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FCC DTS REPORT

FCC Certification

Applicant Name:
LG Electronics MobileComm U.S.A., Inc.

Address:
1000 Sylvan Avenue, Englewood Cliffs NJ 07632

Date of Issue:
August 22, 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-1608-F027
HCT FRN: 0005866421
IC Recognition No.: 5944A-5

FCC ID	**: ZNFH990**
APPLICANT	**: LG Electronics MobileComm U.S.A., Inc.**

Model(s):	LG-H990
Additional Model(s):	LG-H990TR, LG-H990ds
EUT Type:	GSM/WCDMA/LTE Phone with Bluetooth, WLAN, NFC
Peak Output Power:	Wi-Fi 802.11b(21.54 dBm) / Wi-Fi 802.11g (22.56 dBm) / Wi-Fi 802.11n_HT20 (22.66 dBm) / Wi-Fi 802.11ac_VHT20 (22.63 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
: Seul Ki Lee
Test Engineer of RF Team

Approved by
: Kyoung Houn Seo
Manager of RF Team

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1608-F027	August 22, 2016	- First Approval Report

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1. GENERAL INFORMATION

Applicant:	LG Electronics MobileComm U.S.A., Inc.
Address:	1000 Sylvan Avenue, Englewood Cliffs NJ 07632
FCC ID:	ZNFH990
EUT Type:	GSM/WCDMA/LTE Phone with Bluetooth, WLAN, NFC
Model (s):	LG-H990
Date(s) of Tests:	July 18, 2016 ~ August 18, 2016
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea (IC Recognition No. : 5944A-5)

2. EUT DESCRIPTION

Model	LG-H990	
Additional Model(s):	LG-H990TR, LG-H990ds	
EUT Type	GSM/WCDMA/LTE Phone with Bluetooth, WLAN, NFC	
Power Supply	DC 3.85 V	
Battery Information	Model: BL-44E1F Type: Li-ion Battery	
Frequency Range	TX: 2412 MHz ~ 2462 MHz RX: 2412 MHz ~ 2462 MHz	
Max. RF Output Power	Peak	Wi-Fi 802.11b(21.54 dBm) / Wi-Fi 802.11g (22.56 dBm) / Wi-Fi 802.11n_HT20 (22.66 dBm) / Wi-Fi 802.11ac_VHT20 (22.63 dBm)
	Average	Wi-Fi 802.11b(16.30 dBm) / Wi-Fi 802.11g (13.87 dBm) / Wi-Fi 802.11n_HT20 (12.87 dBm) Wi-Fi 802.11ac_VHT20 (12.86 dBm)
Modulation Type	DSSS/CCK(802.11b), OFDM(802.11g, 802.11n, 802.11ac)	
Antenna Specification	Manufacturer: Ace technology Antenna type: INTERNAL ANTENNA Peak Gain : -2.2 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.

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

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

9. TEST RESULT

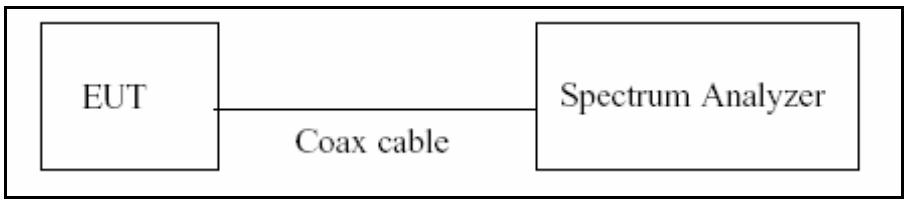
9.1 DUTY CYCLE

▣ 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	12.420	12.430	0.99919549	0.003
	2 Mbps	6.209	6.225	0.99742972	0.011
	5.5 Mbps	2.316	2.331	0.99356499	0.028
	11 Mbps	1.206	1.220	0.98852459	0.050
g	6 Mbps	2.792	2.817	0.99100484	0.039
	9 Mbps	1.865	1.890	0.98659167	0.059
	12 Mbps	1.406	1.429	0.98404255	0.070
	18 Mbps	0.945	0.965	0.97900228	0.092
	24 Mbps	0.716	0.738	0.96948402	0.135
	36 Mbps	0.484	0.506	0.95652174	0.193
	48 Mbps	0.368	0.389	0.94601542	0.241
	54 Mbps	0.328	0.349	0.93982808	0.270
n_HT20	MCS Index 0	2.594	2.614	0.99224679	0.034
	MCS Index 1	1.317	1.338	0.98484599	0.066
	MCS Index 2	0.893	0.913	0.97722961	0.100
	MCS Index 3	0.677	0.698	0.96915631	0.136
	MCS Index 4	0.464	0.485	0.95560613	0.197
	MCS Index 5	0.356	0.377	0.94479830	0.247
	MCS Index 6	0.324	0.346	0.93750000	0.280
	MCS Index 7	0.292	0.314	0.93070909	0.312
ac_VHT20	MCS Index 0	2.599	2.625	0.99034875	0.042
	MCS Index 1	1.322	1.345	0.98305085	0.074
	MCS Index 2	0.896	0.919	0.97547098	0.108
	MCS Index 3	0.685	0.705	0.97051598	0.130
	MCS Index 4	0.468	0.490	0.95575156	0.197
	MCS Index 5	0.364	0.386	0.94381941	0.251
	MCS Index 6	0.328	0.349	0.93949112	0.271
	MCS Index 7	0.300	0.321	0.93425379	0.295
	MCS Index 8	0.256	0.278	0.92384505	0.344

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

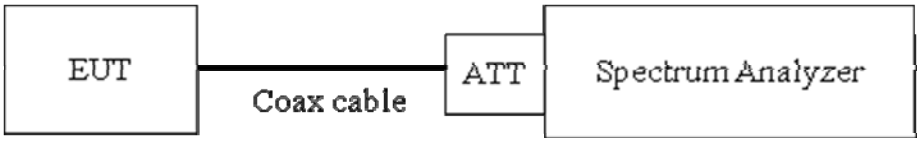
9.2 6dB BANDWIDTH

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	8.057	0.5	Pass
2437	6	7.604	0.5	Pass
2462	11	8.076	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	15.17	0.5	Pass
2437	6	16.33	0.5	Pass
2462	11	15.77	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	15.20	0.5	Pass
2437	6	17.17	0.5	Pass
2462	11	16.11	0.5	Pass

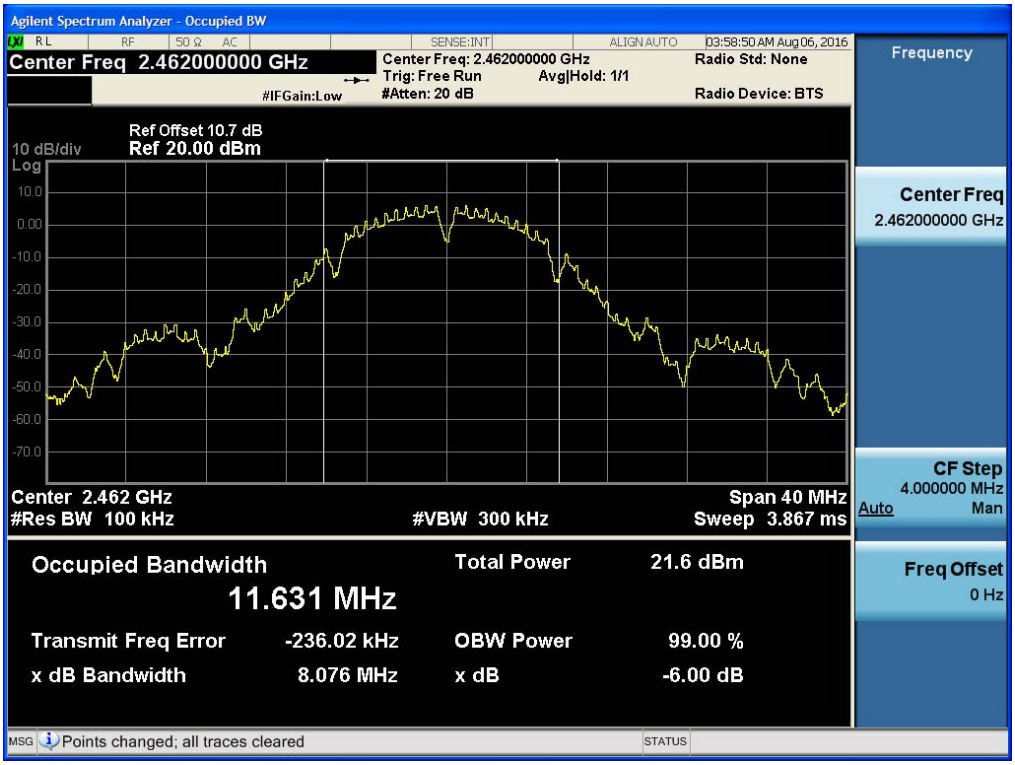
Conducted 6dB Bandwidth Measurements for 802.11ac_VHT20

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	15.19	0.5	Pass
2437	6	16.89	0.5	Pass
2462	11	16.15	0.5	Pass

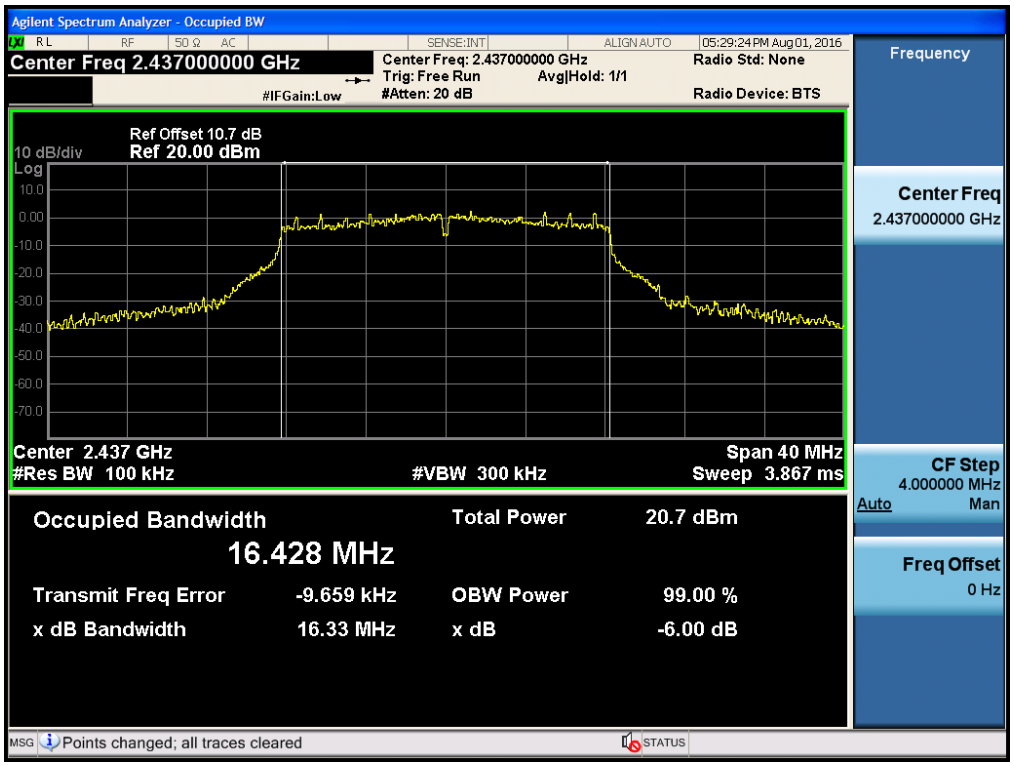
Note : In order to simplify the report, attached plots were only the most wide 6 dB BW channel.

▣ RESULT PLOTS

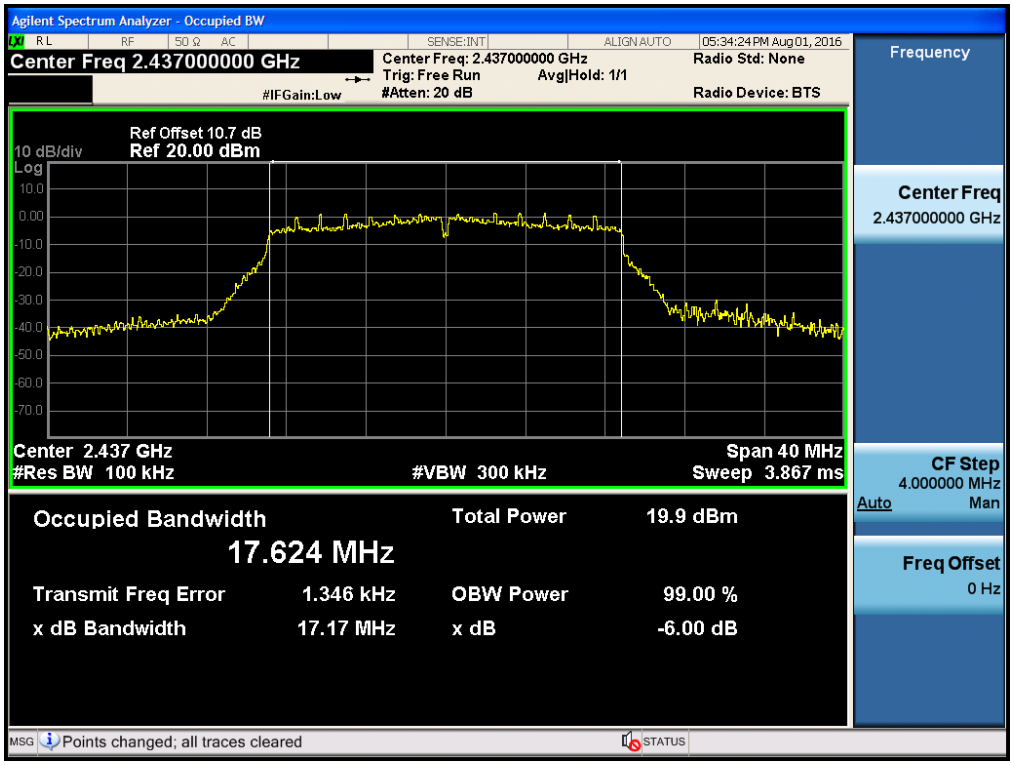
6dB Bandwidth plot (802.11b-CH 11)



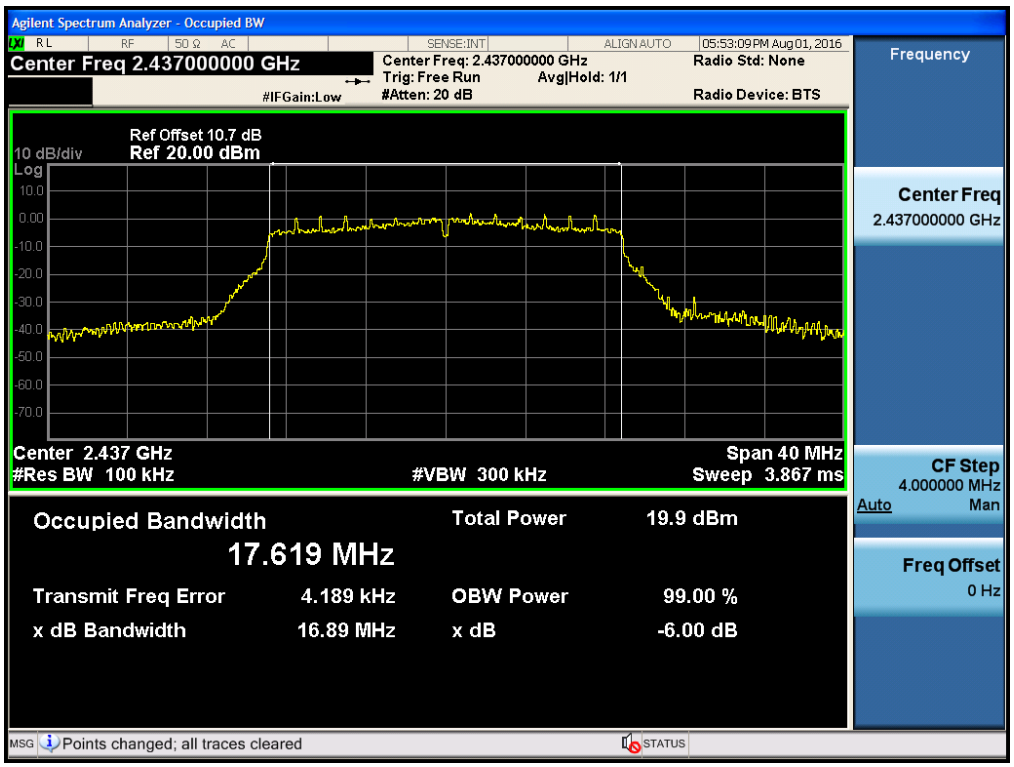
6dB Bandwidth plot (802.11g-CH 6)



6dB Bandwidth plot (802.11n_HT20-CH 6)



6dB Bandwidth plot (802.11ac_VHT20-CH 6)



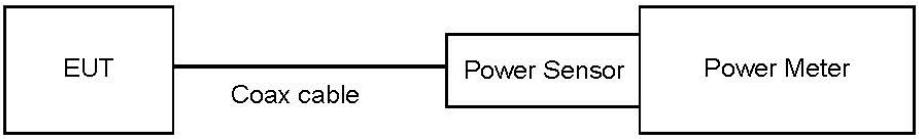
9.3 OUTPUT POWER (802.11b/g/n/ac)

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	19.36	30
		2 Mbps	21.07	30
		5.5 Mbps	20.23	30
		11 Mbps	20.19	30
2437	6	1 Mbps	19.20	30
		2 Mbps	21.54	30
		5.5 Mbps	19.93	30
		11 Mbps	20.02	30
2462	11	1 Mbps	17.50	30
		2 Mbps	18.19	30
		5.5 Mbps	18.18	30
		11 Mbps	18.28	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	22.19	30
		9 Mbps	22.23	30
		12 Mbps	22.37	30
		18 Mbps	22.09	30
		24 Mbps	22.16	30
		36 Mbps	22.17	30
		48 Mbps	22.27	30
		54 Mbps	21.91	30
2437	6	6 Mbps	22.56	30
		9 Mbps	22.45	30
		12 Mbps	22.51	30
		18 Mbps	22.46	30
		24 Mbps	22.12	30
		36 Mbps	22.31	30
		48 Mbps	22.45	30
		54 Mbps	22.19	30
2462	11	6 Mbps	21.15	30
		9 Mbps	21.10	30
		12 Mbps	20.95	30
		18 Mbps	21.01	30
		24 Mbps	20.80	30
		36 Mbps	20.90	30
		48 Mbps	20.75	30
		54 Mbps	20.61	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	22.14	30
		1	22.16	30
		2	21.93	30
		3	22.36	30
		4	22.12	30
		5	22.48	30
		6	22.11	30
		7	22.19	30
2437	6	0	22.52	30
		1	22.59	30
		2	22.35	30
		3	22.66	30
		4	22.53	30
		5	22.65	30
		6	22.31	30
		7	22.32	30
2462	11	0	21.36	30
		1	21.28	30
		2	20.84	30
		3	21.24	30
		4	20.88	30
		5	21.17	30
		6	20.78	30
		7	20.94	30

Conducted Output Power Measurements (802.11ac_VHT20 Mode)

802.11n Mode		MCS	Measured	Limit
Frequency[MHz]	Channel No.	Index	Power[dBm]	[dBm]
2412	1	0	22.15	30
		1	22.04	30
		2	21.92	30
		3	22.31	30
		4	22.35	30
		5	22.15	30
		6	22.16	30
		7	22.06	30
		8	21.87	30
2437	6	0	22.59	30
		1	22.18	30
		2	22.24	30
		3	22.63	30
		4	22.35	30
		5	22.47	30
		6	22.30	30
		7	22.25	30
		8	21.45	30
2462	11	0	21.26	30
		1	20.64	30
		2	20.81	30
		3	21.17	30
		4	20.98	30
		5	21.13	30
		6	20.79	30
		7	20.80	30
		8	20.14	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	15.96	0.003	15.96	30
		2 Mbps	15.87	0.011	15.88	30
		5.5 Mbps	16.27	0.028	16.30	30
		11 Mbps	15.95	0.050	16.00	30
2437	6	1 Mbps	15.80	0.003	15.80	30
		2 Mbps	15.81	0.011	15.82	30
		5.5 Mbps	16.10	0.028	16.13	30
		11 Mbps	15.91	0.050	15.96	30
2462	11	1 Mbps	14.00	0.003	14.00	30
		2 Mbps	14.14	0.011	14.15	30
		5.5 Mbps	14.41	0.028	14.44	30
		11 Mbps	14.14	0.050	14.19	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	13.80	0.039	13.84	30
		9 Mbps	13.78	0.059	13.84	30
		12 Mbps	13.80	0.070	13.87	30
		18 Mbps	13.74	0.092	13.83	30
		24 Mbps	13.63	0.135	13.76	30
		36 Mbps	13.62	0.193	13.81	30
		48 Mbps	12.64	0.241	12.88	30
		54 Mbps	12.58	0.270	12.85	30
2437	6	6 Mbps	13.59	0.039	13.63	30
		9 Mbps	13.61	0.059	13.67	30
		12 Mbps	13.33	0.070	13.40	30
		18 Mbps	13.29	0.092	13.38	30
		24 Mbps	13.36	0.135	13.49	30
		36 Mbps	13.15	0.193	13.34	30
		48 Mbps	12.08	0.241	12.32	30
		54 Mbps	12.26	0.270	12.53	30
2462	11	6 Mbps	11.80	0.039	11.84	30
		9 Mbps	11.77	0.059	11.83	30
		12 Mbps	11.78	0.070	11.85	30
		18 Mbps	11.54	0.092	11.63	30
		24 Mbps	11.66	0.135	11.79	30
		36 Mbps	11.59	0.193	11.78	30
		48 Mbps	10.20	0.241	10.44	30
		54 Mbps	10.13	0.270	10.40	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	12.84	0.034	12.87	30
		1	11.75	0.066	11.82	30
		2	11.73	0.100	11.83	30
		3	12.69	0.136	12.83	30
		4	12.61	0.197	12.81	30
		5	12.61	0.247	12.86	30
		6	12.10	0.280	12.38	30
		7	12.09	0.312	12.40	30
2437	6	0	12.53	0.034	12.56	30
		1	11.32	0.066	11.39	30
		2	11.43	0.100	11.53	30
		3	12.46	0.136	12.60	30
		4	12.51	0.197	12.71	30
		5	12.45	0.247	12.70	30
		6	11.77	0.280	12.05	30
		7	11.88	0.312	12.19	30
2462	11	0	10.80	0.034	10.83	30
		1	9.47	0.066	9.54	30
		2	9.42	0.100	9.52	30
		3	10.63	0.136	10.77	30
		4	10.55	0.197	10.75	30
		5	10.52	0.247	10.77	30
		6	9.74	0.280	10.02	30
		7	9.78	0.312	10.09	30

Conducted Output Power Measurements (802.11ac_VHT20 Mode)

802.11n Mode		MCS Index	Measured Power[dBm]	Duty Cycle Factor [dB]	Measured Power(dBm) + Duty Cycle Factor[dB]	Limit [dBm]
Frequency [MHz]	Channel No.					
2412	1	0	12.78	0.042	12.82	30
		1	11.72	0.074	11.79	30
		2	11.71	0.108	11.82	30
		3	12.51	0.130	12.64	30
		4	12.66	0.197	12.86	30
		5	12.60	0.251	12.85	30
		6	12.10	0.271	12.37	30
		7	12.00	0.295	12.30	30
		8	10.85	0.344	11.19	30
2437	6	0	12.73	0.042	12.77	30
		1	11.34	0.074	11.41	30
		2	11.32	0.108	11.43	30
		3	12.64	0.130	12.77	30
		4	12.49	0.197	12.69	30
		5	12.45	0.251	12.70	30
		6	11.75	0.271	12.02	30
		7	11.78	0.295	12.08	30
		8	10.45	0.344	10.79	30
2462	11	0	10.75	0.042	10.79	30
		1	9.42	0.074	9.49	30
		2	9.45	0.108	9.56	30
		3	10.67	0.130	10.80	30
		4	10.60	0.197	10.80	30
		5	10.56	0.251	10.81	30
		6	9.87	0.271	10.14	30
		7	9.69	0.295	9.99	30
		8	8.72	0.344	9.06	30

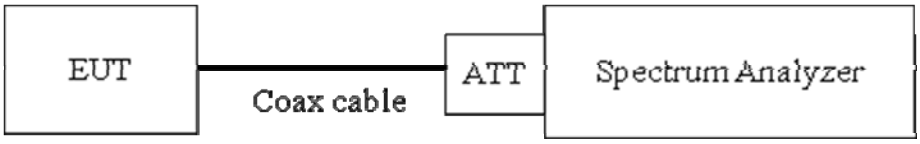
9.4 POWER SPECTRAL DENSITY (802.11b/g/n/ac)

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	-4.711	8	Pass
2437	6		-5.063	8	Pass
2462	11		-7.436	8	Pass
2412	1	802.11g	-8.324	8	Pass
2437	6		-10.005	8	Pass
2462	11		-11.510	8	Pass
2412	1	802.11n _HT20	-11.138	8	Pass
2437	6		-11.164	8	Pass
2462	11		-12.381	8	Pass
2412	1	802.11ac _VHT20	-8.762	8	Pass
2437	6		-11.068	8	Pass
2462	11		-12.921	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 1)

Power Spectral Density (802.11n_HT20 -CH 1)

Power Spectral Density (802.11ac_VHT20 -CH 1)

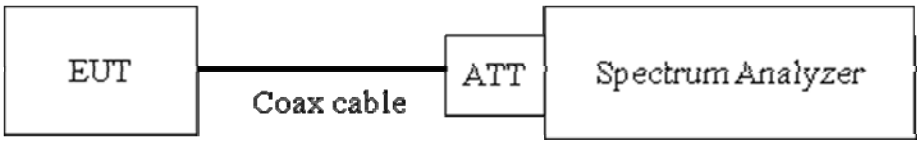
9.5 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

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 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

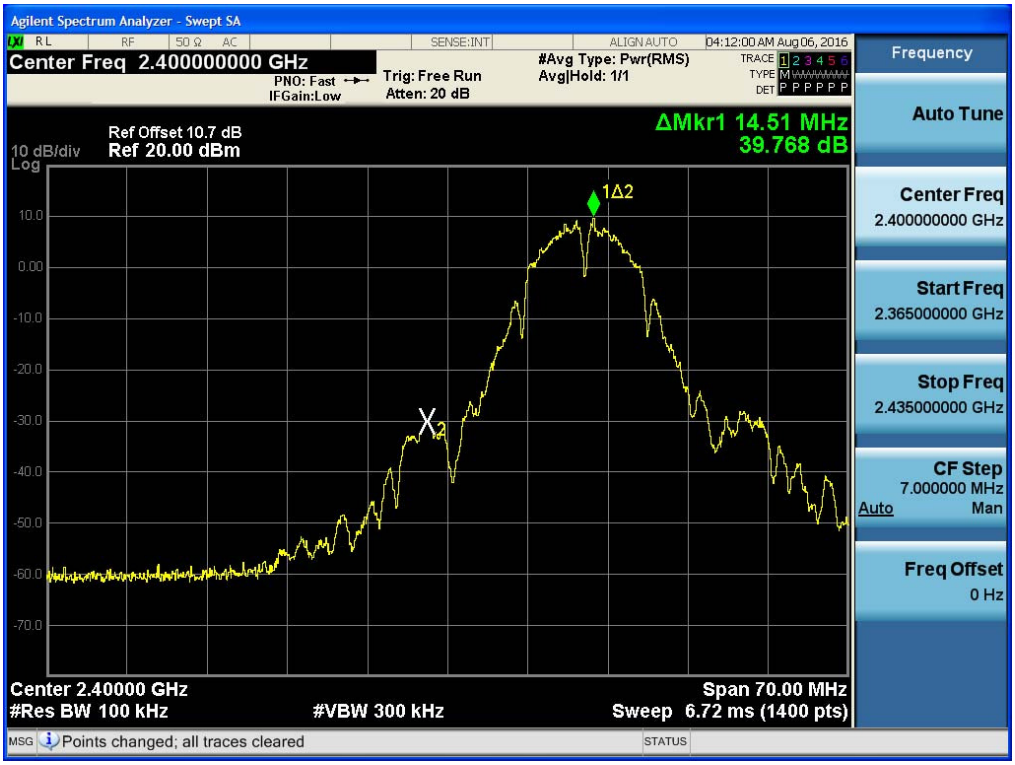
8000	11.32
9000	11.48
10000	11.56
11000	11.56
12000	11.68
13000	11.83
14000	11.90
15000	11.98
16000	12.04
17000	12.02
18000	12.08
19000	12.07
20000	12.14
21000	12.17
22000	12.31
23000	12.60
24000	12.34
25000	12.53

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

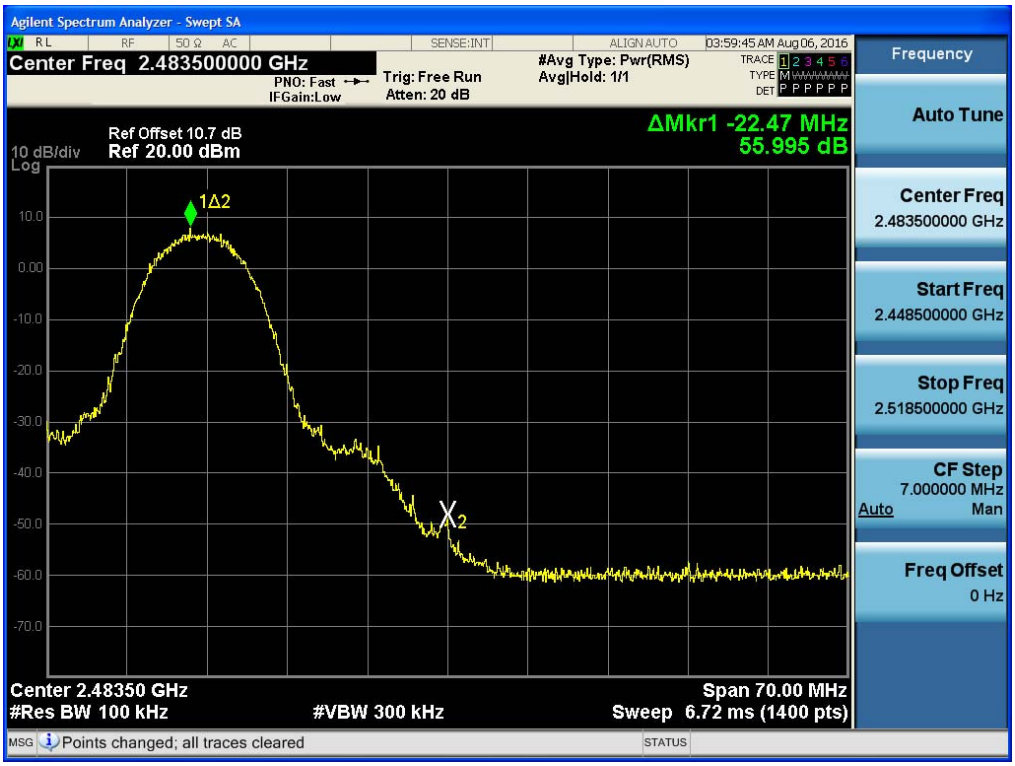
2. Factor = Cable loss + Attenuator loss

▣ RESULT PLOTS

Band Edge (802.11b-CH1)



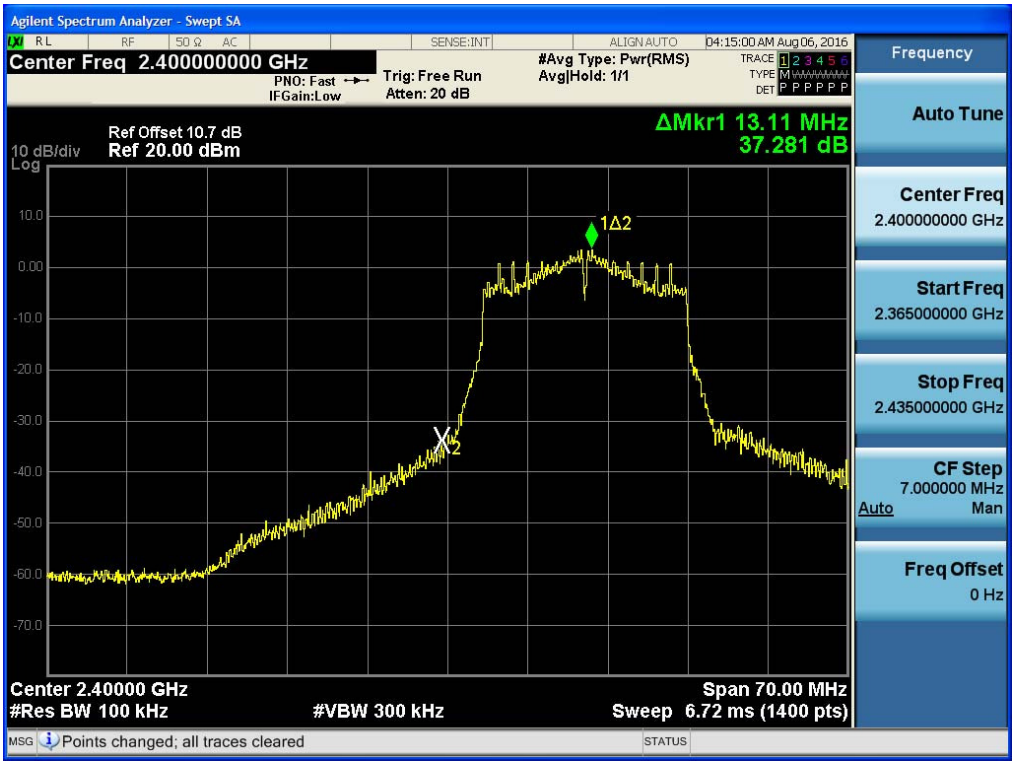
Band Edge (802.11b-CH11)



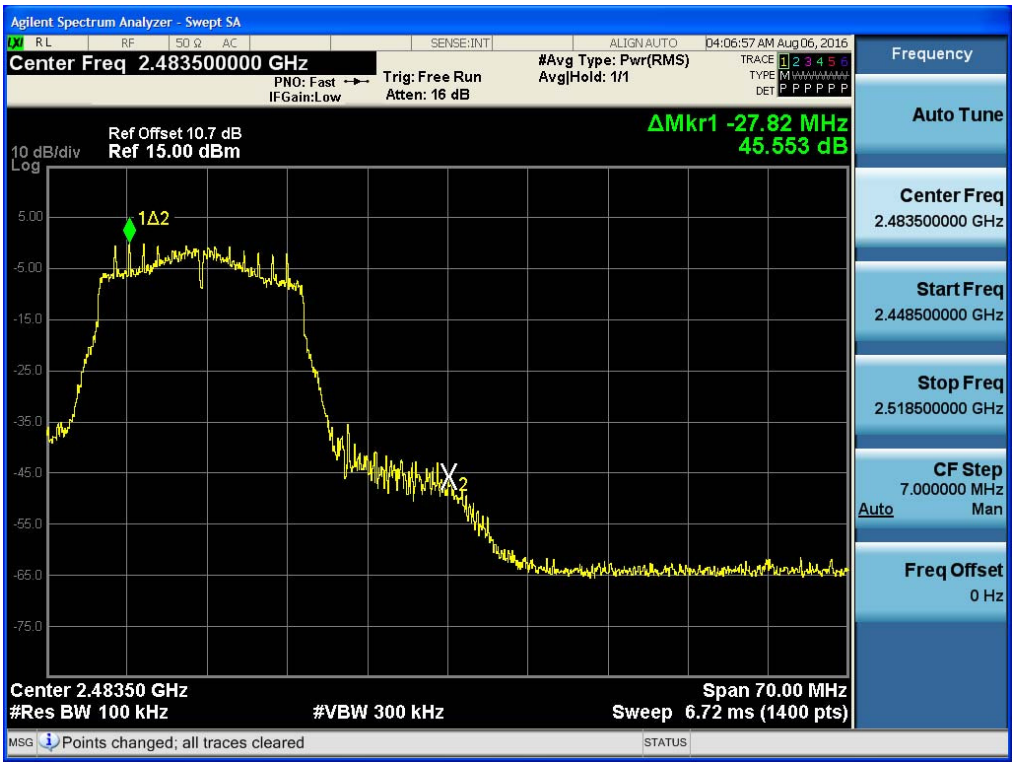
Band Edge (802.11g-CH1)

Band Edge (802.11g-CH11)

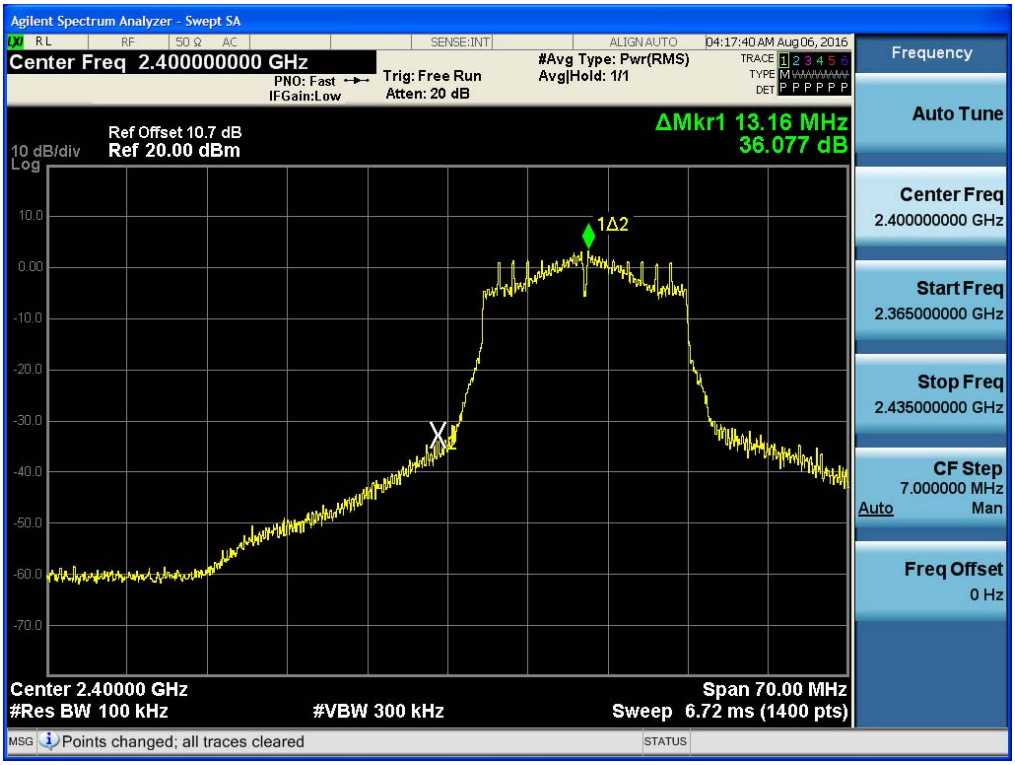
Band Edge (802.11n_HT20-CH1)



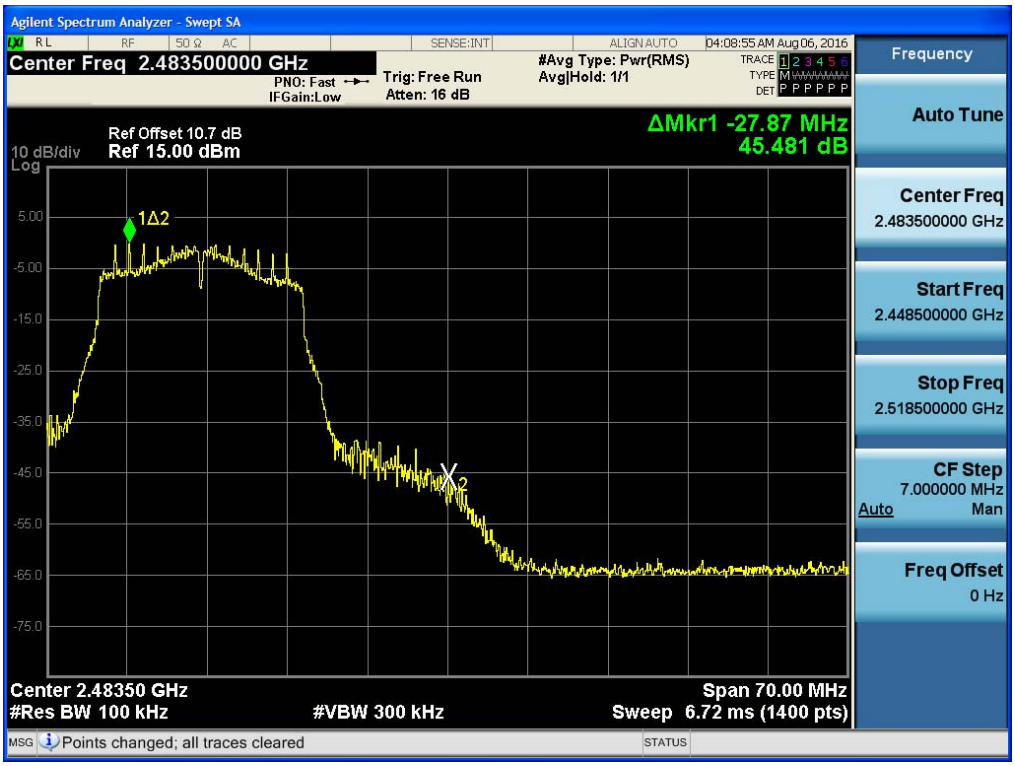
Band Edge (802.11n_HT20-CH11)



Band Edge (802.11ac_VHT20-CH1)

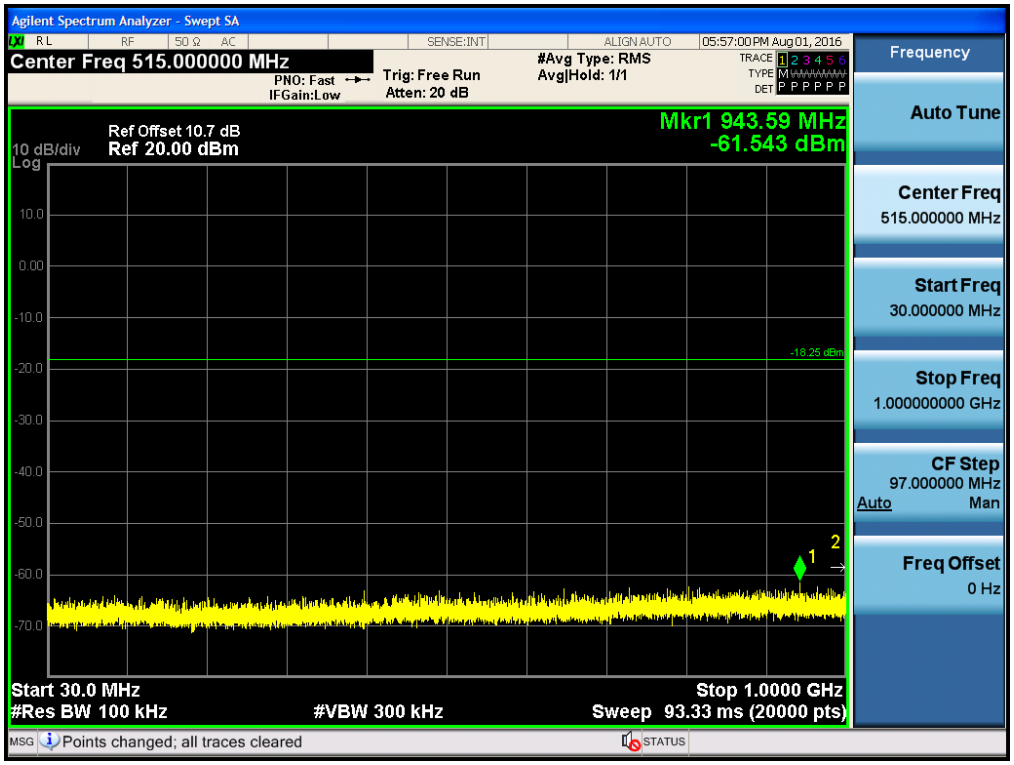


Band Edge (802.11ac_VHT2-CH11)



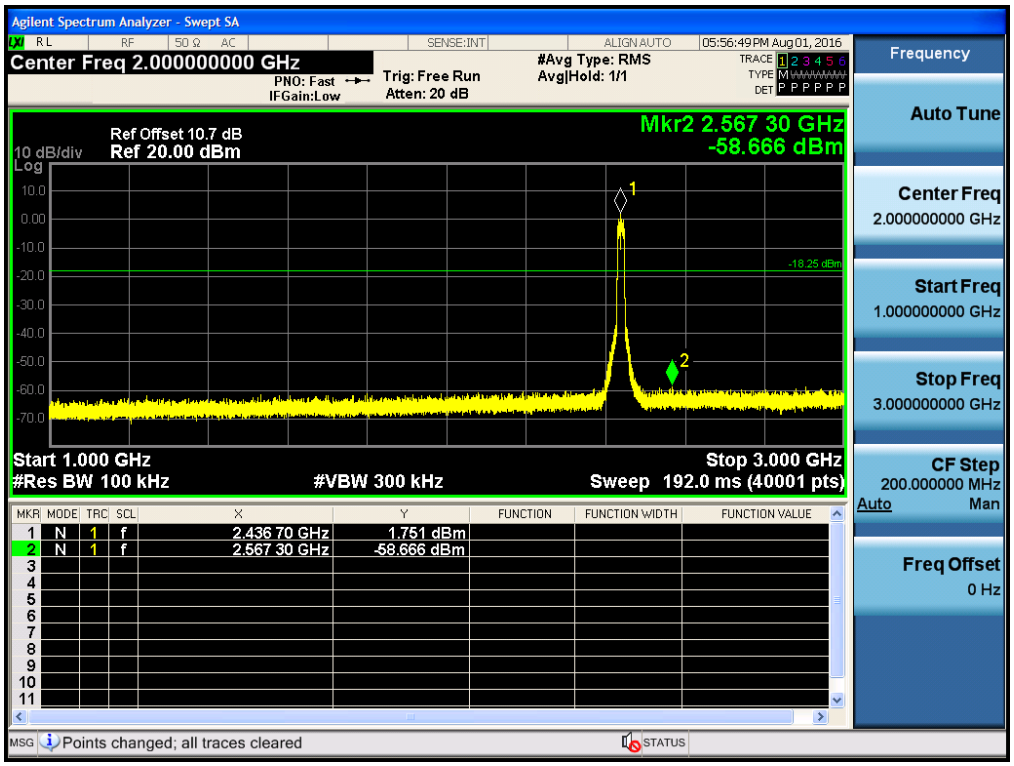
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



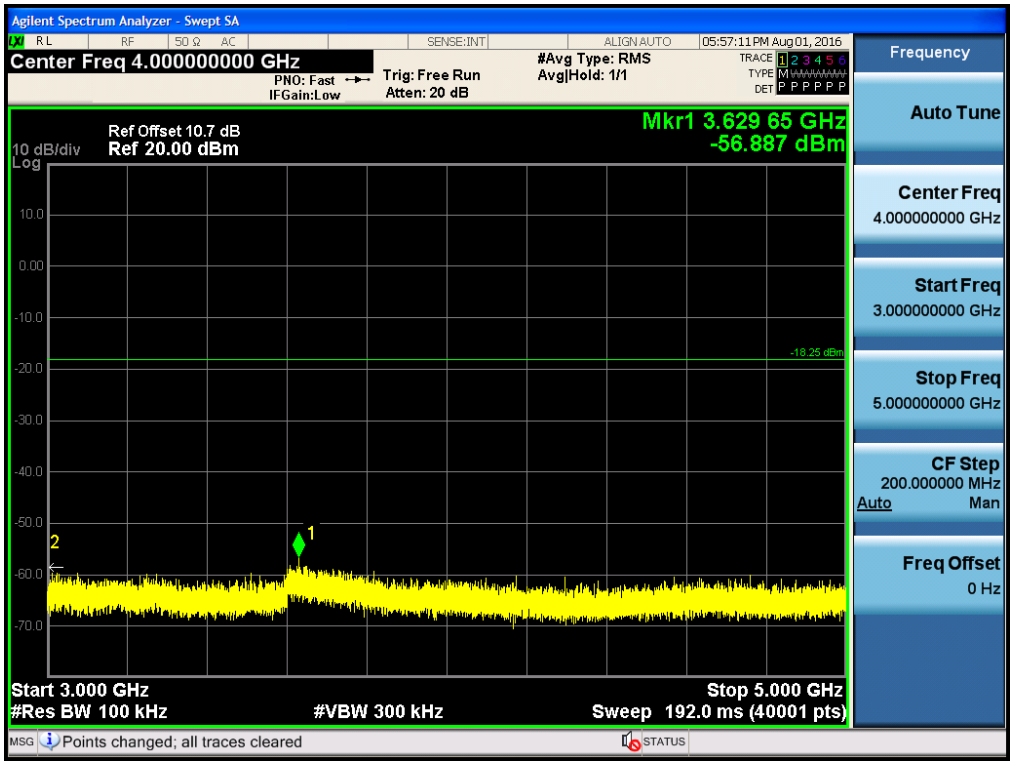
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



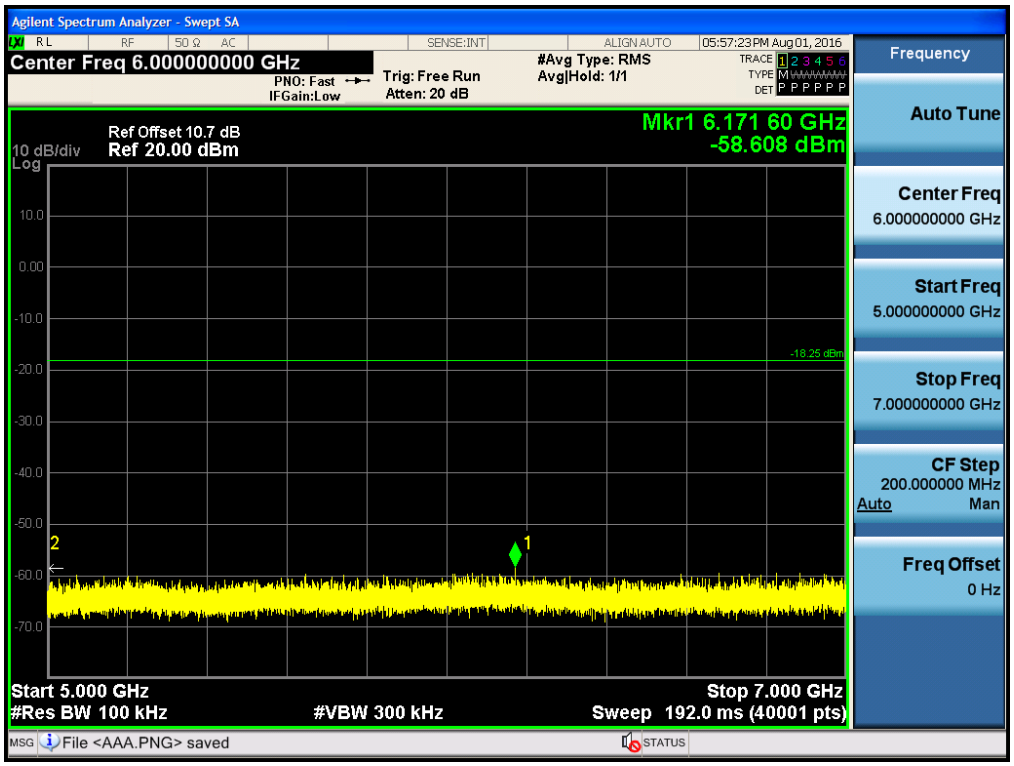
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



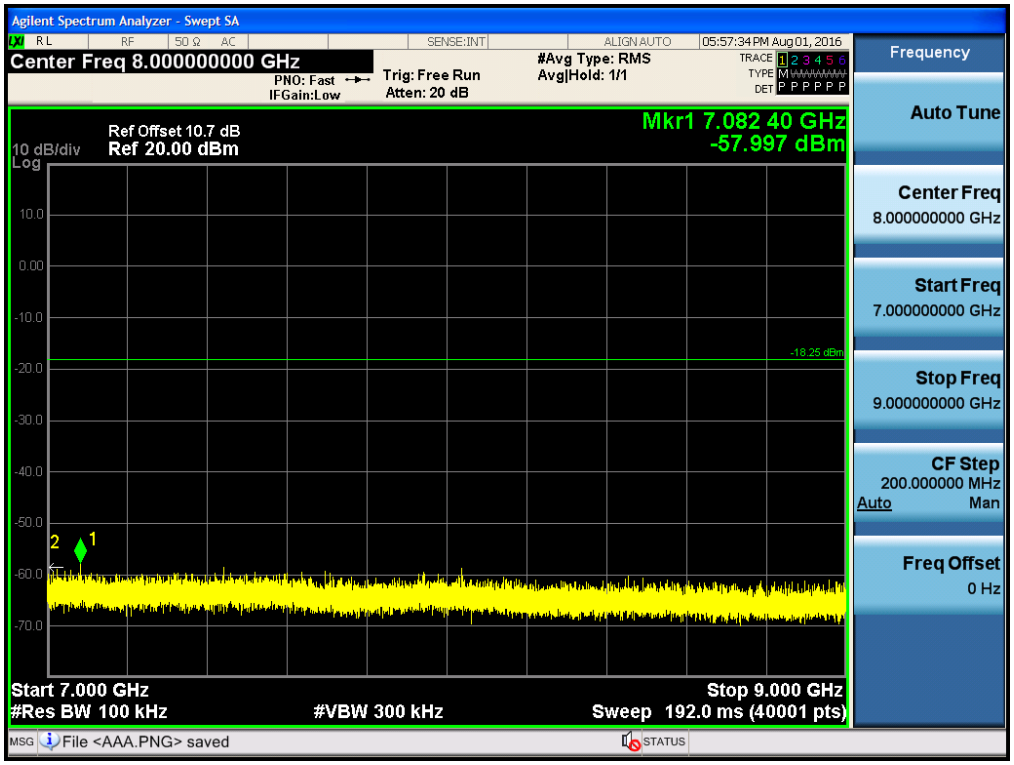
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



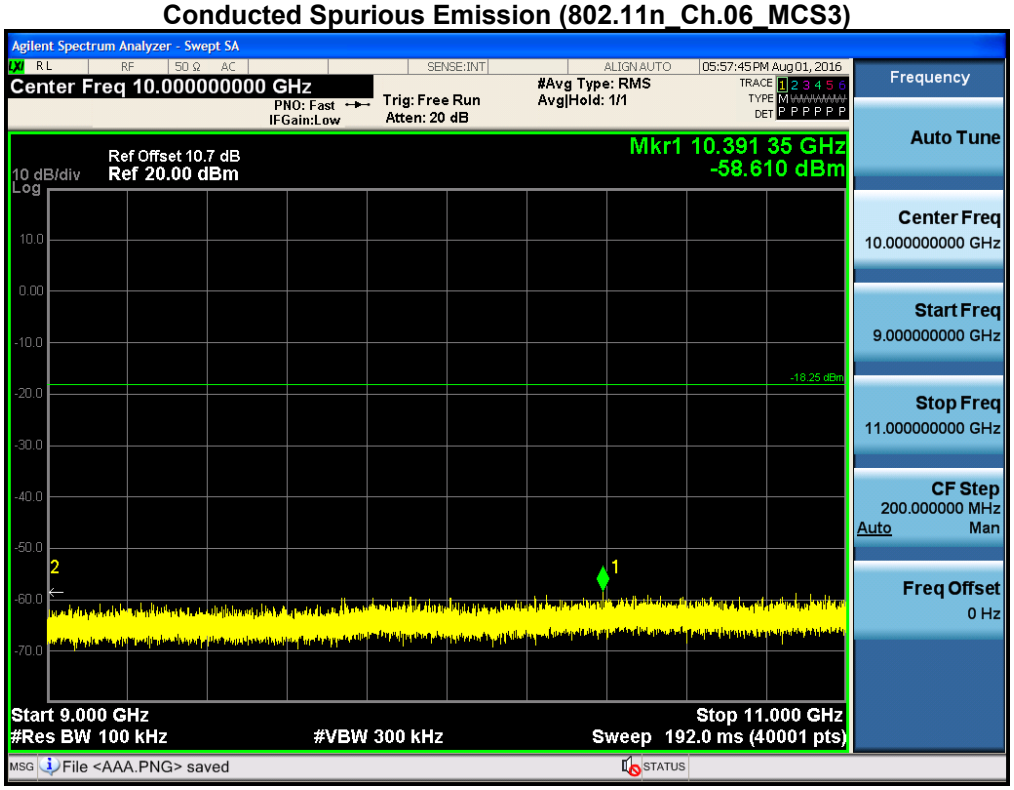
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



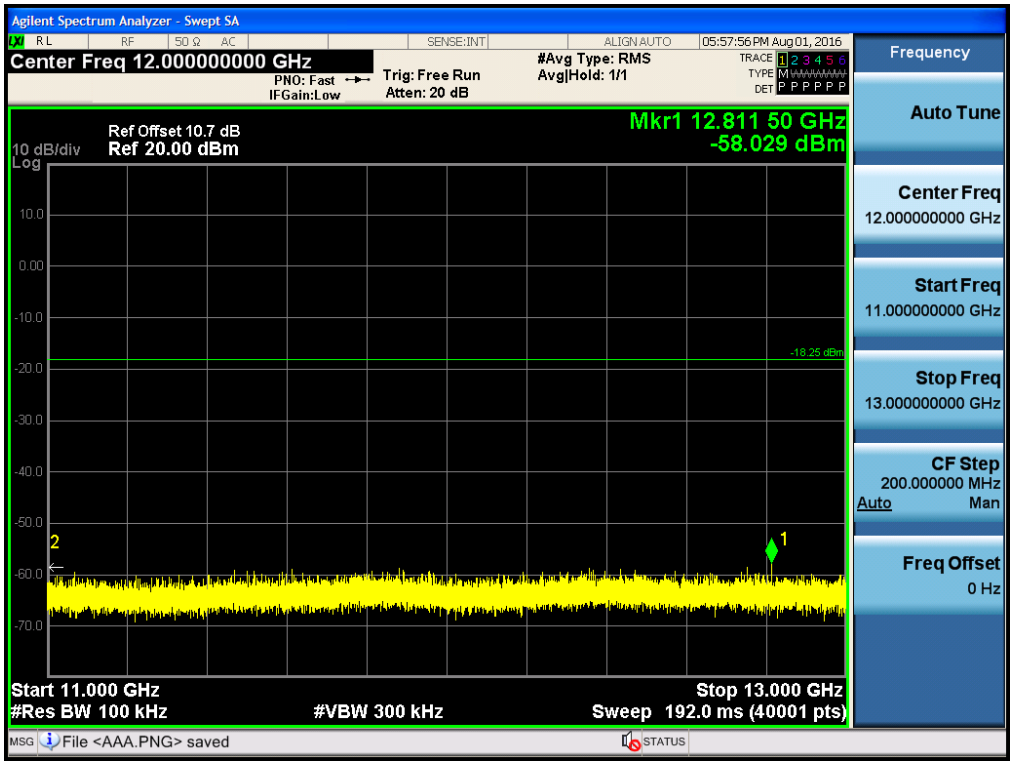
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



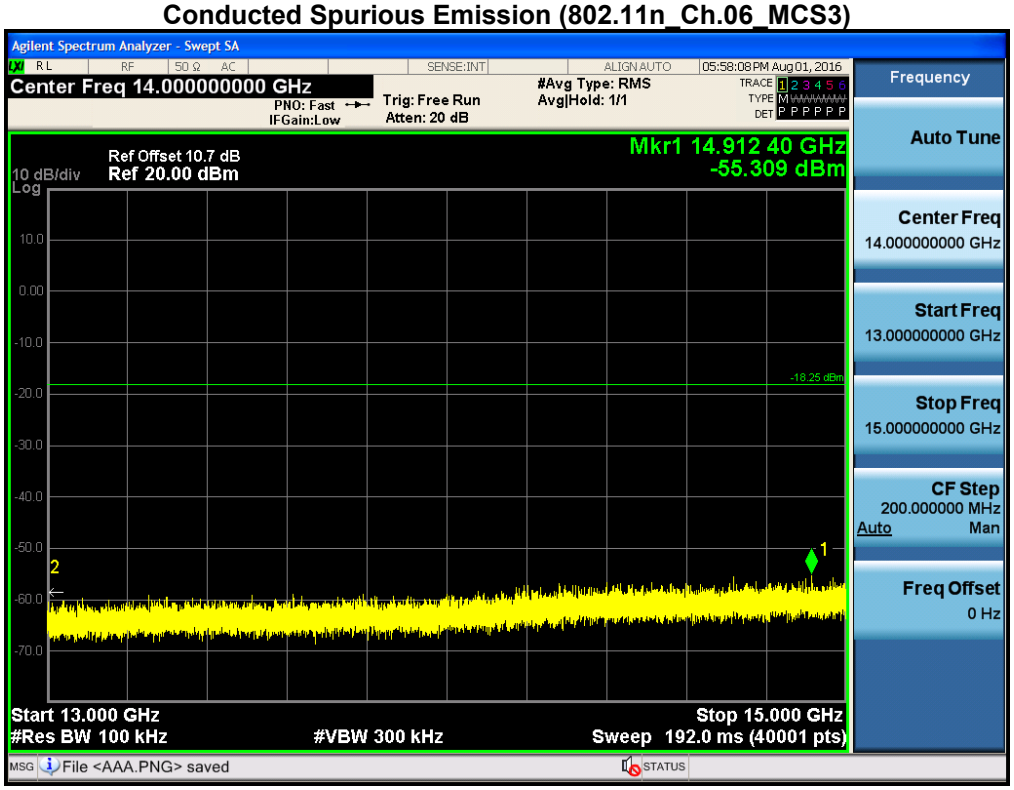
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



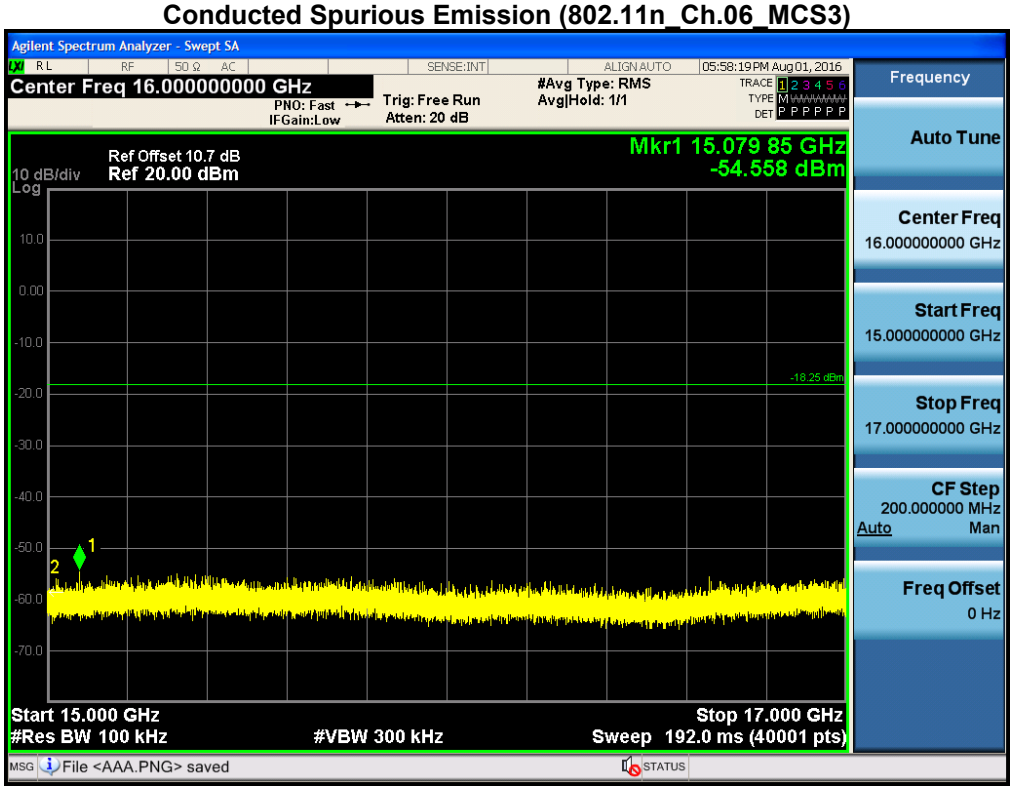
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



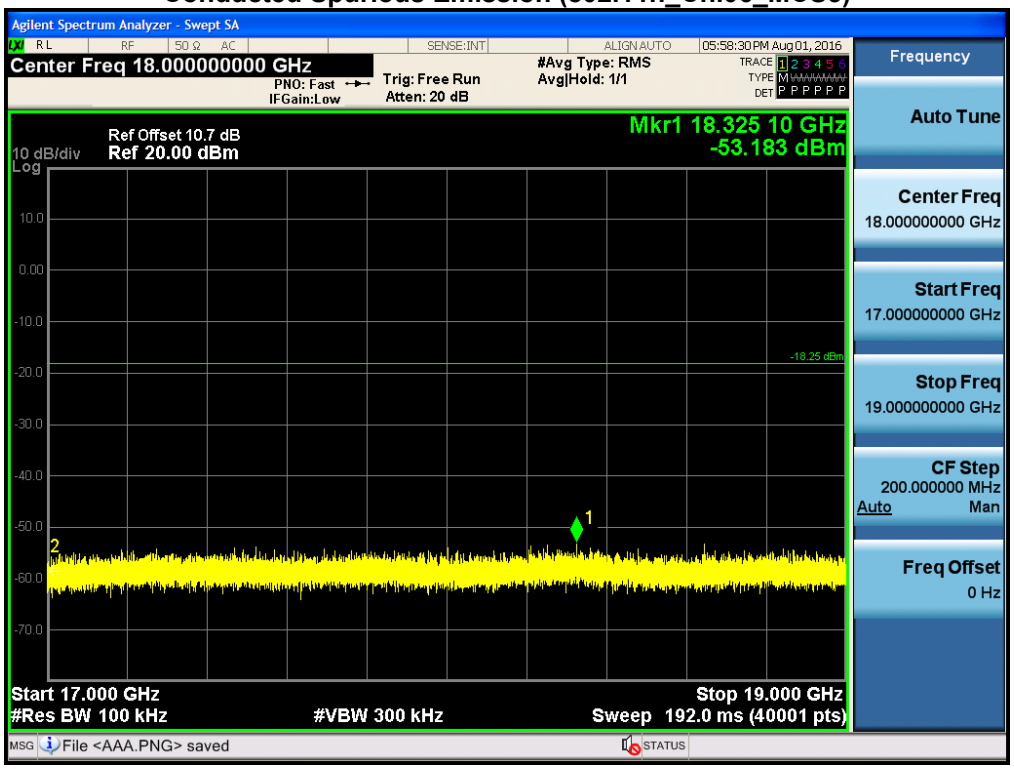
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



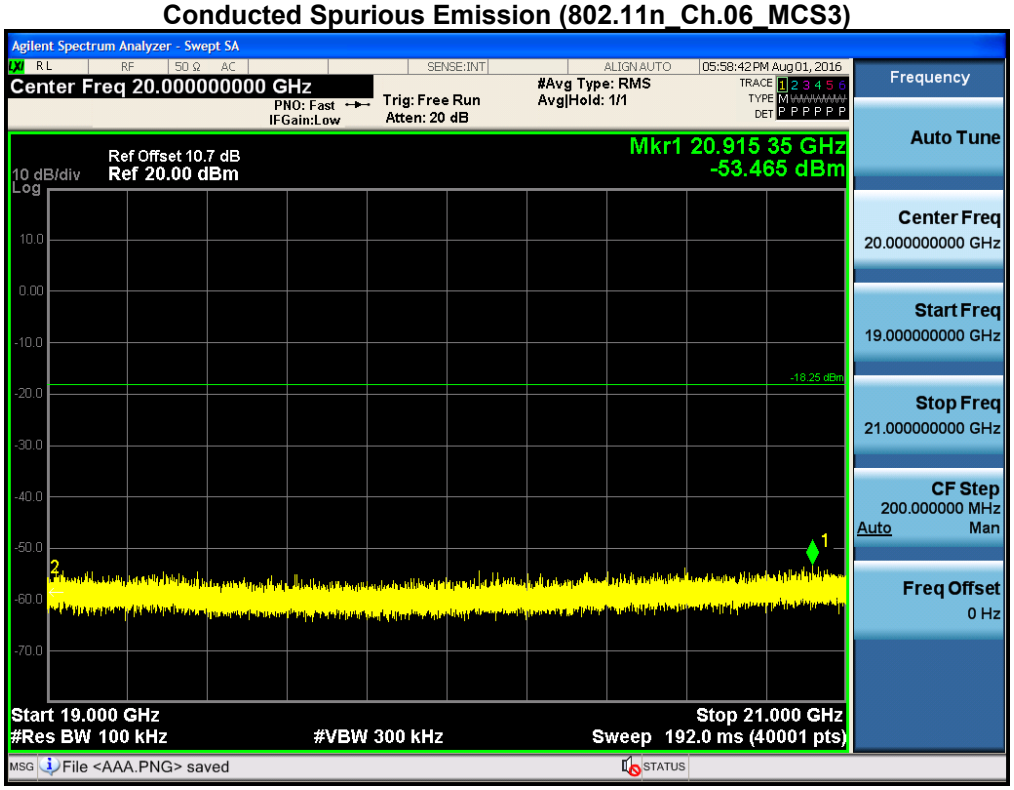
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



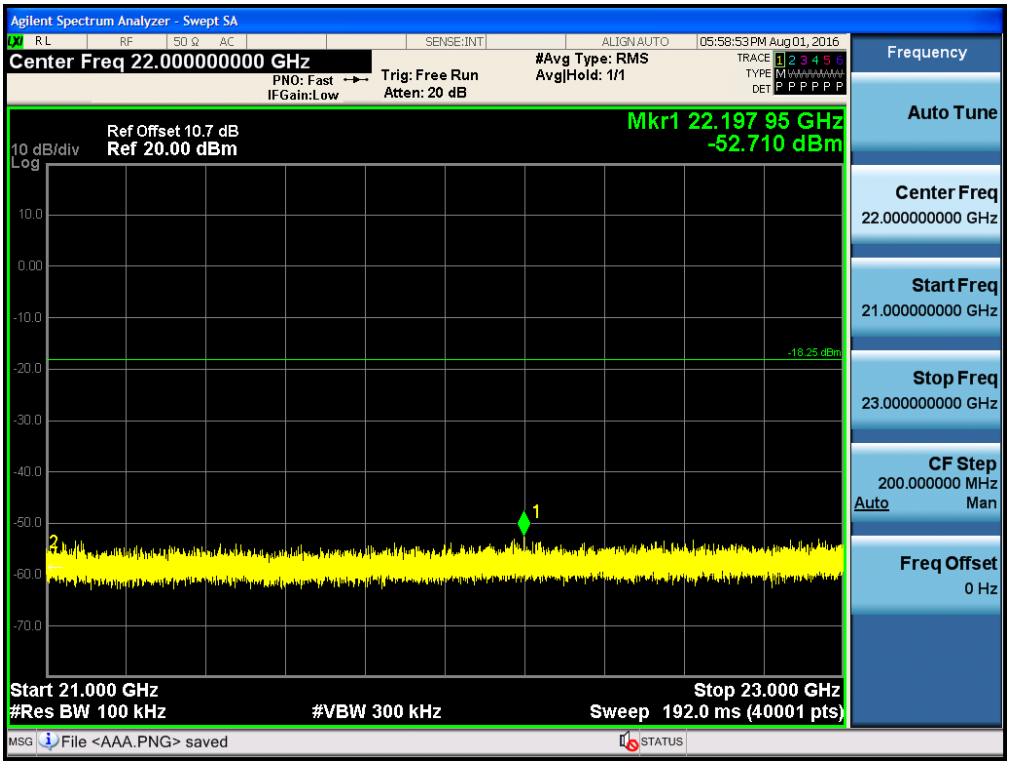
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



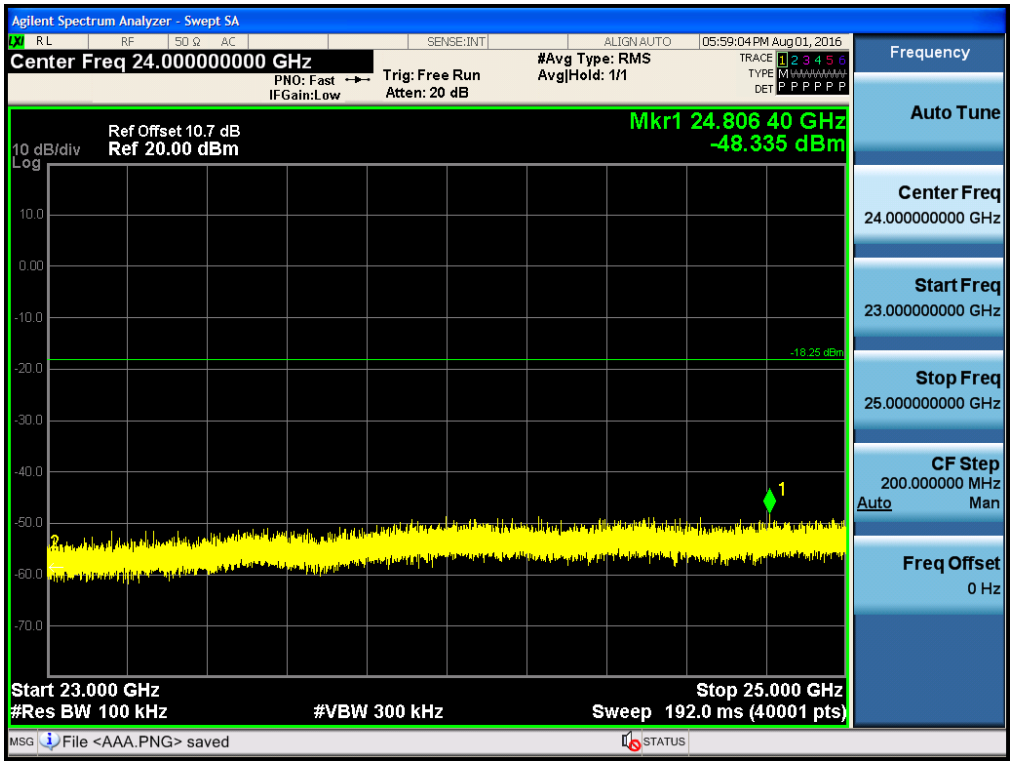
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11n_Ch.06_MCS3)



9.6 RADIATED MEASUREMENT.

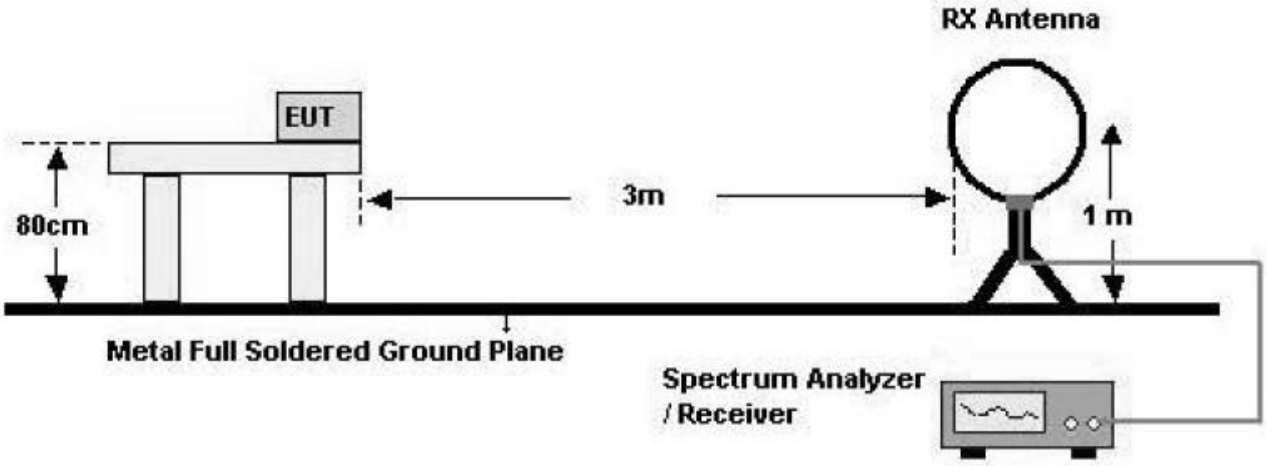
9.6.1 RADIATED SPURIOUS EMISSIONS.

Test Requirements and limit, §15.205, §15.209

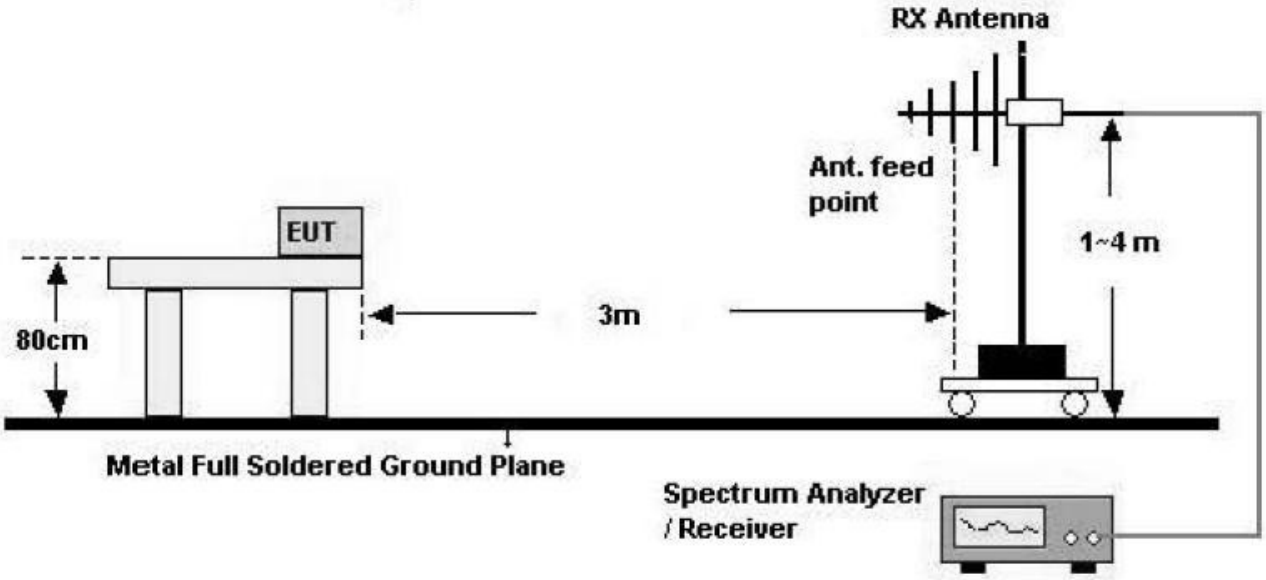
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

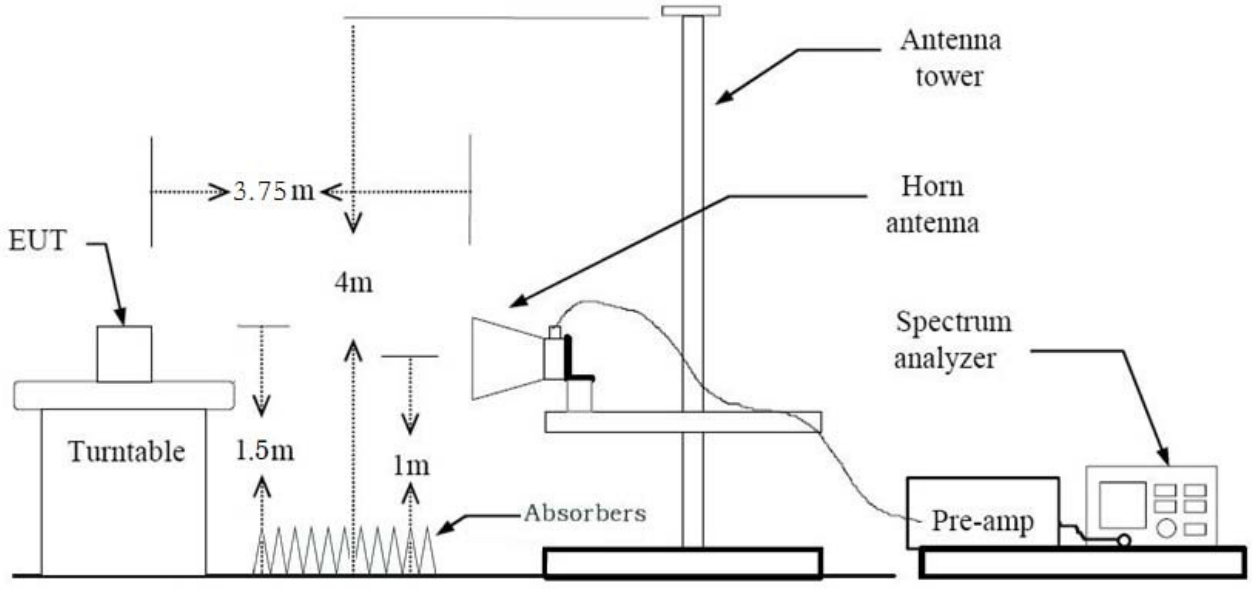
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE USED

Method 12.1 in KDB 558074 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/ac_VHT20

Mode	Worst Data rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
b	1	12.420	12.430	99.92	0.003
g	6	2.792	2.817	99.10	0.039
n_HT20	MCS Index 0	2.594	2.614	99.22	0.034
ac_VHT20	MCS Index 0	2.599	2.625	99.03	0.042

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	48.24	-0.64	V	47.60	73.98	26.38	PK
4824	36.77	-0.64	V	36.13	53.98	17.85	AV
7236	45.29	8.49	V	53.78	73.98	20.20	PK
7236	33.85	8.49	V	42.34	53.98	11.64	AV
4824	48.45	-0.64	H	47.81	73.98	26.17	PK
4824	36.83	-0.64	H	36.19	53.98	17.79	AV
7236	45.55	8.49	H	54.04	73.98	19.94	PK
7236	33.96	8.49	H	42.45	53.98	11.53	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	48.53	-0.64	V	47.89	73.98	26.09	PK
4824	36.74	-0.64	V	36.10	53.98	17.88	AV
7236	46.44	8.49	V	54.93	73.98	19.05	PK
7236	33.97	8.49	V	42.46	53.98	11.52	AV
4824	48.82	-0.64	H	48.18	73.98	25.80	PK
4824	36.70	-0.64	H	36.06	53.98	17.92	AV
7236	46.47	8.49	H	54.96	73.98	19.02	PK
7236	34.00	8.49	H	42.49	53.98	11.49	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	48.55	-0.64	V	47.91	73.98	26.07	PK
4824	36.61	-0.64	V	35.97	53.98	18.01	AV
7236	46.42	8.49	V	54.91	73.98	19.07	PK
7236	33.99	8.49	V	42.48	53.98	11.50	AV
4824	48.78	-0.64	H	48.14	73.98	25.84	PK
4824	36.67	-0.64	H	36.03	53.98	17.95	AV
7236	46.50	8.49	H	54.99	73.98	18.99	PK
7236	34.01	8.49	H	42.50	53.98	11.48	AV

Operation Mode:	802.11 ac_VHT20
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	48.62	-0.64	V	47.98	73.98	26.00	PK
4824	36.57	-0.64	V	35.93	53.98	18.05	AV
7236	46.33	8.49	V	54.82	73.98	19.16	PK
7236	33.91	8.49	V	42.40	53.98	11.58	AV
4824	48.79	-0.64	H	48.15	73.98	25.83	PK
4824	36.68	-0.64	H	36.04	53.98	17.94	AV
7236	46.39	8.49	H	54.88	73.98	19.10	PK
7236	33.93	8.49	H	42.42	53.98	11.56	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	48.92	0.01	V	48.93	73.98	25.05	PK
4874	37.61	0.01	V	37.62	53.98	16.36	AV
7311	46.51	8.94	V	55.45	73.98	18.53	PK
7311	34.23	8.94	V	43.17	53.98	10.81	AV
4874	49.35	0.01	H	49.36	73.98	24.62	PK
4874	37.70	0.01	H	37.71	53.98	16.27	AV
7311	46.92	8.94	H	55.86	73.98	18.12	PK
7311	34.26	8.94	H	43.20	53.98	10.78	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	48.99	0.01	V	49.00	73.98	24.98	PK
4874	37.59	0.01	V	37.60	53.98	16.38	AV
7311	46.21	8.94	V	55.15	73.98	18.83	PK
7311	34.20	8.94	V	43.14	53.98	10.84	AV
4874	49.10	0.01	H	49.11	73.98	24.87	PK
4874	37.73	0.01	H	37.74	53.98	16.24	AV
7311	46.40	8.94	H	55.34	73.98	18.64	PK
7311	34.34	8.94	H	43.28	53.98	10.70	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	48.96	0.01	V	48.97	73.98	25.01	PK
4874	37.51	0.01	V	37.52	53.98	16.46	AV
7311	46.25	8.94	V	55.19	73.98	18.79	PK
7311	34.22	8.94	V	43.16	53.98	10.82	AV
4874	49.08	0.01	H	49.09	73.98	24.89	PK
4874	37.69	0.01	H	37.70	53.98	16.28	AV
7311	46.66	8.94	H	55.60	73.98	18.38	PK
7311	34.28	8.94	H	43.22	53.98	10.76	AV

Operation Mode:	802.11 ac_VHT20
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	48.92	0.01	V	48.93	73.98	25.05	PK
4874	37.64	0.01	V	37.65	53.98	16.33	AV
7311	46.23	8.94	V	55.17	73.98	18.81	PK
7311	34.14	8.94	V	43.08	53.98	10.90	AV
4874	49.13	0.01	H	49.14	73.98	24.84	PK
4874	37.76	0.01	H	37.77	53.98	16.21	AV
7311	46.32	8.94	H	55.26	73.98	18.72	PK
7311	34.23	8.94	H	43.17	53.98	10.81	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	48.66	0.38	V	49.04	73.98	24.94	PK
4924	36.58	0.38	V	36.96	53.98	17.02	AV
7386	45.09	9.02	V	54.11	73.98	19.87	PK
7386	33.20	9.02	V	42.22	53.98	11.76	AV
4924	48.50	0.38	H	48.88	73.98	25.10	PK
4924	36.61	0.38	H	36.99	53.98	16.99	AV
7386	45.50	9.02	H	54.52	73.98	19.46	PK
7386	33.27	9.02	H	42.29	53.98	11.69	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	48.20	0.38	V	48.58	73.98	25.40	PK
4924	36.71	0.38	V	37.09	53.98	16.89	AV
7386	45.18	9.02	V	54.20	73.98	19.78	PK
7386	33.44	9.02	V	42.46	53.98	11.52	AV
4924	48.31	0.38	H	48.69	73.98	25.29	PK
4924	36.85	0.38	H	37.23	53.98	16.75	AV
7386	45.25	9.02	H	54.27	73.98	19.71	PK
7386	33.46	9.02	H	42.48	53.98	11.50	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	48.22	0.38	V	48.60	73.98	25.38	PK
4924	36.74	0.38	V	37.12	53.98	16.86	AV
7386	45.11	9.02	V	54.13	73.98	19.85	PK
7386	33.42	9.02	V	42.44	53.98	11.54	AV
4924	48.28	0.38	H	48.66	73.98	25.32	PK
4924	36.88	0.38	H	37.26	53.98	16.72	AV
7386	45.23	9.02	H	54.25	73.98	19.73	PK
7386	33.44	9.02	H	42.46	53.98	11.52	AV

Operation Mode:	802.11 ac_VHT20
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	48.21	0.38	V	48.59	73.98	25.39	PK
4924	36.70	0.38	V	37.08	53.98	16.90	AV
7386	45.16	9.02	V	54.18	73.98	19.80	PK
7386	33.39	9.02	V	42.41	53.98	11.57	AV
4924	48.27	0.38	H	48.65	73.98	25.33	PK
4924	36.82	0.38	H	37.20	53.98	16.78	AV
7386	45.21	9.02	H	54.23	73.98	19.75	PK
7386	33.48	9.02	H	42.50	53.98	11.48	AV

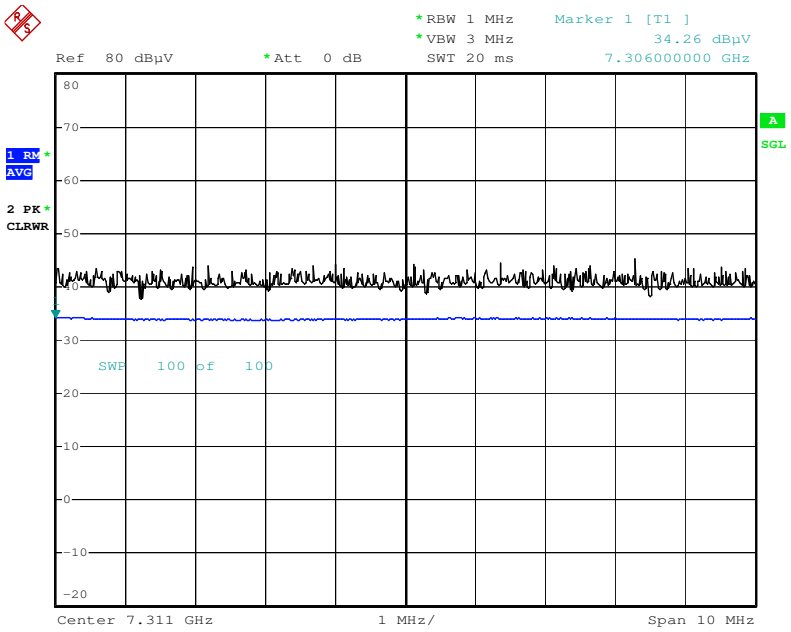
*A.F. : Antenna Factor / C.L. : Cable Loss / A.G. : Amplifier Gain / D.F. : Distance Factor

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor
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.

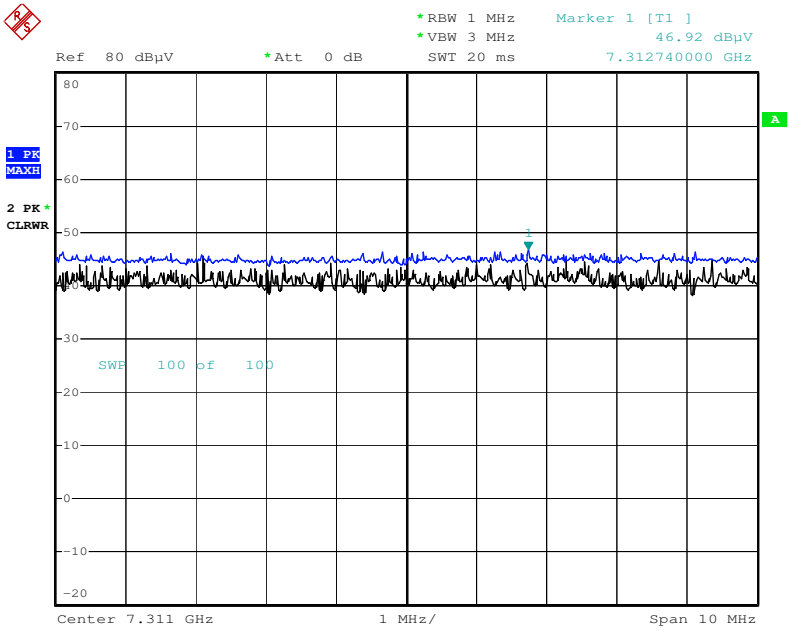
▣ RESULT PLOTS (Worst case : X-H)

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



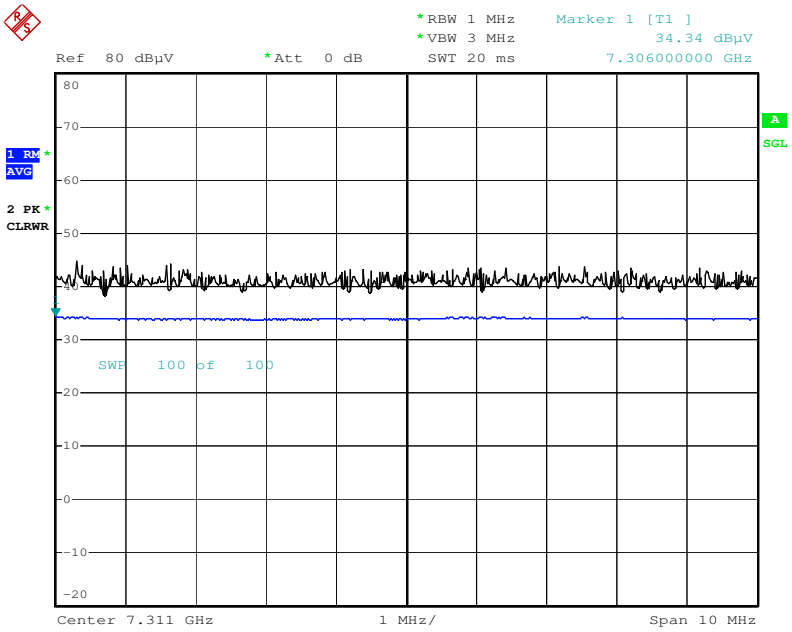
Date: 9.AUG.2016 10:57:59

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



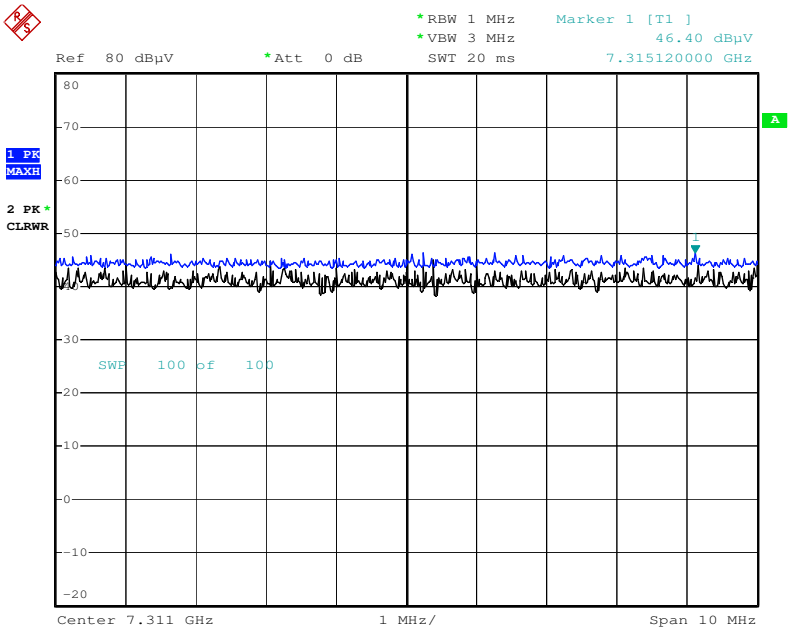
Date: 9.AUG.2016 11:00:03

Radiated Spurious Emissions plot – Average Reading (802.11g, Ch.6 3rd Harmonic)



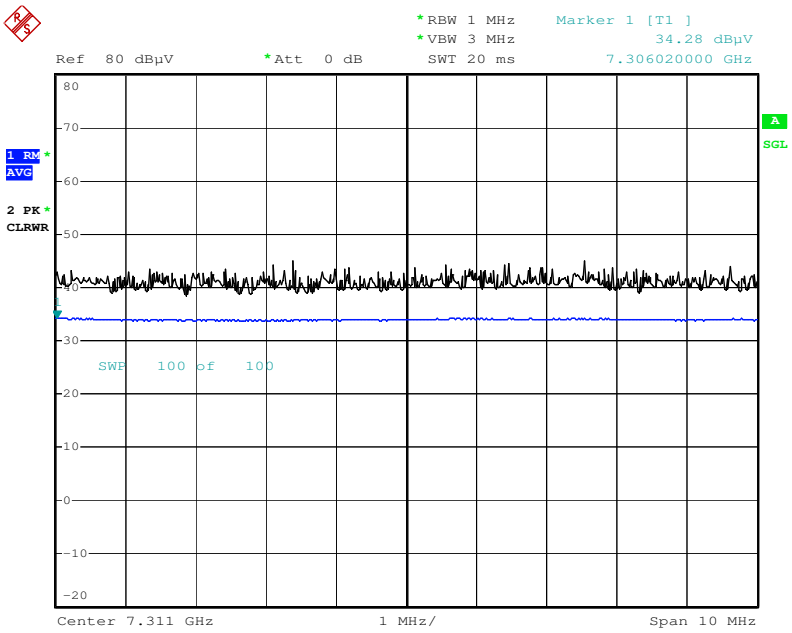
Date: 9.AUG.2016 10:58:19

Radiated Spurious Emissions plot – Peak Reading (802.11g, Ch.6 3rd Harmonic)



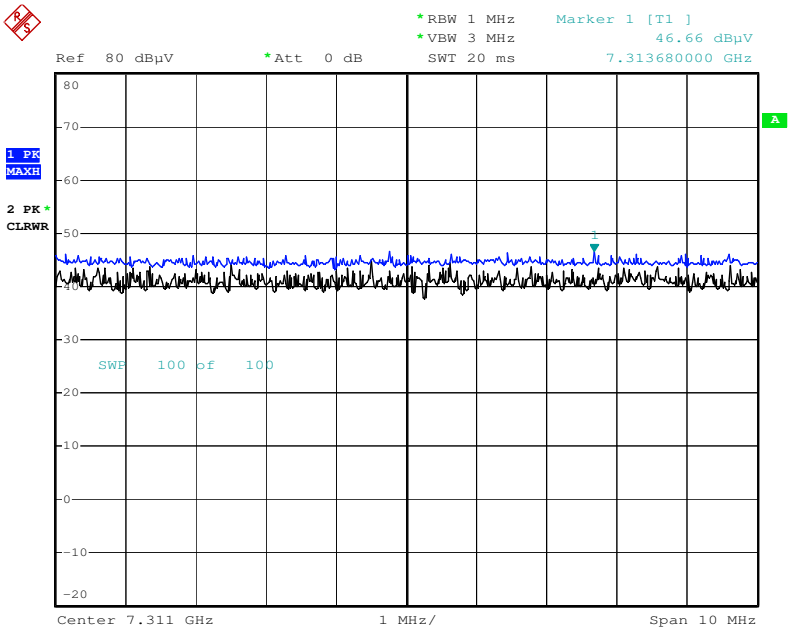
Date: 9.AUG.2016 10:59:44

Radiated Spurious Emissions plot – Average Reading (802.11n_HT20, Ch.6 3rd Harmonic)



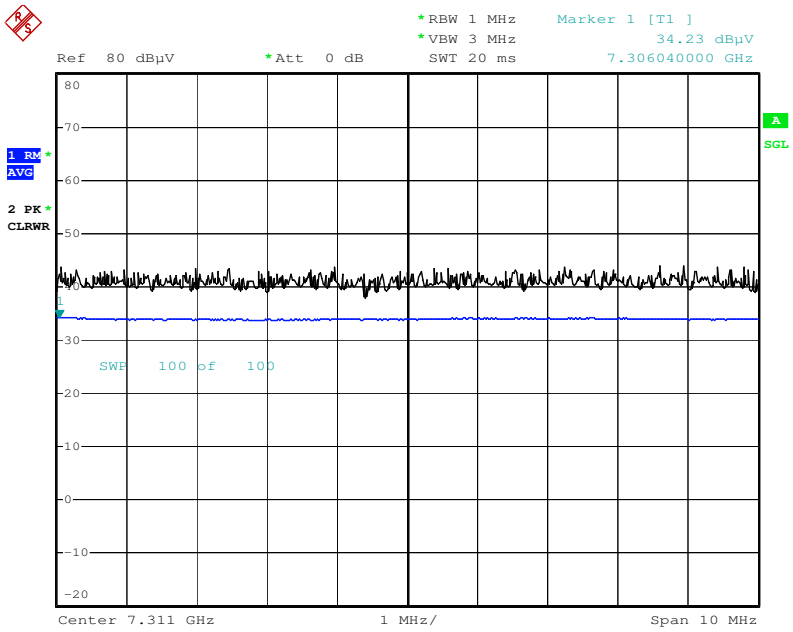
Date: 9.AUG.2016 10:58:35

Radiated Spurious Emissions plot – Peak Reading (802.11n_HT20, Ch.6 3rd Harmonic)



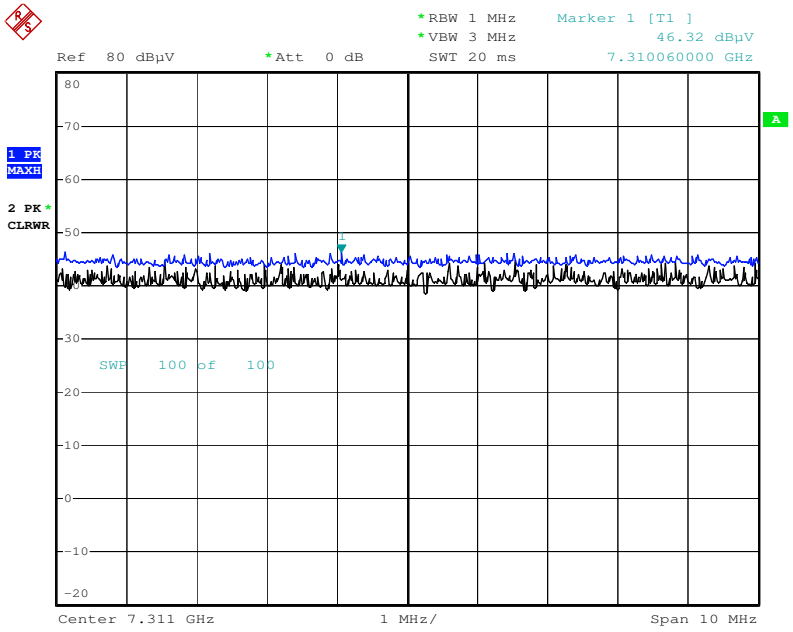
Date: 9.AUG.2016 10:59:30

Radiated Spurious Emissions plot – Average Reading (802.11ac_VHT20, Ch.6 3rd Harmonic)



Date: 9.AUG.2016 10:58:54

Radiated Spurious Emissions plot – Peak Reading (802.11ac_VHT20, Ch.6 3rd Harmonic)



Date: 9.AUG.2016 10:59:15

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:	802.11g
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	27.82	32.68	H	60.50	73.98	13.48	PK
2390.0	15.10	32.68	H	47.78	53.98	6.20	AV
2390.0	28.48	32.68	V	61.16	73.98	12.82	PK
2390.0	15.17	32.68	V	47.85	53.98	6.13	AV
2483.5	31.89	33.05	H	64.94	73.98	9.04	PK
2483.5	16.10	33.05	H	49.15	53.98	4.83	AV
2483.5	32.67	33.05	V	65.72	73.98	8.26	PK
2483.5	16.53	33.05	V	49.58	53.98	4.40	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	25.34	32.68	H	58.02	73.98	15.96	PK
2390.0	13.81	32.68	H	46.49	53.98	7.49	AV
2390.0	25.32	32.68	V	58.00	73.98	15.98	PK
2390.0	13.85	32.68	V	46.53	53.98	7.45	AV
2483.5	25.35	33.05	H	58.40	73.98	15.58	PK
2483.5	14.86	33.05	H	47.91	53.98	6.07	AV
2483.5	26.15	33.05	V	59.20	73.98	14.78	PK
2483.5	15.52	33.05	V	48.57	53.98	5.41	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	27.12	32.68	H	59.80	73.98	14.18	PK
2390.0	14.34	32.68	H	47.02	53.98	6.96	AV
2390.0	27.48	32.68	V	60.16	73.98	13.82	PK
2390.0	14.24	32.68	V	46.92	53.98	7.06	AV
2483.5	28.35	33.05	H	61.40	73.98	12.58	PK
2483.5	14.13	33.05	H	47.18	53.98	6.80	AV
2483.5	29.27	33.05	V	62.32	73.98	11.66	PK
2483.5	14.61	33.05	V	47.66	53.98	6.32	AV

Operation Mode:	802.11ac_VHT20
Transfer MCS Index:	0
Operating Frequency	2412 MHz, 2462 MHz
Channel No.	01 Ch, 11 Ch

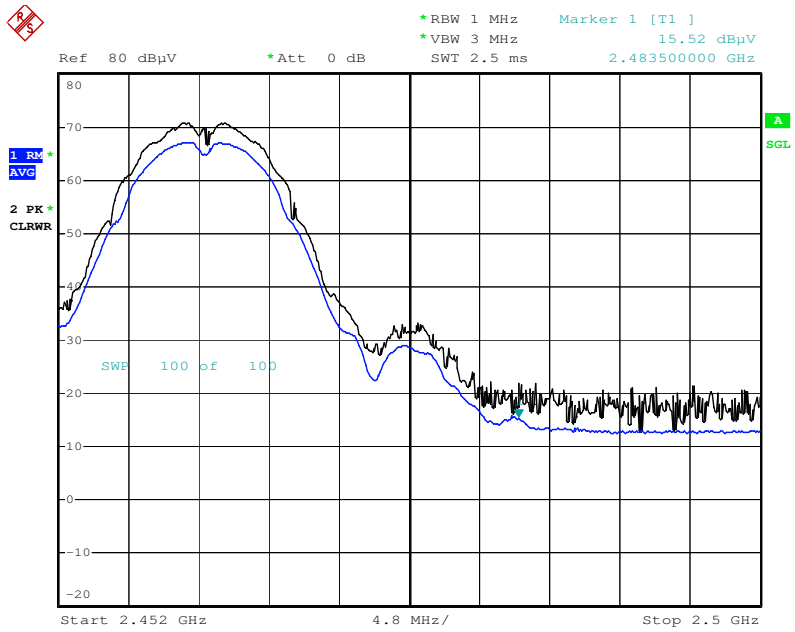
Frequency [MHz]	Reading [dBuV]	A.F.+C.L.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	27.76	32.68	H	60.44	73.98	13.54	PK
2390.0	14.35	32.68	H	47.03	53.98	6.95	AV
2390.0	27.61	32.68	V	60.29	73.98	13.69	PK
2390.0	14.13	32.68	V	46.81	53.98	7.17	AV
2483.5	29.01	33.05	H	62.06	73.98	11.92	PK
2483.5	14.08	33.05	H	47.13	53.98	6.85	AV
2483.5	29.92	33.05	V	62.97	73.98	11.01	PK
2483.5	14.55	33.05	V	47.60	53.98	6.38	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.

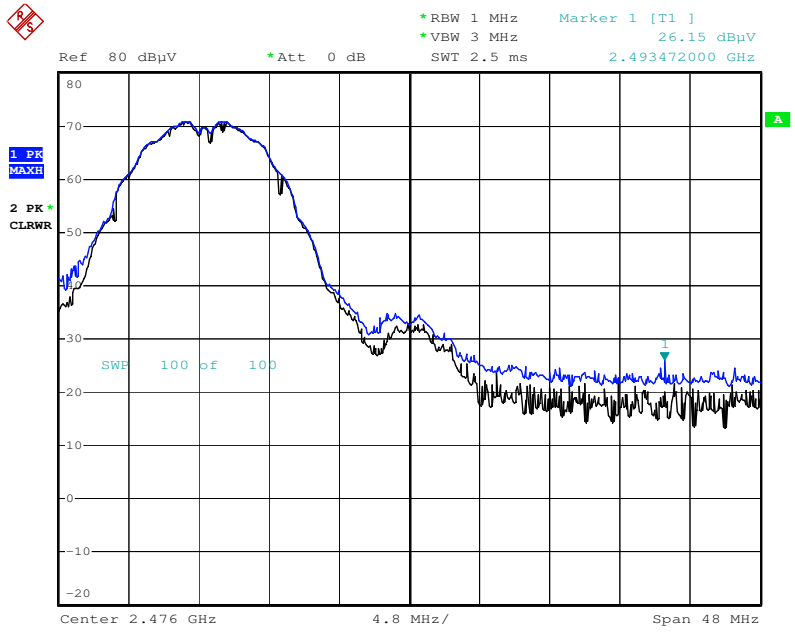
▣ RESULT PLOTS (Worst case : Z-V)

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



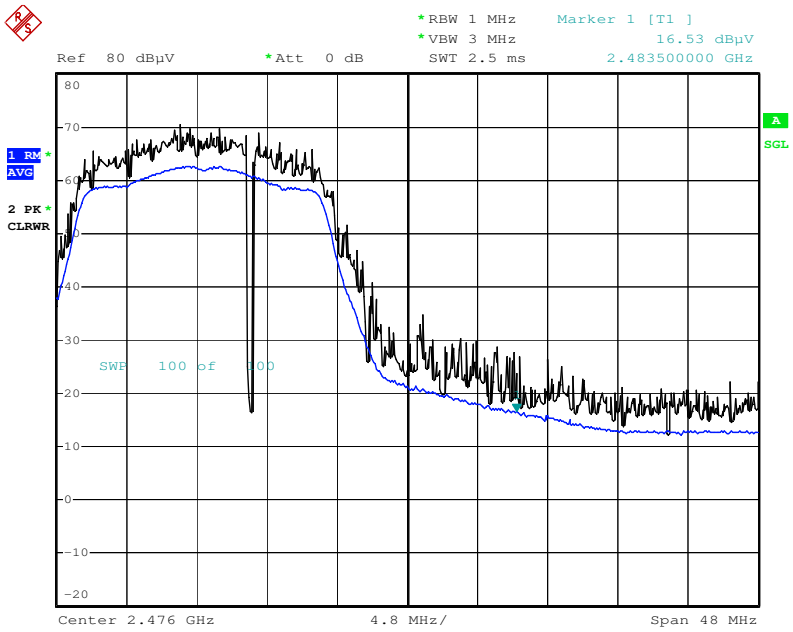
Date: 10.AUG.2016 11:10:57

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



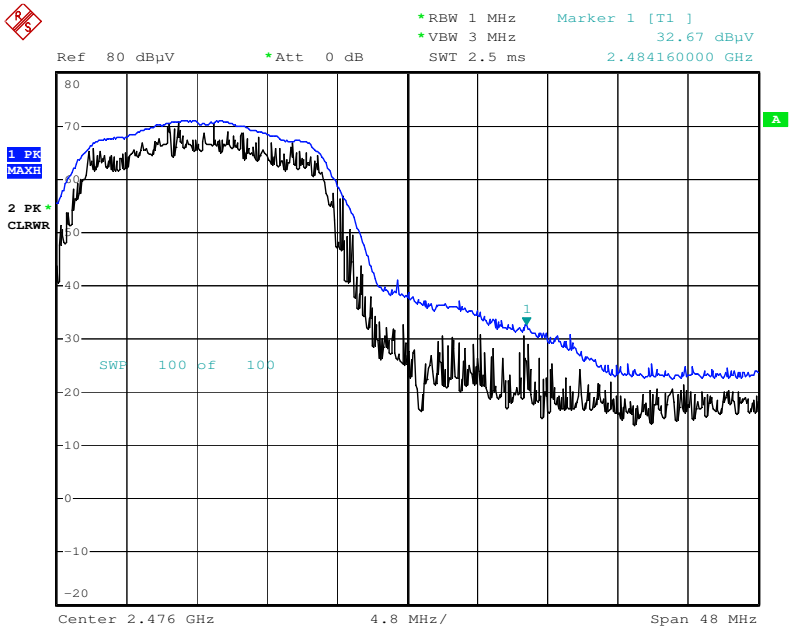
Date: 10.AUG.2016 11:11:33

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



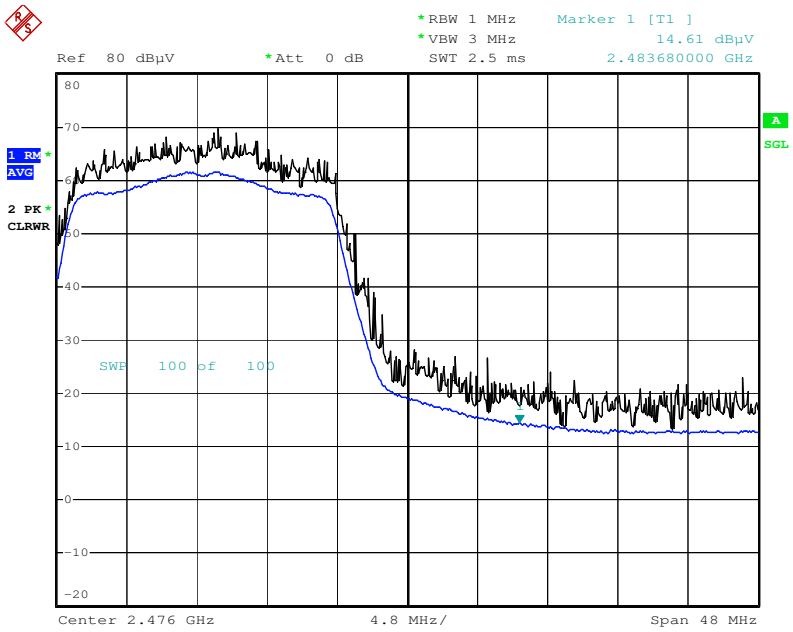
Date: 10.AUG.2016 11:05:43

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



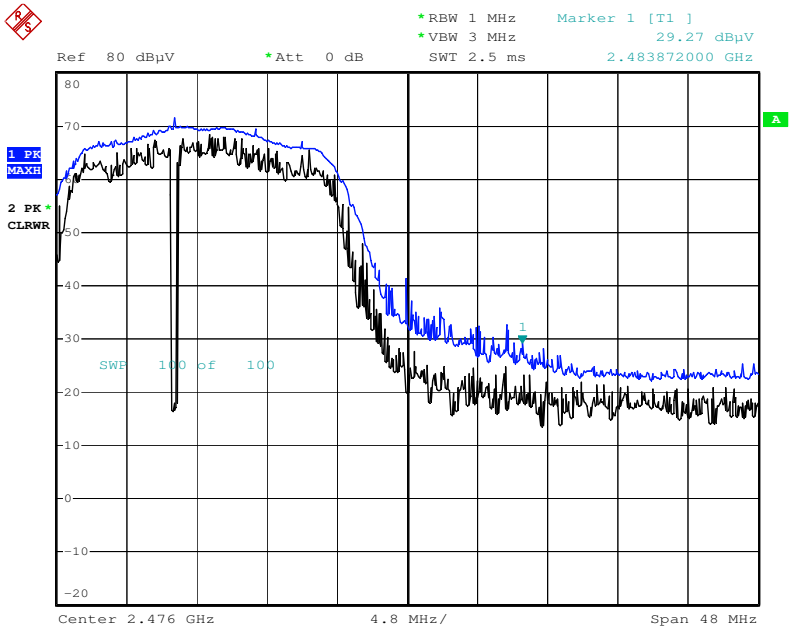
Date: 10.AUG.2016 11:06:39

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



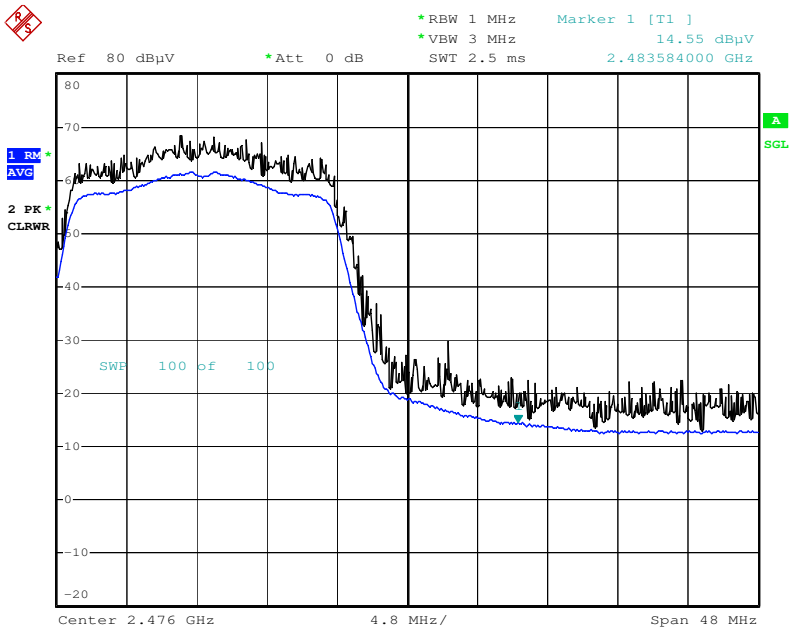
Date: 10.AUG.2016 11:13:38

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



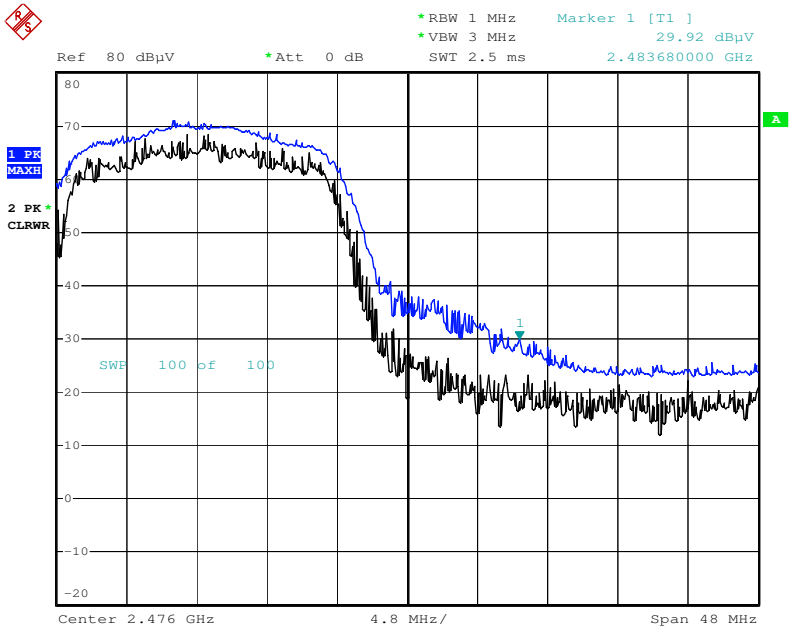
Date: 10.AUG.2016 11:12:56

Radiated Restricted Band Edges plot – Average Reading (802.11ac_VHT20, Ch.11)



Date: 10.AUG.2016 11:14:59

Radiated Restricted Band Edges plot – Peak Reading (802.11ac_VHT20, Ch.11)



Date: 10.AUG.2016 11:17:37

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

9.7 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

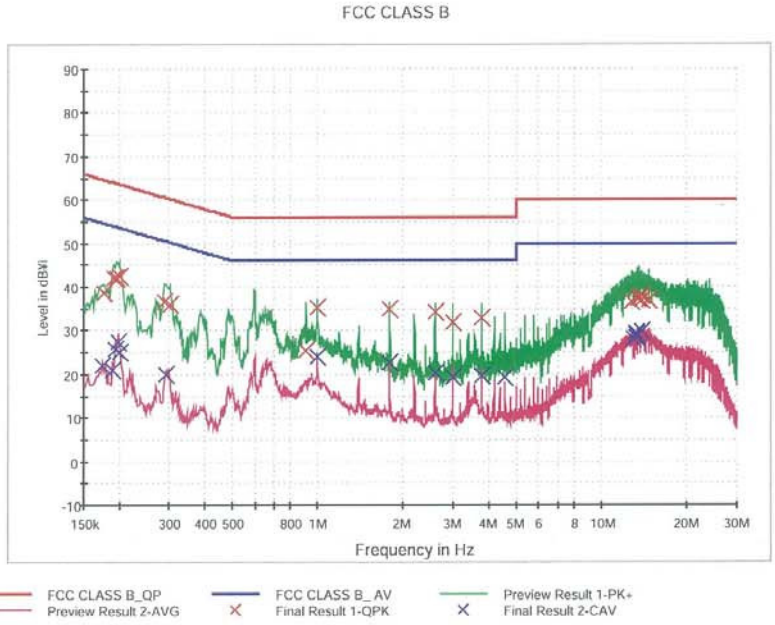
Conducted Emissions (Line 1)

WLAN MODE 2.4G L1 1 / 2

HCT TEST Report

Common Information

EUT:	LG-H990
Manufacturer:	LG
Test Site:	SHIELD ROOM
Operating Conditions:	WLAN MODE _ 2.4G



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.176000	38.8	9.000	Off	L1	9.7	25.9	64.7
0.192000	41.9	9.000	Off	L1	9.7	22.1	63.9
0.196000	42.1	9.000	Off	L1	9.7	21.7	63.8
0.200000	42.3	9.000	Off	L1	9.7	21.3	63.6
0.290000	36.7	9.000	Off	L1	9.7	23.8	60.5
0.302000	35.9	9.000	Off	L1	9.7	24.3	60.2
0.912000	25.3	9.000	Off	L1	9.8	30.7	56.0
0.998000	35.2	9.000	Off	L1	9.8	20.8	56.0
1.794000	34.9	9.000	Off	L1	9.8	21.1	56.0
2.592000	34.2	9.000	Off	L1	9.8	21.8	56.0
2.990000	31.8	9.000	Off	L1	9.8	24.2	56.0
3.788000	33.0	9.000	Off	L1	9.9	23.0	56.0
12.846000	36.7	9.000	Off	L1	10.2	23.3	60.0
13.350000	37.1	9.000	Off	L1	10.2	22.9	60.0
13.524000	37.6	9.000	Off	L1	10.2	22.4	60.0
13.900000	37.0	9.000	Off	L1	10.2	23.0	60.0
13.942000	38.1	9.000	Off	L1	10.2	21.9	60.0
14.732000	37.0	9.000	Off	L1	10.2	23.0	60.0

Final Result 2

2016-08-12

WLAN MODE 2.4G L1 2 / 2

Frequency (MHz)	CAverage (dB¥ì V)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB¥ì V)
0.174000	21.9	9.000	Off	L1	9.7	32.8	54.8
0.190000	21.1	9.000	Off	L1	9.7	32.9	54.0
0.194000	25.7	9.000	Off	L1	9.7	28.2	53.9
0.198000	27.5	9.000	Off	L1	9.7	26.2	53.7
0.202000	25.2	9.000	Off	L1	9.7	28.4	53.5
0.292000	20.0	9.000	Off	L1	9.7	30.4	50.5
0.998000	24.1	9.000	Off	L1	9.8	21.9	46.0
1.794000	22.6	9.000	Off	L1	9.8	23.4	46.0
2.594000	20.4	9.000	Off	L1	9.8	25.6	46.0
2.990000	19.3	9.000	Off	L1	9.8	26.7	46.0
3.788000	19.4	9.000	Off	L1	9.9	26.6	46.0
4.584000	19.4	9.000	Off	L1	9.9	26.6	46.0
12.952000	28.1	9.000	Off	L1	10.2	21.9	50.0
13.182000	29.2	9.000	Off	L1	10.2	20.8	50.0
13.214000	28.6	9.000	Off	L1	10.2	21.4	50.0
13.228000	29.4	9.000	Off	L1	10.2	20.6	50.0
13.350000	28.8	9.000	Off	L1	10.2	21.2	50.0
13.942000	29.9	9.000	Off	L1	10.2	20.1	50.0

2016-08-12

Conducted Emissions (Line 2)

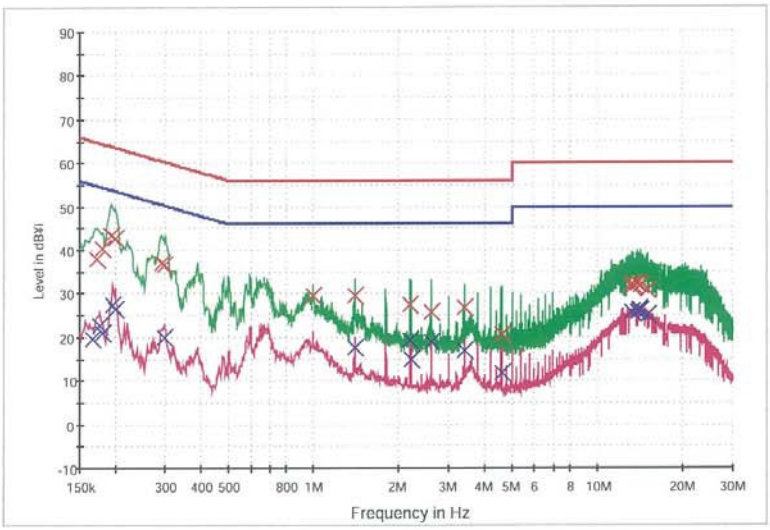
WLAN MODE 2.4G N 1 / 2

HCT TEST Report

Common Information

EUT:	LG-H990
Manufacturer:	LG
Test Site:	SHIELD ROOM
Operating Conditions:	WLAN MODE _ 2.4G

FCC CLASS B



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.172000	38.1	9.000	Off	N	9.7	26.8	64.9
0.180000	40.4	9.000	Off	N	9.7	24.1	64.5
0.194000	43.4	9.000	Off	N	9.7	20.5	63.9
0.202000	42.8	9.000	Off	N	9.7	20.8	63.5
0.292000	37.0	9.000	Off	N	9.7	23.5	60.5
0.298000	36.4	9.000	Off	N	9.7	23.8	60.3
1.000000	29.6	9.000	Off	N	9.7	26.4	56.0
1.398000	29.4	9.000	Off	N	9.7	26.6	56.0
2.196000	27.5	9.000	Off	N	9.8	28.5	56.0
2.596000	25.6	9.000	Off	N	9.8	30.4	56.0
3.394000	26.9	9.000	Off	N	9.8	29.1	56.0
4.592000	20.8	9.000	Off	N	9.9	35.2	56.0
13.238000	32.2	9.000	Off	N	10.1	27.8	60.0
13.268000	31.5	9.000	Off	N	10.1	28.5	60.0
13.374000	31.9	9.000	Off	N	10.1	28.1	60.0
13.804000	32.2	9.000	Off	N	10.2	27.8	60.0
14.170000	31.9	9.000	Off	N	10.2	28.1	60.0
14.974000	30.8	9.000	Off	N	10.2	29.2	60.0

Final Result 2

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WLAN MODE 2.4G N 2 / 2

Frequency (MHz)	CAverage (dB¥ì V)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB¥ì V)
0.166000	19.7	9.000	Off	N	9.7	35.4	55.2
0.176000	22.5	9.000	Off	N	9.7	32.2	54.7
0.180000	21.0	9.000	Off	N	9.7	33.5	54.5
0.196000	27.3	9.000	Off	N	9.7	26.4	53.8
0.200000	26.5	9.000	Off	N	9.7	27.1	53.6
0.298000	20.1	9.000	Off	N	9.7	30.2	50.3
1.400000	17.7	9.000	Off	N	9.7	28.3	46.0
2.194000	19.2	9.000	Off	N	9.8	26.8	46.0
2.198000	14.8	9.000	Off	N	9.8	31.2	46.0
2.594000	18.8	9.000	Off	N	9.8	27.2	46.0
3.394000	17.0	9.000	Off	N	9.8	29.0	46.0
4.592000	11.9	9.000	Off	N	9.9	34.1	46.0
13.268000	25.8	9.000	Off	N	10.1	24.2	50.0
13.814000	25.6	9.000	Off	N	10.2	24.4	50.0
14.038000	26.3	9.000	Off	N	10.2	23.7	50.0
14.086000	26.1	9.000	Off	N	10.2	23.9	50.0
14.116000	25.9	9.000	Off	N	10.2	24.1	50.0
14.974000	25.0	9.000	Off	N	10.2	25.0	50.0

2016-08-12

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	N9030A / Signal Analyzer	11/24/2015	Annual	MY49431210
Agilent	N1911A / Power Meter	03/11/2016	Annual	MY45100523
Agilent	N1921A / Power Sensor	03/11/2016	Annual	MY52260025
Agilent	87300B / Directional Coupler	11/30/2015	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.
Audix	AM4000 / Antenna Position Tower	N/A	N/A	N/A
Audix	Turn Table	N/A	N/A	N/A
Audix	EM1000 / Controller	N/A	N/A	060520
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	05/07/2015	Biennial	937
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	09/03/2015	Biennial	BBHA9170541
Rohde & Schwarz	FSP / Spectrum Analyzer	09/24/2015	Annual	100688
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/23/2015	Annual	101068-SZ
Wainwright Instruments	WHK3.0/18G-10EF / High Pass Filter	06/24/2016	Annual	8
Wainwright Instruments	WHFX7.0/18G-8SS / High Pass Filter	05/13/2016	Annual	29
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
Agilent	8493C-10 / Attenuator(10 dB)	08/11/2016	Annual	76649
CERNEX	CBLU1183540 / Power Amplifier	07/15/2016	Annual	22964
CERNEX	CBL06185030 / Power Amplifier	07/15/2016	Annual	22965
CERNEX	CBL18265035 / Power Amplifier	07/11/2016	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	07/11/2016	Annual	25956