RF TEST REPORT

Test item	:	Mobile Computer
Model No.	:	FCC: XM5 IC: XM5WB
Order No.	:	DTNC1410-04625, DTNC1410-04628
Date of receipt	:	2014-10-23
Test duration	:	2014-11-03 ~ 2014-11-17
Date of issue	:	2014-11-26
Use of report	:	FCC Original Grant

Applicant : Janam Technologies LLC
100 Crossways Park West Suite 105, Woodbury, New York 11797 USA

Test laboratory : DT&C Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification	:	FCC Part 15.407 Subpart E
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

Tested by:

Engineer
SeokHwan Hong

Reviewed by:

Technical Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1411-1505	Nov. 26, 2014	Initial issue

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1. EUT DESCRIPTION

FCC Equipment Class	Unlicensed National Information Infrastructure (UNII)
Product	Mobile Computer
Model Name	FCC: XM5 IC: XM5WB
Add Model Name	NA
Power Supply	DC 3.7 V
Frequency Range	**Band I(5150 ~ 5250MHz)** ▪ 802.11a/n(HT20): 5180 ~ 5240 MHz **Band II(5250 ~ 5350MHz)** ▪ 802.11a/n(HT20): 5260 ~ 5320 MHz **Band III(5470 ~ 5725MHz)** ▪ 802.11a/n(HT20) 5500 ~ 5700 MHz **Band IV(5425 ~ 5850MHz)** ▪ 802.11a/n(HT20): 5745 ~ 5825 MHz
Modulation type	64-QAM, 16QAM, QPSK BPSK for OFDM
Antenna Specification	**Antenna type**: Internal Antenna **Antenna gain** ▪ Band I: -0.594 dBi ▪ Band II: 0.187 dBi ▪ Band III: -2.304 dBi ▪ Band IV: -5.954 dBi

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2. Information about test items

2.1 Test mode / Channel Information

5GHz Band	Mode	Data Rate
Band I	802.11a	6Mbps
	802.11n(HT20)	MCS 0
	802.11n(HT40)	-
	802.11ac(VHT80)	-
Band II	802.11a	6Mbps
	802.11n(HT20)	MCS 0
	802.11n(HT40)	-
	802.11ac(VHT80)	-
Band III	802.11a	6Mbps
	802.11n(HT20)	MCS 0
	802.11n(HT40)	-
	802.11ac(VHT80)	-
Band IV	802.11a	6Mbps
	802.11n(HT20)	MCS 0
	802.11n(HT40)	-
	802.11ac(VHT80)	-

The worst case data rate for each modulation is determined as above table. And all tests conducted in this report were made at the worst case data rate of each modulation.

2.2 Tested Channel Information

5GHz Band	802.11a/n(HT20)	
	Channel	Frequency [MHz]
Band I	36	5180
	40	5200
	48	5240
Band II	52	5260
	60	5300
	64	5320
Band III	100	5500
	116	5580
	140	5700
Band IV	149	5745
	157	5785
	165	5825

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2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2.4 Tested environment

Temperature	:	20 °C ~ 24 °C
Relative humidity content	:	40 % ~ 48 % R.H.
Details of power supply	:	DC 3.7 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

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3. SUMMARY OF TESTS

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)					
15.407(a)	N/A	Emission Bandwidth (26 dB Bandwidth)	N/A	Conducted	C
15.407(e)	RSS-210 [A8.2]	Minimum Emission Bandwidth (6 dB Bandwidth)	> 500 kHz (5725-5850)		C
15.407(a)	RSS-210 [A9.2]	Maximum Conducted Output Power	5150 ~ 5250MHz For FCC: < 30 dBm or < 23.97 dBm 5150 ~ 5250MHz For IC: 200mW or <10 + 10log$_{10}$(B) dBm, whichever power is less. 5250 ~ 5350MHz & 5470 ~ 5725MHz For FCC & IC 250mW or <11 + 10log$_{10}$(B) dBm, whichever power is less. 5725 ~ 5850MHz For FCC: < 30 dBm		C Note.3
15.407(a)	RSS-210 [A9.2]	Peak Power Spectral Density	5150 ~ 5250MHz For FCC: 11dBm/MHz or 17dBm/MHz 5150 ~ 5250MHz For IC: 10dBm/MHz 5250 ~ 5350MHz & 5470 ~ 5725MHz For FCC & IC: 11dBm/MHz 5725 ~ 5850MHz For FCC: 30dBm/500kHz		C Note.4
15.407(g)	N/A	Frequency Stability	N/A		C
-	RSS Gen [6.6]	Occupied Bandwidth (99%)	N/A		NA
15.407(b)	RSS-210 [A9.2]	Undesirable Emissions	5150 ~ 5725MHz: < -27 dBm/MHz EIRP 5725 ~ 5850MHz: < -17 dBm/MHz EIRP or< -27 dBm/MHz EIRP	Radiated	C Note.5
15.205 15.209 15.407(b)	RSS-Gen [8.9&8.10]	General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		C Note.6
15.407(h)	RSS-210 [A9.3]	Dynamic Frequency Selection	See DFS test report	-	C Note.7
15.207	RSS-Gen [8.8]	AC Conducted Emissions	FCC 15.207	AC Line Conducted	C
15.203	RSS-Gen [8.7]	Antenna Requirements	FCC 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: The test items were performed according to the KDB789033 D02 V01 and ANSI C63.10-2009.

Note 3: (i) For access point operating in the band 5.15-5.25 GHz: < 30 dBm
(ii) For mobile and portable client devices in the 5.15-5.25 GHz band: < 23.97 dBm

Note 4: (i) For access point operating in the band 5.15-5.25 GHz: < 17 dBm/MHz
(ii) For mobile and portable client devices in the 5.15-5.25 GHz band: < 11 dBm/MHz

Note 5: For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz

Note 6: These test items were performed in each axis and the worst case data was reported.

Note 7: For DFS testing, please refer to DFS test report.

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4. TEST METHODOLOGY

Generally the tests were performed according to the KDB789033 D02 v01. And ANSI C63.10-2009 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 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.

4.2 EUT exercise

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart C.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB789033 D02 v01. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2009.

The EUT is placed on the table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15MHz and 30MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

Basically the radiated tests were performed with KDB789033 D02 v01. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2009 as stated on KDB789033 D02 v01.

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 highest emission, the relative positions of the EUT were rotated through three orthogonal axis.

4.4 Description of test modes

A test program is used to control the EUT for staying in continuous transmitting mode with maximum fixed duty cycle.

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5. 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.

6. FACILITIES AND ACCREDITATIONS

6.1 Facilities

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number : 165783

6.2 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 peak, 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.”

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203& RSS-Gen [6.6]:

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 internal antenna is attached on the main PCB using the special spring tension.

(Please refer to the internal photo.)

Therefore this E.U.T Complies with the requirement of §15.203

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8. TEST RESULT

8.1 Emission Bandwidth(26 dB Bandwidth)

▣ Test Requirements

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies. The 26dB bandwidth is used to determine the conducted output power limit.

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02 V01**.

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

▣ TEST RESULTS: Comply

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]
802.11a	Band I	36	5180	22.53
		40	5200	21.66
		48	5240	21.80
	Band II	52	5260	21.62
		60	5300	22.85
		64	5320	21.03
	Band III	100	5500	21.53
		116	5580	22.73
		140	5700	22.64
802.11n (HT20)	Band I	36	5180	22.10
		40	5200	23.09
		48	5240	22.83
	Band II	52	5260	22.42
		60	5300	22.49
		64	5320	22.92
	Band III	100	5500	22.33
		116	5580	21.99
		140	5700	22.22

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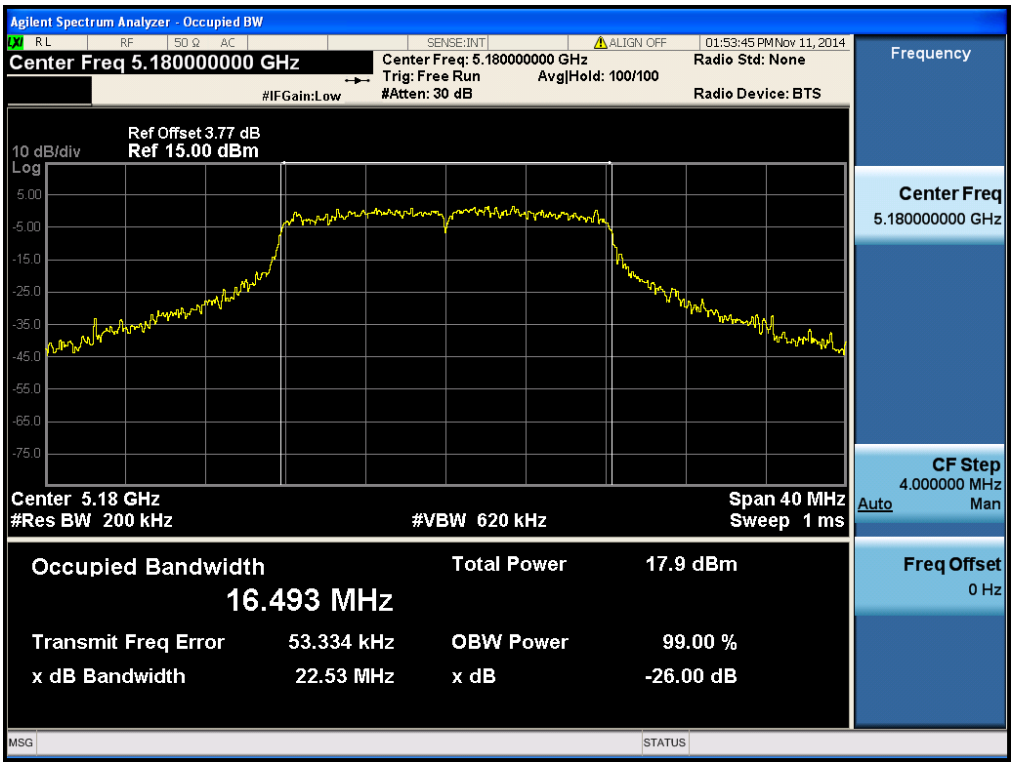
▣ Result Plots

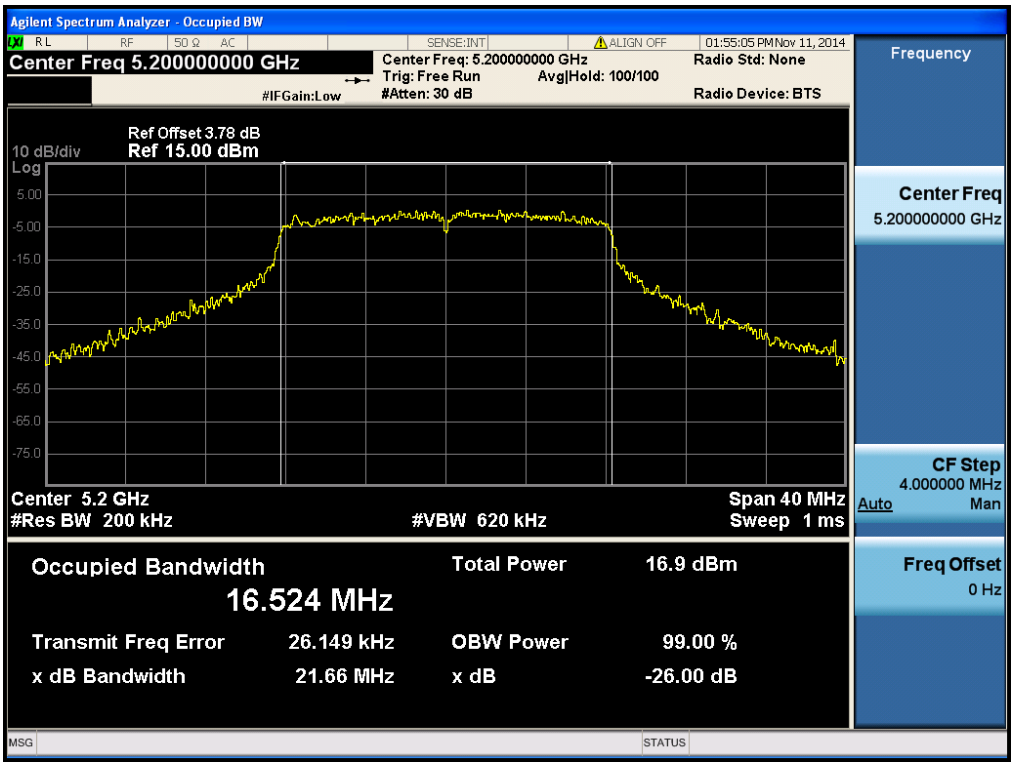
26 dB Bandwidth

Test Mode: 802.11a & Ch.36



26 dB Bandwidth

Test Mode: 802.11a & Ch.40



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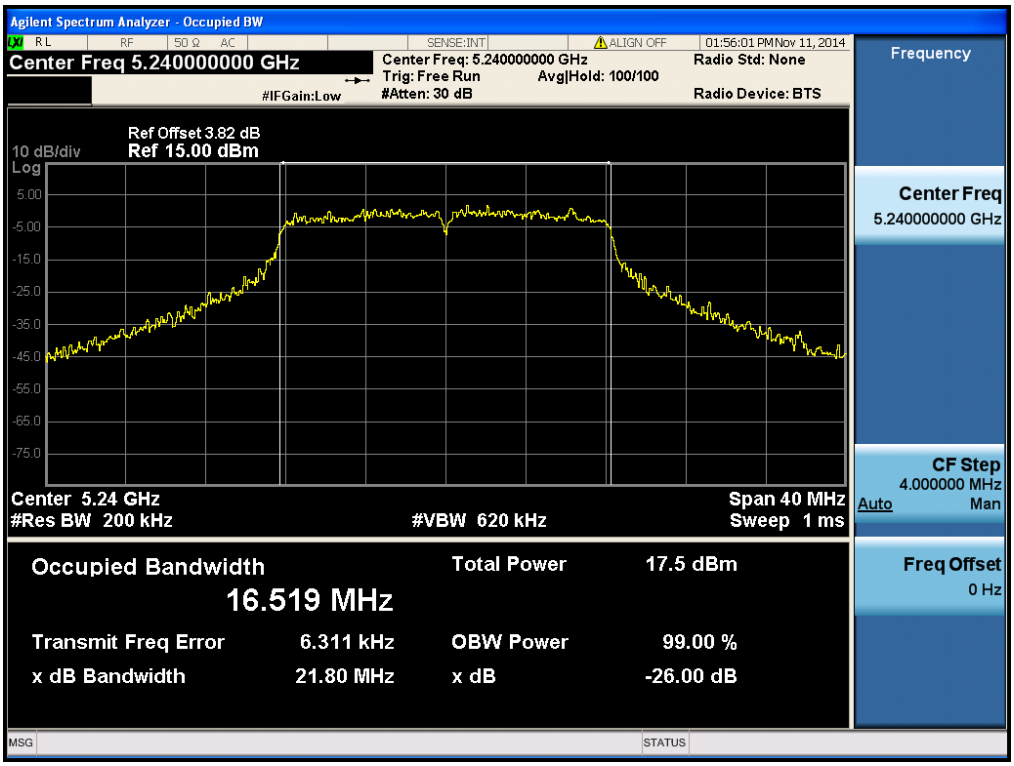
26 dB Bandwidth Test Mode: 802.11a & Ch.48



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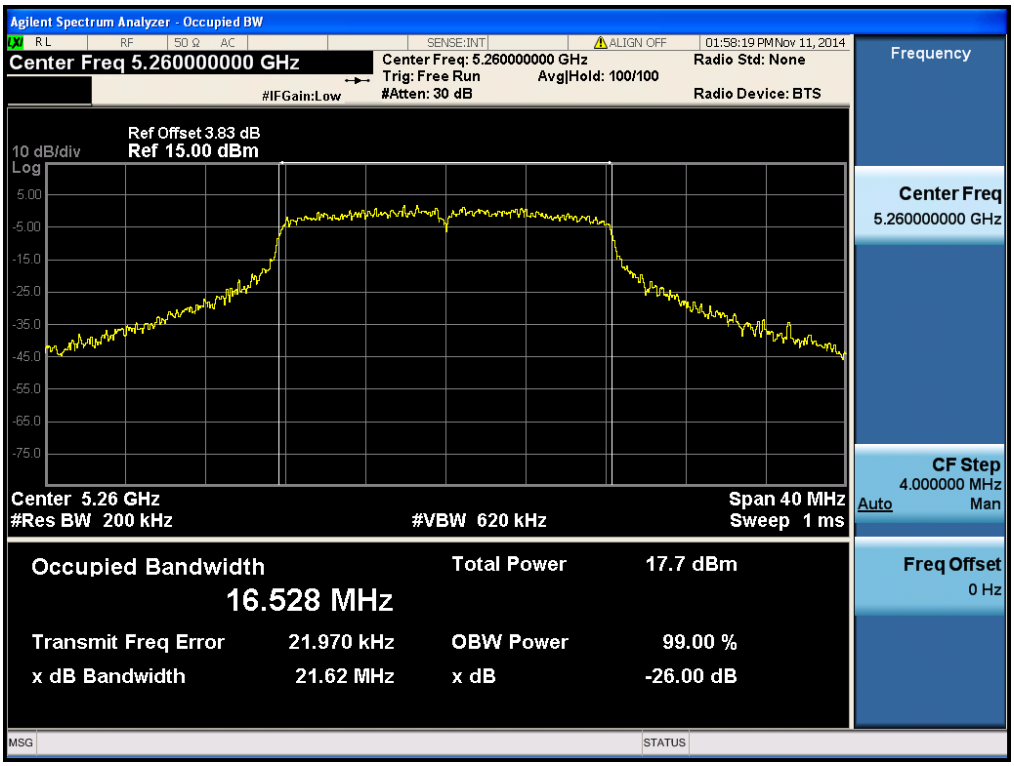
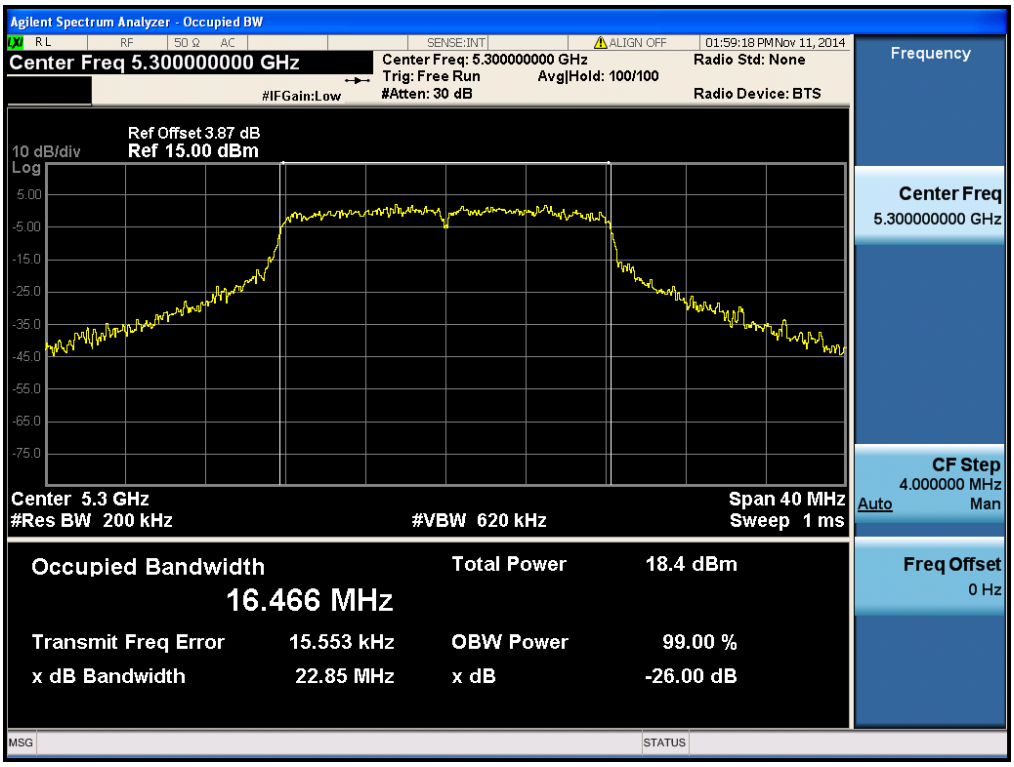
26 dB Bandwidth Test Mode: 802.11a & Ch.52



26 dB Bandwidth Test Mode: 802.11a & Ch.60



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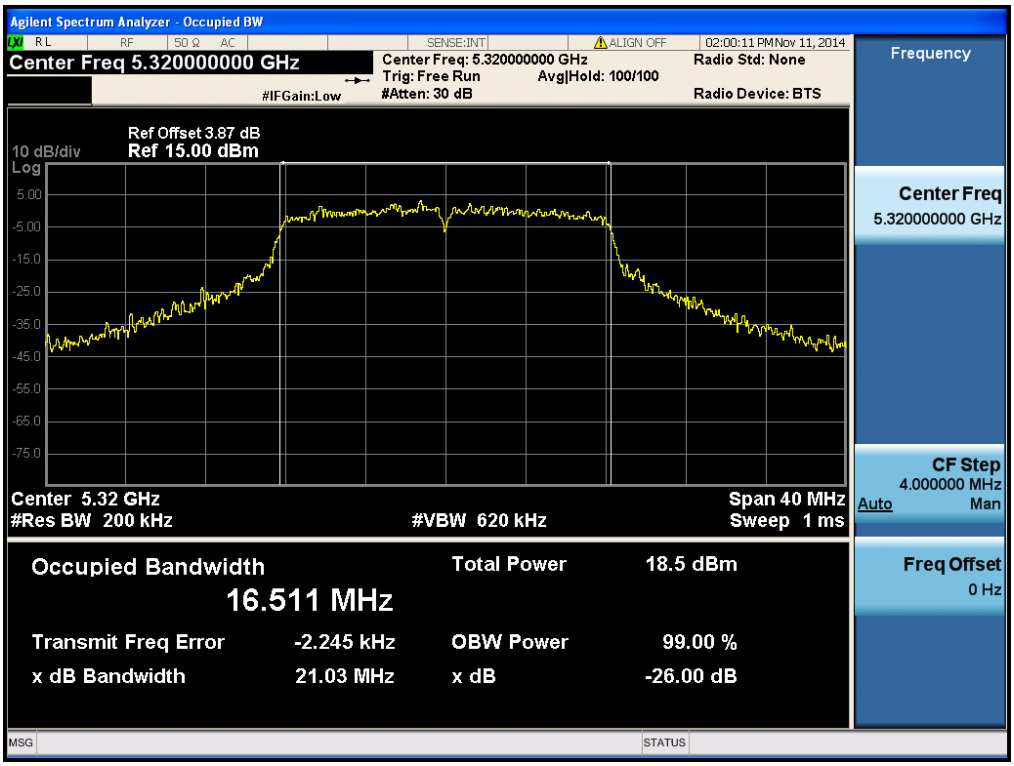
26 dB Bandwidth Test Mode: 802.11a & Ch.64



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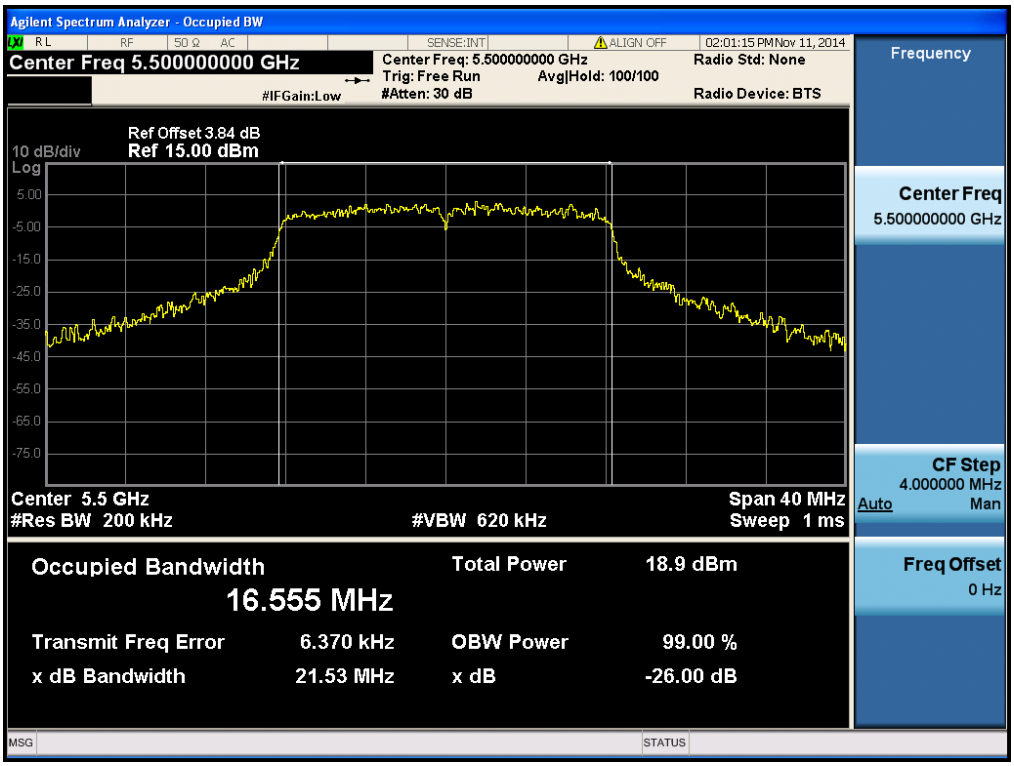
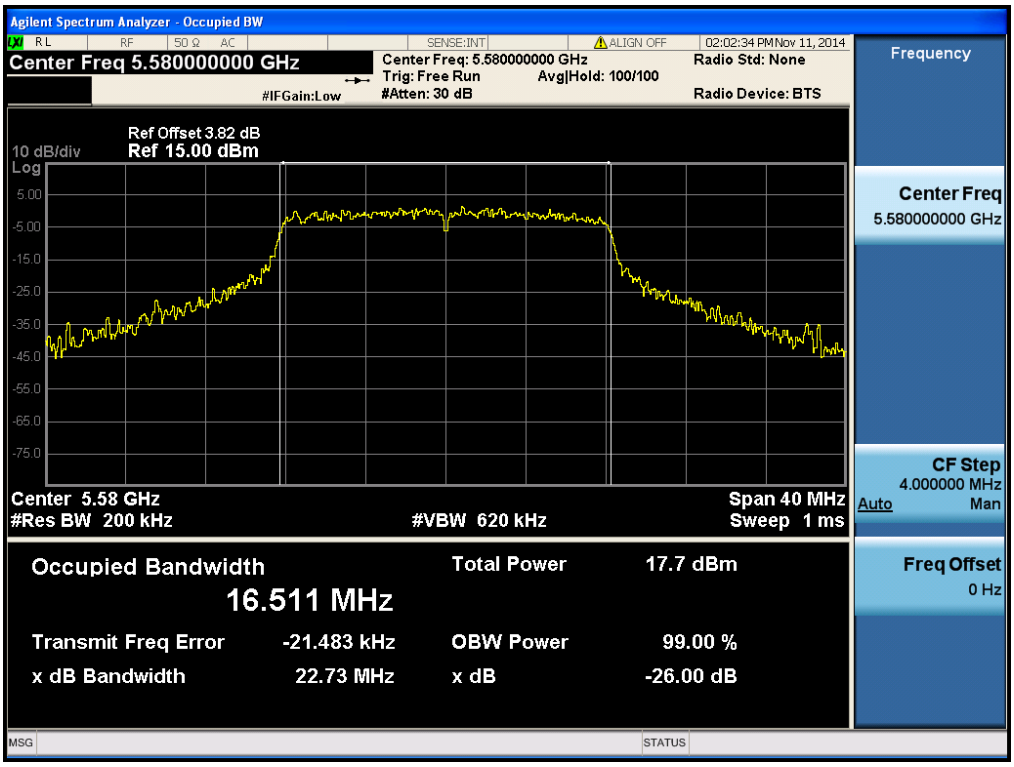
26 dB Bandwidth Test Mode: 802.11a & Ch.100



26 dB Bandwidth Test Mode: 802.11a & Ch.116



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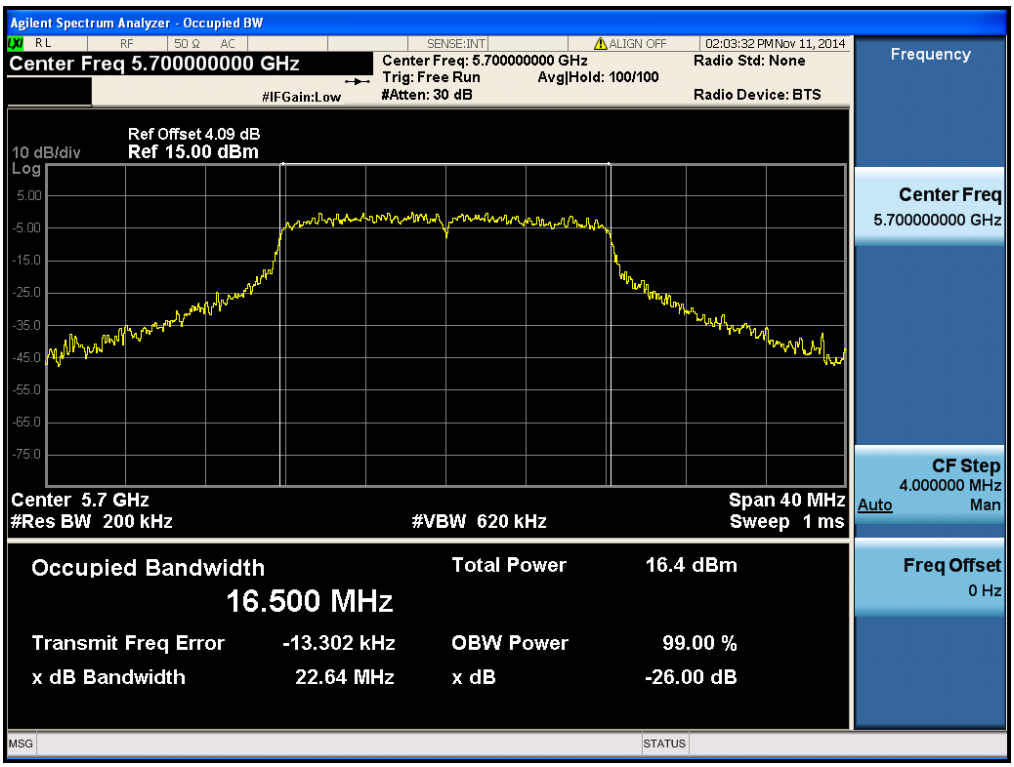
26 dB Bandwidth Test Mode: 802.11a & Ch.140



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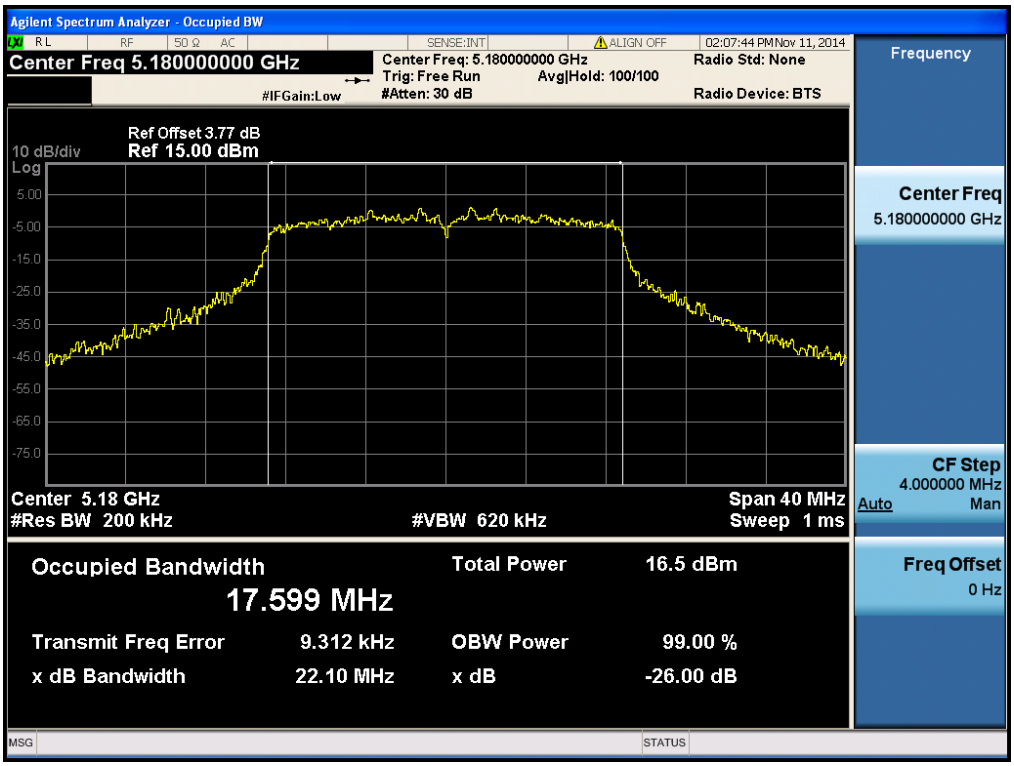
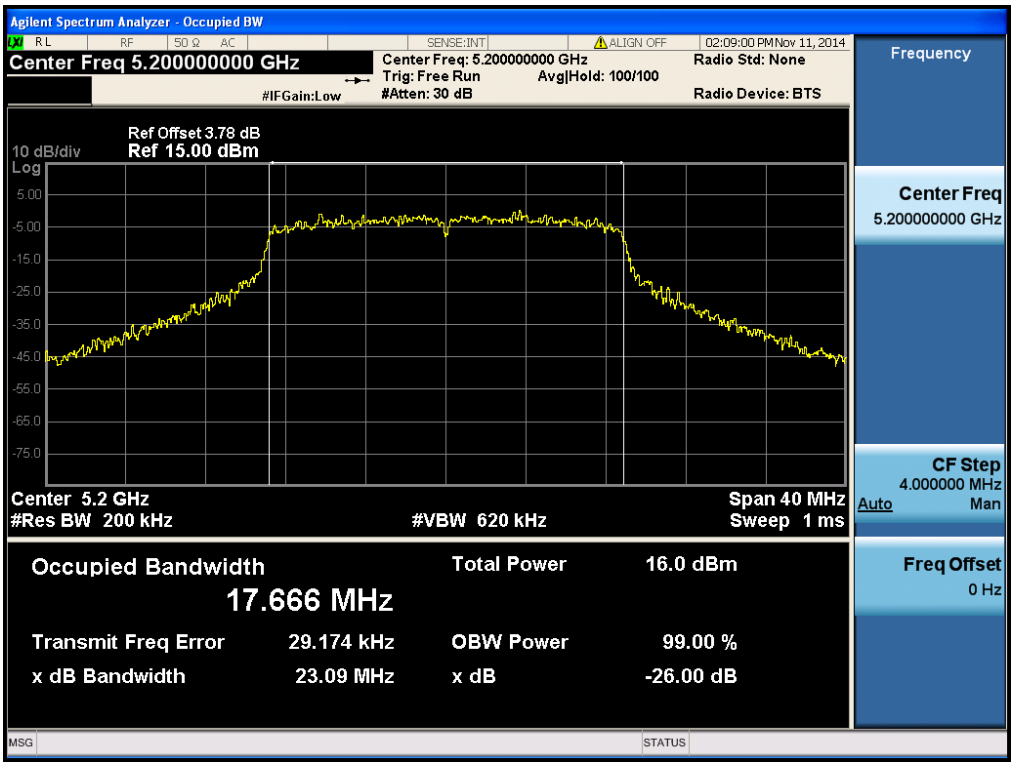
26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.36



26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.40



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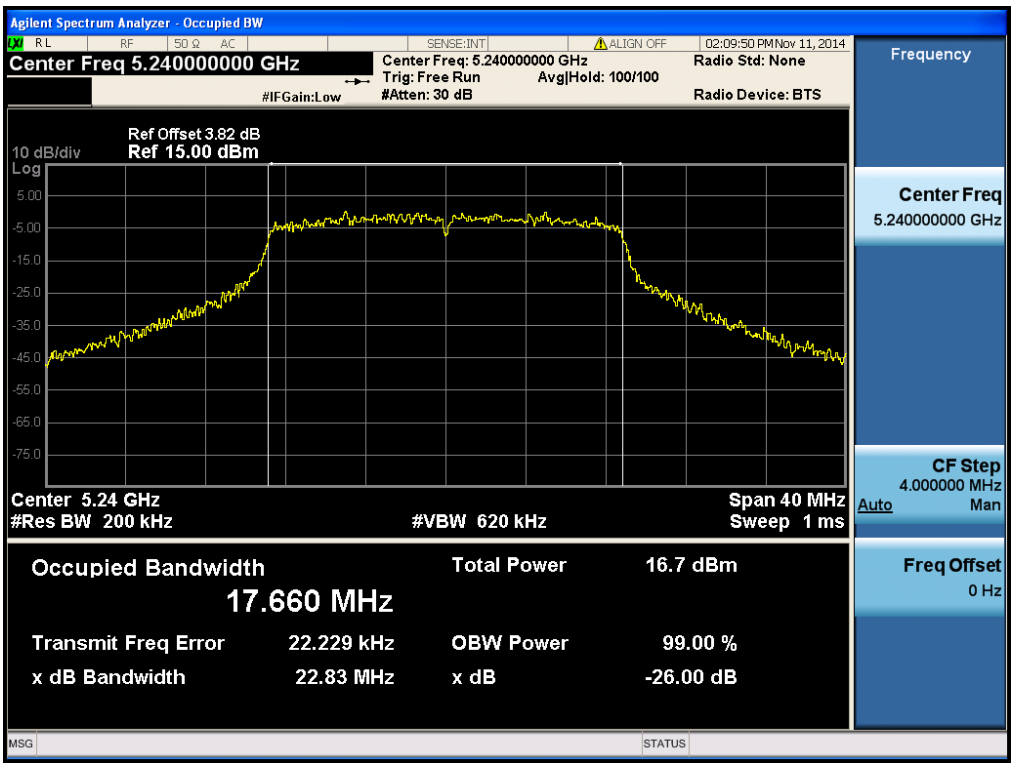
26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.48



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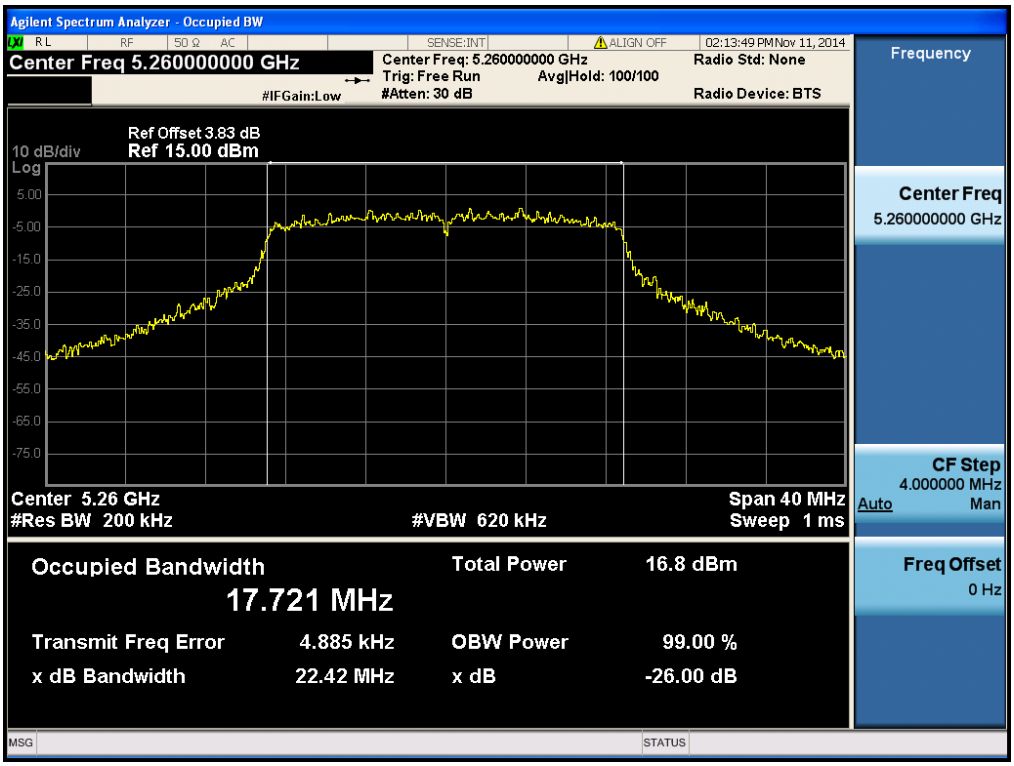
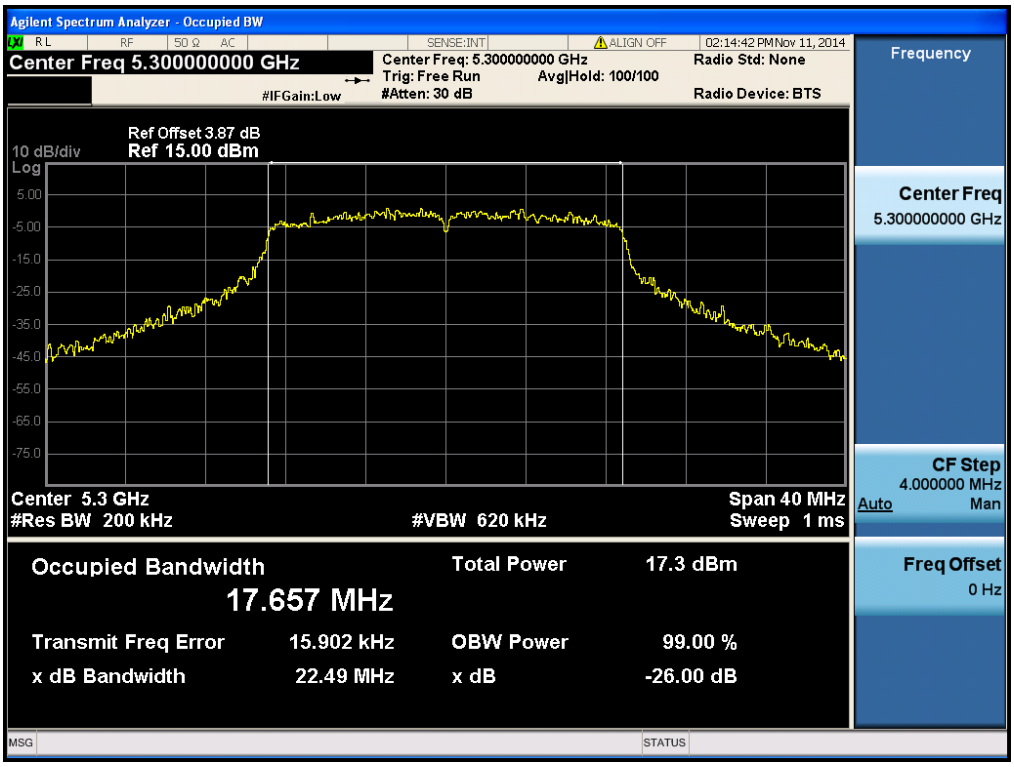
26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.52



26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.60



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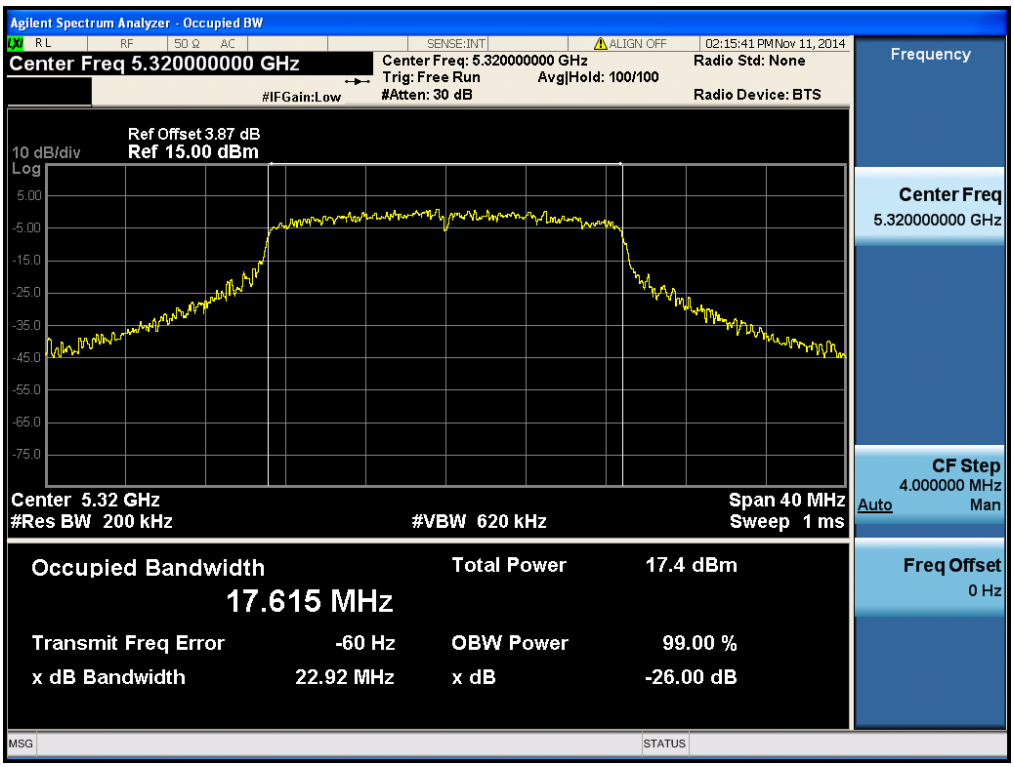
26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.64



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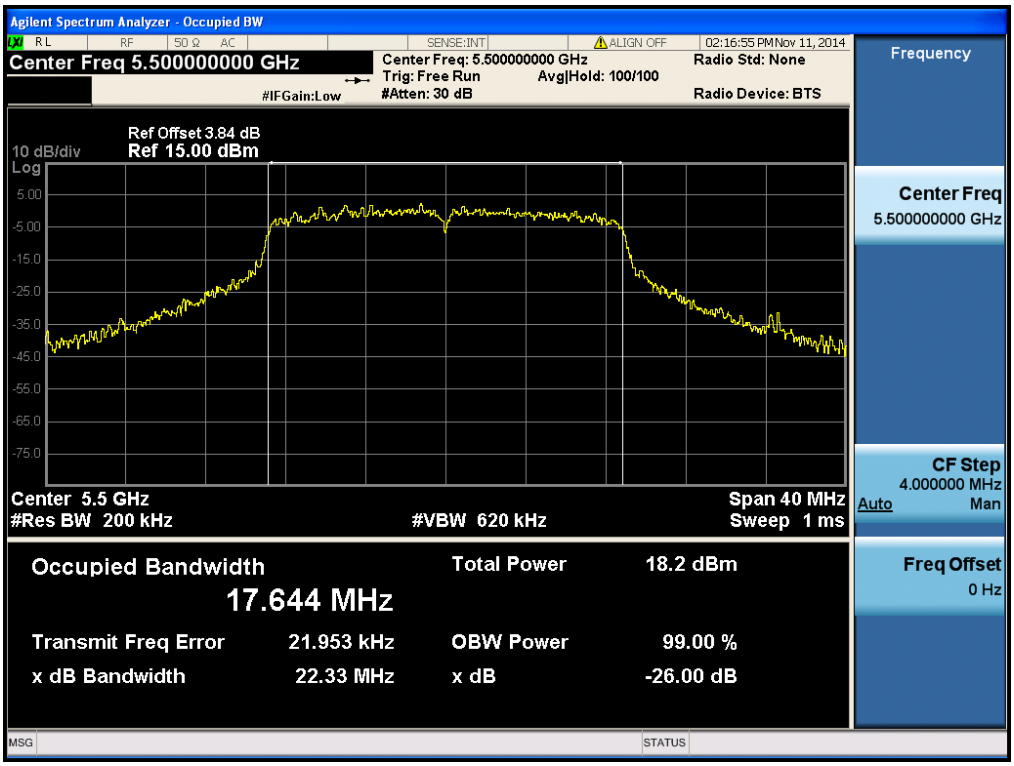
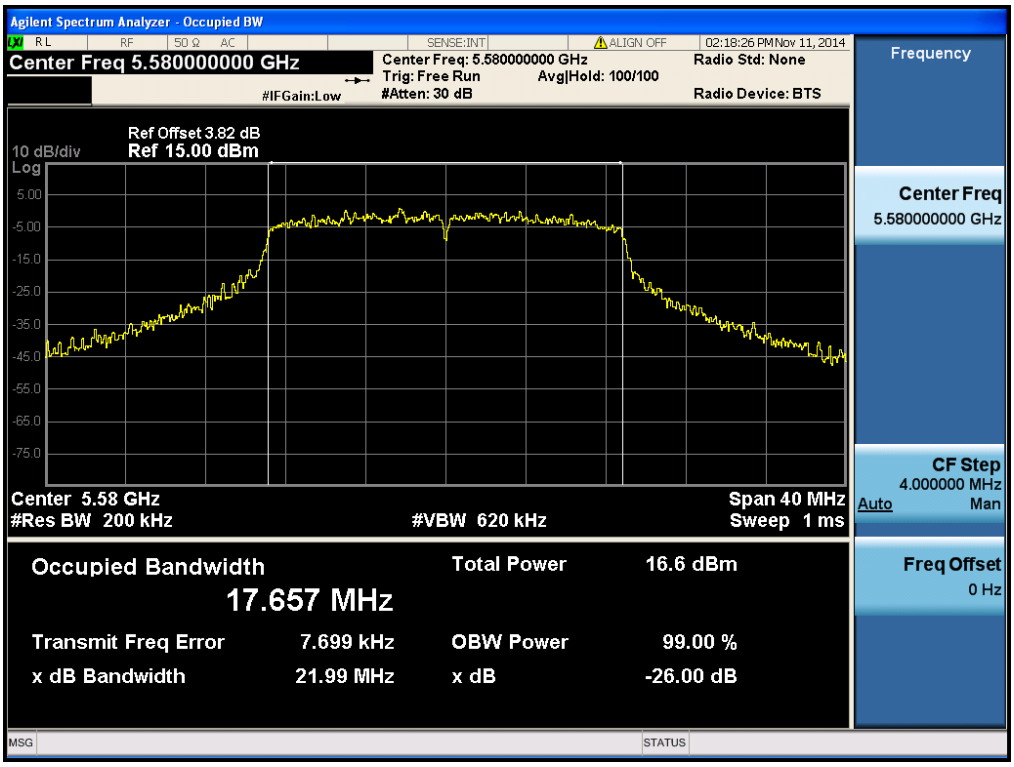
26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.100



26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.116



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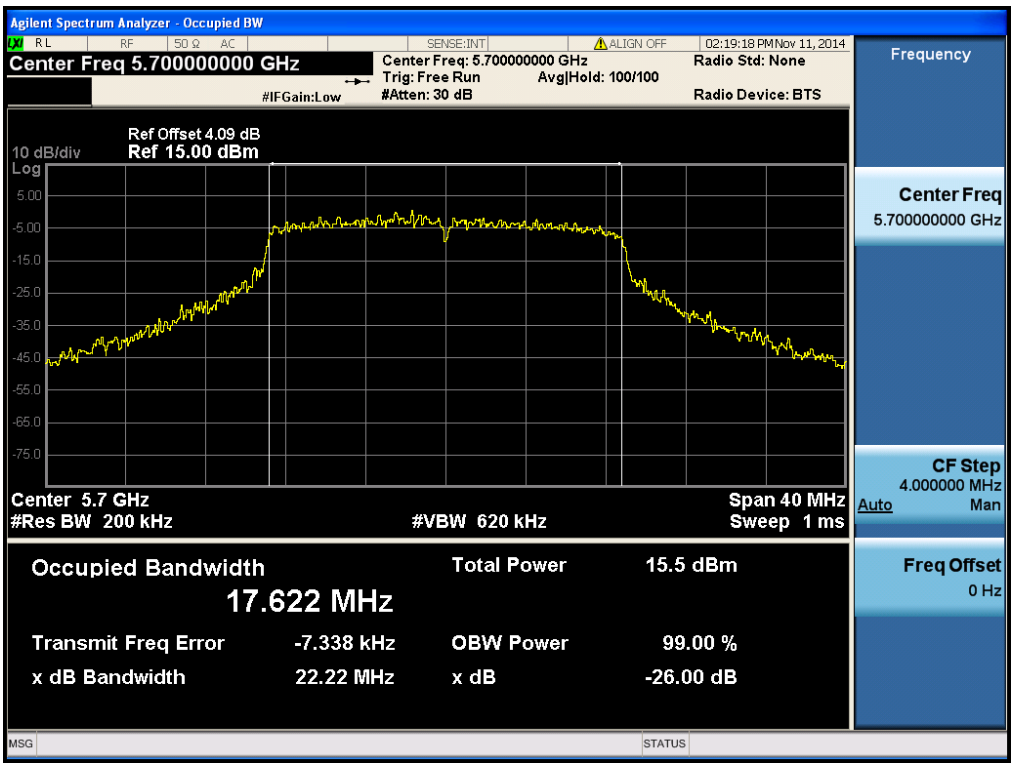
26 dB Bandwidth Test Mode: 802.11n HT20 & Ch.140



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8.2 Minimum Emission Bandwidth(6 dB Bandwidth)

▣ Test Requirements

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz..

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02 V01**.

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

▣ TEST RESULTS: Comply

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]
802.11a	Band IV	149	5745	14.99
		157	5785	15.05
		165	5825	15.93
802.11n (HT20)	Band IV	149	5745	15.06
		157	5785	13.20
		165	5825	16.08

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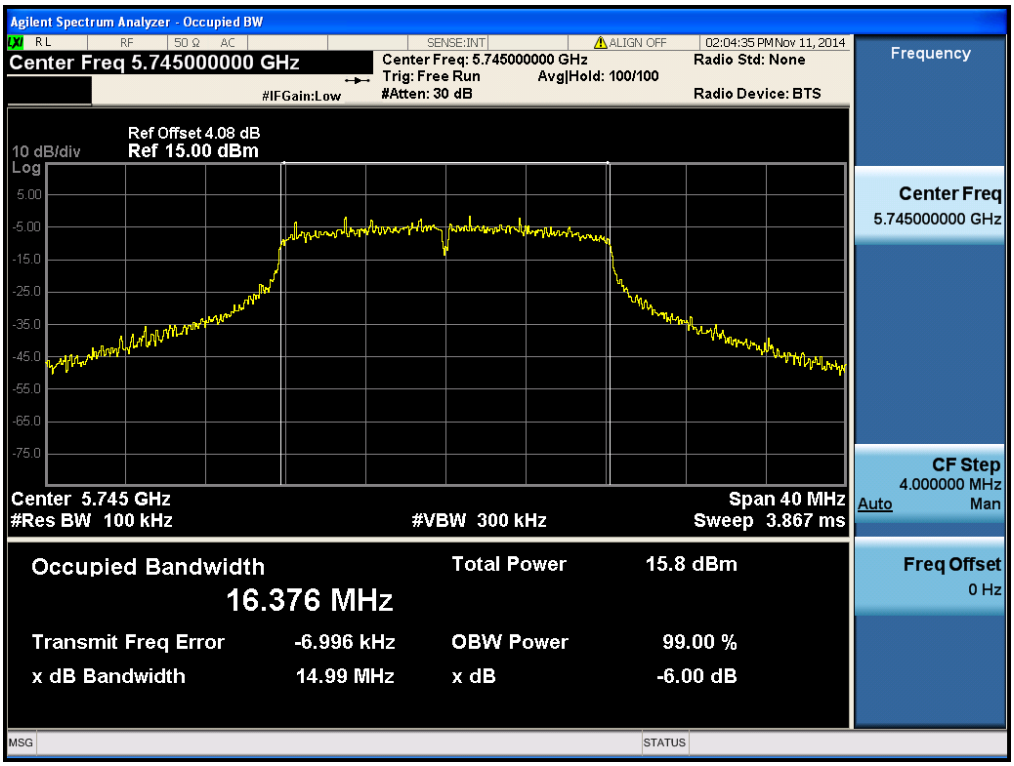
▣ RESULT PLOTS

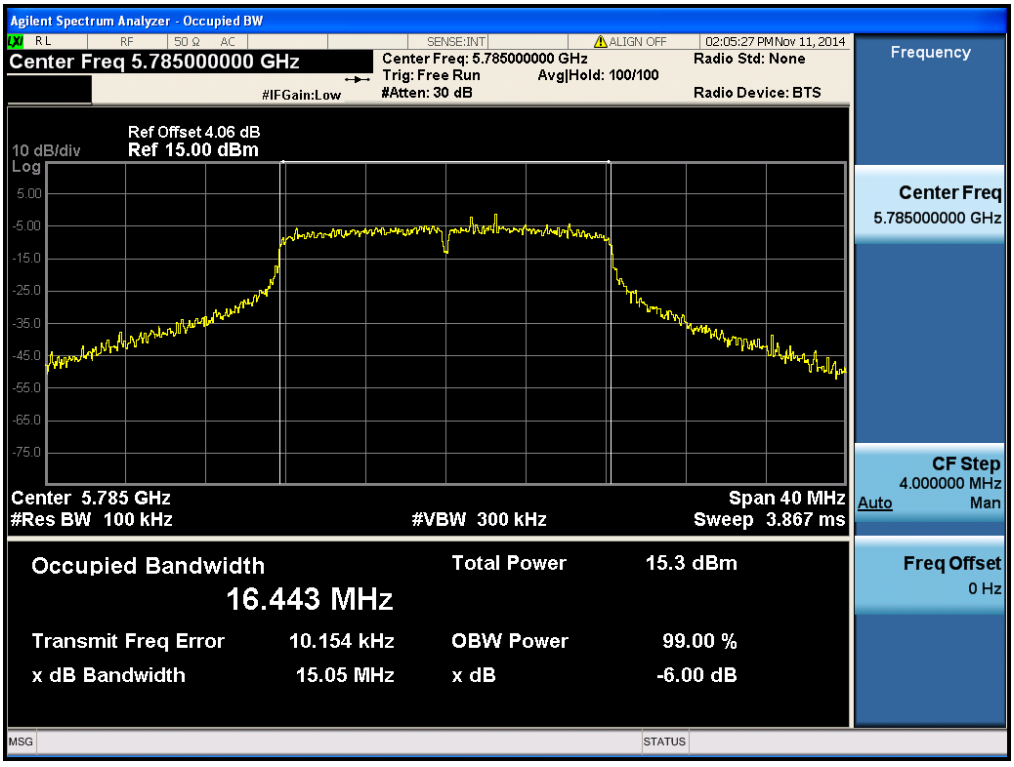
6 dB Bandwidth

Test Mode: 802.11a & Ch.149



6 dB Bandwidth

Test Mode: 802.11a & Ch.157



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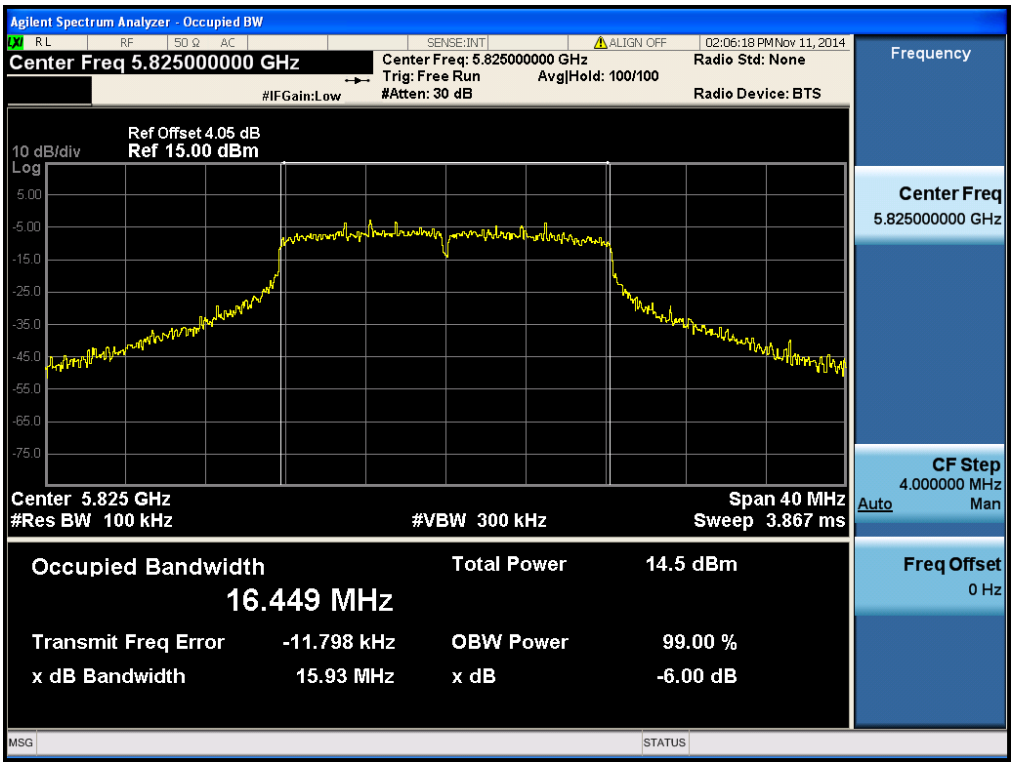
6 dB Bandwidth Test Mode: 802.11a & Ch.165



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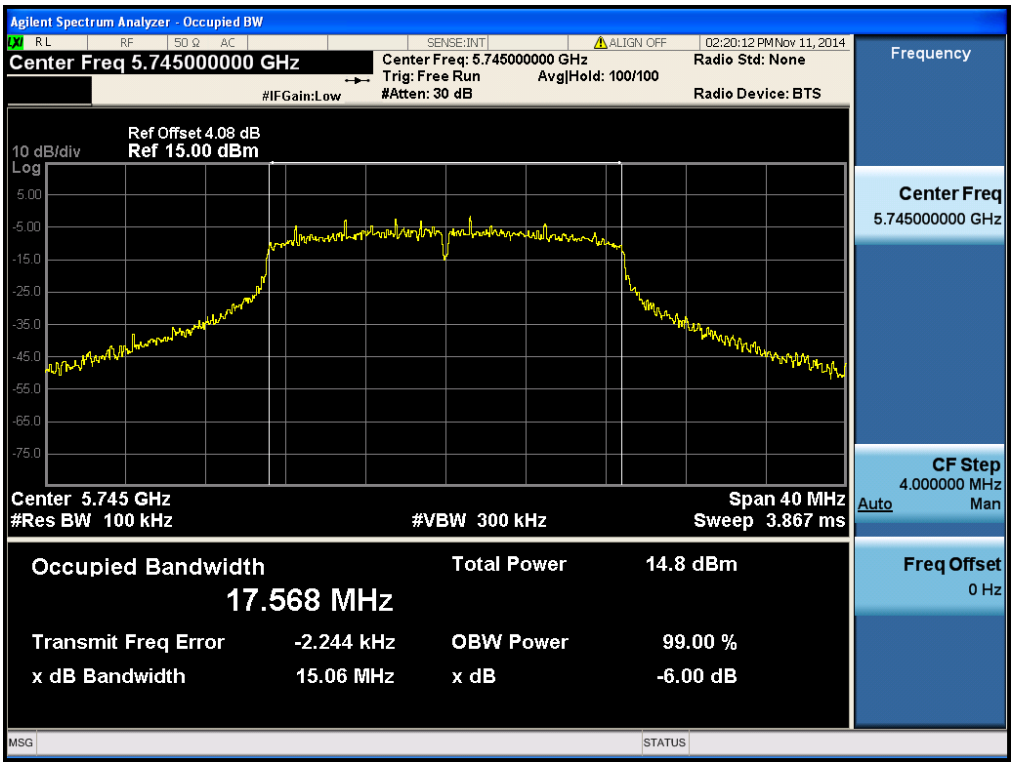
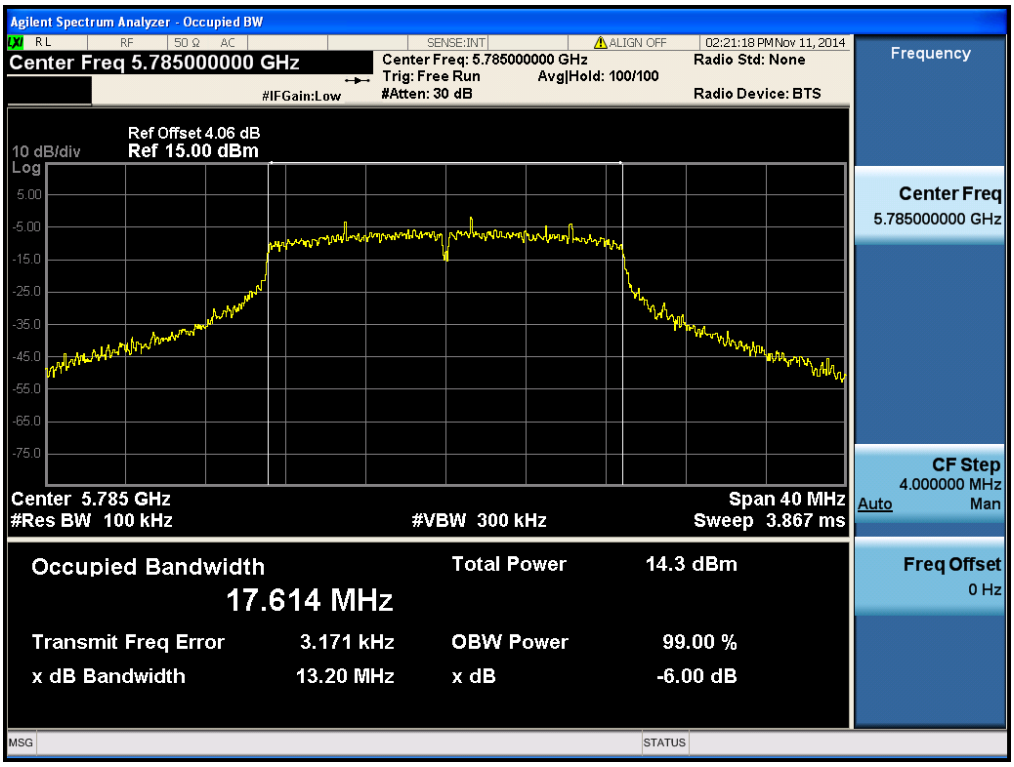
6 dB Bandwidth Test Mode: 802.11n HT20 & Ch.149



6 dB Bandwidth Test Mode: 802.11a HT20 & Ch.157



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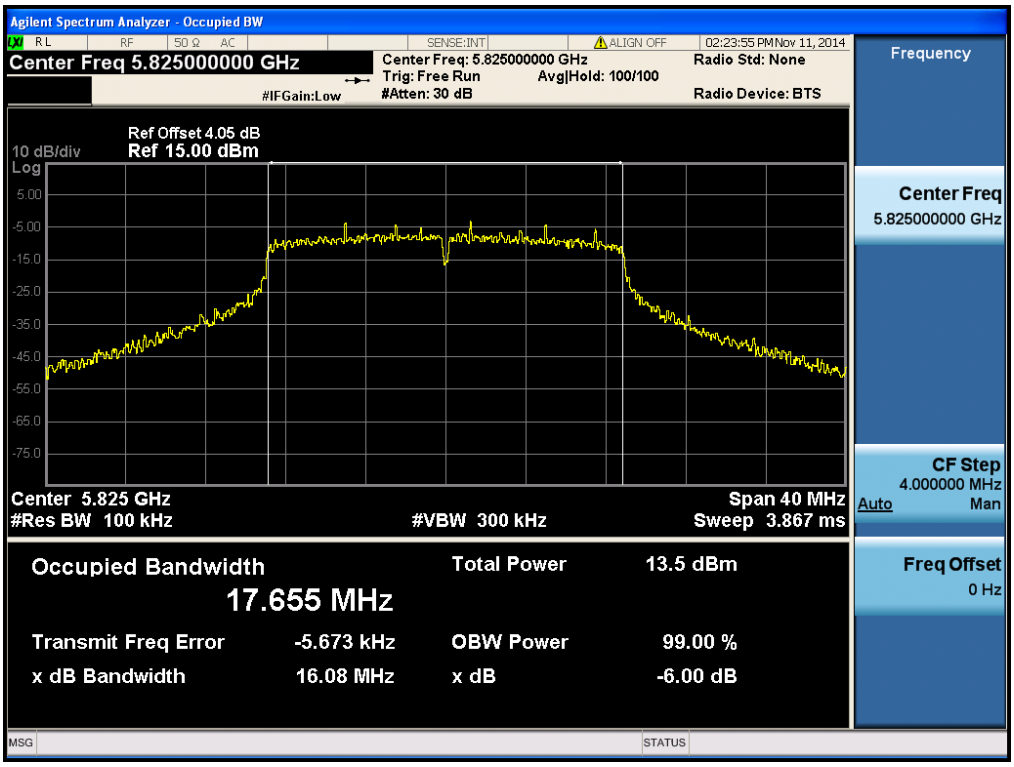
6 dB Bandwidth Test Mode: 802.11n HT20 & Ch.165



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8.3 Maximum Conducted Output Power

▣ **Test Requirements**

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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- Output power Limit Calculation

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	ANT Gain	Determined Limit [dBm]
Band I	802.11a	250	**23.97**	**-0.594**	**23.97**
	802.11n HT20	250	**23.97**		**23.97**
	802.11n HT40	-	**-**		**-**

Bands	Mode	Power Limit [mW] / Least 26dBC BW [MHz]	Calculation Limit [dBm]	ANT Gain	Determined Limit [dBm]
Band II	802.11a	250	**23.97**	**0.187**	**23.97**
		21.030	24.22		
	802.11n HT20	250	**23.97**		**23.97**
		22.420	24.50		
	802.11n HT40	-	**-**		**-**
		-	-		
Band III	802.11a	250	**23.97**	**-2.304**	**23.97**
		21.530	24.33		
	802.11n HT20	250	**23.97**		**23.97**
		21.990	24.42		
	802.11n HT40	-	-		**-**
		-	-		

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	ANT Gain	Determined Limit [dBm]
Band IV	802.11a	1000	**30.00**	**-5.954**	**30.00**
	802.11n HT20	1000	**30.00**		**30.00**
	802.11n HT40	-	**-**		

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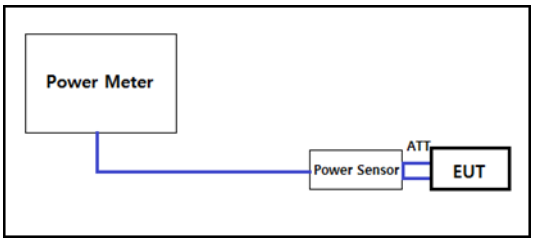
▣ Test Configuration



▣ Test Procedure

Maximum Conducted Output Power is measured using Measurement Procedure **Method PM-G of KDB789033 D02 V01**

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

▣ Test Results : Comply

Mode	Channel	Frequency [MHz]	Test Result [dBm]
802.11a	36	5180	10.970
	40	5200	11.146
	48	5240	11.507
	52	5260	11.948
	60	5300	12.452
	64	5320	12.761
	100	**5500**	12.802
	116	5580	**12.830**
	140	5700	10.852
	149	5745	10.452
	157	5785	10.201
	165	5825	9.962

Mode	Channel	Frequency [MHz]	Test Result [dBm]
802.11n HT20	36	5180	9.906
	40	5200	10.121
	48	5240	10.441
	52	5260	10.953
	60	5300	11.421
	64	5320	11.699
	100	**5500**	11.811
	116	5580	**11.829**
	140	5700	9.858
	149	5745	9.417
	157	5785	9.104
	165	5825	8.854

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8.4 Maximum Power Spectral Density

▣ **Test requirements**

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1MHz band. note1

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1MHz band. note1

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1MHz band. note1

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. note1

(3) For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. note1,note2

Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

- Peak Power Spectral Density Limit Calculation

Band	Limit [dBm]	ANT Gain [dBi]	Determined Limit [dBm]
Band I	4	-0.594	4
Band II	11	0.187	11
Band III	11	-2.304	11
Band IV	30	-5.954	30

▣ **Test configuration**

Refer to the APPENDIX I.

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▣ **Test procedure**

Maximum Power Spectral Density is measured using Measurement Procedure **of KDB789033 D02 V01**

1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power…”. (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2) Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3) Make the following adjustments to the peak value of the spectrum, if applicable:
   a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.
   b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4) The result is the Maximum PSD over 1 MHz reference bandwidth.
5) For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in §15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
   a) Set RBW ≥ 1/T, where T is defined in section II.B.1.a). (Refer to Appendix II)
   b) Set VBW ≥ 3 RBW.
   c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
   d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
   e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since RBW=100 kHZ is available on nearly all spectrum analyzers.

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▣ **Test result : Comply**

Mode	Channel	Frequency [MHz]	Reading [dBm]	DCF [dB] Note 1	Test Result [dBm]
802.11a	36	5180	-0.360	2.370	2.010
	40	5200	-1.620		0.750
	48	5240	-1.180		1.190
	52	5260	-0.400		1.970
	60	5300	0.170		2.540
	64	5320	0.140		2.510
	100	**5500**	**0.280**		**2.650**
	116	5580	-0.770		1.600
	140	5700	-1.990		0.380
	149	5745	-5.055		-2.685
	157	5785	-5.790		-3.420
	165	5825	-6.610		-4.240

Mode	Channel	Frequency [MHz]	Reading [dBm]	DCF [dB] Note 1	Test Result [dBm]
802.11n HT20	36	5180	-2.180	2.520	0.340
	40	5200	-2.590		-0.070
	48	5240	-1.980		0.540
	52	5260	-1.990		0.530
	60	5300	-1.240		1.280
	64	5320	-1.320		1.200
	100	**5500**	**-0.300**		**2.220**
	116	5580	-1.960		0.560
	140	5700	-3.750		-1.230
	149	5745	-6.282		-3.762
	157	5785	-6.543		-4.023
	165	5825	-7.099		-4.579

Note 1 : **Refer to Appendix II. Only applied when Duty cycle < 0.98**
Note 2 : Test Result = Measurement Data + DCF

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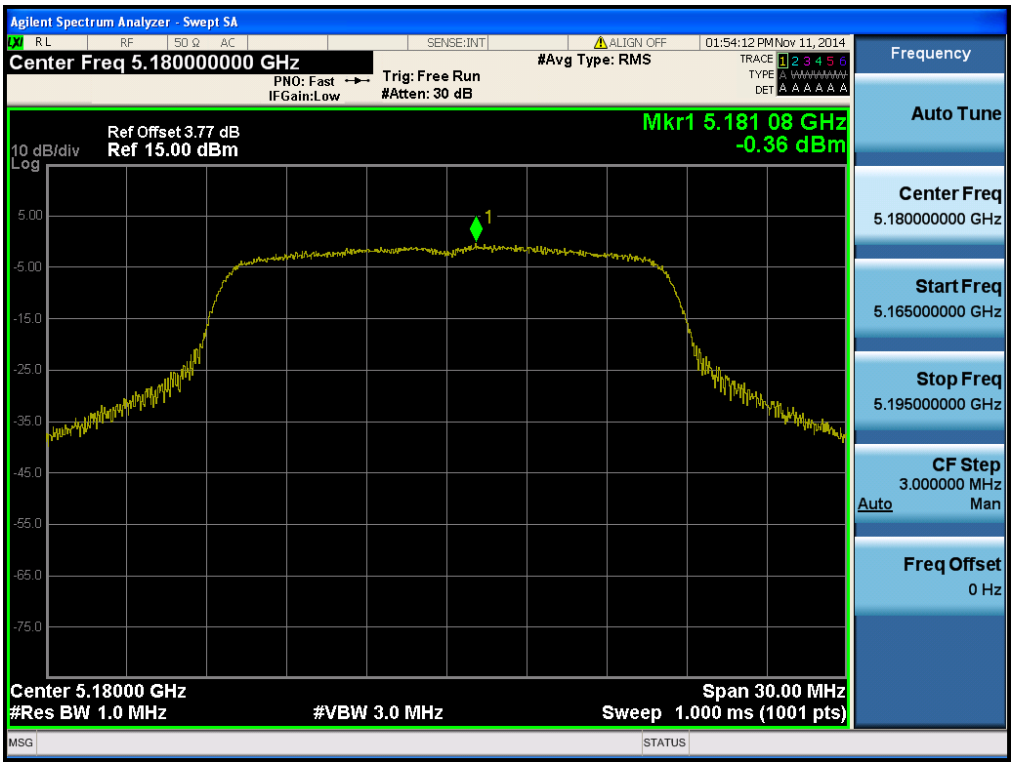
▣ RESULT PLOTS

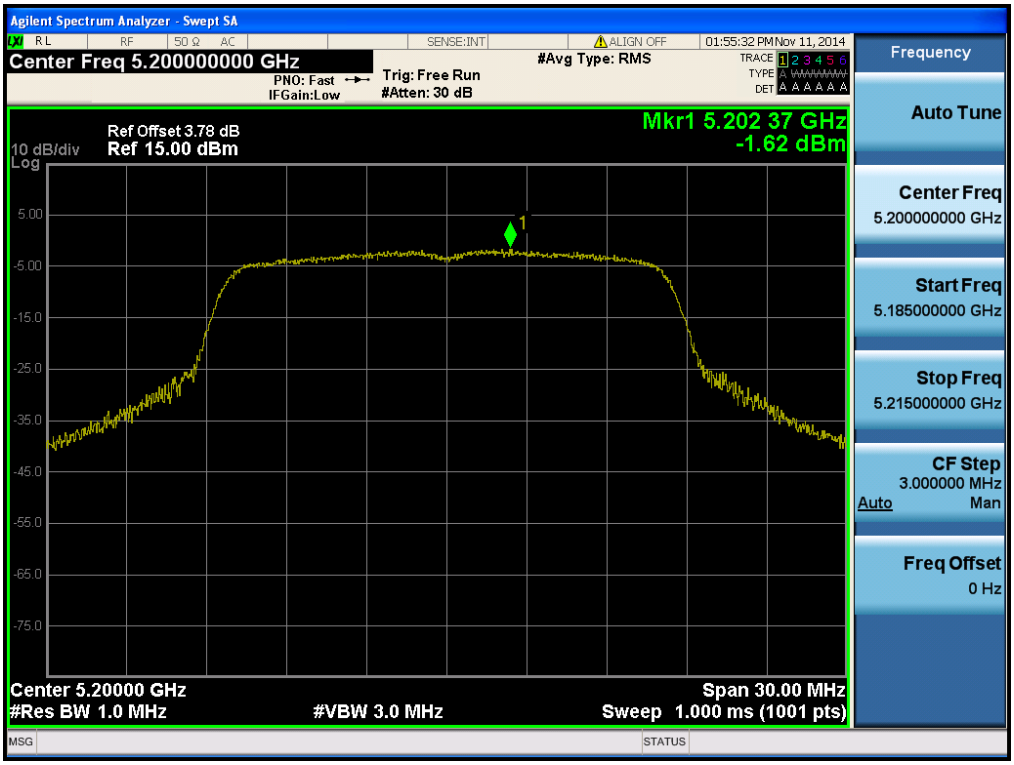
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.36



Maximum Power Spectral Density

Test Mode: 802.11a & Ch.40



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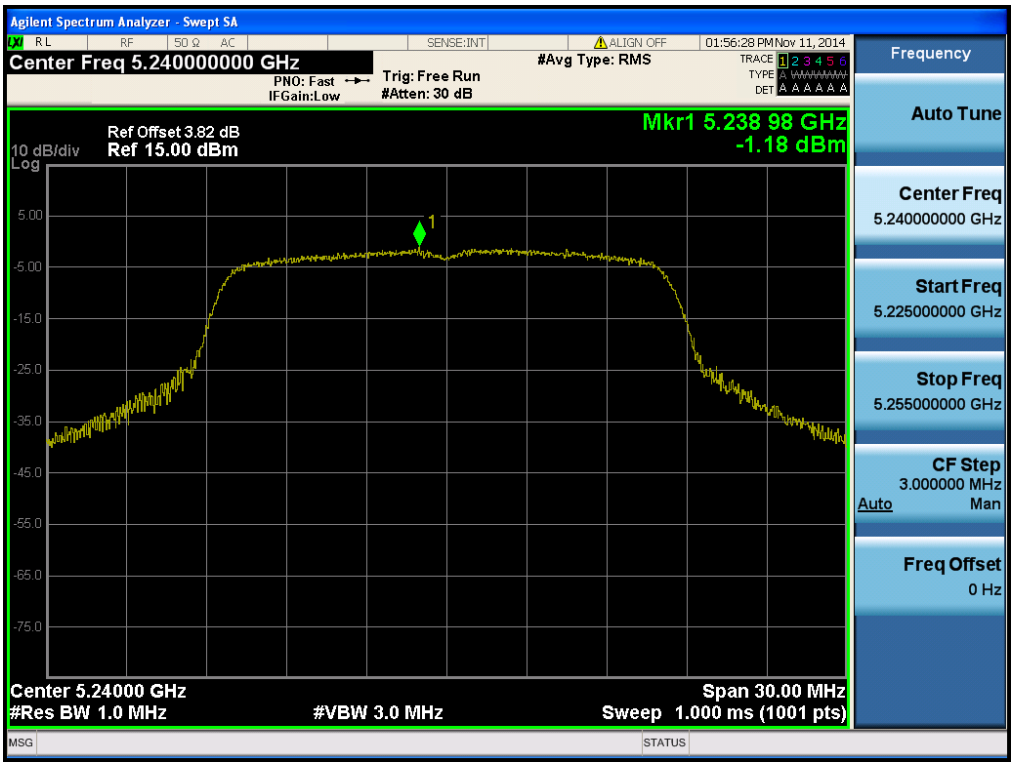
Maximum Power Spectral Density Test Mode: 802.11a & Ch.48



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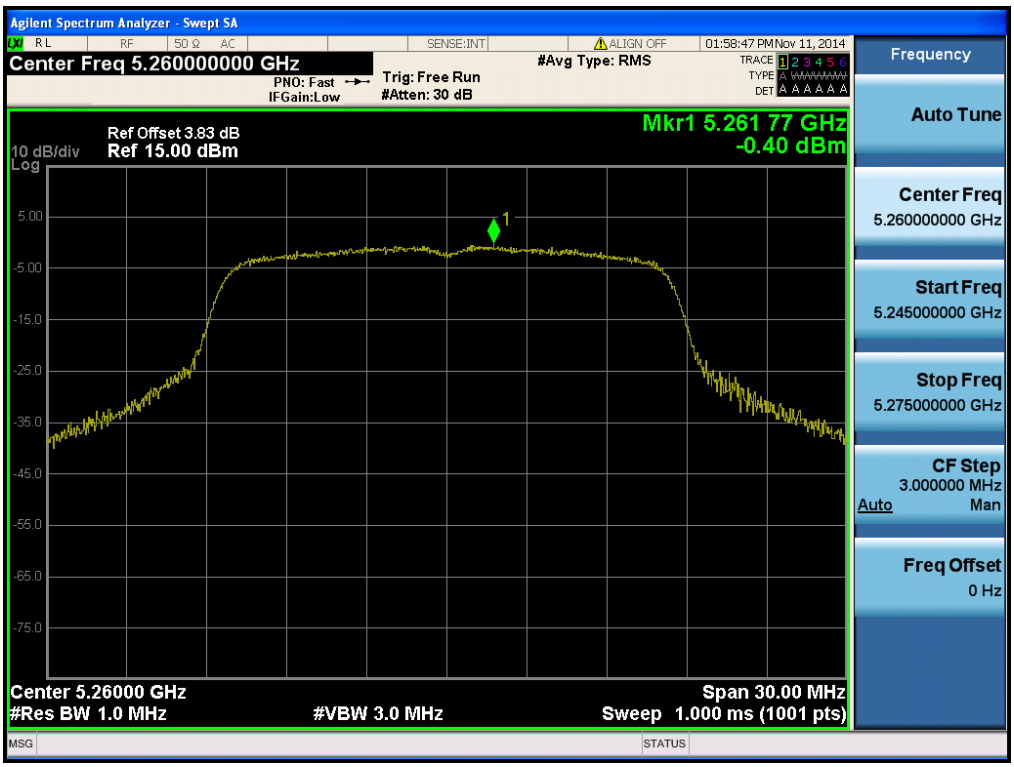
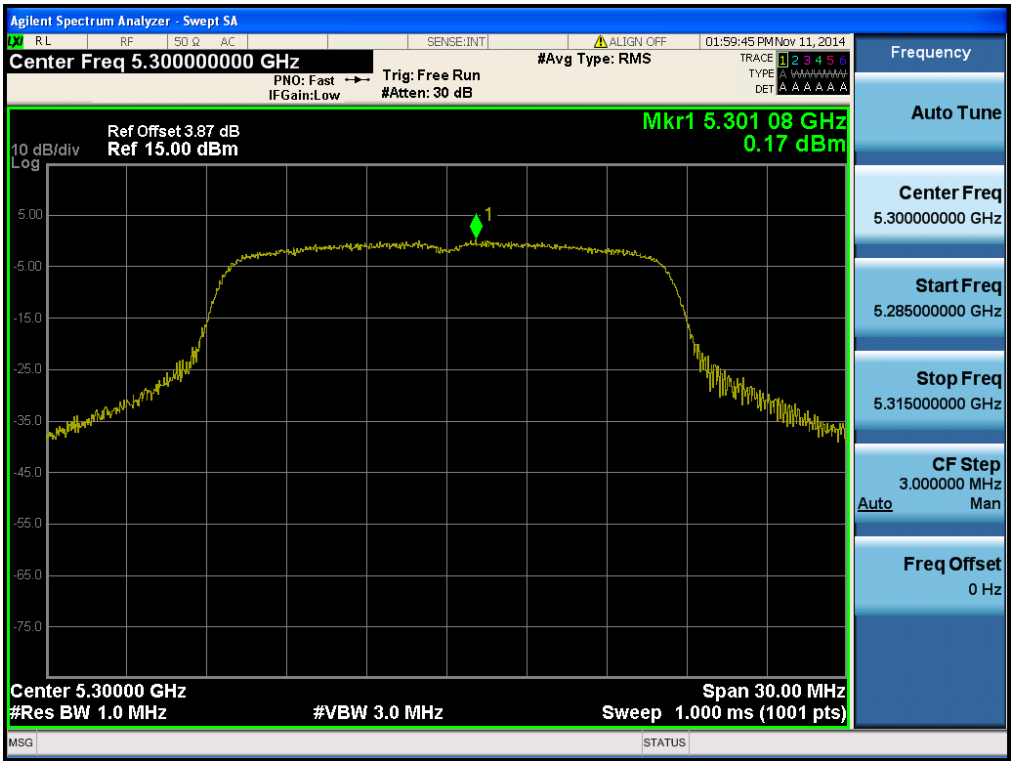
Maximum Power Spectral Density Test Mode: 802.11a & Ch.52



Maximum Power Spectral Density Test Mode: 802.11a & Ch.60



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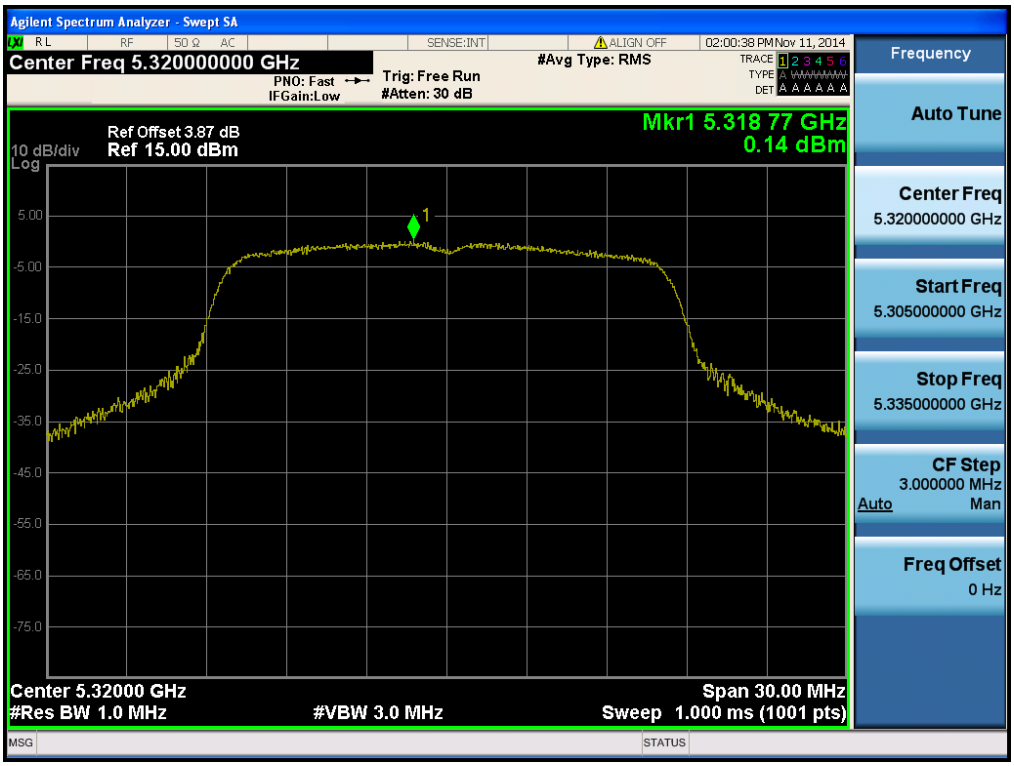
Maximum Power Spectral Density Test Mode: 802.11a & Ch.64



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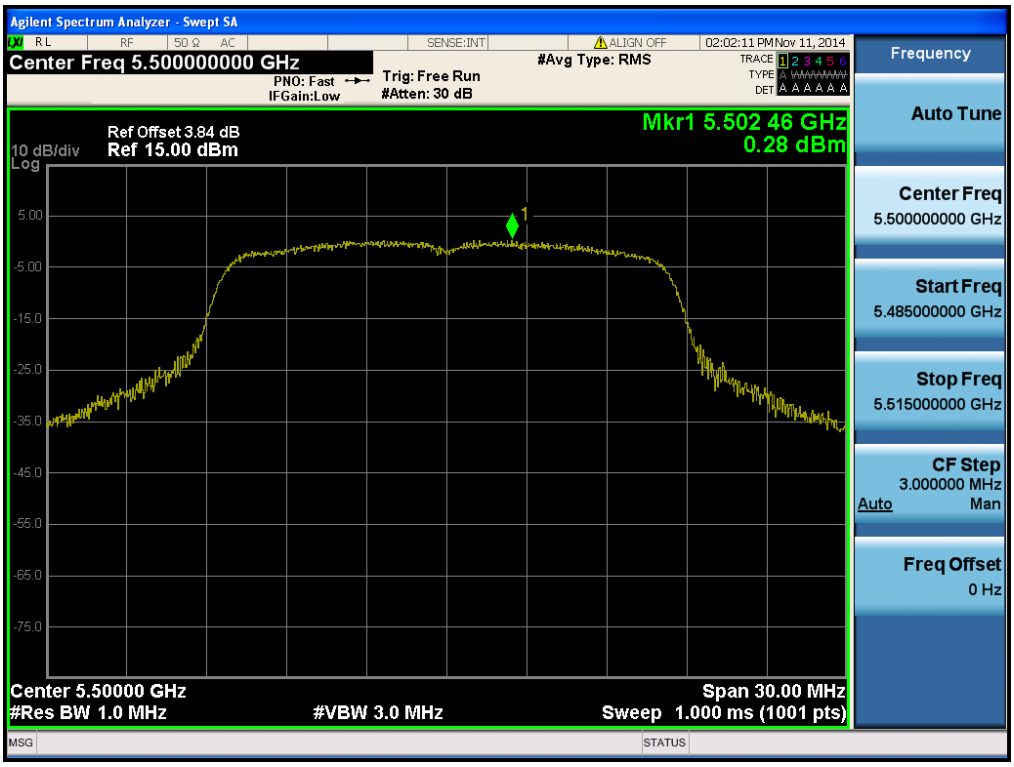
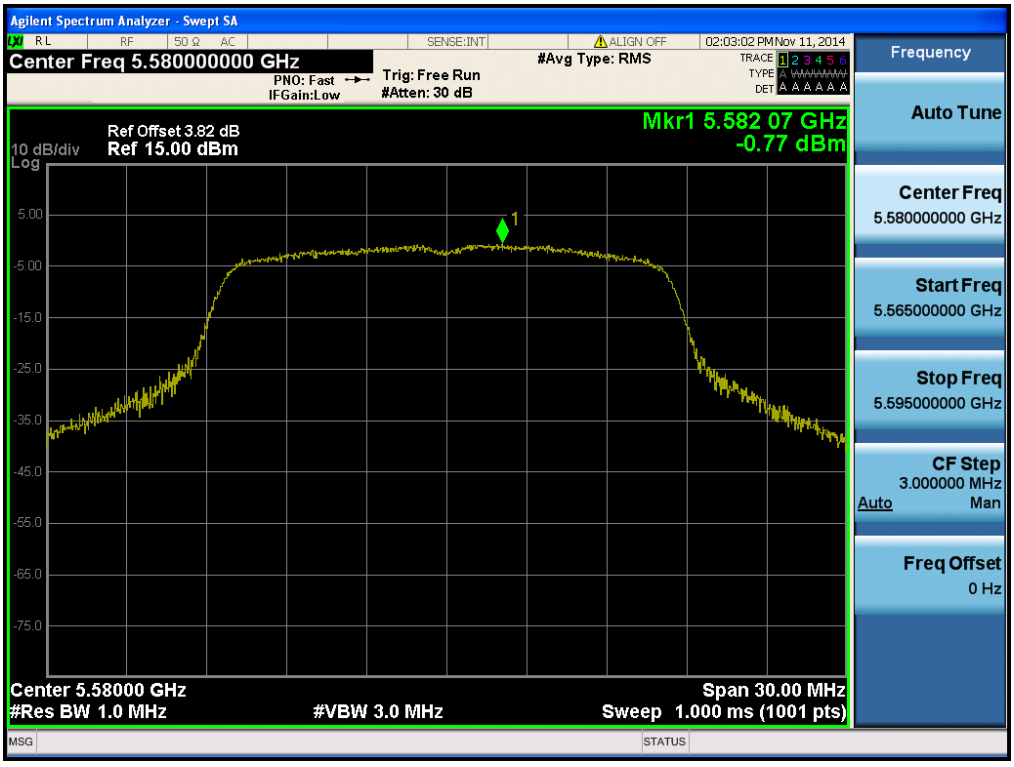
Maximum Power Spectral Density Test Mode: 802.11a & Ch.100



Maximum Power Spectral Density Test Mode: 802.11a & Ch.116



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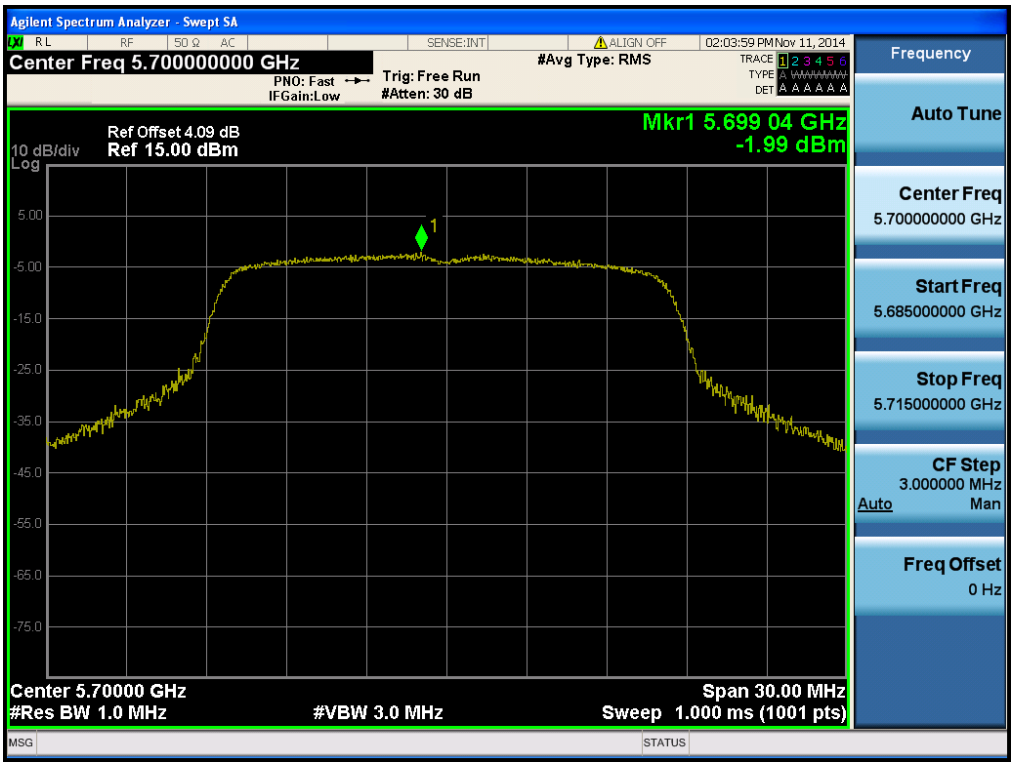
Maximum Power Spectral Density Test Mode: 802.11a & Ch.140



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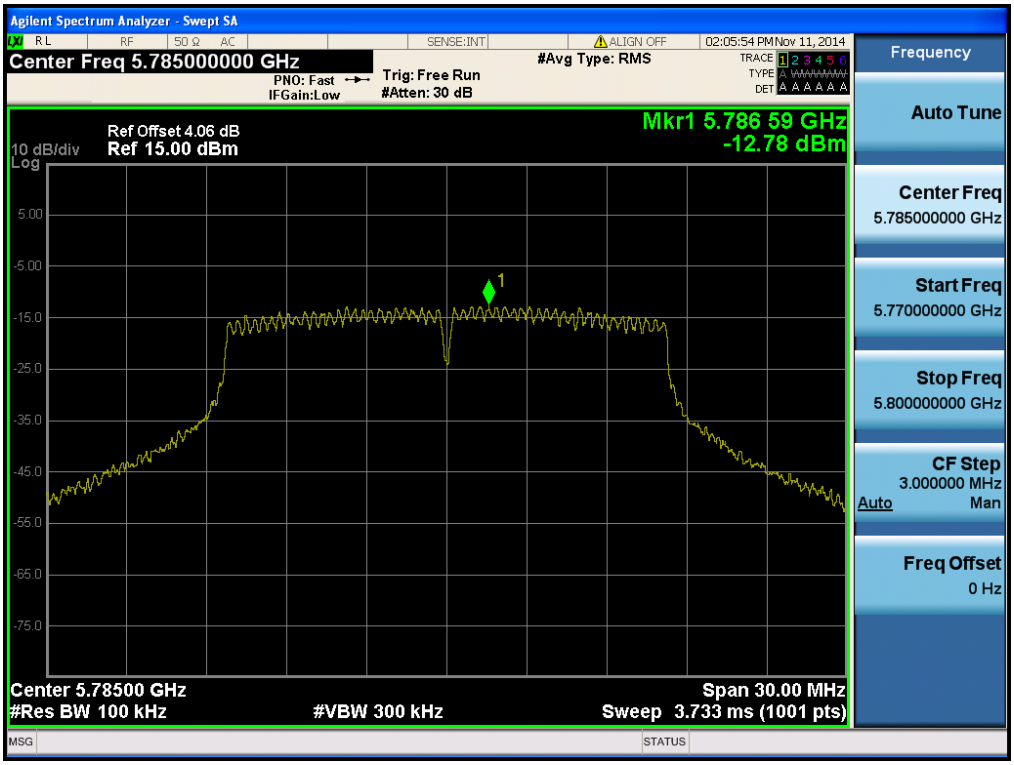
Maximum Power Spectral Density Test Mode: 802.11a & Ch.149

Maximum Power Spectral Density Test Mode: 802.11a & Ch.157



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Maximum Power Spectral Density Test Mode: 802.11a & Ch.165

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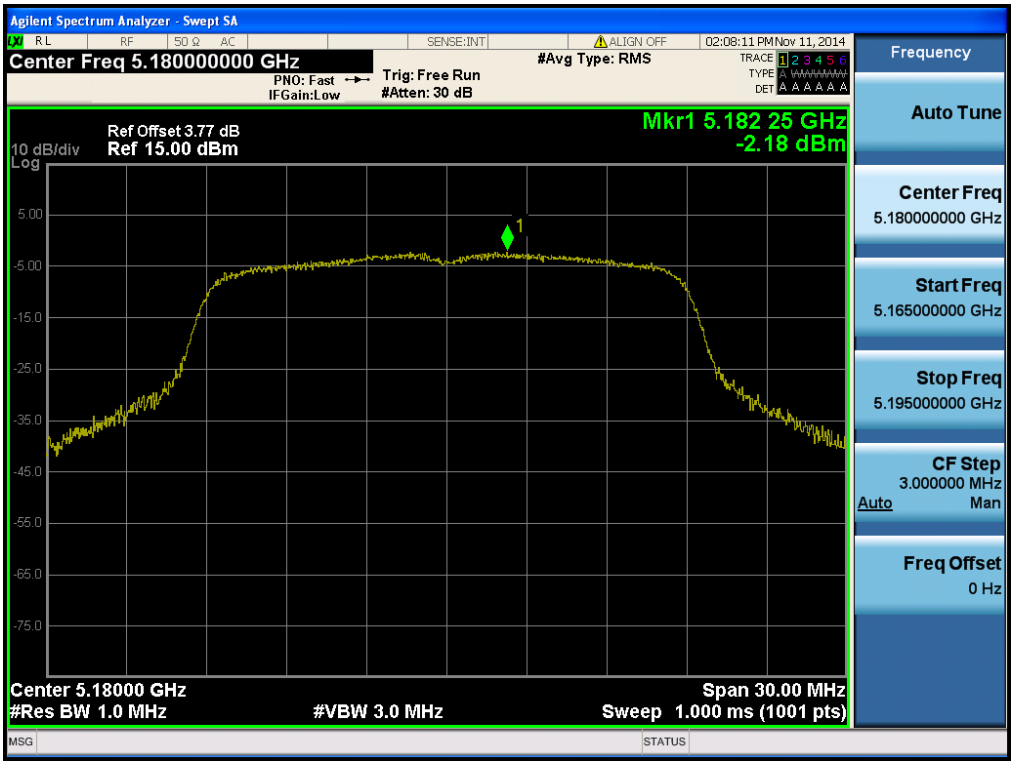
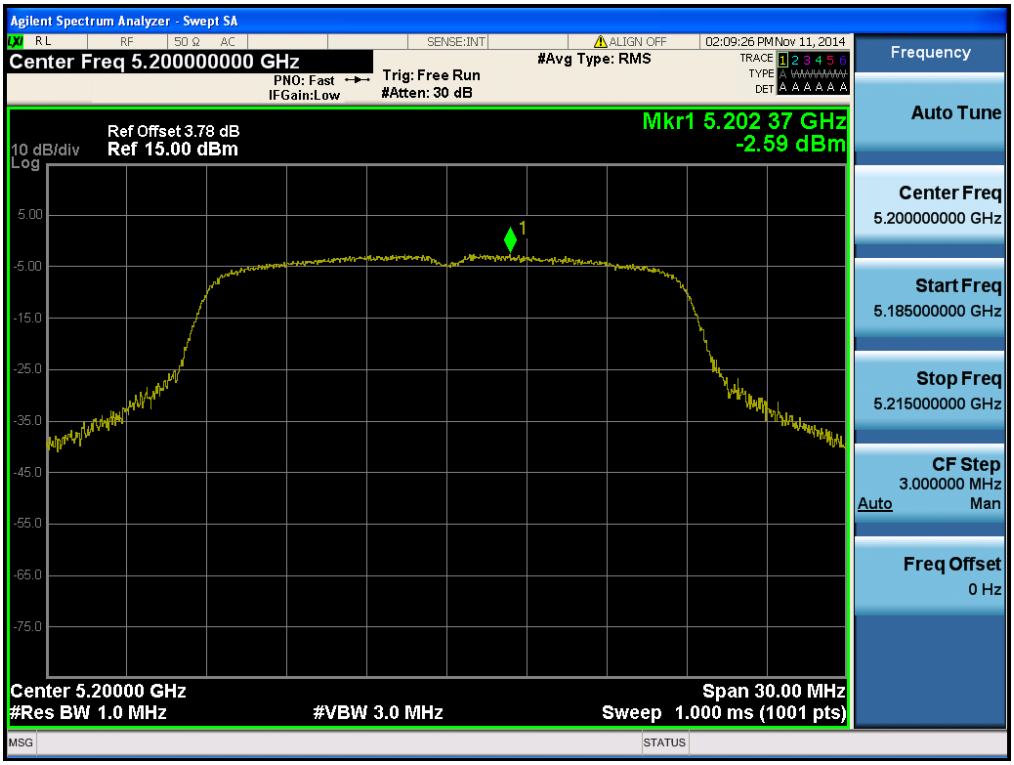
Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.36



Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.40



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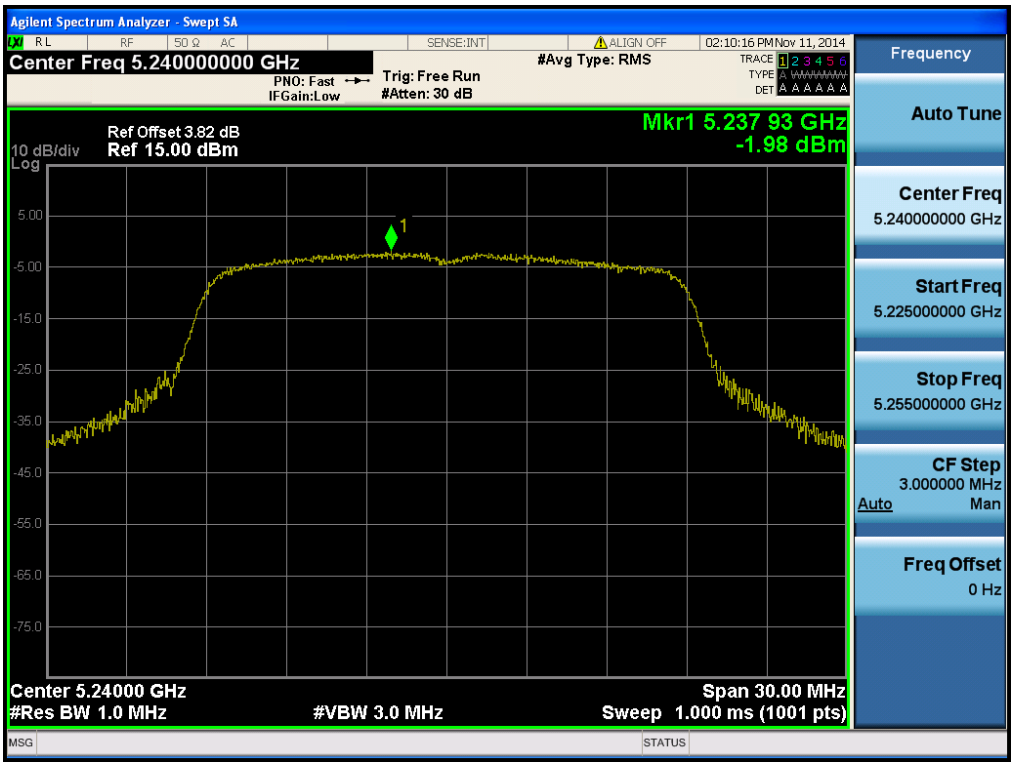
Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.48



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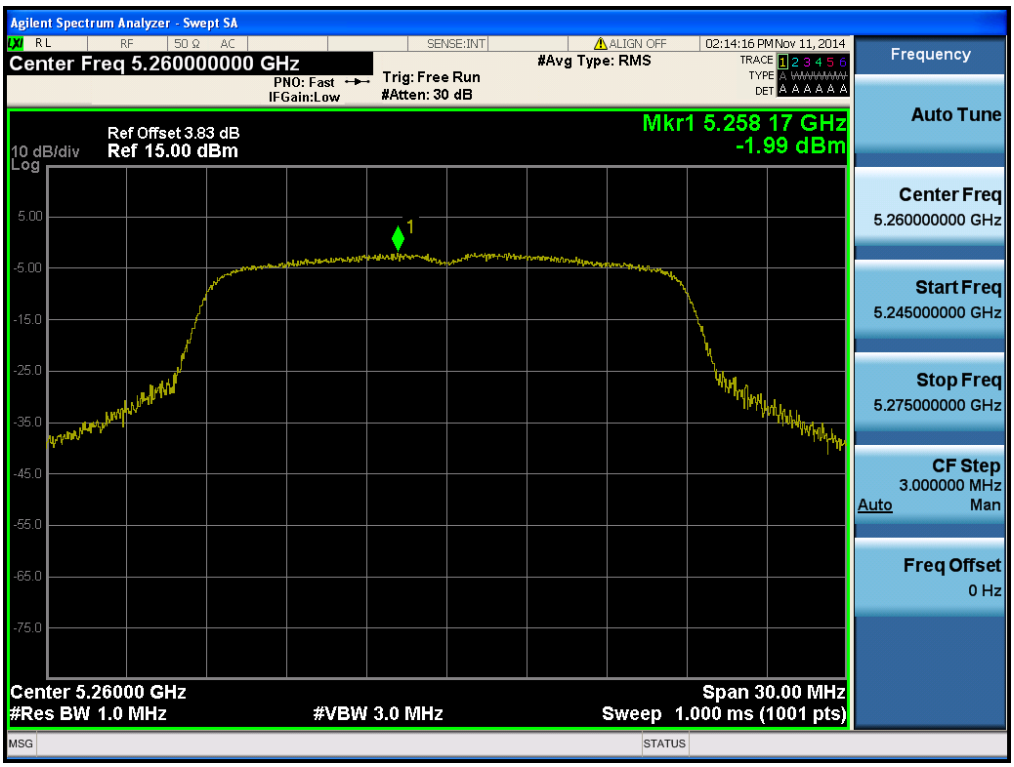

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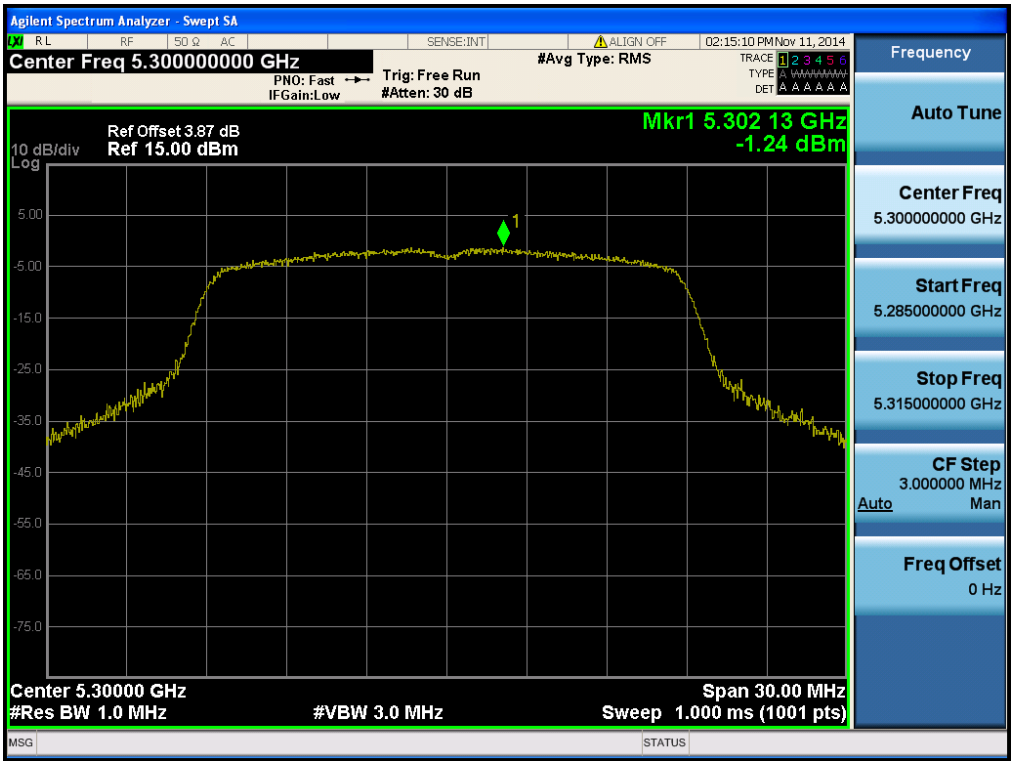

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Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.64

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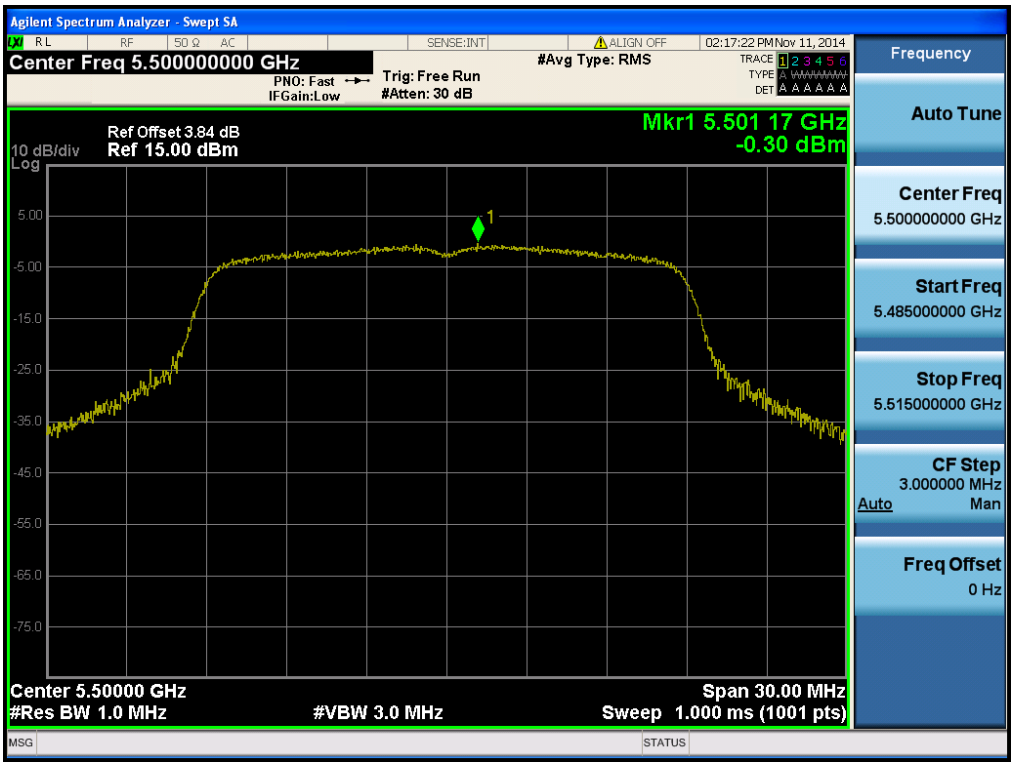
Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.100



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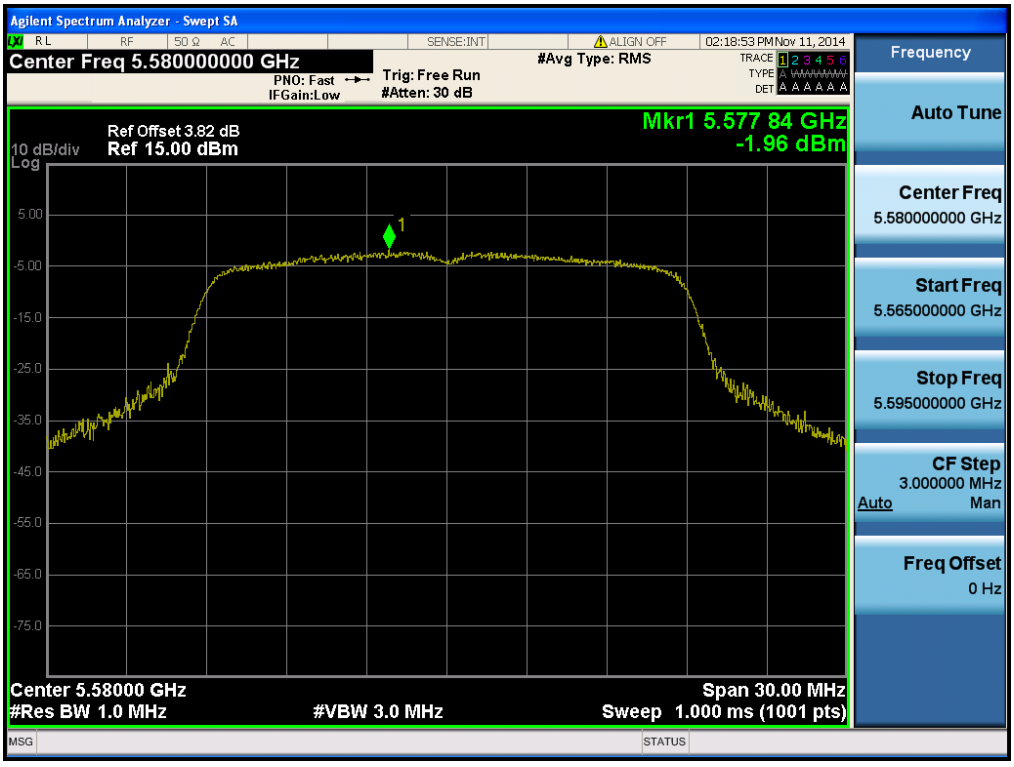

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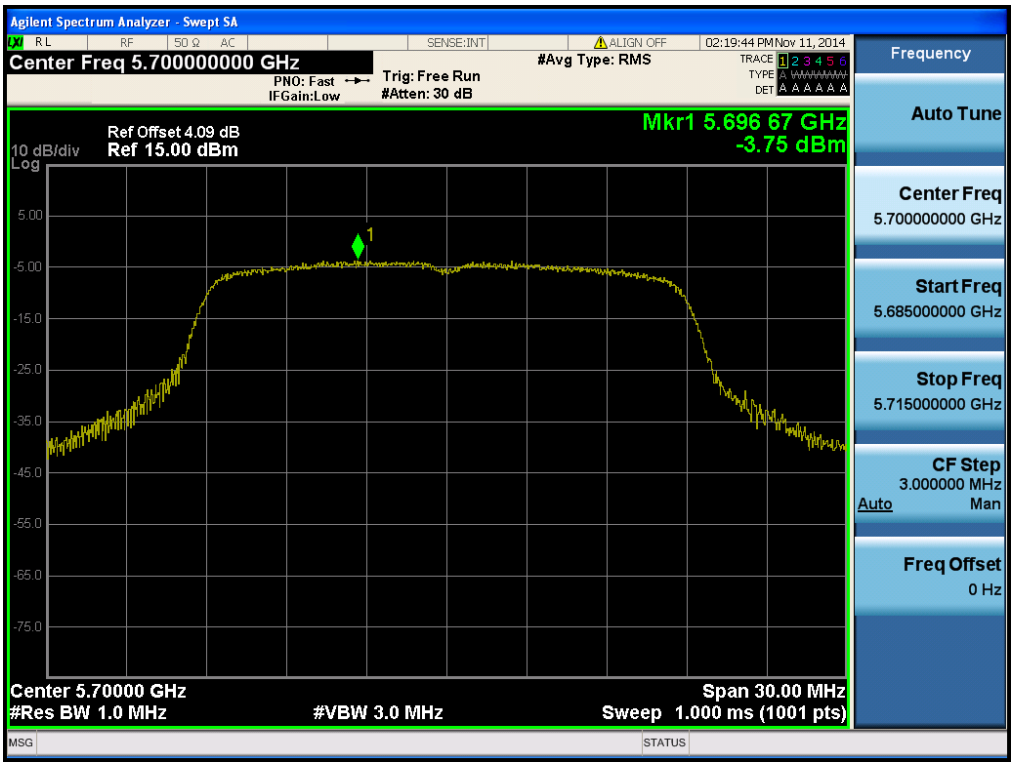
Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.140



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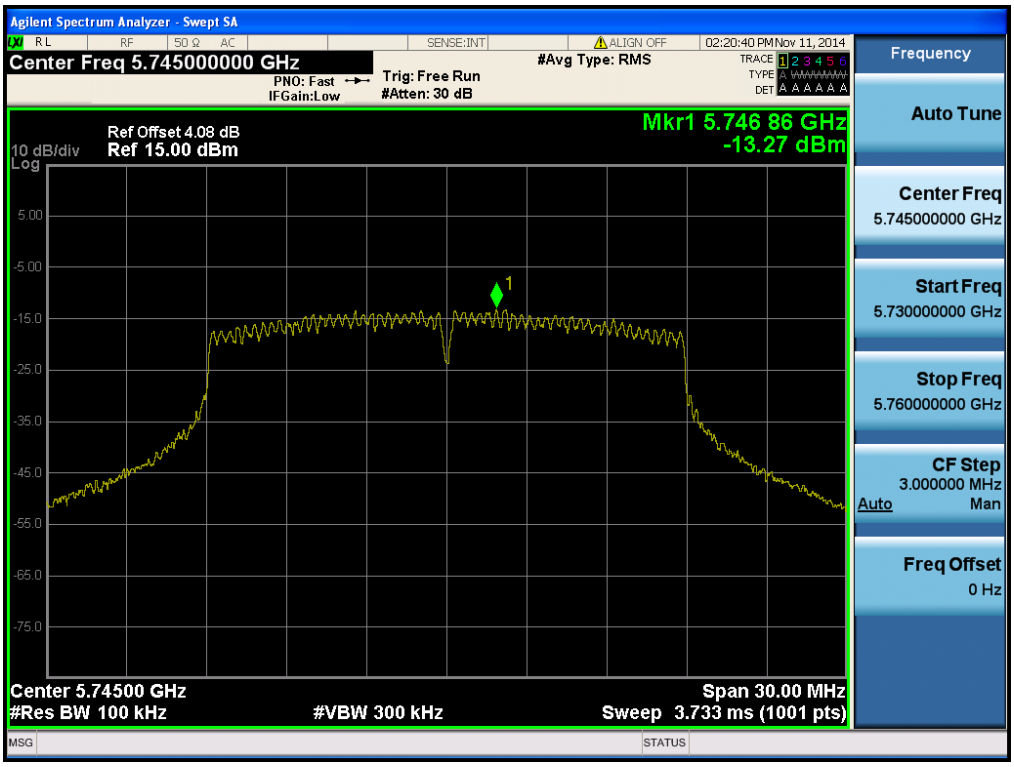

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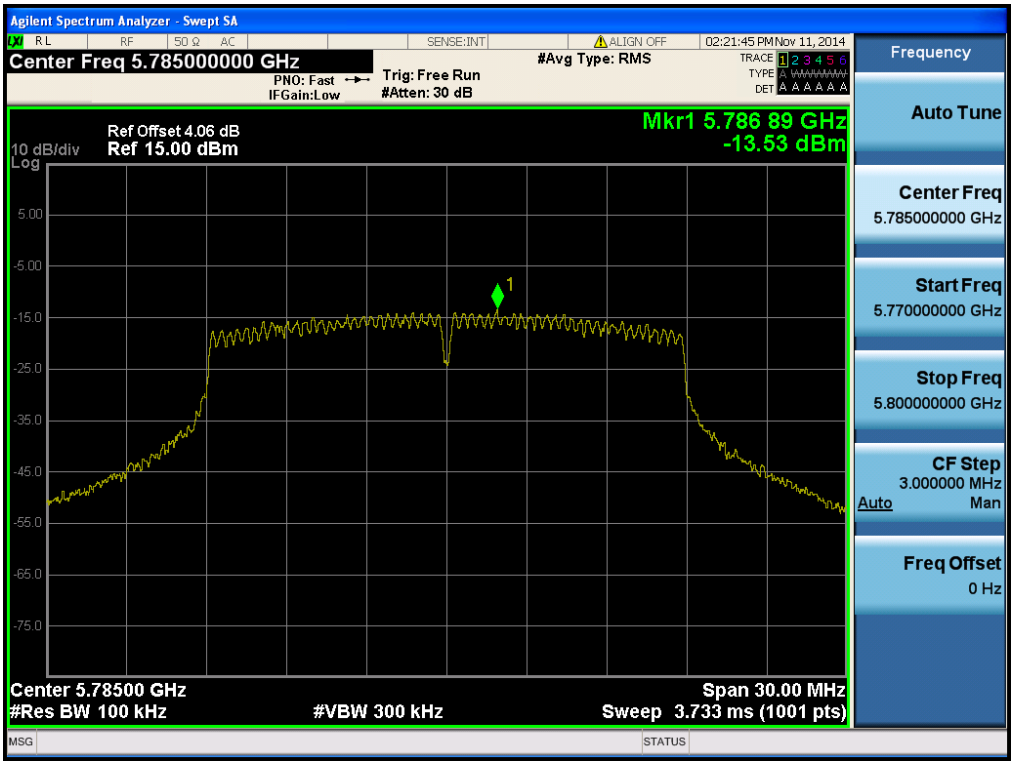

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Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.165

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8.5 Frequency Stability

▣ Test requirements

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

▣ Test Procedure

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between 0℃ and +70℃. The temperature was incremented by 10℃ intervals and the unit was allowed to stabilize at each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

▣ Test Result : Comply

Supply Voltage (V DC)	TEMP (℃)	Band I		Band II		Band III		Band IV	
		Frequency (Hz)	Deviation (%)	Frequency (Hz)	Deviation (%)	Frequency (Hz)	Deviation (%)	Frequency (Hz)	Deviation (%)
3.700	+25	5,199,998,639	-0.000026	5,299,998,565	-0.000027	5,579,998,427	-0.000028	5,784,998,226	-0.000031
	+70	5,199,999,019	-0.000019	5,299,998,869	-0.000021	5,579,998,816	-0.000021	5,784,998,795	-0.000021
	+60	5,199,999,012	-0.000019	5,299,998,826	-0.000022	5,579,998,678	-0.000024	5,784,998,667	-0.000023
	+50	5,199,998,829	-0.000023	5,299,998,723	-0.000024	5,579,998,545	-0.000026	5,784,998,521	-0.000026
	+40	5,199,998,630	-0.000026	5,299,998,564	-0.000027	5,579,998,544	-0.000026	5,784,998,334	-0.000029
	+30	5,199,998,593	-0.000027	5,299,998,550	-0.000027	5,579,998,375	-0.000029	5,784,998,262	-0.000030
	+20	5,199,998,537	-0.000028	5,299,998,490	-0.000028	5,579,998,326	-0.000030	5,784,998,179	-0.000031
	+10	5,199,998,423	-0.000030	5,299,998,489	-0.000029	5,579,997,990	-0.000036	5,784,997,746	-0.000039
	0	5,199,998,245	-0.000034	5,299,998,384	-0.000030	5,579,997,932	-0.000037	5,784,997,555	-0.000042
3.145	+25	5,199,998,551	-0.000028	5,299,998,468	-0.000029	5,579,998,426	-0.000028	5,784,998,053	-0.000034
4.255	+25	5,199,998,602	-0.000027	5,299,998,402	-0.000030	5,579,998,345	-0.000030	5,784,998,117	-0.000033

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8.6 Radiated Spurious Emission Measurements

▣ Test Procedure

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2400/F(KHz)	300
0.490 – 1.705	24000/F(KHz)	30
1.705 – 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	160.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	160.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	160.7 ~ 160.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240	3600 ~ 4000		
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

▪ **FCC Part 15.407 (b):** Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the **5.15-5.25 GHz band**: all emissions outside of the **5.15-5.35 GHz band** shall not exceed an **EIRP of -27 dBm/MHz**.
(2) For transmitters operating in the **5.25-5.35 GHz band**: all emissions outside of the **5.15-5.35 GHz band** shall not exceed an **EIRP of -27 dBm/MHz**.
(3) For transmitters operating in the **5.47-5.725 GHz band**: all emissions outside of the **5.47-5.725 GHz band** shall not exceed an **EIRP of -27 dBm/MHz.**
(4) For transmitters operating in the **5.725-5.85 GHz band**: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions **below 1 GHz** must comply with the general field strength limits set forth in **Section 15.209**. Further, any U-NII devices using an **AC power line** are required to comply also with the conducted limits set forth in **Section 15.207**.
(7) The provisions of §15.205 apply to intentional radiators operating under this section
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

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▣ Test Procedure

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in semi anechoic chamber. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine the worst-case orientation for maximum emissions.

Radiated spurious emission measured using following Measurement Procedure **of KDB789033 D02 V01**

► General Requirements for Unwanted Emissions Measurements

The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:

- EUT Duty Cycle

(1) The EUT shall be configured or modified to **transmit continuously** except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle(**to no lower than 98 percent**) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

(2) If **continuous transmission (or at least 98 percent duty cycle) cannot be achieved** due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle, x, of the transmitter output signal.
- Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.
- The test report shall include the following additional information:
  - The reason for the duty cycle limitation.
  - The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.
  - The sweep time and the amount of time used for trace stabilization during max-hold measurements for peak emission measurements.

(3) **Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.**

► Measurements below 1000 MHz

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.

b) Compliance shall be demonstrated using **CISPR quasi-peak detection**; however, **peak detection** is permitted as an alternative to quasi-peak detection.

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► **Measurements Above 1000MHz(Peak)**

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.
b) Peak emission levels are measured by setting the analyzer as follows:
(i) **RBW = 1 MHz**.
(ii) **VBW ≥ 3 MHz.**
(iii) **Detector = Peak.**
(iv) Sweep time = auto.
(v) Trace mode = max hold.
(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

► **Measurements Above 1000MHz(Method AD)**

(i) **RBW = 1 MHz.**
(ii) **VBW ≥ 3 MHz.**
(iii) **Detector = RMS**, if span/(# of points in sweep) ≤ RBW/2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.
(iv) Averaging type = power (i.e., RMS)
• As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
(v) Sweep time = auto.
(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces shall be averaged.
(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

• **If power averaging (RMS) mode was used in step (iv) above, the correction factor is 10 log(1/x), where x is the duty cycle.**
For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.
• If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.
• If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

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▣ **Measurement Data:**

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11a & Band I*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36 (5180MHz)	5724.840	H	X	PK	60.67	9.98	N/A	N/A	70.65	78.20	7.55
	11490.462	V	Z	PK	41.28	12.26	N/A	-9.54	44.00	74.00	30.00
	11490.031	V	Z	AV	31.97	12.26	2.37	-9.54	37.06	54.00	16.94
40 (5200MHz)	10398.590	V	Z	PK	43.81	9.45	N/A	-9.54	43.72	68.20	24.48
48 (5240MHz)	10479.010	V	Z	PK	43.65	9.57	N/A	-9.54	43.68	68.20	24.52

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11a & Band II*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
52 (5260MHz)	10518.580	V	Z	PK	43.29	9.70	N/A	-9.54	43.45	68.20	24.75
60 (5300MHz)	10601.310	V	Z	PK	44.02	9.91	N/A	-9.54	44.39	74.00	29.61
	10602.360	V	Z	AV	31.94	9.91	2.37	-9.54	34.68	54.00	19.32
64 (5320MHz)	5350.600	H	Z	PK	55.06	9.13	N/A	N/A	64.19	74.00	9.81
	5350.840	H	Z	AV	39.49	9.13	2.37	N/A	50.99	54.00	3.01
	10642.260	V	Z	PK	43.63	10.02	N/A	-9.54	44.11	74.00	29.89
	10641.900	V	Z	AV	32.09	10.02	2.37	-9.54	34.94	54.00	19.06

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
3. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   Therefore Distance Correction Factor(DCF) : - 9.54 dB = 20*log(1m/3m)
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27dBm + 95.2 = 68.2dBuV/m
5. If peak measurement satisfy the average limit, then average measurement are not required.

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▣ **Measurement Data:**

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11a & Band III*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
100 (5500MHz)	5395.650	H	X	PK	56.73	9.13	N/A	N/A	65.86	74.00	8.14
	5396.860	H	X	AV	39.35	9.13	2.37	N/A	50.85	54.00	3.15
	10999.658	V	Z	PK	41.46	10.97	N/A	-9.54	42.89	74.00	31.11
	10999.280	V	Z	AV	31.80	10.97	2.37	-9.54	35.60	54.00	18.40
116 (5580MHz)	11160.939	V	Z	PK	41.70	11.39	N/A	-9.54	43.55	74.00	30.45
	11161.325	V	Z	AV	31.94	11.39	2.37	-9.54	36.16	54.00	17.84
140 (5700MHz)	5725.090	H	X	PK	54.82	10.00	N/A	N/A	64.82	68.20	3.38
	11400.240	V	Z	PK	40.99	12.02	N/A	-9.54	43.47	74.00	30.53
	11400.384	V	Z	AV	32.08	12.02	2.37	-9.54	36.93	54.00	17.07

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11a & Band IV*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
149 (5745MHz)	5724.840	H	X	PK	60.67	9.98	N/A	N/A	70.65	78.20	7.55
	11490.462	V	Z	PK	41.28	12.26	N/A	-9.54	44.00	74.00	30.00
	11490.031	V	Z	AV	31.97	12.26	2.37	-9.54	37.06	54.00	16.94
157 (5785MHz)	11570.342	V	Z	PK	42.63	12.49	N/A	-9.54	45.58	74.00	28.42
	11569.739	V	Z	AV	31.79	12.49	2.37	-9.54	37.11	54.00	16.89
165 (5825MHz)	5850.980	H	X	PK	51.26	10.03	N/A	N/A	61.29	78.20	16.91
	11649.517	V	Z	PK	41.37	12.72	N/A	-9.54	44.55	74.00	29.45
	11649.731	V	Z	AV	31.85	12.72	2.37	-9.54	37.40	54.00	16.60

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
3. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   Therefore Distance Correction Factor(DCF) : - 9.54 dB = 20*log(1m/3m)
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27dBm + 95.2 = 68.2dBuV/m
5. If peak measurement satisfy the average limit, then average measurement are not required.

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▣ **Measurement Data:**

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11n(HT20) & Band I*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36 (5180MHz)	5148.170	H	X	PK	53.47	8.45	N/A	N/A	61.92	74.00	12.08
	5148.150	H	X	AV	39.06	8.45	2.52	N/A	50.03	54.00	3.97
	10359.410	V	Z	PK	43.90	9.37	N/A	-9.54	43.73	68.20	24.47
40 (5200MHz)	10399.150	V	Z	PK	44.21	9.45	N/A	-9.54	44.12	68.20	24.08
48 (5240MHz)	10499.780	V	Z	PK	43.83	9.57	N/A	-9.54	43.86	68.20	24.34

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11n(HT20) & Band II*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
52 (5260MHz)	10520.400	V	Z	PK	43.66	9.70	N/A	-9.54	43.82	68.20	24.38
60 (5300MHz)	10601.650	V	Z	PK	42.14	9.91	N/A	-9.54	42.51	74.00	31.49
	10601.560	V	Z	AV	31.90	9.91	2.52	-9.54	34.79	54.00	19.21
64 (5320MHz)	5353.630	H	Z	PK	55.06	9.13	N/A	N/A	64.19	74.00	9.81
	5353.630	H	Z	AV	39.49	9.13	2.52	N/A	51.14	54.00	2.86
	10641.570	V	Z	PK	42.45	10.02	N/A	-9.54	42.93	74.00	31.07
	10641.720	V	Z	AV	32.02	10.02	2.52	-9.54	35.02	54.00	18.98

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
3. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   Therefore Distance Correction Factor(DCF) : - 9.54 dB = 20*log(1m/3m)
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27dBm + 95.2 = 68.2dBuV/m
5. If peak measurement satisfy the average limit, then average measurement are not required.

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▣ **Measurement Data:**

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11n(HT20) & Band III*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
100 (5500MHz)	5381.460	H	X	PK	57.99	9.13	N/A	N/A	67.12	74.00	6.88
	5376.840	H	X	AV	39.95	9.13	2.52	N/A	51.60	54.00	2.40
	11000.102	V	Z	PK	42.00	10.97	N/A	-9.54	43.43	74.00	30.57
	11000.030	V	Z	AV	32.05	10.97	2.52	-9.54	36.00	54.00	18.00
116 (5580MHz)	11159.406	V	Z	PK	41.71	11.39	N/A	-9.54	43.56	74.00	30.44
	11159.337	V	Z	AV	31.95	11.39	2.52	-9.54	36.32	54.00	17.68
140 (5700MHz)	5725.310	H	X	PK	53.54	10.00	N/A	N/A	63.54	68.20	4.66
	11400.933	V	Z	PK	42.10	12.02	N/A	-9.54	44.58	74.00	29.42
	11401.455	V	Z	AV	31.88	12.02	2.52	-9.54	36.88	54.00	17.12

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11n(HT20) & Band IV*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
149 (5745MHz)	5724.750	H	X	PK	58.08	9.98	N/A	N/A	68.06	78.20	10.14
	11489.670	V	Z	PK	42.07	12.26	N/A	-9.54	44.79	74.00	29.21
	11490.330	V	Z	AV	31.76	12.26	2.52	-9.54	37.00	54.00	17.00
157 (5785MHz)	11571.287	V	Z	PK	41.41	12.49	N/A	-9.54	44.36	74.00	29.64
	11570.897	V	Z	AV	31.82	12.49	2.52	-9.54	37.29	54.00	16.71
165 (5825MHz)	5850.070	H	X	PK	51.20	10.03	N/A	N/A	61.23	78.20	16.97
	11650.432	V	Z	PK	41.80	12.72	N/A	-9.54	44.98	74.00	29.02
	11650.261	V	Z	AV	31.90	12.72	2.52	-9.54	37.60	54.00	16.40

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
3. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   Therefore Distance Correction Factor(DCF) : - 9.54 dB = 20*log(1m/3m)
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27dBm + 95.2 = 68.2dBuV/m
5. If peak measurement satisfy the average limit, then average measurement are not required.

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8.7 AC Conducted Emissions

▣ **TEST PROCEDURE :**

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. Emissions closest to the limit are measured in the quasi-peak mode (QP) and average mode (AV) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

▣ **Measurement Data: Comply**

Note 1: See next pages for actual measured spectrum plots and data.

▣ **Minimum Standard: FCC Part 15.207(a)/EN 55022**

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

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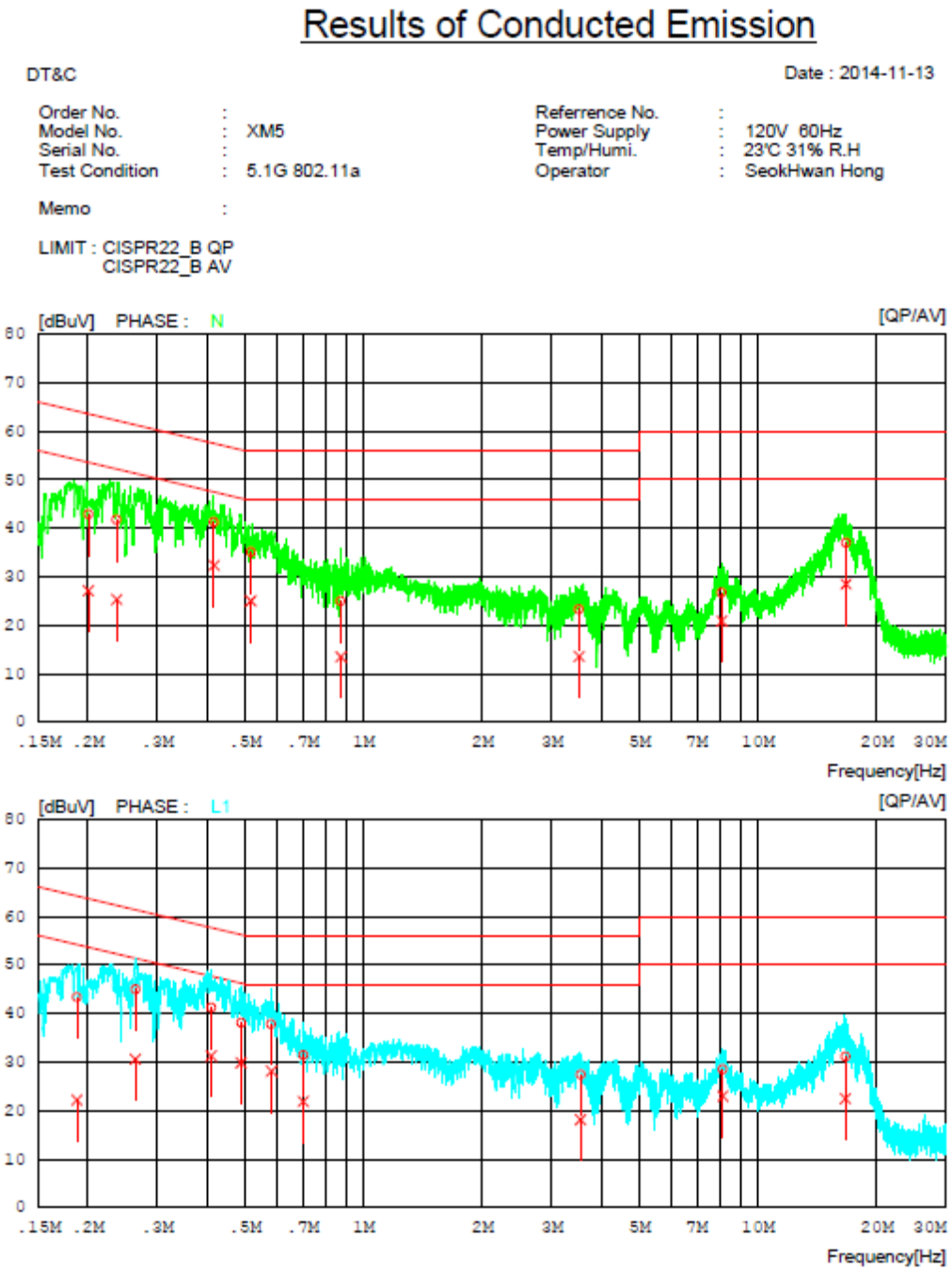
AC Line Conducted Emissions (Graph)

Test Mode: Band I &802.11a



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AC Line Conducted Emissions (Data List)

Test Mode: Band I &802.11a

Results of Conducted Emission

DT&C

Date : 2014-11-13

Order No.	:		Referrence No.	:	
Model No.	:	XM5	Power Supply	:	120V 60Hz
Serial No.	:		Temp/Humi.	:	23℃ 31% R.H
Test Condition	:	5.1G 802.11a	Operator	:	SeokHwan Hong

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.20050	42.7	27.0	0.1	42.8	27.1	63.6	53.6	20.8	26.5	N
2	0.23646	41.6	25.2	0.1	41.7	25.3	62.2	52.2	20.5	26.9	N
3	0.41710	41.0	32.1	0.2	41.2	32.3	57.5	47.5	16.3	15.2	N
4	0.51779	34.8	24.8	0.2	35.0	25.0	56.0	46.0	21.0	21.0	N
5	0.87462	24.8	13.3	0.2	25.0	13.5	56.0	46.0	31.0	32.5	N
6	3.51520	23.0	13.4	0.2	23.2	13.6	56.0	46.0	32.8	32.4	N
7	8.08720	26.2	20.3	0.5	26.7	20.8	60.0	50.0	33.3	29.2	N
8	16.70420	36.3	27.8	0.7	37.0	28.5	60.0	50.0	23.0	21.5	N
9	0.18743	43.1	22.0	0.2	43.3	22.2	64.1	54.1	20.8	31.9	L1
10	0.26382	44.7	30.3	0.2	44.9	30.5	61.3	51.3	16.4	20.8	L1
11	0.41088	41.1	31.2	0.1	41.2	31.3	57.6	47.6	16.4	16.3	L1
12	0.48885	37.9	29.7	0.1	38.0	29.8	56.2	46.2	18.2	16.4	L1
13	0.58278	37.6	28.0	0.1	37.7	28.1	56.0	46.0	18.3	17.9	L1
14	0.70309	31.3	21.7	0.1	31.4	21.8	56.0	46.0	24.6	24.2	L1
15	3.54960	27.0	17.7	0.4	27.4	18.1	56.0	46.0	28.6	27.9	L1
16	8.13160	27.8	22.2	0.7	28.5	22.9	60.0	50.0	31.5	27.1	L1
17	16.63400	30.1	21.4	1.0	31.1	22.4	60.0	50.0	28.9	27.6	L1

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AC Line Conducted Emissions (Graph)

Test Mode: Band II &802.11a

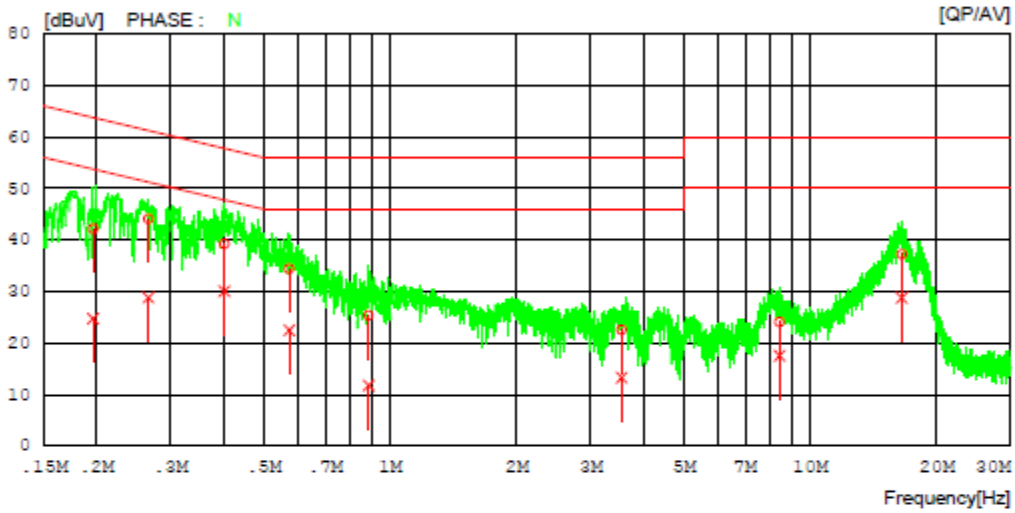
Results of Conducted Emission

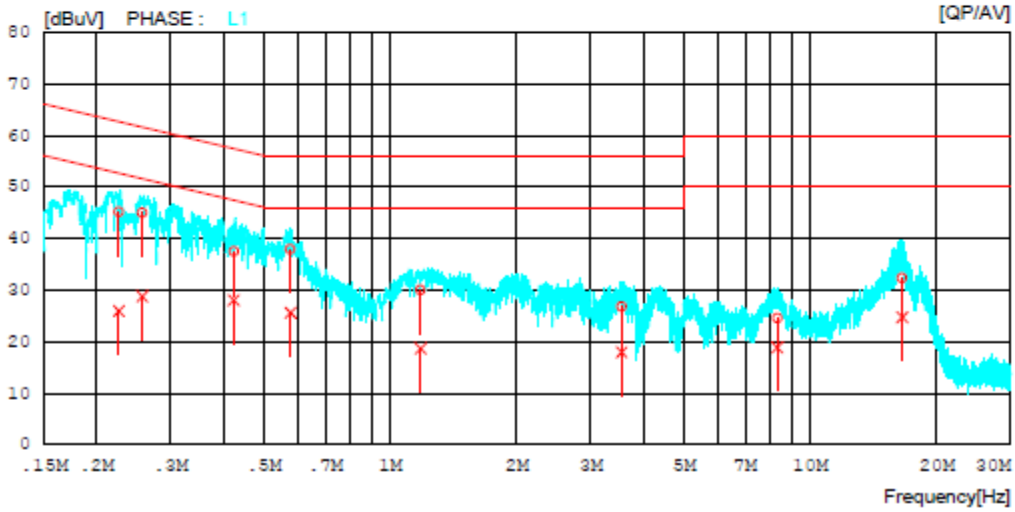
DT&C

Date : 2014-11-13

Order No.	:		Referrence No.	:	
Model No.	:	XM5	Power Supply	:	120V 60Hz
Serial No.	:		Temp/Humi.	:	23℃ 31% R.H
Test Condition	:	5.3G 802.11a	Operator	:	SeokHwan Hong
Memo	:				

LIMIT : CISPR22_B QP
CISPR22_B AV





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AC Line Conducted Emissions (Data List)

Test Mode: Band II &802.11a

Results of Conducted Emission

DT&C

Date : 2014-11-13

Order No.	:		Referrence No.	:	
Model No.	:	XM5	Power Supply	:	120V 60Hz
Serial No.	:		Temp/Humi.	:	23'C 31% R.H
Test Condition	:	5.3G 802.11a	Operator	:	SeokHwan Hong

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.19591	42.1	24.6	0.1	42.2	24.7	63.8	53.8	21.6	29.1	N
2	0.26563	44.0	28.7	0.1	44.1	28.8	61.3	51.3	17.2	22.5	N
3	0.40268	39.0	29.9	0.2	39.2	30.1	57.8	47.8	18.6	17.7	N
4	0.57433	34.2	22.3	0.2	34.4	22.5	56.0	46.0	21.6	23.5	N
5	0.88663	25.2	11.6	0.2	25.4	11.8	56.0	46.0	30.6	34.2	N
6	3.55200	22.3	13.1	0.2	22.5	13.3	56.0	46.0	33.5	32.7	N
7	8.44300	23.5	17.0	0.5	24.0	17.5	60.0	50.0	36.0	32.5	N
8	16.49240	36.4	28.0	0.7	37.1	28.7	60.0	50.0	22.9	21.3	N
9	0.22556	44.9	25.7	0.2	45.1	25.9	62.6	52.6	17.5	26.7	L1
10	0.25655	44.7	28.5	0.2	44.9	28.7	61.5	51.5	16.6	22.8	L1
11	0.42379	37.3	27.9	0.1	37.4	28.0	57.4	47.4	20.0	19.4	L1
12	0.57757	37.8	25.5	0.1	37.9	25.6	56.0	46.0	18.1	20.4	L1
13	1.18080	29.8	18.4	0.2	30.0	18.6	56.0	46.0	26.0	27.4	L1
14	3.55080	26.3	17.5	0.4	26.7	17.9	56.0	46.0	29.3	28.1	L1
15	8.33720	23.8	18.1	0.7	24.5	18.8	60.0	50.0	35.5	31.2	L1
16	16.53220	31.3	23.6	1.0	32.3	24.6	60.0	50.0	27.7	25.4	L1

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AC Line Conducted Emissions (Graph)

Test Mode: Band III &802.11a

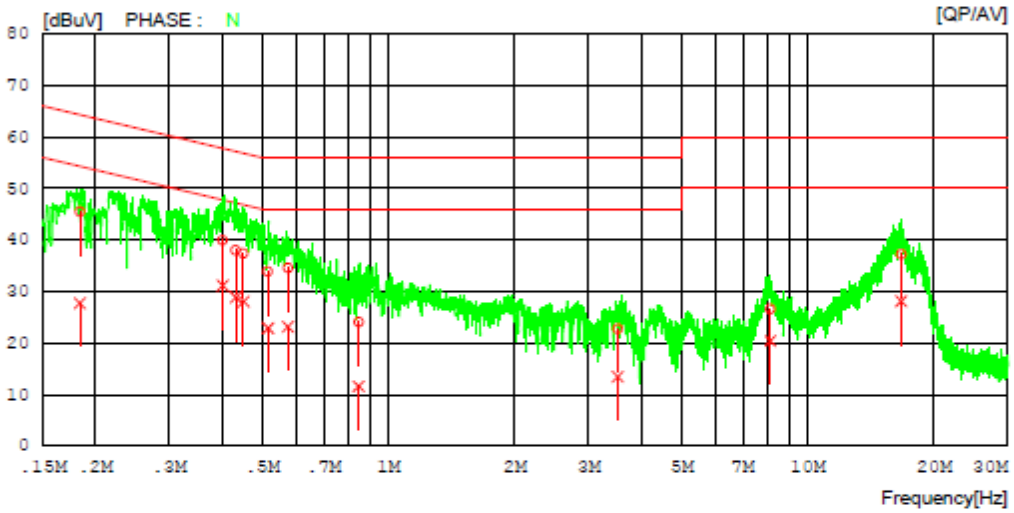
Results of Conducted Emission

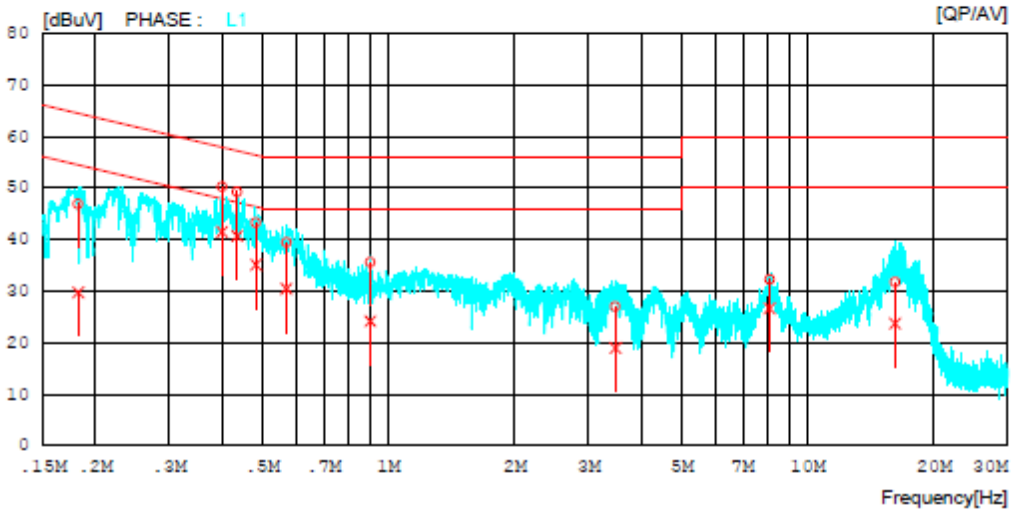
DT&C

Date : 2014-11-13

Order No.	:		Referrence No.	:	
Model No.	:	XM5	Power Supply	:	120V 60Hz
Serial No.	:		Temp/Humi.	:	23'C 31% R.H
Test Condition	:	5.5G 802.11a	Operator	:	SeokHwan Hong
Memo	:				

LIMIT : CISPR22_B QP
CISPR22_B AV





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AC Line Conducted Emissions (Data List)

Test Mode: Band III &802.11a

Results of Conducted Emission

DT&C

Date : 2014-11-13

Order No.	:		Referrence No.	:	
Model No.	:	XM5	Power Supply	:	120V 60Hz
Serial No.	:		Temp/Humi.	:	23℃ 31% R.H
Test Condition	:	5.5G 802.11a	Operator	:	SeokHwan Hong

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18350	45.4	27.7	0.1	45.5	27.8	64.3	54.3	18.8	26.5	N
2	0.40198	39.7	30.9	0.2	39.9	31.1	57.8	47.8	17.9	16.7	N
3	0.43204	37.8	28.7	0.2	38.0	28.9	57.2	47.2	19.2	18.3	N
4	0.45076	37.2	27.8	0.2	37.4	28.0	56.9	46.9	19.5	18.9	N
5	0.51572	33.6	22.7	0.2	33.8	22.9	56.0	46.0	22.2	23.1	N
6	0.57521	34.4	22.9	0.2	34.6	23.1	56.0	46.0	21.4	22.9	N
7	0.84896	23.8	11.4	0.2	24.0	11.6	56.0	46.0	32.0	34.4	N
8	3.51680	22.5	13.3	0.2	22.7	13.5	56.0	46.0	33.3	32.5	N
9	8.13280	26.0	19.9	0.5	26.5	20.4	60.0	50.0	33.5	29.6	N
10	16.69440	36.5	27.4	0.7	37.2	28.1	60.0	50.0	22.8	21.9	N
11	0.18183	46.6	29.5	0.2	46.8	29.7	64.4	54.4	17.6	24.7	L1
12	0.40057	50.0	41.3	0.1	50.1	41.4	57.8	47.8	7.7	6.4	L1
13	0.43530	49.1	40.5	0.1	49.2	40.6	57.2	47.2	8.0	6.6	L1
14	0.48228	43.1	35.0	0.1	43.2	35.1	56.3	46.3	13.1	11.2	L1
15	0.57036	39.3	30.3	0.1	39.4	30.4	56.0	46.0	16.6	15.6	L1
16	0.90399	35.4	24.0	0.1	35.5	24.1	56.0	46.0	20.5	21.9	L1
17	3.47360	26.5	18.5	0.4	26.9	18.9	56.0	46.0	29.1	27.1	L1
18	8.10760	31.5	25.9	0.7	32.2	26.6	60.0	50.0	27.8	23.4	L1
19	16.12640	30.7	22.7	1.0	31.7	23.7	60.0	50.0	28.3	26.3	L1

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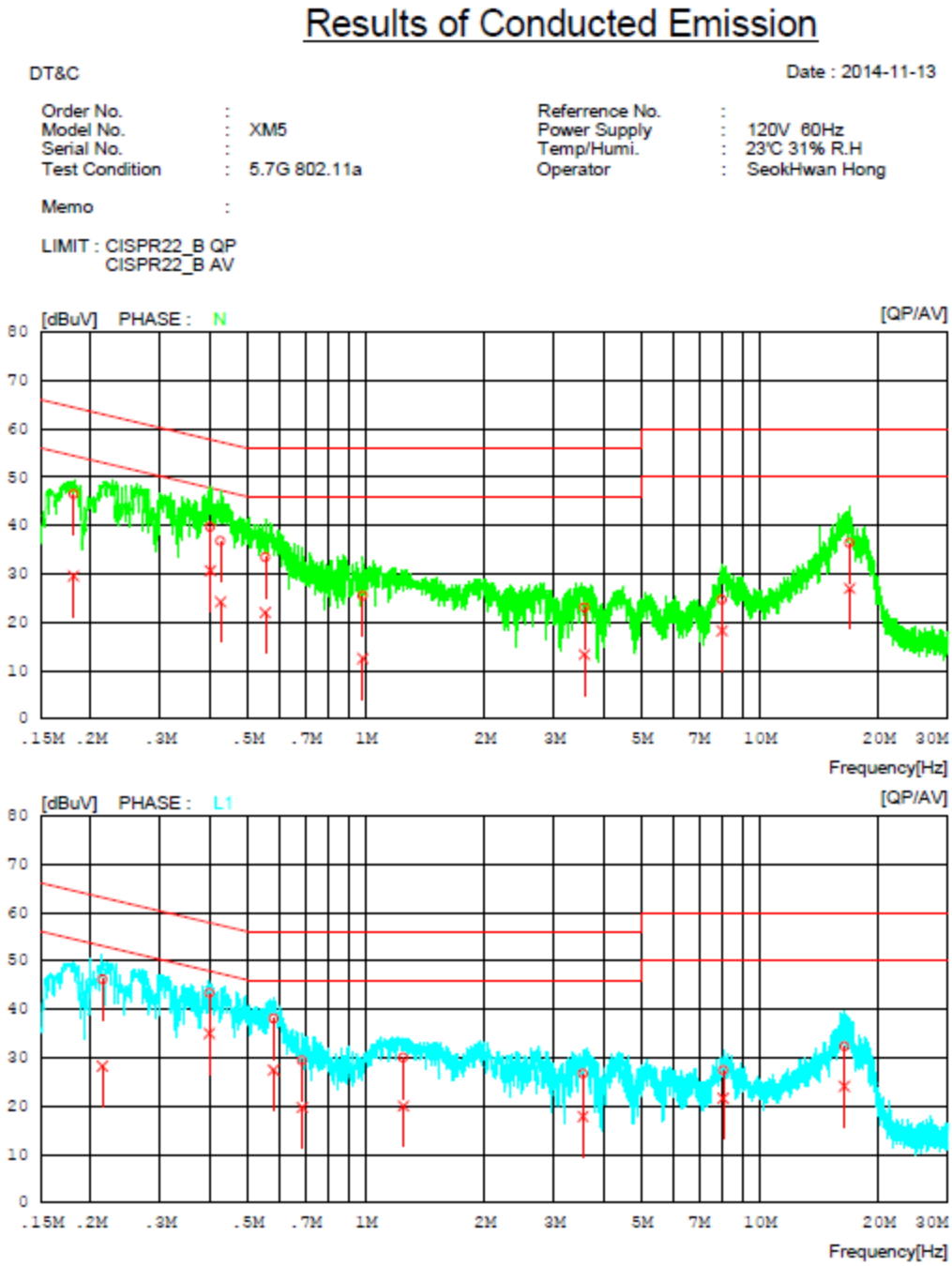
AC Line Conducted Emissions (Graph)

Test Mode: Band IV &802.11a



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AC Line Conducted Emissions (Data List)

Test Mode: Band IV &802.11a

Results of Conducted Emission

DT&C Date : 2014-11-13

Order No.	:		Referrence No.	:	
Model No.	:	XM5	Power Supply	:	120V 60Hz
Serial No.	:		Temp/Humi.	:	23℃ 31% R.H
Test Condition	:	5.7G 802.11a	Operator	:	SeokHwan Hong

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18095	46.4	29.4	0.1	46.5	29.5	64.4	54.4	17.9	24.9	N
2	0.40225	39.5	30.5	0.2	39.7	30.7	57.8	47.8	18.1	17.1	N
3	0.42711	36.6	24.0	0.2	36.8	24.2	57.3	47.3	20.5	23.1	N
4	0.55420	33.2	21.7	0.2	33.4	21.9	56.0	46.0	22.6	24.1	N
5	0.98034	25.3	12.3	0.2	25.5	12.5	56.0	46.0	30.5	33.5	N
6	3.57920	22.8	13.1	0.2	23.0	13.3	56.0	46.0	33.0	32.7	N
7	8.00160	24.1	17.7	0.5	24.6	18.2	60.0	50.0	35.4	31.8	N
8	16.86420	35.7	26.3	0.7	36.4	27.0	60.0	50.0	23.6	23.0	N
9	0.21416	46.0	28.0	0.2	46.2	28.2	63.0	53.0	16.8	24.8	L1
10	0.40032	43.2	34.9	0.1	43.3	35.0	57.8	47.8	14.5	12.8	L1
11	0.58216	38.0	27.3	0.1	38.1	27.4	56.0	46.0	17.9	18.6	L1
12	0.68785	29.3	19.6	0.1	29.4	19.7	56.0	46.0	26.6	26.3	L1
13	1.24280	29.8	19.8	0.2	30.0	20.0	56.0	46.0	26.0	26.0	L1
14	3.55200	26.3	17.4	0.4	26.7	17.8	56.0	46.0	29.3	28.2	L1
15	8.05680	26.6	20.9	0.7	27.3	21.6	60.0	50.0	32.7	28.4	L1
16	16.35840	31.2	23.0	1.0	32.2	24.0	60.0	50.0	27.8	26.0	L1

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8.8 Occupied Bandwidth

▣ **Test Requirements**

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured

▣ **Test Configuration**

Refer to the APPENDIX I.

▣ **Test Procedure :**

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%.
The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted.
Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual

▣ **Test Result : NA**

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9. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	14/10/21	15/10/21	MY48011075
PXA Signal Analyzer	Agilent	N9030A	14/10/21	15/10/21	MY53310140
Digital Multimeter	H.P	34401A	14/02/27	15/02/27	3146A13475
Dynamic Measurement DC Source	Agilent	66332A	14/09/11	15/09/11	MY43000440
Thermohygrometer	BODYCOM	BJ5478	14/05/13	16/05/13	120612-2
Vector Signal Generator	Rohde Schwarz	SMJ100A	14/01/07	15/01/07	100148
Signal Generator	Rohde Schwarz	SMF100A	14/07/01	15/07/01	102341
Attenuator(3dB)	SMAJK	SMAJK-2-3	14/10/21	15/10/21	3
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	14/03/10	15/03/10	SJ-TH-S50-140205
High-pass filter	Wainwright	WHNX8.5	14/09/11	15/09/11	1
High-pass filter	Wainwright	WHKX3.0	14/09/11	15/09/11	9
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
BILOG ANTENNA	SCHAFFNER	VULB 9160	13/12/16	15/12/16	3358
Horn Antenna	ETS-LINDGREN	3117	14/05/12	16/05/12	00140394
HORN ANT	A.H.Systems	SAS-574	13/03/20	15/03/20	154
Amplifier (22dB)	H.P	8447E	14/01/07	15/01/07	2945A02865
Amplifier (30dB)	Agilent	8449B	14/02/27	15/02/27	3008A00370
EMI TEST RECEIVER	R&S	ESU	14/01/07	15/01/07	100014
EMI TEST RECEIVER	R&S	ESCI	14/02/27	15/02/27	100910
CVCF	NF	4420	14/09/11	15/09/11	3049354420023
LISN	R&S	ESH2-Z5	14/09/11	15/09/11	828739/006
PULSE LIMITER	R&S	ESH3-Z2	14/01/08	15/01/08	101334
Wideband Power Sensor	Rohde Schwarz	NRP-Z81	14/05/13	15/05/13	1137.9009.02-101001
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A/ MA2411B	14/10/21	15/10/21	1338004 / 1306053

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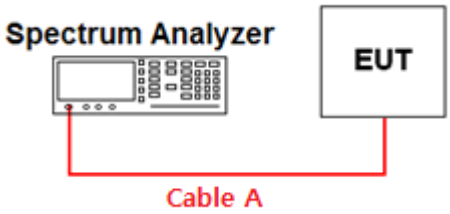
APPENDIX I
Conducted Test set up Diagram

- **Conducted Measurement**



APPENDIX II

Duty Cycle Information

TEST PROCEDURE

Duty Cycle [X = On Time / (On + Off time)] is measured using Measurement Procedure **of KDB789033 D02 V01**

1. Set the center frequency of the spectrum analyzer to the center frequency of the transmission.
2. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW ≥ RBW.
4. Set detector = peak.
5. Note : The zero-span measurement method shall not be used unless both **RBW and VBW are> 50/*T***, where *T* is defined in section II.B.1.a), and **the number of sweep points across duration *T* exceeds 100**. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if *T* ≤ 16.7 microseconds.)

   T : The minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
   (***T* = On time** of the above table since the EUT operates with above fixed Duty Cycle and it is the minimum On time)

TEST DATA

Mode	Channel	Tested Frequency [MHz]	Maximum Achievable Duty Cycle (*x*) = On / (On+Off)			Duty Cycle Correction Factor [dB]	1/*T* [Hz]
			On Time [ms]	On+OffTime [ms]	*x*		
802.11a	40	5200	1.394	2.403	0.58	2.37	717.37
802.11n (HT20)	40	5200	1.311	2.320	0.56	2.52	762.78

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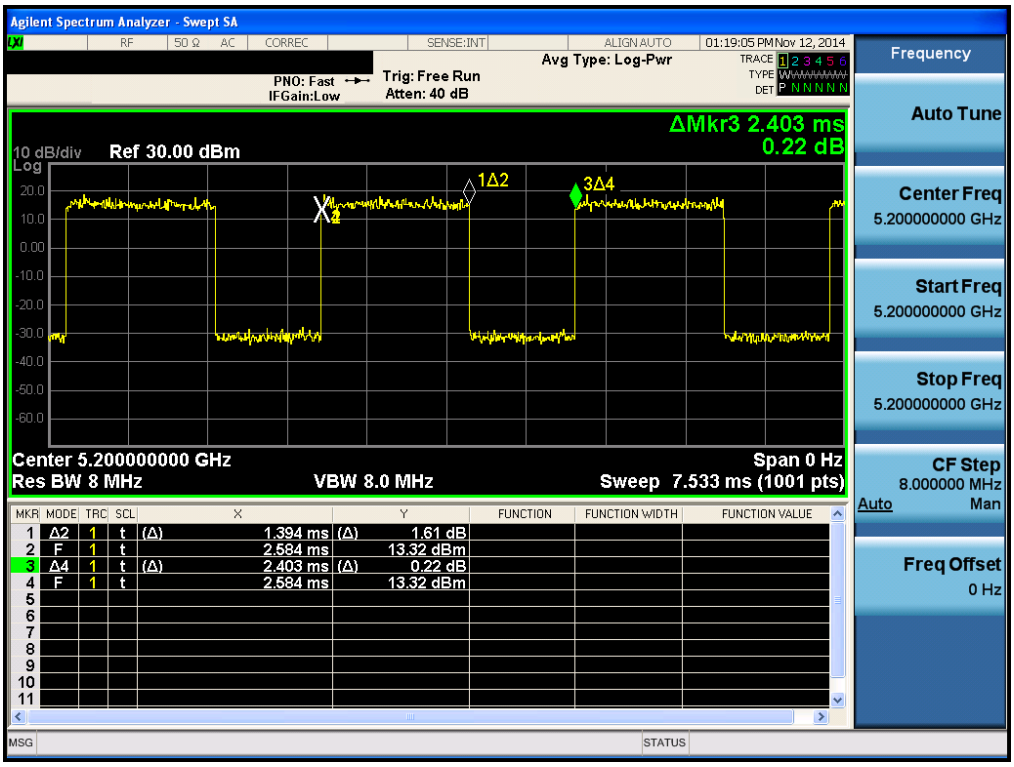
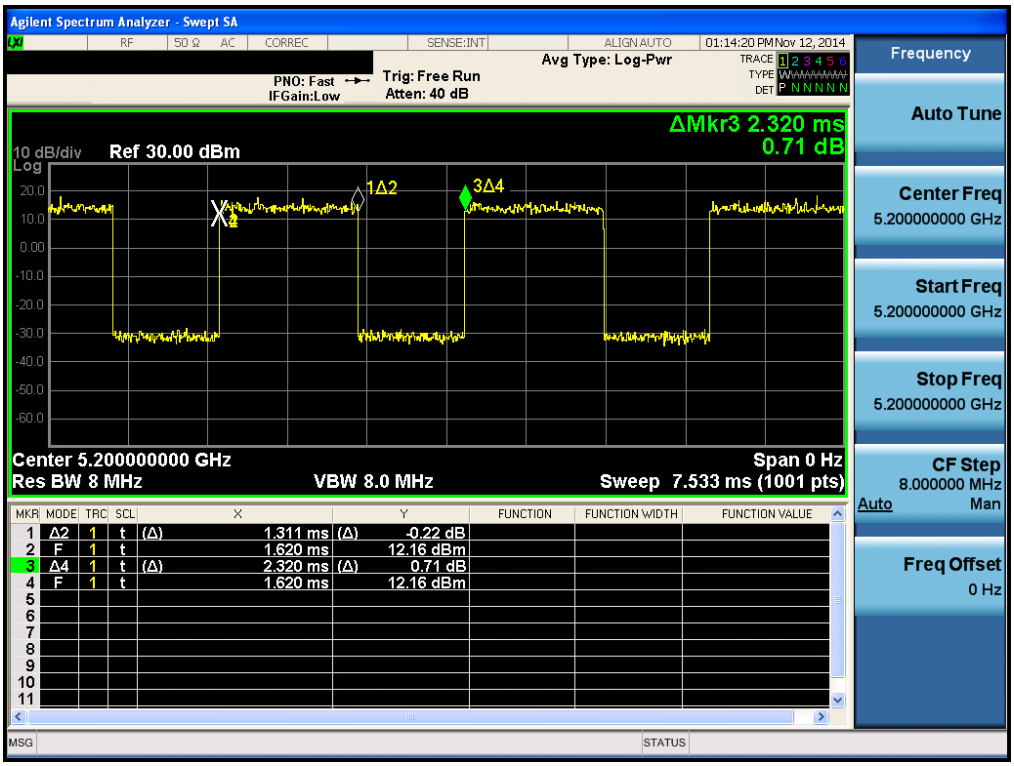
Duty Cycle Test Mode: 802.11a & Ch.40



Duty Cycle Test Mode: 802.11n HT20 & Ch.40



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