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FCC DTS REPORT

Certification

Applicant Name:
I&C Technology Co.,Ltd.

Address:
(Sampyeong-dong , I&C Building), 24, Pangyo-ro255beon-gil,Bundang-gu Seongnam-si, South Korea

Date of Issue:
June 18, 2018
Test Site/Location:
HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majang-myeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
Report No.: HCT-RF-1806-FC008-R2

FCC ID:	**2ADXS-WFM60-SFP201**
APPLICANT:	**I&C Technology Co.,Ltd.**

Model:	WFM60-SFP201
EUT Type:	2.4GHz WLAN Stand-alone Module
Peak Output Power:	Wi-Fi 802.11b(21.43 dBm) / Wi-Fi 802.11g (23.11 dBm) / Wi-Fi 802.11n_HT20 (23.10 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

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 : Jeong Ho Kim
Engineer of Telecommunication testing center

Approved by : Jong Seok Lee
Manager of Telecommunication testing center

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1806-FC008	June 08, 2018	- First Approval Report
HCT-RF-1806-FC008-R1	June 18, 2018	- Add the AC Power line Conducted Emissions Test
HCT-RF-1806-FC008-R2	June 20, 2018	- Revised the test requirements and limit on page 73.

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
9. TEST RESULT 9
9.1 DUTY CYCLE 9
9.2 6dB BANDWIDTH 11
9.3 OUTPUT POWER (802.11b/g/n) 15
9.4 POWER SPECTRAL DENSITY (802.11b/g/n) 26
9.5 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS 30
9.6 RADIATED MEASUREMENT 46
9.6.1 RADIATED SPURIOUS EMISSIONS 46
9.6.2 RADIATED RESTRICTED BAND EDGES 59
9.7 POWERLINE CONDUCTED EMISSIONS 73
10. LIST OF TEST EQUIPMENT 78
10.1 LIST OF TEST EQUIPMENT(Conducted Test) 78
10.2 LIST OF TEST EQUIPMENT(Radiated Test) 79

1. GENERAL INFORMATION

Applicant:	I&C Technology Co.,Ltd.
Address:	(Sampyeong-dong , I&C Building), 24, Pangyo-ro255beon-gil,Bundang-gu Seongnam-si, South Korea
FCC ID:	2ADXS-WFM60-SFP201
EUT Type:	2.4GHz WLAN Stand-alone Module
Model:	WFM60-SFP201
Date(s) of Tests:	April 17, 2018 ~ May 24, 2018 & June 17 ~ 18, 2018 (AC Power line Conducted Emissions Test)
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

2. EUT DESCRIPTION

Model	WFM60-SFP201	
EUT Type	2.4GHz WLAN Stand-alone Module	
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(21.43 dBm) / Wi-Fi 802.11g (23.11 dBm) / Wi-Fi 802.11n_HT20 (23.10 dBm)
	Average	Wi-Fi 802.11b(17.97 dBm) / Wi-Fi 802.11g (16.70 dBm) / Wi-Fi 802.11n_HT20 (15.72 dBm)
Modulation Type	DSSS/CCK(802.11b), OFDM(802.11g, 802.11n)	
Antenna Specification	Antenna type: PCB Antenna Peak Gain : 2.71 dBi	

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.

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

7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

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)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.71

8. SUMMARY TEST OF RESULTS

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 > 20 dBc		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 9.7		N/A
Radiated Spurious Emissions	§15.205, 15.209	cf. Section 9.6.1	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 9.6.2		PASS

9. TEST RESULT

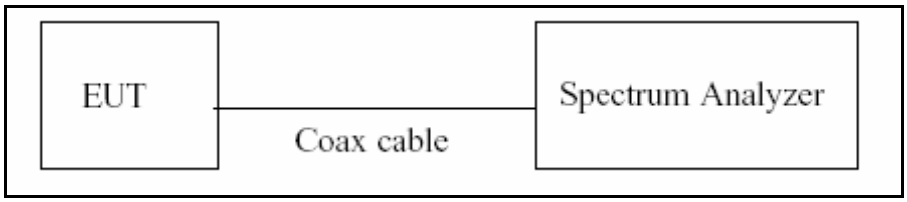
9.1 DUTY CYCLE

▣ TEST PROCEDURE

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 ≥ 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 v04

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	32.210	32.340	0.99598021	0.017
	2 Mbps	16.120	16.350	0.98593272	0.062
	5.5 Mbps	5.925	6.066	0.97675569	0.102
	11 Mbps	3.008	3.149	0.95522388	0.199
g	6 Mbps	5.362	5.430	0.98747698	0.055
	9 Mbps	3.579	3.654	0.97947455	0.090
	12 Mbps	2.693	2.775	0.97045045	0.130
	18 Mbps	1.801	1.879	0.95848856	0.184
	24 Mbps	1.357	1.435	0.94564460	0.243
	36 Mbps	0.913	0.982	0.92974239	0.316
	48 Mbps	0.688	0.758	0.90770042	0.421
	54 Mbps	0.616	0.695	0.88701785	0.521
n_HT20	MCS0_6.5 Mbps	3.868	3.939	0.98197512	0.079
	MCS1_13 Mbps	1.952	2.030	0.96157635	0.170
	MCS2_19.5 Mbps	1.315	1.385	0.94945848	0.225
	MCS3_26 Mbps	0.996	1.066	0.93442777	0.295
	MCS4_39 Mbps	0.676	0.746	0.90565532	0.430
	MCS5_52 Mbps	0.517	0.586	0.88111888	0.550
	MCS6_58.5 Mbps	0.465	0.534	0.86971172	0.606
	MCS7_65 Mbps	0.420	0.490	0.85763889	0.667

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

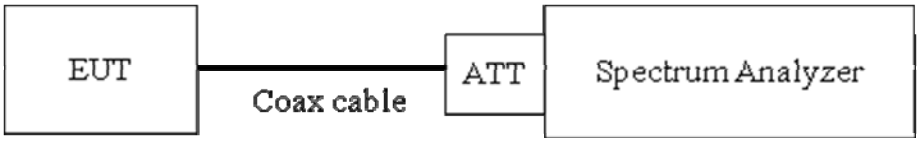
9.2 6dB BANDWIDTH

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 v04)

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	8.602	0.5	Pass
2417	2	9.036	0.5	Pass
2437	6	8.618	0.5	Pass
2457	10	9.091	0.5	Pass
2462	11	9.087	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	16.37	0.5	Pass
2417	2	16.35	0.5	Pass
2437	6	16.38	0.5	Pass
2457	10	16.34	0.5	Pass
2462	11	16.30	0.5	Pass

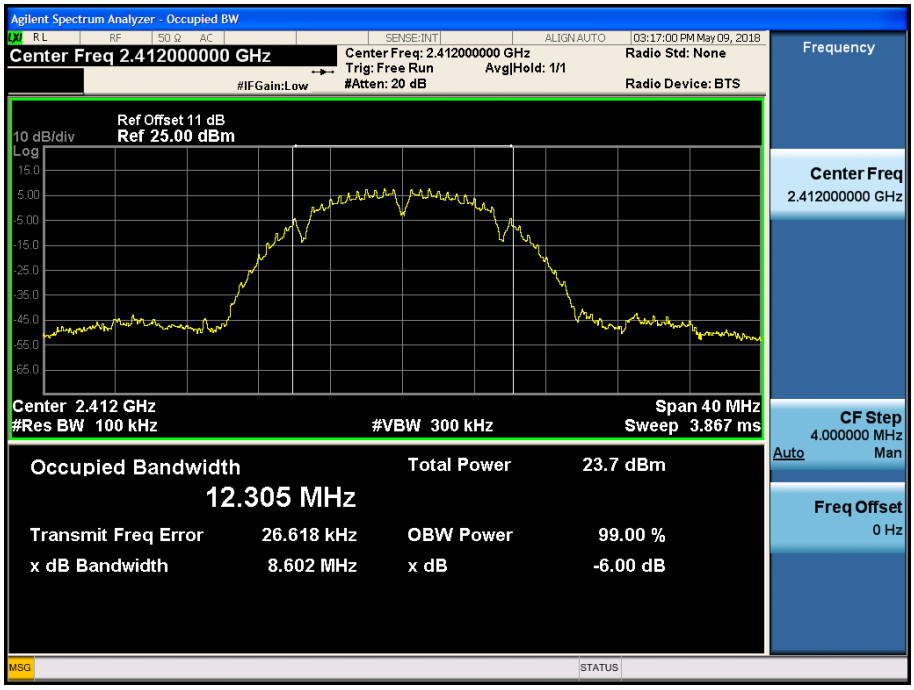
Conducted 6dB Bandwidth Measurements for 802.11n_HT20

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	16.34	0.5	Pass
2417	2	16.62	0.5	Pass
2437	6	16.35	0.5	Pass
2457	10	16.35	0.5	Pass
2462	11	16.50	0.5	Pass

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

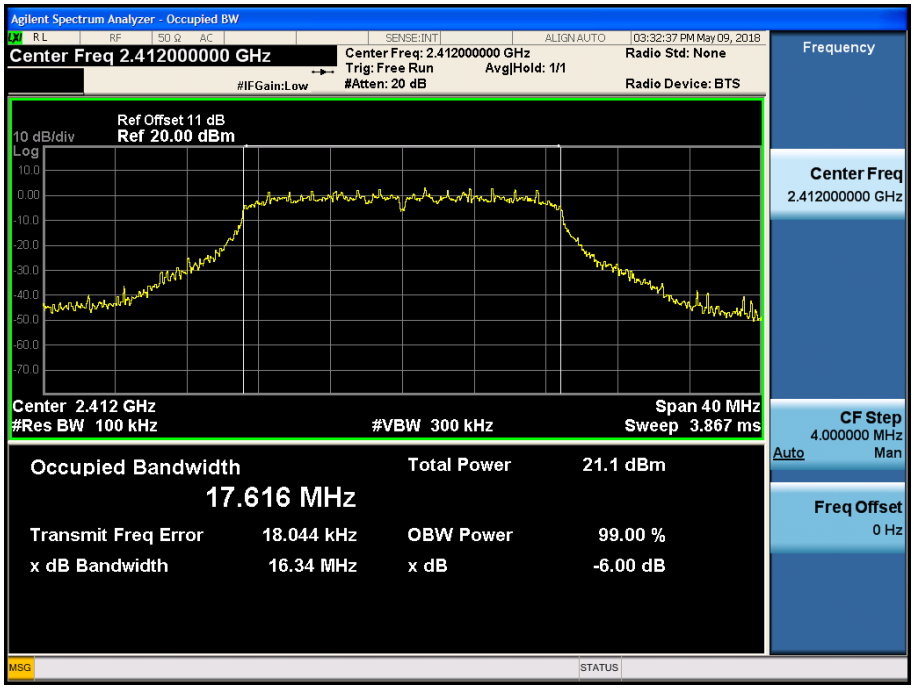
▣ RESULT PLOTS

6dB Bandwidth plot (802.11b-CH 1)



6dB Bandwidth plot (802.11g-CH 11)

6dB Bandwidth plot (802.11n_HT20-CH 1)



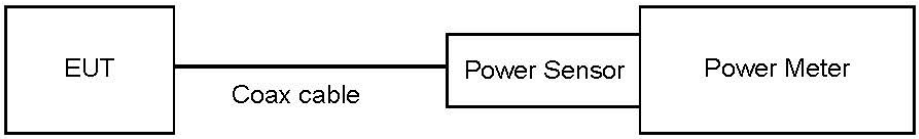
9.3 OUTPUT POWER (802.11b/g/n)

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 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 tenth dB. So, 11.0 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	11.00
	2437	11.00
	2462	11.00

(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	20.25	30
		2 Mbps	20.26	30
		5.5 Mbps	20.16	30
		11 Mbps	19.97	30
2417	2	1 Mbps	19.91	30
		2 Mbps	19.93	30
		5.5 Mbps	19.75	30
		11 Mbps	19.86	30
2437	6	1 Mbps	21.23	30
		2 Mbps	21.43	30
		5.5 Mbps	21.43	30
		11 Mbps	21.41	30
2457	10	1 Mbps	20.06	30
		2 Mbps	19.98	30
		5.5 Mbps	19.84	30
		11 Mbps	19.94	30
2462	11	1 Mbps	19.81	30
		2 Mbps	19.87	30
		5.5 Mbps	19.81	30
		11 Mbps	19.92	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	22.95	30
		9 Mbps	22.96	30
		12 Mbps	22.84	30
		18 Mbps	22.81	30
		24 Mbps	22.70	30
		36 Mbps	22.65	30
		48 Mbps	22.06	30
		54 Mbps	22.02	30
2417	2	6 Mbps	23.11	30
		9 Mbps	23.09	30
		12 Mbps	23.04	30
		18 Mbps	22.74	30
		24 Mbps	22.98	30
		36 Mbps	22.47	30
		48 Mbps	21.88	30
		54 Mbps	22.08	30
2437	6	6 Mbps	22.85	30
		9 Mbps	22.86	30
		12 Mbps	22.78	30
		18 Mbps	22.72	30
		24 Mbps	22.71	30
		36 Mbps	22.65	30
		48 Mbps	22.57	30
		54 Mbps	22.65	30
2457	10	6 Mbps	22.71	30
		9 Mbps	22.78	30
		12 Mbps	22.09	30
		18 Mbps	22.28	30
		24 Mbps	22.17	30
		36 Mbps	22.32	30
		48 Mbps	22.08	30
		54 Mbps	22.79	30

2462	11	6 Mbps	22.60	30
		9 Mbps	22.71	30
		12 Mbps	20.03	30
		18 Mbps	20.69	30
		24 Mbps	20.37	30
		36 Mbps	20.01	30
		48 Mbps	20.33	30
		54 Mbps	21.25	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	23.10	30
		1	22.04	30
		2	22.17	30
		3	22.50	30
		4	22.42	30
		5	22.23	30
		6	20.93	30
		7	20.92	30
2417	2	0	23.00	30
		1	23.00	30
		2	22.83	30
		3	22.65	30
		4	22.31	30
		5	22.36	30
		6	21.55	30
		7	20.87	30
2437	6	0	22.80	30
		1	22.82	30
		2	22.72	30
		3	22.83	30
		4	22.79	30
		5	22.54	30
		6	22.52	30
		7	22.37	30
2457	10	0	22.84	30
		1	22.17	30
		2	22.65	30
		3	22.69	30
		4	22.21	30
		5	21.74	30
		6	21.14	30
		7	20.97	30

2462	11	0	20.97	30
		1	20.10	30
		2	20.92	30
		3	20.52	30
		4	20.11	30
		5	19.98	30
		6	20.55	30
		7	20.88	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	17.04	0.017	17.06	30
		2 Mbps	16.96	0.062	17.02	30
		5.5 Mbps	16.79	0.102	16.89	30
		11 Mbps	16.47	0.199	16.67	30
2417	2	1 Mbps	16.75	0.017	16.77	30
		2 Mbps	16.64	0.062	16.70	30
		5.5 Mbps	16.47	0.102	16.57	30
		11 Mbps	16.24	0.199	16.44	30
2437	6	1 Mbps	17.95	0.017	17.97	30
		2 Mbps	17.84	0.062	17.91	30
		5.5 Mbps	17.55	0.102	17.65	30
		11 Mbps	17.61	0.199	17.81	30
2457	10	1 Mbps	16.78	0.017	16.79	30
		2 Mbps	16.73	0.062	16.79	30
		5.5 Mbps	16.62	0.102	16.72	30
		11 Mbps	16.37	0.199	16.57	30
2462	11	1 Mbps	16.62	0.017	16.63	30
		2 Mbps	16.51	0.062	16.57	30
		5.5 Mbps	16.43	0.102	16.53	30
		11 Mbps	15.43	0.199	15.63	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	15.32	0.055	15.38	30
		9 Mbps	15.03	0.090	15.12	30
		12 Mbps	15.34	0.130	15.47	30
		18 Mbps	15.28	0.184	15.47	30
		24 Mbps	15.23	0.243	15.48	30
		36 Mbps	14.37	0.316	14.69	30
		48 Mbps	13.65	0.421	14.07	30
		54 Mbps	12.98	0.521	13.50	30
2417	2	6 Mbps	15.41	0.055	15.46	30
		9 Mbps	15.07	0.090	15.16	30
		12 Mbps	15.29	0.130	15.42	30
		18 Mbps	15.15	0.184	15.33	30
		24 Mbps	15.07	0.243	15.31	30
		36 Mbps	14.19	0.316	14.51	30
		48 Mbps	13.43	0.421	13.86	30
		54 Mbps	12.81	0.521	13.33	30
2437	6	6 Mbps	16.65	0.055	16.70	30
		9 Mbps	16.25	0.090	16.34	30
		12 Mbps	16.46	0.130	16.59	30
		18 Mbps	16.35	0.184	16.54	30
		24 Mbps	16.23	0.243	16.47	30
		36 Mbps	15.33	0.316	15.65	30
		48 Mbps	14.62	0.421	15.04	30
		54 Mbps	13.82	0.521	14.34	30
2457	10	6 Mbps	13.96	0.055	14.01	30
		9 Mbps	13.55	0.090	13.64	30
		12 Mbps	13.68	0.130	13.81	30
		18 Mbps	13.59	0.184	13.77	30
		24 Mbps	13.47	0.243	13.71	30
		36 Mbps	12.60	0.316	12.92	30
		48 Mbps	11.83	0.421	12.25	30
		54 Mbps	11.22	0.521	11.74	30

2462	11	6 Mbps	11.95	0.055	12.00	30
		9 Mbps	11.60	0.090	11.69	30
		12 Mbps	11.87	0.130	12.00	30
		18 Mbps	11.80	0.184	11.98	30
		24 Mbps	11.74	0.243	11.98	30
		36 Mbps	10.78	0.316	11.10	30
		48 Mbps	10.12	0.421	10.54	30
		54 Mbps	9.42	0.521	9.94	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	14.39	0.079	14.47	30
		1	14.29	0.170	14.46	30
		2	14.22	0.225	14.44	30
		3	14.15	0.295	14.44	30
		4	13.95	0.430	14.38	30
		5	13.15	0.550	13.70	30
		6	12.58	0.606	13.19	30
		7	11.76	0.667	12.43	30
2417	2	0	14.42	0.079	14.50	30
		1	14.15	0.170	14.32	30
		2	14.14	0.225	14.36	30
		3	14.00	0.295	14.30	30
		4	13.85	0.430	14.28	30
		5	13.02	0.550	13.56	30
		6	12.41	0.606	13.01	30
		7	11.50	0.667	12.17	30
2437	6	0	15.64	0.079	15.72	30
		1	15.48	0.170	15.65	30
		2	15.40	0.225	15.62	30
		3	15.31	0.295	15.61	30
		4	15.11	0.430	15.54	30
		5	14.40	0.550	14.95	30
		6	13.74	0.606	14.34	30
		7	12.78	0.667	13.45	30
2457	10	0	13.89	0.079	13.97	30
		1	13.82	0.170	13.99	30
		2	13.76	0.225	13.99	30
		3	13.73	0.295	14.02	30
		4	13.52	0.430	13.95	30
		5	12.89	0.550	13.44	30
		6	12.30	0.606	12.91	30
		7	11.55	0.667	12.22	30

2462	11	0	11.34	0.079	11.42	30
		1	11.25	0.170	11.42	30
		2	11.15	0.225	11.38	30
		3	11.06	0.295	11.35	30
		4	10.82	0.430	11.25	30
		5	10.16	0.550	10.71	30
		6	9.51	0.606	10.12	30
		7	8.62	0.667	9.29	30

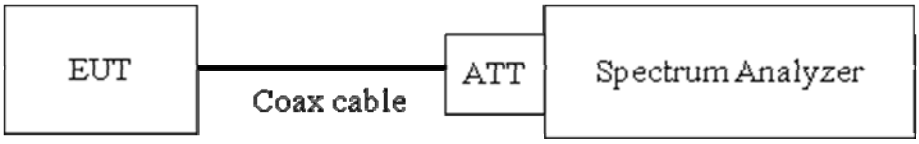
9.4 POWER SPECTRAL DENSITY (802.11b/g/n)

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 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)

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	11.00
	2437	11.00
	2462	11.00

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

▣ TEST RESULTS

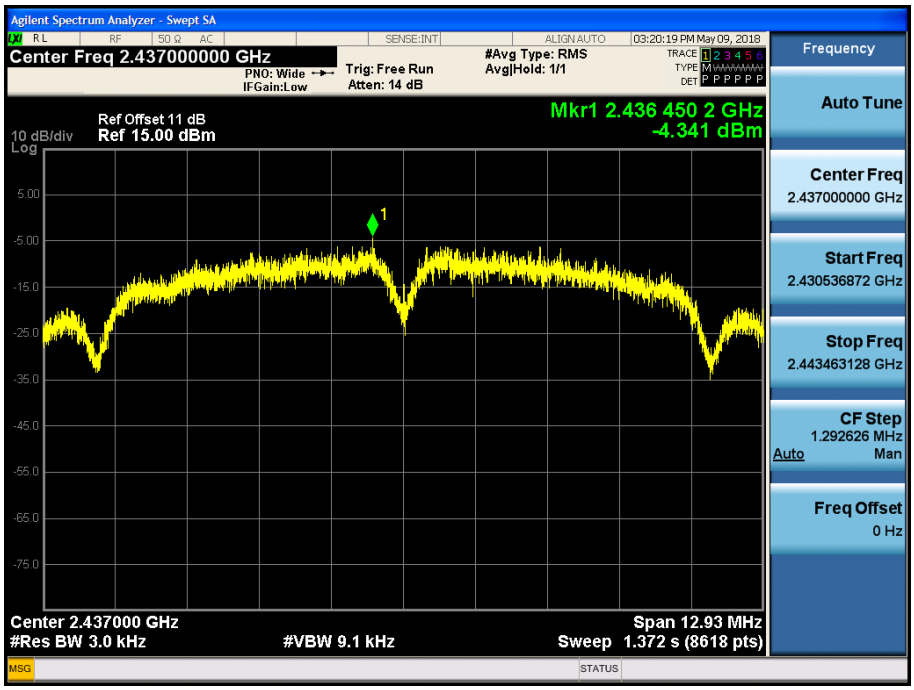
Conducted Power Density Measurements

Frequency [MHz]	Channel No.	Mode	Test Result		
			PSD [dBm]	Limit [dBm]	Pass/ Fail
2412	1	802.11b	-5.728	8	Pass
2417	2		-5.079	8	Pass
2437	6		-4.341	8	Pass
2457	10		-5.443	8	Pass
2462	11		-6.614	8	Pass
2412	1	802.11g	-9.353	8	Pass
2417	2		-8.062	8	Pass
2437	6		-8.971	8	Pass
2457	10		-10.109	8	Pass
2462	11		-10.291	8	Pass
2412	1	802.11n _HT20	-10.093	8	Pass
2417	2		-9.867	8	Pass
2437	6		-7.983	8	Pass
2457	10		-10.013	8	Pass
2462	11		-13.381	8	Pass

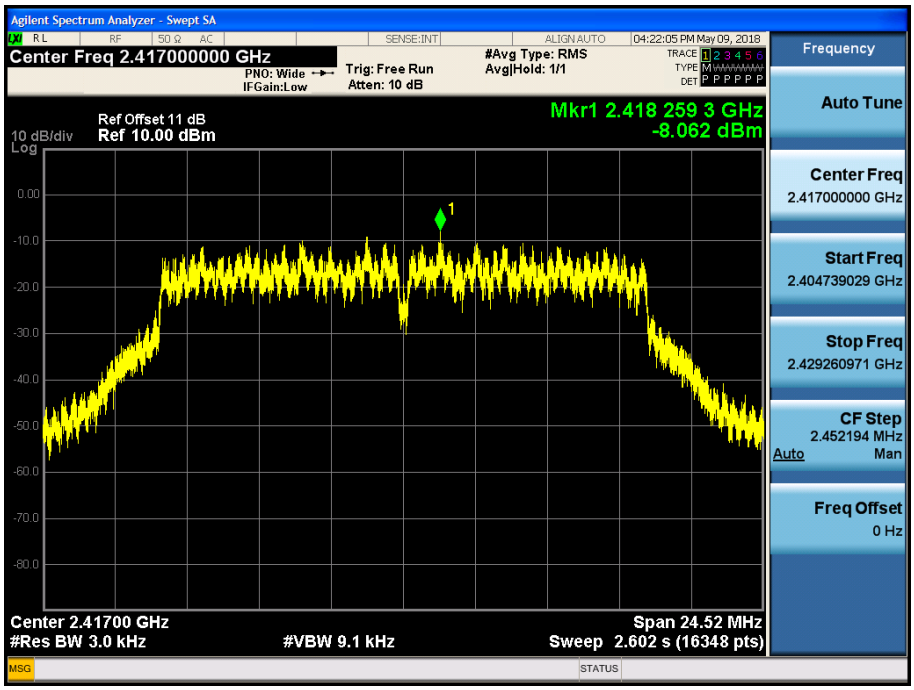
Note : In order to simplify the report, attached plots were only the highest PSD channel.

▣ RESULT PLOTS

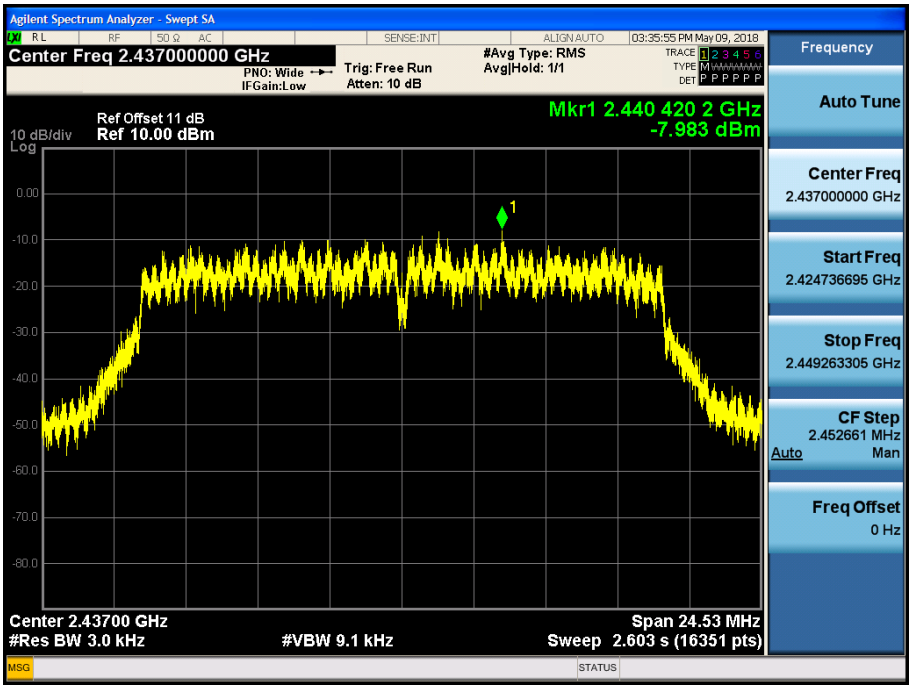
Power Spectral Density (802.11b-CH 6)



Power Spectral Density (802.11g-CH 2)



Power Spectral Density (802.11n_HT20 -CH 6)



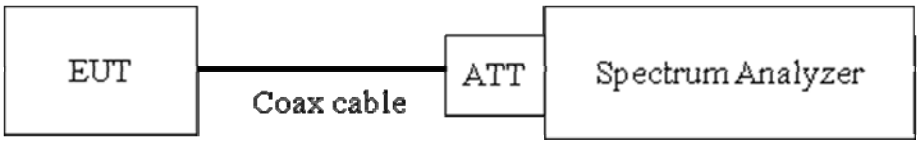
9.5 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

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 v04)

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 v04), 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, 11.00 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	11.00
	2437	11.00
	2462	11.00

(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	11.50
100	9.93
200	10.29
300	10.43
400	10.53
500	10.55
600	10.62
700	10.65
800	10.65
900	10.64
1000	10.69
2000	10.94
2400*	11.00
2500*	11.07
3000	11.18
4000	11.19
5000	11.27
6000	11.36
7000	11.55

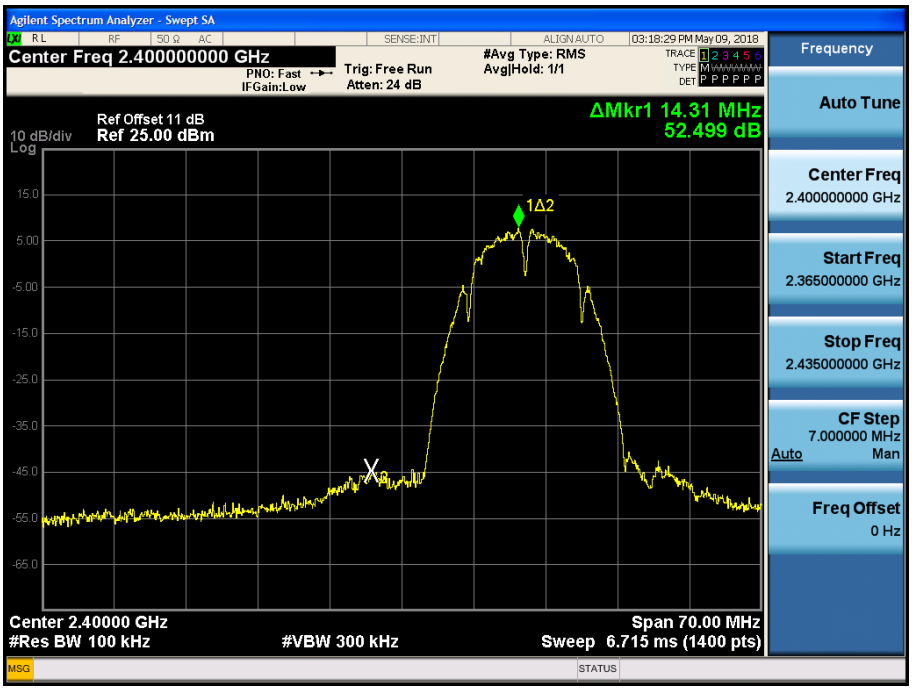
8000	11.62
9000	11.78
10000	11.86
11000	11.56
12000	11.98
13000	12.13
14000	12.20
15000	12.28
16000	12.34
17000	12.32
18000	12.38
19000	12.37
20000	12.44
21000	12.47
22000	12.61
23000	12.90
24000	12.64
25000	12.83

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

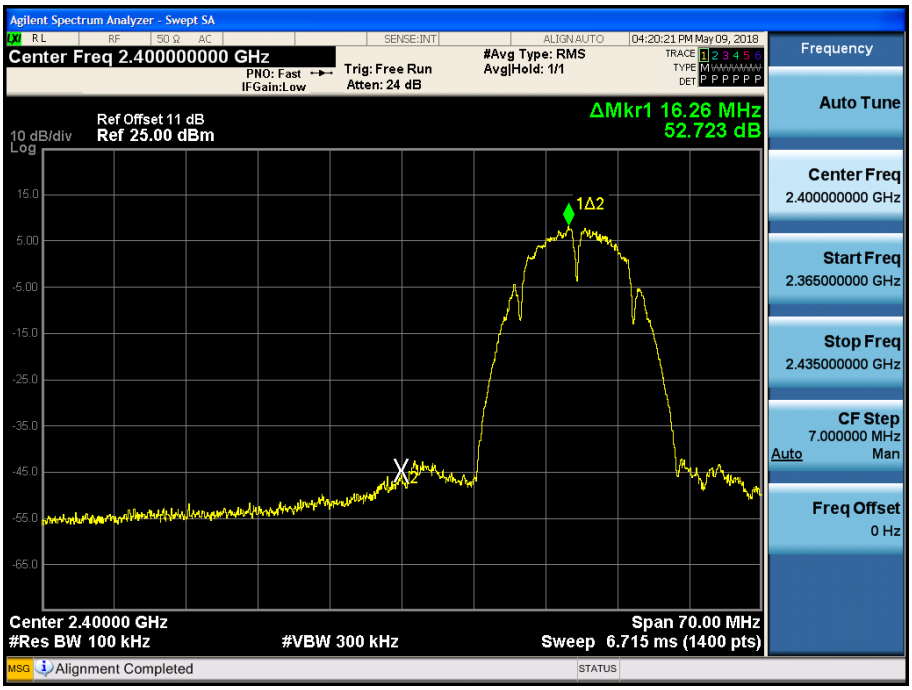
2. Factor = Cable loss + Attenuator loss

▣ RESULT PLOTS

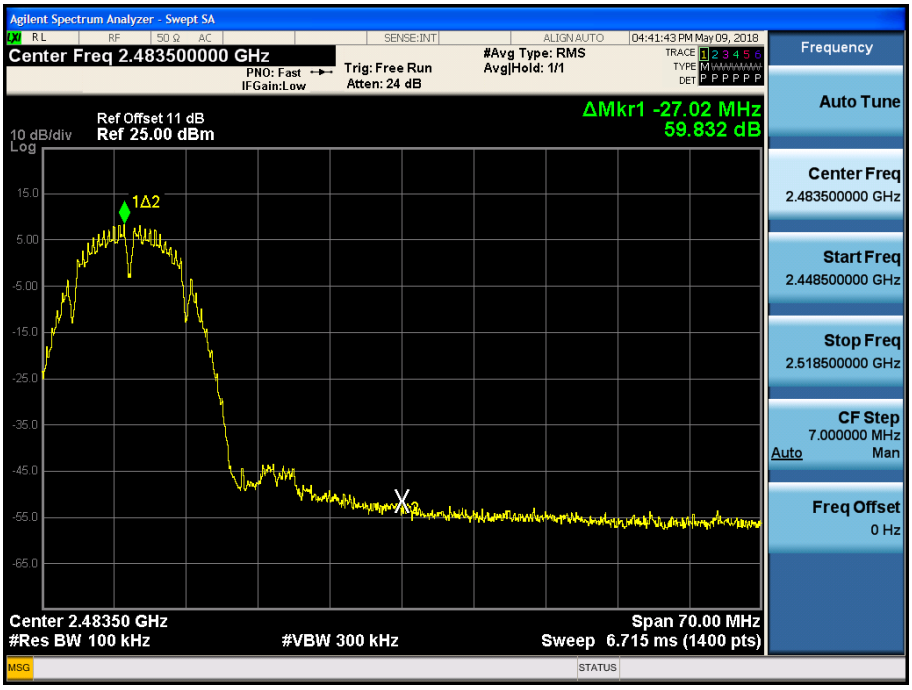
Band Edge (802.11b-CH1)



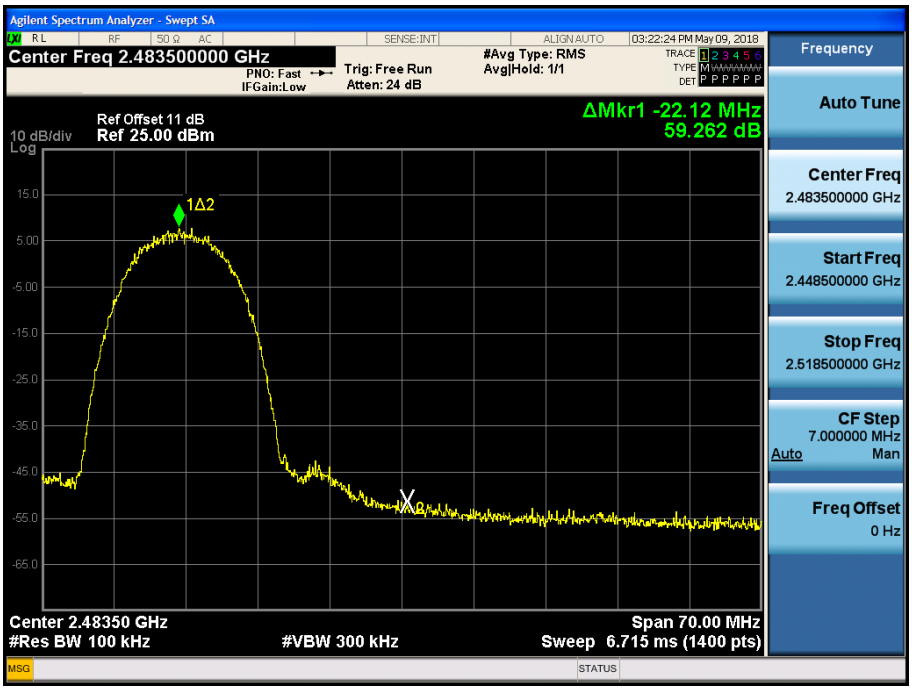
Band Edge (802.11b-CH2)



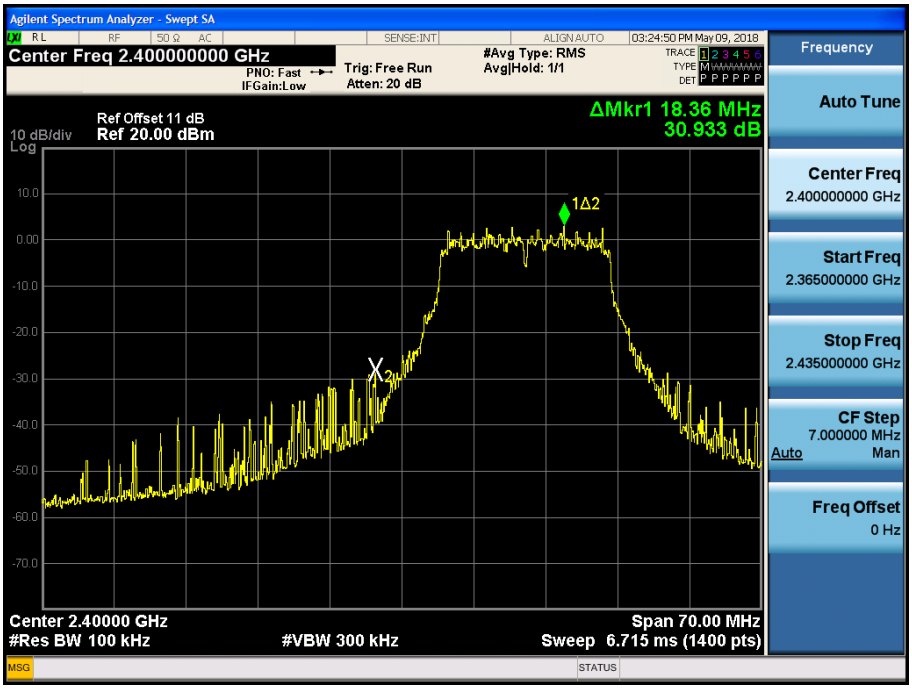
Band Edge (802.11b-CH10)



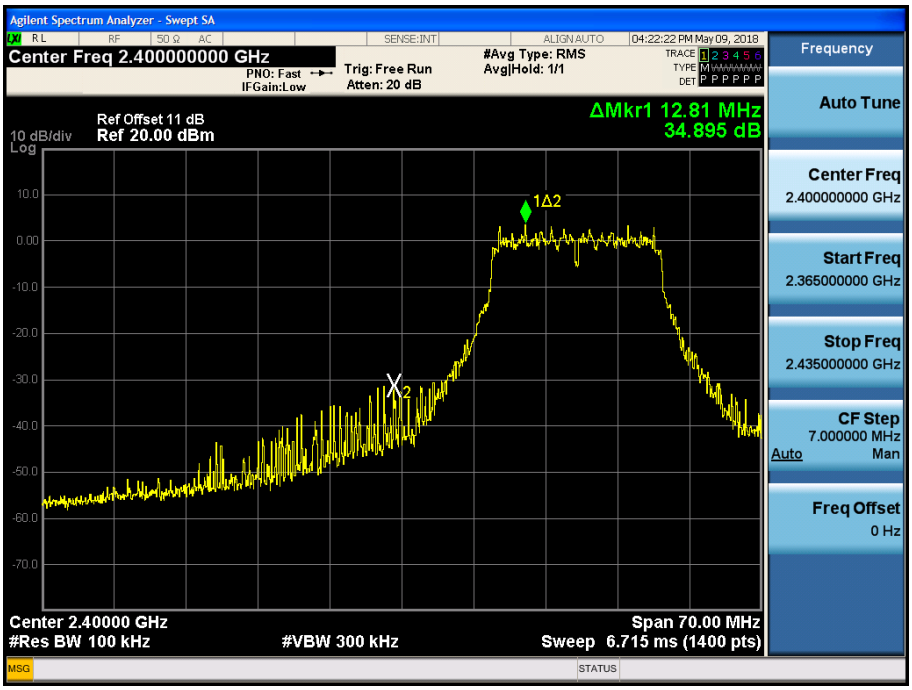
Band Edge (802.11b-CH11)



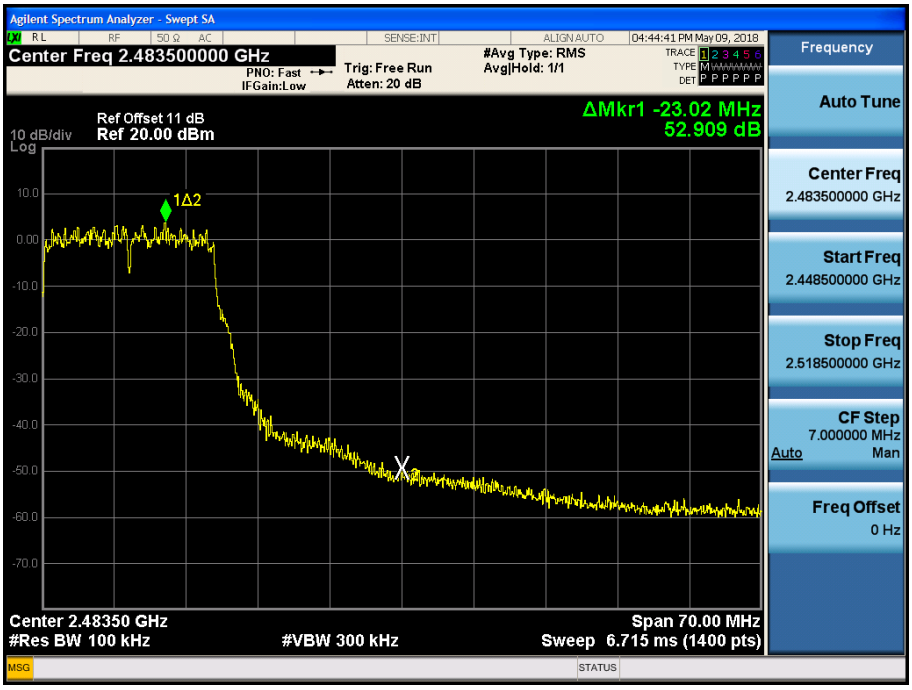
Band Edge (802.11g-CH1)



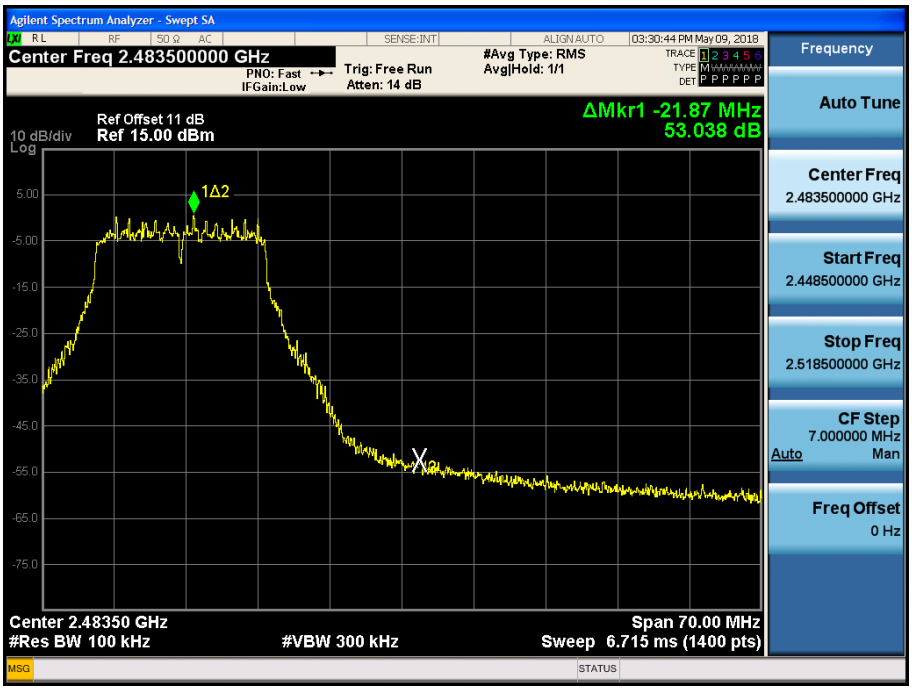
Band Edge (802.11g-CH2)



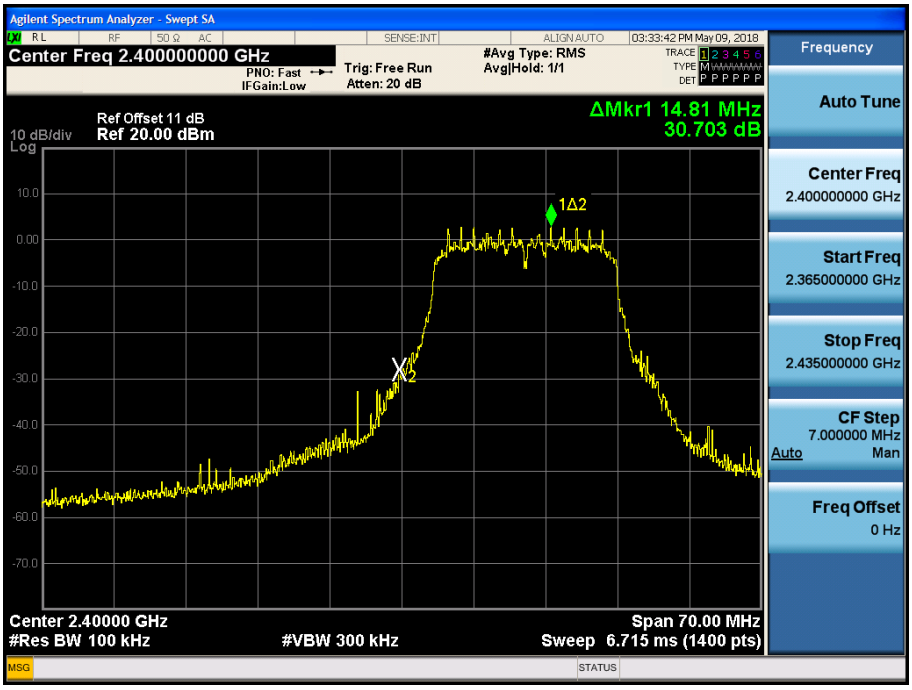
Band Edge (802.11g-CH10)



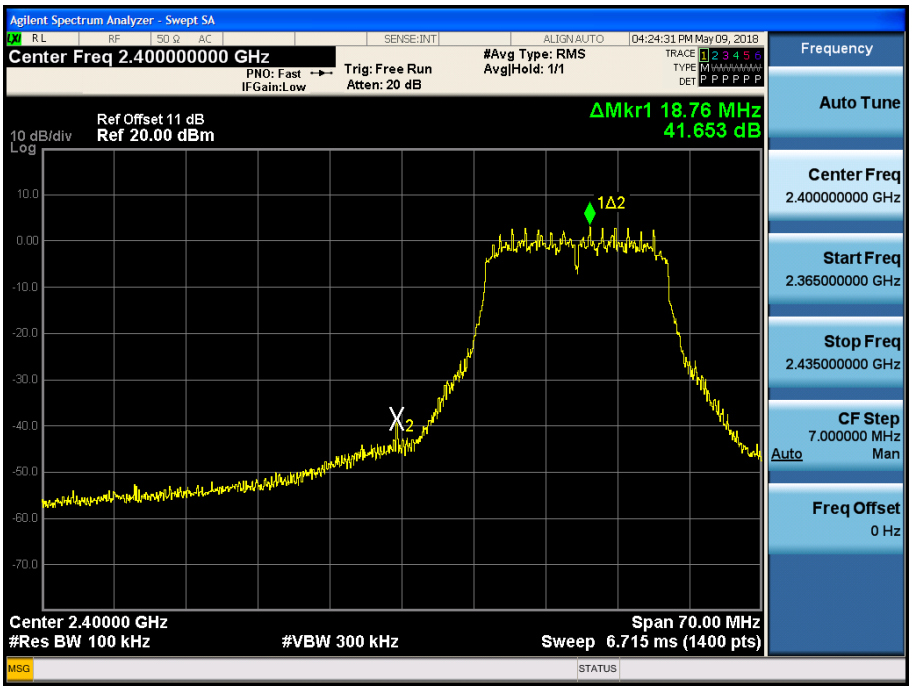
Band Edge (802.11g-CH11)



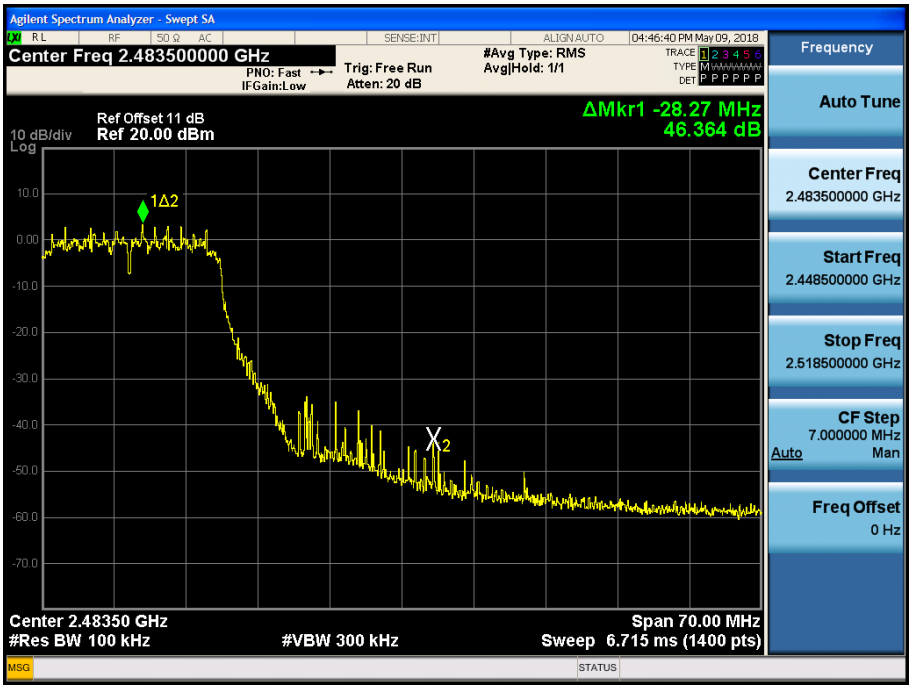
Band Edge (802.11n_HT20-CH1)



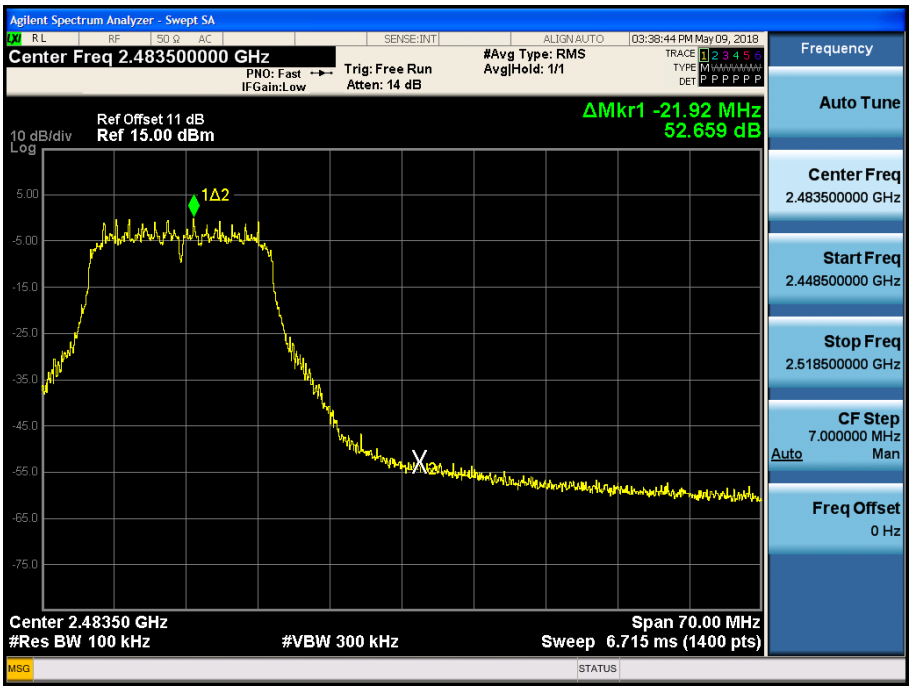
Band Edge (802.11n_HT20-CH2)



Band Edge (802.11n_HT20-CH10)

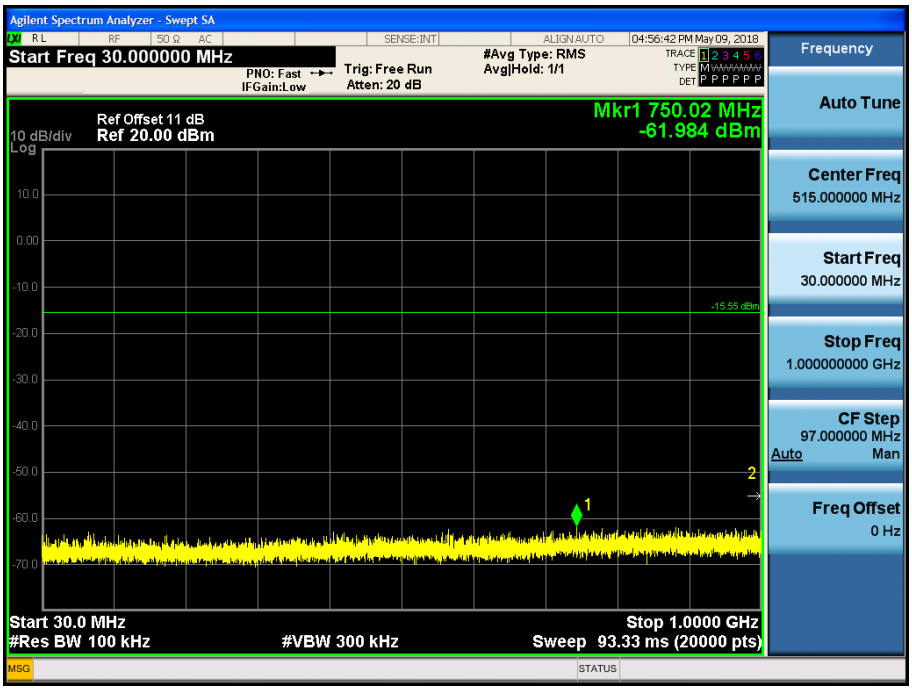


Band Edge (802.11n_HT20-CH11)



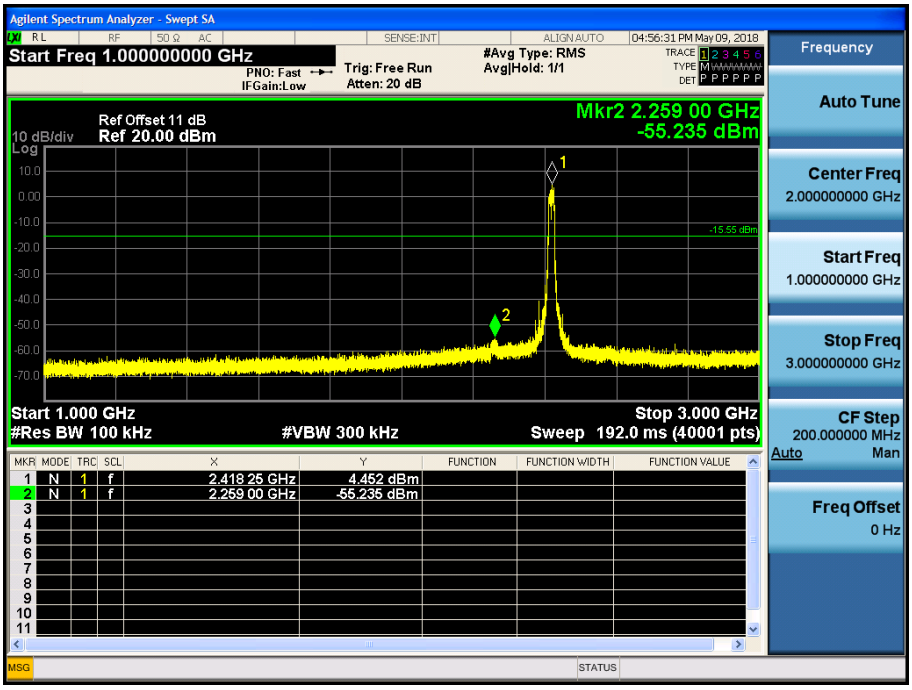
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



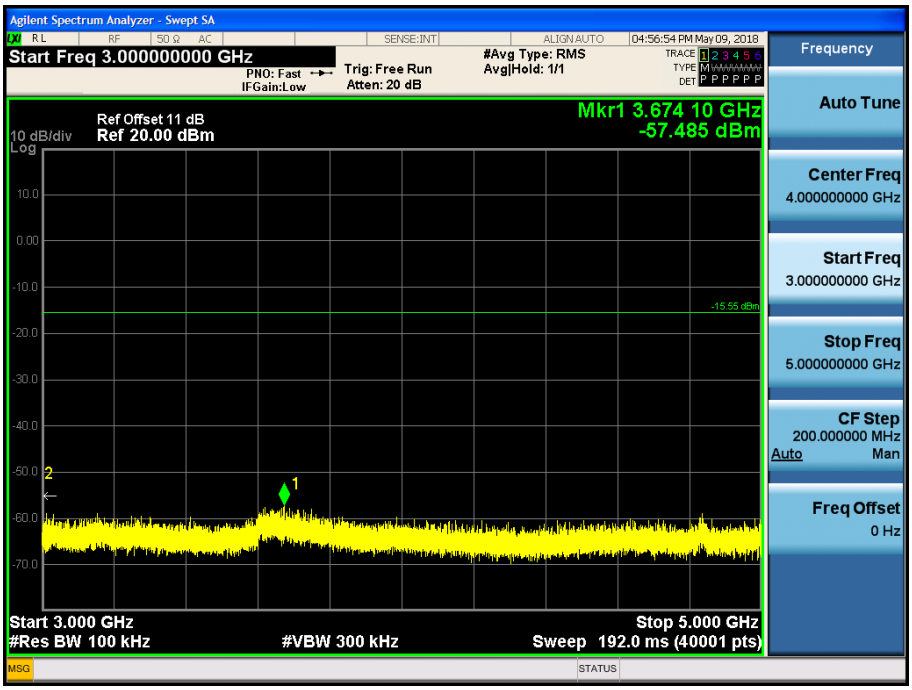
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



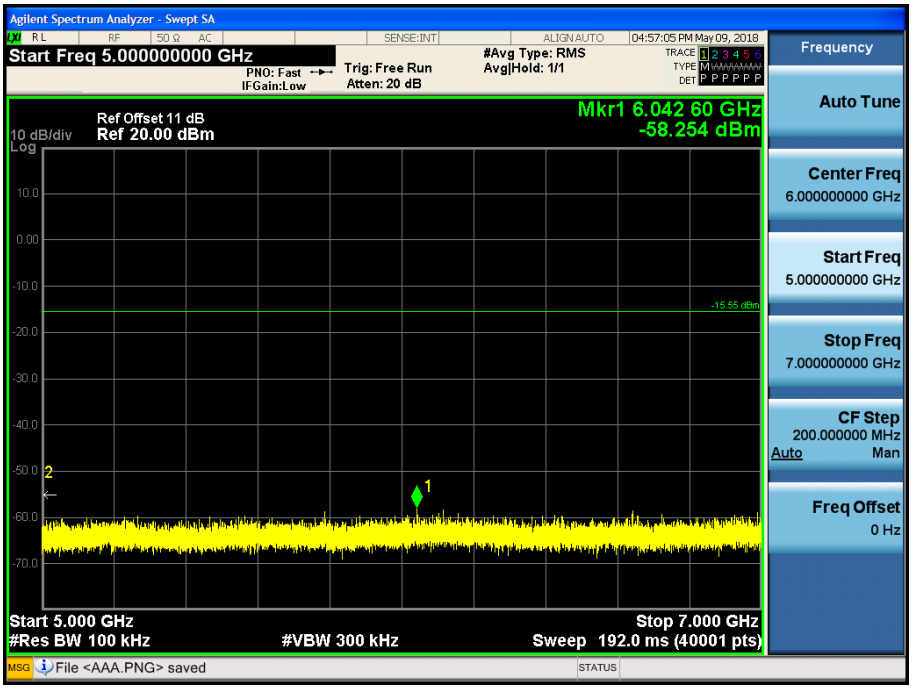
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



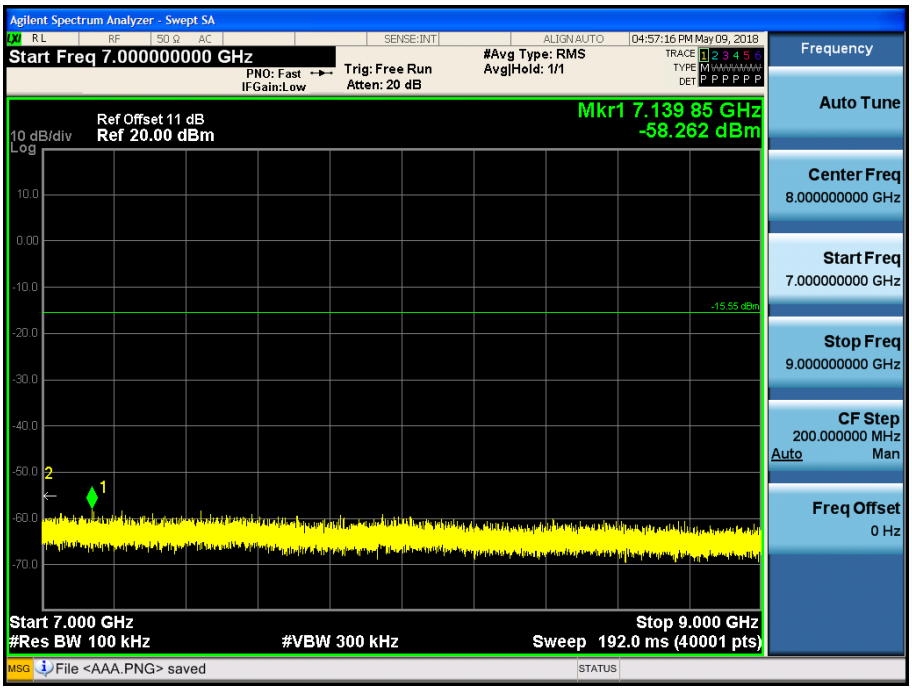
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



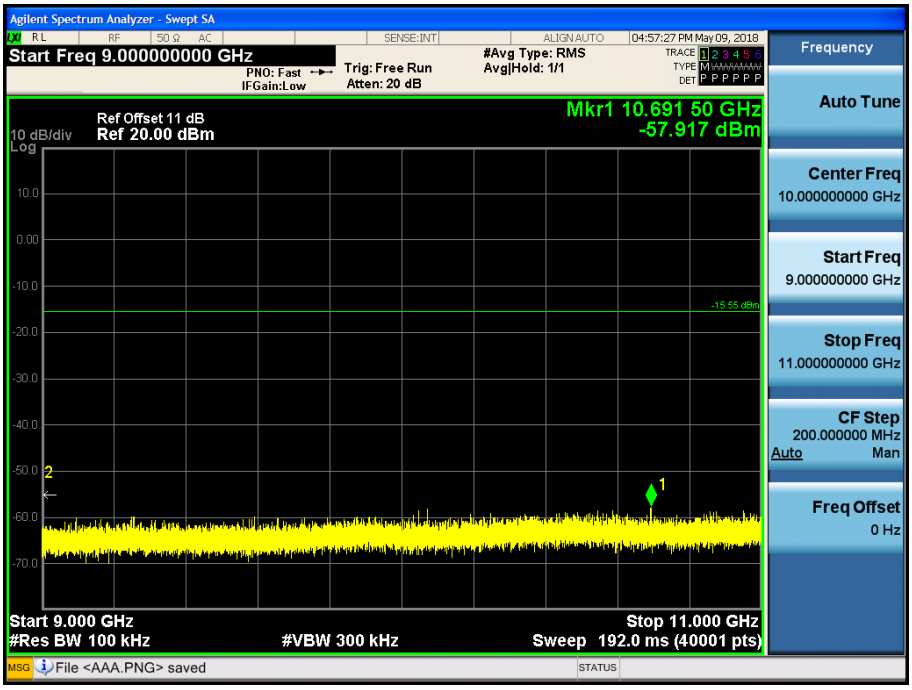
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



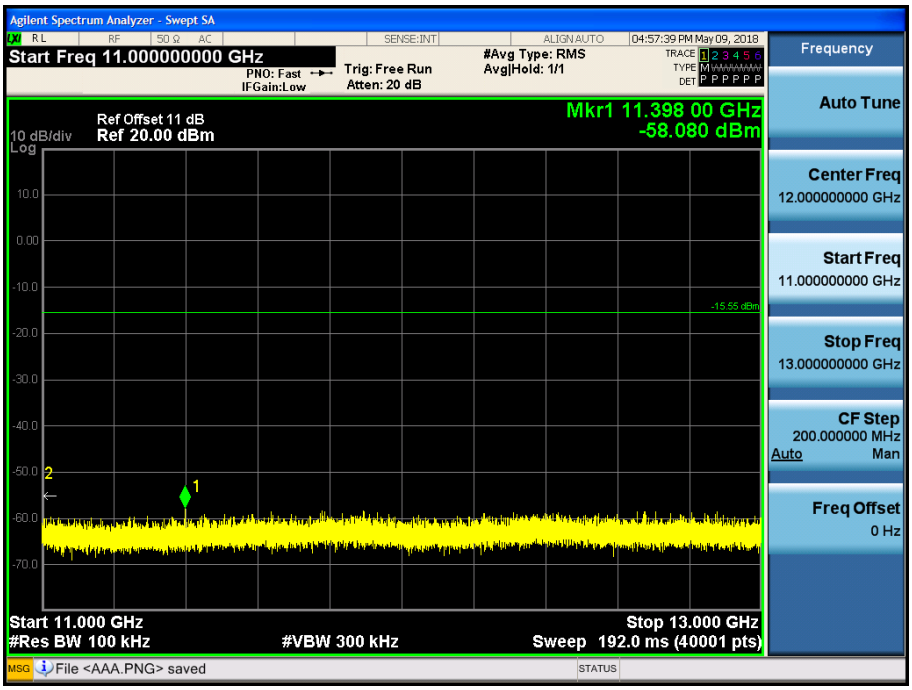
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



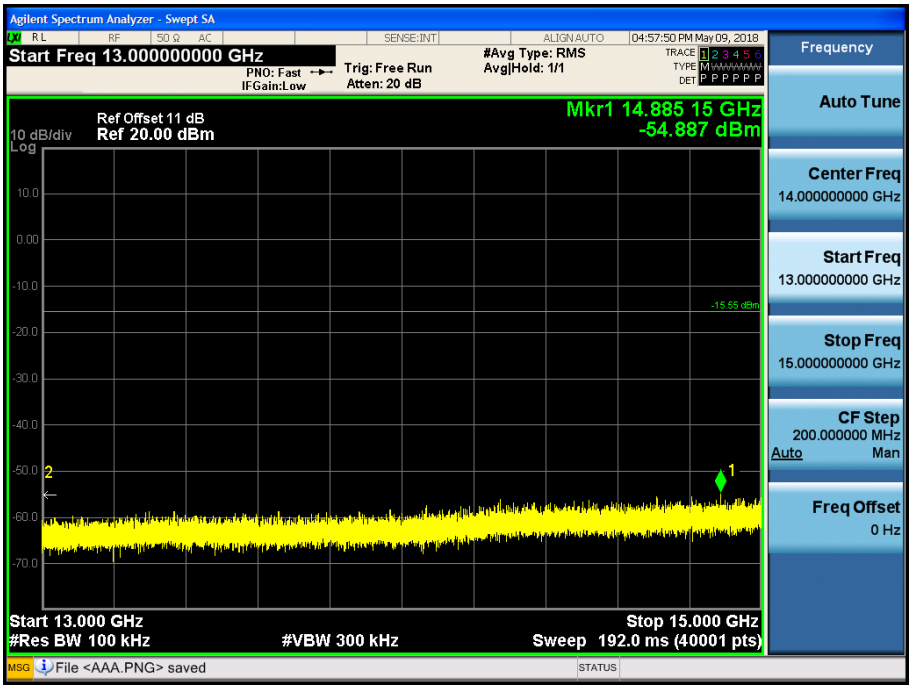
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



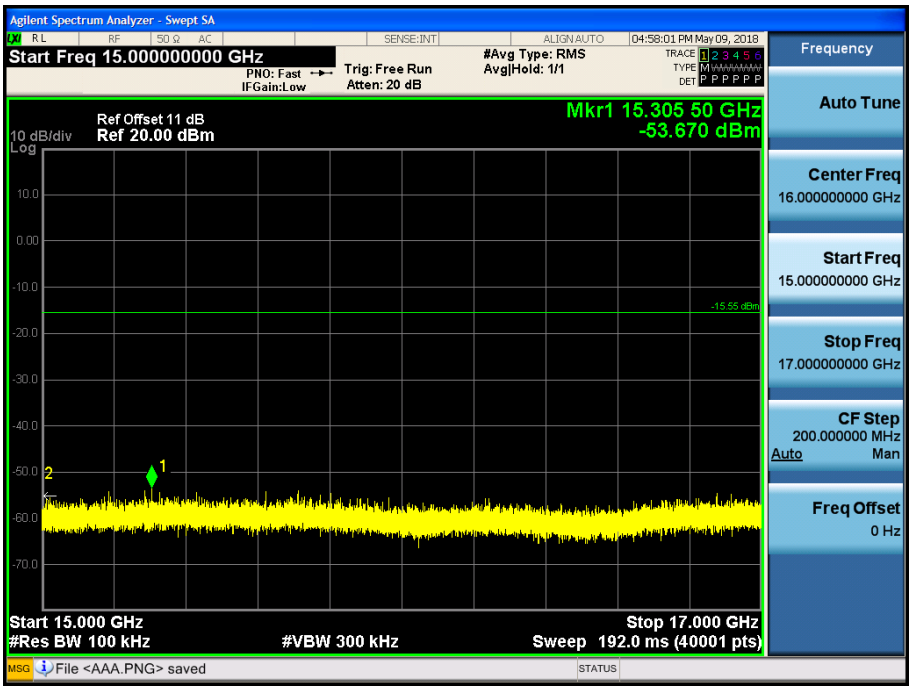
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



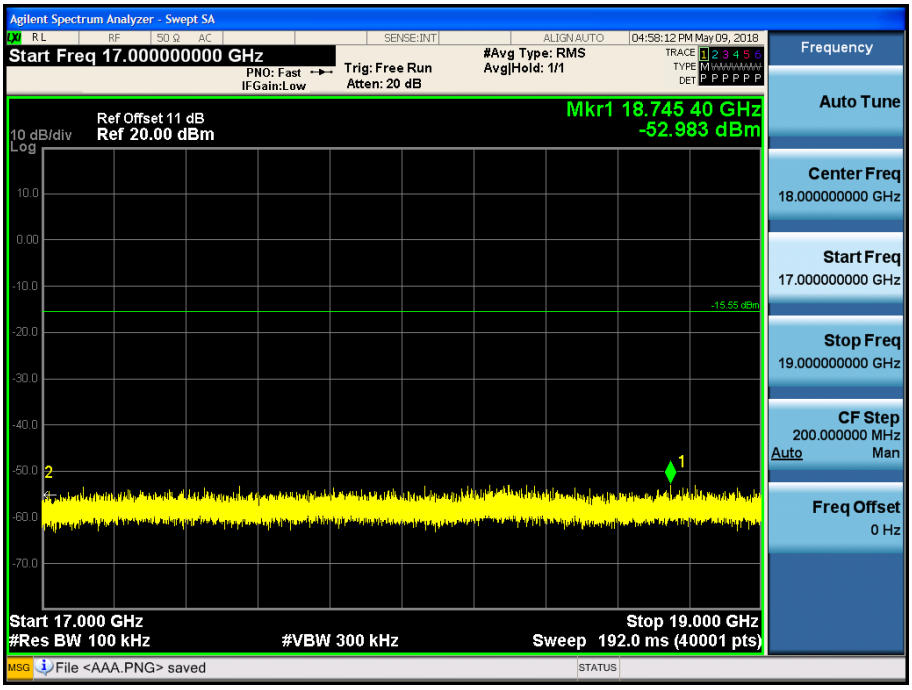
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



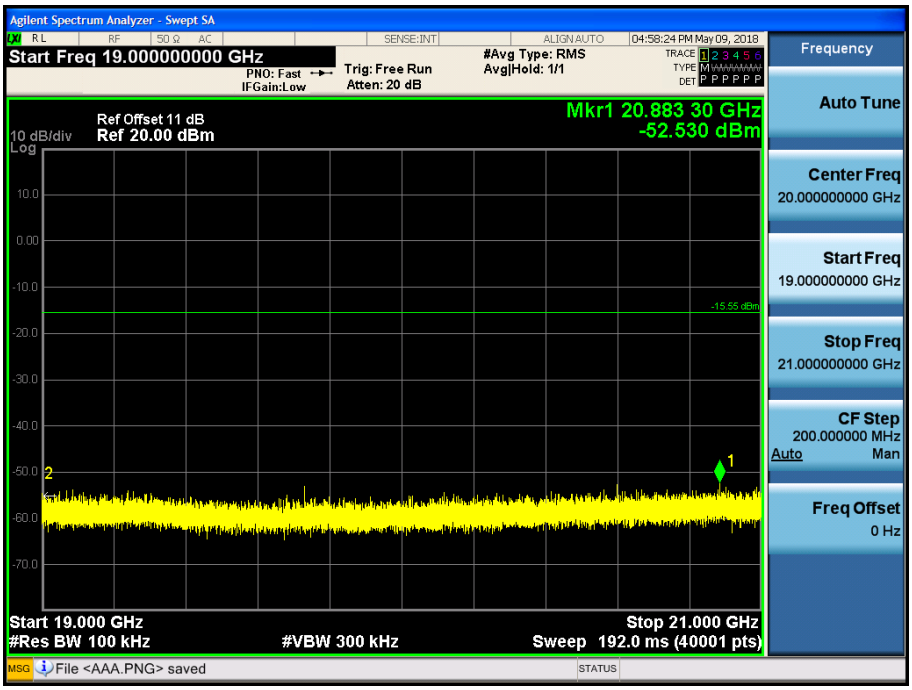
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



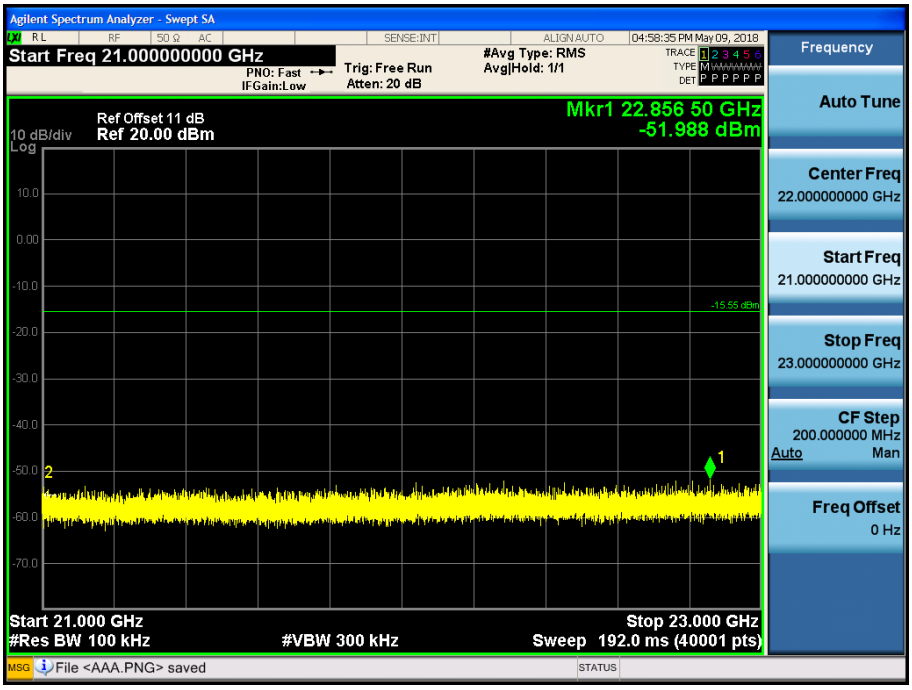
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



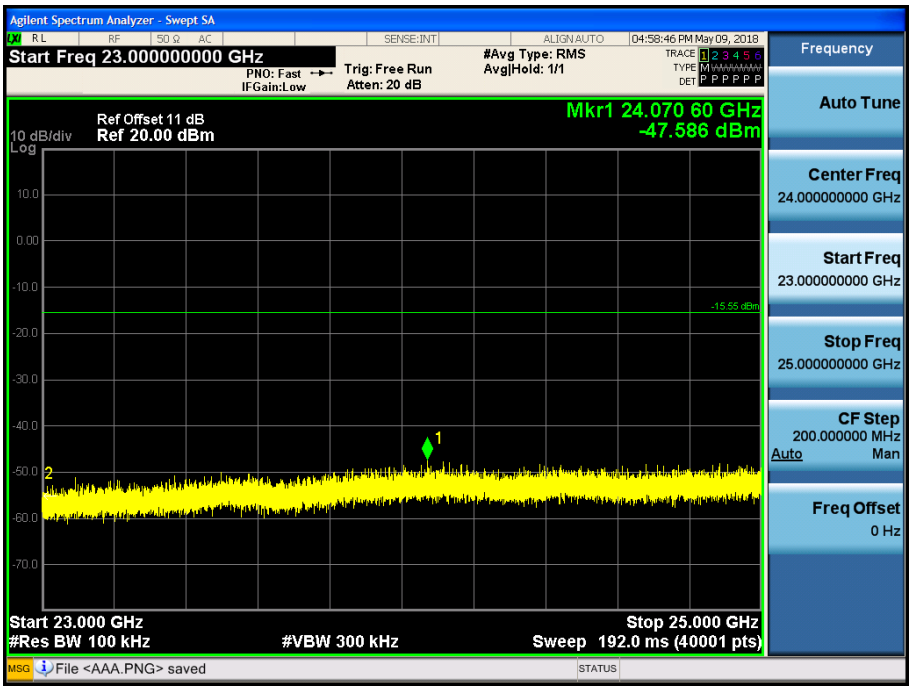
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11g_Ch.02_6 Mbps)



9.6 RADIATED MEASUREMENT.

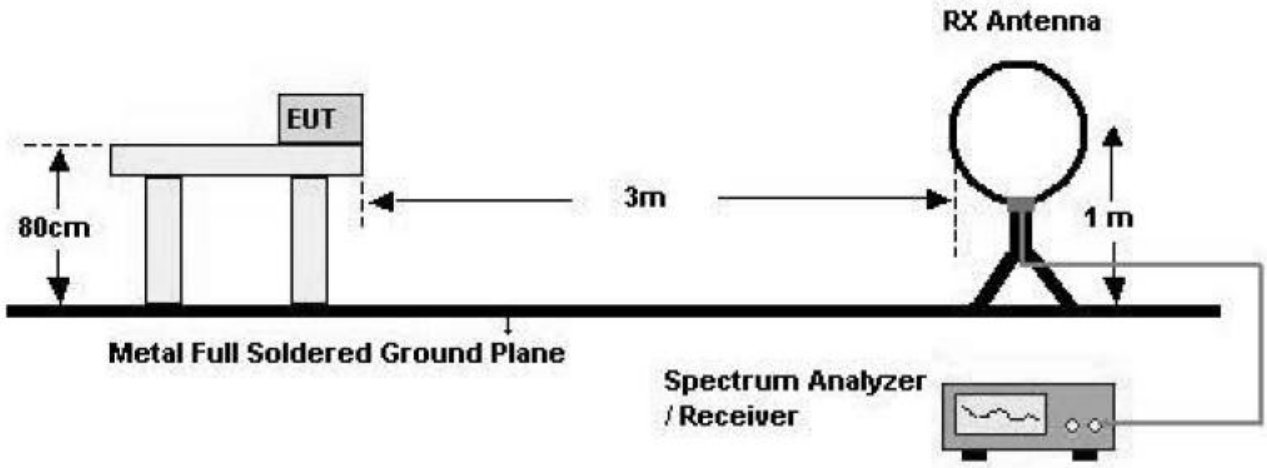
9.6.1 RADIATED SPURIOUS EMISSIONS.

Test Requirements and limit, §15.205, §15.209

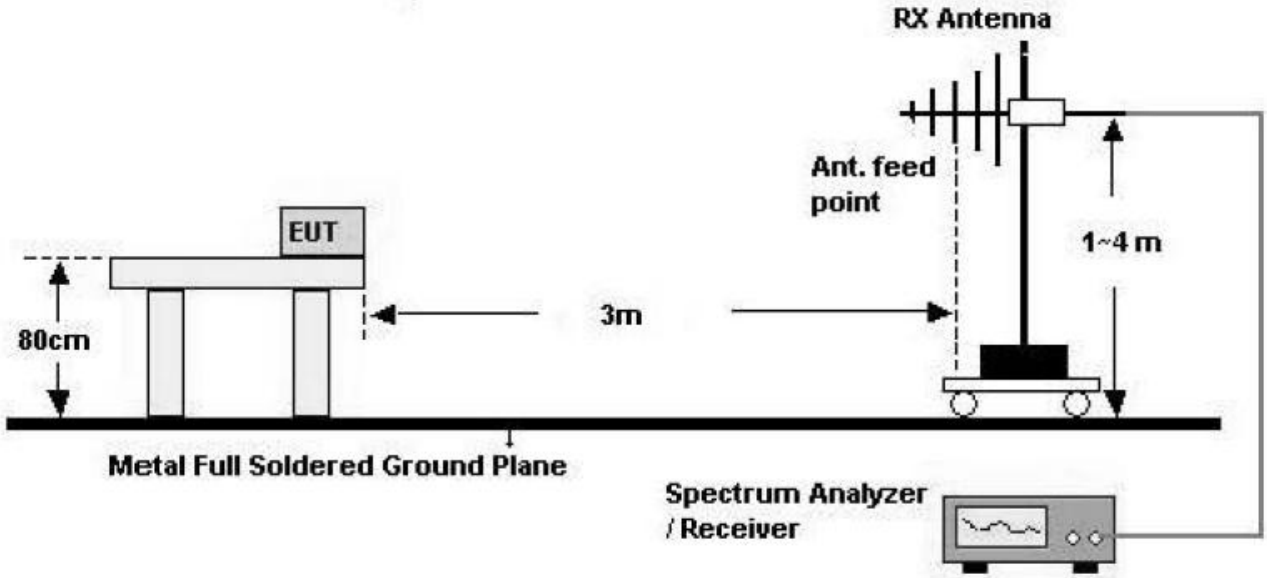
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

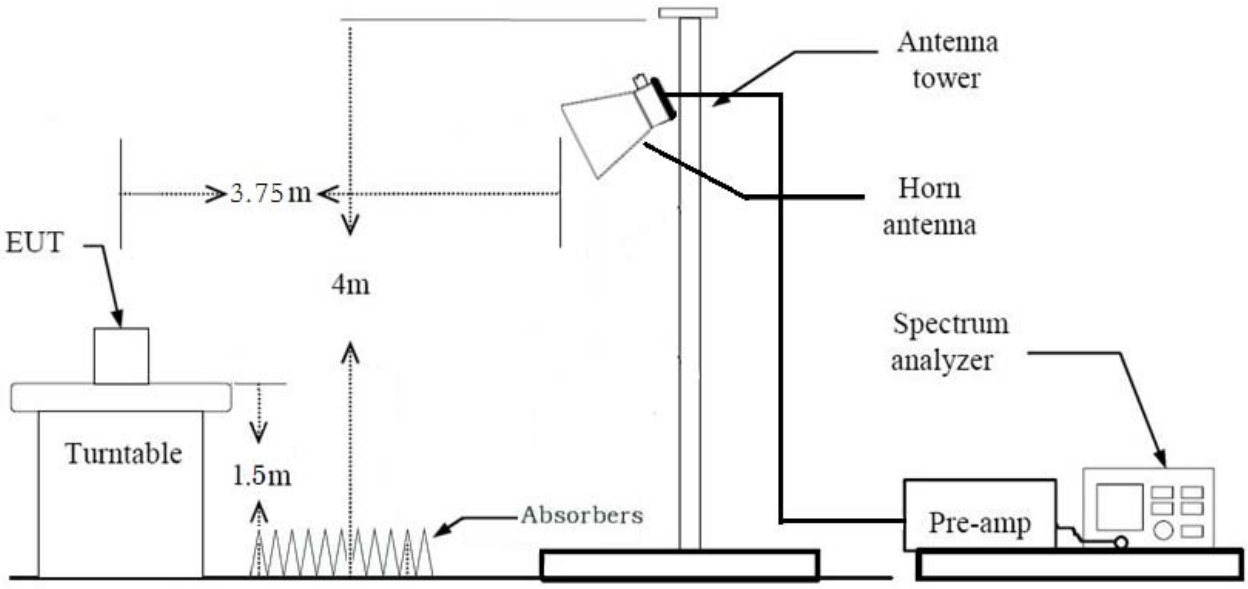
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE USED

Method 12.1 in KDB 558074 v04

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	32.210	32.340	99.60	0.017
g	6	5.362	5.430	98.75	0.055
n_HT20	MCS0_6.5 Mbps	3.868	3.939	98.20	0.079

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	54.20	1.45	V	55.65	73.98	18.33	PK
4824	49.61	1.45	V	51.06	53.98	2.92	AV
7236	45.98	11.43	V	57.41	73.98	16.57	PK
7236	35.34	11.43	V	46.77	53.98	7.21	AV
4824	53.48	1.45	H	54.93	73.98	19.05	PK
4824	49.12	1.45	H	50.57	53.98	3.41	AV
7236	46.94	11.43	H	58.37	73.98	15.61	PK
7236	35.85	11.43	H	47.28	53.98	6.70	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	51.35	1.45	V	52.80	73.98	21.18	PK
4824	39.40	1.45	V	40.85	53.98	13.13	AV
7236	45.61	11.43	V	57.04	73.98	16.94	PK
7236	33.67	11.43	V	45.10	53.98	8.88	AV
4824	51.11	1.45	H	52.56	73.98	21.42	PK
4824	38.90	1.45	H	40.35	53.98	13.63	AV
7236	45.86	11.43	H	57.29	73.98	16.69	PK
7236	33.97	11.43	H	45.40	53.98	8.58	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	50.65	1.45	V	52.10	73.98	21.88	PK
4824	39.39	1.45	V	40.84	53.98	13.14	AV
7236	45.19	11.43	V	56.62	73.98	17.36	PK
7236	33.52	11.43	V	44.95	53.98	9.03	AV
4824	49.65	1.45	H	51.10	73.98	22.88	PK
4824	39.12	1.45	H	40.57	53.98	13.41	AV
7236	45.91	11.43	H	57.34	73.98	16.64	PK
7236	33.79	11.43	H	45.22	53.98	8.76	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 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.
8. Duty cycle factor applies only below 98%.
   Therefore, test result did not apply the duty cycle factor.

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	54.79	1.66	V	56.45	73.98	17.53	PK
4874	49.96	1.66	V	51.62	53.98	2.36	AV
7311	48.05	10.10	V	58.15	73.98	15.83	PK
7311	37.59	10.10	V	47.69	53.98	6.29	AV
4874	53.78	1.66	H	55.44	73.98	18.54	PK
4874	49.32	1.66	H	50.98	53.98	3.00	AV
7311	48.43	10.10	H	58.53	73.98	15.45	PK
7311	37.94	10.10	H	48.04	53.98	5.94	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	53.28	1.66	V	54.94	73.98	19.04	PK
4874	40.90	1.66	V	42.56	53.98	11.42	AV
7311	46.31	10.10	V	56.41	73.98	17.57	PK
7311	34.77	10.10	V	44.87	53.98	9.11	AV
4874	52.68	1.66	H	54.34	73.98	19.64	PK
4874	40.75	1.66	H	42.41	53.98	11.57	AV
7311	46.70	10.10	H	56.80	73.98	17.18	PK
7311	35.05	10.10	H	45.15	53.98	8.83	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	52.38	1.66	V	54.04	73.98	19.94	PK
4874	41.11	1.66	V	42.77	53.98	11.21	AV
7311	46.17	10.10	V	56.27	73.98	17.71	PK
7311	34.19	10.10	V	44.29	53.98	9.69	AV
4874	51.33	1.66	H	52.99	73.98	20.99	PK
4874	40.84	1.66	H	42.50	53.98	11.48	AV
7311	46.55	10.10	H	56.65	73.98	17.33	PK
7311	34.48	10.10	H	44.58	53.98	9.40	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 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.
8. Duty cycle factor applies only below 98%.
   Therefore, test result did not apply the duty cycle factor.

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	51.99	1.00	V	52.99	73.98	20.99	PK
4924	46.96	1.00	V	47.96	53.98	6.02	AV
7386	46.88	11.10	V	57.98	73.98	16.00	PK
7386	36.75	11.10	V	47.85	53.98	6.13	AV
4924	51.42	1.00	H	52.42	73.98	21.56	PK
4924	46.56	1.00	H	47.56	53.98	6.42	AV
7386	47.26	11.10	H	58.36	73.98	15.62	PK
7386	36.94	11.10	H	48.04	53.98	5.94	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	51.18	1.00	V	52.18	73.98	21.80	PK
4924	39.24	1.00	V	40.24	53.98	13.74	AV
7386	45.74	11.10	V	56.84	73.98	17.14	PK
7386	34.02	11.10	V	45.12	53.98	8.86	AV
4924	50.73	1.00	H	51.73	73.98	22.25	PK
4924	38.89	1.00	H	39.89	53.98	14.09	AV
7386	45.82	11.10	H	56.92	73.98	17.06	PK
7386	34.15	11.10	H	45.25	53.98	8.73	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	51.44	1.00	V	52.44	73.98	21.54	PK
4924	39.02	1.00	V	40.02	53.98	13.96	AV
7386	45.32	11.10	V	56.42	73.98	17.56	PK
7386	33.67	11.10	V	44.77	53.98	9.21	AV
4924	50.46	1.00	H	51.46	73.98	22.52	PK
4924	38.58	1.00	H	39.58	53.98	14.40	AV
7386	45.83	11.10	H	56.93	73.98	17.05	PK
7386	33.91	11.10	H	45.01	53.98	8.97	AV

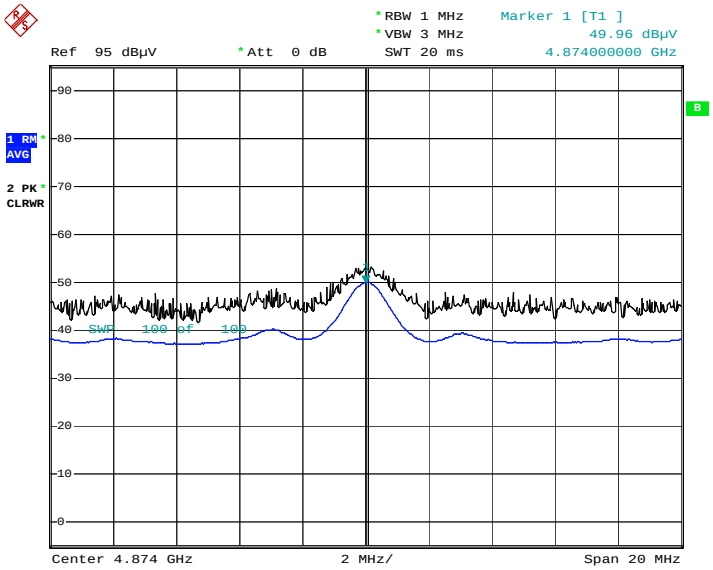
*A.F. : Antenna Factor / C.L. : Cable Loss / A.G. : Amplifier Gain / D.F. : Distance Factor

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 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.
8. Duty cycle factor applies only below 98%.
   Therefore, test result did not apply the duty cycle factor.

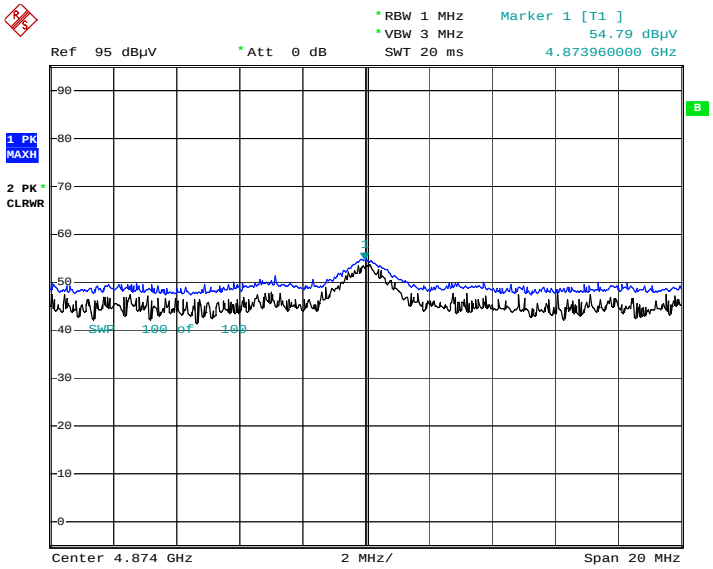
▣ RESULT PLOTS (Worst case : Z-V)

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



Date: 3.MAY.2018 11:31:00

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



Date: 3.MAY.2018 11:31:47

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

9.6.2 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: 802.11b

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	26.37	33.30	H	59.67	73.98	14.31	PK
2390.0	15.55	33.30	H	48.85	53.98	5.13	AV
2390.0	26.31	33.30	V	59.61	73.98	14.37	PK
2390.0	15.48	33.30	V	48.78	53.98	5.20	AV
2483.5	26.58	33.41	H	59.99	73.98	13.99	PK
2483.5	15.30	33.41	H	48.71	53.98	5.27	AV
2483.5	25.98	33.41	V	59.39	73.98	14.59	PK
2483.5	15.14	33.41	V	48.55	53.98	5.43	AV

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

Operation Mode: 802.11g
Transfer Rate: 6 Mbps
Operating Frequency 2457 MHz
Channel No. 10 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
2483.5	31.48	33.41	H	64.89	73.98	9.09	PK
2483.5	14.74	33.41	H	48.15	53.98	5.83	AV

Operation Mode: 802.11 n_HT20
Transfer Rate: 6.5 Mbps
Operating Frequency 2412 MHz, 2457 MHz
Channel No. 01 Ch , 10 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	37.57	33.30	H	70.87	73.98	3.11	PK
2390.0	18.68	33.30	H	51.98	53.98	2.00	AV
2390.0	37.57	33.30	V	70.87	73.98	3.11	PK
2390.0	19.01	33.30	V	52.31	53.98	1.67	AV
2483.5	27.14	33.41	H	60.55	73.98	13.43	PK
2483.5	14.67	33.41	H	48.08	53.98	5.90	AV

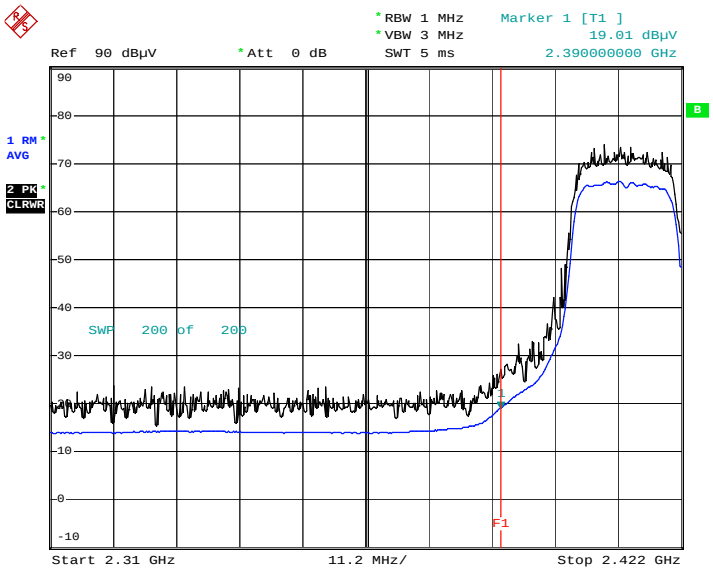
Notes:

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.
5. Duty cycle factor applies only below 98%.
   Therefore, test result did not apply the duty cycle factor.
6. Method 12.1 in KDB 558074 v04

▣ RESULT PLOTS:

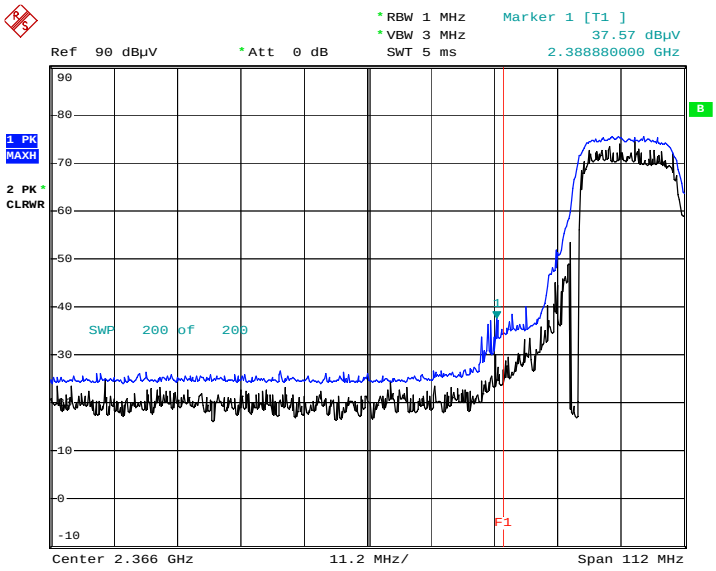
(Worst case : Y-V)

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



Date: 3.MAY.2018 16:46:01

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



Date: 3.MAY.2018 16:43:44

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

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

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
2388.0	37.41	33.30	H	70.71	73.98	3.27	PK
2390.0	18.91	33.30	H	52.21	53.98	1.77	AV
* 2388~2389	31.61	33.30	H	64.91	73.98	9.07	PK
* 2389~2390	32.11	33.30	H	65.41	73.98	8.57	PK
2485.5	38.08	33.41	H	71.49	73.98	2.49	PK
2483.5	15.28	33.41	H	48.69	53.98	5.29	AV
*2483.5~2484.5	32.64	33.41	H	66.05	73.98	7.93	PK
*2484.5~2485.5	31.90	33.41	H	65.31	73.98	8.67	PK

Notes:

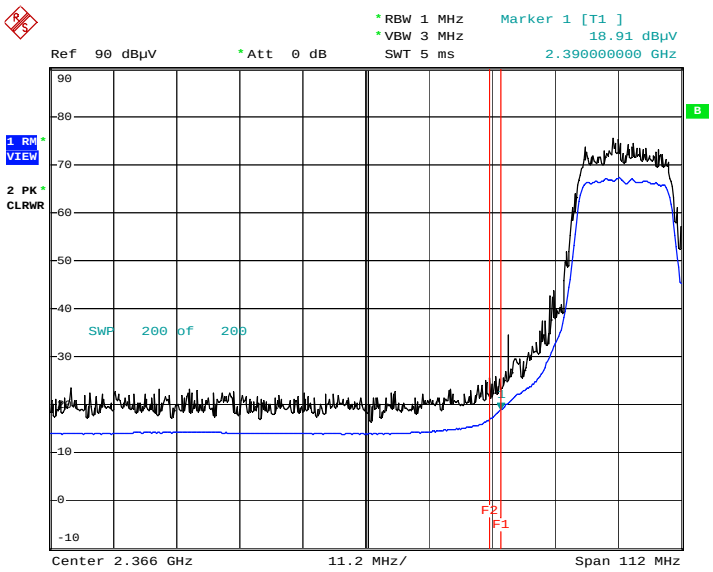
1. Total = Reading Value + Antenna Factor + Cable Loss + Distance Factor
2. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
3. We have done 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
   In order to simplify the report, attached data of worst case.
5. Duty cycle factor applies only below 98%. Therefore, test result did not apply the duty cycle factor.
6. Method 12.1 in KDB 558074 v04
7. '*' : Method 13.3 in KDB 558074 v04 (Integration Method)

▣ RESULT PLOTS:

(Worst case : Y-V)

Radiated Restricted Band Edges plot – Average Reading

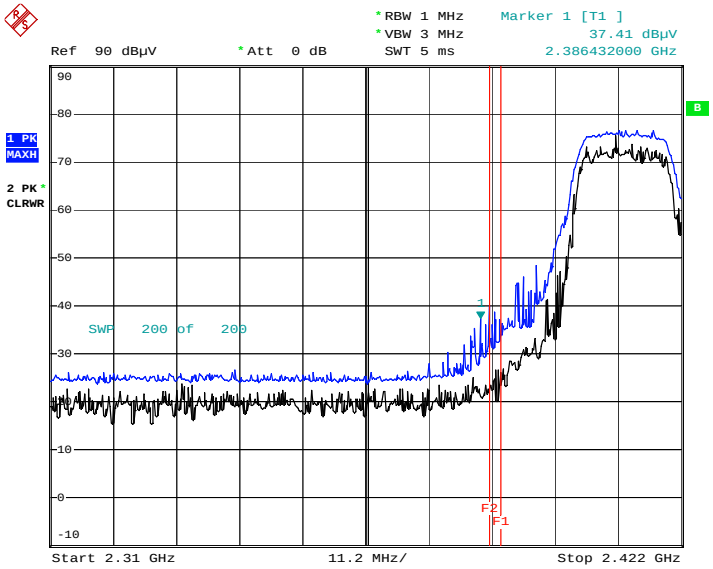
(802.11g, Ch.1_ 2310 ~ 2390 MHz)



Date: 3.MAY.2018 16:33:08

Radiated Restricted Band Edges plot – Peak Reading

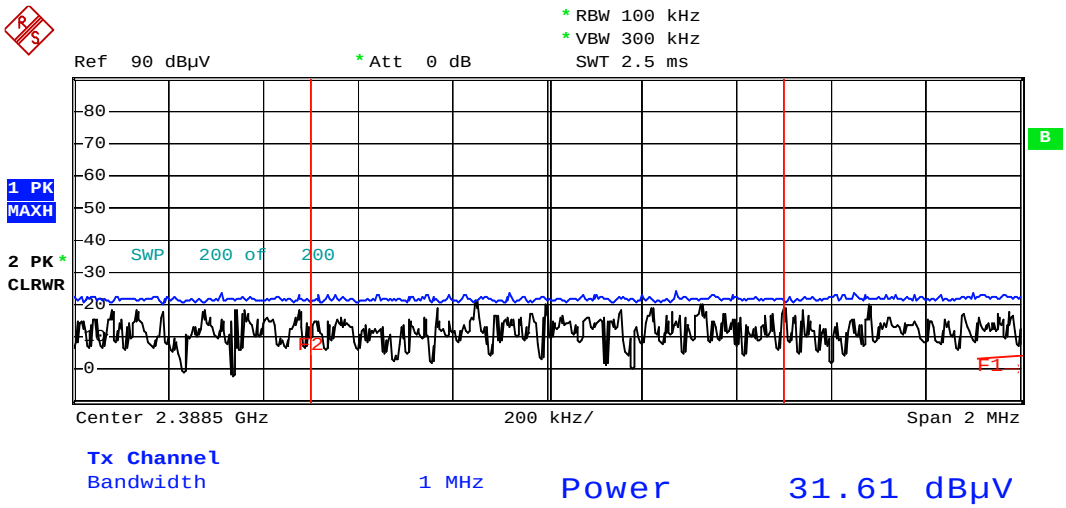
(802.11g, Ch.1_ 2310 ~ 2388 MHz)



Date: 3.MAY.2018 16:32:29

Radiated Restricted Band Edges plot – Integration method Peak Reading

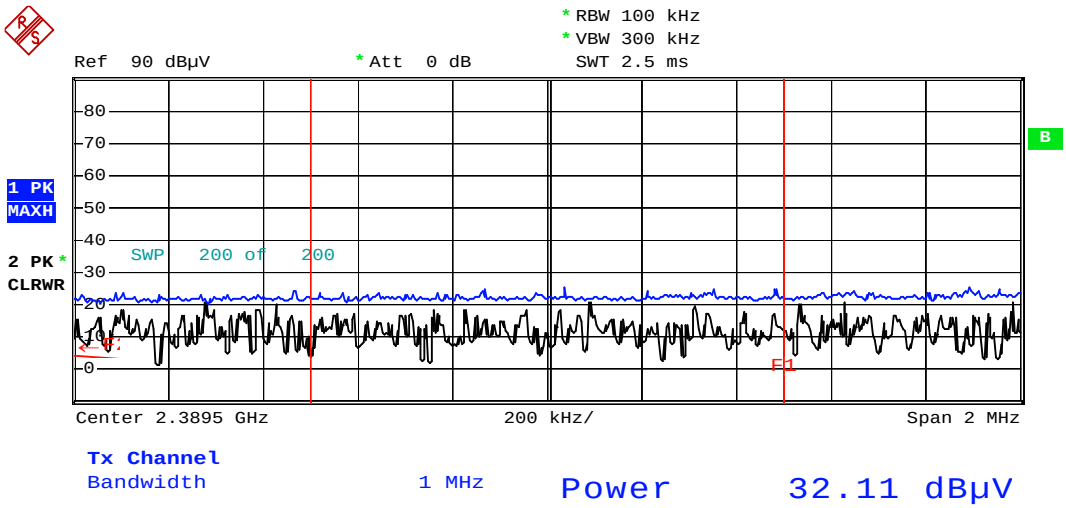
(802.11g, Ch.1_ 2388~2389 MHz)



Date: 3.MAY.2018 16:38:14

Radiated Restricted Band Edges plot – Integration method Peak Reading

(802.11g, Ch.1_ 2389~2390 MHz)

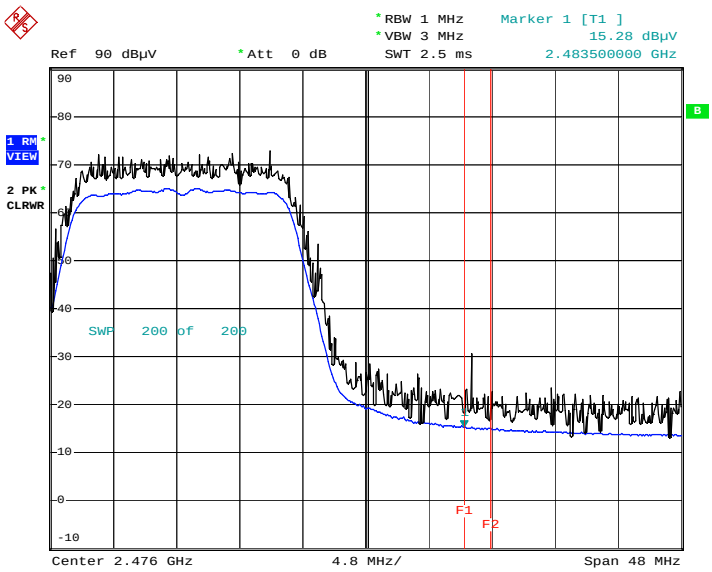


Date: 3.MAY.2018 16:37:10

(Worst case : X-H)

Radiated Restricted Band Edges plot – Average Reading

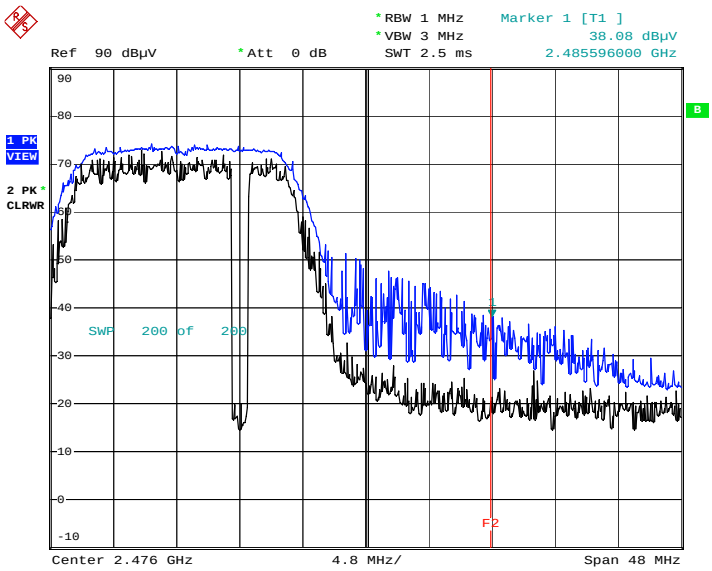
(802.11g, Ch.11_ 2483.5~2500 MHz)



Date: 3.MAY.2018 15:42:23

Radiated Restricted Band Edges plot – Peak Reading

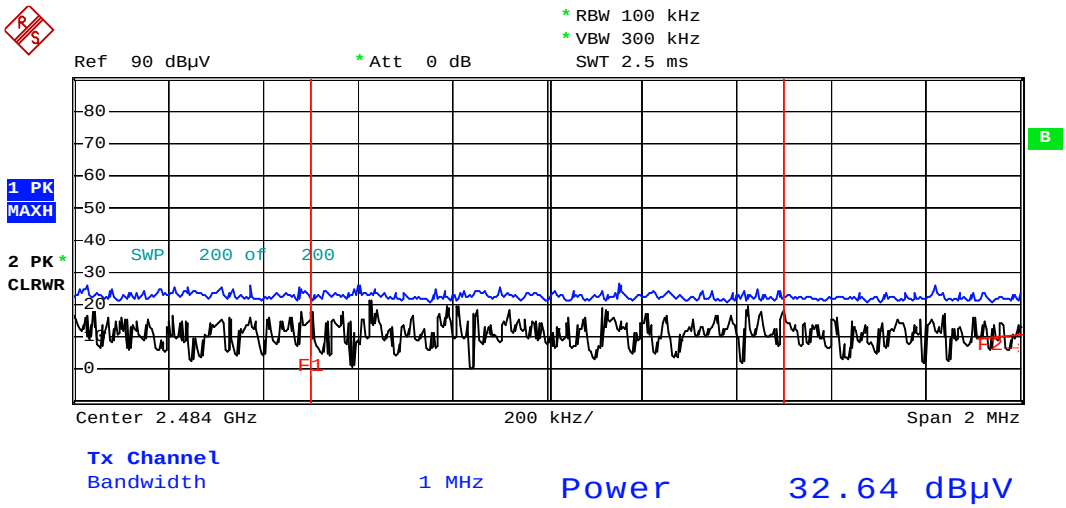
(802.11g, Ch.11_ 2485.5 ~ 2500 MHz)



Date: 3.MAY.2018 15:41:19

Radiated Restricted Band Edges plot – Integration method Peak Reading

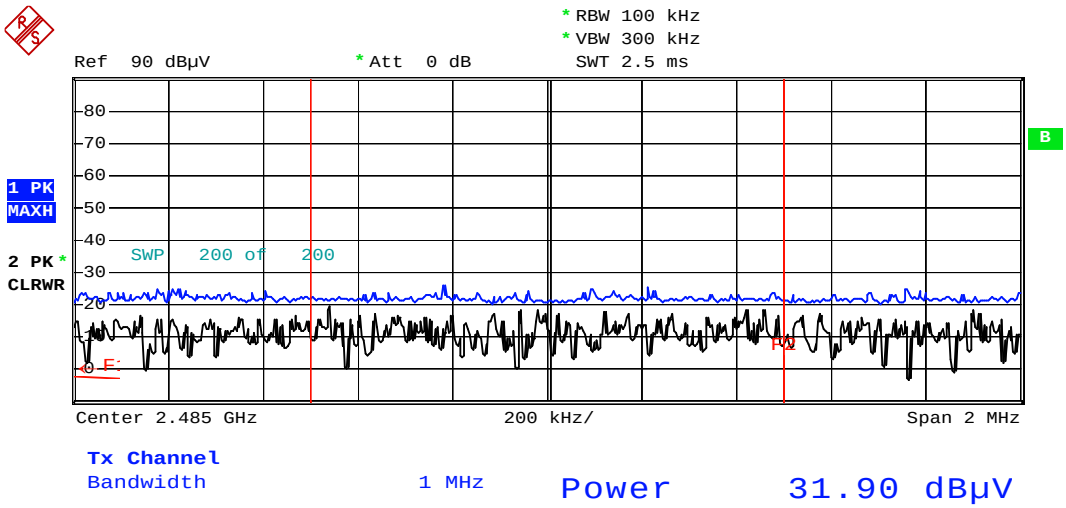
(802.11g, Ch.11_ 2483.5 ~ 2484.5 MHz)



Date: 3.MAY.2018 15:45:18

Radiated Restricted Band Edges plot – Integration method Peak Reading

(802.11g, Ch.11_ 2484.5 ~ 2485.5 MHz)



Date: 3.MAY.2018 15:48:19

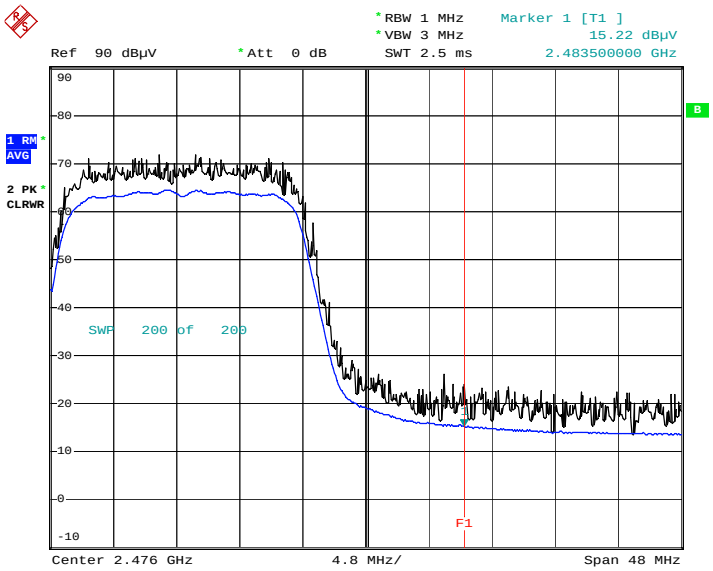
Operation Mode:	802.11 n_HT20
Transfer Rate:	6.5 Mbps
Operating Frequency	2462 MHz
Channel No.	11 Ch

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
2485.5	38.06	33.41	H	71.47	73.98	2.51	PK
2483.5	15.22	33.41	H	48.63	53.98	5.35	AV
*2483.5~2484.5	31.17	33.41	H	64.58	73.98	9.40	PK
*2484.5~2485.5	30.88	33.41	H	64.29	73.98	9.69	PK

Notes:

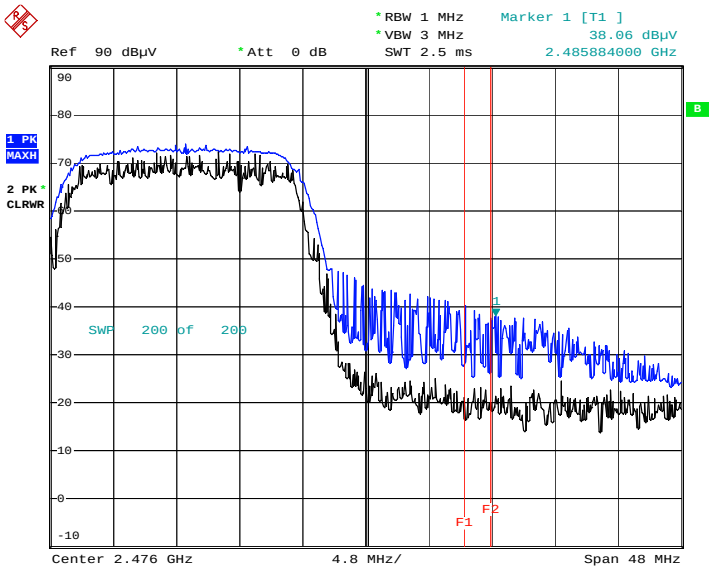
1. Total = Reading Value + Antenna Factor + Cable Loss + Distance Factor
2. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
3. We have done 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
   In order to simplify the report, attached data of worst case.
5. Duty cycle factor applies only below 98%. Therefore, test result did not apply the duty cycle factor.
6. Method 12.1 in KDB 558074 v04
7. '*' : Method 13.3 in KDB 558074 v04 (Integration Method)

Radiated Restricted Band Edges plot – Average Reading
(802.11 n_HT20, Ch.11_ 2483.5 ~ 2500 MHz)



Date: 3.MAY.2018 16:07:40

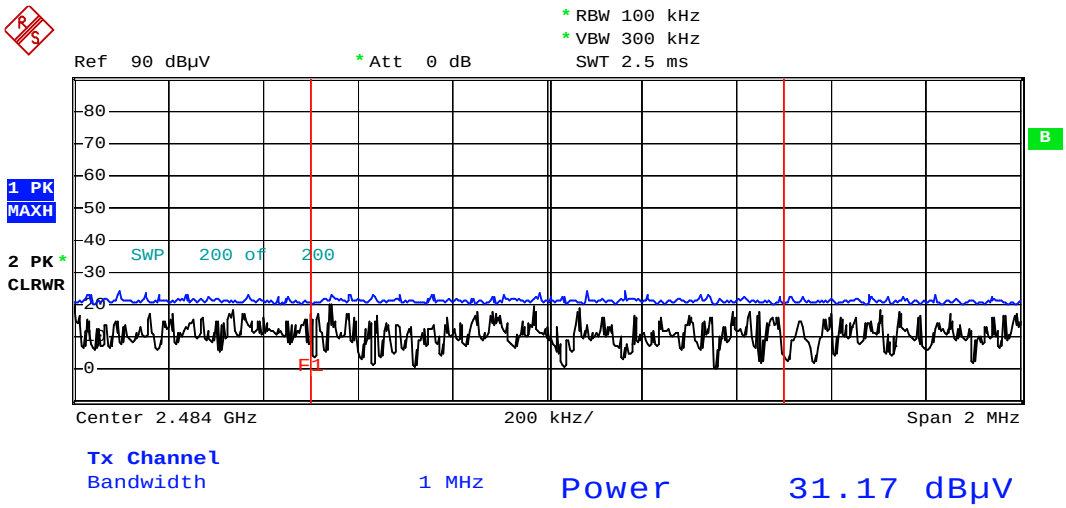
Radiated Restricted Band Edges plot – Peak Reading
(802.11 n_HT20, Ch.11_ 2485.5 ~ 2500 MHz)



Date: 3.MAY.2018 16:07:08

Radiated Restricted Band Edges plot – Integral Peak Reading

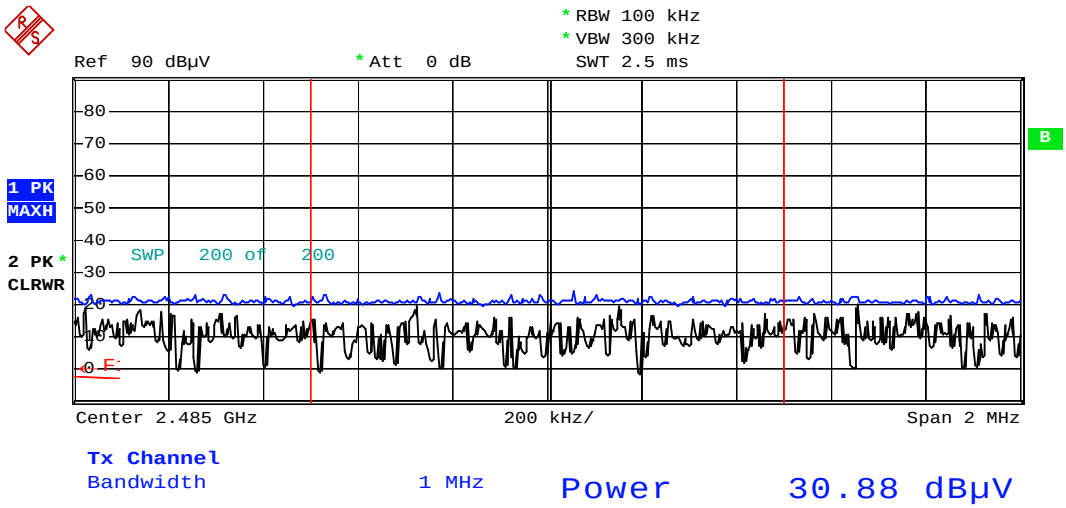
(802.11 n_HT20, Ch.11_ 2483.5 ~ 2484.5 MHz)



Date: 3.MAY.2018 16:09:03

Radiated Restricted Band Edges plot – Integral Peak Reading

(802.11 n_HT20, Ch.11_ 2484.5 ~ 2485.5 MHz)



Date: 3.MAY.2018 16:10:13

9.7 POWERLINE CONDUCTED EMISSIONS

Test Requirements and limit, §15.207

All modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

All conducted emissions must not exceed the limits shown in the table below

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

*Decreases with the logarithm of the frequency.

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)

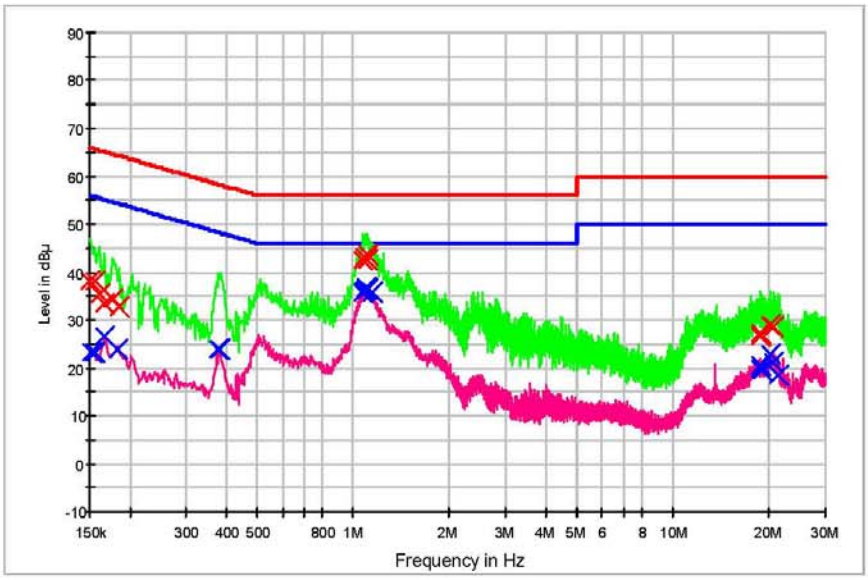
EMI Auto Test(1) 1 / 2

HCT TEST Report

Common Information

EUT:	WFM60-SFP201
Manufacturer:	I&C TECHNOLOGY
Test Site:	SHIELD ROOM
Operating Conditions:	WLAN MODE

FCC CLASS B_Exten Cable



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	38.0	9.000	Off	N	9.7	28.0	66.0
0.156000	38.0	9.000	Off	N	9.7	27.6	65.7
0.160000	35.4	9.000	Off	N	9.7	30.1	65.5
0.166000	33.5	9.000	Off	N	9.7	31.6	65.2
0.176000	34.3	9.000	Off	N	9.7	30.4	64.7
0.186000	32.7	9.000	Off	N	9.7	31.5	64.2
1.070000	42.6	9.000	Off	N	9.8	13.4	56.0
1.078000	43.2	9.000	Off	N	9.8	12.8	56.0
1.088000	43.3	9.000	Off	N	9.8	12.7	56.0
1.092000	42.9	9.000	Off	N	9.8	13.1	56.0
1.106000	43.7	9.000	Off	N	9.8	12.3	56.0
1.112000	42.6	9.000	Off	N	9.8	13.4	56.0
18.758000	27.2	9.000	Off	N	10.6	32.8	60.0
18.846000	27.0	9.000	Off	N	10.6	33.0	60.0
18.888000	26.7	9.000	Off	N	10.6	33.3	60.0
20.094000	29.0	9.000	Off	N	10.7	31.0	60.0
20.172000	29.1	9.000	Off	N	10.7	30.9	60.0
20.596000	28.5	9.000	Off	N	10.7	31.5	60.0

2018-06-17 오후 11:56:02

EMI Auto Test(1) 2 / 2

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.152000	23.3	9.000	Off	N	9.7	32.5	55.9
0.156000	23.2	9.000	Off	N	9.7	32.5	55.7
0.166000	26.5	9.000	Off	N	9.7	28.7	55.2
0.184000	24.0	9.000	Off	N	9.7	30.3	54.3
0.378000	23.8	9.000	Off	N	9.7	24.5	48.3
0.382000	23.8	9.000	Off	N	9.7	24.5	48.2
1.070000	35.6	9.000	Off	N	9.8	10.4	46.0
1.078000	36.2	9.000	Off	N	9.8	9.8	46.0
1.090000	36.4	9.000	Off	N	9.8	9.6	46.0
1.098000	36.6	9.000	Off	N	9.8	9.4	46.0
1.106000	36.6	9.000	Off	N	9.8	9.4	46.0
1.142000	35.7	9.000	Off	N	9.8	10.3	46.0
18.758000	20.4	9.000	Off	N	10.6	29.6	50.0
18.832000	19.8	9.000	Off	N	10.6	30.2	50.0
18.960000	19.5	9.000	Off	N	10.6	30.5	50.0
20.172000	22.9	9.000	Off	N	10.7	27.1	50.0
20.596000	21.4	9.000	Off	N	10.7	28.6	50.0
21.336000	18.5	9.000	Off	N	10.7	31.5	50.0

2018-06-17 오후 11:56:02

Conducted Emissions (Line 2)

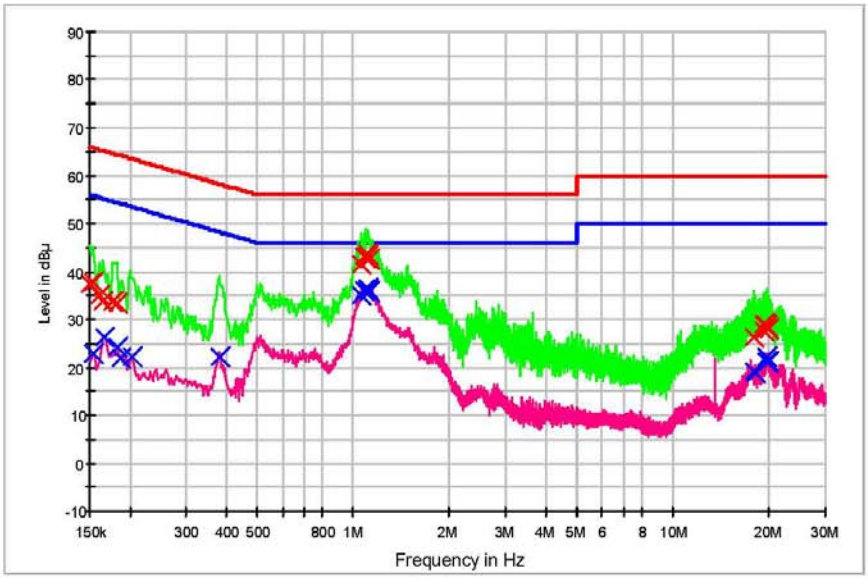
EMI Auto Test(1) 1 / 2

HCT TEST Report

Common Information

EUT:	WFM60-SFP201
Manufacturer:	I&C TECHNOLOGY
Test Site:	SHIELD ROOM
Operating Conditions:	WLAN MODE

FCC CLASS B_Exten Cable



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

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	37.3	9.000	Off	L1	9.7	28.7	66.0
0.154000	37.6	9.000	Off	L1	9.7	28.1	65.8
0.160000	35.2	9.000	Off	L1	9.7	30.3	65.5
0.164000	33.7	9.000	Off	L1	9.7	31.5	65.3
0.176000	33.8	9.000	Off	L1	9.7	30.9	64.7
0.182000	33.5	9.000	Off	L1	9.7	30.9	64.4
1.058000	41.6	9.000	Off	L1	9.8	14.4	56.0
1.080000	43.1	9.000	Off	L1	9.8	12.9	56.0
1.100000	43.0	9.000	Off	L1	9.8	13.0	56.0
1.104000	43.2	9.000	Off	L1	9.8	12.8	56.0
1.114000	43.4	9.000	Off	L1	9.8	12.6	56.0
1.126000	42.5	9.000	Off	L1	9.8	13.5	56.0
17.922000	26.4	9.000	Off	L1	10.3	33.6	60.0
19.186000	27.8	9.000	Off	L1	10.4	32.2	60.0
19.316000	29.1	9.000	Off	L1	10.4	30.9	60.0
19.566000	29.1	9.000	Off	L1	10.4	30.9	60.0
19.616000	28.7	9.000	Off	L1	10.4	31.3	60.0
19.858000	27.9	9.000	Off	L1	10.4	32.1	60.0

2018-06-18 오전 12:07:35

EMI Auto Test(1) 2 / 2

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.154000	23.0	9.000	Off	L1	9.7	32.8	55.8
0.166000	26.3	9.000	Off	L1	9.7	28.9	55.2
0.184000	24.4	9.000	Off	L1	9.7	29.9	54.3
0.188000	22.0	9.000	Off	L1	9.7	32.2	54.1
0.204000	22.3	9.000	Off	L1	9.7	31.1	53.4
0.382000	22.3	9.000	Off	L1	9.7	26.0	48.2
1.058000	35.1	9.000	Off	L1	9.8	10.9	46.0
1.080000	36.0	9.000	Off	L1	9.8	10.0	46.0
1.106000	36.3	9.000	Off	L1	9.8	9.7	46.0
1.112000	35.9	9.000	Off	L1	9.8	10.1	46.0
1.116000	35.9	9.000	Off	L1	9.8	10.1	46.0
1.126000	35.7	9.000	Off	L1	9.8	10.3	46.0
17.922000	19.2	9.000	Off	L1	10.3	30.8	50.0
18.140000	18.8	9.000	Off	L1	10.3	31.2	50.0
19.592000	22.1	9.000	Off	L1	10.4	27.9	50.0
19.616000	21.1	9.000	Off	L1	10.4	28.9	50.0
19.650000	21.1	9.000	Off	L1	10.4	28.9	50.0
19.858000	21.2	9.000	Off	L1	10.4	28.8	50.0

2018-06-18 오전 12:07:35

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	12/20/2017	Annual	102245
Rohde & Schwarz	ESCI / Test Receiver	06/27/2017	Annual	100033
ESPAC	SU-642 /Temperature Chamber	03/30/2018	Annual	0093008124
Agilent	N9020A / Signal Analyzer	06/13/2017	Annual	MY51110085
Agilent	N9030A / Signal Analyzer	11/22/2017	Annual	MY49431210
Agilent	N1911A / Power Meter	04/16/2018	Annual	MY45100523
Agilent	N1921A / Power Sensor	04/16/2018	Annual	MY52260025
Agilent	87300B / Directional Coupler	11/20/2017	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	06/12/2017	Annual	05001
Hewlett Packard	E3632A / DC Power Supply	06/30/2017	Annual	KR75303960
Agilent	8493C / Attenuator(10 dB)	07/10/2017	Annual	07560
Rohde & Schwarz	EMC32 / Software	N/A	N/A	N/A
HCT CO., LTD.	FCC WLAN&BT&BLE Conducted Test Software v3.0	N/A	N/A	N/A

10.2 LIST OF TEST EQUIPMENT(Radiated Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Audix	EM1000 / Controller	N/A	N/A	060520
Audix	Turn Table	N/A	N/A	N/A
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	05/02/2017	Biennial	9120D-937
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	12/04/2017	Biennial	BBHA9170541
Rohde & Schwarz	FSP(9 kHz ~ 30 GHz) / Spectrum Analyzer	09/06/2017	Annual	100688
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/27/2017	Annual	101068-SZ
Wainwright Instruments	WHK3.0/18G-10EF / High Pass Filter	06/12/2017	Annual	8
Wainwright Instruments	WHFX7.0/18G-8SS / High Pass Filter	05/09/2018	Annual	29
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	01/03/2018	Annual	2
Api tech.	18B-03 / Attenuator (3 dB)	06/12/2017	Annual	1
Agilent	8493C-10 / Attenuator(10 dB)	07/19/2017	Annual	08285
CERNEX	CBLU1183540 / Power Amplifier	07/11/2017	Annual	22964
CERNEX	CBL06185030 / Power Amplifier	07/11/2017	Annual	22965
CERNEX	CBL18265035 / Power Amplifier	01/10/2018	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	06/30/2017	Annual	25956