

HCT CO., LTD.

CERTIFICATE OF COMPLIANCE FCC Certification

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

Address:
1000 Sylvan Avenue, Englewood Cliffs NJ 07632

Date of Issue:

December 23, 2013

Test Site/Location:

HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

Report No.: HCTR1312FR22

HCT FRN: 0005866421

FCC ID : ZNFD685

APPLICANT : LG Electronics MobileComm U.S.A., Inc.

FCC Model(s): LG-D685

Additional FCC Model(s): LGD685, D685

EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n(2.4GHz_HT40), VoIP, Hotspot support

Max. RF Output Power: Wi-Fi 802.11b(16.71 dBm) / Wi-Fi 802.11g (21.54 dBm)
/ Wi-Fi 802.11n_20 MHz (20.76 dBm) / Wi-Fi 802.11n_40 MHz (17.57 dBm)

Frequency Range: 2412 MHz - 2462 MHz (2.4 GHz Band)
2422 MHz - 2452 MHz (2.4 GHz Band)_40 MHz BW

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
: Jong Seok Lee

Test engineer of RF Team



Approved by
: Chang Seok Choi

Manager of RF Team

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FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		www.hct.co.kr
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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1312FR22	December 23, 2013	- 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: ZNFD685
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n(2.4GHz_HT40), VoIP, Hotspot support
Model name(s): LG-D685
Additional Model name(s): LGD685, D685
Date(s) of Tests: December 02, 2013 ~ December 20, 2013
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	GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n(2.4GHz_HT40), VoIP, Hotspot support	
FCC Model Name	LG-D685	
Additional FCC Model Name	LGD685, D685	
Power Supply	DC 3.8 V	
Battery type	Li-ion Battery(Standard)	
Frequency Range	TX: 2412 MHz ~ 2462 MHz, 2422 MHz - 2452 MHz_40 MHz BW RX: 2412 MHz ~ 2462 MHz, 2422 MHz - 2452 MHz_40 MHz BW	
Max. RF Output Power	Peak	Wi-Fi 802.11b(16.71 dBm) / Wi-Fi 802.11g (21.54 dBm) / Wi-Fi 802.11n_20 MHz (20.76 dBm) / Wi-Fi 802.11n_40 MHz (17.57 dBm)
	Average	Wi-Fi 802.11b(12.83 dBm) / Wi-Fi 802.11g (10.03 dBm) / Wi-Fi 802.11n_20 MHz (8.93 dBm) / Wi-Fi 802.11n_40 MHz (9.42 dBm)
Modulation Type	DSSS/CCK(802.11b), OFDM(802.11g, 802.11n)	
Antenna Specification	Manufacturer: LS Mtron Ltd. Antenna type: PIFA Antenna Peak Gain : -1.021 dBi	

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3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v03r01 dated April 09, 2013 entitled "Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) and the measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices(ANSI C63.4-2003) Operating Under §15.247" 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 15.247 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 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 9.1 to 9.2.(KDB 558074)

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.

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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 June 21, 2011 (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."

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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

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7. SUMMARY TEST OF RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§15.247(a)(2)	> 500 kHz	CONDUCTED	PASS
Conducted Maximum Peak Output Power	§15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	§15.247(d)	Conducted < 20 dBc		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 8.6		PASS
Radiated Spurious Emissions	§15.205, 15.209	cf. Section 8.5.1	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 8.5.2		PASS

8. TEST RESULT

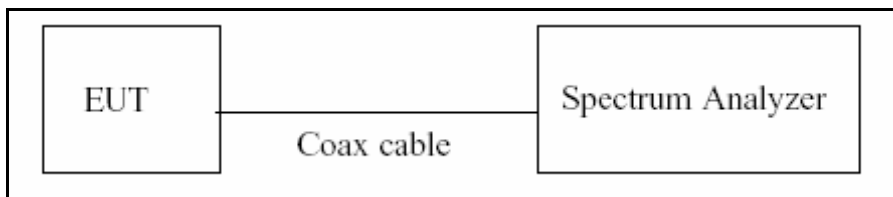
8.1 DUTY CYCLE

TEST PROCEDURE

According to KDB 558074)6)b), issued 04/09/2013)

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

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, 6.0)b) in KDB 558074(issued 04/09/2013)

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

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

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

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Duty Cycle Factor

Mode	Data Rate	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
b	1 Mbps	12.180	12.300	0.99024390	0.043
	2 Mbps	6.160	6.280	0.98089172	0.084
	5.5 Mbps	2.365	2.471	0.95710239	0.190
	11 Mbps	1.281	1.383	0.92624729	0.333
g	6 Mbs	2.025	2.135	0.94847775	0.230
	9 Mbs	1.350	1.460	0.92465753	0.340
	12 Mbs	1.023	1.134	0.90211640	0.447
	18 Mbs	0.684	0.795	0.86037736	0.653
	24 Mbs	0.523	0.632	0.82753165	0.822
	36 Mbs	0.355	0.464	0.76508621	1.163
	48 Mbs	0.271	0.380	0.71315789	1.468
	54 Mbs	0.244	0.353	0.69121813	1.604
n_20 MHz BW	6.5 Mbs	1.885	1.995	0.94486216	0.246
	13 Mbs	0.963	1.074	0.89664804	0.474
	19.5 Mbs	0.654	0.762	0.85826772	0.664
	26 Mbs	0.500	0.609	0.82101806	0.856
	39 Mbs	0.346	0.455	0.76043956	1.189
	52 Mbs	0.267	0.367	0.72752044	1.382
	58.5 Mbs	0.244	0.353	0.69121813	1.604
	65 Mbs	0.223	0.332	0.67168675	1.728
n_40 MHz BW	13.5 Mbps	0.924	1.035	0.89275362	0.493
	27 Mbps	0.483	0.592	0.81587838	0.884
	40.5 Mbps	0.334	0.441	0.75736961	1.207
	54 Mbps	0.259	0.367	0.70572207	1.514
	81 Mbps	0.187	0.295	0.63389831	1.980
	108 Mbps	0.147	0.254	0.57874016	2.375
	121.5 Mbps	0.136	0.243	0.55967078	2.521
	135 Mbps	0.127	0.235	0.54042553	2.673

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

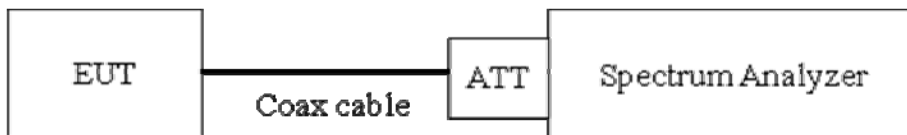
8.2 6dB BANDWIDTH (802.11b/g/n)

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 (Page 5 in KDB 558074, issued 04/09/2013)

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

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

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TEST RESULTS

Conducted 6dB Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	9.067	0.500	Pass
2437	6	9.068	0.500	Pass
2462	11	9.073	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11g

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	16.41	0.500	Pass
2437	6	16.42	0.500	Pass
2462	11	16.43	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11n_20 MHz BW

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	17.62	0.500	Pass
2437	6	17.62	0.500	Pass
2462	11	17.64	0.500	Pass

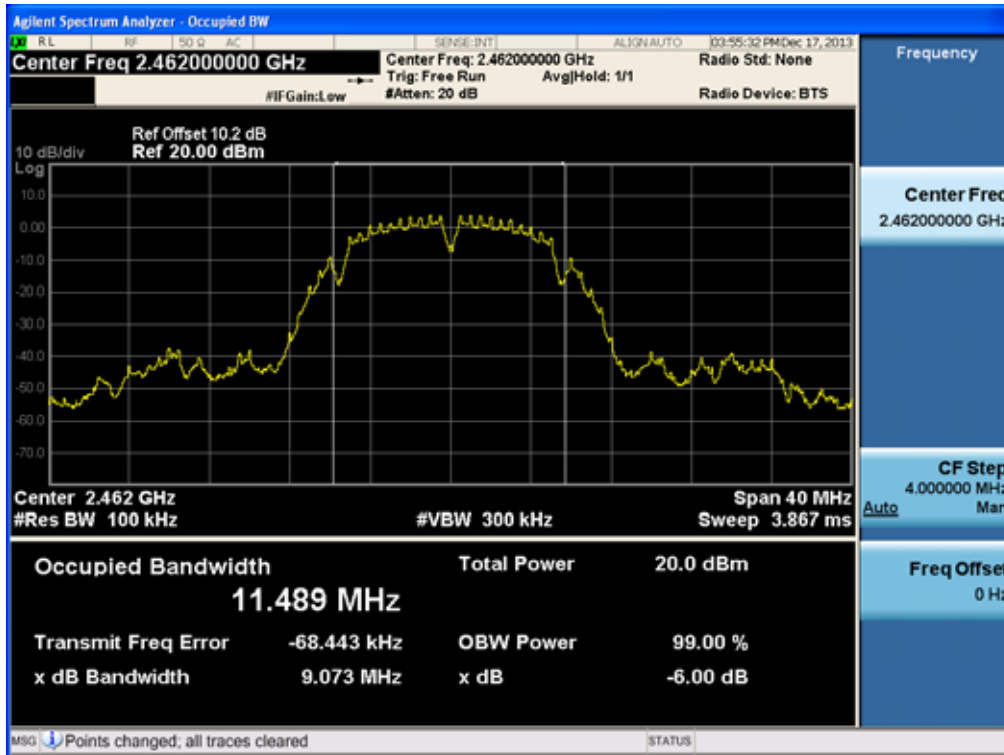
Conducted 6dB Bandwidth Measurements for 802.11n_40 MHz BW

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2422	3	35.02	0.500	Pass
2437	6	35.17	0.500	Pass
2452	9	35.16	0.500	Pass

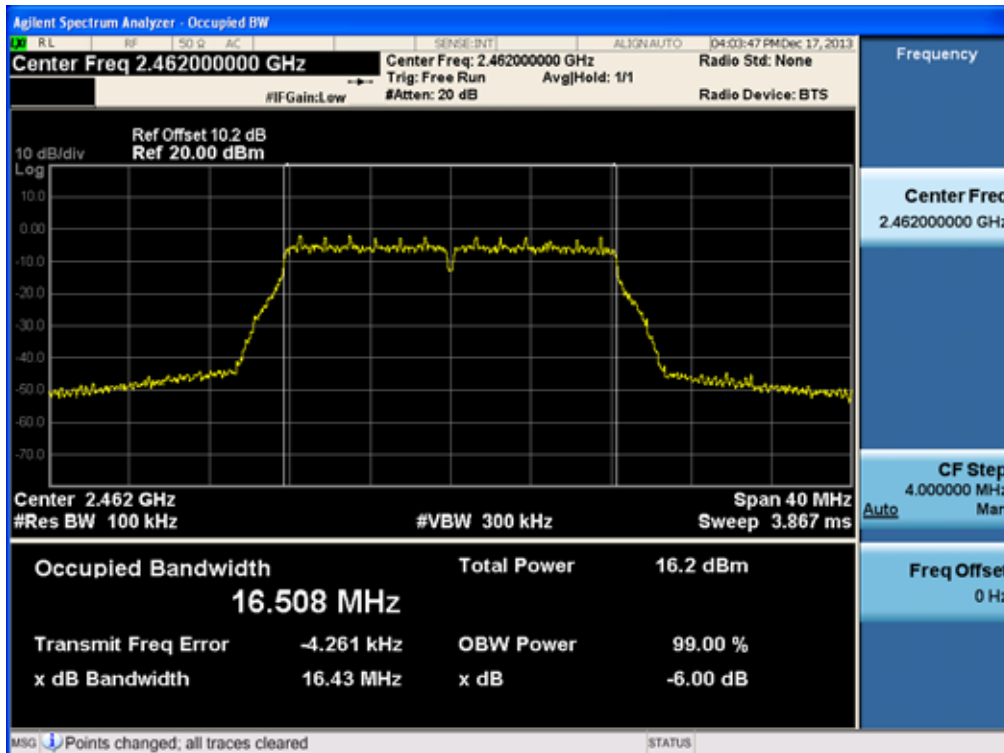
Note : In order to simplify the report, attached plots were only the most wide 6 dB BW channel.

RESULT PLOTS

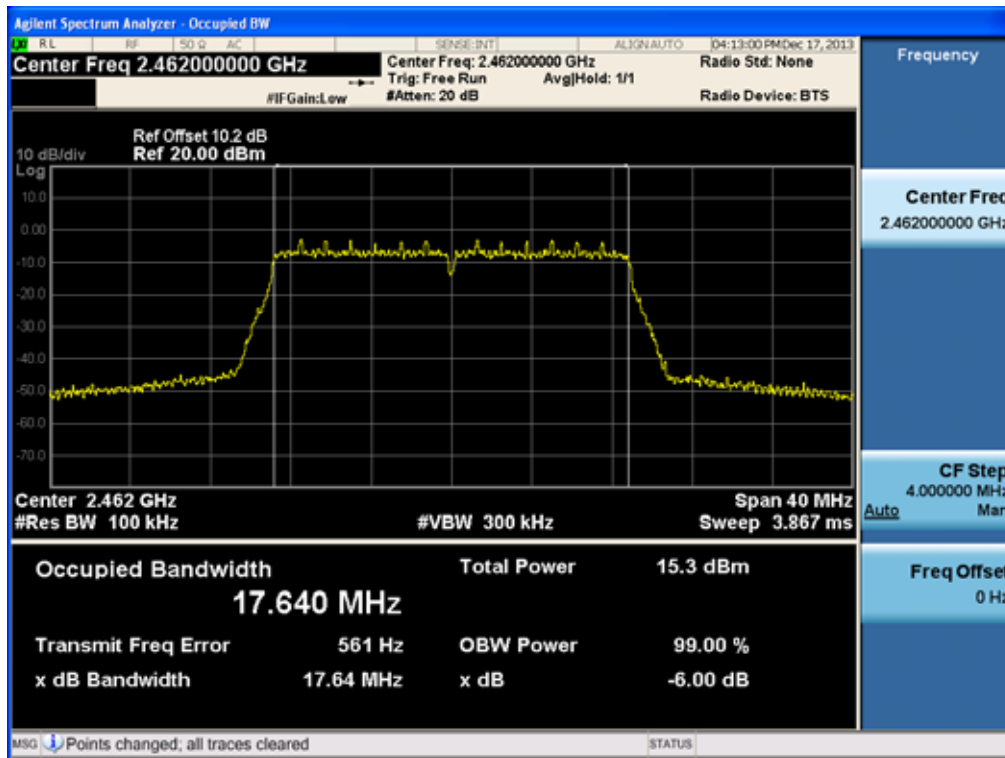
6dB Bandwidth plot (802.11b-CH 11)



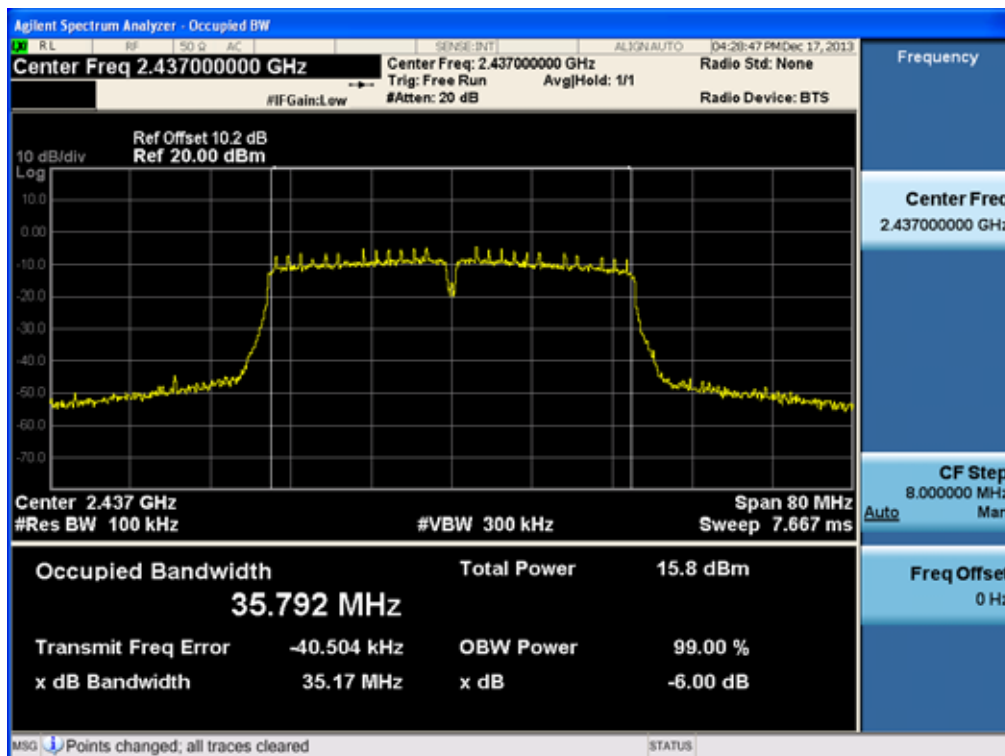
6dB Bandwidth plot (802.11g-CH 11)



6dB Bandwidth plot (802.11n-CH 11) _20 MHz BW



6dB Bandwidth plot (802.11n-CH 6) _40 MHz BW



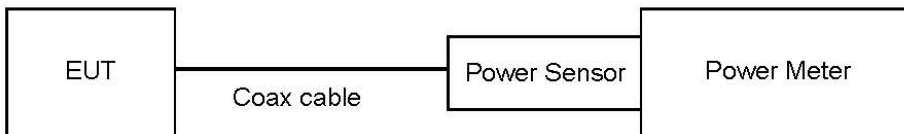
8.3 OUTPUT POWER (802.11b/g/n)

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

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

The maximum permissible conducted output power is 1 Watt.

TEST CONFIGURATION(20 MHz BW)



TEST PROCEDURE(20 MHz BW)

- Peak Power (Procedure 9.1.3 in KDB 558074, issued 04/09/2013)
 1. Measure the peak power of the transmitter.
- Average Power (Procedure 9.2.3.1 in KDB 558074, issued 04/09/2013)
 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 :

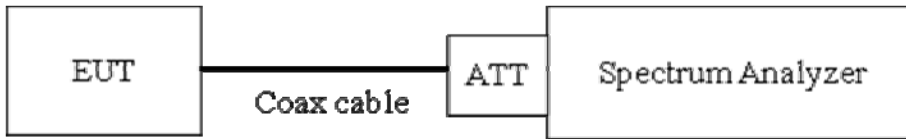
1. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 20.2 dB is offset for 2.4 GHz Band.

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

Band	Frequency(MHz)	Loss(dB)
2.4 GHz	2412	20.21
	2437	20.24
	2462	20.24

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

TEST CONFIGURATION(40 MHz BW)



TEST PROCEDURE(40 MHz BW)

The transmitter output is connected to the Spectrum Analyzer. We use the spectrum analyzer's integrated band power measurement function.

The Spectrum Analyzer is set to

- Peak Power (Procedure 9.1.2 in KDB 558074, issued 04/09/2013)

RBW = 1 MHz

VBW $\geq 3 \times$ RBW

SPAN $\geq 1.5 \times$ DTS bandwidth

Detector Mode = Peak

Sweep = auto couple

Trace Mode = max hold

Allow trace to fully stabilize.

Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector).

- Average Power (Procedure 9.2.2.4 in KDB 558074, issued 04/09/2013)

Measure the duty cycle

Set span to at least 1.5 times the OBW

RBW = 1-5 % of the OBW, not to exceed 1 MHz.

VBW $\geq 3 \times$ RBW.

Number of points in sweep $\geq 2 \times$ span / RBW. (This gives bin-to-bin spacing $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)

Sweep time = auto.

Detector = RMS(i.e., power averaging)

Do not use sweep triggering. Allow the sweep to "free run".

Trace average at least 100 traces in power averaging(RMS) mode.

Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.

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.

Sample Calculation

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

Output Power = 10 dBm + 20 dB + 0.8 dB + 0.2 dB = 31.0 dBm

Note :

1. Spectrum reading values are not plot data. The power 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, 10.2 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	20.21
	2437	20.24
	2462	20.24

(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	16.32	30
		2 Mbps	16.71	30
		5.5 Mbps	15.89	30
		11 Mbps	15.49	30
2437	6	1 Mbps	16.42	30
		2 Mbps	16.40	30
		5.5 Mbps	15.92	30
		11 Mbps	15.86	30
2462	11	1 Mbps	16.42	30
		2 Mbps	16.64	30
		5.5 Mbps	16.09	30
		11 Mbps	16.19	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	20.78	30
		9 Mbps	21.13	30
		12 Mbps	20.56	30
		18 Mbps	20.84	30
		24 Mbps	20.54	30
		36 Mbps	20.32	30
		48 Mbps	20.73	30
		54 Mbps	21.09	30
2437	6	6 Mbps	20.99	30
		9 Mbps	20.99	30
		12 Mbps	21.19	30
		18 Mbps	20.68	30
		24 Mbps	21.11	30
		36 Mbps	21.18	30
		48 Mbps	20.32	30
		54 Mbps	21.15	30
2462	11	6 Mbps	21.34	30
		9 Mbps	20.78	30
		12 Mbps	20.95	30
		18 Mbps	20.84	30
		24 Mbps	21.19	30
		36 Mbps	21.54	30
		48 Mbps	21.29	30
		54 Mbps	20.84	30

Conducted Output Power Measurements (802.11n Mode) _20 MHz BW

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6.5 Mbps	19.94	30
		13 Mbps	19.59	30
		19.5 Mbps	19.58	30
		26 Mbps	20.17	30
		39 Mbps	19.57	30
		52 Mbps	19.56	30
		58.5 Mbps	20.02	30
		65 Mbps	19.68	30
2437	6	6.5 Mbps	20.09	30
		13 Mbps	19.90	30
		19.5 Mbps	20.17	30
		26 Mbps	20.03	30
		39 Mbps	19.75	30
		52 Mbps	20.07	30
		58.5 Mbps	20.17	30
		65 Mbps	19.84	30
2462	11	6.5 Mbps	20.23	30
		13 Mbps	19.75	30
		19.5 Mbps	19.94	30
		26 Mbps	20.14	30
		39 Mbps	20.76	30
		52 Mbps	19.92	30
		58.5 Mbps	19.82	30
		65 Mbps	20.10	30

Conducted Output Power Measurements (802.11n Mode) _40 MHz BW

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2422	3	13.5 Mbps	16.18	30
		27 Mbps	16.53	30
		40.5 Mbps	16.54	30
		54 Mbps	17.07	30
		81 Mbps	17.06	30
		108 Mbps	16.78	30
		121.5 Mbps	16.76	30
		135 Mbps	16.78	30
2437	6	13.5 Mbps	16.30	30
		27 Mbps	16.29	30
		40.5 Mbps	16.30	30
		54 Mbps	17.30	30
		81 Mbps	17.32	30
		108 Mbps	17.31	30
		121.5 Mbps	17.46	30
		135 Mbps	17.45	30
2452	9	13.5 Mbps	16.49	30
		27 Mbps	17.02	30
		40.5 Mbps	16.89	30
		54 Mbps	17.42	30
		81 Mbps	17.01	30
		108 Mbps	17.53	30
		121.5 Mbps	17.57	30
		135 Mbps	17.02	30

Note : In order to simplify the report, attached plots were only the highest conducted power channel and data rate.

TEST RESULTS-Average

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1 Mbps	12.51	0.043	12.55	30
		2 Mbps	12.70	0.084	12.78	30
		5.5 Mbps	12.31	0.190	12.50	30
		11 Mbps	11.85	0.333	12.19	30
2437	6	1 Mbps	12.52	0.043	12.56	30
		2 Mbps	12.46	0.084	12.55	30
		5.5 Mbps	12.34	0.190	12.53	30
		11 Mbps	12.13	0.333	12.46	30
2462	11	1 Mbps	12.56	0.043	12.60	30
		2 Mbps	12.75	0.084	12.83	30
		5.5 Mbps	12.60	0.190	12.79	30
		11 Mbps	12.50	0.333	12.83	30

Conducted Output Power Measurements (802.11g Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6 Mbps	9.18	0.230	9.41	30
		9 Mbps	9.11	0.340	9.45	30
		12 Mbps	9.02	0.447	9.47	30
		18 Mbps	8.84	0.653	9.50	30
		24 Mbps	8.70	0.822	9.52	30
		36 Mbps	8.43	1.163	9.60	30
		48 Mbps	8.17	1.468	9.64	30
		54 Mbps	8.05	1.604	9.66	30
2437	6	6 Mbps	9.14	0.230	9.37	30
		9 Mbps	8.98	0.340	9.32	30
		12 Mbps	9.46	0.447	9.90	30
		18 Mbps	8.70	0.653	9.35	30
		24 Mbps	8.59	0.822	9.42	30
		36 Mbps	8.83	1.163	10.00	30
		48 Mbps	8.08	1.468	9.55	30
		54 Mbps	8.43	1.604	10.03	30
2462	11	6 Mbps	9.43	0.230	9.66	30
		9 Mbps	8.96	0.340	9.30	30
		12 Mbps	9.35	0.447	9.80	30
		18 Mbps	9.17	0.653	9.82	30
		24 Mbps	9.02	0.822	9.84	30
		36 Mbps	8.71	1.163	9.87	30
		48 Mbps	8.50	1.468	9.97	30
		54 Mbps	8.30	1.604	9.91	30

Conducted Output Power Measurements (802.11n Mode) _20 MHz BW

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6.5 Mbps	8.11	0.246	8.36	30
		13 Mbps	8.07	0.474	8.54	30
		19.5 Mbps	7.80	0.664	8.46	30
		26 Mbps	7.63	0.856	8.48	30
		39 Mbps	7.33	1.189	8.52	30
		52 Mbps	7.13	1.382	8.51	30
		58.5 Mbps	7.00	1.604	8.60	30
		65 Mbps	6.87	1.728	8.60	30
2437	6	6.5 Mbps	8.05	0.246	8.30	30
		13 Mbps	8.35	0.474	8.82	30
		19.5 Mbps	8.19	0.664	8.85	30
		26 Mbps	8.07	0.856	8.93	30
		39 Mbps	7.73	1.189	8.92	30
		52 Mbps	7.48	1.382	8.86	30
		58.5 Mbps	6.90	1.604	8.50	30
		65 Mbps	6.84	1.728	8.57	30
2462	11	6.5 Mbps	8.06	0.246	8.31	30
		13 Mbps	7.78	0.474	8.25	30
		19.5 Mbps	8.13	0.664	8.80	30
		26 Mbps	7.49	0.856	8.35	30
		39 Mbps	7.69	1.189	8.88	30
		52 Mbps	6.95	1.382	8.33	30
		58.5 Mbps	6.86	1.604	8.46	30
		65 Mbps	6.74	1.728	8.47	30

Conducted Output Power Measurements (802.11n Mode) _40 MHz BW

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2422	3	13.5 Mbps	7.85	0.493	8.34	30
		27 Mbps	7.93	0.884	8.82	30
		40.5 Mbps	7.66	1.207	8.87	30
		54 Mbps	7.41	1.514	8.92	30
		81 Mbps	6.97	1.980	8.95	30
		108 Mbps	6.24	2.375	8.62	30
		121.5 Mbps	6.13	2.521	8.65	30
		135 Mbps	6.00	2.673	8.67	30
2437	6	13.5 Mbps	7.96	0.493	8.46	30
		27 Mbps	7.68	0.884	8.56	30
		40.5 Mbps	7.32	1.207	8.52	30
		54 Mbps	7.58	1.514	9.10	30
		81 Mbps	7.28	1.980	9.26	30
		108 Mbps	6.87	2.375	9.24	30
		121.5 Mbps	6.76	2.521	9.28	30
		135 Mbps	6.61	2.673	9.29	30
2452	9	13.5 Mbps	8.23	0.493	8.72	30
		27 Mbps	8.35	0.884	9.23	30
		40.5 Mbps	7.95	1.207	9.15	30
		54 Mbps	7.70	1.514	9.21	30
		81 Mbps	6.90	1.980	8.88	30
		108 Mbps	7.05	2.375	9.42	30
		121.5 Mbps	6.89	2.521	9.41	30
		135 Mbps	6.29	2.673	8.97	30

Note : In order to simplify the report, attached plots were only the highest conducted power channel and data rate.

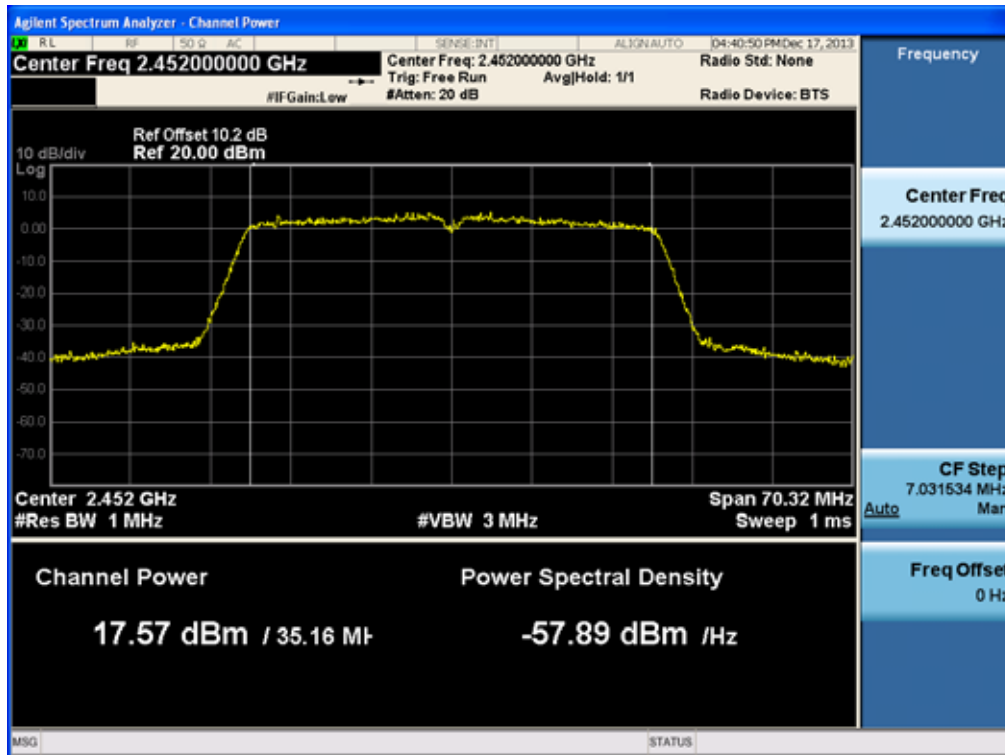


RESULT PLOTS-Peak

40 MHz BW

(2422 MHz ~2452 MHz)

Conducted Output Power (802.11n-CH 9) 121.5 Mbps



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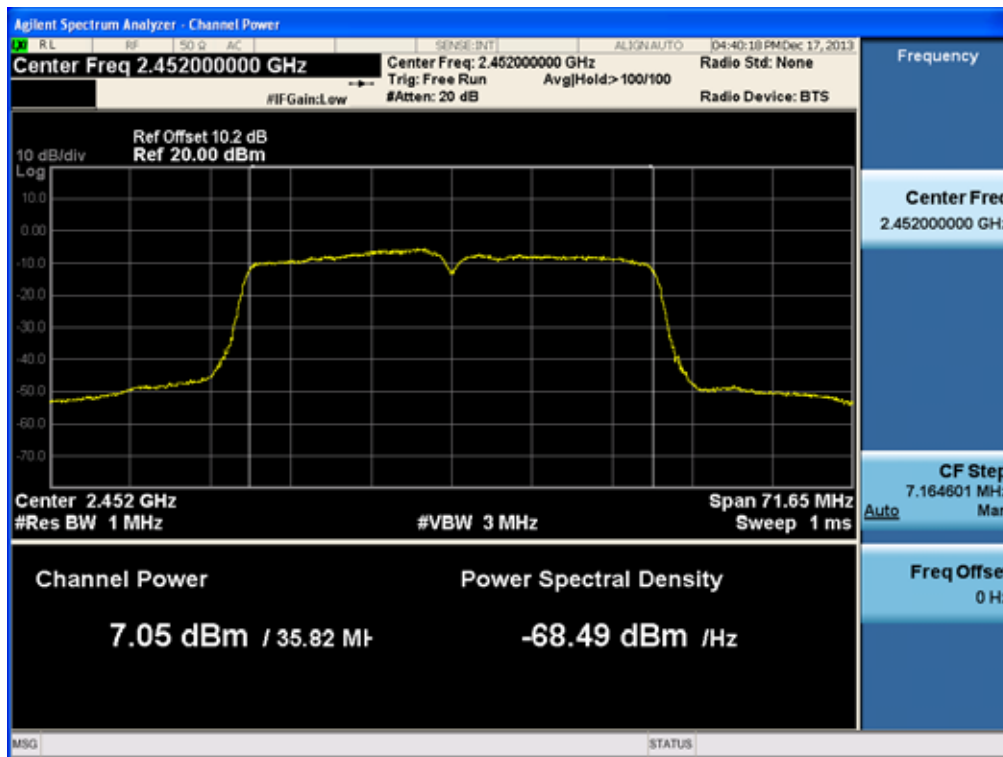


RESULT PLOTS-Average

40 MHz BW

(2422 MHz ~2452 MHz)

Conducted Output Power (802.11n-CH 9) 108 Mbps



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		www.hct.co.kr
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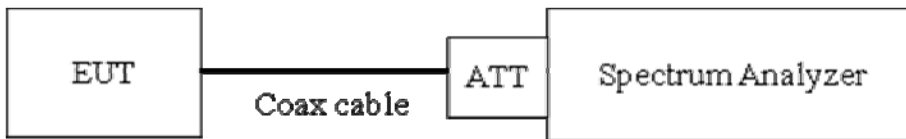
8.4 POWER SPECTRAL DENSITY (802.11b/g/n)

Test Requirements and limit, §15.247(e)

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

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

TEST CONFIGURATION



TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074, issued 04/09/2013

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

$$\begin{aligned} \text{PSD} &= \text{Reading Value} + \text{ATT loss} + \text{Cable loss}(1 \text{ ea}) \\ &= -5 \text{ dBm} + 10 \text{ dB} + 0.8 \text{ dB} = 5.8 \text{ dBm} \end{aligned}$$

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, 10.2 dB is offset for 2.4 GHz Band.

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

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Band	Frequency(MHz)	Loss(dB)
2.4 GHz	2412	10.21
	2437	10.24
	2462	10.24

(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	-9.961	8	Pass
2437	6		-9.769	8	Pass
2462	11		-10.262	8	Pass
2412	1	802.11g	-14.703	8	Pass
2437	6		-15.755	8	Pass
2462	11		-16.575	8	Pass
2412	1	802.11n (20 MHz BW)	-16.322	8	Pass
2437	6		-16.509	8	Pass
2462	11		-17.030	8	Pass
2422	3	802.11n (40 MHz BW)	-17.620	8	Pass
2437	6		-20.337	8	Pass
2452	9		-20.455	8	Pass

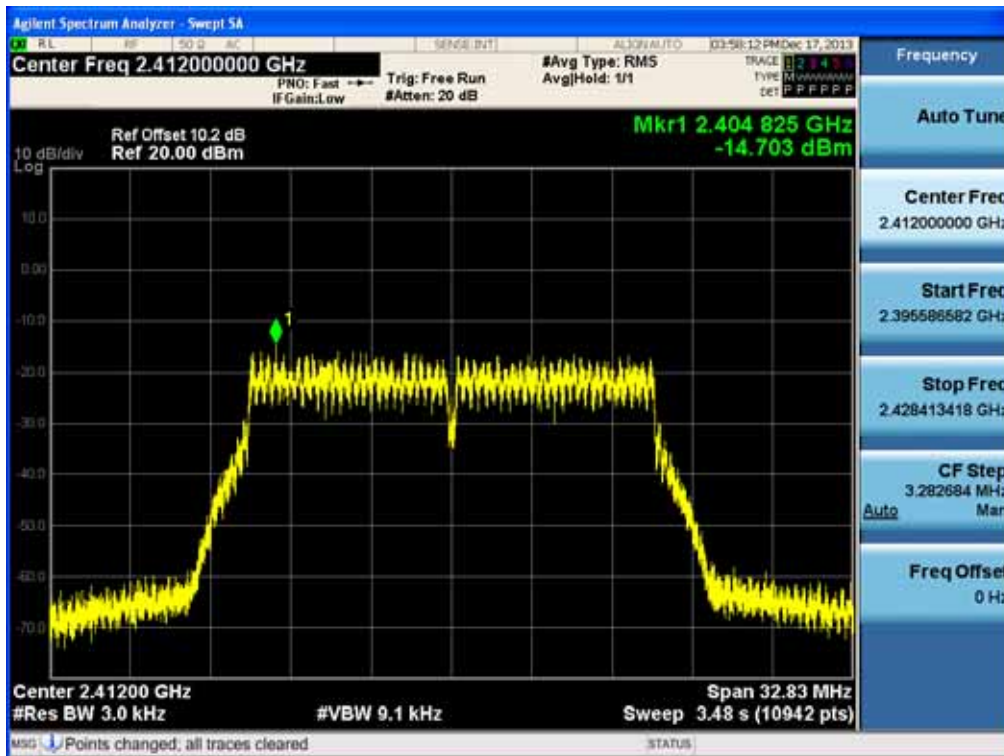
Note : In order to simplify the report, attached plots were only the highest PSD channel.

RESULT PLOTS

Power Spectral Density (802.11b-CH 6)

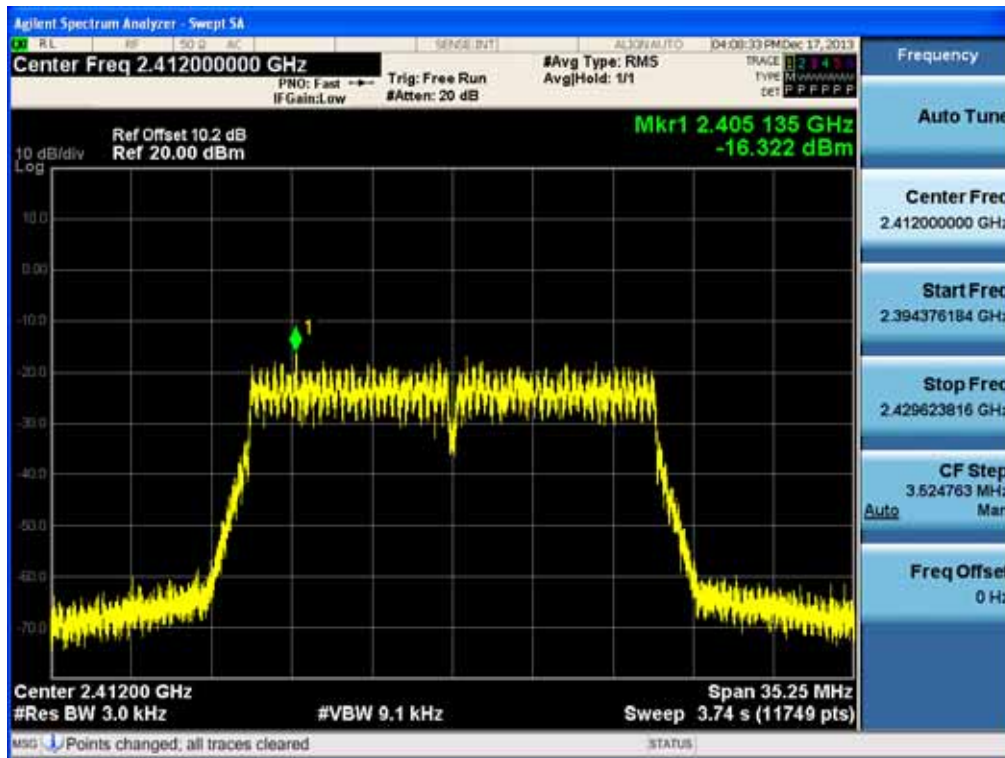


Power Spectral Density (802.11g-CH 1)

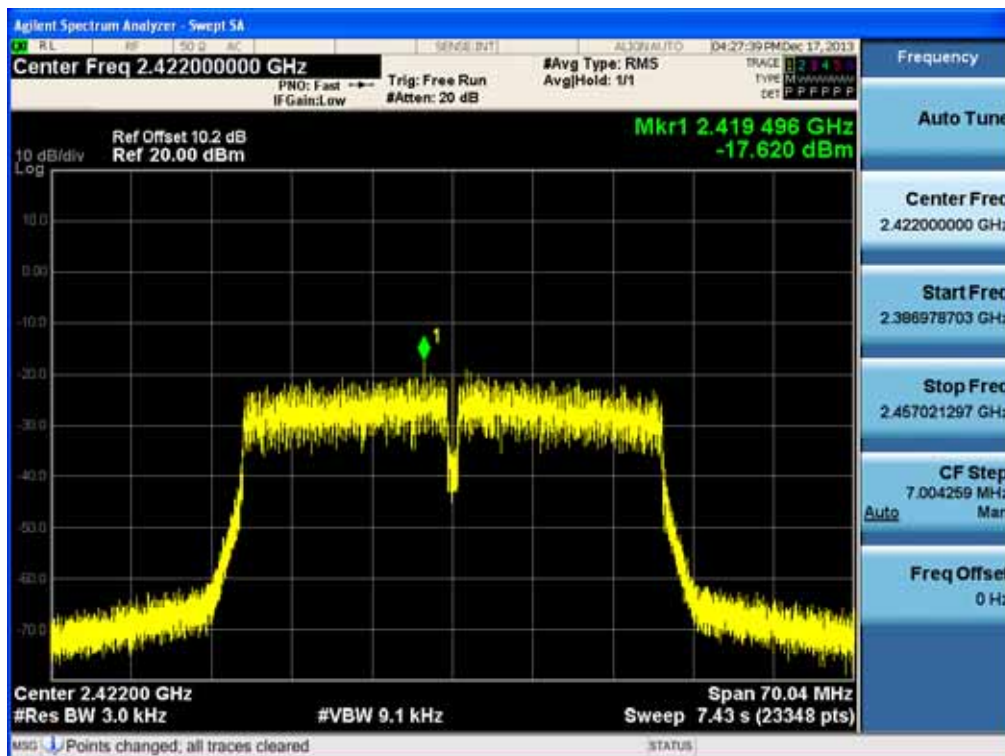


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
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Power Spectral Density (802.11n-CH 1) _ 20 MHz BW



Power Spectral Density (802.11n-CH 3) _ 40 MHz BW



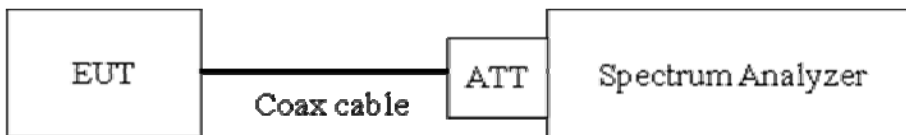
8.5 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

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, issued 04/09/2013)

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Set span to encompass the spectrum to be examined

Detector = Peak

Trace Mode = max hold

Sweep time = auto couple

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

Allow trace to fully stabilize.

Use peak marker function to determine the maximum amplitude level.

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

Note :

1. The band edge results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.2 dB is

FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
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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	10.21
	2437	10.24
	2462	10.24

(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.

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
2400*	10.19
2500*	10.26
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

Note : 1. '**' is fundamental frequency range.
2. Factor = Cable loss + Attenuator loss

RESULT PLOTS

BandEdge (802.11b-CH1)

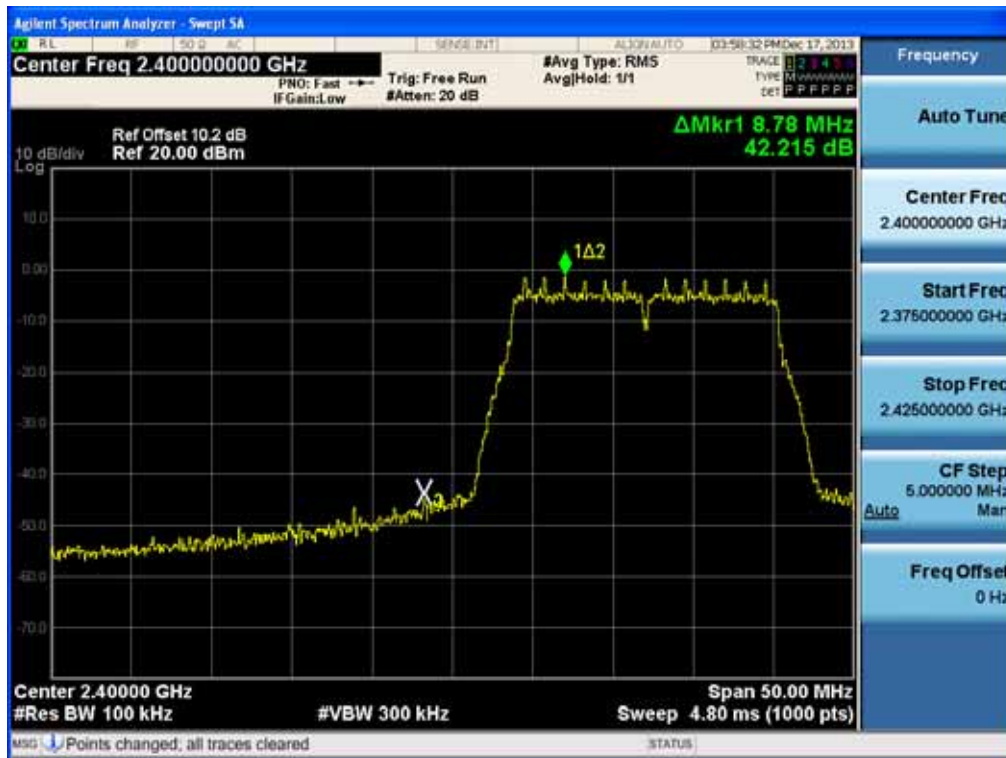


BandEdge (802.11b-CH11)

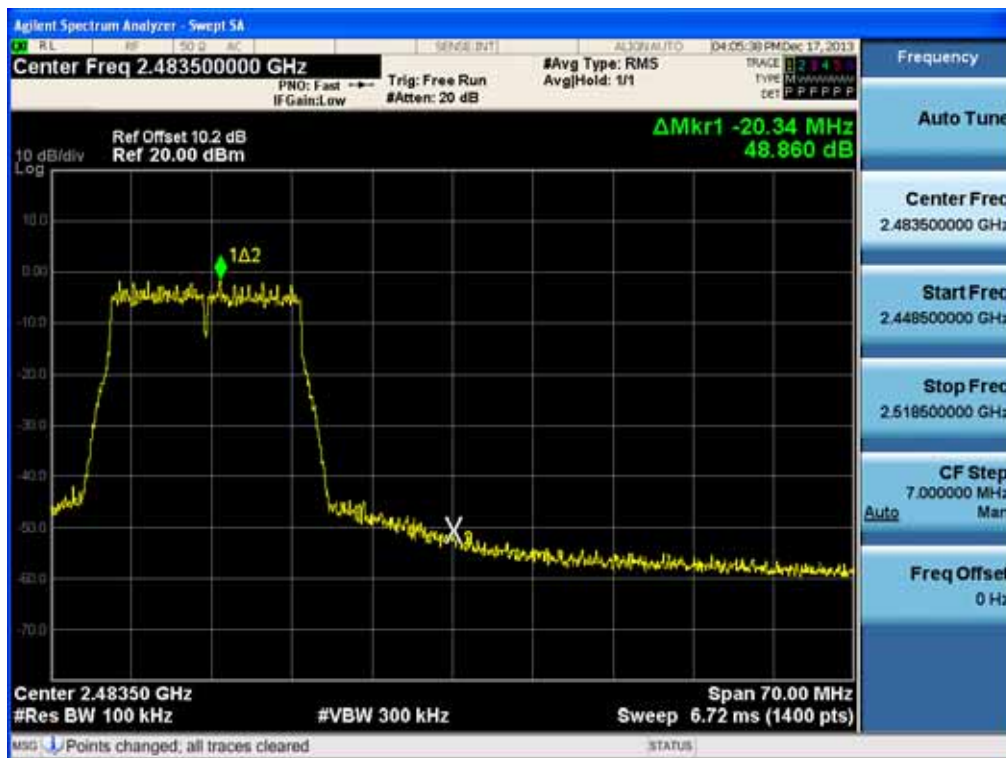


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
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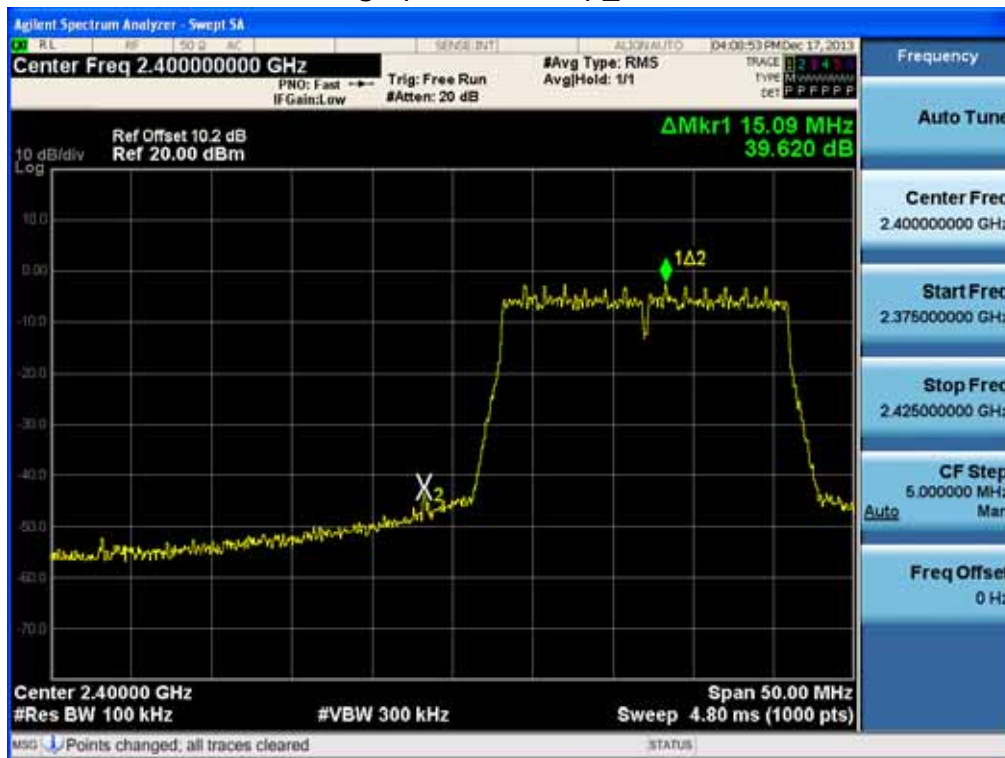
BandEdge (802.11g-CH1)



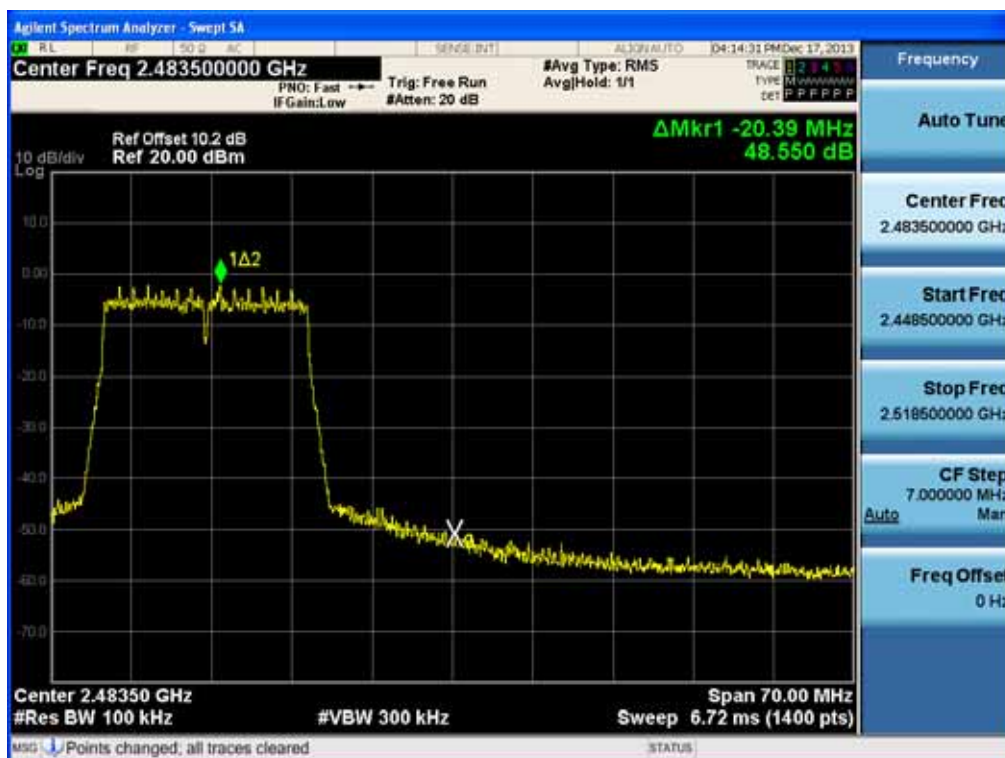
BandEdge (802.11g-CH11)



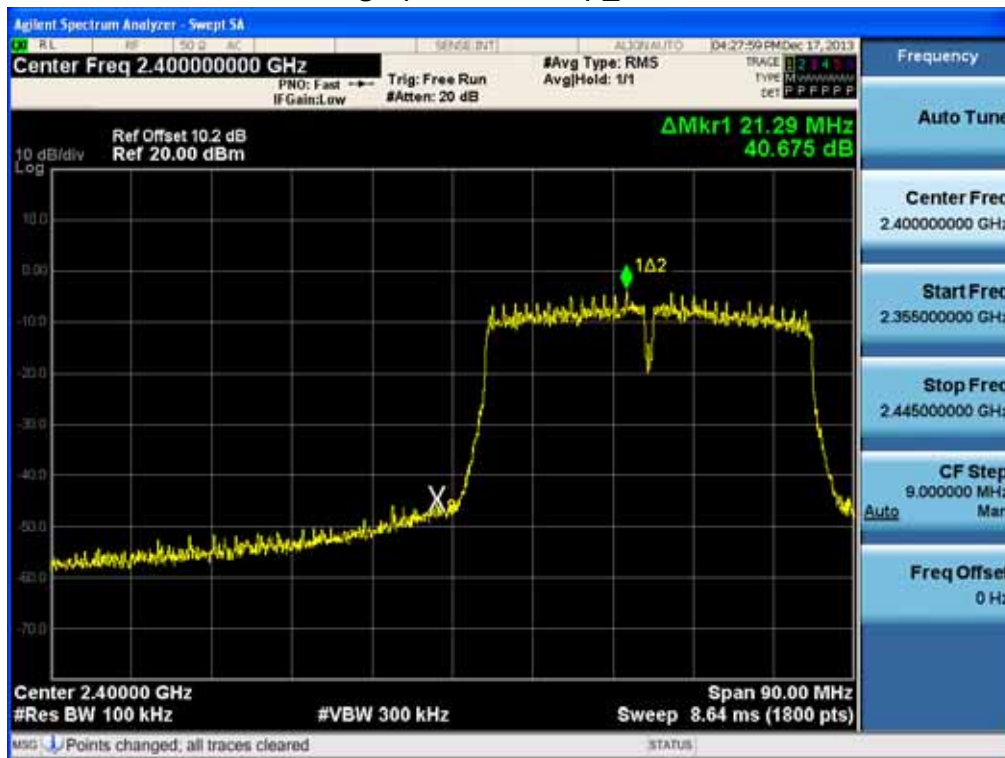
Band Edge (802.11n-CH1) _ 20 MHz BW



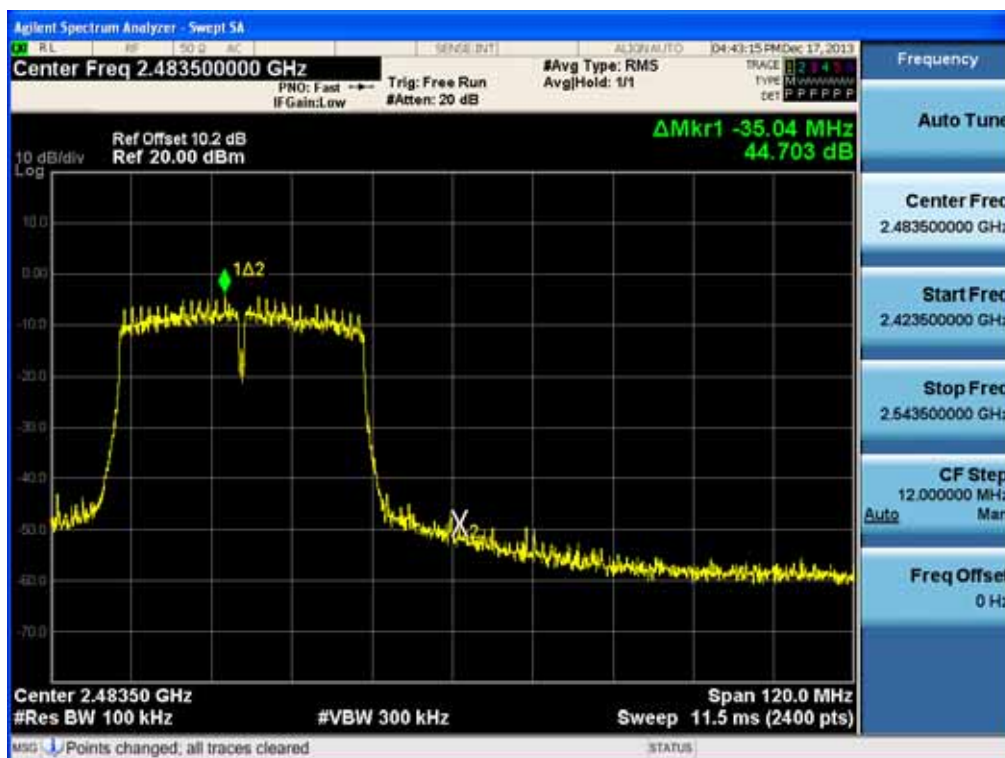
Band Edge (802.11n-CH11) _ 20 MHz BW



Band Edge (802.11n-CH1) _ 40 MHz BW

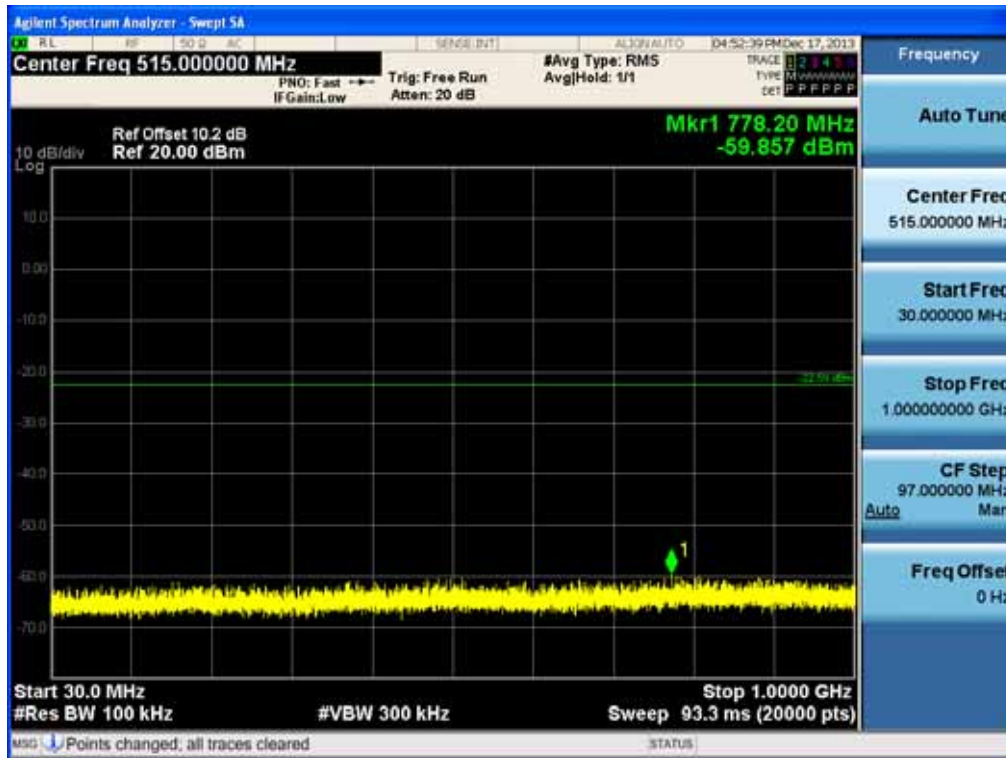


Band Edge (802.11n-CH11) _ 40 MHz BW



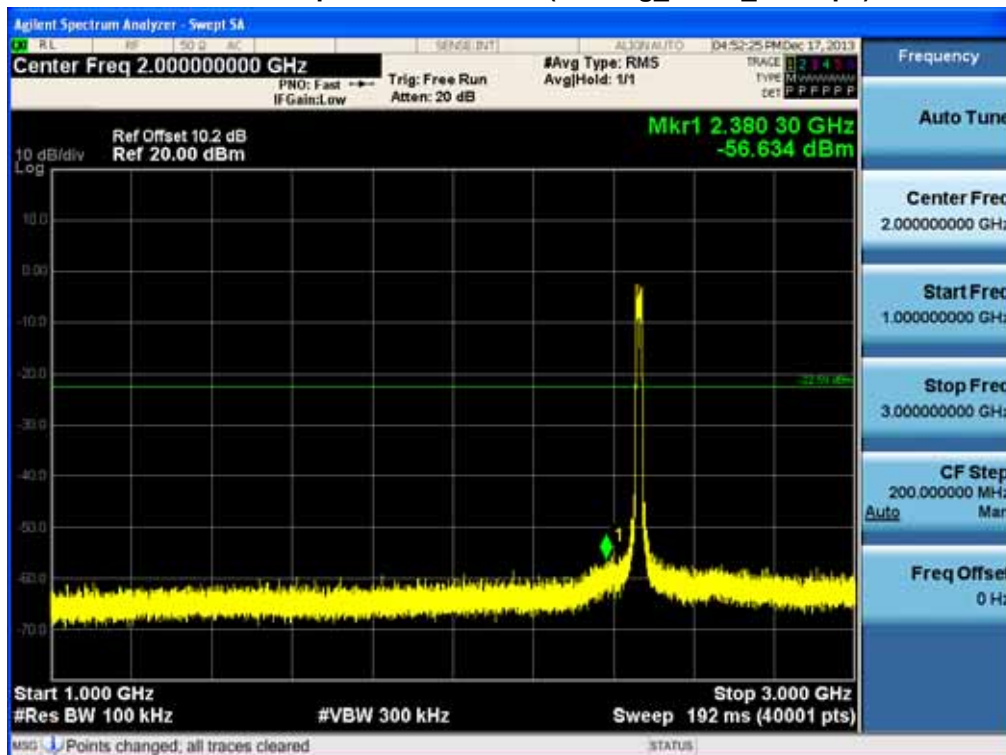
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



1 GHz ~ 3 GHz

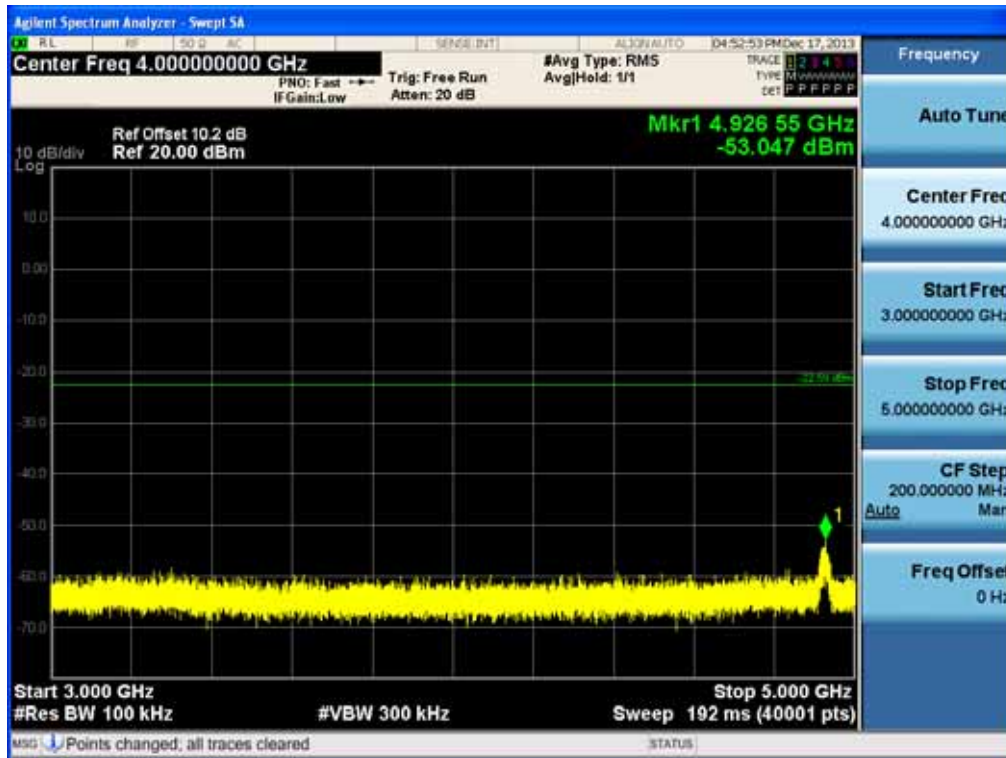
Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		www.hct.co.kr
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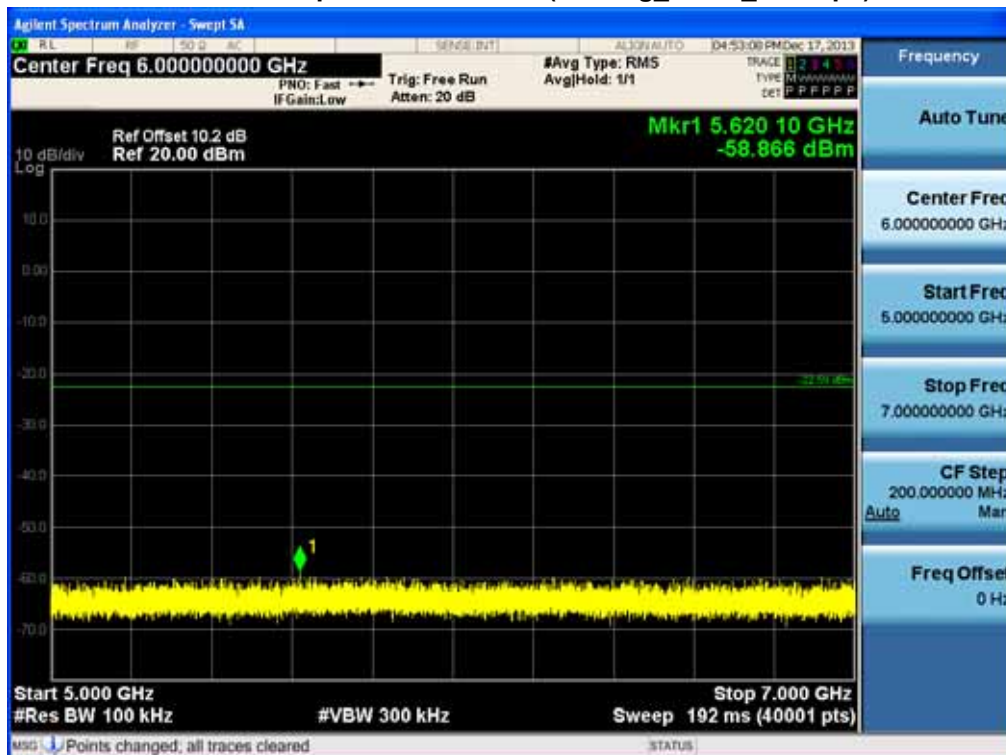
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



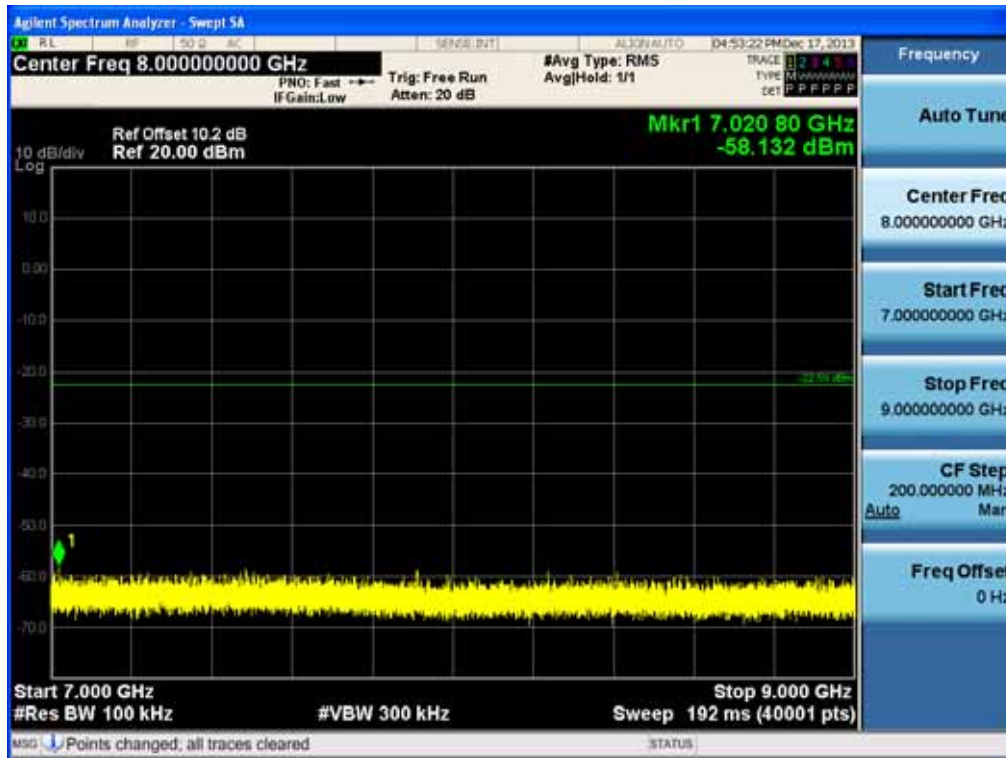
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



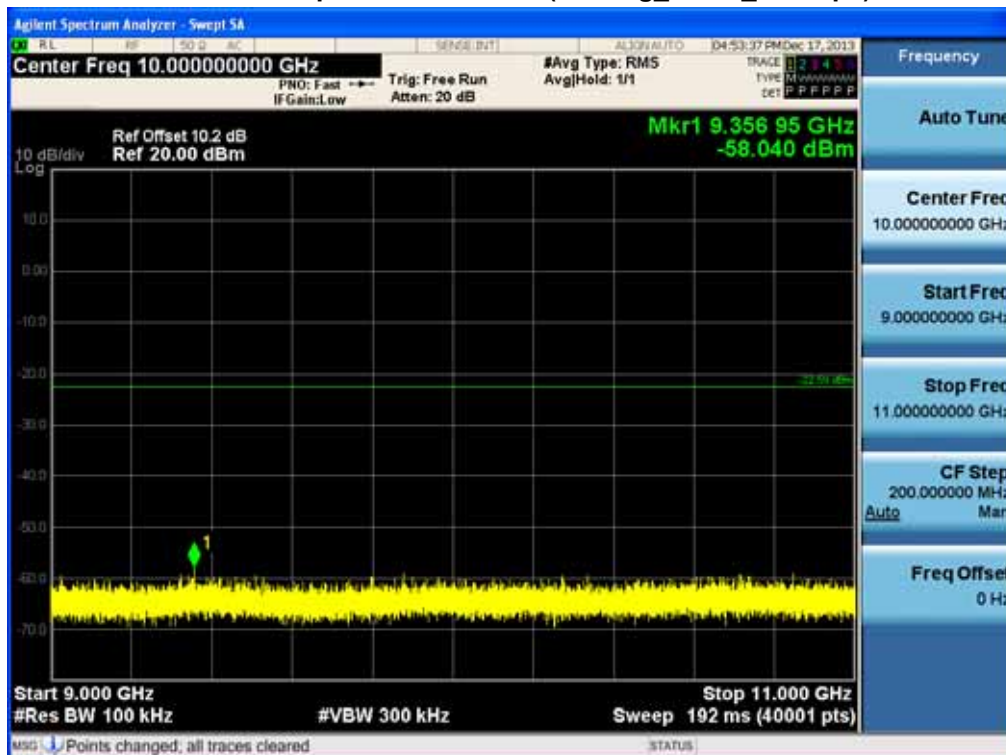
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



9 GHz ~ 11 GHz

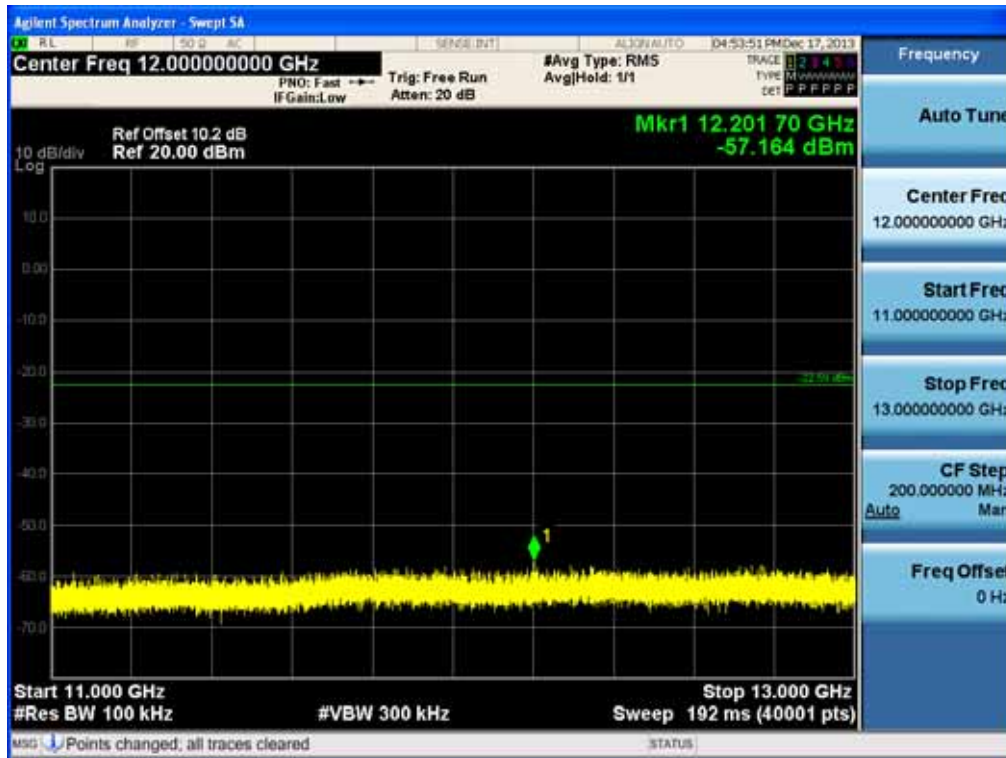
Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



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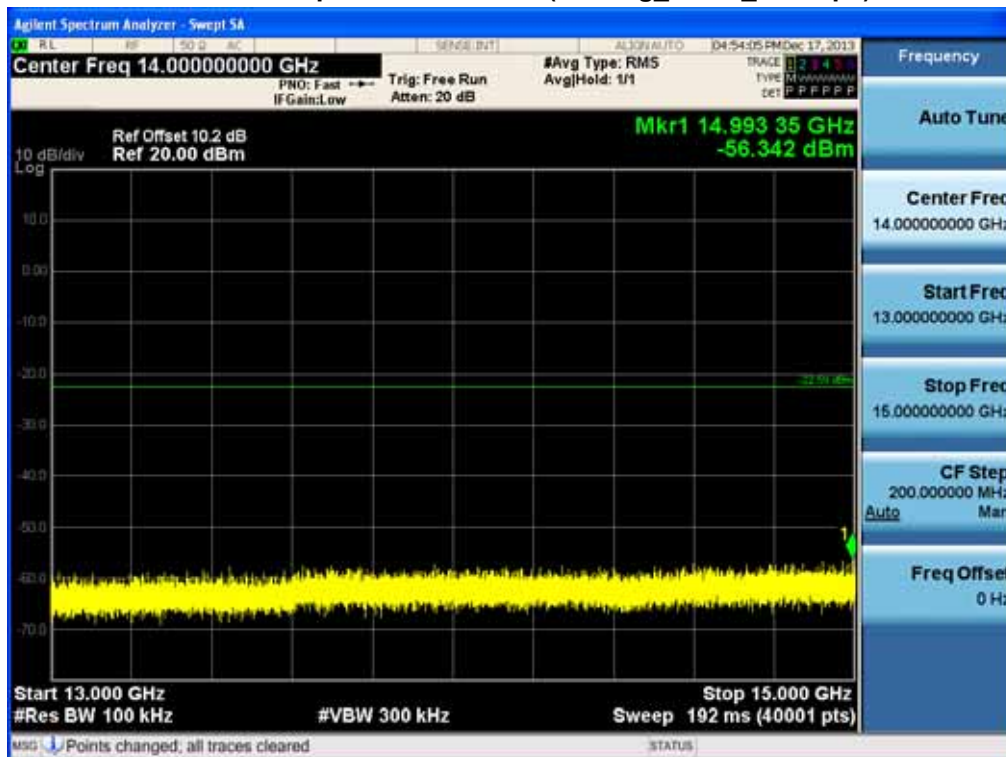
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



13 GHz ~ 15 GHz

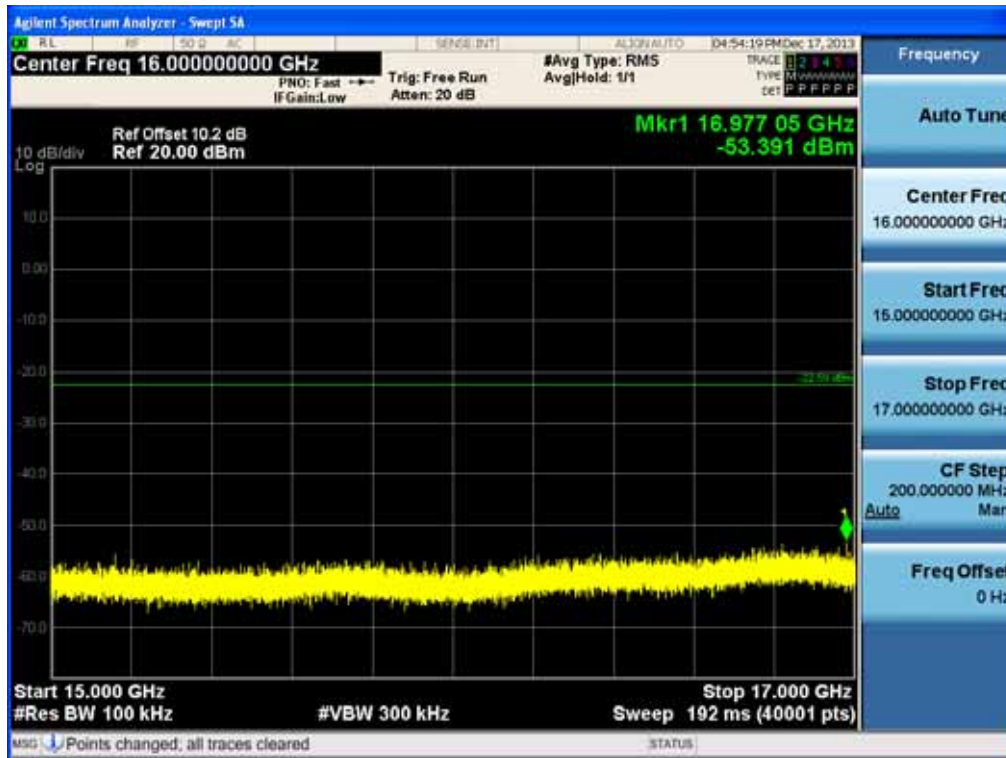
Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		www.hct.co.kr
Test Report No. HCTR1312FR22	Date of Issue: December 23, 2013	EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n(2.4GHz_HT40), VoIP, Hotspot support	FCC ID: ZNFD685

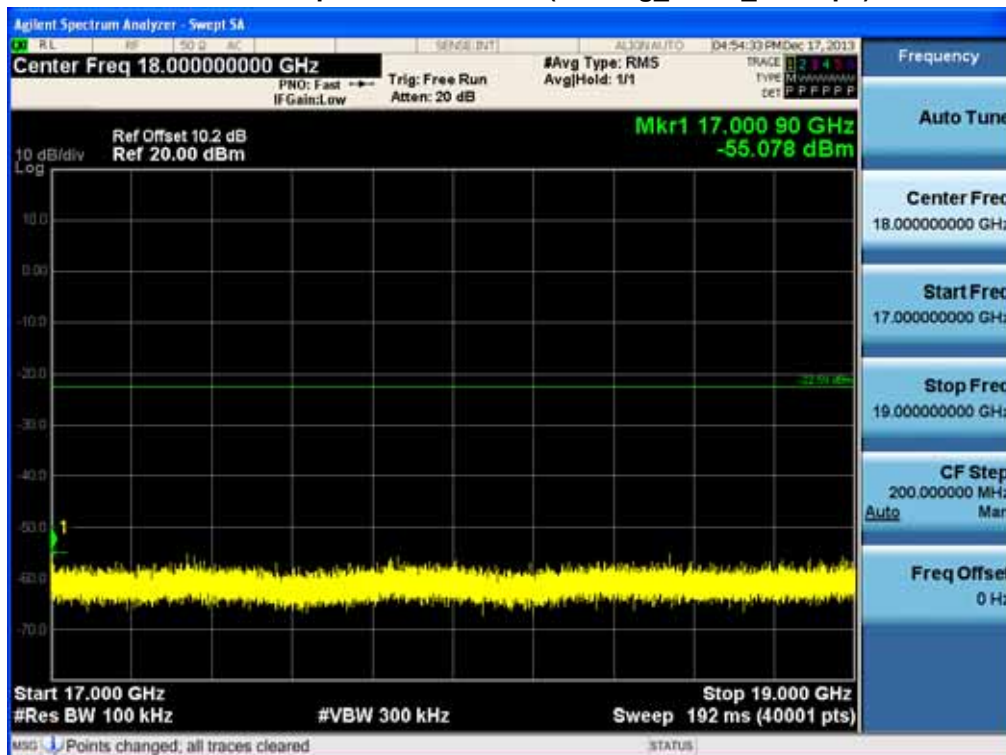
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



17 GHz ~ 19 GHz

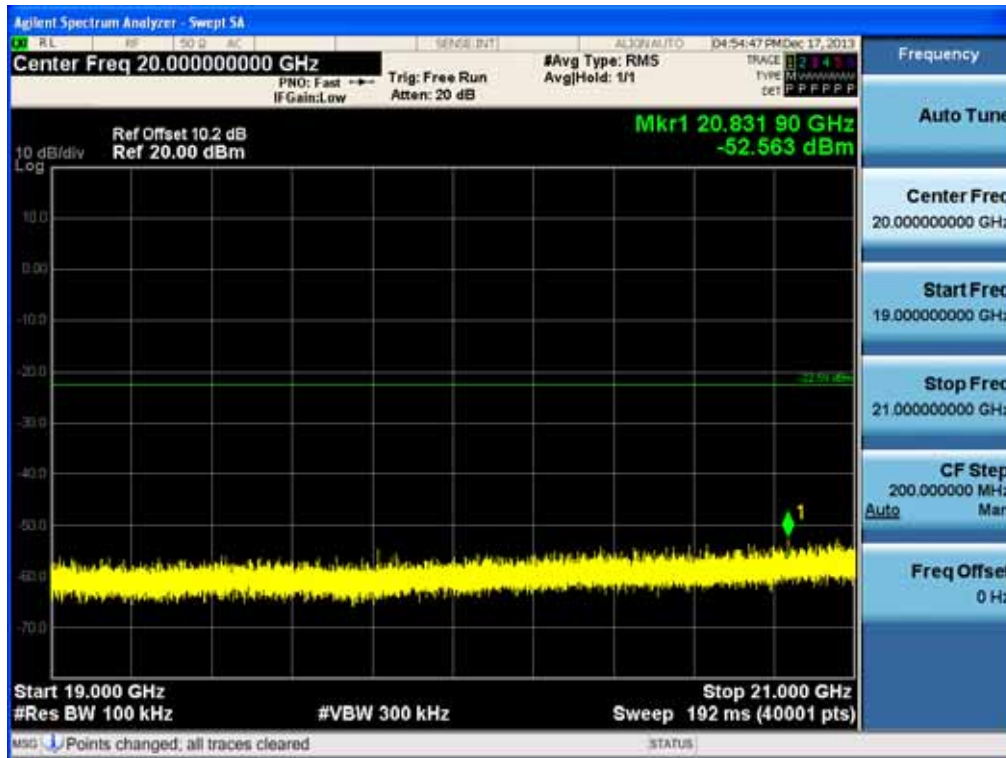
Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		www.hct.co.kr
Test Report No. HCTR1312FR22	Date of Issue: December 23, 2013	EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n(2.4GHz_HT40), VoIP, Hotspot support	FCC ID: ZNFD685

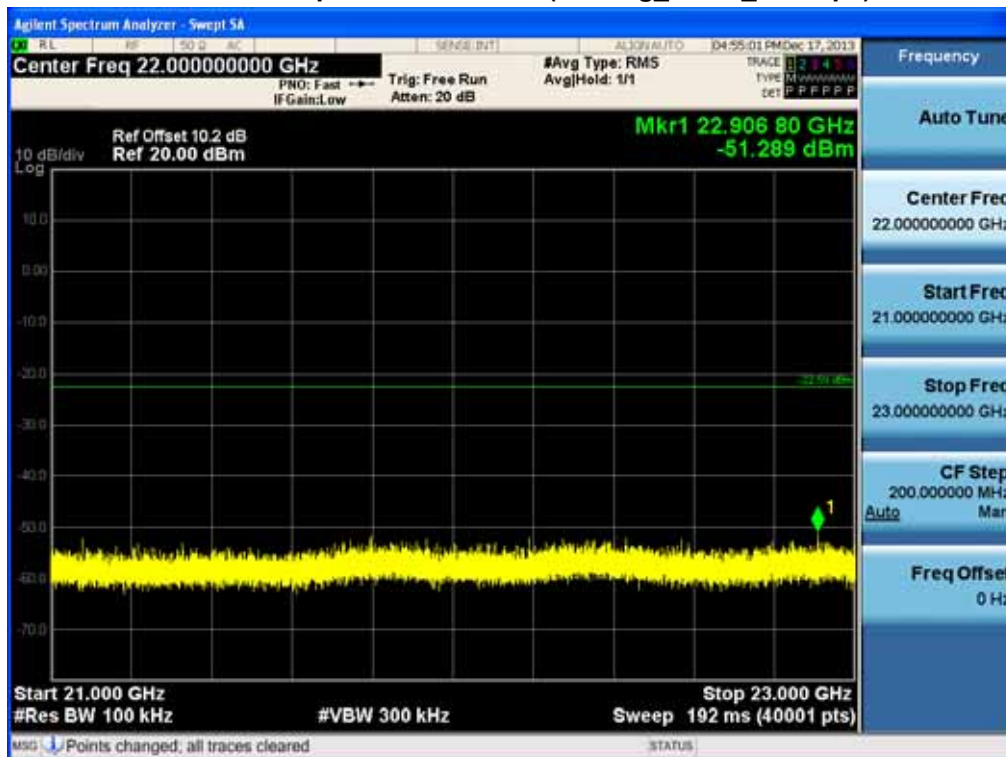
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



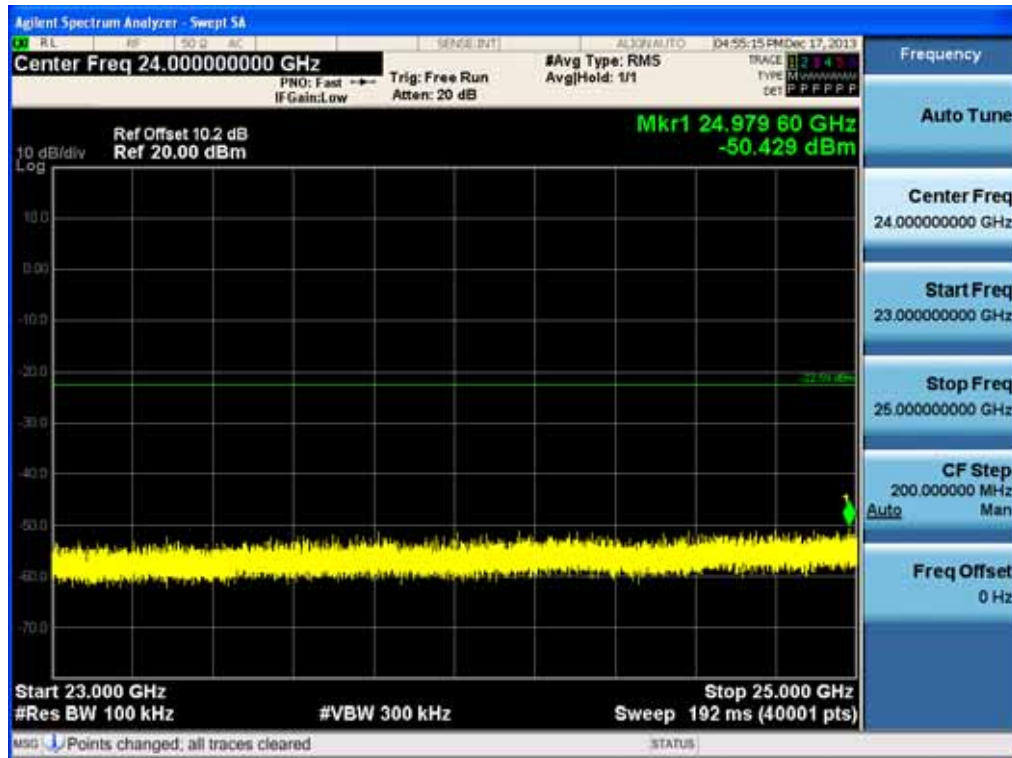
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11g_Ch.11_36 Mbps)



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8.6 RADIATED MEASUREMENT.

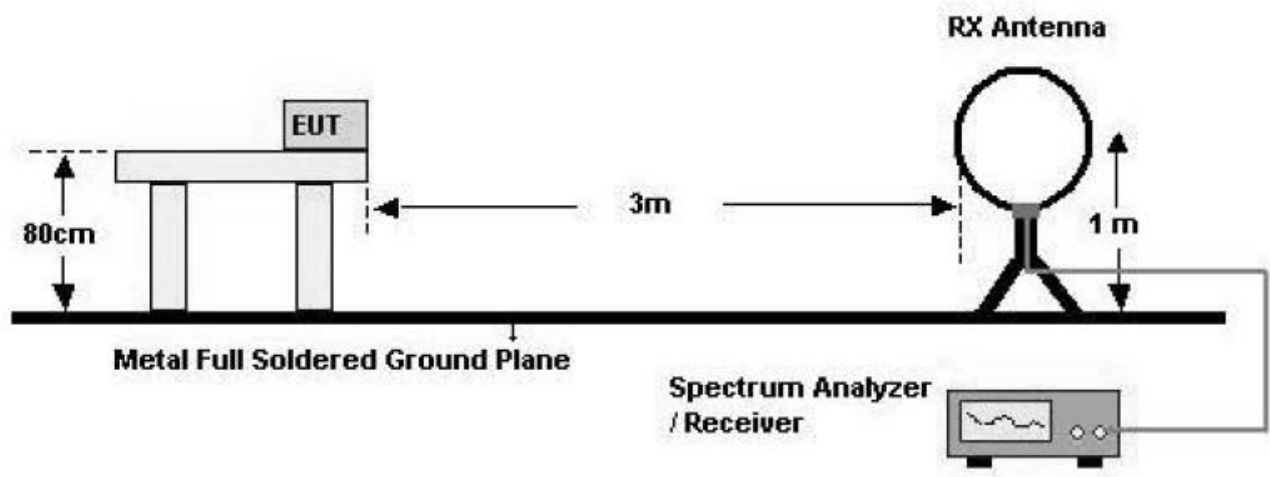
8.6.1 RADIATED SPURIOUS EMISSIONS.

Test Requirements and limit, §15.205, §15.209

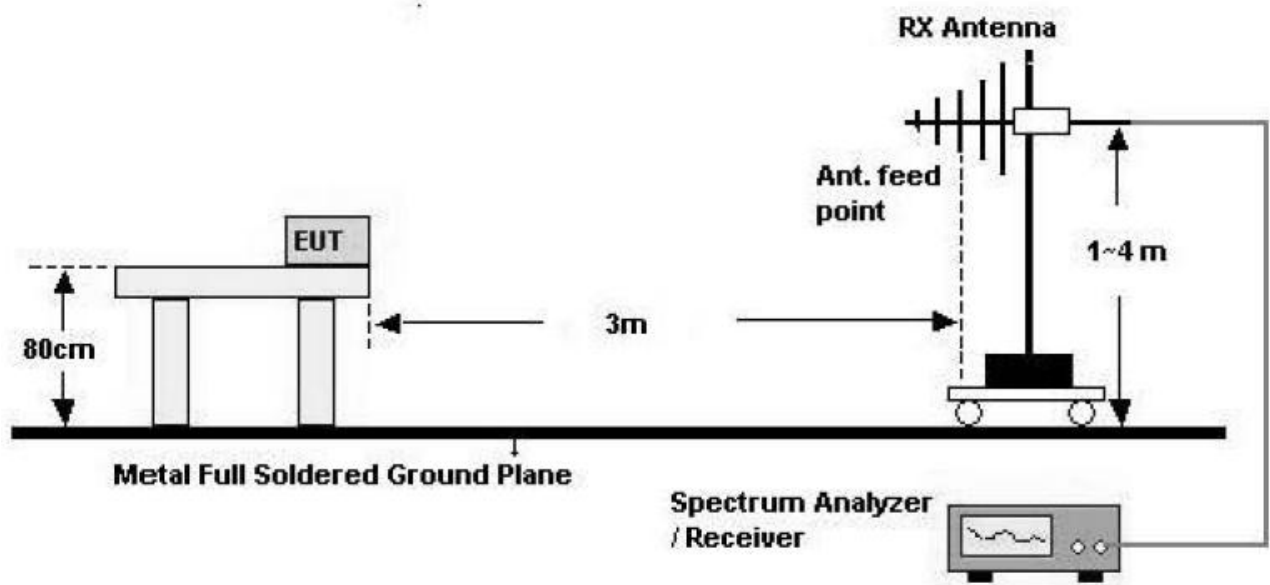
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

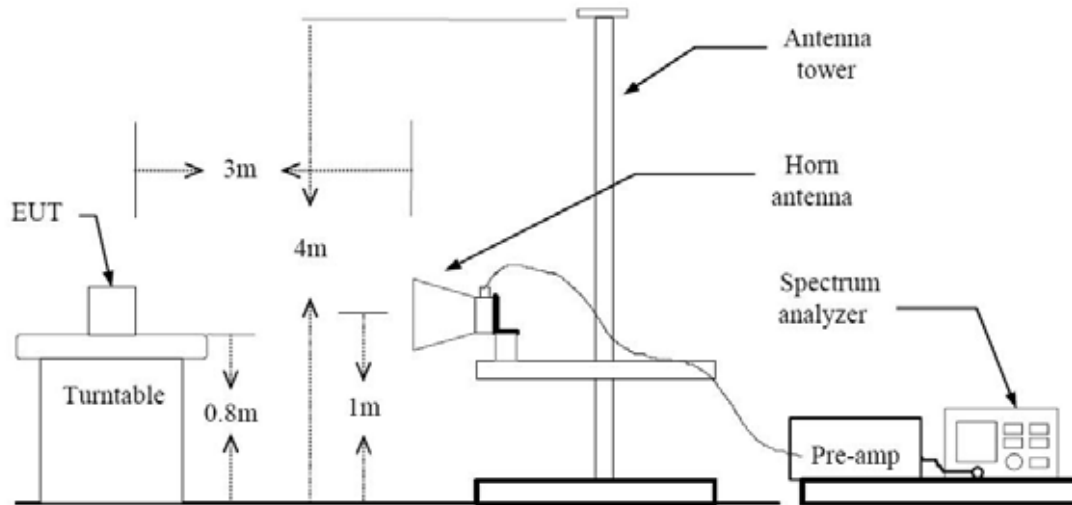
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE USED

ANSI C63.4(2003)

Method 12.2.4 in KDB 558074, issued 04/09/2013 (Peak)

Method 12.2.5.1 in KDB 558074, issued 04/09/2013(Average Case 1)

Method 12.2.5.3 in KDB 558074, issued 04/09/2013(Average Case 2)

Spectrum Setting

- Peak

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

RBW = cf. Table 1.

VBW $\geq 3 \times$ RBW.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweeps to continue until the trace stabilizes.

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

Table 1 —RBW as a function of frequency

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

- Average

Case 1

If the EUT can be configured or modified to transmit continuously (duty cycle ≥ 98 percent) then the average emission levels shall be measured using the following method (with EUT transmitting continuously).

RBW = 1 MHz (unless otherwise specified).

VBW $\geq 3 \times$ RBW.

Detector = RMS, if span/(# of points in sweep) $\leq$ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

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

- 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
- 2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

Sweep time = auto.

Perform a trace average of at least 100 traces.

Case 2

If continuous transmission of the EUT (i.e., duty cycle ≥ 98 percent) cannot be achieved and the duty cycle is not constant (i.e., duty cycle variations exceed ± 2 percent), then the following procedure shall be used:

Set RBW = 1 MHz.

Set VBW $\geq 1/T$.

Video bandwidth mode or display mode

- 1) The instrument shall be set to ensure that video filtering is applied in the power domain. Typically, this requires setting the detector mode to RMS and setting the Average-VBW Type to Power (RMS).
- 2) As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

Allow max hold to run for at least 50 times (1/duty cycle) traces.

Note :

1. We used the case 1 for 802.11b mode and the case 2 for 802.11g/n to perform the average filed strength measurements for RSE and radiated band edge test.
2. The actual setting value of VBW for 802.11g/n

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Mode	Worst Data rate (Mbps)	T _{on} (ms)	T _{total} (ms)	Duty Cycle (%)	VBW(1/T) (Hz)	The actual setting value of VBW (Hz)
g	6	2.025	2.135	94.85	494	1000
n_2 MHz BW	6.5	1.885	1.995	94.49	531	1000
n_40 MHz BW	13	0.924	1.035	89.28	1082	3000

TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

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

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	dB μ V	dB /m	dB	(H/V)	dB μ V/m	dB μ V/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	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4824	54.03	-1.98	V	52.05	73.98	21.93	PK
4824	48.50	-1.98	V	46.52	53.98	7.46	AV
7236	45.26	7.60	V	52.86	73.98	21.12	PK
7236	33.64	7.60	V	41.24	53.98	12.74	AV
4824	53.66	-1.98	H	51.68	73.98	22.30	PK
4824	48.02	-1.98	H	46.04	53.98	7.94	AV
7236	45.44	7.60	H	53.04	73.98	20.94	PK
7236	33.70	7.60	H	41.30	53.98	12.68	AV

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

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4824	50.29	-1.98	V	48.31	73.98	25.67	PK
4824	39.59	-1.98	V	37.61	53.98	16.37	AV
7236	45.69	7.60	V	53.29	73.98	20.69	PK
7236	31.96	7.60	V	39.56	53.98	14.42	AV
4824	50.00	-1.98	H	48.02	73.98	25.96	PK
4824	39.15	-1.98	H	37.17	53.98	16.81	AV
7236	45.43	7.60	H	53.03	73.98	20.95	PK
7236	31.92	7.60	H	39.52	53.98	14.46	AV



Operation Mode:	802.11 n_20 MHz BW
Transfer Rate:	6.5 Mbps
Operating Frequency	2412
Channel No.	01 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4824	50.04	-1.98	V	48.06	73.98	25.92	PK
4824	38.77	-1.98	V	36.79	53.98	17.19	AV
7236	45.66	7.60	V	53.26	73.98	20.72	PK
7236	31.99	7.60	V	39.59	53.98	14.39	AV
4824	49.88	-1.98	H	47.90	73.98	26.08	PK
4824	38.26	-1.98	H	36.28	53.98	17.70	AV
7236	45.56	7.60	H	53.16	73.98	20.82	PK
7236	31.90	7.60	H	39.50	53.98	14.48	AV

Operation Mode:	802.11 n_40 MHz BW
Transfer Rate:	13.5 Mbps
Operating Frequency	2422
Channel No.	03 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4844	49.39	-2.12	V	47.27	73.98	26.71	PK
4844	37.22	-2.12	V	35.10	53.98	18.88	AV
7266	46.25	7.44	V	53.69	73.98	20.29	PK
7266	32.88	7.44	V	40.32	53.98	13.66	AV
4844	49.15	-2.12	H	47.03	73.98	26.95	PK
4844	37.05	-2.12	H	34.93	53.98	19.05	AV
7266	46.09	7.44	H	53.53	73.98	20.45	PK
7266	32.85	7.44	H	40.29	53.98	13.69	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.

FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
Test Report No. HCTR1312FR22	Date of Issue: December 23, 2013	EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n(2.4GHz_HT40), VoIP, Hotspot support		FCC ID: ZNF685



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 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

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Operation Mode: 802.11 b

Transfer Rate: 1 Mbps

Operating Frequency: 2437

Channel No. 06 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4874	54.68	-1.92	V	52.76	73.98	21.22	PK
4874	50.31	-1.92	V	48.39	53.98	5.59	AV
7311	46.33	7.38	V	53.71	73.98	20.27	PK
7311	34.55	7.38	V	41.93	53.98	12.05	AV
4874	53.99	-1.92	H	52.07	73.98	21.91	PK
4874	49.68	-1.92	H	47.76	53.98	6.22	AV
7311	46.26	7.38	H	53.64	73.98	20.34	PK
7311	34.50	7.38	H	41.88	53.98	12.10	AV

Operation Mode: 802.11 g

Transfer Rate: 6 Mbps

Operating Frequency: 2437

Channel No. 06 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4874	51.48	-1.92	V	49.56	73.98	24.42	PK
4874	40.11	-1.92	V	38.19	53.98	15.79	AV
7311	46.04	7.38	V	53.42	73.98	20.56	PK
7311	32.61	7.38	V	39.99	53.98	13.99	AV
4874	51.22	-1.92	H	49.30	73.98	24.68	PK
4874	39.68	-1.92	H	37.76	53.98	16.22	AV
7311	46.44	7.38	H	53.82	73.98	20.16	PK
7311	32.70	7.38	H	40.08	53.98	13.90	AV



Operation Mode: 802.11 n_20 MHz BW

Transfer Rate: 6.5 Mbps

Operating Frequency: 2437

Channel No. 06 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4874	50.55	-1.92	V	48.63	73.98	25.35	PK
4874	39.24	-1.92	V	37.32	53.98	16.66	AV
7311	45.97	7.38	V	53.35	73.98	20.63	PK
7311	32.51	7.38	V	39.89	53.98	14.09	AV
4874	50.21	-1.92	H	48.29	73.98	25.69	PK
4874	38.99	-1.92	H	37.07	53.98	16.91	AV
7311	46.03	7.38	H	53.41	73.98	20.57	PK
7311	32.54	7.38	H	39.92	53.98	14.06	AV

Operation Mode: 802.11 n_40 MHz BW

Transfer Rate: 13.5 Mbps

Operating Frequency: 2437

Channel No. 06 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4874	48.88	-1.92	V	46.96	73.98	27.02	PK
4874	38.02	-1.92	V	36.10	53.98	17.88	AV
7311	46.30	7.38	V	53.68	73.98	20.30	PK
7311	33.24	7.38	V	40.62	53.98	13.36	AV
4874	48.55	-1.92	H	46.63	73.98	27.35	PK
4874	37.64	-1.92	H	35.72	53.98	18.26	AV
7311	46.31	7.38	H	53.69	73.98	20.29	PK
7311	33.29	7.38	H	40.67	53.98	13.31	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.

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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 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

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Operation Mode: 802.11 b

Transfer Rate: 1 Mbps

Operating Frequency: 2462

Channel No. 11 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4924	55.99	-1.93	V	54.06	73.98	19.92	PK
4924	52.80	-1.93	V	50.87	53.98	3.11	AV
7386	45.98	7.28	V	53.26	73.98	20.72	PK
7386	33.99	7.28	V	41.27	53.98	12.71	AV
4924	55.71	-1.93	H	53.78	73.98	20.20	PK
4924	52.39	-1.93	H	50.46	53.98	3.52	AV
7386	45.50	7.28	H	52.78	73.98	21.20	PK
7386	33.94	7.28	H	41.22	53.98	12.76	AV

Operation Mode: 802.11 g

Transfer Rate: 6 Mbps

Operating Frequency: 2462

Channel No. 11 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4924	53.03	-1.93	V	51.10	73.98	22.88	PK
4924	41.60	-1.93	V	39.67	53.98	14.31	AV
7386	45.45	7.28	V	52.73	73.98	21.25	PK
7386	32.25	7.28	V	39.53	53.98	14.45	AV
4924	52.88	-1.93	H	50.95	73.98	23.03	PK
4924	41.21	-1.93	H	39.28	53.98	14.70	AV
7386	45.32	7.28	H	52.60	73.98	21.38	PK
7386	32.20	7.28	H	39.48	53.98	14.50	AV



Operation Mode: 802.11 n

Transfer Rate: 6.5 Mbps

Operating Frequency: 2462

Channel No. 11 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4924	54.56	-1.93	V	52.63	73.98	21.35	PK
4924	40.43	-1.93	V	38.50	53.98	15.48	AV
7386	45.11	7.28	V	52.39	73.98	21.59	PK
7386	32.15	7.28	V	39.43	53.98	14.55	AV
4924	54.02	-1.93	H	52.09	73.98	21.89	PK
4924	40.00	-1.93	H	38.07	53.98	15.91	AV
7386	45.06	7.28	H	52.34	73.98	21.64	PK
7386	32.11	7.28	H	39.39	53.98	14.59	AV

Operation Mode: 802.11 n_40 MHz BW

Transfer Rate: 13.5 Mbps

Operating Frequency: 2452

Channel No. 09 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4904	51.05	-1.95	V	49.10	73.98	24.88	PK
4904	38.41	-1.95	V	36.46	53.98	17.52	AV
7356	45.92	7.23	V	53.15	73.98	20.83	PK
7356	32.83	7.23	V	40.06	53.98	13.92	AV
4904	50.85	-1.95	H	48.90	73.98	25.08	PK
4904	38.13	-1.95	H	36.18	53.98	17.80	AV
7356	46.03	7.23	H	53.26	73.98	20.72	PK
7356	32.88	7.23	H	40.11	53.98	13.87	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.

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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 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

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8.6.2 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	AN.+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	26.45	31.47	H	57.92	73.98	16.06	PK
2390.0	13.34	31.47	H	44.81	53.98	9.17	AV
2390.0	26.05	31.47	V	57.52	73.98	16.46	PK
2390.0	13.29	31.47	V	44.76	53.98	9.22	AV
2483.5	27.01	31.46	H	58.47	73.98	15.51	PK
2483.5	13.31	31.46	H	44.77	53.98	9.21	AV
2483.5	27.11	31.46	V	58.57	73.98	15.41	PK
2483.5	13.29	31.46	V	44.75	53.98	9.23	AV

Operation Mode: 802.11b

Transfer Rate: 1 Mbps

Operating Frequency: 2412 MHz, 2462 MHz

Channel No. 01 Ch, 11 Ch

Frequency [MHz]	Reading dBuV	AN.+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	25.43	31.47	H	56.90	73.98	17.08	PK
2390.0	14.16	31.47	H	45.63	53.98	8.35	AV
2390.0	25.11	31.47	V	56.58	73.98	17.40	PK
2390.0	14.09	31.47	V	45.56	53.98	8.42	AV
2483.5	24.85	31.46	H	56.31	73.98	17.67	PK
2483.5	13.43	31.46	H	44.89	53.98	9.09	AV
2483.5	24.77	31.46	V	56.23	73.98	17.75	PK
2483.5	13.28	31.46	V	44.74	53.98	9.24	AV

Operation Mode: 802.11n_20 MHz

Transfer Rate: 6.5 Mbps

Operating Frequency: 2412 MHz, 2462 MHz

Channel No. 01 Ch, 11 Ch

Frequency [MHz]	Reading dBuV	AN.+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	27.52	31.47	H	58.99	73.98	14.99	PK
2390.0	13.04	31.47	H	44.51	53.98	9.47	AV
2390.0	27.69	31.47	V	59.16	73.98	14.82	PK
2390.0	13.08	31.47	V	44.55	53.98	9.43	AV
2483.5	26.10	31.46	H	57.56	73.98	16.42	PK
2483.5	12.63	31.46	H	44.09	53.98	9.89	AV
2483.5	26.35	31.46	V	57.81	73.98	16.17	PK
2483.5	12.60	31.46	V	44.06	53.98	9.92	AV

Operation Mode:	802.11n_40 MHz
Transfer Rate:	13.5 Mbps
Operating Frequency	2422 MHz, 2452 MHz
Channel No.	03 Ch, 09 Ch

Frequency [MHz]	Reading dBuV	AN.+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	26.54	31.47	H	58.01	73.98	15.97	PK
2390.0	13.74	31.47	H	45.21	53.98	8.77	AV
2390.0	27.00	31.47	V	58.47	73.98	15.51	PK
2390.0	13.79	31.47	V	45.26	53.98	8.72	AV
2483.5	26.27	31.46	H	57.73	73.98	16.25	PK
2483.5	13.81	31.46	H	45.27	53.98	8.71	AV
2483.5	27.51	31.46	V	58.97	73.98	15.01	PK
2483.5	13.99	31.46	V	45.45	53.98	8.53	AV

Notes:

1. Total = Reading Value + Antenna Factor + Cable Loss
2. We have done 802.11b/g/n mode and all data rate. Worst data rate is the lowest data of each mode.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

8.7 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 36 Mbps, Ch.11 and 802.11g. Because 802.11g mode is worst case.

RESULT PLOTS

Conducted Emissions (Line 1)

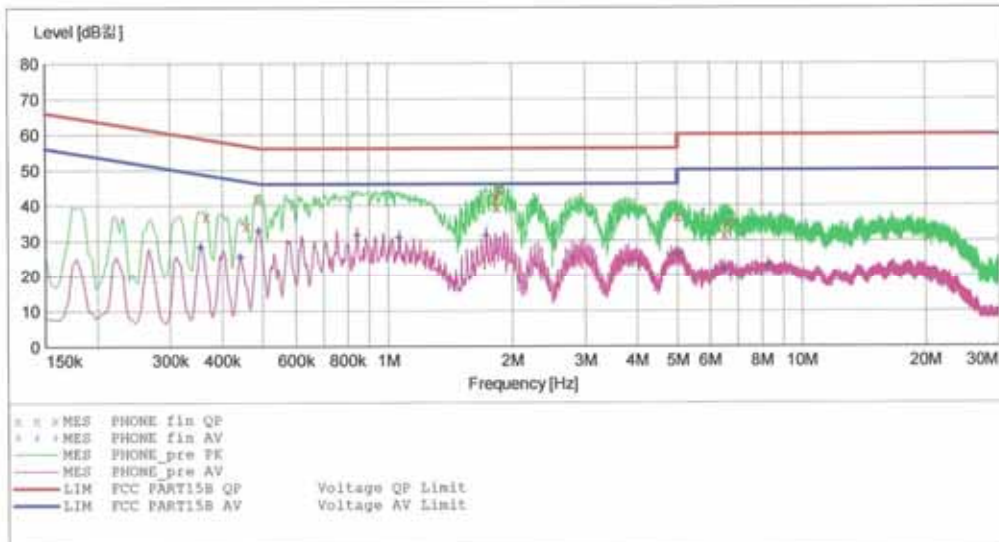
HCT

EMC

EUT: LG-D685
 Manufacturer: LG
 Operating Condition: WLAN MODE
 Test Site: SHIELD ROOM
 Operator: JS LEE
 Test Specification: FCC PART15B
 Comment: H
 Start of Test: 2013-12-17 / 7:54:28 오후

SCAN TABLE: "FCC CLASS B(H)"

Short Description:				FCC CLASS B(H)			
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer	
Frequency	Frequency	Width					
150.0 kHz	500.0 kHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None	
			Average				
500.0 kHz	5.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None	
			Average				
5.0 MHz	30.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None	
			Average				



MEASUREMENT RESULT: "PHONE_fin QP"

2013-12-17 7:57 오후

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.366001	36.80	9.8	59	21.8	---	---
0.458001	34.30	9.8	57	22.4	---	---
0.486001	41.90	9.8	56	14.3	---	---
1.820000	42.30	9.9	56	13.7	---	---
1.836000	39.40	9.9	56	16.6	---	---
1.860000	44.50	9.9	56	11.5	---	---
5.000000	36.70	10.2	56	19.3	---	---
6.488000	31.70	10.3	60	28.3	---	---
6.644000	35.00	10.3	60	25.0	---	---

MEASUREMENT RESULT: "PHONE_fin AV"

2013-12-17 7:57오.후

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.354001	28.30	9.8	49	20.5	---	---
0.442001	25.50	9.8	47	21.6	---	---
0.490001	33.00	9.8	46	13.2	---	---
0.844000	31.60	9.8	46	14.4	---	---
1.064000	30.90	9.8	46	15.1	---	---
1.728000	31.50	9.9	46	14.5	---	---
5.000000	26.10	10.2	46	19.9	---	---
6.472000	21.90	10.3	50	28.1	---	---
8.284000	23.00	10.4	50	27.0	---	---

Conducted Emissions (Line 2)

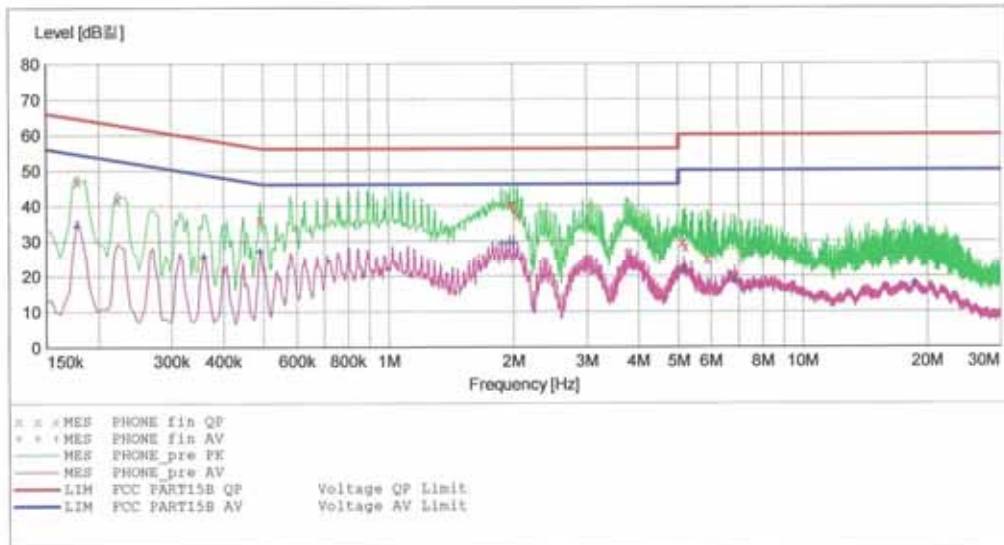
HCT

EMC

EUT: LG-D685
 Manufacturer: LG
 Operating Condition: WLAN MODE
 Test Site: SHIELD ROOM
 Operator: JS LEE
 Test Specification: FCC PART15B
 Comment: N
 Start of Test: 2013-12-17 / 7:47:22오후

SCAN TABLE: "FCC CLASS B(N)"

Short Description:			FCC CLASS B(N)			
Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	500.0 kHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
500.0 kHz	5.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
5.0 MHz	30.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			



MEASUREMENT RESULT: "PHONE_fin QP"

2013-12-17 7:50오후

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.178001	47.00	10.0	65	17.5	---	---
0.222001	41.90	10.0	63	20.8	---	---
0.490001	36.10	10.0	56	20.1	---	---
1.960000	40.30	10.1	56	15.7	---	---
2.004000	40.30	10.1	56	15.7	---	---
2.052000	37.50	10.1	56	18.5	---	---
5.124000	29.60	10.4	60	30.4	---	---
5.204000	28.40	10.4	60	31.6	---	---
5.876000	24.90	10.4	60	35.1	---	---

MEASUREMENT RESULT: "PHONE_fin AV"

2013-12-17 7:50오.후

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.178001	34.20	10.0	55	20.4	---	---
0.358001	25.50	10.0	49	23.3	---	---
0.490001	27.00	10.0	46	19.2	---	---
1.872000	29.30	10.1	46	16.7	---	---
1.960000	29.50	10.1	46	16.5	---	---
2.004000	29.40	10.1	46	16.6	---	---
5.160000	21.70	10.4	50	28.3	---	---
6.844000	18.80	10.5	50	31.2	---	---
18.580000	17.90	11.2	50	32.1	---	---

9. LIST OF TEST EQUIPMENT

Manufacturer	Model / Equipment	Calibration Interval	Calibration Due	Serial No.
Rohde & Schwarz	ENV216/ LISN	Annual	02/06/2014	100073
Schwarzbeck	VULB 9160/ TRILOG Antenna	Biennial	12/17/2014	3150
Rohde & Schwarz	ESI 40 / EMI TEST RECEIVER	Annual	04/16/2014	831564103
Agilent	E4440A/ Spectrum Analyzer	Annual	04/25/2014	US45303008
Agilent	N9020A/ SIGNAL ANALYZER	Annual	05/14/2014	MY51110063
Audix	AM4000/ Antenna Position Tower	N/A	N/A	060520-AM
Audix	Turn Table	N/A	N/A	N/A
Audix	EM 1000/ Controller	N/A	N/A	13
Rohde & Schwarz	SCU-18/ Signal Conditioning Unit	Annual	09/10/2014	10094
CERNEX	CBL18265035 / POWER AMP	Annual	07/24/2014	22966
CERNEX	CBL26405040 / POWER AMP	Annual	04/16/2014	19660
Schwarzbeck	BBHA 9120D/ Horn Antenna	Biennial	07/05/2015	1151
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	Biennial	10/30/2014	BBHA9170124
Rohde & Schwarz	FSP / Spectrum Analyzer	Annual	02/08/2014	839117/011
Agilent	N1911A/Power Meter	Annual	01/22/2014	MY45100523
Agilent	N1921A /POWER SENSOR	Annual	07/11/2014	MY45241059
Wainwright Instrument	WHF3.0/18G-10EF / High Pass Filter	Annual	02/08/2014	F6
Wainwright Instrument	WHNX6.0/26.5G-6SS / High Pass Filter	Annual	04/16/2014	1
Wainwright Instrument	WHNX7.0/18G-8SS / High Pass Filter	Annual	04/16/2014	29
Wainwright Instrument	WRCJ2400/2483.5-2370/2520-60/14SS / Band Reject Filter	Annual	03/19/2014	1
Hewlett Packard	11636B/Power Divider	Annual	10/22/2014	11377
Agilent	87300B/Directional Coupler	Annual	12/18/2014	3116A03621
Hewlett Packard	11667B / Power Splitter	Annual	05/29/2014	05001
DIGITAL	EP-3010 /DC POWER SUPPLY	Annual	10/29/2014	3110117
ITECH	IT6720 / DC POWER SUPPLY	Annual	11/05/2014	010002156287001199
TESCOM	TC-3000C / BLUETOOTH TESTER	Annual	04/24/2014	3000C000276
Rohde & Schwarz	CBT / BLUETOOTH TESTER	Annual	04/25/2014	100422
EMCO	6502.LOOP ANTENNA	Biennial	01/11/2014	9009-2536
Agilent	8493C / Attenuator(10 dB)	Annual	07/24/2014	76649
WEINSCHEL	2-3 / Attenuator(3 dB)	Annual	10/28/2014	BR0617
CERNEX	CBL06185030 / POWER AMP	Annual	07/24/2014	22965
CERNEX	CBLU1183540 / POWER AMP	Annual	07/24/2014	22964