ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name:	**802.11 b/g/n High Power 2T2R WiFi Repeater**
Brand Name:	**jjPlus**
Model No.:	**JWAP223**
Model Difference:	**N/A**
FCC ID:	**W23-JWAP223**
Report No.:	**E2/2014/70003**
Issue Date:	**Jul. 28, 2014**
FCC Rule Part:	**§15.247, Cat: DTS**
Prepared for:	**jjPlus CORP.** **13F,-3, No.120, Qiaohe Rd., Zhonghe Dist., New Taipei City 235, Taiwan.**
Prepared by:	**SGS Taiwan Ltd.** **Electronics & Communication Laboratory** **No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan 333**

Testing Laboratory
0513

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VERIFICATION OF COMPLIANCE

Applicant:	jjPlus CORP. 13F,-3, No.120, Qiaohe Rd., Zhonghe Dist., New Taipei City 235, Taiwan.
Product Name:	802.11 b/g/n High Power 2T2R WiFi Repeater
Brand Name:	jjPlus
Model No.:	JWAP223
Model Difference:	N/A
FCC ID:	W23-JWAP223
File Number:	E2/2014/70003
Date of test:	Jul. 01, 2014 ~ Jul. 25, 2014
Date of EUT Received:	Jul. 01, 2014

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247.

The test results of this report relate only to the tested sample identified in this report.

Test By:	Jazz Huang	***Date***	Jul. 28, 2014
	Jazz Huang / Sr. Engineer		
Prepared By:	Tiffany Kao	***Date***	Jul. 28, 2014
	Tiffany Kao / Clerk		
Approved By:	Jim Chang	***Date***	Jul. 28, 2014
	Jim Chang / Supervisor		

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Version

Version No.	Date	Description
00	Jul. 28, 2014	Initial creation of document

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1 GENERAL INFORMATION

1.1 Product description

General:

Product Name:	802.11 b/g/n High Power 2T2R WiFi Repeater	
Brand Name:	jjPlus	
Model No.:	JWAP223	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply:	5Vdc from AC/DC adapter	
	Adapter:	Model No.: JHD-AP012U-050200AB, Supplier: Shenzhen Jihongda Power Co., Ltd

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WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power (Peak)	Modulation Technology	Type of Emission
11b/g	2412-2462	11	b: 24.76dBm g: 24.83dBm	DSSS, OFDM	b: 13M9G1D g: 16M5D1D
11n HT20	2412-2462	11	Aux: 23.80dBm MIMO Chain0: 22.89dBm MIMO Chain1: 24.35dBm MIMO Chain0+1: 26.69dBm	OFDM	16M7D1D
11n HT40	2422-2452	7	Aux: 25.83dBm MIMO Chain0: 22.92dBm MIMO Chain1: 24.22dBm MIMO Chain0+1: 26.59dBm	OFDM	36M5D1D
Antenna Designation:		1. Main Antenna Dipole Antenna, Gain: 2.36dBi 2. Aux Antenna: PIFA Antenna, Gain: 2.13dBi			
Modulation type:		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM			
Transition Rate:		802.11 b: 1/2/5.5/11 Mbps 802.11 g: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 150Mbps 802.11 n_40MHz: 13.5 – 300Mbps			

The 2.4G max antenna gain is 2.36dBi which was choosing for Radiated Spurious Emission test.

The test report applies for WLAN 802.11 b/g/n function.

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IEEE 802.11n Spec:

MCS Index	Nss	Modulation	R	NBPSC	NCBPS		NDBPS		Datarate(Mbps)			
									800nsGI		400nsGI	
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5	7.200	15
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0	14.400	30
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5	21.700	45
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0	28.900	60
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0	43.300	90
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0	57.800	120
6	1	64-QAM	3/4	6	312	648	234	486	58.5	121.5	65.000	135
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0	72.200	150

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bite per single carrier
NCBPS	Number of coded bite per symbol
NDBPS	Number of data bite per symbol
GI	Guard interval

802.11n_HT20 MCS8 -15

MCS Index	Modulation	R	$N_{BPSCS}(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI (see NOTE)
8	BPSK	1/2	1	52	4	104	52	13.0	14.4
9	QPSK	1/2	2	52	4	208	104	26.0	28.9
10	QPSK	3/4	2	52	4	208	156	39.0	43.3
11	16-QAM	1/2	4	52	4	416	208	52.0	57.8
12	16-QAM	3/4	4	52	4	416	312	78.0	86.7
13	64-QAM	2/3	6	52	4	624	416	104.0	115.6
14	64-QAM	3/4	6	52	4	624	468	117.0	130.0
15	64-QAM	5/6	6	52	4	624	520	130.0	144.4
NOTE—The 400 ns GI rate values are rounded to 1 decimal place.									

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MCS Index	Modulation	R	$N_{BPSCS}(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI
8	BPSK	1/2	1	108	6	216	108	27.0	30.0
9	QPSK	1/2	2	108	6	432	216	54.0	60.0
10	QPSK	3/4	2	108	6	432	324	81.0	90.0
11	16-QAM	1/2	4	108	6	864	432	108.0	120.0
12	16-QAM	3/4	4	108	6	864	648	162.0	180.0
13	64-QAM	2/3	6	108	6	1296	864	216.0	240.0
14	64-QAM	3/4	6	108	6	1296	972	243.0	270.0
15	64-QAM	5/6	6	108	6	1296	1080	270.0	300.0

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Member of SGS Group

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: W23-JWAP223** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4:2009. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with Jun 2014 KDB558074 D01 v03r02 for compliance to FCC 47CFR 15.247 requirements.

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan 333 which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number: 628985.The address of SGS Taiwan Ltd. Electronics & Communication Laboratory 1F, No.134, Wukung Road New Taipei City TAIWAN 24803, Canada Registration Number: 4620A-5.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County,Taiwan which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. FCC Registration Number: 455997. The address of SGS Taiwan Ltd. Electronics & Communication Laboratory 1F, No.134, Wukung Road New Taipei City TAIWAN 24803.

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the general criterion in Section 7.1 of ANSI C63.4:2009.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m 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 and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna. according to the requirements in Section 8 and 13 and of ANSI C63.4:2009.

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2.4 Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted (Antenna Port) Configuration

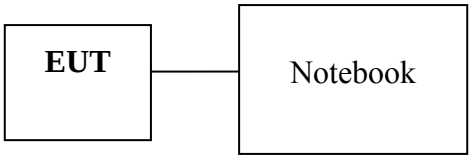

Fig. 2-2 AC Power Line Conducted Emission

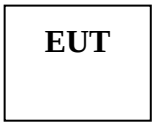

Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Notebook	Lenovo	L430	R9-YYG88	shielding	Un-shielding
2.	WLAN Test Software	Atheros	Atheros Radio Test 2 (ART2-GUI)	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(d)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(d)	Spurious Emission	Compliant
§15.247(e)	Peak Power Density	Compliant
§15.203	Antenna Requirement	Compliant

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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.

802.11 b mode: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 1Mbps lowest data rate are chosen for full testing.

802.11 g mode: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 6Mbps lowest data rate are chosen for full testing.

802.11 n_20MHz mode: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 6.5Mbps lowest data rate are chosen for full testing.

802.11 n_40MHz: Lowest (2422MHz) and mid (2437MHz) and high (2452MHz) with 13.5Mbps lowest data rate are chosen for full testing.

The worst case is determined by the output power that generates the highest emission. As examined in the section of output power measurement, the section 7.5, the lowest data rate at b/g/n_HT20/n_HT40 resulted the highest level of fundamental emission, and therefore, the lowest data rate is chosen as the worst-case to conduct the remaining of other mandatory test cases.

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11b/g/n WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

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Directional gain (MIMO)

Array gain = 2.36dBi (ERP/EIRP related measurement)
Array gain = 3.01dBi (peak spectral density)

MIMO gain = gain (nominal gain) + array gain = (2.36 + 0)dBi =2.36dBi

Gain with 2.4G is combined with different magnitude of two antennas:

(ii) If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream:

- Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain; or,

- $$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

where

Each antenna is driven by no more than one spatial stream;
N_{SS} = the number of independent spatial streams of data;
N_{ANT} = the total number of antennas
$g_{j,k} = 10^{G_k/20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;
G_k is the gain in dBi of the kth antenna.

802.11n_20M
Directive Gain = 2.2dBi(Wifi 2.4G),
MIMO Gain = (2.2+2.36)=4.57dBi (Wifi 2.4G)

802.11n_40M
Directive Gain = 2.23dBi(Wifi 2.4G),
MIMO Gain = (2.23+2.36)=4.59dBi (Wifi 2.4G)

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 1.55dB (for Spectrum) +/- 1.42 dB (for Power Meter)
6dB Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Peak Power Density	+/- 1.55 dB
99% Power Bandwidth	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC=+/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : **Vertical**)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : **Horizontal**)	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

According to §15.207, frequency range within 150KHz to 30MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2 Measurement Equipment Used:

SGS Conducted Emission Test Site No.A					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EMI Test Receiver	R&S	ESCI 3	101311	2014/06/20	2015/06/19
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	2014/02/07	2015/02/06
LISN	Schwarzbeck	NSLK 8127	8127-648	2014/06/10	2015/06/09
LISN	Rolf-Heine	NNB-2/16Z	99012	2014/03/26	2015/03/25
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

6.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4:2009.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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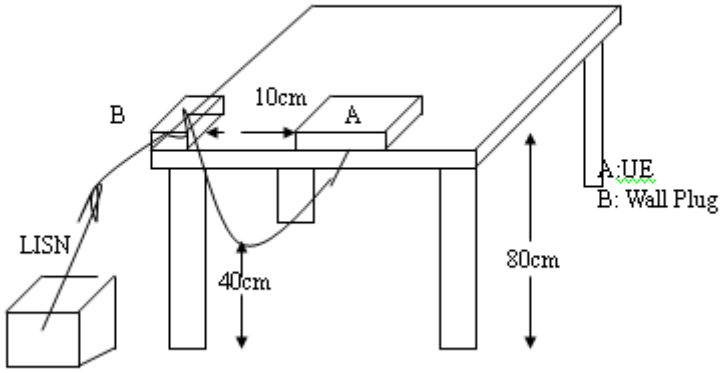
6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

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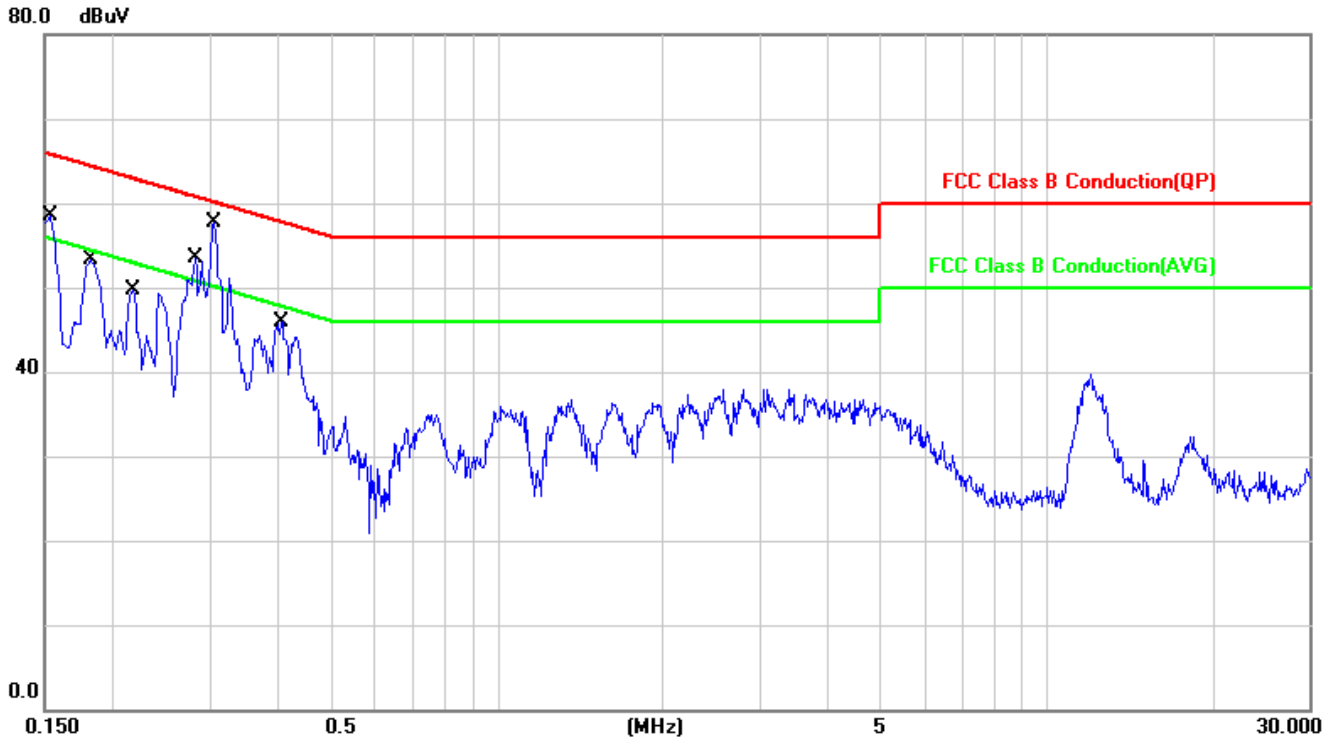
AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Jul. 21, 2014
Temperature:	24 ℃	Humidity:	60 %	Test By:	Jazz
Phase:	L1				



No.	Mk.	Freq. (MHz)	Reading dBuV	Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1		0.3940	47.00	0.16	47.16	57.98	-10.82	peak	
2		0.3960	31.85	0.16	32.01	47.94	-15.93	AVG	
3		0.4940	39.79	0.23	40.02	56.10	-16.08	peak	
4		1.3860	38.76	0.49	39.25	56.00	-16.75	peak	
5		3.3540	36.34	0.60	36.94	56.00	-19.06	peak	
6	*	23.1285	42.07	0.64	42.71	50.00	-7.29	AVG	
7		23.1300	47.13	0.64	47.77	60.00	-12.23	peak	
8		26.6100	45.99	0.76	46.75	60.00	-13.25	peak	

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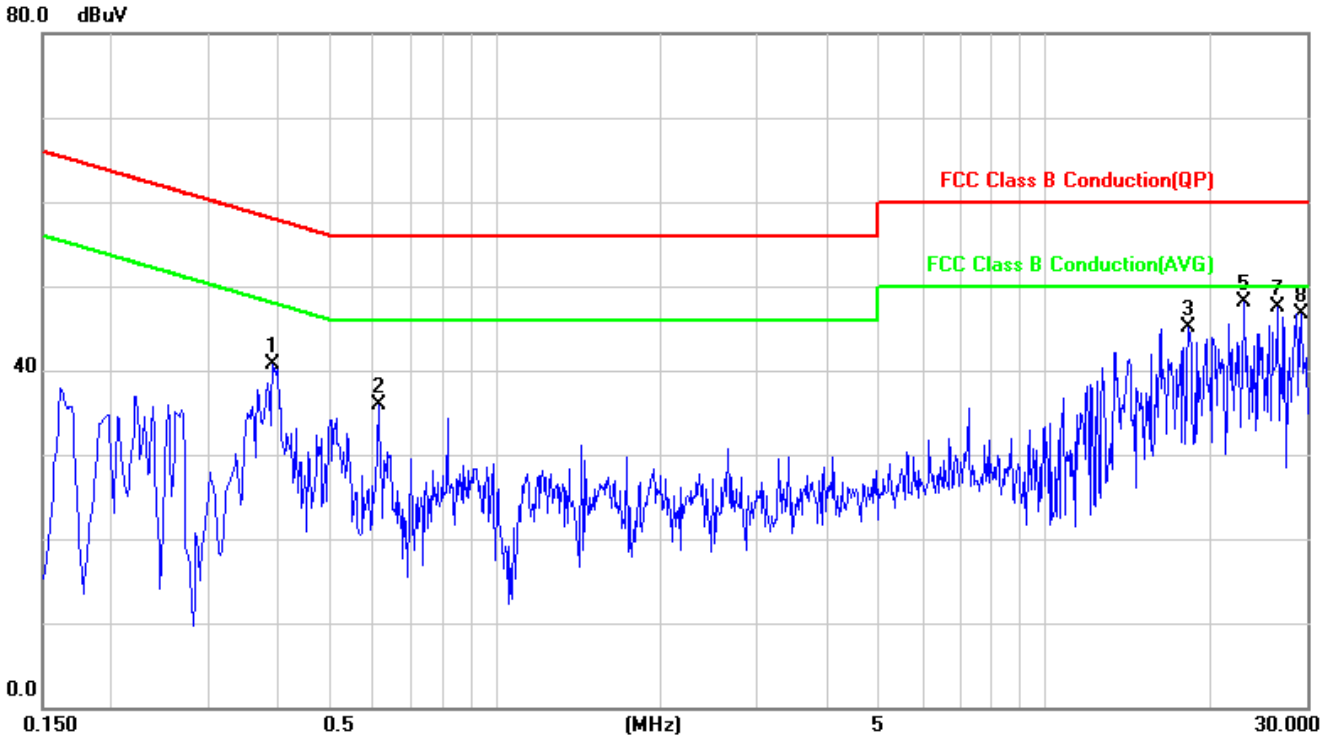
Operation Mode:	Operation mode			Test Date:	Jul. 21, 2014
Temperature:	24 °C	Humidity:	60 %	Test By:	Jazz
Phase:	N				



No.	Mk.	Freq. (MHz)	Reading dBuV	Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1		0.3940	40.59	0.17	40.76	57.98	-17.22	peak	
2		0.6140	35.72	0.26	35.98	56.00	-20.02	peak	
3		18.2460	44.60	0.57	45.17	60.00	-14.83	peak	
4	*	23.1284	44.20	0.68	44.88	50.00	-5.12	AVG	
5		23.1300	47.51	0.68	48.19	60.00	-11.81	peak	
6		26.6092	42.44	0.81	43.25	50.00	-6.75	AVG	
7		26.6100	46.77	0.81	47.58	60.00	-12.42	peak	
8		29.2340	45.85	0.87	46.72	60.00	-13.28	peak	

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7 PEAK OUTPUT POWER MEASUREMENT

7.1 Standard Applicable:

According to §15.247 (b)

(3) For systems using digital modulation in the 902-928 MHz and 2400-2483.5 MHz: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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7.2 Measurement Equipment Used:

SGS Conducted Room					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum Analyzer	Agilent	N9010A	MY53400256	2013/10/26	2014/10/25
Power Meter	Anritsu	ML2496A	1326001	2014/06/20	2015/06/19
Power Sensor	Anritsu	MA2411B	1315048	2014/06/20	2015/06/19
Power Sensor	Anritsu	MA2411B	1315049	2014/06/20	2015/06/19
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	2	2014/01/06	2015/01/05
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	3	2014/01/06	2015/01/05
Coaxial Cable 80cm	WOKEN	00100A1F1A185C	1	2014/01/06	2015/01/05
DC Block	Mini-Circuits	BLK-18-S+	4	2014/01/06	2015/01/05
DC Block	PASTERNACK	PE8210	5	2014/01/06	2015/01/05
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-019	2014/01/06	2015/01/05
Splitter	WOKEN	NA	DOM35LW1A2	2014/01/06	2015/01/05
Attenuator	Mini-Circuits	BW-S10W2+	6	2014/01/06	2015/01/05
Attenuator	WOKEN	218FS-10	7	2014/01/06	2015/01/05
Temperature Chamber	TERCHY	MHK-120LK	1020582	2014/06/18	2015/06/17
Communication Tester	R&S	CMW500	131121	2014/01/16	2015/01/15
Communication Tester	Anritsu	MT8820C	6201107337	2014/04/24	2015/04/23
DC Power Supply	Agilent	E3640A	MY53140006	2014/05/31	2015/05/30
DC Power Supply	Agilent	E3640A	MY53130054	2014/05/21	2015/05/20

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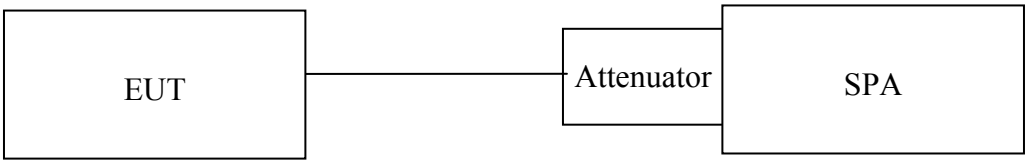
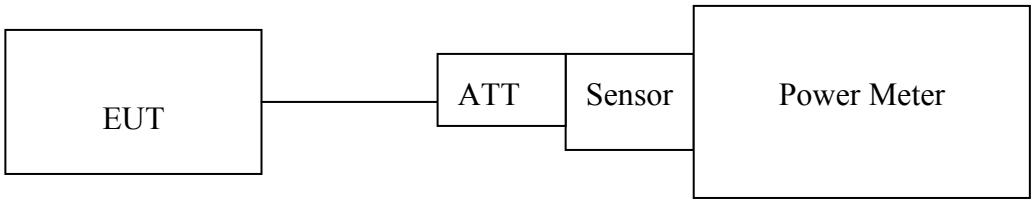
7.3 Test Set-up:

Spectrum:



Power Meter:



7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (**Peak power setting on Spectrum:** Channel power function, RBW = 1MHz, VBW = 3MHz, Span: 30/60MHz, Detector =peak, Sweep = Auto. Setting on spectrum is adjusted based on the mandatory procedure in 9.1.2 of the KDB558074). Power Meter is used as the auxiliary test equipment to conduct the output power measurement. 9.1.3 in KDB558074 is followed.

   (**Avg. power setting on Spectrum:** Channel power function, RBW = 1MHz, VBW = 3MHz, Span: 30/60MHz, Detector =Avg., Trace avg =100, Sweep = Auto, Setting on spectrum is adjusted based on the mandatory procedure in 9.2.2.4 of the KDB558074). Power Meter is used as the auxiliary test equipment to conduct the output power measurement. 9.2.3, option 3 in KDB558074 is followed.
3. Record the max. Reading as observed from Spectrum or Power Meter.
4. Repeat above procedures until all frequency of interest measured was complete.

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Pre-anaysis Check: While conducting average power measurement, duty cycle of each mode (a/n_ht20 /n_ht40) shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle. All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones

b = 99.5%, g = 96.5%, and n_ht_20 (MIMO) = 93%, n_ht_40 (MIMO) = 89.6%, where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

Formula:

Duty Cycle = Ton / (Ton+Toff)

Test Procedure:

Set span = 0, RBW = 8MHz, VBW = 8MHz, Detector = Peak

Duty Cycle:

	Antenna	Duty Cycle	Duty Factor (dBm)
802.11b	Single	0.995	0.042
802.11g	Single	0.965	0.314
802.11n_20 (2.4G)	SISO_Main	0.961	0.342
802.11n_20 (2.4G)	MIMO	0.930	0.634
802.11n_40 (2.4G)	SISO_Aux	0.943	0.513
802.11n_40 (2.4G)	MIMO	0.896	0.957

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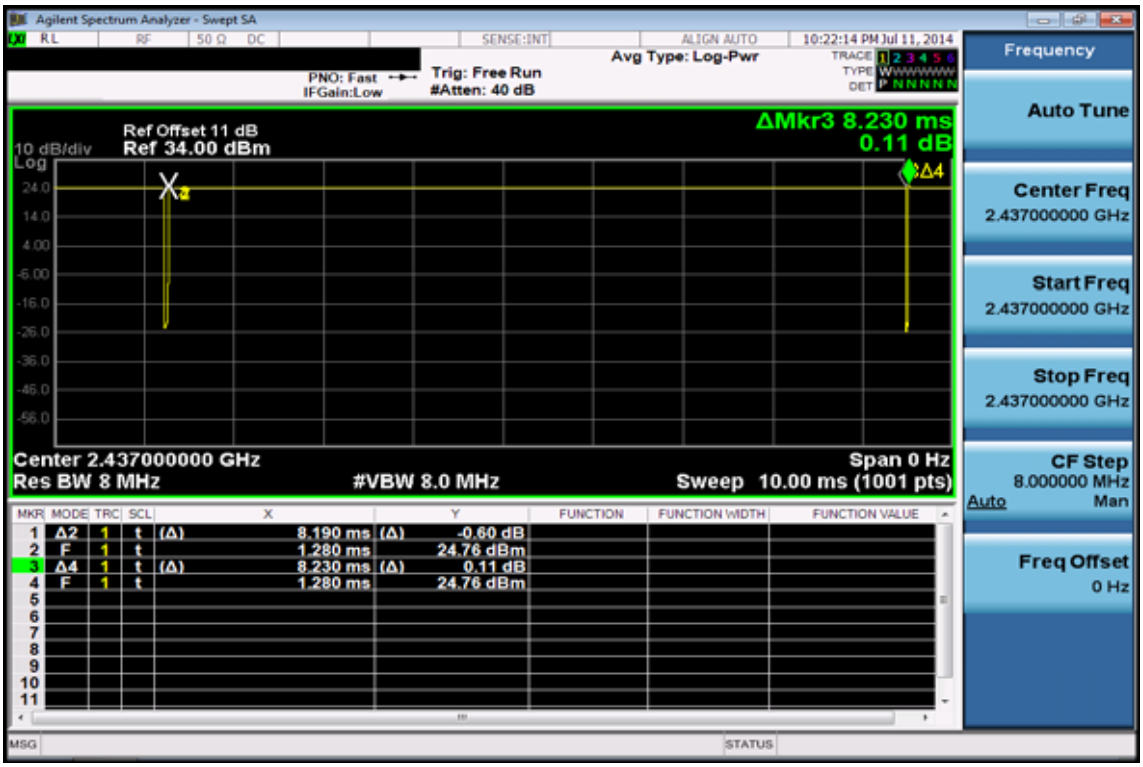
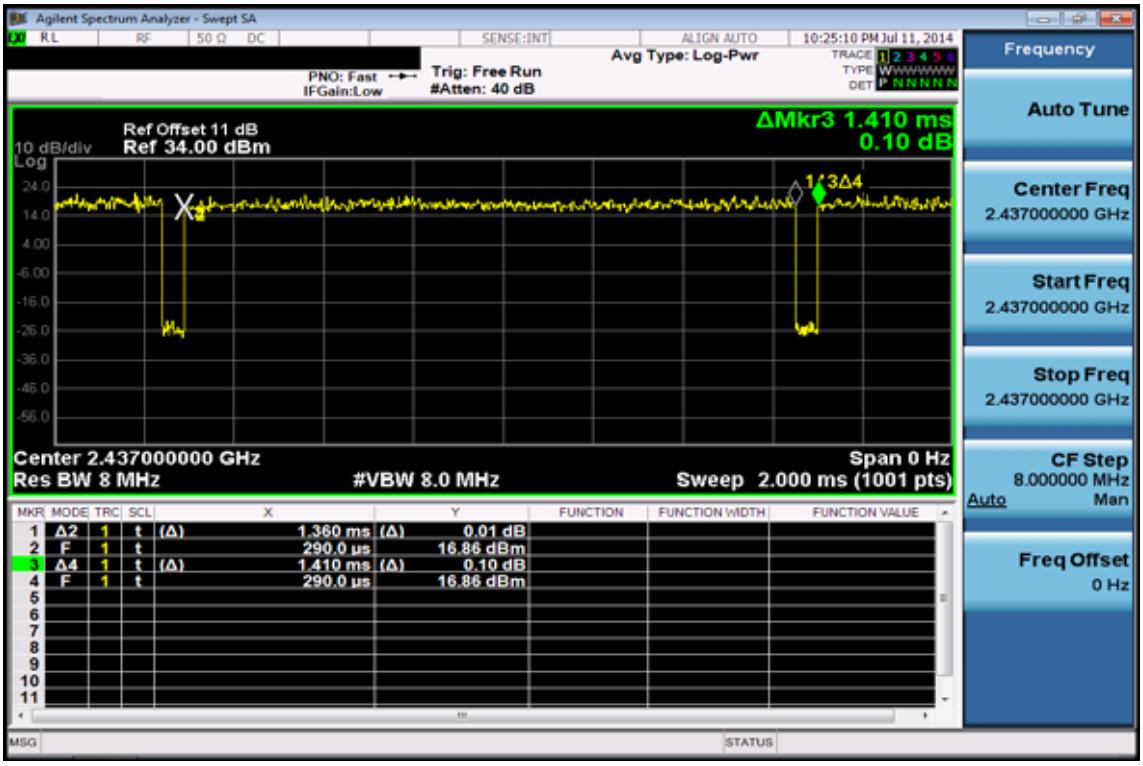
Duty Factor:

802.11 b



802.11 g



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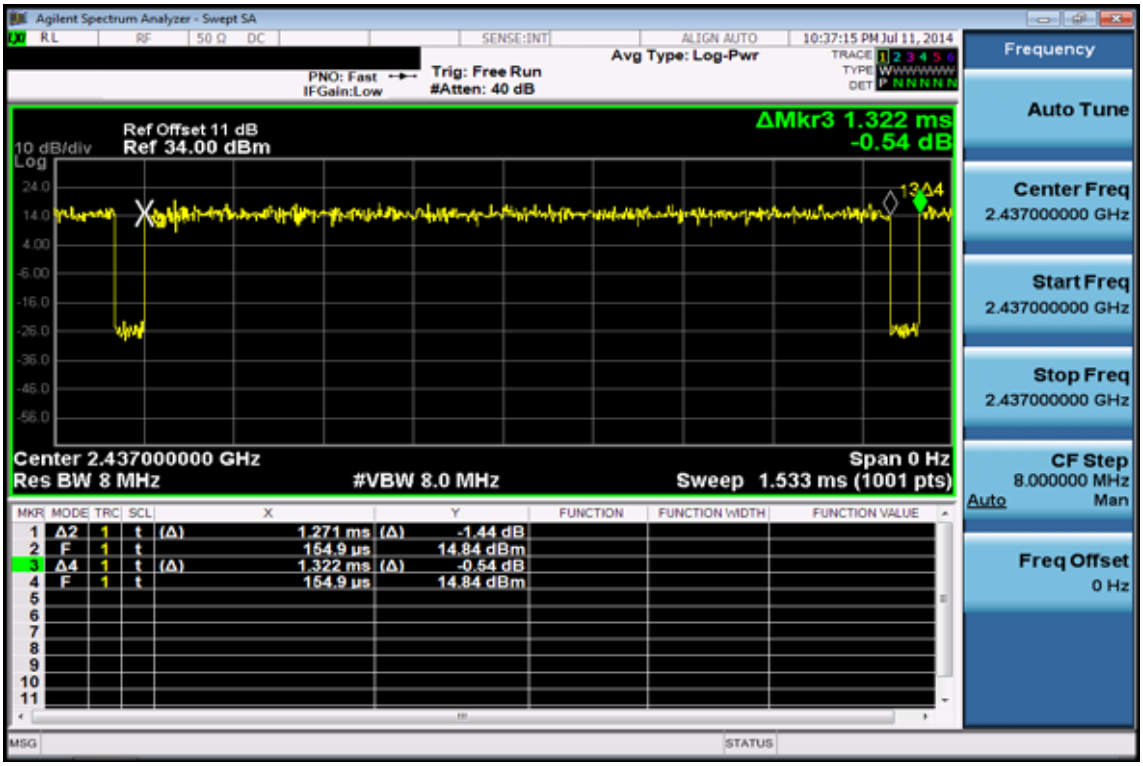
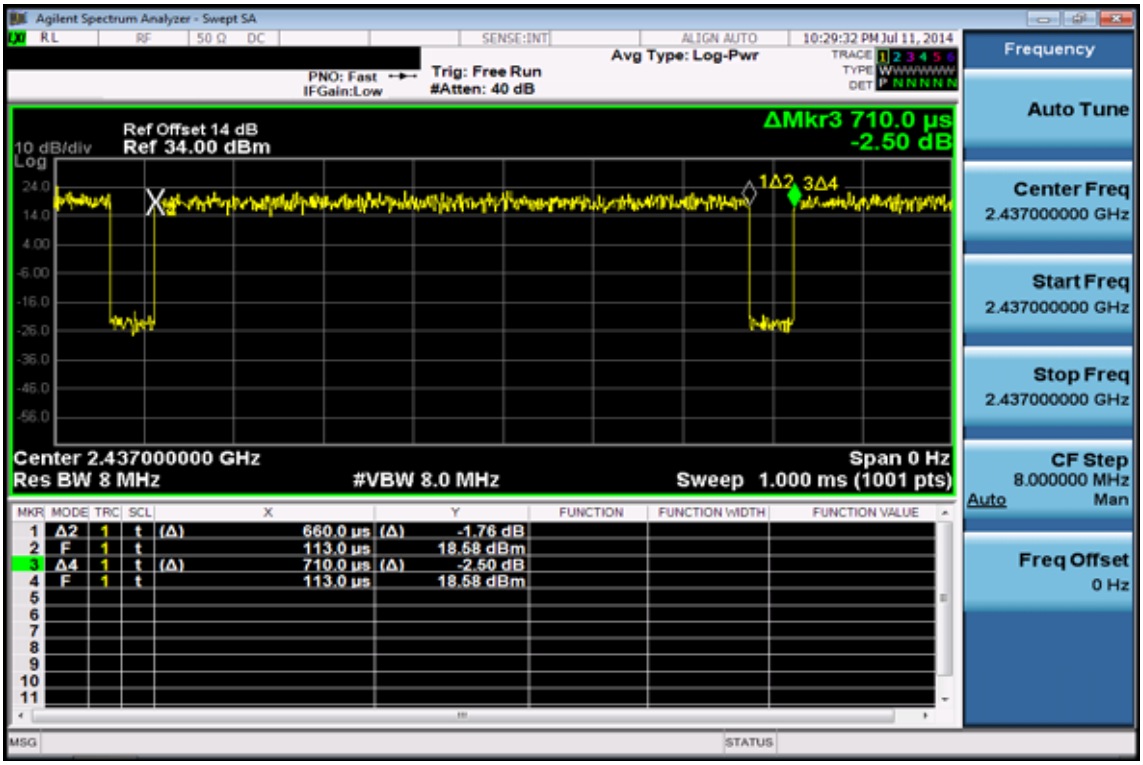
802.11 n_20 MHz (Main)



802.11 n_20 MHz (MIMO)



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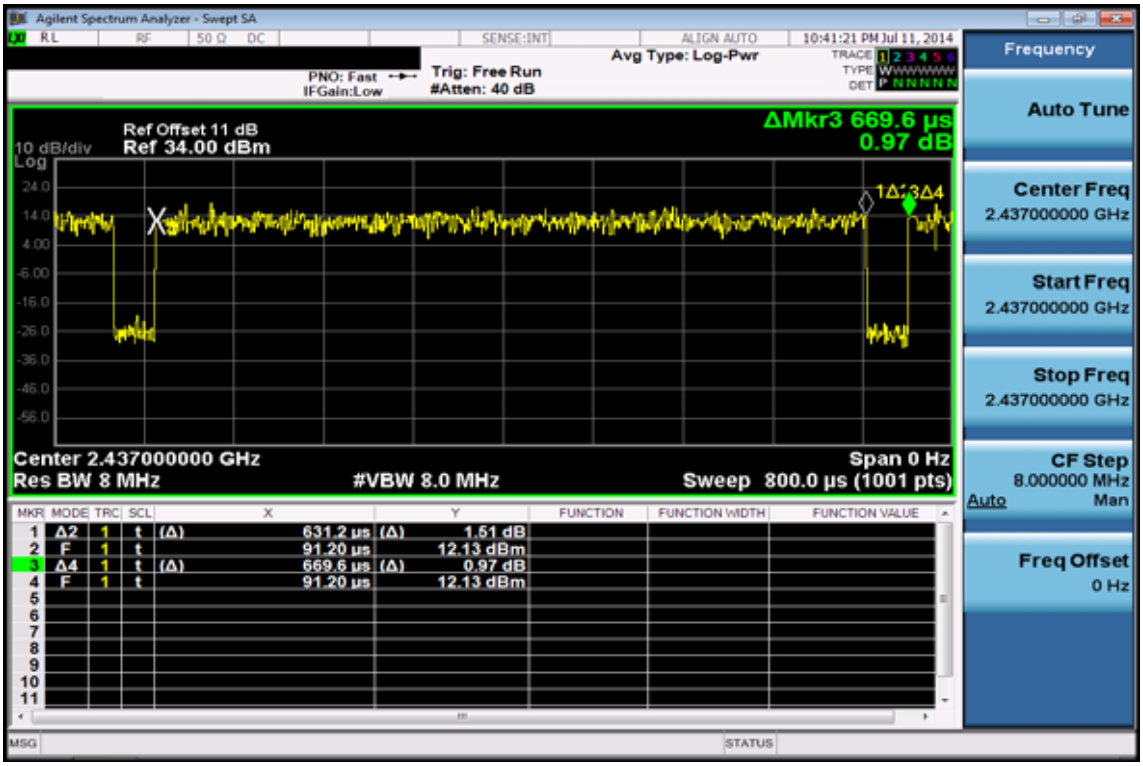
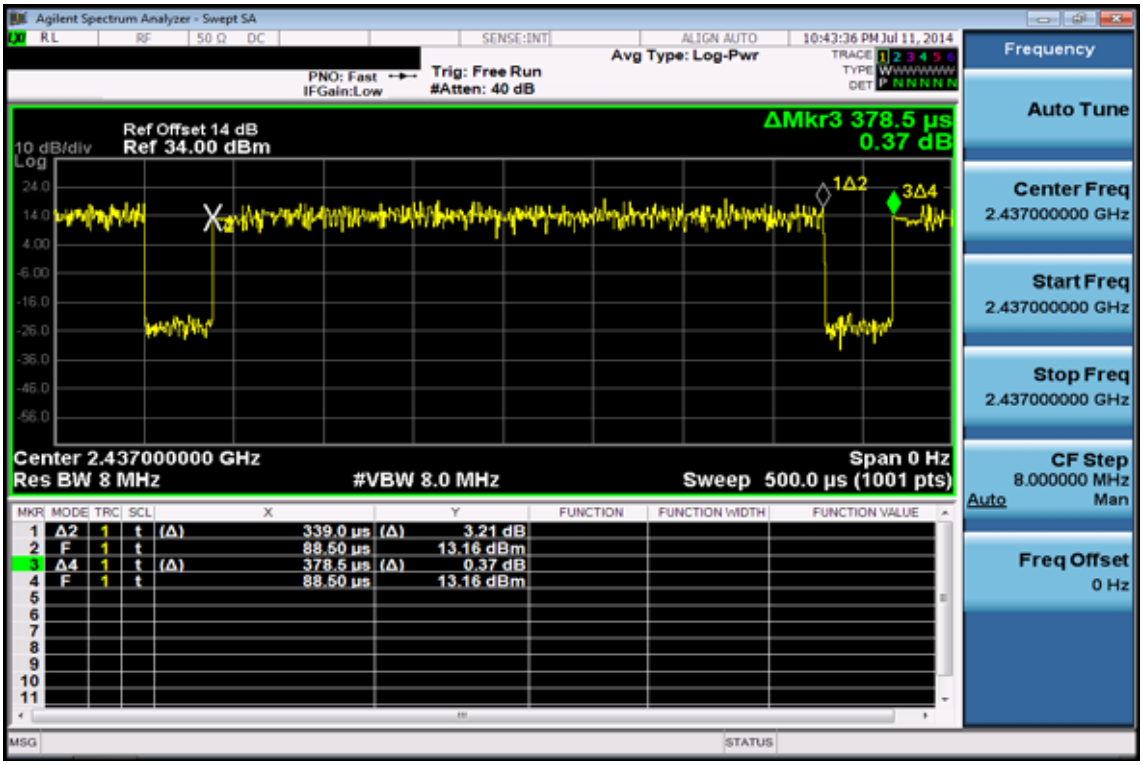
802.11 n_40 MHz (Aux)



802.11 n_40 MHz (MIMO)



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7.5 Measurement Result (Worst Case Data Rate):

802.11b (Main)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		1	
1	2412	22.95	1 Watt = 30 dBm
6	2437	22.85	1 Watt = 30 dBm
11	2462	**23.24**	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		1	
1	2412	20.49	1 Watt = 30 dBm
6	2437	20.34	1 Watt = 30 dBm
11	2462	**20.91**	1 Watt = 30 dBm

802.11b (Aux)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		1	
1	2412	**24.76**	1 Watt = 30 dBm
6	2437	24.47	1 Watt = 30 dBm
11	2462	24.73	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		1	
1	2412	21.97	1 Watt = 30 dBm
6	2437	21.87	1 Watt = 30 dBm
11	2462	**21.99**	1 Watt = 30 dBm

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802.11g (Main)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		6	
1	2412	23.86	1 Watt = 30 dBm
6	2437	23.91	1 Watt = 30 dBm
11	2462	**23.94**	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		6	
1	2412	13.58	1 Watt = 30 dBm
6	2437	13.60	1 Watt = 30 dBm
11	2462	**13.63**	1 Watt = 30 dBm

802.11g (Aux)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		6	
1	2412	24.72	1 Watt = 30 dBm
6	2437	**24.83**	1 Watt = 30 dBm
11	2462	24.64	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		6	
1	2412	**14.86**	1 Watt = 30 dBm
6	2437	14.69	1 Watt = 30 dBm
11	2462	14.50	1 Watt = 30 dBm

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802.11n_20M (Main)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS0	Required Limit
1	2412	22.41	1 Watt = 30 dBm
6	2437	22.60	1 Watt = 30 dBm
11	2462	22.65	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS0	Required Limit
1	2412	12.08	1 Watt = 30 dBm
6	2437	12.35	1 Watt = 30 dBm
11	2462	12.26	1 Watt = 30 dBm

802.11n_20M (Aux)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS0	Required Limit
1	2412	23.80	1 Watt = 30 dBm
6	2437	23.65	1 Watt = 30 dBm
11	2462	23.37	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS0	Required Limit
1	2412	13.40	1 Watt = 30 dBm
6	2437	13.38	1 Watt = 30 dBm
11	2462	13.05	1 Watt = 30 dBm

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802.11n_20M (MIMO Chain 0)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2412	22.89	1 Watt = 30 dBm
6	2437	22.76	1 Watt = 30 dBm
11	2462	22.78	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2412	12.42	1 Watt = 30 dBm
6	2437	12.37	1 Watt = 30 dBm
11	2462	12.36	1 Watt = 30 dBm

802.11n_20M (MIMO Chain 1)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2412	24.35	1 Watt = 30 dBm
6	2437	24.30	1 Watt = 30 dBm
11	2462	23.96	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2412	13.84	1 Watt = 30 dBm
6	2437	13.76	1 Watt = 30 dBm
11	2462	13.42	1 Watt = 30 dBm

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802.11n_20M (MIMO Chain 0+1)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2412	26.69	1 Watt = 30 dBm
6	2437	26.61	1 Watt = 30 dBm
11	2462	26.42	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2412	16.20	1 Watt = 30 dBm
6	2437	16.13	1 Watt = 30 dBm
11	2462	15.93	1 Watt = 30 dBm

802.11n_40M (Main)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS0	Required Limit
1	2422	24.98	1 Watt = 30 dBm
6	2437	24.97	1 Watt = 30 dBm
11	2452	25.16	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS0	Required Limit
1	2422	12.07	1 Watt = 30 dBm
6	2437	12.01	1 Watt = 30 dBm
11	2452	12.29	1 Watt = 30 dBm

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802.11n_40M (Aux)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS0	Required Limit
1	2422	25.77	1 Watt = 30 dBm
6	2437	25.83	1 Watt = 30 dBm
11	2452	25.71	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS0	Required Limit
1	2422	12.93	1 Watt = 30 dBm
6	2437	12.90	1 Watt = 30 dBm
11	2452	12.89	1 Watt = 30 dBm

802.11n_40M (MIMO Chain 0)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2422	22.92	1 Watt = 30 dBm
6	2437	22.59	1 Watt = 30 dBm
11	2452	22.73	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2422	12.24	1 Watt = 30 dBm
6	2437	11.94	1 Watt = 30 dBm
11	2452	12.20	1 Watt = 30 dBm

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802.11n_40M (MIMO Chain 1)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2422	24.15	1 Watt = 30 dBm
6	2437	24.22	1 Watt = 30 dBm
11	2452	24.10	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2422	13.47	1 Watt = 30 dBm
6	2437	13.40	1 Watt = 30 dBm
11	2452	13.45	1 Watt = 30 dBm

802.11n_40M (MIMO Chain 0+1)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2422	26.59	1 Watt = 30 dBm
6	2437	26.49	1 Watt = 30 dBm
11	2452	26.48	1 Watt = 30 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2422	15.91	1 Watt = 30 dBm
6	2437	15.74	1 Watt = 30 dBm
11	2452	15.88	1 Watt = 30 dBm

**** Note: The duty cycle factor is compensated to obtain the maximum value of measurement in average.***

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8 6dB BANDWIDTH

8.1 Standard Applicable:

According to §15.247(a)(2), Systems using digital modulation techniques may operate in the 902 - 928 MHz and 2400 - 2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500kHz.

8.2 Measurement Equipment Used:

SGS Conducted Room					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum Analyzer	Agilent	N9010A	MY53400256	2013/10/26	2014/10/25
Power Meter	Anritsu	ML2496A	1326001	2014/06/20	2015/06/19
Power Sensor	Anritsu	MA2411B	1315048	2014/06/20	2015/06/19
Power Sensor	Anritsu	MA2411B	1315049	2014/06/20	2015/06/19
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	2	2014/01/06	2015/01/05
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	3	2014/01/06	2015/01/05
Coaxial Cable 80cm	WOKEN	00100A1F1A185C	1	2014/01/06	2015/01/05
DC Block	Mini-Circuits	BLK-18-S+	4	2014/01/06	2015/01/05
DC Block	PASTERNACK	PE8210	5	2014/01/06	2015/01/05
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-019	2014/01/06	2015/01/05
Splitter	WOKEN	NA	DOM35LW1A2	2014/01/06	2015/01/05
Attenuator	Mini-Circuits	BW-S10W2+	6	2014/01/06	2015/01/05
Attenuator	WOKEN	218FS-10	7	2014/01/06	2015/01/05
Temperature Chamber	TERCHY	MHK-120LK	1020582	2014/06/18	2015/06/17
Communication Tester	R&S	CMW500	131121	2014/01/16	2015/01/15
Communication Tester	Anritsu	MT8820C	6201107337	2014/04/24	2015/04/23
DC Power Supply	Agilent	E3640A	MY53140006	2014/05/31	2015/05/30
DC Power Supply	Agilent	E3640A	MY53130054	2014/05/21	2015/05/20

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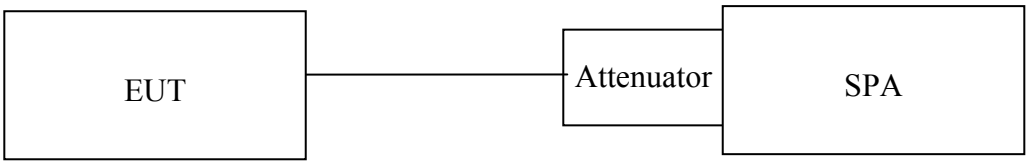
8.3 Test Set-up:



8.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100 kHz, VBW = 3*RBW, Span = 30M/50MHz, Detector=Peak, Sweep=auto, the setting on spectrum is adjusted based on the procedure as guide in 8.1 option 1 of KDB558074.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat above procedures until all frequency of interest measured was complete.

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8.5 Measurement Result:

802.11b

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	10100	> 500	PASS
2437	10100	> 500	PASS
2462	10100	> 500	PASS

802.11g

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	16350	> 500	PASS
2437	16360	> 500	PASS
2462	16340	> 500	PASS

802.11n_20M

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	17630	> 500	PASS
2437	17640	> 500	PASS
2462	17620	> 500	PASS

802.11n_40M

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2422	36380	> 500	PASS
2437	36370	> 500	PASS
2452	36430	> 500	PASS

** Note: Offset 11dB for 2.4G 802.11b/g; Offset 14dB for 2.4G 802.11 n_20/n_40.*

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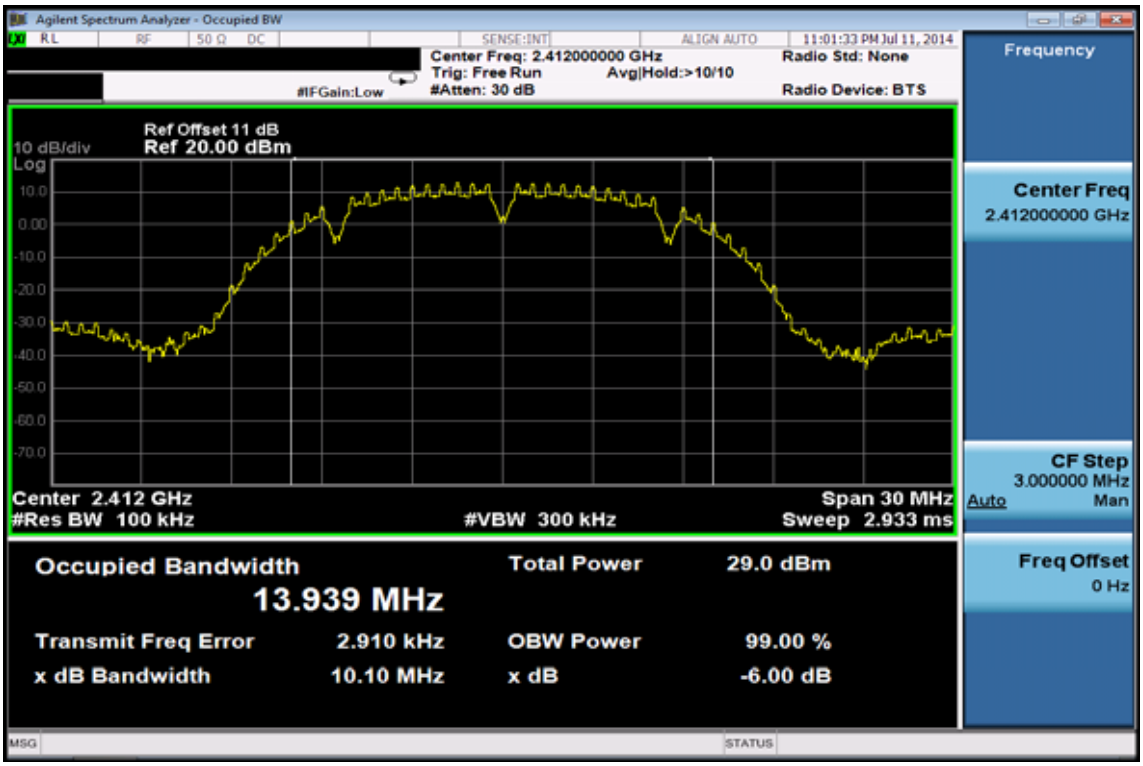
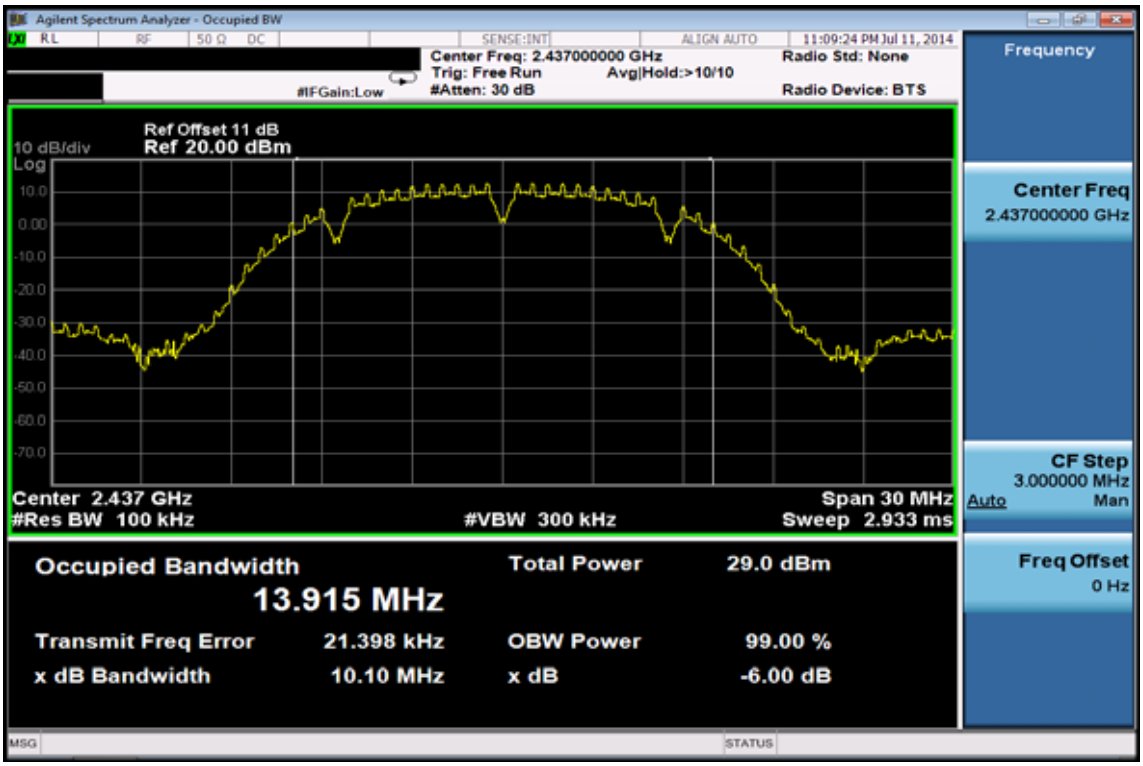
802.11b

6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid



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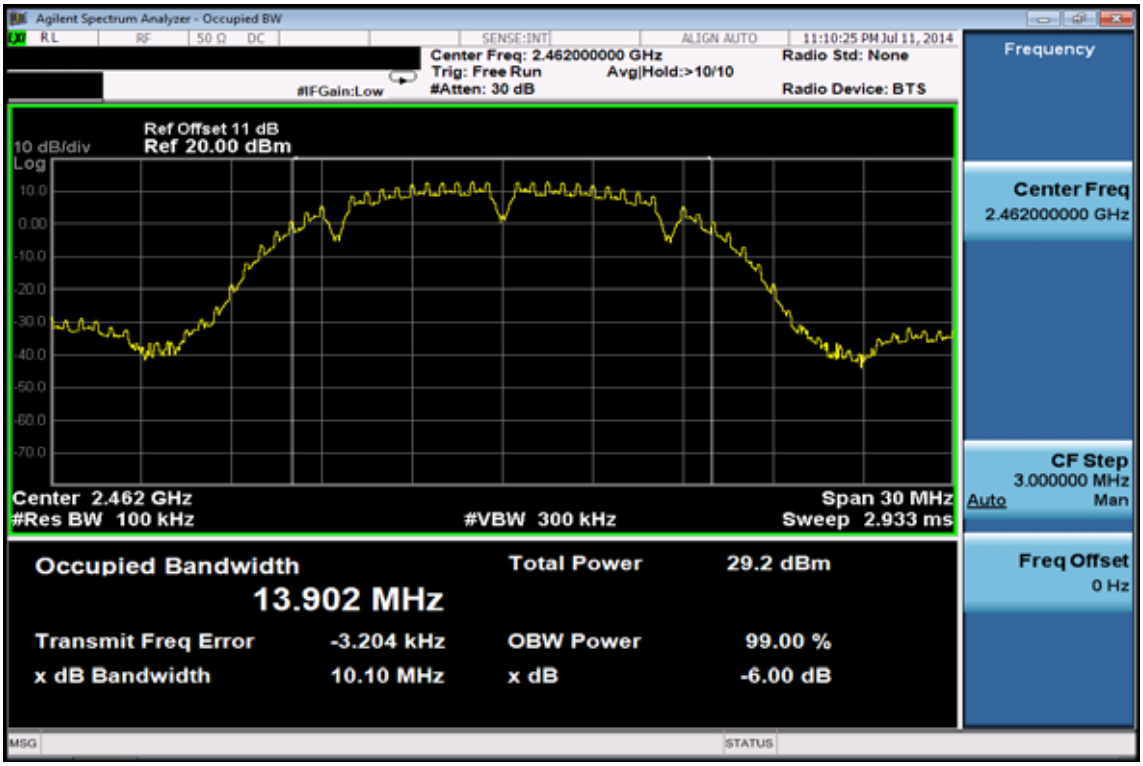
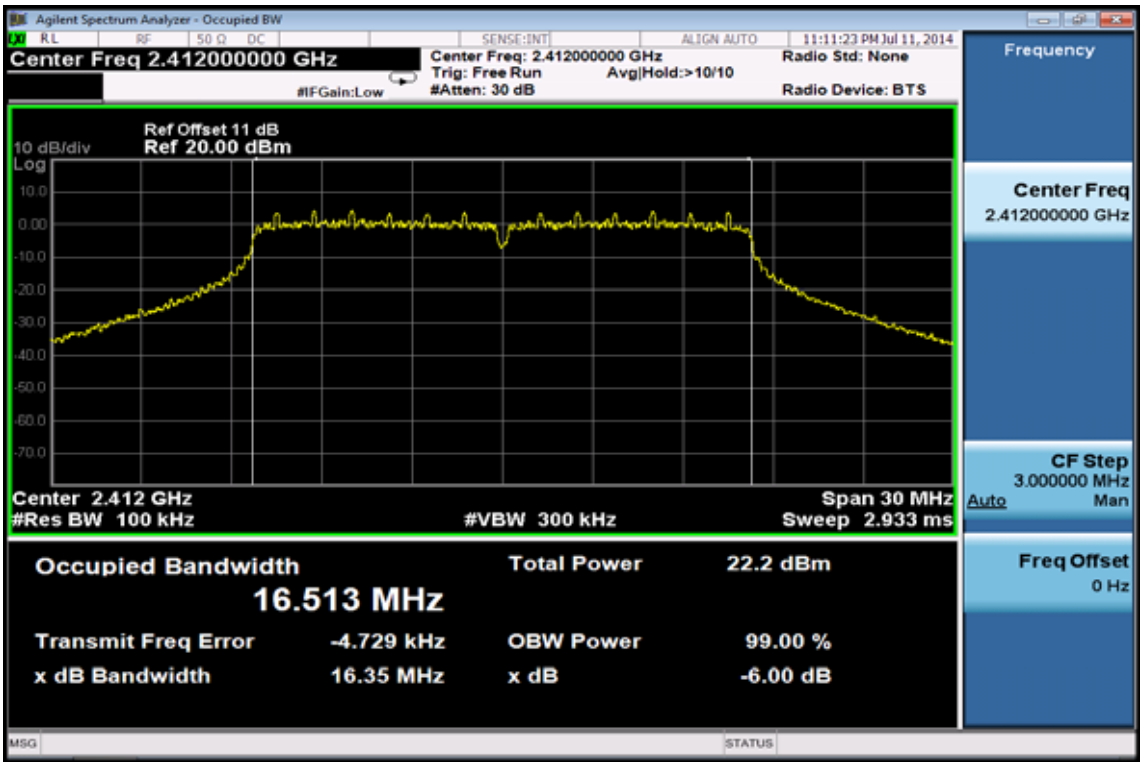
6dB Band Width Test Data CH-High



802.11g

6dB Band Width Test Data CH-Low



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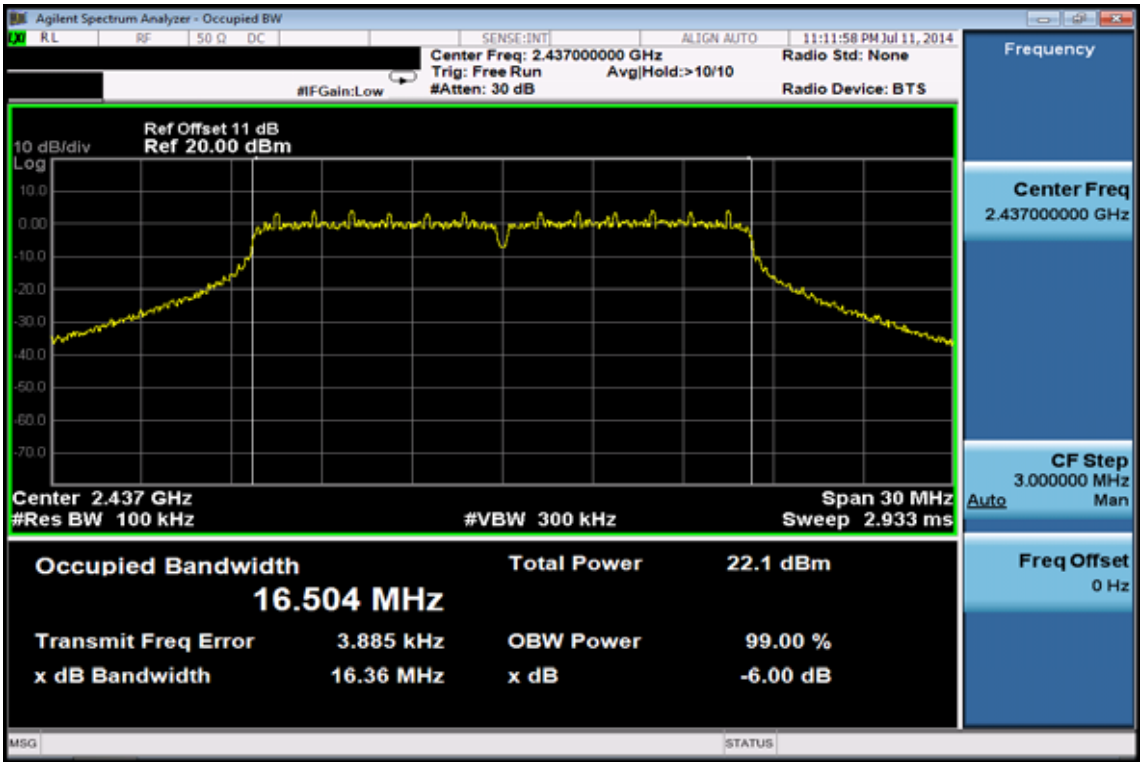
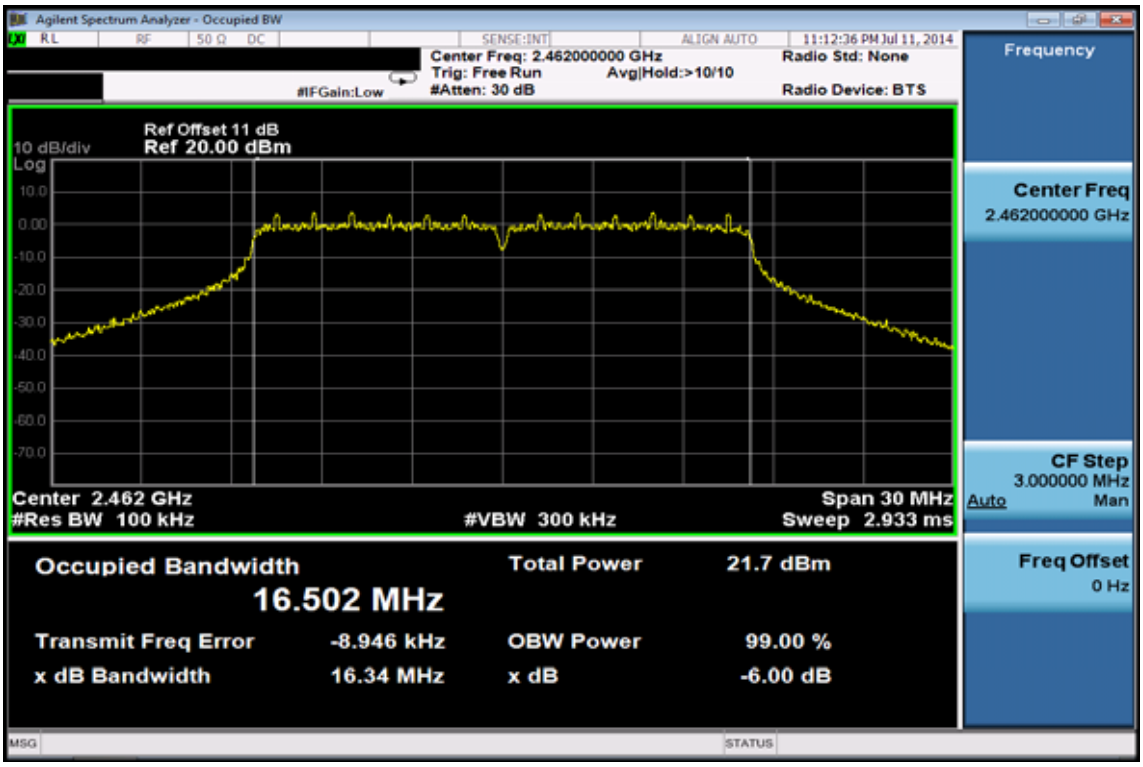
6dB Band Width Test Data CH-Mid



6dB Band Width Test Data CH-High



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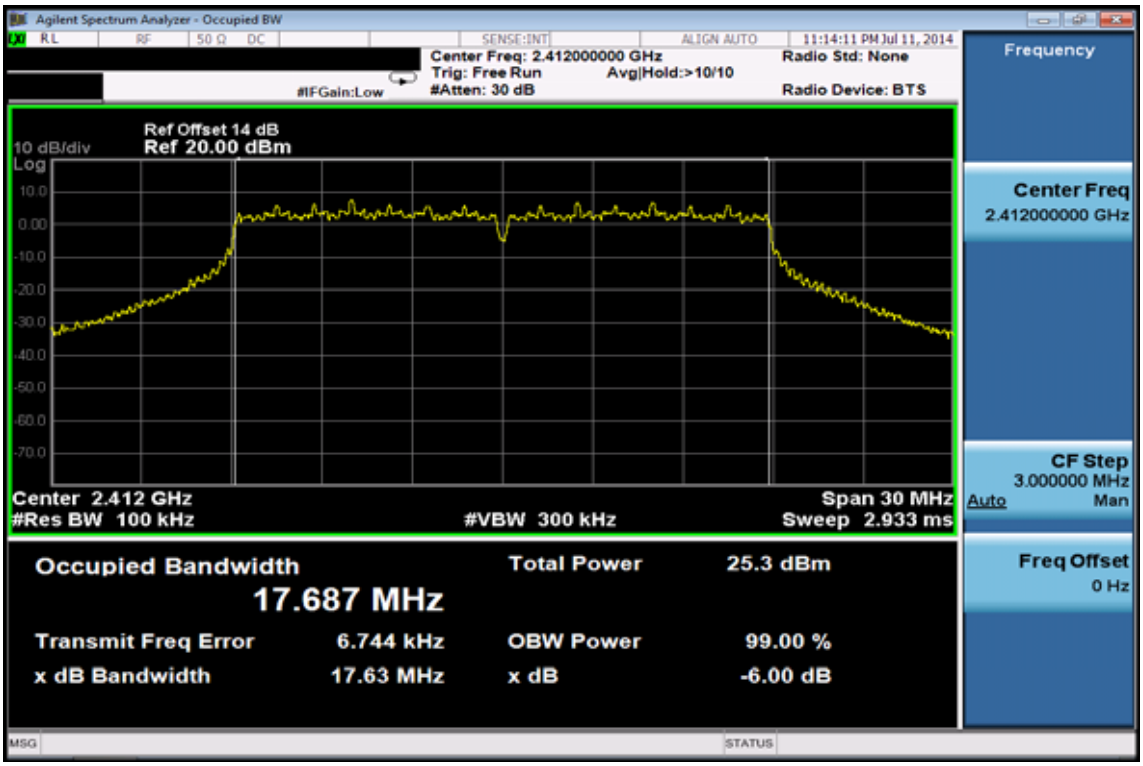
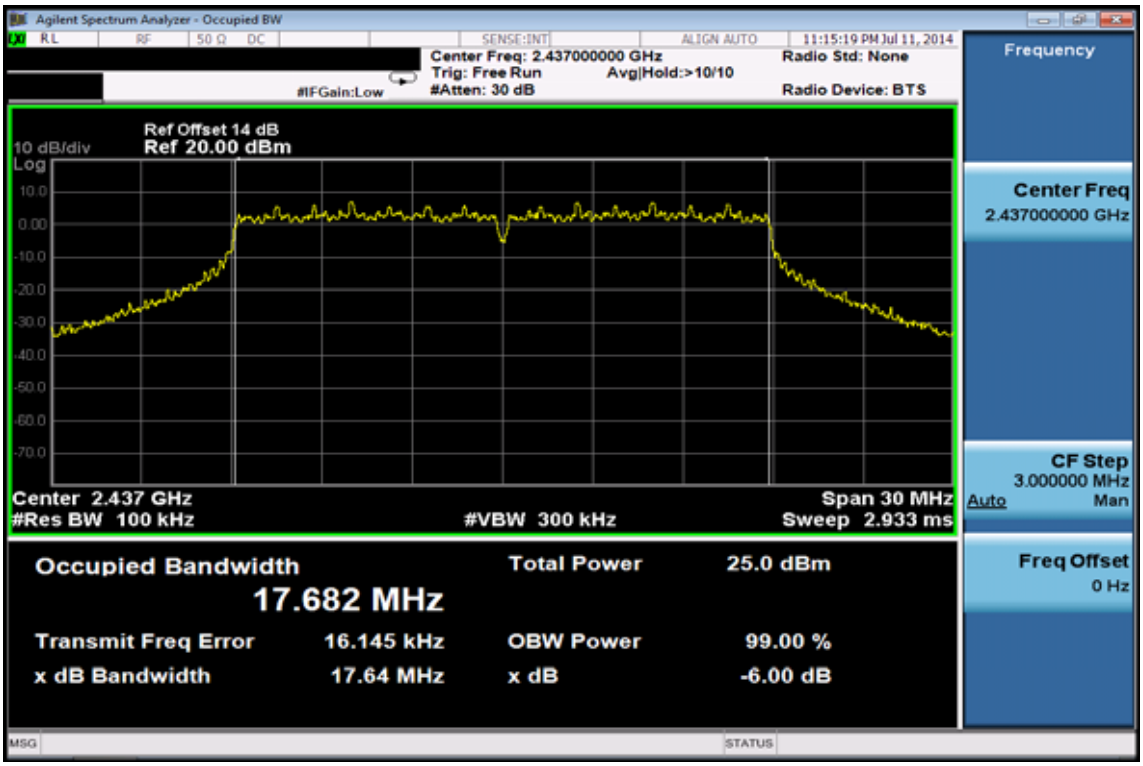
802.11n_20M (MIMO)

6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid



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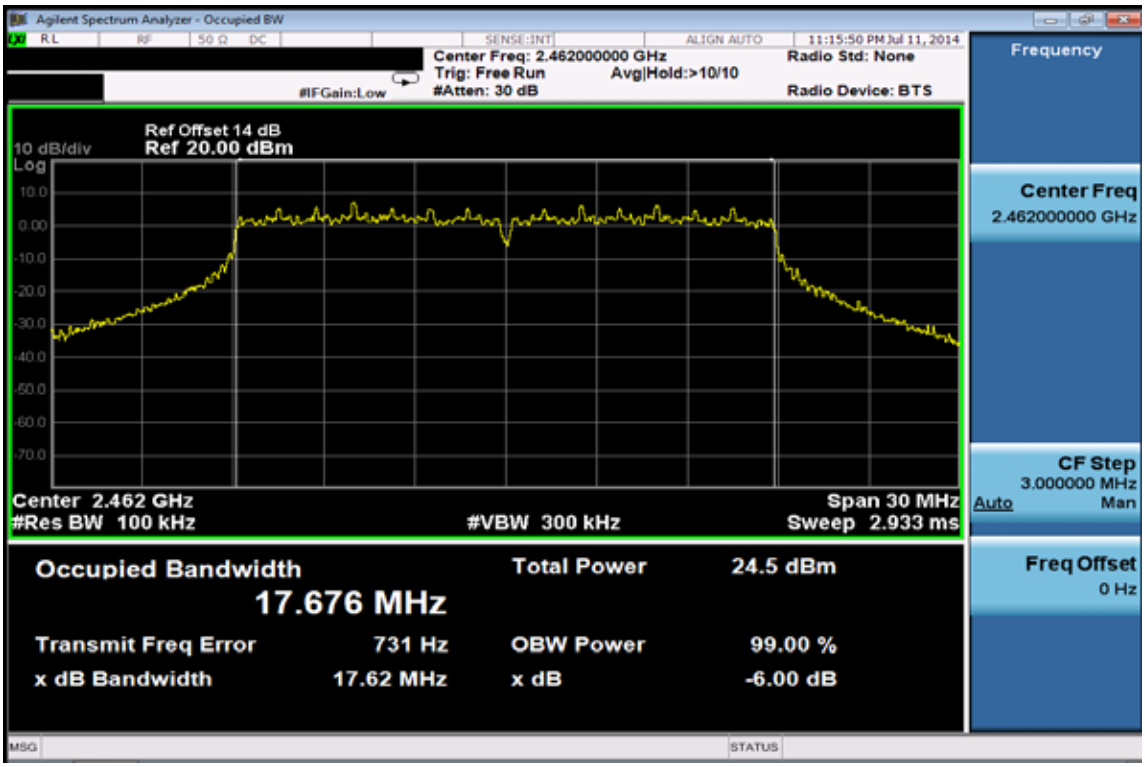
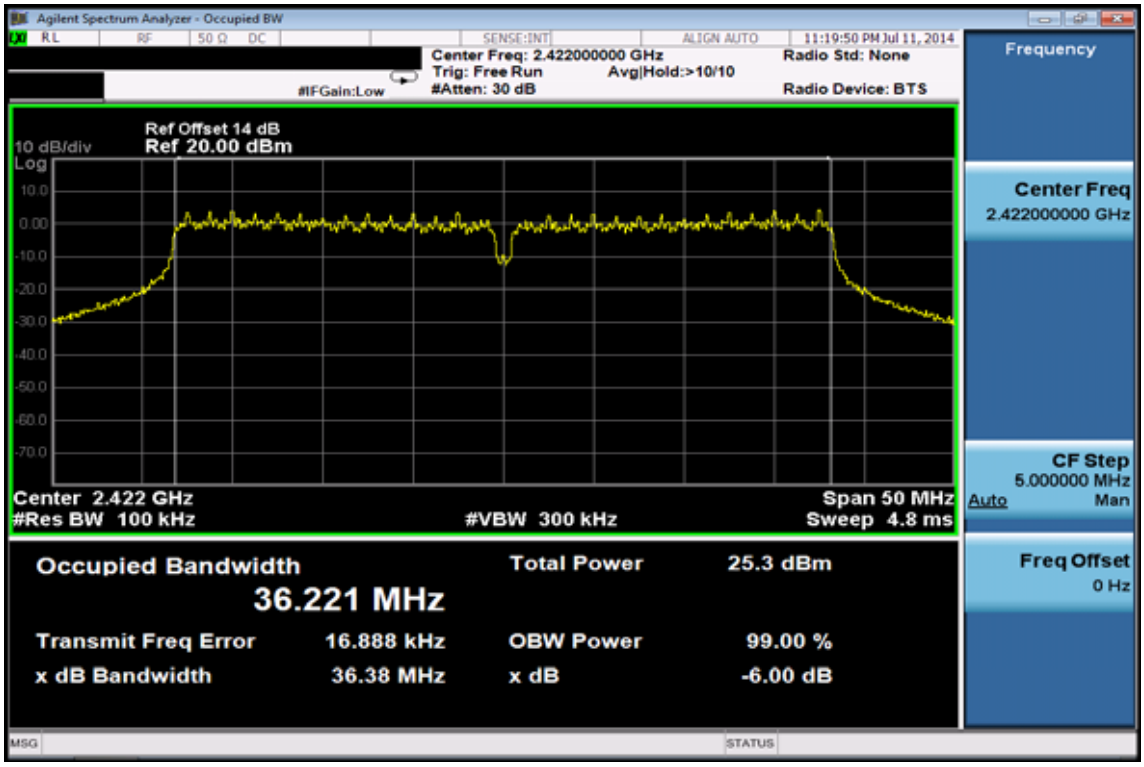
6dB Band Width Test Data CH-High



802.11n_40M (MIMO)

6dB Band Width Test Data CH-Low



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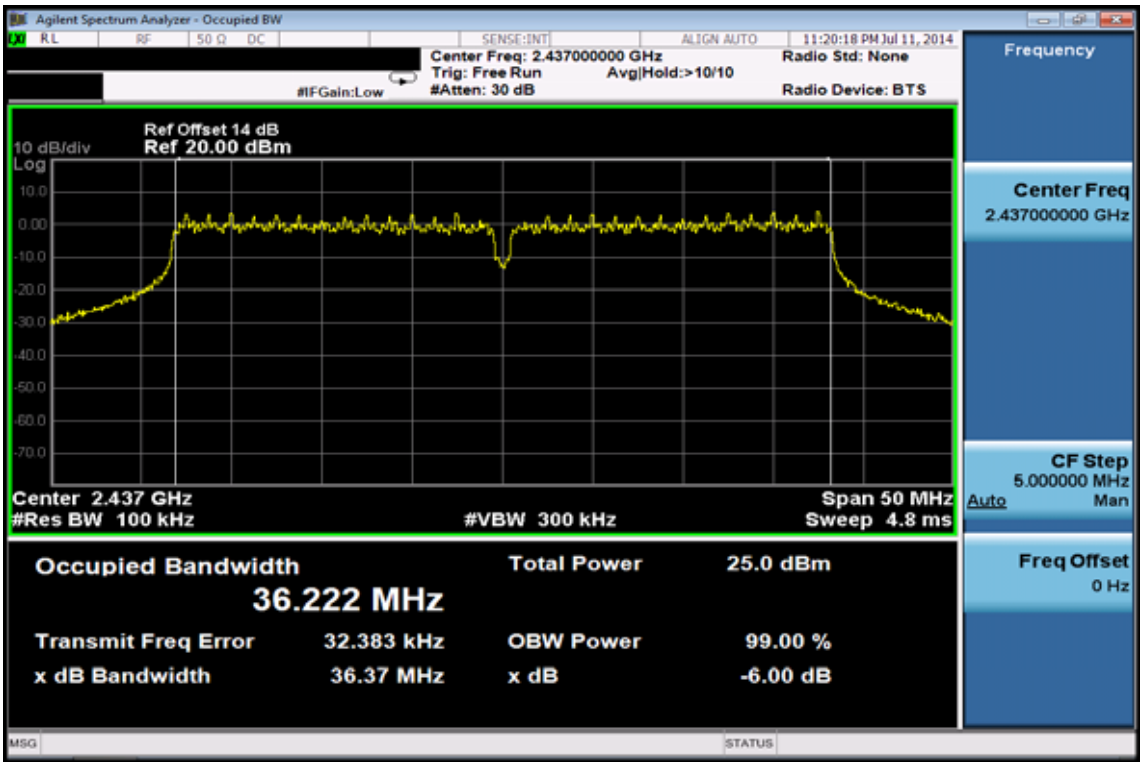
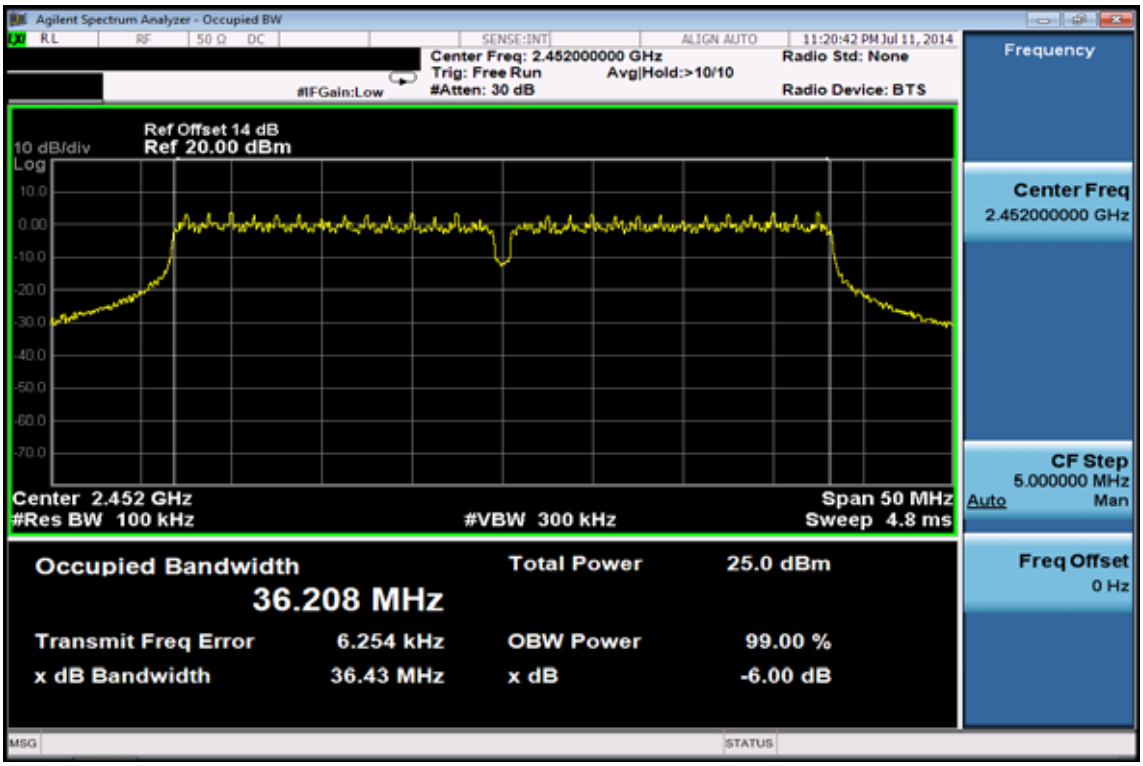
6dB Band Width Test Data CH-Mid



6dB Band Width Test Data CH-High



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9 BAND EDGES MEASUREMENT

9.1 Standard Applicable:

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

9.2 Measurement Equipment Used:

9.2.1 Conducted Emission at antenna port:

Refer to section 7.2 for details.

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9.2.2 Radiated emission:

SGS 966 Chamber No.C					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EMI Test Receiver	R&S	ESU 40	100363	2014/04/12	2015/04/11
Loop Antenna	ETS-Lindgren	6502	00143303	2014/01/16	2015/01/15
Broadband Antenna	TESEQ	CBL 6112D	35240	2014/01/17	2015/01/16
Horn Antenna	ETS-Lindgren	3117	00143272	2014/01/27	2015/01/26
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170-184	2014/01/23	2015/01/22
Horn Antenna	ETS-Lindgren	3160-09	00117911	2014/01/22	2015/01/21
Horn Antenna	ETS-Lindgren	3160-10	00117783	2014/01/22	2015/01/21
Pre Amplifier	R&S	SCU-18	10204	2014/03/26	2015/03/25
Pre Amplifier	R&S	SCU-26	100780	2014/03/26	2015/03/25
Pre Amplifier	R&S	SCU-40	100356	2014/03/26	2015/03/25
Pre Amplifier	EMC Instruments	EMC330	980096	2014/03/26	2015/03/25
Pre Amplifier	EMC Instruments	EMC184045	980135	2014/01/24	2015/01/23
Coaxial Cable	Huber+Suhner	RG 214/U	W21.03	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	RG 214/U	W22.03	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17413/4	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17404/4	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17394/4	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17386/4	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17388/4	2014/03/26	2015/03/25
Attenuator	WOKEN	218FS-10	HY-151	2014/01/06	2015/01/05
Communication Tester	R&S	CMW500	131121	2014/01/16	2015/01/15
Communication Tester	Anritsu	MT8820C	6201107337	2014/04/23	2015/04/22
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Site NSA	SGS	966 Chamber C	SAC-C	2014/03/05	2015/03/04
Site VSWR	SGS	966 Chamber C	SAC-C	2014/04/10	2015/04/09
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

Note: N.C.R refers to Not Calibrated Required.

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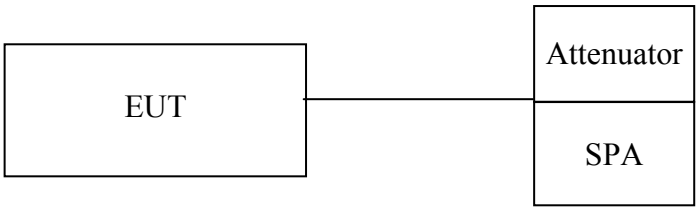
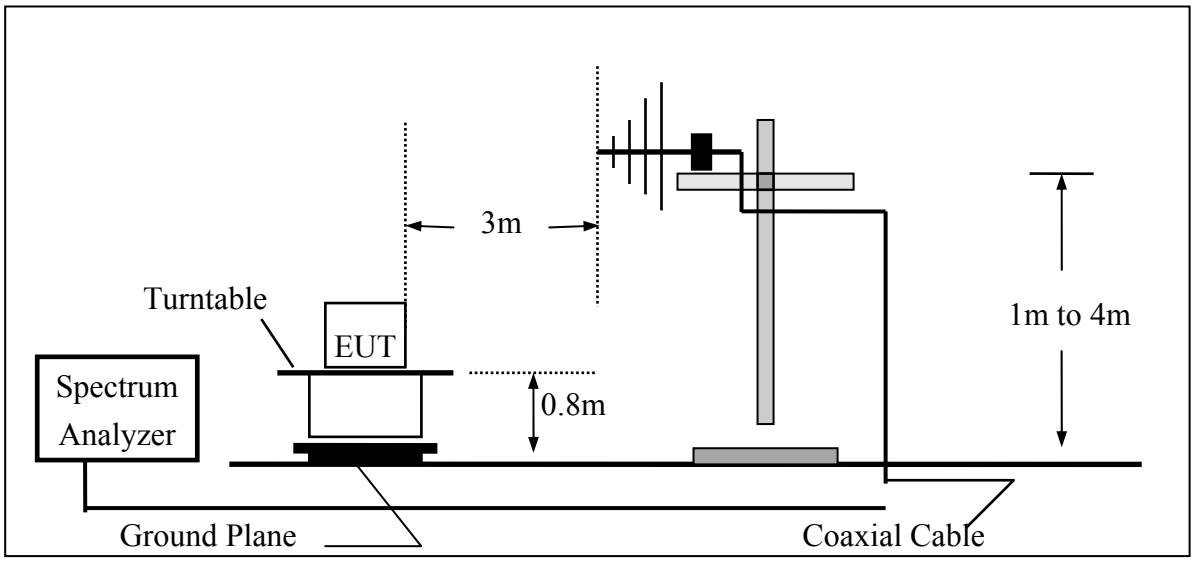
9.3 Test SET-UP:

9.3.1 Conducted Emission at antenna port:

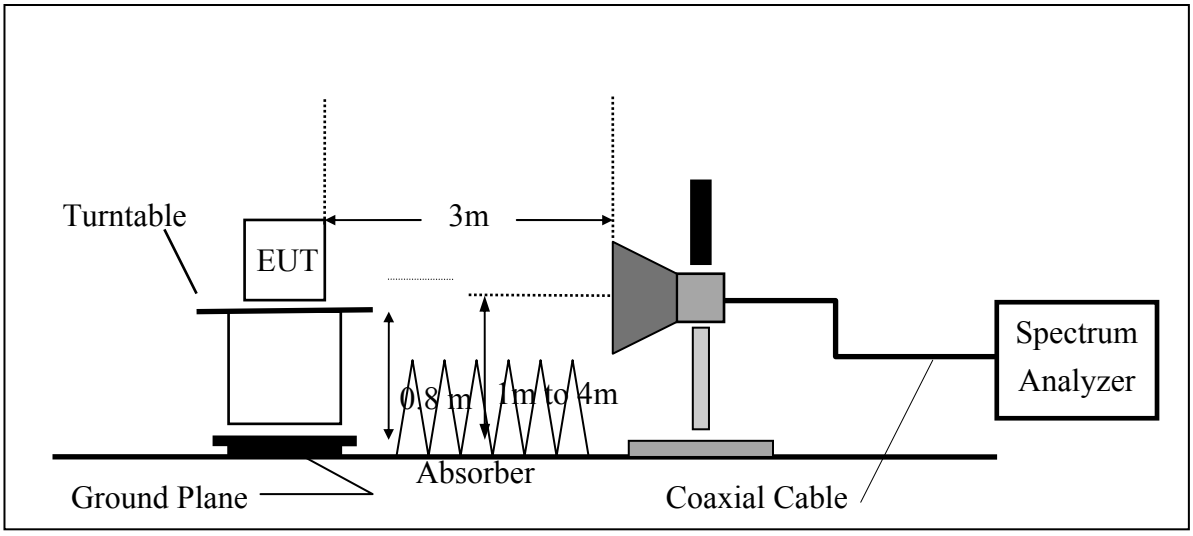


9.3.2 Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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9.4 Measurement Procedure:

Unwanted Emissions into Non-Restricted Frequency Bands, Measurement Procedure followed by 11.1 of KDB558074 D01

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
4. Set the spectrum analyzer as RBW, VBW=300KHz, Detector = Peak, Sweep = auto
5. Mark the highest reading of the emission as the reference level measurement.
6. Set DL as the limit = reading on marker 1 – 20dBm
7. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 KHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete.

Unwanted Emission falling into Restricted Frequency Bands, Measurement Procedure followed by 12.1 of KDB558074:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. On spectrum, following 8.1.2, and RBW = 1MHz, VBW = 3MHz, & Marker 2390MHz, and 2483.5MHz (Peak Measurement). Average Measurement: following 8.2 with the modification span to 1MHz, &RBW = 1MHz, VBW = 3MHz and peak marker function to obtain the highest reading on 2390, and 2483.5MHz.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete

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9.5 Field Strength Calculation:

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

9.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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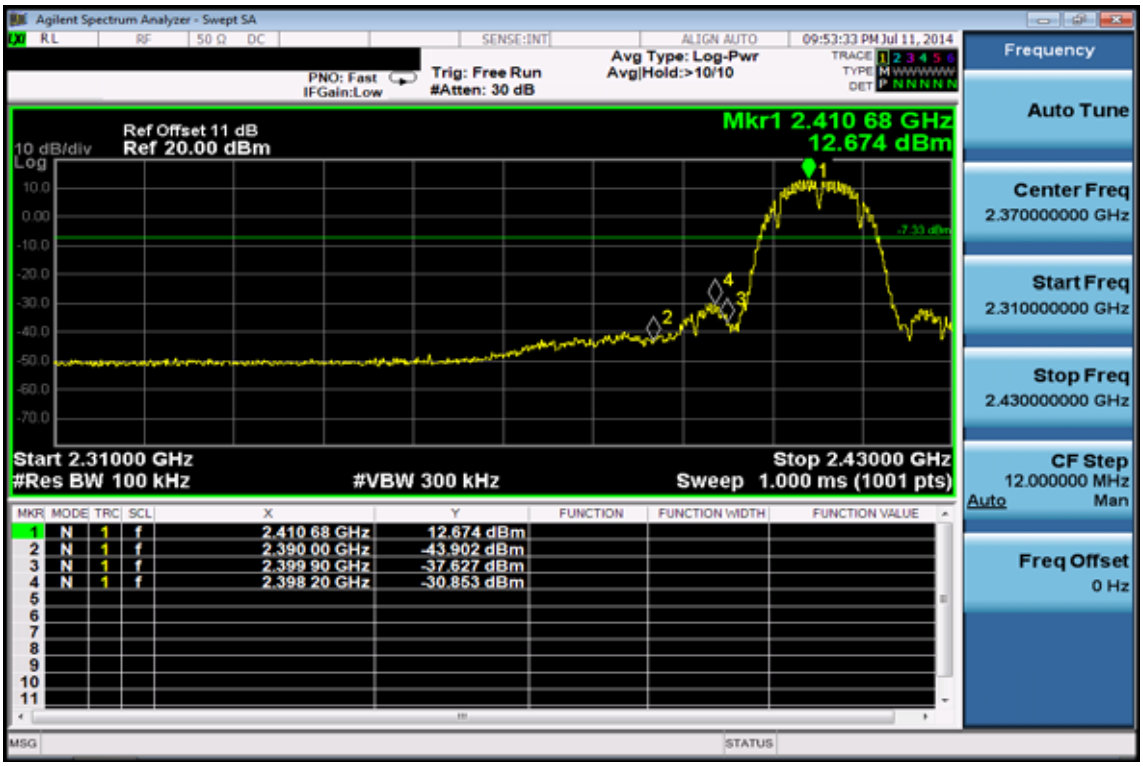
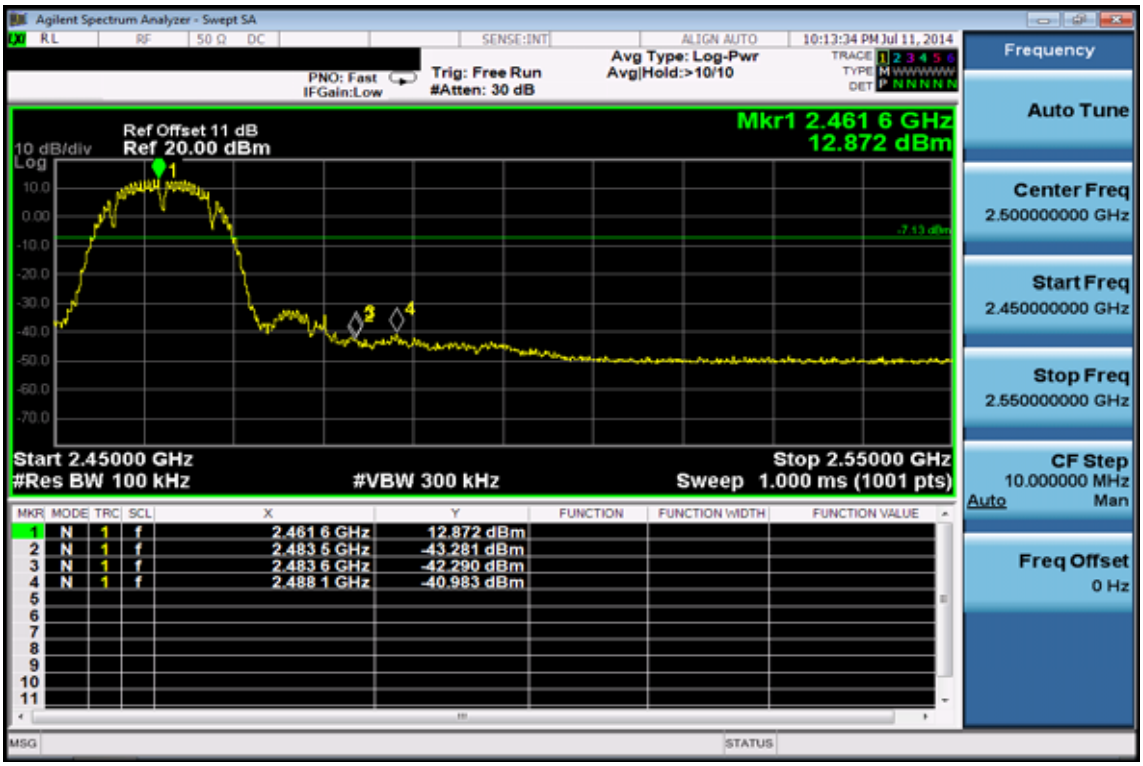
802.11b - Unwanted Emissions into Non-Restricted Frequency Bands

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission:

(Unwanted Emissions into Restricted Frequency Bands): 802.11 b mode

Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2390.00	Peak	E	57.97	3.14	61.10	74.00	-12.90
2390.00	Average	E	36.06	3.14	39.20	54.00	-14.80

Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2390.00	Peak	E	65.52	3.14	68.66	74.00	-5.34
2390.00	Average	E	41.90	3.14	45.04	54.00	-8.96

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Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2483.50	Peak	E	56.36	3.35	59.72	74.00	-14.28
2483.50	Average	E	32.05	3.35	35.40	54.00	-18.60

Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2483.50	Peak	E	61.40	3.35	64.76	74.00	-9.24
2483.50	Average	E	38.82	3.35	42.17	54.00	-11.83

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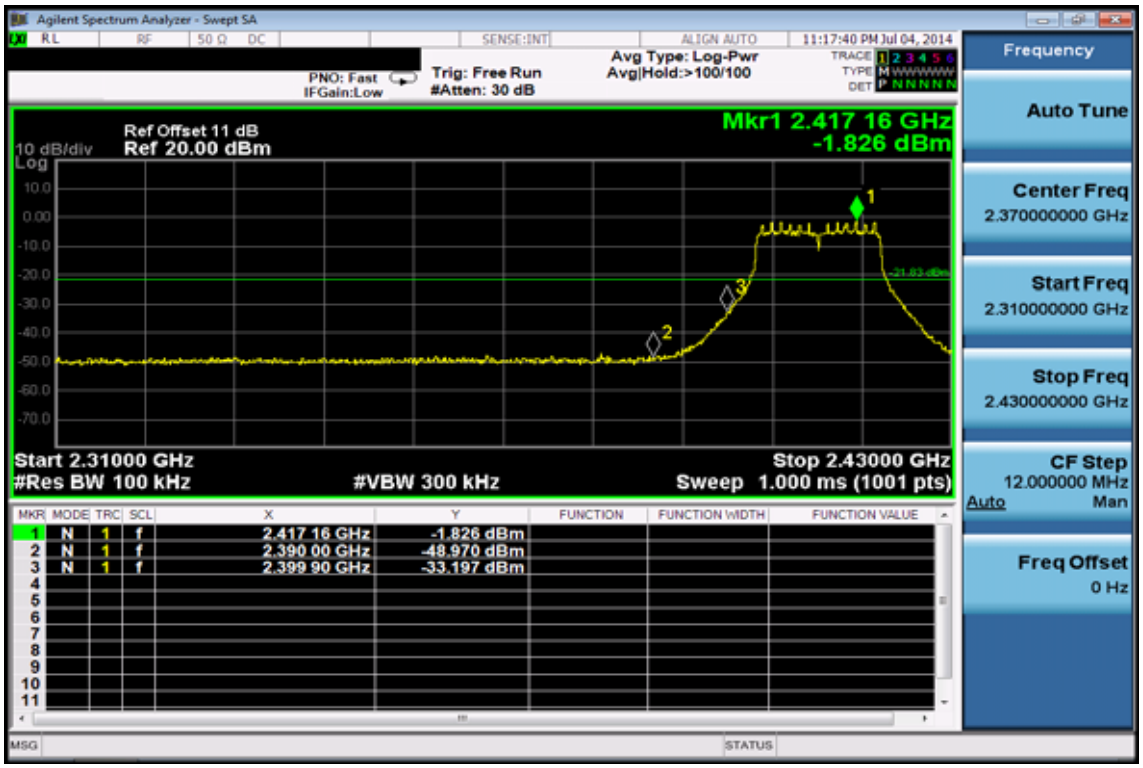
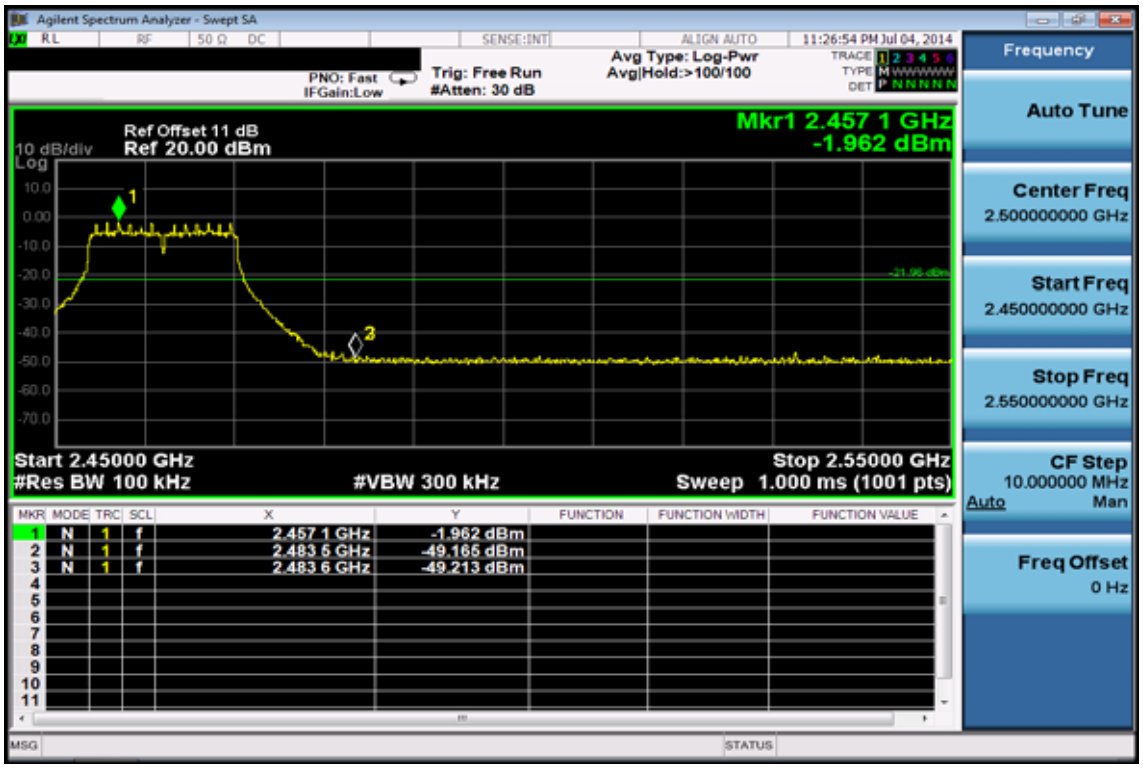
802.11g - Unwanted Emissions into Non-Restricted Frequency Bands

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission:

(Unwanted Emissions into Restricted Frequency Bands): 802.11 g mode

Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2390.00	Peak	E	50.59	3.14	53.73	74.00	-20.27
2390.00	Average	E	36.37	3.14	39.51	54.00	-14.49

Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2390.00	Peak	E	60.05	3.14	63.18	74.00	-10.82
2390.00	Average	E	40.94	3.14	44.08	54.00	-9.92

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Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2483.50	Peak	E	48.11	3.35	51.46	74.00	-22.54
2483.50	Average	E	33.81	3.35	37.16	54.00	-16.84

Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2483.50	Peak	E	58.77	3.35	62.13	74.00	-11.87
2483.50	Average	E	38.26	3.35	41.61	54.00	-12.39

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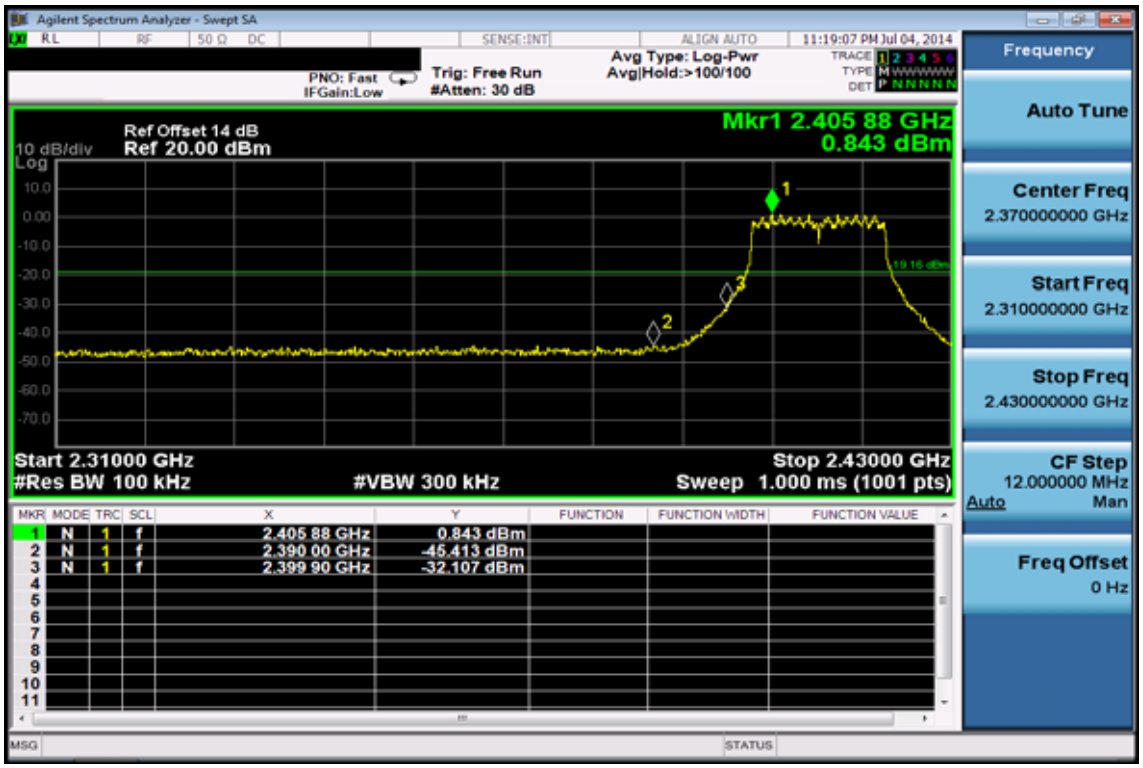
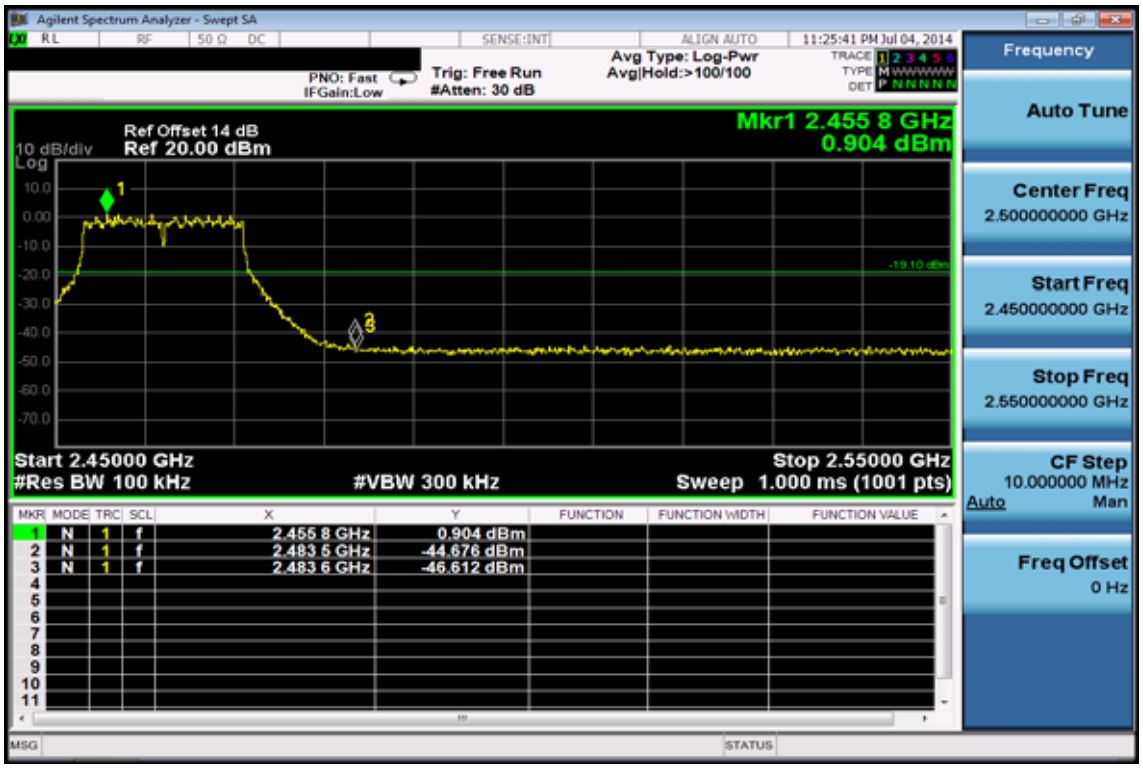
802.11n_20M- Unwanted Emissions into Non-Restricted Frequency Bands

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission: 802.11 n_20M mode

(Unwanted Emissions into Restricted Frequency Bands): 802.11 n_20M mode

Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2390.00	Peak	E	60.80	3.14	63.94	74.00	-10.06
2390.00	Average	E	40.68	3.14	43.82	54.00	-10.18

Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2390.00	Peak	E	58.18	3.14	61.32	74.00	-12.68
2390.00	Average	E	40.11	3.14	43.25	54.00	-10.75

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Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2483.50	Peak	E	58.99	3.35	62.34	74.00	-11.66
2483.50	Average	E	39.94	3.35	43.29	54.00	-10.71

Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2483.50	Peak	E	58.26	3.35	61.61	74.00	-12.39
2483.50	Average	E	39.19	3.35	42.54	54.00	-11.46

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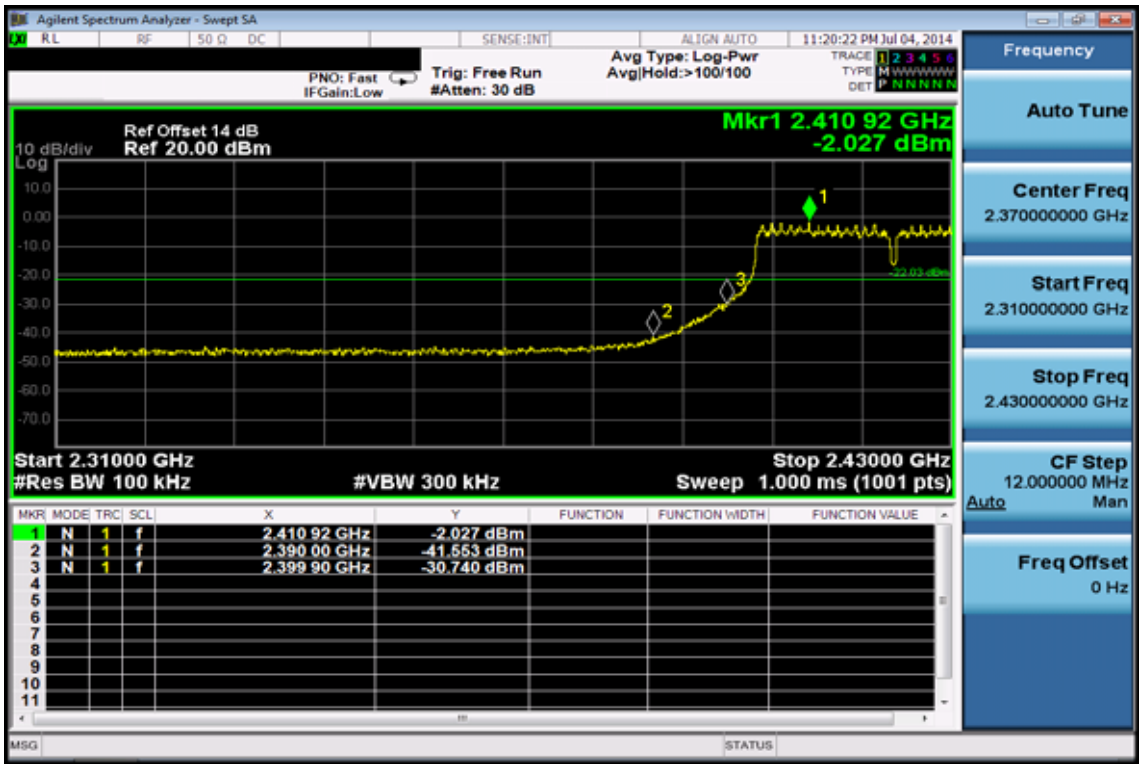
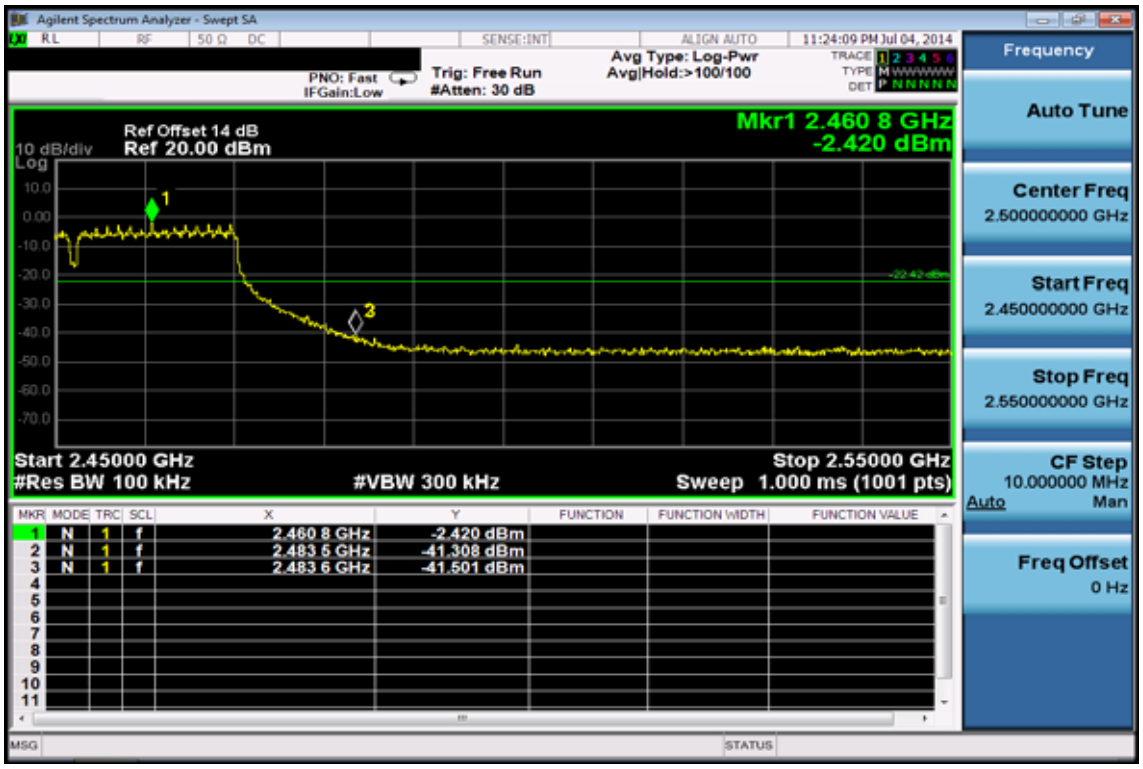
802.11n_40M - Unwanted Emissions into Non-Restricted Frequency Bands

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission: 802.11 n_40M mode

(Unwanted Emissions into Restricted Frequency Bands): 802.11 n_40M mode

Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2422 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2390.00	Peak	E	64.94	3.14	68.08	74.00	-5.92
2390.00	Average	E	44.20	3.14	47.34	54.00	-6.66

Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2422 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2390.00	Peak	E	65.34	3.14	68.47	74.00	-5.53
2390.00	Average	E	44.42	3.14	47.56	54.00	-6.44

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Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2452 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2483.50	Peak	E	64.82	3.35	68.17	74.00	-5.83
2483.50	Average	E	43.39	3.35	46.74	54.00	-7.26

Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2452 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:Band Edge HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2483.50	Peak	E	63.67	3.35	67.02	74.00	-6.98
2483.50	Average	E	44.08	3.35	47.43	54.00	-6.57

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10 SPURIOUS EMISSION TEST

10.1 Standard Applicable

According to §15.247(d),

Emission at antenna port:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Radiated Spurious Emission

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

10.2 Measurement Equipment Used:

10.2.1 Conducted Emission at antenna port:

Refer to section 7.2 for details.

10.2.2 Radiated emission:

Refer to section 9.2.2 for details.

10.3 Test SET-UP:

10.3.1 Conducted Emission at antenna port:

Refer to section 7.3 for details.

10.3.2 Radiated emission:

Refer to section 9.3.2 for details.

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10.4 Measurement Procedure:

Radiated Emission:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
7. Repeat above procedures until all default test channel measured were complete.

Conducted Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 100K & VBW = 300K on Spectrum.
3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30 to 3G, 3G to 8G, 8G to 13G, 13G to 18G and 18G to 26.5GHz, 18G to 40GHz (applicable if operation mode is 5GHz)
4. Via Software, combine 5 spans of frequency range into one plot
5. Repeat above procedures until all default test channel measured were complete.

10.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

10.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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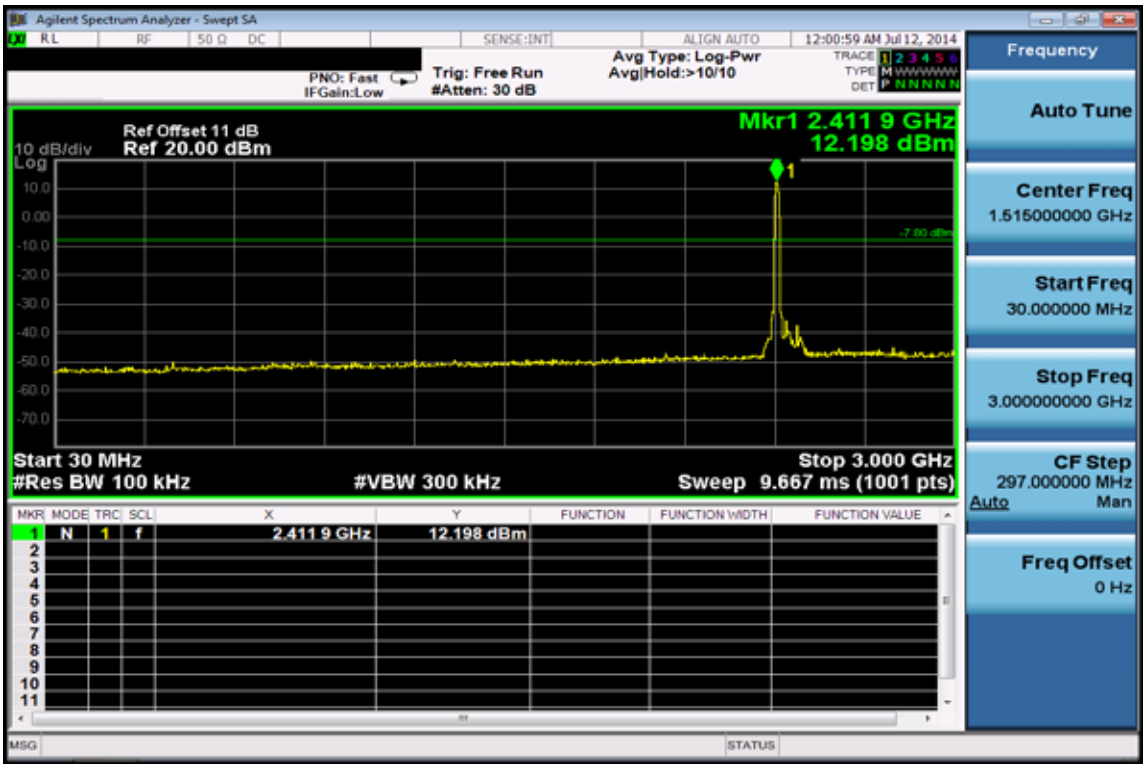
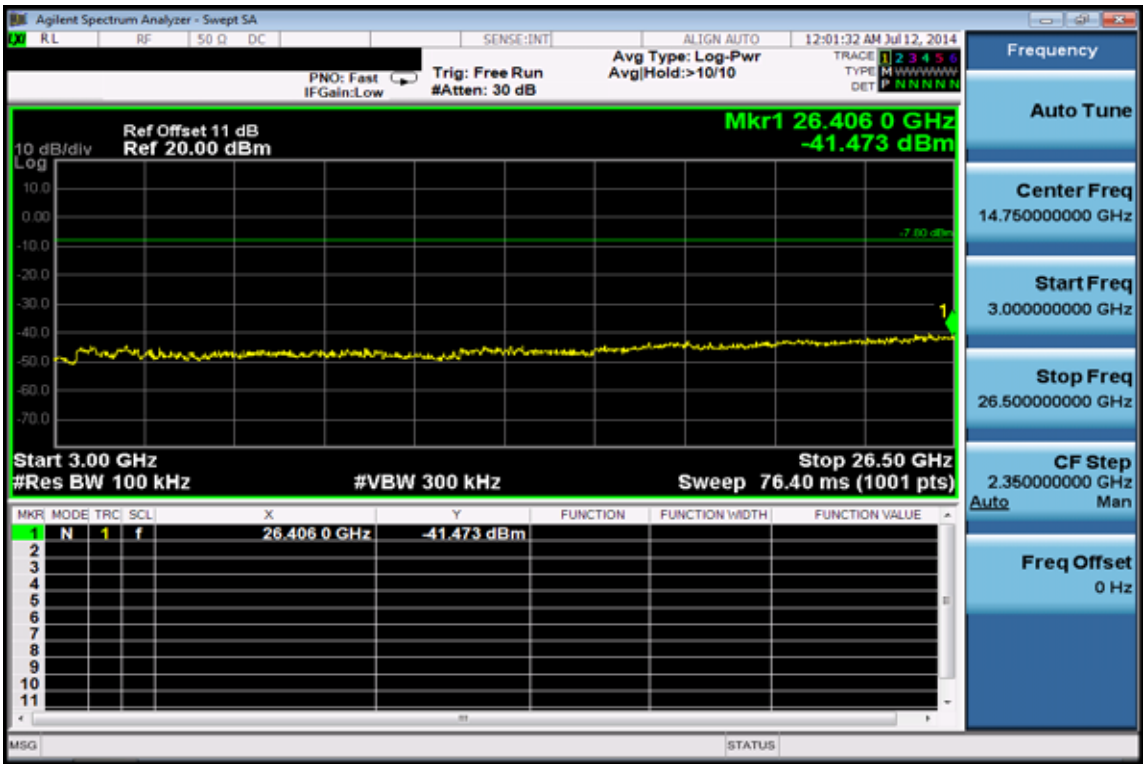
Conducted Spurious Emission Measurement Result (802.11b)

Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz



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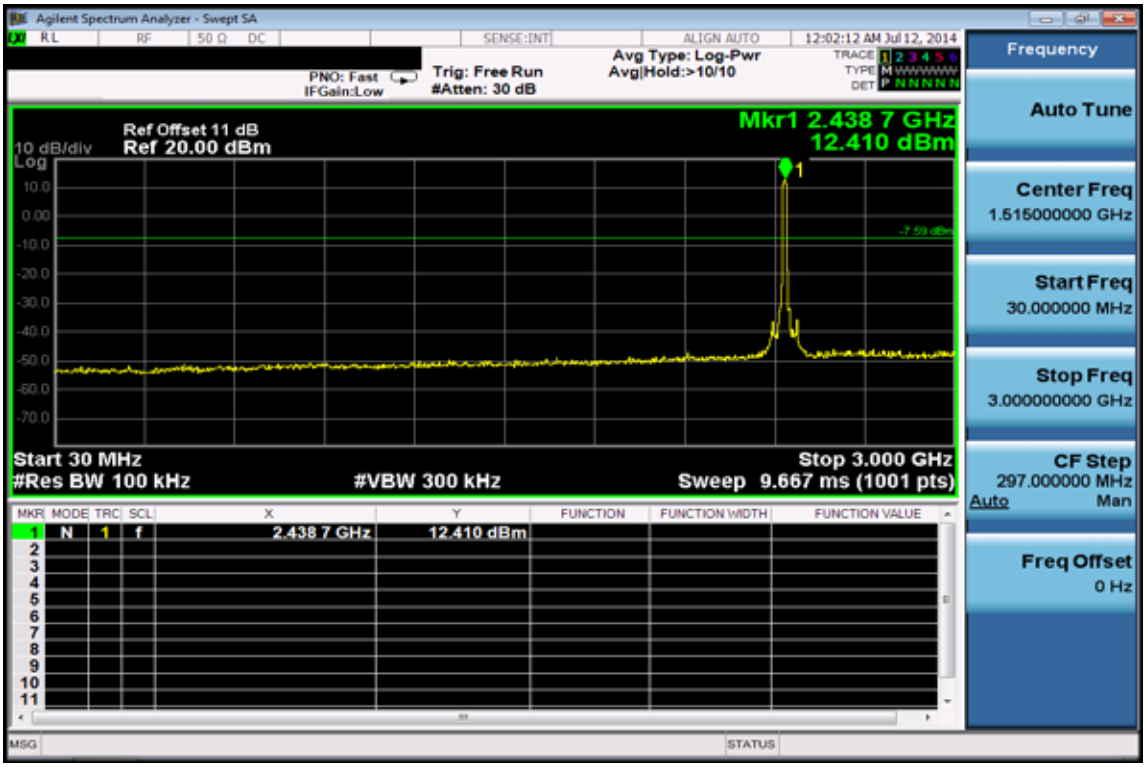
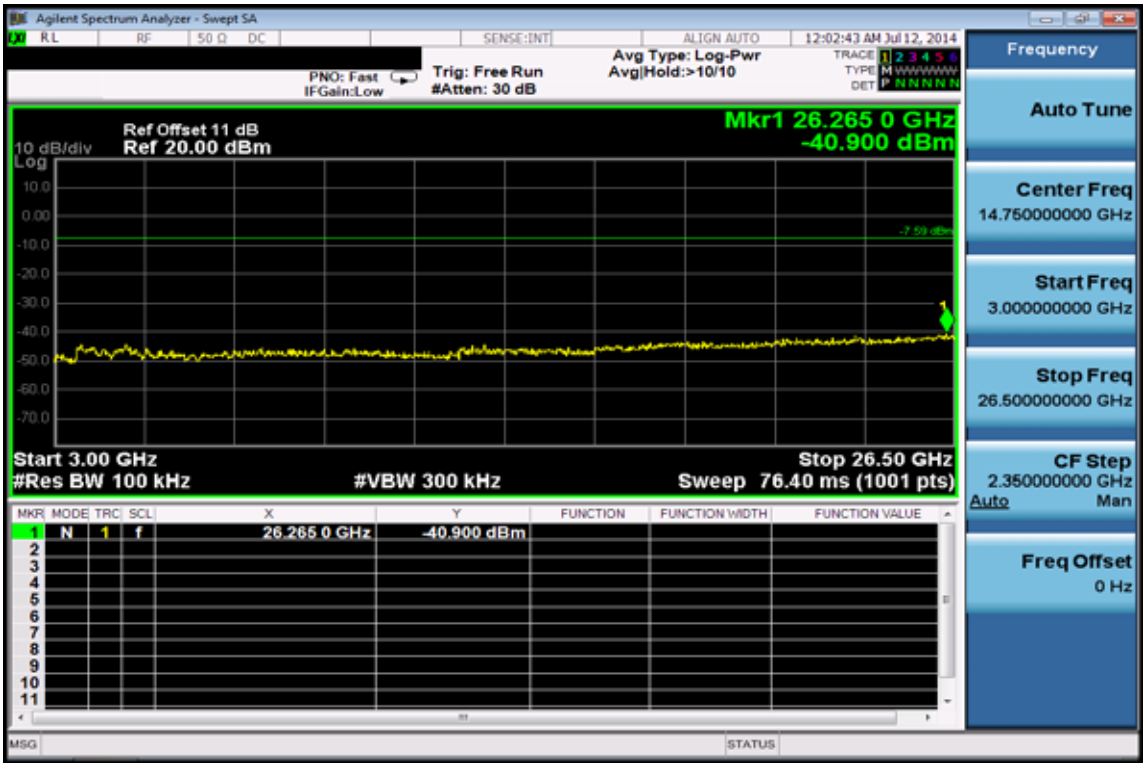
Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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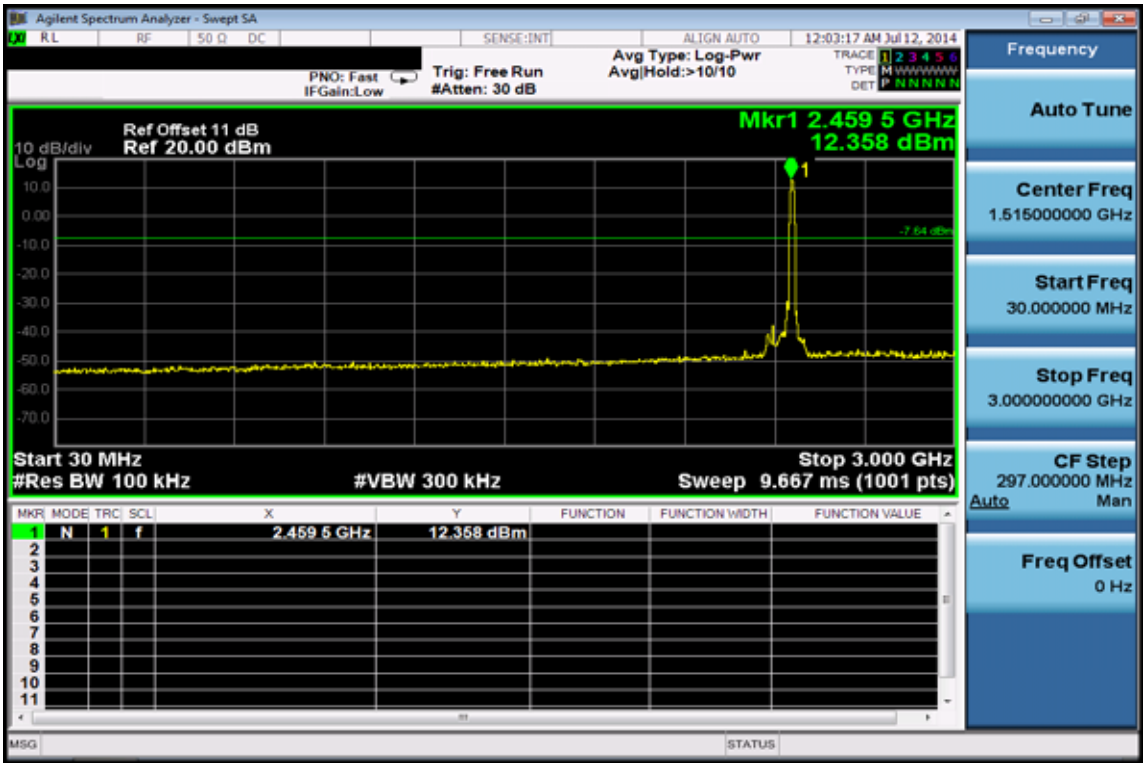
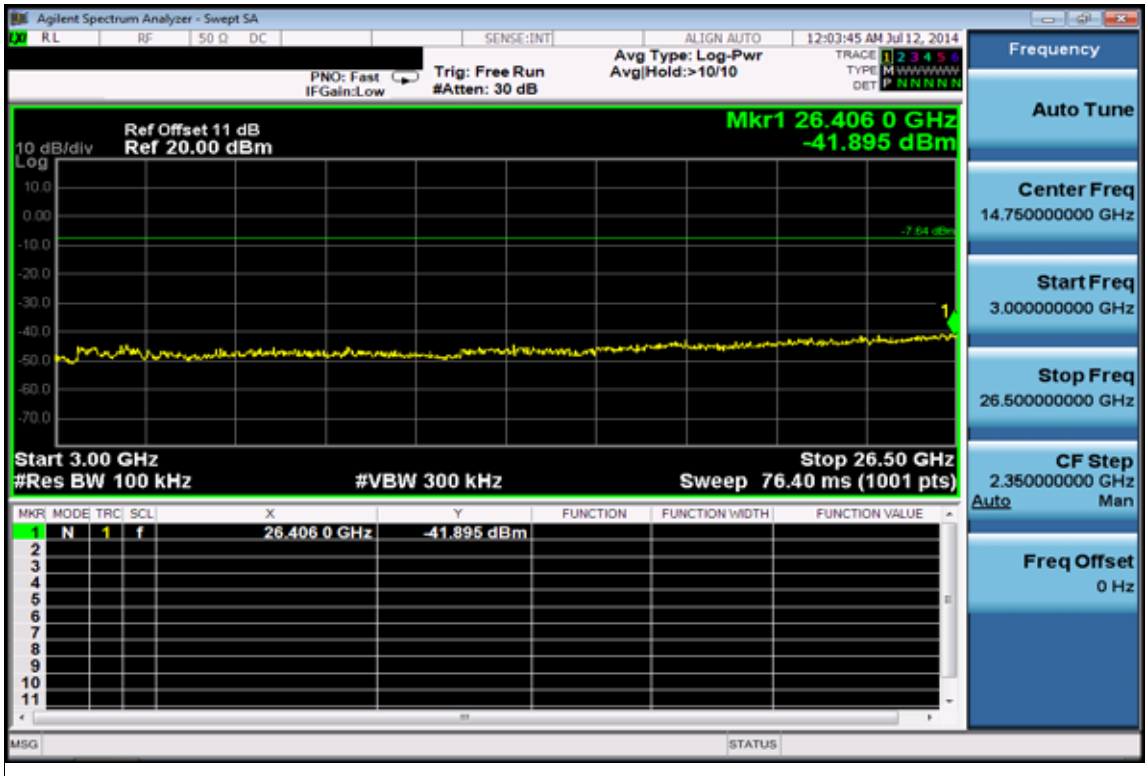
Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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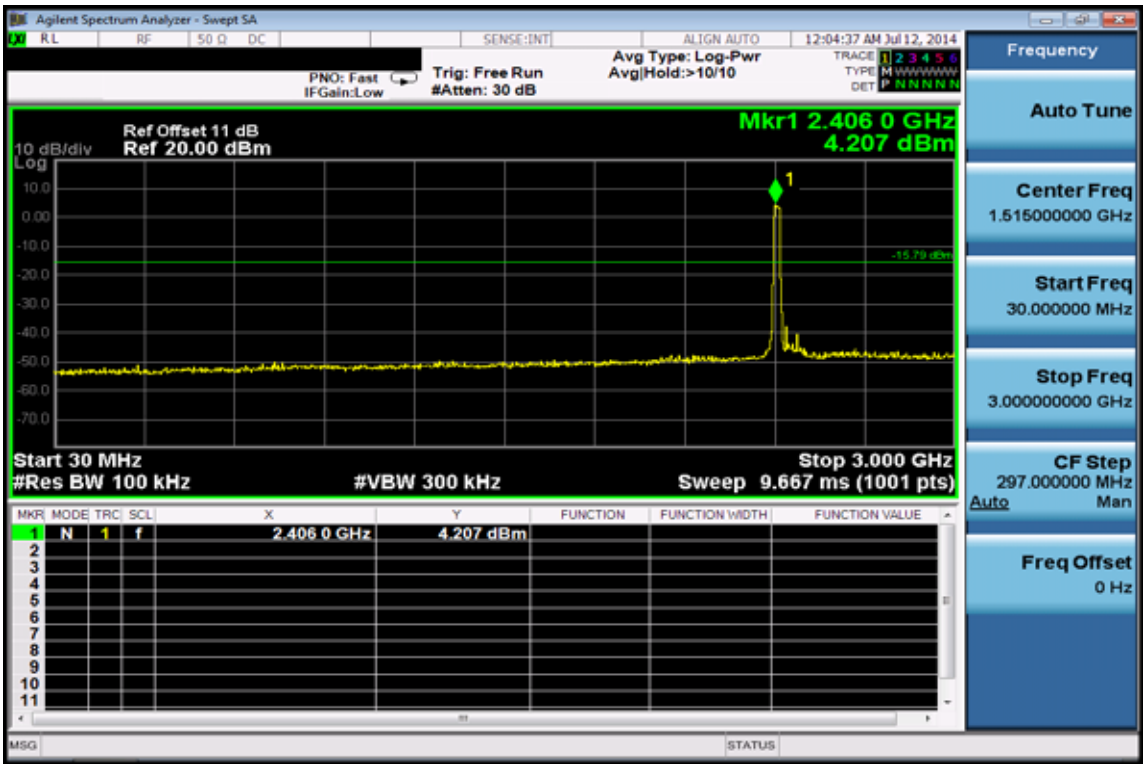
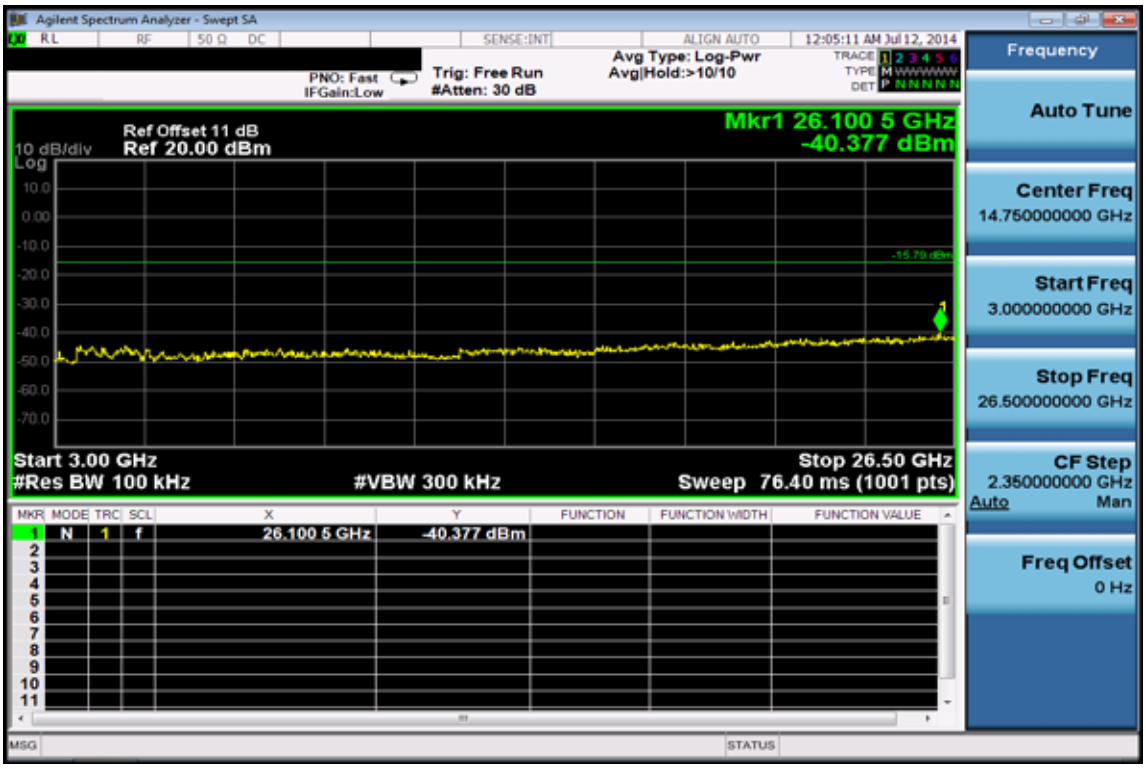
Conducted Spurious Emission Measurement Result (802.11g)

Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz



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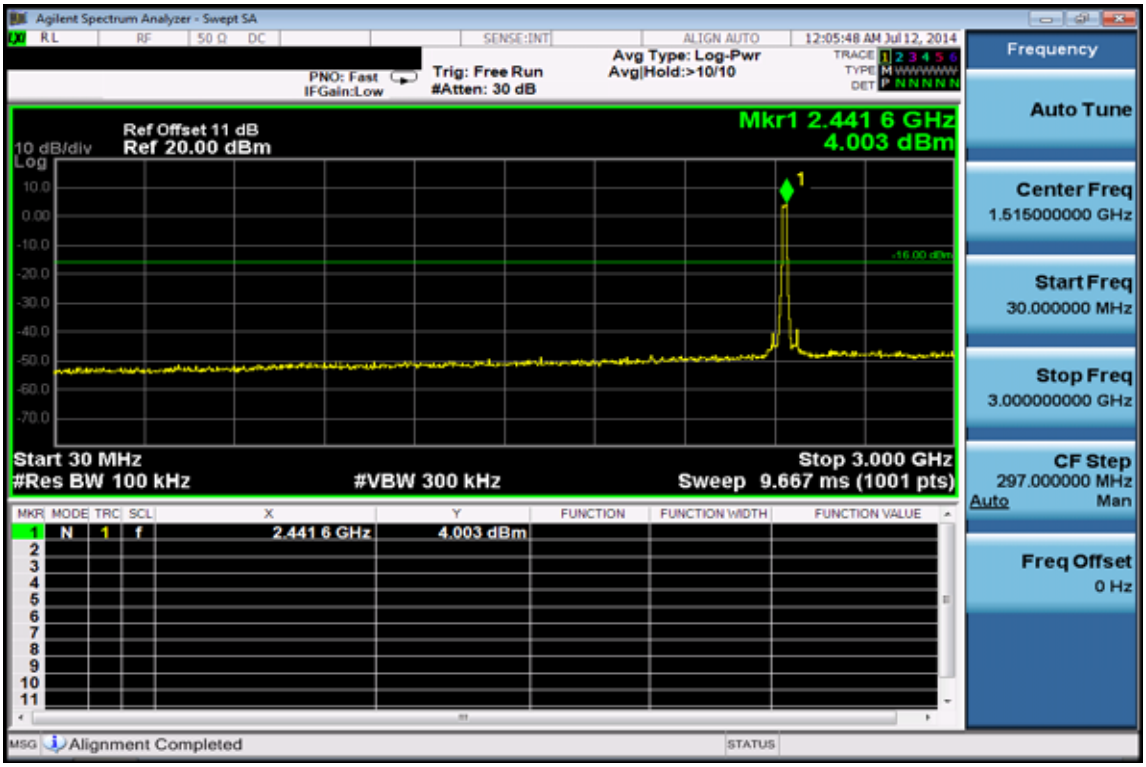
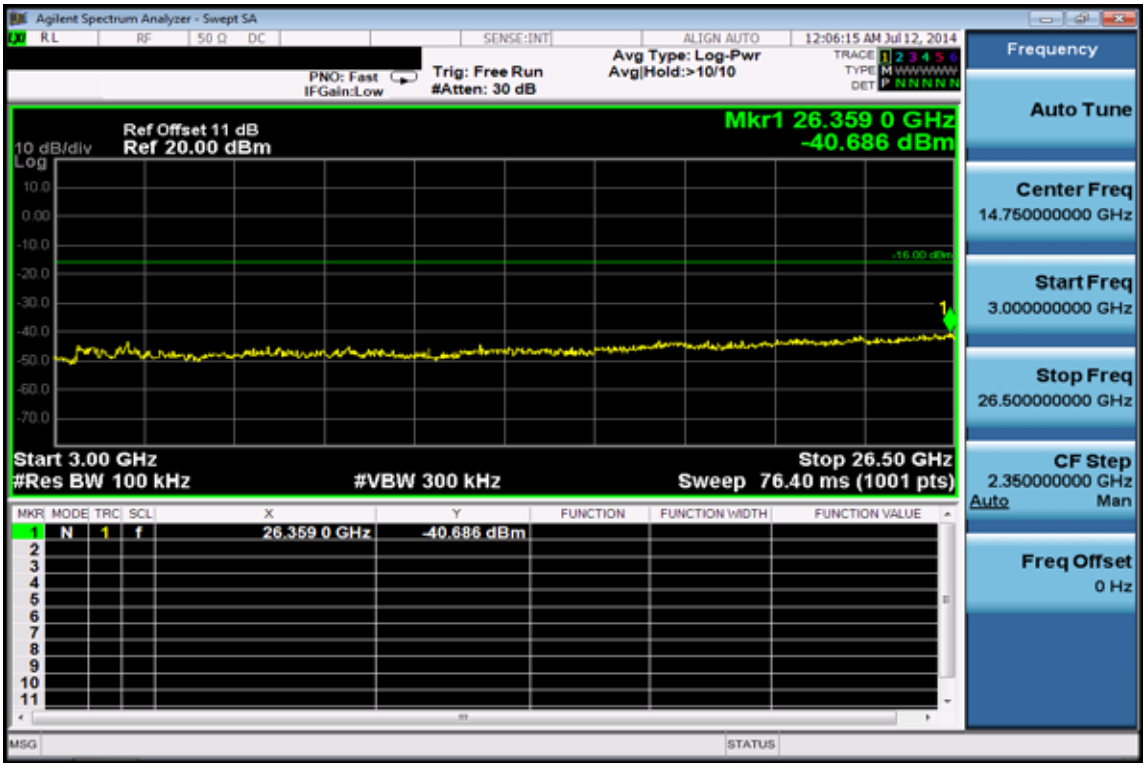
Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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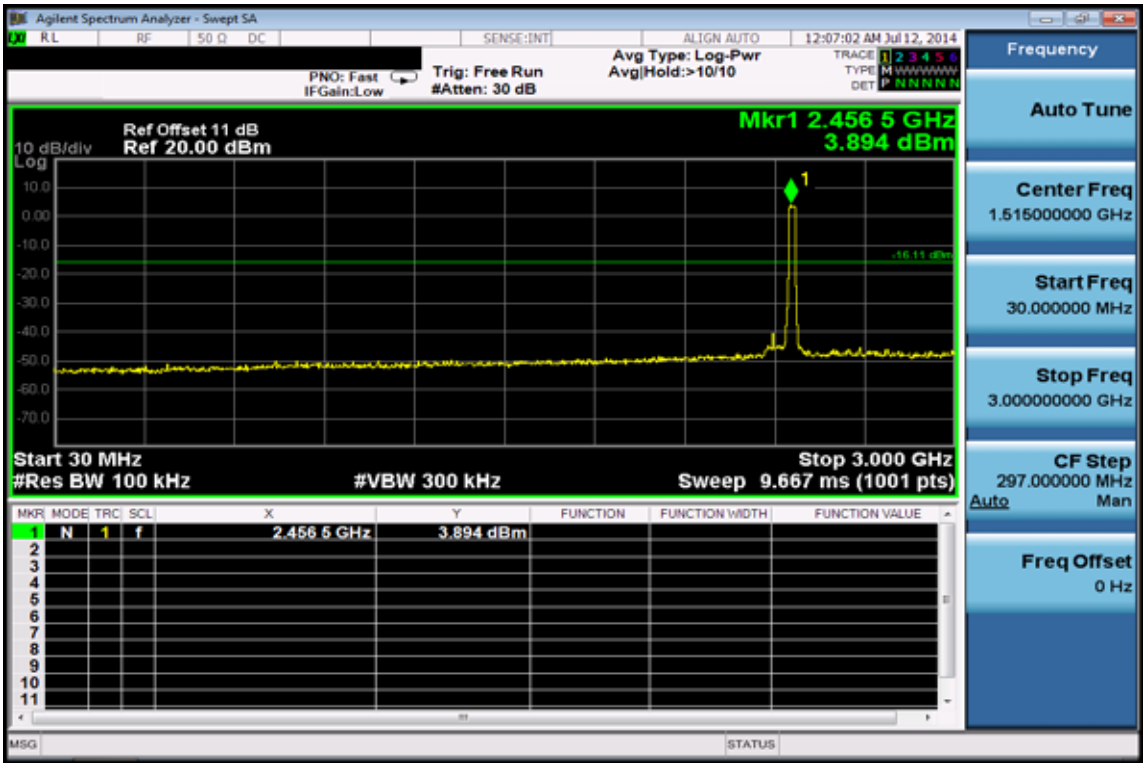
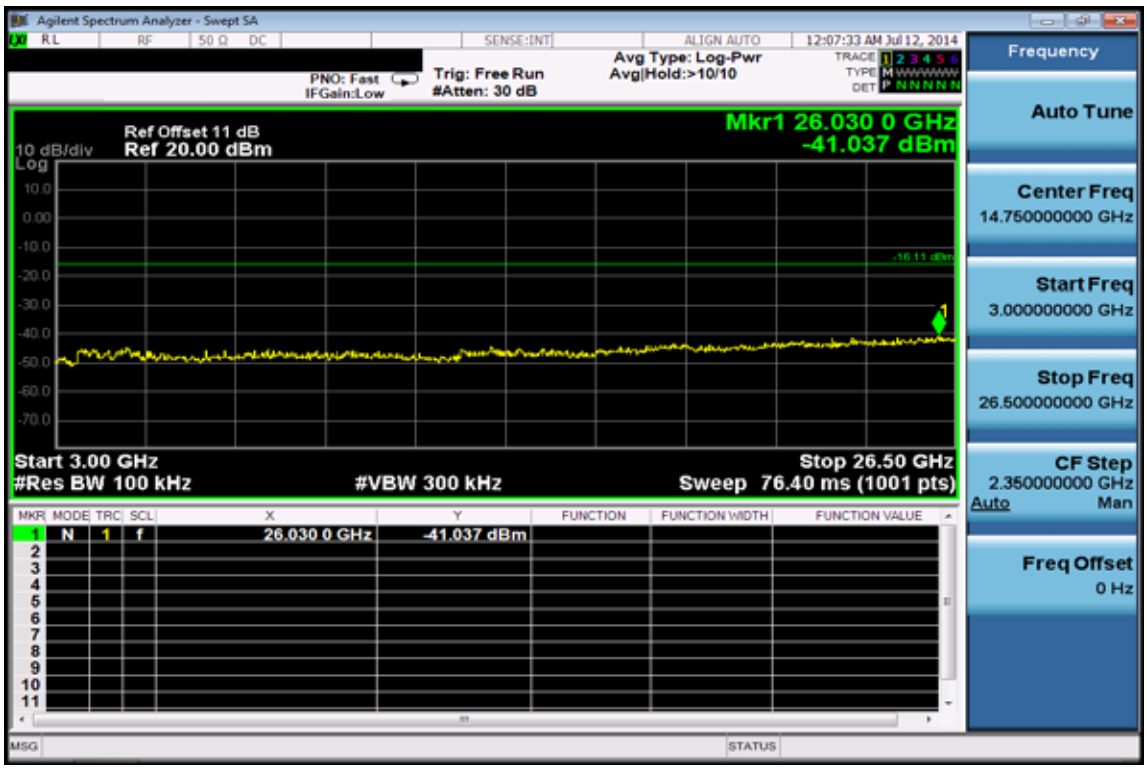
Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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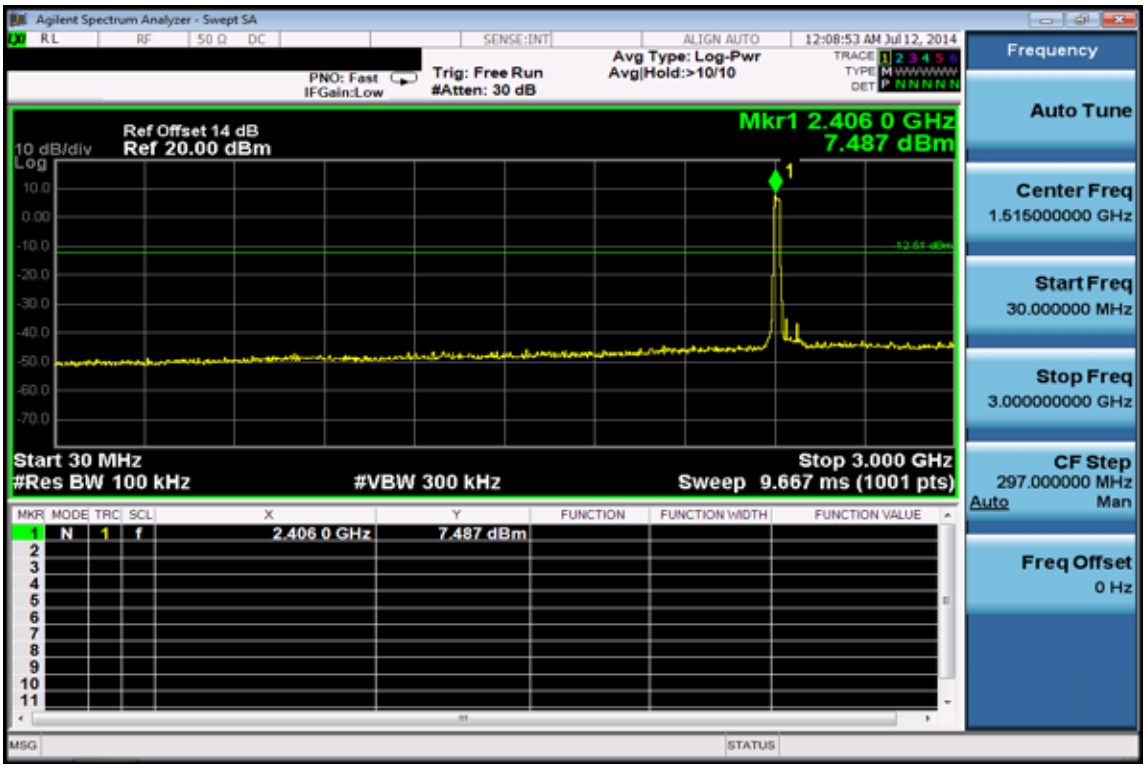
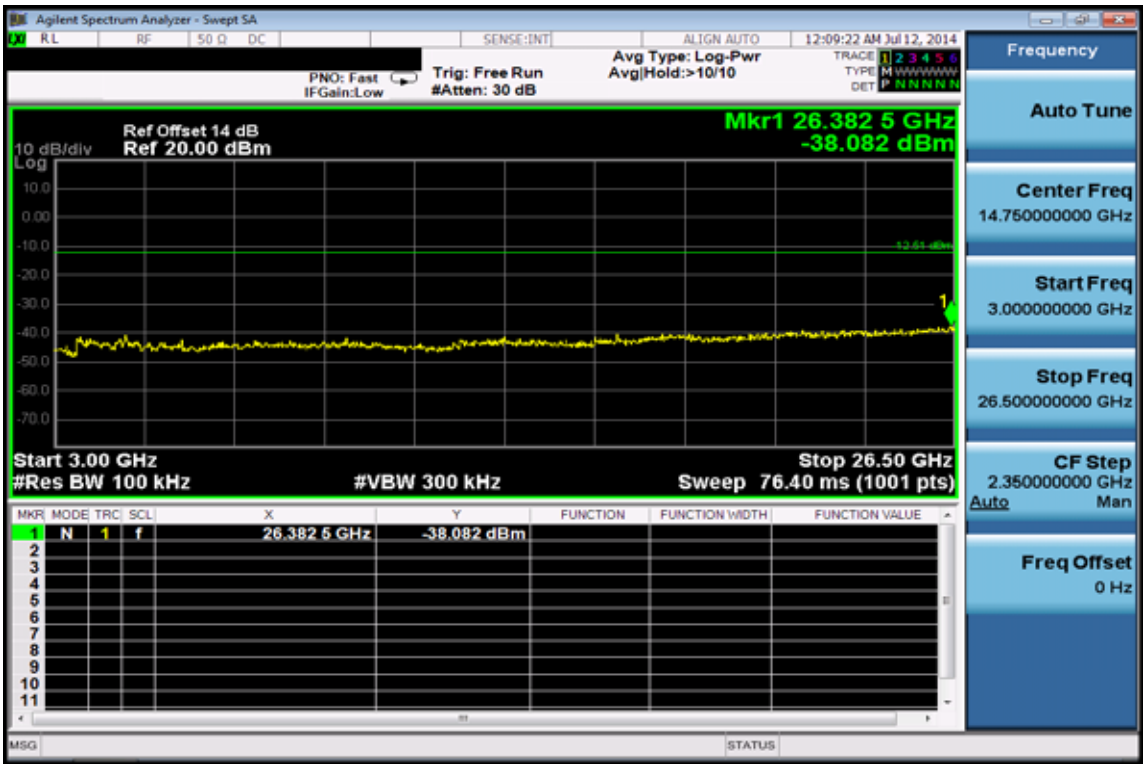
Conducted Spurious Emission Measurement Result (802.11n_20M) (MIMO)

Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz



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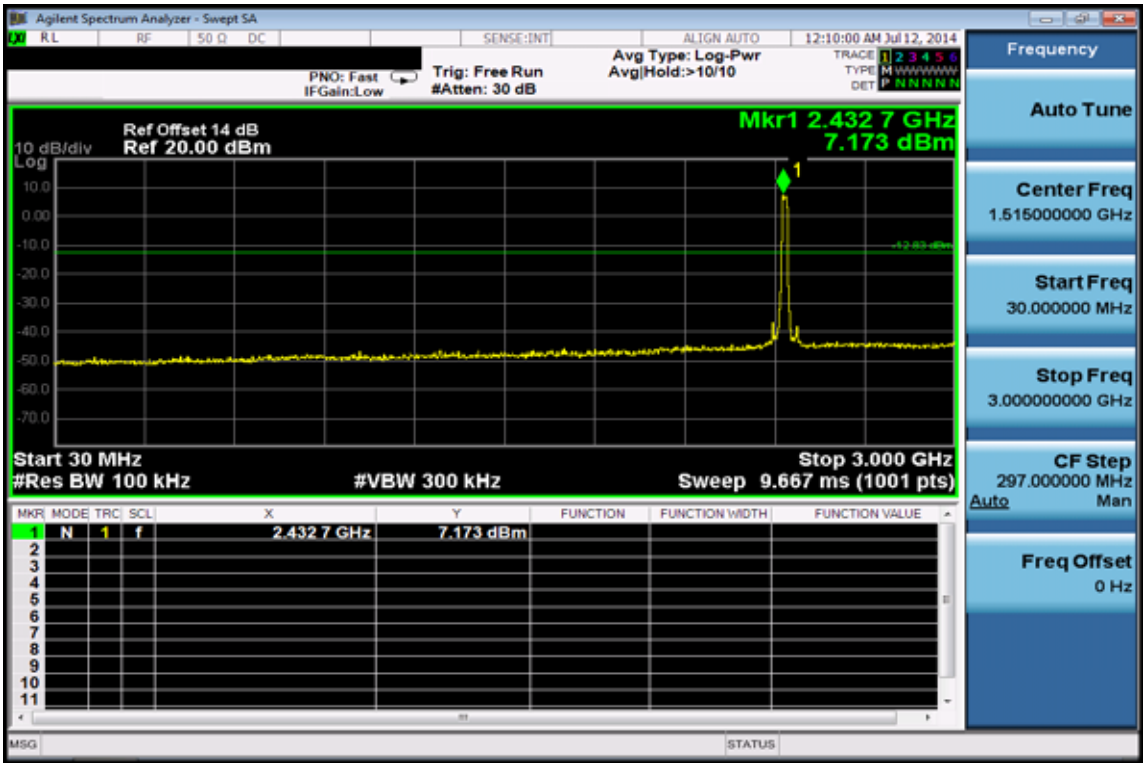
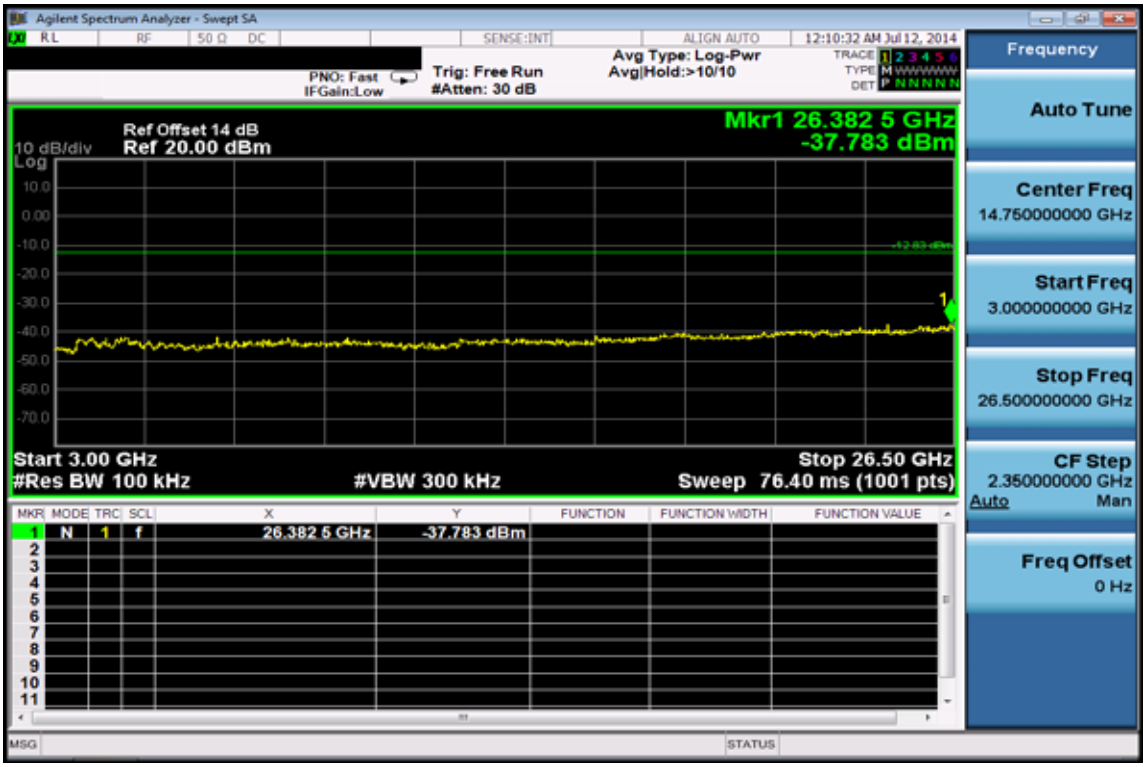
Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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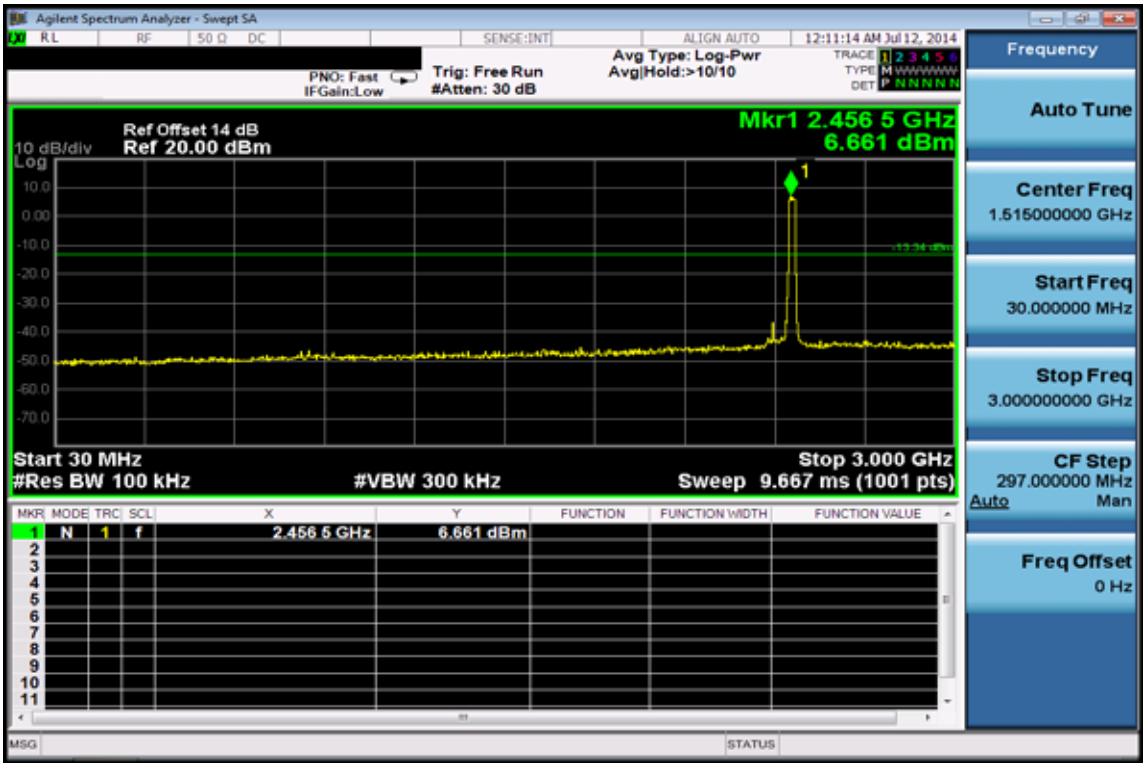
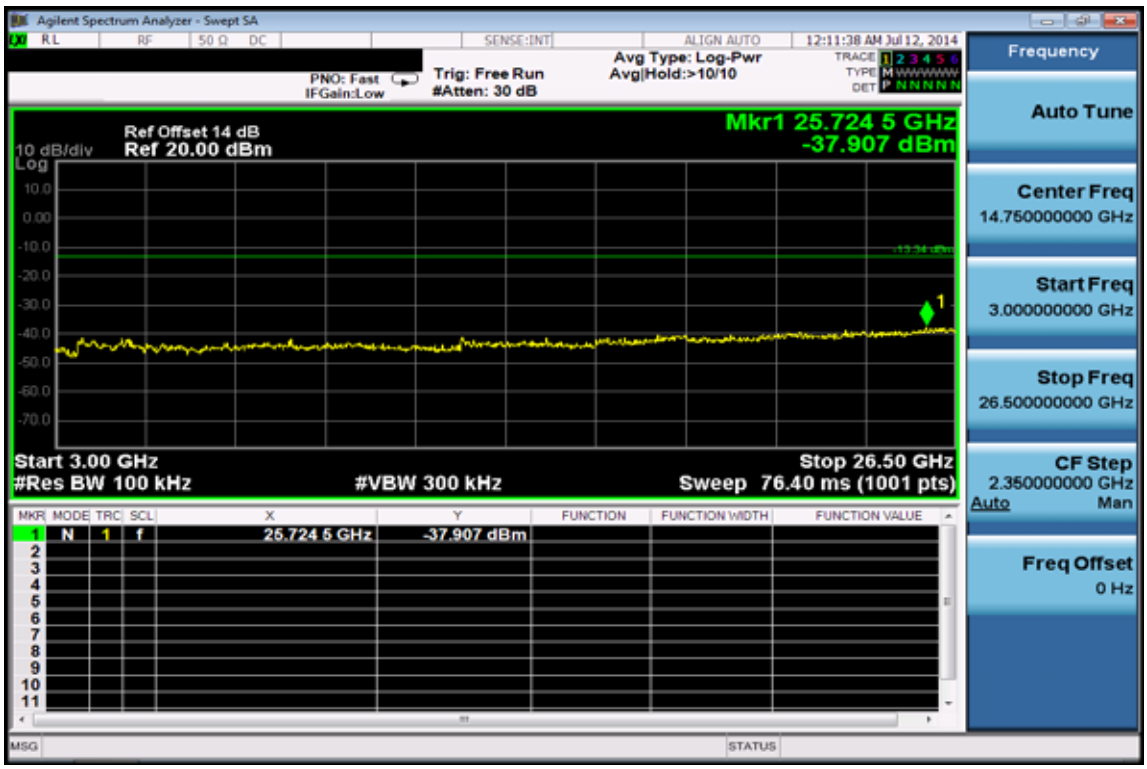
Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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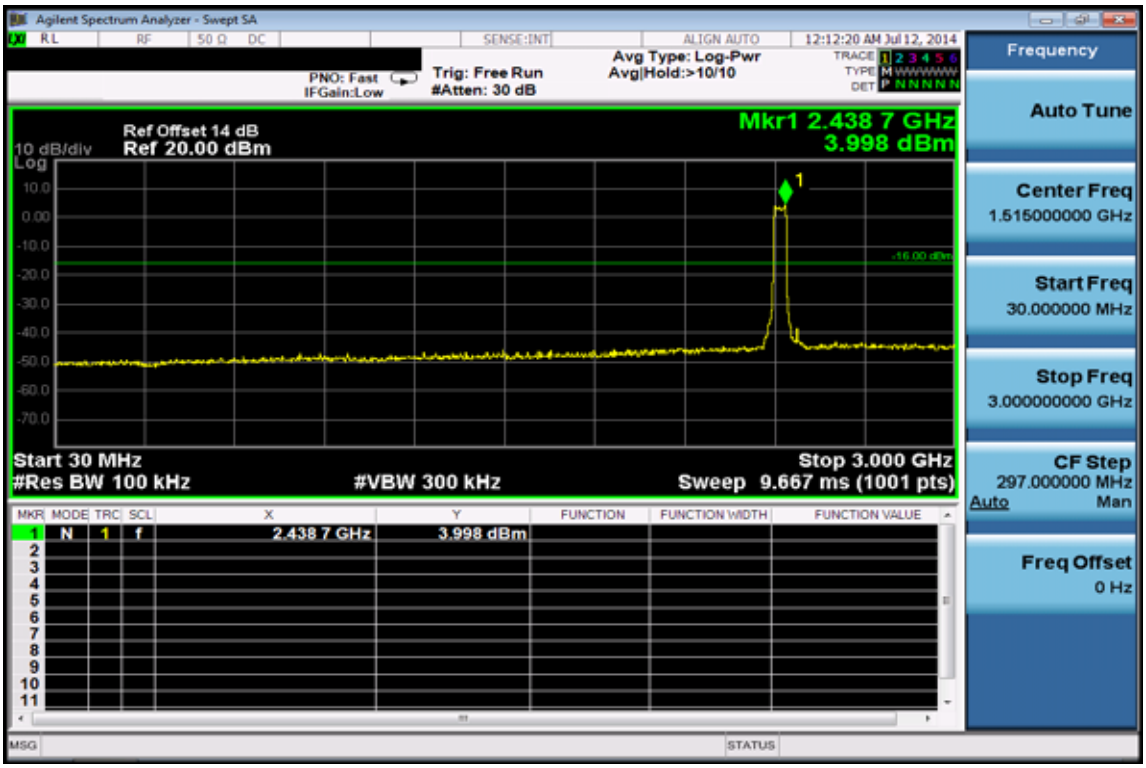
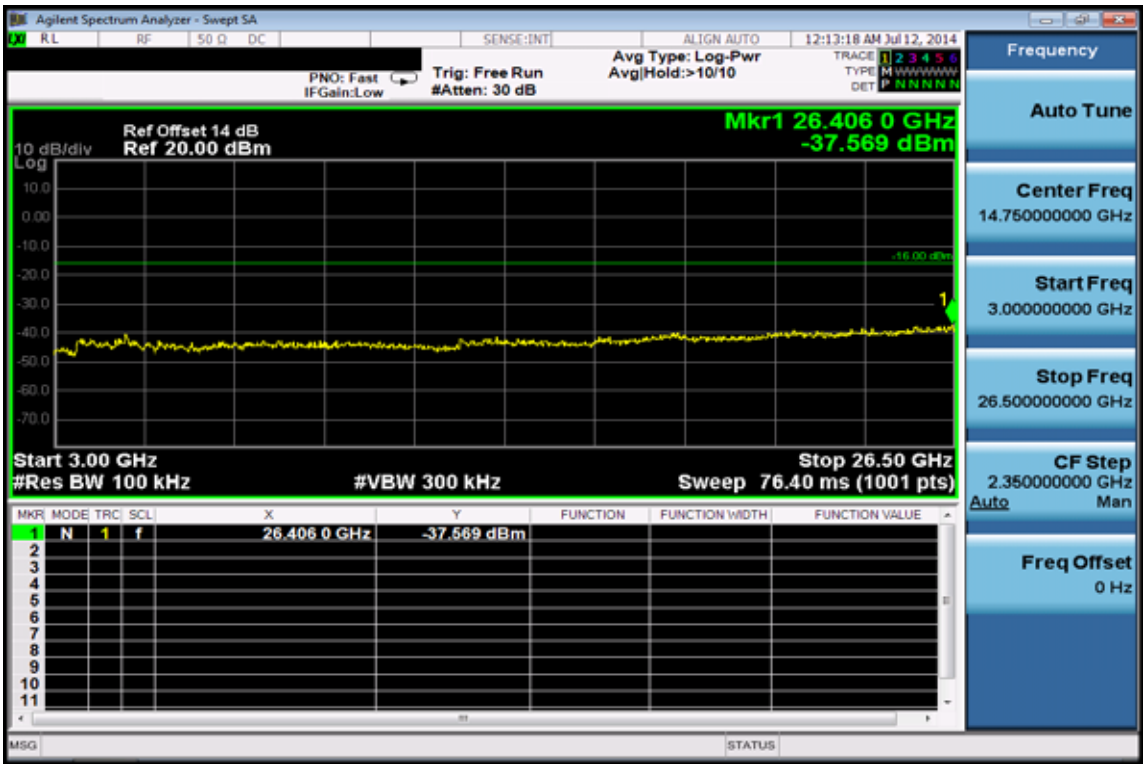
Conducted Spurious Emission Measurement Result (802.11n_40M) (MIMO)

Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz



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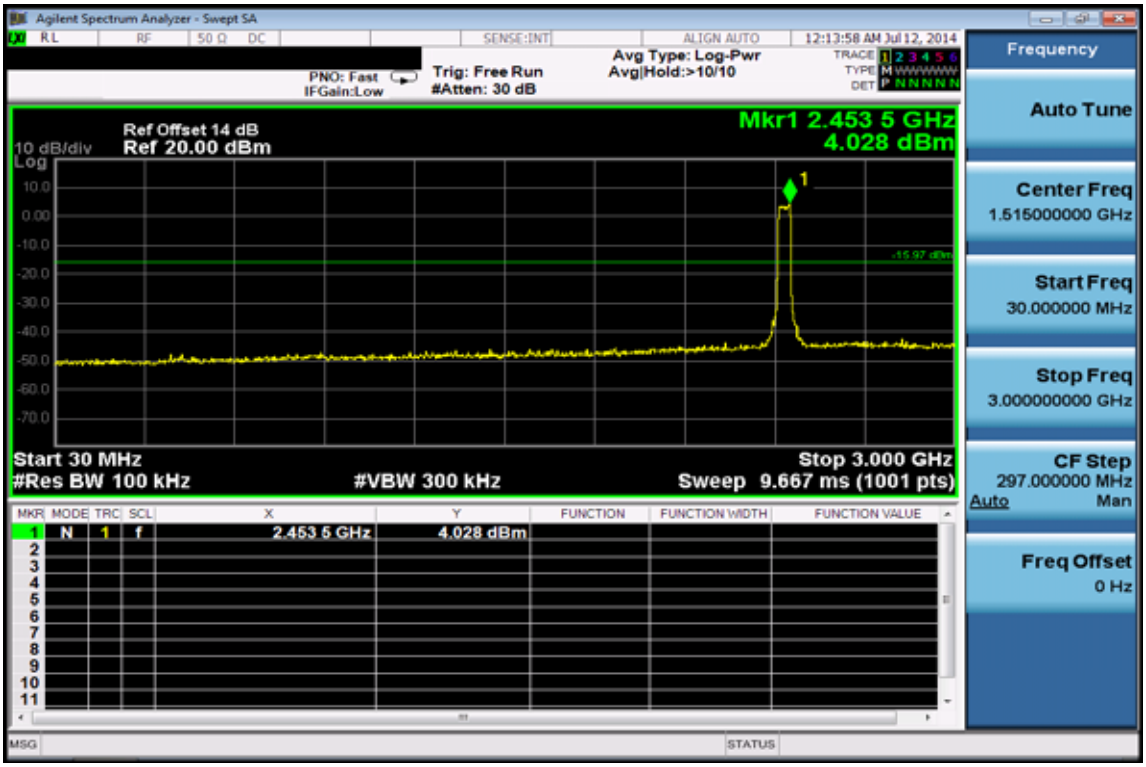
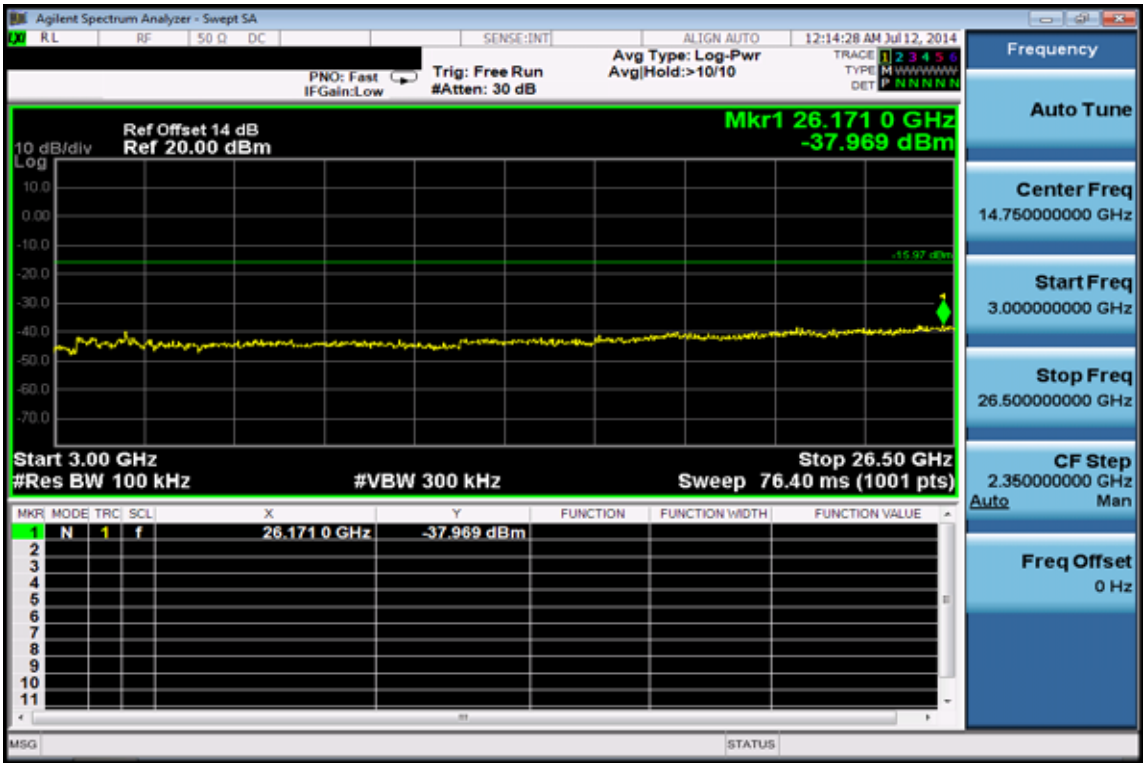
Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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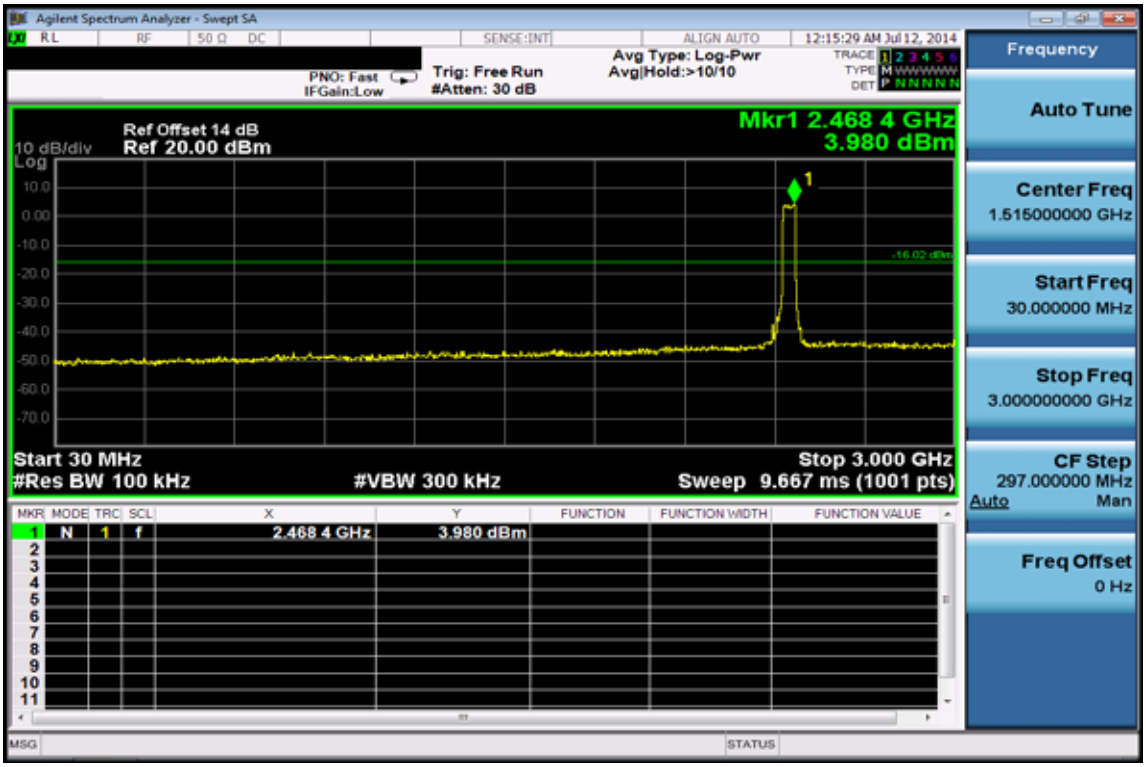
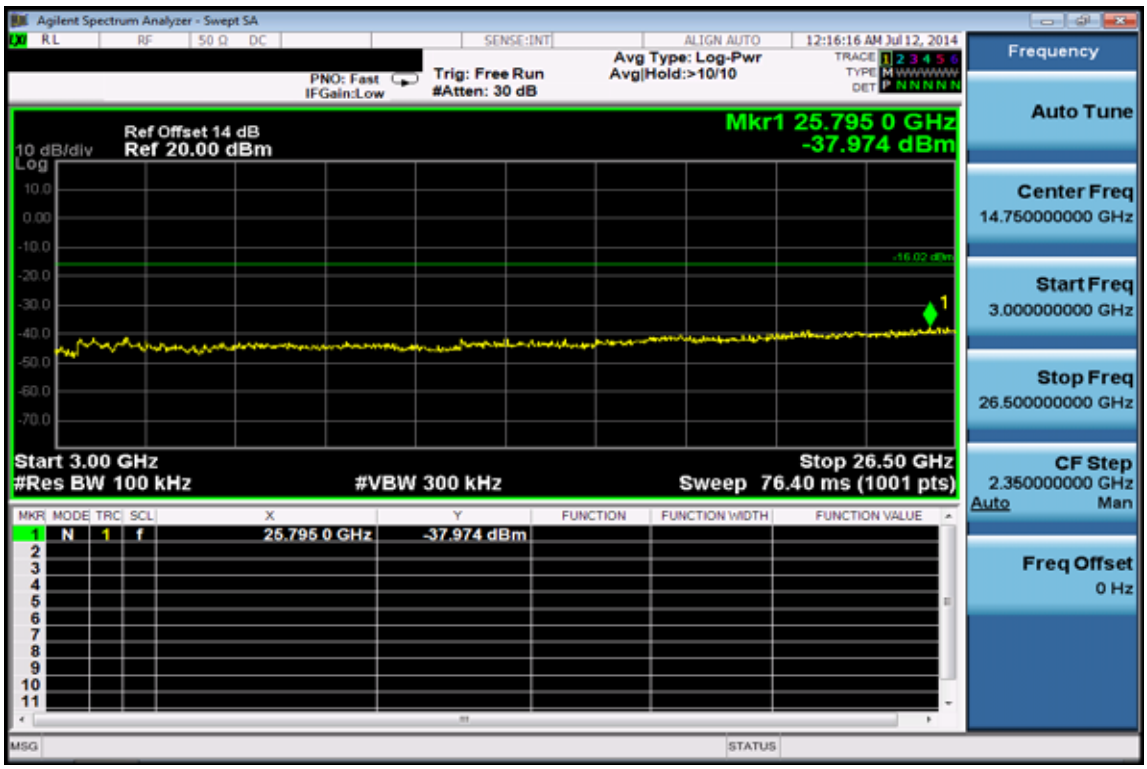
Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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Radiated Spurious Emission Measurement Result (802.11b)

Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
80.44	Peak	S	58.87	-26.61	32.26	40.00	-7.74
185.20	QP	S	62.90	-24.39	38.51	43.50	-4.99
399.57	Peak	S	53.42	-15.64	37.78	46.00	-8.22
506.27	Peak	S	51.00	-14.08	36.92	46.00	-9.08
650.80	Peak	S	50.84	-11.89	38.94	46.00	-7.06
699.30	Peak	S	51.06	-11.47	39.59	46.00	-6.41
3191.00	Peak	S	47.38	-2.89	44.50	74.00	-29.50
3191.00	Average	S	30.27	-2.89	27.38	54.00	-26.62
4824.00	Peak	H	55.19	0.38	55.57	74.00	-18.43
4824.00	Average	H	52.13	0.38	52.51	54.00	-1.49
7236.00	Peak	H	-	-	-	-	-
9648.00	Peak	H	-	-	-	-	-
12060.00	Peak	H	-	-	-	-	-
14472.00	Peak	H	-	-	-	-	-
16884.00	Peak	H	-	-	-	-	-
19296.00	Peak	H	-	-	-	-	-
21708.00	Peak	H	-	-	-	-	-
24120.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
32.91	Peak	S	40.23	-17.34	22.88	40.00	-17.12
184.23	QP	S	59.50	-24.41	35.09	43.50	-8.41
375.32	Peak	S	56.70	-16.66	40.04	46.00	-5.96
506.27	Peak	S	53.58	-14.08	39.51	46.00	-6.49
650.80	Peak	S	51.52	-11.89	39.63	46.00	-6.37
750.71	Peak	S	50.92	-10.71	40.21	46.00	-5.79
4824.00	Peak	H	47.99	0.38	48.38	74.00	-25.62
4824.00	Average	H	29.59	0.38	29.97	54.00	-24.03
7236.00	Peak	H	-	-	-	-	-
9648.00	Peak	H	-	-	-	-	-
12060.00	Peak	H	-	-	-	-	-
14472.00	Peak	H	-	-	-	-	-
16884.00	Peak	H	-	-	-	-	-
19296.00	Peak	H	-	-	-	-	-
21708.00	Peak	H	-	-	-	-	-
24120.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2437 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	47.98	-16.84	31.14	40.00	-8.86
166.77	QP	S	64.00	-23.50	40.50	43.50	-3.00
399.57	Peak	S	53.92	-15.64	38.28	46.00	-7.72
506.27	Peak	S	50.94	-14.08	36.87	46.00	-9.13
650.80	Peak	S	51.43	-11.89	39.54	46.00	-6.46
699.30	Peak	S	51.13	-11.47	39.66	46.00	-6.34
4874.00	Peak	H	55.66	0.41	56.07	74.00	-17.93
4874.00	Average	H	51.71	0.41	52.12	54.00	-1.88
7311.00	Peak	H	-	-	-	-	-
9748.00	Peak	H	-	-	-	-	-
12185.00	Peak	H	-	-	-	-	-
14622.00	Peak	H	-	-	-	-	-
17059.00	Peak	H	-	-	-	-	-
19496.00	Peak	H	-	-	-	-	-
21933.00	Peak	H	-	-	-	-	-
24370.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2437 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
71.71	Peak	S	49.22	-28.33	20.89	40.00	-19.11
180.35	Peak	S	64.73	-24.37	40.36	43.50	-3.14
375.32	Peak	S	57.13	-16.66	40.47	46.00	-5.53
506.27	Peak	S	53.42	-14.08	39.34	46.00	-6.66
750.71	Peak	S	51.30	-10.71	40.59	46.00	-5.41
875.84	Peak	S	50.73	-9.48	41.25	46.00	-4.75
3002.00	Peak	S	51.37	-4.46	46.91	74.00	-27.09
3002.00	Average	S	30.18	-4.46	25.72	54.00	-28.28
4874.00	Peak	H	50.06	0.41	50.46	74.00	-23.54
4874.00	Average	H	46.59	0.41	47.00	54.00	-7.00
7311.00	Peak	H	-	-	-	-	-
9748.00	Peak	H	-	-	-	-	-
12185.00	Peak	H	-	-	-	-	-
14622.00	Peak	H	-	-	-	-	-
17059.00	Peak	H	-	-	-	-	-
19496.00	Peak	H	-	-	-	-	-
21933.00	Peak	H	-	-	-	-	-
24370.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	47.60	-16.84	30.77	40.00	-9.23
166.77	QP	S	65.30	-23.50	41.80	43.50	-1.70
399.57	Peak	S	52.78	-15.64	37.14	46.00	-8.86
506.27	Peak	S	51.75	-14.08	37.67	46.00	-8.33
650.80	Peak	S	51.09	-11.89	39.19	46.00	-6.81
699.30	Peak	S	51.62	-11.47	40.15	46.00	-5.85
2995.00	Peak	S	51.99	-3.47	48.52	74.00	-25.48
2995.00	Average	S	29.93	-3.47	26.46	54.00	-27.54
4924.00	Peak	H	53.89	0.51	54.40	74.00	-19.60
4924.00	Average	H	51.11	0.51	51.62	54.00	-2.38
7386.00	Peak	H	-	-	-	-	-
9848.00	Peak	H	-	-	-	-	-
12310.00	Peak	H	-	-	-	-	-
14772.00	Peak	H	-	-	-	-	-
17234.00	Peak	H	-	-	-	-	-
19696.00	Peak	H	-	-	-	-	-
22158.00	Peak	H	-	-	-	-	-
24620.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 b	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
71.71	Peak	S	49.37	-28.33	21.04	40.00	-18.96
180.35	Peak	S	64.94	-24.37	40.57	43.50	-2.93
375.32	Peak	S	56.15	-16.66	39.49	46.00	-6.51
506.27	Peak	S	53.29	-14.08	39.22	46.00	-6.78
650.80	Peak	S	51.88	-11.89	39.99	46.00	-6.01
750.71	Peak	S	50.67	-10.71	39.96	46.00	-6.04
4924.00	Peak	H	49.01	0.51	49.52	74.00	-24.48
4924.00	Average	H	45.04	0.51	45.55	54.00	-8.45
7386.00	Peak	H	-	-	-	-	-
9848.00	Peak	H	-	-	-	-	-
12310.00	Peak	H	-	-	-	-	-
14772.00	Peak	H	-	-	-	-	-
17234.00	Peak	H	-	-	-	-	-
19696.00	Peak	H	-	-	-	-	-
22158.00	Peak	H	-	-	-	-	-
24620.00	Peak	H	-	-	-	-	-

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Radiated Spurious Emission Measurement Result (802.11g)

Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
38.73	Peak	S	51.20	-20.40	30.80	40.00	-9.20
166.77	QP	S	64.90	-23.50	41.40	43.50	-2.10
506.27	Peak	S	51.47	-14.08	37.40	46.00	-8.60
650.80	Peak	S	50.94	-11.89	39.05	46.00	-6.95
699.30	Peak	S	50.52	-11.47	39.04	46.00	-6.96
750.71	Peak	S	48.29	-10.71	37.58	46.00	-8.42
4824.00	Peak	H	43.94	0.38	44.32	74.00	-29.68
4824.00	Average	H	30.98	0.38	31.36	54.00	-22.64
7236.00	Peak	H	-	-	-	-	-
9648.00	Peak	H	-	-	-	-	-
12060.00	Peak	H	-	-	-	-	-
14472.00	Peak	H	-	-	-	-	-
16884.00	Peak	H	-	-	-	-	-
19296.00	Peak	H	-	-	-	-	-
21708.00	Peak	H	-	-	-	-	-
24120.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	46.00	-16.84	29.17	40.00	-10.83
166.77	Peak	S	64.98	-23.50	41.48	43.50	-2.02
375.32	Peak	S	57.32	-16.66	40.66	46.00	-5.34
506.27	Peak	S	53.11	-14.08	39.03	46.00	-6.97
650.80	Peak	S	52.05	-11.89	40.16	46.00	-5.84
750.71	Peak	S	50.25	-10.71	39.54	46.00	-6.46
4824.00	Peak	H	41.77	0.38	42.16	74.00	-31.84
4824.00	Average	H	29.12	0.38	29.50	54.00	-24.50
7236.00	Peak	H	-	-	-	-	-
9648.00	Peak	H	-	-	-	-	-
12060.00	Peak	H	-	-	-	-	-
14472.00	Peak	H	-	-	-	-	-
16884.00	Peak	H	-	-	-	-	-
19296.00	Peak	H	-	-	-	-	-
21708.00	Peak	H	-	-	-	-	-
24120.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2437 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	48.22	-16.84	31.38	40.00	-8.62
168.71	QP	S	65.20	-23.61	41.59	43.50	-1.91
399.57	Peak	S	53.28	-15.64	37.64	46.00	-8.36
506.27	Peak	S	51.24	-14.08	37.17	46.00	-8.83
650.80	Peak	S	50.43	-11.89	38.54	46.00	-7.46
750.71	Peak	S	48.27	-10.71	37.56	46.00	-8.44
3191.00	Peak	S	49.64	-2.89	46.75	74.00	-27.25
3191.00	Average	S	29.94	-2.89	27.05	54.00	-26.95
4874.00	Peak	H	42.09	0.41	42.50	74.00	-31.50
4874.00	Average	H	30.04	0.41	30.45	54.00	-23.55
7311.00	Peak	H	-	-	-	-	-
9748.00	Peak	H	-	-	-	-	-
12185.00	Peak	H	-	-	-	-	-
14622.00	Peak	H	-	-	-	-	-
17059.00	Peak	H	-	-	-	-	-
19496.00	Peak	H	-	-	-	-	-
21933.00	Peak	H	-	-	-	-	-
24370.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2437 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
71.71	Peak	S	49.34	-28.33	21.01	40.00	-18.99
180.35	Peak	S	64.94	-24.37	40.57	43.50	-2.93
375.32	Peak	S	55.93	-16.66	39.27	46.00	-6.73
506.27	Peak	S	53.80	-14.08	39.73	46.00	-6.27
650.80	Peak	S	51.75	-11.89	39.86	46.00	-6.14
750.71	Peak	S	50.99	-10.71	40.28	46.00	-5.72
4874.00	Peak	H	42.64	0.41	43.05	74.00	-30.95
4874.00	Average	H	28.69	0.41	29.10	54.00	-24.90
7311.00	Peak	H	-	-	-	-	-
9748.00	Peak	H	-	-	-	-	-
12185.00	Peak	H	-	-	-	-	-
14622.00	Peak	H	-	-	-	-	-
17059.00	Peak	H	-	-	-	-	-
19496.00	Peak	H	-	-	-	-	-
21933.00	Peak	H	-	-	-	-	-
24370.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	47.49	-16.84	30.66	40.00	-9.34
166.77	QP	S	65.10	-23.50	41.60	43.50	-1.90
399.57	Peak	S	53.08	-15.64	37.44	46.00	-8.56
506.27	Peak	S	51.10	-14.08	37.03	46.00	-8.97
650.80	Peak	S	51.89	-11.89	40.00	46.00	-6.00
699.30	Peak	S	50.36	-11.47	38.89	46.00	-7.11
3002.00	Peak	S	52.68	-3.46	49.22	74.00	-24.78
3002.00	Average	S	29.70	-3.46	26.24	54.00	-27.76
4924.00	Peak	H	43.46	0.51	43.97	74.00	-30.03
4924.00	Average	H	37.27	0.51	37.78	54.00	-16.22
7386.00	Peak	H	-	-	-	-	-
9848.00	Peak	H	-	-	-	-	-
12310.00	Peak	H	-	-	-	-	-
14772.00	Peak	H	-	-	-	-	-
17234.00	Peak	H	-	-	-	-	-
19696.00	Peak	H	-	-	-	-	-
22158.00	Peak	H	-	-	-	-	-
24620.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 g	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
71.71	Peak	S	49.41	-28.33	21.08	40.00	-18.92
179.38	Peak	S	64.49	-24.30	40.19	43.50	-3.31
250.19	Peak	S	59.31	-20.40	38.91	46.00	-7.09
506.27	Peak	S	53.32	-14.08	39.24	46.00	-6.76
650.80	Peak	S	51.87	-11.89	39.97	46.00	-6.03
750.71	Peak	S	50.97	-10.71	40.26	46.00	-5.74
4924.00	Peak	H	41.70	0.51	42.21	74.00	-31.79
4924.00	Average	H	32.51	0.51	33.02	54.00	-20.98
7386.00	Peak	H	-	-	-	-	-
9848.00	Peak	H	-	-	-	-	-
12310.00	Peak	H	-	-	-	-	-
14772.00	Peak	H	-	-	-	-	-
17234.00	Peak	H	-	-	-	-	-
19696.00	Peak	H	-	-	-	-	-
22158.00	Peak	H	-	-	-	-	-
24620.00	Peak	H	-	-	-	-	-

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Radiated Spurious Emission Measurement Result (802.11n_20M)

Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	47.11	-16.84	30.27	40.00	-9.73
166.77	QP	S	65.60	-23.50	42.10	43.50	-1.40
399.57	Peak	S	53.22	-15.64	37.58	46.00	-8.42
506.27	Peak	S	51.33	-14.08	37.26	46.00	-8.74
650.80	Peak	S	50.52	-11.89	38.62	46.00	-7.38
699.30	Peak	S	50.10	-11.47	38.63	46.00	-7.37
3191.00	Peak	S	49.04	-2.89	46.15	74.00	-27.85
3191.00	Average	S	30.03	-2.89	27.14	54.00	-26.86
4824.00	Peak	H	42.85	0.38	43.23	74.00	-30.77
4824.00	Average	H	30.06	0.38	30.44	54.00	-23.56
7236.00	Peak	H	-	-	-	-	-
9648.00	Peak	H	-	-	-	-	-
12060.00	Peak	H	-	-	-	-	-
14472.00	Peak	H	-	-	-	-	-
16884.00	Peak	H	-	-	-	-	-
19296.00	Peak	H	-	-	-	-	-
21708.00	Peak	H	-	-	-	-	-
24120.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2412 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
82.38	Peak	S	50.11	-26.27	23.83	40.00	-16.17
181.32	Peak	S	64.37	-24.37	40.00	43.50	-3.50
375.32	Peak	S	56.98	-16.66	40.32	46.00	-5.68
506.27	Peak	S	53.03	-14.08	38.96	46.00	-7.04
650.80	Peak	S	51.94	-11.89	40.05	46.00	-5.95
750.71	Peak	S	50.74	-10.71	40.03	46.00	-5.97
4824.00	Peak	H	42.35	0.38	42.73	74.00	-31.27
4824.00	Average	H	29.21	0.38	29.59	54.00	-24.41
7236.00	Peak	H	-	-	-	-	-
9648.00	Peak	H	-	-	-	-	-
12060.00	Peak	H	-	-	-	-	-
14472.00	Peak	H	-	-	-	-	-
16884.00	Peak	H	-	-	-	-	-
19296.00	Peak	H	-	-	-	-	-
21708.00	Peak	H	-	-	-	-	-
24120.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2437 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
33.88	Peak	S	49.04	-17.83	31.21	40.00	-8.79
168.71	QP	S	65.20	-23.61	41.59	43.50	-1.91
399.57	Peak	S	52.65	-15.64	37.01	46.00	-8.99
506.27	Peak	S	51.14	-14.08	37.07	46.00	-8.93
650.80	Peak	S	50.88	-11.89	38.99	46.00	-7.01
699.30	Peak	S	50.94	-11.47	39.46	46.00	-6.54
3198.00	Peak	S	48.27	-2.85	45.42	74.00	-28.58
3198.00	Average	S	30.29	-2.85	27.44	54.00	-26.56
4874.00	Peak	H	41.84	0.41	42.24	74.00	-31.76
4874.00	Average	H	29.54	0.41	29.95	54.00	-24.05
7311.00	Peak	H	-	-	-	-	-
9748.00	Peak	H	-	-	-	-	-
12185.00	Peak	H	-	-	-	-	-
14622.00	Peak	H	-	-	-	-	-
17059.00	Peak	H	-	-	-	-	-
19496.00	Peak	H	-	-	-	-	-
21933.00	Peak	H	-	-	-	-	-
24370.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2437 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
71.71	Peak	S	49.38	-28.33	21.06	40.00	-18.94
185.20	Peak	S	64.53	-24.39	40.14	43.50	-3.36
375.32	Peak	S	56.79	-16.66	40.13	46.00	-5.87
506.27	Peak	S	53.86	-14.08	39.79	46.00	-6.21
650.80	Peak	S	52.06	-11.89	40.17	46.00	-5.83
750.71	Peak	S	51.23	-10.71	40.52	46.00	-5.48
4874.00	Peak	H	42.20	0.41	42.61	74.00	-31.39
4874.00	Average	H	30.66	0.41	31.07	54.00	-22.93
7311.00	Peak	H	-	-	-	-	-
9748.00	Peak	H	-	-	-	-	-
12185.00	Peak	H	-	-	-	-	-
14622.00	Peak	H	-	-	-	-	-
17059.00	Peak	H	-	-	-	-	-
19496.00	Peak	H	-	-	-	-	-
21933.00	Peak	H	-	-	-	-	-
24370.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	47.11	-16.84	30.27	40.00	-9.73
168.71	QP	S	65.20	-23.61	41.59	43.50	-1.91
399.57	Peak	S	53.41	-15.64	37.77	46.00	-8.23
506.27	Peak	S	51.51	-14.08	37.44	46.00	-8.56
650.80	Peak	S	50.84	-11.89	38.95	46.00	-7.05
699.30	Peak	S	50.37	-11.47	38.90	46.00	-7.10
3191.00	Peak	S	48.17	-2.89	45.28	74.00	-28.72
3191.00	Average	S	30.08	-2.89	27.19	54.00	-26.81
4924.00	Peak	H	41.48	0.51	41.99	74.00	-32.01
4924.00	Average	H	30.62	0.51	31.13	54.00	-22.87
7386.00	Peak	H	-	-	-	-	-
9848.00	Peak	H	-	-	-	-	-
12310.00	Peak	H	-	-	-	-	-
14772.00	Peak	H	-	-	-	-	-
17234.00	Peak	H	-	-	-	-	-
19696.00	Peak	H	-	-	-	-	-
22158.00	Peak	H	-	-	-	-	-
24620.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n20M	Test Date	:2014-07-22
Fundamental Frequency	:2462 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
62.01	Peak	S	53.10	-29.22	23.88	40.00	-16.12
168.71	Peak	S	64.02	-23.61	40.41	43.50	-3.09
250.19	Peak	S	59.24	-20.40	38.84	46.00	-7.16
375.32	Peak	S	57.69	-16.66	41.03	46.00	-4.97
506.27	Peak	S	53.64	-14.08	39.57	46.00	-6.43
650.80	Peak	S	51.57	-11.89	39.68	46.00	-6.32
4924.00	Peak	H	41.24	0.51	41.75	74.00	-32.25
4924.00	Average	H	29.66	0.51	30.17	54.00	-23.83
7386.00	Peak	H	-	-	-	-	-
9848.00	Peak	H	-	-	-	-	-
12310.00	Peak	H	-	-	-	-	-
14772.00	Peak	H	-	-	-	-	-
17234.00	Peak	H	-	-	-	-	-
19696.00	Peak	H	-	-	-	-	-
22158.00	Peak	H	-	-	-	-	-
24620.00	Peak	H	-	-	-	-	-

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Radiated Spurious Emission Measurement Result (802.11n_40M)

Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2422 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	47.49	-16.84	30.66	40.00	-9.34
172.59	Peak	S	64.15	-23.83	40.32	43.50	-3.18
399.57	Peak	S	52.53	-15.64	36.89	46.00	-9.11
506.27	Peak	S	51.50	-14.08	37.43	46.00	-8.57
650.80	Peak	S	50.74	-11.89	38.85	46.00	-7.15
699.30	Peak	S	50.94	-11.47	39.46	46.00	-6.54
4844.00	Peak	H	42.62	0.39	43.01	74.00	-30.99
4844.00	Average	H	30.07	0.39	30.46	54.00	-23.54
7266.00	Peak	H	-	-	-	-	-
9688.00	Peak	H	-	-	-	-	-
12110.00	Peak	H	-	-	-	-	-
14532.00	Peak	H	-	-	-	-	-
16954.00	Peak	H	-	-	-	-	-
19376.00	Peak	H	-	-	-	-	-
21798.00	Peak	H	-	-	-	-	-
24220.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2422 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
71.71	Peak	S	48.64	-28.33	20.31	40.00	-19.69
167.74	Peak	S	60.75	-23.57	37.19	43.50	-6.31
375.32	Peak	S	57.00	-16.66	40.34	46.00	-5.66
506.27	Peak	S	53.77	-14.08	39.69	46.00	-6.31
650.80	Peak	S	52.08	-11.89	40.19	46.00	-5.81
875.84	Peak	S	51.10	-9.48	41.62	46.00	-4.38
4844.00	Peak	H	41.95	0.39	42.34	74.00	-31.66
4844.00	Average	H	30.93	0.39	31.32	54.00	-22.68
7266.00	Peak	H	-	-	-	-	-
9688.00	Peak	H	-	-	-	-	-
12110.00	Peak	H	-	-	-	-	-
14532.00	Peak	H	-	-	-	-	-
16954.00	Peak	H	-	-	-	-	-
19376.00	Peak	H	-	-	-	-	-
21798.00	Peak	H	-	-	-	-	-
24220.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2437 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
33.88	Peak	S	47.99	-17.83	30.16	40.00	-9.84
172.59	Peak	S	63.95	-23.83	40.12	43.50	-3.38
399.57	Peak	S	53.62	-15.64	37.98	46.00	-8.02
506.27	Peak	S	52.01	-14.08	37.93	46.00	-8.07
699.30	Peak	S	50.77	-11.47	39.30	46.00	-6.70
875.84	Peak	S	47.81	-9.48	38.33	46.00	-7.67
4874.00	Peak	H	41.62	0.41	42.02	74.00	-31.98
4874.00	Average	H	30.44	0.41	30.85	54.00	-23.15
7311.00	Peak	H	-	-	-	-	-
9748.00	Peak	H	-	-	-	-	-
12185.00	Peak	H	-	-	-	-	-
14622.00	Peak	H	-	-	-	-	-
17059.00	Peak	H	-	-	-	-	-
19496.00	Peak	H	-	-	-	-	-
21933.00	Peak	H	-	-	-	-	-
24370.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2437 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
71.71	Peak	S	48.90	-28.33	20.57	40.00	-19.43
167.74	Peak	S	60.68	-23.57	37.11	43.50	-6.39
375.32	Peak	S	57.74	-16.66	41.08	46.00	-4.92
506.27	Peak	S	53.56	-14.08	39.48	46.00	-6.52
650.80	Peak	S	51.79	-11.89	39.90	46.00	-6.10
875.84	Peak	S	50.83	-9.48	41.34	46.00	-4.66
4874.00	Peak	H	41.05	0.41	41.45	74.00	-32.55
4874.00	Average	H	30.63	0.41	31.04	54.00	-22.96
7311.00	Peak	H	-	-	-	-	-
9748.00	Peak	H	-	-	-	-	-
12185.00	Peak	H	-	-	-	-	-
14622.00	Peak	H	-	-	-	-	-
17059.00	Peak	H	-	-	-	-	-
19496.00	Peak	H	-	-	-	-	-
21933.00	Peak	H	-	-	-	-	-
24370.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2452 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
31.94	Peak	S	48.17	-16.84	31.33	40.00	-8.67
172.59	Peak	S	63.92	-23.83	40.10	43.50	-3.40
399.57	Peak	S	54.07	-15.64	38.43	46.00	-7.57
506.27	Peak	S	51.27	-14.08	37.20	46.00	-8.80
650.80	Peak	S	50.57	-11.89	38.68	46.00	-7.32
699.30	Peak	S	50.47	-11.47	39.00	46.00	-7.00
4904.00	Peak	H	41.46	0.43	41.89	74.00	-32.11
4904.00	Average	H	30.21	0.43	30.64	54.00	-23.36
7356.00	Peak	H	-	-	-	-	-
9808.00	Peak	H	-	-	-	-	-
12260.00	Peak	H	-	-	-	-	-
14712.00	Peak	H	-	-	-	-	-
17164.00	Peak	H	-	-	-	-	-
19616.00	Peak	H	-	-	-	-	-
22068.00	Peak	H	-	-	-	-	-
24520.00	Peak	H	-	-	-	-	-

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Operation Band	:802.11 n40M	Test Date	:2014-07-22
Fundamental Frequency	:2452 MHz	Temp./Humi.	:27.6 deg_C / 54 RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV / m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV / m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV / m	Limit @3m dBμV / m	Margin dB
71.71	Peak	S	48.06	-28.33	19.73	40.00	-20.27
173.56	Peak	S	61.02	-23.87	37.16	43.50	-6.34
375.32	Peak	S	57.62	-16.66	40.96	46.00	-5.04
506.27	Peak	S	53.15	-14.08	39.07	46.00	-6.93
650.80	Peak	S	52.17	-11.89	40.28	46.00	-5.72
875.84	Peak	S	51.16	-9.48	41.67	46.00	-4.33
4904.00	Peak	H	41.63	0.43	42.06	74.00	-31.94
4904.00	Average	H	29.28	0.43	29.71	54.00	-24.29
7356.00	Peak	H	-	-	-	-	-
9808.00	Peak	H	-	-	-	-	-
12260.00	Peak	H	-	-	-	-	-
14712.00	Peak	H	-	-	-	-	-
17164.00	Peak	H	-	-	-	-	-
19616.00	Peak	H	-	-	-	-	-
22068.00	Peak	H	-	-	-	-	-
24520.00	Peak	H	-	-	-	-	-

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11 PEAK POWER SPECTRAL DENSITY

11.1 Standard Applicable:

According to §15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

11.2 Measurement Equipment Used:

Refer to section 7.2 for details.

11.3 Test Set-up:

Refer to section 7.3 for details. (Spectrum Option)

11.4 Measurement Procedure (following the measurement procedure 10.2 of KDB558074):

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW ≥ 3 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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11.5 Measurement Result:

802.11b

Frequency MHz	RF Power Density Reading (dBm)	Maximum Limit (dBm)
2412	-1.737	8
2437	-1.739	8
2462	-1.771	8

802.11g

Frequency MHz	RF Power Density Reading (dBm)	Maximum Limit (dBm)
2412	-8.703	8
2437	-9.108	8
2462	-10.103	8

802.11n_20M (MIMO)

Frequency MHz	RF Power Density Reading (dBm)	Maximum Limit (dBm)
2412	-7.655	8
2437	-7.496	8
2462	-7.509	8

802.11n_40M (MIMO)

Frequency MHz	RF Power Density Reading (dBm)	Maximum Limit (dBm)
2422	-10.444	8
2437	-10.600	8
2452	-9.831	8

** Note: Offset 11dB for 2.4G 802.11b/g;*

Offset 14dB for 2.4G 802.11n_20/n_40.

**Refer to next page for plots*

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802.11b

Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

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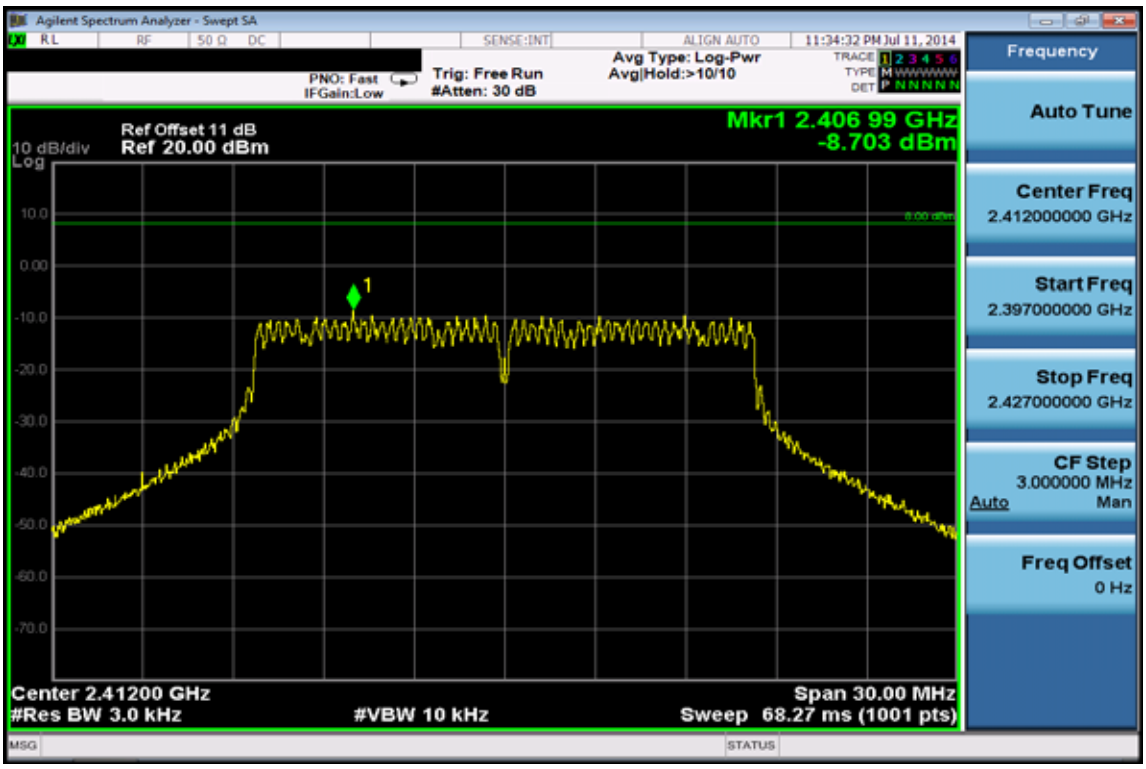
Power Spectral Density Test Plot (CH-High)

802.11g

Power Spectral Density Test Plot (CH-Low)



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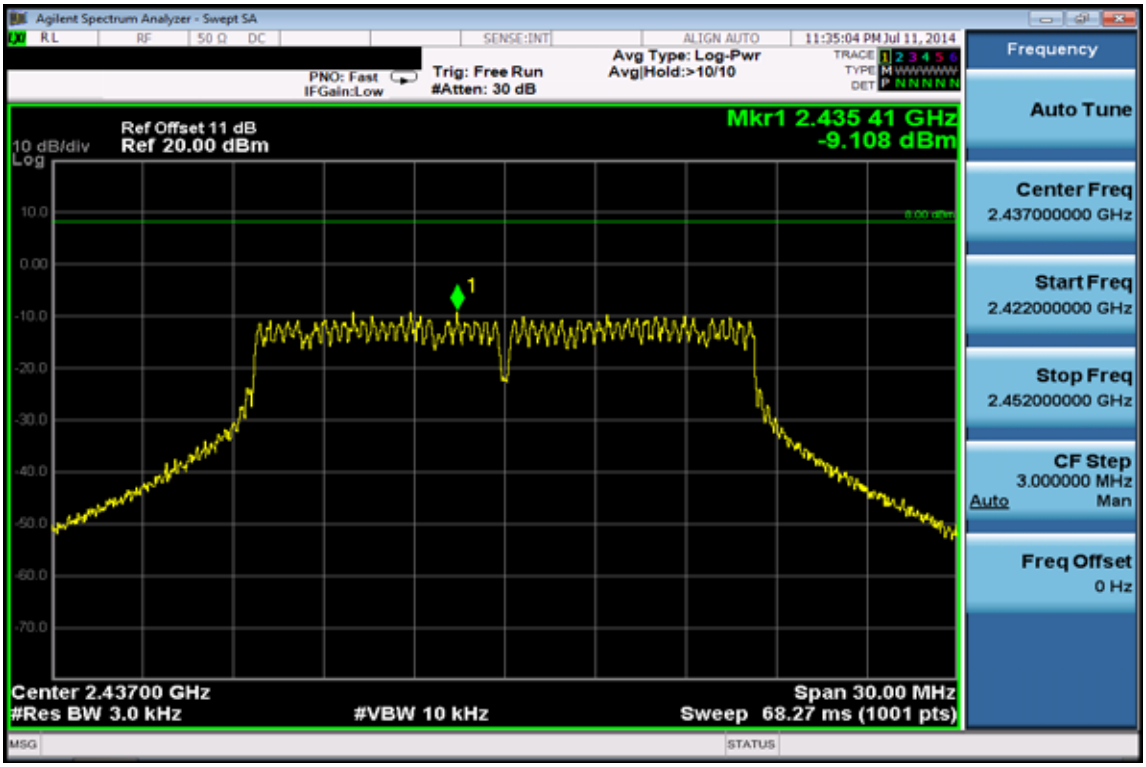
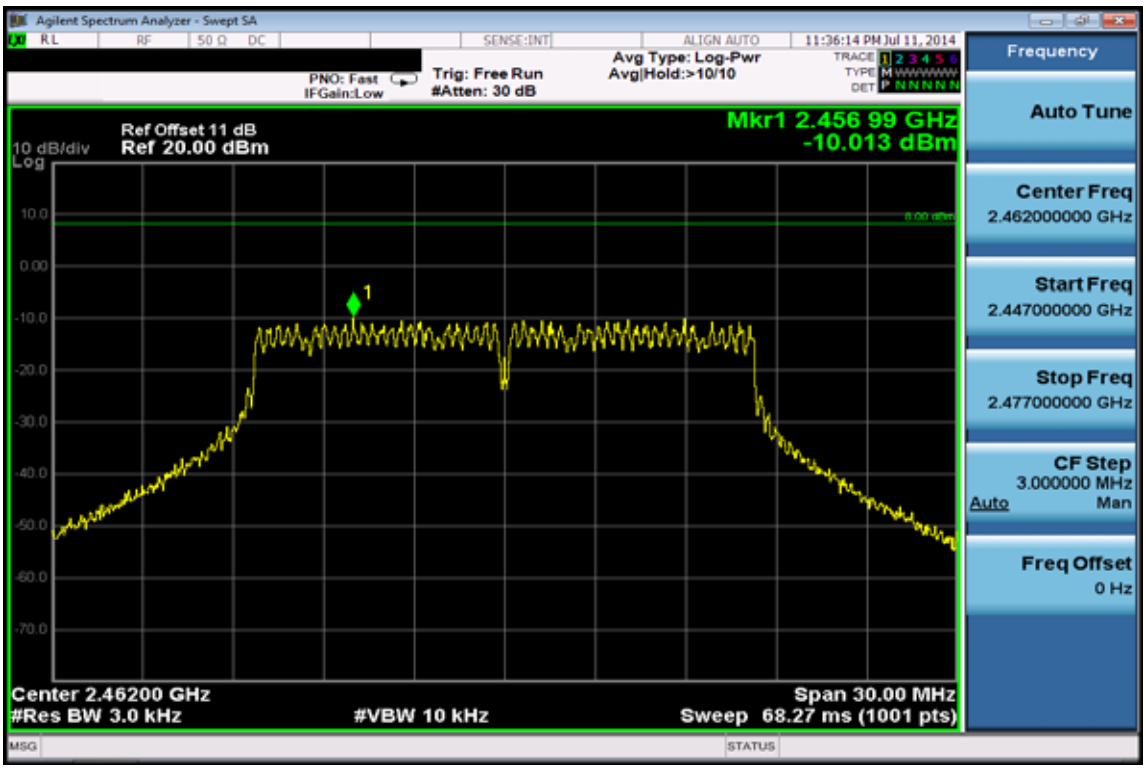
Power Spectral Density Test Plot (CH-Mid)



Power Spectral Density Test Plot (CH-High)



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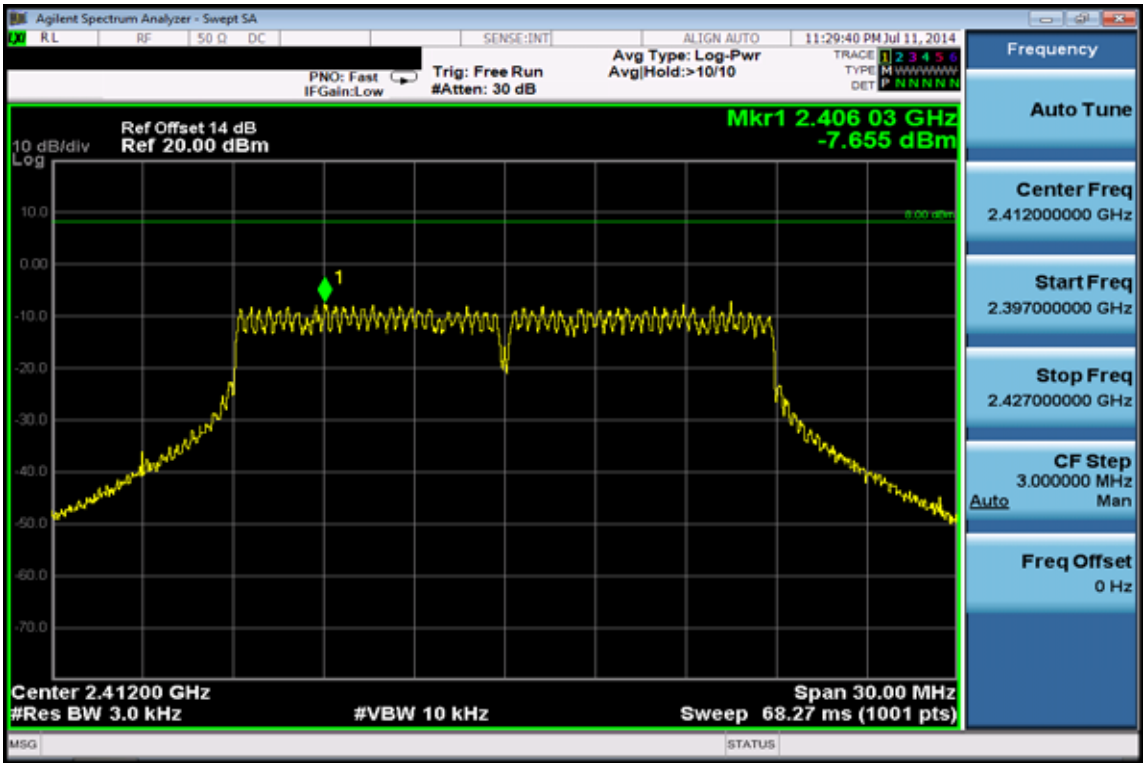
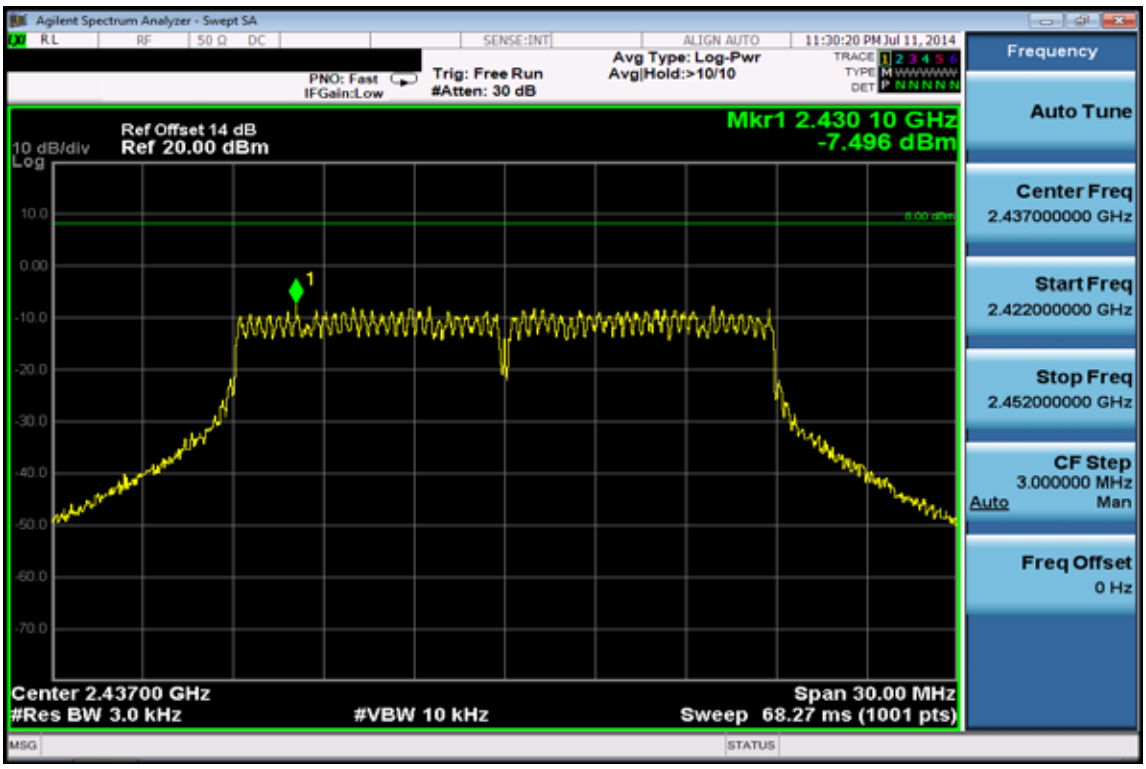
802.11n_20M (MIMO)

Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



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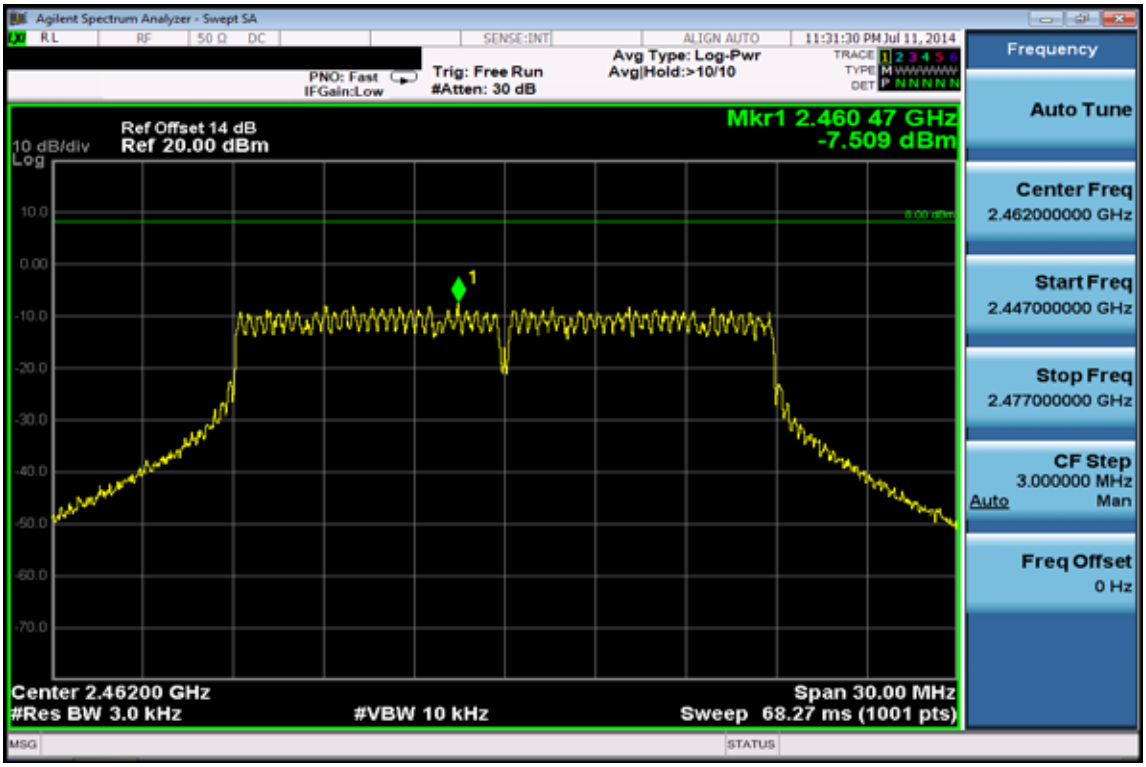
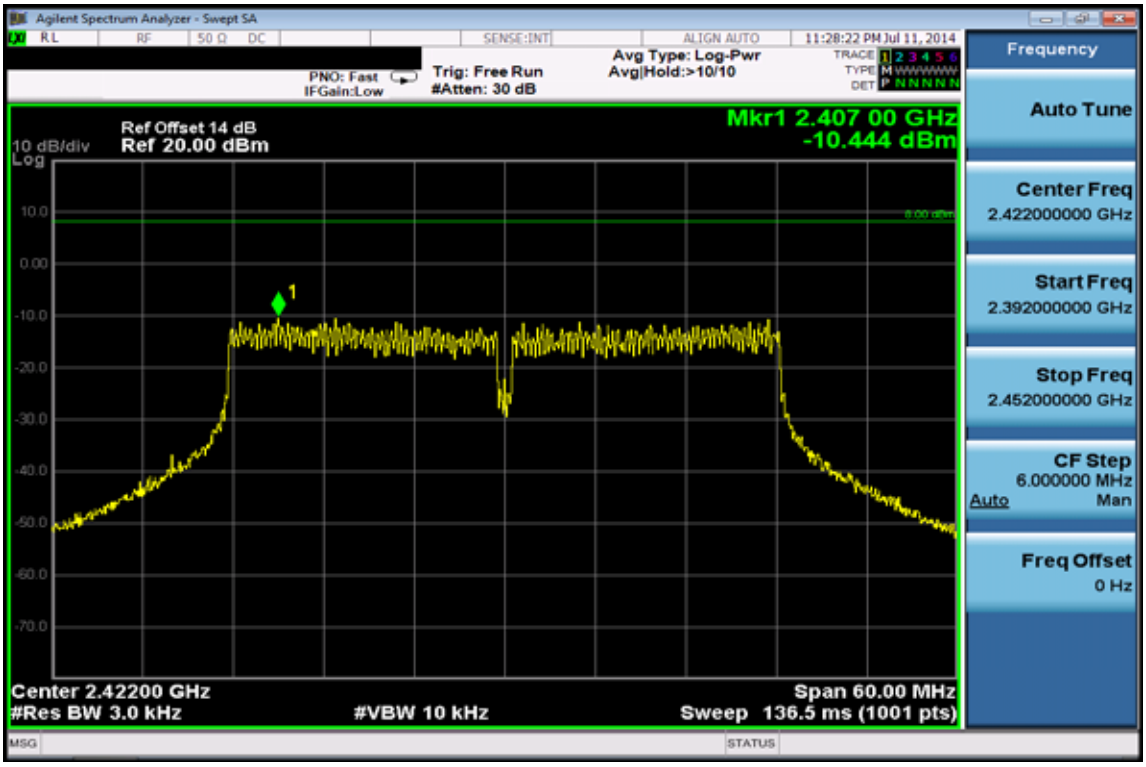
Power Spectral Density Test Plot (CH-High)



802.11n_40M (MIMO)

Power Spectral Density Test Plot (CH-Low)



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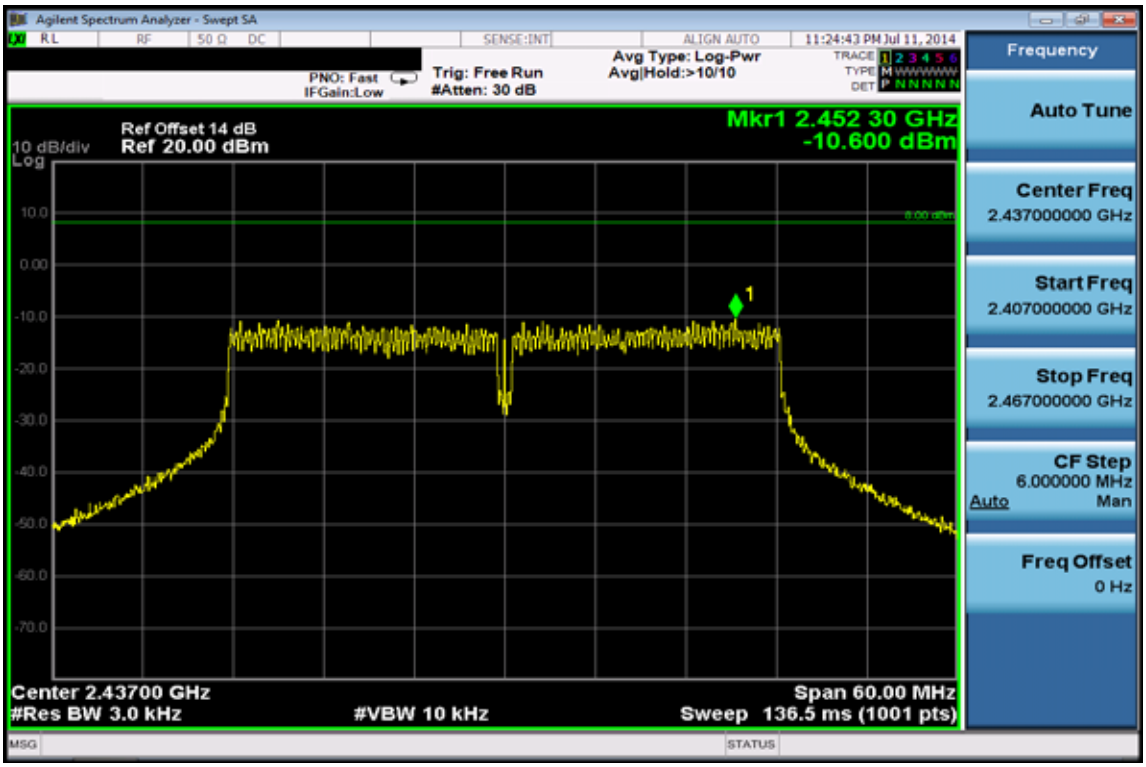
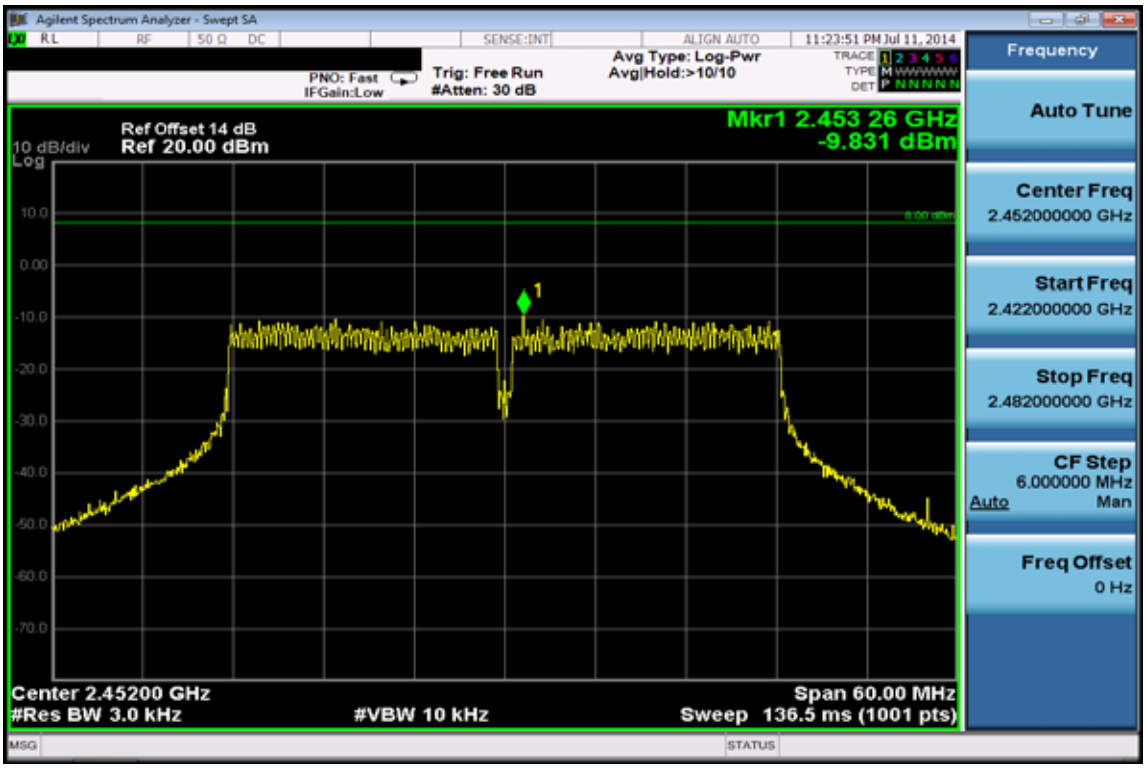
Power Spectral Density Test Plot (CH-Mid)



Power Spectral Density Test Plot (CH-High)



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12 ANTENNA REQUIREMENT

12.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

12.2 Antenna Connected Construction:

The directional gains of antenna used for transmitting is: 2.36dBi for 2.4GHz (Main Antenna), 2.13dBi for 2.4GHz (Aux Antenna), 4.57dBi for 2.4GHz (802.11n_20M MIMO) and 4.59dBi for 2.4GHz (802.11n_40M MIMO) and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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