

HCT CO., LTD.

CERTIFICATE OF COMPLIANCE

FCC Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu Suwon-si,
Gyeonggi-do, 443-742 Rep. of Korea

Date of Issue:

June 17, 2013

Test Site/Location:

HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon,
Icheon-si, Kyunggi-Do, Korea

Report No.: HCTR1306FR17

HCT FRN: 0005866421

FCC ID : A3LSGHT189N

APPLICANT : SAMSUNG Electronics Co., Ltd.

FCC Model(s): SGH-T189N

EUT Type: 850/1900 GSM/GPRS/WCDMA Phone with Bluetooth v2.1, EDR, 802.11b/g

Max. RF Output Power: Wi-Fi 802.11b(20.75 dBm) / Wi-Fi 802.11g (19.87 dBm)

Frequency Range: 2412 MHz - 2462 MHz

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
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Test engineer of RF Team



Approved by
: Chang Seok Choi
Manager of RF Team

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1306FR17	June 17, 2013	- First Approval Report

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1. GENERAL INFORMATION

Applicant: SAMSUNG Electronics Co., Ltd.
Address: 129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 443-742 Rep. of Korea
FCC ID: A3LSGHT189N
EUT Type: 850/1900 GSM/GPRS/WCDMA Phone with Bluetooth v2.1, EDR, 802.11b/g
Model name(s): SGH-T189N
Date(s) of Tests: May 25, 2013 ~ June 14, 2013
Place of Tests: HCT Co., Ltd.
 105-1, Jangam-ri, Majang-Myeon, Icheon-si, Kyunggi-Do, 467-811, KOREA.
 (IC Recognition No. : 5944A-3)

2. EUT DESCRIPTION

EUT Type	850/1900 GSM/GPRS/WCDMA Phone with Bluetooth v2.1, EDR, 802.11b/g	
FCC Model Name	SGH-T189N	
Power Supply	DC 3.7 V	
Battery type	Li-ion Battery(Standard)	
Frequency Range	TX: 2412 MHz ~ 2462 MHz RX: 2412 MHz ~ 2462 MHz	
Max. RF Output Power	Peak	Wi-Fi 802.11b(20.75 dBm) / Wi-Fi 802.11g (19.87 dBm)
	Average	Wi-Fi 802.11b(14.48 dBm) / Wi-Fi 802.11g (12.00 dBm)
Modulation Type	DSSS/CCK(802.11b), OFDM(802.11g)	
Antenna Specification	Manufacturer: Samsung Electronics Antenna type: Cap Type Antenna Peak Gain : -1.7 dBi	

3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v03r01 dated April 9, 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 105-1, Jangam-ri, Majang-Myeon, Icheon-si, Kyunggi-Do, 467-811, 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.)

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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	8.610	9.720	0.885802469	0.527
	2 Mbps	4.400	5.510	0.798548094	0.977
	5.5 Mbps	1.720	2.830	0.607773852	2.163
	11 Mbps	0.954	2.067	0.461538462	3.358
g	6 Mbps	1.422	2.544	0.558962264	2.526
	9 Mbps	0.950	2.070	0.458937198	3.382
	12 Mbps	0.717	1.839	0.389885808	4.091
	18 Mbps	0.482	1.606	0.300124533	5.227
	24 Mbps	0.364	1.486	0.244952894	6.109
	36 Mbps	0.246	1.369	0.180350621	7.439
	48 Mbps	0.188	1.309	0.144079450	8.414
	54 Mbps	0.171	1.294	0.132689335	8.772

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

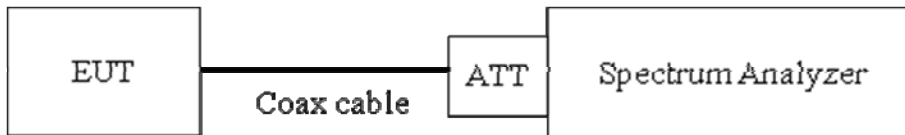
8.2 6dB BANDWIDTH (802.11b/g)

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.

■ 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	10.07	0.500	Pass
2437	6	10.07	0.500	Pass
2462	11	10.07	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11g

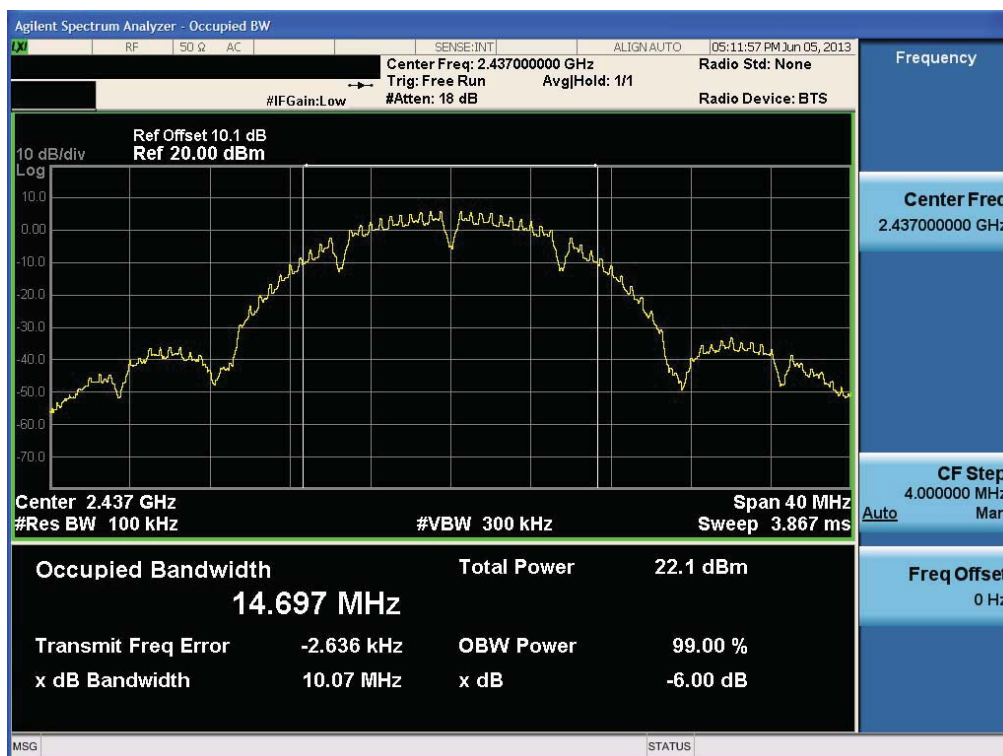
802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	16.38	0.500	Pass
2437	6	16.38	0.500	Pass
2462	11	16.38	0.500	Pass

RESULT PLOTS

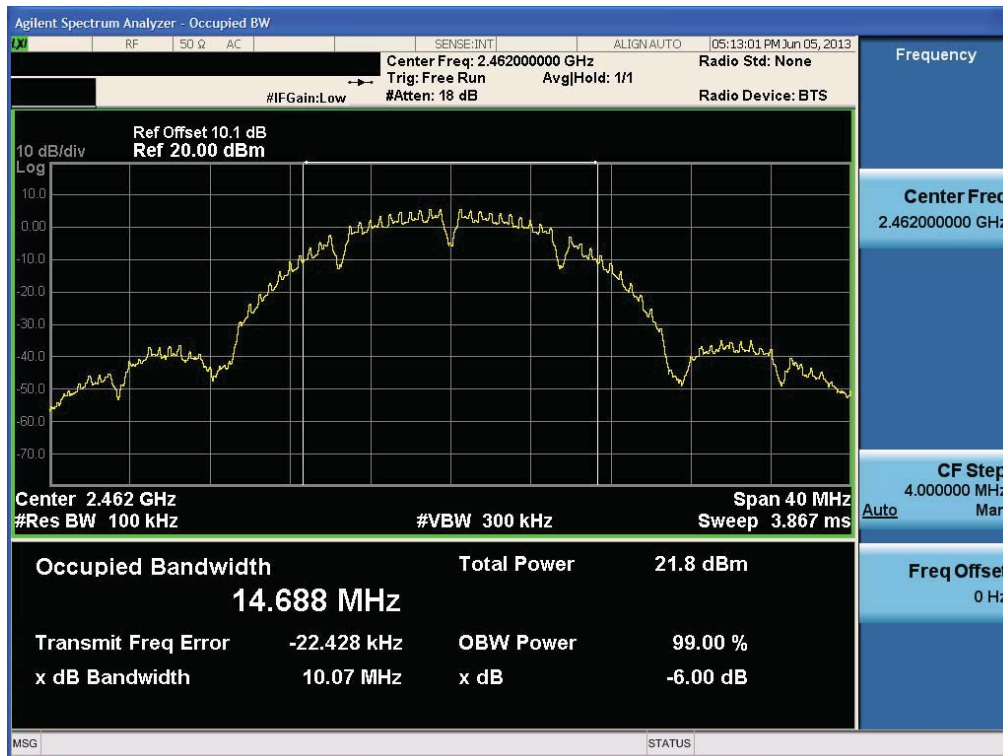
6dB Bandwidth plot (802.11b-CH 1)



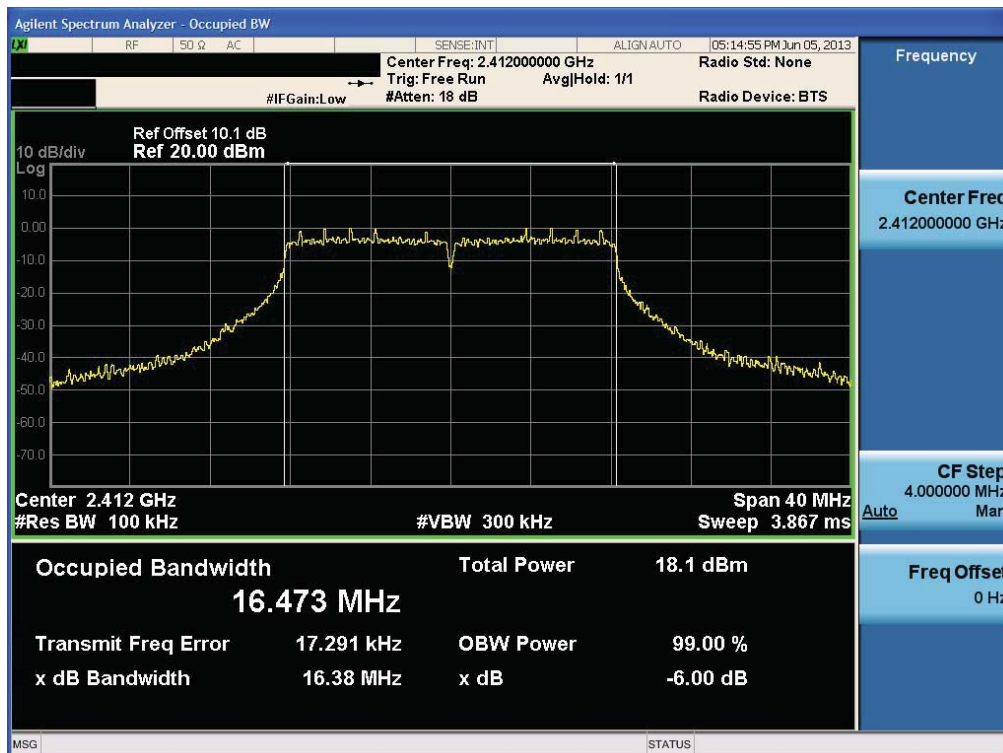
6dB Bandwidth plot (802.11b-CH 6)



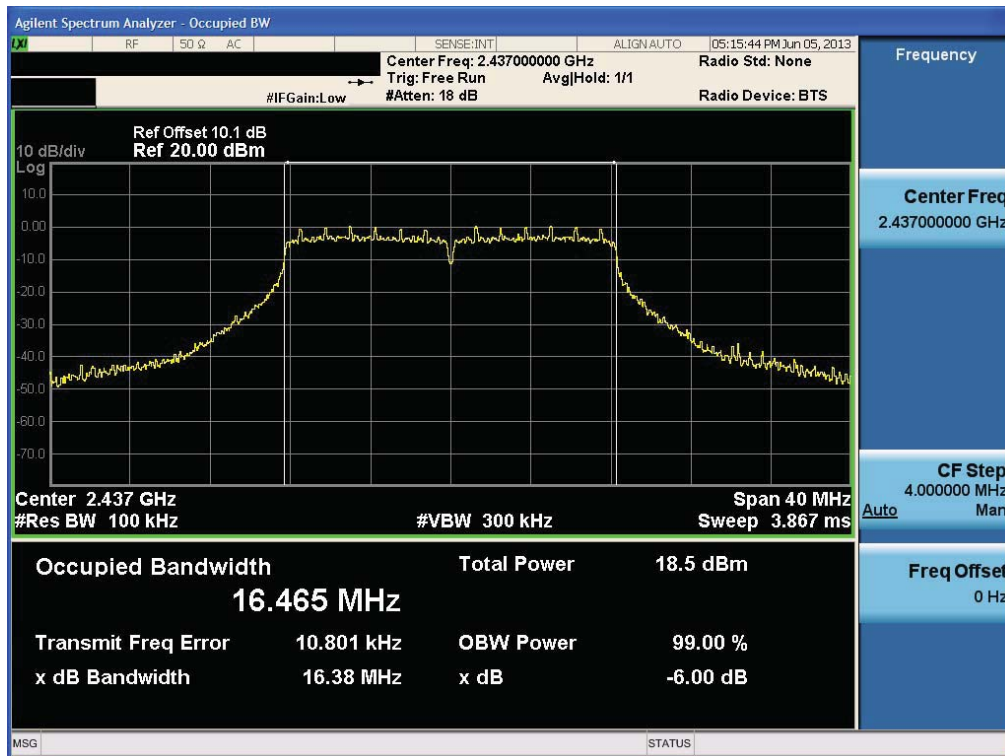
6dB Bandwidth plot (802.11b-CH 11)



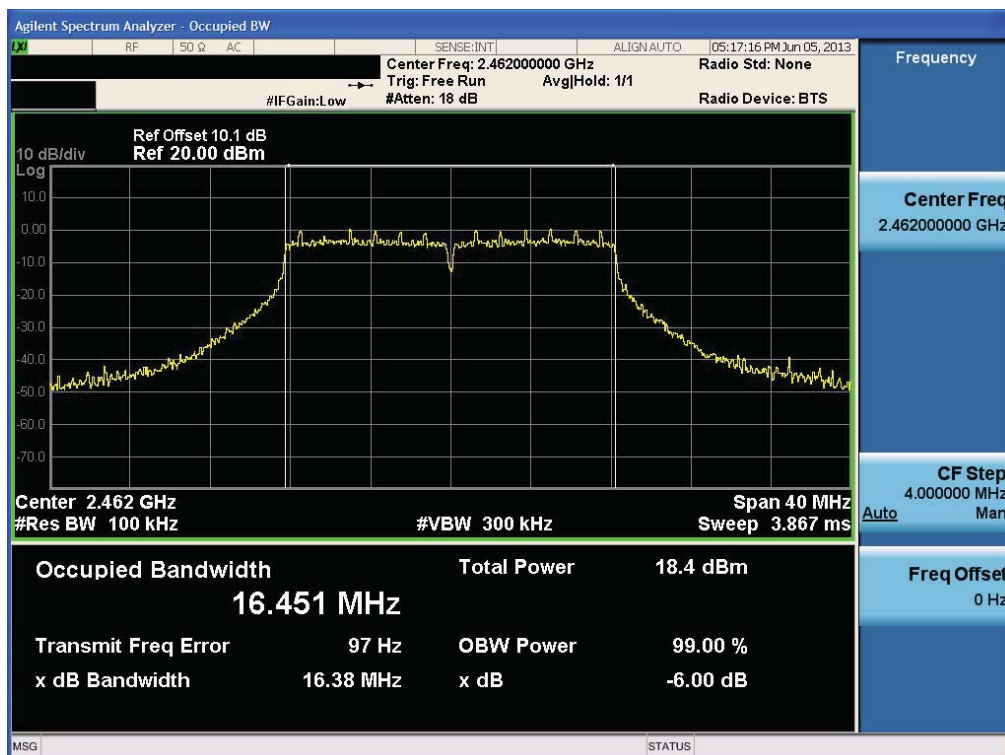
6dB Bandwidth plot (802.11g-CH 1)



6dB Bandwidth plot (802.11g-CH 6)



6dB Bandwidth plot (802.11g-CH 11)



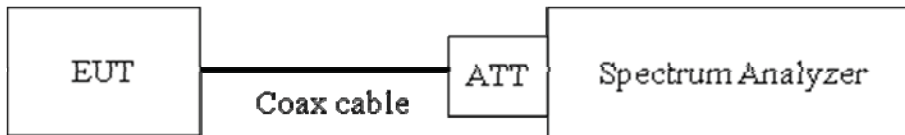
8.3 OUTPUT POWER (802.11b/g)

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

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

The maximum permissible conducted output power is 1 Watt.

■ TEST CONFIGURATION



■ TEST PROCEDURE

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 x RBW

SPAN $\geq$ 1.5 x 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 x RBW.

Number of points in sweep $\geq$ 2 x 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

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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

$$\begin{aligned} \text{Output Power} &= \text{Reading Value} + \text{ATT loss} + \text{Cable loss(1 ea)} + \text{Duty Cycle Factor} \\ &= 10 \text{ dBm} + 10 \text{ dB} + 0.8 \text{ dB} + 0.2 \text{ dB} = 21.0 \text{ dBm} \end{aligned}$$

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. Actual value of loss for the attenuator and cable combination is below table.
So, 10.1 dB is offset. And the offset gap in the 2.4 GHz range do not affect the conducted peak power final result.

Band	Frequency(MHz)	Loss(dB)
2.4 GHz	2412	10.11
	2437	10.10
	2462	10.12

(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	16.76	30
		2 Mbps	17.35	30
		5.5 Mbps	18.72	30
		11 Mbps	20.57	30
2437	6	1 Mbps	16.90	30
		2 Mbps	17.33	30
		5.5 Mbps	18.92	30
		11 Mbps	20.75	30
2462	11	1 Mbps	16.89	30
		2 Mbps	17.30	30
		5.5 Mbps	18.69	30
		11 Mbps	20.41	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	19.00	30
		9 Mbps	19.02	30
		12 Mbps	19.09	30
		18 Mbps	19.13	30
		24 Mbps	19.25	30
		36 Mbps	19.35	30
		48 Mbps	19.44	30
		54 Mbps	19.58	30
2437	6	6 Mbps	19.04	30
		9 Mbps	19.19	30
		12 Mbps	19.29	30
		18 Mbps	19.33	30
		24 Mbps	19.53	30
		36 Mbps	19.64	30
		48 Mbps	19.72	30
		54 Mbps	19.87	30
2462	11	6 Mbps	18.87	30
		9 Mbps	18.98	30
		12 Mbps	19.10	30
		18 Mbps	19.21	30
		24 Mbps	19.42	30
		36 Mbps	19.54	30
		48 Mbps	19.72	30
		54 Mbps	19.83	30

■ TEST RESULTS-Average

Conducted Output Power Measurements (802.11b Mode)

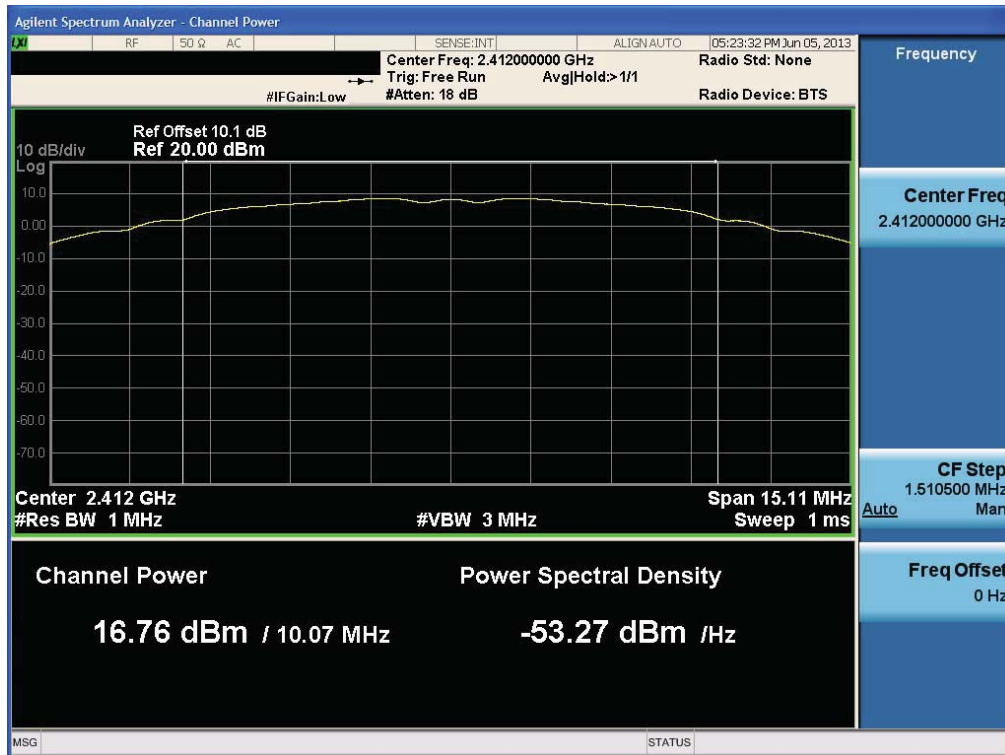
802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1 Mbps	13.86	0.527	14.39	30
		2 Mbps	13.50	0.977	14.48	30
		5.5 Mbps	12.20	2.163	14.36	30
		11 Mbps	11.09	3.358	14.45	30
2437	6	1 Mbps	13.44	0.527	13.97	30
		2 Mbps	13.27	0.977	14.25	30
		5.5 Mbps	11.76	2.163	13.92	30
		11 Mbps	10.88	3.358	14.24	30
2462	11	1 Mbps	13.68	0.527	14.21	30
		2 Mbps	13.14	0.977	14.12	30
		5.5 Mbps	12.25	2.163	14.41	30
		11 Mbps	10.85	3.358	14.21	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	8.81	2.526	11.34	30
		9 Mbps	8.62	3.382	12.00	30
		12 Mbps	7.23	4.091	11.32	30
		18 Mbps	6.15	5.227	11.38	30
		24 Mbps	5.23	6.109	11.34	30
		36 Mbps	4.09	7.439	11.53	30
		48 Mbps	3.07	8.414	11.48	30
		54 Mbps	2.73	8.772	11.50	30
2437	6	6 Mbps	8.85	2.526	11.38	30
		9 Mbps	8.42	3.382	11.80	30
		12 Mbps	7.44	4.091	11.53	30
		18 Mbps	6.23	5.227	11.46	30
		24 Mbps	5.32	6.109	11.43	30
		36 Mbps	3.93	7.439	11.37	30
		48 Mbps	3.08	8.414	11.49	30
		54 Mbps	2.96	8.772	11.73	30
2462	11	6 Mbps	8.94	2.526	11.47	30
		9 Mbps	8.52	3.382	11.90	30
		12 Mbps	7.30	4.091	11.39	30
		18 Mbps	6.09	5.227	11.32	30
		24 Mbps	5.20	6.109	11.31	30
		36 Mbps	4.00	7.439	11.44	30
		48 Mbps	3.19	8.414	11.60	30
		54 Mbps	2.92	8.772	11.69	30

RESULT PLOTS-Peak

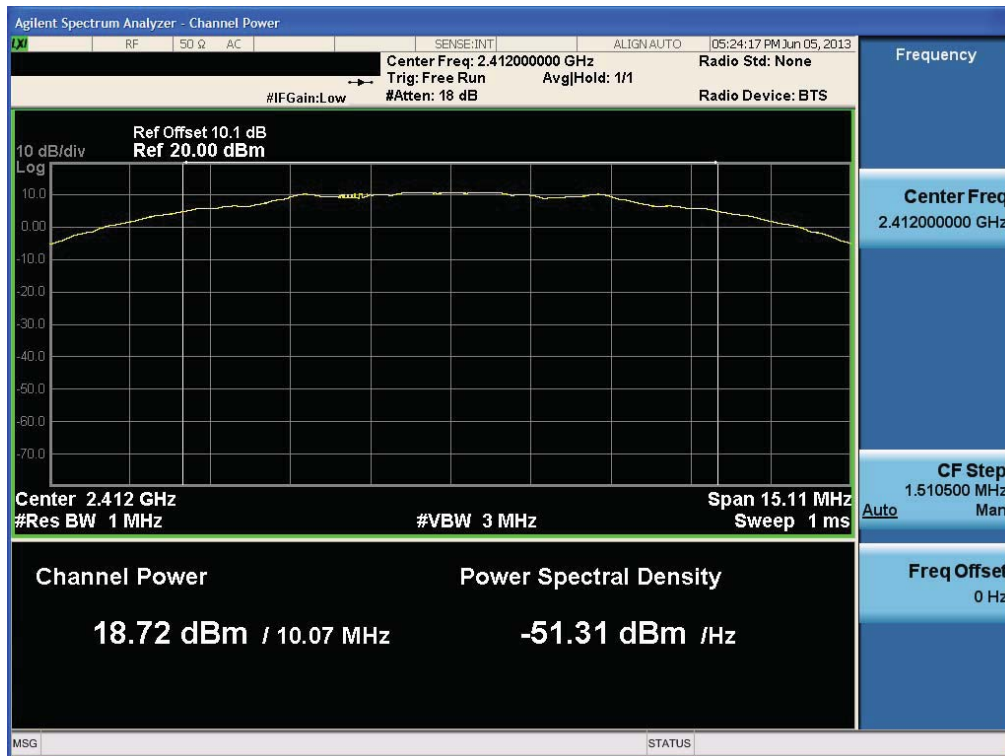
Conducted Output Power (802.11b-CH 1) 1Mbps



Conducted Output Power (802.11b-CH 1) 2Mbps



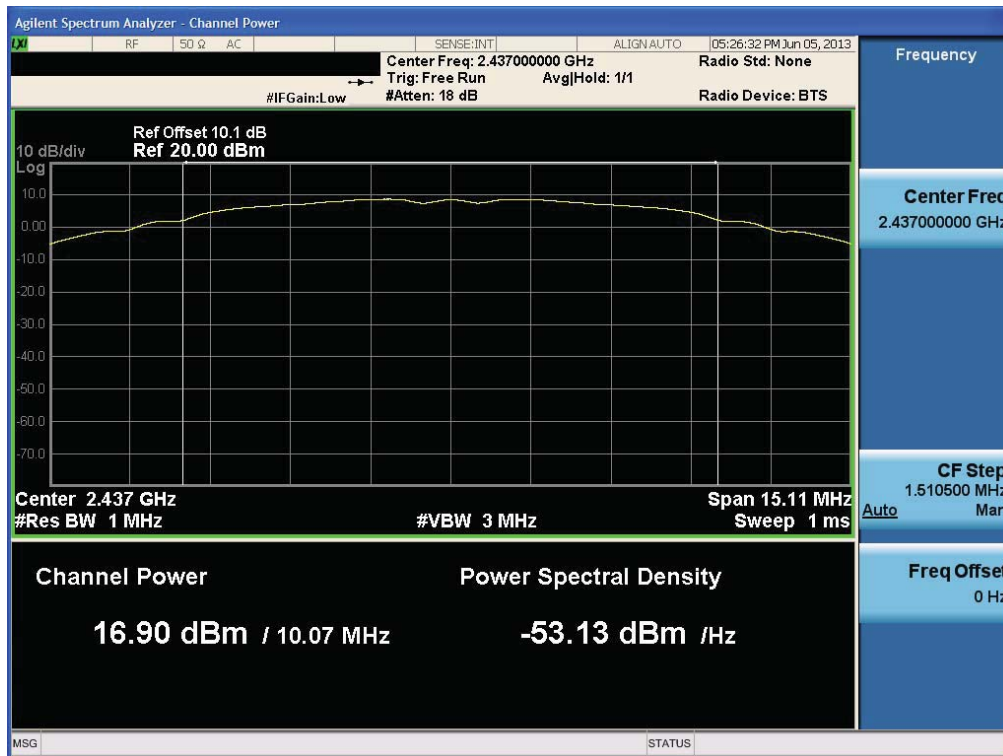
Conducted Output Power (802.11b-CH 1) 5.5Mbps



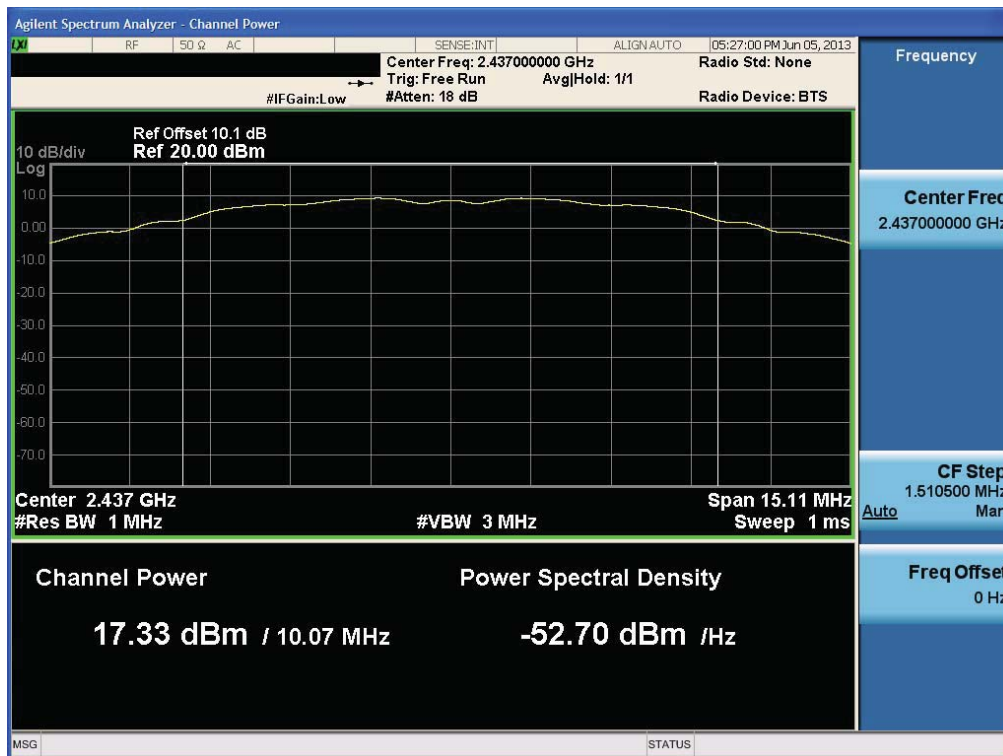
Conducted Output Power (802.11b-CH 1) 11Mbps



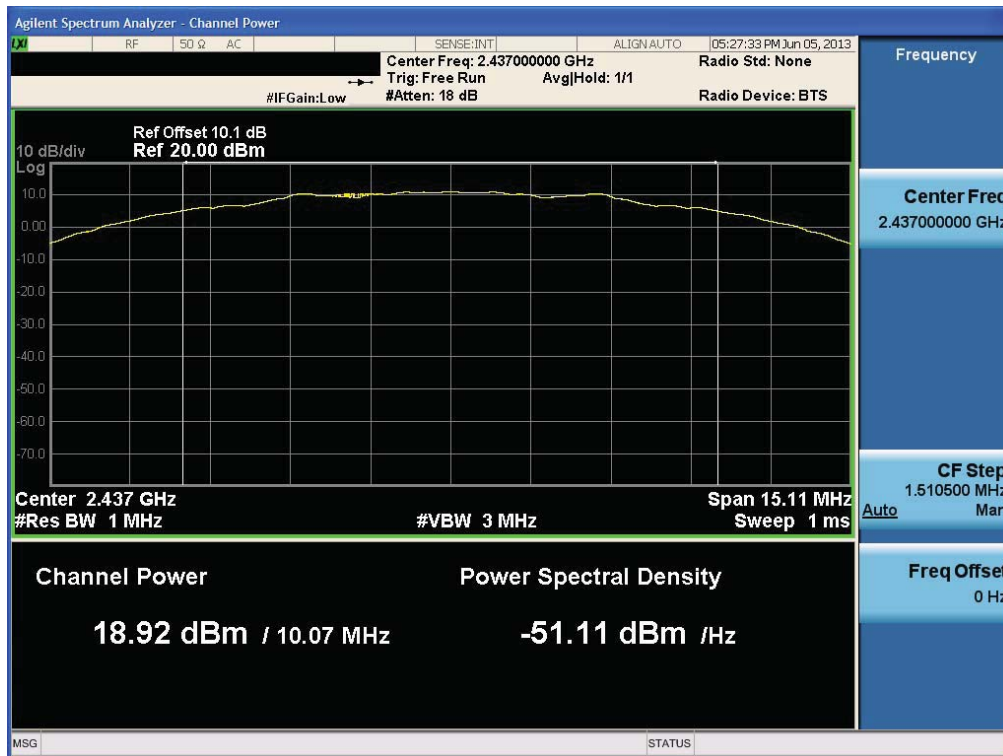
Conducted Output Power (802.11b-CH 6) 1Mbps



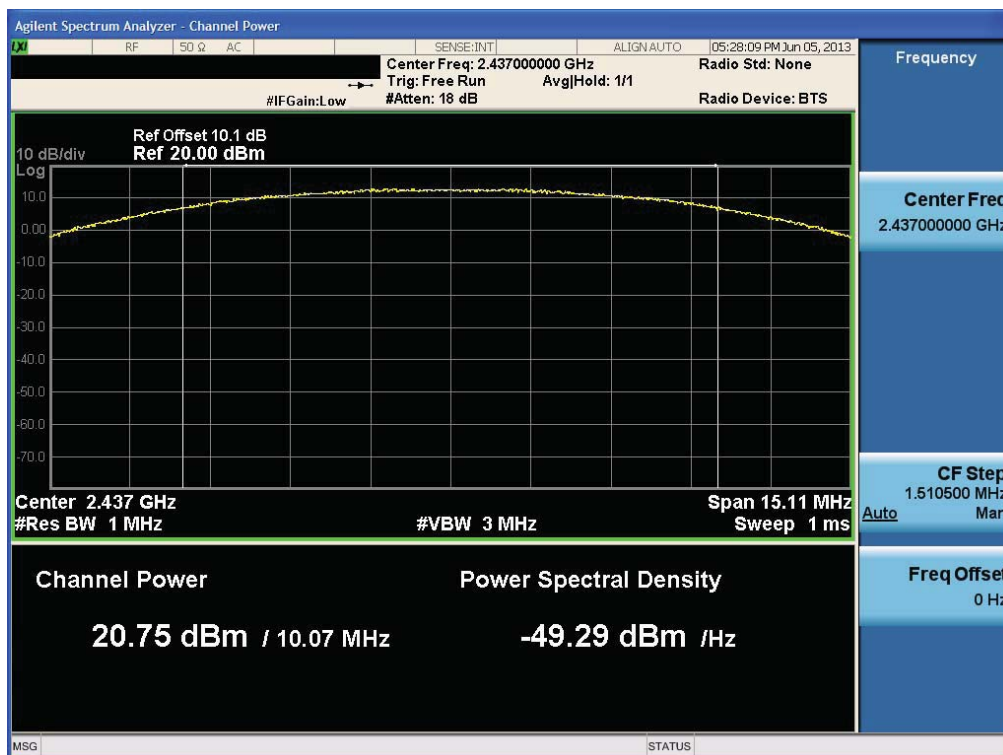
Conducted Output Power (802.11b-CH 6) 2Mbps



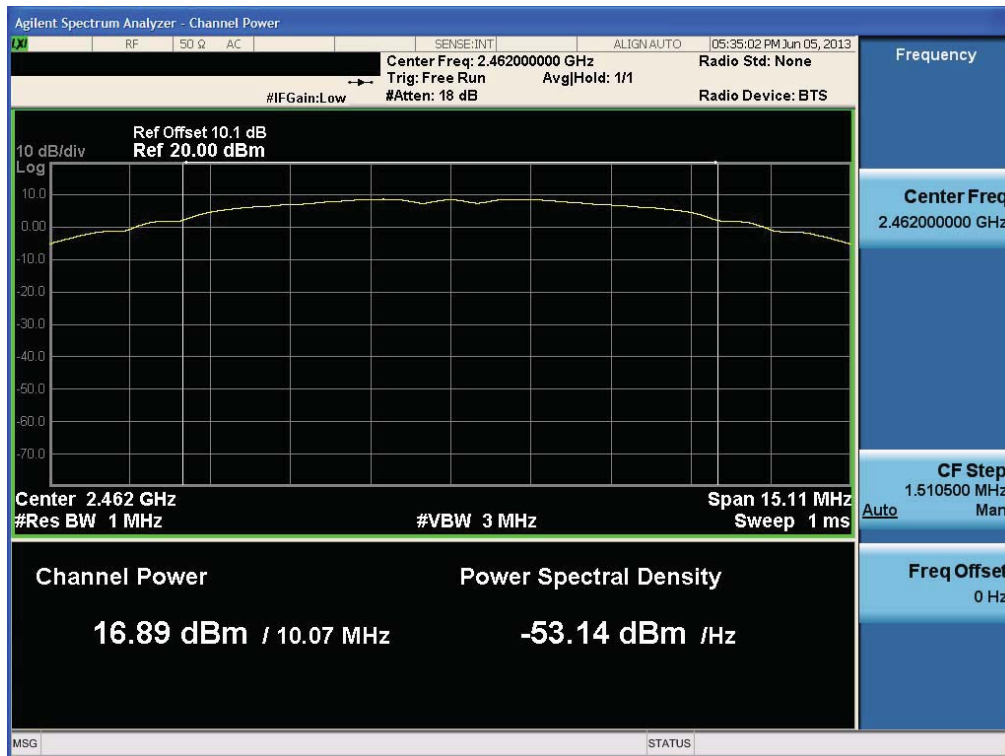
Conducted Output Power (802.11b-CH 6) 5.5Mbps



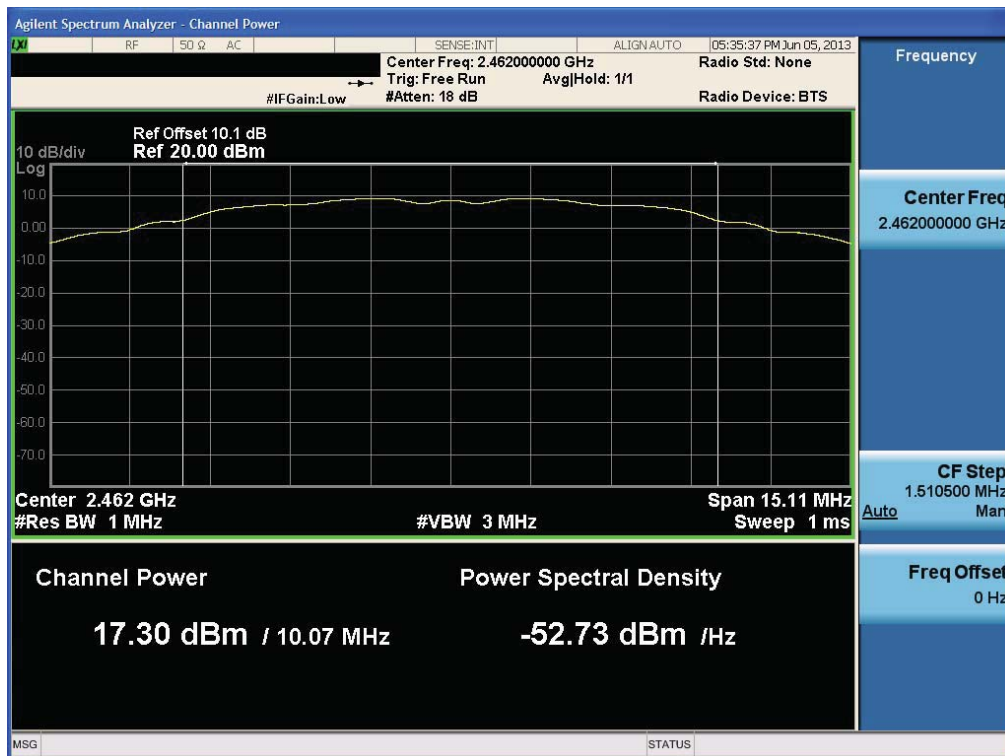
Conducted Output Power (802.11b-CH 6) 11Mbps



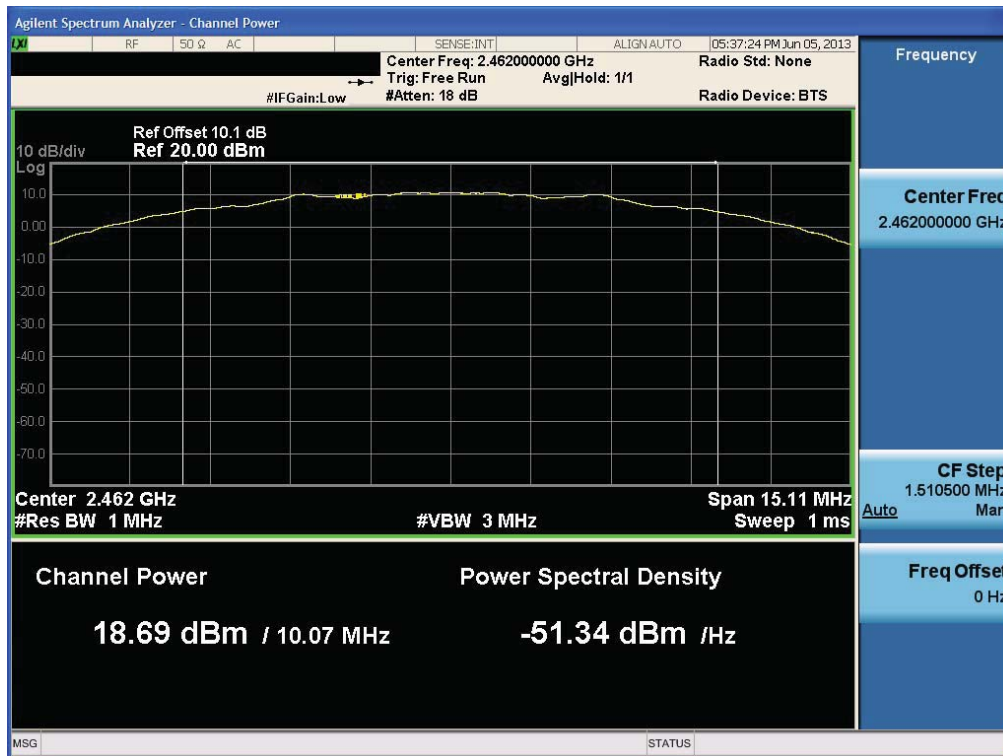
Conducted Output Power (802.11b-CH 11) 1Mbps



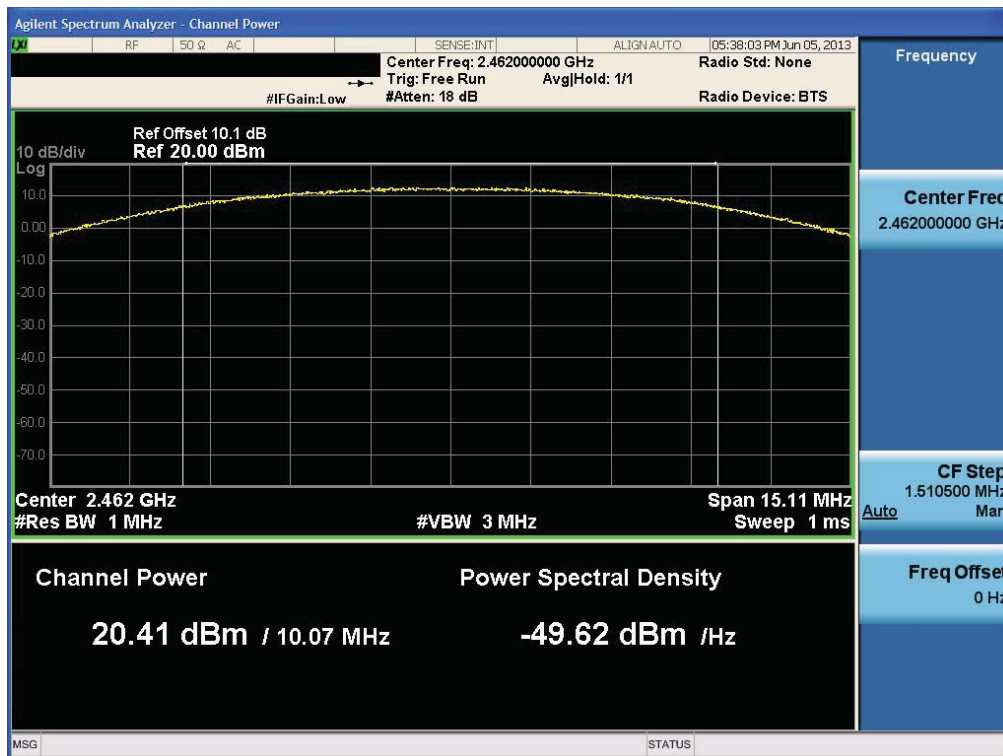
Conducted Output Power (802.11b-CH 11) 2Mbps



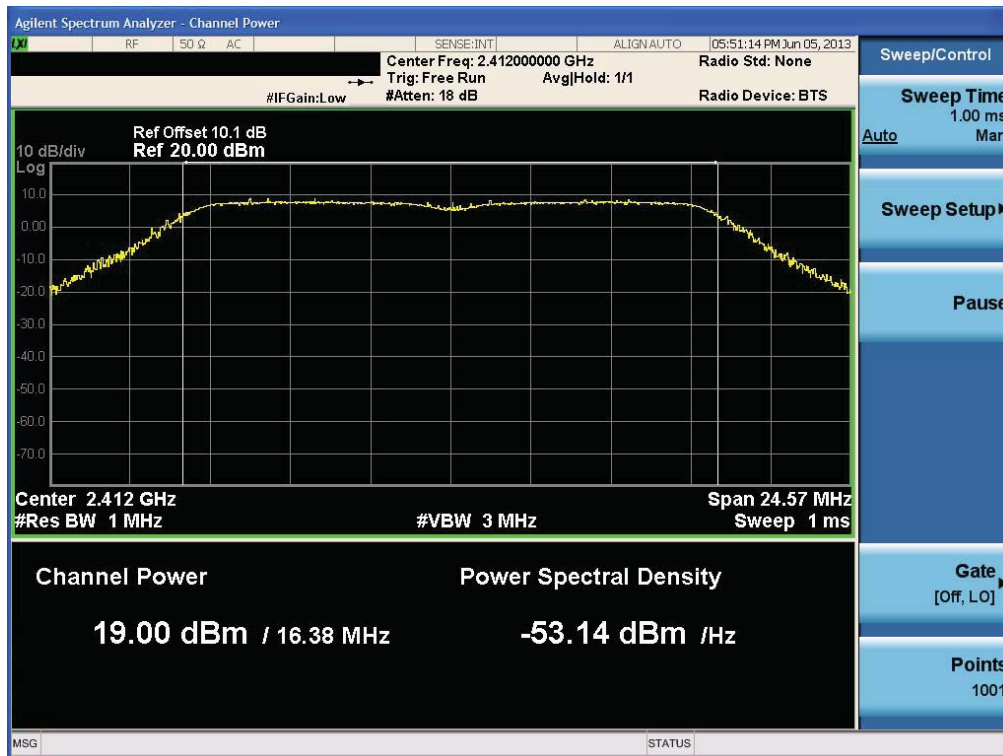
Conducted Output Power (802.11b-CH 11) 5.5Mbps



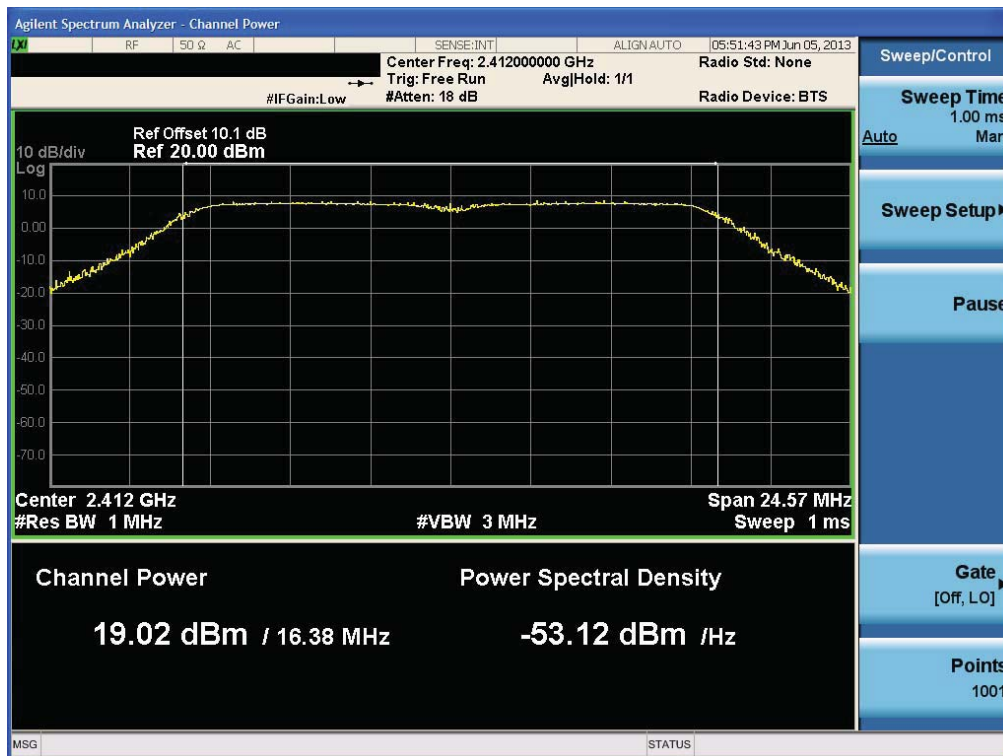
Conducted Output Power (802.11b-CH 11) 11Mbps



Conducted Output Power (802.11g-CH 1) 6Mbps



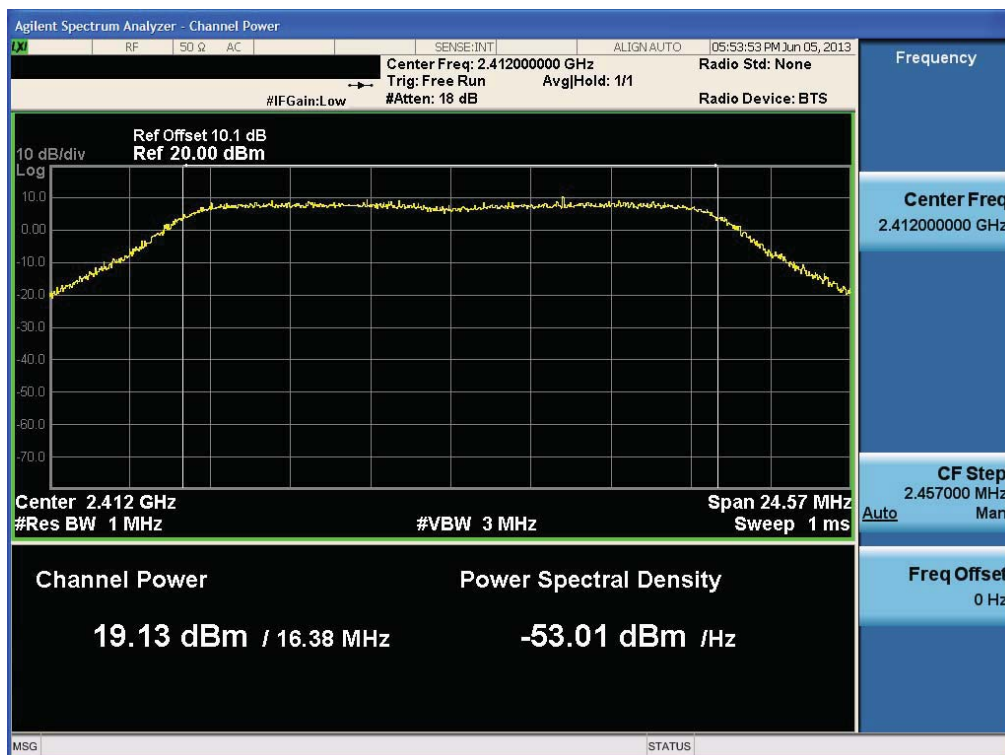
Conducted Output Power (802.11g-CH 1) 9Mbps



Conducted Output Power (802.11g-CH 1) 12Mbps



Conducted Output Power (802.11g-CH 1) 18Mbps



Conducted Output Power (802.11g-CH 1) 24Mbps



Conducted Output Power (802.11g-CH 1) 36Mbps

