

FCC / ISED DTS REPORT

Certification

Applicant Name:

LG Electronics Inc.

Address:222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do,
Korea**Date of Issue:**

November 24, 2017

Test Site/Location:HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-
myeo, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA**Report No.:** HCT-R-1711-F012**ISED Registration Number:** 5944A-5

FCC ID :	BEJ-WC1NP8
ISED ID :	2703H-WC1NP8
APPLICANT :	LG Electronics Inc.

Model:

WC1NP8

EUT Type:

RF Module

Peak Output Power:

Mode	Ant.0(SISO)	Ant.1(SISO)	Ant.0 & 1 (MIMO)
802.11b	19.11 dBm	16.32 dBm	-
802.11g	22.56 dBm	22.73 dBm	25.66 dBm
802.11n_HT20	22.76 dBm	22.86 dBm	25.82 dBm

Frequency Range:

2412 MHz - 2462 MHz (2.4 GHz Band)

Modulation type:

CCK/DSSS/OFDM

FCC Classification:

Digital Transmission System(DTS)

FCC Rule Part(s):

Part 15.247

ISED Rule Part(s):

RSS-247 Issue 2(February 2017), RSS-Gen Issue 4(November 2014)

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC / IC Rules under normal use and maintenance.

**Report prepared by : Kyung Soo Kang****Engineer of Telecommunication testing center****Approved by : Jong Seok Lee****Manager of Telecommunication testing center**

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1711-F012	November 24, 2017	- First Approval Report

Table of Contents

1. GENERAL INFORMATION	4
2. EUT DESCRIPTION	4
2.1 EUT OPERATING MODE	5
3. TEST METHODOLOGY	6
3.1 EUT CONFIGURATION	6
3.2 EUT EXERCISE	6
3.3 GENERAL TEST PROCEDURES	6
3.4 DESCRIPTION OF TEST MODES	6
4. INSTRUMENT CALIBRATION.....	7
5. FACILITIES AND ACCREDITATIONS	7
5.1 FACILITIES	7
5.2 EQUIPMENT	7
6. ANTENNA REQUIREMENTS	7
7. MEASUREMENT UNCERTAINTY	9
8. SUMMARY TEST OF RESULTS	10
8.1 FCC Part	10
8.2 ISED Part	11
9. TEST RESULT	12
9.1 DUTY CYCLE.....	12
9.2 6dB BANDWIDTH.....	14
9.3 99% BANDWIDTH	21
9.4 OUTPUT POWER (802.11b/g/n)	34
9.5 POWER SPECTRAL DENSITY (802.11b/g/n).....	51
9.6 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS	59
9.7 RADIATED MEASUREMENT.....	82
9.7.1 RADIATED SPURIOUS EMISSIONS.....	82
9.7.2 RADIATED RESTRICTED BAND EDGES	100
9.7.3 RECEIVER SPURIOUS EMISSIONS	107
9.8 POWERLINE CONDUCTED EMISSIONS	108
10. LIST OF TEST EQUIPMENT	113
10.1 LIST OF TEST EQUIPMENT(Conducted Test)	113
10.2 LIST OF TEST EQUIPMENT(Radiated Test).....	114

1. GENERAL INFORMATION

Applicant: LG Electronics Inc.
Address: 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, Korea
FCC ID: BEJ-WC1NP8
ISED ID: 2703H-WC1NP8
EUT Type: RF Module
Model: WC1NP8
Date(s) of Tests: October 24, 2017 ~ November 21, 2017
Place of Tests: HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

2. EUT DESCRIPTION

Model	WC1NP8		
EUT Type	RF Module		
Power Supply	3.3 V		
Frequency Range	TX: 2412 MHz ~ 2462 MHz RX: 2412 MHz ~ 2462 MHz		
Max. RF Output Power	Peak	Ant. 0 (SISO)	Wi-Fi 802.11b(19.11 dBm) / Wi-Fi 802.11g (22.56 dBm) / Wi-Fi 802.11n_HT20 (22.76 dBm)
		Ant.1 (SISO)	Wi-Fi 802.11b(16.32 dBm) / Wi-Fi 802.11g (22.73 dBm) / Wi-Fi 802.11n_HT20 (22.86 dBm)
		Ant.0 & 1 (MIMO)	Wi-Fi 802.11g (25.66 dBm) / Wi-Fi 802.11n_HT20 (25.82 dBm)
	Average	Ant.0 (SISO)	Wi-Fi 802.11b(16.55 dBm) / Wi-Fi 802.11g (16.39 dBm) / Wi-Fi 802.11n_HT20 (16.52 dBm)
		Ant.1 (SISO)	Wi-Fi 802.11b(16.32 dBm) / Wi-Fi 802.11g (22.73 dBm) / Wi-Fi 802.11n_HT20 (22.86 dBm)
		Ant.0 & 1 (MIMO)	Wi-Fi 802.11g (19.72 dBm) / Wi-Fi 802.11n_HT20 (19.83 dBm)
Modulation Type	DSSS/CCK(802.11b), OFDM(802.11g, 802.11n)		
Antenna Specification	Manufacturer: INPAQ TECHNOLOGY CO., LTD Antenna type: FPCB Antenna Peak Gain : cf. Section 6		

2.1 EUT OPERATING MODE

■ Operating mode

Mode	Operating Mode	Operating Ant.
802.11b/g/n	SISO	Ant. 0
		Ant. 1
802.11g/n	MIMO	Ant. 0 & 1

Note : We have done all test case. Worst case is MIMO(CDD) for 802.11g/n_HT20 mode and (SISO) for 802.11b mode. So, we attached the result of MIMO for 802.11g/n mode and (SISO) for 802.11b mode.

3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v04 dated April 05, 2017 entitled "Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) and the measurement procedure described in ANSI C63.10(Version : 2013) 'the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices'.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C/ RSS-Gen issue 4, RSS-247 issue 2.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3.75 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

Conducted Antenna Terminal

See Section from 9.1 to 9.2.(KDB 558074 v04)

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661)

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antennas of this E.U.T are permanently attached.

*The E.U.T Complies with the requirement of §15.203

Directional Gain Calculations

- If any transmit signals are correlated with each other(802.11g/n_HT20),

$$\text{Directional gain} = 10 \cdot \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N] \text{ dBi}$$

Antenna Gain

2.4 GHz Band

Antenna Gain	802.11b/g/n	Ant 0	-0.92 dBi
		Ant 1	-3.88 dBi
Directional Antenna Gain	802.11g/n	Ant 0 & 1	0.74 dBi

7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

Parameter	Expanded Uncertainty ($\pm$ dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70

8. SUMMARY TEST OF RESULTS

8.1 FCC Part

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§15.247(a)(2)	> 500 kHz	CONDUCTED	PASS
Conducted Maximum Peak Output Power	§15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	§15.247(d)	Conducted > 30 dBc		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 9.8		PASS
Radiated Spurious Emissions	§15.205, 15.209	cf. Section 9.7.1	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 9.7.2		PASS

8.2 ISED Part

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	RSS-247, 5.2	> 500 kHz	CONDUCTED	PASS
99% Bandwidth	RSS-Gen, 6.6	NA		NA
Conducted Maximum Peak Output Power And e.i.r.p.	RSS-247, 5.4.d.	< 1 Watt <4 Watt(e.i.r.p.)		PASS
Power Spectral Density	RSS-247, 5.2	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	RSS-247, 5.5	Conducted > 20 dBc		PASS
AC Power line Conducted Emissions	RSS-Gen, 8.8	cf. Section 8.7		PASS
Radiated Spurious Emissions	RSS-Gen, 8.9	RSS-Gen section 8.9 table 4, 5	RADIATED	PASS
Receiver Spurious Emissions	RSS-Gen, 5 RSS-Gen, 7.1.2	RSS-Gen section 7.1.2 table 2		PASS
Radiated Restricted Band Edge	RSS-Gen, 8.10	RSS-Gen section 8.10 table 6		PASS

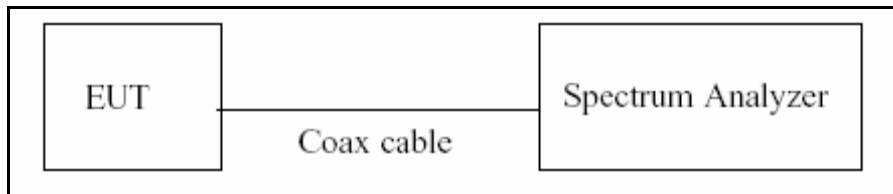
9. TEST RESULT

9.1 DUTY CYCLE

According to Section 6.0)b) in KDB 558074 v04

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value. Set $VBW \geq RBW$. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

■ TEST CONFIGURATION



■ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, 6.0)b) in KDB 558074 v04.

The largest available value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if $T \leq 6.25$ microseconds. ($50/6.25 = 8$)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are $> 50/T$.

1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ($\geq$ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = $10 \cdot \log(1/\text{Duty Cycle})$

Duty Cycle Factor

Mode	Data Rate	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
b	1 Mbps	12.441	12.542	0.99199471	0.035
	2 Mbps	6.311	6.405	0.98535565	0.064
	5.5 Mbps	2.414	2.516	0.95922747	0.181
	11 Mbps	1.307	1.408	0.92815077	0.324
g	6 Mbps	2.063	2.188	0.94257722	0.257
	9 Mbps	1.382	1.517	0.91142437	0.403
	12 Mbps	1.043	1.152	0.90547553	0.431
	18 Mbps	0.704	0.827	0.85046654	0.703
	24 Mbps	0.532	0.639	0.83298495	0.794
	36 Mbps	0.364	0.489	0.74386972	1.285
	48 Mbps	0.276	0.383	0.72222309	1.413
	54 Mbps	0.248	0.400	0.62018380	2.075
n_HT20	MCS 0	1.924	2.041	0.94267516	0.256
	MCS 1	0.981	1.087	0.90283401	0.444
	MCS 2	0.669	0.774	0.86363636	0.637
	MCS 3	0.509	0.634	0.80324021	0.952
	MCS 4	0.352	0.458	0.76855895	1.143
	MCS 5	0.272	0.379	0.71767810	1.441
	MCS 6	0.248	0.382	0.64921466	1.876
	MCS 7	0.228	0.335	0.68121563	1.667

Note : Duty Cycle Factor = $10 \cdot \log(1/\text{Duty Cycle})$. where, Duty Cycle = $T_{\text{on}} / T_{\text{total}}$

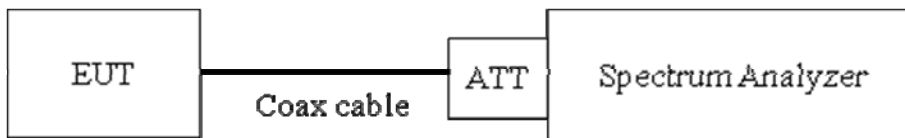
9.2 6dB BANDWIDTH

Test Requirements and limit, §15.247(a)(2) / RSS-247(Issue 2) Section 5.2.

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6dB bandwidth is 500 kHz.

■ TEST CONFIGURATION



■ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to (Procedure 8.1 in KDB 558074 v04)

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

TEST RESULTS_Ant.0

Conducted 6dB Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	8.105	0.500	Pass
2437	6	8.103	0.500	Pass
2462	11	8.103	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11g

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	16.17	0.500	Pass
2437	6	15.84	0.500	Pass
2462	11	16.12	0.500	Pass

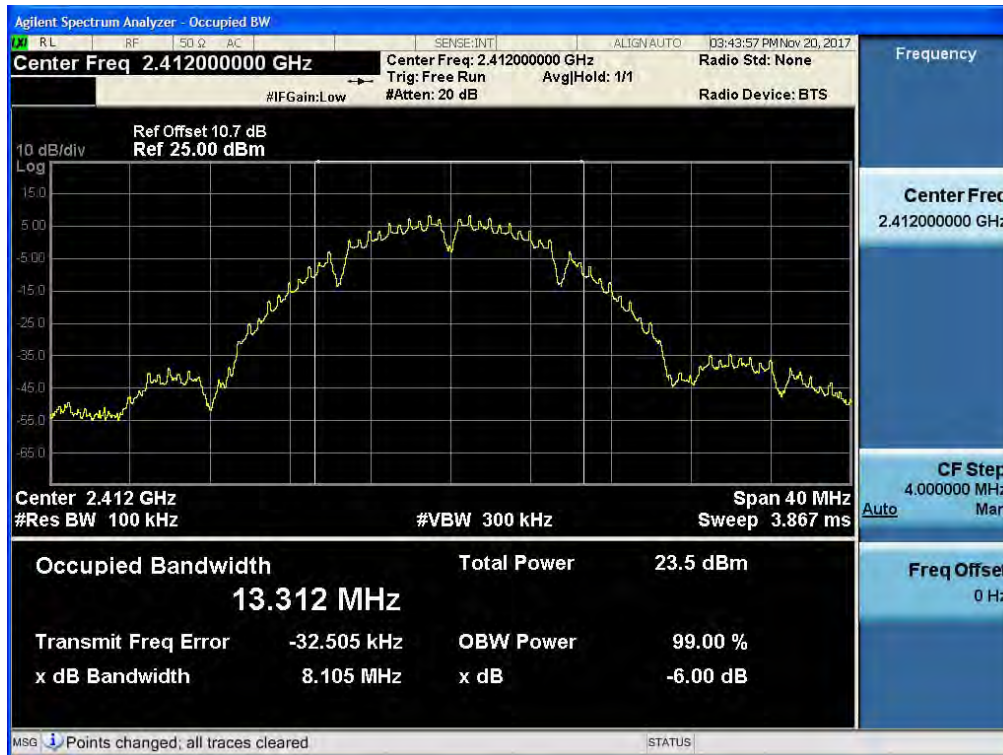
Conducted 6dB Bandwidth Measurements for 802.11n_HT20

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	16.85	0.500	Pass
2437	6	16.83	0.500	Pass
2462	11	16.87	0.500	Pass

Note : In order to simplify the report, attached plots were only the most wide 6 dB BW channel.

■ RESULT PLOTS

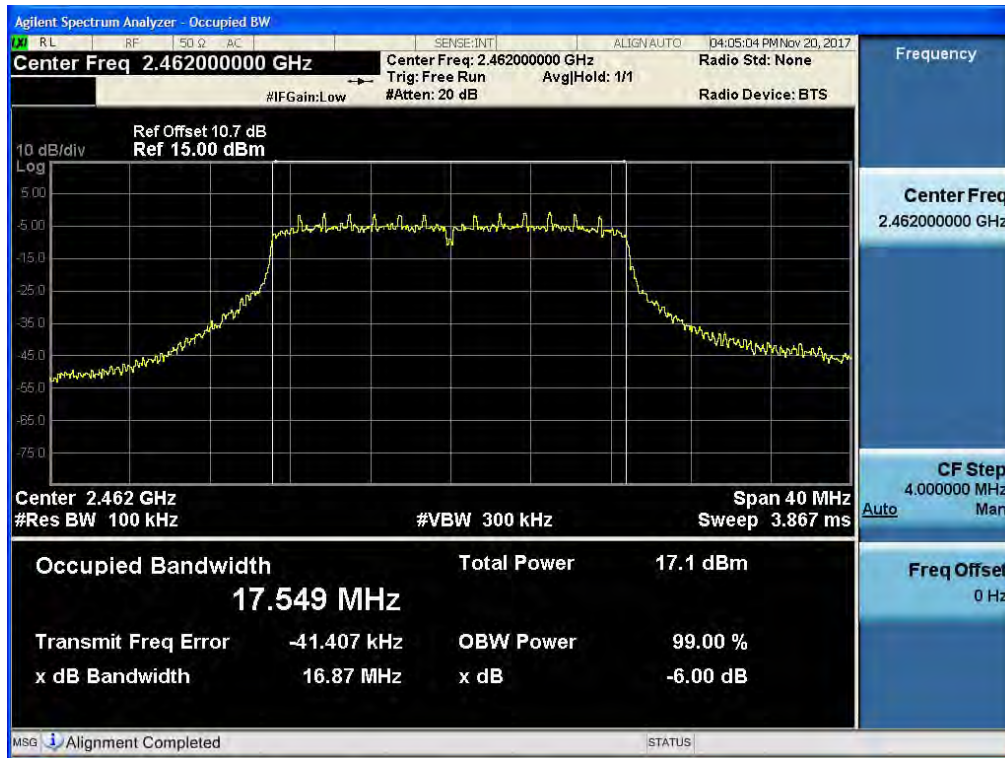
6dB Bandwidth plot (802.11b-CH 1)



6dB Bandwidth plot (802.11g-CH 1)



6dB Bandwidth plot (802.11n_HT20-CH 11)



TEST RESULTS_Ant.1

Conducted 6dB Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	8.101	0.500	Pass
2437	6	8.102	0.500	Pass
2462	11	8.102	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11g

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	15.88	0.500	Pass
2437	6	16.10	0.500	Pass
2462	11	16.11	0.500	Pass

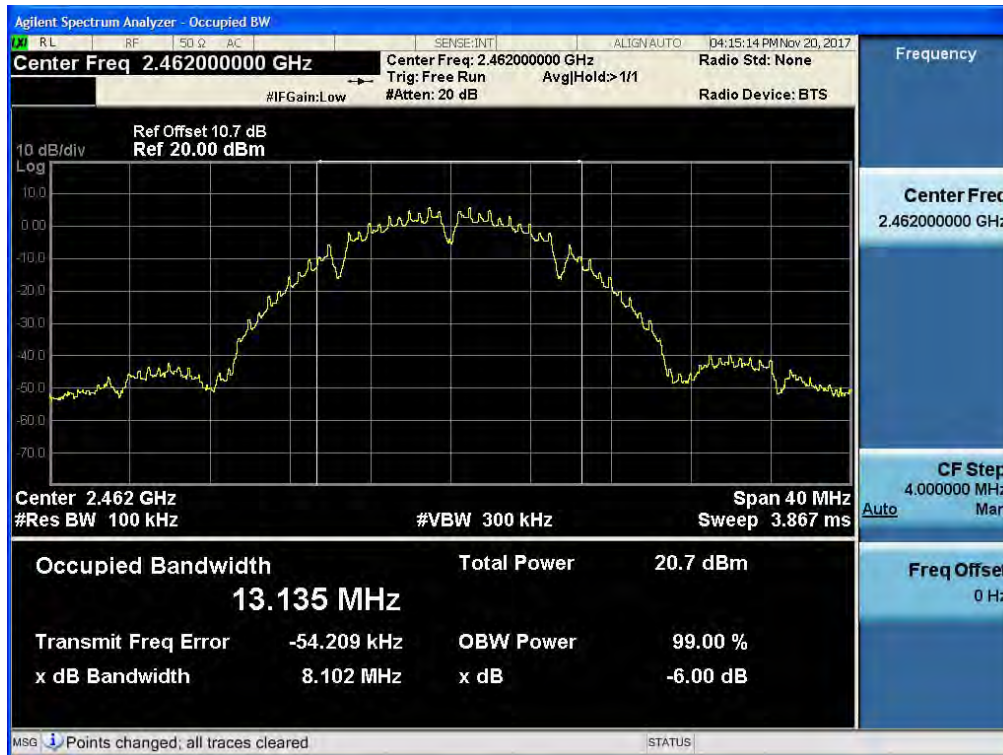
Conducted 6dB Bandwidth Measurements for 802.11n_HT20

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	16.83	0.500	Pass
2437	6	16.81	0.500	Pass
2462	11	16.82	0.500	Pass

Note : In order to simplify the report, attached plots were only the most wide 6 dB BW channel.

RESULT PLOTS

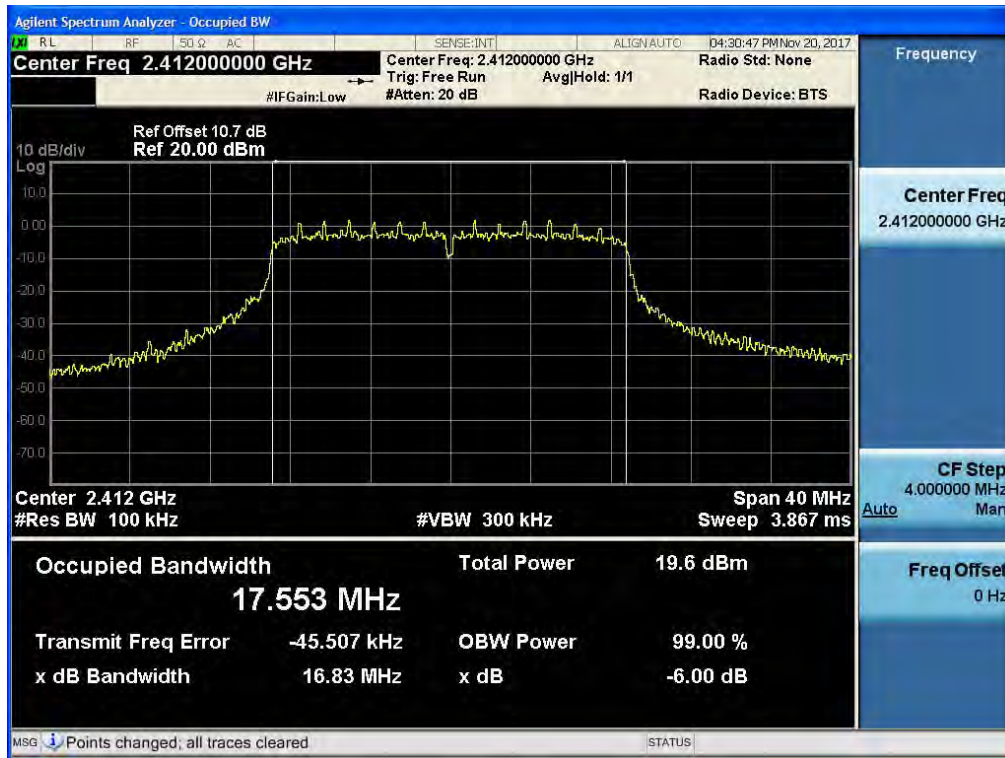
6dB Bandwidth plot (802.11b-CH 11)



6dB Bandwidth plot (802.11g-CH 11)



6dB Bandwidth plot (802.11n_HT20-CH 1)

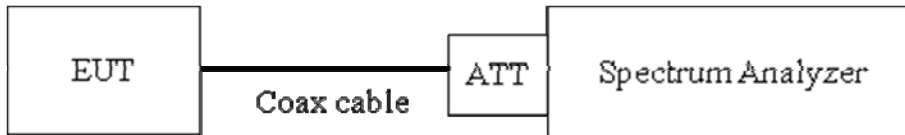


9.3 99% BANDWIDTH

Limit, RSS-Gen(Issue 4) Section 6.6

The 99 % bandwidth is used to determine the conducted power limits.

■ TEST CONFIGURATION



■ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW $\approx$ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

■ TEST RESULTS_Ant.0

Conducted 99% Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	13.29	N/A
2437	6	13.34	N/A
2462	11	13.20	N/A

Conducted 99% Bandwidth Measurements for 802.11g

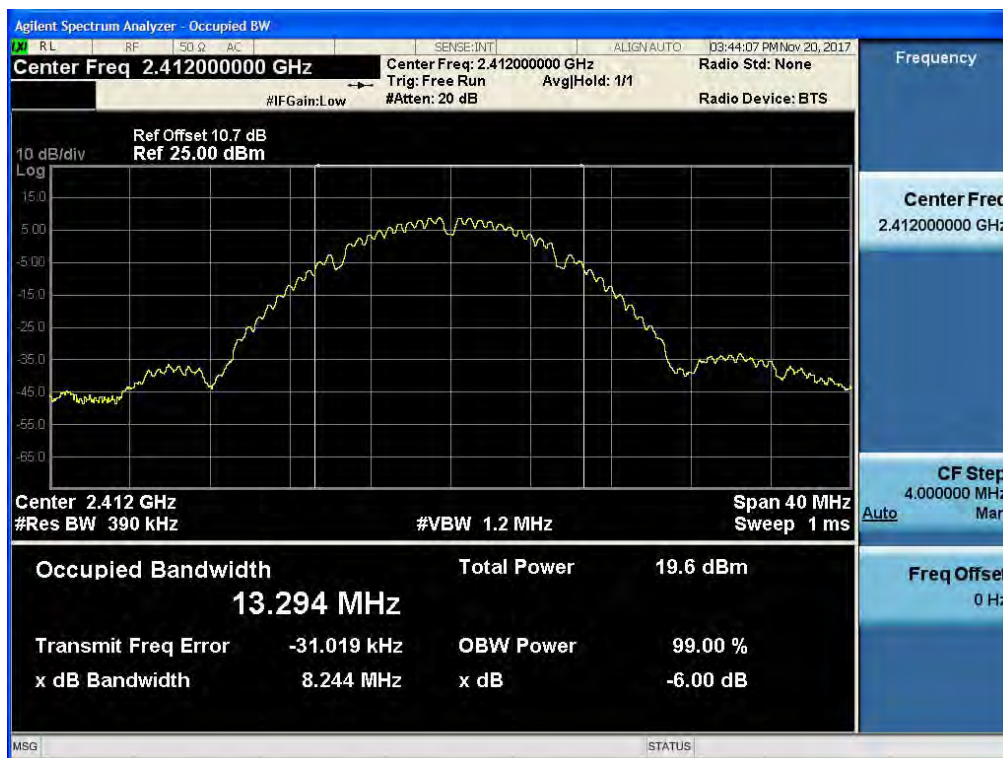
802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.63	N/A
2437	6	16.69	N/A
2462	11	16.61	N/A

Conducted 99% Bandwidth Measurements for 802.11n_HT20

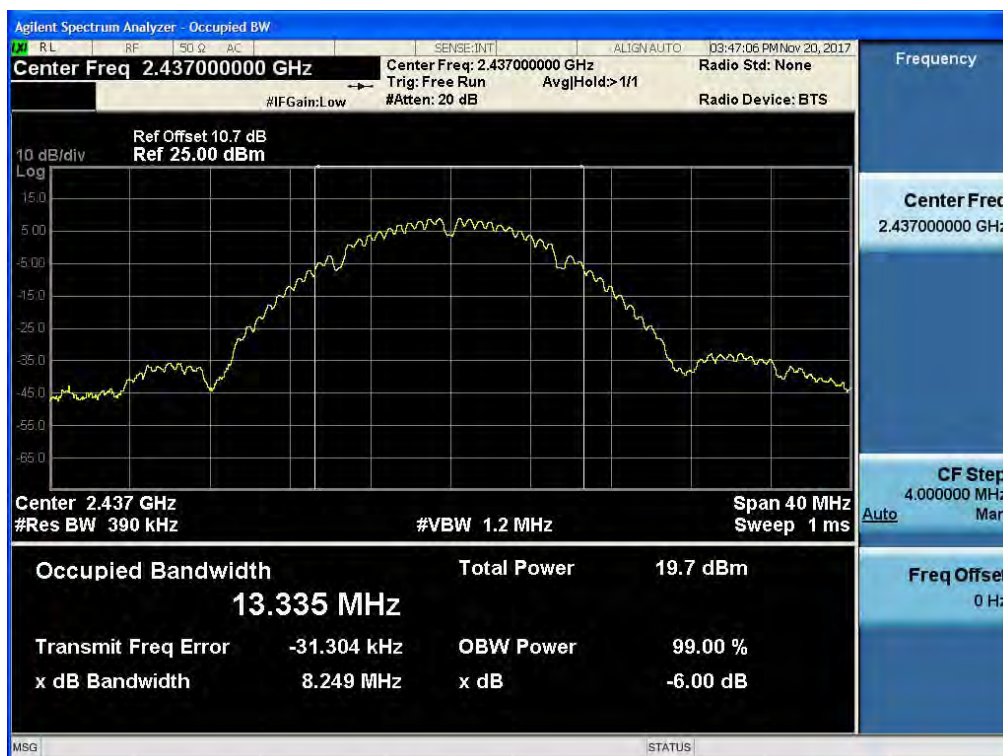
802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.69	N/A
2437	6	17.79	N/A
2462	11	17.69	N/A

■ RESULT PLOTS

99% Bandwidth plot (802.11b - CH 1)



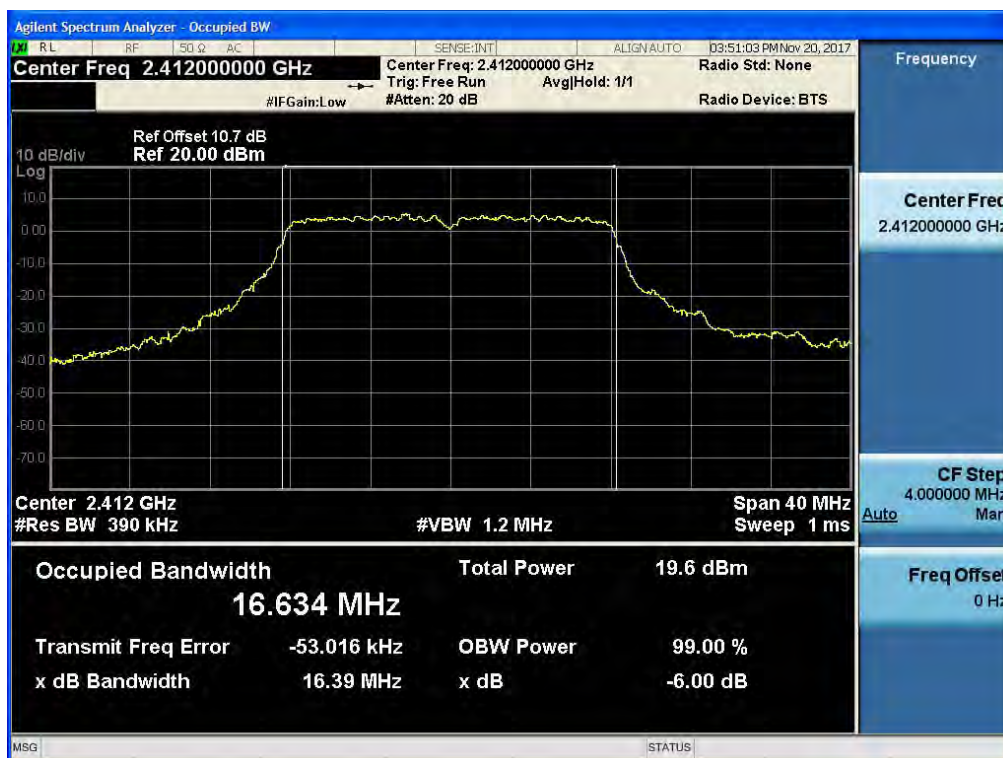
99% Bandwidth plot (802.11b - CH 6)



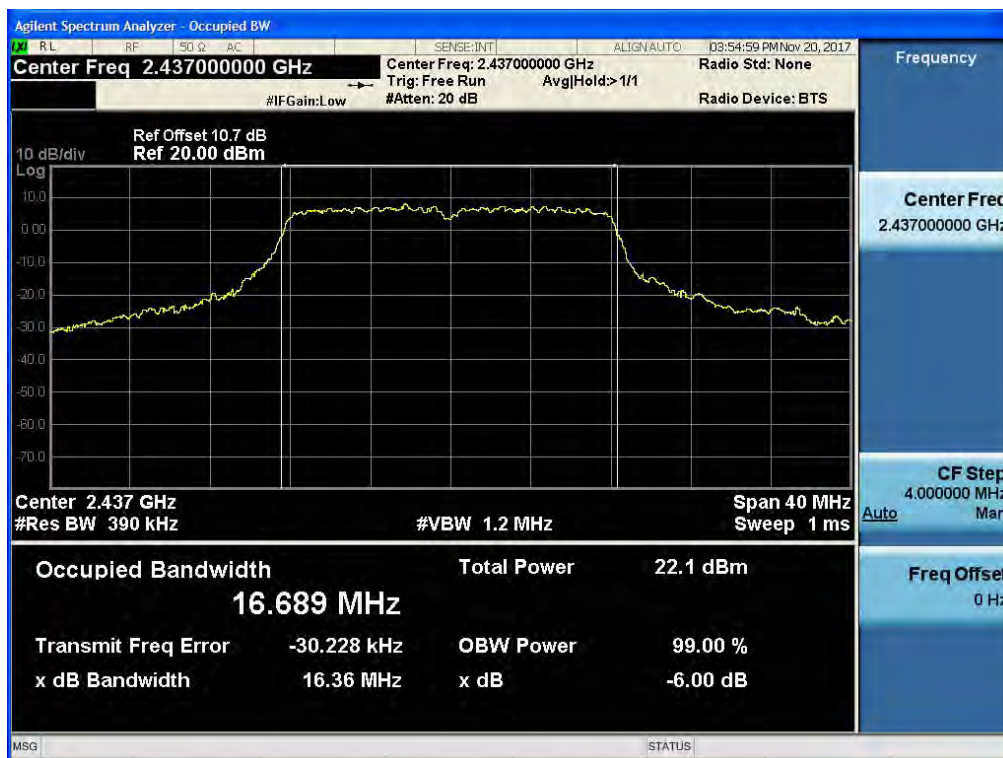
99% Bandwidth plot (802.11b - CH 11)



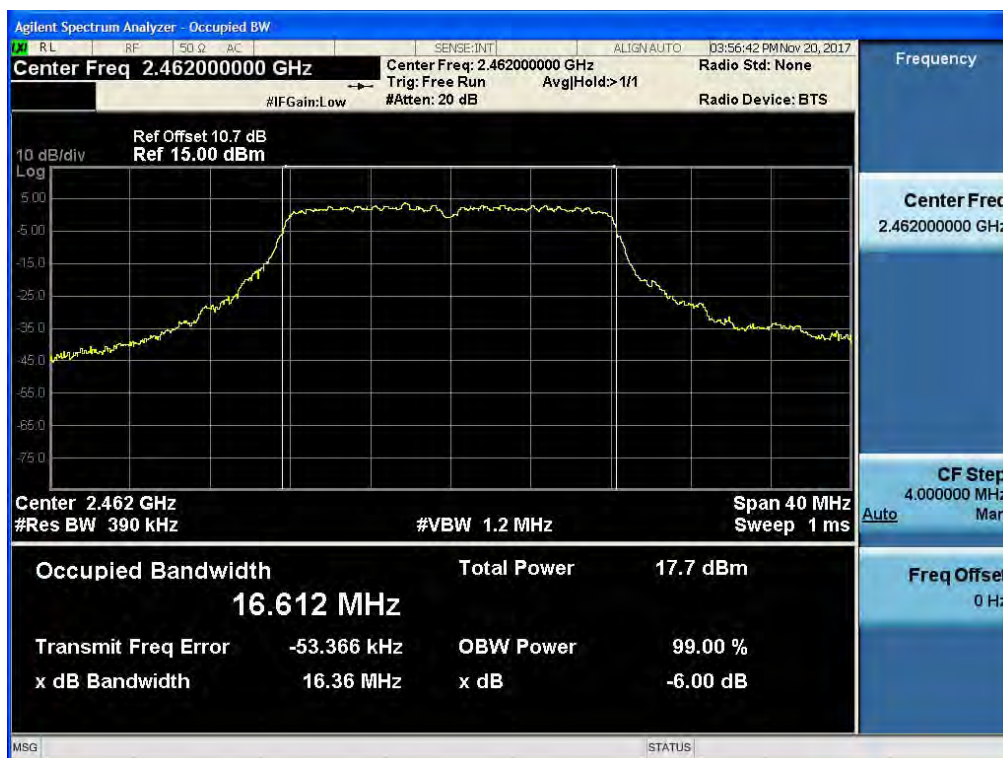
99% Bandwidth plot (802.11g - CH 1)



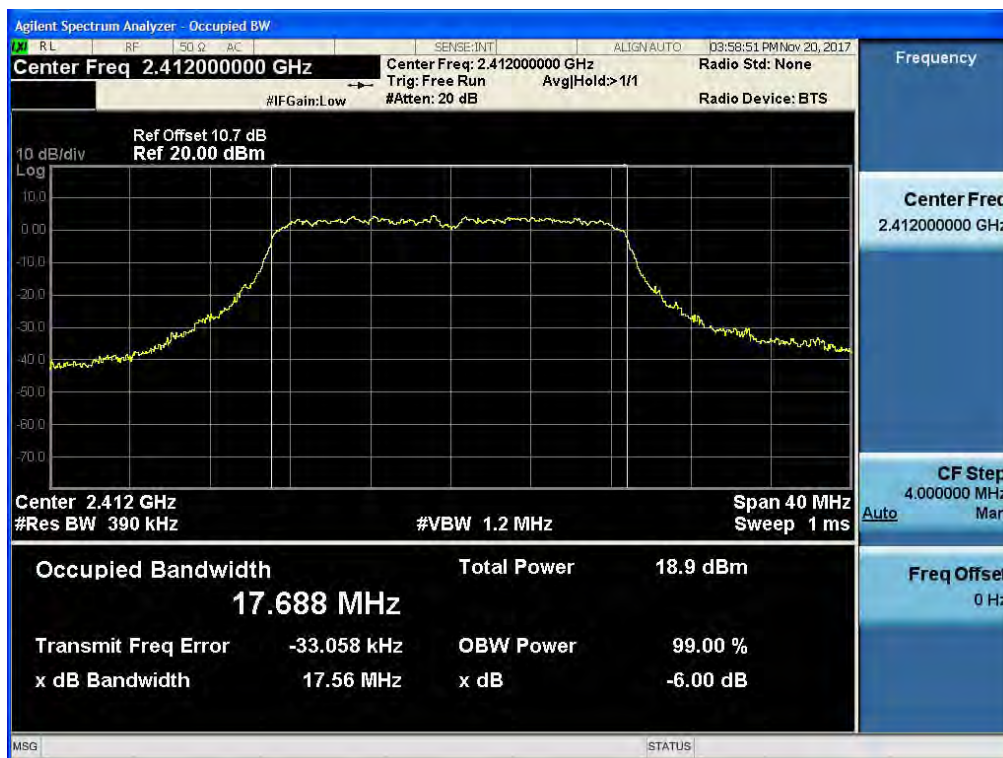
99% Bandwidth plot (802.11g - CH 6)



99% Bandwidth plot (802.11g - CH 11)



99% Bandwidth plot (802.11n_HT20 - CH 1)



99% Bandwidth plot (802.11n_HT20 - CH 6)



99% Bandwidth plot (802.11n_HT20 - CH 11)



■ TEST RESULTS_Ant.1

Conducted 99% Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	13.10	N/A
2437	6	13.13	N/A
2462	11	13.17	N/A

Conducted 99% Bandwidth Measurements for 802.11g

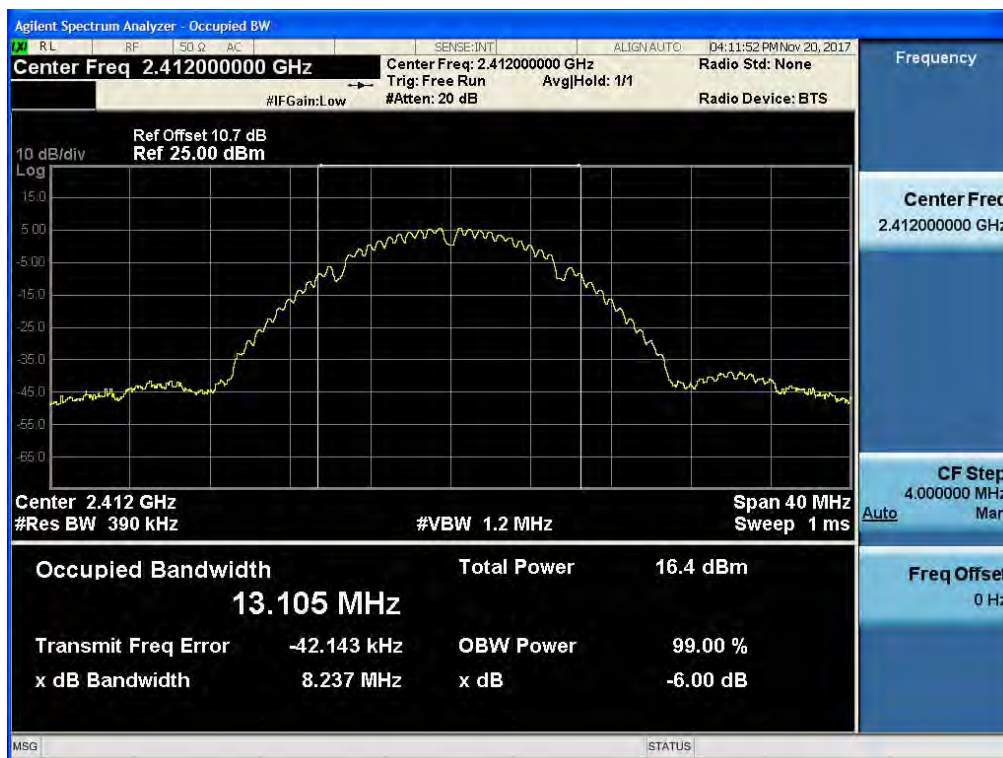
802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.64	N/A
2437	6	16.75	N/A
2462	11	16.62	N/A

Conducted 99% Bandwidth Measurements for 802.11n_HT20

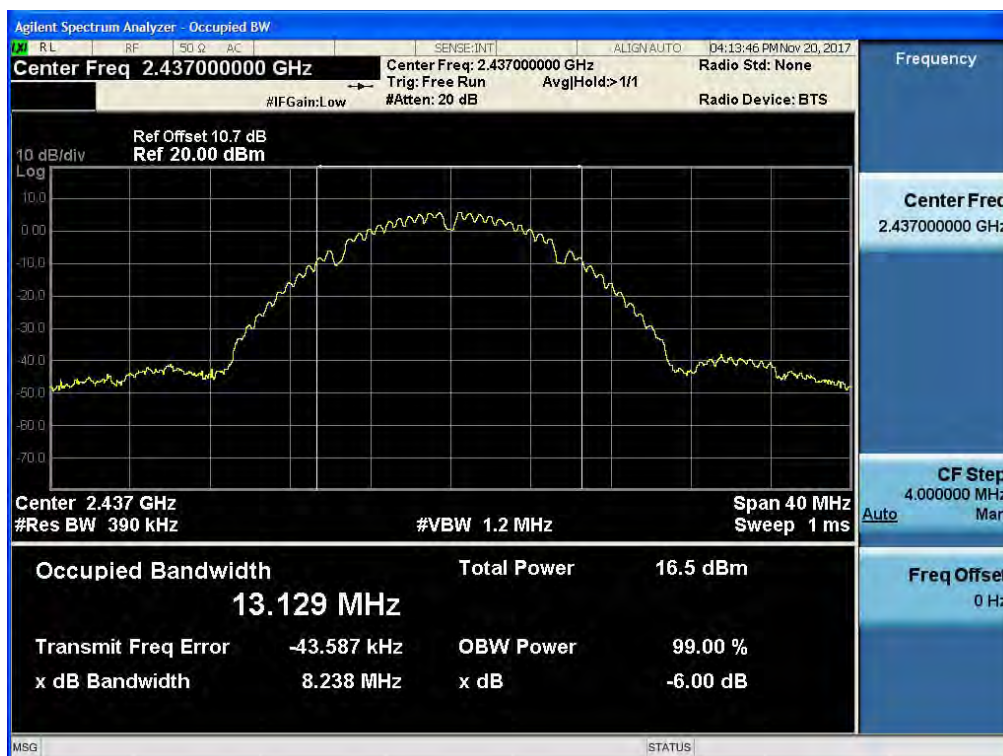
802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.70	N/A
2437	6	17.81	N/A
2462	11	17.69	N/A

RESULT PLOTS

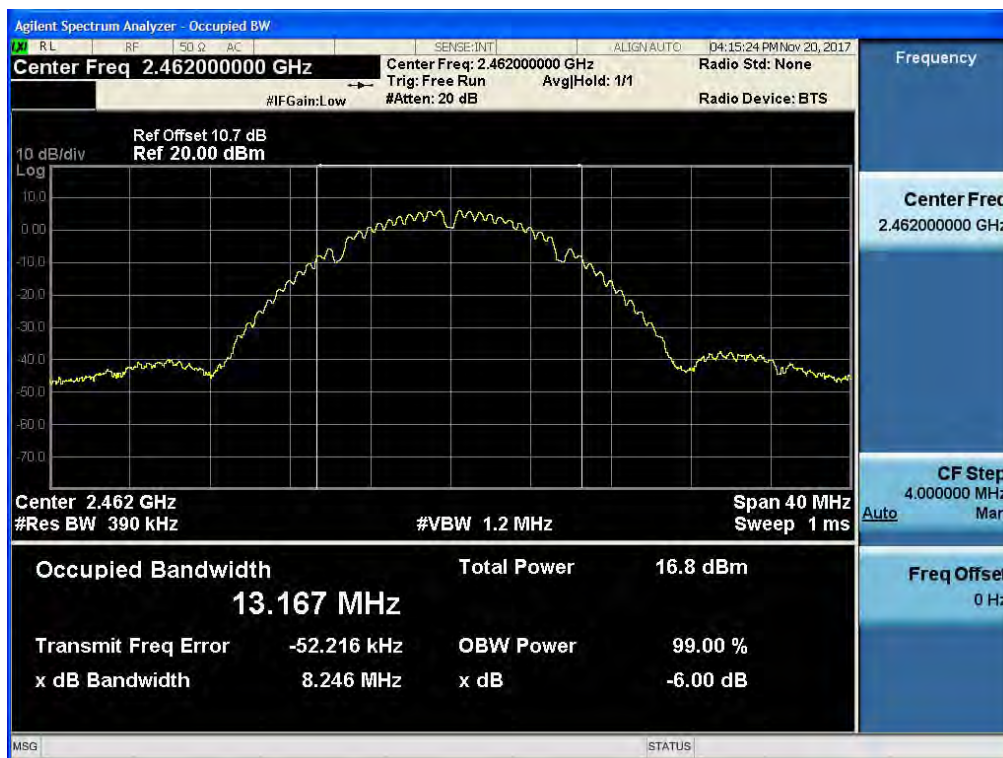
99% Bandwidth plot (802.11b - CH 1)



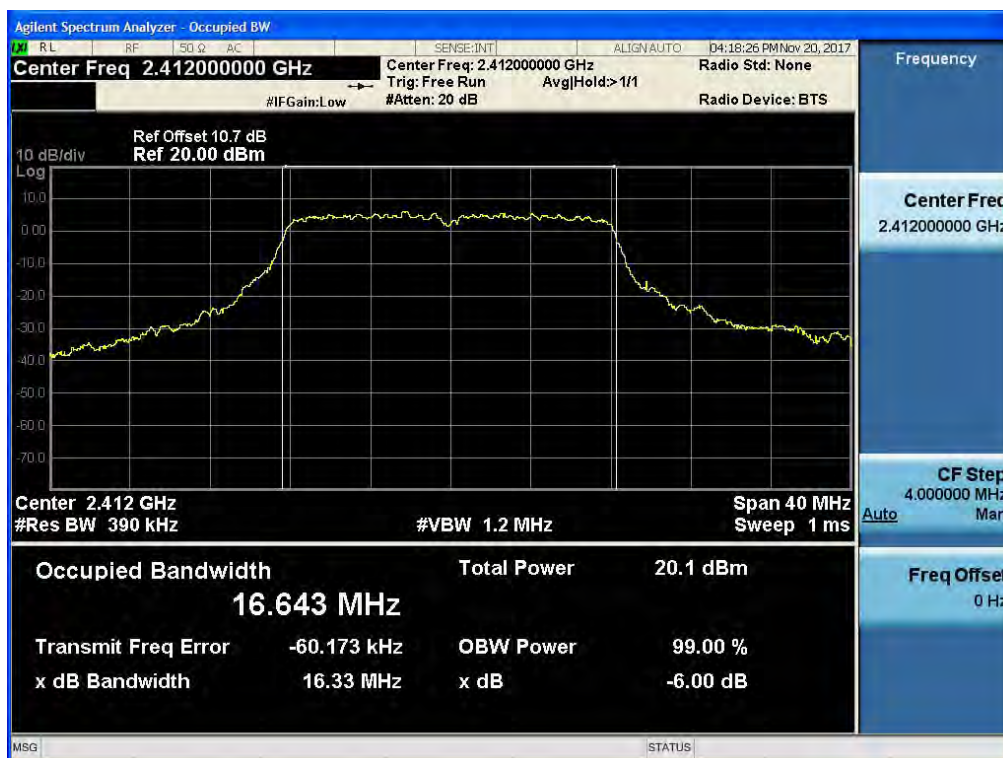
99% Bandwidth plot (802.11b - CH 6)



99% Bandwidth plot (802.11b - CH 11)



99% Bandwidth plot (802.11g - CH 1)



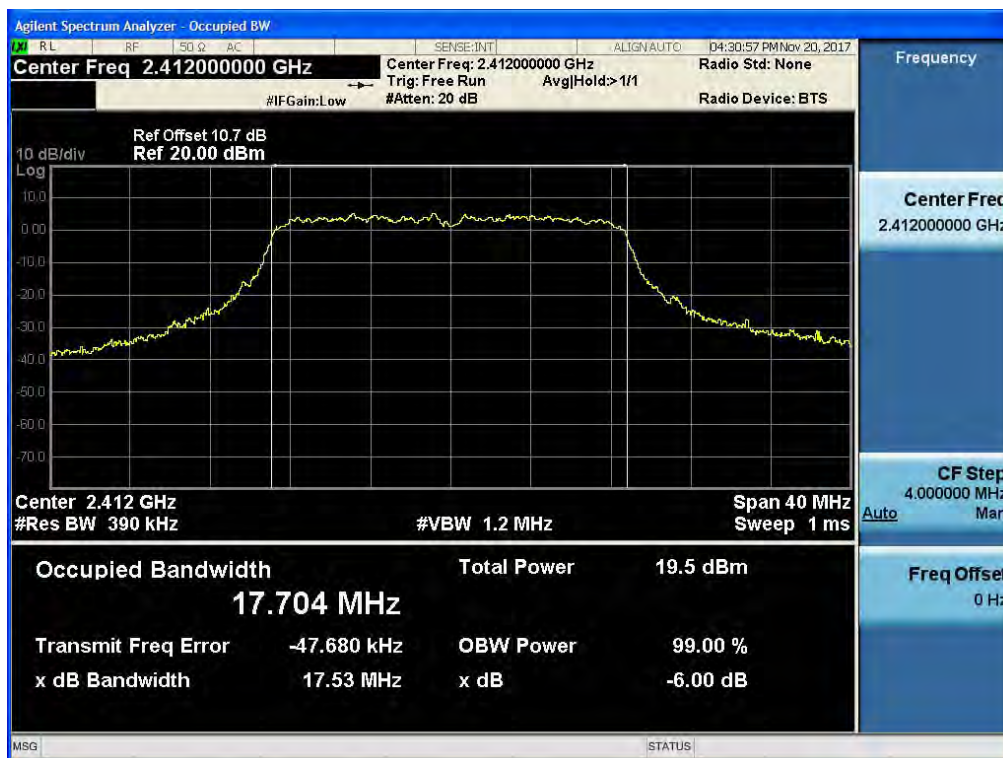
99% Bandwidth plot (802.11g - CH 6)



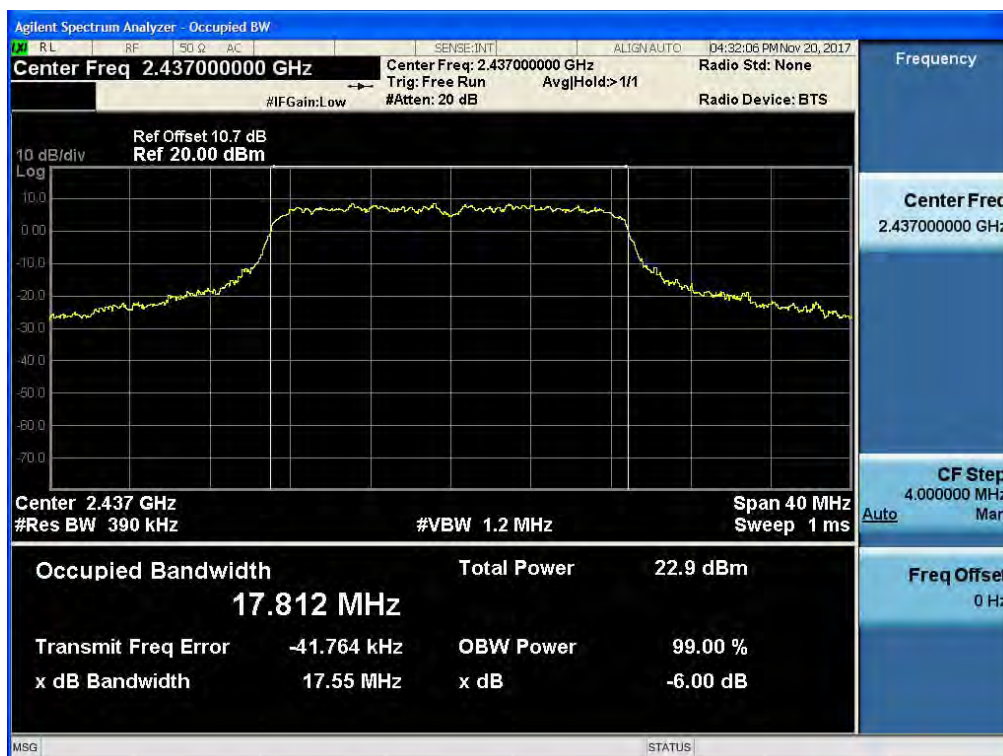
99% Bandwidth plot (802.11g - CH 11)



99% Bandwidth plot (802.11n_HT20 - CH 1)



99% Bandwidth plot (802.11n_HT20 - CH 6)



99% Bandwidth plot (802.11n_HT20 - CH 11)



9.4 OUTPUT POWER (802.11b/g/n)

Test Requirements and limit, §15.247(b)(3) / RSS-247(Issue 2) Section 5.4.d.

The transmitter output is connected to the input of an RF power sensor. Measurement is made using a broadband power meter capable of making peak and average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

■ Limit(CDD)

Maximum Conducted Output Power

Operating Mode	Band	Mode	Ant. Port	Ant. Gain (dBi)	Limit (dBm)
SISO	2.4 GHz	802.11b/g/n	0	-0.92	30.0
			1	-3.88	30.0
MIMO(2 TX)		802.11g/n	0 & 1	0.74	30.0

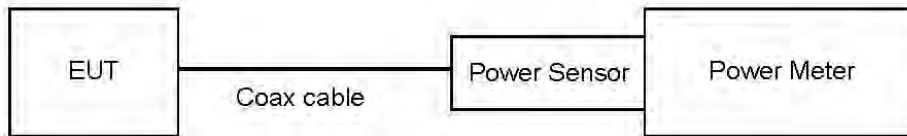
Note : 1. If antenna gains are not equal,

$$\text{Directional gain} = 10 \cdot \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N] \text{ dBi (802.11g/n)}$$

(according to KDB662911 D01 v02r01)

2. Limit is calculated by antenna gain.

■ TEST CONFIGURATION(20 MHz BW)



■ TEST PROCEDURE(20 MHz BW)

- Peak Power (Procedure 9.1.2 in KDB 558074 v04)
 1. Measure the peak power of the transmitter.
- Average Power (Procedure 9.2.3.1 in KDB 558074 v04)
 1. Measure the duty cycle.
 2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
 3. Add $10 \log (1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

Note :

1. We apply to the offset in the 2.4 GHz range that was rounded off to the closest 20 dB.
2. We apply the offset of Ant.0 and Ant.1 respectively.

The offset of the 2.4 GHz band on Ant.0, 1 are 10.7 dB. .

Actual value of loss for the attenuator and cable combination is below table.

ANT	Band	Loss(dB)
0, 1	2.4 GHz	10.7

(Actual value of loss for the attenuator and cable combination)

3. MIMO output power results are calculated by each antenna output power on MIMO operating mode.
So, in case of MIMO output power, we attached only MIMO output power except each antenna power result.

■ Sample Calculation

ANT.0

Output Power = Reading Value + ATT loss + Cable loss(1 ea) + Duty Cycle Factor

Ex) Output Power = 10 dBm + 20 dB + 0.61 dB + 0.2 dB = 31.0 dBm

ANT.1

Output Power = Reading Value + ATT loss + Cable loss(2 ea) + Duty Cycle Factor

Ex) Output Power = 10 dBm + 20 dB + 1.28 dB + 0.2 dB = 31.7 dBm

■ TEST RESULTS-Peak

■ TEST RESULTS-Ant.0

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	1 Mbps	19.05	30
		2 Mbps	19.11	30
		5.5 Mbps	19.08	30
		11 Mbps	19.04	30
2437	6	1 Mbps	19.00	30
		2 Mbps	19.05	30
		5.5 Mbps	19.05	30
		11 Mbps	19.05	30
2462	11	1 Mbps	17.21	30
		2 Mbps	17.40	30
		5.5 Mbps	17.34	30
		11 Mbps	17.36	30

■ TEST RESULTS-Ant.1

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	1 Mbps	16.07	30
		2 Mbps	16.17	30
		5.5 Mbps	16.16	30
		11 Mbps	16.22	30
2437	6	1 Mbps	16.06	30
		2 Mbps	16.04	30
		5.5 Mbps	15.99	30
		11 Mbps	16.03	30
2462	11	1 Mbps	16.28	30
		2 Mbps	16.31	30
		5.5 Mbps	16.30	30
		11 Mbps	16.32	30

■ TEST RESULTS-Ant.0

Conducted Output Power Measurements (802.11g SISO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	19.34	30
		9 Mbps	19.42	30
		12 Mbps	19.38	30
		18 Mbps	19.25	30
		24 Mbps	18.14	30
		36 Mbps	17.83	30
		48 Mbps	21.03	30
		54 Mbps	21.40	30
2437	6	6 Mbps	21.17	30
		9 Mbps	21.23	30
		12 Mbps	21.22	30
		18 Mbps	21.24	30
		24 Mbps	20.26	30
		36 Mbps	20.08	30
		48 Mbps	22.22	30
		54 Mbps	22.56	30
2462	11	6 Mbps	17.53	30
		9 Mbps	17.62	30
		12 Mbps	17.74	30
		18 Mbps	17.62	30
		24 Mbps	16.41	30
		36 Mbps	16.09	30
		48 Mbps	19.80	30
		54 Mbps	20.05	30

■ TEST RESULTS-Ant.1

Conducted Output Power Measurements (802.11g SISO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	19.94	30
		9 Mbps	20.00	30
		12 Mbps	19.95	30
		18 Mbps	19.88	30
		24 Mbps	18.86	30
		36 Mbps	18.52	30
		48 Mbps	21.53	30
		54 Mbps	21.87	30
2437	6	6 Mbps	21.62	30
		9 Mbps	21.58	30
		12 Mbps	21.52	30
		18 Mbps	21.53	30
		24 Mbps	20.80	30
		36 Mbps	20.47	30
		48 Mbps	22.49	30
		54 Mbps	22.73	30
2462	11	6 Mbps	17.85	30
		9 Mbps	17.74	30
		12 Mbps	17.69	30
		18 Mbps	17.66	30
		24 Mbps	16.51	30
		36 Mbps	16.12	30
		48 Mbps	19.91	30
		54 Mbps	20.00	30

■ TEST RESULTS- _Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11g MIMO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	22.66	30
		9 Mbps	22.73	30
		12 Mbps	22.68	30
		18 Mbps	22.58	30
		24 Mbps	21.52	30
		36 Mbps	21.19	30
		48 Mbps	24.29	30
		54 Mbps	24.65	30
2437	6	6 Mbps	24.41	30
		9 Mbps	24.42	30
		12 Mbps	24.38	30
		18 Mbps	24.40	30
		24 Mbps	23.54	30
		36 Mbps	23.29	30
		48 Mbps	25.37	30
		54 Mbps	25.66	30
2462	11	6 Mbps	20.70	30
		9 Mbps	20.69	30
		12 Mbps	20.73	30
		18 Mbps	20.65	30
		24 Mbps	19.47	30
		36 Mbps	19.12	30
		48 Mbps	22.87	30
		54 Mbps	23.04	30

■ TEST RESULTS-Ant.0

Conducted Output Power Measurements (802.11n_HT20 SISO Mode)

802.11n Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	19.09	30
		1	18.92	30
		2	18.95	30
		3	17.67	30
		4	17.40	30
		5	20.72	30
		6	21.35	30
		7	20.46	30
2437	6	0	21.55	30
		1	21.47	30
		2	21.58	30
		3	20.57	30
		4	20.38	30
		5	22.38	30
		6	22.76	30
		7	22.39	30
2462	11	0	17.07	30
		1	17.30	30
		2	17.33	30
		3	15.90	30
		4	15.66	30
		5	18.99	30
		6	20.15	30
		7	19.05	30

■ TEST RESULTS-Ant.1

Conducted Output Power Measurements (802.11n_HT20 SISO Mode)

802.11n Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	19.59	30
		1	19.46	30
		2	19.63	30
		3	18.36	30
		4	17.98	30
		5	21.16	30
		6	21.87	30
		7	21.66	30
2437	6	0	21.86	30
		1	21.78	30
		2	21.96	30
		3	21.08	30
		4	20.84	30
		5	22.82	30
		6	22.86	30
		7	22.68	30
2462	11	0	17.25	30
		1	17.26	30
		2	17.28	30
		3	15.98	30
		4	15.62	30
		5	19.28	30
		6	20.29	30
		7	19.10	30

■ TEST RESULTS- _Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11n_HT20 MIMO Mode)

802.11n Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	22.35	30
		1	22.20	30
		2	22.31	30
		3	21.03	30
		4	20.71	30
		5	23.95	30
		6	24.62	30
		7	24.09	30
2437	6	0	24.72	30
		1	24.64	30
		2	24.78	30
		3	23.84	30
		4	23.62	30
		5	25.61	30
		6	25.82	30
		7	25.55	30
2462	11	0	20.17	30
		1	20.29	30
		2	20.32	30
		3	18.95	30
		4	18.65	30
		5	22.15	30
		6	23.23	30
		7	22.09	30

■ TEST RESULTS-Average

■ TEST RESULTS_Ant.0

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1 Mbps	16.46	0.035	16.49	30
		2 Mbps	16.39	0.064	16.46	30
		5.5 Mbps	16.37	0.181	16.55	30
		11 Mbps	16.12	0.324	16.45	30
2437	6	1 Mbps	16.37	0.035	16.40	30
		2 Mbps	16.33	0.064	16.40	30
		5.5 Mbps	16.33	0.181	16.51	30
		11 Mbps	16.06	0.324	16.38	30
2462	11	1 Mbps	14.55	0.035	14.59	30
		2 Mbps	14.51	0.064	14.57	30
		5.5 Mbps	14.41	0.181	14.59	30
		11 Mbps	14.22	0.324	14.54	30

TEST RESULTS_Ant.1

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1 Mbps	13.41	0.035	13.45	30
		2 Mbps	13.40	0.064	13.46	30
		5.5 Mbps	13.33	0.181	13.51	30
		11 Mbps	13.09	0.324	13.42	30
2437	6	1 Mbps	13.35	0.035	13.38	30
		2 Mbps	13.29	0.064	13.35	30
		5.5 Mbps	13.15	0.181	13.33	30
		11 Mbps	12.99	0.324	13.31	30
2462	11	1 Mbps	13.57	0.035	13.60	30
		2 Mbps	13.57	0.064	13.64	30
		5.5 Mbps	13.48	0.181	13.66	30
		11 Mbps	13.28	0.324	13.60	30

■ TEST RESULTS_Ant.0

Conducted Output Power Measurements (802.11g SISO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6 Mbps	13.78	0.257	14.03	30
		9 Mbps	13.61	0.403	14.01	30
		12 Mbps	12.83	0.431	13.26	30
		18 Mbps	12.71	0.703	13.41	30
		24 Mbps	10.22	0.794	11.01	30
		36 Mbps	8.84	1.285	10.12	30
		48 Mbps	10.14	1.413	11.55	30
		54 Mbps	9.90	2.075	11.97	30
2437	6	6 Mbps	16.13	0.257	16.39	30
		9 Mbps	15.98	0.403	16.38	30
		12 Mbps	15.27	0.431	15.70	30
		18 Mbps	15.19	0.703	15.90	30
		24 Mbps	12.80	0.794	13.59	30
		36 Mbps	11.32	1.285	12.60	30
		48 Mbps	12.60	1.413	14.02	30
		54 Mbps	12.45	2.075	14.52	30
2462	11	6 Mbps	11.76	0.257	12.01	30
		9 Mbps	11.60	0.403	12.00	30
		12 Mbps	10.93	0.431	11.36	30
		18 Mbps	10.86	0.703	11.57	30
		24 Mbps	8.31	0.794	9.10	30
		36 Mbps	6.88	1.285	8.17	30
		48 Mbps	8.24	1.413	9.65	30
		54 Mbps	8.02	2.075	10.09	30

■ TEST RESULTS_Ant.1

Conducted Output Power Measurements (802.11g SISO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6 Mbps	14.46	0.257	14.72	30
		9 Mbps	14.34	0.403	14.74	30
		12 Mbps	13.56	0.431	13.99	30
		18 Mbps	13.49	0.703	14.19	30
		24 Mbps	11.02	0.794	11.81	30
		36 Mbps	9.55	1.285	10.83	30
		48 Mbps	10.87	1.413	12.28	30
		54 Mbps	10.72	2.075	12.80	30
2437	6	6 Mbps	16.76	0.257	17.01	30
		9 Mbps	16.57	0.403	16.98	30
		12 Mbps	15.85	0.431	16.28	30
		18 Mbps	15.73	0.703	16.43	30
		24 Mbps	13.42	0.794	14.22	30
		36 Mbps	12.01	1.285	13.29	30
		48 Mbps	13.26	1.413	14.67	30
		54 Mbps	13.04	2.075	15.12	30
2462	11	6 Mbps	12.08	0.257	12.34	30
		9 Mbps	11.86	0.403	12.26	30
		12 Mbps	11.11	0.431	11.54	30
		18 Mbps	10.99	0.703	11.69	30
		24 Mbps	8.63	0.794	9.43	30
		36 Mbps	7.14	1.285	8.42	30
		48 Mbps	8.47	1.413	9.89	30
		54 Mbps	8.32	2.075	10.39	30

■ TEST RESULTS_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11g MIMO Mode)

802.11g Mode		Rate (Mbps)	Sum Power of Ant.0 & 1 (dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	17.39	30
		9 Mbps	17.39	30
		12 Mbps	16.64	30
		18 Mbps	16.82	30
		24 Mbps	14.43	30
		36 Mbps	13.49	30
		48 Mbps	14.93	30
		54 Mbps	15.41	30
2437	6	6 Mbps	19.72	30
		9 Mbps	19.70	30
		12 Mbps	19.01	30
		18 Mbps	19.18	30
		24 Mbps	16.92	30
		36 Mbps	15.96	30
		48 Mbps	17.36	30
		54 Mbps	17.84	30
2462	11	6 Mbps	15.19	30
		9 Mbps	15.14	30
		12 Mbps	14.46	30
		18 Mbps	14.64	30
		24 Mbps	12.28	30
		36 Mbps	11.31	30
		48 Mbps	12.78	30
		54 Mbps	13.25	30

■ TEST RESULTS_Ant.0

Conducted Output Power Measurements (802.11n_HT20 SISO Mode)

802.11n Mode		MCS Index	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	12.83	0.256	13.08	30
		1	11.86	0.444	12.30	30
		2	11.85	0.637	12.49	30
		3	9.77	0.952	10.72	30
		4	8.26	1.143	9.40	30
		5	9.51	1.441	10.96	30
		6	9.45	1.876	11.33	30
		7	9.25	1.667	10.91	30
2437	6	0	16.26	0.256	16.52	30
		1	15.34	0.444	15.78	30
		2	15.37	0.637	16.01	30
		3	13.29	0.952	14.25	30
		4	11.79	1.143	12.93	30
		5	13.04	1.441	14.48	30
		6	12.94	1.876	14.81	30
		7	12.79	1.667	14.46	30
2462	11	0	10.87	0.256	11.13	30
		1	9.97	0.444	10.41	30
		2	10.00	0.637	10.63	30
		3	7.85	0.952	8.80	30
		4	6.39	1.143	7.54	30
		5	7.70	1.441	9.14	30
		6	7.57	1.876	9.45	30
		7	7.41	1.667	9.08	30

■ TEST RESULTS_Ant.1

Conducted Output Power Measurements (802.11n_HT20 SISO Mode)

802.11n Mode		MCS Index	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	13.67	0.256	13.93	30
		1	12.65	0.444	13.10	30
		2	12.61	0.637	13.24	30
		3	10.57	0.952	11.52	30
		4	9.04	1.143	10.19	30
		5	10.36	1.441	11.80	30
		6	10.28	1.876	12.16	30
		7	10.09	1.667	11.75	30
2437	6	0	16.85	0.256	17.10	30
		1	15.89	0.444	16.34	30
		2	15.91	0.637	16.55	30
		3	13.97	0.952	14.92	30
		4	12.51	1.143	13.65	30
		5	13.71	1.441	15.15	30
		6	13.56	1.876	15.44	30
		7	13.40	1.667	15.06	30
2462	11	0	11.16	0.256	11.42	30
		1	10.17	0.444	10.62	30
		2	10.17	0.637	10.81	30
		3	8.16	0.952	9.11	30
		4	6.66	1.143	7.80	30
		5	7.95	1.441	9.40	30
		6	7.87	1.876	9.75	30
		7	7.69	1.667	9.35	30

■ TEST RESULTS_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11n_HT20 MIMO Mode)

802.11n Mode		MCS Index	Sum Power of Ant.0 & 1 (dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	16.53	30
		1	15.72	30
		2	15.88	30
		3	14.14	30
		4	12.81	30
		5	14.40	30
		6	14.77	30
		7	14.35	30
2437	6	0	19.83	30
		1	19.07	30
		2	19.29	30
		3	17.60	30
		4	16.31	30
		5	17.83	30
		6	18.14	30
		7	17.78	30
2462	11	0	14.29	30
		1	13.53	30
		2	13.73	30
		3	11.97	30
		4	10.68	30
		5	12.28	30
		6	12.61	30
		7	12.23	30

9.5 POWER SPECTRAL DENSITY (802.11b/g/n)

Test Requirements and limit, §15.247(e) / RSS-247(Issue 2) Section 5.2.

The peak power spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

■ Limit

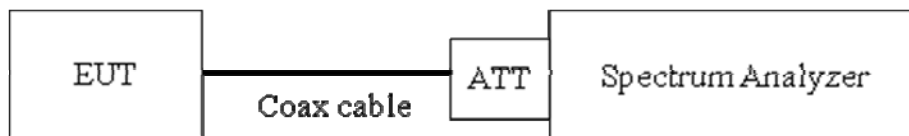
Operating Mode	Band	Mode	Ant. Port	Ant. Gain (dBi)	Limit (dBm)
SISO	2.4 GHz	802.11b/g/n	0	-0.92	8.0
			1	-3.88	8.0
MIMO(2 TX)		802.11g/n	0 & 1	0.74	8.0

Note : 1. If antenna gains are not equal,

$$\text{Directional gain} = 10 \cdot \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N] \text{ dBi (802.11g/n)}$$

(according to KDB662911 D01 v02r01)

2. Limit is calculated by antenna gain.

■ TEST CONFIGURATION**■ TEST PROCEDURE**

We tested according to Procedure 10.2 in KDB 558074 v04

The spectrum analyzer is set to :

Set analyzer center frequency to DTS channel center frequency.

Span = 1.5 times the DTS channel bandwidth.

RBW = 3 kHz ≤ RBW ≤ 100 kHz.

VBW ≥ 3 x RBW.

Sweep = auto couple

Detector = peak

Trace Mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

■ Sample Calculation

PSD = Reading Value + ATT loss + Cable loss(1 ea)

Note :

1. Spectrum reading values are not plot data. The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.

2. Spectrum offset = Attenuator loss + Cable loss

3. We apply the offset of Ant.0 and Ant.1 respectively.

The offset of the 2.4 GHz band on Ant.0, 1 are 10.7 dB. .

Actual value of loss for the attenuator and cable combination is below table.

ANT	Band	Loss(dB)
0, 1	2.4 GHz	10.7

(Actual value of loss for the attenuator and cable combination)

4. MIMO output power results are calculated by each antenna output power on MIMO operating mode.

So, in case of MIMO output power, we attached only MIMO output power except each antenna power result.

■ TEST RESULTS_Ant.0

Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result		
			PSD (dBm)	Limit (dBm)	Pass/Fail
2412	1	802.11b	7.398	8	Pass
2437	6		0.055	8	Pass
2462	11		5.781	8	Pass
2412	1	802.11g (SISO)	-15.596	8	Pass
2437	6		-11.409	8	Pass
2462	11		-16.642	8	Pass
2412	1	802.11n HT20 (SISO)	-14.124	8	Pass
2437	6		-10.309	8	Pass
2462	11		-16.309	8	Pass

■ TEST RESULTS_Ant.1

Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result		
			PSD (dBm)	Limit (dBm)	Pass/Fail
2412	1	802.11b	0.921	8	Pass
2437	6		-10.629	8	Pass
2462	11		-0.200	8	Pass
2412	1	802.11g (SISO)	-14.257	8	Pass
2437	6		-11.244	8	Pass
2462	11		-16.433	8	Pass
2412	1	802.11n HT20 (SISO)	-12.991	8	Pass
2437	6		-11.016	8	Pass
2462	11		-15.589	8	Pass

■ TEST RESULTS_Sum Data of Ant.0 and Ant.1

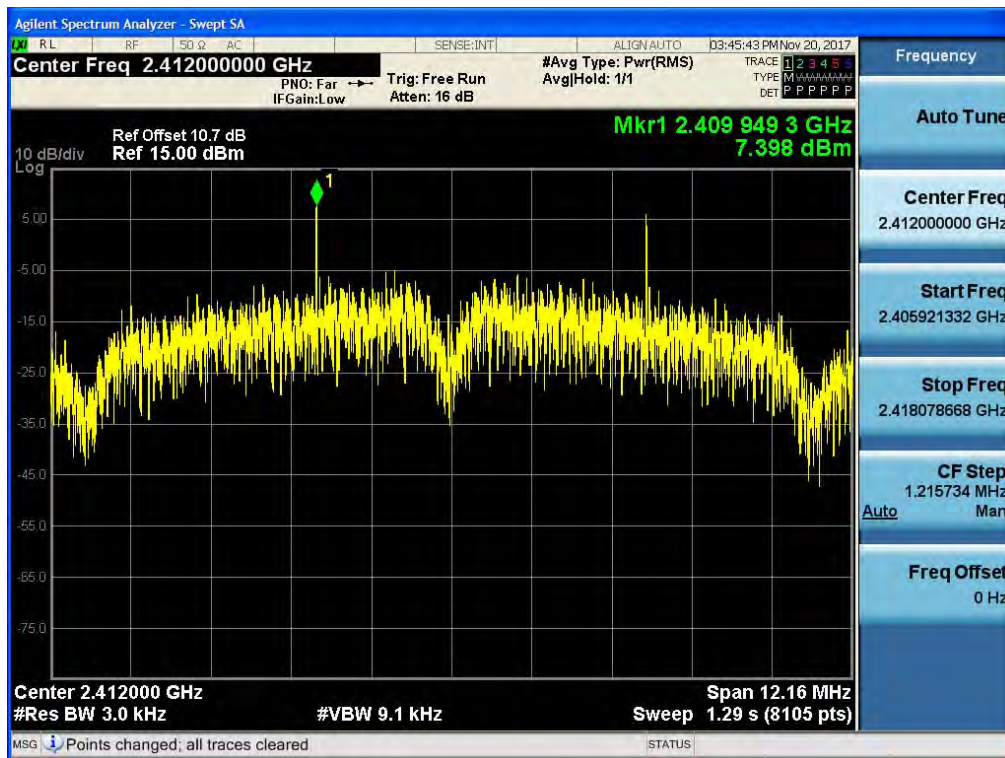
Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result		
			PSD (dBm)	Limit (dBm)	Pass/Fail
2412	1	802.11g (MIMO)	-11.89	8	Pass
2437	6		-8.32		Pass
2462	11		-13.53		Pass
2412	1	802.11n HT20 (MIMO)	-10.53	8	Pass
2437	6		-7.65		Pass
2462	11		-12.93		Pass

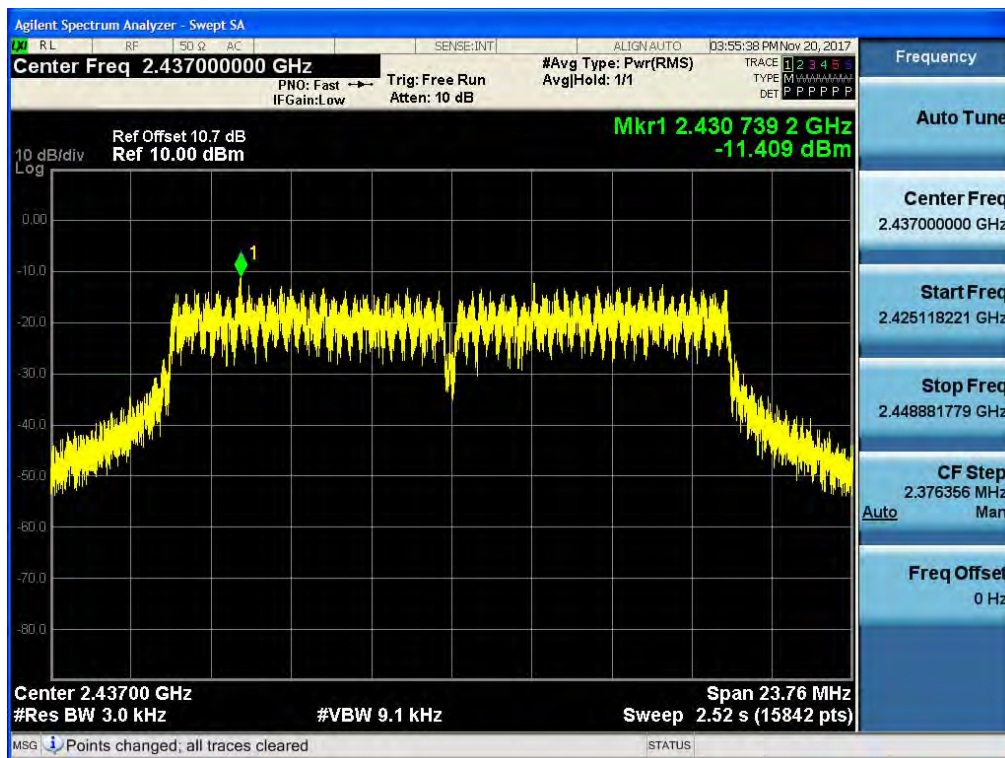
Note : In order to simplify the report, attached plots were only the highest PSD channel.

■ RESULT PLOTS_Ant.0

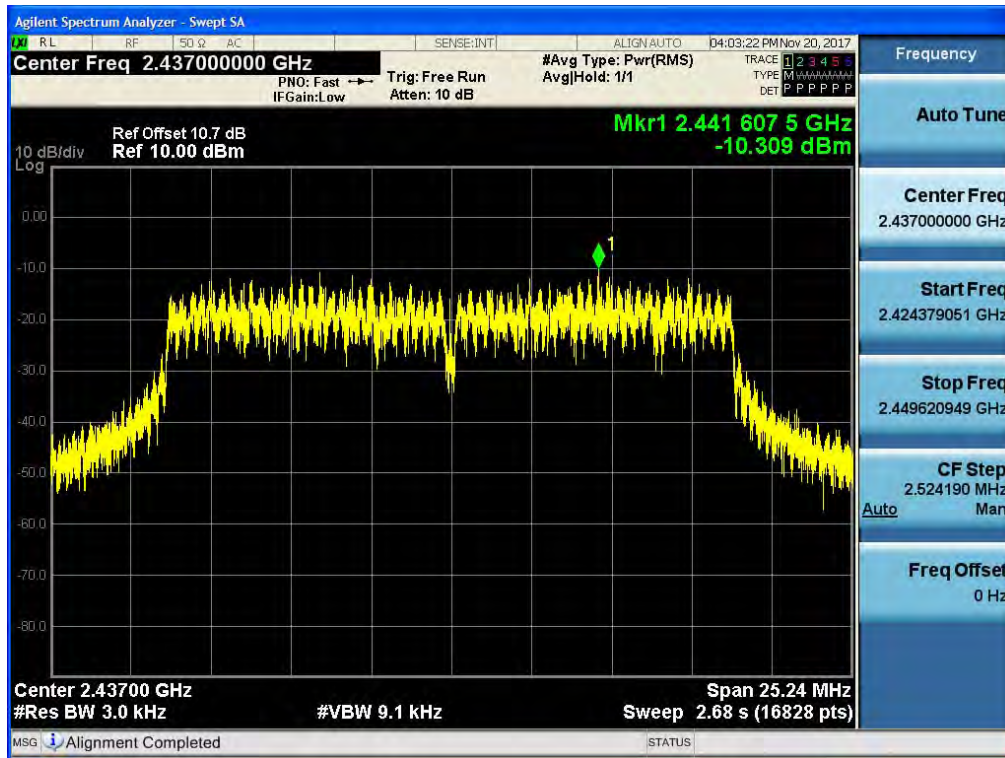
Power Spectral Density (802.11b-CH 1)



Power Spectral Density (802.11g-CH 6)

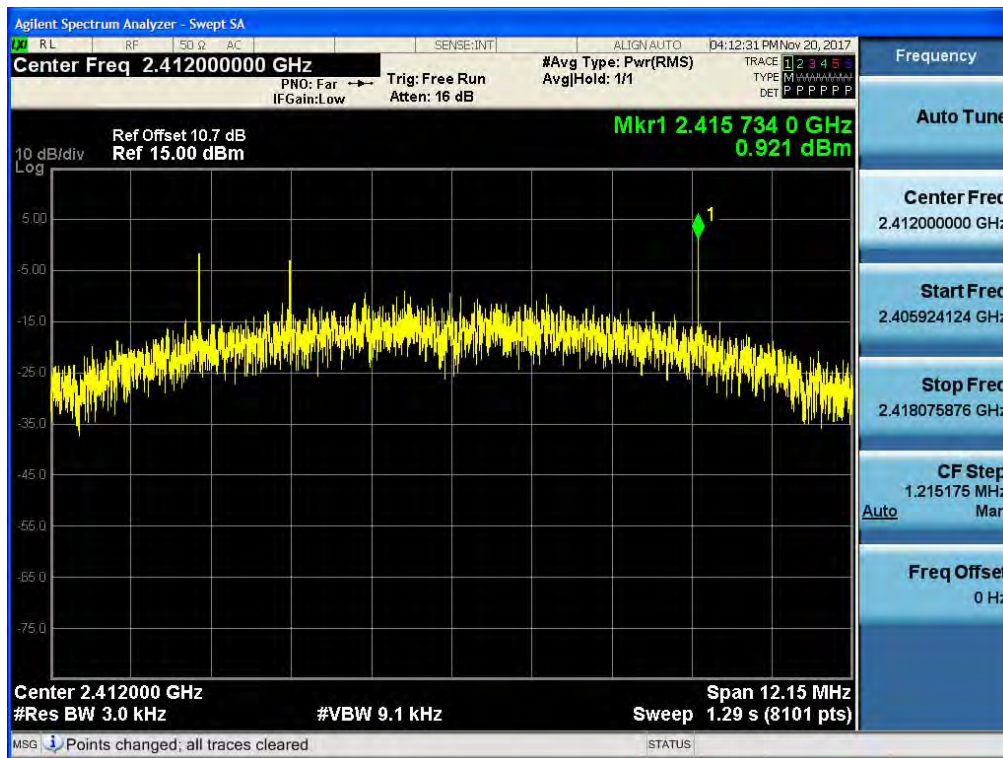


Power Spectral Density (802.11n_HT20 -CH 6)

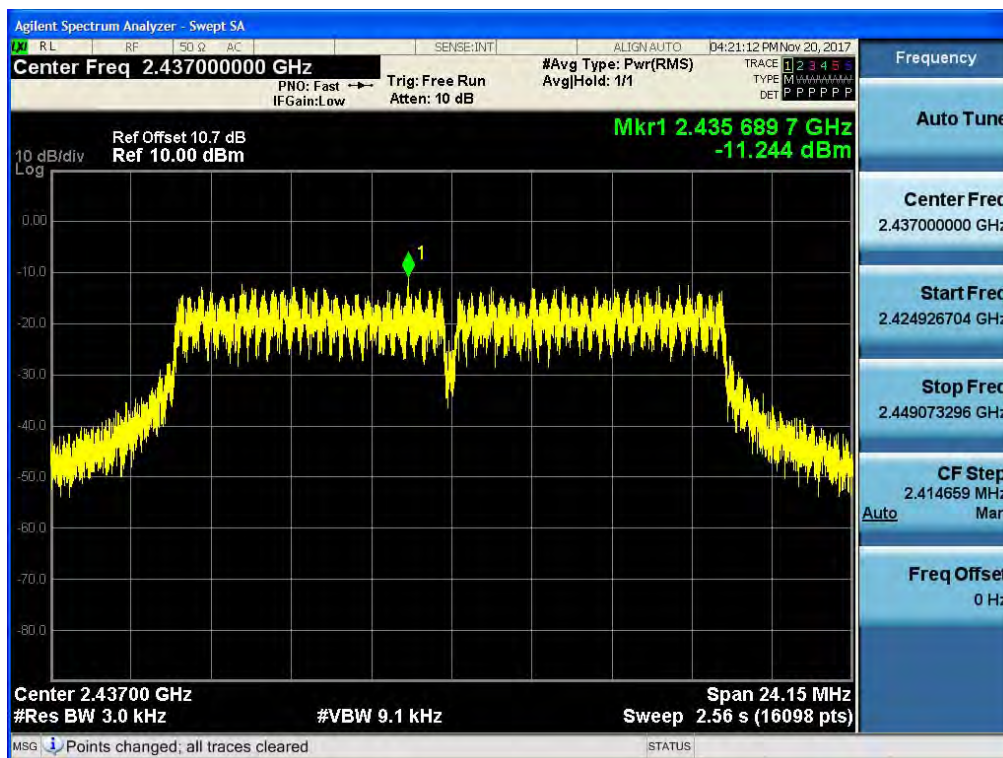


■ RESULT PLOTS_Ant.1

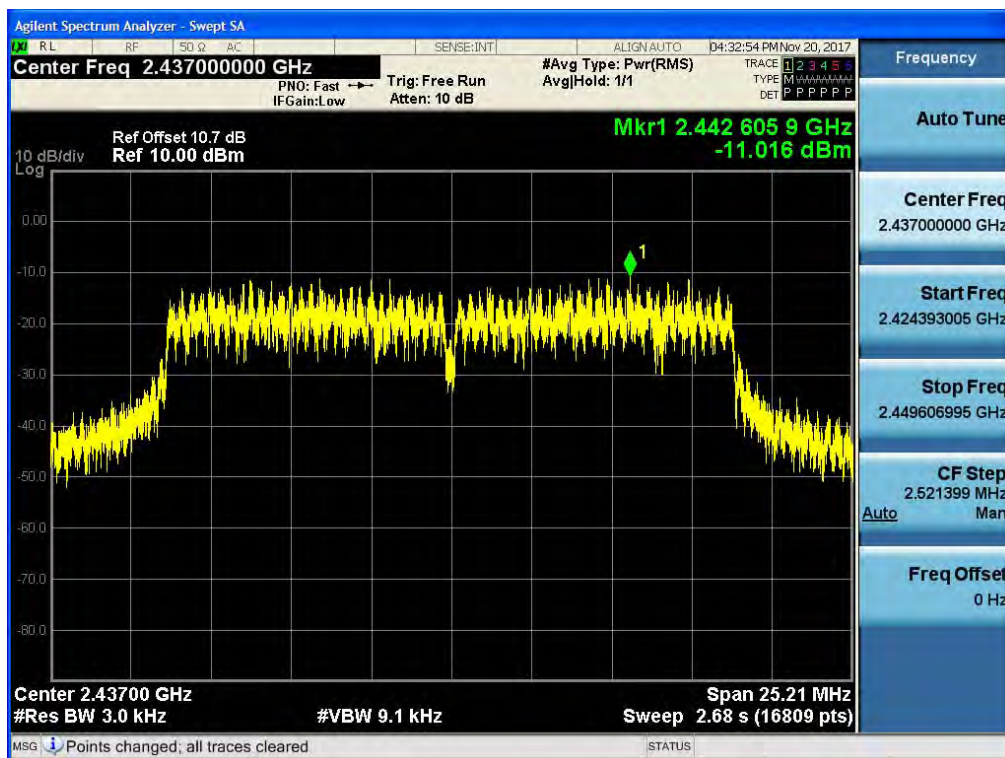
Power Spectral Density (802.11b-CH 1)



Power Spectral Density (802.11g-CH 6)

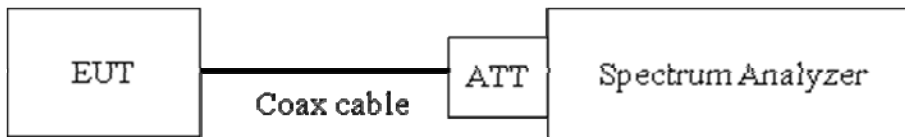


Power Spectral Density (802.11n_HT20 -CH 6)



9.6 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS**Test Requirements and limit, §15.247(d) / RSS-247(Issue 2) Section 5.5.**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) / RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit : 20 dBc**■ TEST CONFIGURATION****■ TEST PROCEDURE**

The transmitter output is connected to the spectrum analyzer. (Procedure 11.0 in KDB 558074 v04)

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Set span to encompass the spectrum to be examined

Detector = Peak

Trace Mode = max hold

Sweep time = auto couple

Ensure that the number of measurement points $\geq$ Span/RBW

Allow trace to fully stabilize.

Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 10th harmonic range with the transmitter set to the lowest, middle, and highest channels.

Note :

1. The band edge results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply the offset of Ant.0 and Ant.1 respectively.

The offset of the 2.4 GHz band on Ant.0, 1 are 10.7 dB. .

Actual value of loss for the attenuator and cable combination is below table.

ANT	Band	Loss(dB)
0, 1	2.4 GHz	10.7

(Actual value of loss for the attenuator and cable combination)

4. In case of conducted spurious emissions test(not band edge), please check factors blow table.

5. In order to simplify the report, attached plots were only the worst case. (where, worst case is SISO mode and highest power channel)

■ FACTORS FOR FREQUENCY

ANT 0	
Freq(MHz)	Factor(dB)
30	10.56
100	10.57
200	10.58
300	10.58
400	10.58
500	10.58
600	10.59
700	10.59
800	10.59
900	10.59
1000	10.59
2000	10.61
2400*	10.70
2500*	10.62
3000	10.65
4000	10.63
5000	10.65
6000	10.62
7000	10.62
8000	10.62
9000	10.63
10000	10.64
11000	10.50

12000	10.51
13000	10.38
14000	10.51
15000	10.61
16000	10.66
17000	10.71
18000	10.72
19000	10.76
20000	10.72
21000	10.70
22000	10.74
23000	10.59
24000	10.66
25000	10.27

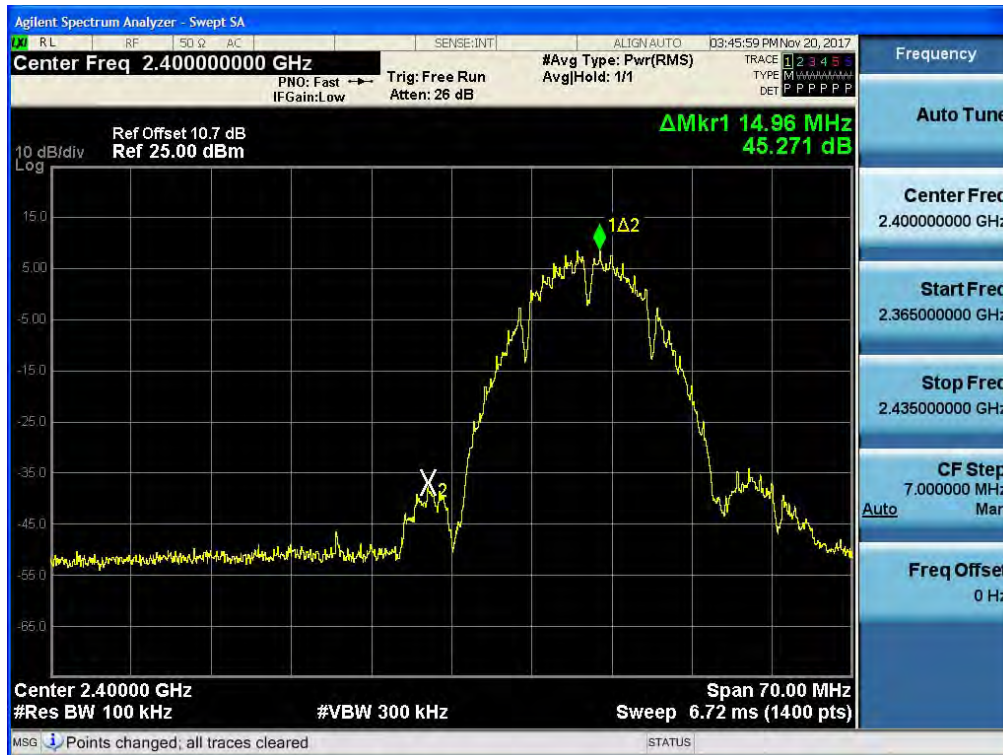
Note : 1. ** is fundamental frequency range.

2. Factor

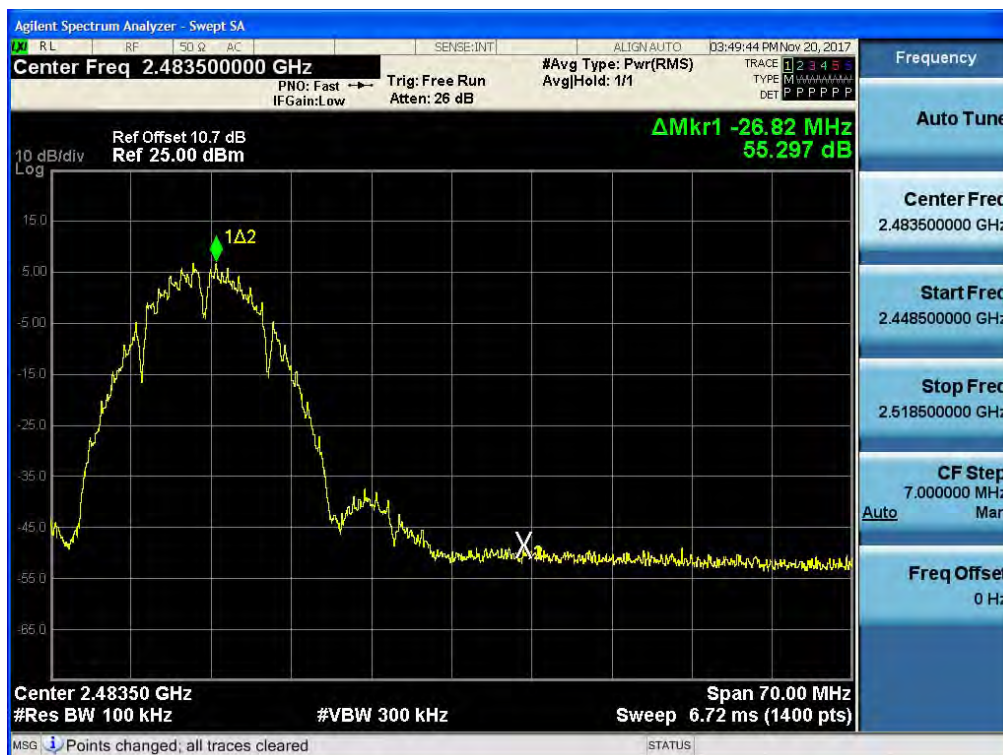
ANT.0 and ANT.1 = ATT loss + Cable loss(1 ea)

■ RESULT PLOTS_Ant.0

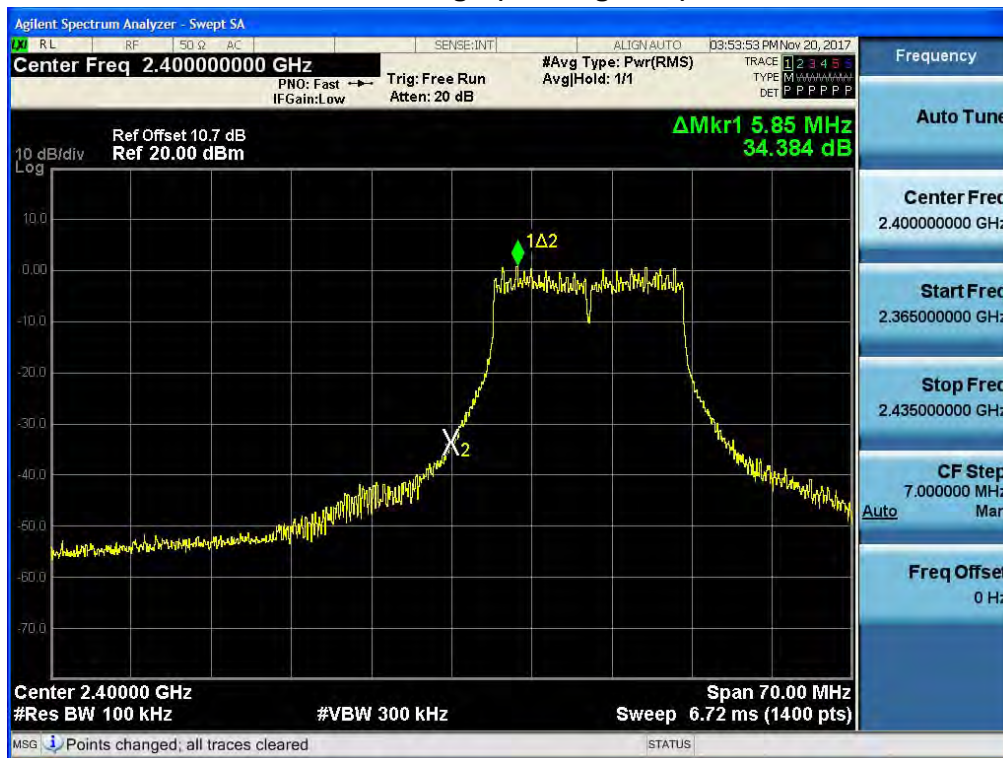
Band Edge (802.11b-CH1)



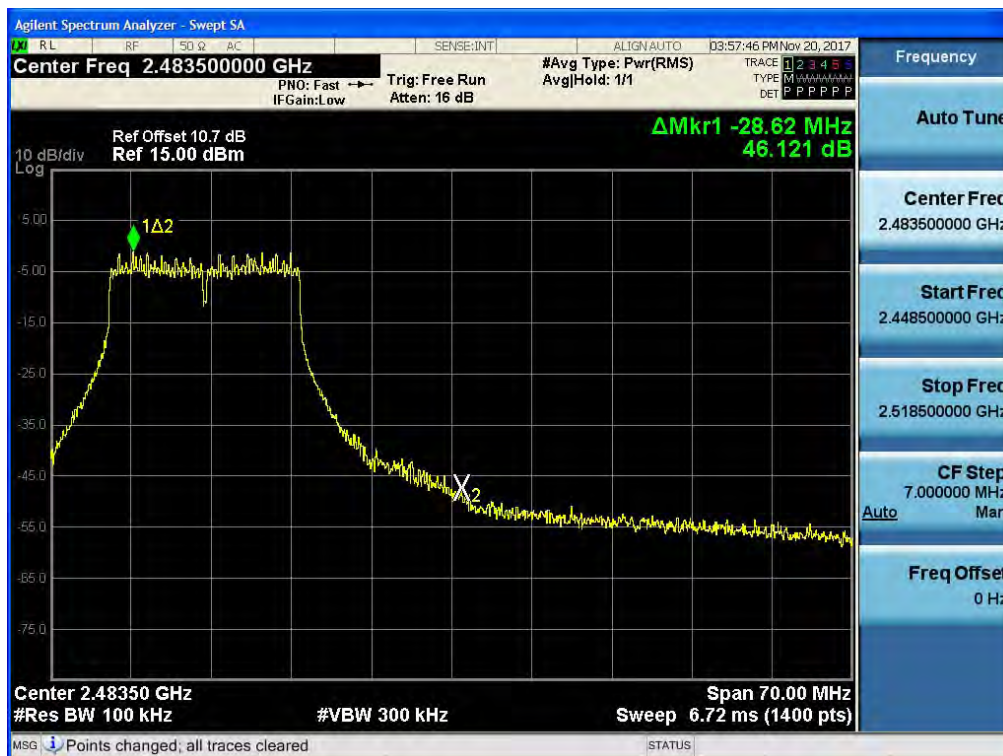
Band Edge (802.11b-CH11)



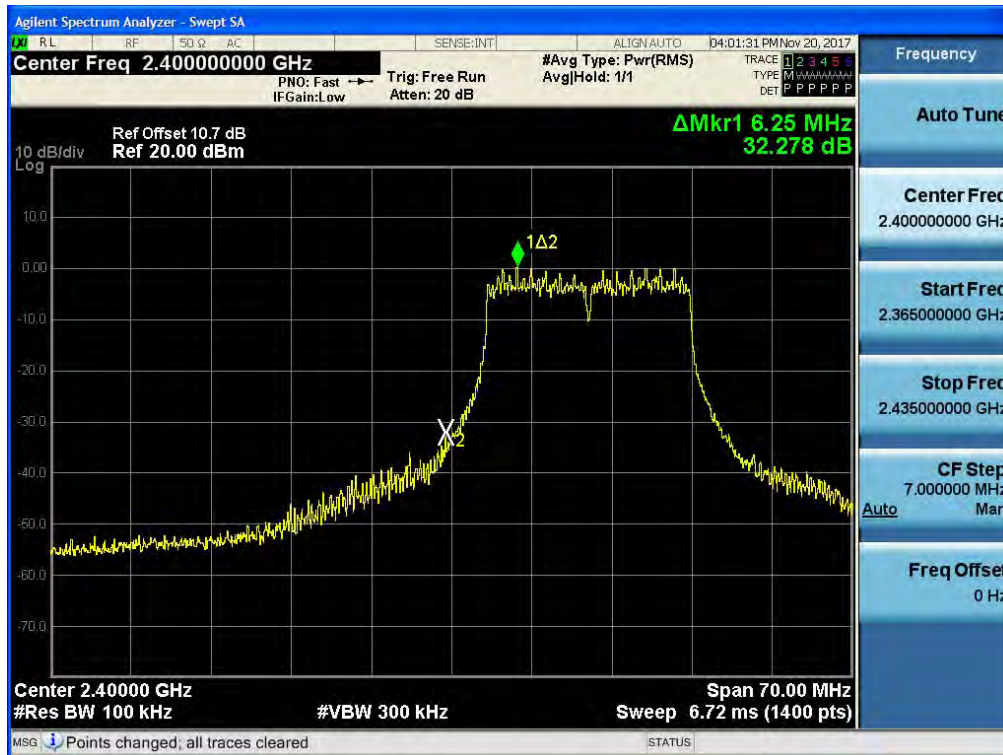
Band Edge (802.11g-CH1)



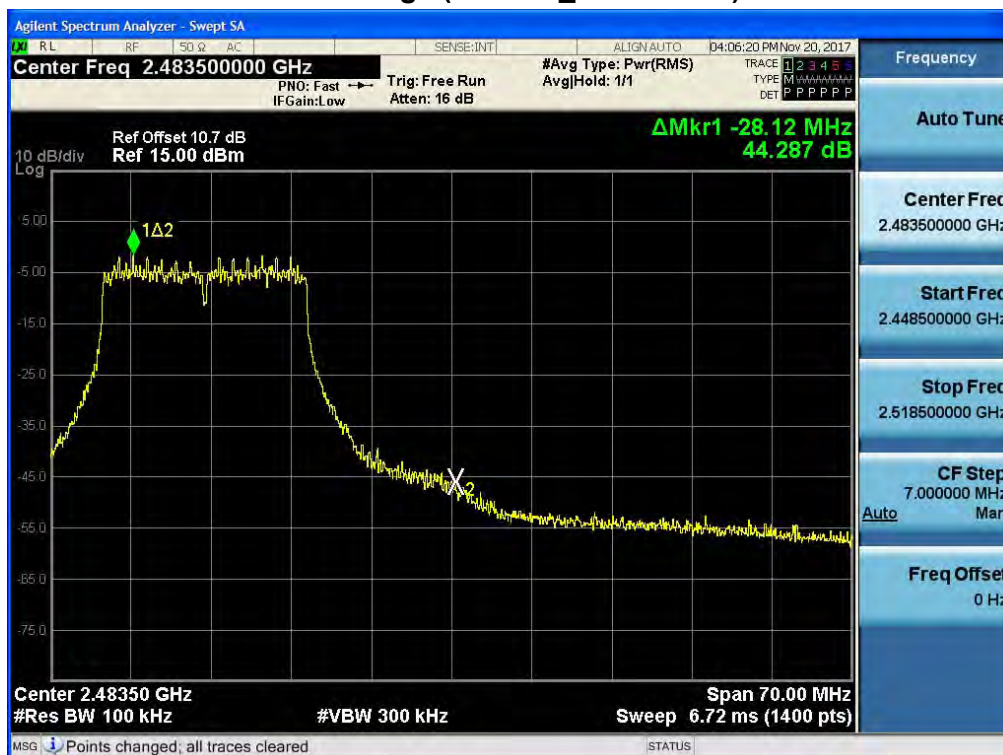
Band Edge (802.11g-CH11)



Band Edge (802.11n_HT20-CH1)

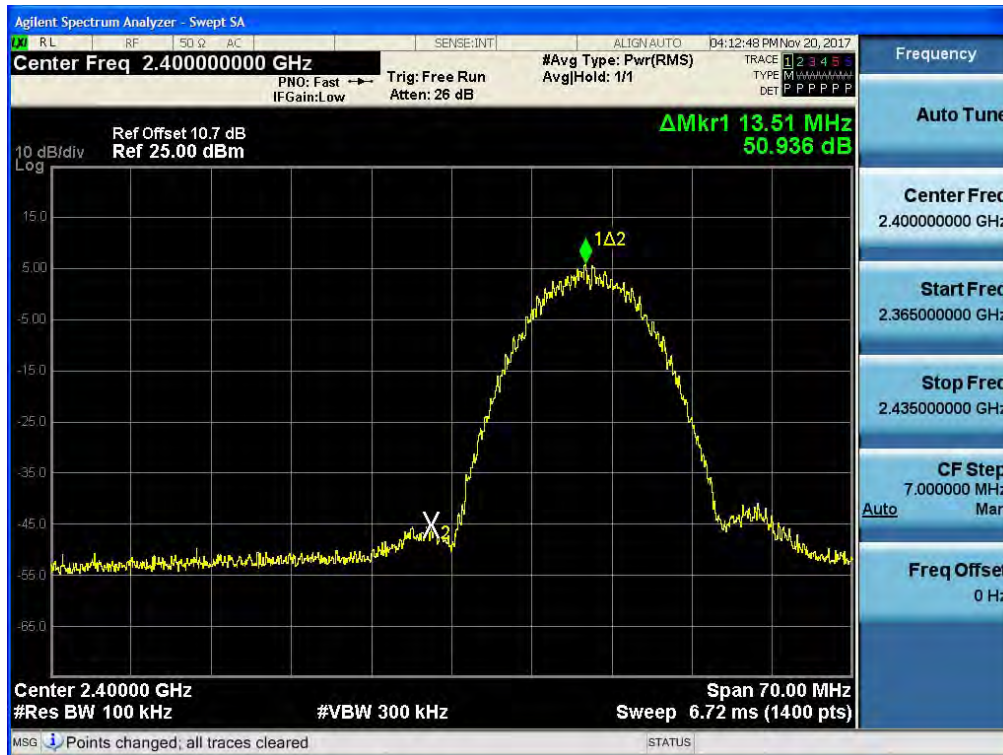


Band Edge (802.11n_HT20-CH11)

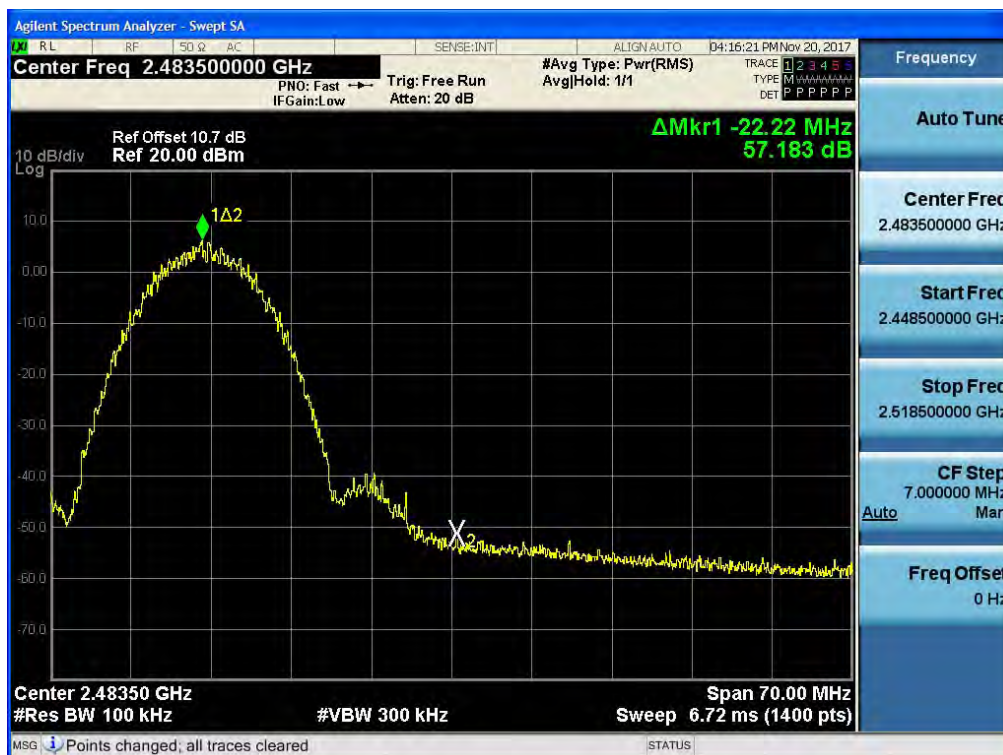


■ RESULT PLOTS_Ant.1

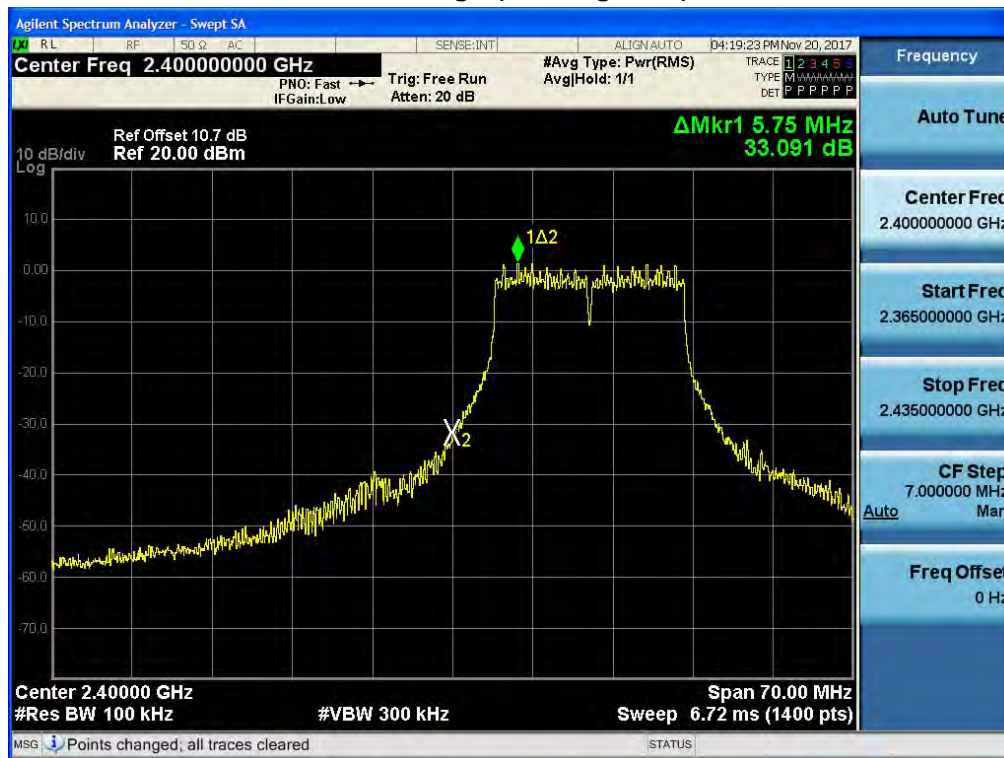
Band Edge (802.11b-CH1)



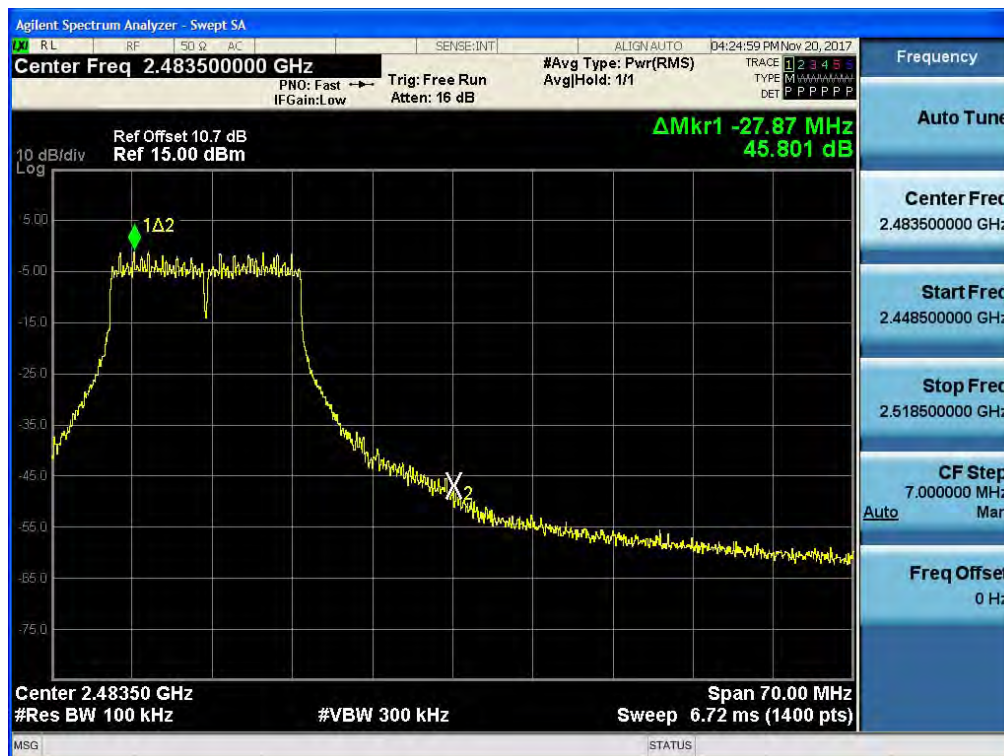
Band Edge (802.11b-CH11)



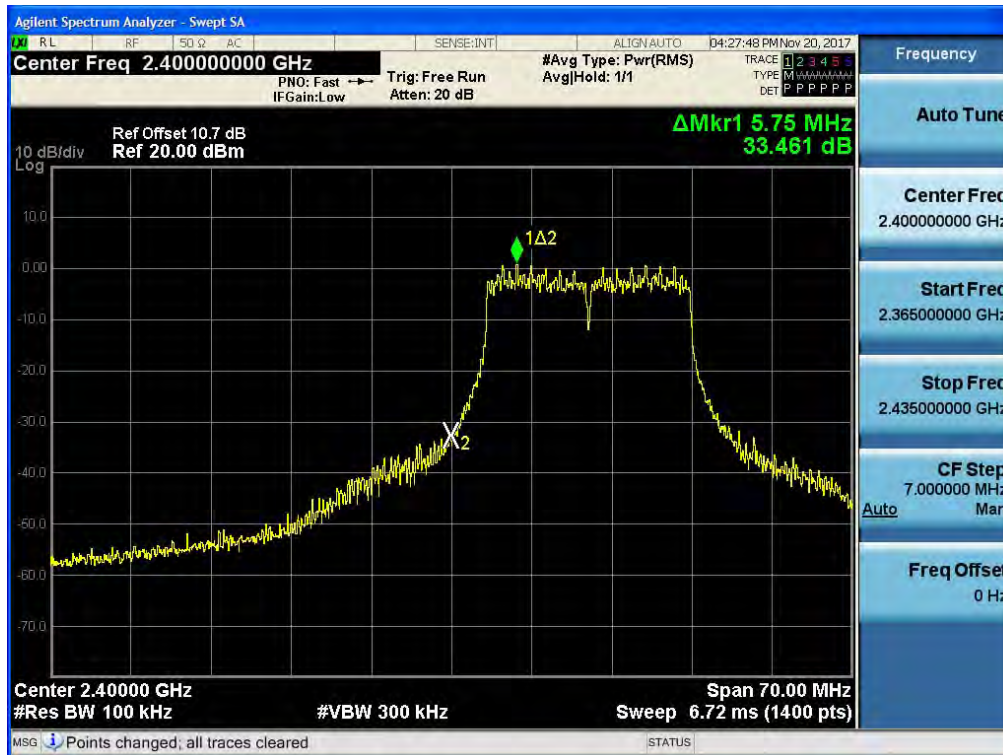
Band Edge (802.11g-CH1)



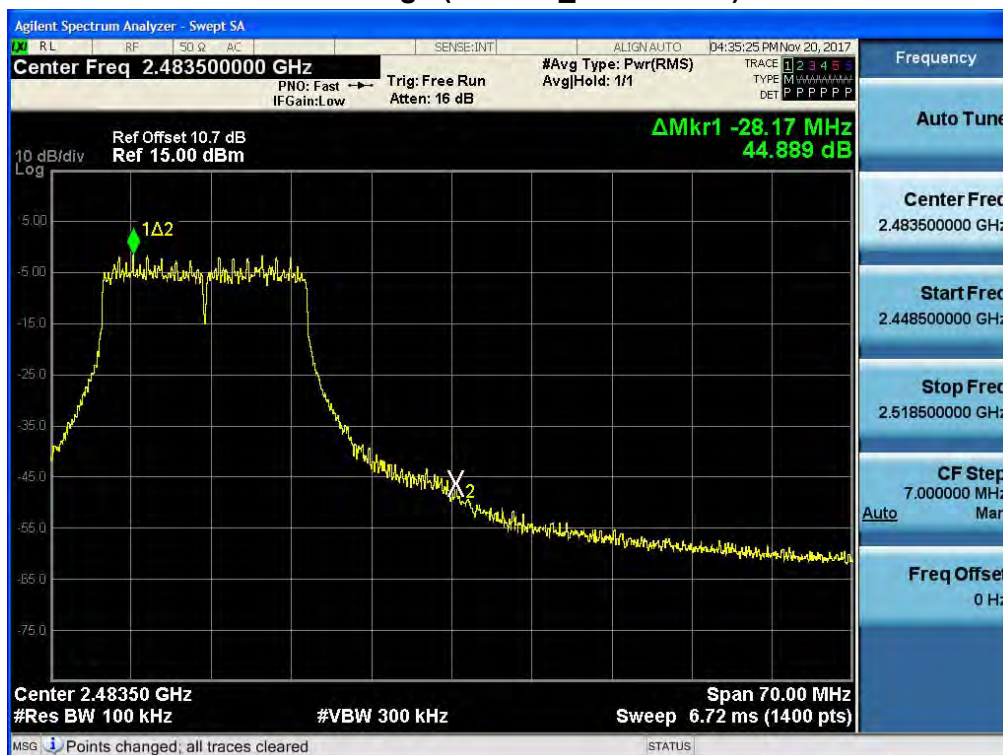
Band Edge (802.11g-CH11)



Band Edge (802.11n_HT20-CH1)



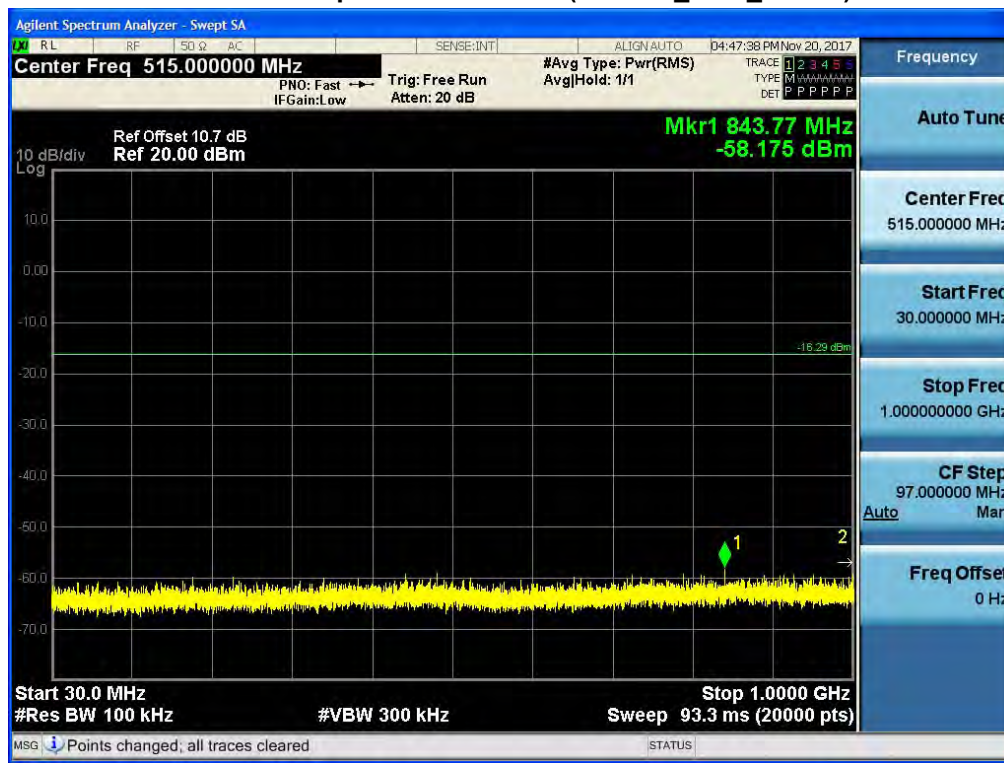
Band Edge (802.11n_HT20-CH11)



[Ant.0]

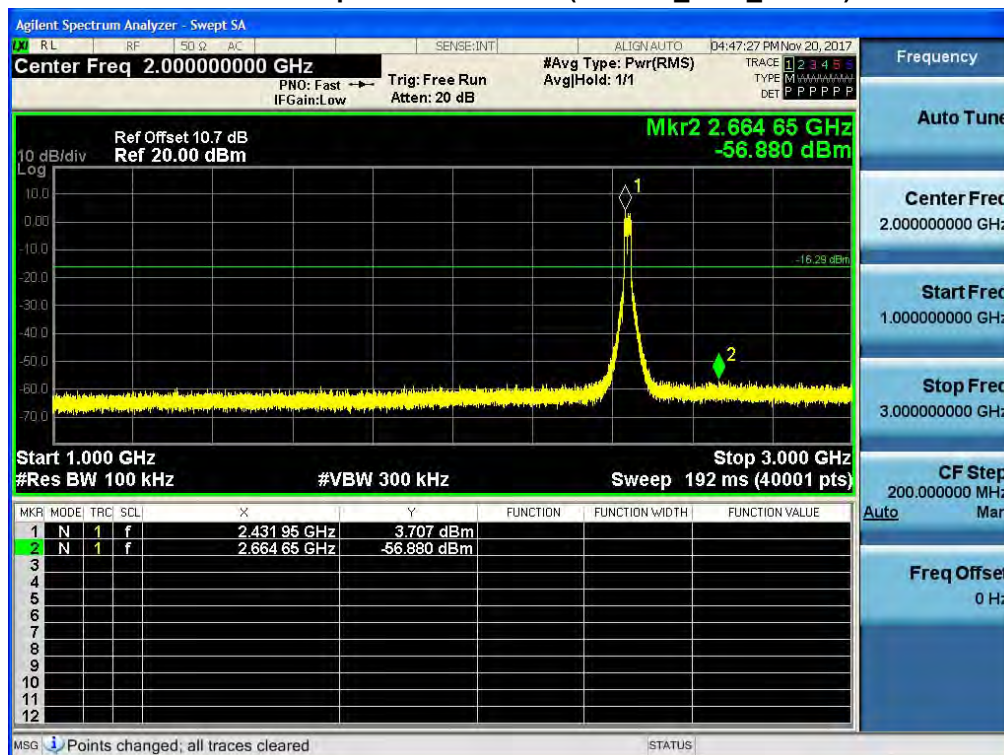
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



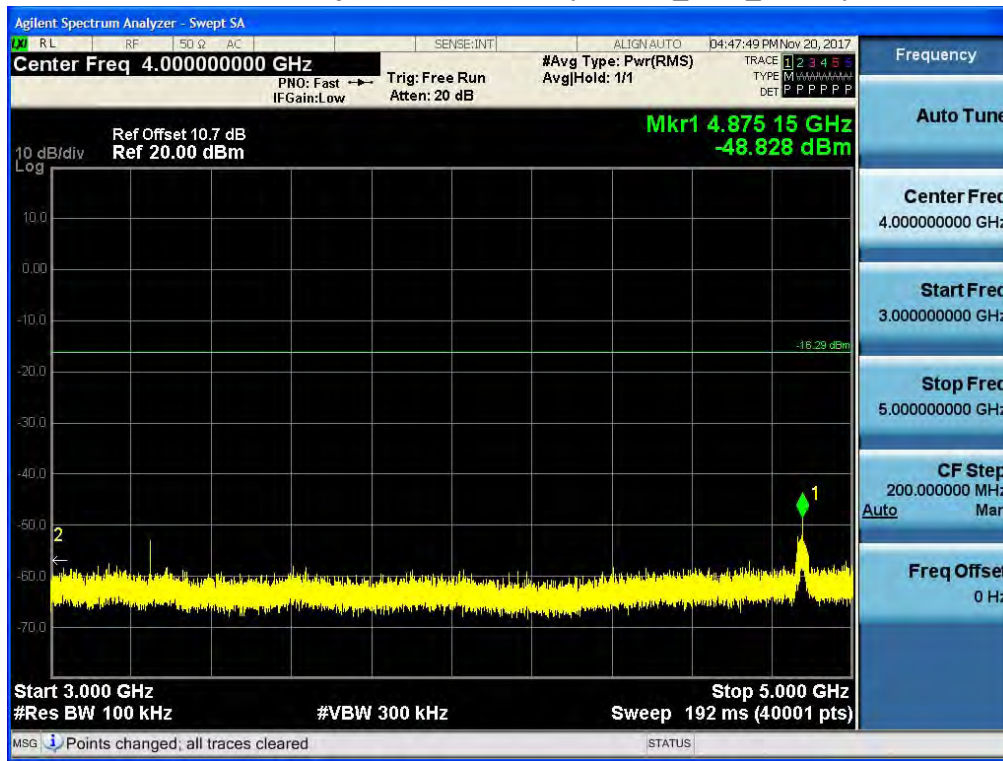
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



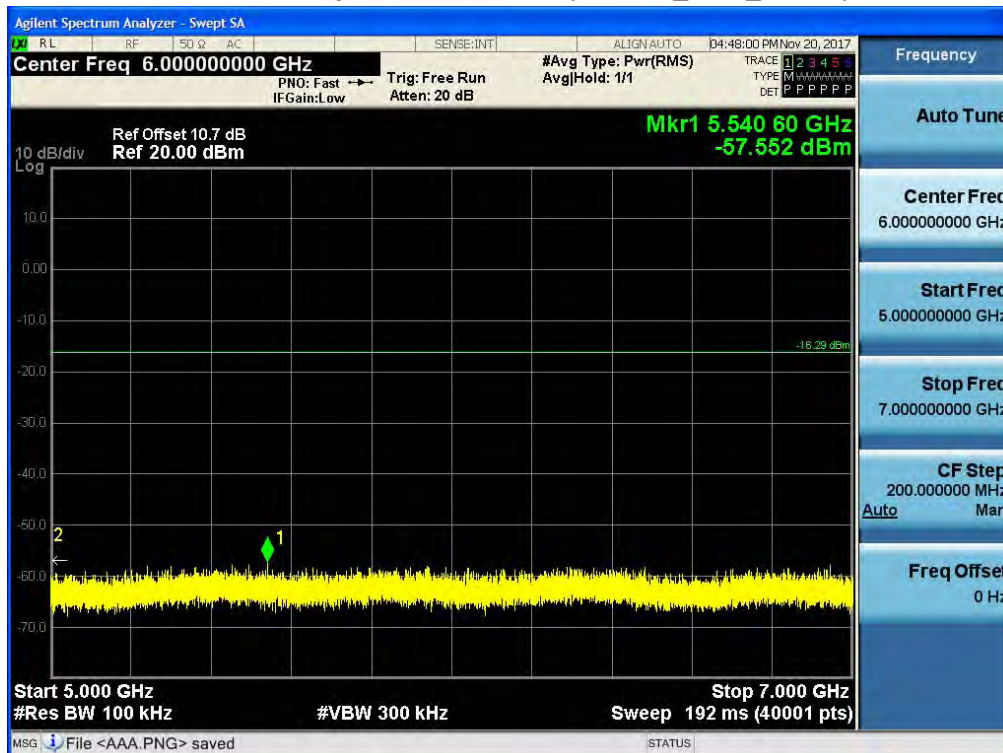
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



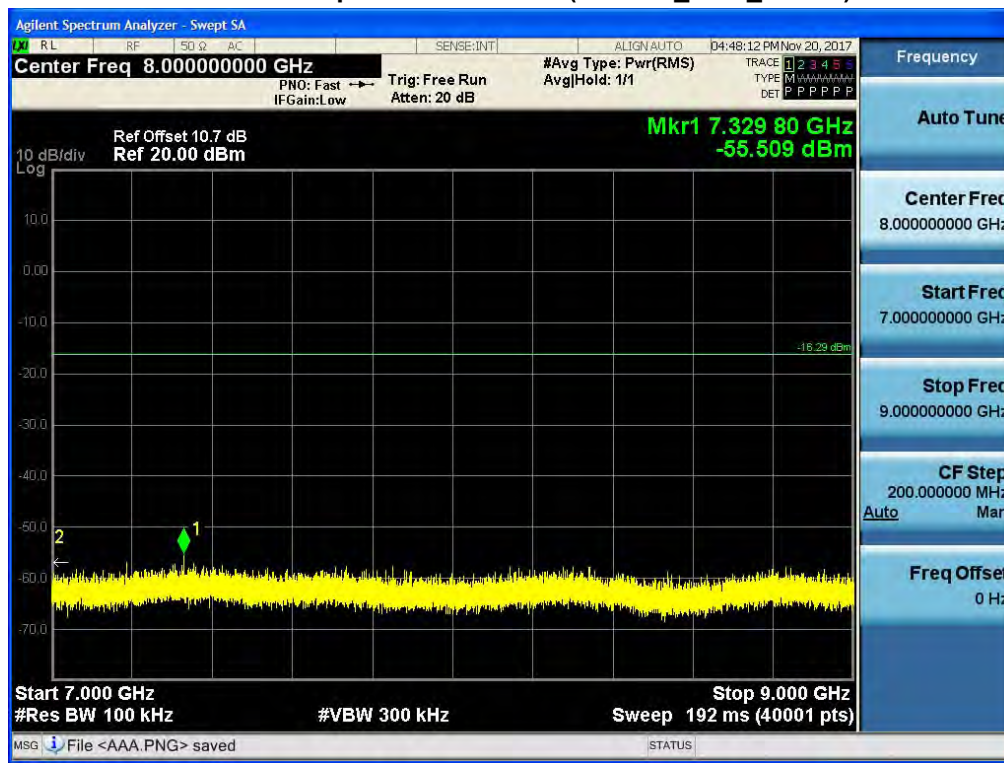
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



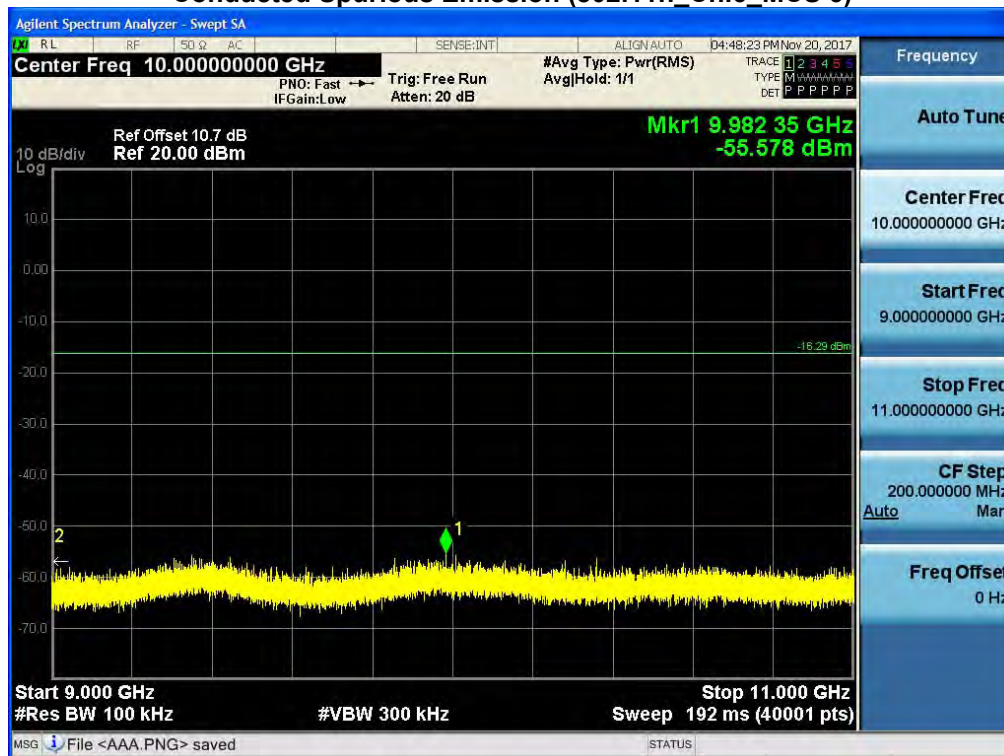
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



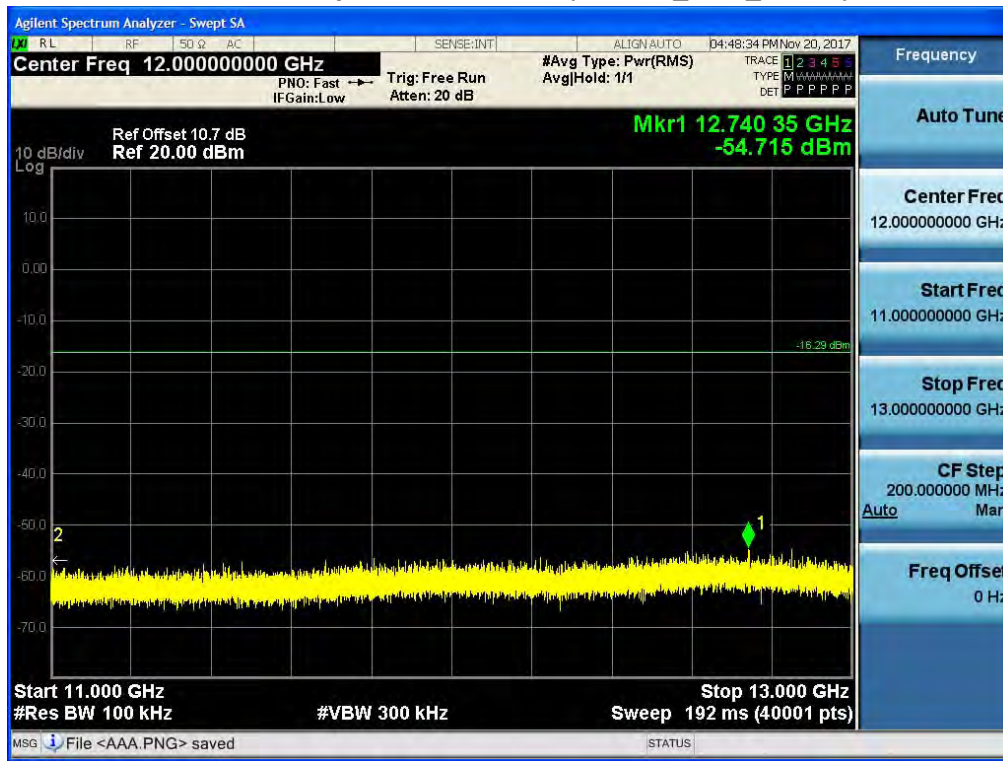
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



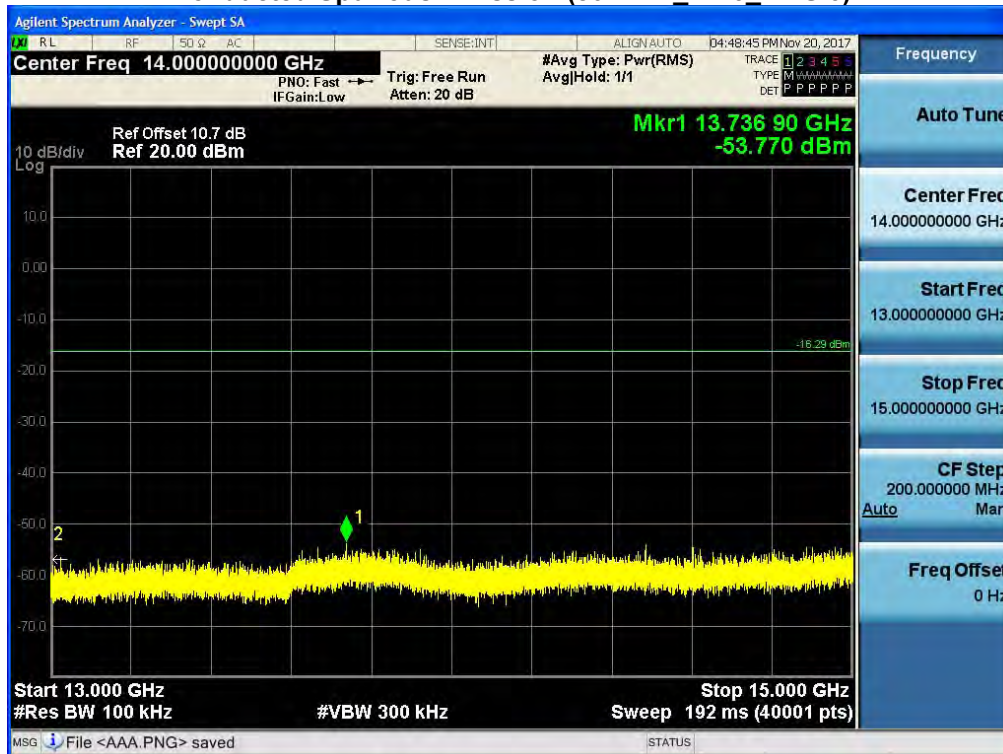
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



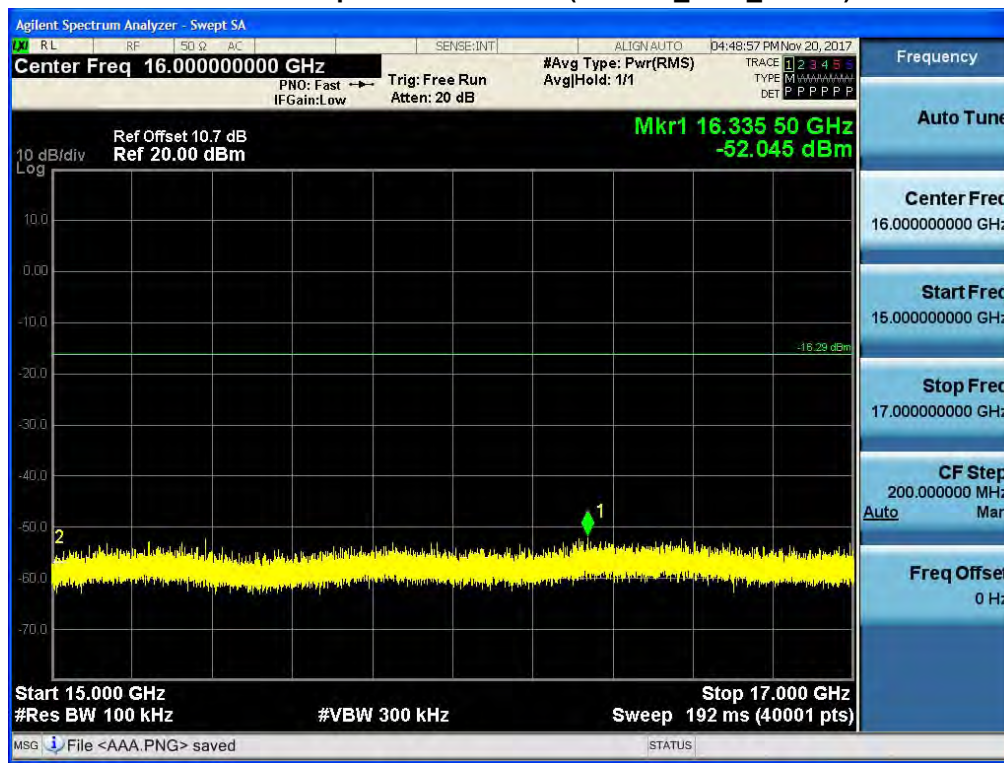
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



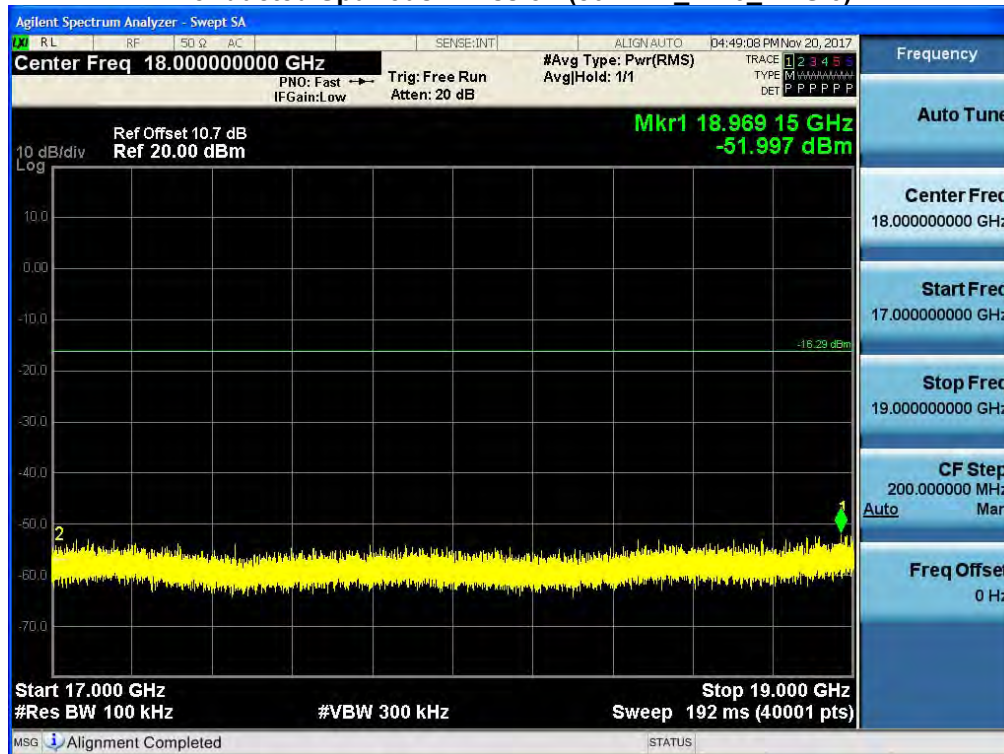
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



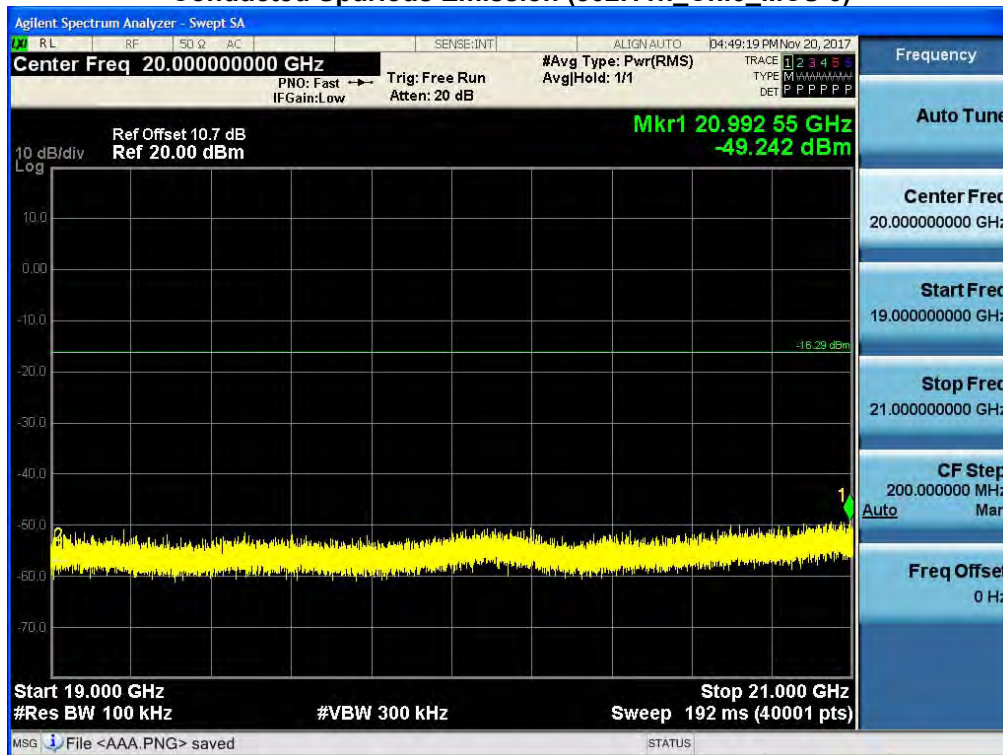
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



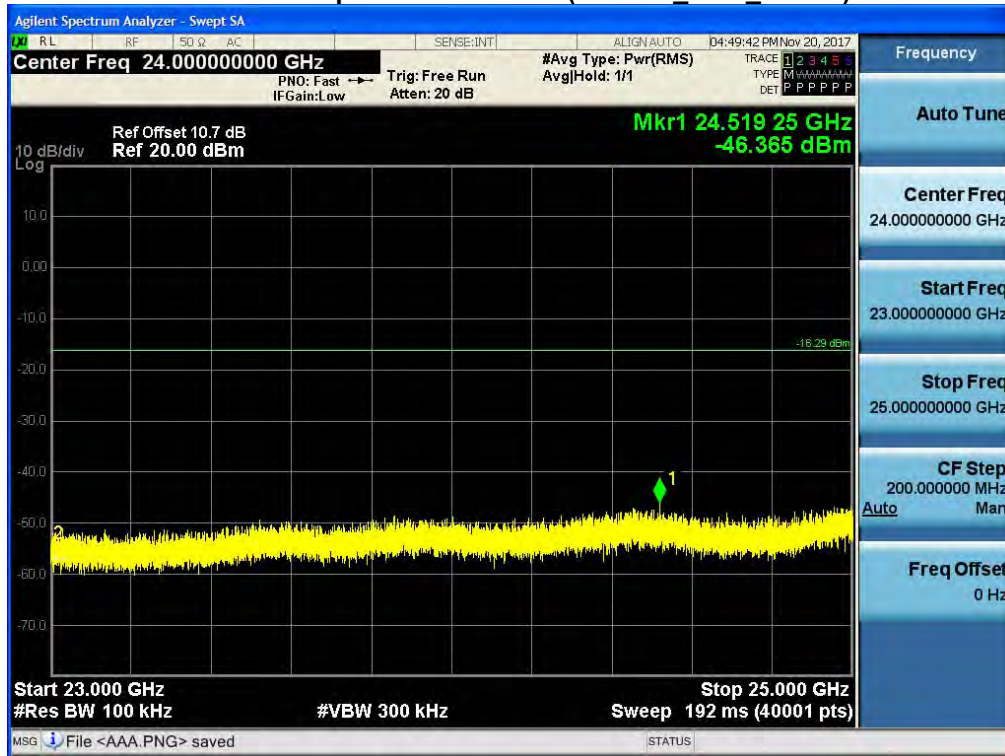
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



23 GHz ~ 25 GHz

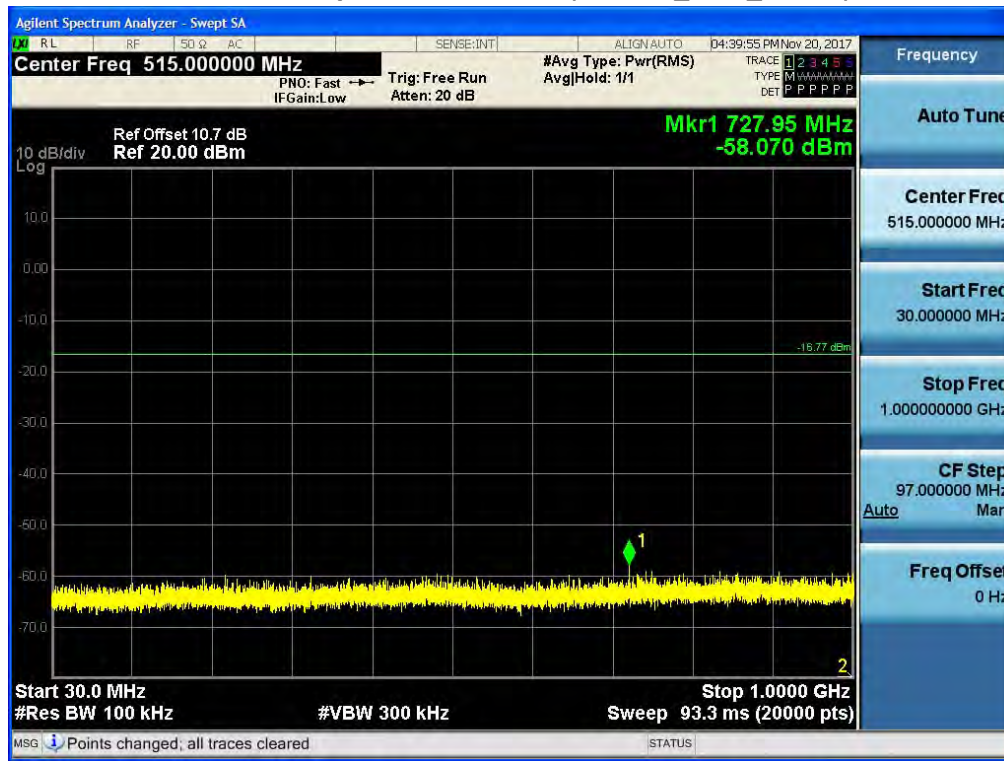
Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



[Ant.1]

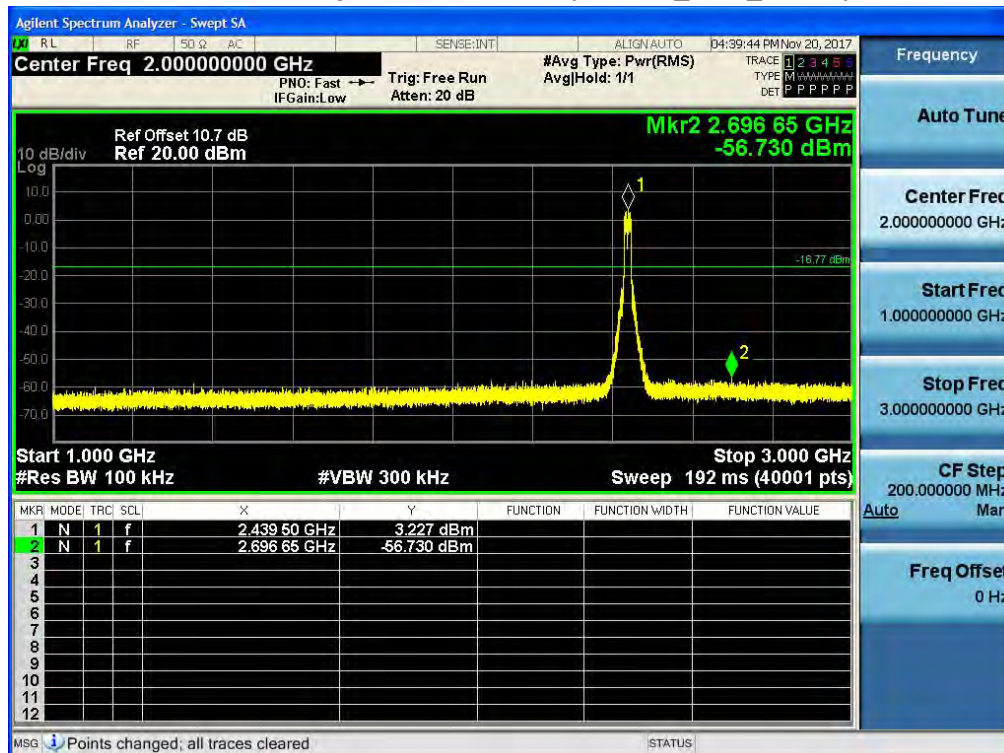
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



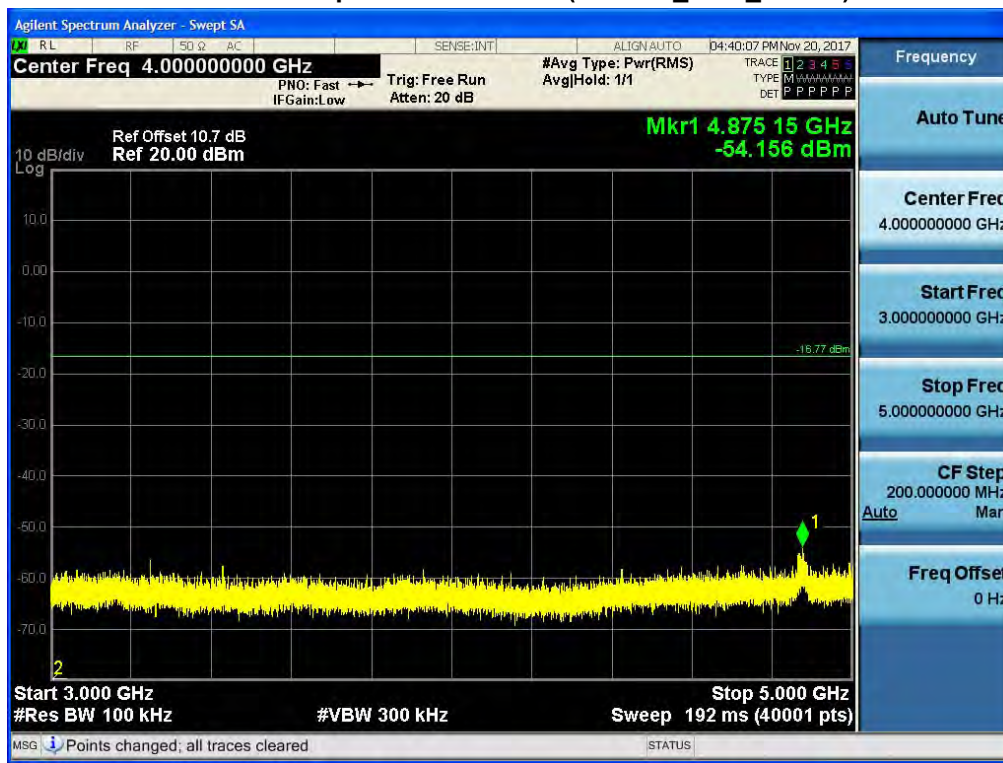
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



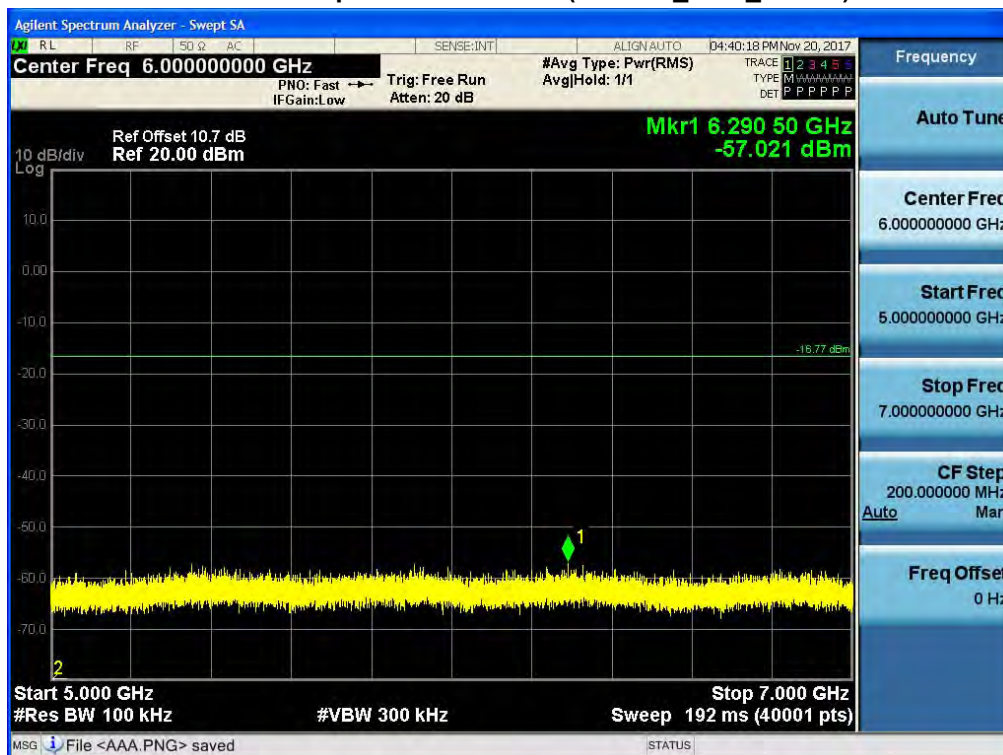
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



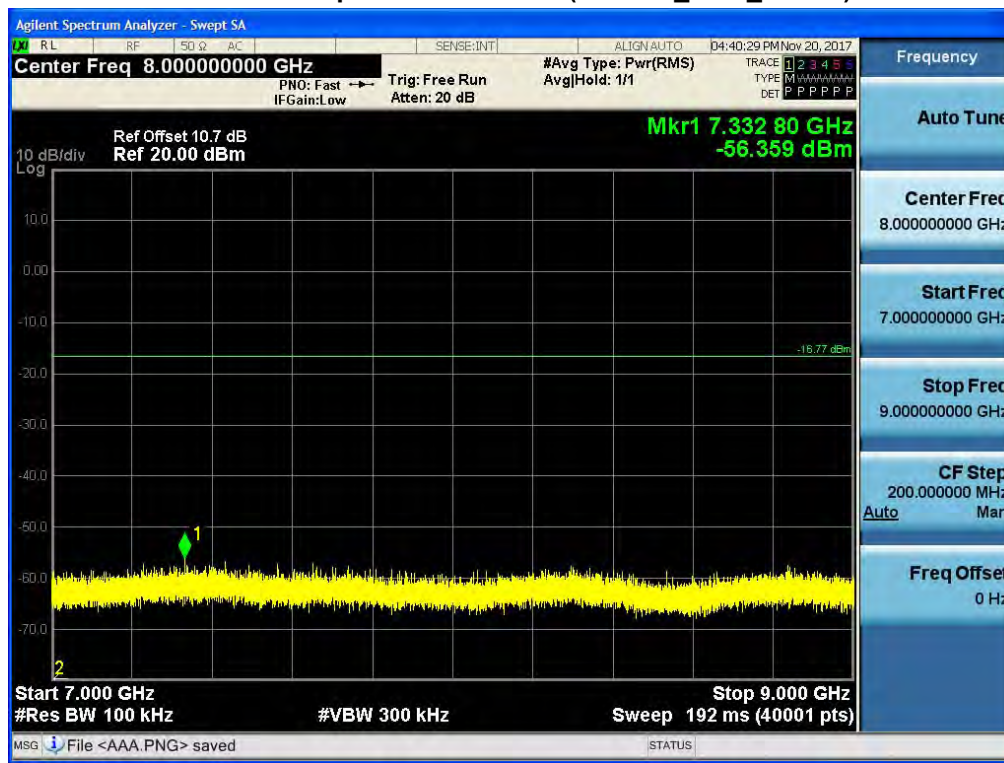
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



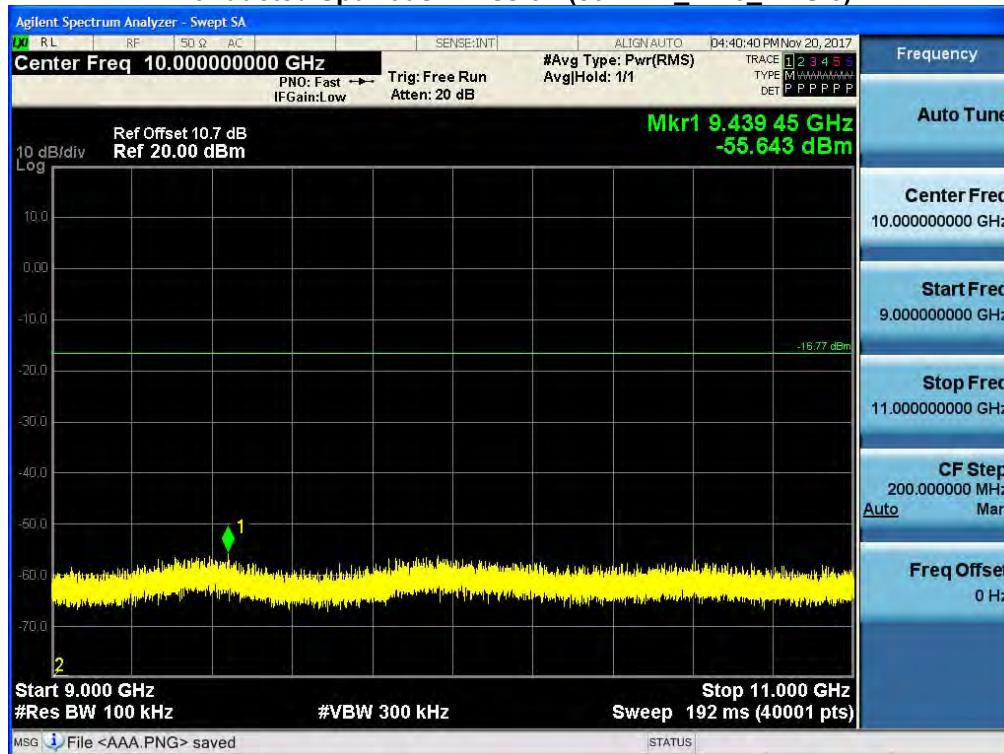
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



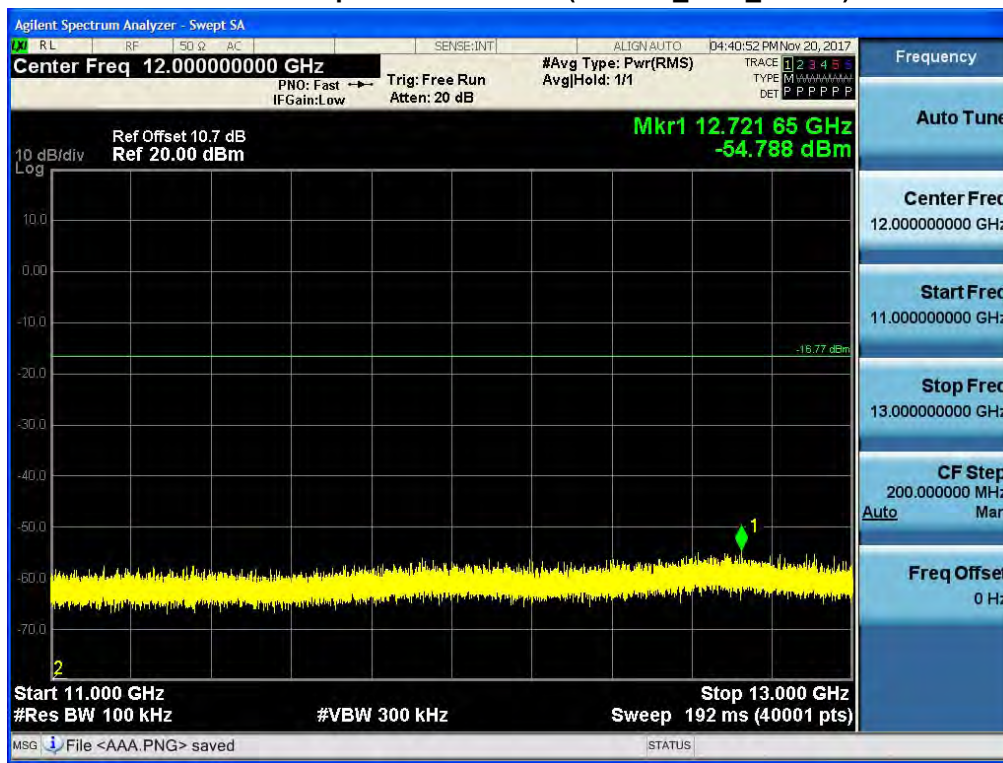
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



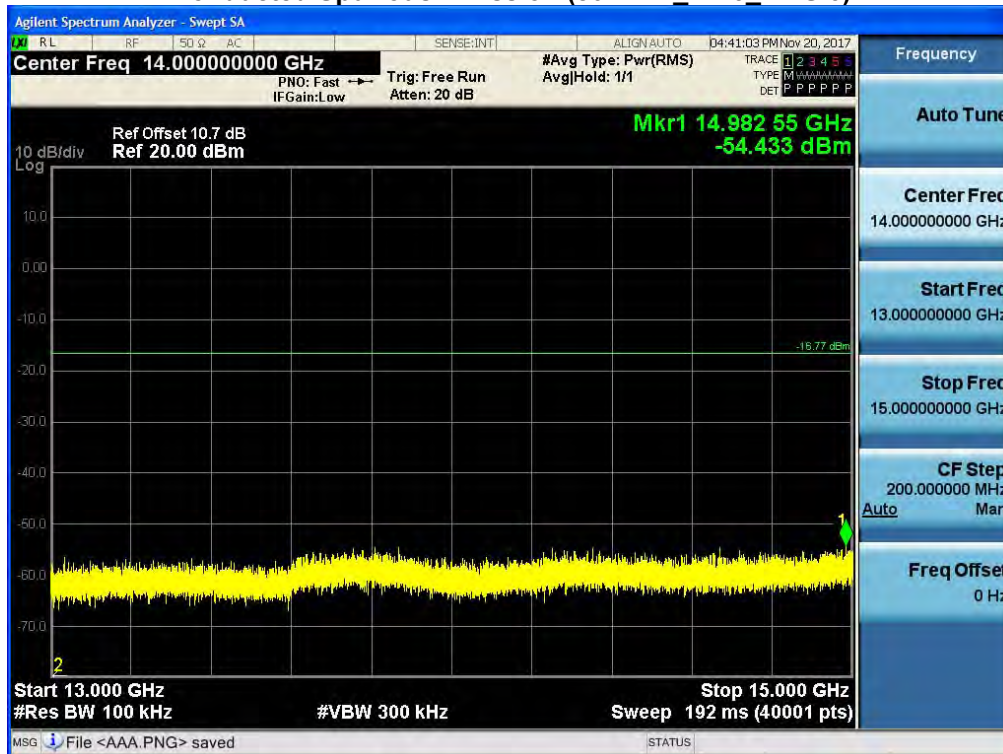
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



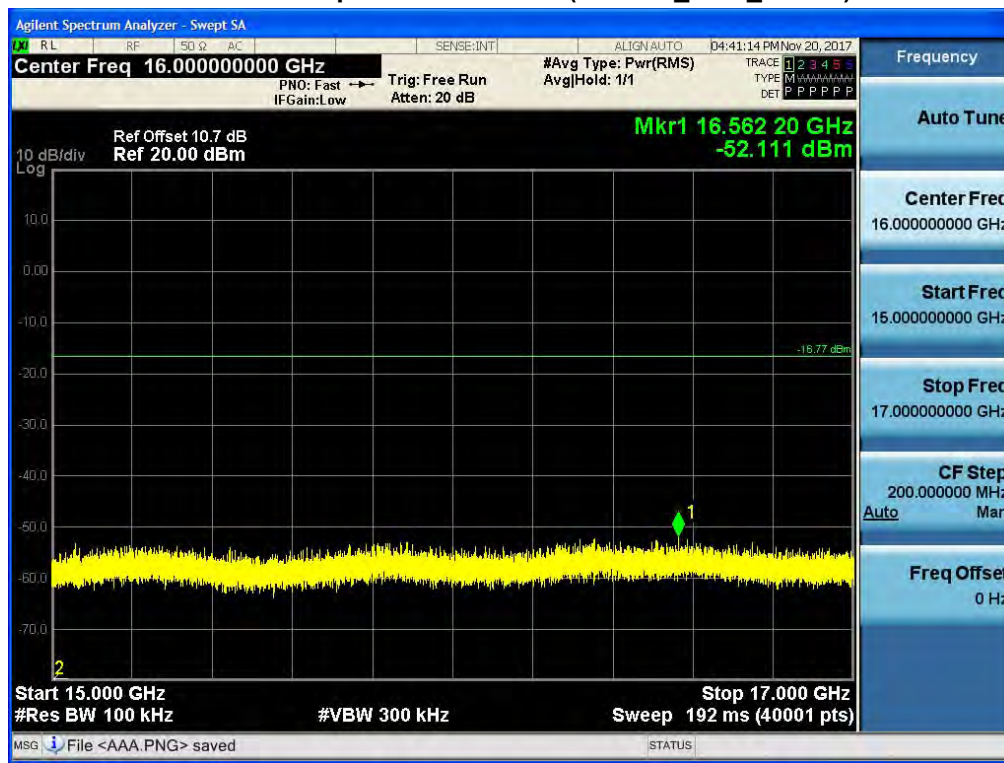
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



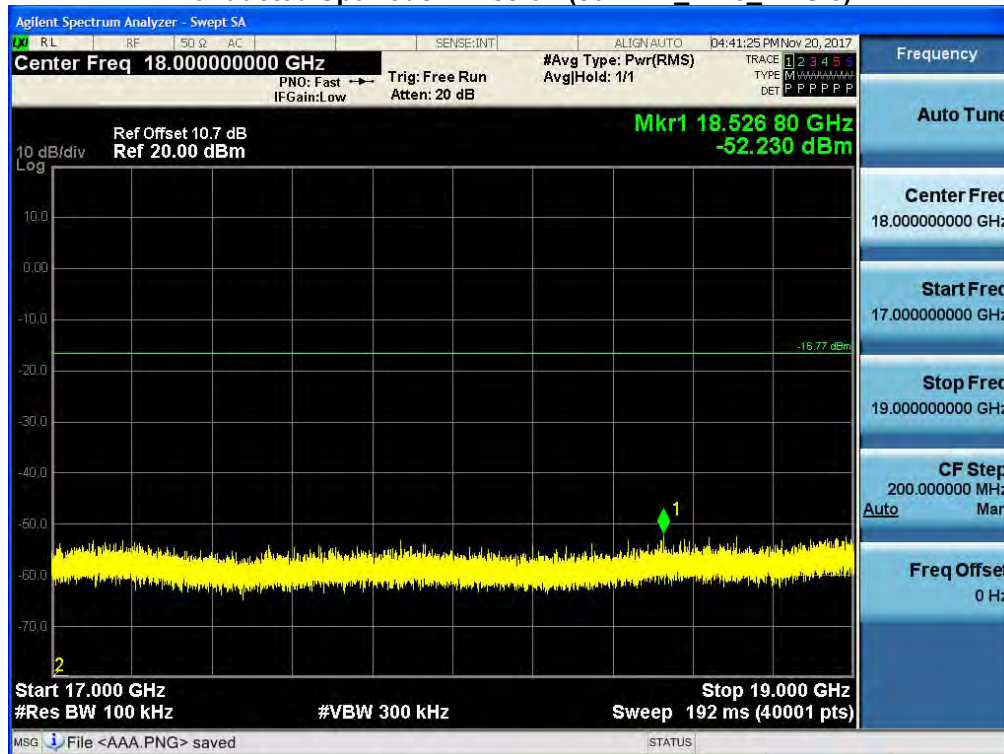
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



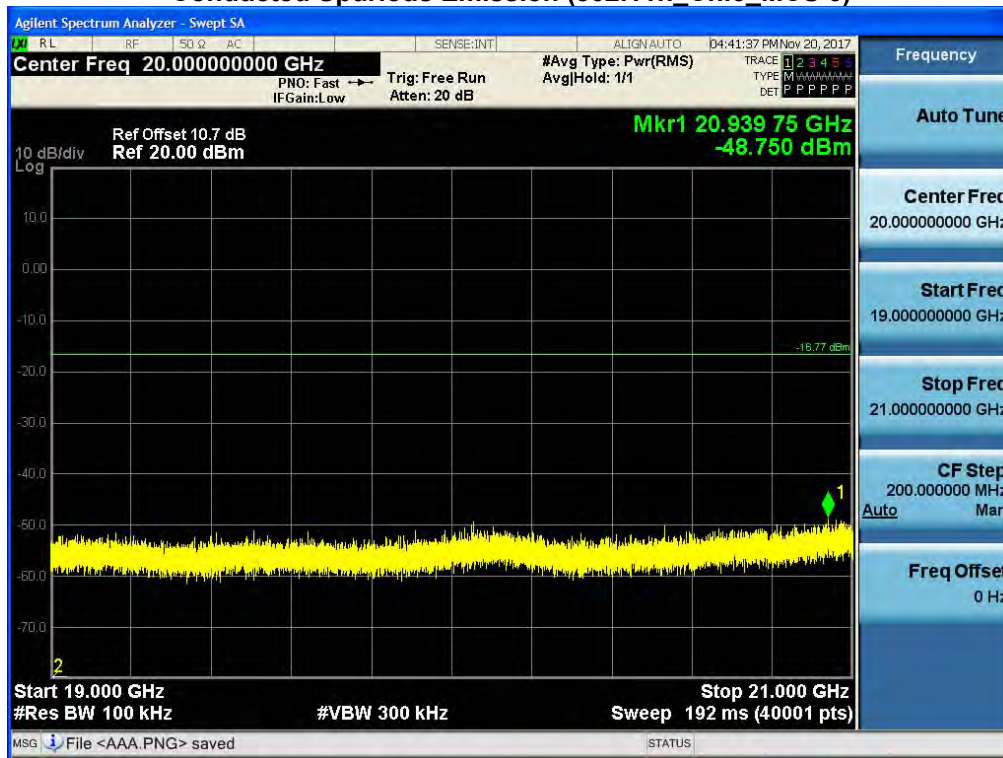
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



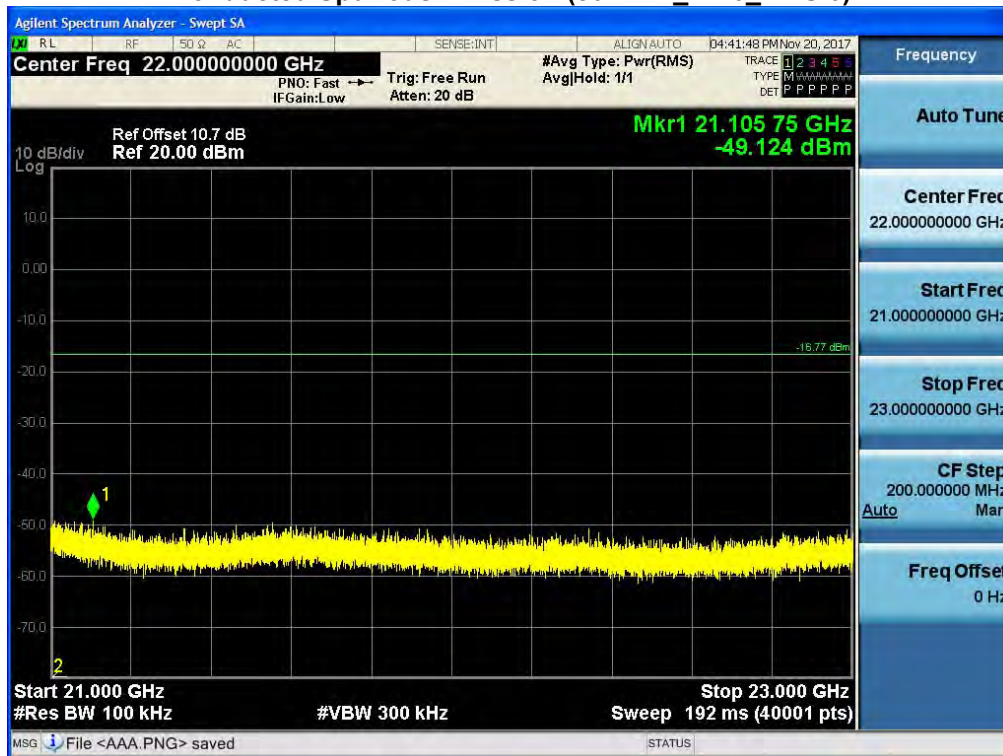
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11n_Ch.6_MCS 6)



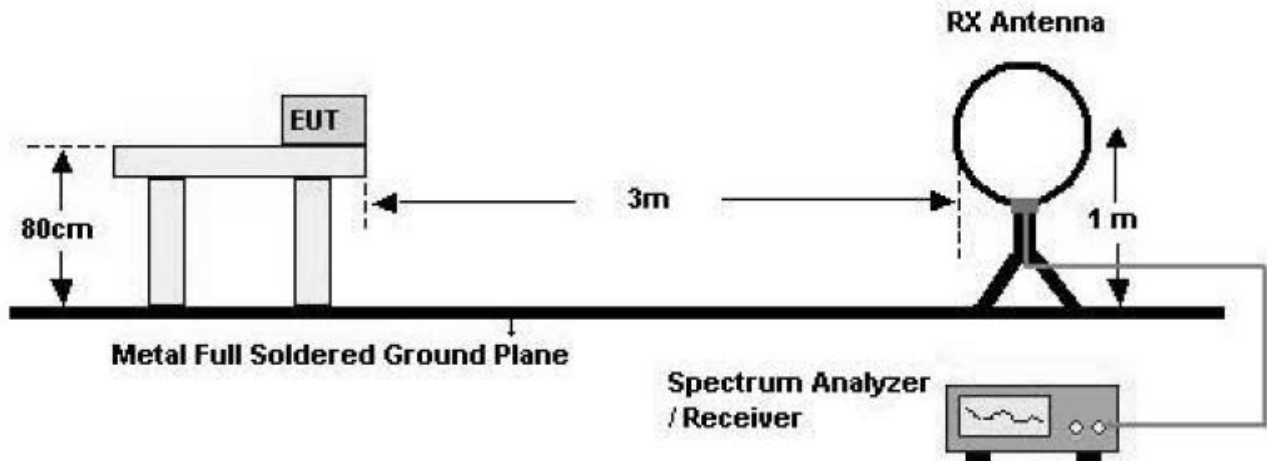
9.7 RADIATED MEASUREMENT.**9.7.1 RADIATED SPURIOUS EMISSIONS.**

Test Requirements and limit, §15.205, §15.209/ RSS-Gen(Issue 4) Section 8.9.

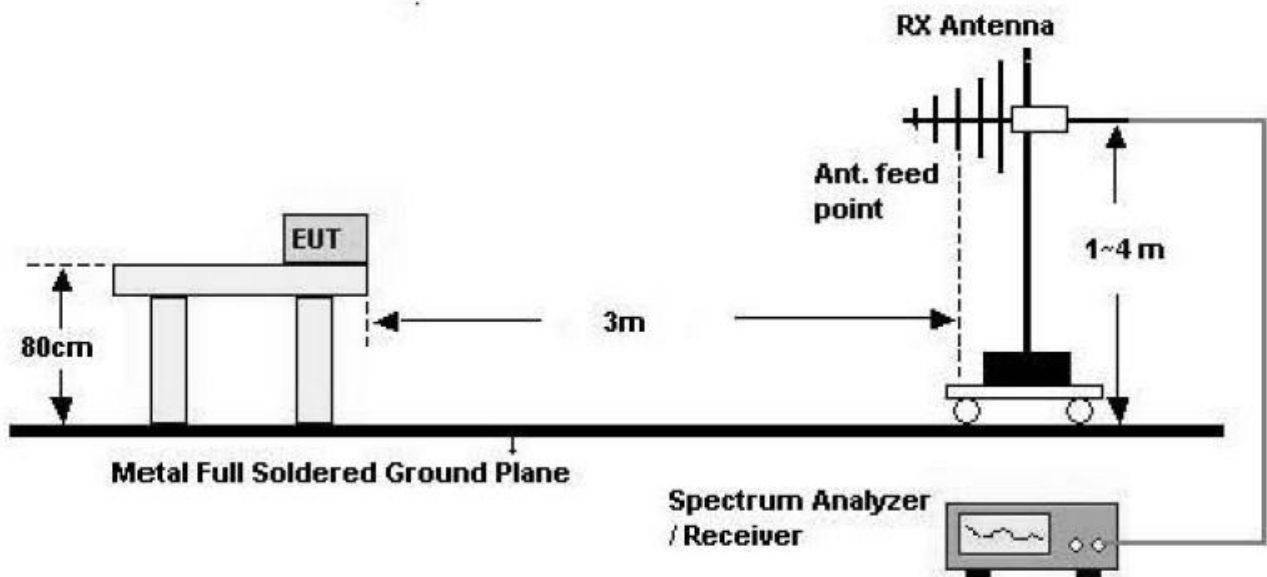
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

TEST CONFIGURATION

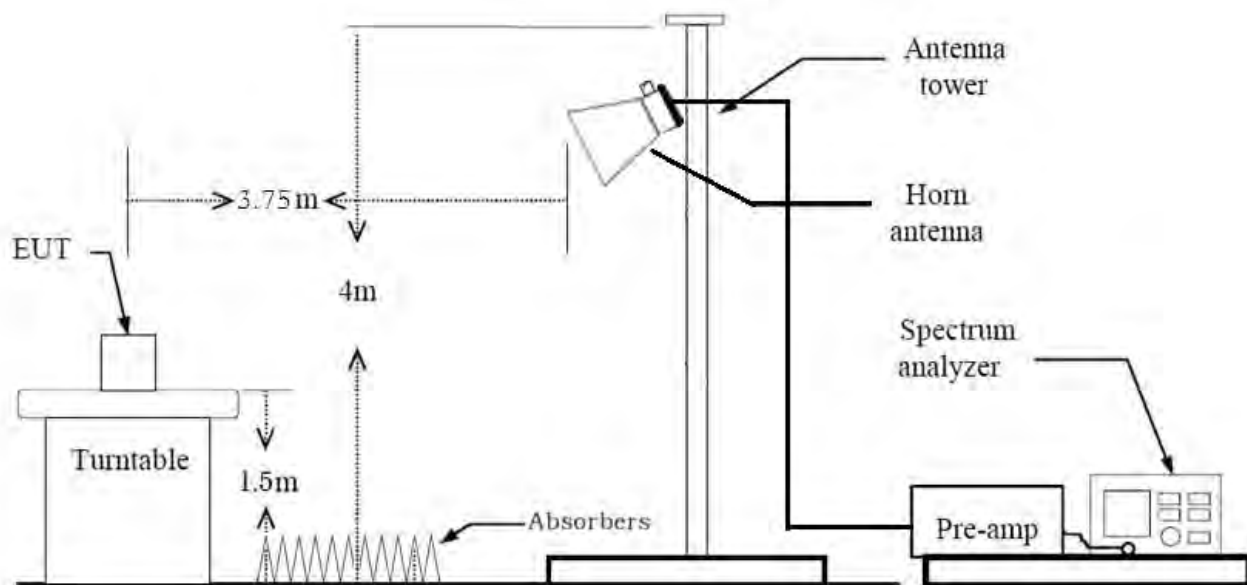
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE USED

Method 12.1 in KDB 558074 v04

Spectrum Setting

- Peak

Peak emission levels are measured by setting the instrument as follows:

RBW = cf. Table 1.

VBW $\geq 3 \times$ RBW.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweeps to continue until the trace stabilizes.

(Note that the required measurement time may be longer for low duty cycle applications).

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

- Average (duty cycle $\geq 98\%$)

Set RBW = 1 MHz

Set VBW $\geq 3 \times$ RBW

Detector = RMS

Averaging type = power (*i.e.*, RMS).

Sweep time = auto.

Trace mode = average (at least 100 traces).

- Average (duty cycle $< 98\%$, duty cycle variations are less than $\pm 2\%$)

Set RBW = 1 MHz

Set VBW $\geq 3 \times$ RBW

Detector = RMS.

Averaging type = power (*i.e.*, RMS).

Sweep time = auto.

Trace mode = average (at least 100 traces).

A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle.

Note :

1. We are performed the RSE and radiated band edge using standard radiated method(RMS).
2. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
3. Distance extrapolation factor = $20 \log (\text{test distance} / \text{specific distance})$ (dB)
4. The duty cycle factor for 802.11 b/g/n_HT20/n_HT40

Mode	Worst Data rate (Mbps)	T _{on} (ms)	T _{total} (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
b	1	12.441	12.542	99.20	0.035
g	6	2.063	2.188	94.26	0.257
n_HT20	MCS Index 0	1.924	2.041	94.27	0.256

TEST RESULTS**9 kHz – 30MHz****Operation Mode:** Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)
4. Limit line = specific Limits (dBuV) + Distance extrapolation factor
5. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
6. The test results for below 30 MHz is correlated to an open site.
The result on OATS is about 2 dB higher than semi-anechoic chamber (10 m chamber)

TEST RESULTS**Below 1 GHz****Operation Mode:** Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Above 1 GHz

Operation Mode:	802.11 b_Ant 0
Transfer Rate:	1 Mbps
Operating Frequency	2412
Channel No.	01 Ch

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	56.57	-1.02	V	55.55	73.98	18.43	PK
4824	51.45	-1.02	V	50.43	53.98	3.55	AV
7236	53.06	5.72	V	58.78	73.98	15.20	PK
7236	44.17	5.72	V	49.89	53.98	4.09	AV
4824	56.10	-1.02	H	55.08	73.98	18.90	PK
4824	50.95	-1.02	H	49.93	53.98	4.05	AV
7236	52.48	5.72	H	58.20	73.98	15.78	PK
7236	43.84	5.72	H	49.56	53.98	4.42	AV

Operation Mode:	802.11 b_Ant 1
Transfer Rate:	1 Mbps
Operating Frequency	2412
Channel No.	01 Ch

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	55.61	-1.02	V	54.59	73.98	19.39	PK
4824	49.89	-1.02	V	48.87	53.98	5.11	AV
7236	52.48	5.72	V	58.20	73.98	15.78	PK
7236	43.27	5.72	V	48.99	53.98	4.99	AV
4824	56.26	-1.02	H	55.24	73.98	18.74	PK
4824	50.71	-1.02	H	49.69	53.98	4.29	AV
7236	53.25	5.72	H	58.97	73.98	15.01	PK
7236	44.17	5.72	H	49.89	53.98	4.09	AV

Operation Mode: 802.11 g

Transfer Rate: 6 Mbps

Operating Frequency: 2412

Channel No.: 01 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+CL-AMP G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	58.13	0.00	-1.02	V	57.11	73.98	16.87	PK
4824	46.86	0.26	-1.02	V	46.10	53.98	7.88	AV
7236	57.84	0.00	5.72	V	63.56	73.98	10.42	PK
7236	43.57	0.26	5.72	V	49.55	53.98	4.43	AV
4824	59.05	0.00	-1.02	H	58.03	73.98	15.95	PK
4824	47.75	0.26	-1.02	H	46.99	53.98	6.99	AV
7236	58.37	0.00	5.72	H	64.09	73.98	9.89	PK
7236	44.30	0.26	5.72	H	50.28	53.98	3.70	AV

Operation Mode: 802.11 n_HT20

Transfer MCS Index: 0

Operating Frequency: 2412

Channel No.: 01 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+CL-AMP G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	58.91	0.00	-1.02	V	57.89	73.98	16.09	PK
4824	46.57	0.26	-1.02	V	45.81	53.98	8.17	AV
7236	57.81	0.00	5.72	V	63.53	73.98	10.45	PK
7236	42.67	0.26	5.72	V	48.65	53.98	5.33	AV
4824	59.84	0.00	-1.02	H	58.82	73.98	15.16	PK
4824	47.23	0.26	-1.02	H	46.47	53.98	7.51	AV
7236	58.69	0.00	5.72	H	64.41	73.98	9.57	PK
7236	43.52	0.26	5.72	H	49.50	53.98	4.48	AV

*A.F. : Antenna Factor / C.L. : Cable Loss / A.G. : Amplifier Gain / D.F. : Distance Factor

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor (802.11b)
5. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor
+ Duty Cycle Factor (802.11g/n)
6. Distance extrapolation factor = $20 \log (\text{test distance} / \text{specific distance})$ (dB)
7. We have done 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
8. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode: 802.11 b_Ant 0

Transfer Rate: 1 Mbps

Operating Frequency: 2437

Channel No.: 06 Ch

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	56.54	-0.70	V	55.84	73.98	18.14	PK
4874	51.05	-0.70	V	50.35	53.98	3.63	AV
7311	52.21	5.94	V	58.15	73.98	15.83	PK
7311	42.00	5.94	V	47.94	53.98	6.04	AV
4874	55.81	-0.70	H	55.11	73.98	18.87	PK
4874	50.48	-0.70	H	49.78	53.98	4.20	AV
7311	51.76	5.94	H	57.70	73.98	16.28	PK
7311	41.55	5.94	H	47.49	53.98	6.49	AV

Operation Mode: 802.11 b_Ant 1

Transfer Rate: 1 Mbps

Operating Frequency: 2437

Channel No.: 06 Ch

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	54.81	-0.70	V	54.11	73.98	19.87	PK
4874	48.56	-0.70	V	47.86	53.98	6.12	AV
7311	53.80	5.94	V	59.74	73.98	14.24	PK
7311	43.27	5.94	V	49.21	53.98	4.77	AV
4874	55.27	-0.70	H	54.57	73.98	19.41	PK
4874	49.46	-0.70	H	48.76	53.98	5.22	AV
7311	54.57	5.94	H	60.51	73.98	13.47	PK
7311	44.40	5.94	H	50.34	53.98	3.64	AV

Operation Mode: 802.11 g

Transfer Rate: 6 Mbps

Operating Frequency: 2437

Channel No.: 06 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+CL-AMP G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	57.68	0.00	-0.70	V	56.98	73.98	17.00	PK
4874	46.10	0.26	-0.70	V	45.66	53.98	8.32	AV
7311	56.44	0.00	5.94	V	62.38	73.98	11.60	PK
7311	42.57	0.26	5.94	V	48.77	53.98	5.21	AV
4874	58.41	0.00	-0.70	H	57.71	73.98	16.27	PK
4874	46.84	0.26	-0.70	H	46.40	53.98	7.58	AV
7311	57.10	0.00	5.94	H	63.04	73.98	10.94	PK
7311	43.31	0.26	5.94	H	49.51	53.98	4.47	AV

Operation Mode: 802.11 n_HT20

Transfer MCS Index: 0

Operating Frequency: 2437

Channel No.: 06 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+CL-AMP G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	59.37	0.00	-0.70	V	58.67	73.98	15.31	PK
4874	45.79	0.26	-0.70	V	45.35	53.98	8.63	AV
7311	58.66	0.00	5.94	V	64.60	73.98	9.38	PK
7311	42.89	0.26	5.94	V	49.09	53.98	4.89	AV
4874	60.14	0.00	-0.70	H	59.44	73.98	14.54	PK
4874	46.92	0.26	-0.70	H	46.48	53.98	7.50	AV
7311	59.76	0.00	5.94	H	65.70	73.98	8.28	PK
7311	43.52	0.26	5.94	H	49.72	53.98	4.26	AV

*A.F. : Antenna Factor / C.L. : Cable Loss / A.G. : Amplifier Gain / D.F. : Distance Factor

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor (802.11b)
5. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor
+ Duty Cycle Factor (802.11g/n)
6. Distance extrapolation factor = $20 \log (\text{test distance} / \text{specific distance})$ (dB)
7. We have done 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
8. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode: 802.11 b_Ant 0

Transfer Rate: 1 Mbps

Operating Frequency: 2462

Channel No. 11 Ch

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	55.83	-0.45	V	55.38	73.98	18.60	PK
4924	50.70	-0.45	V	50.25	53.98	3.73	AV
7386	50.47	6.14	V	56.61	73.98	17.37	PK
7386	39.31	6.14	V	45.45	53.98	8.53	AV
4924	55.33	-0.45	H	54.88	73.98	19.10	PK
4924	49.86	-0.45	H	49.41	53.98	4.57	AV
7386	50.07	6.14	H	56.21	73.98	17.77	PK
7386	39.04	6.14	H	45.18	53.98	8.80	AV

Operation Mode: 802.11 b_Ant 1

Transfer Rate: 1 Mbps

Operating Frequency: 2462

Channel No. 11 Ch

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	55.94	-0.45	V	55.49	73.98	18.49	PK
4924	50.16	-0.45	V	49.71	53.98	4.27	AV
7386	49.90	6.14	V	56.04	73.98	17.94	PK
7386	37.00	6.14	V	43.14	53.98	10.84	AV
4924	56.42	-0.45	H	55.97	73.98	18.01	PK
4924	51.14	-0.45	H	50.69	53.98	3.29	AV
7386	50.99	6.14	H	57.13	73.98	16.85	PK
7386	37.88	6.14	H	44.02	53.98	9.96	AV

Operation Mode: 802.11 g

Transfer Rate: 6 Mbps

Operating Frequency: 2462

Channel No.: 11 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+CL-AMP G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	56.17	0.00	-0.45	V	55.72	73.98	18.26	PK
4924	43.19	0.26	-0.45	V	43.00	53.98	10.98	AV
7386	56.04	0.00	6.14	V	62.18	73.98	11.80	PK
7386	43.58	0.26	6.14	V	49.98	53.98	4.00	AV
4924	57.07	0.00	-0.45	H	56.62	73.98	17.36	PK
4924	44.89	0.26	-0.45	H	44.70	53.98	9.28	AV
7386	55.80	0.00	6.14	H	61.94	73.98	12.04	PK
7386	44.08	0.26	6.14	H	50.48	53.98	3.50	AV

Operation Mode: 802.11 n_HT20

Transfer MCS Index: 0

Operating Frequency: 2462

Channel No.: 11 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+CL-AMP G+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	56.81	0.00	-0.45	V	56.36	73.98	17.62	PK
4924	43.99	0.26	-0.45	V	43.80	53.98	10.18	AV
7386	57.10	0.00	6.14	V	63.24	73.98	10.74	PK
7386	42.97	0.26	6.14	V	49.37	53.98	4.61	AV
4924	57.42	0.00	-0.45	H	56.97	73.98	17.01	PK
4924	44.93	0.26	-0.45	H	44.74	53.98	9.24	AV
7386	58.49	0.00	6.14	H	64.63	73.98	9.35	PK
7386	43.98	0.26	6.14	H	50.38	53.98	3.60	AV

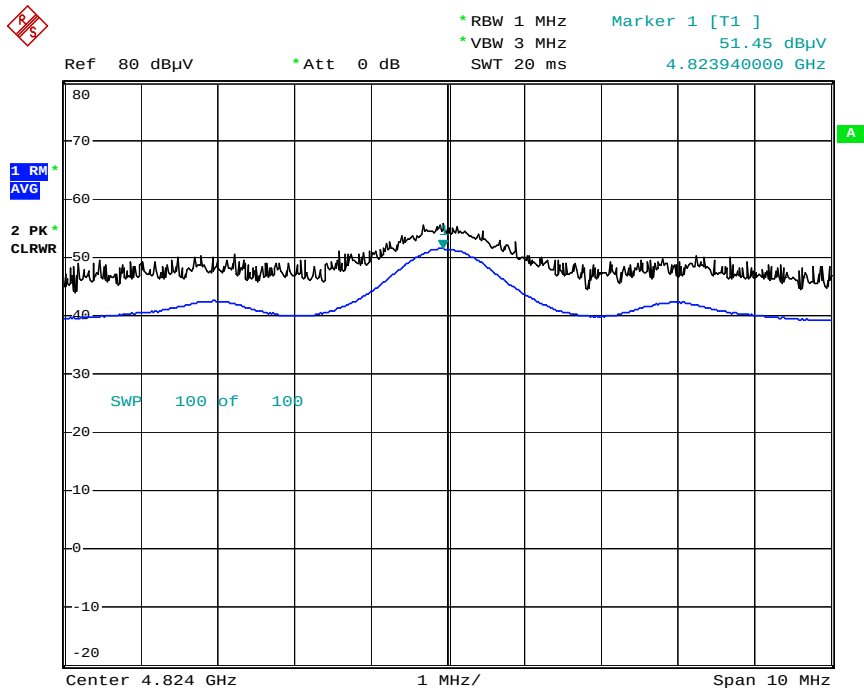
*A.F. : Antenna Factor / C.L. : Cable Loss / A.G. : Amplifier Gain / D.F. : Distance Factor

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor (802.11b)
5. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor
+ Duty Cycle Factor (802.11g/n)
6. Distance extrapolation factor = $20 \log (\text{test distance} / \text{specific distance})$ (dB)
7. We have done 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
8. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

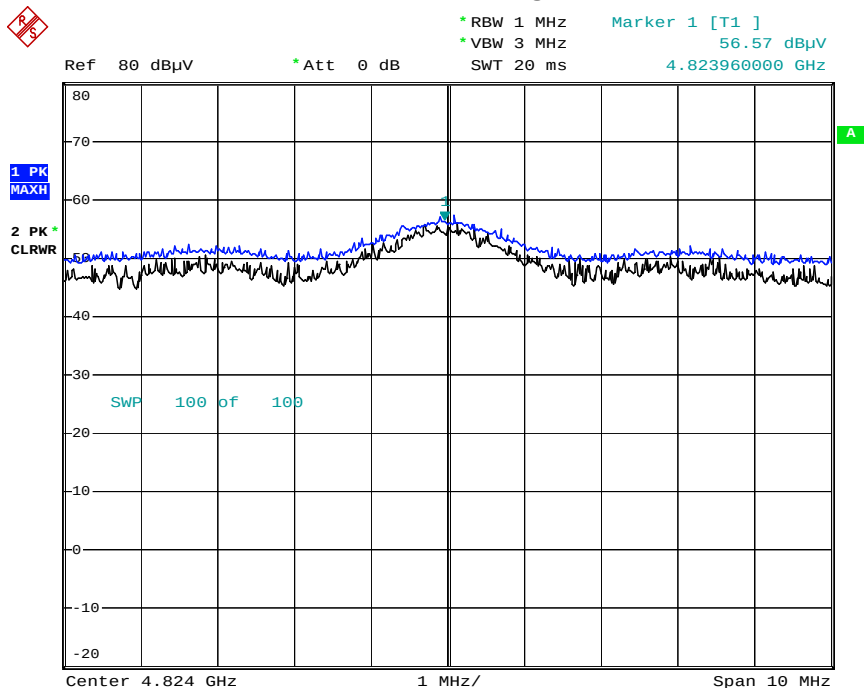
■ **RESULT PLOTS_Ant 0**

Radiated Spurious Emissions plot – Average Reading (802.11b, Ch.1 2nd Harmonic, Z-V)



Date: 3.NOV.2017 03:54:54

Radiated Spurious Emissions plot – Peak Reading (802.11b, Ch.1 2nd Harmonic, Z-V)

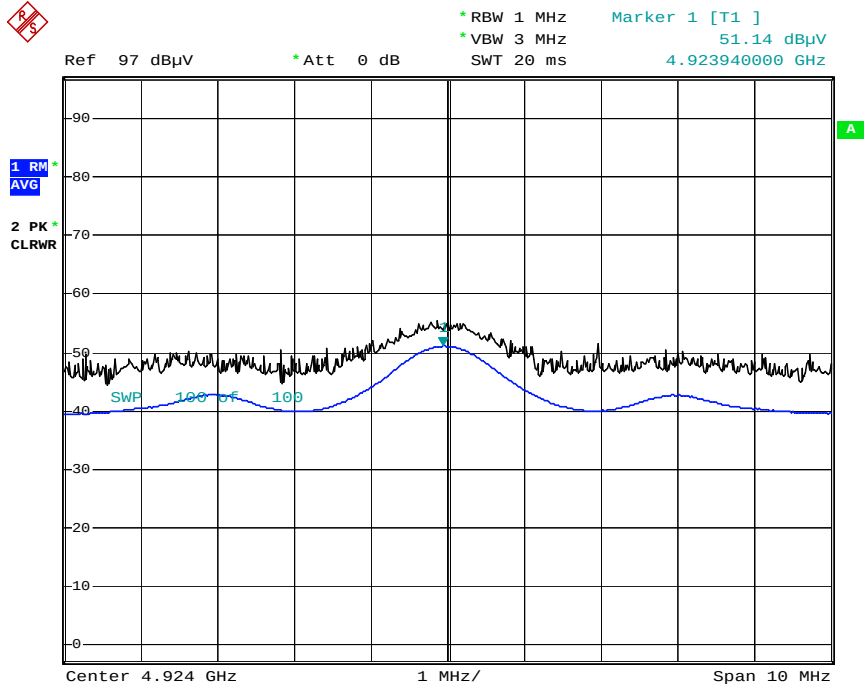


Date: 3.NOV.2017 03:56:05

Note : Only the worst case plots for Radiated Spurious Emissions.

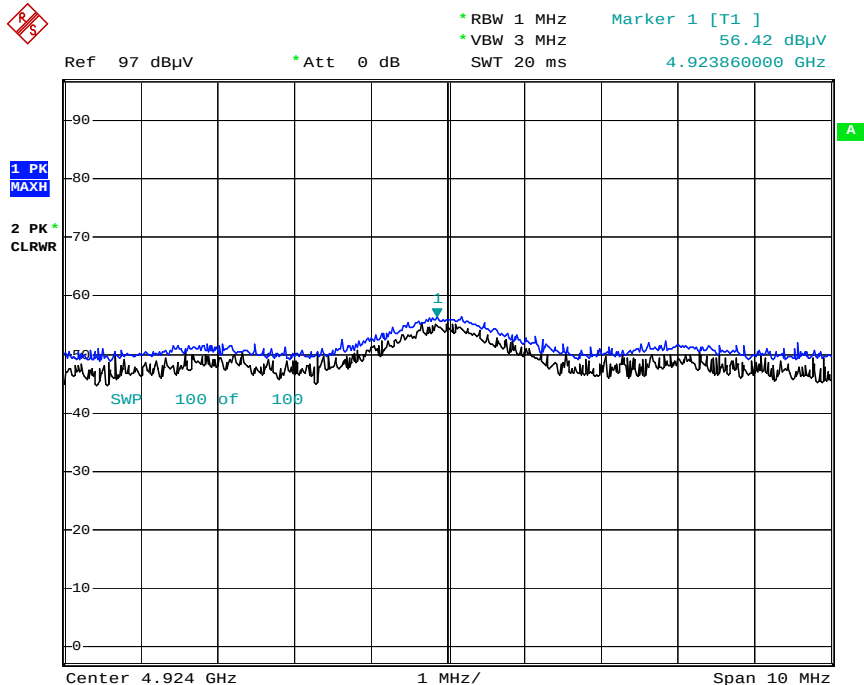
■ RESULT PLOTS_Ant 1

Radiated Spurious Emissions plot – Average Reading (802.11b, Ch.11 2nd Harmonic, X-H)



Date: 3.NOV.2017 07:37:25

Radiated Spurious Emissions plot – Peak Reading (802.11b, Ch.11 2nd Harmonic, X-H)

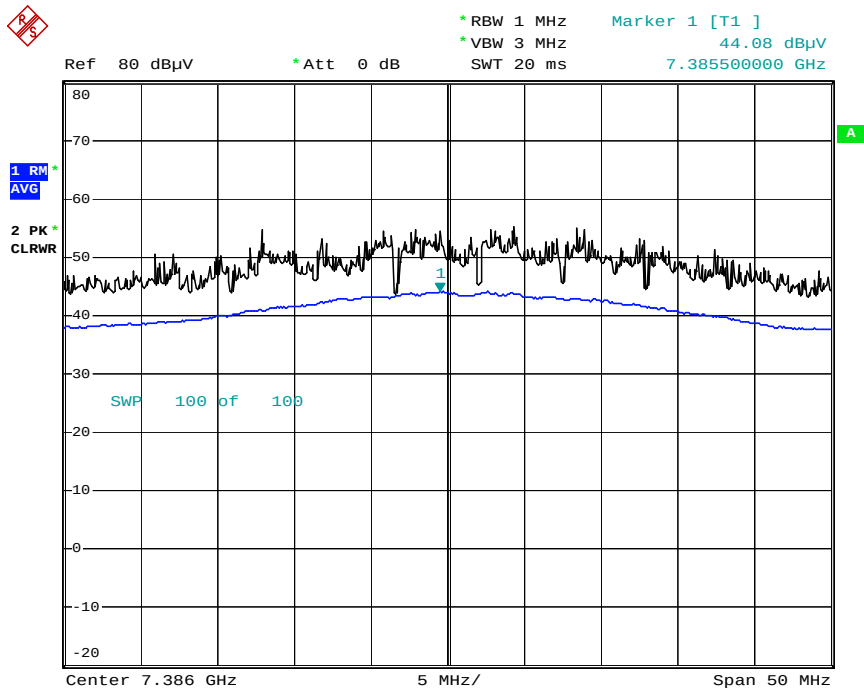


Date: 3.NOV.2017 07:37:57

Note : Only the worst case plots for Radiated Spurious Emissions.

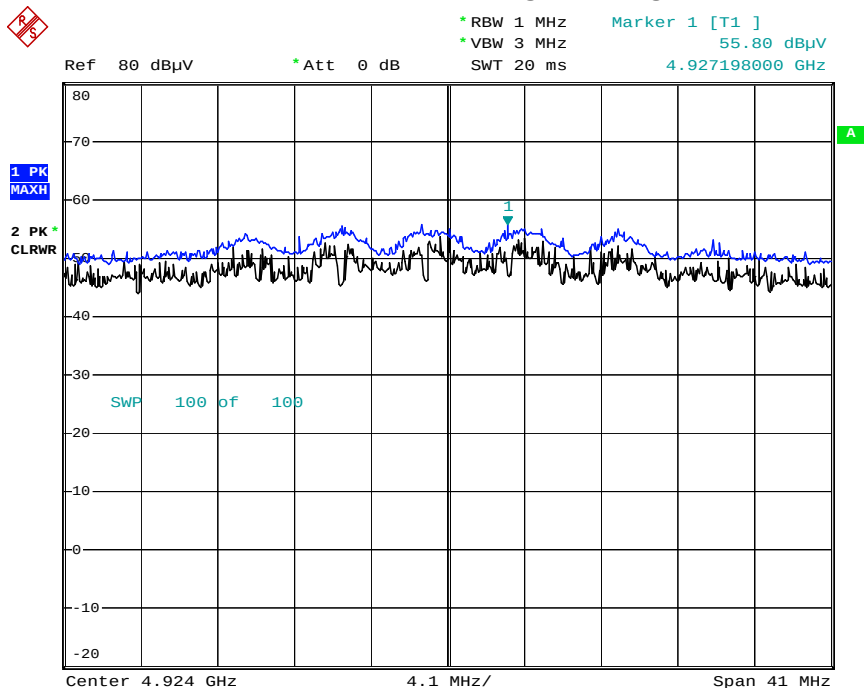
RESULT PLOTS_MIMO

Radiated Spurious Emissions plot – Average Reading (802.11g, Ch.11 3rd Harmonic, X-H)



Date: 6.NOV.2017 07:25:00

Radiated Spurious Emissions plot – Peak Reading (802.11g, Ch.11 3rd Harmonic, X-H)



Date: 20.NOV.2017 01:42:52

Note : Only the worst case plots for Radiated Spurious Emissions.

9.7.2 RADIATED RESTRICTED BAND EDGES

Test Requirements and limit, §15.247(d) §15.205, §15.209, RSS-Gen(Issue 4) 8.10

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c)).

Operation Mode:	802.11g
Transfer Rate:	6 Mbps
Operating Frequency	2412 MHz, 2462 MHz
Channel No.	01 Ch, 11 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+CL+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	61.98	0.00	-0.07	H	61.91	73.98	12.07	PK
2390.0	49.10	0.26	-0.07	H	49.29	53.98	4.69	AV
2390.0	60.70	0.00	-0.07	V	60.63	73.98	13.35	PK
2390.0	48.66	0.26	-0.07	V	48.85	53.98	5.13	AV
2483.5	63.41	0.00	0.04	H	63.45	73.98	10.53	PK
2483.5	50.47	0.26	0.04	H	50.77	53.98	3.21	AV
2483.5	62.78	0.00	0.04	V	62.82	73.98	11.16	PK
2483.5	49.88	0.26	0.04	V	50.18	53.98	3.80	AV

*A.F. : Antenna Factor / C.L. : Cable Loss / D.F. : Distance Factor

Operation Mode: 802.11b_Ant 0
Transfer Rate: 1 Mbps
Operating Frequency: 2412 MHz, 2462 MHz
Channel No.: 01 Ch, 11 Ch

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	54.27	-0.07	H	54.20	73.98	19.78	PK
2390.0	43.59	-0.07	H	43.52	53.98	10.46	AV
2390.0	54.81	-0.07	V	54.74	73.98	19.24	PK
2390.0	44.04	-0.07	V	43.97	53.98	10.01	AV
2483.5	52.68	0.04	H	52.72	73.98	21.26	PK
2483.5	41.89	0.04	H	41.93	53.98	12.05	AV
2483.5	53.00	0.04	V	53.04	73.98	20.94	PK
2483.5	42.12	0.04	V	42.16	53.98	11.82	AV

Operation Mode: 802.11b_Ant 1
Transfer Rate: 1 Mbps
Operating Frequency: 2412 MHz, 2462 MHz
Channel No.: 01 Ch, 11 Ch

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	54.31	-0.07	H	54.24	73.98	19.74	PK
2390.0	43.41	-0.07	H	43.34	53.98	10.64	AV
2390.0	53.19	-0.07	V	53.12	73.98	20.86	PK
2390.0	42.67	-0.07	V	42.60	53.98	11.38	AV
2483.5	58.49	0.04	H	58.53	73.98	15.45	PK
2483.5	50.90	0.04	H	50.94	53.98	3.04	AV
2483.5	57.62	0.04	V	57.66	73.98	16.32	PK
2483.5	49.58	0.04	V	49.62	53.98	4.36	AV

Operation Mode: 802.11n_HT20
Transfer MCS Index: 0
Operating Frequency: 2412 MHz, 2462 MHz
Channel No. 01 Ch, 11 Ch

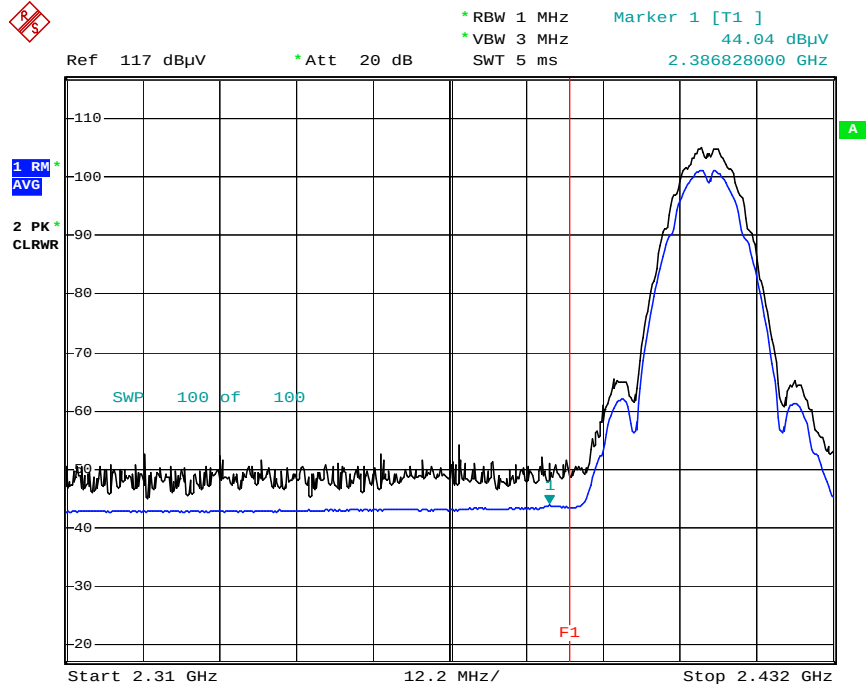
Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+CL+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	61.36	0.00	-0.07	H	61.29	73.98	12.69	PK
2390.0	49.92	0.26	-0.07	H	50.11	53.98	3.87	AV
2390.0	60.37	0.00	-0.07	V	60.30	73.98	13.68	PK
2390.0	48.96	0.26	-0.07	V	49.15	53.98	4.83	AV
2483.5	60.94	0.00	0.04	H	60.98	73.98	13.00	PK
2483.5	50.05	0.26	0.04	H	50.35	53.98	3.63	AV
2483.5	59.91	0.00	0.04	V	59.95	73.98	14.03	PK
2483.5	49.27	0.26	0.04	V	49.57	53.98	4.41	AV

Notes:

1. Total = Reading Value + Antenna Factor + Cable Loss + Distance Factor(802.11b)
2. Total = Reading Value + Antenna Factor + Cable Loss + Distance Factor + Duty Cycle Factor (802.11g/n)
3. Distance extrapolation factor = $20 \log (\text{test distance} / \text{specific distance})$ (dB)
4. We have done 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
5. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

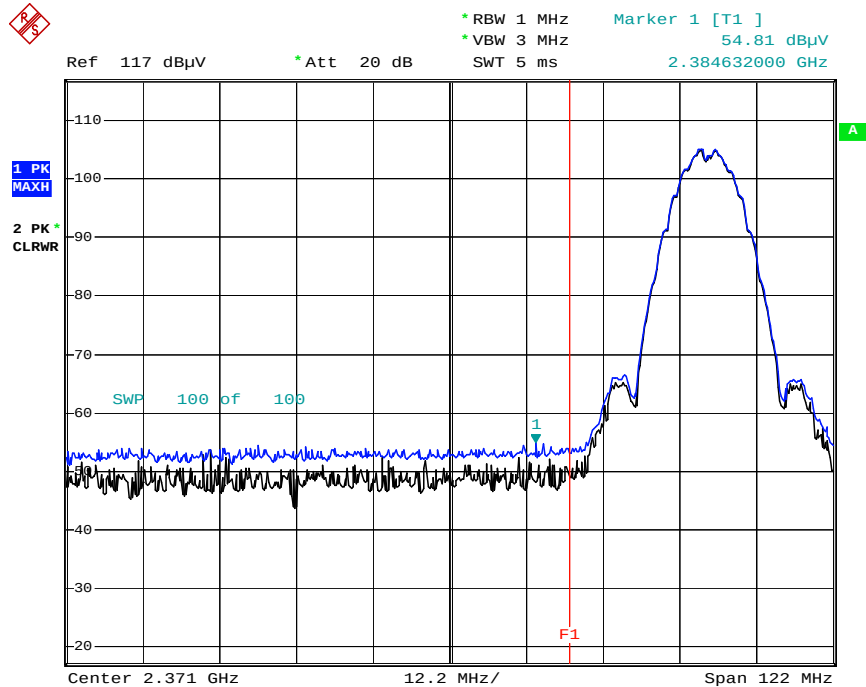
■ **RESULT PLOTS_Ant 0**

Radiated Restricted Band Edges plot – Average Reading (802.11b, Ch.1, Z-V)



Date: 3.NOV.2017 02:42:17

Radiated Restricted Band Edges plot – Peak Reading ((802.11b, Ch.1, Z-V)

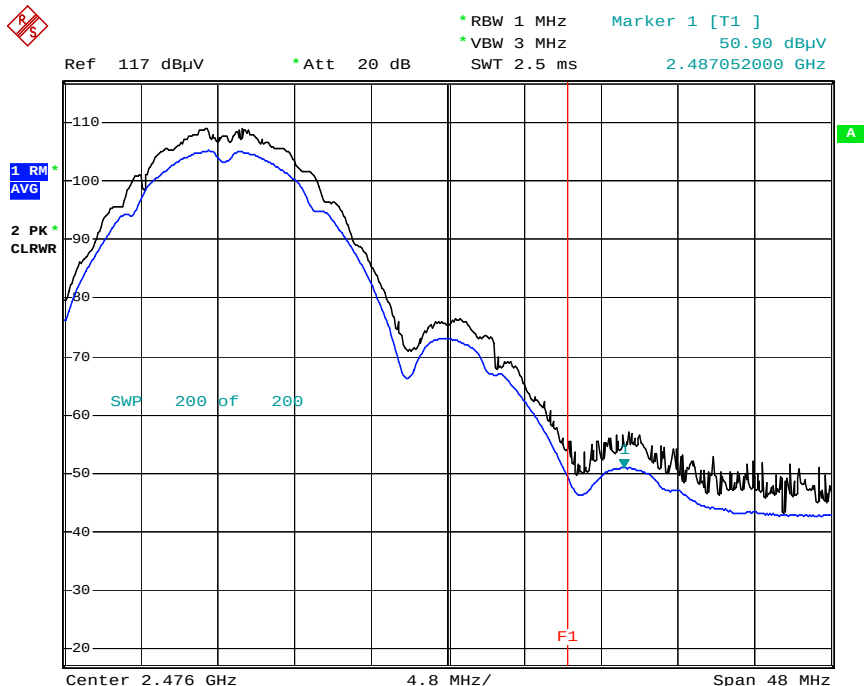


Date: 3.NOV.2017 02:42:44

Note : Only the worst case plots for Radiated Restricted Band Edges.

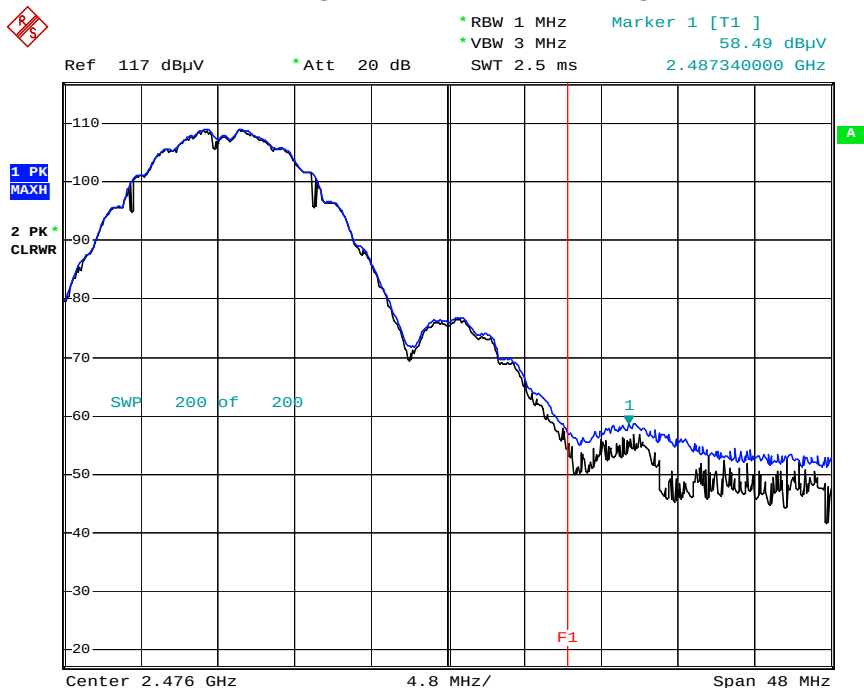
■ **RESULT PLOTS_Ant 1**

Radiated Restricted Band Edges plot – Average Reading (802.11b, Ch.11, X-H)



Date: 3.NOV.2017 05:58:57

Radiated Restricted Band Edges plot – Peak Reading ((802.11b, Ch.11, X-H)

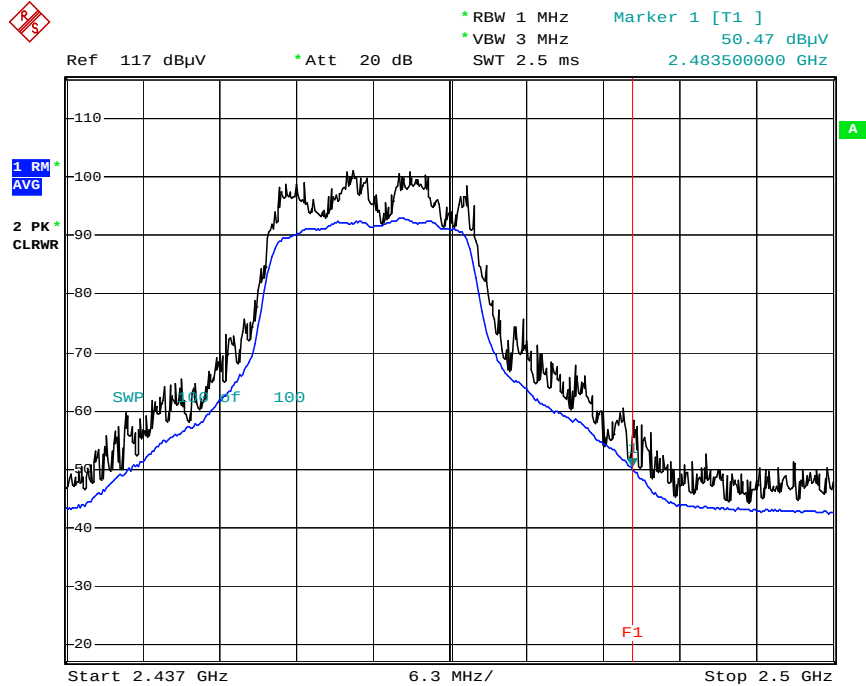


Date: 3.NOV.2017 06:01:11

Note : Only the worst case plots for Radiated Restricted Band Edges.

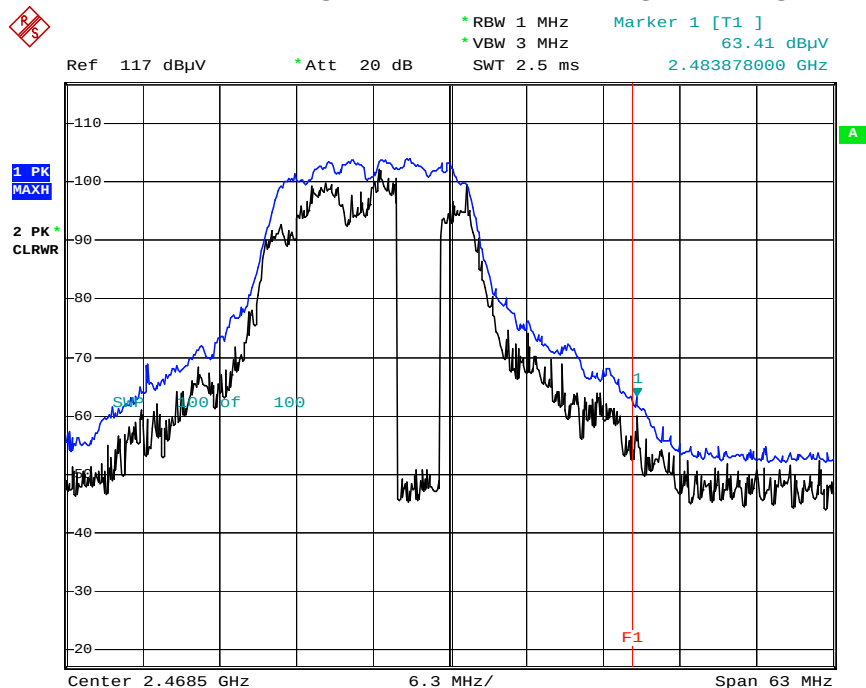
■ **RESULT PLOTS_MIMO**

Radiated Restricted Band Edges plot – Average Reading (802.11g, Ch.11, Y-H)



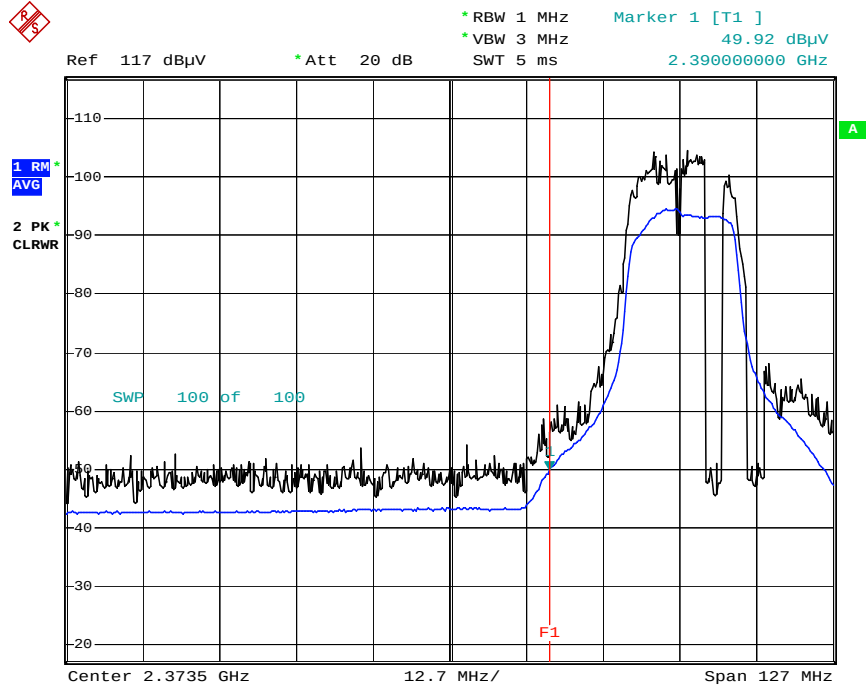
Date: 6.NOV.2017 01:50:51

Radiated Restricted Band Edges plot – Peak Reading ((802.11g, Ch.11, Y-H)



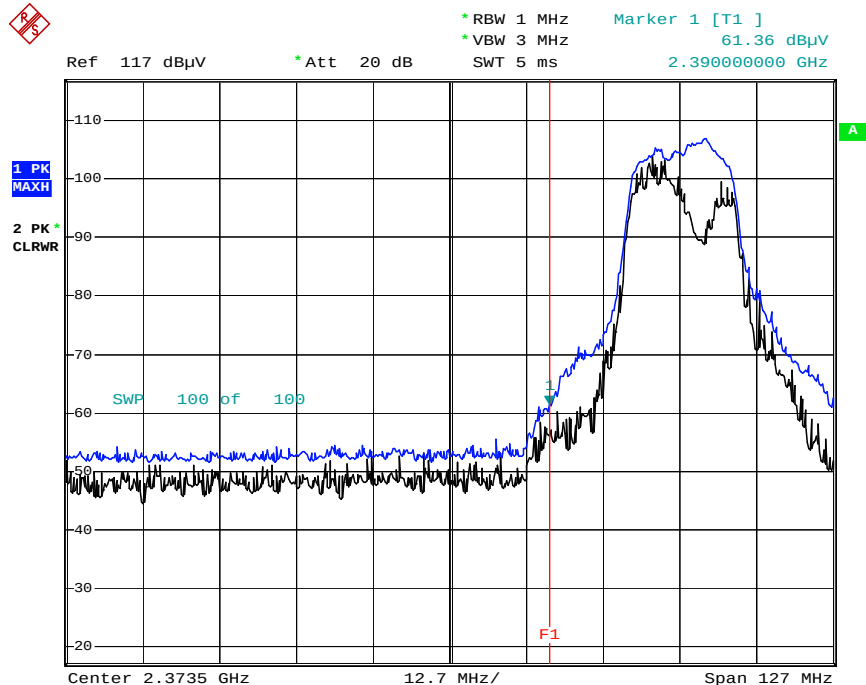
Date: 6.NOV.2017 01:51:40

Radiated Restricted Band Edges plot – Average Reading (802.11n_HT20, Ch.1, Y-H)



Date: 6.NOV.2017 02:13:12

Radiated Restricted Band Edges plot – Peak Reading ((802.11n_HT20, Ch.1, Y-H)



Date: 6.NOV.2017 02:13:49

Note : Only the worst case plots for Radiated Restricted Band Edges.

9.7.3 RECEIVER SPURIOUS EMISSIONS

ISED Rule(s) RSS-Gen
Test Requirements: Blow the table
Operating conditions: Under normal test conditions
Method of testing: Radiated

S/A. Settings: F < 1 GHz: RBW: 120 kHz, VBW: 300 kHz (Quasi Peak)
F > 1 GHz: RBW: 1 MHz, VBW: 3 MHz (Peak)

Mode of operation: Receive

Frequency (MHz)	Field Strength (microvolts/m at 3 meters)
30 – 88	100
88 - 216	150
216 – 960	200
Above 960	500

Operation Mode: Receive:

30 MHz ~ 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dB μ V	dB /m	dB	(H/V)	dB μ V/m	dB μ V/m	dB
No critical peaks found							

Above 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dB μ V	dB /m	dB	(H/V)	dB μ V/m	dB μ V/m	dB
No critical peaks found							

9.8 POWERLINE CONDUCTED EMISSIONS

Test Requirements and limit, §15.207, RSS-Gen(Issue 4) Section 8.8

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.
5. We are performed the AC Power Line Conducted Emission test for worst data rate, channel, operation mode.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

■ RESULT PLOTS

Conducted Emissions (Line 1)

WLAN 2.4GHz MODE_H

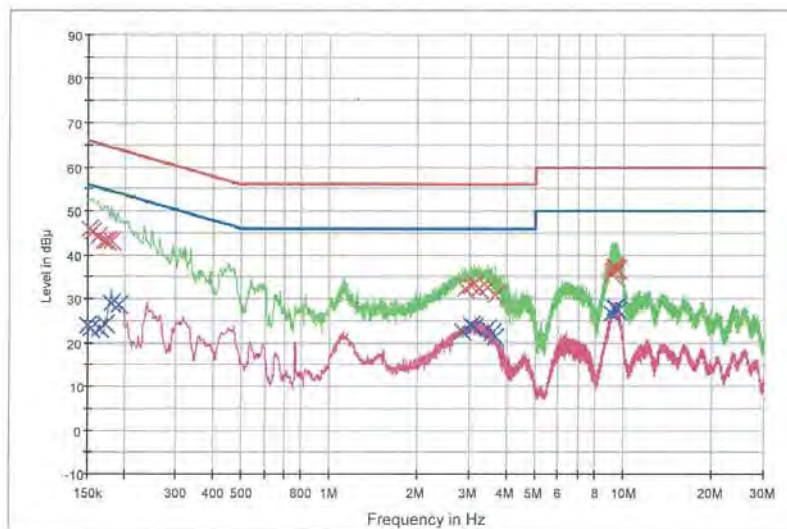
1 / 2

HCT TEST Report

Common Information

EUT: WC1NP8
Manufacturer: LG
Test Site: SHIELD ROOM
Operating Conditions: WLAN 2.4GHz MODE_H

FCC CLASS B



— FCC CLASS B_QP — Preview Result 1-PK+
— FCC CLASS B_AV Final Result 1-QPK — Preview Result 2-AVG
X Final Result 2-CAV

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.152000	45.9	9.000	Off	L1	9.6	20.0	65.9
0.156000	45.3	9.000	Off	L1	9.6	20.4	65.7
0.162000	44.3	9.000	Off	L1	9.6	21.0	65.4
0.170000	43.3	9.000	Off	L1	9.6	21.6	65.0
0.174000	43.2	9.000	Off	L1	9.6	21.6	64.8
0.180000	43.4	9.000	Off	L1	9.6	21.1	64.5
2.908000	32.5	9.000	Off	L1	9.8	23.5	56.0
3.042000	33.2	9.000	Off	L1	9.8	22.8	56.0
3.106000	33.9	9.000	Off	L1	9.8	22.1	56.0
3.210000	32.5	9.000	Off	L1	9.8	23.5	56.0
3.446000	32.8	9.000	Off	L1	9.8	23.2	56.0
3.644000	31.0	9.000	Off	L1	9.8	25.0	56.0
9.124000	35.8	9.000	Off	L1	10.0	24.2	60.0
9.162000	36.5	9.000	Off	L1	10.0	23.5	60.0
9.300000	37.1	9.000	Off	L1	10.0	22.9	60.0
9.324000	37.4	9.000	Off	L1	10.0	22.6	60.0
9.458000	36.8	9.000	Off	L1	10.1	23.2	60.0
9.494000	36.7	9.000	Off	L1	10.1	23.3	60.0

2017-11-17

오후 4:48:12

WLAN 2.4GHz MODE_H

2 / 2

Final Result 2

Frequency (MHz)	CAverage (dBμ V)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)
0.150000	23.7	9.000	Off	L1	9.6	32.3	56.0
0.154000	23.3	9.000	Off	L1	9.6	32.5	55.8
0.164000	23.2	9.000	Off	L1	9.6	32.1	55.3
0.172000	24.2	9.000	Off	L1	9.6	30.7	54.9
0.180000	29.1	9.000	Off	L1	9.6	25.4	54.5
0.192000	28.5	9.000	Off	L1	9.6	26.4	53.9
2.814000	22.6	9.000	Off	L1	9.8	23.4	46.0
3.042000	23.9	9.000	Off	L1	9.8	22.1	46.0
3.100000	23.6	9.000	Off	L1	9.8	22.4	46.0
3.444000	23.3	9.000	Off	L1	9.8	22.7	46.0
3.578000	22.1	9.000	Off	L1	9.8	23.9	46.0
3.644000	21.1	9.000	Off	L1	9.8	24.9	46.0
9.124000	26.5	9.000	Off	L1	10.0	23.5	50.0
9.324000	28.0	9.000	Off	L1	10.0	22.0	50.0
9.358000	27.9	9.000	Off	L1	10.1	22.1	50.0
9.362000	28.0	9.000	Off	L1	10.1	22.0	50.0
9.458000	27.9	9.000	Off	L1	10.1	22.1	50.0
9.578000	27.3	9.000	Off	L1	10.1	22.7	50.0

2017-11-17

오후 4:48:12

Conducted Emissions (Line 2)

WLAN 2.4GHz MODE_N

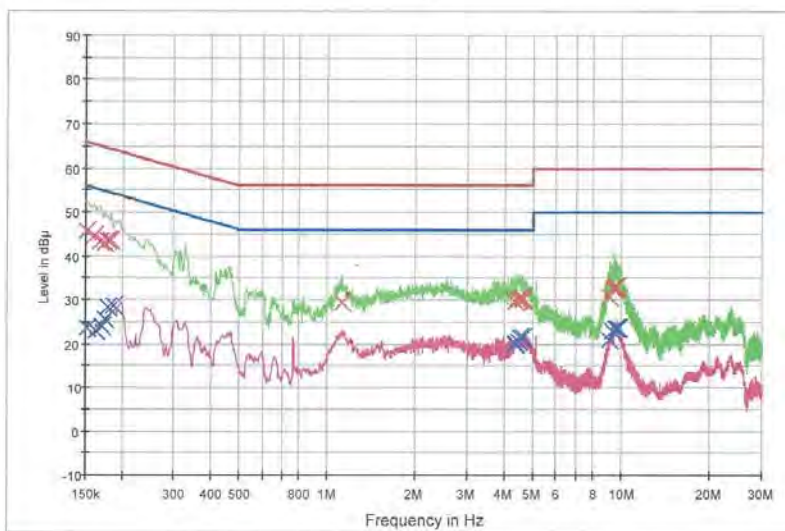
1 / 2

HCT TEST Report

Common Information

EUT: WC1NP8
Manufacturer: LG
Test Site: SHIELD ROOM
Operating Conditions: WLAN 2.4GHz MODE_N

FCC CLASS B



— FCC CLASS B_QP — FCC CLASS B_AV X Preview Result 1-PK+
— Preview Result 2-AVG X Final Result 1-QPK X Final Result 2-CAV

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.152000	45.7	9.000	Off	N	9.6	20.2	65.9
0.160000	44.5	9.000	Off	N	9.6	21.0	65.5
0.168000	43.4	9.000	Off	N	9.6	21.7	65.1
0.174000	42.8	9.000	Off	N	9.6	22.0	64.8
0.178000	43.5	9.000	Off	N	9.6	21.1	64.6
0.184000	43.4	9.000	Off	N	9.6	20.9	64.3
1.116000	29.2	9.000	Off	N	9.7	26.8	56.0
4.374000	29.7	9.000	Off	N	9.8	26.3	56.0
4.458000	30.1	9.000	Off	N	9.8	25.9	56.0
4.520000	30.2	9.000	Off	N	9.8	25.8	56.0
4.592000	30.0	9.000	Off	N	9.8	26.0	56.0
4.604000	30.2	9.000	Off	N	9.8	25.8	56.0
9.130000	30.7	9.000	Off	N	10.0	29.3	60.0
9.436000	32.5	9.000	Off	N	10.1	27.5	60.0
9.468000	32.8	9.000	Off	N	10.1	27.2	60.0
9.502000	33.1	9.000	Off	N	10.1	26.9	60.0
9.564000	32.8	9.000	Off	N	10.1	27.2	60.0
9.674000	33.0	9.000	Off	N	10.1	27.0	60.0

2017-11-17

오후 4:58:07

WLAN 2.4GHz MODE_N

2 / 2

Final Result 2

Frequency (MHz)	CAverage (dBμ V)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)
0.152000	23.5	9.000	Off	N	9.6	32.4	55.9
0.162000	23.0	9.000	Off	N	9.6	32.3	55.4
0.170000	23.7	9.000	Off	N	9.6	31.2	55.0
0.174000	25.5	9.000	Off	N	9.6	29.3	54.8
0.178000	28.2	9.000	Off	N	9.6	26.4	54.6
0.188000	28.6	9.000	Off	N	9.6	25.6	54.1
4.354000	19.8	9.000	Off	N	9.8	26.2	46.0
4.374000	20.2	9.000	Off	N	9.8	25.8	46.0
4.442000	20.6	9.000	Off	N	9.8	25.4	46.0
4.524000	21.6	9.000	Off	N	9.8	24.4	46.0
4.532000	21.5	9.000	Off	N	9.8	24.5	46.0
4.592000	21.5	9.000	Off	N	9.8	24.5	46.0
9.130000	20.7	9.000	Off	N	10.0	29.3	50.0
9.354000	22.7	9.000	Off	N	10.1	27.3	50.0
9.504000	23.7	9.000	Off	N	10.1	26.3	50.0
9.564000	23.7	9.000	Off	N	10.1	26.3	50.0
9.674000	23.6	9.000	Off	N	10.1	26.4	50.0
9.732000	23.6	9.000	Off	N	10.1	26.4	50.0

2017-11-17

오후 4:58:07

10. LIST OF TEST EQUIPMENT

10.1 LIST OF TEST EQUIPMENT(Conducted Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216 / LISN	12/23/2016	Annual	100073
Rohde & Schwarz	ESCI / Test Receiver	12/23/2016	Annual	100584
Agilent	N9020A / Signal Analyzer	06/13/2017	Annual	MY51110085
Agilent	N9030A / Signal Analyzer	11/30/2016	Annual	MY49431210
Agilent	N1911A / Power Meter	04/17/2017	Annual	MY45100523
Agilent	N1921A / Power Sensor	04/17/2017	Annual	MY52260025
Hewlett Packard	E3632A / DC Power Supply	04/11/2017	Annual	KR75306225
Agilent	8493C / Attenuator(10 dB)	07/10/2017	Annual	07560
Rohde & Schwarz	EMC32 / Software	-	-	-

10.2 LIST OF TEST EQUIPMENT(Radiated Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Innco system	MA4000-EP / Antenna Position Tower	N/A	N/A	N/A
Innco system	CT0800 / Turn Table	N/A	N/A	N/A
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
ETS	2090 / Controller(Turn table)	N/A	N/A	1646
Rohde & Schwarz	Loop Antenna	04/19/2017	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	04/06/2017	Biennial	760
Schwarzbeck	BBHA 9120D / Horn Antenna	12/11/2015	Biennial	9120D-1191
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	04/25/2017	Biennial	BBHA9170124
Rohde & Schwarz	FSP / Spectrum Analyzer	09/21/2017	Annual	836650/016
Wainwright Instruments	WHKX10-2700-3000-18000-40SS / High Pass Filter	08/01/2017	Annual	4
Wainwright Instruments	WHKX8-6090-7000-18000-40SS / High Pass Filter	07/11/2017	Annual	5
Wainwright Instruments	WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter	06/30/2017	Annual	2
Wainwright Instruments	WRCJV5100/5850-40/50-8EEK / Band Reject Filter	01/24/2017	Annual	2
H.P.	8491A / Attenuator(10 dB)	08/01/2017	Annual	18593
CERNEX	CBLU1183540 / Power Amplifier	01/25/2017	Annual	24614
CERNEX	CBL06185030 / Power Amplifier	01/25/2017	Annual	24615
CERNEX	CBL18265035 / Power Amplifier	01/23/2017	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	06/30/2017	Annual	25956