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REPORT

FCC/IC Certification

Applicant Name:
LG Electronics Inc.

Address:
222 LG-ro Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do 451-713, Korea

Date of Issue:
January 12, 2015
Test Site/Location:
HCT CO., LTD., 74,Seoicheon-ro 578beon-gil, Majang-myeo,Icheon-si, Gyeonggi-do, Korea
Report No.: HCT-R-1501-F005
HCT FRN: 0005866421
IC Recognition No.: 5944A-3

FCC ID:	**BEJLC7F**
IC:	**2703H-LC7F**
APPLICANT:	**LG Electronics Inc.**

FCC/ IC Model(s):	LC7F
EUT Type:	Faceplate RADIO ASM-RECEIVER
Max. RF Output Power(Average):	Wi-Fi 802.11a (5180~5240) (15.22 dBm)/ Wi-Fi 802.11a (5765~5825) (19.29dBm) Wi-Fi 802.11n_20 MHz BW (5180~5240) (15.21 dBm)/ Wi-Fi 802.11n_20 MHz BW(5765~5825)(18.11 dBm)
Frequency Range:	5180 MHz - 5240 MHz (UNII 1)/ 5765 MHz - 5825 MHz (UNII 3)
Modulation type	OFDM
FCC Classification:	Unlicensed National Information Infrastructure(UNII)
IC Rule Part(s) :	RSS-210 Issue 8(December 2010) , RSS-GEN Issue 4(November 2014)

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

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

Report prepared by
: Jong Seok Lee
Test engineer of RF Team

Approved by
: Yong Hyun Lee
Manager of RF Team

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1501-F005	January 12, 2015	- First Approval Report

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1. GENERAL INFORMATION

Applicant:	LG Electronics Inc.
Address:	222 LG-ro Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do 451-713, Korea
FCC ID:	BEJLC7F
IC:	2703H-LC7F
EUT Type:	Faceplate RADIO ASM-RECEIVER
FCC/IC Model name(s):	LC7F
Date(s) of Tests:	October 20, 2014 ~ January 09, 2015
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. (IC Recognition No. : 5944A-3)

2. EUT DESCRIPTION

EUT Type	Faceplate RADIO ASM-RECEIVER	
FCC/ IC Model Name	LC7F	
Power Supply	DC 12.0 V	
Frequency Range	TX_20 MHz BW:	5180 MHz - 5240 MHz (UNII 1) / 5765 MHz - 5825 MHz (UNII 3)
	RX_20 MHz BW:	5180 MHz - 5240 MHz (UNII 1) / 5765 MHz - 5825 MHz (UNII 3
Max. RF Output Power:	Wi-Fi 802.11a (5180~5240) (15.21 dBm)/ Wi-Fi 802.11a (5765~5825) (19.29 dBm)/ Wi-Fi 802.11n_20 MHz BW (5180~5240)(15.22 dBm)/ Wi-Fi 802.11n_20 MHz BW (5765~5825)(18.11 dBm)	
Modulation Type	OFDM(802.11a, 802.11n)	
Antenna Specification	Manufacturer: AMOTECH Antenna type:Chip Antenna Peak Gain : 3.92 dBi (5180~5240 UNII1 BAND)/ 5.5 dBi (5765~5825 UNII3 BAND)	

3. TEST METHODOLOGY

The measurement procedure described in FCC KDB 789033 D02 General UNII Test Procedures New Rules v01 dated June 06, 2014 entitled " Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part15, Subpart E" and the American National Standard for Testing Unlicensed Wireless Devices(ANSI C63.4-2003) were used in the measurement.

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 15.407 under the FCC Rules Part 15 Subpart E.

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 13.1.4.1 of ANSI C63.4. (Version :2003) 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. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 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 13.1.4.1 of ANSI C63.4. (Version: 2003)

Conducted Antenna Terminal

See Section from 8.1 to 8.4.(KDB 789033)

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

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 :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated February 28, 2014 (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, §15.407, RSS-GEN 7.1.2

“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, §15.407, RSS-GEN 7.1.2

7. SUMMARY OF TEST RESULTS

7.1 FCC Part

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
26dB Bandwidth	§15.407 (for Power Measurement)	NA	CONDUCTED	PASS
6 dB Bandwidth	§15.407(e)	>500 kHz (5725-5850 MHz)		PASS
Maximum Conducted Output Power,	§15.407(a)(1)	< 250 mW (5150-5250 MHz) <1 W (5725-5850 MHz)		PASS
Peak Power Spectral Density	§15.407(a)(1), (5)	<11 dBm/ MHz (5150-5250 MHz) <30 dBm/500 kHz(5725-5850 MHz)		PASS
Frequency Stability	§15.407(g)	NA		NA
AC Conducted Emissions 150 kHz-30 MHz	§15.207	<FCC 15.207 limits		NA
Undesirable Emissions	§15.407(b)(1), (2), (3)	<-27 dBm/MHz EIRP (5150-5250 MHz) <-17 dBm/MHz EIRP within 5715-5725 MHz and 5850-5860 MHz, <-27 dBm/MHz EIRP outside 5715-5850 MHz(UNII3)	RADIATED	PASS
General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	§15.205, 5.407(b)(1), (5), (6)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS

7.2 IC Part

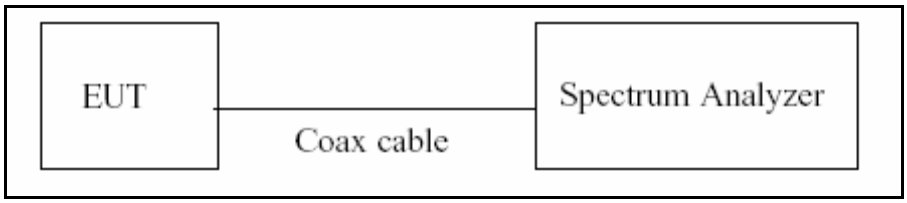
Test Description	IC Part Section(s)	Test Limit	Test Condition	Test Result
99% Bandwidth(IC)	RSS-GEN 4.6.1	NA	CONDUCTED	PASS
6 dB Bandwidth	RSS-210 [A8.2]	> 500 kHz		PASS
Maximum Conducted Output Power,	RSS-210 [A8.4]	<1 W (5725-5850 MHz)		PASS
Maximum e.i.r.p	RSS-210 [A9.2]	< 200 mW or 10+10 log $_{10}$ (BW) dBm (5150-5250 MHz) <4 W (5725-5850 MHz)		
Peak Power Spectral Density	RSS-210 [A9.2]	<10 dBm/ MHz(e.i.r.p.) (5150-5250)		PASS
	RSS-210 [A8.2]	<8 dBm/3 kHz (5725-5850 MHz)		
AC Conducted Emissions 150 kHz-30 MHz	RSS-GEN, Section 7.2.4	RSS-GEN section 7.2.4 table 4		NA
Undesirable Emissions	RSS-210 [A9.2]	<-27 dBm/ MHz EIRP (5150-5250 MHz)	RADIATED	PASS
	RSS-210 [A8.5]	>20 dBc(Conducted) (5725-5850 MHz)		
General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	RSS-GEN, Section 7.2.3	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS
Receiver Spurious Emissions	RSS-GEN, Section 7.2.3	cf. Section 8.8.3		PASS

8. TEST RESULT

8.1 DUTY CYCLE

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 ≥ EBW 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*, where *T* is defined in section B)1)a), 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 according to the zero-span measurement method, (B.2 in KDB 789033 D02, issued 06/06/2014)
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 becaure 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**

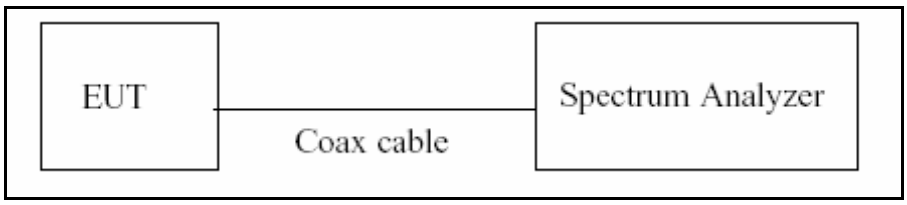
Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11a	6	2.055	2.165	0.94919169	0.226
	9	1.381	1.486	0.92934051	0.318
	12	1.041	1.145	0.90917031	0.414
	18	0.702	0.808	0.86881188	0.611
	24	0.531	0.635	0.83622047	0.777
	36	0.364	0.466	0.78111588	1.073
	48	0.275	0.379	0.72559367	1.393
	54	0.248	0.351	0.70655271	1.509
802.11n_20 MHz BW	6.5	1.911	2.018	0.94697721	0.237
	13	0.978	1.081	0.90471785	0.435
	19.5	0.661	0.766	0.86292428	0.640
	26	0.507	0.610	0.83114754	0.803
	39	0.350	0.455	0.76923077	1.139
	52	0.272	0.375	0.72533333	1.395
	58.5	0.248	0.351	0.70655271	1.509
	65	0.228	0.332	0.68674699	1.632

8.2 EMISSION BANDWIDTH AND MINIMUM EMISSION BANDWIDTH MEASUREMENT

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum power control level, as defined in KDB 789033 D02(issued 06/06/2014), at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26 dB bandwidth and 6 dB bandwidth.

The 26 dB bandwidth is used to determine the conducted power limits.
The 6 dB bandwidth is at least 500 kHz.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE(26 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.
The Spectrum Analyzer is set to(C.1 in KDB 789033 D02, issued 06/06/2014)

1. RBW = approximately 1 % of the emission bandwidth
2. VBW > RBW
3. Detector = Peak
4. Trace mode = max hold
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

Note : We tested 26 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 26 dB.

▣ TEST PROCEDURE(6 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to(C.2 in KDB 789033 D02, issued 06/06/2014)

1. RBW = 100 kHz
2. VBW ≥ 3*RBW
3. Detector = Peak
4. Trace mode = max hold
5. Allow the trace to stabilize
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points(upper and lower frequencies) that are attenuated by 6 dB relative to the maximum lever measured in the fundamental emission.

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 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	18.831	N/A	Pass
5200	40	18.872	N/A	Pass
5240	48	19.792	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5765	153	30.346	N/A	Pass
5785	157	18.660	N/A	Pass
5825	165	18.620	N/A	Pass

6 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5765	153	17.254	0.5	Pass
5785	157	15.512	0.5	Pass
5825	165	15.953	0.5	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_20 MHz BW

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	19.235	N/A	Pass
5200	40	19.038	N/A	Pass
5240	48	19.131	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_20 MHz BW

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5765	153	27.451	N/A	Pass
5785	157	19.020	N/A	Pass
5825	165	18.990	N/A	Pass

6 dB Bandwidth Measurements for 802.11n_20 MHz BW

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5765	153	16.770	0.5	Pass
5785	157	16.169	0.5	Pass
5825	165	15.147	0.5	Pass

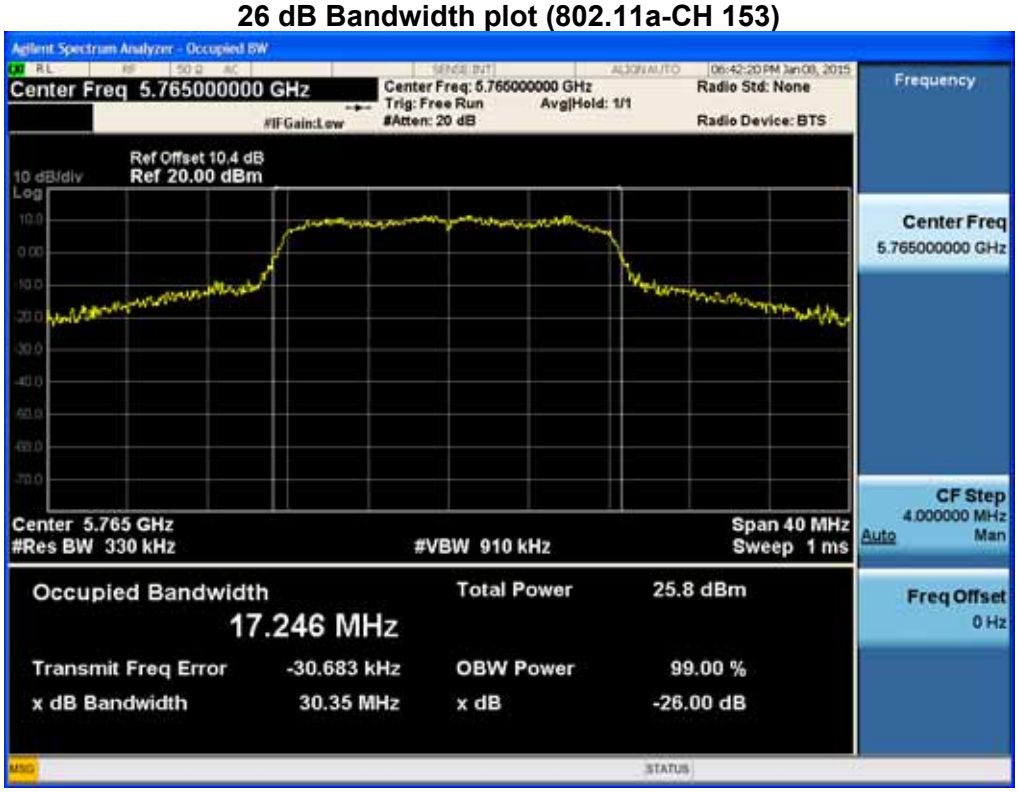
Note :

1. **In order to simplify the report, attached plots were only the most wide channel.**

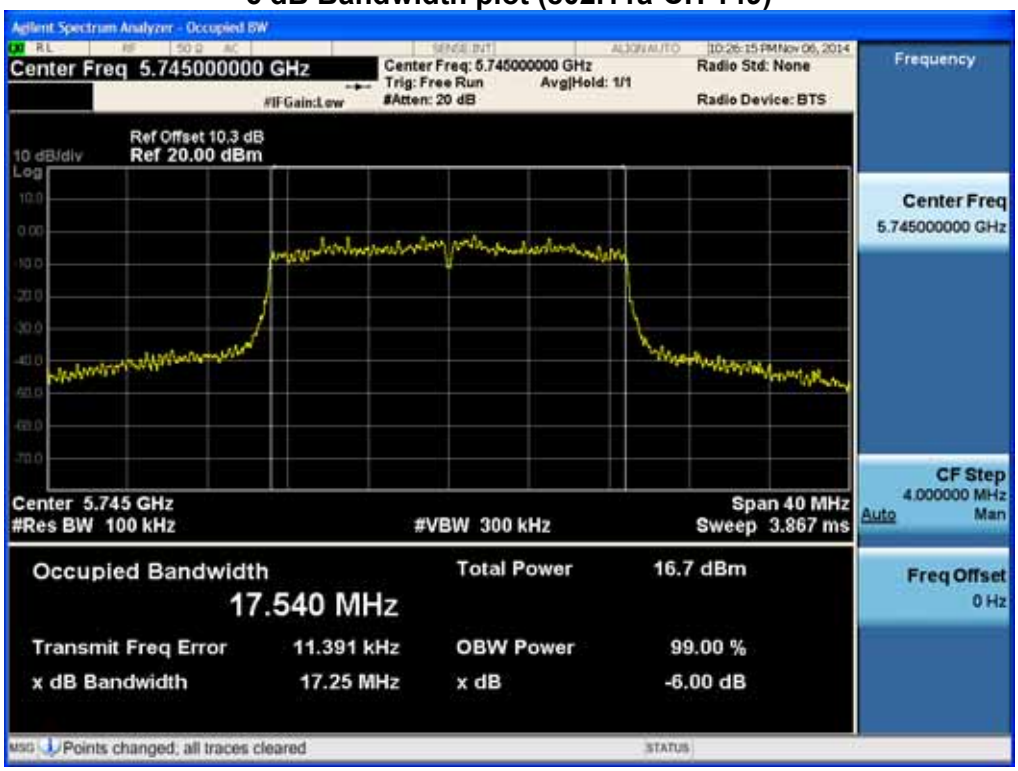
▣ RESULT PLOTS

26 dB Bandwidth plot (802.11a-CH 48)

26 dB Bandwidth plot (802.11a-CH 153)



6 dB Bandwidth plot (802.11a-CH 149)



26 dB Bandwidth plot (802.11n_20MHz BW-CH 36)

26 dB Bandwidth plot (802.11n_20MHz BW-CH 153)

6 dB Bandwidth plot (802.11n_20 MHz BW-CH 149)

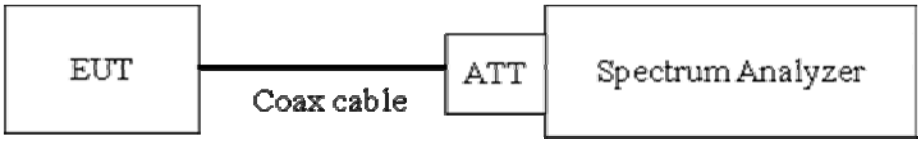
8.3 99% BANDWIDTH MEASUREMENT

limit

None; for IC reporting purposes only

The 99 % bandwidth is used to determine the conducted power limits(for IC).

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to as close to 1% of the selected span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RBW = 1% of the total span

VBW ≥ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

▣ TEST RESULTS

Conducted 99% Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	16.524
5200	40	16.530
5240	48	16.551
5765	153	16.290
5785	157	16.499
5825	165	16.536

Conducted 99% Bandwidth Measurements for 802.11n_20 MHz BW

802.11n Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	17.542
5200	40	17.540
5240	48	17.559
5765	153	17.430
5785	157	17.539
5825	165	17.537

Note :

1. **In order to simplify the report, attached plots were only the most wide channel.**
2. **DFS test channels should be defined. So, We performed the OBW test to prove that no part of the fundamental emissions of any UNII1 48 channels for DFS.**

▣ TEST Plot

99% Bandwidth plot (802.11a-CH48)

99% Bandwidth plot (802.11a-CH165)

99% Bandwidth plot (802.11n-CH48)_20 MHz BW

99% Bandwidth plot (802.11n-CH157)_20 MHz BW

8.4 OUTPUT POWER MEASUREMENT

Test Requirements and limit, §15.407(a)(1) & RSS-210

A transmitter antenna terminal of EUT is connected to the input of a Power meter or Spectrum Analyzer .Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

▣ **Limit**

1. Maximum Conducted Output Power :

Band	Mode	Limit (dBm)
UNII 1	802.11a,n,ac	23.98(Only FCC)
UNII 3	802.11a,n,ac	30(FCC and IC)

2. Maximum EIRP(for IC) :

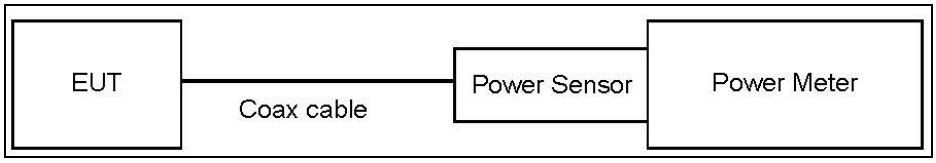
Band	Mode	Limit (dBm)
UNII 1	802.11a,n,ac	23.01
UNII 3	802.11a,n,ac	36

Note : 1. In case of UNII3, the gap of Conducted limit and EIRP limit is about 6 dB. The antenna gain of EUT is not exceed 6 dBi. Therefore, if conducted power is pass, EIRP is also pass. So, we attached only conducted power table.

2. Maximum conducted output power of UNII 3 band for IC is average power including duty cycle.(RSS210-i8, Annex 8.4.(4) Alternative peak power measurement)

3. Limit of UNII1 for IC is used the conducted level. Limit is 19.09 dBm(EIRP Limit – Antenna Gain = 23.01 dBm-3.92 dBi)

▣ TEST CONFIGURATION(20 MHz BW)



▣ TEST PROCEDURE(20 MHz BW)

▪ Average Power (Procedure E.3.a in KDB 789033, issued 06/06/2014).

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

Band	Loss(dB)
UNII 1, 2A, 2C, 3	10.4

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

▣ TEST RESULTS

Conducted Output Power Measurements (802.11a Mode: 5180~5240)

802.11a Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
5180	36	6	14.94	0.226	15.17	19.09
		9	14.89	0.318	15.21	19.09
		12	14.80	0.414	15.21	19.09
		18	14.51	0.611	15.12	19.09
		24	14.37	0.777	15.14	19.09
		36	14.02	1.073	15.09	19.09
		48	13.78	1.393	15.17	19.09
		54	13.68	1.509	15.19	19.09
5200	40	6	14.77	0.226	15.00	19.09
		9	14.70	0.318	15.02	19.09
		12	14.56	0.414	14.97	19.09
		18	14.53	0.611	15.14	19.09
		24	14.30	0.777	15.07	19.09
		36	13.99	1.073	15.07	19.09
		48	13.55	1.393	14.94	19.09
		54	13.46	1.509	14.97	19.09
5240	48	6	14.84	0.226	15.07	19.09
		9	14.77	0.318	15.09	19.09
		12	14.70	0.414	15.12	19.09
		18	14.59	0.611	15.20	19.09
		24	14.18	0.777	14.95	19.09
		36	13.91	1.073	14.98	19.09
		48	13.62	1.393	15.02	19.09
		54	13.53	1.509	15.04	19.09

Conducted Output Power Measurements (802.11a Mode: 5765~5825)

802.11a Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
5765	153	6	19.03	0.232	19.26	30
		9	18.90	0.327	19.23	30
		12	18.81	0.430	19.24	30
		18	18.67	0.595	19.27	30
		24	18.40	0.786	19.19	30
		36	18.14	1.097	19.24	30
		48	17.85	1.425	19.27	30
		54	17.73	1.561	19.29	30
5785	157	6	14.80	0.226	15.03	30
		9	14.65	0.318	14.97	30
		12	14.43	0.414	14.85	30
		18	14.36	0.611	14.97	30
		24	14.26	0.777	15.03	30
		36	14.02	1.073	15.10	30
		48	13.75	1.393	15.15	30
		54	13.54	1.509	15.05	30
5825	165	6	14.89	0.226	15.11	30
		9	14.69	0.318	15.01	30
		12	14.59	0.414	15.00	30
		18	14.46	0.611	15.07	30
		24	14.25	0.777	15.03	30
		36	14.04	1.073	15.11	30
		48	13.81	1.393	15.20	30
		54	13.44	1.509	14.95	30

Conducted Output Power Measurements (802.11n Mode: 5180~5240)

802.11n Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
5180	36	6.5	14.86	0.237	15.09	19.09
		13	14.63	0.435	15.07	19.09
		19.5	14.35	0.640	14.99	19.09
		26	14.21	0.803	15.01	19.09
		39	13.97	1.139	15.11	19.09
		52	13.70	1.395	15.10	19.09
		58.5	13.64	1.509	15.14	19.09
		65	13.59	1.632	15.22	19.09
5200	40	6.5	14.77	0.237	15.00	19.09
		13	14.56	0.435	14.99	19.09
		19.5	14.34	0.640	14.98	19.09
		26	14.20	0.803	15.00	19.09
		39	13.71	1.139	14.85	19.09
		52	13.48	1.395	14.87	19.09
		58.5	13.40	1.509	14.91	19.09
		65	13.30	1.632	14.93	19.09
5240	48	6.5	13.36	0.237	13.59	19.09
		13	13.08	0.435	13.52	19.09
		19.5	13.21	0.640	13.85	19.09
		26	13.98	0.803	14.78	19.09
		39	13.74	1.139	14.88	19.09
		52	13.51	1.395	14.91	19.09
		58.5	13.46	1.509	14.97	19.09
		65	13.42	1.632	15.05	19.09

Conducted Output Power Measurements (802.11n Mode: 5765~5825)

802.11n Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
5765	153	6.5	17.75	0.249	18.00	30
		13	17.49	0.456	17.95	30
		19.5	17.36	0.641	18.00	30
		26	17.26	0.843	18.11	30
		39	16.94	1.127	18.07	30
		52	16.54	1.411	17.95	30
		58.5	16.44	1.526	17.97	30
		65	16.34	1.651	17.99	30
5785	157	6.5	14.73	0.237	14.97	30
		13	14.51	0.435	14.95	30
		19.5	14.31	0.640	14.95	30
		26	14.17	0.803	14.97	30
		39	13.90	1.139	15.04	30
		52	13.63	1.395	15.02	30
		58.5	13.52	1.509	15.03	30
		65	13.31	1.632	14.94	30
5825	165	6.5	14.76	0.237	15.00	30
		13	14.52	0.435	14.96	30
		19.5	14.38	0.640	15.02	30
		26	14.26	0.803	15.06	30
		39	13.97	1.139	15.11	30
		52	13.70	1.395	15.09	30
		58.5	13.59	1.509	15.10	30
		65	13.44	1.632	15.08	30

Note : In case of UNII 1 band, we applied IC limit instead of FCC limit because IC limit is worst case.

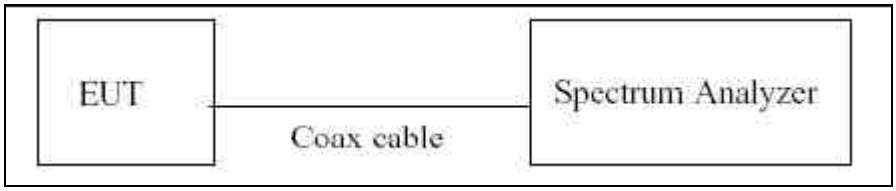
8.5 POWER SPECTRAL DENSITY

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

▣ Limit

Band	Mode	Limit(For FCC)	Limit(For IC)
UNII 1	802.11a,n	11 dBm/MHz	10 dBm/MHz(e.i.r.p.)
UNII 3	802.11a,n	30 dBm/500 kHz	8 dBm/3 kHz

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

We tested according to Method in KDB 789033(issued 06/06/2014).

The spectrum analyzer is set to :

1. Set span to encompass the entire emission bandwidth(EBW) of the signal.
2. RBW = 1 MHz.
3. VBW ≥ 3 MHz.
4. Number of points in sweep ≥ 2*span/RBW.
5. Sweep time = auto.
6. Detector = RMS(i.e., power averaging), if available. Otherwise, use sample detector mode.
7. Do not use sweep triggering. Allow the sweep to “free run”.
8. Trace average at least 100 traces in power averaging(RMS) mode
9. Use the peak search function on the spectrum analyzer to find the peak of the spectrum.
10. If Method SA-2 was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.

▣ TEST PROCEDURE(Additional Test for UNII3 of IC)

We tested according to Procedure 10.2 in KDB 558074, issued 06/05/2014

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 (Conducted)

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

▣ Sample Calculation (EIRP)

EIRP Spectral Density = Reading Value + ATT loss + Cable loss(1 ea) + Duty Cycle Factor + Ant gain

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

Band	Loss(dB)
UNII 1, 3	10.4

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

▣ TEST RESULTS for FCC

Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result				
			Measured Power Density (dBm)	Duty Cycle Factor (dB)	Measured Power Density(dBm) + Duty Cycle Factor	Limit (dBm)	Pass/Fail
5180	36	802.11a	4.805	0.41355	5.219	11	Pass
5200	40		4.651	0.61074	5.262	11	Pass
5240	48		4.401	0.61074	5.012	11	Pass
5765	153		14.850	1.56100	16.411	30	Pass
5785	157		3.257	0.37657	3.634	30	Pass
5825	165		2.819	0.37657	3.196	30	Pass
5180	36	802.11n 20MHz BW	3.309	1.63203	4.941	11	Pass
5200	40		4.594	0.2366	4.831	11	Pass
5240	48		3.174	1.63203	4.806	11	Pass
5765	153		13.405	0.84300	14.248	30	Pass
5785	157		3.704	0.45186	4.156	30	Pass
5825	165		3.404	0.41711	3.551	30	Pass

▣ TEST RESULTS for IC

Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result						
			Measured Power Density (dBm)	Duty Cycle Factor (dB)	Measured Power Density(dBm) + Duty Cycle Factor	Ant. Gain (dBi)	EIRP	Limit (dBm)	Pass/Fail
5180	36	802.11a	4.805	0.41355	5.219	3.92	9.139	10	Pass
5200	40		4.651	0.61074	5.262	3.92	9.182	10	Pass
5240	48		4.401	0.61074	5.012	3.92	8.932	10	Pass
5765	153		-5.379	-	-	-	-	8	Pass
5785	157		-8.640	-	-	-	-	8	Pass
5825	165		-10.222	-	-	-	-	8	Pass
5180	36	802.11n 20MHz BW	3.309	1.63203	4.941	3.92	8.861	10	Pass
5200	40		4.594	0.2366	4.831	3.92	8.751	10	Pass
5240	48		3.174	1.63203	4.806	3.92	8.726	10	Pass
5765	153		-6.115	-	-	-	-	8	Pass
5785	157		-9.284	-	-	-	-	8	Pass
5825	165		-9.701	-	-	-	-	8	Pass

▣ RESULT PLOTS for FCC

Power Spectral Density (802.11a-CH 40)

Power Spectral Density (802.11a-CH 153)

Power Spectral Density (802.11n -CH 48) _20MHz BW

Power Spectral Density (802.11n-CH 153) _20MHz BW

▣ RESULT PLOTS for IC

Power Spectral Density (802.11a-CH 40)

Power Spectral Density (802.11a-CH 153)

Power Spectral Density (802.11n -CH 48) _20MHz BW

Power Spectral Density (802.11n-CH 153) _20MHz BW

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

Test Requirements and limit, RSS-210-i8 A8.5(Only for UNII3 of IC)

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 Section A8.4(4), the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in RSS-Gen is not required.

▣ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. (Procedure 11.0 in KDB 558074, issued 06/05/2014)

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 band edge results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the UNII3 band that was rounded off to the closest tenth dB.
   Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1, 3	10.4

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

4. In case of conducted spurious emissions test, please check factors blow table.

5. In order to simplify the report, attached plots were only the worst case channel and data rate.

▣ FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	9.95
100	10.01
200	10.03
300	10.04
400	10.05
500	10.04
600	10.03
700	10.09
800	10.10
900	10.08
1000	10.11
2000	10.25
3000	10.27
4000	10.22
5000	10.48
5700*	10.42
5800*	10.48
6000	10.48
7000	10.57
8000	10.45
9000	10.50
10000	10.64
11000	10.69
12000	10.75
13000	10.92
14000	11.90
15000	11.00
16000	11.03
17000	10.93
18000	10.96
19000	10.85
20000	12.11

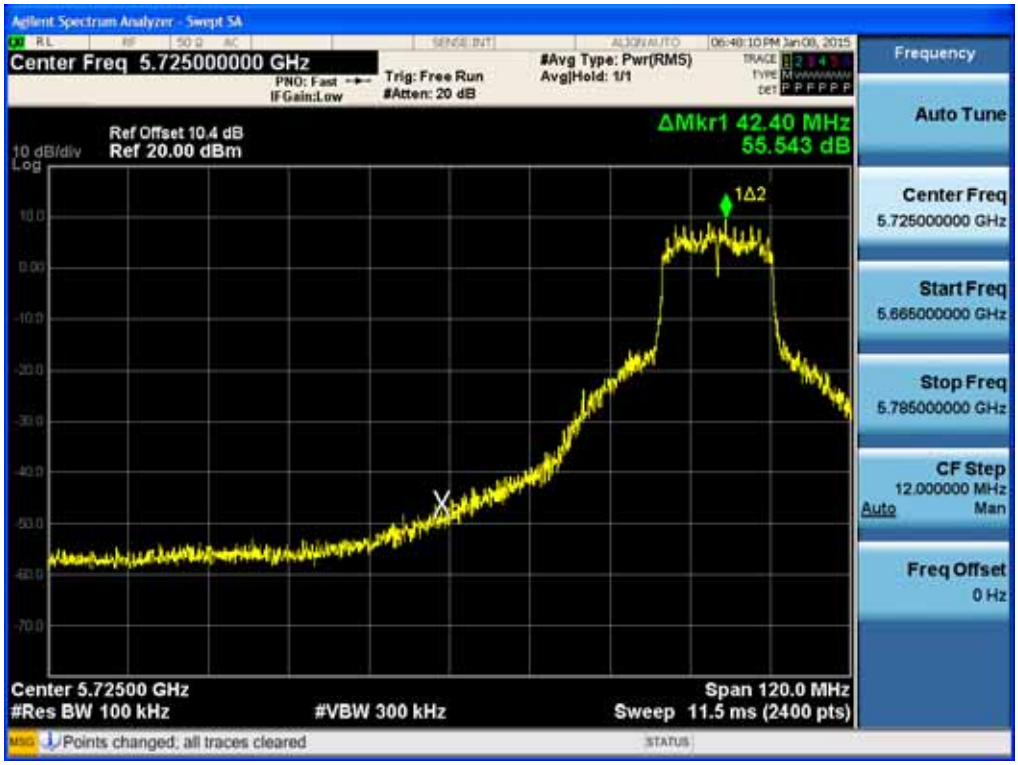
21000	11.17
22000	10.99
23000	11.12
24000	11.10
25000	11.42
26000	11.28
27000	10.83
28000	11.03
29000	10.99
30000	12.08
31000	10.99
32000	11.32
33000	11.33
34000	12.62
35000	14.85
36000	14.78
37000	15.73
38000	15.81
39000	13.47
40000	14.89

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

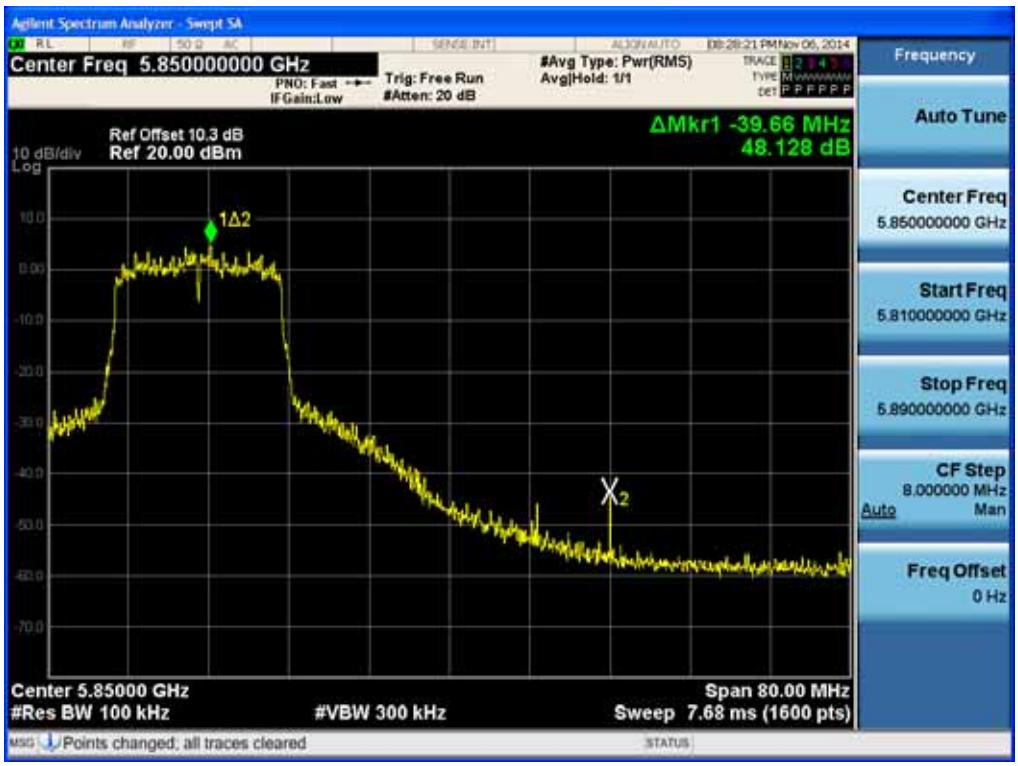
2. Factor = Cable loss + Attenuator loss

▣ RESULT PLOTS

BandEdge (802.11a-CH 153)

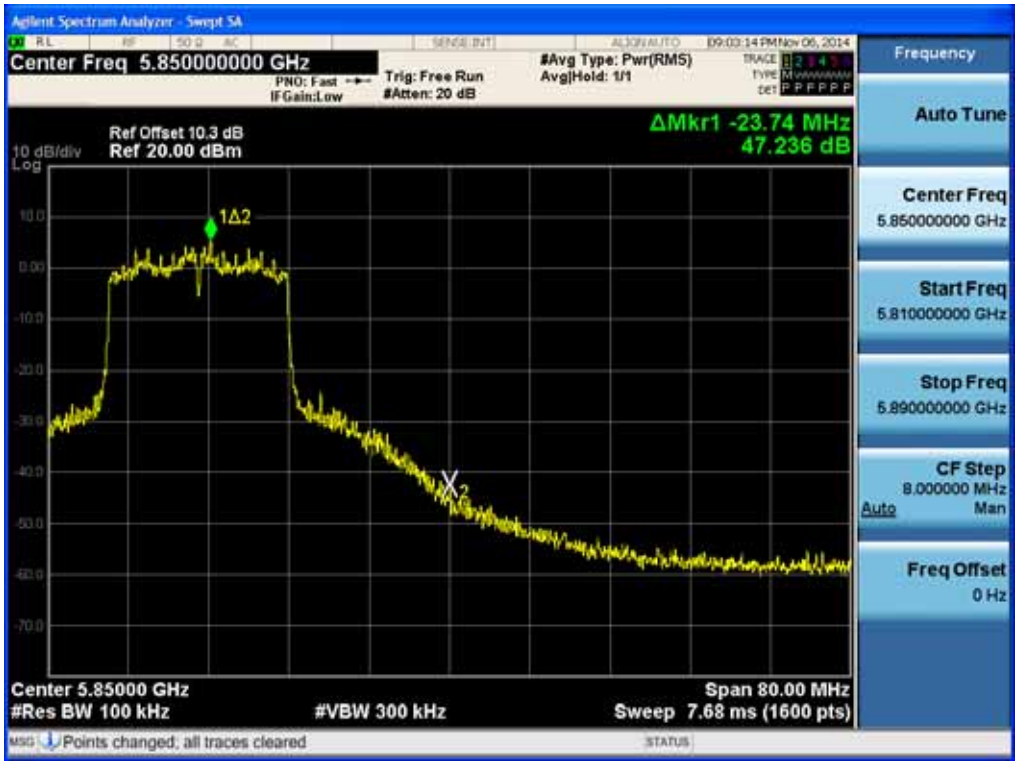


BandEdge (802.11a-CH 165)



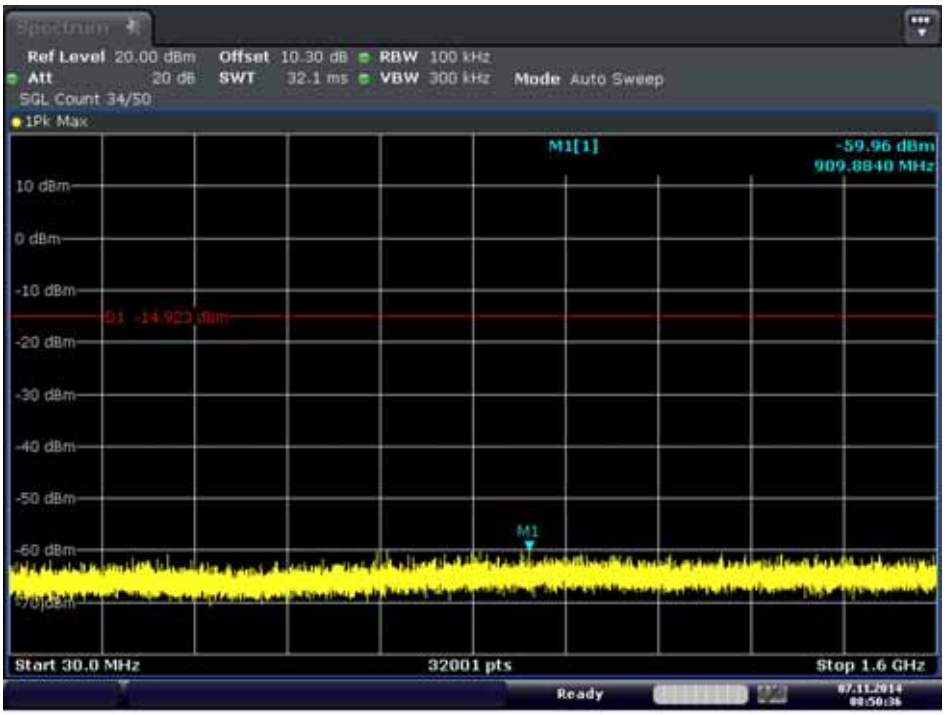
BandEdge (802.11n-CH 153) _20 MHz BW

BandEdge (802.11n-CH 165) _20 MHz BW



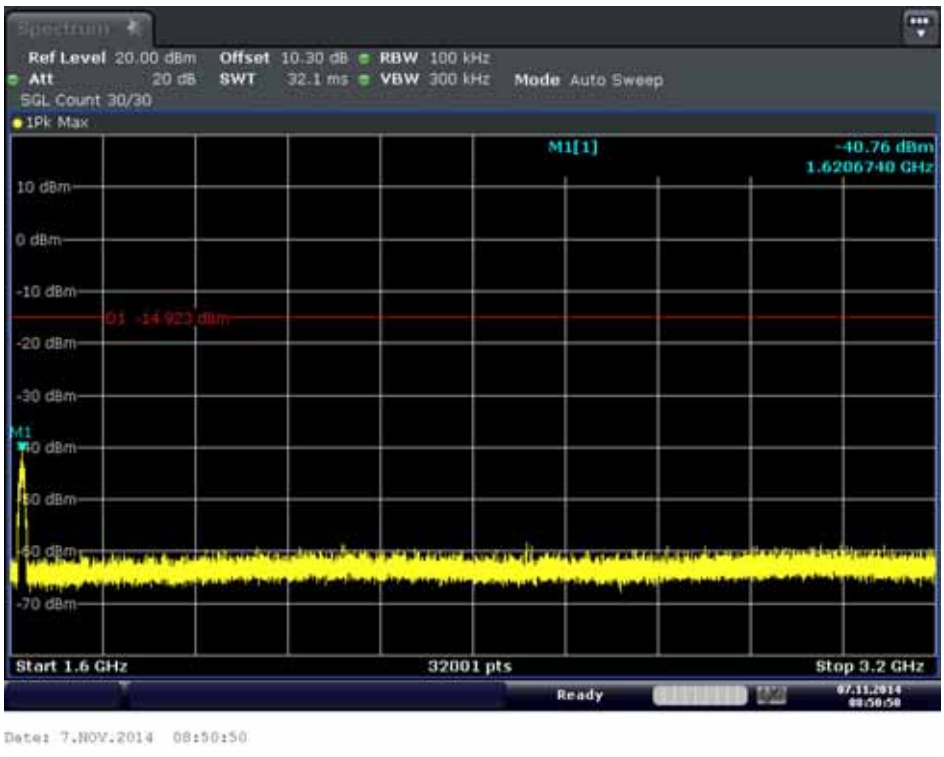
30 MHz ~ 1.6 GHz

Conducted Spurious Emission (802.11a-CH153)



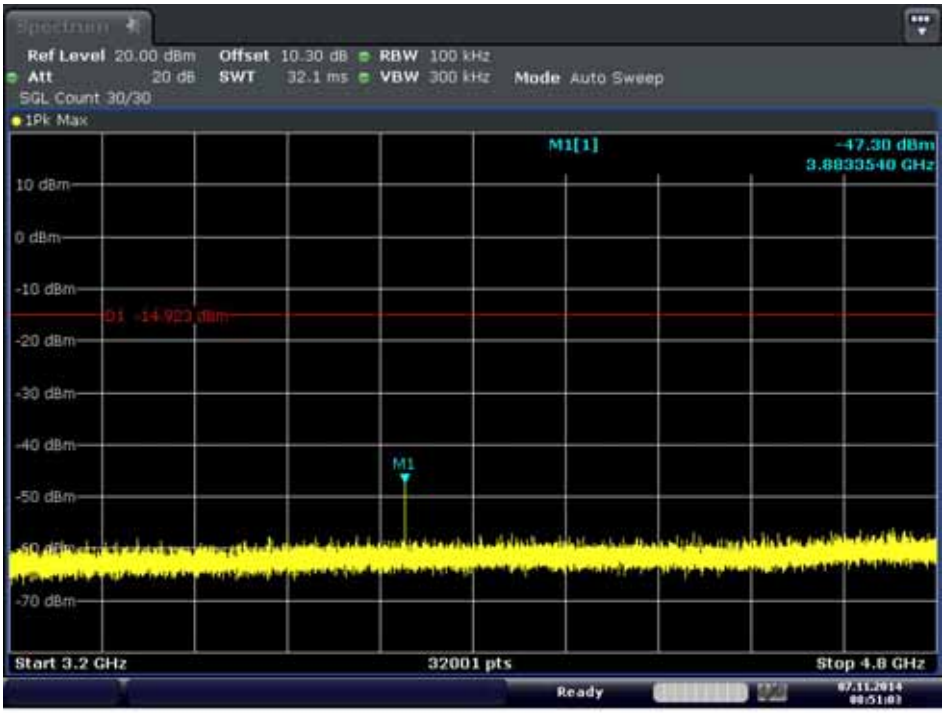
1.6 GHz ~ 3.2 GHz

Conducted Spurious Emission (802.11a-CH153)



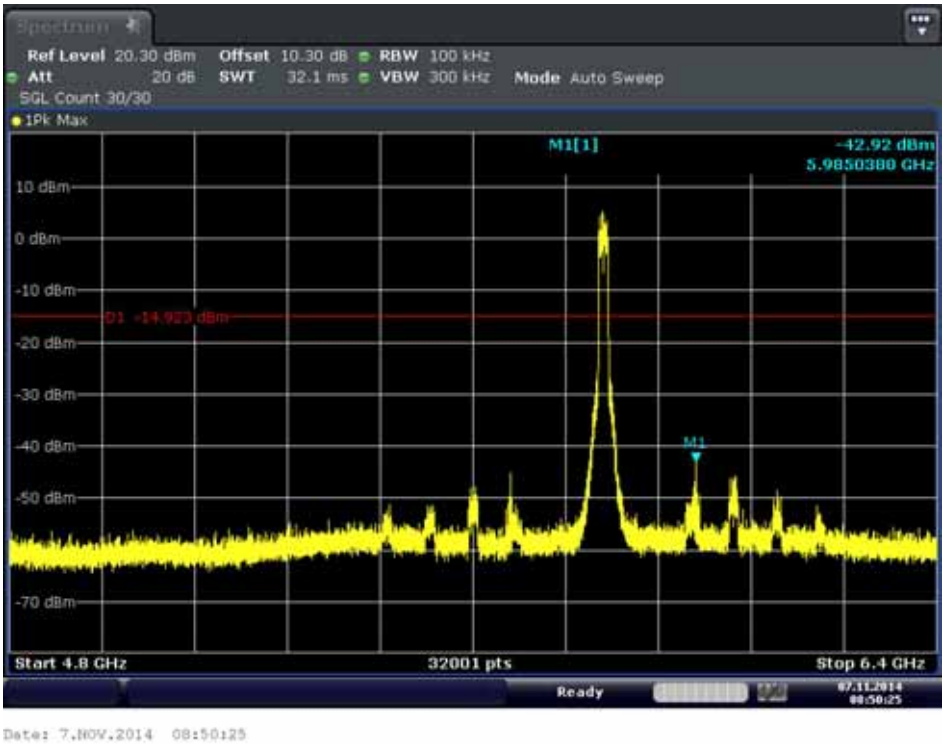
3.2 GHz ~ 4.8 GHz

Conducted Spurious Emission (802.11a-CH153)



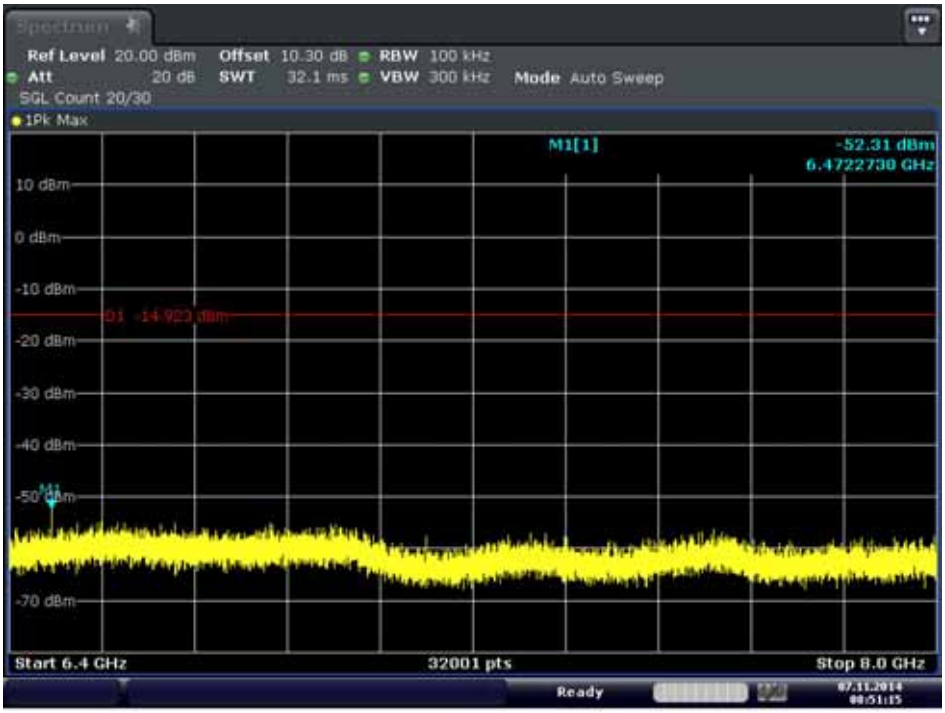
4.8 GHz ~ 6.4 GHz

Conducted Spurious Emission (802.11a-CH153)



6.4 GHz ~ 8 GHz

Conducted Spurious Emission (802.11a-CH153)



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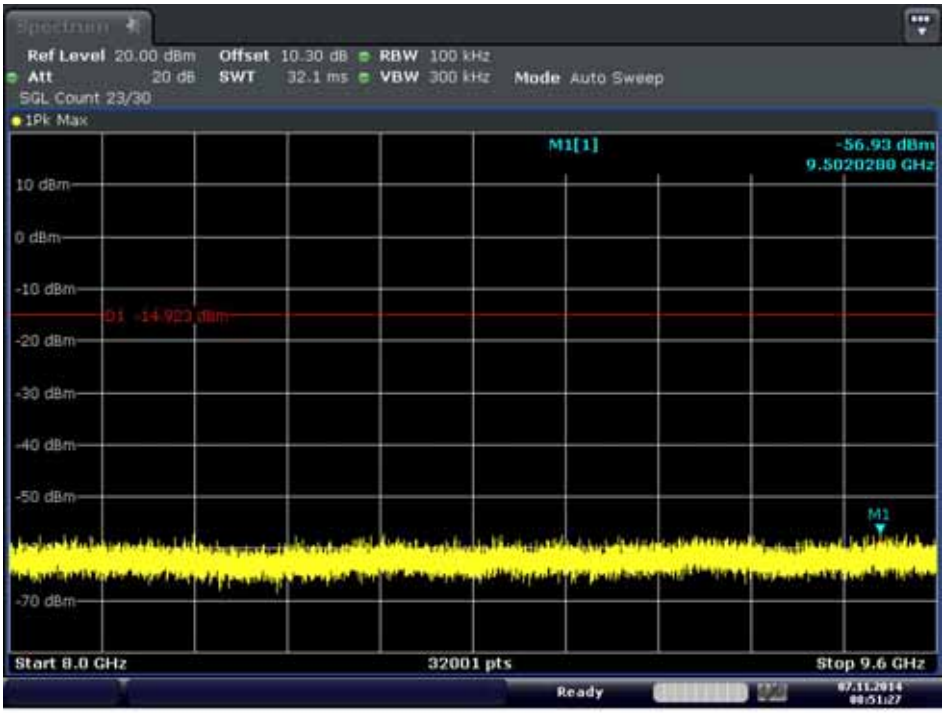
8 GHz ~ 9.6 GHz

Conducted Spurious Emission (802.11a-CH153)



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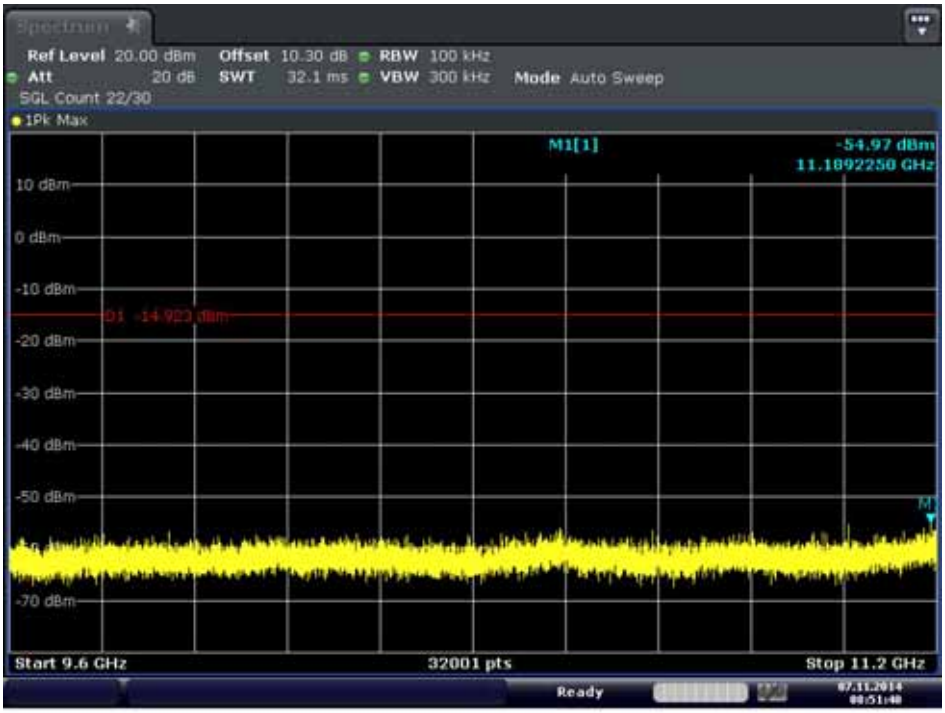
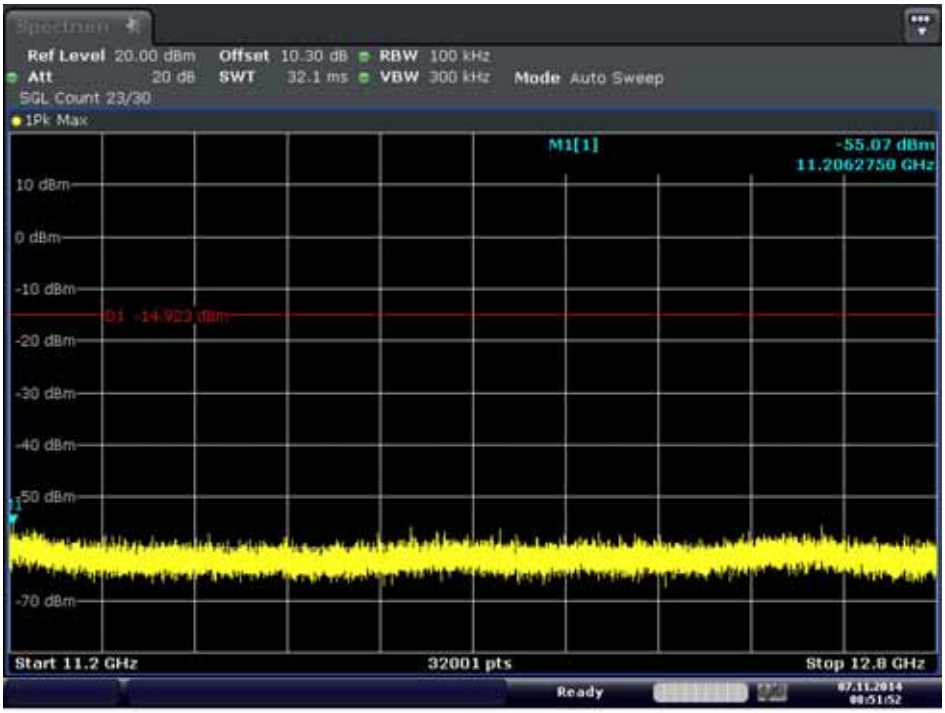
9.6 GHz ~ 11.2 GHz

Conducted Spurious Emission (802.11a-CH153)



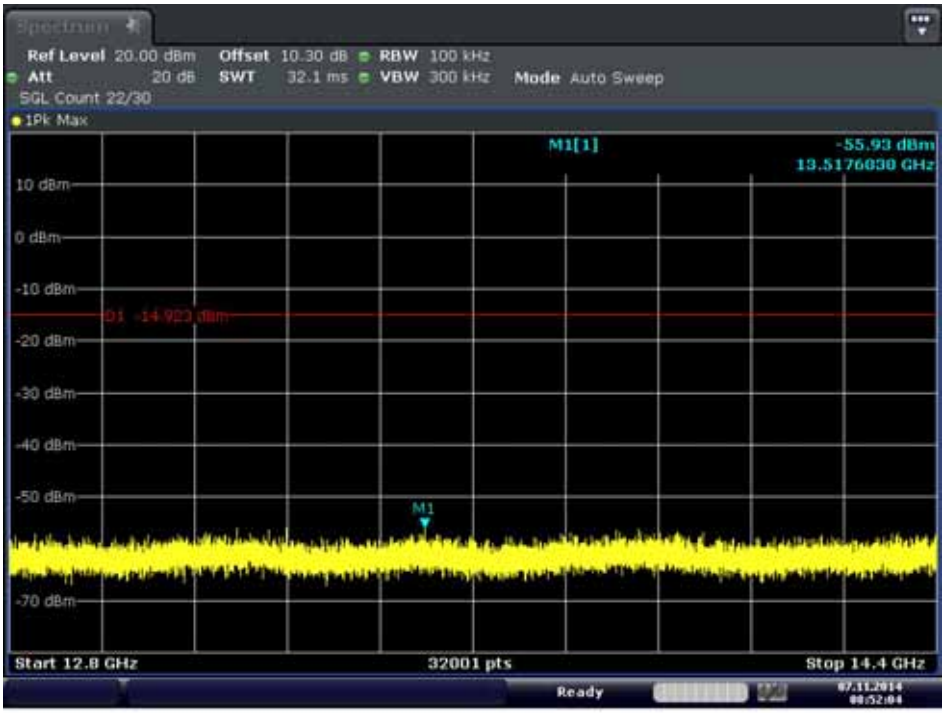
11.2 GHz ~ 12.8 GHz

Conducted Spurious Emission (802.11a-CH153)



12.8 GHz ~ 14.4 GHz

Conducted Spurious Emission (802.11a-CH153)



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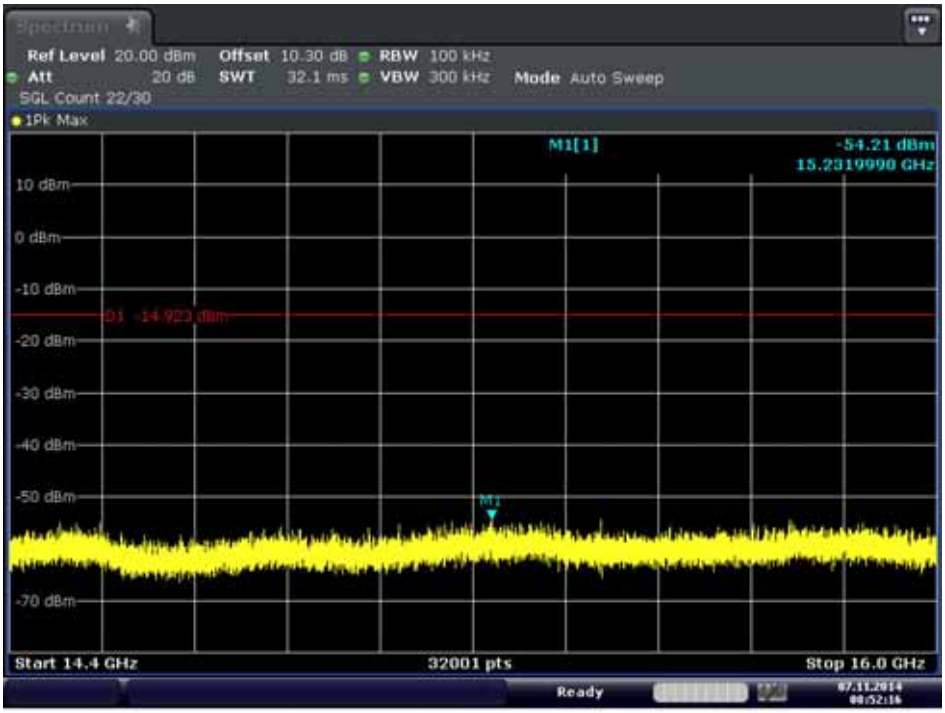
14.4 GHz ~ 16 GHz

Conducted Spurious Emission (802.11a-CH153)



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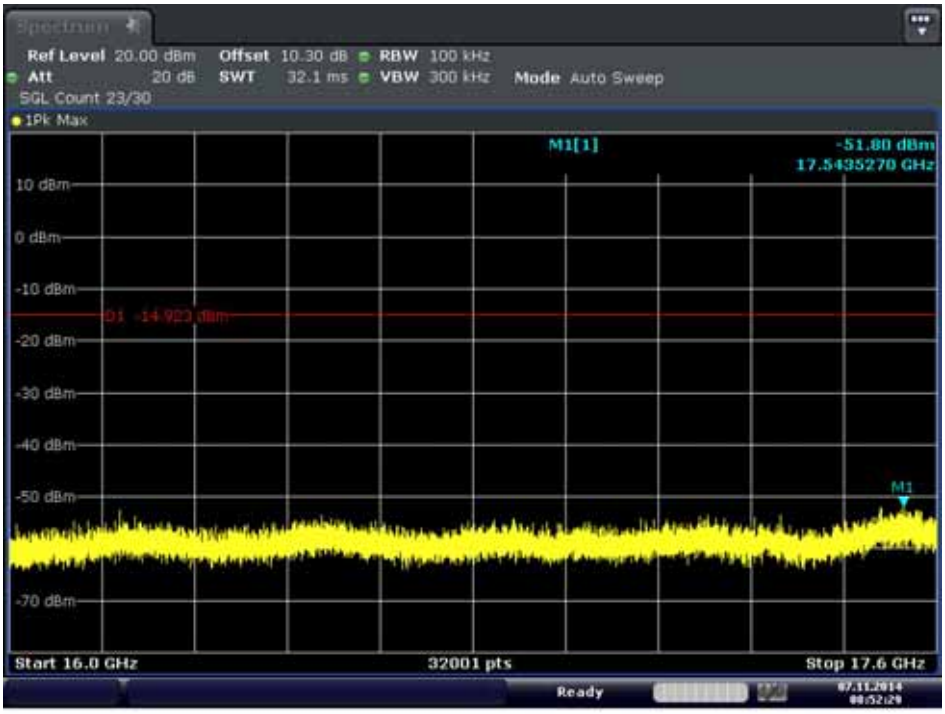
16 GHz ~ 17.6 GHz

Conducted Spurious Emission (802.11a-CH153)



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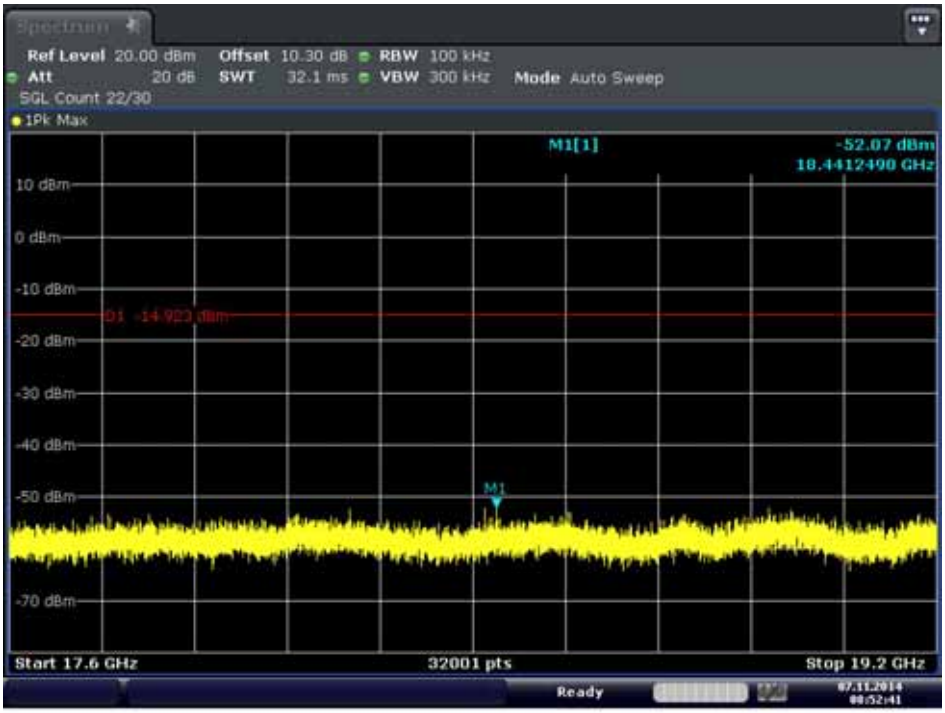
17.6 GHz ~ 19.2 GHz

Conducted Spurious Emission (802.11a-CH153)



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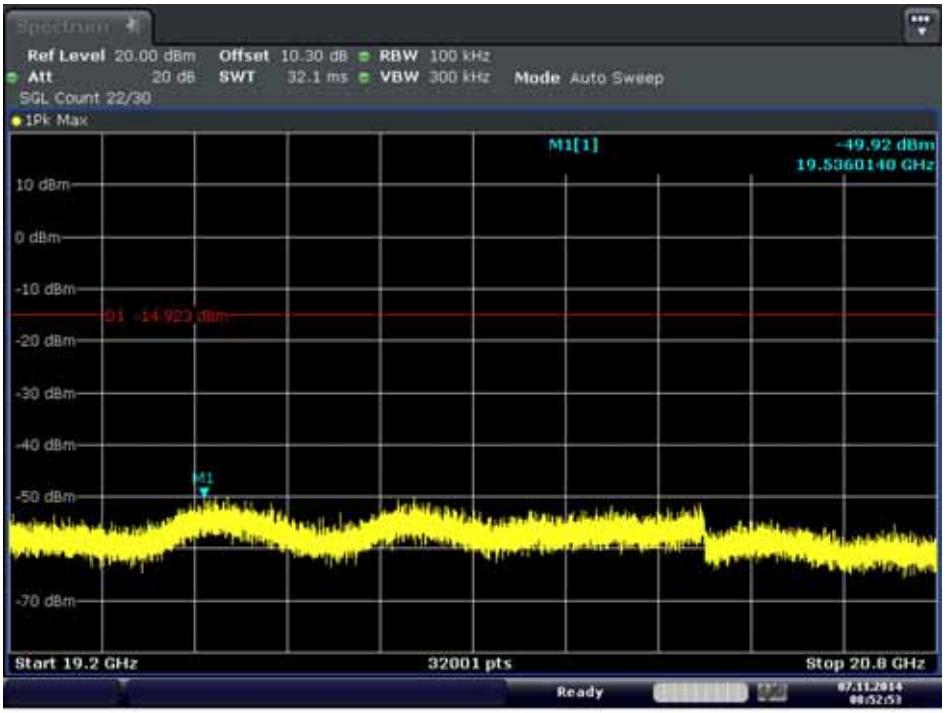
19.2 GHz ~ 20.8 GHz

Conducted Spurious Emission (802.11a-CH153)



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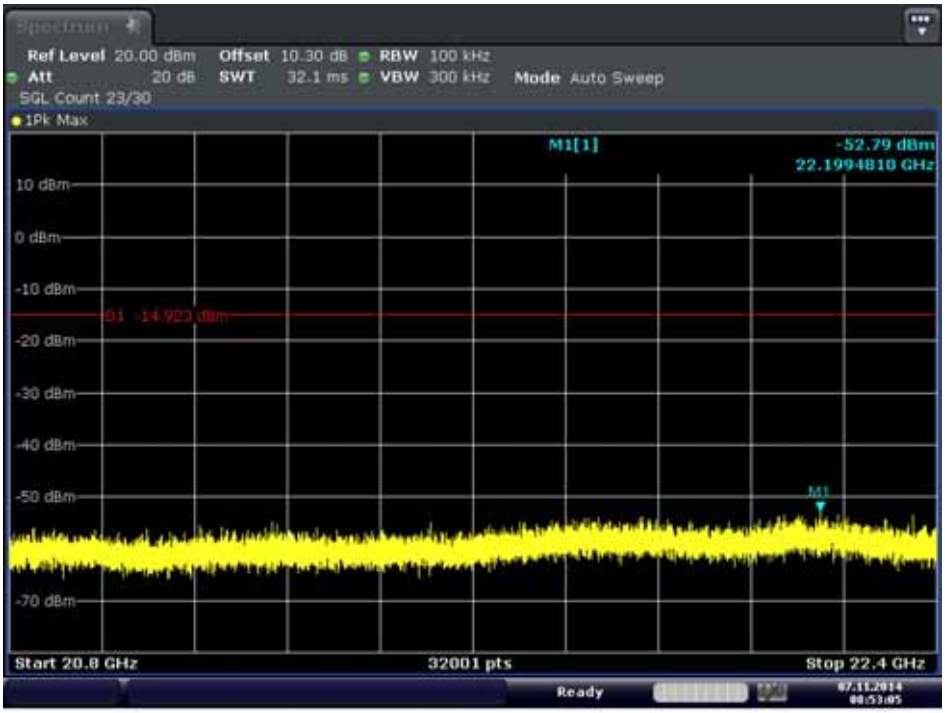
20.8 GHz ~ 22.4 GHz

Conducted Spurious Emission (802.11a-CH153)



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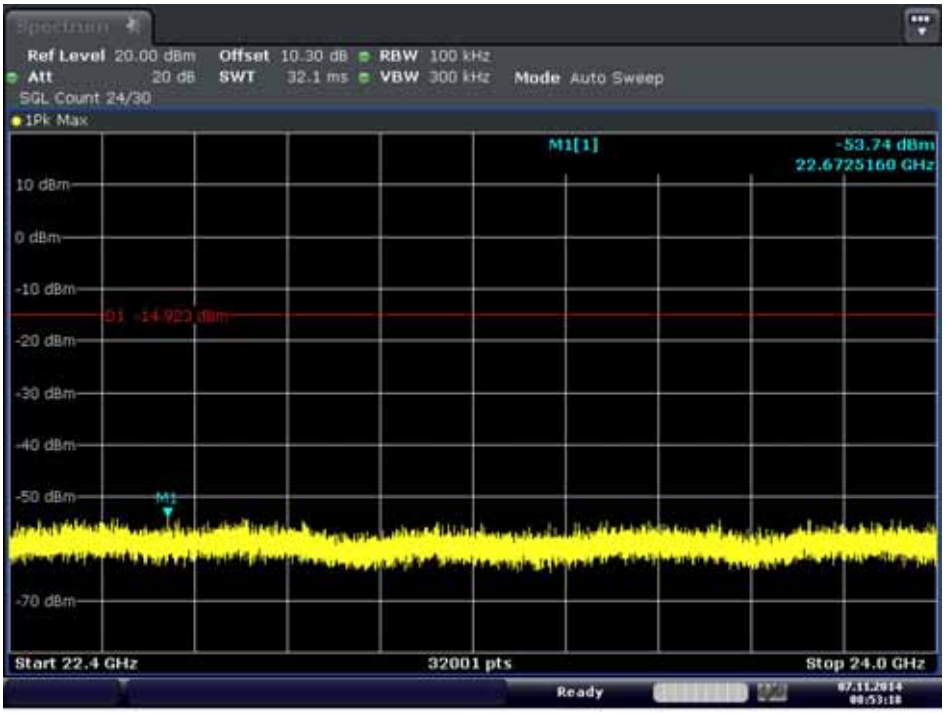
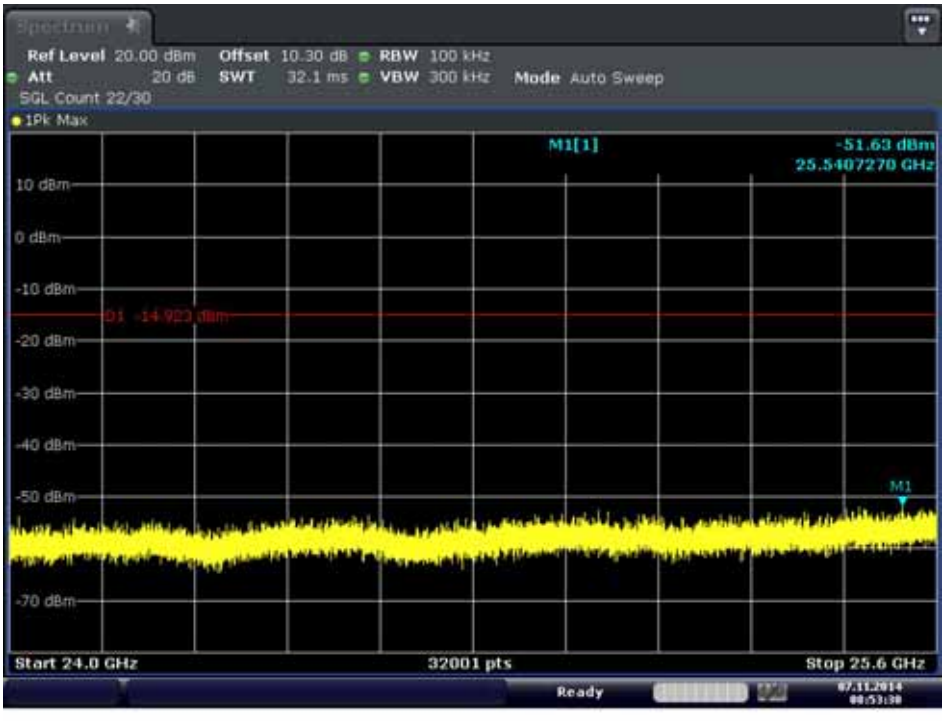
22.4 GHz ~ 24 GHz

Conducted Spurious Emission (802.11a-CH153)



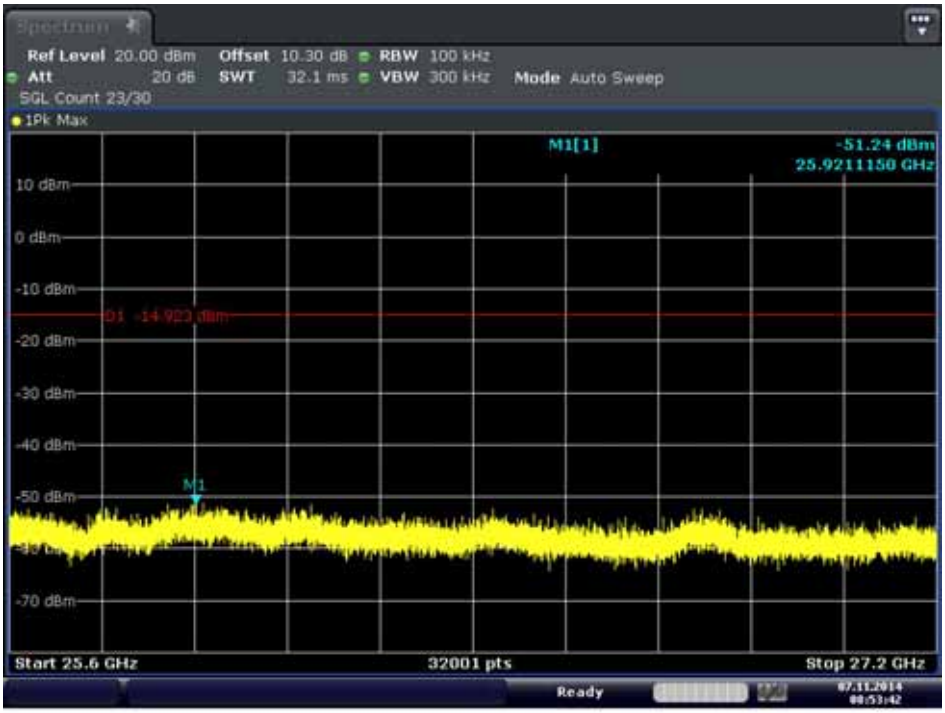
24 GHz ~ 25.6 GHz

Conducted Spurious Emission (802.11a-CH153)



25.6 GHz ~ 27.2 GHz

Conducted Spurious Emission (802.11a-CH153)



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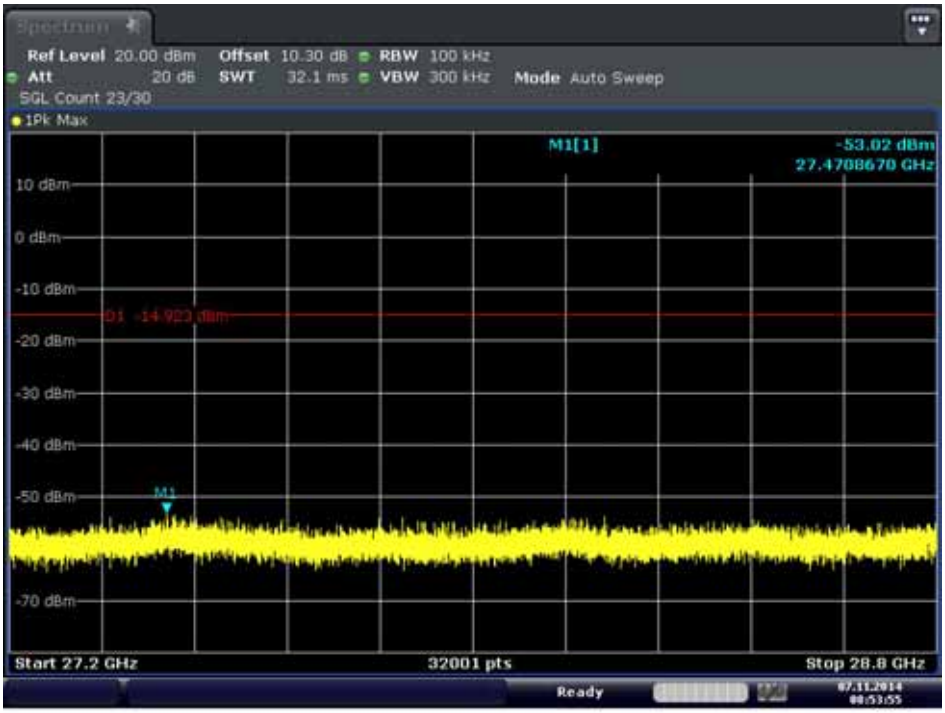
27.2 GHz ~ 28.8 GHz

Conducted Spurious Emission (802.11a-CH153)



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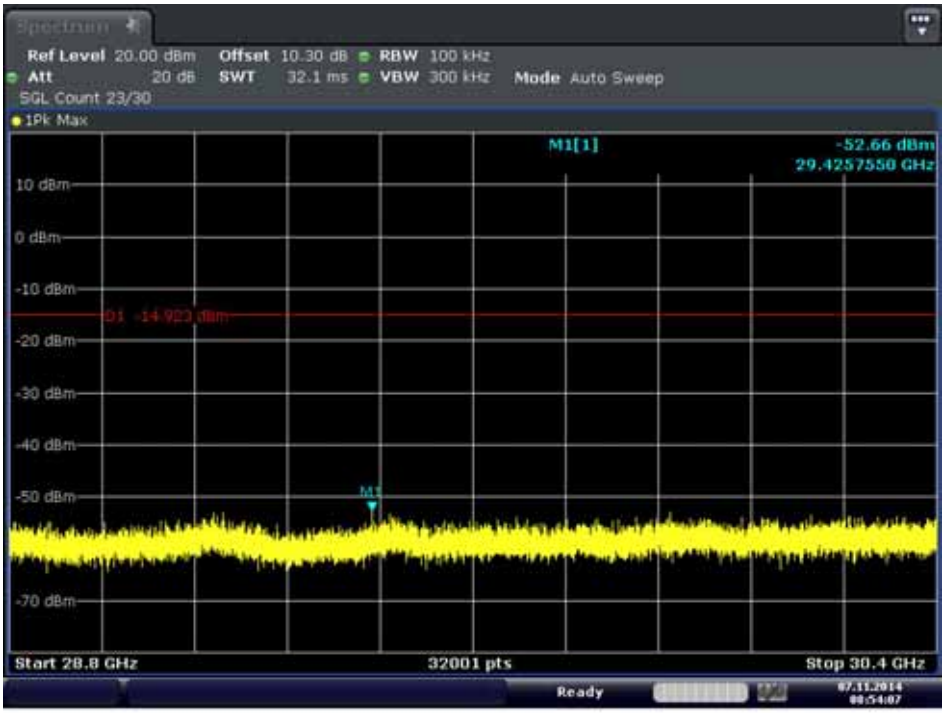
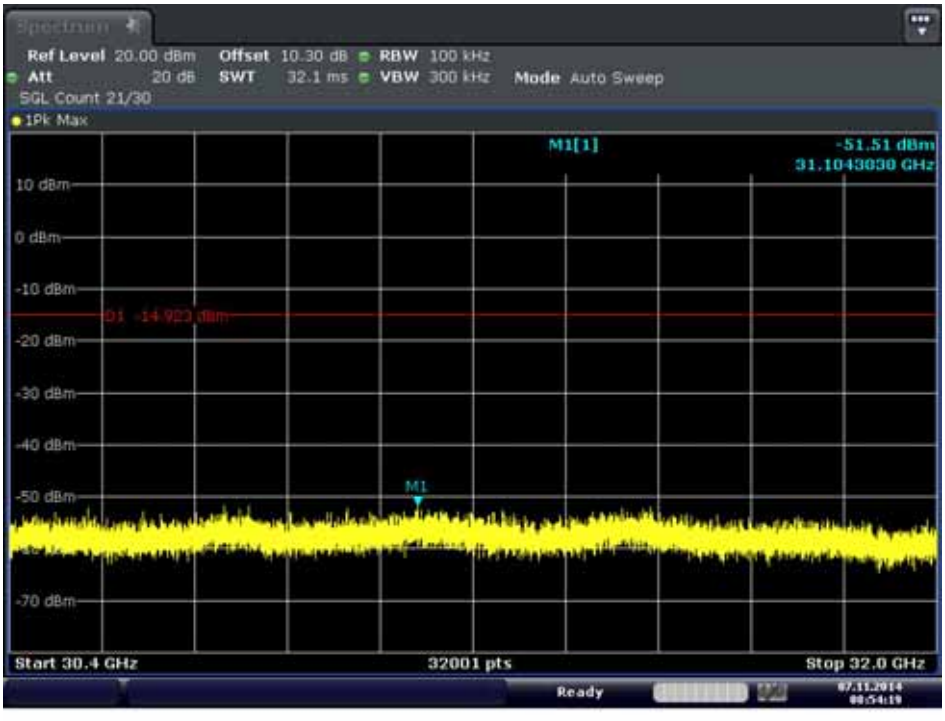
28.8 GHz ~ 30.4 GHz

Conducted Spurious Emission (802.11a-CH153)



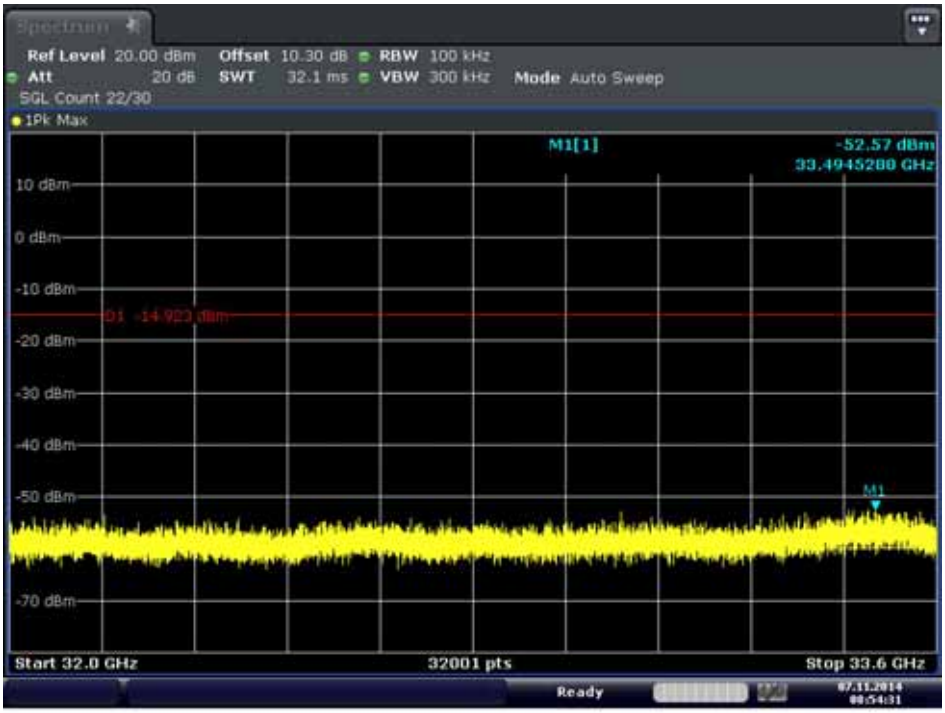
30.4 GHz ~ 32 GHz

Conducted Spurious Emission (802.11a-CH153)



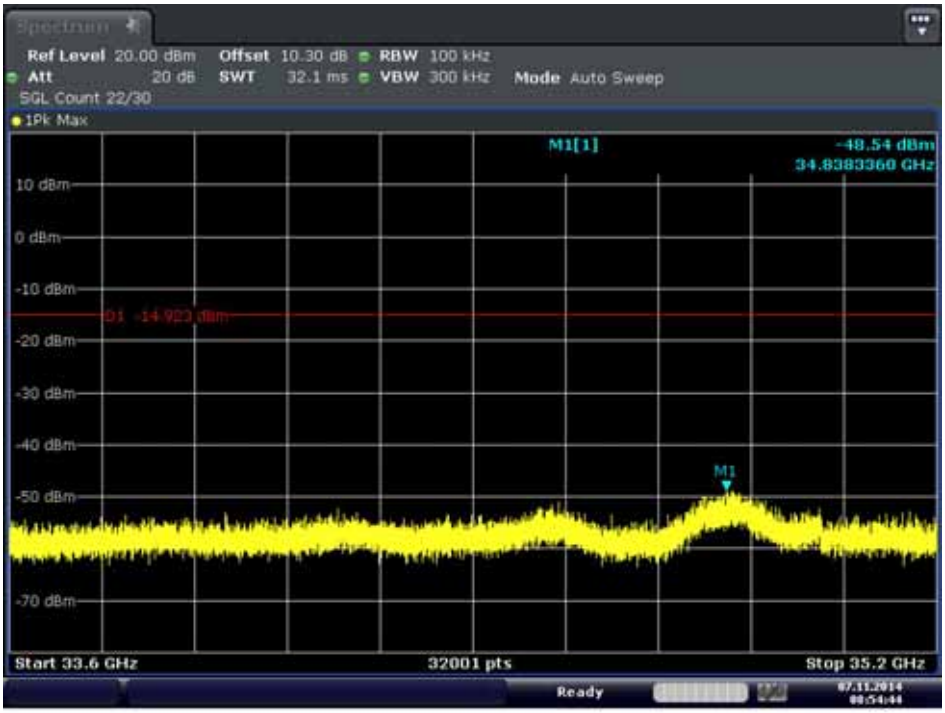
32 GHz ~ 33.6 GHz

Conducted Spurious Emission (802.11a-CH153)



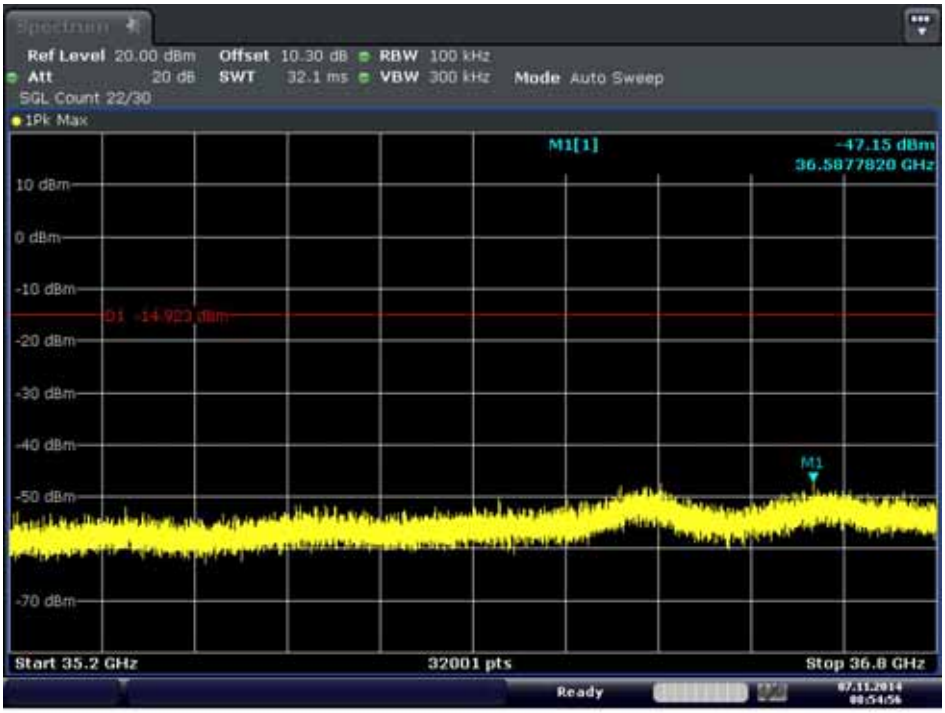
33.6 GHz ~ 35.2 GHz

Conducted Spurious Emission (802.11a-CH153)



35.2 GHz ~ 36.8 GHz

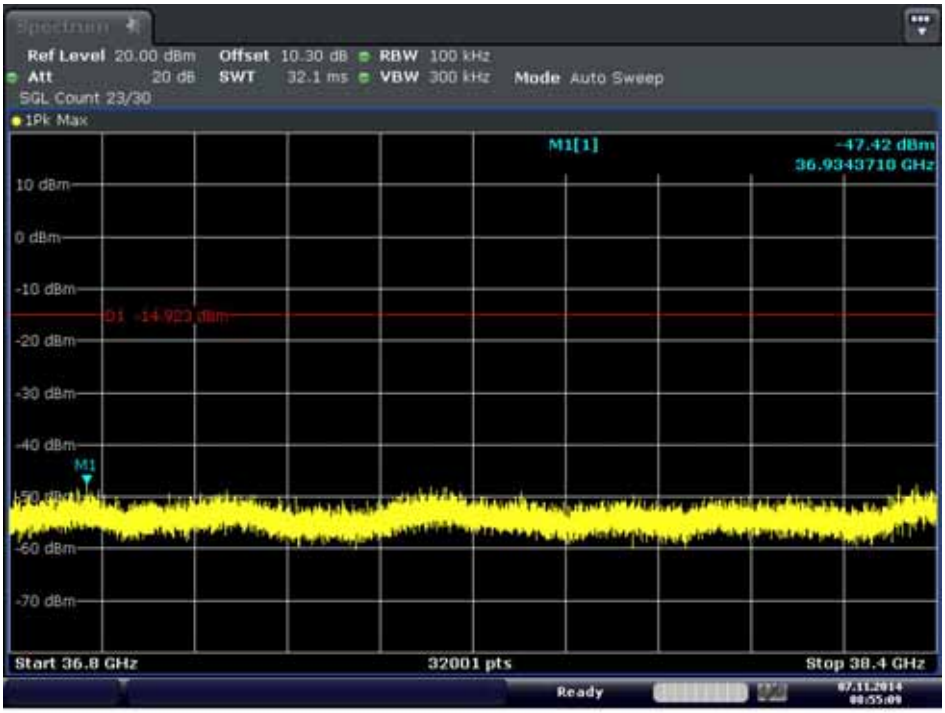
Conducted Spurious Emission (802.11a-CH153)



Date: 7.NOV.2014 08:54:56

36.8 GHz ~ 38.4 GHz

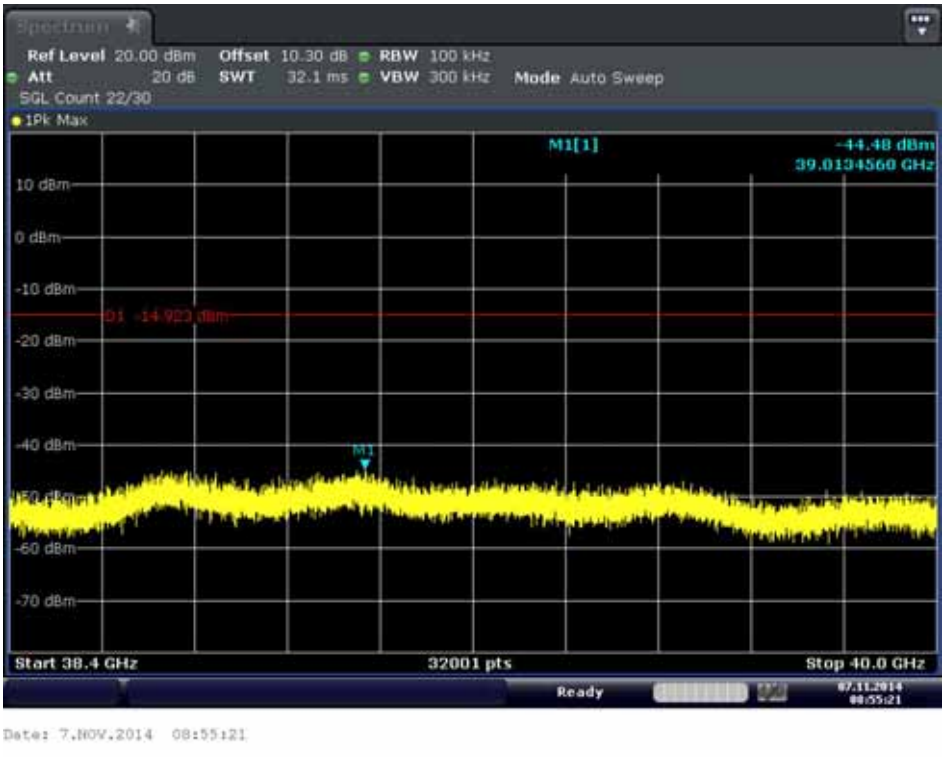
Conducted Spurious Emission (802.11a-CH153)



Date: 7.NOV.2014 08:55:09

38.4 GHz ~ 40 GHz

Conducted Spurious Emission (802.11a-CH153)



8.7 FREQUENCY STABILITY.

The EUT was placed inside an environmental chamber as the temperature in the chamber was varied between -30 °C and 50 °C. The temperature was incremented by 10 °C intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

20 MHz BW

OPERATING BAND: UNII Band 1

OPERATING FREQUENCY: 5,180,000,000 Hz

CHANNEL: 36

REFERENCE VOLTAGE: 12 VDC

Voltage	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	12.0	+20(Ref)	5180013.59	13.59
100%		-30	5179982.36	-17.64
100%		-20	5179988.85	-11.15
100%		-10	5179993.57	-6.43
100%		0	5180003.52	3.52
100%		10	5180008.49	8.49
100%		30	5180016.38	16.38
100%		40	5180021.92	21.92
100%		50	5180028.56	28.56
115%	13.8	20	5180012.31	12.31
85 %	10.2	20	5180011.06	11.06

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

OPERATING BAND: UNII Band 3

OPERATING FREQUENCY: 5,765,000,000 Hz

CHANNEL: 153

REFERENCE VOLTAGE: 12.0 VDC

Voltage	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	12.0	+20(Ref)	5765014.74	14.74
100%		-30	5764988.44	-11.56
100%		-20	5764987.65	-12.35
100%		-10	5764991.06	-8.94
100%		0	5765006.32	6.32
100%		10	5765007.77	7.77
100%		30	5765015.21	15.21
100%		40	5765019.62	19.62
100%		50	5765024.65	24.65
115%	13.8	20	5765013.55	13.55
85 %	10.2	20	5765012.94	12.94

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

8.8 RADIATED MEASUREMENT

8.8.1 RADIATED SPURIOUS EMISSIONS.

Test Requirements and limit, §15.205, §15.209, §15.407

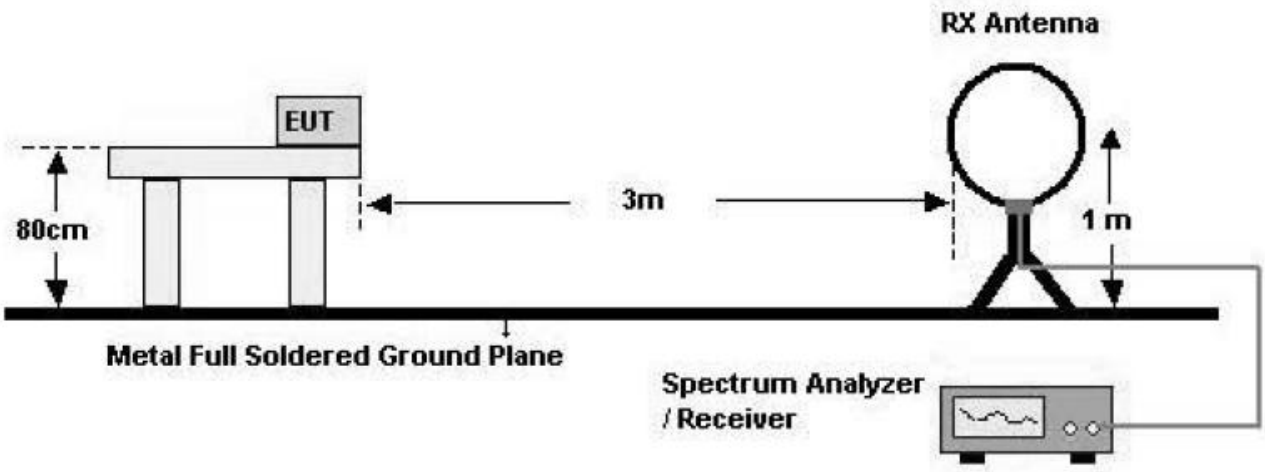
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

▣ §15.407, KDB 789033 D02

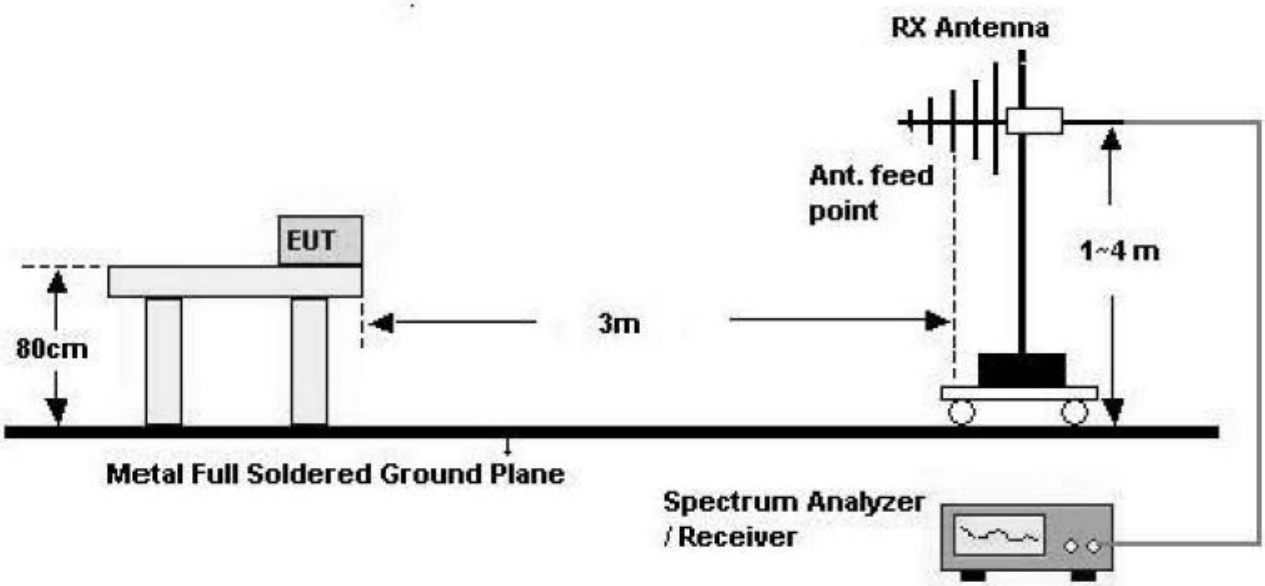
All harmonics that do not lie in a restricted band are subject to a peak limit of -27 dBm/MHz. At a distance of 3 meters the field strength limit in dBμV/m can be determined by adding a “conversion” factor of 95.2 dB to the EIRP limit of -27 dBm/MHz to obtain the limit for out of band spurious emissions of 68.2 dBμV/m. Espectally, for transmitter operating in the 5725 Mhz – 5850 MHz : all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequency 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

Test Configuration

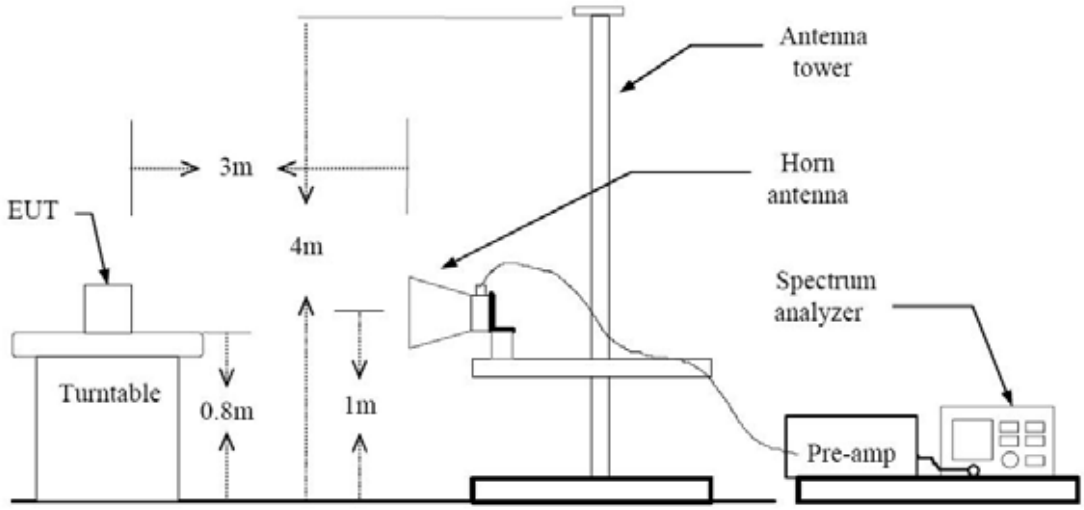
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE USED

ANSI C63.4(2003)

Method H)5) in KDB 789033, issued 06/06/2014 (Peak)

Method H)6)d) in KDB 789033, issued 06/06/2014 (Average)

. Spectrum setting:

- Peak.

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = Peak
4. Sweep Time = auto
5. Trace mode = max hold
6. Allow sweeps to continue until the trace stabilizes.
7. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle.

- Average (Method VB :Averaging using reduced video bandwidth)

1. RBW = 1 MHz
2. VBW
   2.1. If the EUT is configured to transmit with duty cycle ≥ 98 percent, set VBW ≤ RBW/100(i.e., 10 kHz) but not less than 10 Hz.
   2.2. If the EUT duty cycle is < 98 percent, set VBW ≥ 1/T, where T is the minimum transmission duration.

3. The analyzer is set to linear detector mode.
4. Detector = Peak.
5. Sweep time = auto.
6. Trace mode = max hold.
7. Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimym number of traces by a factor of 1/x, where x is the duty cycle.

Note :

1. We used the case 2 for 802.11a/n_20 mode to perform the average filed strength measurements.
2. The actual setting value of VBW for 802.11a/n_20

Mode	Worst Data rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle (%)	VBW(1/T) (Hz)	The actual setting value of VBW (Hz)
a	**6**	**2.055**	**2.165**	**94.92**	**487**	**1000**
n_20	**6.5**	**1.911**	**2.018**	**94.70**	**523**	**1000**

TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

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

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
㎒	dBμV	dB /m	dB	(H/V)	dBμV/m	dBμV/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

Band :	UNII 1
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5180 MHz
Channel No.	36 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
10360	62.81	-6.51	V	56.30	68.20	11.90	PK
15540	64.19	-6.42	V	57.77	73.98	16.21	PK
15540	50.17	-6.42	V	43.75	53.98	10.23	AV
10360	62.93	-6.51	H	56.42	68.20	11.78	PK
15540	64.67	-6.42	H	58.25	73.98	15.73	PK
15540	50.22	-6.42	H	43.80	53.98	10.18	AV

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
5. We have done all data rate in 802.11a. Worst case is 6 Mbps in 802.11a.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 1
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5200 MHz
Channel No.	40 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
10400	63.01	-6.49	V	56.52	68.20	11.68	PK
15600	64.09	-7.15	V	56.94	73.98	17.04	PK
15600	49.68	-7.15	V	42.53	53.98	11.45	AV
10400	63.08	-6.49	H	56.59	68.20	11.61	PK
15600	64.21	-7.15	H	57.06	73.98	16.92	PK
15600	49.71	-7.15	H	42.56	53.98	11.42	AV

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
5. We have done all data rate in 802.11a. Worst case is 6 Mbps in 802.11a.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 1
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5240 MHz
Channel No.	48 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
10480	63.10	-6.96	V	56.14	68.20	12.06	PK
15720	63.32	-6.62	V	56.70	73.98	17.28	PK
15720	50.13	-6.62	V	43.51	53.98	10.47	AV
10480	63.29	-6.96	H	56.33	68.20	11.87	PK
15720	63.64	-6.96	H	56.68	73.98	17.30	PK
15720	50.16	-6.62	H	43.54	53.98	10.44	AV

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
5. We have done all data rate in 802.11a. Worst case is 6 Mbps in 802.11a.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna

Band :	UNII 1
Operation Mode:	802.11 n_20 MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	5180 MHz
Channel No.	36 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
10360	62.43	-6.51	V	55.92	68.20	12.28	PK
15540	64.61	-6.42	V	58.19	73.98	15.79	PK
15540	50.24	-6.42	V	43.82	53.98	10.16	AV
10360	62.95	-6.51	H	56.44	68.20	11.76	PK
15540	64.81	-6.42	H	58.39	73.98	15.59	PK
15540	50.25	-6.42	H	43.83	53.98	10.15	AV

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
5. We have done all data rate in 802.11n_20 MHz BW. Worst case is 6.5 Mbps in 802.11n_20 MHz BW.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 1
Operation Mode:	802.11 n_20 MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	5200 MHz
Channel No.	40 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
10400	63.02	-6.49	V	56.53	68.20	11.67	PK
15600	63.90	-7.15	V	56.75	73.98	17.23	PK
15600	49.68	-7.15	V	42.53	53.98	11.45	AV
10400	63.24	-6.49	H	56.75	68.20	11.45	PK
15600	64.19	-7.15	H	57.04	73.98	16.94	PK
15600	49.68	-7.15	H	42.53	53.98	11.45	AV

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
5. We have done all data rate in 802.11n_20 MHz BW. Worst case is 6.5 Mbps in 802.11n_20 MHz BW.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 1
Operation Mode:	802.11 n_20 MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	5240 MHz
Channel No.	48 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
10480	62.96	-6.96	V	56.00	68.20	12.20	PK
15720	63.48	-6.62	V	56.86	73.98	17.12	PK
15720	50.13	-6.62	V	43.51	53.98	10.47	AV
10480	63.18	-6.96	H	56.22	68.20	11.98	PK
15720	63.52	-6.96	H	56.56	73.98	17.42	PK
15720	50.14	-6.62	H	43.52	53.98	10.46	AV

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
5. We have done all data rate in 802.11n_20 MHz BW. Worst case is 6.5 Mbps in 802.11n_20 MHz BW.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 3
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5765 MHz
Channel No.	153 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
11530	63.46	-5.79	V	57.67	73.98	16.31	PK
11530	49.49	-5.79	V	43.7	53.98	10.28	AV
17295	63.08	-1.35	V	61.73	68.20	6.47	PK
11530	63.71	-5.79	H	57.92	73.98	16.06	PK
11530	49.59	-5.79	H	43.8	53.98	10.18	AV
17295	63.30	-1.35	H	61.95	68.20	6.25	PK

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
5. We have done all data rate in 802.11a. Worst case is 6 Mbps in 802.11a.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 3
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5785 MHz
Channel No.	157 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
11570	63.06	-5.57	V	57.49	73.98	16.49	PK
11570	49.41	-5.57	V	43.84	53.98	10.14	AV
17355	62.45	-0.39	V	62.06	68.20	6.14	PK
11570	63.35	-5.57	H	57.78	73.98	16.2	PK
11570	49.48	-5.57	H	43.91	53.98	10.07	AV
17355	62.59	-0.39	H	62.20	68.20	6.00	PK

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
5. We have done all data rate in 802.11a. Worst case is 6 Mbps in 802.11a.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 3
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5825 MHz
Channel No.	165 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
11650	63.29	-6.63	V	56.66	73.98	17.32	PK
11650	49.37	-6.63	V	42.74	53.98	11.24	AV
17475	62.48	0.29	V	62.77	68.20	5.43	PK
11650	64.14	-6.63	H	57.51	73.98	16.47	PK
11650	49.44	-6.63	H	42.81	53.98	11.17	AV
17475	62.85	0.29	H	63.14	68.20	5.06	PK

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
5. We have done all data rate in data rate in 802.11a. Worst case is 6 Mbps in 802.11a.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 3
Operation Mode:	802.11n_20 MHz BW
Transfer Rate:	6.5Mbps
Operating Frequency	5765 MHz
Channel No.	153 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
11530	63.10	-5.79	V	57.31	73.98	16.67	PK
11530	49.46	-5.79	V	43.67	53.98	10.31	AV
17295	63.01	-1.35	V	61.66	68.20	6.54	PK
11530	63.27	-5.79	H	57.48	73.98	16.5	PK
11530	49.52	-5.79	H	43.73	53.98	10.25	AV
17295	63.41	-1.35	H	62.06	68.20	6.14	PK

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
5. We have done all data rate in 802.11n_20 MHz BW. Worst case is 6.5 Mbps in 802.11n_20 MHz BW.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 3
Operation Mode:	802.11n_20 MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	5785 MHz
Channel No.	157 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
11570	63.19	-5.57	V	57.62	73.98	16.36	PK
11570	49.48	-5.57	V	43.91	53.98	10.07	AV
17355	62.49	-0.39	V	62.1	68.20	6.1	PK
11570	63.50	-5.57	H	57.93	73.98	16.05	PK
11570	49.48	-5.57	H	43.91	53.98	10.07	AV
17355	62.68	-0.39	H	62.29	68.20	5.91	PK

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
5. We have done all data rate in 802.11n_20 MHz BW. Worst case is 6.5 Mbps in 802.11n_20 MHz BW.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Band :	UNII 3
Operation Mode:	802.11n_20MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	5825 MHz
Channel No.	165 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-Amp G. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
11650	63.86	-6.63	V	57.23	73.98	16.75	PK
11650	49.40	-6.63	V	42.77	53.98	11.21	AV
17475	62.71	0.29	V	63.00	68.20	5.20	PK
11650	64.18	-6.63	H	57.55	73.98	16.43	PK
11650	49.42	-6.63	H	42.79	53.98	11.19	AV
17475	63.05	0.29	H	63.34	68.20	4.86	PK

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
5. We have done all data rate in 802.11n_20 MHz. Worst case is 6.5 Mbps in 802.11n_20MHz
6. We have done x, y, z planes in EUT and horizontal and verti

8.8.2 RADIATED RESTRICTED BAND EDGE MEASUREMENTS

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)).

Band :	UNII 1
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5180 MHz
Channel No.	36 Ch

Frequency [MHz]	Reading dBuV	AN.+CL+AMP+ATT. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
5150	58.50	8.79	H	67.29	73.98	6.69	PK
5150	37.36	8.79	H	46.15	53.98	7.83	AV
5150	56.20	8.79	V	64.99	73.98	8.99	PK
5150	34.26	8.79	V	43.05	53.98	10.93	AV

Band :	UNII 1
Operation Mode:	802.11 n_20 MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	5180 MHz
Channel No.	36 Ch

Frequency [MHz]	Reading dBuV	AN.+CL+AMP+ATT. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
5150	59.06	8.79	H	67.85	73.98	6.13	PK
5150	39.24	8.79	H	48.03	53.98	5.95	AV
5150	57.31	8.79	V	66.1	73.98	7.88	PK
5150	36.64	8.79	V	45.43	53.98	8.55	AV

Band :	UNII 3
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5765MHz
Channel No.	153 Ch

Frequency [MHz]	Reading DBuV	AN.+CL+AMP+ATT. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
5725	56.24	11.37	H	67.61	78.20	10.59	AV
5725	59.44	11.37	V	70.81	78.20	7.39	PK
5715	52.61	11.37	H	63.98	68.20	4.22	PK
5715	54.69	11.37	V	66.06	68.20	2.14	PK

Band :	UNII 3
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5825 MHz
Channel No.	165 Ch

Frequency [MHz]	Reading DBuV	AN.+CL+AMP+ATT. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
5850	57.25	11.37	H	68.62	78.20	9.58	PK
5850	61.01	11.37	V	72.38	78.20	5.82	PK
5860	52.56	11.37	H	63.93	68.20	4.27	PK
5860	54.54	11.37	V	65.91	68.20	2.29	PK

Band :	UNII 3
Operation Mode:	802.11 n_20 MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	5765 MHz
Channel No.	153 Ch

Frequency [MHz]	Reading DBuV	AN.+CL+AMP+ATT. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
5725	54.69	11.37	H	66.06	78.20	12.14	PK
5725	57.22	11.37	V	68.59	78.20	9.61	PK
5715	52.87	11.37	H	64.24	68.20	3.96	PK
5715	54.50	11.37	V	65.87	68.20	2.33	PK

Band :	UNII 3
Operation Mode:	802.11 n_20 MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	5825 MHz
Channel No.	165 Ch

Frequency [MHz]	Reading DBuV	AN.+CL+AMP+ATT. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
5850	61.92	11.37	H	73.29	78.20	4.91	PK
5850	64.72	11.37	V	76.09	78.20	2.11	PK
5860	50.33	11.37	H	61.70	68.20	6.50	PK
5860	52.15	11.37	V	63.52	68.20	4.68	PK

8.8.3 RECEIVER SPURIOUS EMISSIONS

IC Rule(s)	**RSS-GEN**
Test Requirements:	**Blow the table**
Operating conditions:	**Under normal test conditions**
Method of testing:	**Radiated**
S/A. Settings:	**F < 1 GHz: RBW: 120 kHz, VBW: 300 kHz (Quasi Peak)** **F > 1 GHz: RBW: 1 MHz, VBW: 1 MHz (Peak)**
Mode of operation:	**Receive**

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

Operation Mode: Receive:

30 MHz ~ 1 GHz

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

Above 1 GHz

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

8.9 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 groundplane.
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.

Note : We don't perform powerline conducted emission test. Because this EUT is used with vehicle.

9. LIST OF TEST EQUIPMENT

9.1 LIST OF TEST EQUIPMENT(Conducted Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216/ LISN	01/29/2014	Annual	100073
Agilent	E4440A/ Spectrum Analyzer	04/09/2014	Annual	US45303008
Agilent	N9020A/ SIGNAL ANALYZER	05/23/2014	Annual	MY51110063
Agilent	N1911A/Power Meter	01/24/2014	Annual	MY45100523
Agilent	N1921A /POWER SENSOR	07/09/2014	Annual	MY45241059
Agilent	87300B/Directional Coupler	12/08/2014	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	01/27/2014	Annual	10545
ITECH	IT6720 / DC POWER SUPPLY	11/04/2014	Annual	010002156287001199
TESCOM	TC-3000C / BLUETOOTH TESTER	04/11/2014	Annual	3000C000276
Rohde & Schwarz	CBT / BLUETOOTH TESTER	05/07/2014	Annual	100422
Agilent	8493C / Attenuator(10 dB)	07/21/2014	Annual	76649

9.2 LIST OF TEST EQUIPMENT(Radiated Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Schwarzbeck	VULB 9160/ TRILOG Antenna	10/10/2014	Biennial	3368
Rohde & Schwarz	ESCI / EMI TEST RECEIVER	01/24/2014	Annual	100584
HD	MA240/ Antenna Position Tower	N/A	N/A	556
EMCO	1050/ Turn Table	N/A	N/A	114
HD GmbH	HD 100/ Controller	N/A	N/A	13
HD GmbH	KMS 560/ SlideBar	N/A	N/A	12
Rohde & Schwarz	SCU-18/ Signal Conditioning Unit	09/04/2014	Annual	10094
CERNEX	CBL18265035 / POWER AMP	07/23/2014	Annual	22966
CERNEX	CBL26405040 / POWER AMP	04/04/2014	Annual	19660
Schwarzbeck	BBHA 9120D/ Horn Antenna	07/05/2013	Biennial	1151
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	07/05/2013	Biennial	BBHA9170541
Rohde & Schwarz	FSP / Spectrum Analyzer	01/24/2014	Annual	839117/011
Wainwright Instrument	WHF3.0/18G-10EF / High Pass Filter	02/03/2014	Annual	F6
Wainwright Instrument	WHNX6.0/26.5G-6SS / High Pass Filter	04/09/2014	Annual	1
Wainwright Instrument	WHNX7.0/18G-8SS / High Pass Filter	04/04/2014	Annual	29
Wainwright Instrument	WRCJ2400/2483.5-2370/2520-60/14SS / Band Reject Filter	06/17/2014	Annual	1
TESCOM	TC-3000C / BLUETOOTH TESTER	04/11/2014	Annual	3000C000276
Rohde & Schwarz	CBT / BLUETOOTH TESTER	05/07/2014	Annual	100422
Rohde & Schwarz	LOOP ANTENNA	09/03/2014	Biennial	1513-175
CERNEX	CBL06185030 / POWER AMP	07/21/2014	Annual	22965
CERNEX	CBLU1183540 / POWER AMP	07/21/2014	Annual	22964