted Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	u(Xi) (dB)	Ci	Ci u(Xi) (dB)
		Value (dB)	Probability Distribution				
Receiver reading	RI	± 0.1	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	LC	± 0.08	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	LAMN	± 0.8	normal 2	2.000	0.4	1	0.4
Sine wave voltage	dVSW	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	dVPA	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	dVPR	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	dVNF	± 0.00	-	-	0.00	1	0.00
AMN Impedance	dZ	± 1.80	triangular	2.449	0.73	1	0.73
ⓐ Mismatch	M	+ 0.70	U-Shaped	1.414	0.49	1	0.49
ⓑ Mismatch	M	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	RS	0.05	normal 1	1.000	0.05	1	0.05
Remark	ⓐ: AMN-Receiver Mismatch : + ⓑ: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			± 1.88			
Expended Uncertainty U	Normal (k = 2)			± 3.76			

2. Radiation Uncertainty Calculation

Source of Uncertainty	*Xi*	Uncertainty of *Xi*		Coverage factor *k*	*u(Xi)* (dB)	*Ci*	*Ci u(Xi)* (dB)
		Value (dB)	Probability Distribution				
Receiver reading	***RI***	± 0.10	normal 1	1.000	0.10	1	0.10
Sine wave voltage	***dVsw***	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	***dVpa***	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	***dVpr***	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	***dVnf***	± 0.50	normal 2	2.000	0.25	1	0.25
Antenna Factor Calibration	***AF***	± 1.50	normal 2	2.000	0.75	1	0.75
Attenuation Antenna-receiver	***CL***	± 0.52	normal 2	2.000	0.26	1	0.26
Antenna Directivity	***AD***	± 1.00	rectangular	1.732	0.58	1	0.58
Antenna Factor Height Dependence	***AH***	± 0.50	rectangular	1.732	0.29	1	0.29
Antenna Phase Centre Variation	***AP***	± 0.30	rectangular	1.732	0.17	1	0.17
Antenna Factor Frequency Interpolation	***AI***	± 0.30	rectangular	1.732	0.17	1	0.17
Site Imperfections	***SI***	± 4.00	triangular	2.449	1.63	1	1.63
Measurement Distance Variation	***DV***	± 0.10	rectangular	1.732	0.06	1	0.06
Antenna Balance	***Dbal***	± 0.90	rectangular	1.732	0.52	1	0.52
Cross Polarisation	***DCross***	± 0.90	rectangular	1.732	0.52	1	0.52
ⓐ Mismatch	***M***	+ 0.25	U-Shaped	1.414	0.18	1	0.18
ⓑ Mismatch	***M***	- 0.26	U-Shaped	1.414	- 0.18	1	- 0.18
ⓒ Mismatch	***M***	+ 0.98	U-Shaped	1.414	0.69	1	0.69
ⓓ Mismatch	***M***	- 1.11	U-Shaped	1.414	- 0.79	1	- 0.79
Measurement System Repeatability	***RS***	0.09	normal 1	1.000	0.09	1	0.09
Remark	ⓐ: Biconical Antenna-receiver Mismatch : + (< 200 MHz) ⓑ: Biconical Antenna-receiver Mismatch : - (< 200 MHz) ⓒ: Log Periodic Antenna-receiver Mismatch : + (≧ 200 MHz) ⓓ: Log Periodic Antenna-receiver Mismatch : - (≧ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 (≧200 MHz)			
Expended Uncertainty U	Normal (*k* = 2)			± 5.26 (< 200 MHz) ± 5.48 (≧200 MHz)			