HCT CO.,LTD.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
TEL: +82-31-645-6300 **FAX: +82-31-645-6401**

FCC/ISED DTS REPORT

Certification

Applicant Name:
EVERINT Co.,Ltd.

Address:
(Yongtan-dong) 129, Chungjusandan 1-ro, Chungju-si, Chungcheongbuk-do, Korea

Date of Issue:
December 28, 2016
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-1612-F069
HCT FRN: 0005866421
ISED Registration Number : 5944A-5

FCC ID	**: 2AKMF-WD-MSO**
IC	**: 22266-WDMSO**
APPLICANT	**: EVERINT Co.,Ltd.**

Model(s):	WD-MSO
EUT Type:	WLAN Module (Data transmission equipment)
Peak Output Power:	Wi-Fi 802.11b(21.78 dBm) / Wi-Fi 802.11g (22.02 dBm) / Wi-Fi 802.11n_HT20 (22.04 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
IC Rule Part(s):	RSS-247 Issue 1(May 2015) , 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.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by
: Seul Ki Lee
Test Engineer of RF Team

Approved by
: Jong Seok Lee
Manager of RF Team

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1612-F069	December 28, 2016	- First Approval Report

Table of Contents

1. GENERAL INFORMATION 4
2. EUT DESCRIPTION 4
3. TEST METHODOLOGY 5
3.1 EUT CONFIGURATION 5
3.2 EUT EXERCISE 5
3.3 GENERAL TEST PROCEDURES 5
3.4 DESCRIPTION OF TEST MODES 5
4. INSTRUMENT CALIBRATION 6
5. FACILITIES AND ACCREDITATIONS 6
5.1 FACILITIES 6
5.2 EQUIPMENT 6
6. ANTENNA REQUIREMENTS 6
7. MEASUREMENT UNCERTAINTY 7
8. SUMMARY TEST OF RESULTS 8
8.1 FCC Part 8
8.2 IC Part 9
9. TEST RESULT 10
9.1 DUTY CYCLE 10
9.2 6dB BANDWIDTH 12
9.3 99% BANDWIDTH (802.11b/g/n) 16
9.4 OUTPUT POWER (802.11b/g/n) 23
9.5 POWER SPECTRAL DENSITY (802.11b/g/n) 30
9.6 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS 34
9.7 RADIATED MEASUREMENT 47
9.7.1 RADIATED SPURIOUS EMISSIONS 47
9.7.2 RECEIVER SPURIOUS EMISSIONS 65
9.7.3 RADIATED RESTRICTED BAND EDGES 66
9.8 POWERLINE CONDUCTED EMISSIONS 72
10. LIST OF TEST EQUIPMENT 77
10.1 LIST OF TEST EQUIPMENT(Conducted Test) 77
10.2 LIST OF TEST EQUIPMENT(Radiated Test) 78

1. GENERAL INFORMATION

Applicant:	EVERINT Co.,Ltd.
Address:	(Sampyeong-dong, 7th~8th FL, Miraeasset Venture Tower), 20, Pangyoyeok-ro241beon-gil, Bundang-gu Seongnam-si, Gyeonggi-do, Korea
FCC ID:	2AKMF-WD-MSO
IC:	22266-WDMSO
EUT Type:	WLAN Module (Data transmission equipment)
Model (s):	WD-MSO
Date(s) of Tests:	November 09, 2016 ~ November 21, 2016
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea (ISED Registration Number : 5944A-5)

2. EUT DESCRIPTION

Model	WD-MSO	
EUT Type	WLAN Module (Data transmission equipment)	
Power Supply	DC 3.3 V	
Frequency Range	TX: 2412 MHz ~ 2462 MHz RX: 2412 MHz ~ 2462 MHz	
Max. RF Output Power	Peak	Wi-Fi 802.11b(21.78 dBm) / Wi-Fi 802.11g (22.02 dBm) / Wi-Fi 802.11n_HT20 (22.04 dBm)
	Average	Wi-Fi 802.11b(16.12 dBm) / Wi-Fi 802.11g (13.46 dBm) / Wi-Fi 802.11n_HT20 (13.41 dBm)
Modulation Type	DSSS/CCK(802.11b), OFDM(802.11g, 802.11n)	
Antenna Specification	Manufacturer: N.K.C Wireless Solution Antenna type: CHIP ANTENNA Peak Gain : 0.27 dBi	

3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v03r05 dated April 08, 2016 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 / the RSS-GEN issue 4, RSS-247 issue 1.

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 v03r05)

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

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. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±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)	6.07

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 8.7		PASS
Radiated Spurious Emissions	§15.205, 15.209	cf. Section 8.6.1	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 8.6.2		PASS

8.2 IC Part

Test Description	IC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	RSS-247, 5.2	> 500 kHz	CONDUCTED	PASS
99% Bandwidth	RSS-GEN [4.6.1]	N/A		NA
Conducted Maximum Peak Output Power And e.i.r.p.	RSS-210 [A8.4]	< 1 Watt <4 Watt(e.i.r.p.)		PASS
Power Spectral Density	RSS-210 [A8.2]	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	RSS-210 [A8.5]	Conducted > 20 dBc		PASS
AC Power line Conducted Emissions	RSS-GEN [7.2.2]	cf. Section 8.8		PASS
Radiated Spurious Emissions	RSS-210 [A8.5]	cf. Section 8.7.1	RADIATED	PASS
Receiver Spurious Emissions	RSS-GEN, Section 7.2.3	cf. Section 8.7.2		PASS
Radiated Restricted Band Edge	RSS-210 [A8.5]	cf. Section 8.7.3		PASS

9. TEST RESULT

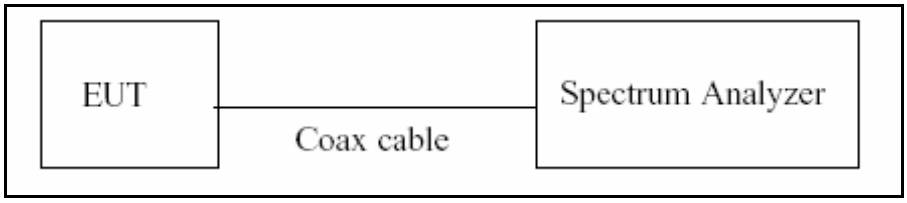
9.1 DUTY CYCLE

▣ TEST PROCEDURE

According to Section 6.0)b) in KDB 558074 v03r05.

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 ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ 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 ≤ 16.7 microseconds.)

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested accroding to the zero-span measurement method, 6.0)b) in KDB 558074 v03r05.

The largest availble 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 ≤ 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 availble value)
2. VBW = 8 MHz (≥ 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*log(1/Duty Cycle)

▣ **Duty Cycle Factor**

Mode	Data Rate	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
b	1 Mbps	32.160	32.310	0.99535747	0.020
	2 Mbps	16.070	16.220	0.99075216	0.040
	5.5 Mbps	5.903	6.014	0.98154307	0.081
	11 Mbps	3.007	3.118	0.96440026	0.157
g	6 Mbps	5.340	5.391	0.99053979	0.041
	9 Mbps	3.579	3.614	0.99031544	0.042
	12 Mbps	2.683	2.723	0.98531032	0.064
	18 Mbps	1.795	1.829	0.98141061	0.081
	24 Mbps	1.351	1.385	0.97545126	0.108
	36 Mbps	0.908	0.943	0.96288441	0.164
	48 Mbps	0.685	0.719	0.95271210	0.210
	54 Mbps	0.616	0.648	0.95061728	0.220
n_HT20	MCS Index 0	5.069	5.119	0.99023247	0.043
	MCS Index 1	2.559	2.604	0.98271889	0.076
	MCS Index 2	1.715	1.752	0.97888128	0.093
	MCS Index 3	1.296	1.330	0.97443609	0.112
	MCS Index 4	0.877	0.910	0.96373626	0.160
	MCS Index 5	0.667	0.700	0.95285714	0.210
	MCS Index 6	0.598	0.632	0.94620253	0.240
	MCS Index 7	0.542	0.576	0.94097222	0.264

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

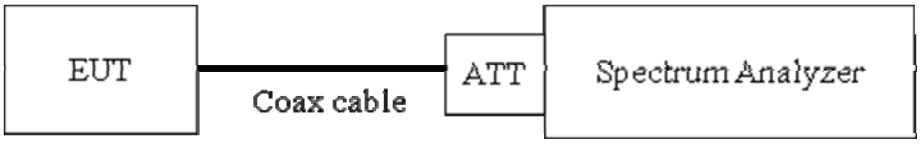
9.2 6dB BANDWIDTH

Test Requirements and limit, §15.247(a)(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 v03r05)

RBW = 100 kHz

VBW ≥ 3 x 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

Conducted 6dB Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	9.069	0.5	Pass
2437	6	9.081	0.5	Pass
2462	11	9.090	0.5	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	16.42	0.5	Pass
2437	6	16.42	0.5	Pass
2462	11	16.42	0.5	Pass

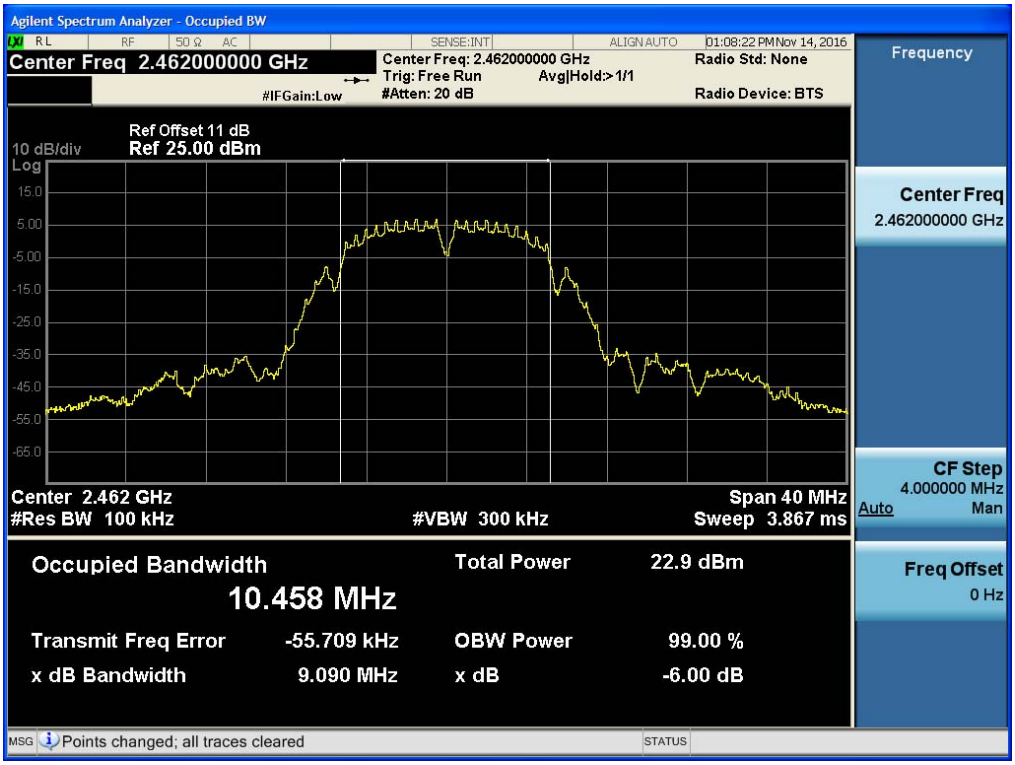
Conducted 6dB Bandwidth Measurements for 802.11n_HT20

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	17.66	0.5	Pass
2437	6	17.64	0.5	Pass
2462	11	17.65	0.5	Pass

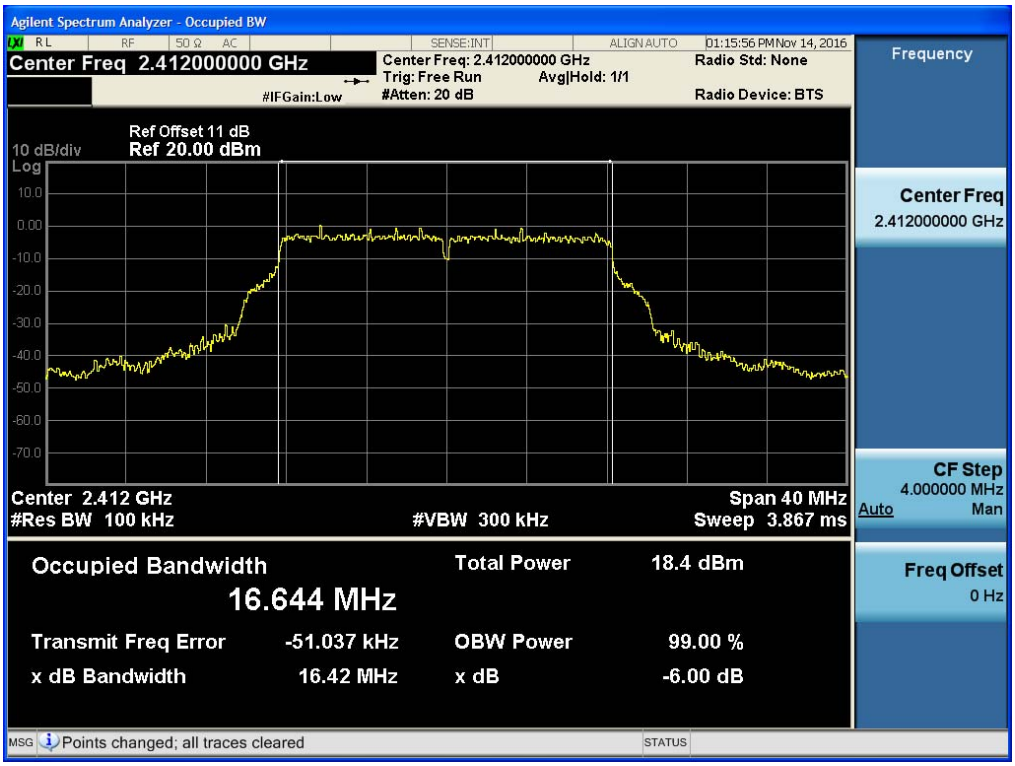
Note : In order to simplify the report, attached plots were only the most wide 6 dB BW channel.

▣ RESULT PLOTS

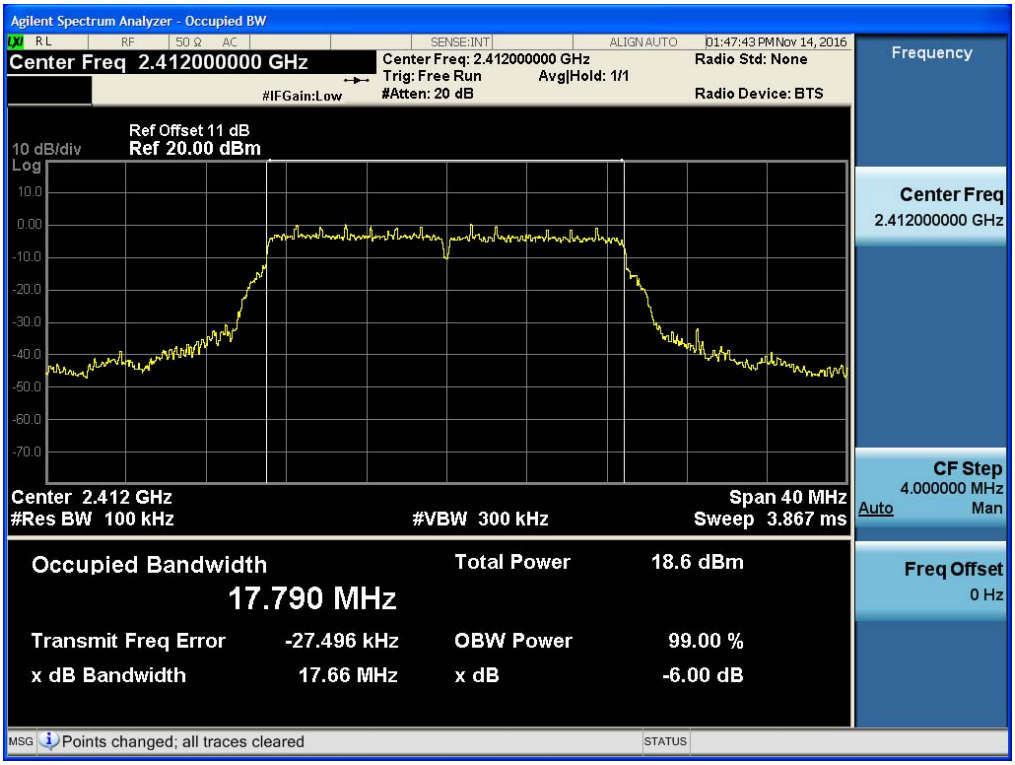
6dB Bandwidth plot (802.11b-CH 11)



6dB Bandwidth plot (802.11g-CH 1)



6dB Bandwidth plot (802.11n_HT20-CH 1)

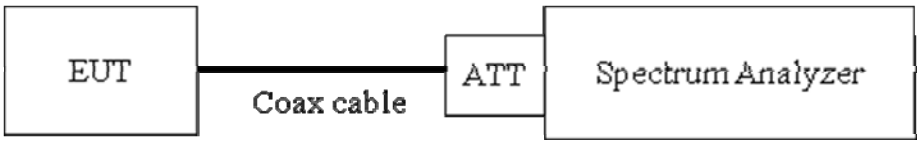


9.3 99% BANDWIDTH (802.11b/g/n)

Limit

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 ≒ 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

Conducted 99% Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
2412	1	10.319
2437	6	10.333
2462	11	10.348

Conducted 99% Bandwidth Measurements for 802.11g

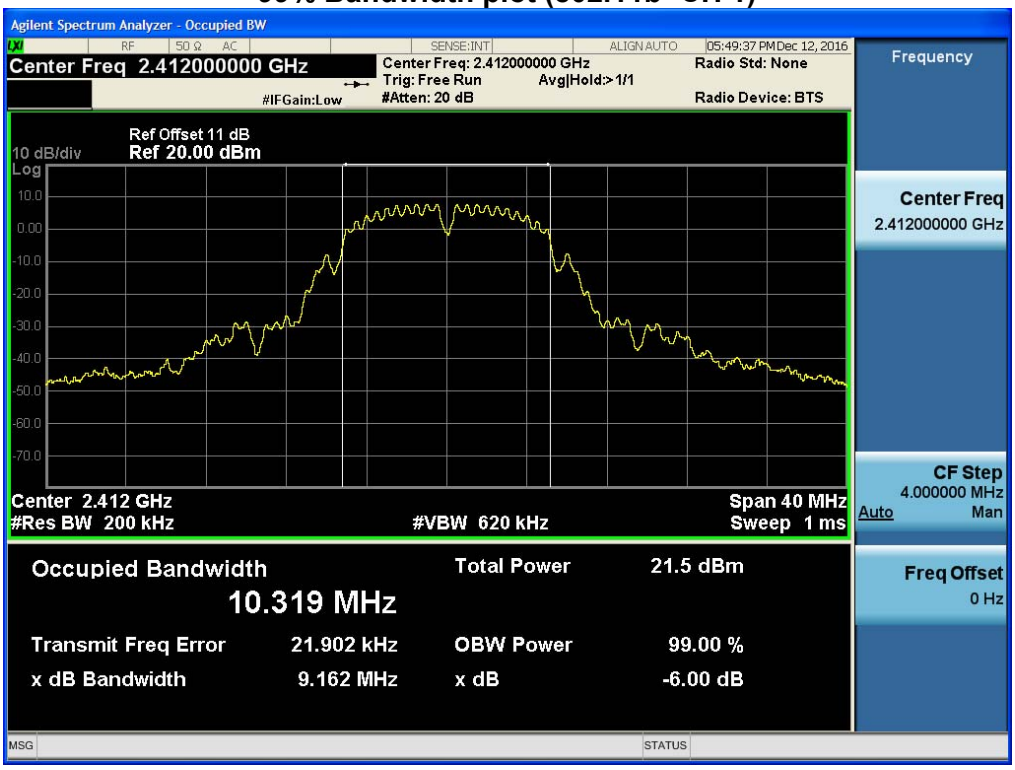
802.11g Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
2412	1	16.950
2437	6	16.959
2462	11	16.969

Conducted 99% Bandwidth Measurements for 802.11n_HT20

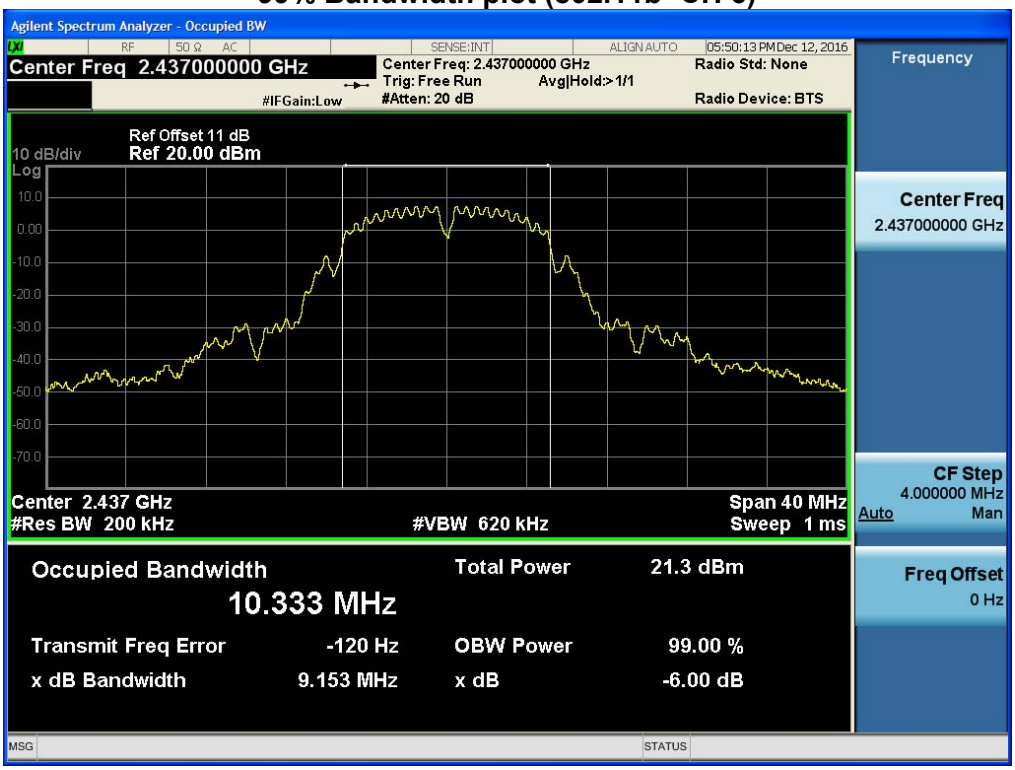
802.11n Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
2412	1	17.988
2437	6	18.061
2462	11	17.995

▣ RESULT PLOTS

99% Bandwidth plot (802.11b- CH 1)



99% Bandwidth plot (802.11b- CH 6)

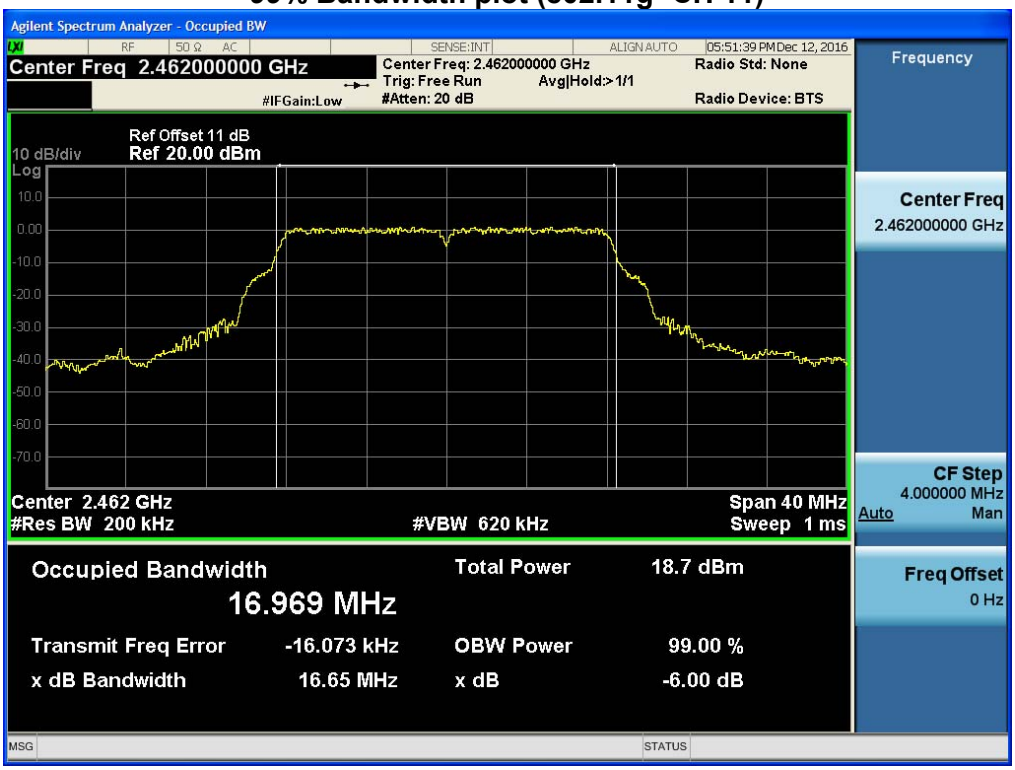


99% Bandwidth plot (802.11b- CH 11)

99% Bandwidth plot (802.11g- CH 1)

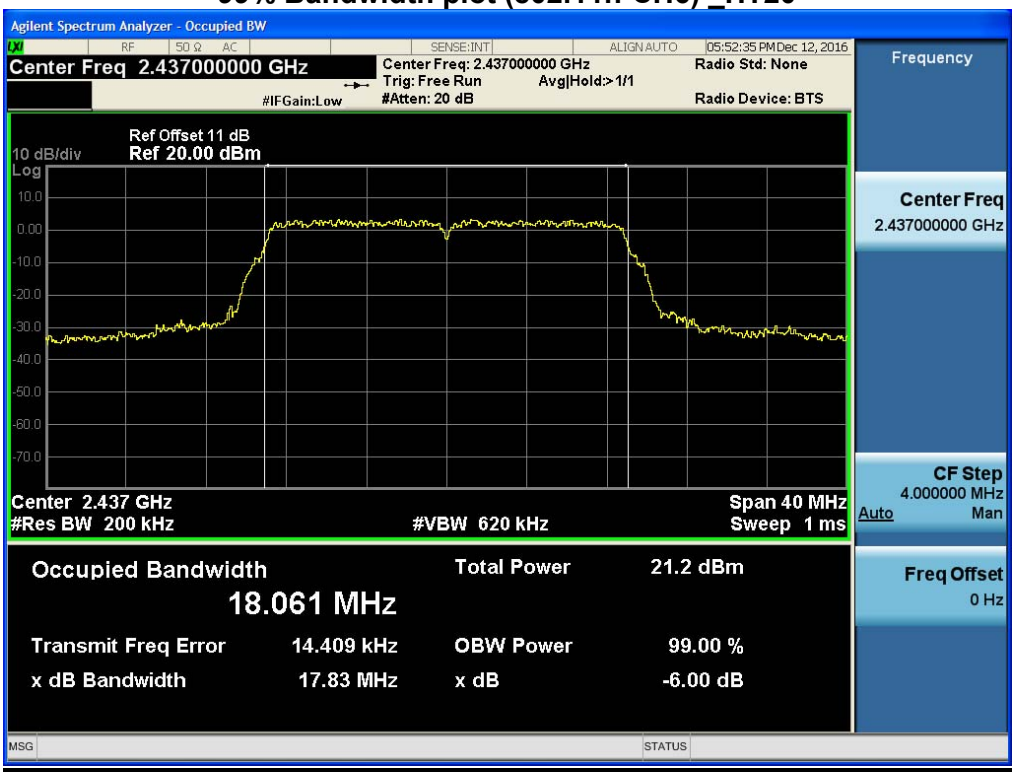
99% Bandwidth plot (802.11g- CH 6)

99% Bandwidth plot (802.11g- CH 11)

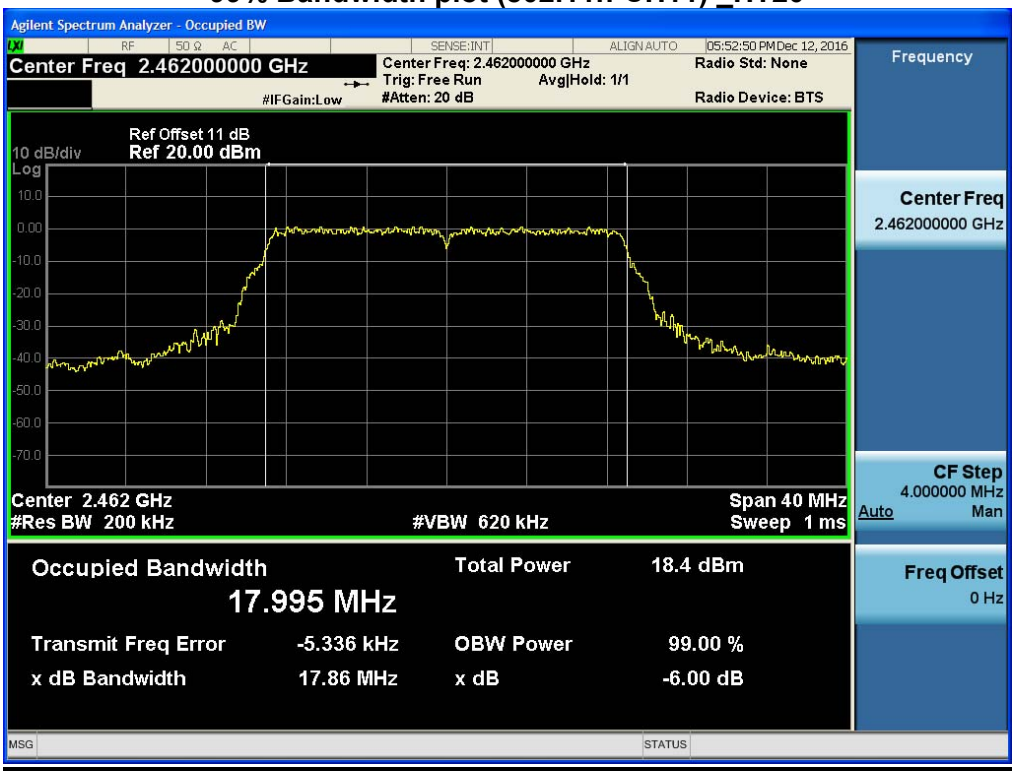


99% Bandwidth plot (802.11n-CH1) _HT20

99% Bandwidth plot (802.11n-CH6) _HT20



99% Bandwidth plot (802.11n-CH11) _HT20



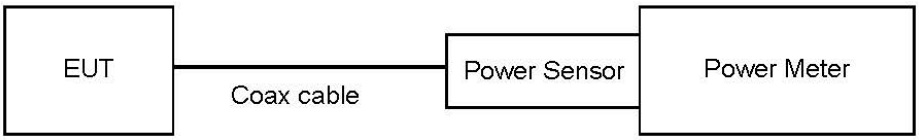
9.4 OUTPUT POWER (802.11b/g/n)

Test Requirements and limit, §15.247(b)(3)

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.

▣ TEST CONFIGURATION(20 MHz BW)



▣ TEST PROCEDURE(20 MHz BW)

▪ Peak Power (Procedure 9.1.2 in KDB 558074 v03r05)

1. Measure the peak power of the transmitter.

▪ Average Power (Procedure 9.2.3.1 in KDB 558074 v03r05)

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 tenth dB. So, 10.7 dB is offset for 2.4 GHz Band.
   Actual value of loss for the attenuator and cable combination is below table.

Band	Frequency[MHz]	Loss[dB]
2.4 GHz	2412	10.65
	2437	10.65
	2462	10.66

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

▣ TEST RESULTS-Peak

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	18.37	30
		2 Mbps	18.67	30
		5.5 Mbps	19.91	30
		11 Mbps	21.78	30
2437	6	1 Mbps	18.16	30
		2 Mbps	18.30	30
		5.5 Mbps	19.60	30
		11 Mbps	21.48	30
2462	11	1 Mbps	18.08	30
		2 Mbps	18.30	30
		5.5 Mbps	19.59	30
		11 Mbps	21.46	30

Conducted Output Power Measurements (802.11g Mode)

802.11g Mode		Rate [Mbps]	Measured Power[dBm]	Limit [dBm]
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	19.24	30
		9 Mbps	19.24	30
		12 Mbps	19.45	30
		18 Mbps	19.39	30
		24 Mbps	19.98	30
		36 Mbps	19.91	30
		48 Mbps	20.08	30
		54 Mbps	20.10	30
2437	6	6 Mbps	21.48	30
		9 Mbps	21.43	30
		12 Mbps	21.63	30
		18 Mbps	21.58	30
		24 Mbps	22.00	30
		36 Mbps	22.02	30
		48 Mbps	20.78	30
		54 Mbps	20.36	30
2462	11	6 Mbps	19.01	30
		9 Mbps	19.06	30
		12 Mbps	19.28	30
		18 Mbps	19.25	30
		24 Mbps	19.74	30
		36 Mbps	19.72	30
		48 Mbps	19.94	30
		54 Mbps	19.90	30

Conducted Output Power Measurements (802.11n_HT20 Mode)

802.11n Mode		MCS	Measured	Limit
Frequency[MHz]	Channel No.	Index	Power[dBm]	[dBm]
2412	1	0	19.40	30
		1	19.45	30
		2	19.48	30
		3	19.93	30
		4	19.95	30
		5	20.06	30
		6	20.08	30
		7	19.49	30
2437	6	0	21.46	30
		1	21.62	30
		2	21.55	30
		3	21.96	30
		4	22.04	30
		5	21.21	30
		6	20.32	30
		7	19.83	30
2462	11	0	19.04	30
		1	19.21	30
		2	19.22	30
		3	19.70	30
		4	19.80	30
		5	19.88	30
		6	19.92	30
		7	19.43	30

▣ **TEST RESULTS-Average**

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	16.10	0.020	16.12	30
		2 Mbps	16.06	0.040	16.10	30
		5.5 Mbps	15.86	0.081	15.94	30
		11 Mbps	15.84	0.157	16.00	30
2437	6	1 Mbps	15.86	0.020	15.88	30
		2 Mbps	15.70	0.040	15.74	30
		5.5 Mbps	15.58	0.081	15.66	30
		11 Mbps	15.52	0.157	15.68	30
2462	11	1 Mbps	15.75	0.020	15.77	30
		2 Mbps	15.70	0.040	15.74	30
		5.5 Mbps	15.53	0.081	15.61	30
		11 Mbps	15.50	0.157	15.66	30

Conducted Output Power Measurements (802.11g 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	11.21	0.041	11.25	30
		9 Mbps	11.22	0.042	11.26	30
		12 Mbps	11.23	0.064	11.30	30
		18 Mbps	11.22	0.081	11.30	30
		24 Mbps	11.25	0.108	11.36	30
		36 Mbps	11.17	0.164	11.33	30
		48 Mbps	11.17	0.210	11.38	30
		54 Mbps	11.16	0.220	11.38	30
2437	6	6 Mbps	13.42	0.041	13.46	30
		9 Mbps	13.36	0.042	13.40	30
		12 Mbps	13.38	0.064	13.45	30
		18 Mbps	13.35	0.081	13.43	30
		24 Mbps	13.30	0.108	13.41	30
		36 Mbps	13.29	0.164	13.46	30
		48 Mbps	11.93	0.210	12.14	30
		54 Mbps	11.46	0.220	11.68	30
2462	11	6 Mbps	11.03	0.041	11.07	30
		9 Mbps	11.04	0.042	11.08	30
		12 Mbps	11.07	0.064	11.14	30
		18 Mbps	11.06	0.081	11.14	30
		24 Mbps	11.04	0.108	11.15	30
		36 Mbps	11.02	0.164	11.18	30
		48 Mbps	11.01	0.210	11.22	30
		54 Mbps	11.01	0.220	11.23	30

Conducted Output Power Measurements (802.11n_HT20 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	11.31	0.043	11.35	30
		1	11.26	0.076	11.34	30
		2	11.22	0.093	11.31	30
		3	11.21	0.112	11.32	30
		4	11.17	0.160	11.33	30
		5	11.17	0.210	11.38	30
		6	11.13	0.240	11.37	30
		7	11.09	0.264	11.36	30
2437	6	0	13.36	0.043	13.41	30
		1	13.32	0.076	13.40	30
		2	13.29	0.093	13.38	30
		3	13.27	0.112	13.39	30
		4	13.25	0.160	13.41	30
		5	12.30	0.210	12.51	30
		6	11.45	0.240	11.69	30
		7	11.50	0.264	11.76	30
2462	11	0	11.01	0.043	11.05	30
		1	11.01	0.076	11.09	30
		2	11.00	0.093	11.10	30
		3	11.00	0.112	11.12	30
		4	11.00	0.160	11.16	30
		5	11.01	0.210	11.22	30
		6	11.01	0.240	11.25	30
		7	10.98	0.264	11.24	30

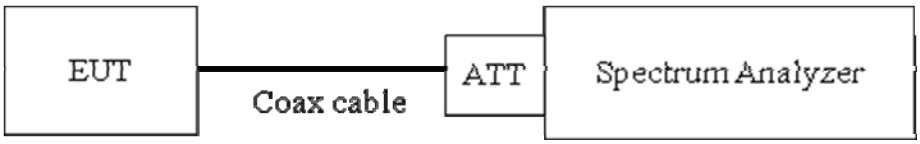
9.5 POWER SPECTRAL DENSITY (802.11b/g/n)

Test Requirements and limit, §15.247(e)

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.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074 v03r05

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)

Output Power = -5 dBm + 10 dB + 0.8 dB = 5.8 dBm

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 to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.7 dB is offset for 2.4 GHz Band.

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

Band	Frequency(MHz)	Loss(dB)
2.4 GHz	2412	10.65
	2437	10.65
	2462	10.66

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

▣ TEST RESULTS

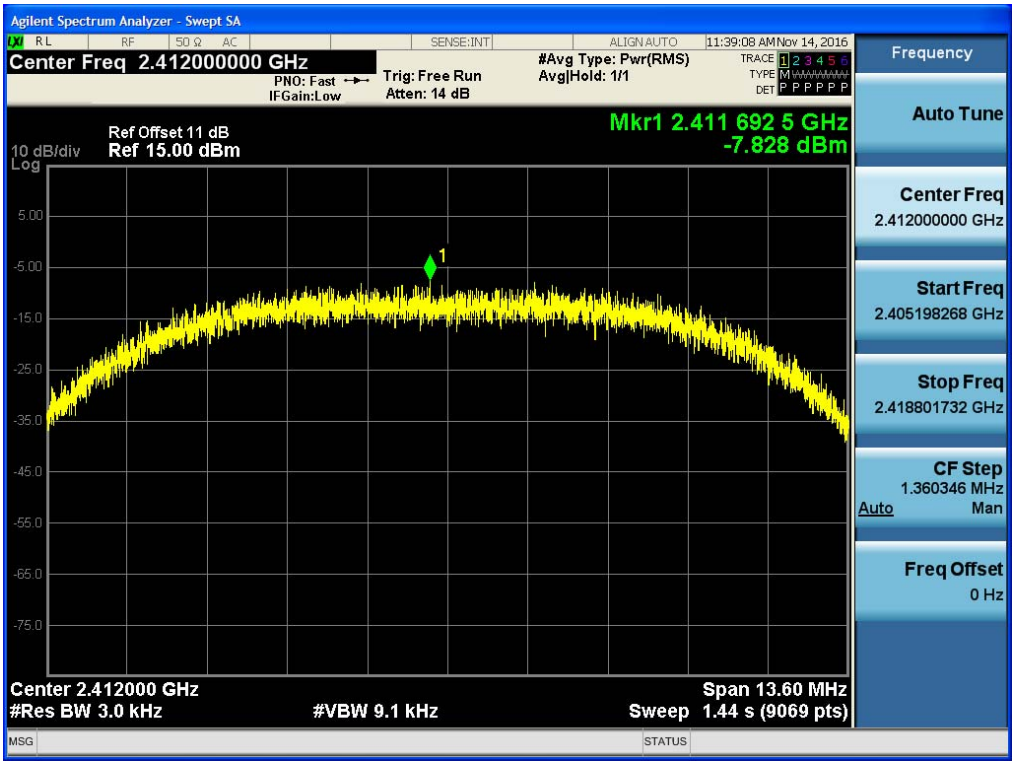
Conducted Power Density Measurements

Frequency [MHz]	Channel No.	Mode	Test Result		
			PSD [dBm]	Limit [dBm]	Pass/Fail
2412	1	802.11b	-7.828	8	Pass
2437	6		-7.956	8	Pass
2462	11		-7.958	8	Pass
2412	1	802.11g	-13.371	8	Pass
2437	6		-10.655	8	Pass
2462	11		-12.734	8	Pass
2412	1	802.11n _HT20	-14.454	8	Pass
2437	6		-11.728	8	Pass
2462	11		-13.910	8	Pass

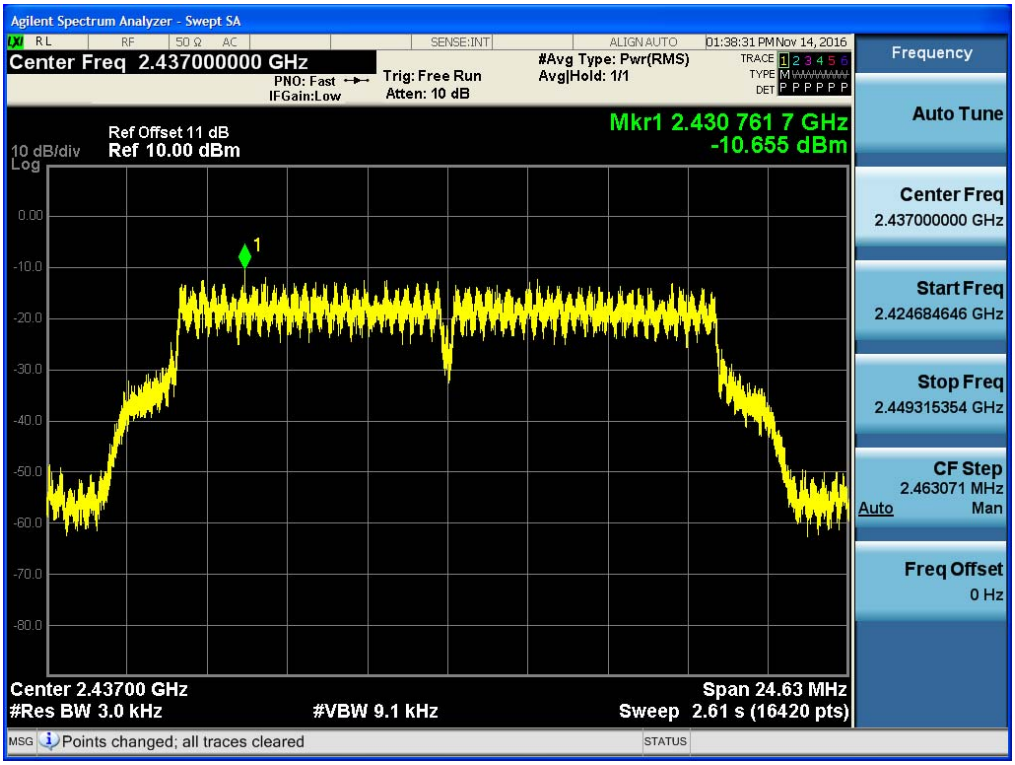
Note : In order to simplify the report, attached plots were only the highest PSD channel.

▣ RESULT PLOTS

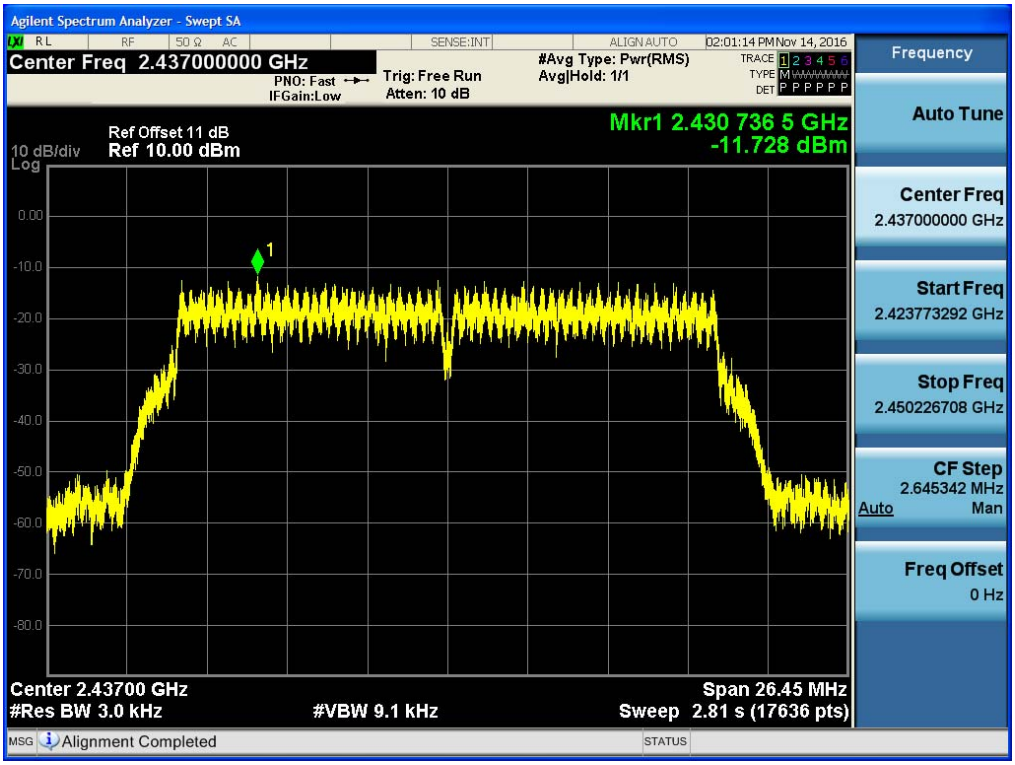
Power Spectral Density (802.11b-CH 1)



Power Spectral Density (802.11g-CH 6)



Power Spectral Density (802.11n_HT20 -CH 6)



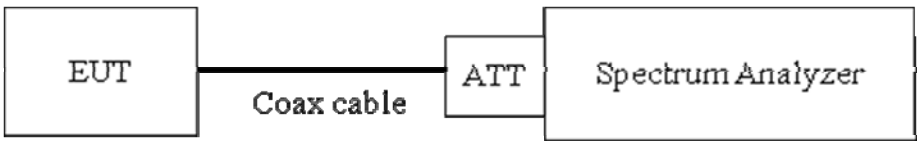
9.6 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §15.247(d)

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) 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 v03r05)

RBW = 100 kHz

VBW ≥ 3 x 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 ≥ 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 maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1(KDB558074 v03r05), so the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-

band peak PSD level in 100 kHz (i.e., 20 dBc).

2. The band edge results in plot is already including the actual values of loss for the attenuator and cable combination.
3. Spectrum offset = Attenuator loss + Cable loss
4. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.7 dB is offset for 2.4 GHz Band. Actual value of loss for the attenuator and cable combination is below table.

Band	Frequency(MHz)	Loss(dB)
2.4 GHz	2412	10.65
	2437	10.65
	2462	10.66

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

5. In case of conducted spurious emissions test, please check factors blow table.
6. In order to simplify the report, attached plots were only the worst case channel.

▣ FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	11.30
100	9.83
200	10.19
300	10.13
400	10.23
500	10.25
600	10.32
700	10.35
800	10.35
900	10.34
1000	10.39
2000	10.64
2400*	10.65
2500*	10.67
3000	10.68
4000	10.89
5000	11.07
6000	11.06
7000	11.35

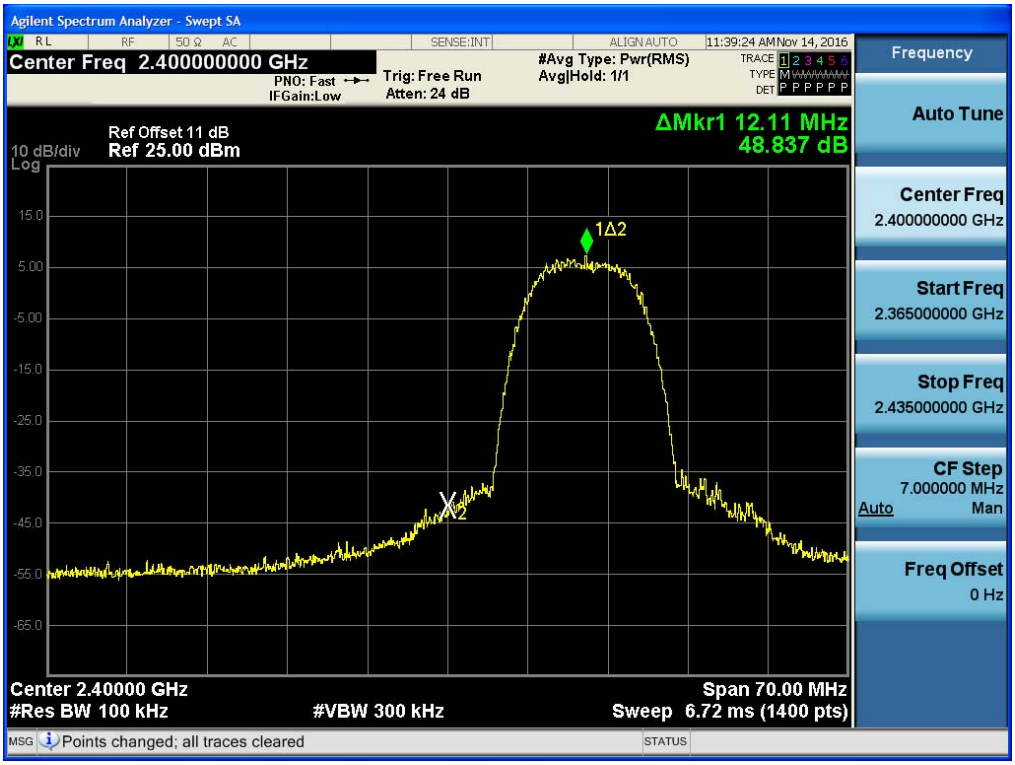
8000	11.32
9000	11.48
10000	11.56
11000	11.56
12000	11.68
13000	11.83
14000	11.90
15000	11.98
16000	12.04
17000	12.02
18000	12.08
19000	12.07
20000	12.14
21000	12.17
22000	12.31
23000	12.60
24000	12.34
25000	12.53

Note : 1. '*' is fundamental frequency range.

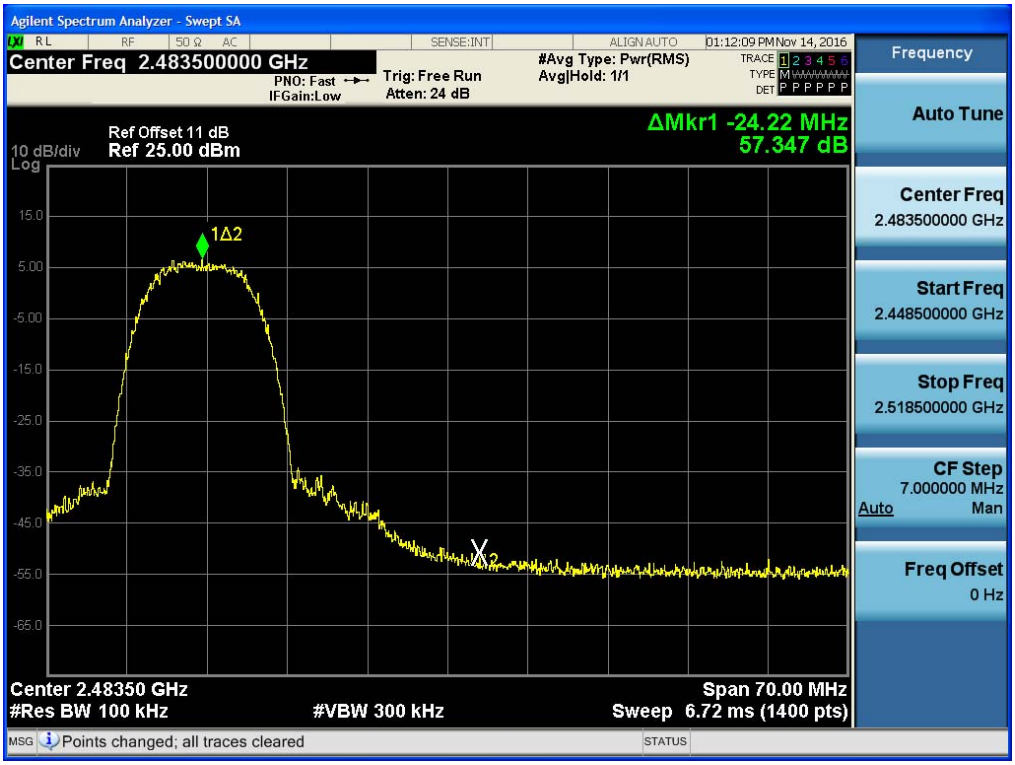
2. Factor = Cable loss + Attenuator loss

▣ RESULT PLOTS

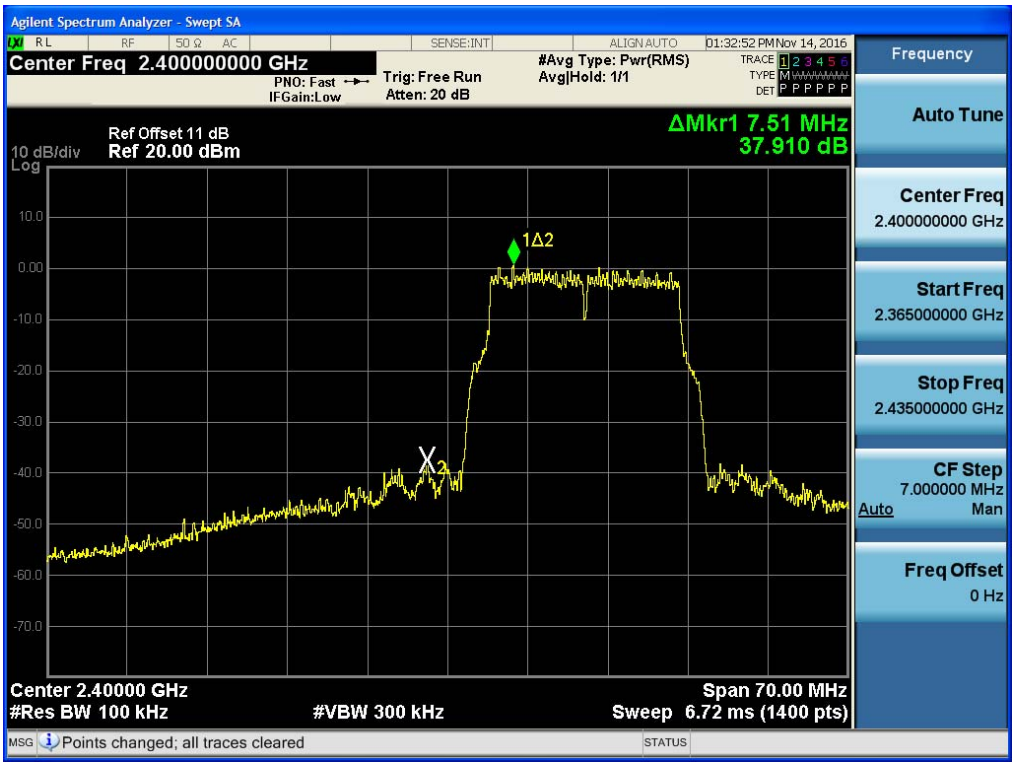
Band Edge (802.11b-CH1)



Band Edge (802.11b-CH11)

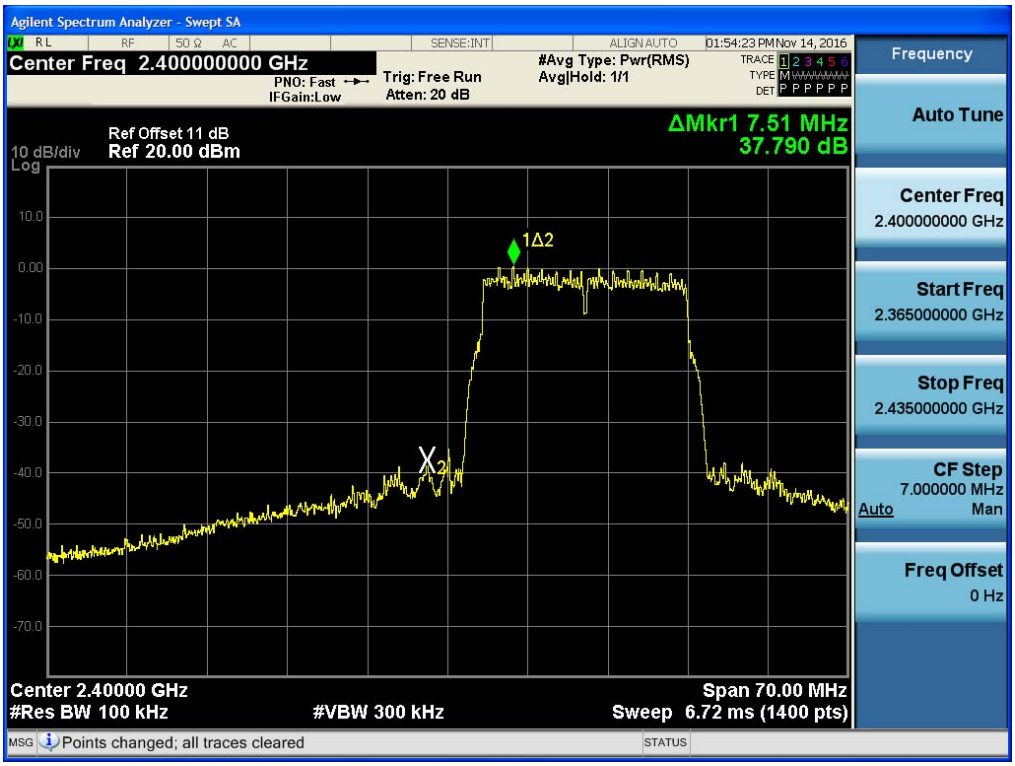


Band Edge (802.11g-CH1)

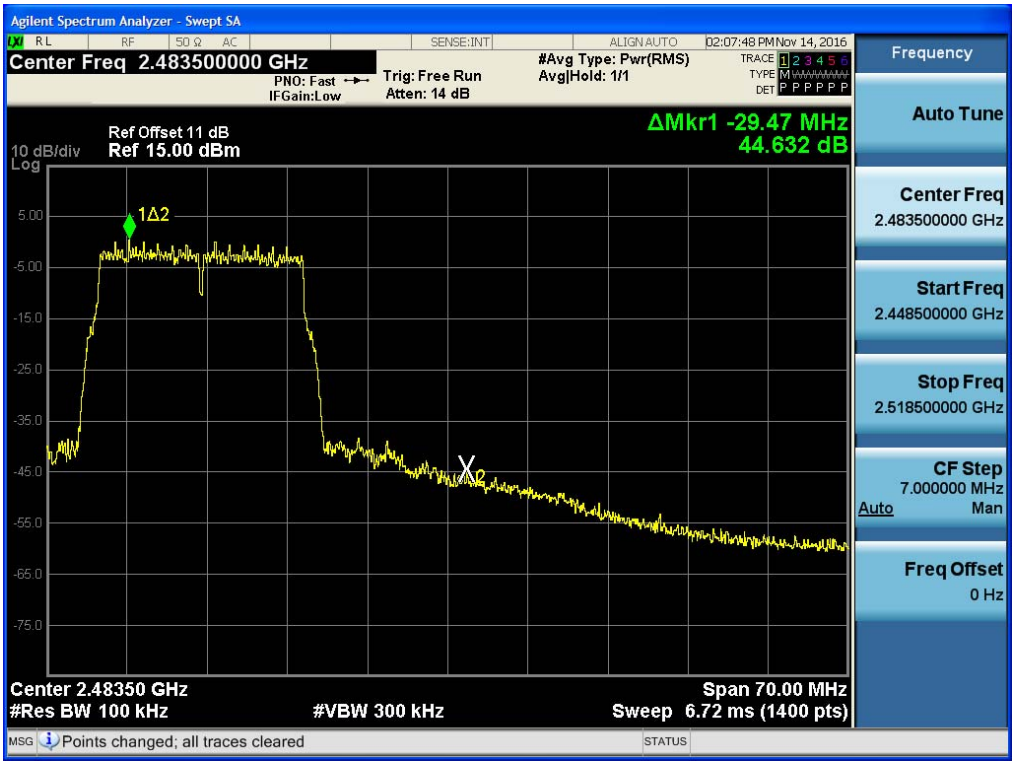


Band Edge (802.11g-CH11)

Band Edge (802.11n_HT20-CH1)

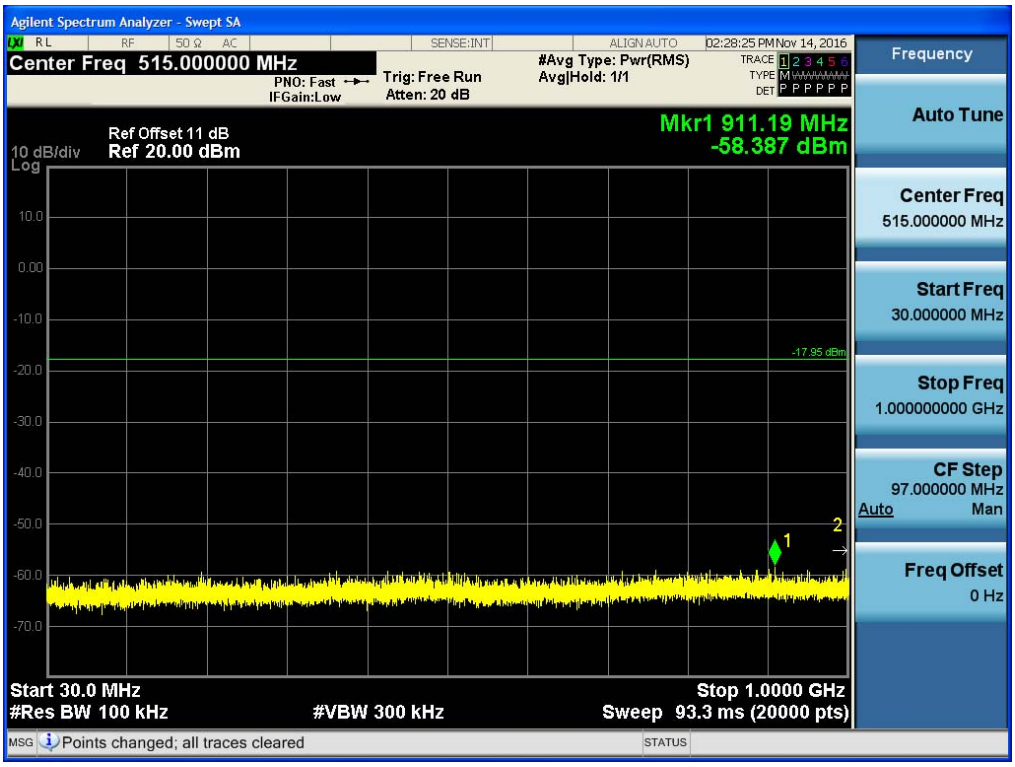


Band Edge (802.11n_HT20-CH11)



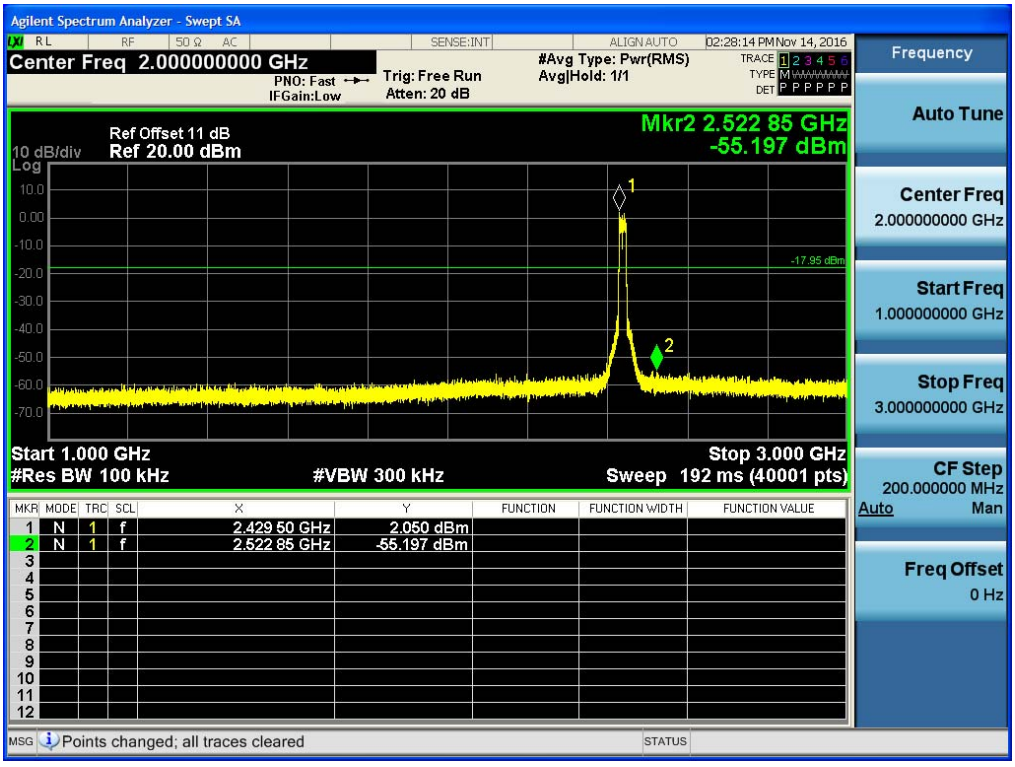
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS4)



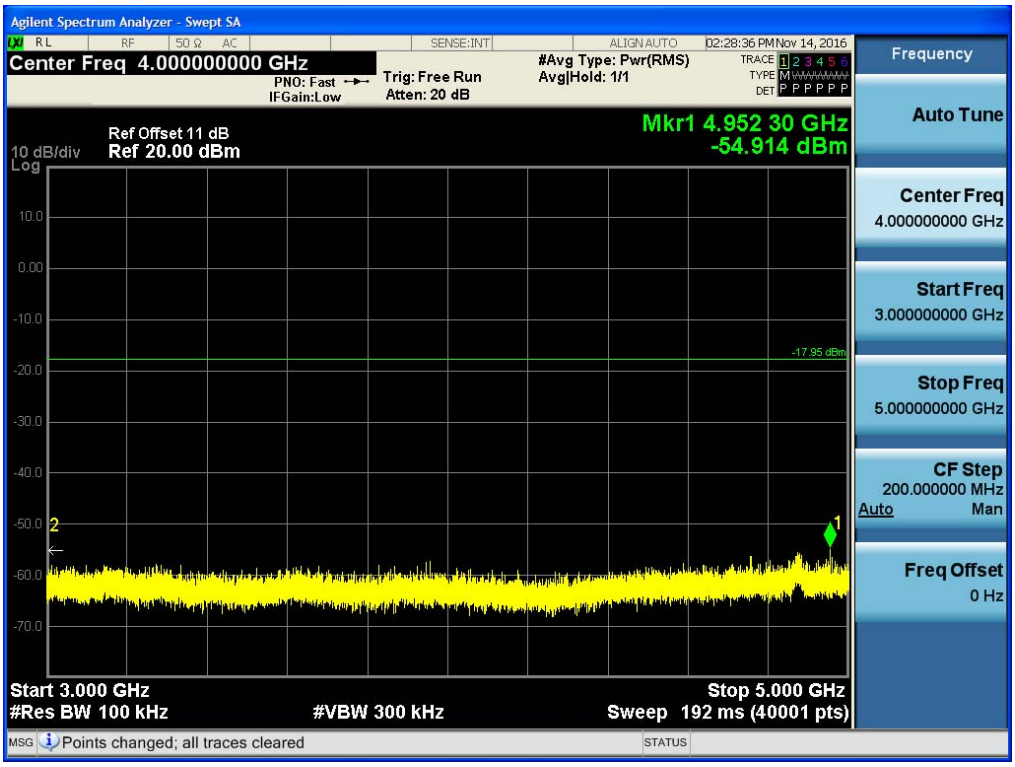
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



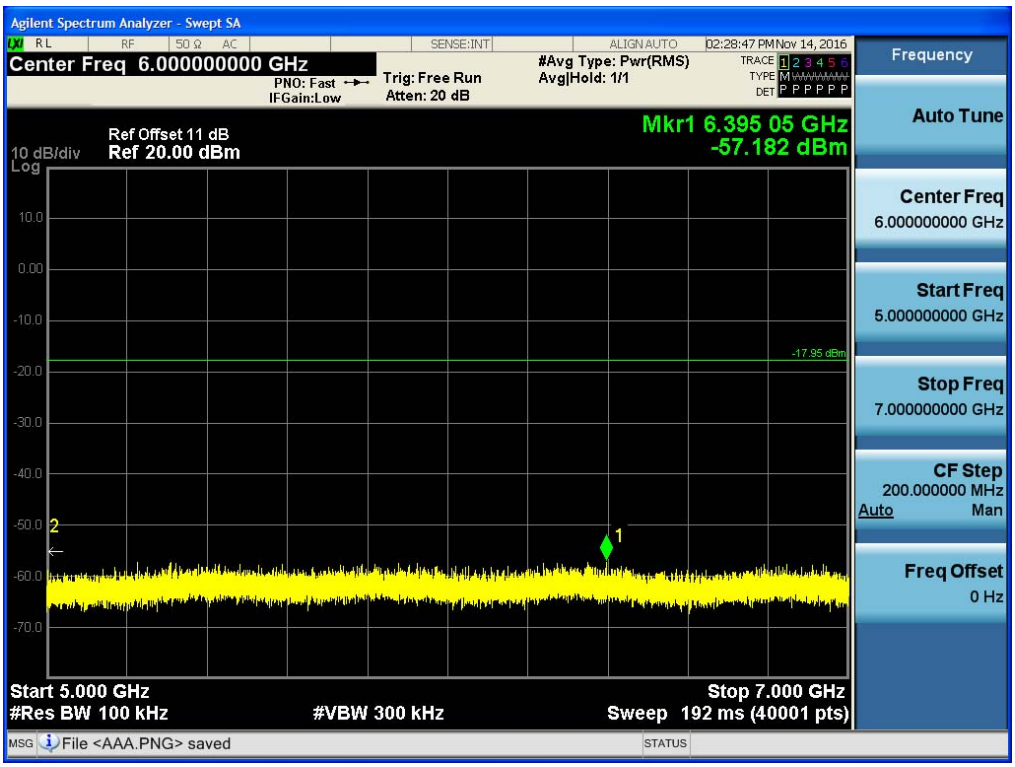
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



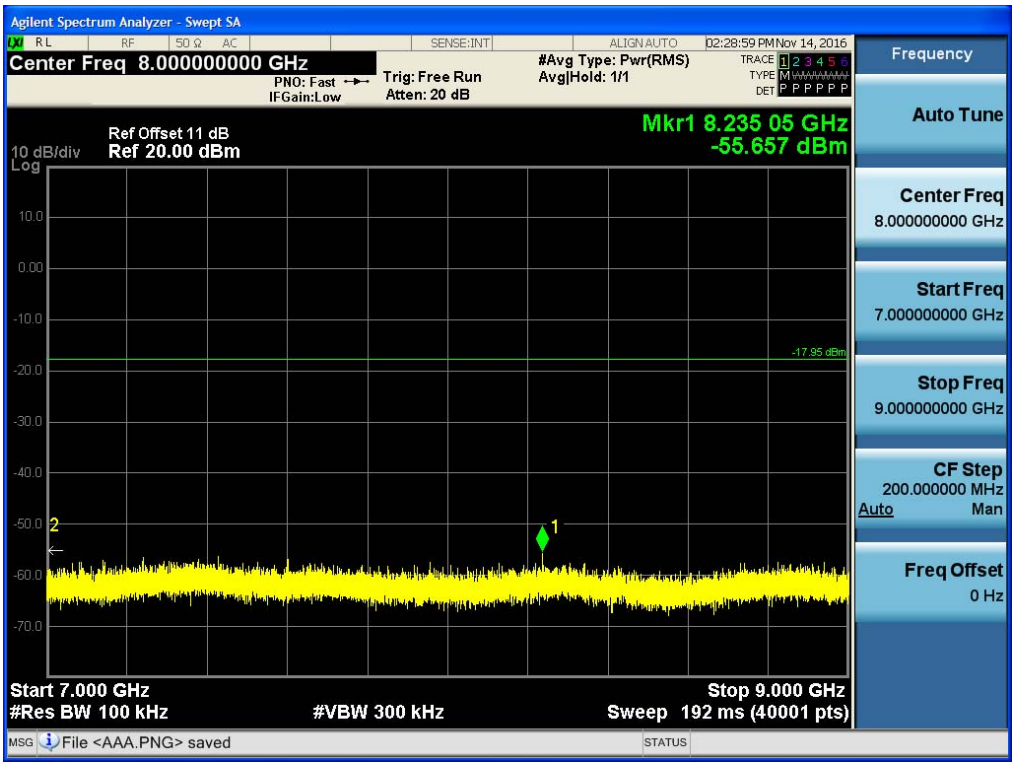
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



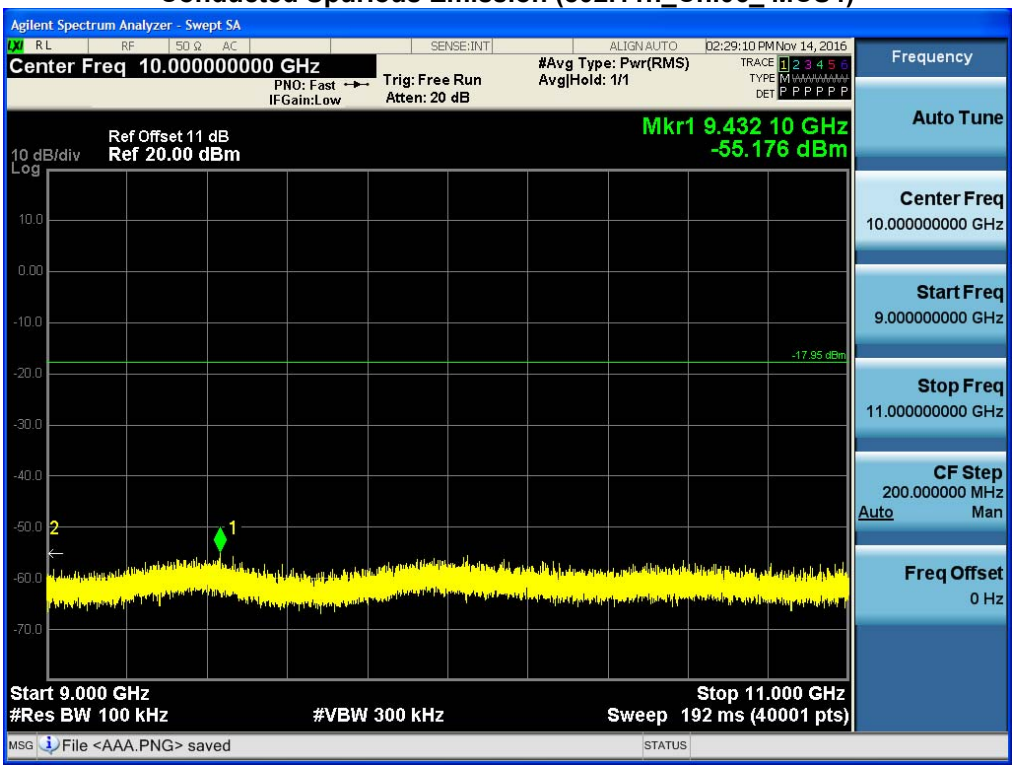
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



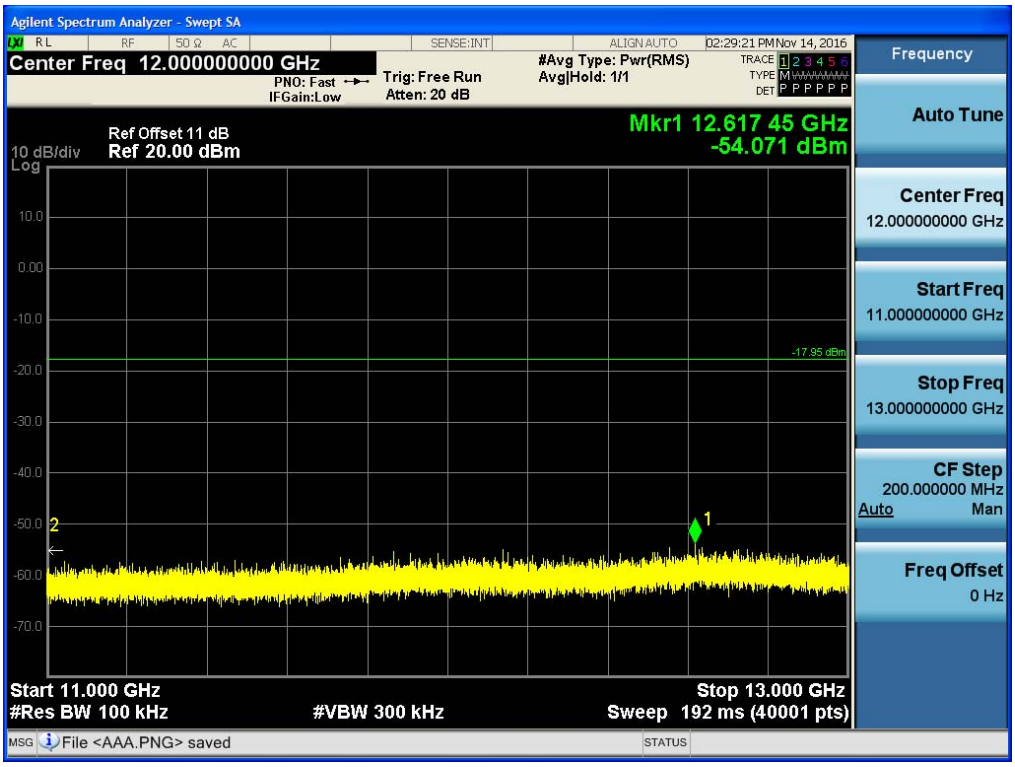
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



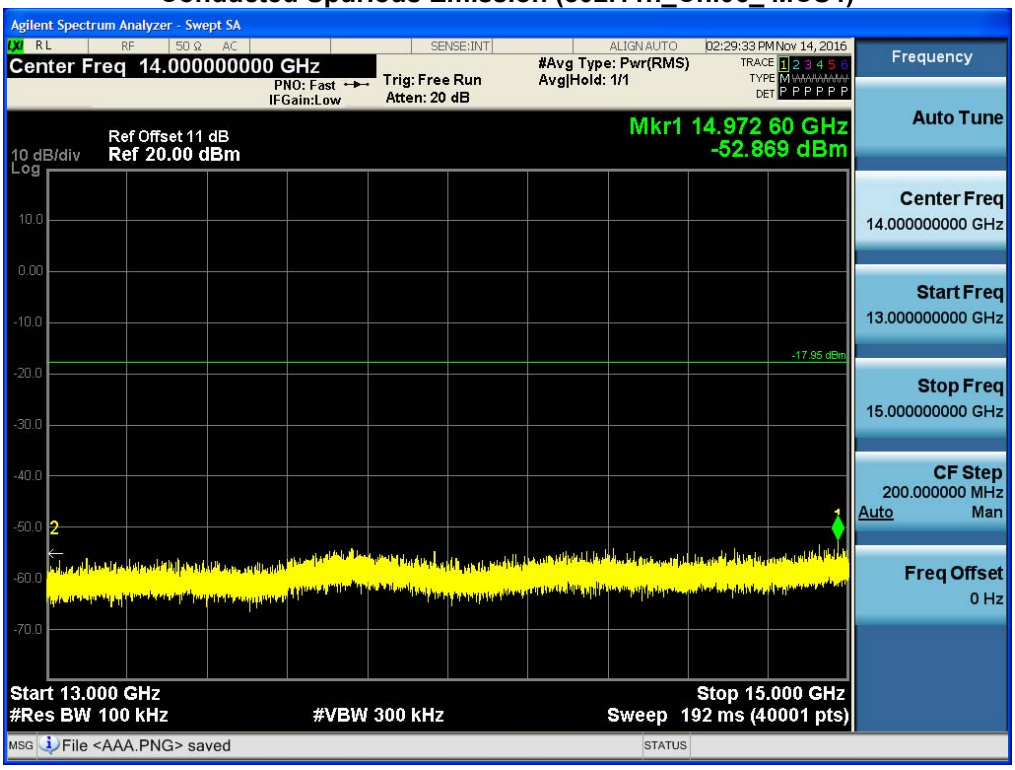
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



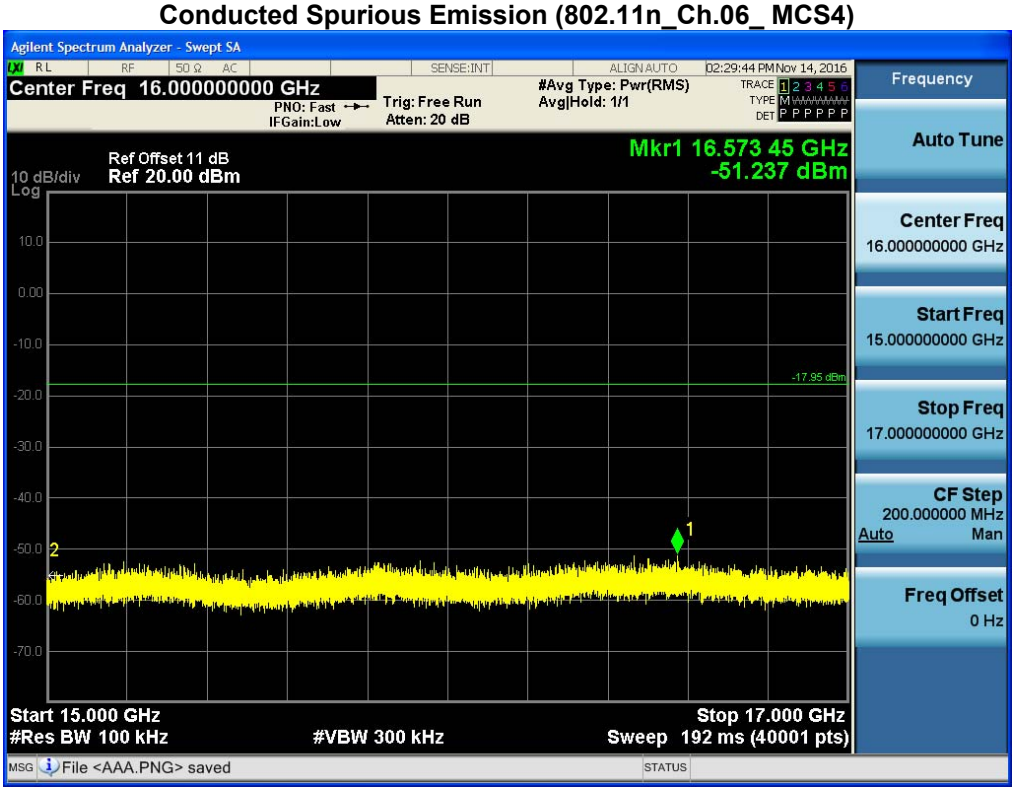
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



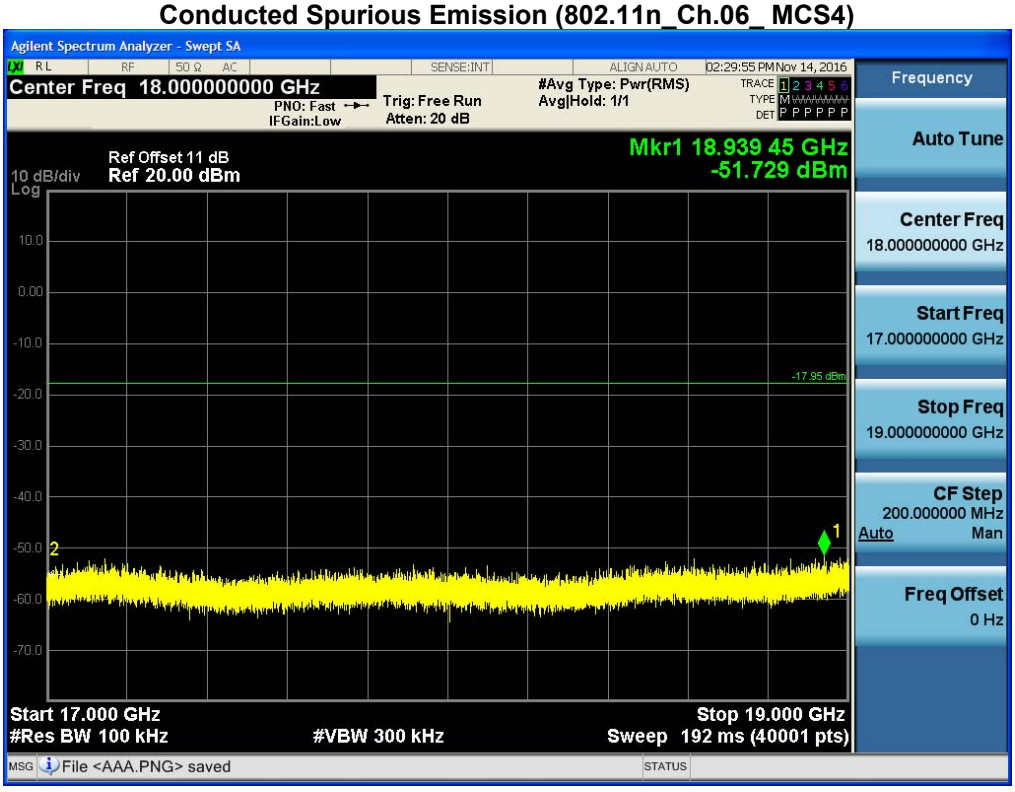
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



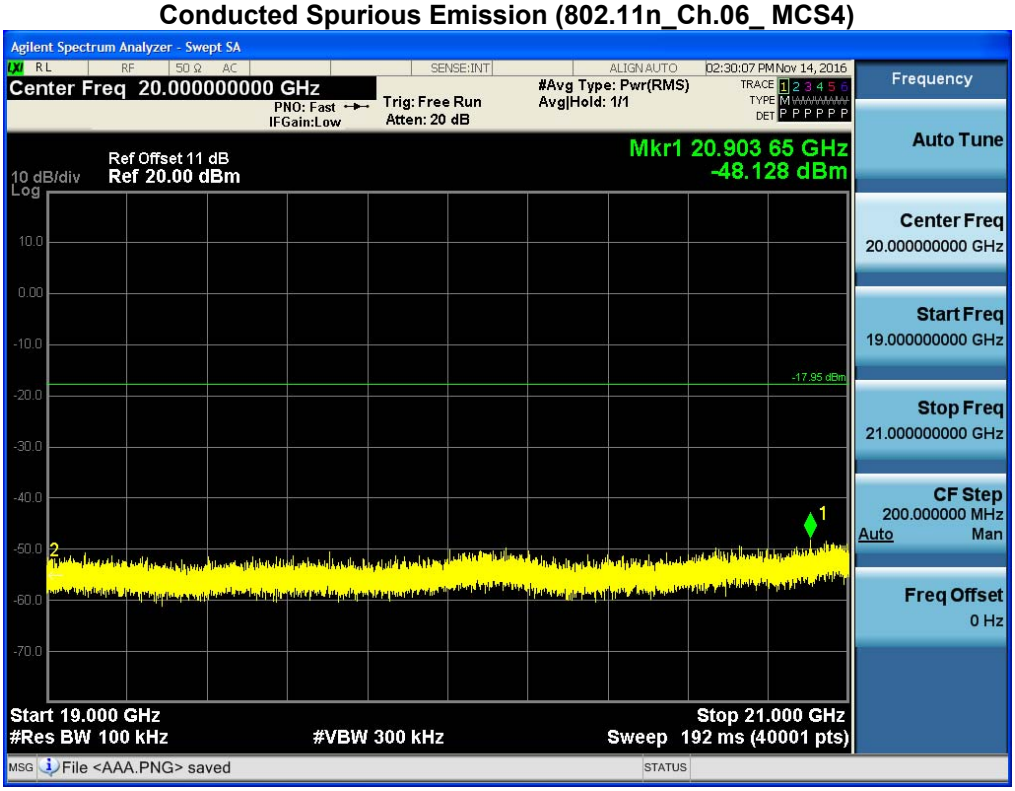
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



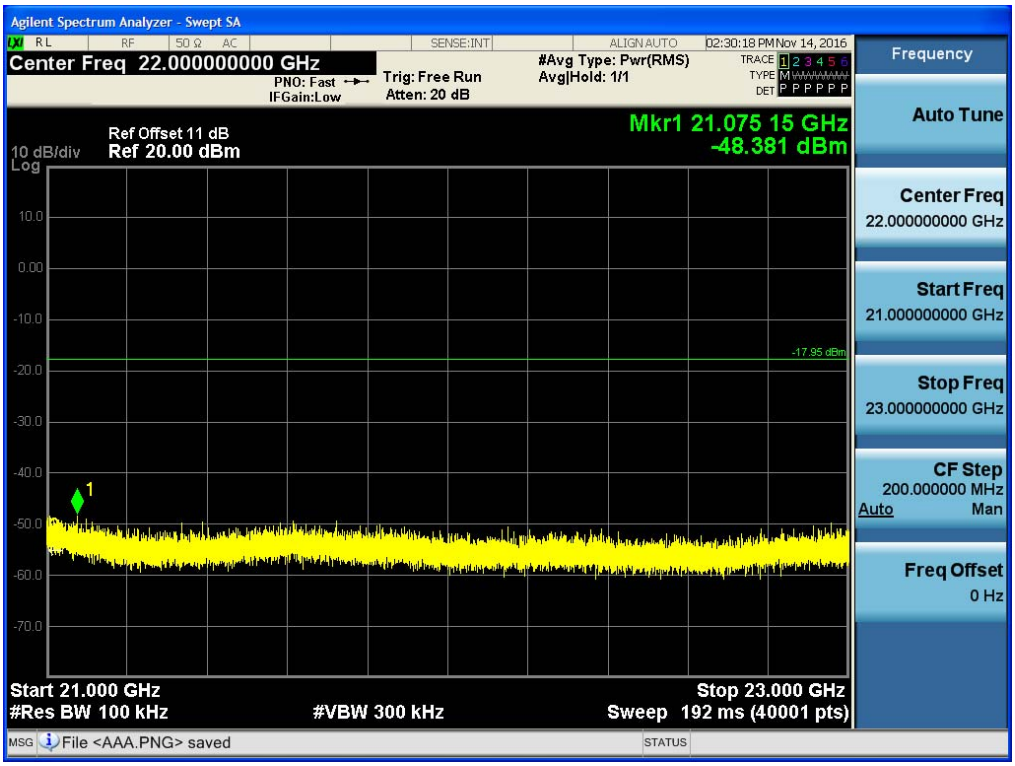
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



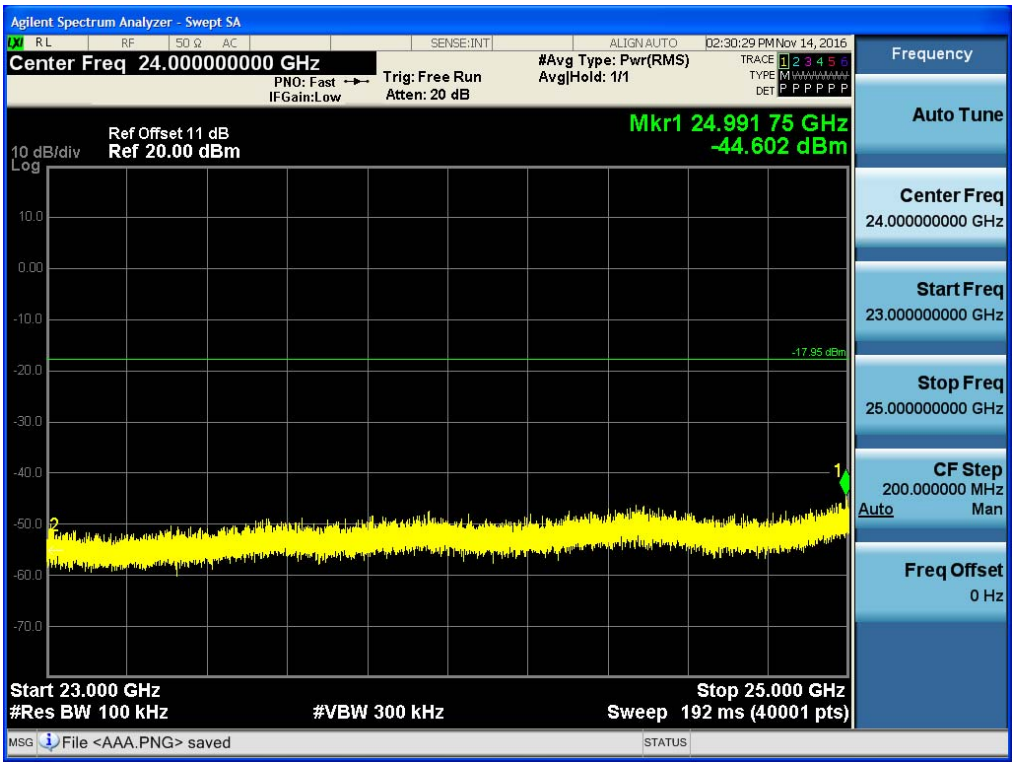
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11n_Ch.06_ MCS4)



9.7 RADIATED MEASUREMENT.

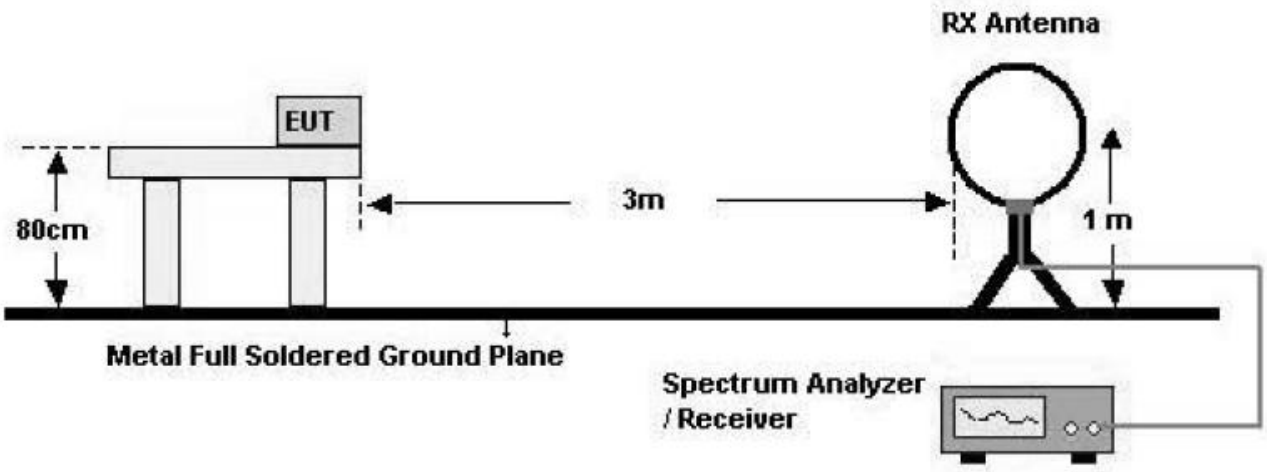
9.7.1 RADIATED SPURIOUS EMISSIONS.

Test Requirements and limit, §15.205, §15.209

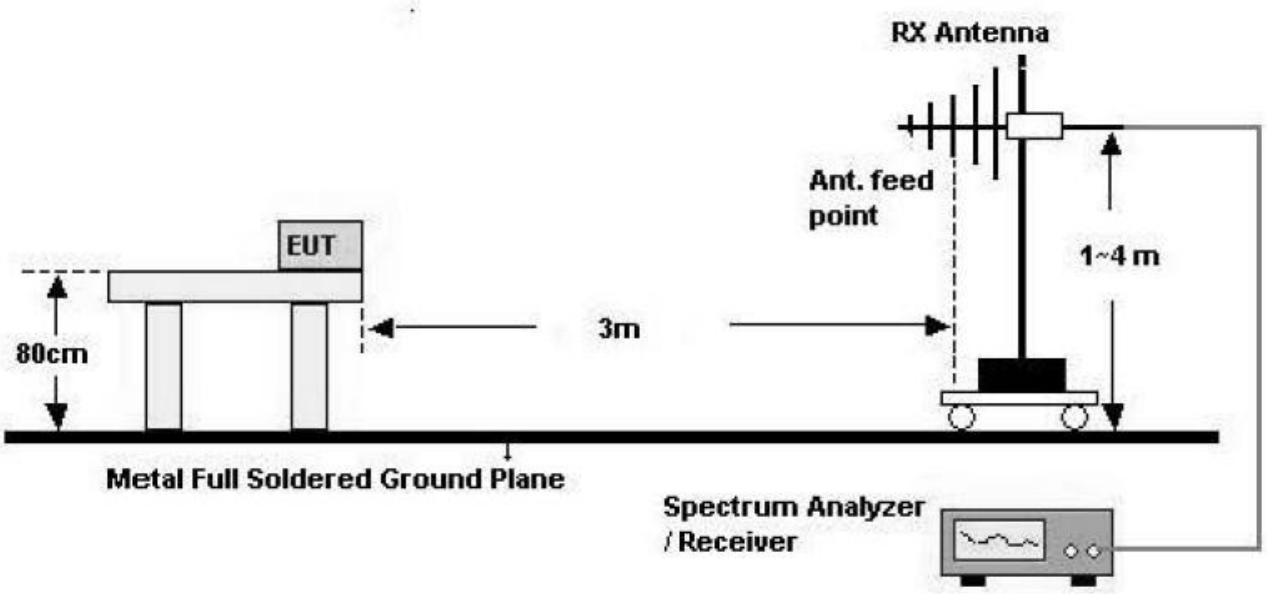
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

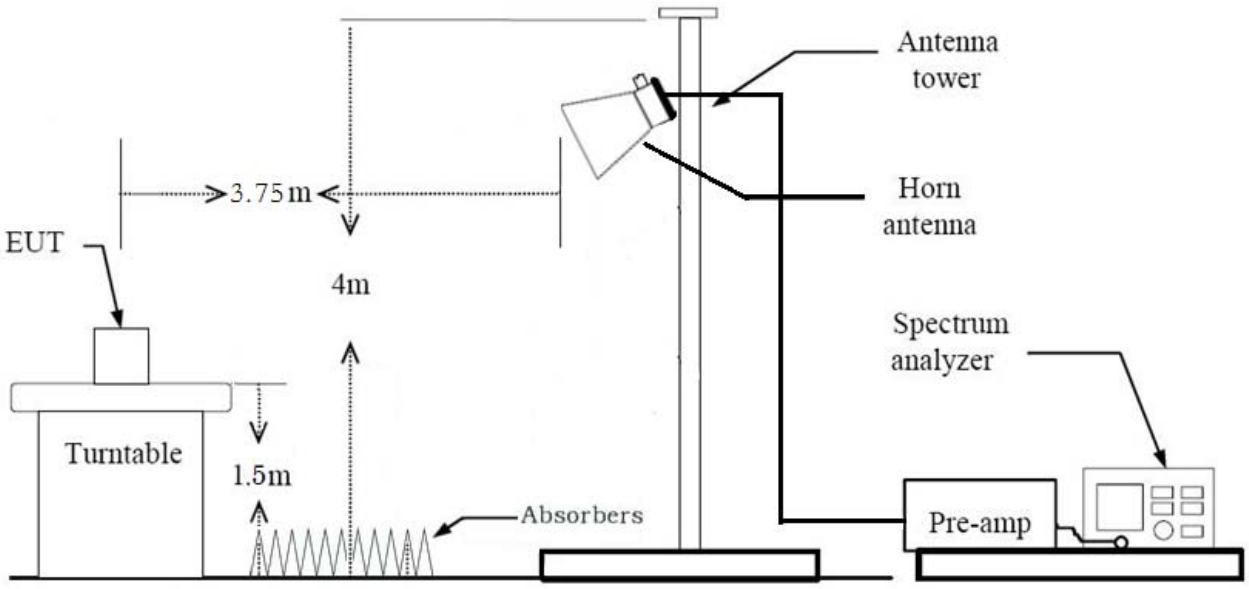
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE USED

Method 12.1 in KDB 558074 v03r05

Spectrum Setting

- Peak

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

RBW = cf. Table 1.

VBW ≥ 3 x 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 ≥ 98%)

Set RBW = 1 MHz

Set VBW ≥ 3 x 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 ±2%)

Set RBW = 1 MHz

Set VBW ≥ 3 x 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 (test distance / specific distance) (dB)
4. The duty cycle factor for 802.11 b/g/n_HT20

Mode	Worst Data rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
b	1	32.160	32.310	99.54	0.020
g	6	5.340	5.391	99.05	0.041
n_HT20	MCS Index 0	5.069	5.119	99.02	0.043

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 (specific distance / 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.

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
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	58.88	-6.51	V	52.37	73.98	21.61	PK
4824	52.10	-6.51	V	45.59	53.98	8.39	AV
7236	53.90	-0.62	V	53.28	73.98	20.70	PK
7236	42.17	-0.62	V	41.55	53.98	12.43	AV
4824	58.75	-6.51	H	52.24	73.98	21.74	PK
4824	51.94	-6.51	H	45.43	53.98	8.55	AV
7236	53.83	-0.62	H	53.21	73.98	20.77	PK
7236	42.25	-0.62	H	41.63	53.98	12.35	AV

Operation Mode:	802.11 g
Transfer Rate:	6 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	55.22	-6.51	V	48.71	73.98	25.27	PK
4824	43.08	-6.51	V	36.57	53.98	17.41	AV
7236	53.72	-0.62	V	53.10	73.98	20.88	PK
7236	41.50	-0.62	V	40.88	53.98	13.10	AV
4824	55.28	-6.51	H	48.77	73.98	25.21	PK
4824	43.05	-6.51	H	36.54	53.98	17.44	AV
7236	53.74	-0.62	H	53.12	73.98	20.86	PK
7236	41.60	-0.62	H	40.98	53.98	13.00	AV

Operation Mode:	802.11 n_HT20
Transfer MCS Index:	0
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	55.18	-6.51	V	48.67	73.98	25.31	PK
4824	43.00	-6.51	V	36.49	53.98	17.49	AV
7236	53.58	-0.62	V	52.96	73.98	21.02	PK
7236	41.58	-0.62	V	40.96	53.98	13.02	AV
4824	55.03	-6.51	H	48.52	73.98	25.46	PK
4824	43.02	-6.51	H	36.51	53.98	17.47	AV
7236	53.54	-0.62	H	52.92	73.98	21.06	PK
7236	41.52	-0.62	H	40.90	53.98	13.08	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
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. We have done 802.11b/g/n/ac mode and all data rate. Worst data rate is the lowest data of each mode.
7. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode:	802.11 b
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	58.69	-6.14	V	52.55	73.98	21.43	PK
4874	51.85	-6.14	V	45.71	53.98	8.27	AV
7311	53.39	-0.34	V	53.05	73.98	20.93	PK
7311	41.51	-0.34	V	41.17	53.98	12.81	AV
4874	58.53	-6.14	H	52.39	73.98	21.59	PK
4874	52.69	-6.14	H	46.55	53.98	7.43	AV
7311	53.85	-0.34	H	53.51	73.98	20.47	PK
7311	41.80	-0.34	H	41.46	53.98	12.52	AV

Operation Mode:	802.11 g
Transfer Rate:	6 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	56.01	-6.14	V	49.87	73.98	24.11	PK
4874	44.18	-6.14	V	38.04	53.98	15.94	AV
7311	53.63	-0.34	V	53.29	73.98	20.69	PK
7311	41.54	-0.34	V	41.20	53.98	12.78	AV
4874	55.92	-6.14	H	49.78	73.98	24.20	PK
4874	43.94	-6.14	H	37.80	53.98	16.18	AV
7311	53.38	-0.34	H	53.04	73.98	20.94	PK
7311	41.55	-0.34	H	41.21	53.98	12.77	AV

Operation Mode:	802.11 n_HT20
Transfer MCS Index:	0
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	56.10	-6.14	V	49.96	73.98	24.02	PK
4874	44.03	-6.14	V	37.89	53.98	16.09	AV
7311	53.36	-0.34	V	53.02	73.98	20.96	PK
7311	41.48	-0.34	V	41.14	53.98	12.84	AV
4874	55.90	-6.14	H	49.76	73.98	24.22	PK
4874	43.90	-6.14	H	37.76	53.98	16.22	AV
7311	53.21	-0.34	H	52.87	73.98	21.11	PK
7311	41.61	-0.34	H	41.27	53.98	12.71	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
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. We have done 802.11b/g/n/ac mode and all data rate. Worst data rate is the lowest data of each mode.
7. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode:	802.11 b
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	57.29	-5.71	V	51.58	73.98	22.40	PK
4924	49.83	-5.71	V	44.12	53.98	9.86	AV
7386	53.83	0.02	V	53.85	73.98	20.13	PK
7386	42.29	0.02	V	42.31	53.98	11.67	AV
4924	57.47	-5.71	H	51.76	73.98	22.22	PK
4924	50.74	-5.71	H	45.03	53.98	8.95	AV
7386	53.90	0.02	H	53.92	73.98	20.06	PK
7386	42.09	0.02	H	42.11	53.98	11.87	AV

Operation Mode:	802.11 g
Transfer Rate:	6 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	54.37	-5.71	V	48.66	73.98	25.32	PK
4924	42.72	-5.71	V	37.01	53.98	16.97	AV
7386	53.71	0.02	V	53.73	73.98	20.25	PK
7386	42.01	0.02	V	42.03	53.98	11.95	AV
4924	54.24	-5.71	H	48.53	73.98	25.45	PK
4924	42.65	-5.71	H	36.94	53.98	17.04	AV
7386	54.14	0.02	H	54.16	73.98	19.82	PK
7386	41.90	0.02	H	41.92	53.98	12.06	AV

Operation Mode:	802.11 n_HT20
Transfer MCS Index:	0
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	54.64	-5.71	V	48.93	73.98	25.05	PK
4924	42.68	-5.71	V	36.97	53.98	17.01	AV
7386	54.50	0.02	V	54.52	73.98	19.46	PK
7386	41.93	0.02	V	41.95	53.98	12.03	AV
4924	55.06	-5.71	H	49.35	73.98	24.63	PK
4924	42.60	-5.71	H	36.89	53.98	17.09	AV
7386	53.80	0.02	H	53.82	73.98	20.16	PK
7386	41.80	0.02	H	41.82	53.98	12.16	AV

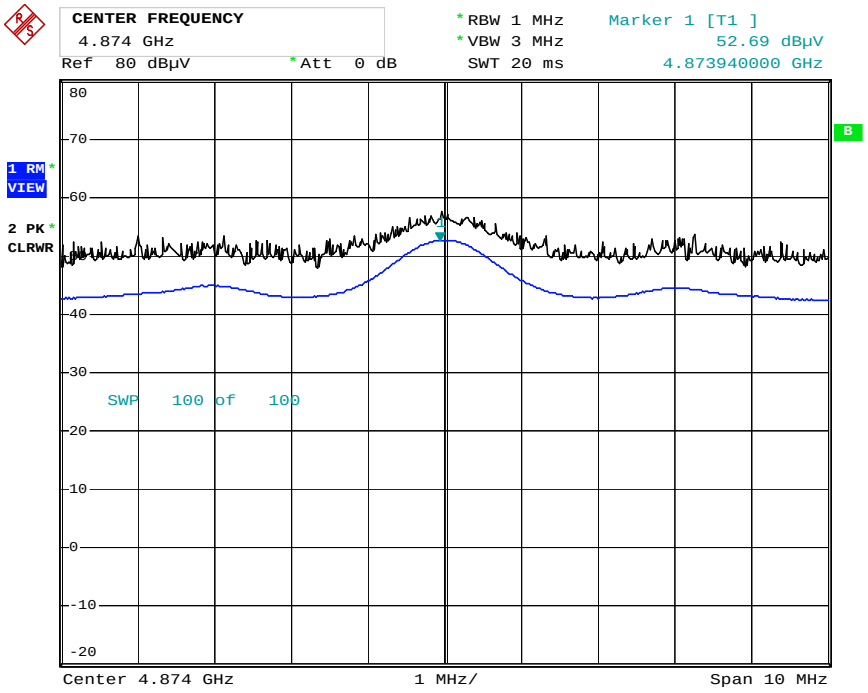
*A.F. : Antenna Factor / C.L. : Cable Loss / A.G. : Amplifier Gain / D.F. : Distance Factor

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
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. We have done 802.11b/g/n/ac mode and all data rate. Worst data rate is the lowest data of each mode.
7. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

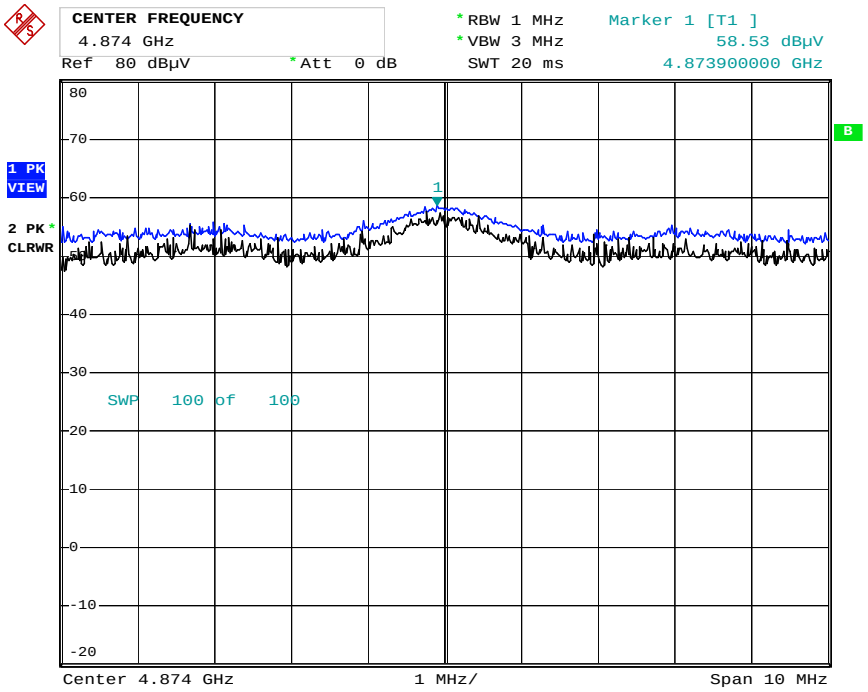
▣ RESULT PLOTS

Radiated Spurious Emissions plot – Average Reading (802.11b, Ch.6 2nd Harmonic, Z-H)



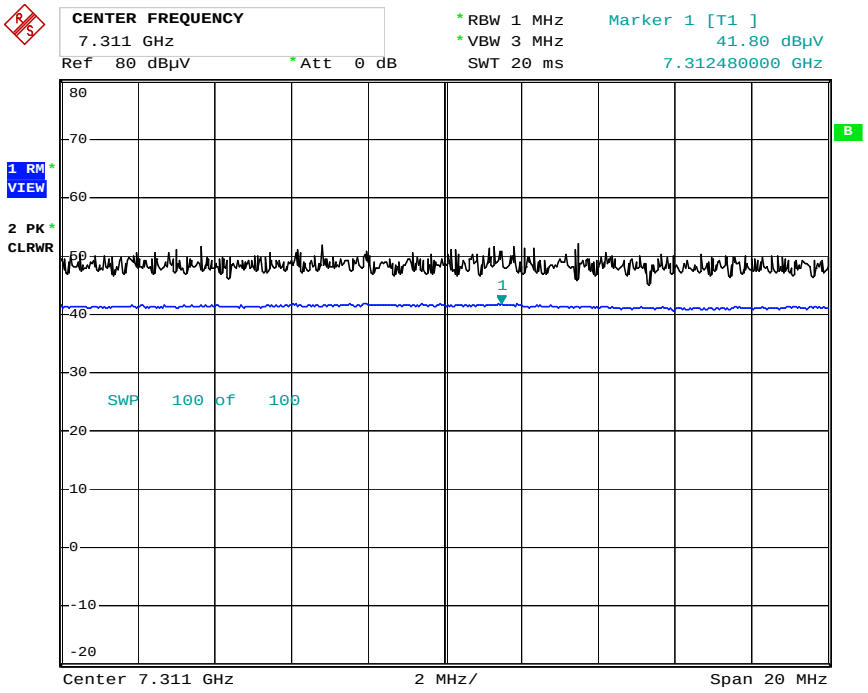
Date: 14.NOV.2016 06:22:09

Radiated Spurious Emissions plot – Peak Reading (802.11b, Ch.6 2nd Harmonic, Z-H)



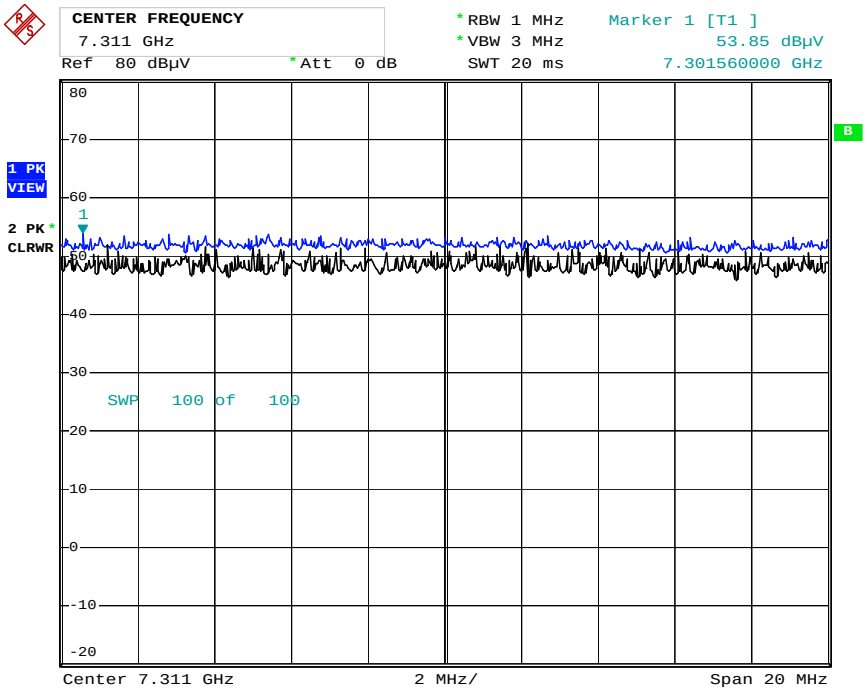
Date: 14.NOV.2016 06:22:44

Radiated Spurious Emissions plot – Average Reading (802.11b, Ch.6 3rd Harmonic, Z-H)



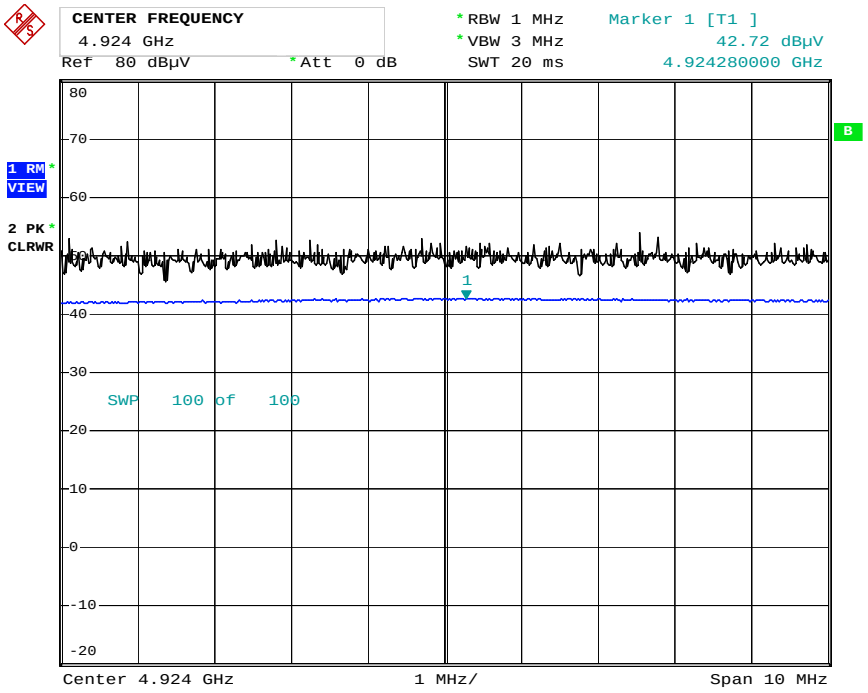
Date: 14.NOV.2016 06:23:37

Radiated Spurious Emissions plot – Peak Reading (802.11b, Ch.6 3rd Harmonic, Z-H)



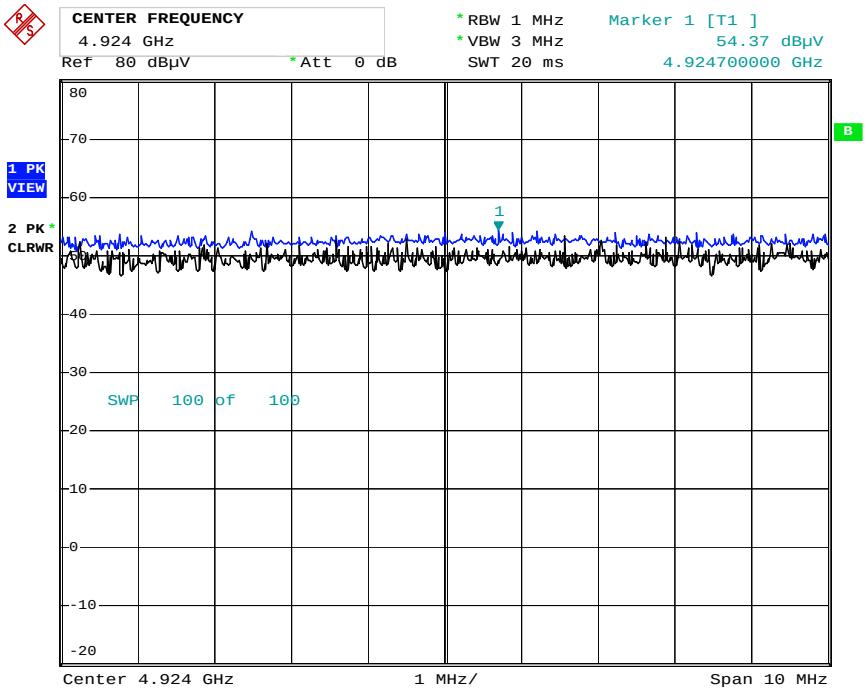
Date: 14.NOV.2016 06:23:18

Radiated Spurious Emissions plot – Average Reading (802.11g, Ch.11 2nd Harmonic, Y-V)



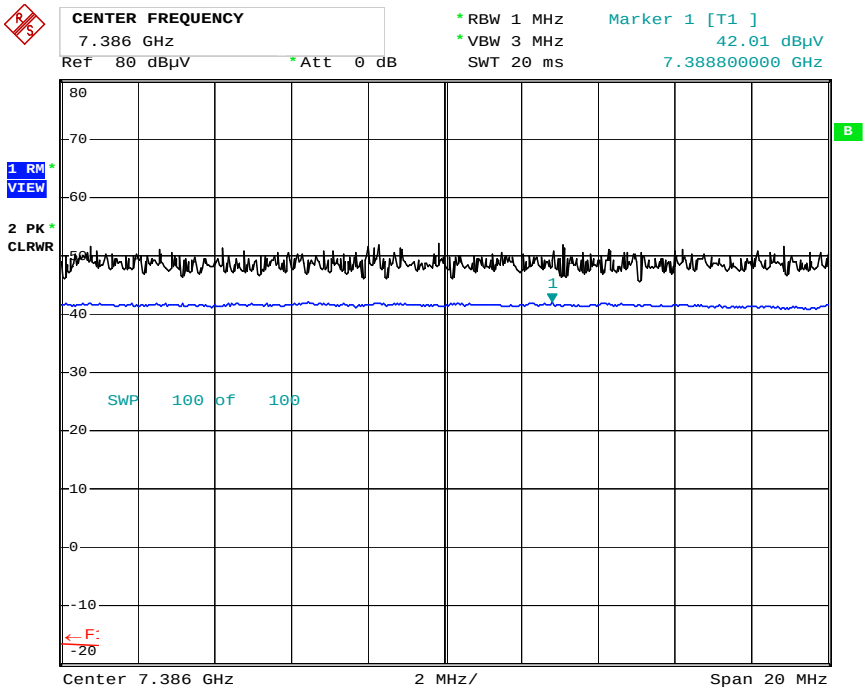
Date: 14.NOV.2016 06:20:00

Radiated Spurious Emissions plot – Peak Reading (802.11g, Ch.11 2nd Harmonic, Y-V)



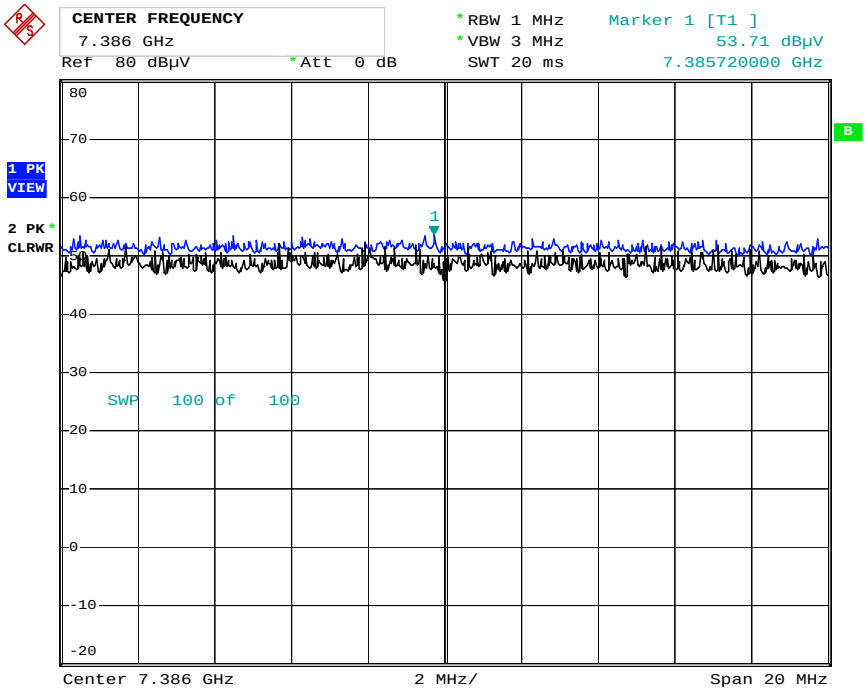
Date: 14.NOV.2016 06:18:34

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



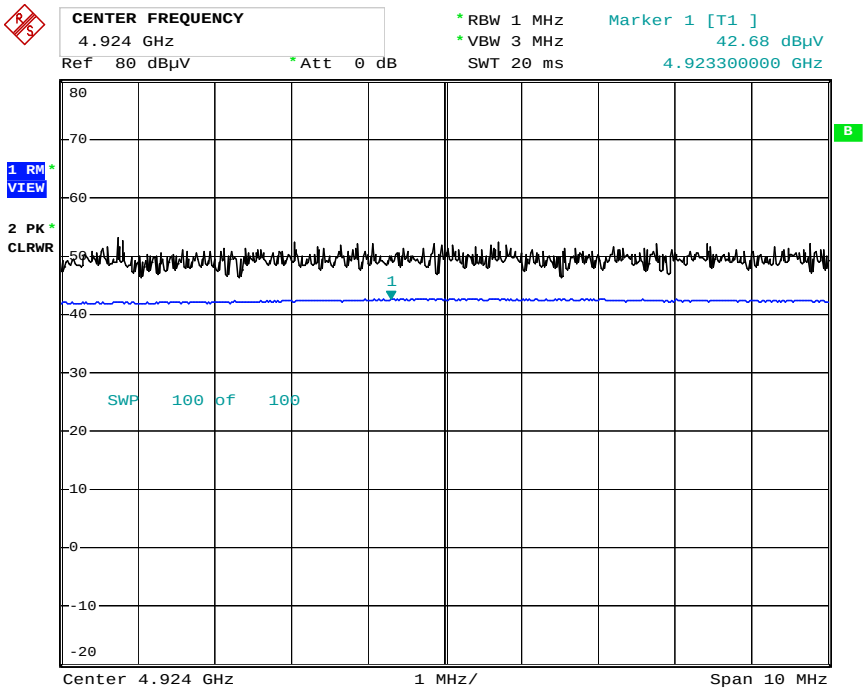
Date: 14.NOV.2016 06:15:46

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



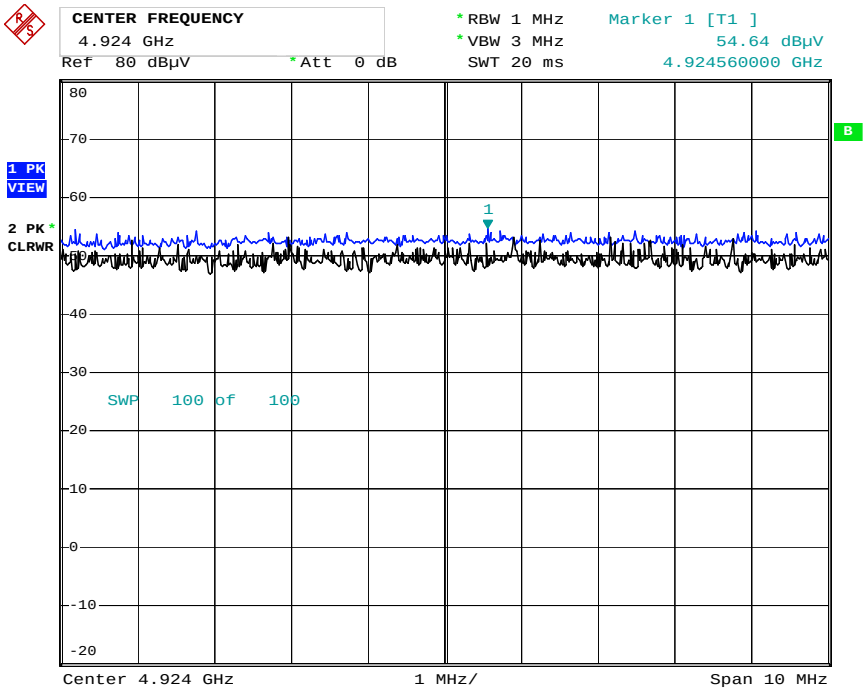
Date: 14.NOV.2016 06:18:02

Radiated Spurious Emissions plot – Average Reading (802.11n_HT20, Ch.11 2nd Harmonic, Y-V)



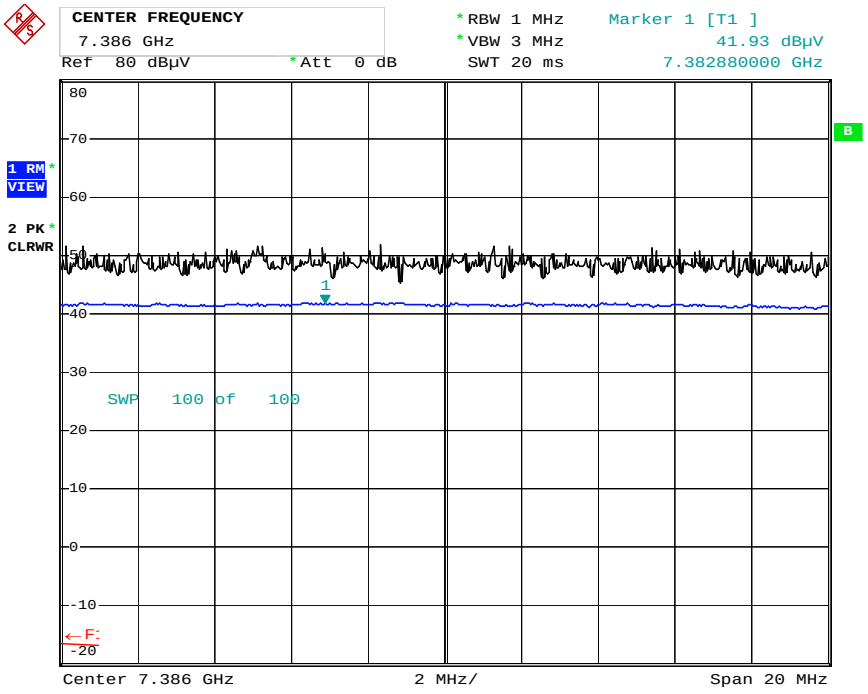
Date: 14.NOV.2016 06:19:37

Radiated Spurious Emissions plot – Peak Reading (802.11n_HT20, Ch.11 2nd Harmonic, Y-V)



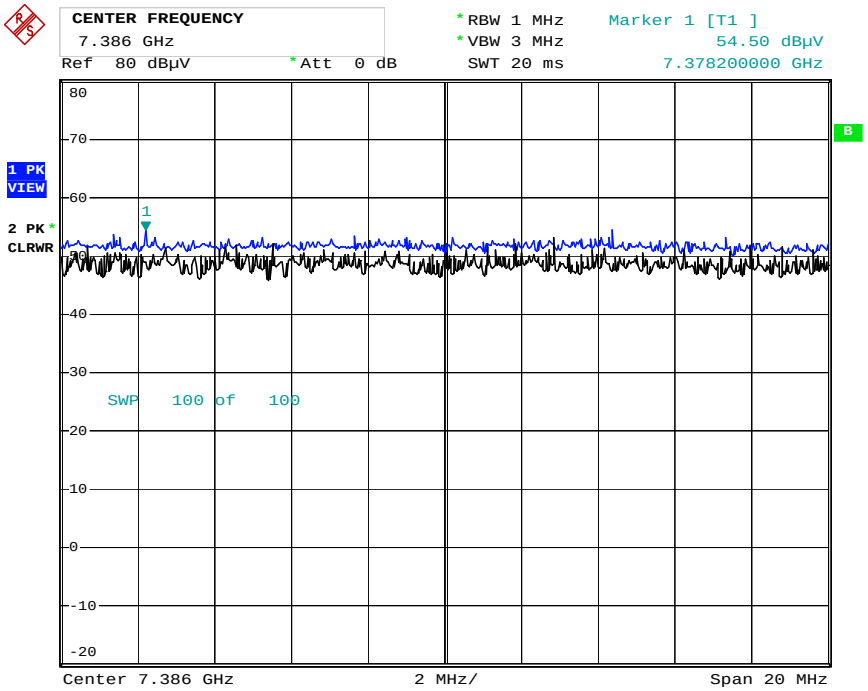
Date: 14.NOV.2016 06:19:04

Radiated Spurious Emissions plot – Average Reading (802.11n_HT20, Ch.11 3rd Harmonic, Y-V)



Date: 14.NOV.2016 06:16:30

Radiated Spurious Emissions plot – Peak Reading (802.11n_HT20, Ch.11 3rd Harmonic, Y-V)



Date: 14.NOV.2016 06:17:05

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

9.7.2 RECEIVER SPURIOUS EMISSIONS

IC 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	dBμV	dB /m	dB	(H/V)	dBμV/m	dBμV/m	dB
No critical peaks found							

Above 1 GHz

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

9.7.3 RADIATED RESTRICTED BAND EDGES

Test Requirements and limit, §15.247(d) §15.205, §15.209

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]	A.F.+C.L.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	60.69	-3.91	H	56.78	73.98	17.20	PK
2390.0	49.43	-3.91	H	45.52	53.98	8.46	AV
2390.0	60.47	-3.91	V	56.56	73.98	17.42	PK
2390.0	49.60	-3.91	V	45.69	53.98	8.29	AV
2483.5	66.58	-3.62	H	62.96	73.98	11.02	PK
2483.5	53.01	-3.62	H	49.39	53.98	4.59	AV
2483.5	64.67	-3.62	V	61.05	73.98	12.93	PK
2483.5	52.24	-3.62	V	48.62	53.98	5.36	AV

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

Operation Mode:	802.11b
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	57.13	-3.91	H	53.22	73.98	20.76	PK
2390.0	46.70	-3.91	H	42.79	53.98	11.19	AV
2390.0	56.86	-3.91	V	52.95	73.98	21.03	PK
2390.0	46.82	-3.91	V	42.91	53.98	11.07	AV
2483.5	59.56	-3.62	H	55.94	73.98	18.04	PK
2483.5	49.58	-3.62	H	45.96	53.98	8.02	AV
2483.5	58.63	-3.62	V	55.01	73.98	18.97	PK
2483.5	48.27	-3.62	V	44.65	53.98	9.33	AV

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

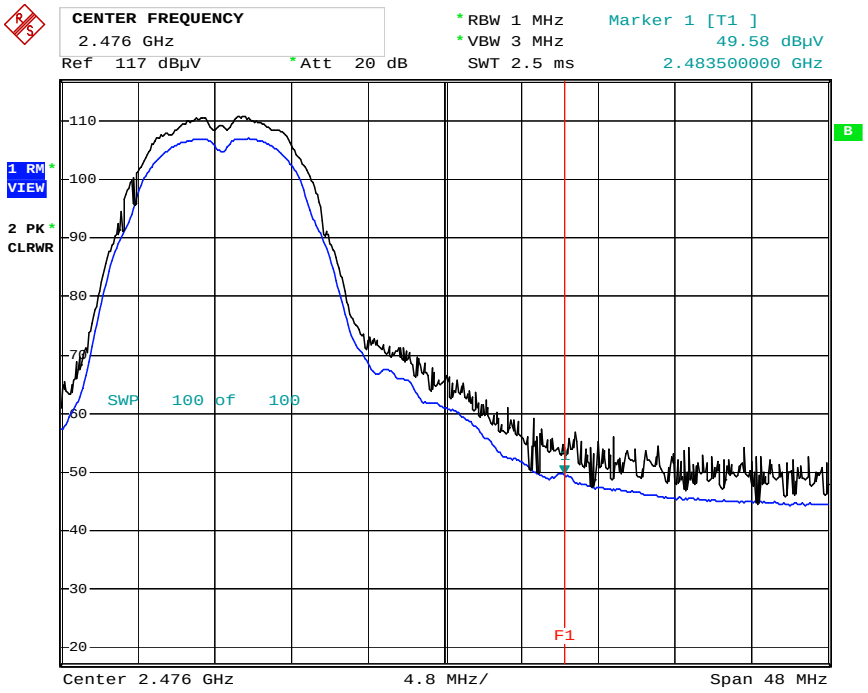
Frequency [MHz]	Reading [dBuV]	A.F.+C.L.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	60.46	-3.91	H	56.55	73.98	17.43	PK
2390.0	49.43	-3.91	H	45.52	53.98	8.46	AV
2390.0	60.94	-3.91	V	57.03	73.98	16.95	PK
2390.0	49.50	-3.91	V	45.59	53.98	8.39	AV
2483.5	63.55	-3.62	H	59.93	73.98	14.05	PK
2483.5	52.68	-3.62	H	49.06	53.98	4.92	AV
2483.5	64.12	-3.62	V	60.50	73.98	13.48	PK
2483.5	52.24	-3.62	V	48.62	53.98	5.36	AV

Notes:

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

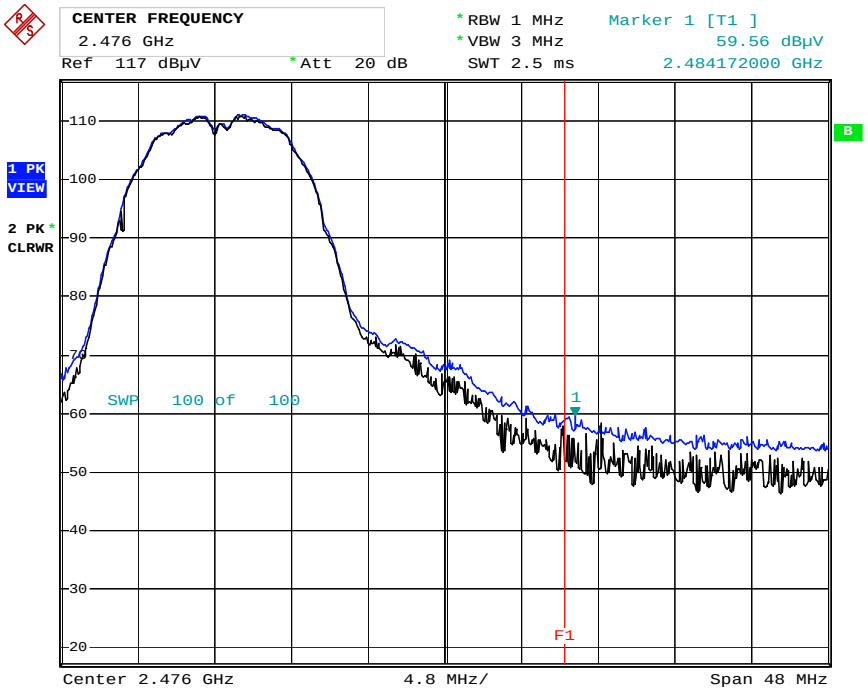
▣ RESULT PLOTS (Worst case : Z-H)

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



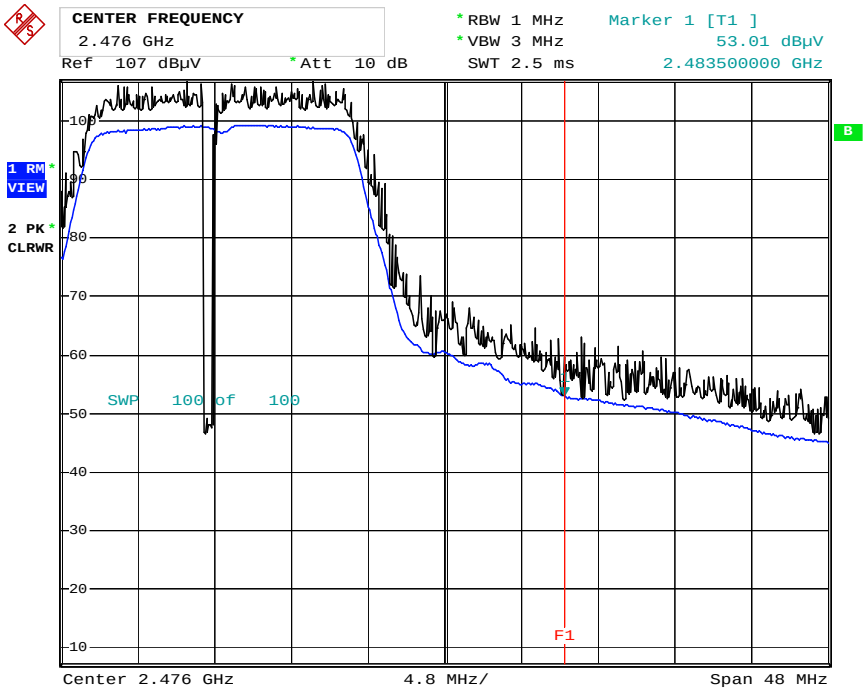
Date: 14.NOV.2016 06:31:24

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



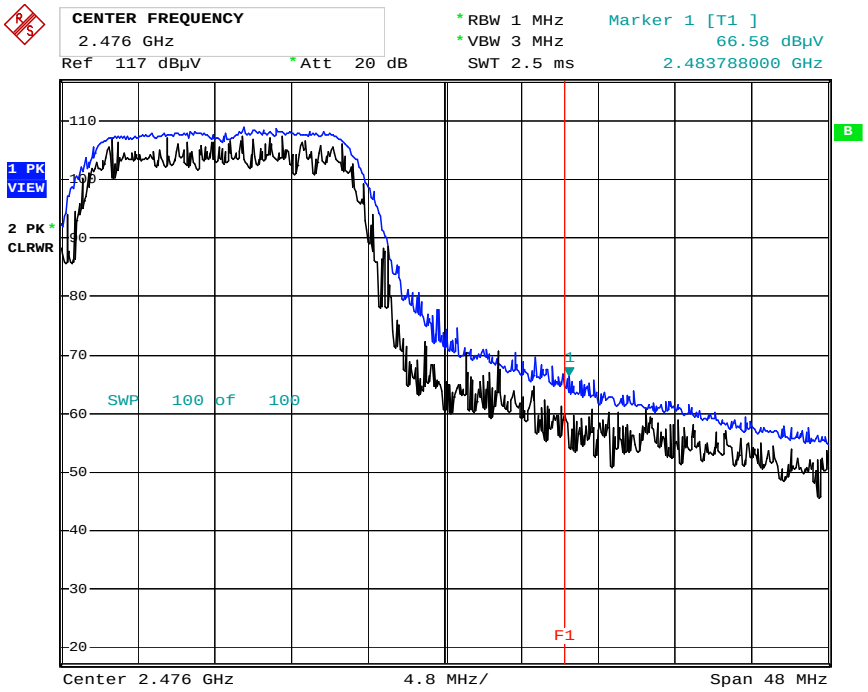
Date: 14.NOV.2016 06:30:21

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



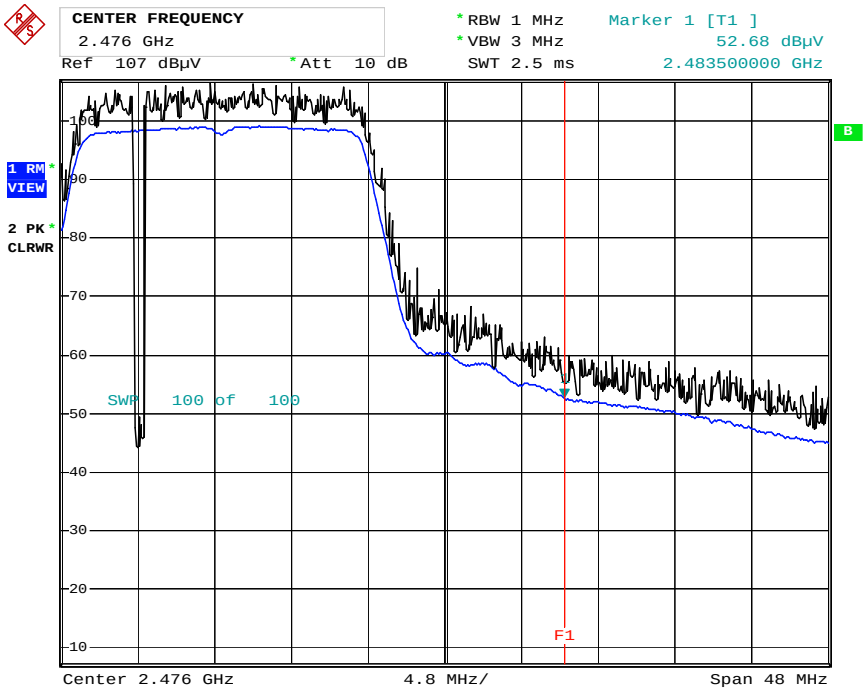
Date: 14.NOV.2016 06:26:50

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



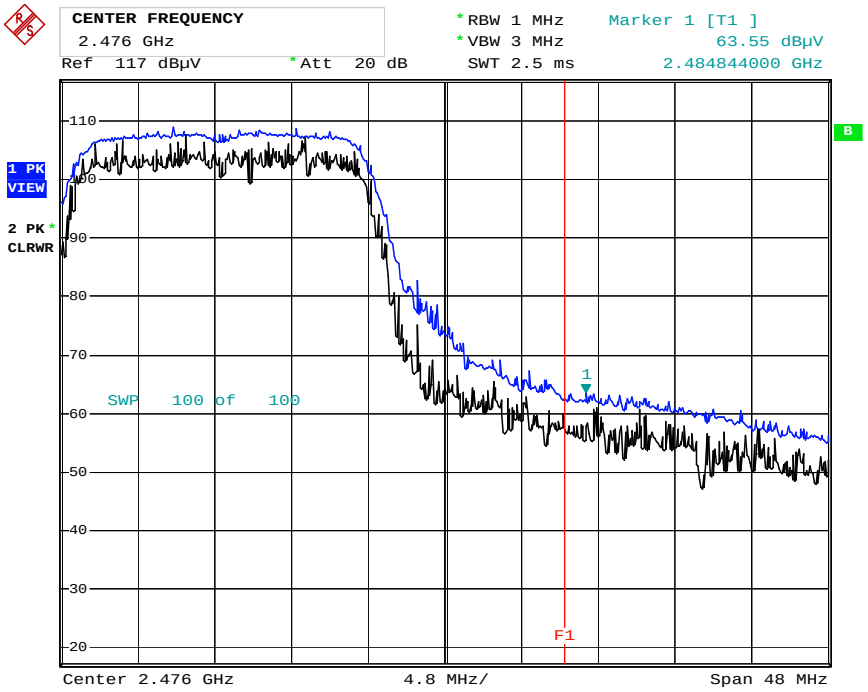
Date: 14.NOV.2016 06:29:07

Radiated Restricted Band Edges plot – Average Reading (802.11n_HT20, Ch.11)



Date: 14.NOV.2016 02:56:14

Radiated Restricted Band Edges plot – Peak Reading (802.11n_HT20, Ch.11)



Date: 14.NOV.2016 02:58:13

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

9.8 POWERLINE CONDUCTED EMISSIONS

Test Requirements and limit, §15.207

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)

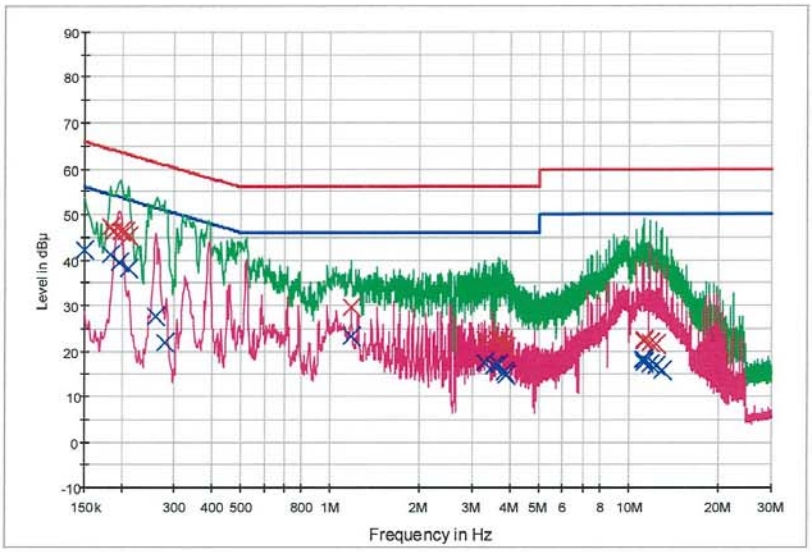
EMI Auto Test(3) 1 / 2

HCT TEST Report

Common Information

EUT:	WD-MSO
Manufacturer:	EVERINT Co.,Ltd
Test Site:	SHIELD ROOM
Operating Conditions:	WLAN_2.4G_L1

FCC CLASS B



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.184000	47.2	9.000	Off	L1	9.7	17.2	64.3
0.188000	46.4	9.000	Off	L1	9.7	17.7	64.1
0.198000	46.1	9.000	Off	L1	9.7	17.6	63.7
0.202000	46.5	9.000	Off	L1	9.7	17.0	63.5
0.206000	46.4	9.000	Off	L1	9.7	16.9	63.4
0.210000	45.3	9.000	Off	L1	9.7	17.9	63.2
1.172000	29.5	9.000	Off	L1	9.8	26.5	56.0
3.272000	22.6	9.000	Off	L1	9.9	33.4	56.0
3.664000	22.6	9.000	Off	L1	9.9	33.4	56.0
3.678000	22.7	9.000	Off	L1	9.9	33.3	56.0
3.794000	21.8	9.000	Off	L1	9.9	34.2	56.0
3.860000	20.8	9.000	Off	L1	9.9	35.2	56.0
11.170000	22.5	9.000	Off	L1	10.1	37.5	60.0
11.254000	22.2	9.000	Off	L1	10.1	37.8	60.0
11.728000	22.0	9.000	Off	L1	10.1	38.0	60.0
11.792000	21.8	9.000	Off	L1	10.1	38.2	60.0
12.288000	21.6	9.000	Off	L1	10.1	38.4	60.0
12.328000	21.5	9.000	Off	L1	10.1	38.5	60.0

Final Result 2

2016-11-23 오후 2:08:24

EMI Auto Test(3) 2 / 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	42.2	9.000	Off	L1	9.7	13.8	56.0
0.182000	41.1	9.000	Off	L1	9.7	13.3	54.4
0.196000	39.4	9.000	Off	L1	9.7	14.3	53.8
0.210000	38.1	9.000	Off	L1	9.7	15.1	53.2
0.260000	27.5	9.000	Off	L1	9.7	24.0	51.4
0.278000	21.8	9.000	Off	L1	9.7	29.1	50.9
1.174000	23.2	9.000	Off	L1	9.8	22.8	46.0
3.272000	17.5	9.000	Off	L1	9.9	28.5	46.0
3.512000	16.8	9.000	Off	L1	9.9	29.2	46.0
3.662000	17.2	9.000	Off	L1	9.9	28.8	46.0
3.808000	15.6	9.000	Off	L1	9.9	30.4	46.0
3.860000	14.7	9.000	Off	L1	9.9	31.3	46.0
11.166000	18.0	9.000	Off	L1	10.1	32.0	50.0
11.172000	18.0	9.000	Off	L1	10.1	32.0	50.0
11.254000	17.3	9.000	Off	L1	10.1	32.7	50.0
11.726000	17.1	9.000	Off	L1	10.1	32.9	50.0
12.286000	16.9	9.000	Off	L1	10.1	33.1	50.0
12.862000	15.8	9.000	Off	L1	10.2	34.2	50.0

2016-11-23 오후 2:08:24

Conducted Emissions (Line 2)

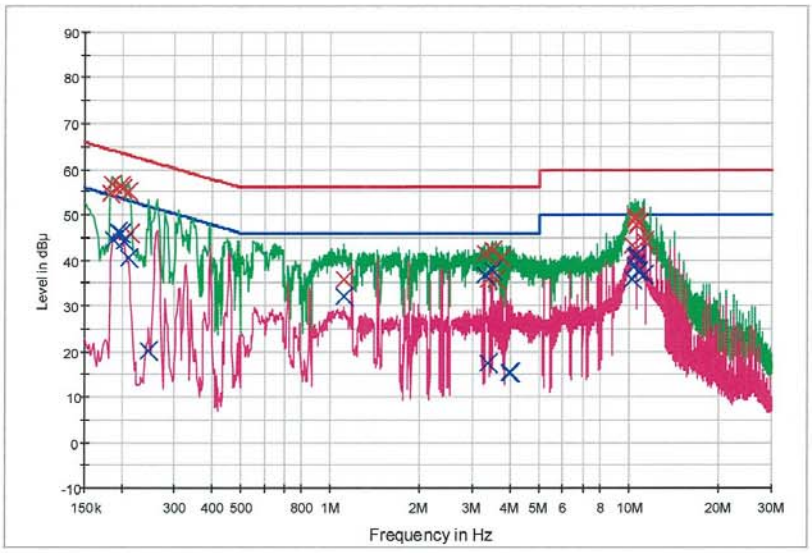
EMI Auto Test(3) 1 / 2

HCT TEST Report

Common Information

EUT:	WD-MSO
Manufacturer:	EVERINT Co.,Ltd
Test Site:	SHIELD ROOM
Operating Conditions:	WLAN_2.4G_N

FCC CLASS B



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.182000	54.7	9.000	Off	N	9.7	9.7	64.4
0.186000	56.9	9.000	Off	N	9.7	7.3	64.2
0.198000	56.3	9.000	Off	N	9.7	7.4	63.7
0.202000	55.6	9.000	Off	N	9.7	7.9	63.5
0.210000	55.2	9.000	Off	N	9.7	8.0	63.2
0.214000	45.9	9.000	Off	N	9.7	17.2	63.0
1.112000	35.6	9.000	Off	N	9.7	20.4	56.0
3.272000	41.4	9.000	Off	N	9.8	14.6	56.0
3.380000	35.7	9.000	Off	N	9.8	20.3	56.0
3.468000	42.2	9.000	Off	N	9.8	13.8	56.0
3.590000	35.9	9.000	Off	N	9.8	20.1	56.0
3.730000	40.5	9.000	Off	N	9.8	15.5	56.0
10.282000	43.1	9.000	Off	N	10.1	16.9	60.0
10.424000	48.9	9.000	Off	N	10.1	11.1	60.0
10.492000	49.5	9.000	Off	N	10.1	10.5	60.0
10.602000	47.6	9.000	Off	N	10.1	12.4	60.0
10.772000	48.3	9.000	Off	N	10.1	11.7	60.0
11.168000	44.3	9.000	Off	N	10.1	15.7	60.0

Final Result 2

2016-11-23 오후 3:17:48

EMI Auto Test(3) 2 / 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.188000	44.6	9.000	Off	N	9.7	9.5	54.1
0.194000	46.3	9.000	Off	N	9.7	7.5	53.9
0.198000	45.8	9.000	Off	N	9.7	7.9	53.7
0.204000	44.4	9.000	Off	N	9.7	9.1	53.4
0.210000	40.3	9.000	Off	N	9.7	12.9	53.2
0.246000	20.3	9.000	Off	N	9.7	31.6	51.9
1.112000	32.0	9.000	Off	N	9.7	14.0	46.0
3.272000	36.7	9.000	Off	N	9.8	9.3	46.0
3.380000	17.6	9.000	Off	N	9.8	28.4	46.0
3.468000	37.7	9.000	Off	N	9.8	8.3	46.0
3.944000	15.5	9.000	Off	N	9.8	30.5	46.0
4.008000	15.5	9.000	Off	N	9.9	30.5	46.0
10.282000	35.7	9.000	Off	N	10.1	14.3	50.0
10.422000	38.9	9.000	Off	N	10.1	11.1	50.0
10.492000	40.8	9.000	Off	N	10.1	9.2	50.0
10.600000	41.2	9.000	Off	N	10.1	8.8	50.0
10.772000	37.3	9.000	Off	N	10.1	12.7	50.0
11.168000	36.6	9.000	Off	N	10.1	13.4	50.0

2016-11-23 오후 3:17:48

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	12/28/2015	Annual	100073
Rohde & Schwarz	ESCI / Test Receiver	12/28/2015	Annual	100584
Agilent	N9020A / Signal Analyzer	06/24/2016	Annual	MY51110085
Agilent	N1911A / Power Meter	03/11/2016	Annual	MY45100523
Agilent	N1921A / Power Sensor	03/11/2016	Annual	MY52260025
Agilent	87300B / Directional Coupler	11/23/2016	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	06/14/2016	Annual	05001
Hewlett Packard	E3632A / DC Power Supply	03/09/2016	Annual	KR75303962
Agilent	8493C / Attenuator(10 dB)	07/15/2016	Annual	07560

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	02/23/2016	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	04/15/2015	Biennial	255
Schwarzbeck	BBHA 9120D / Horn Antenna	12/11/2015	Biennial	9120D-1191
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	09/03/2015	Biennial	BBHA9170541
Rohde & Schwarz	FSP / Spectrum Analyzer	09/29/2016	Annual	836650/016
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/23/2016	Annual	101068-SZ
Wainwright Instruments	WHKX10-2700-3000-18000-40SS / High Pass Filter	08/11/2016	Annual	4
Wainwright Instruments	WHKX8-6090-7000-18000-40SS / High Pass Filter	07/15/2016	Annual	5
Wainwright Instruments	WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter	07/06/2016	Annual	2
Wainwright Instruments	WRCJV5100/5850-40/50-8EEK / Band Reject Filter	01/26/2016	Annual	2
H.P.	8491A / Attenuator(10 dB)	08/11/2016	Annual	18593
CERNEX	CBLU1183540 / Power Amplifier	02/01/2016	Annual	24614
CERNEX	CBL06185030 / Power Amplifier	02/01/2016	Annual	24615
CERNEX	CBL18265035 / Power Amplifier	07/11/2016	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	07/11/2016	Annual	25956