

# HCT CO., LTD.

## CERTIFICATE OF COMPLIANCE FCC Certification

<b>Applicant Name:</b> LG Electronics MobileComm U.S.A., Inc.  <b>Address:</b> 1000 Sylvan Avenue, Englewood Cliffs NJ 07632	<b>Date of Issue:</b> November 28, 2013 <b>Test Site/Location:</b> HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea <b>Report No.:</b> HCTR1311FR17 <b>HCT FRN:</b> 0005866421
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**FCC ID : ZNFD955**

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

<b>FCC Model(s):</b> <b>Additional FCC Model(s):</b> <b>EUT Type:</b> <b>Max. RF Output Power:</b>  <b>Frequency Range:</b>  <b>Modulation type</b> <b>FCC Classification:</b> <b>FCC Rule Part(s):</b>	LG-D955 LGD955, D955 Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID Wi-Fi 802.11b (19.63 dBm) / Wi-Fi 802.11g (23.62 dBm) / Wi-Fi 802.11n (2.4 GHz) (24.24 dBm) / Wi-Fi 802.11ac (2.4 GHz) (22.94 dBm) / Wi-Fi 802.11a (5.8 GHz) (23.39 dBm) / Wi-Fi 802.11n_20 MHz BW (5.8 GHz) (23.62 dBm) / Wi-Fi 802.11n_40 MHz BW (5.8 GHz) (17.70 dBm) / Wi-Fi 802.11ac_20 MHz BW (5.8 GHz) (21.86 dBm) / Wi-Fi 802.11ac_40 MHz BW (5.8 GHz) (16.48 dBm) / Wi-Fi 802.11ac_80 MHz BW (5.8 GHz) (15.98 dBm)  2412 MHz - 2462 MHz (2.4 GHz Band) 5745 MHz - 5825 MHz (5.8 GHz Band)_20 MHz BW, 5755 MHz - 5795 MHz (5.8 GHz Band)_40 MHz BW 5775 MHz (5.8 GHz Band)_80 MHz BW  CCK/DSSS/OFDM  Digital Transmission System(DTS)  Part 15.247
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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**  
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**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		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID		FCC ID: ZNFD955



# Version

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1311FR17	November 28, 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:** ZNFD955  
**EUT Type:** Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID  
**Model name(s):** LG-D955  
**Additional Model name(s):** LGD955, D955  
**Date(s) of Tests:** November 12, 2013 ~ November 25, 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

<b>EUT Type</b>	Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	
<b>FCC Model Name</b>	LG-D955	
<b>Additional FCC Model Name</b>	LGD955, D955	
<b>Power Supply</b>	DC 3.8 V	
<b>Battery type</b>	Li-ion Battery(Standard)	
<b>Frequency Range</b>	TX	: 2412 MHz~2462 MHz, 5745 MHz~5825 MHz_20 MHz, 5755 MHz~5795 MHz_40 MHz 5775 MHz_80 MHz
	RX	: 2412 MHz~2462 MHz, 5745 MHz~5825 MHz_20 MHz, 5755 MHz~5795 MHz_40 MHz 5775 MHz_80 MHz
<b>Max. RF Output Power</b>	Peak	Wi-Fi 802.11b (19.63 dBm) / Wi-Fi 802.11g (23.62 dBm)/ Wi-Fi 802.11n (2.4 GHz) (24.24 dBm) / Wi-Fi 802.11ac (2.4 GHz) (22.94 dBm) / Wi-Fi 802.11a (5.8 GHz) (23.39 dBm)/ Wi-Fi 802.11n_20 MHz BW (5.8 GHz) (23.62 dBm) / Wi-Fi 802.11n_40 MHz BW (5.8 GHz) (17.70 dBm) / Wi-Fi 802.11ac_20 MHz BW (5.8 GHz) (21.86 dBm) / Wi-Fi 802.11ac_40 MHz BW (5.8 GHz) (16.48 dBm) / Wi-Fi 802.11ac_80 MHz BW (5.8 GHz) (15.98 dBm)
	Average	Wi-Fi 802.11b (16.00 dBm) / Wi-Fi 802.11g (12.50 dBm)/ Wi-Fi 802.11n (2.4 GHz) (12.50 dBm) / Wi-Fi 802.11ac (2.4 GHz) (11.50 dBm) / Wi-Fi 802.11a (5.8 GHz) (11.63 dBm)/ Wi-Fi 802.11n_20 MHz BW (5.8 GHz) (10.78 dBm) / Wi-Fi 802.11n_40 MHz BW (5.8 GHz) (10.01 dBm) / Wi-Fi 802.11ac_20 MHz BW (5.8 GHz) (9.74 dBm) / Wi-Fi 802.11ac_40 MHz BW (5.8 GHz) (8.86 dBm) / Wi-Fi 802.11ac_80 MHz BW (5.8 GHz) (8.33 dBm)
<b>Modulation Type</b>	DSSS/CCK(802.11b), OFDM(802.11a, 802.11g, 802.11n, 802.11ac)	
<b>Antenna Specification</b>	Manufacturer: KOMATECH Co., Ltd. Antenna type: PIFA Antenna Peak Gain : 0.404 dBi (2.4 GHz Band), -8.243 dBi (5.8 GHz Band)	

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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. For 802.11ac, KDB644545 D01 v01r01 dated April 08, 2013.

#### 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."

## 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

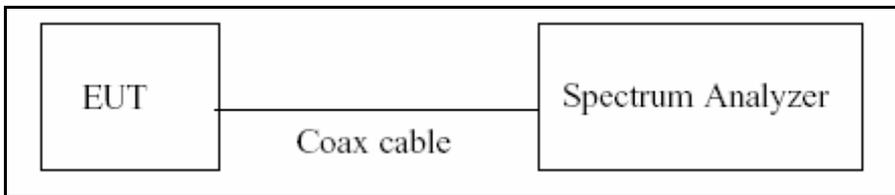
Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§15.247(a)(2)	> 500 kHz	CONDUCTED	PASS
Conducted Maximum Peak Output Power	§15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	§15.247(d)	Conducted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

## 8. TEST RESULT

### 8.1 DUTY CYCLE(802.11a/b/g/n/ac)

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 <sub>on</sub> (ms)	T <sub>total</sub> (ms)	Duty Cycle	Duty Cycle Factor (dB)
2.4 GHz Band 802.11b	1	12.390	12.510	0.99040767	0.042
	2	6.180	6.300	0.98095238	0.084
	5.5	2.313	2.418	0.95657568	0.193
	11	1.203	1.302	0.92396313	0.343
2.4 GHz Band 802.11g and 5.8 GHz Band 802.11a	6	2.060	2.165	0.95150115	0.216
	9	1.380	1.485	0.92929293	0.318
	12	1.041	1.146	0.90837696	0.417
	18	0.702	0.806	0.87096774	0.600
	24	0.530	0.632	0.83860759	0.764
	36	0.363	0.465	0.78064516	1.075
	48	0.275	0.376	0.73138298	1.359
2.4 GHz Band 802.11n_20 MHz BW and 5.8 GHz Band 802.11n_20 MHz BW	54	0.247	0.349	0.70773639	1.501
	6.5	1.925	2.030	0.94827586	0.231
	13	0.975	1.080	0.90277778	0.444
	19.5	0.662	0.766	0.86422977	0.634
	26	0.507	0.610	0.83114754	0.803
	39	0.351	0.453	0.77483444	1.108
	52	0.271	0.374	0.72459893	1.399
2.4 GHz & 5.8 GHz Band 802.11n_40 MHz BW	58.5	0.246	0.348	0.70689655	1.506
	65	0.227	0.329	0.68996960	1.612
	13.5	0.942	1.044	0.90229885	0.446
	27	0.491	0.592	0.82939189	0.812
	40.5	0.339	0.440	0.77045455	1.133
	54	0.263	0.364	0.72252747	1.411
	81	0.188	0.288	0.65277778	1.852
	108	0.151	0.252	0.59920635	2.224
2.4 GHz Band 802.11ac_20 MHz BW and 5.8 GHz Band 802.11ac_20 MHz BW	121.5	0.139	0.240	0.57916667	2.372
	135	0.128	0.228	0.56140351	2.507
	6.5	1.925	2.030	0.94827586	0.231
	13	0.986	1.088	0.90625000	0.428
	19.5	0.670	0.772	0.86787565	0.615
	26	0.516	0.616	0.83766234	0.769
	39	0.355	0.456	0.77850877	1.087
	52	0.280	0.380	0.73684211	1.326
	58.5	0.251	0.352	0.71306818	1.469
65	0.231	0.332	0.69578313	1.575	
78	0.199	0.300	0.66333333	1.783	

Mode	Data Rate	T <sub>on</sub> (ms)	T <sub>total</sub> (ms)	Duty Cycle	Duty Cycle Factor (dB)
5.8 GHz Band 802.11ac_40 MHz BW	13.5	0.950	1.052	0.90304183	0.443
	27	0.494	0.596	0.82885906	0.815
	40.5	0.343	0.444	0.77252252	1.121
	54	0.267	0.368	0.72554348	1.393
	81	0.192	0.292	0.65753425	1.821
	108	0.156	0.256	0.60937500	2.151
	121.5	0.143	0.244	0.58606557	2.321
	135	0.131	0.232	0.56465517	2.482
	162	0.115	0.216	0.53240741	2.738
	180	0.111	0.212	0.52358491	2.810
5.8 GHz Band 802.11ac_80 MHz BW	29.3	0.458	0.560	0.81785714	0.873
	58.5	0.251	0.352	0.71306818	1.469
	87.8	0.179	0.280	0.63928571	1.943
	117	0.148	0.248	0.59677419	2.242
	175.5	0.112	0.212	0.52830189	2.771
	234	0.096	0.196	0.48979592	3.100
	263.3	0.087	0.188	0.46276596	3.346
	292.5	0.084	0.184	0.45652174	3.405
	351	0.075	0.176	0.42613636	3.705
	390	0.072	0.172	0.41860465	3.782

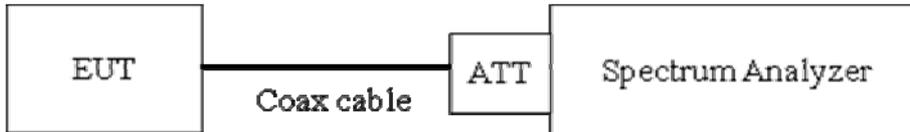
## 8.2 6dB BANDWIDTH (802.11a/b/g/n/ac)

### 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 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

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

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**TEST RESULTS**

**2.4 GHz Band**

**Conducted 6dB Bandwidth Measurements for 802.11b**

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	10.02	0.500	Pass
2437	6	9.13	0.500	Pass
2462	11	9.56	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	16.36	0.500	Pass
2437	6	16.36	0.500	Pass
2462	11	16.38	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	17.59	0.500	Pass
2437	6	17.60	0.500	Pass
2462	11	17.62	0.500	Pass

**Conducted 6 dB Bandwidth Measurements for 802.11ac\_20 MHz BW**

802.11ac Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	17.59	0.500	Pass
2437	6	17.62	0.500	Pass
2462	11	17.63	0.500	Pass

**5.8 GHz Band**

Conducted 6 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.39	0.500	Pass
5785	157	16.42	0.500	Pass
5825	165	16.38	0.500	Pass

Conducted 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.			
5745	149	17.66	0.500	Pass
5785	157	17.65	0.500	Pass
5825	165	17.62	0.500	Pass

Conducted 6 dB Bandwidth Measurements for 802.11n\_40 MHz BW

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.35	0.500	Pass
5795	159	36.37	0.500	Pass

Conducted 6 dB Bandwidth Measurements for 802.11ac\_20 MHz BW

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.63	0.500	Pass
5785	157	17.67	0.500	Pass
5825	165	17.60	0.500	Pass

Conducted 6 dB Bandwidth Measurements for 802.11ac\_40 MHz BW

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.39	0.500	Pass
5795	159	36.33	0.500	Pass

Conducted 6 dB Bandwidth Measurements for 802.11ac\_80 MHz BW

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	75.57	0.500	Pass

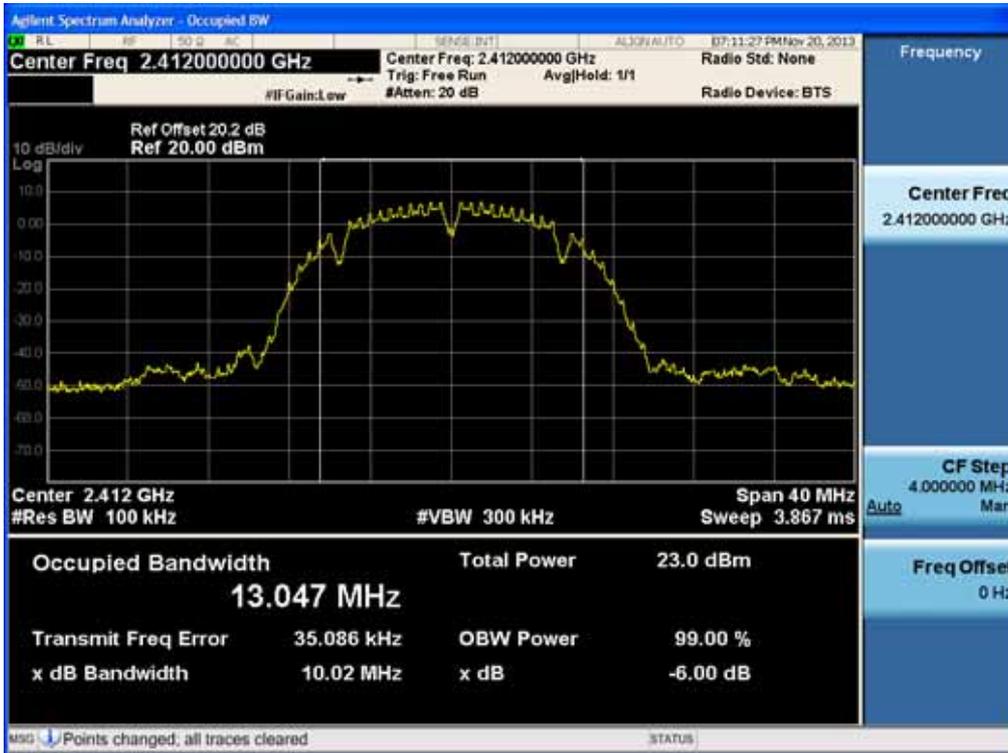
Note : In order to simplify the report, attached plots were only the most wide 6 dB BW channel.



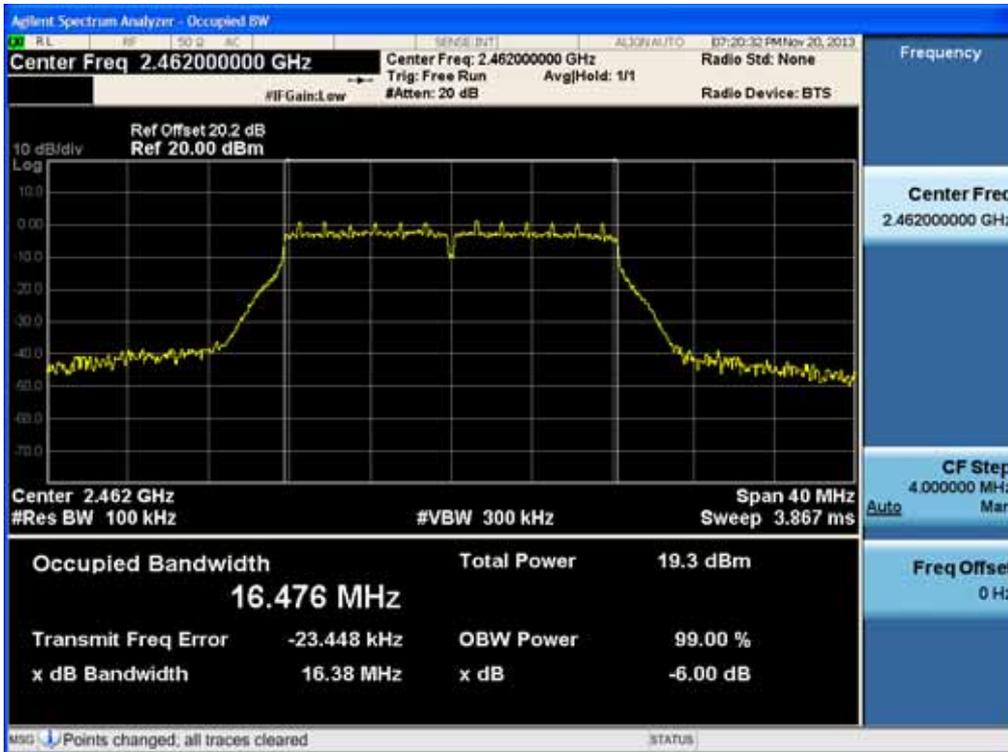
RESULT PLOTS

2.4 GHz Band

6dB Bandwidth plot (802.11b-CH 1)

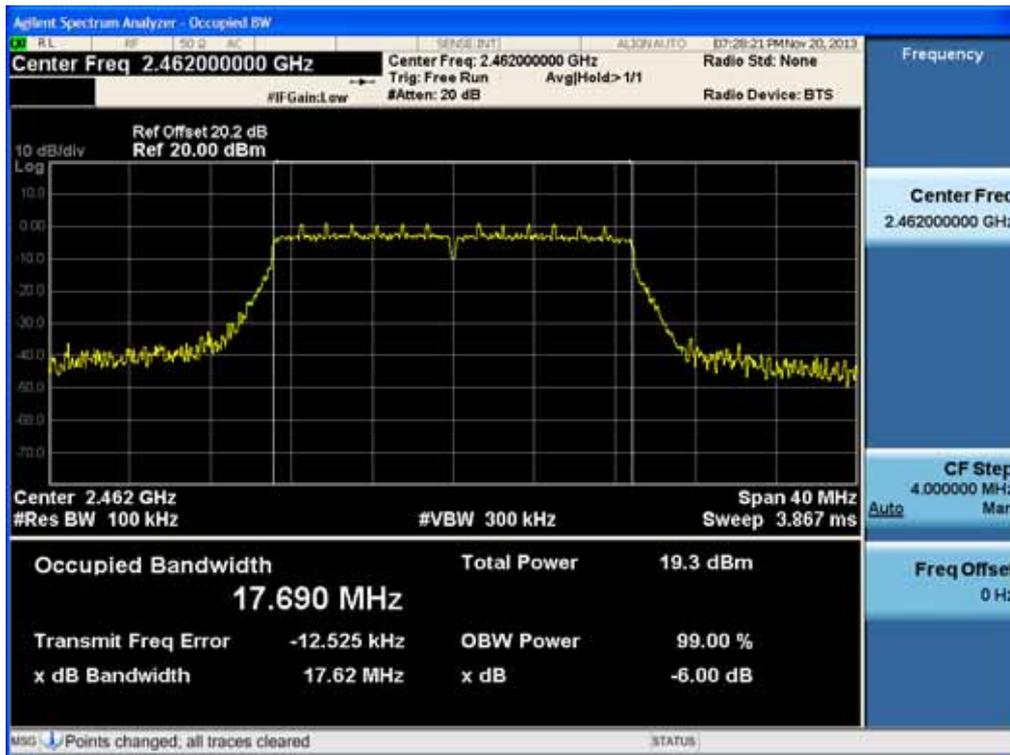


6dB Bandwidth plot (802.11g-CH 11)

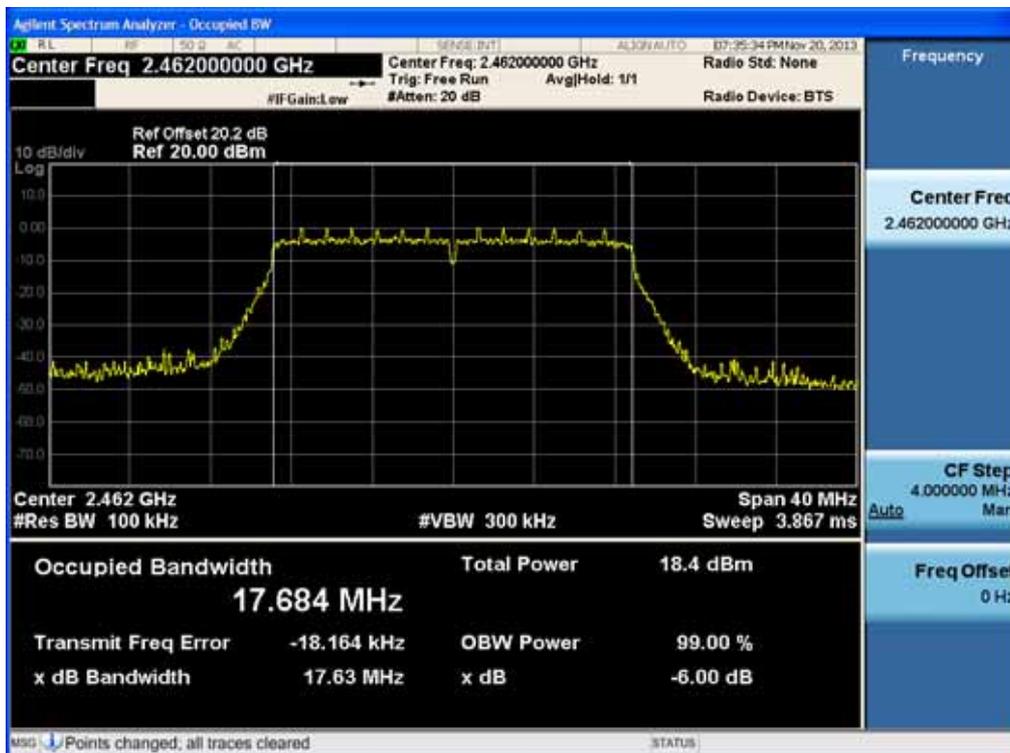


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### 6dB Bandwidth plot (802.11n-CH 11)



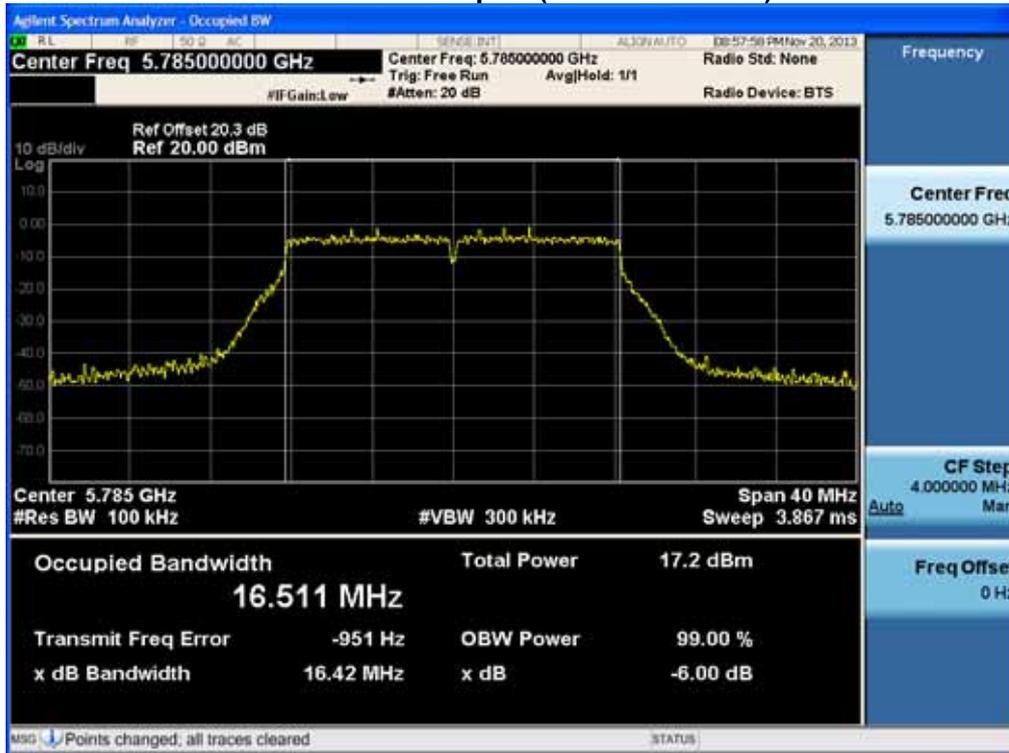
### Conducted Output Power (802.11ac-CH 11)



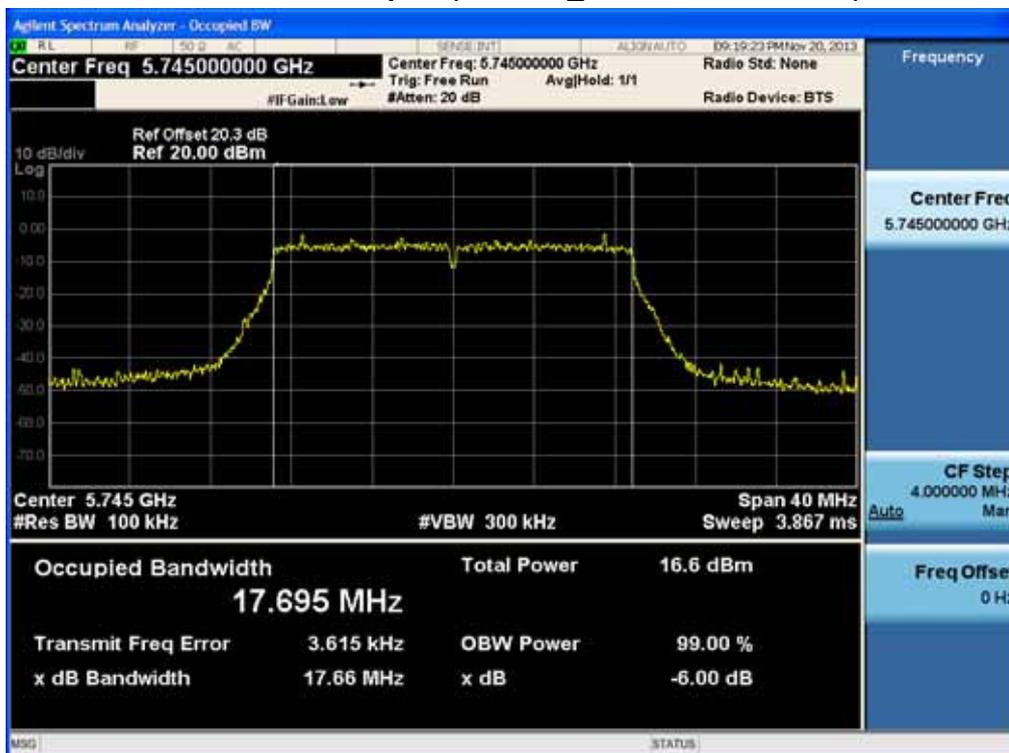
FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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## 5.8 GHz Band

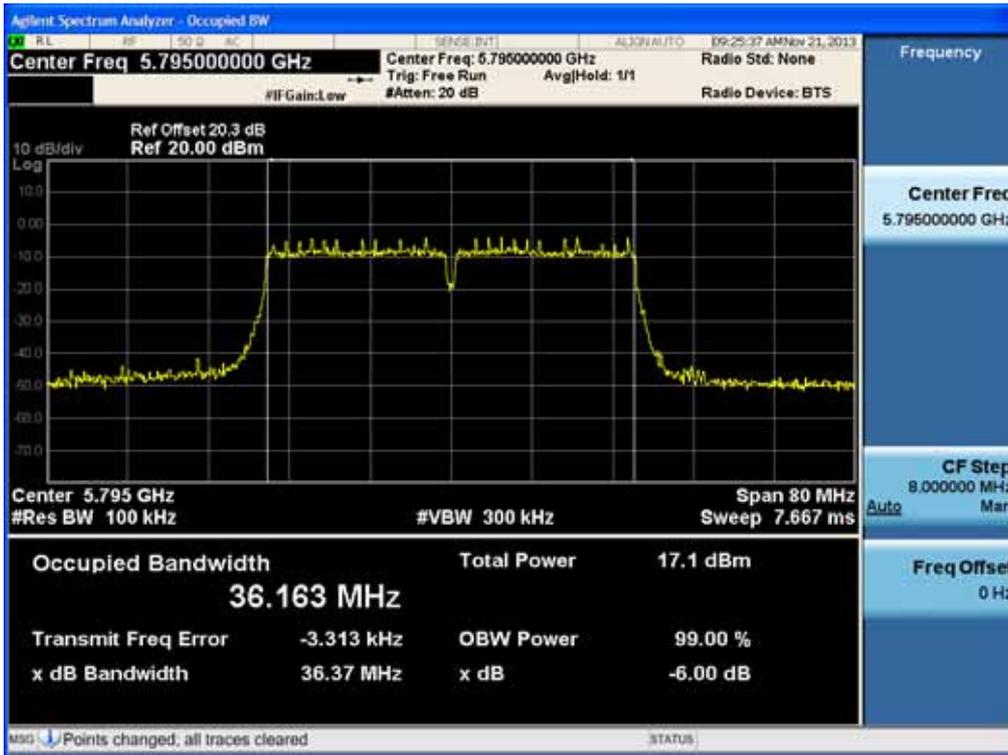
6dB Bandwidth plot (802.11a-CH 157)



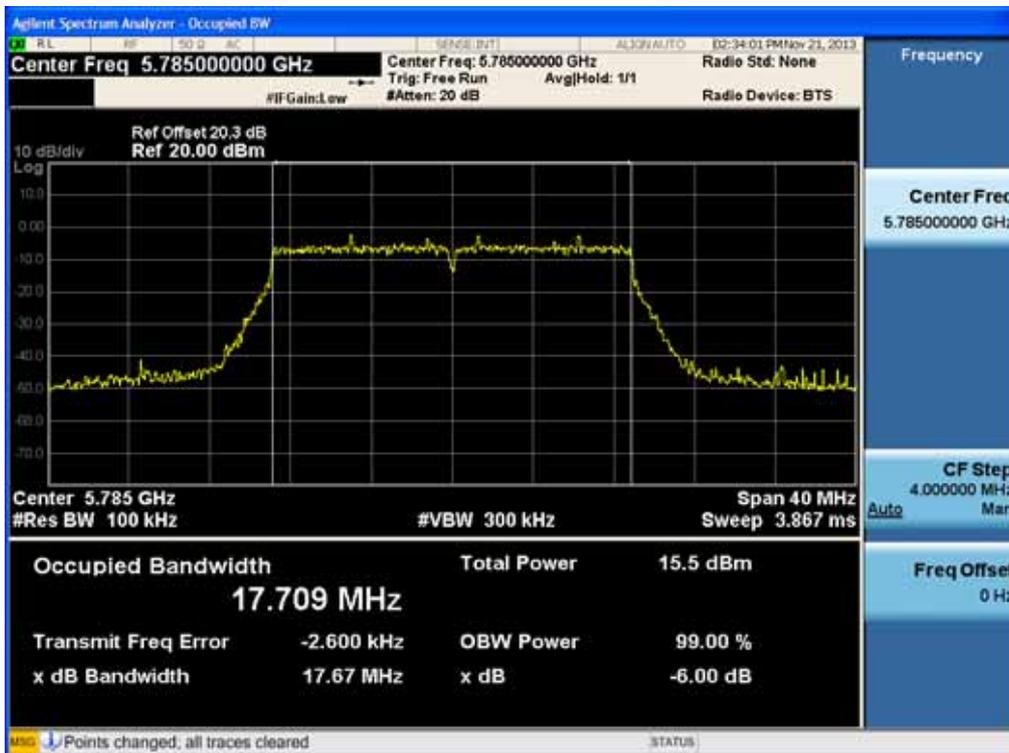
6dB Bandwidth plot (802.11n\_20 MHz BW-CH 149)



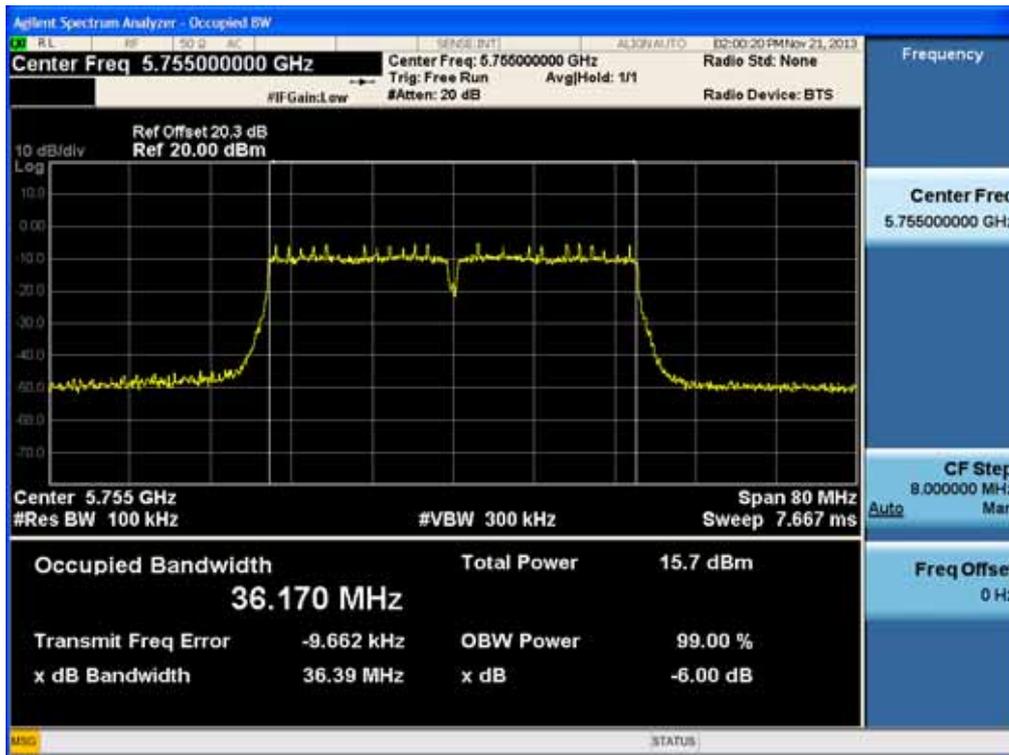
### 6dB Bandwidth plot (802.11n\_40 MHz BW-CH 159)



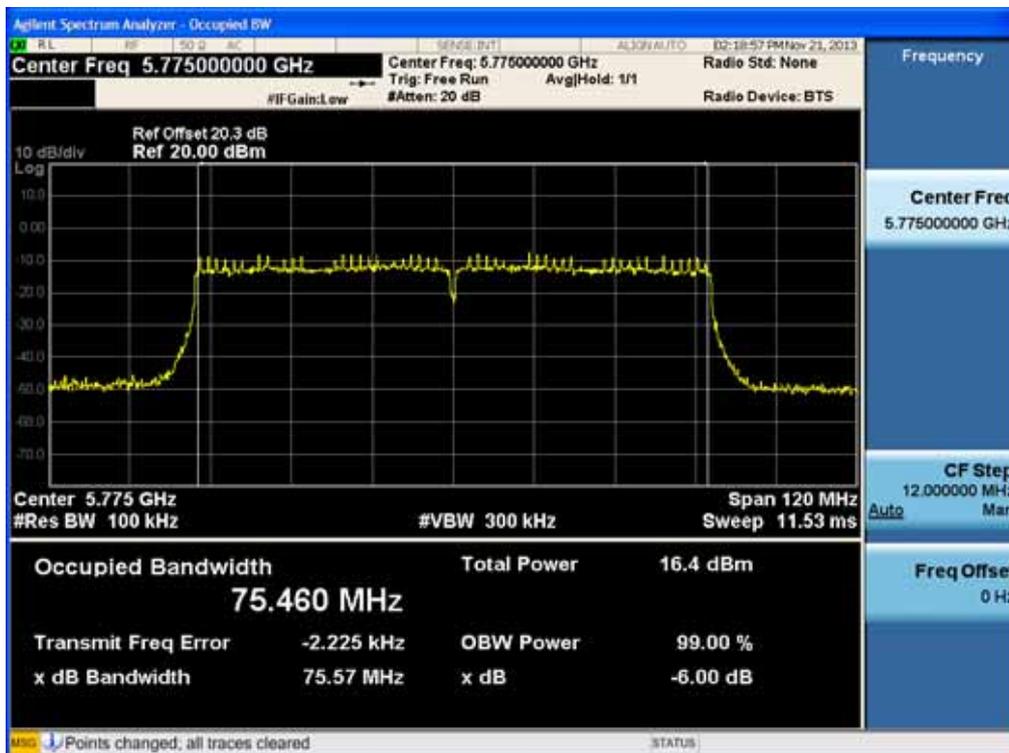
### 6dB Bandwidth plot (802.11ac\_20 MHz BW-CH 157)



### 6dB Bandwidth plot (802.11ac\_40 MHz BW-CH 151)



### 6dB Bandwidth plot (802.11ac\_80 MHz BW-CH 155)



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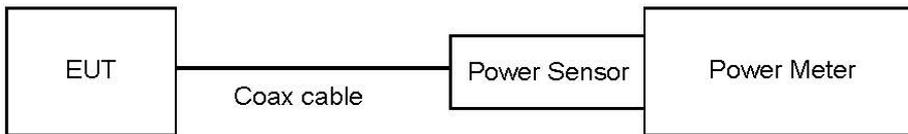
### 8.3 OUTPUT POWER (802.11a/b/g/n/ac)

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

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

**The maximum permissible conducted output power is 1 Watt.**

#### TEST CONFIGURATION(20 MHz BW)



#### TEST PROCEDURE(20 MHz BW)

- Peak Power ( Procedure 9.1.3 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 :

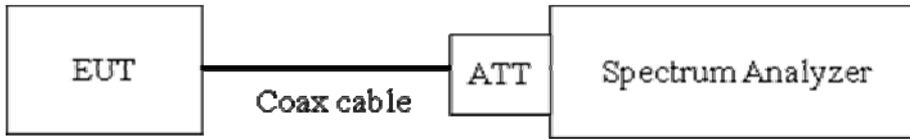
1. We apply to the offset in the 2.4 GHz and 5.8 GHz range that was rounded off to the closest tenth dB. So, 20.2 dB is offset for 2.4 GHz Band and 20.3 dB is offset for 5.8 GHz Band.

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
5.8 GHz	5745	20.31
	5755	20.30
	5785	20.29
	5795	20.26
	5825	20.28

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

### TEST CONFIGURATION(40 MHz & 80 MHz BW)



### TEST PROCEDURE(40 MHz & 80 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.

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### 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 and 5.8 GHz range that was rounded off to the closest tenth dB. So, 10.2 dB is offset for 2.4 GHz Band and 10.3 dB is offset for 5.8 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
5.8 GHz	5745	20.31
	5755	20.30
	5785	20.29
	5795	20.26
	5825	20.28

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

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**TEST RESULTS-Peak**

**2.4 GHz Band**

**Conducted Output Power Measurements (802.11b Mode)**

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	1	18.93	30
		2	18.90	30
		5.5	18.85	30
		11	19.00	30
2437	6	1	19.51	30
		2	19.47	30
		5.5	19.62	30
		11	19.63	30
2462	11	1	19.51	30
		2	19.22	30
		5.5	19.19	30
		11	19.29	30

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Conducted Output Power Measurements (802.11g Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6	21.76	30
		9	21.98	30
		12	22.45	30
		18	22.10	30
		24	22.44	30
		36	21.97	30
		48	22.97	30
		54	23.24	30
2437	6	6	22.43	30
		9	22.45	30
		12	22.85	30
		18	23.00	30
		24	22.91	30
		36	22.43	30
		48	23.62	30
		54	22.99	30
2462	11	6	22.15	30
		9	22.88	30
		12	23.16	30
		18	22.57	30
		24	22.27	30
		36	22.14	30
		48	23.30	30
		54	22.18	30

Conducted Output Power Measurements (802.11n Mode)

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6.5	22.46	30
		13	22.94	30
		19.5	23.72	30
		26	22.49	30
		39	22.79	30
		52	23.05	30
		58.5	23.14	30
		65	22.77	30
2437	6	6.5	22.39	30
		13	24.24	30
		19.5	23.98	30
		26	23.11	30
		39	23.22	30
		52	23.59	30
		58.5	23.55	30
		65	23.26	30
2462	11	6.5	22.53	30
		13	24.20	30
		19.5	23.69	30
		26	22.82	30
		39	22.57	30
		52	22.97	30
		58.5	23.45	30
		65	23.21	30

Conducted Output Power Measurements (802.11ac Mode)

802.11ac Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6.5	21.92	30
		13	22.47	30
		19.5	21.95	30
		26	22.08	30
		39	21.68	30
		52	22.47	30
		58.5	22.25	30
		65	22.10	30
		78	21.87	30
2437	6	6.5	22.44	30
		13	22.70	30
		19.5	22.37	30
		26	22.73	30
		39	22.43	30
		52	22.94	30
		58.5	22.71	30
		65	22.82	30
		78	22.46	30
2462	11	6.5	22.24	30
		13	21.90	30
		19.5	22.16	30
		26	22.58	30
		39	22.08	30
		52	22.63	30
		58.5	22.56	30
		65	22.29	30
		78	22.36	30

**5.8 GHz Band**

**Conducted Output Power Measurements (802.11a Mode: 5745~5825)**

802.11a Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
5745	149	6	22.52	30
		9	22.68	30
		12	22.75	30
		18	22.69	30
		24	22.26	30
		36	22.11	30
		48	23.39	30
		54	22.76	30
5785	157	6	22.34	30
		9	22.45	30
		12	22.63	30
		18	22.34	30
		24	22.35	30
		36	21.92	30
		48	22.86	30
		54	22.52	30
5825	165	6	22.14	30
		9	22.16	30
		12	22.28	30
		18	22.23	30
		24	22.05	30
		36	21.62	30
		48	22.66	30
		54	22.34	30

Conducted Output Power Measurements (802.11n\_20 MHz BW Mode: 5745~5825)

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
5745	149	6.5	22.00	30
		13	23.62	30
		19.5	23.60	30
		26	22.33	30
		39	21.93	30
		52	22.21	30
		58.5	22.45	30
		65	22.19	30
5785	157	6.5	22.07	30
		13	22.38	30
		19.5	21.85	30
		26	22.01	30
		39	22.02	30
		52	22.08	30
		58.5	22.15	30
		65	21.98	30
5825	165	6.5	21.70	30
		13	21.46	30
		19.5	22.57	30
		26	21.77	30
		39	21.92	30
		52	21.99	30
		58.5	21.81	30
		65	22.35	30

Conducted Output Power Measurements (802.11n\_40 MHz BW Mode: 5755~5795)

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
5755	151	13.5	17.31	30
		27	17.05	30
		40.5	17.00	30
		54	17.22	30
		81	17.10	30
		108	17.29	30
		121.5	16.90	30
		135	17.05	30
5795	159	13.5	17.60	30
		27	17.21	30
		40.5	17.25	30
		54	17.70	30
		81	17.41	30
		108	16.67	30
		121.5	17.46	30
		135	16.78	30

Conducted Output Power Measurements (802.11ac\_20 MHz BW Mode: 5745~5825)

802.11ac Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
5745	149	6.5	21.44	30
		13	21.33	30
		19.5	21.09	30
		26	21.25	30
		39	21.33	30
		52	21.46	30
		58.5	21.86	30
		65	20.87	30
		78	21.06	30
5785	157	6.5	21.54	30
		13	21.47	30
		19.5	21.07	30
		26	21.07	30
		39	20.70	30
		52	20.84	30
		58.5	21.04	30
		65	20.73	30
		78	20.94	30
5825	165	6.5	20.54	30
		13	21.30	30
		19.5	20.92	30
		26	21.02	30
		39	20.58	30
		52	21.19	30
		58.5	21.63	30
		65	20.85	30
		78	20.56	30

Conducted Output Power Measurements (802.11ac\_40 MHz BW Mode: 5755~5795)

802.11ac Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
5755	151	13.5	16.09	30
		27	16.00	30
		40.5	15.78	30
		54	16.22	30
		81	16.04	30
		108	16.19	30
		121.5	16.22	30
		135	15.90	30
		162	16.13	30
		180	16.03	30
5795	159	13.5	15.85	30
		27	16.10	30
		40.5	15.95	30
		54	16.46	30
		81	16.28	30
		108	16.48	30
		121.5	15.80	30
		135	16.29	30
		162	15.57	30
		180	15.68	30

Conducted Output Power Measurements (802.11ac\_80 MHz BW Mode: 5775)

802.11ac Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
5775	155	29.3	15.98	30
		58.5	15.62	30
		87.8	15.45	30
		117	15.89	30
		175.5	15.62	30
		234	15.66	30
		263.3	15.48	30
		292.5	15.49	30
		351	15.45	30
		390	15.51	30



**TEST RESULTS-Average**

**2.4 GHz Band**

**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	15.34	0.042	15.38	30
		2	15.27	0.084	15.36	30
		5.5	15.10	0.193	15.30	30
		11	15.07	0.343	15.41	30
2437	6	1	15.96	0.042	16.00	30
		2	15.89	0.084	15.97	30
		5.5	15.79	0.193	15.98	30
		11	15.62	0.343	15.96	30
2462	11	1	15.62	0.042	15.66	30
		2	15.52	0.084	15.61	30
		5.5	15.36	0.193	15.55	30
		11	15.32	0.343	15.67	30

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**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	11.59	0.216	11.81	30
		9	11.39	0.318	11.70	30
		12	11.41	0.417	11.83	30
		18	11.18	0.600	11.78	30
		24	11.08	0.764	11.85	30
		36	10.80	1.075	11.87	30
		48	10.68	1.359	12.03	30
		54	10.31	1.501	11.81	30
2437	6	6	12.09	0.216	12.30	30
		9	11.91	0.318	12.23	30
		12	11.84	0.417	12.26	30
		18	11.85	0.600	12.45	30
		24	11.61	0.764	12.37	30
		36	11.23	1.075	12.31	30
		48	11.14	1.359	12.50	30
		54	10.92	1.501	12.42	30
2462	11	6	11.66	0.216	11.87	30
		9	11.63	0.318	11.94	30
		12	11.62	0.417	12.04	30
		18	11.33	0.600	11.93	30
		24	11.13	0.764	11.89	30
		36	10.85	1.075	11.93	30
		48	10.78	1.359	12.14	30
		54	10.55	1.501	12.05	30

**Conducted Output Power Measurements (802.11n Mode)**

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	11.45	0.231	11.68	30
		13	11.29	0.444	11.73	30
		19.5	11.10	0.634	11.73	30
		26	10.90	0.803	11.70	30
		39	10.76	1.108	11.87	30
		52	10.54	1.399	11.94	30
		58.5	10.40	1.506	11.90	30
		65	10.31	1.612	11.92	30
2437	6	6.5	11.91	0.231	12.14	30
		13	11.81	0.444	12.25	30
		19.5	11.71	0.634	12.35	30
		26	11.48	0.803	12.29	30
		39	11.32	1.108	12.43	30
		52	11.07	1.399	12.47	30
		58.5	10.99	1.506	12.50	30
		65	10.87	1.612	12.48	30
2462	11	6.5	11.59	0.231	11.82	30
		13	11.50	0.444	11.95	30
		19.5	11.25	0.634	11.88	30
		26	11.17	0.803	11.98	30
		39	10.90	1.108	12.01	30
		52	10.74	1.399	12.14	30
		58.5	10.67	1.506	12.18	30
		65	10.56	1.612	12.17	30

**Conducted Output Power Measurements (802.11ac Mode)**

802.11ac 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	10.34	0.231	10.57	30
		13	10.39	0.428	10.82	30
		19.5	10.25	0.615	10.87	30
		26	10.08	0.769	10.84	30
		39	9.76	1.087	10.85	30
		52	9.56	1.326	10.89	30
		58.5	9.47	1.469	10.93	30
		65	9.39	1.575	10.96	30
		78	9.30	1.783	11.08	30
2437	6	6.5	11.04	0.231	11.27	30
		13	10.96	0.428	11.39	30
		19.5	10.60	0.615	11.22	30
		26	10.61	0.769	11.37	30
		39	10.26	1.087	11.35	30
		52	10.10	1.326	11.43	30
		58.5	10.03	1.469	11.50	30
		65	9.91	1.575	11.48	30
		78	9.68	1.783	11.47	30
2462	11	6.5	10.58	0.231	10.81	30
		13	10.36	0.428	10.79	30
		19.5	10.34	0.615	10.96	30
		26	10.24	0.769	11.01	30
		39	9.98	1.087	11.07	30
		52	9.77	1.326	11.09	30
		58.5	9.77	1.469	11.23	30
		65	9.71	1.575	11.28	30
		78	9.52	1.783	11.31	30

**5.8 GHz Band**

**Conducted Output Power Measurements (802.11a Mode: 5745~5825)**

802.11a Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
5745	149	6	11.33	0.216	11.54	30
		9	11.30	0.318	11.61	30
		12	11.21	0.417	11.62	30
		18	11.02	0.600	11.62	30
		24	10.77	0.764	11.54	30
		36	10.50	1.075	11.58	30
		48	10.27	1.359	11.63	30
		54	10.09	1.501	11.59	30
5785	157	6	11.15	0.216	11.37	30
		9	11.08	0.318	11.40	30
		12	11.05	0.417	11.47	30
		18	10.84	0.600	11.44	30
		24	10.66	0.764	11.42	30
		36	10.36	1.075	11.43	30
		48	10.14	1.359	11.50	30
		54	9.86	1.501	11.36	30
5825	165	6	10.95	0.216	11.17	30
		9	10.87	0.318	11.19	30
		12	10.80	0.417	11.22	30
		18	10.65	0.600	11.25	30
		24	10.46	0.764	11.22	30
		36	10.13	1.075	11.20	30
		48	9.93	1.359	11.29	30
		54	9.68	1.501	11.18	30

Conducted Output Power Measurements (802.11n\_20 MHz BW Mode: 5745~5825)

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
5745	149	6.5	10.35	0.231	10.58	30
		13	10.30	0.444	10.74	30
		19.5	10.11	0.634	10.74	30
		26	9.98	0.803	10.78	30
		39	9.61	1.108	10.72	30
		52	9.28	1.399	10.68	30
		58.5	9.21	1.506	10.72	30
		65	9.08	1.612	10.69	30
5785	157	6.5	10.29	0.231	10.53	30
		13	10.17	0.444	10.62	30
		19.5	9.82	0.634	10.45	30
		26	9.70	0.803	10.51	30
		39	9.42	1.108	10.53	30
		52	9.06	1.399	10.46	30
		58.5	9.02	1.506	10.53	30
		65	8.88	1.612	10.49	30
5825	165	6.5	10.06	0.231	10.29	30
		13	9.82	0.444	10.27	30
		19.5	9.71	0.634	10.34	30
		26	9.56	0.803	10.36	30
		39	9.16	1.108	10.27	30
		52	8.94	1.399	10.33	30
		58.5	8.91	1.506	10.41	30
		65	8.79	1.612	10.40	30

Conducted Output Power Measurements (802.11n\_40 MHz BW Mode: 5755~5795)

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
5755	151	13.5	9.26	0.446	9.70	30
		27	8.85	0.812	9.66	30
		40.5	8.54	1.133	9.67	30
		54	8.20	1.411	9.61	30
		81	7.61	1.852	9.46	30
		108	7.42	2.224	9.64	30
		121.5	6.99	2.372	9.36	30
		135	6.97	2.507	9.48	30
5795	159	13.5	9.56	0.446	10.01	30
		27	9.15	0.812	9.96	30
		40.5	8.84	1.133	9.98	30
		54	8.60	1.411	10.01	30
		81	7.93	1.852	9.78	30
		108	6.91	2.224	9.13	30
		121.5	7.49	2.372	9.87	30
		135	6.72	2.507	9.23	30



Conducted Output Power Measurements (802.11ac\_20 MHz BW Mode: 5745~5825)

802.11ac Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
5745	149	6.5	9.44	0.231	9.67	30
		13	9.28	0.428	9.71	30
		19.5	9.12	0.615	9.74	30
		26	8.97	0.769	9.74	30
		39	8.62	1.087	9.70	30
		52	8.34	1.326	9.67	30
		58.5	8.20	1.469	9.67	30
		65	8.13	1.575	9.70	30
		78	7.91	1.783	9.69	30
5785	157	6.5	9.25	0.231	9.48	30
		13	9.16	0.428	9.59	30
		19.5	9.01	0.615	9.62	30
		26	8.78	0.769	9.55	30
		39	8.43	1.087	9.52	30
		52	8.18	1.326	9.50	30
		58.5	8.10	1.469	9.57	30
		65	7.94	1.575	9.52	30
		78	7.78	1.783	9.56	30
5825	165	6.5	9.10	0.231	9.33	30
		13	9.00	0.428	9.42	30
		19.5	8.73	0.615	9.35	30
		26	8.56	0.769	9.33	30
		39	8.32	1.087	9.41	30
		52	8.04	1.326	9.36	30
		58.5	8.00	1.469	9.46	30
		65	7.78	1.575	9.35	30
		78	7.58	1.783	9.37	30



Conducted Output Power Measurements (802.11ac\_40 MHz BW Mode: 5755~5795)

802.11ac Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
5755	151	13.5	8.10	0.443	8.54	30
		27	7.94	0.815	8.75	30
		40.5	7.45	1.121	8.57	30
		54	7.19	1.393	8.58	30
		81	6.70	1.821	8.52	30
		108	6.47	2.151	8.62	30
		121.5	6.45	2.321	8.77	30
		135	6.05	2.482	8.53	30
		162	5.90	2.738	8.64	30
		180	5.86	2.810	8.67	30
5795	159	13.5	7.91	0.443	8.35	30
		27	7.99	0.815	8.80	30
		40.5	7.63	1.121	8.75	30
		54	7.47	1.393	8.86	30
		81	7.02	1.821	8.84	30
		108	6.60	2.151	8.75	30
		121.5	6.05	2.321	8.37	30
		135	6.33	2.482	8.81	30
		162	5.45	2.738	8.19	30
		180	5.51	2.810	8.32	30

FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNFD955

Conducted Output Power Measurements (802.11ac\_80 MHz BW Mode: 5755)

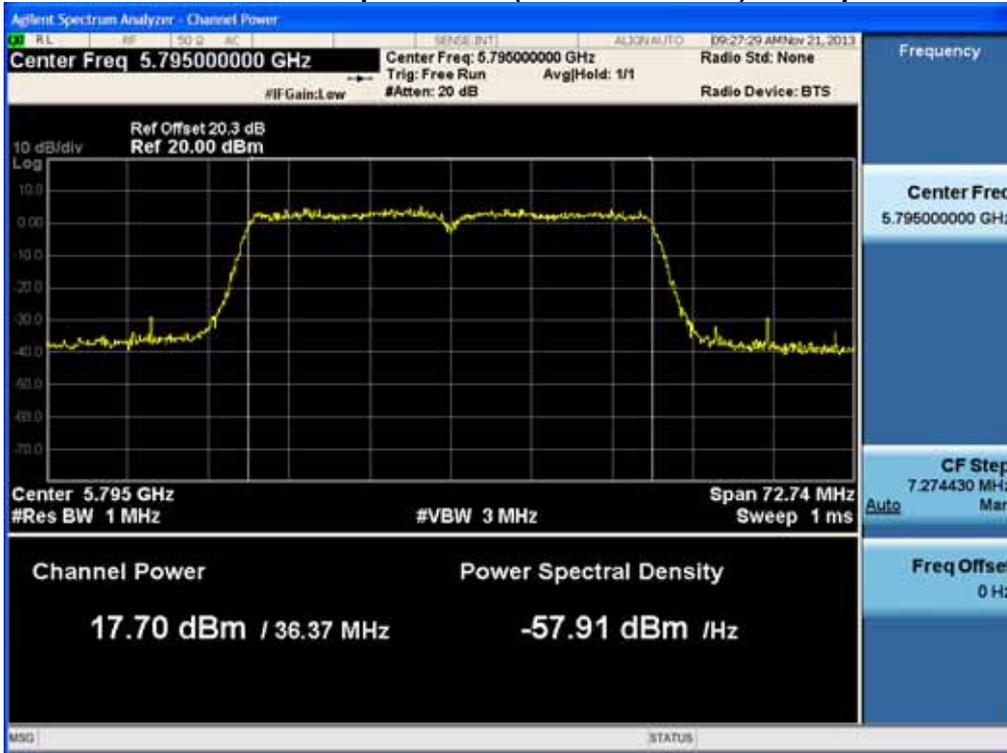
802.11ac Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
5775	155	29.3	7.45	0.873	8.33	30
		58.5	6.81	1.469	8.28	30
		87.8	6.32	1.943	8.26	30
		117	5.95	2.242	8.19	30
		175.5	5.46	2.771	8.23	30
		234	5.19	3.100	8.29	30
		263.3	4.86	3.346	8.21	30
		292.5	4.81	3.405	8.22	30
		351	4.47	3.705	8.17	30
		390	4.44	3.782	8.22	30

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

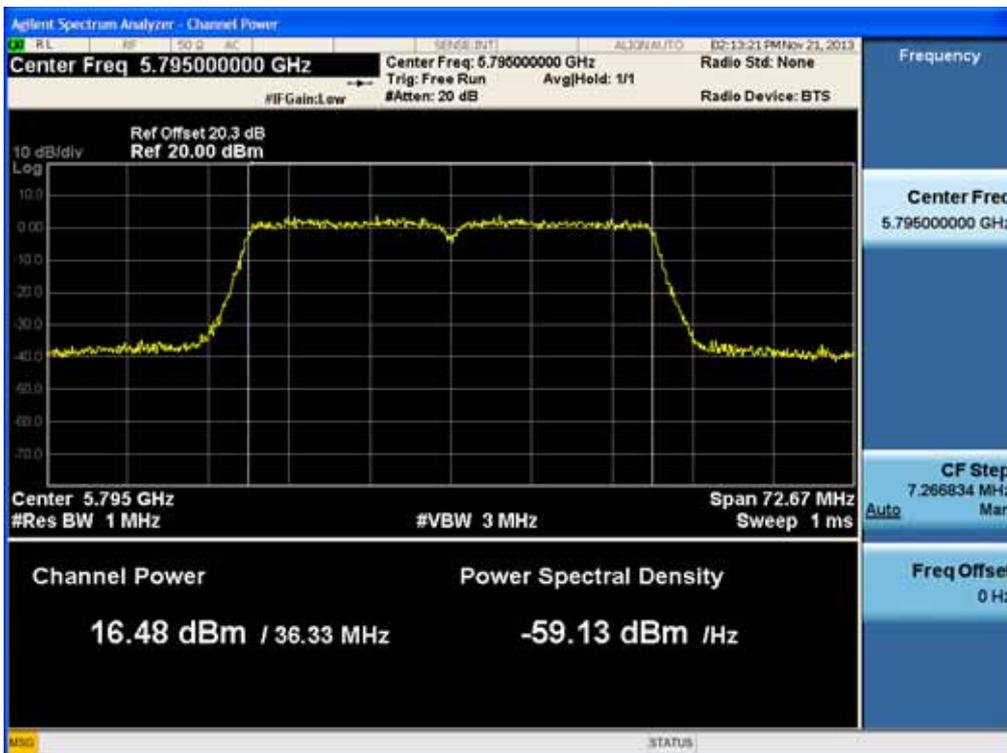


**RESULT PLOTS-Peak**  
**40 MHz BW**  
**(5755 MHz ~5795 MHz)**

**Conducted Output Power (802.11n-CH 159) 54 Mbps**



**Conducted Output Power (802.11ac-CH 159) 108 Mbps**



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80 MHz BW  
(5755 MHz)

**Conducted Output Power (802.11ac-CH 155) 29.3 Mbps**



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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**RESULT PLOTS-Average**  
**40 MHz BW**  
**(5755 MHz ~5795 MHz)**

**Conducted Output Power (802.11n-CH 159) 13.5 Mbps**



**Conducted Output Power (802.11ac-CH 159) 54 Mbps**



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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80 MHz BW  
(5755 MHz)

**Conducted Output Power (802.11ac-CH 155) 29.3 Mbps**



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNF0955

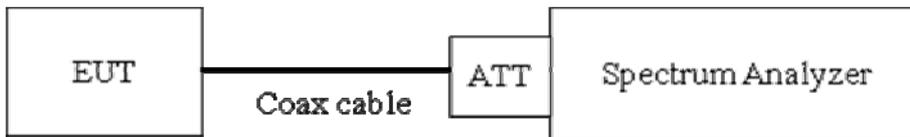
## 8.4 POWER SPECTRAL DENSITY (802.11a/b/g/n/ac)

### Test Requirements and limit, §15.247(e)

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

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

### TEST CONFIGURATION



### TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074, 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 and 5.8 GHz range that was rounded off to the closest tenth dB. So, 20.2 dB is offset for 2.4 GHz Band and 20.3 dB is offset for 5.8 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	20.21
	2437	20.24
	2462	20.24
5.8 GHz	5745	20.31
	5755	20.30
	5785	20.29
	5795	20.26
	5825	20.28

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

**TEST RESULTS**

**Conducted Power Density Measurements**

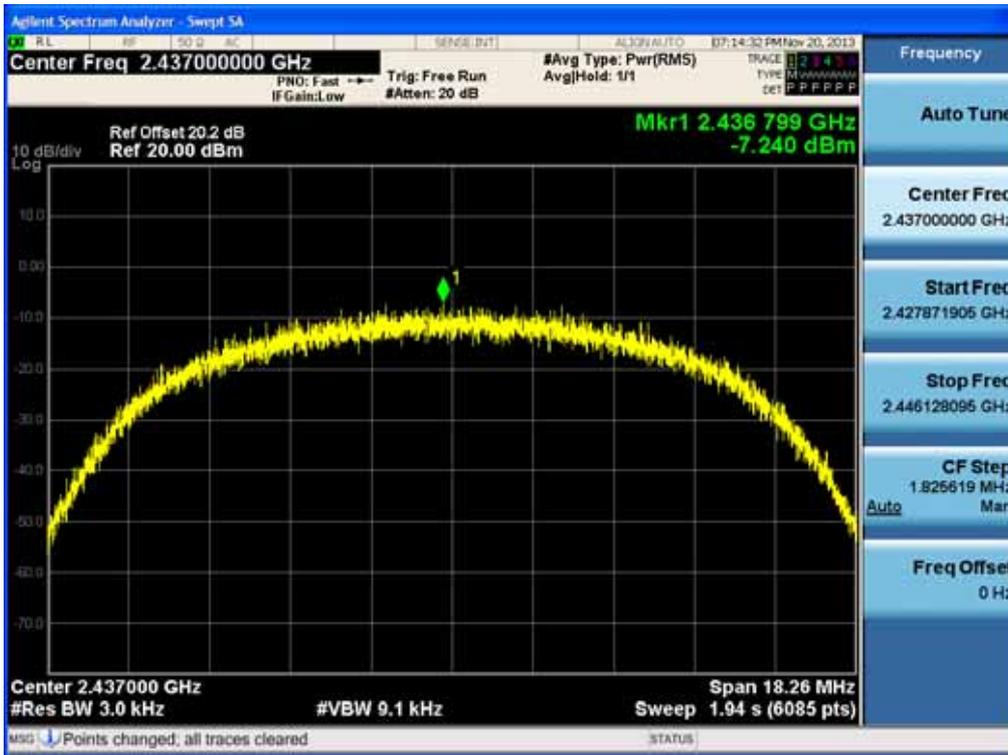
Frequency (MHz)	Channel No.	Mode	Test Result		
			PSD (dBm)	Limit (dBm)	Pass/Fail
2412	1	802.11b	-7.701	8	Pass
2437	6		-7.240		Pass
2462	11		-7.302		Pass
2412	1	802.11g	-14.402		Pass
2437	6		-13.328		Pass
2462	11		-13.624		Pass
2412	1	802.11n(20M) 2.4 GHz Band	-13.669		Pass
2437	6		-13.565		Pass
2462	11		-13.416		Pass
2412	1	802.11ac 2.4 GHz Band	-14.487		Pass
2437	6		-14.117		Pass
2462	11		-14.231		Pass
5745	149	802.11a	-15.318		Pass
5785	157		-15.686		Pass
5825	165		-15.947		Pass
5745	149	802.11n_20 MHz BW 5.8 GHz Band	-15.742		Pass
5785	157		-15.859		Pass
5825	165		-16.210		Pass
5755	151	802.11n_40 MHz BW 5.8 GHz Band	-19.408		Pass
5795	159		-18.853		Pass
5745	149		802.11ac_20 MHz BW 5.8 GHz Band	-17.214	Pass
5785	157	-16.459		Pass	
5825	165	-17.364		Pass	
5755	151	802.11ac_40 MHz BW 5.8 GHz Band	-21.226	Pass	
5795	159		-20.772	Pass	
5775	155	802.11ac_80MHz BW 5.8 GHz Band	-22.565	Pass	

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

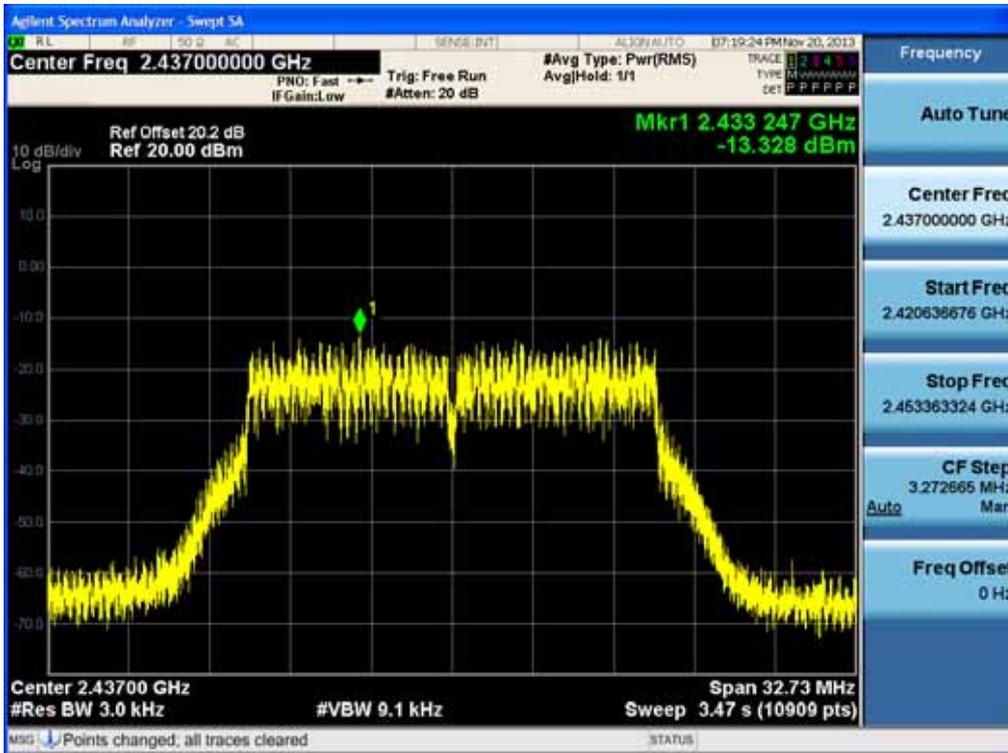
RESULT PLOTS

2.4 GHz Band

Power Spectral Density (802.11b-CH 6)

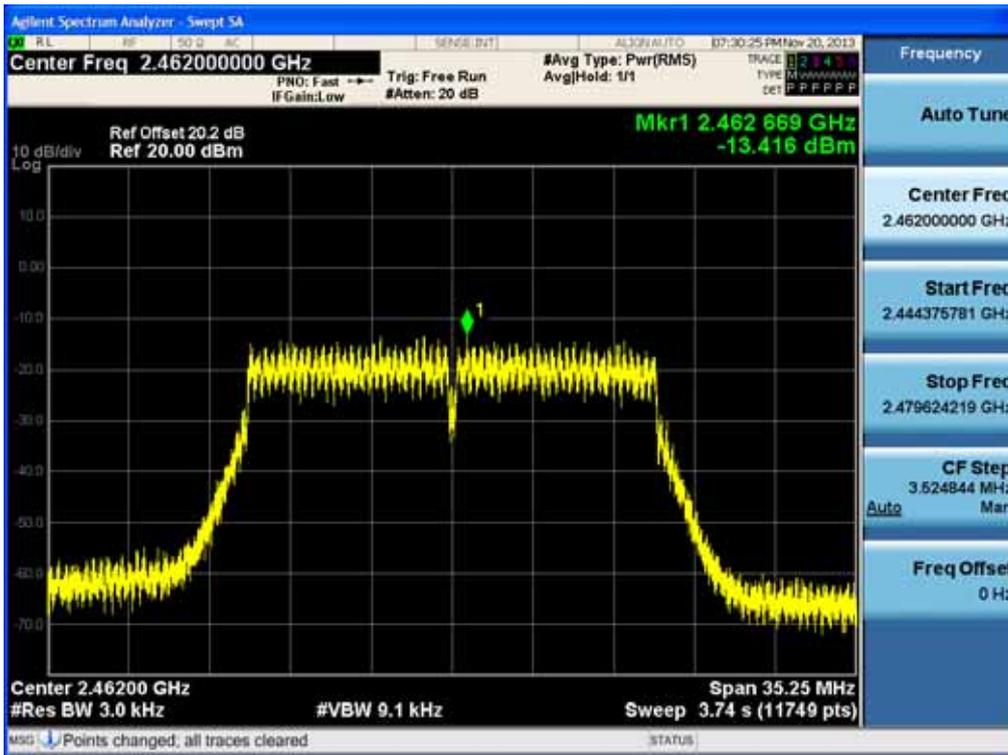


Power Spectral Density (802.11g-CH 6)

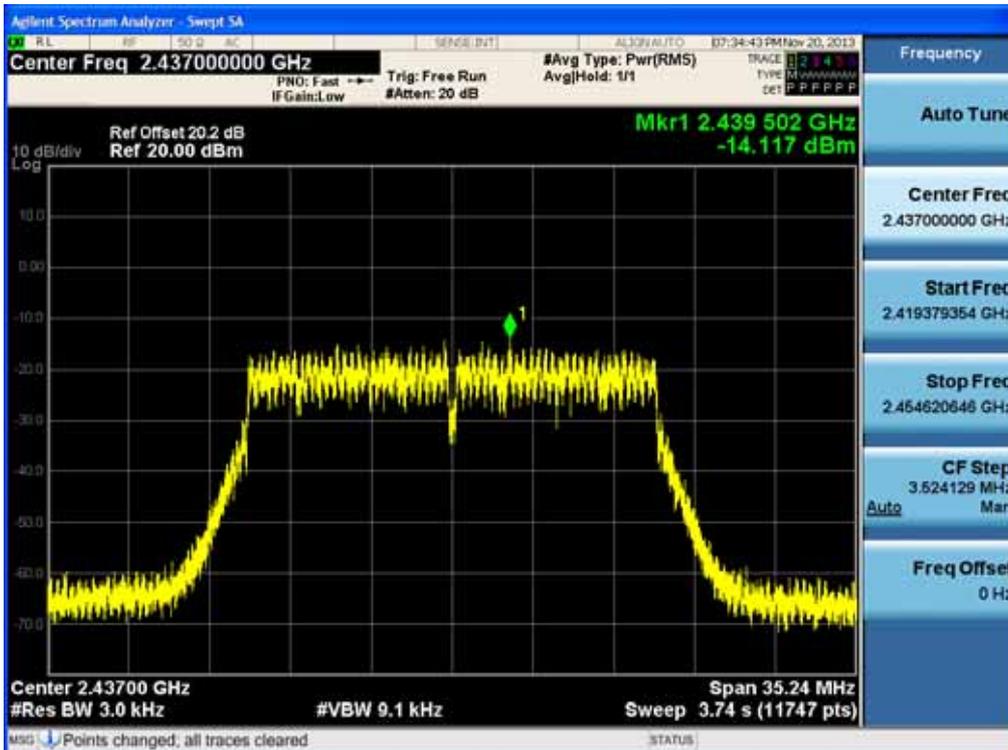


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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### Power Spectral Density (802.11n-CH 11)



### Power Spectral Density (802.11ac-CH 6)

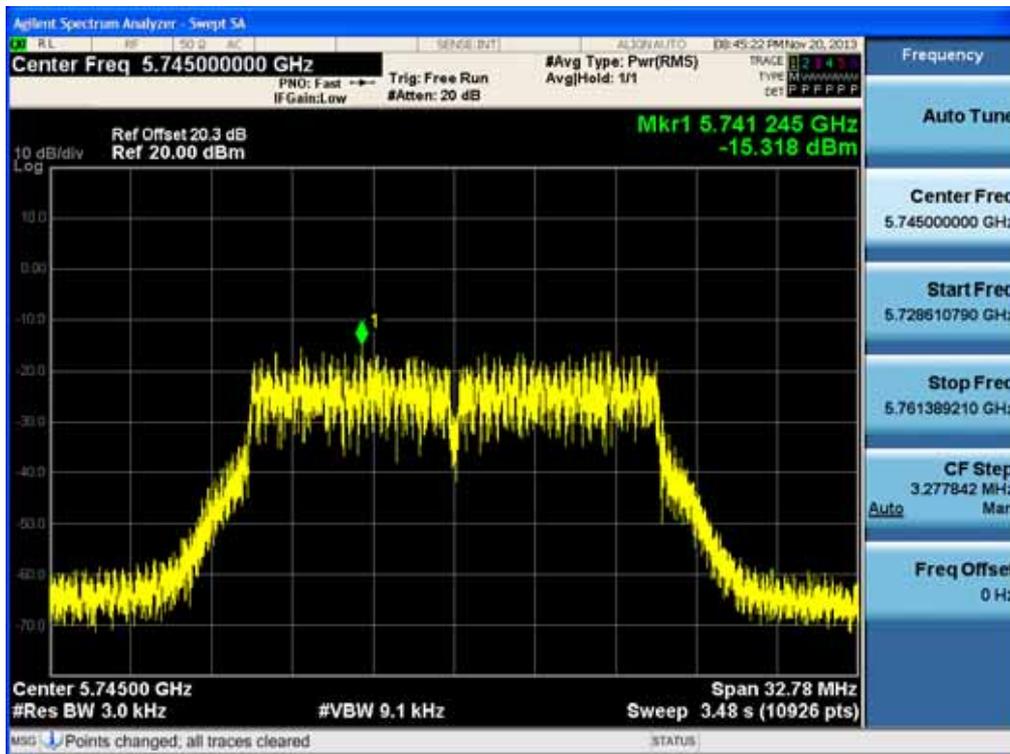


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNFD955

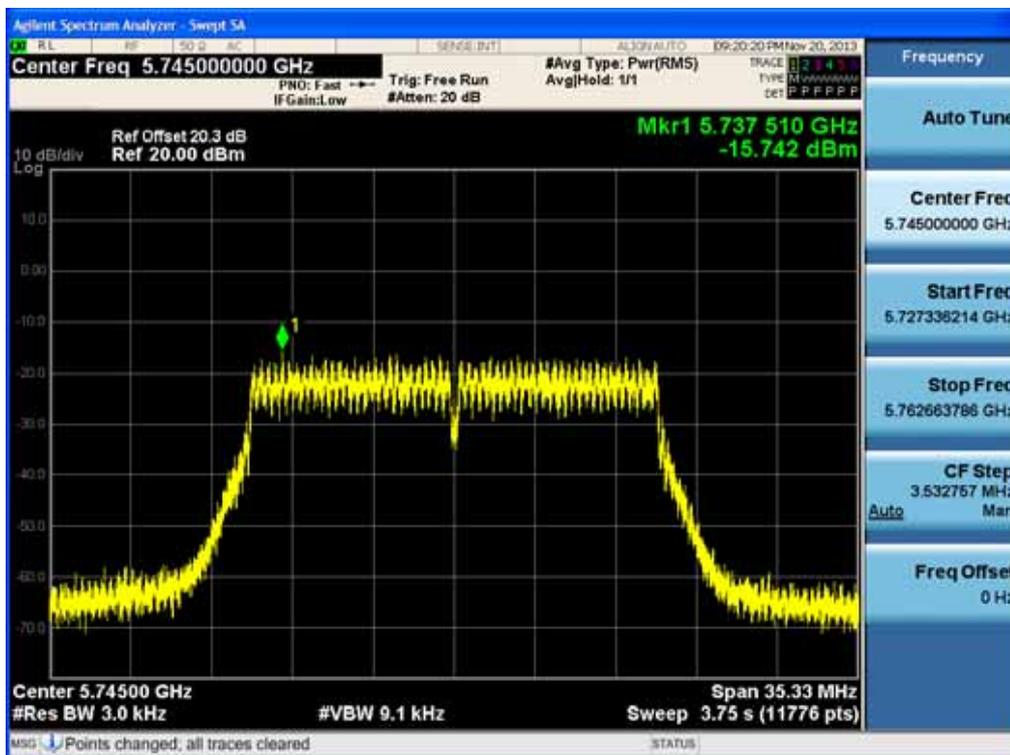


**5.8 GHz Band**  
20 MHz BW

**Power Spectral Density (802.11a-CH 149)**



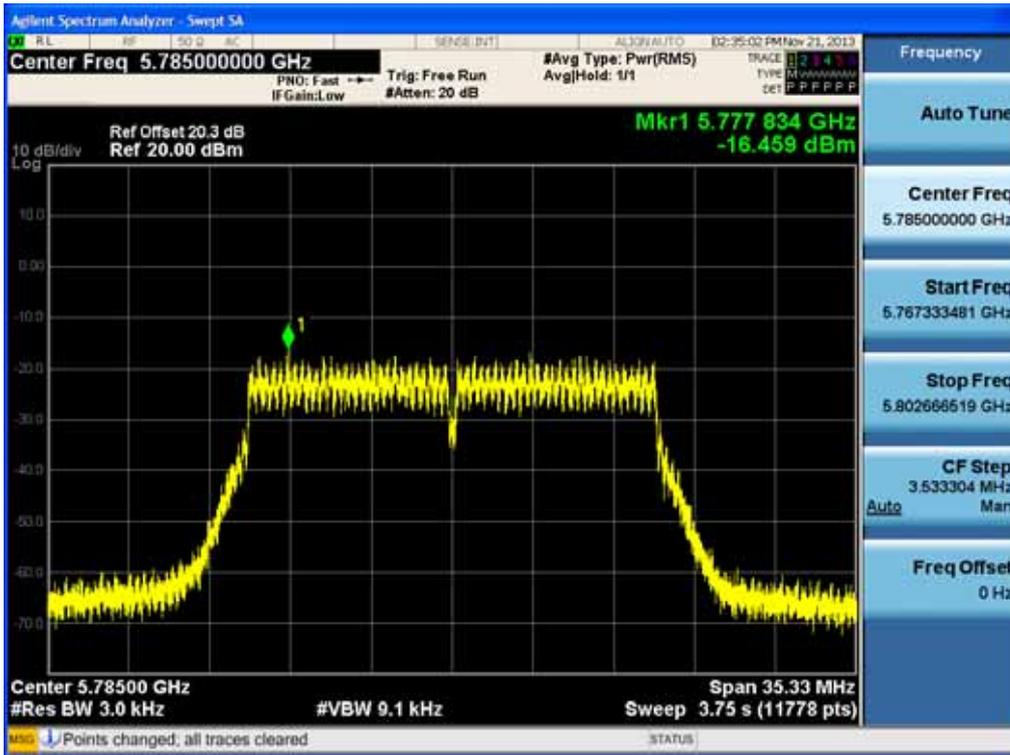
**Power Spectral Density (802.11n-CH 149)**



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNF0955

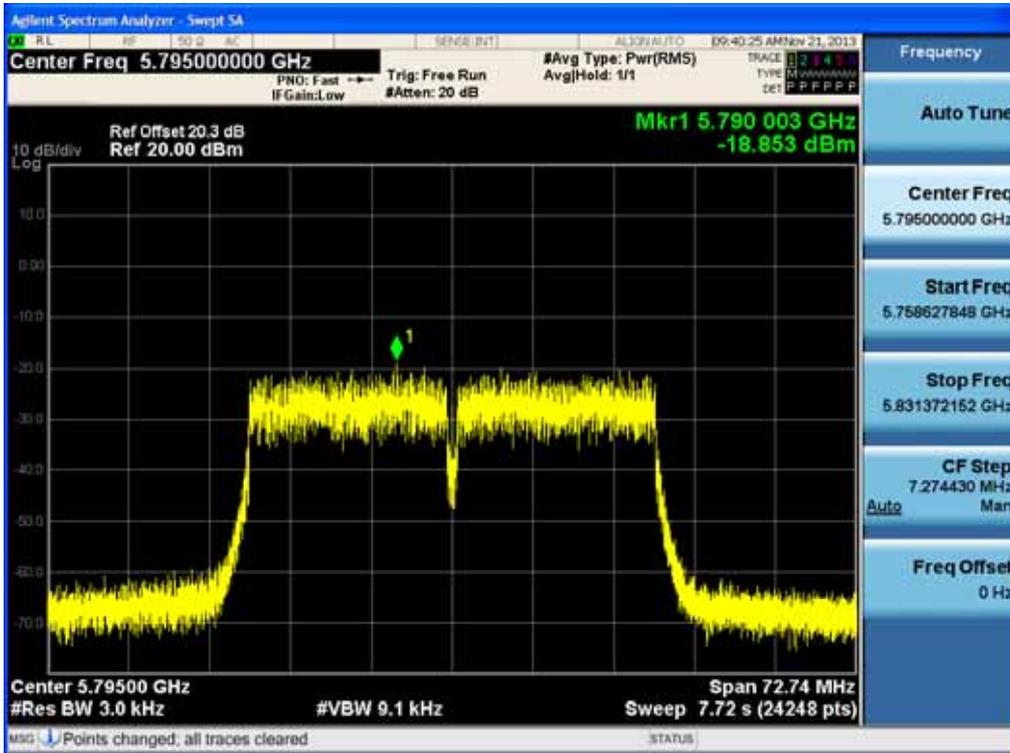


### Power Spectral Density (802.11ac\_CH 157)



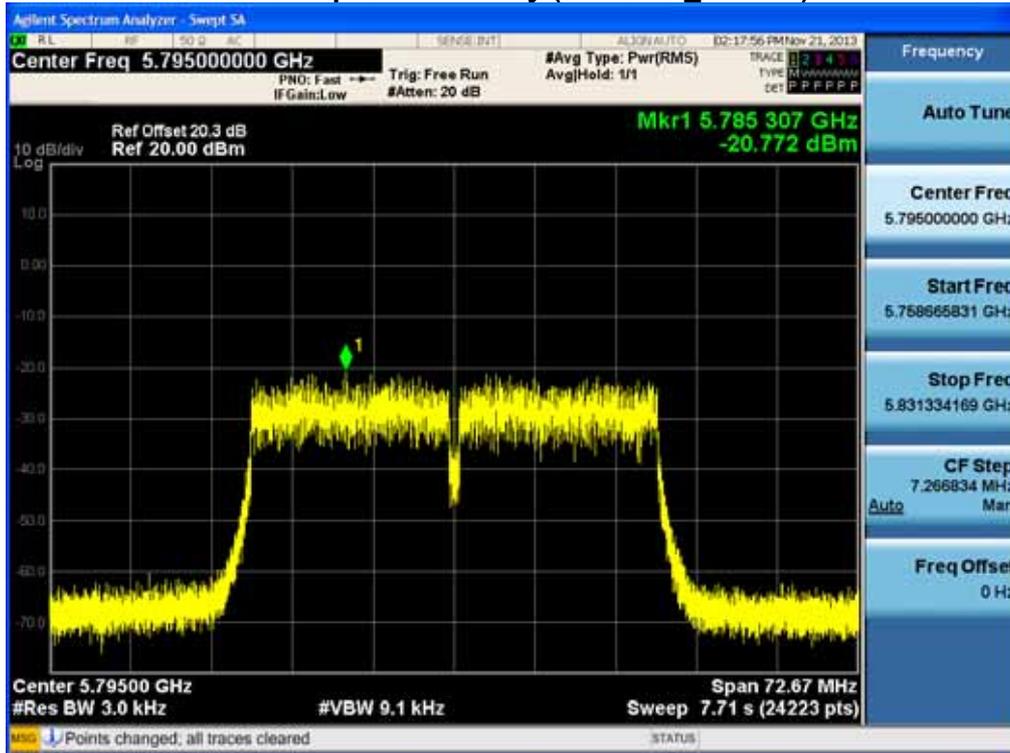
40 MHz BW

### Power Spectral Density (802.11n-CH 159)



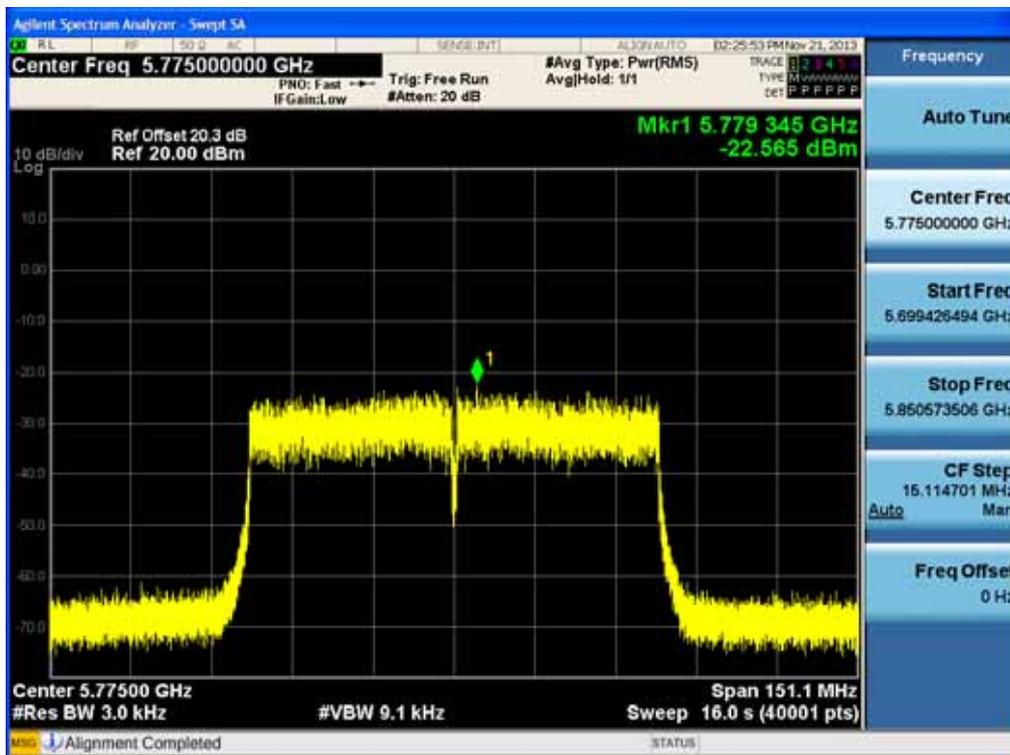
FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNF0955

### Power Spectral Density (802.11ac\_CH 159)



80 MHz BW

### Power Spectral Density (802.11ac\_CH 155)



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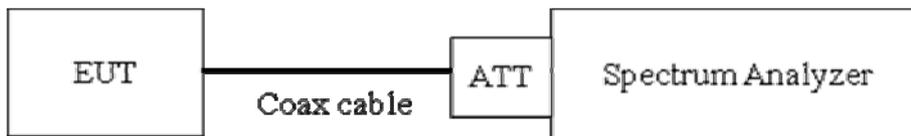
## 8.5 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

### 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  $\geq 2 \times$  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 10<sup>th</sup> 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 and 5.8 GHz range that was rounded off to the closest tenth dB. So,

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10.2 dB is offset for 2.4 GHz Band and 10.3 dB is offset for 5.8 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
5.8 GHz	5745	10.31
	5755	10.30
	5785	10.29
	5795	10.26
	5825	10.28

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

4. In case of conducted spurious emissions test, please check factors below 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
2400*	10.19
2500*	10.26
3000	10.27
4000	10.22
5000	10.48
5700*	10.42
5800*	10.48
6000	10.48

<b>FCC PT.15.247 TEST REPORT</b>	<b>FCC CERTIFICATION REPORT</b>		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
<b>Test Report No.</b> HCTR1311FR17	<b>Date of Issue:</b> November 28, 2013	<b>EUT Type:</b> Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	<b>FCC ID:</b> ZNFD955

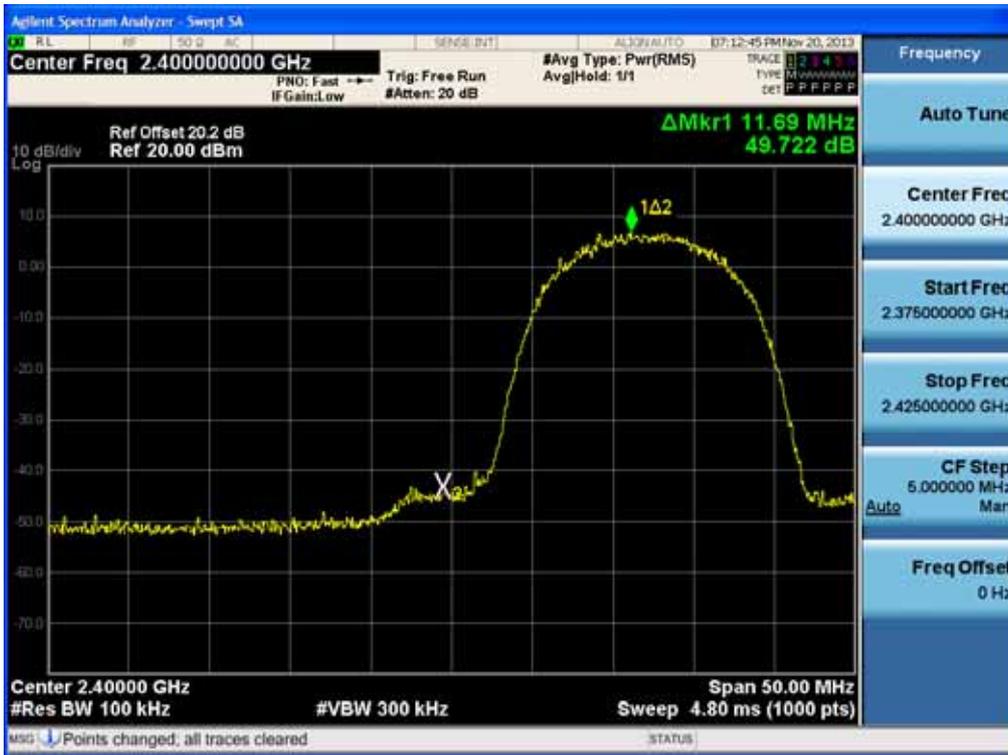
7000	10.57
8000	10.45
9000	10.50
10000	10.64
11000	10.69
12000	10.75
13000	10.92
14000	11.90
15000	11.00
16000	11.03
17000	10.93
18000	10.96
19000	10.85
20000	12.11
21000	11.17
22000	10.99
23000	11.12
24000	11.10
25000	11.42
26000	11.28
27000	10.83
28000	11.03
29000	10.99
30000	12.08
31000	10.99
32000	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

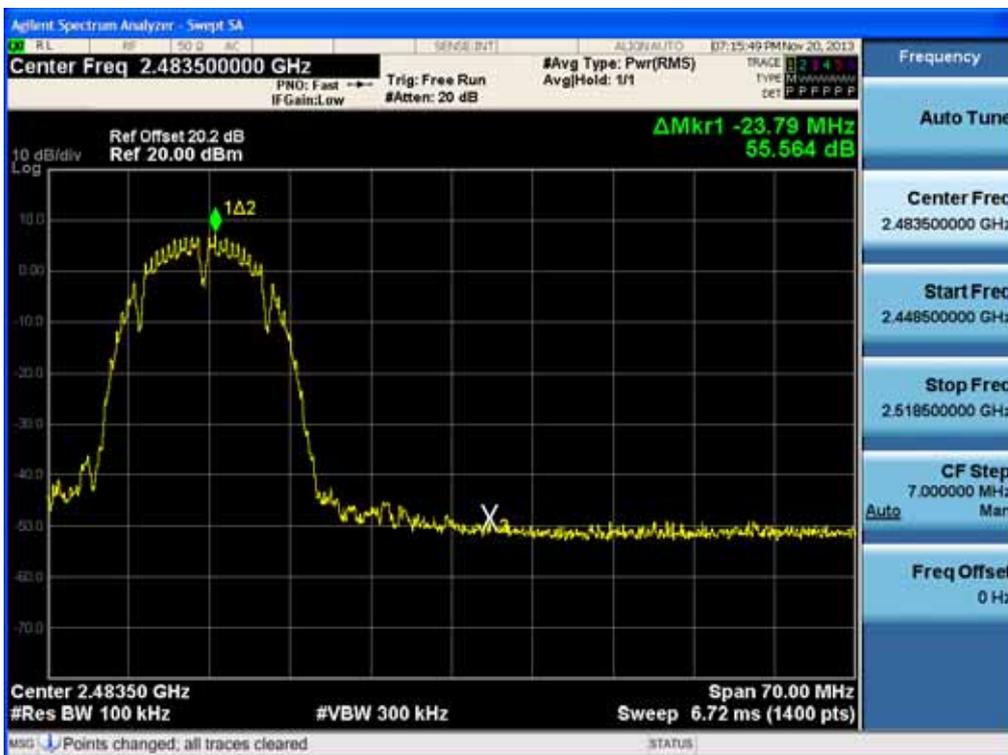
RESULT PLOTS

2.4 GHz Band

BandEdge (802.11b-CH1)



BandEdge (802.11b-CH11)

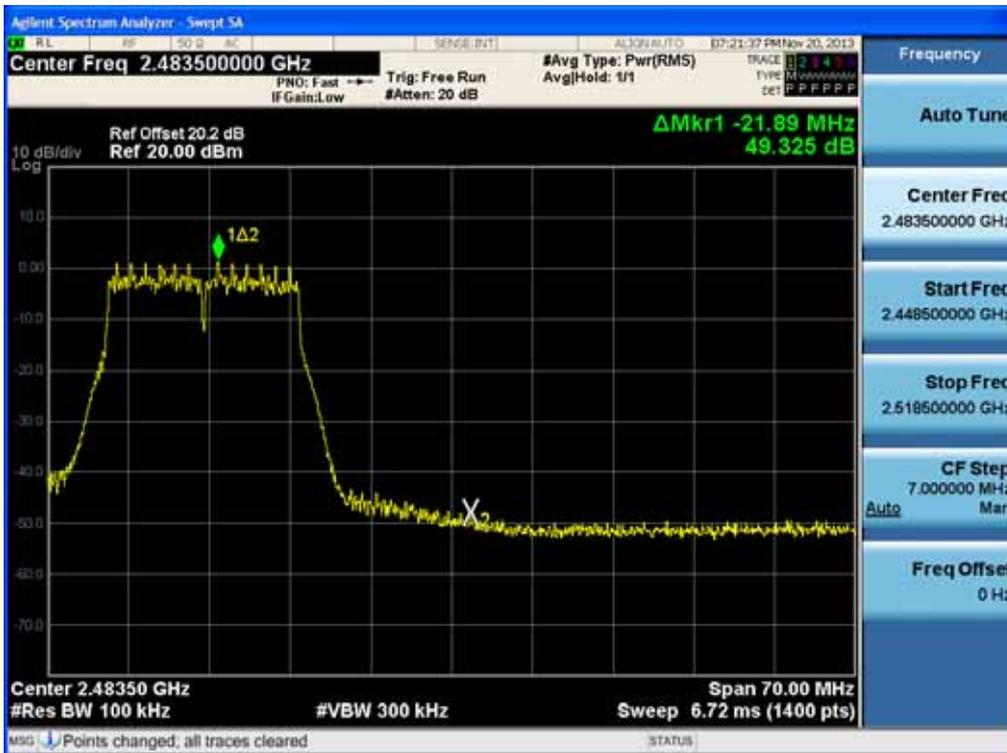


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### BandEdge (802.11g-CH1)



### BandEdge (802.11g-CH11)

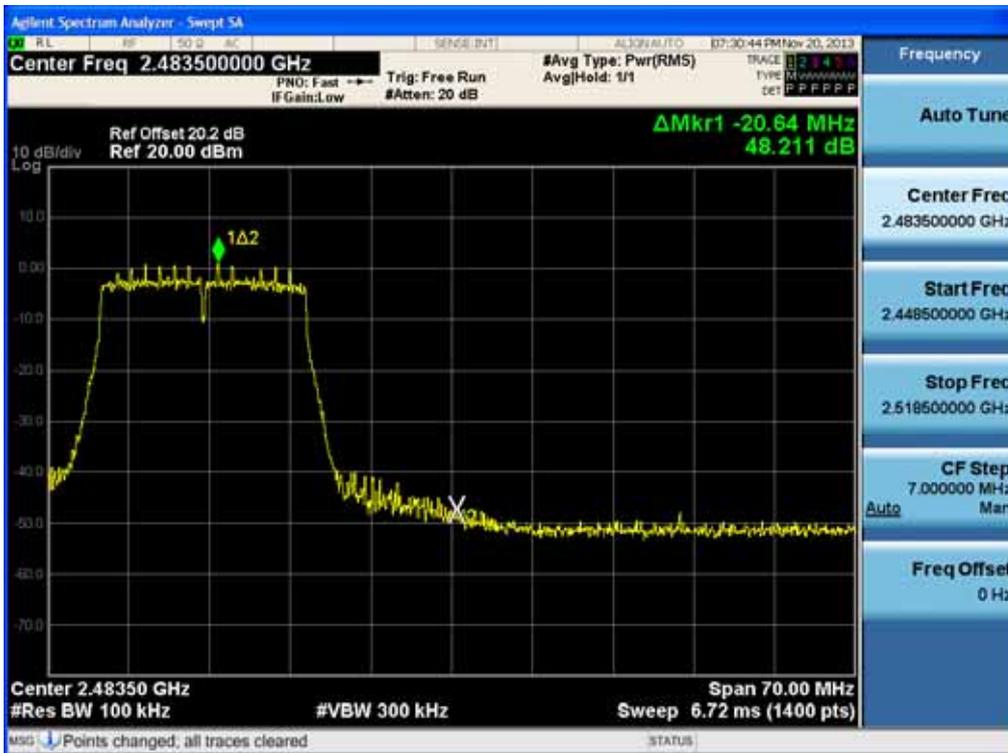


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### BandEdge (802.11n-CH1)

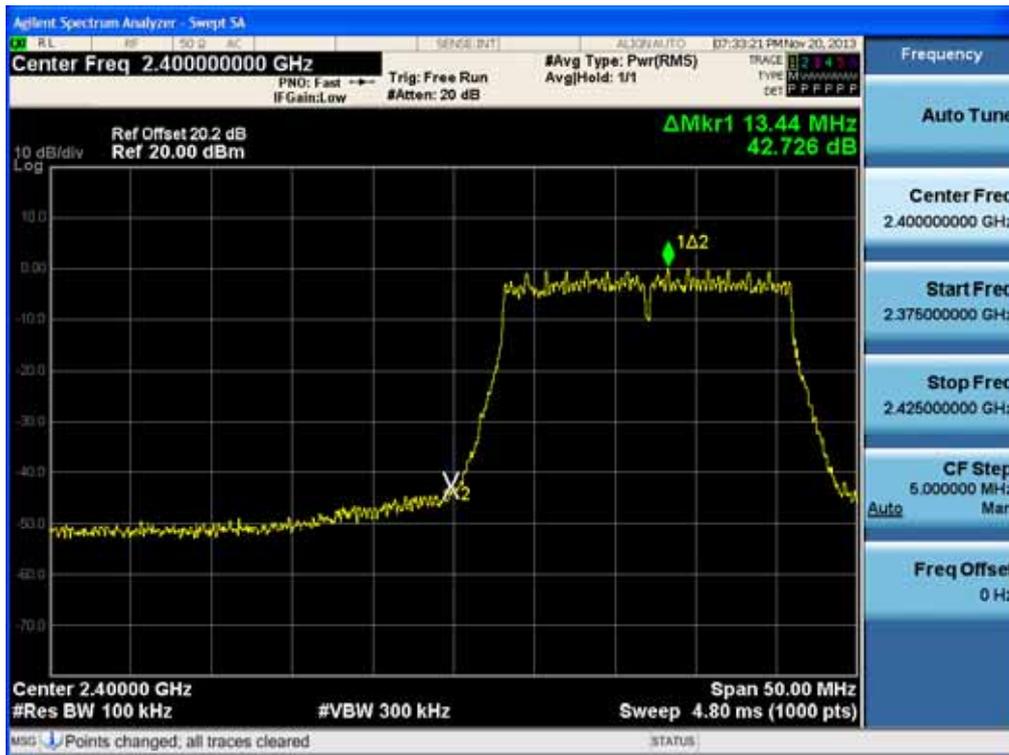


### BandEdge (802.11n-CH11)

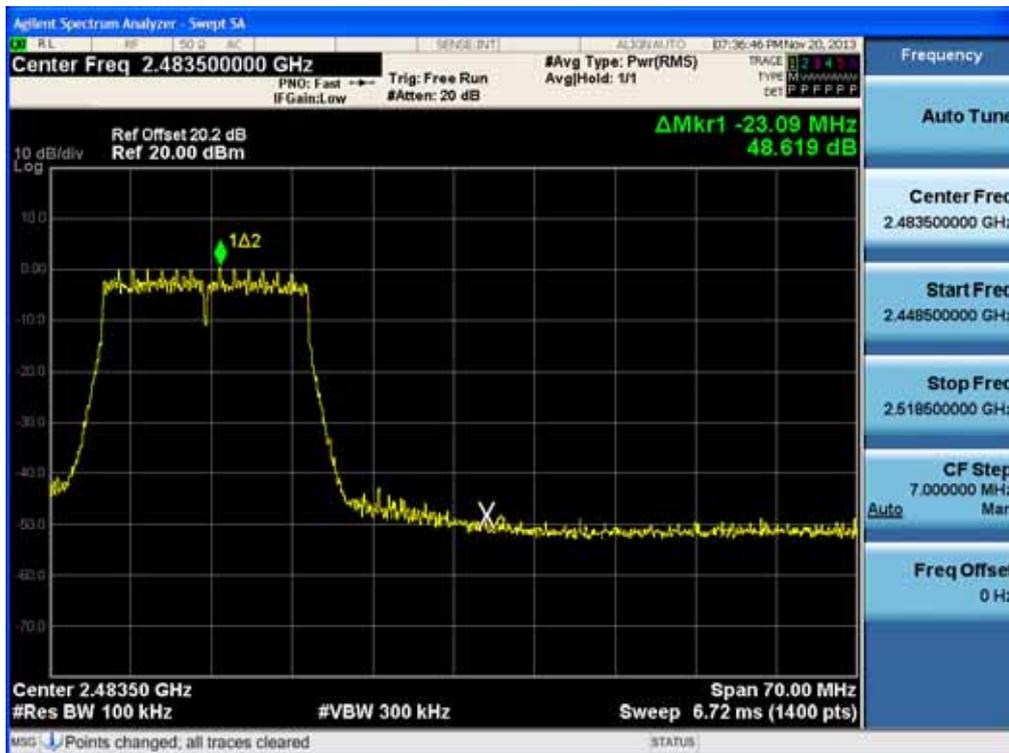


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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### BandEdge (802.11ac-CH1)



### BandEdge (802.11ac-CH11)



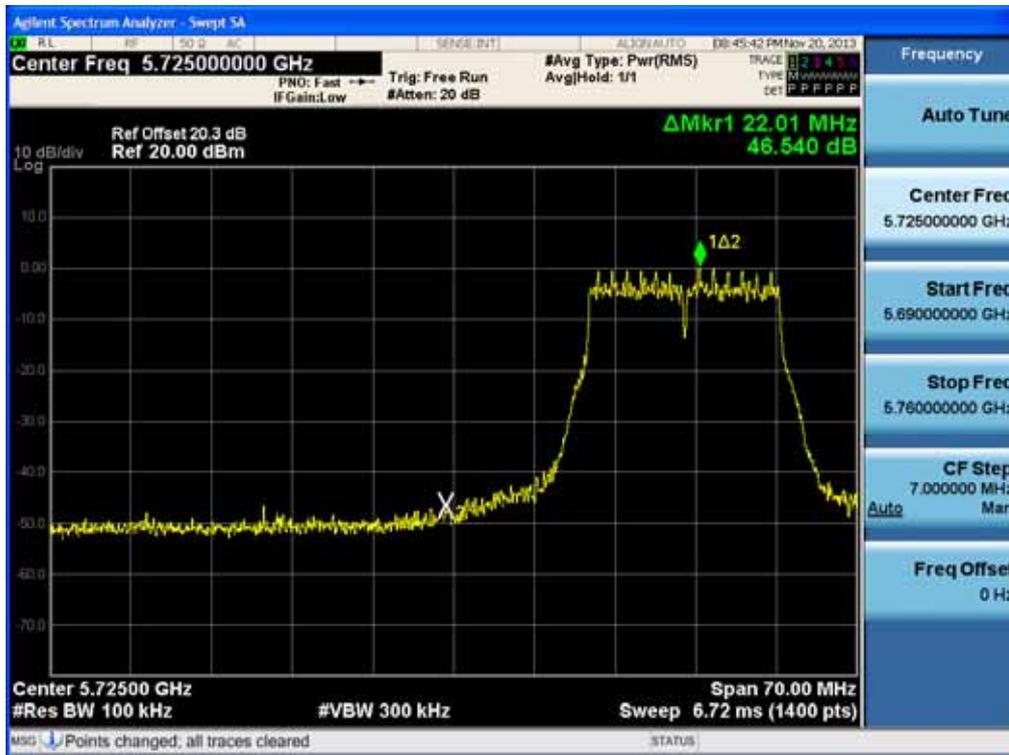
FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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**5.8 GHz Band**

20 MHz BW

**BandEdge (802.11a-CH 149)**

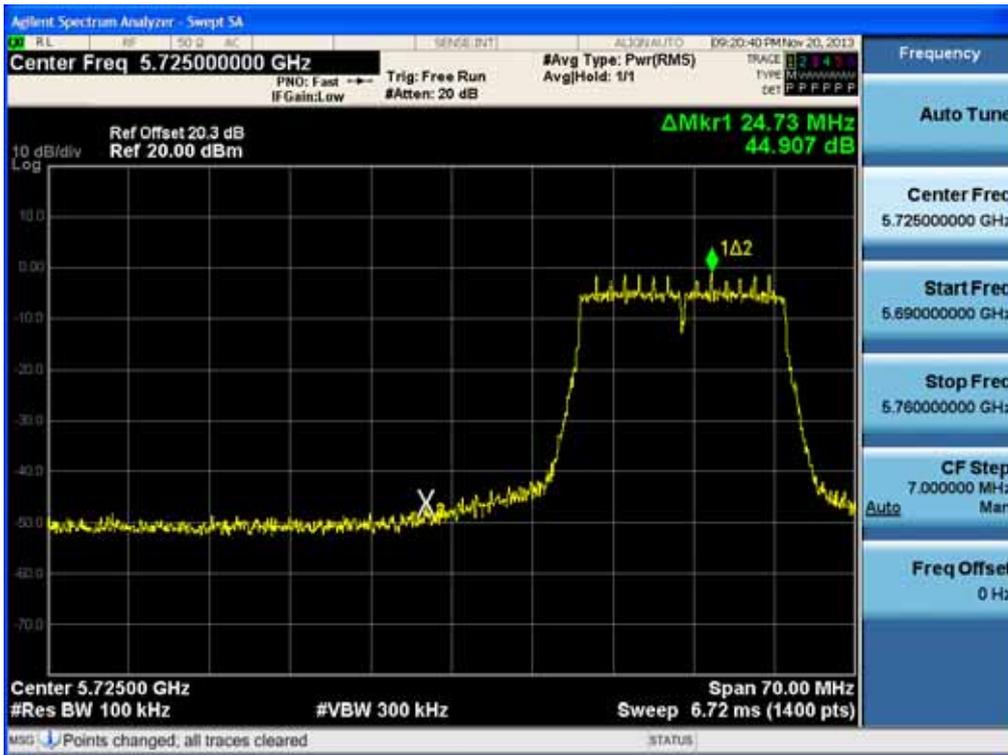


**BandEdge (802.11a-CH 165)**

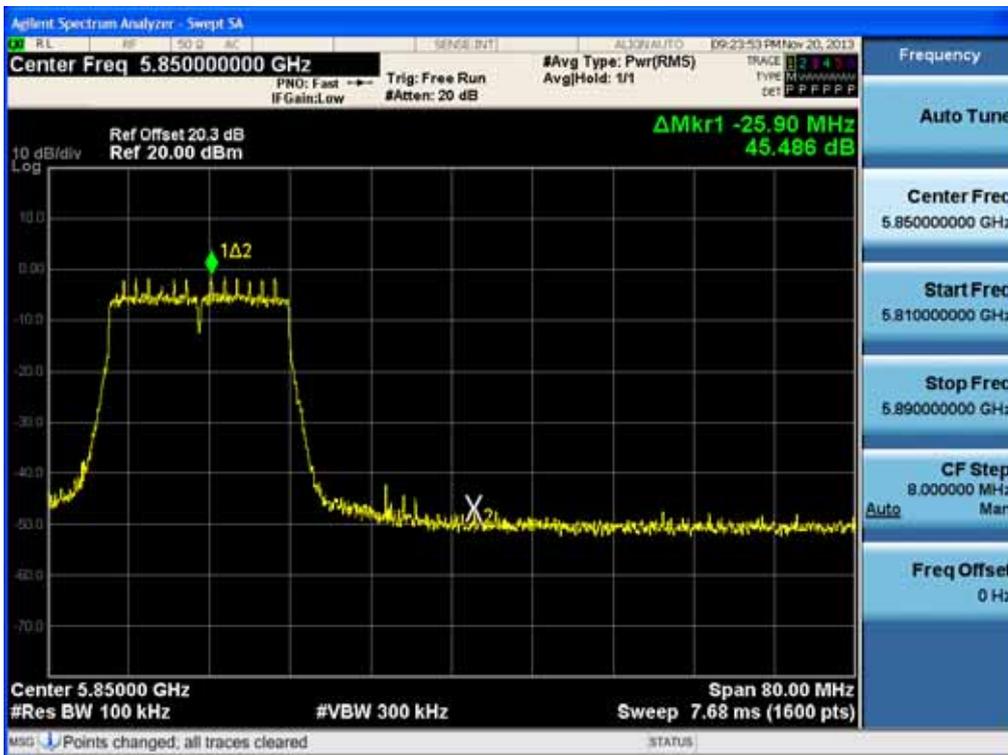


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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### BandEdge (802.11n-CH 149)

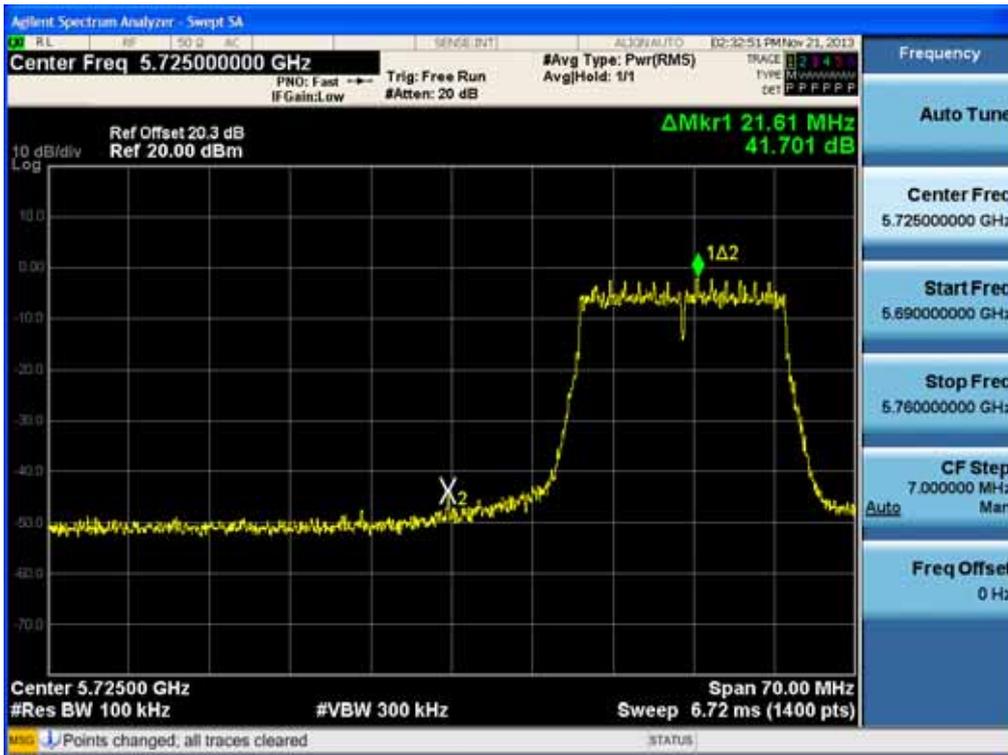


### BandEdge (802.11n-CH 165)

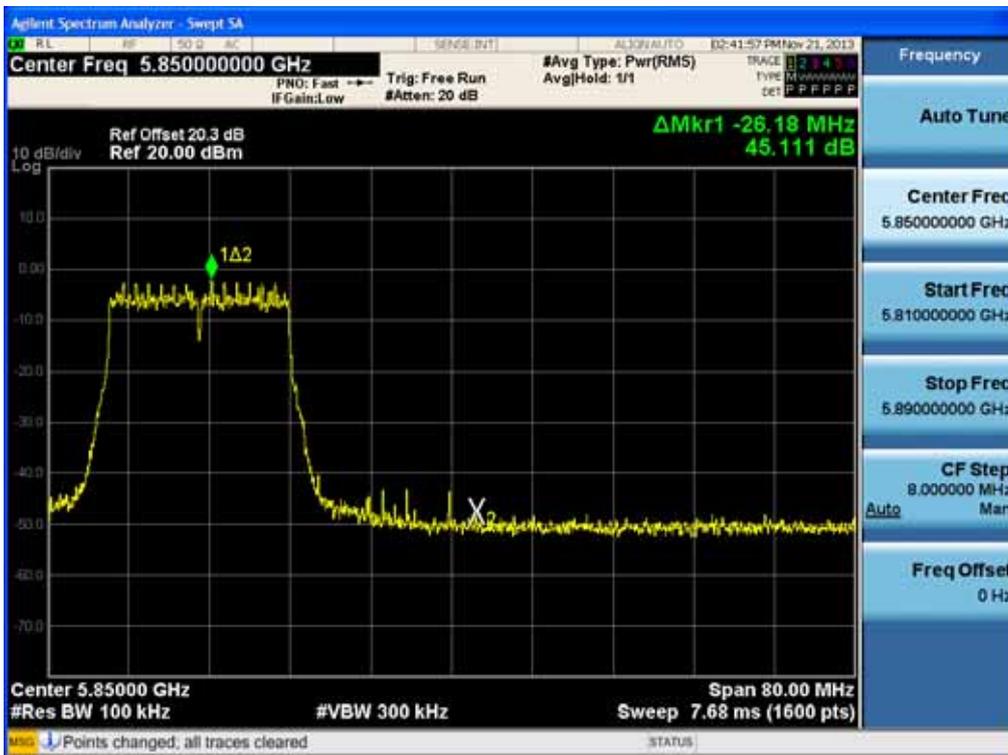


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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### BandEdge (802.11ac-CH 149)

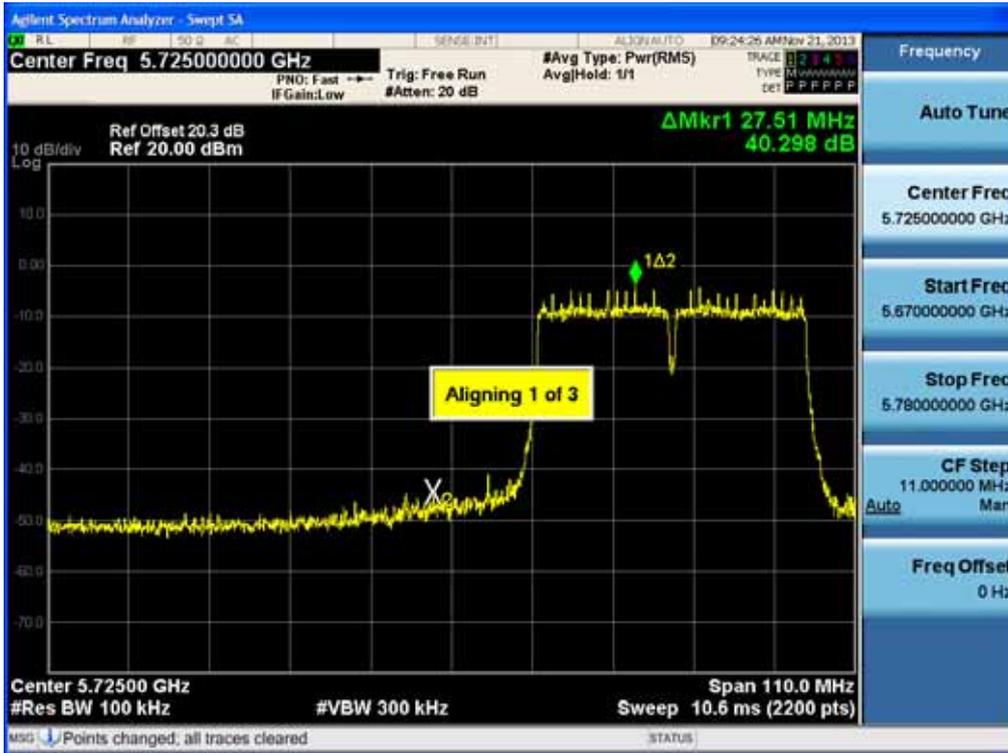


### BandEdge (802.11ac-CH 165)

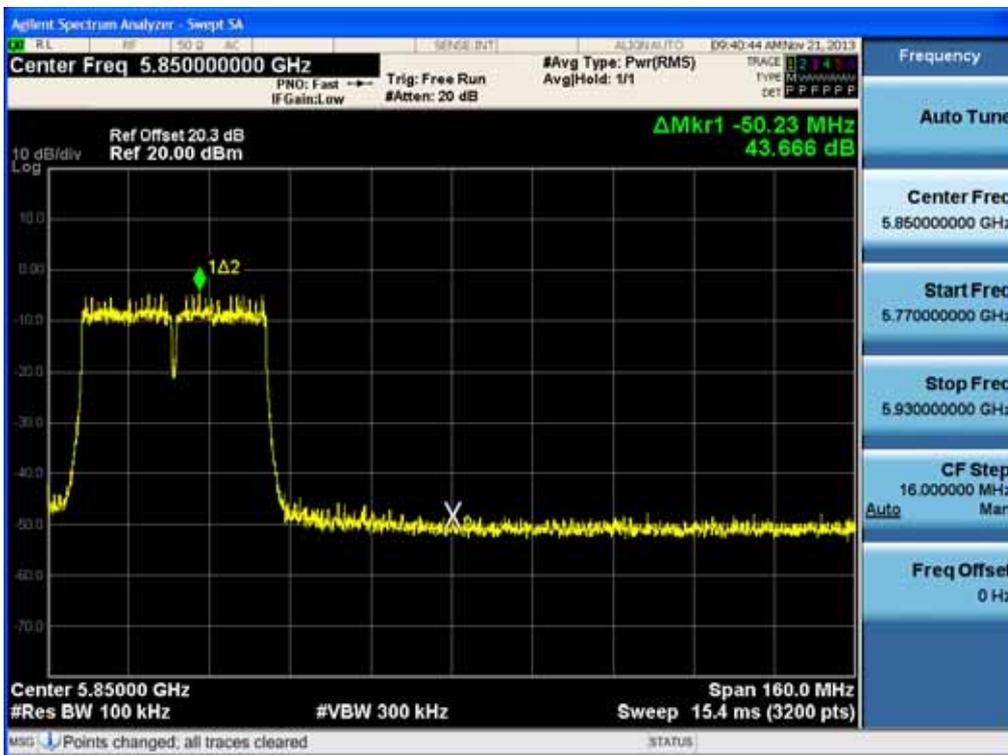


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BandEdge (802.11n-CH 151)



BandEdge (802.11n-CH 159)



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### BandEdge (802.11ac-CH 151)

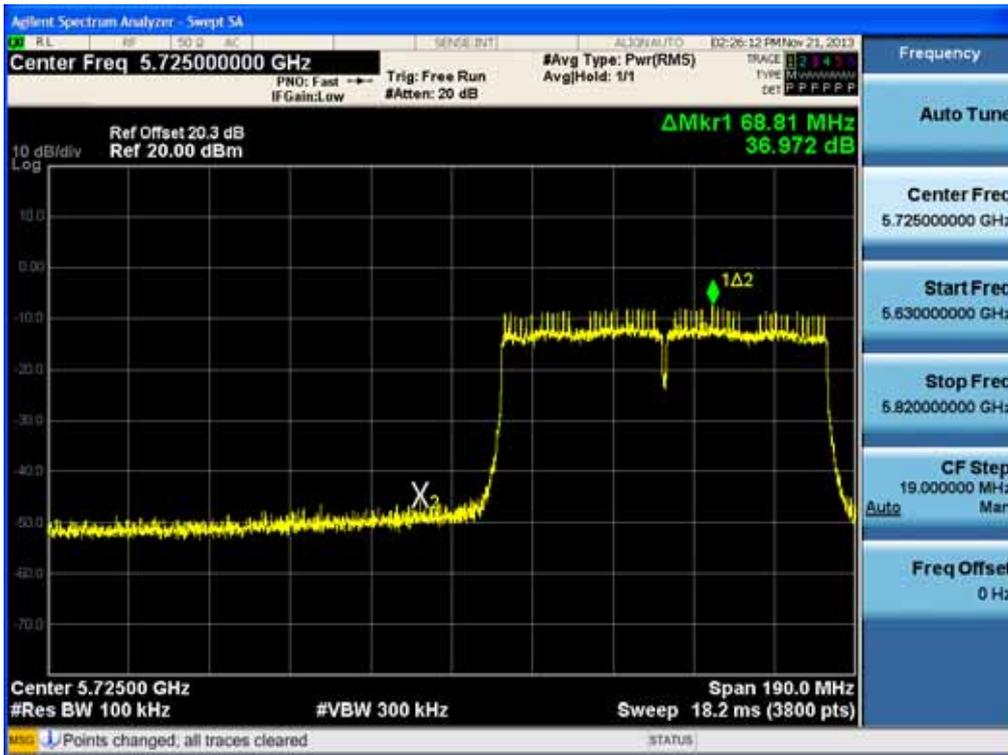


### BandEdge (802.11ac-CH 159)

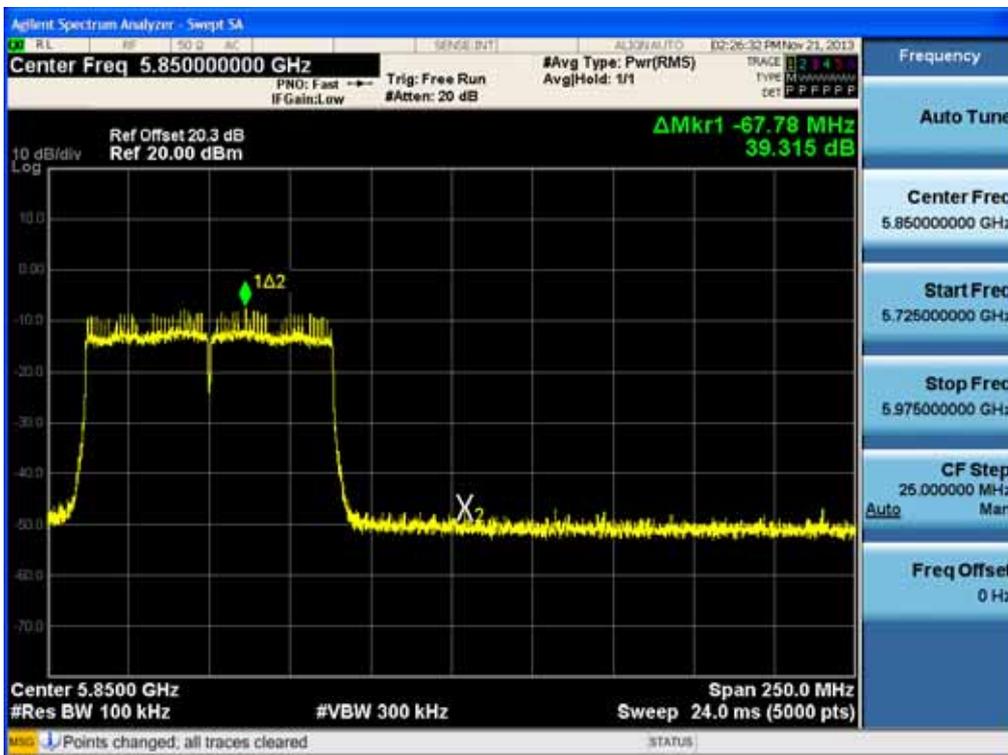


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
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BandEdge (802.11ac-CH 155)



BandEdge (802.11ac-CH 155)



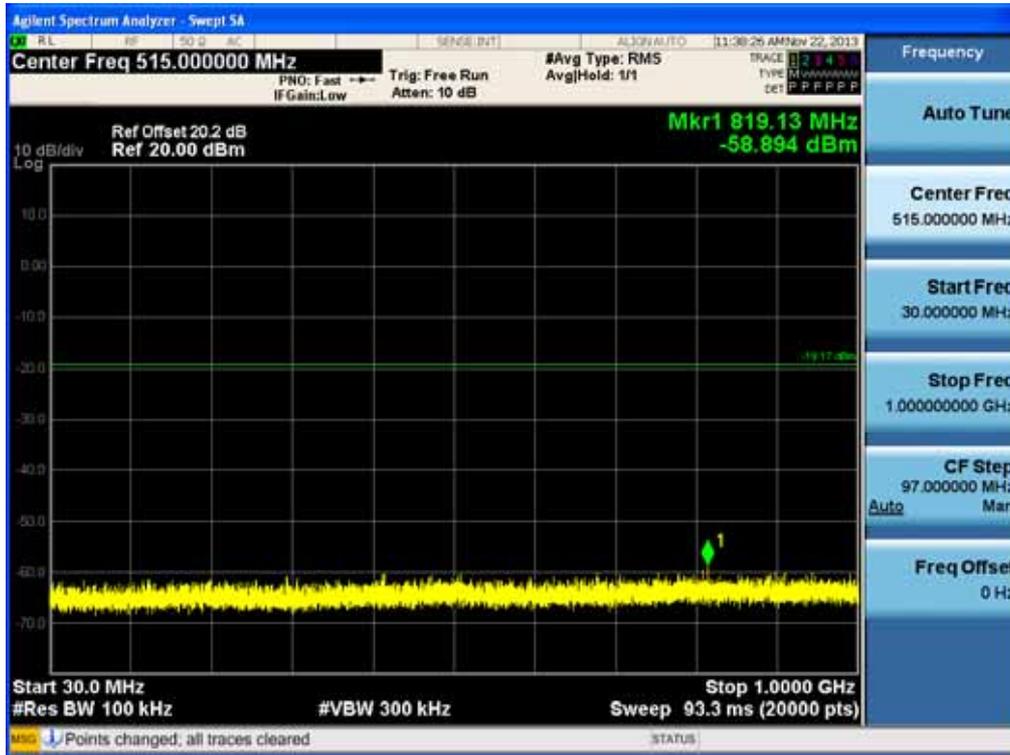
FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNF0955



**2.4 GHz Band**

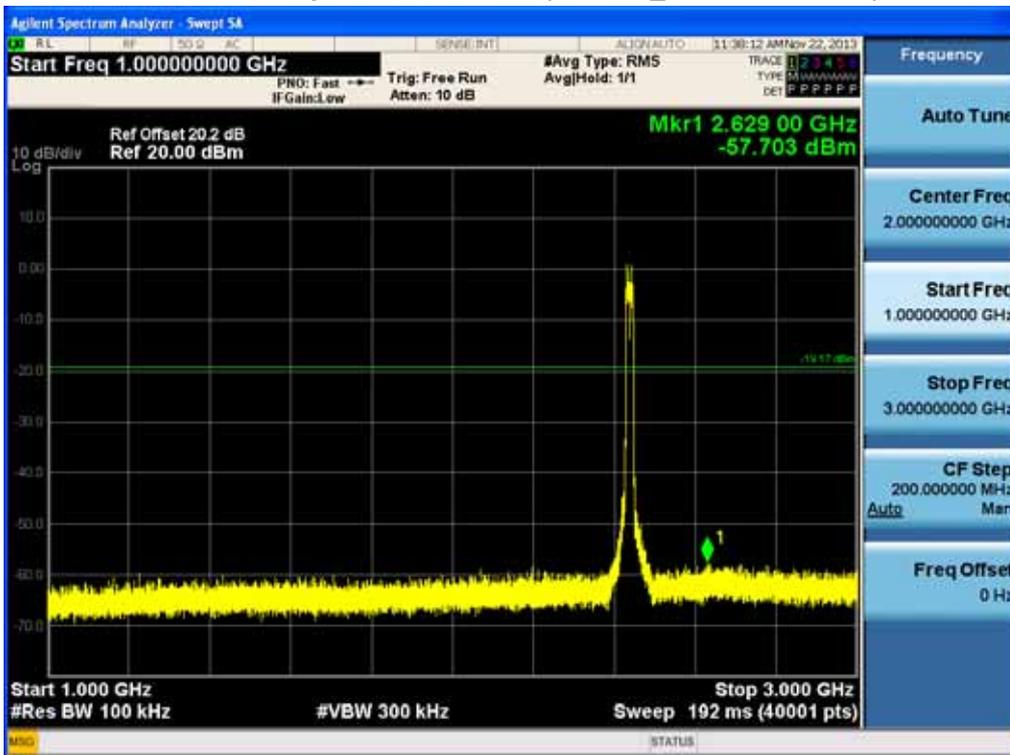
30 MHz ~ 1 GHz

**Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)**



1 GHz ~ 3 GHz

**Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)**

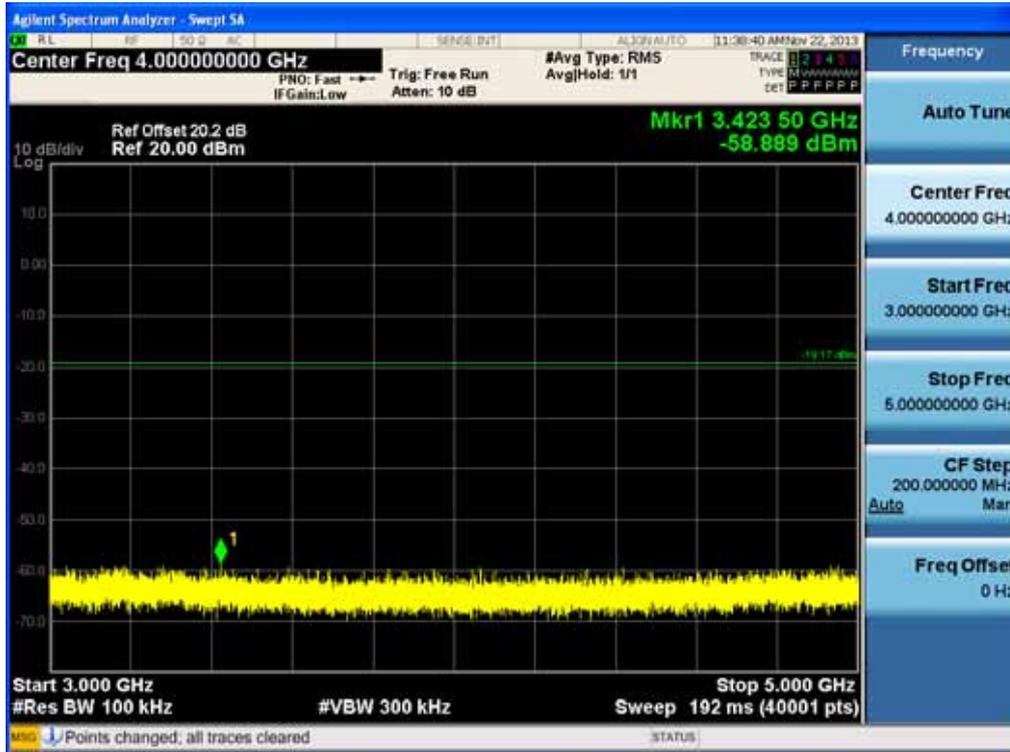


FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNF955



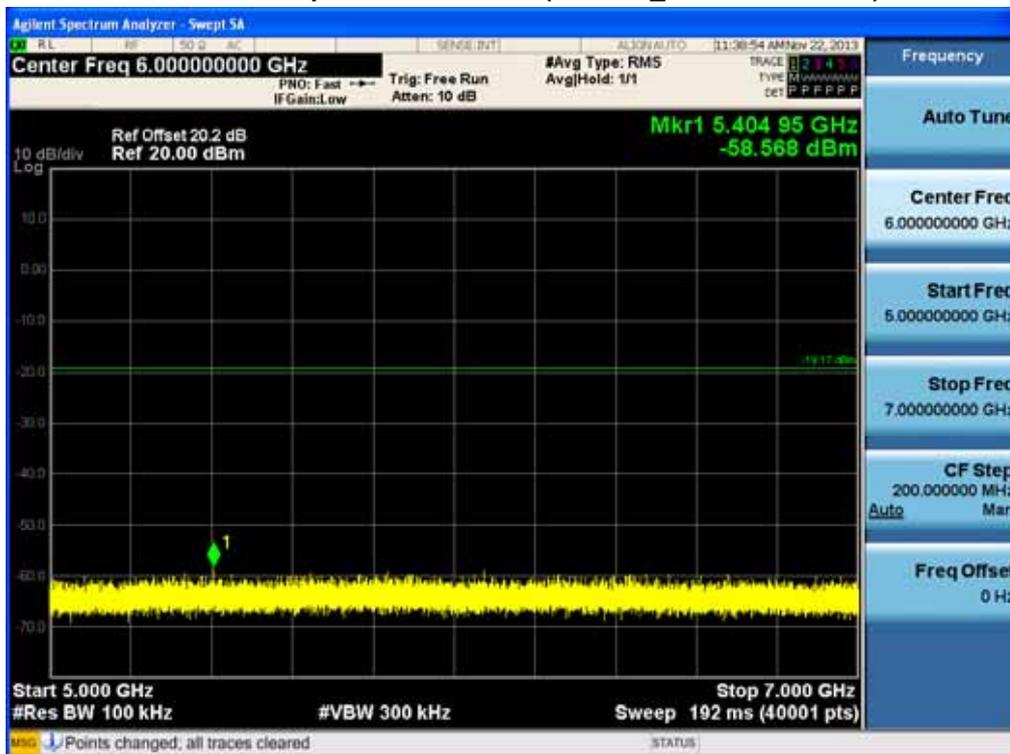
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



5 GHz ~ 7 GHz

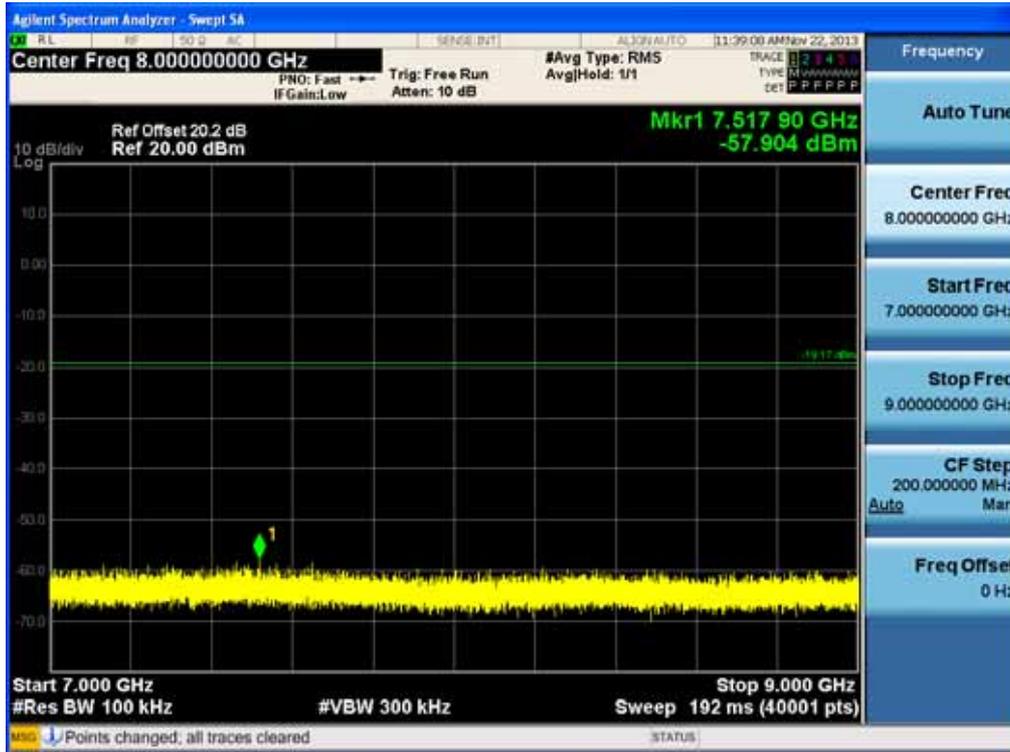
Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



FCC PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT		<a href="http://www.hct.co.kr">www.hct.co.kr</a>
Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNF0955

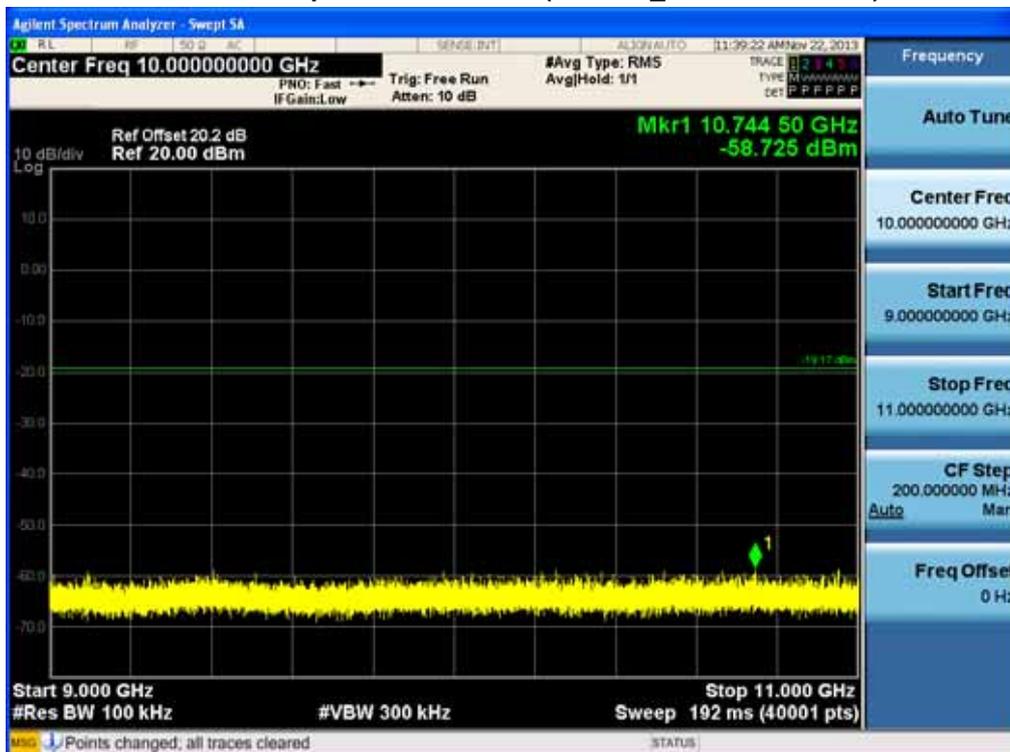
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



9 GHz ~ 11 GHz

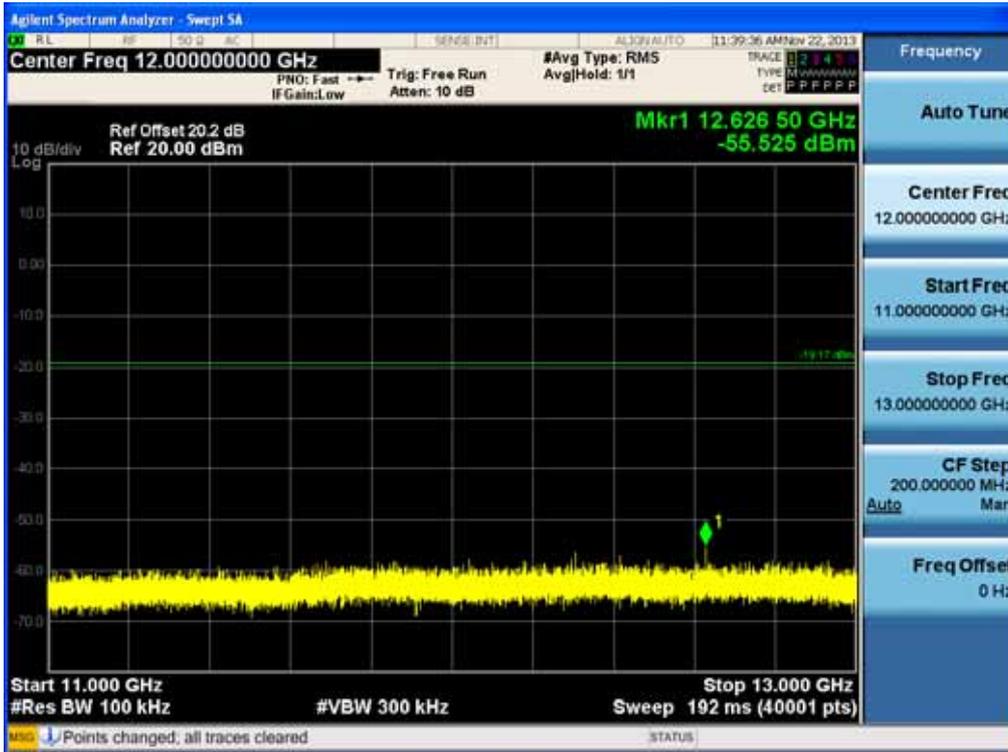
Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



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Test Report No. HCTR1311FR17	Date of Issue: November 28, 2013	EUT Type: Cellular/PCS GSM/GPRS Phone with Bluetooth, WLAN and RFID	FCC ID: ZNF0955

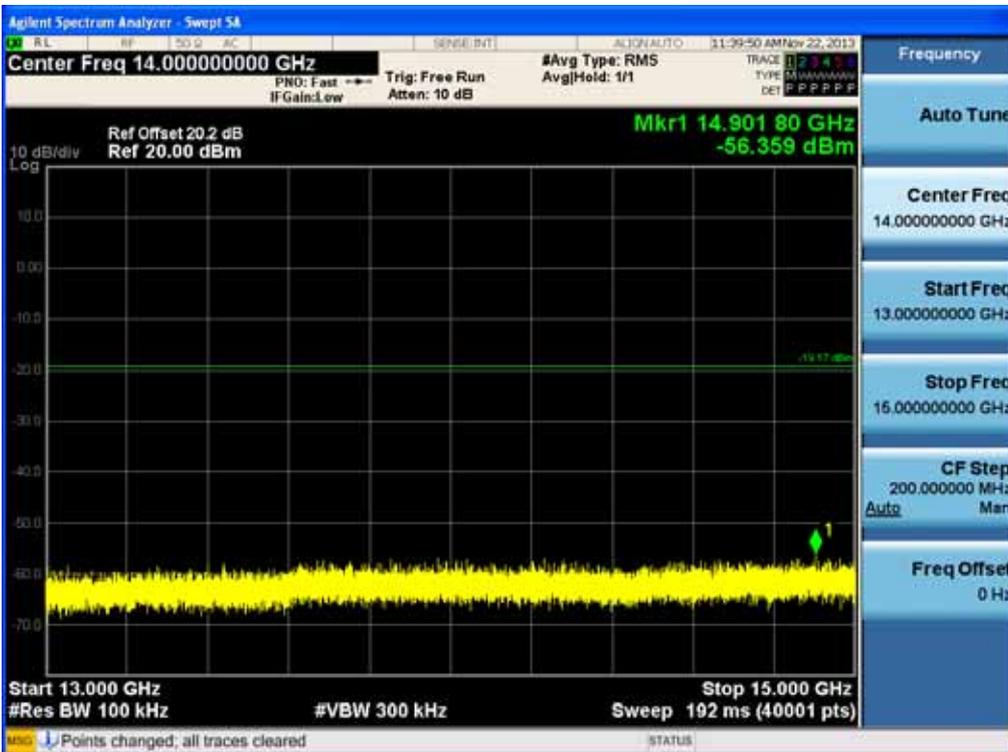
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



13 GHz ~ 15 GHz

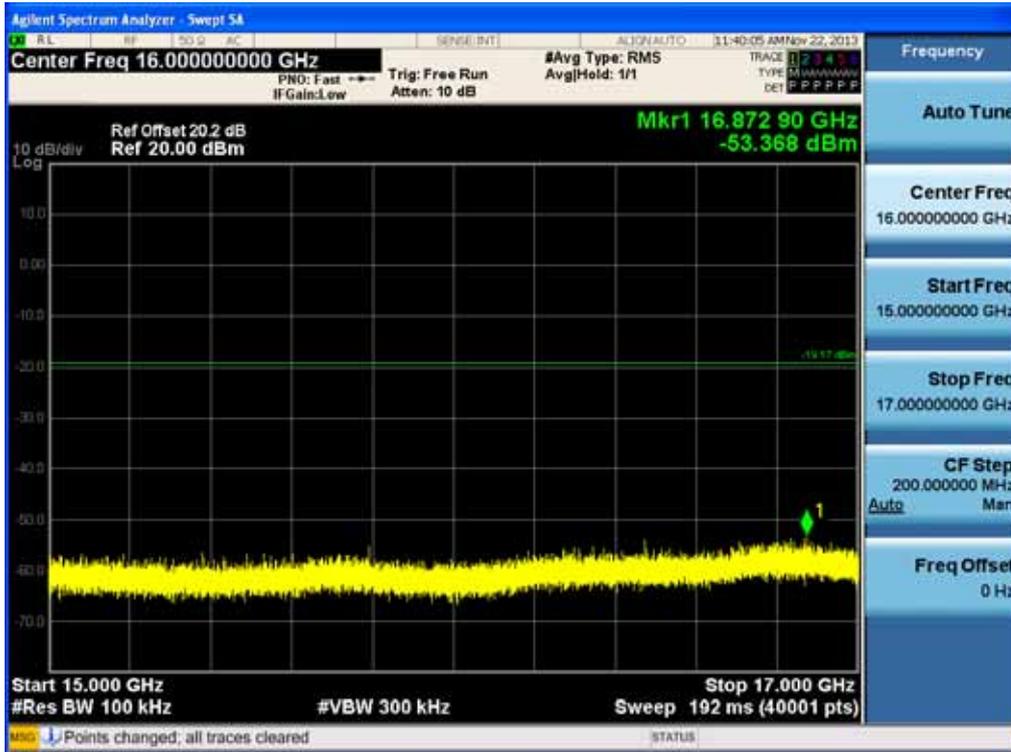
Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



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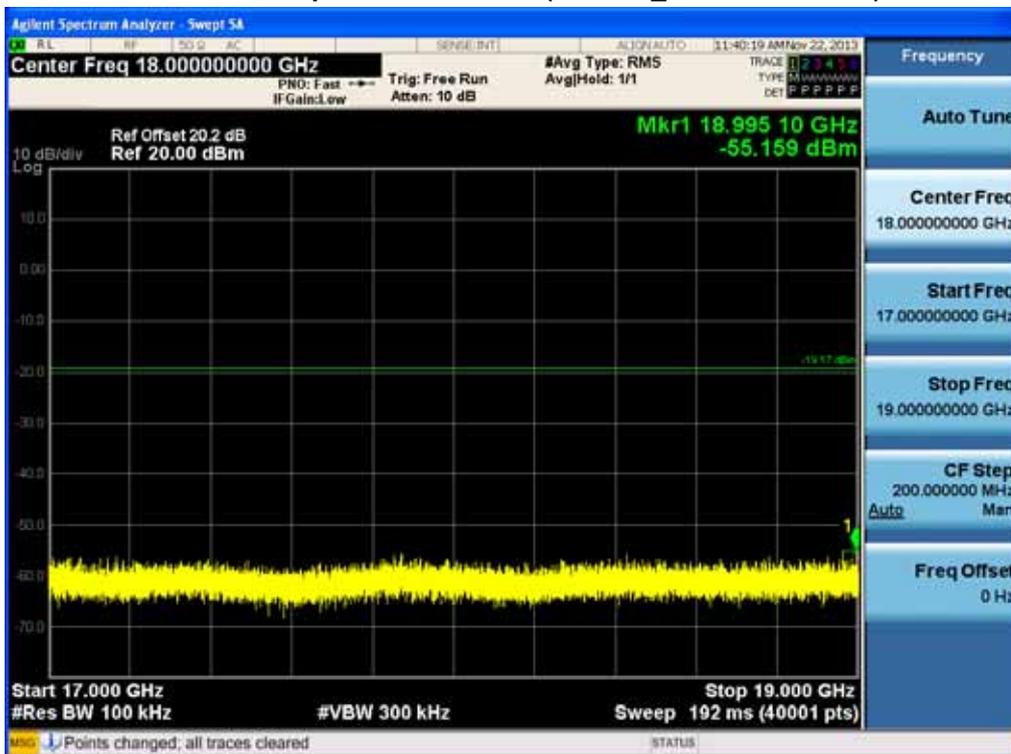
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



17 GHz ~ 19 GHz

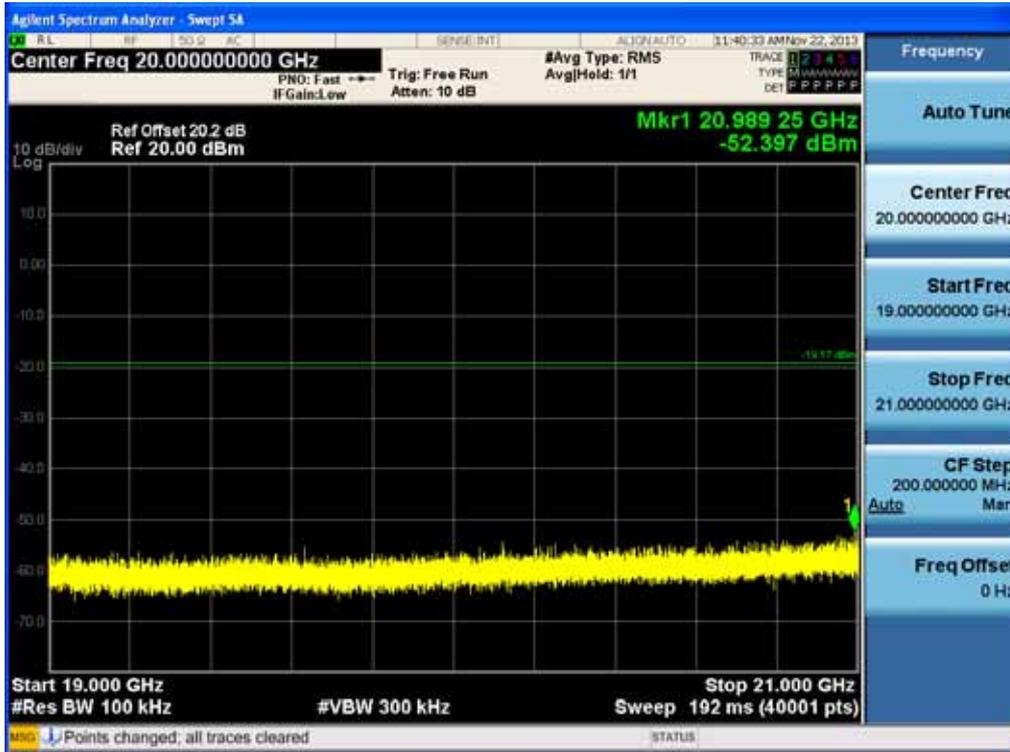
Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



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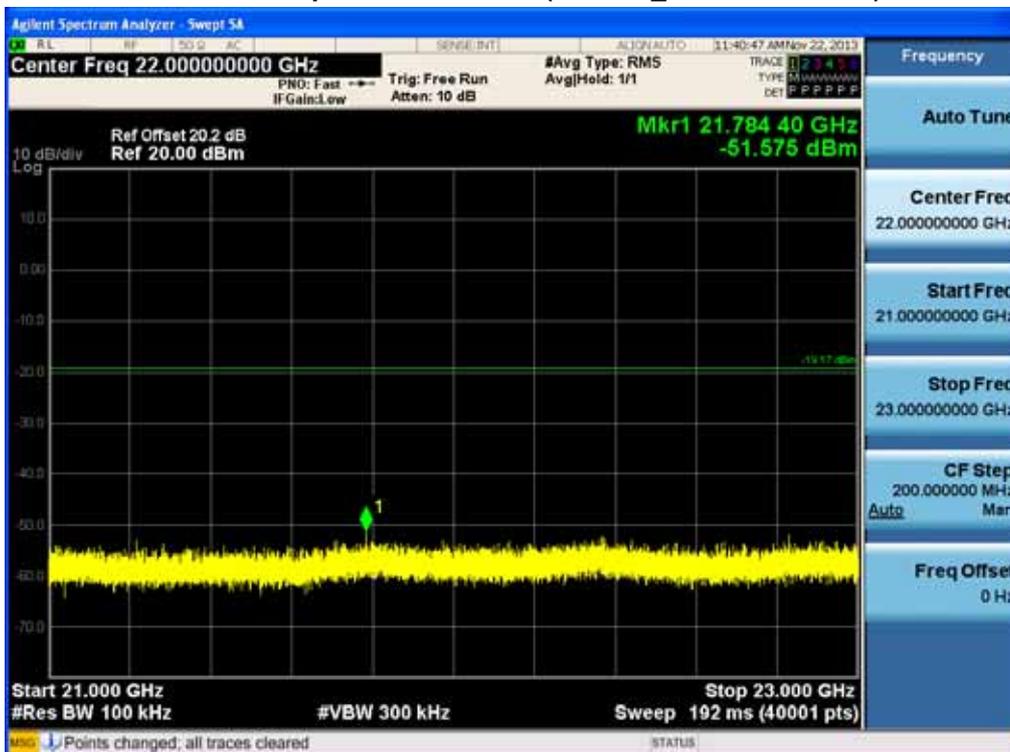
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



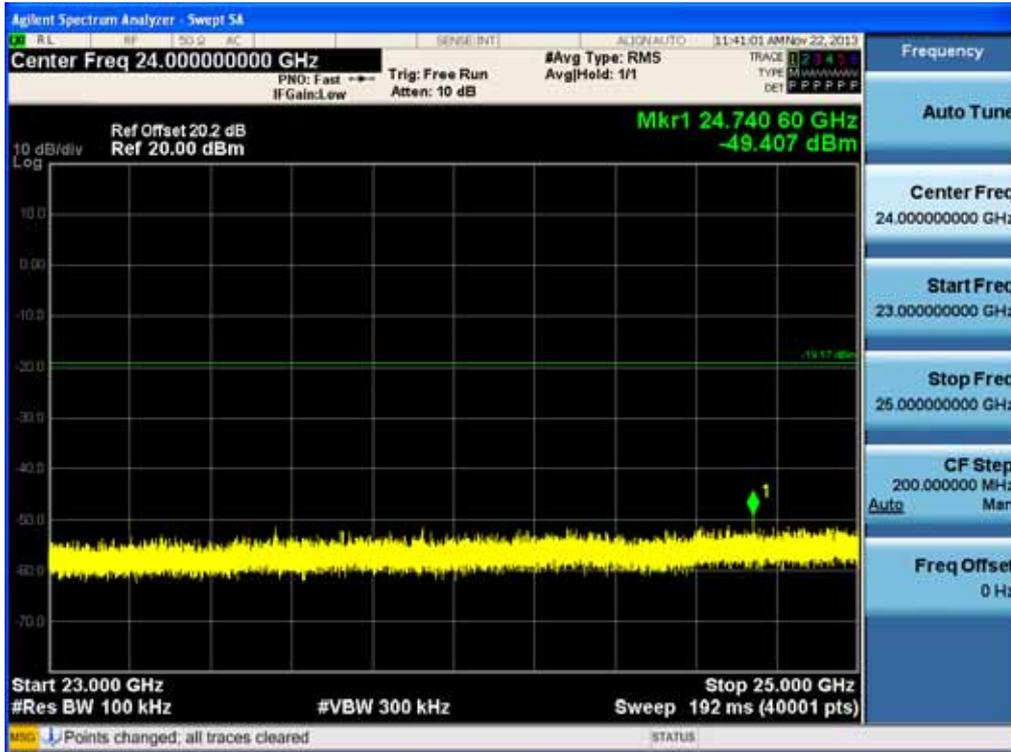
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



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Conducted Spurious Emission (802.11n\_20 MHz BW-CH6)



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