TEST REPORT

of

FCC Part 15 Subpart C

☒ New Application; ☐ Class I PC; ☐ Class II PC

Full Modular Approval

Product :	**5G +2.4G 2T/2R WLAN FMC**
Brand:	**Nane**
Model:	**Detail please refer to page 6**
Model Difference:	**Market Segmentation**
FCC ID:	**O7N-CWFB211-XXX** **it identifies a single equipment "X" is letter of the alphabet**
FCC Rule Part:	**§15.247, Cat: DTS**
Applicant:	**ChipSiP Technology CO., Ltd.**
Address:	**8F.-1, No.186, Jian 1st Rd., Zhonghe Dist., New Taipei City 235, Taiwan**

Test Performed by:

International Standards Laboratory
<Lung-Tan LAB>
*Site Registration No.
BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997; IC: IC4067B-3;
*Address:
No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd.
Lung-Tan Hsiang, Tao Yuan County 325, Taiwan
*Tel : 886-3-407-1718; Fax: 886-3-407-1738

Report No.: **ISL-13LR006FC**

Issue Date : **2013/02/21**

VERIFICATION OF COMPLIANCE

Applicant:	ChipSiP Technology CO., Ltd.
Product Description:	5G +2.4G 2T/2R WLAN FMC
Brand Name:	Nane
Model No.:	Detail please refer to page 6
Model Difference:	Market segmentation
FCC ID:	O7N-CWFB211-XXX, it identifies a single equipment "X" is letter of the alphabet
Date of test:	2013/01/07 ~ 2013/01/19
Date of EUT Received:	2013/01/07

We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:	Dino Chen	***Date:***	2013/02/21
	Dion Chang / Engineer		
Prepared By:	Eva Kao	***Date:***	2013/02/21
	Eva Kao / Technical Supervisor		
Approved By:	Vincent Su	***Date:***	2013/02/21
	Vincent Su / Technical Manager		

Version

Version No.	Date	Description
00	2013/02/21	Initial creation of document

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1 GENERAL INFORMATION

General:

Product Name	5G +2.4G 2T/2R WLAN FMC			
Brand Name	Nane			
Model Name	CWFB210		CWFB211-D00	
	CWFB210-T01	CWFB210-R01	CWFB211-D01	CWFB212-L01
	CWFB210-T02	CWFB210-R02	CWFB211-D02	CWFB212-L02
	CWFB210-T03	CWFB210-R03	CWFB211-D03	CWFB212-L03
	CWFB210-T04	CWFB210-R04	CWFB211-D04	CWFB212-L04
	CWFB210-T05	CWFB210-R05	CWFB211-D05	CWFB212-L05
	CWFB210-T06	CWFB210-R06	CWFB211-D06	CWFB212-L06
	CWFB210-T07	CWFB210-R07	CWFB211-D07	CWFB212-L07
	CWFB210-T08	CWFB210-R08	CWFB211-D08	CWFB212-L08
	CWFB210-T09	CWFB210-R09	CWFB211-D09	CWFB212-L09
	CWFB210-T10	CWFB210-R10	CWFB211-D10	CWFB212-L10
Model Difference	Market segmentation			
Power Supply	3.7Vdc			

WLAN: 2X2 MIMO

Wi-Fi	Frequency Range (MHz)	Channels	Peak Rated Power	Modulation Technology
802.11b	2412 – 2462(DTS)	11	19.52dBm	DSSS
802.11g	2412 – 2462(DTS)	11	23.87dBm	DSSS, OFDM
802.11n	HT20 2412 – 2462(DTS)	11	23.77dBm	OFDM
	HT40 2422 – 2452(DTS)	7	23.71dBm	
802.11a	5180 – 5240(NII)	4	9.19dBm	OFDM
	5745 – 5825(DTS)	5	23.88dBm	
802.11n	HT20 5180 – 5240(NII)	4	8.65dBm	OFDM
	HT20 5745 – 5825(DTS)	5	24.81dBm	
	HT40 5190 – 5230(NII)	2	10.93dBm	
	HT40 5755 – 5795(DTS)	2	24.60dBm	
Modulation type		CCK, DQPSK, DBPSK for DSSS 64QAM. 16QAM, QPSK, BPSK for OFDM		
Transition Rate:		Upto 300Mbps		

Antenna Designation:

	Manufacturer	Model No.	Connector Type	Type	Gain (2.4GHz)	Gain (5GHz)
Ant 1	Airwave Technologies INC.	EDA-8709-25GR2-A4-RM	Revise SMA, unique	Dipole Ant	2 dBi	2 dBi
Ant 2	ARISTRTLE	RFA-25-C2S1-70-90	unique	Dipole Ant	2 dBi	2 dBi
Ant 3	Tranwo technology corp.	SD001-201003-A101	Revise SMA, unique	Dipole Ant	2dBi	2 dBi
Ant 3-1	Tranwo technology corp.	RFA-05-2-L14M3-B70-1	Revise SMA, unique	Dipole Ant	2dBi	2 dBi
Ant 3-2	Tranwo technology corp.	202-000442-00	unique	Patch Ant	0 dBi	-1 dBi
Ant 3-3	Tranwo technology corp.	202-000441-00	unique	Patch Ant	0.5 dBi	-0.5 dBi
Ant 4	UDM Group Technology Co., Ltd	26-52-01800G	unique	PCB Ant (Green)	2.5 dBi	4 dBi
Ant 5	Unictron Technologies Corporation	H2P566WKBA0100	unique	PCB Ant (Blue)	2.3 dBi	4dBi

The EUT is compliance with IEEE 802.11 a/b/g/n Standard. This report is applied for 2412-2464MHz and 5745-5825MHz.

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.1 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: O7N-CWFB211-XXX** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with Subpart B is authorized under a DoC procedure.

1.2 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2003). Radiated testing was performed at an antenna to EUT distance 3 meters.

KDB Document:

558074 D01 DTS Meas Guidance v02

1.3 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory** <Lung-Tan LAB> No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd., Lung-Tan Hsiang, Tao Yuan County 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003. FCC Registration Number is: TW1036, Canada Registration Number: 4067B-3.

1.4 Special Accessories

Not available for this EUT intended for grant.

1.5 Equipment Modifications

Not available for this EUT intended for grant.

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

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

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 requirements in Section 7 and 13 of ANSI C63.4-2003.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

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 according to the requirements in Section 8 and 13 of ANSI C63.4-2003.

2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	Notebook	IBM	X40	N/A	Shield	Non-shield
2	Kit	N/A	N/A	N/A	Shield	Non-shield

3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3),(4)	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

4 DESCRIPTION OF TEST MODES

The EUT has been tested under engineering operating condition.
Test program used to control the EUT for staying in continuous transmitting mode is programmed.

2.4GHz:
802.11 b mode: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 1Mbps lowest data rate are chosen for pre-test testing of radiated emissions.
802.11 g mode: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 6Mbps lowest data rate are chosen for pre-test testing of radiated emissions.
802.11 n HT20: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 6.5Mbps lowest data rate are chosen for pre-test testing of radiated emissions.
802.11 n HT40: Channel low (2422MHz)、mid (2437MHz) and high (2452MHz) with 13.5Mbps lowest data rate are chosen for pre-test testing of radiated emissions.

5745-5825MHz:
802.11a mode: Channel low (5745MHz)、mid (5785MHz) and high (5825MHz) with 6Mbps lowest data rate are chosen for pre-test testing of radiated emissions.
802.11 n HT20: Channel low (5745MHz)、mid (5785MHz) and high (5825MHz) with 6.5Mbps lowest data rate are chosen for pre-test testing of radiated emissions.
802.11 n HT40: Channel low (5755MHz) and high (5795MHz) with 13.5Mbps lowest data rate are chosen for pre-test testing of radiated emissions.

The worst case 802.11 n HT20 (5GHz) with antenna 4 was reported for Radiated Emission.

5 CONDUCTED EMISSION TEST

5.1 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.		

5.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Conduction 03 -1 Cable	WOKEN	CFD 300-NL	Conduction 0-1	06/28/2012	06/28/2013
EMI Receiver 12	ROHDE & SCHWARZ	ESCI	100804	07/13/2012	07/13/2013
LISN 07	FCC Inc.	FCC-LISN-50-100-4-02	07040	07/13/2012	07/13/2013
LISN 08	FCC	FCC-LISN50-25-2-01	07039	07/13/2012	07/13/2013

5.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2003.
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.

5.4 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 frequency measured were complete.

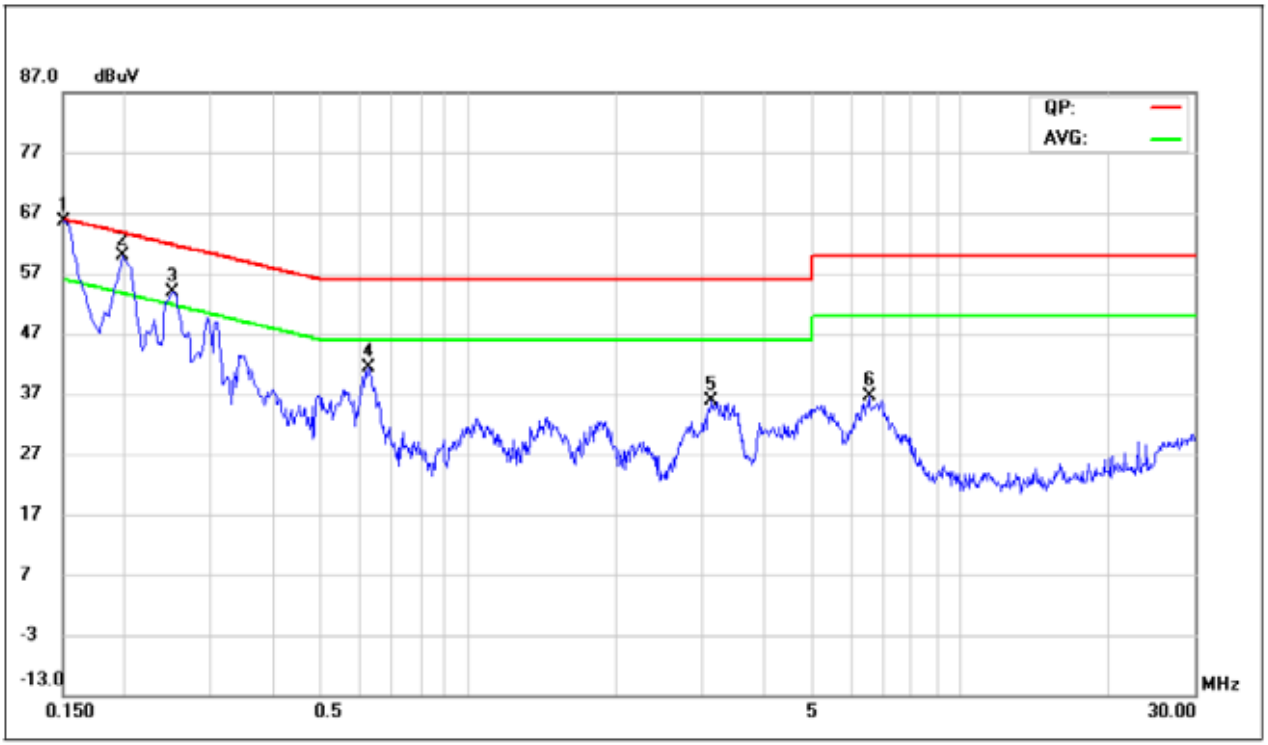
5.5 Measurement Result:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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

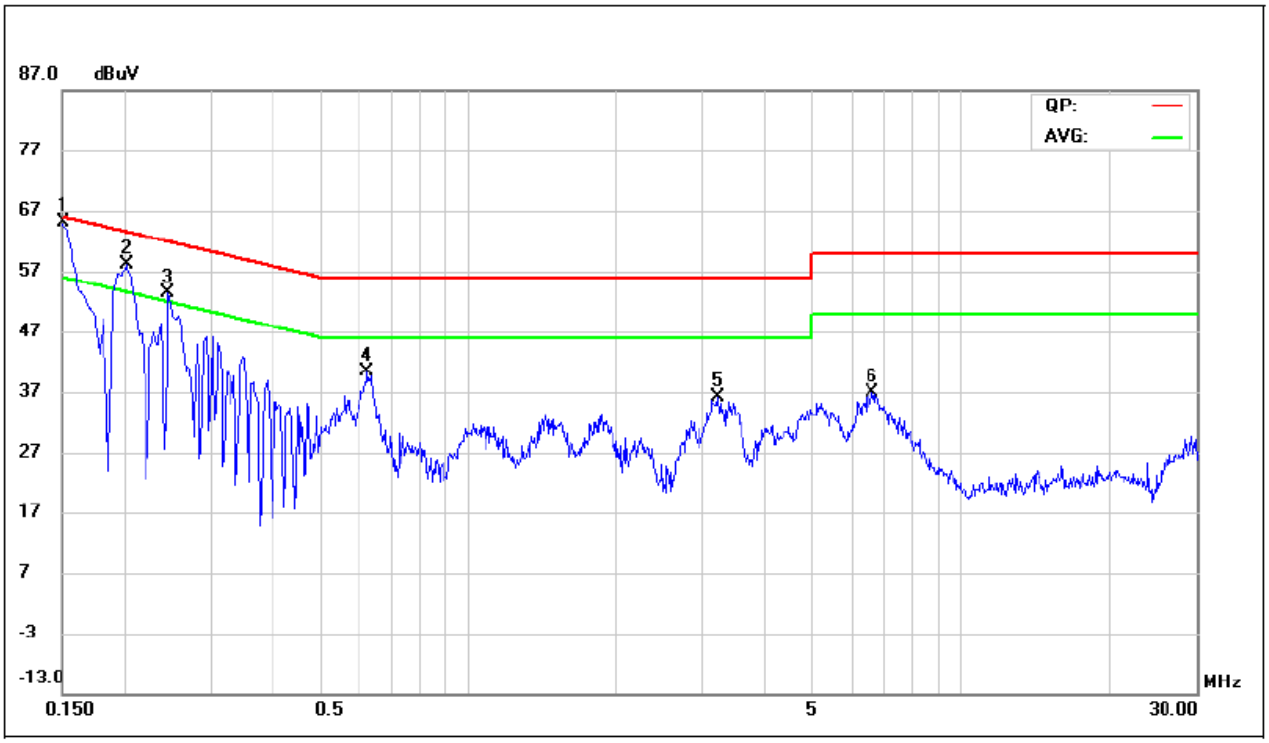
AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation Mode	Test Date:	2013/01/17
Test By:	Dino		



Site:	Conduction 04	Phase: L1	Temperature(℃):26(℃)
Condition:	CISPR13 Class B Conduction		Humidity:54%
		Power:	AC 120V/60Hz

No.	Frequency)	reading(dBuV)			Factor(dB)	Measurement(dBuV)			limit(dBuV)		margin(dB)		Comment
	(MHz)	Peak	QP	AVG	(dB)	Peak	QP	AVG	P/Q	AVG	P/Q	AVG	
1	0.1516	56.77	53.97	39.66	9.58	66.35	63.55	49.24	65.91	55.91	-2.36	-6.67	
2	0.1980	50.23	47.29	33.14	9.59	59.82	56.88	42.73	63.69	53.69	-6.81	-10.96	
3	0.2500	45.13	41.78	29.18	9.59	54.72	51.37	38.77	61.76	51.76	-10.39	-12.99	
4	0.6300	33.00	28.97	23.35	9.60	42.60	38.57	32.95	56.00	46.00	-17.43	-13.05	
5	3.1260	25.97	21.27	15.36	9.60	35.57	30.87	24.96	56.00	46.00	-25.13	-21.04	
6	6.5500	26.69	22.23	16.64	9.63	36.32	31.86	26.27	60.00	50.00	-28.14	-23.73	



Site:	Conduction 04	Phase: N	Temperature(℃):26(℃)
Condition:	CISPR13 Class B Conduction		Humidity:54%
Compamy:	景鉅	Power:	AC 120V/60Hz

No.	Frequency)	reading(dBuV)			Factor(dB)`	Measurement(dBuV)			limit(dBuV)		margin(dB)		Comment
	(MHz)	Peak	QP	AVG	(dB)	Peak	QP	AVG	P/Q	AVG	P/Q	AVG	
1	0.1500	31.43	23.72	19.59	9.59	41.02	33.31	29.18	66.00	56.00	-32.69	-26.82	
2	0.2020	49.00	46.13	30.70	9.59	58.59	55.72	40.29	63.53	53.53	-7.81	-13.24	
3	0.2460	43.95	39.26	24.10	9.59	53.54	48.85	33.69	61.89	51.89	-13.04	-18.20	
4	0.6260	31.51	27.80	22.10	9.60	41.11	37.40	31.70	56.00	46.00	-18.60	-14.30	
5	3.2100	27.08	22.14	15.91	9.60	36.68	31.74	25.51	56.00	46.00	-24.26	-20.49	
6	6.6100	28.52	22.46	16.76	9.63	38.15	32.09	26.39	60.00	50.00	-27.91	-23.61	

6 PEAK /AVERAGE UTPUT POWER MEASUREMENT

6.1 Standard Applicable:

According to §15.247(b)(3),(4)(b)

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 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.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

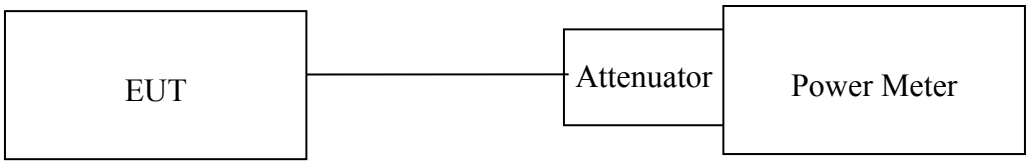
(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

6.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Power Meter 05	Anritsu	ML2495A	1116010	04/17/2012	04/16/2013
Power Sensor 05	Anritsu	MA2411B	34NKF50	04/16/2012	04/15/2013
Temperature Chamber	KSON	THS-B4H100	2287	03/03/2012	03/02/2013
DC Power supply	ABM	51850	N/A	06/17/2012	06/16/2013
AC Power supply	EXTECH	CFC105W	NA	12/19/2012	12/18/2013
Splitter	MCLI	PS4-199	12465	07/18/2012	07/17/2013
Spectrum analyzer	Agilent	N9030A	MY51360021	03/11/2012	03/10/2013

6.3 Test Set-up:



6.4 Measurement Procedure:

Refer to section 8.1 and 8.2 of KDB Document: 558074 D01 DTS Meas Guidance v02

6.5 Measurement Result:

802.11b

Cable loss = 0		Output Power		Limit (dBm)
CH	Frequency (MHz)	Detector		
		PK (dBm)	AV (dBm)	
1	2412	19.20	17.13	30
6	2437	19.29	17.15	
11	2462	19.52	17.31	

802.11g

Cable loss = 0		Output Power		Limit (dBm)
CH	Frequency (MHz)	Detector		
		PK (dBm)	AV (dBm)	
1	2412	23.45	11.68	30
6	2437	23.73	15.66	
11	2462	23.87	13.75	

802.11n for 2.4GHz
Peak Measurement:
2*2 MIMO

Channel		Frequency (MHz)	Output Chain (dBm)		Combine Output Power (dBm)	Limit(dBm)	Result
			Chain A	chain B			
AN HT20	1	2412	19.23	18.22	21.76	30	Pass
	6	2437	21.24	20.22	23.77	30	Pass
	11	2462	20.24	19.74	23.01	30	Pass
AN HT40	3	2422	18.26	19.18	21.75	30	Pass
	6	2437	20.87	20.52	23.71	30	Pass
	9	2452	18.78	19.05	21.93	30	Pass

Average Measurement
2*2 MIMO

Channel		Frequency (MHz)	Output Chain (dBm)		Combine Output Power (dBm)	Limit(dBm)	Result
			Chain A	chain B			
AN HT20	1	2412	9.43	9.62	12.54	30	Pass
	6	2437	11.87	10.89	14.42	30	Pass
	11	2462	9.91	10.25	13.09	30	Pass
AN HT40	3	2422	8.83	9.18	12.02	30	Pass
	6	2437	11.61	11.24	14.44	30	Pass
	9	2452	9.23	9.56	12.41	30	Pass

802.11a(5G)

Cable loss = 0		Output Power		Limit (dBm)
CH	Frequency (MHz)	Detector		
		PK (dBm)	AV (dBm)	
149	5745	23.15	14.28	30
153	5765	23.08	14.11	
157	5785	23.88	14.01	
161	5805	23.42	13.84	
165	5825	20.93	10.63	

802.11n for 5GHz
Peak Measurement:
2*2 MIMO

Channel		Frequency (MHz)	Output Chain (dBm)		Combine Output Power (dBm)	Limit(dBm)	Result
			Chain A	chain B			
AN HT20	149	5745	22.51	21.16	24.70	30	Pass
	153	5765	22.46	20.84	24.74	30	Pass
	157	5785	22.62	20.79	24.81	30	Pass
	161	5805	22.51	20.66	24.69	30	Pass
	165	5825	22.39	20.61	24.60	30	Pass
AN HT40	151	5755	22.44	20.48	24.58	30	Pass
	159	5795	22.17	19.79	24.15	30	Pass

Average Measurement
2*2 MIMO

Channel		Frequency (MHz)	Output Chain (dBm)		Combine Output Power (dBm)	Limit(dBm)	Result
			Chain A	chain B			
AN HT20	149	5745	11.04	10.82	13.94	30	Pass
	153	5765	11.86	10.22	14.13	30	Pass
	157	5785	11.63	10.61	14.16	30	Pass
	161	5805	11.33	10.24	13.83	30	Pass
	165	5825	11.57	10.66	14.15	30	Pass
AN HT40	151	5755	11.73	10.61	14.22	30	Pass
	159	5795	11.22	10.03	13.68	30	Pass

7 6dB Bandwidth(EBW)

7.1 Standard Applicable:

According to §15.247(a)(2), Systems using digital modulation techniques may operate in the 902 - 928 MHz,2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500kHz.

7.2 Measurement Equipment Used:

Refer to section 6.2 for details.

7.3 Test Set-up:

Refer to section 6.3 for details.

7.4 Measurement Procedure:

Refer to section 7.0 6dB EBW Measurement Procedure of KDB Document: 558074 D01 DTS Meas Guidance v02

1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW). (802.11b/g/n_HT20MHz =200KHz),(802.11n_HT40=400KHz)
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

7.5 Measurement Result:

2.4GHz

802.11b

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
2412	10.10	> 500	PASS
2437	10.10	> 500	PASS
2462	10.10	> 500	PASS

802.11g

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
2412	16.58	> 500	PASS
2437	16.58	> 500	PASS
2462	16.58	> 500	PASS

802.11n HT20

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
2412	17.74	> 500	PASS
2437	17.68	> 500	PASS
2462	17.69	> 500	PASS

802.11n HT40

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
2422	36.40	> 500	PASS
2437	36.36	> 500	PASS
2452	36.10	> 500	PASS

5GHz

802.11a

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
5745	16.55	> 500	PASS
5785	16.53	> 500	PASS
5825	16.54	> 500	PASS

802.11n 20MHz

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
5745	17.74	> 500	PASS
5785	17.79	> 500	PASS
5825	17.71	> 500	PASS

802.11n 40MHz

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
5755	36.40	> 500	PASS
5795	36.44	> 500	PASS

Note: Refer to next page for plots.

802.11b

6dB Band Width Test Data CH-Low

6dB Band Width Test Data CH-Mid

6dB Band Width Test Data CH-High

802.11g

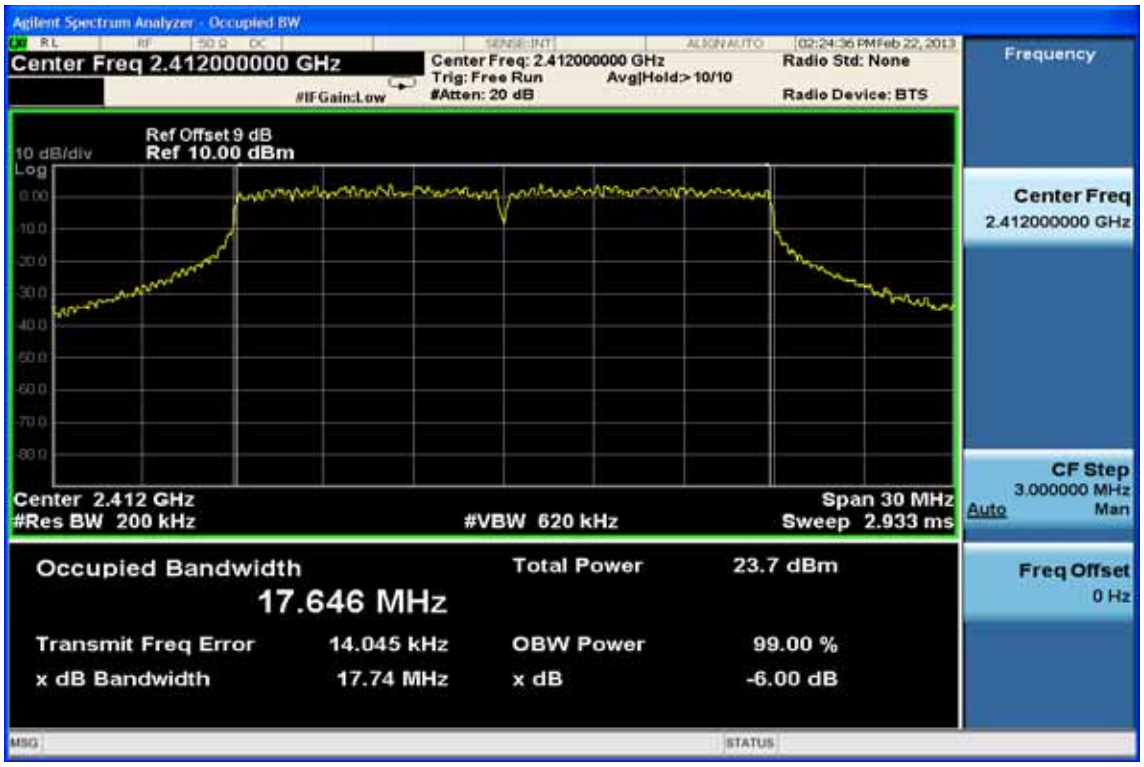
6dB Band Width Test Data CH-Low

6dB Band Width Test Data CH-Mid

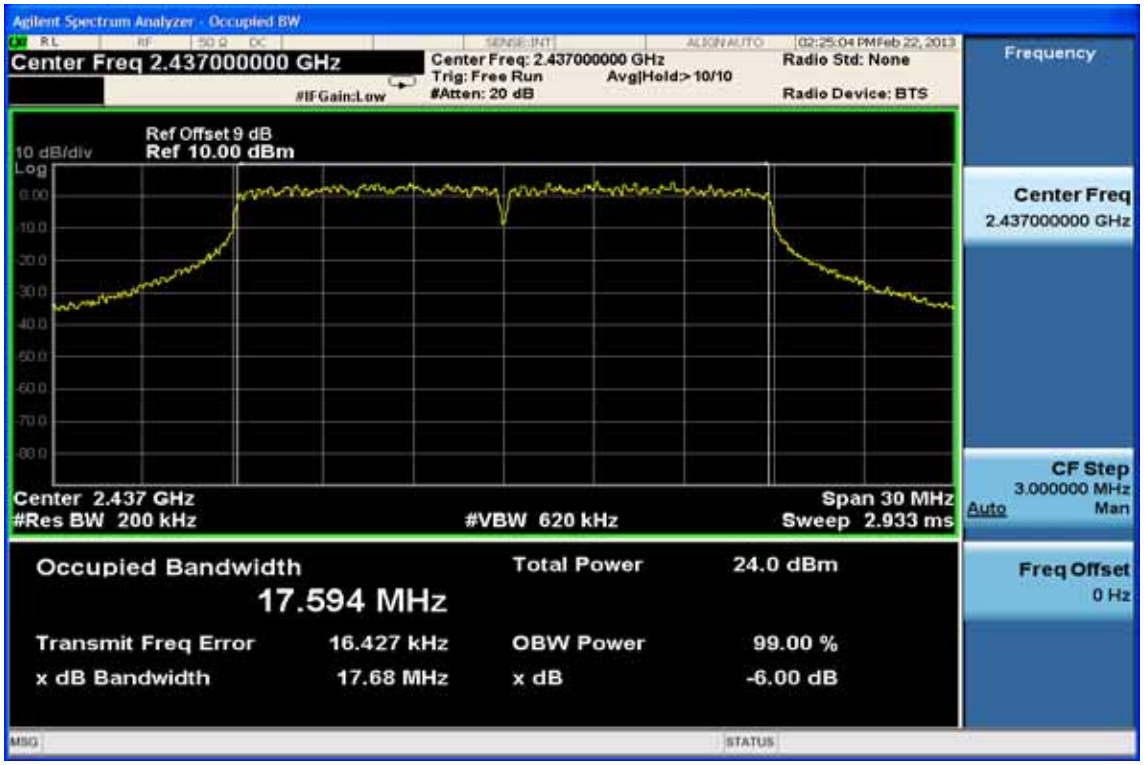
6dB Band Width Test Data CH-High

802.11n_20M for 2.4GHz

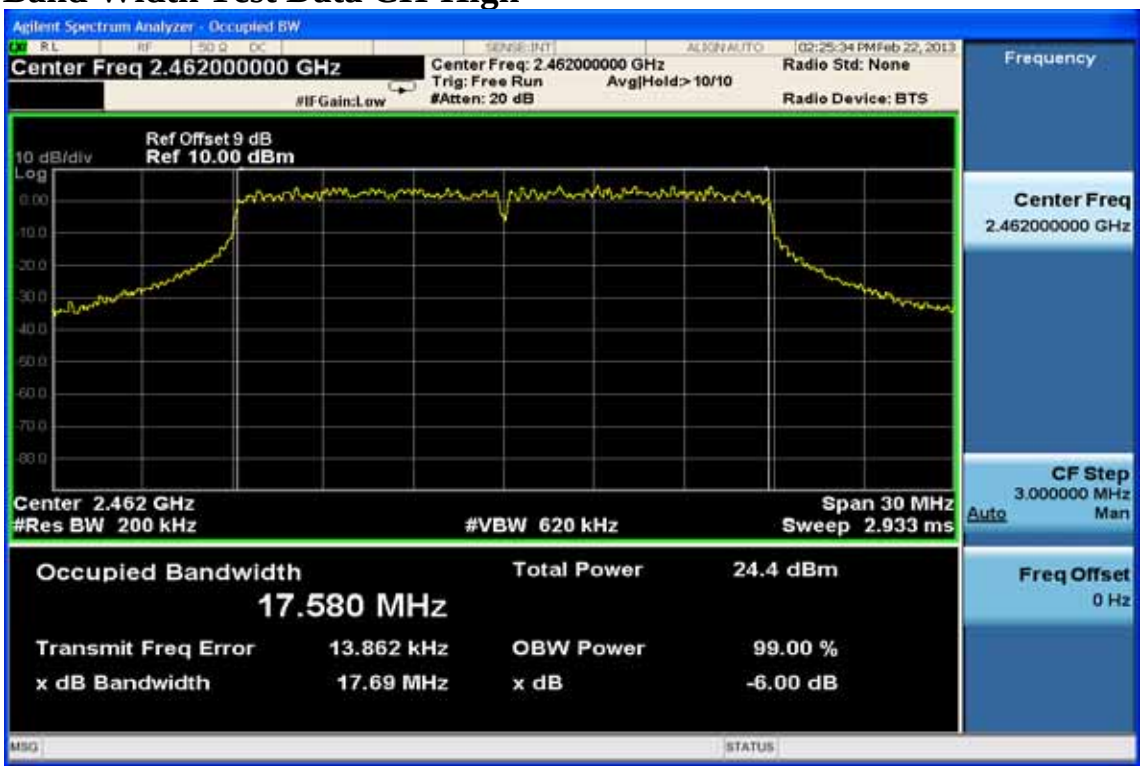
6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid

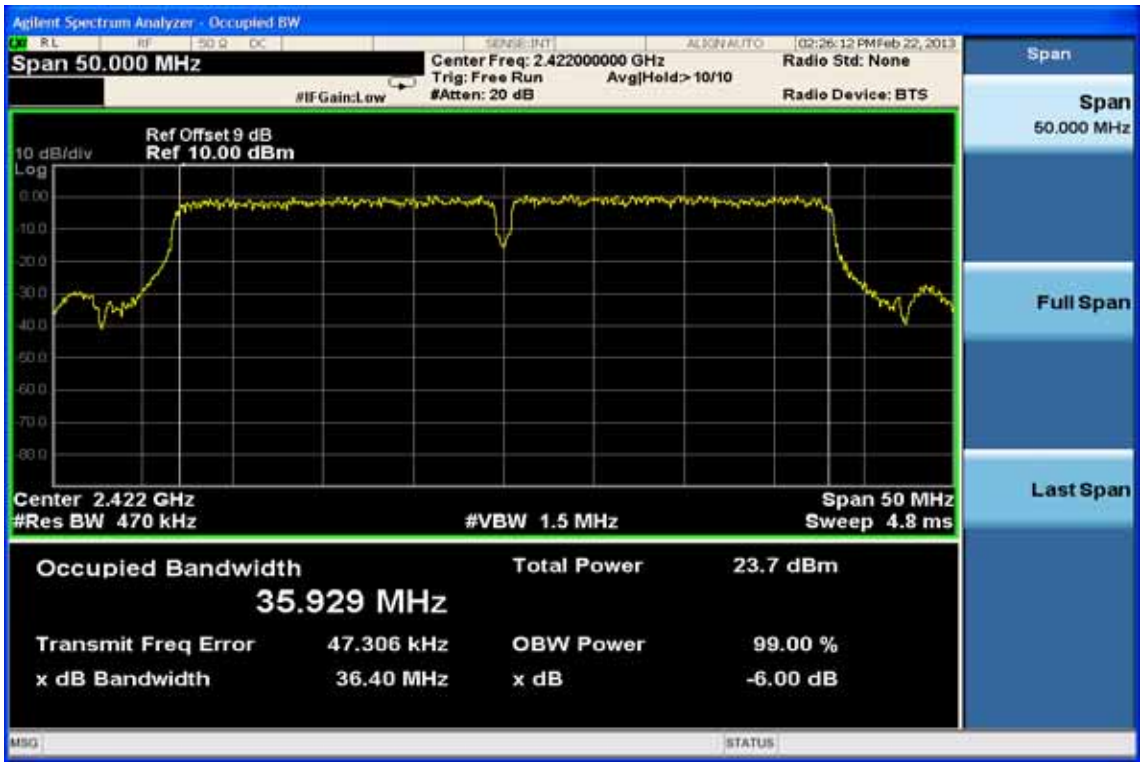


6dB Band Width Test Data CH-High

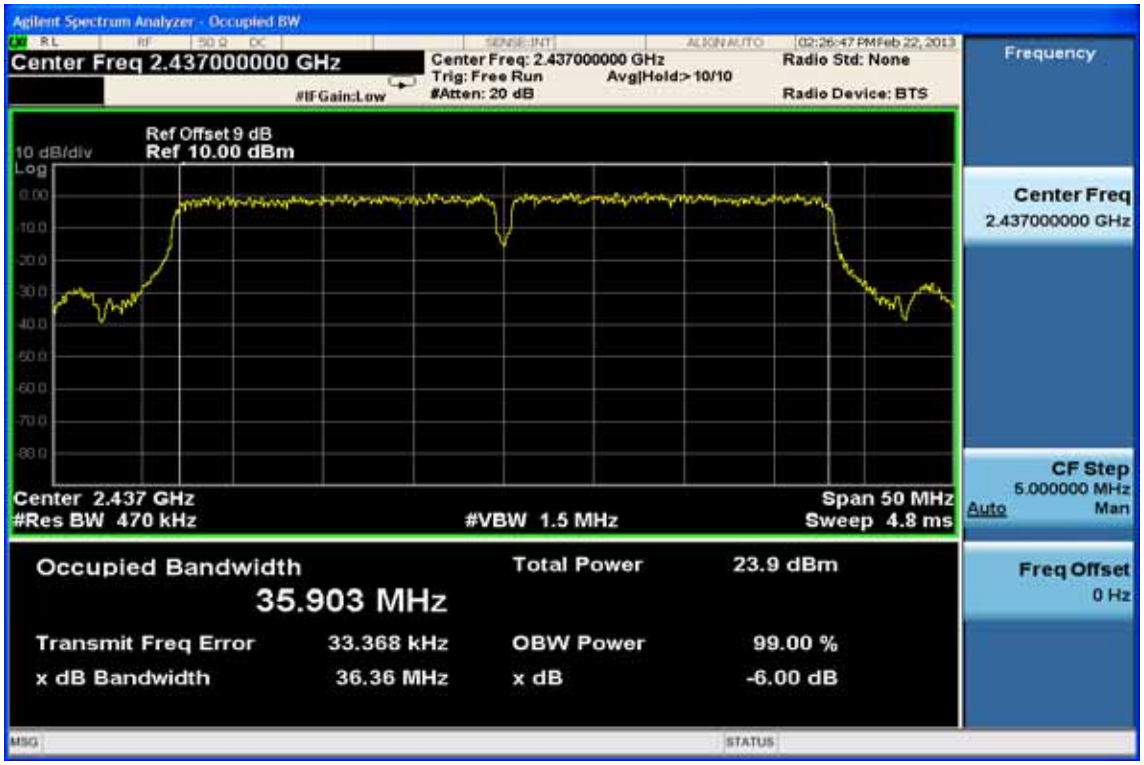


802.11n_40M for 2.4GHz

6dB Band Width Test Data CH-Low



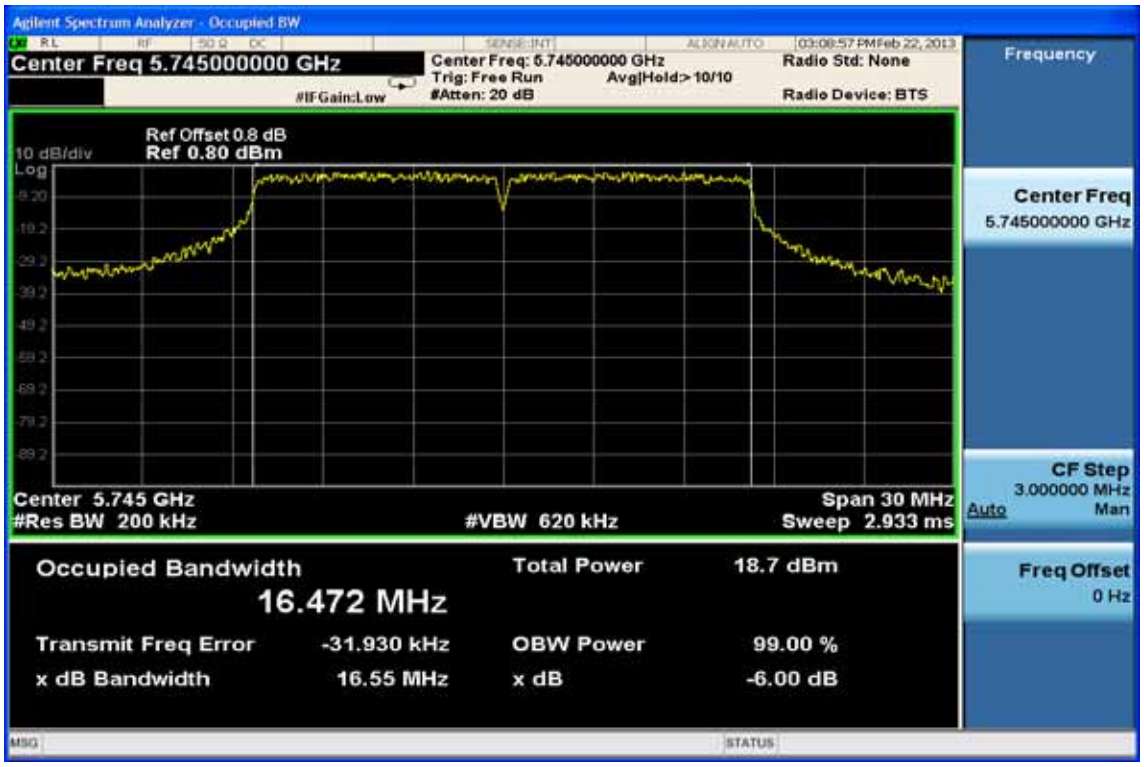
6dB Band Width Test Data CH-Mid



6dB Band Width Test Data CH-High

802.11a

6dB Band Width Test Data CH-Low

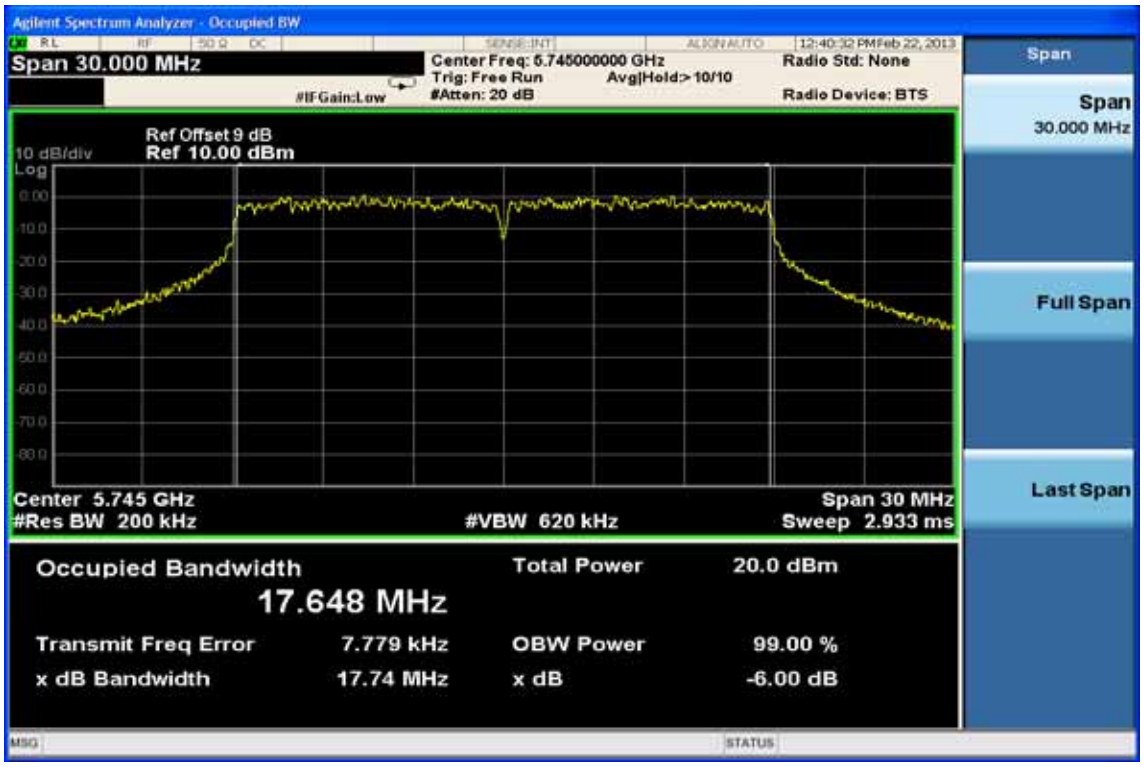


6dB Band Width Test Data CH-Mid

6dB Band Width Test Data CH-High

802.11n_20M for 5GHz

6dB Band Width Test Data CH-Low

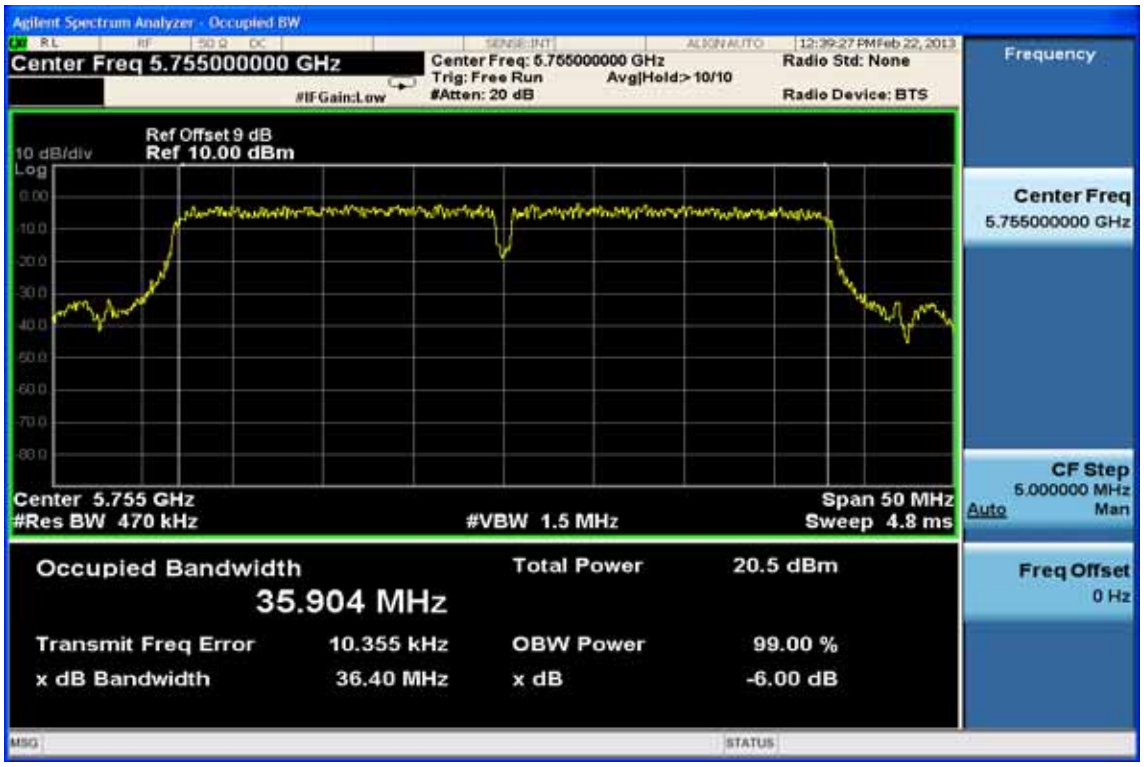


6dB Band Width Test Data CH-Mid

6dB Band Width Test Data CH-High

802.11n_40M for 5GHz

6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-High

8 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

8.1 Standard Applicable:

According to §15.247(c), 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 100KHz 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).

8.2 Measurement Equipment Used:

8.2.1 Conducted Emission at antenna port:

Refer to section 6.2 for details.

8.2.2 Radiated emission:

Chamber 14(966)					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer 21(26.5GHz)	Agilent	N9010A	MY49060537	07/17/2012	07/16/2013
Spectrum Analyzer 20(6.5GHz)	Agilent	E4443A	MY48250315	05/24/2012	05/23/2013
Spectrum Analyzer 22(43GHz)	R&S	FSU43	100143	04/25/2012	04/24/2013
Dipole antenna	SCHWARZBECK	VHAP,30-300	919	11/16/2011	11/15/2013
Dipole antenna	SCHWARZBECK	UHAP,300-1000	1195	10/25/2011	10/24/2013
Loop Antenna9K-30M	A.H.SYSTEM	SAS-564	294	02/28/2011	02/27/2013
Bilog Antenna30-1G	Schaffner	CBL 6111B	2756	01/13/2013	01/12/2014
Horn antenna1-18G	COM-POWER	AH118	2011071401	03/01/2012	02/29/2013
Horn antenna1-18G(06)	EMCO	3117	0006665	10/15/2012	10/14/2013
Horn antenna26-40G(05)	Com-power	AH-640	100A	01/09/2013	01/08/2015
Horn antenna18-26G(04)	Com-power	AH-826	081001	05/04/2011	05/03/2013
Preamplifier9-1000M	HP	8447D	NA	02/10/2012	02/09/2013
Preamplifier1-18G	MITEQ	AFS44-00101800-25-10P-44	1329256	07/23/2012	07/22/2013
Preamplifier1-26G	EM	EM01M26G	NA	02/21/2012	02/202013
Preamplifier26-40G	MITEQ	JS-26004000-27-5A	818471	05/21/2011	05/20/2013
Cable1-18G	HUBER SUHNER	Sucoflex 106	NA	02/10/2012	02/09/2013
Cable UP to 1G	HUBER SUHNER	RG 214/U	NA	10/08/2012	10/07/2013
SUCOFLEX 1GHz~40GHz cable	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	09/21/2011	09/20/2013
Signal Generator	R&S	SMU200A	102330	02/07/2012	02/06/2013
Signal Generator	Anritsu	MG3692A	20311	09/18/2012	09/17/2013
2.4G Filter	Micro-Tronics	Brm50702	76	12/27/2012	12/26/2013
5G Filter	Micro-Tronics	Brm50716	005	12/27/2012	12/26/2013

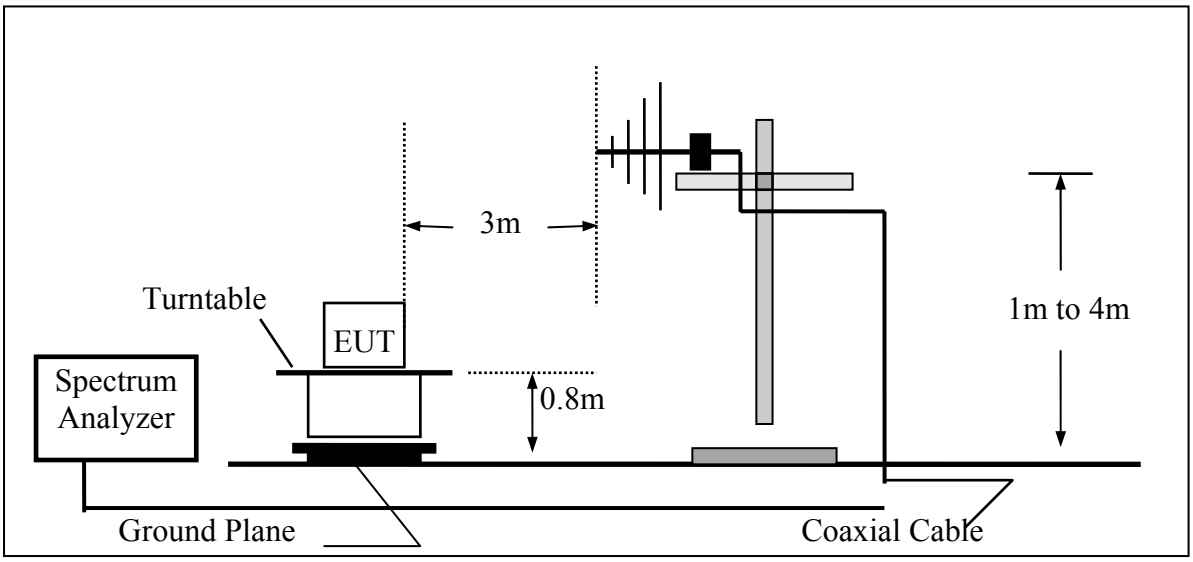
8.3 Test SET-UP:

8.3.1 Conducted Emission at antenna port:

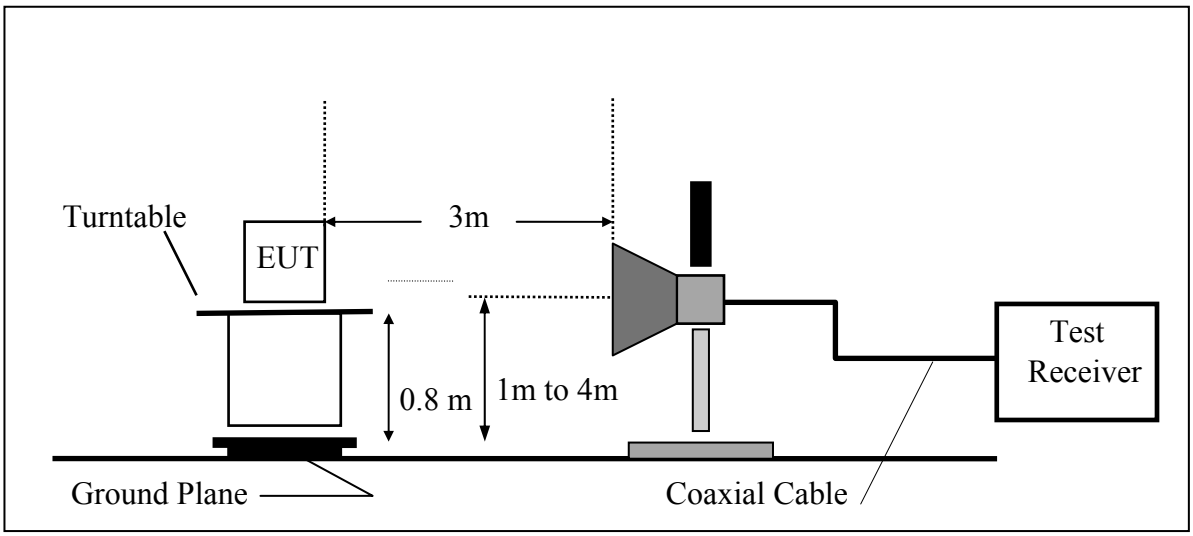
Refer to section 6.3 for details.

8.3.2 Radiated emission:

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



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



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 center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

Refer to section 10.2.5 Band-Edge Measurements of KDB Document: 558074 D01 DTS Meas Guidance v02

The measurement of unwanted emissions at the edge of the authorized frequency bands can be complicated by the leakage of RF energy from the fundamental emission into the RBW pass band. Thus, for measurements at the band edges, a narrower resolution bandwidth (no less than 10 kHz) can be used within the first 1 MHz beyond the fundamental emission, provided that that measured energy is subsequently integrated over the appropriate reference bandwidth (i.e., 100 kHz or 1 MHz). This integration can be performed using the band power function of the spectrum analyzer or by summing the spectral levels (in linear power units) over the appropriate reference bandwidth.

8.5 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	

8.6 Measurement Result:

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

802.11b

Band Edges Test Data CH-Low

Band Edges Test Data CH-High

Radiated Emission: 802.11b mode

Operation Mode	TX CH Low	Test Date	2013/01/14
Fundamental Frequency	2412 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2385.94	59.19	-11.26	47.93	74.00	-26.07	Peak	VERTICAL
2	2390.00	55.56	-11.25	44.31	74.00	-29.69	Peak	VERTICAL
1	2386.61	61.64	-11.26	50.38	54.00	-3.62	Average	HORIZONTAL
2	2386.61	70.22	-11.26	58.96	74.00	-15.04	Peak	HORIZONTAL
3	2390.00	55.71	-11.25	44.46	54.00	-9.54	Average	HORIZONTAL
4	2390.00	64.29	-11.25	53.04	74.00	-20.96	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2013/01/14
Fundamental Frequency	2462 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2483.50	59.28	-11.01	48.27	74.00	-25.73	Peak	VERTICAL
2	2488.14	61.69	-11.00	50.69	74.00	-23.31	Peak	VERTICAL
1	2483.50	58.04	-11.01	47.03	54.00	-6.97	Average	HORIZONTAL
2	2483.50	66.62	-11.01	55.61	74.00	-18.39	Peak	HORIZONTAL
3	2487.42	62.01	-11.00	51.01	54.00	-2.99	Average	HORIZONTAL
4	2487.42	70.59	-11.00	59.59	74.00	-14.41	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

802.11g

Band Edges Test Data CH-Low

Band Edges Test Data CH-High

Radiated Emission: 802.11g mode

Operation Mode	TX CH Low	Test Date	2013/01/14
Fundamental Frequency	2412 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2390.00	49.64	-11.25	38.39	54.00	-15.61	Average	VERTICAL
2	2390.00	67.80	-11.25	56.55	74.00	-17.45	Peak	VERTICAL
1	2390.00	62.48	-11.25	51.23	54.00	-2.77	Average	HORIZONTAL
2	2390.00	80.64	-11.25	69.39	74.00	-4.61	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2013/01/14
Fundamental Frequency	2462 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2483.50	53.33	-11.01	42.32	54.00	-11.68	Average	VERTICAL
2	2483.50	71.49	-11.01	60.48	74.00	-13.52	Peak	VERTICAL
1	2483.50	63.63	-11.01	52.62	54.00	-1.38	Average	HORIZONTAL
2	2483.50	81.79	-11.01	70.78	74.00	-3.22	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

802.11n_20M for 2.4GHz (antenna A port), Conducted

Band Edges Test Data CH-Low

Band Edges Test Data CH-High

802.11n_20M for 2.4GHz (antenna B port)

Band Edges Test Data CH-Low

Band Edges Test Data CH-High

Radiated Emission: 802.11 n_20M mode

Operation Mode	TX CH Low	Test Date	2013/01/14
Fundamental Frequency	2412 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2390.00	62.94	-11.25	51.69	74.00	-22.31	Peak	VERTICAL
1	2390.00	63.29	-11.25	52.04	54.00	-1.96	Average	HORIZONTAL
2	2390.00	76.09	-11.25	64.84	74.00	-9.16	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2013/01/14
Fundamental Frequency	2462 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2483.50	52.72	-11.01	41.71	54.00	-12.29	Average	VERTICAL
2	2483.50	65.52	-11.01	54.51	74.00	-19.49	Peak	VERTICAL
1	2483.50	63.71	-11.01	52.70	54.00	-1.30	Average	HORIZONTAL
2	2483.50	76.51	-11.01	65.50	74.00	-8.50	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

802.11n_40M for 2.4GHz (antenna A port), Conducted

Band Edges Test Data CH-Low

Band Edges Test Data CH-High

802.11n_40M for 2.4GHz (antenna B port)

Band Edges Test Data CH-Low

Band Edges Test Data CH-High

Radiated Emission: 802.11 n_40M mode

Operation Mode	TX CH Low	Test Date	2013/01/14
Fundamental Frequency	2422 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2387.50	53.55	-11.26	42.29	54.00	-11.71	Average	VERTICAL
2	2387.50	67.48	-11.26	56.22	74.00	-17.78	Peak	VERTICAL
3	2390.00	51.72	-11.25	40.47	54.00	-13.53	Average	VERTICAL
4	2390.00	65.66	-11.25	54.41	74.00	-19.59	Peak	VERTICAL
1	2388.40	63.45	-11.25	52.20	54.00	-1.80	Average	HORIZONTAL
2	2388.40	77.39	-11.25	66.14	74.00	-7.86	Peak	HORIZONTAL
3	2390.00	60.17	-11.25	48.92	54.00	-5.08	Average	HORIZONTAL
4	2390.00	74.11	-11.25	62.86	74.00	-11.14	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2013/01/14
Fundamental Frequency	2452 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2483.49	63.41	-11.01	52.40	74.00	-21.60	Peak	VERTICAL
2	2485.46	53.12	-11.00	42.12	54.00	-11.88	Average	VERTICAL
3	2485.46	67.07	-11.00	56.07	74.00	-17.93	Peak	VERTICAL
1	2483.50	63.86	-11.01	52.85	54.00	-1.15	Average	HORIZONTAL
2	2483.50	77.90	-11.01	66.89	74.00	-7.11	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

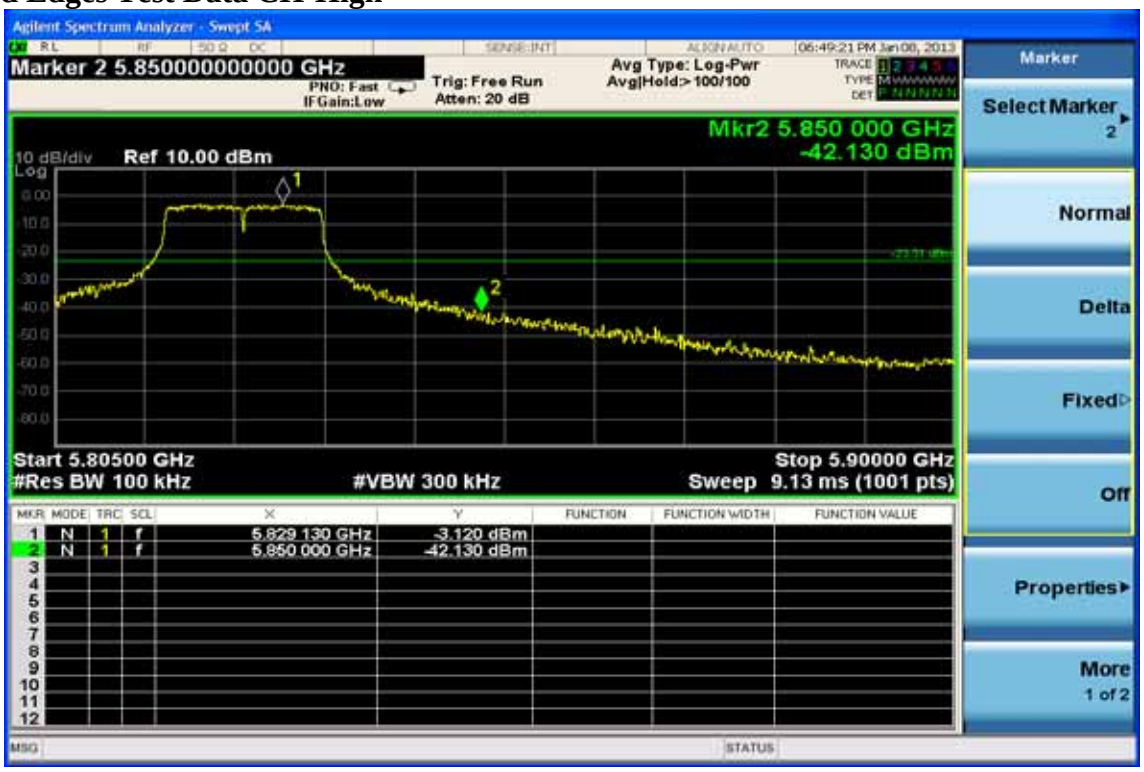
4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

802.11a

Band Edges Test Data CH-Low

Band Edges Test Data CH-High



Radiated Emission: 802.11a mode

Operation Mode	TX CH Low	Test Date	2013/01/14
Fundamental Frequency	5745 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	5725.00	50.31	0.23	50.54	54.00	-3.46	Average	VERTICAL
2	5725.00	62.92	0.23	63.15	74.00	-10.85	Peak	VERTICAL
1	5725.00	50.50	0.23	50.73	54.00	-3.27	Average	HORIZONTAL
2	5725.00	63.11	0.23	63.34	74.00	-10.66	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2013/01/14
Fundamental Frequency	5825 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	5850.00	49.00	0.56	49.56	54.00	-4.44	Average	VERTICAL
2	5850.00	61.62	0.56	62.18	74.00	-11.82	Peak	VERTICAL
1	5850.00	46.66	0.56	47.22	54.00	-6.78	Average	HORIZONTAL
2	5850.00	59.28	0.56	59.84	74.00	-14.16	Peak	HORIZONTAL
3	5851.08	51.74	0.56	52.30	54.00	-1.70	Average	HORIZONTAL
4	5851.08	64.35	0.56	64.91	74.00	-9.09	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

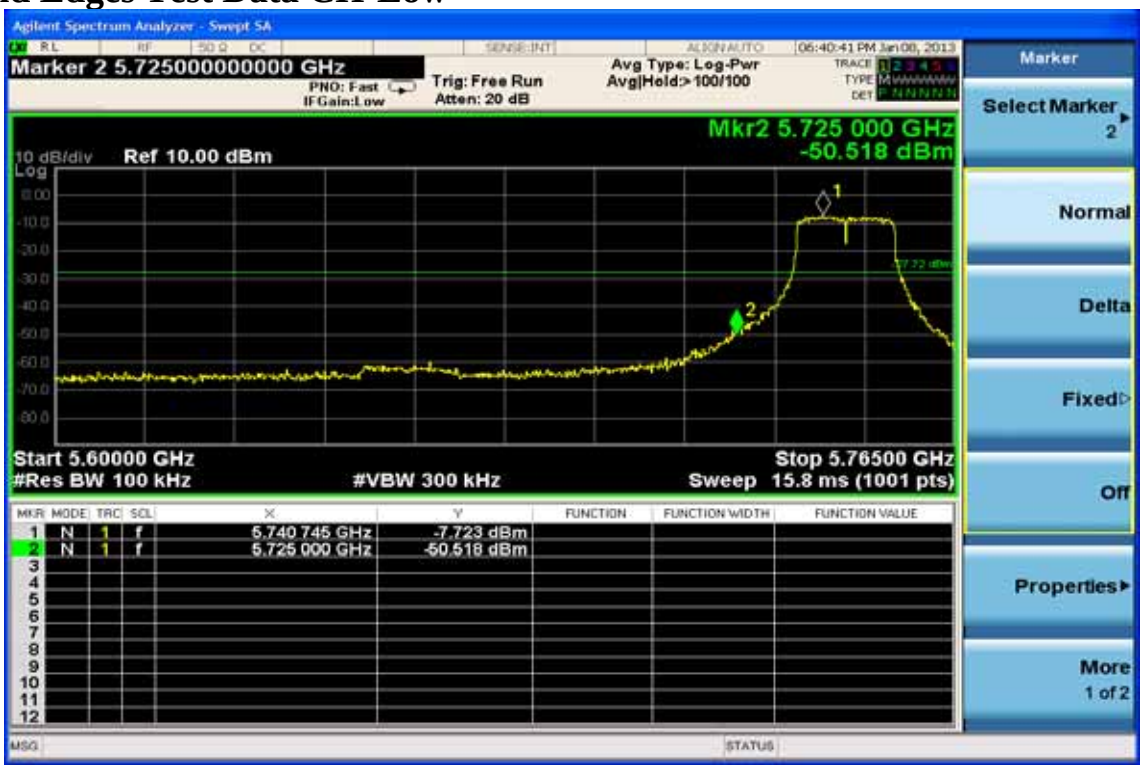
3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

802.11n_20M for 5GHz (antenna A port), Conducted

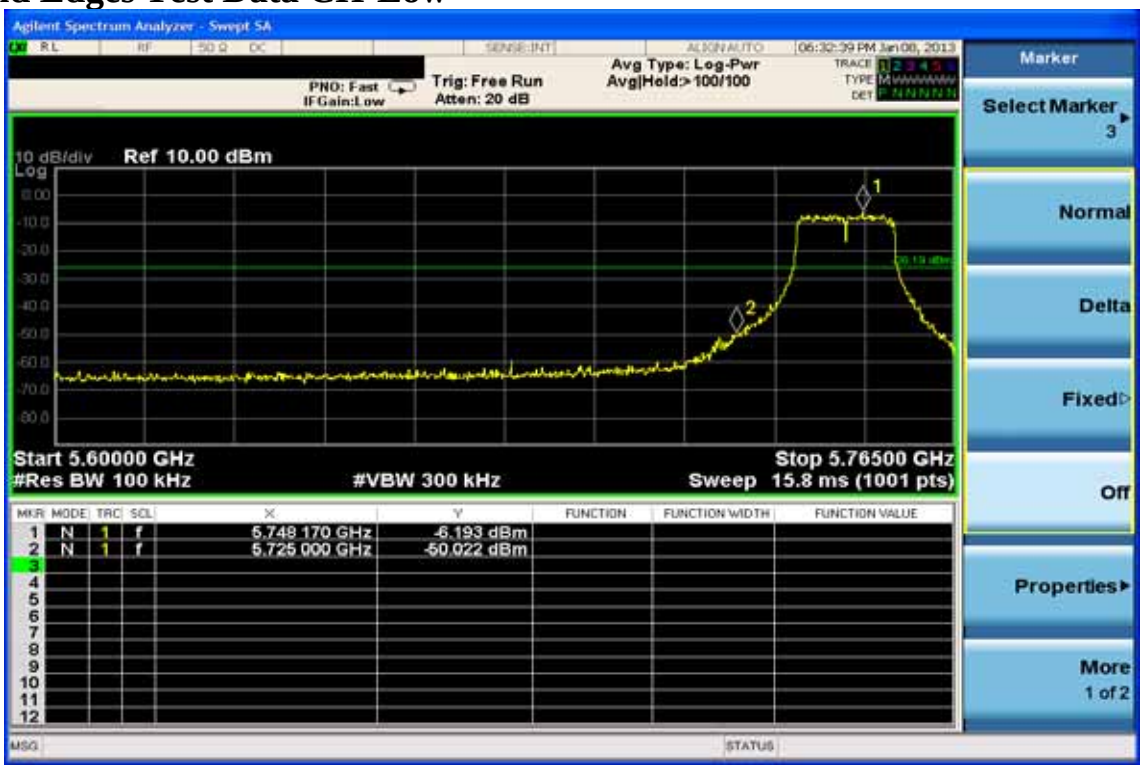
Band Edges Test Data CH-Low



Band Edges Test Data CH-High

802.11n_20M for 5GHz (antenna B port)

Band Edges Test Data CH-Low



Band Edges Test Data CH-High

Radiated Emission: 802.11 n_20M mode

Operation Mode	TX CH Low	Test Date	2013/01/14
Fundamental Frequency	5745 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	5725.00	49.92	0.23	50.15	74.00	-23.85	Peak	VERTICAL
1	5725.00	42.63	0.23	42.86	54.00	-11.14	Average	HORIZONTAL
2	5725.00	56.63	0.23	56.86	74.00	-17.14	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2013/01/14
Fundamental Frequency	5825 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	5850.00	51.76	0.56	52.32	54.00	-1.68	Average	VERTICAL
2	5850.00	65.76	0.56	66.32	74.00	-7.68	Peak	VERTICAL
1	5850.00	51.76	0.56	52.32	54.00	-1.68	Average	HORIZONTAL
2	5850.00	65.76	0.56	66.32	74.00	-7.68	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

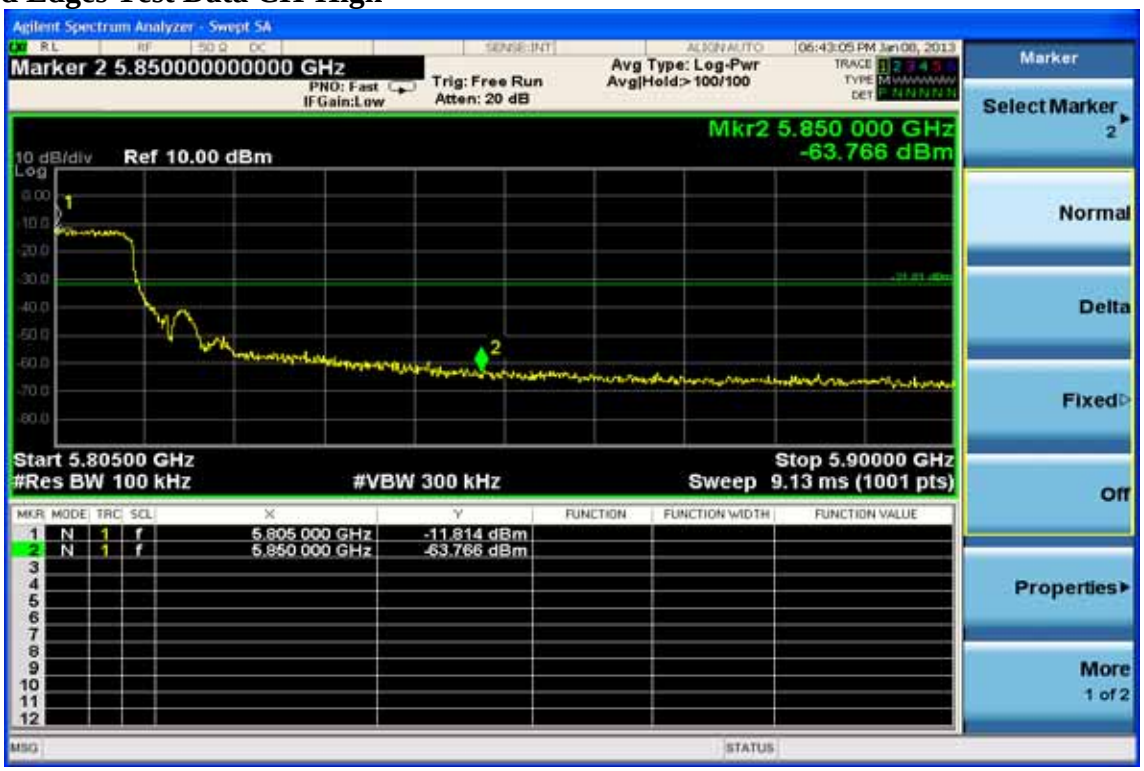
4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

802.11n_40M for 5GHz (antenna A port), Conducted

Band Edges Test Data CH-Low

Band Edges Test Data CH-High



802.11n_40M for 5GHz (antenna B port)

Band Edges Test Data CH-Low

Band Edges Test Data CH-High

Radiated Emission: 802.11 n_40M mode

Operation Mode	TX CH Low	Test Date	2013/01/14
Fundamental Frequency	5755 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	5725.00	39.96	0.23	40.19	54.00	-13.81	Average	VERTICAL
2	5725.00	53.96	0.23	54.19	74.00	-19.81	Peak	VERTICAL
1	5725.00	43.76	0.23	43.99	54.00	-10.01	Average	HORIZONTAL
2	5725.00	57.76	0.23	57.99	74.00	-16.01	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2013/01/14
Fundamental Frequency	5795 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	5850.00	46.63	0.56	47.19	74.00	-26.81	Peak	VERTICAL
2	5850.79	50.87	0.56	51.43	74.00	-22.57	Peak	VERTICAL
1	5850.00	47.69	0.56	48.25	74.00	-25.75	Peak	HORIZONTAL
2	5850.00	50.38	0.56	50.94	74.00	-23.06	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

9 SPURIOUS RADIATED EMISSION TEST

9.1 Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). 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.

9.2 Measurement Equipment Used:

9.2.1 Conducted Emission at antenna port:

Refer to section 6.2 for details.

9.2.2 Radiated emission:

Refer to section 7.2 for details.

9.3 Test SET-UP:

9.3.1 Conducted Emission at antenna port:

Refer to section 6.3 for details.

9.3.2 Radiated emission:

Refer to section 7.3 for details.

9.4 Measurement Procedure:

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. Repeat above procedures until all frequency measured were complete.

Refer to section 10 Maximum Unwanted Emissions level of KDB Document: 558074 D01 DTS Meas Guidance v02

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

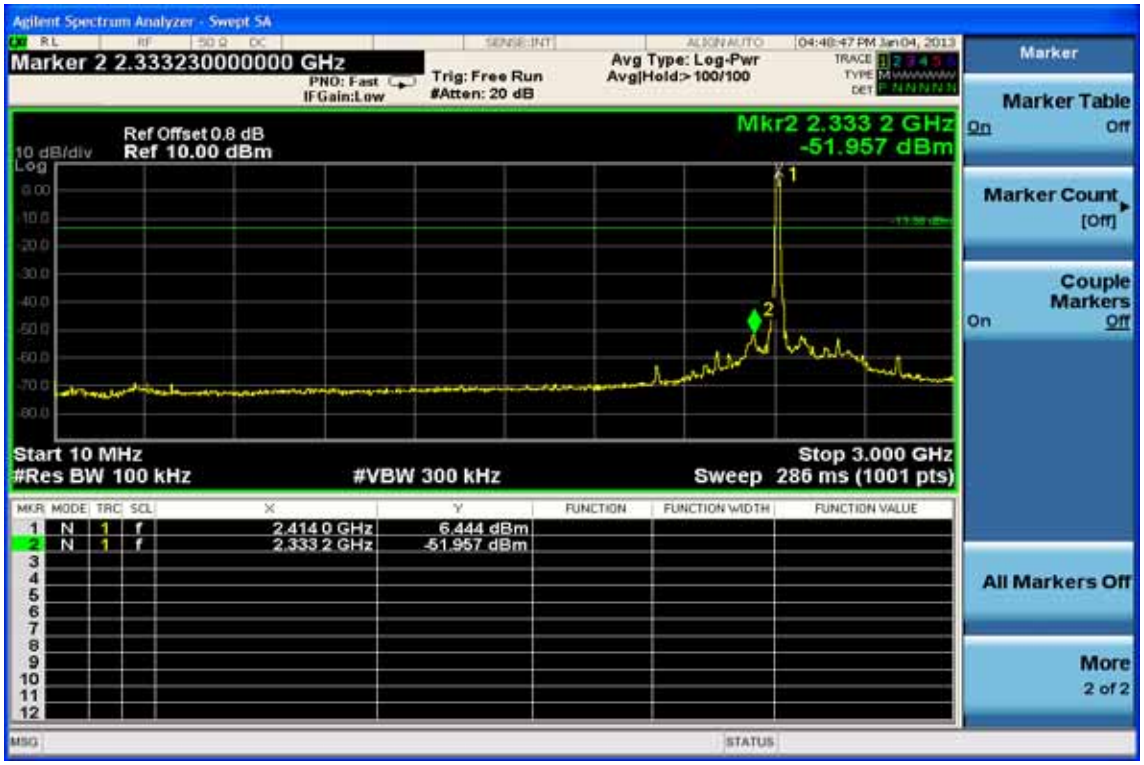
Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

9.6 Measurement Result:

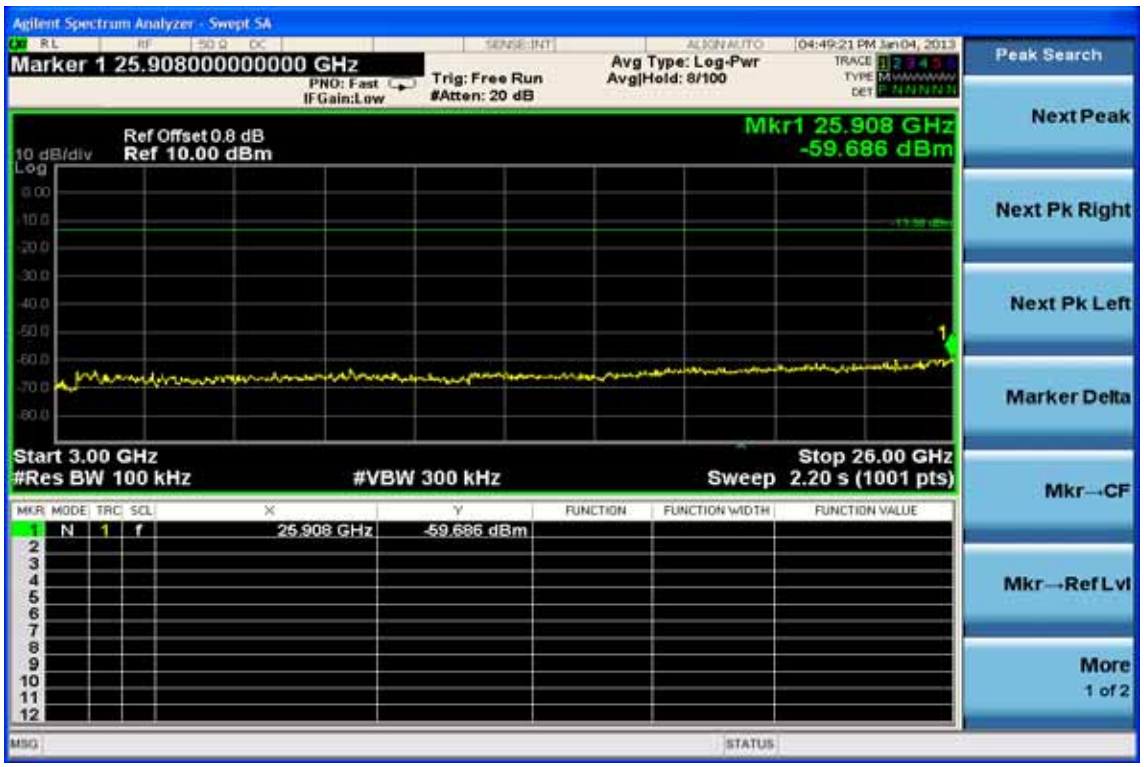
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Conducted Spurious Emission Measurement Result
802.11b

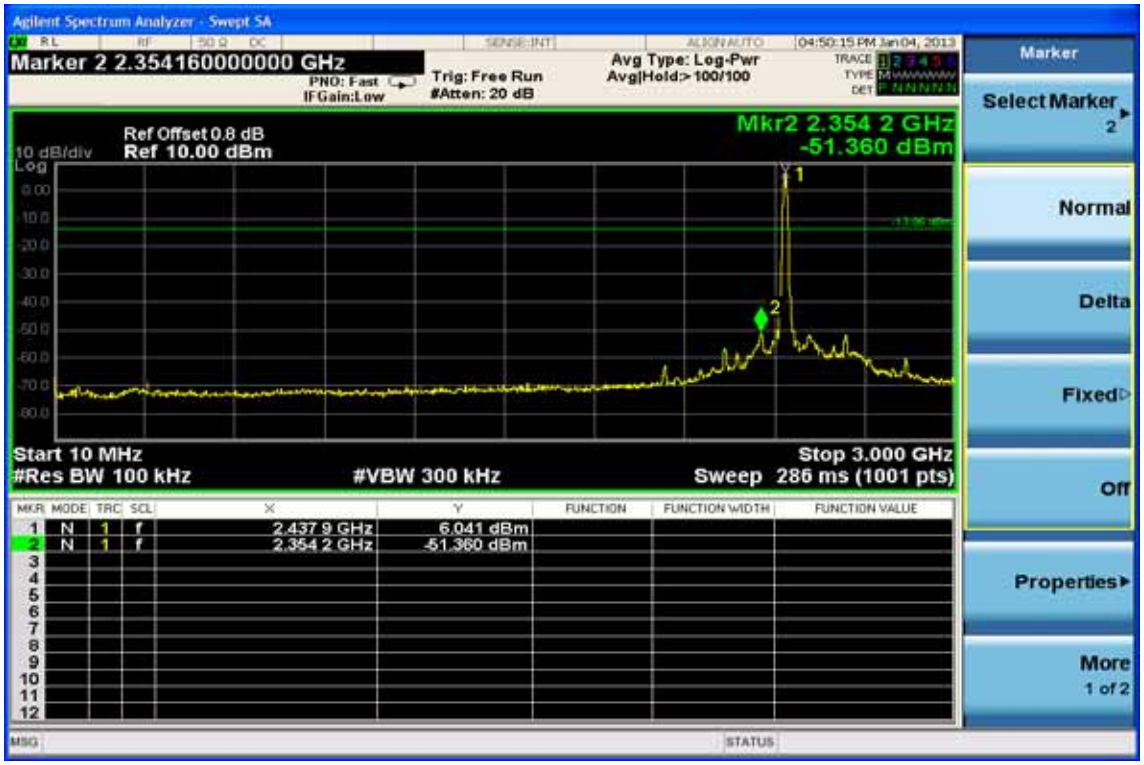
Ch Low 30MHz – 3GHz



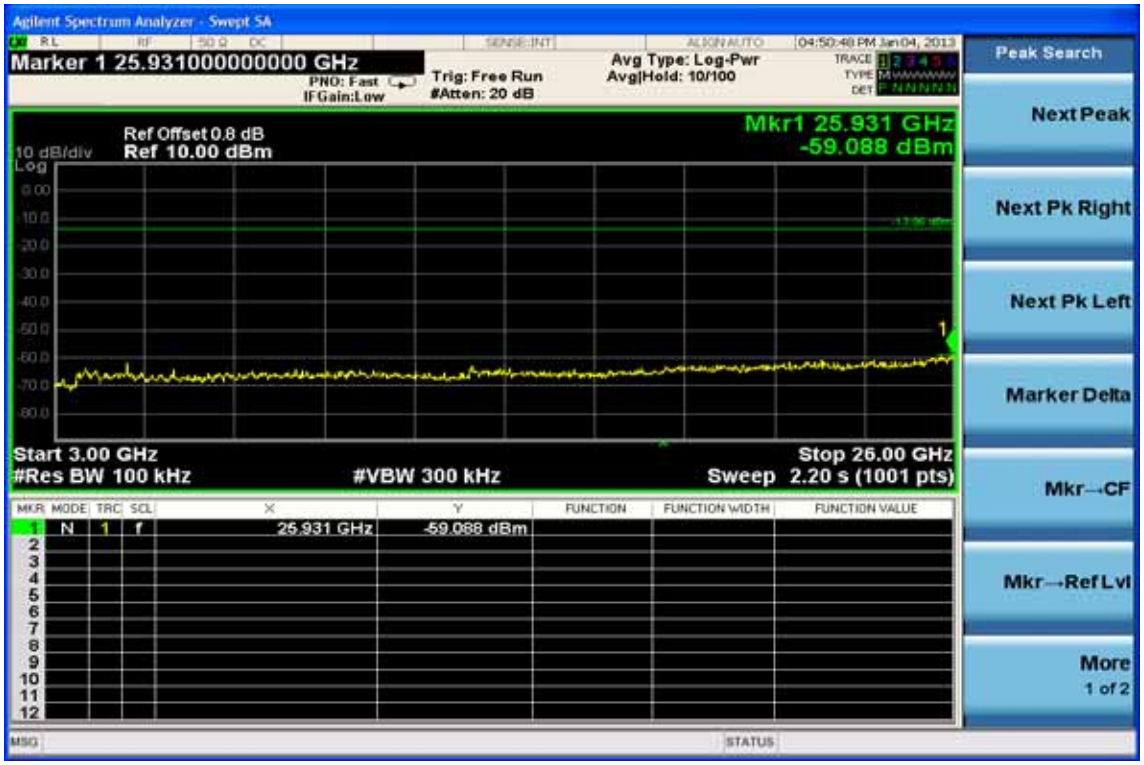
Ch Low 3GHz – 26.5GHz



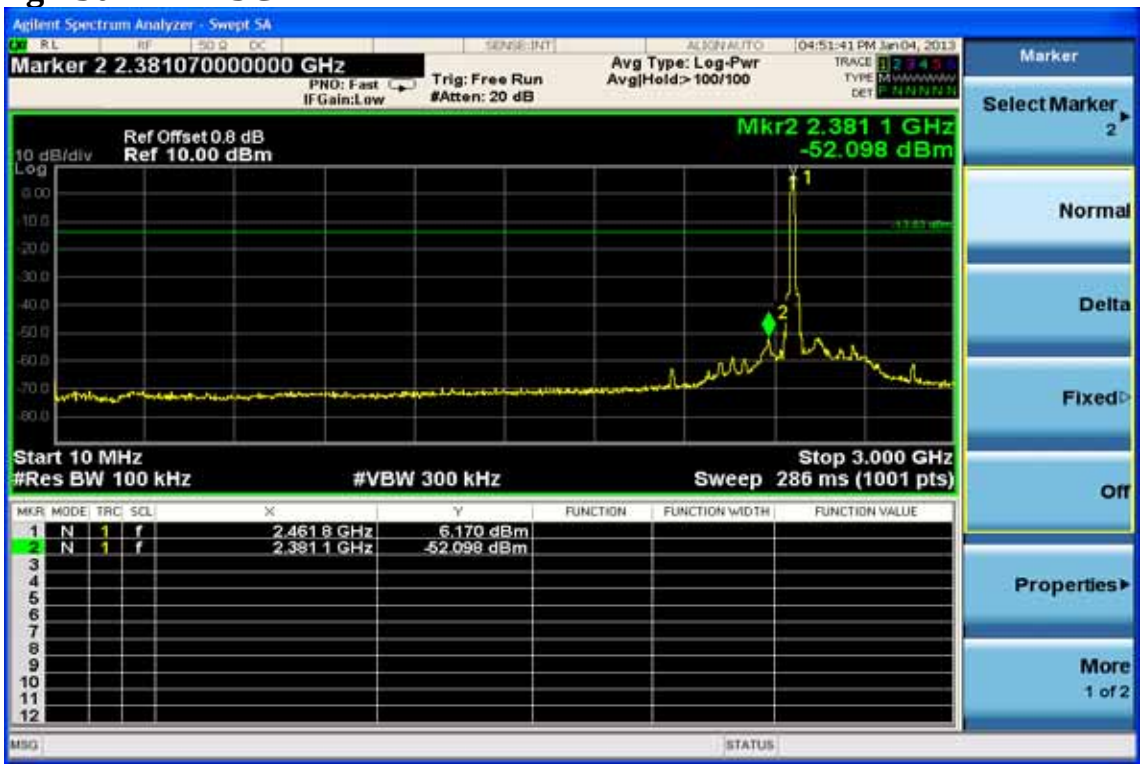
Ch Mid 30MHz – 3GHz



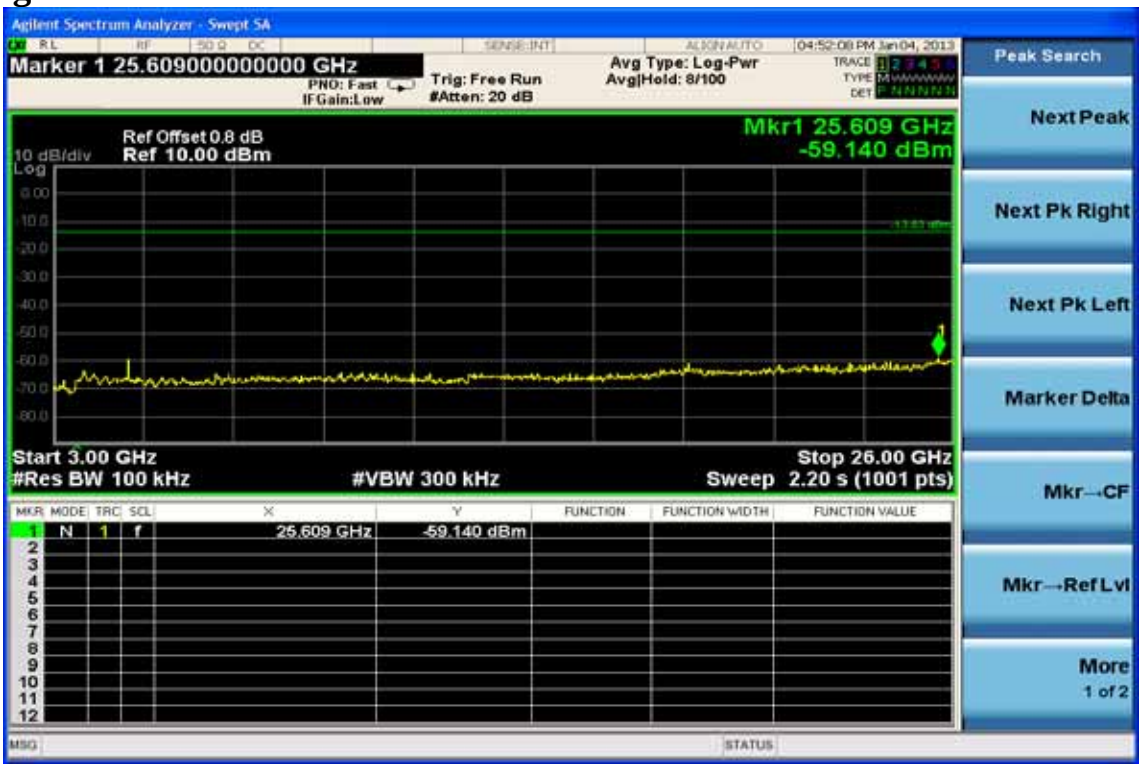
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

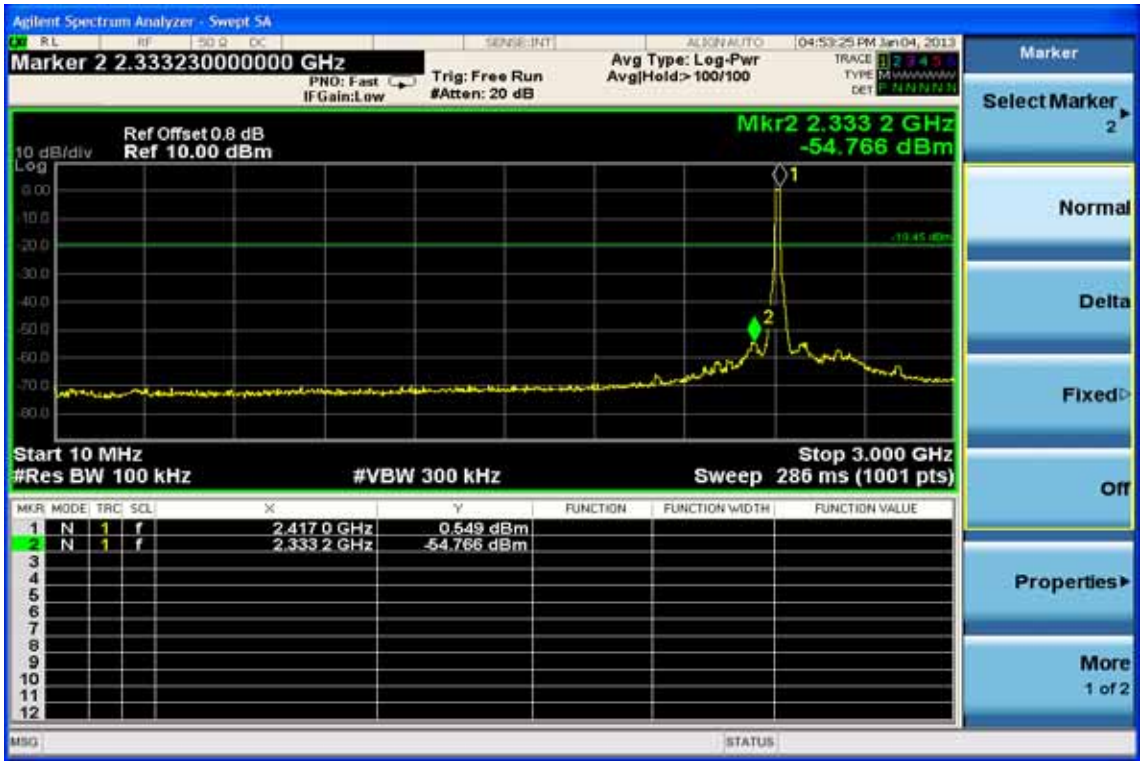


Ch High 3GHz – 26.5GHz

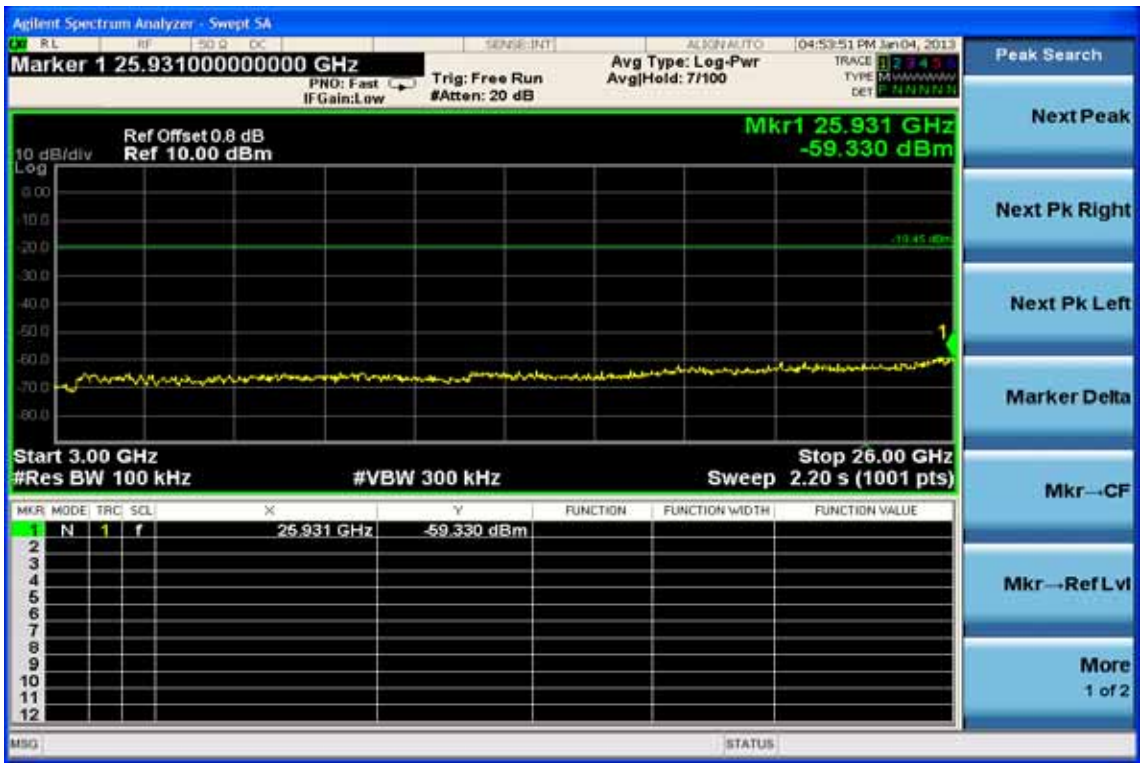


Conducted Spurious Emission Measurement Result
802.11g

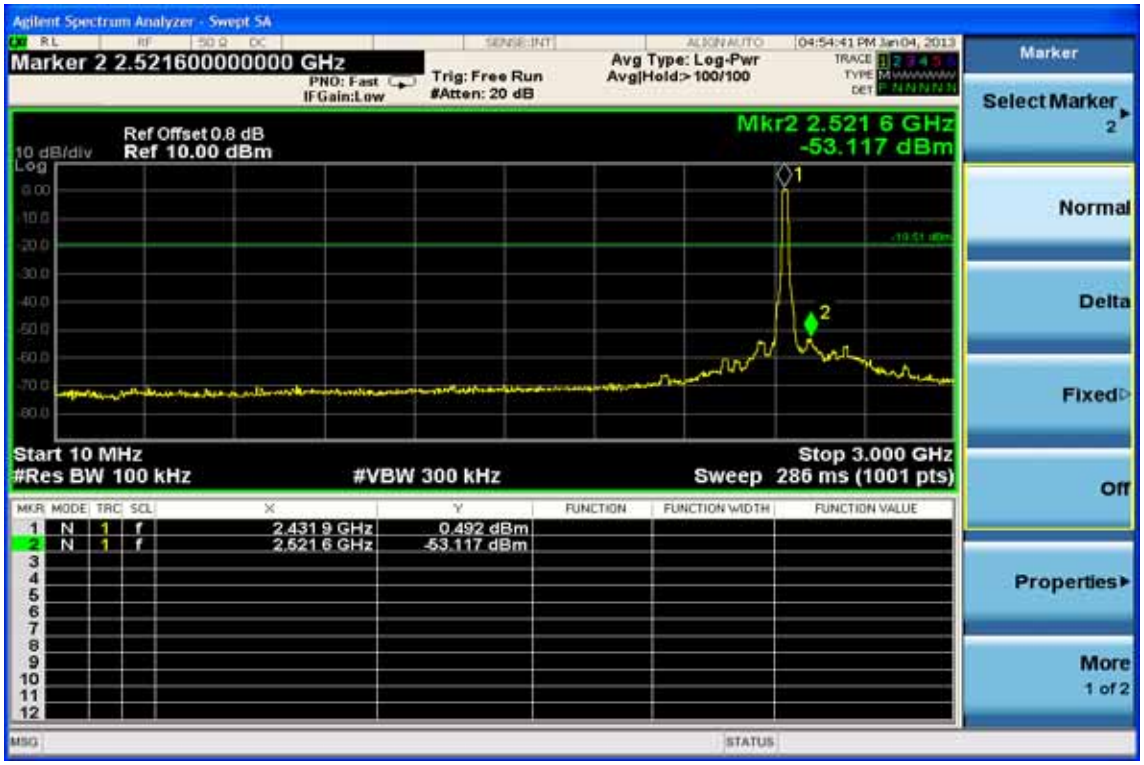
Ch Low 30MHz – 3GHz



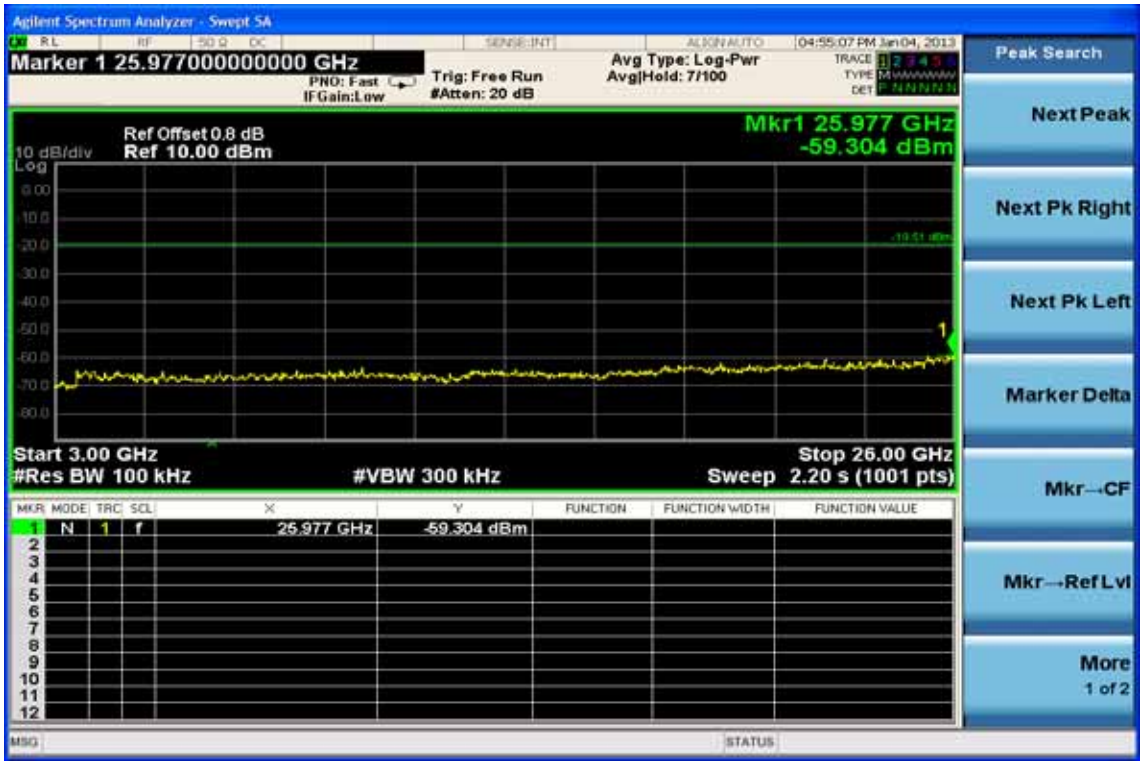
Ch Low 3GHz – 26.5GHz



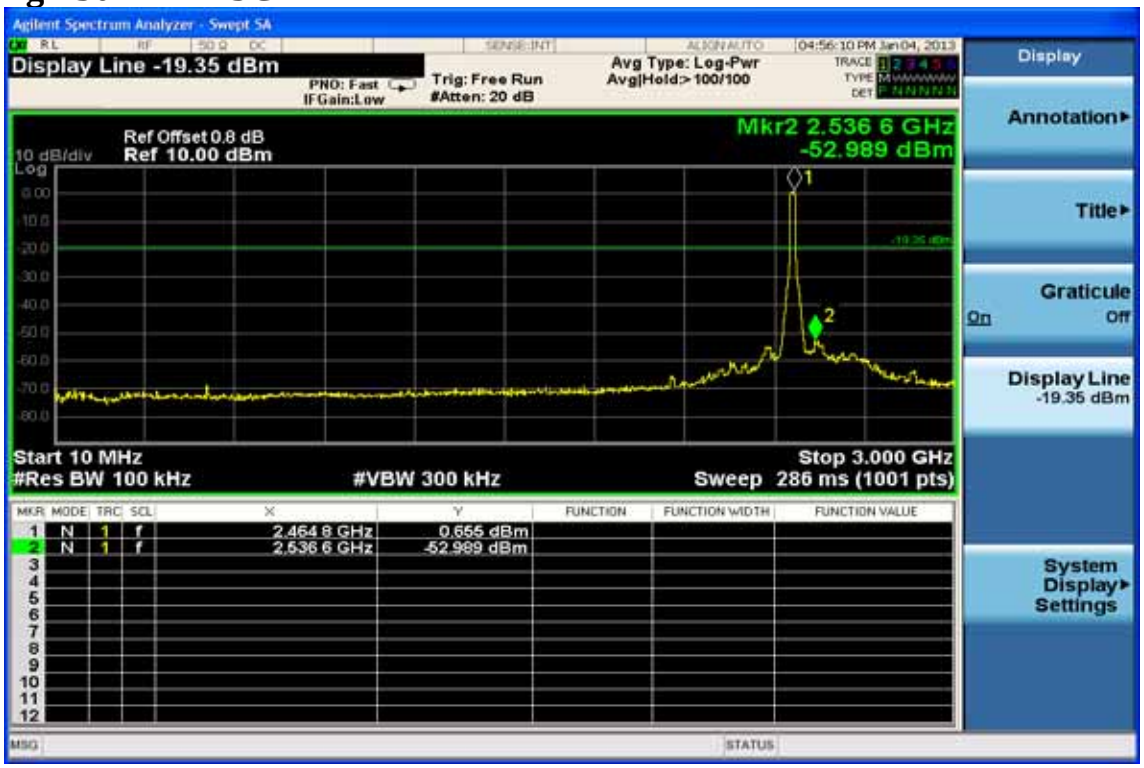
Ch Mid 30MHz – 3GHz



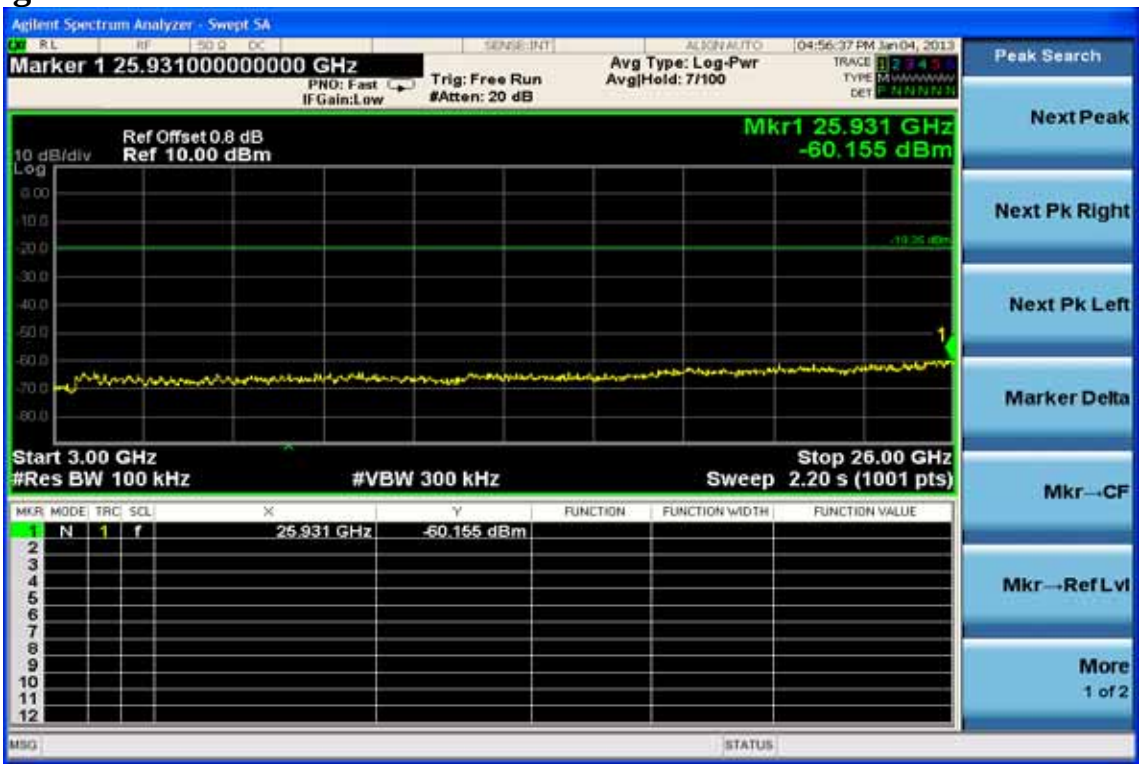
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

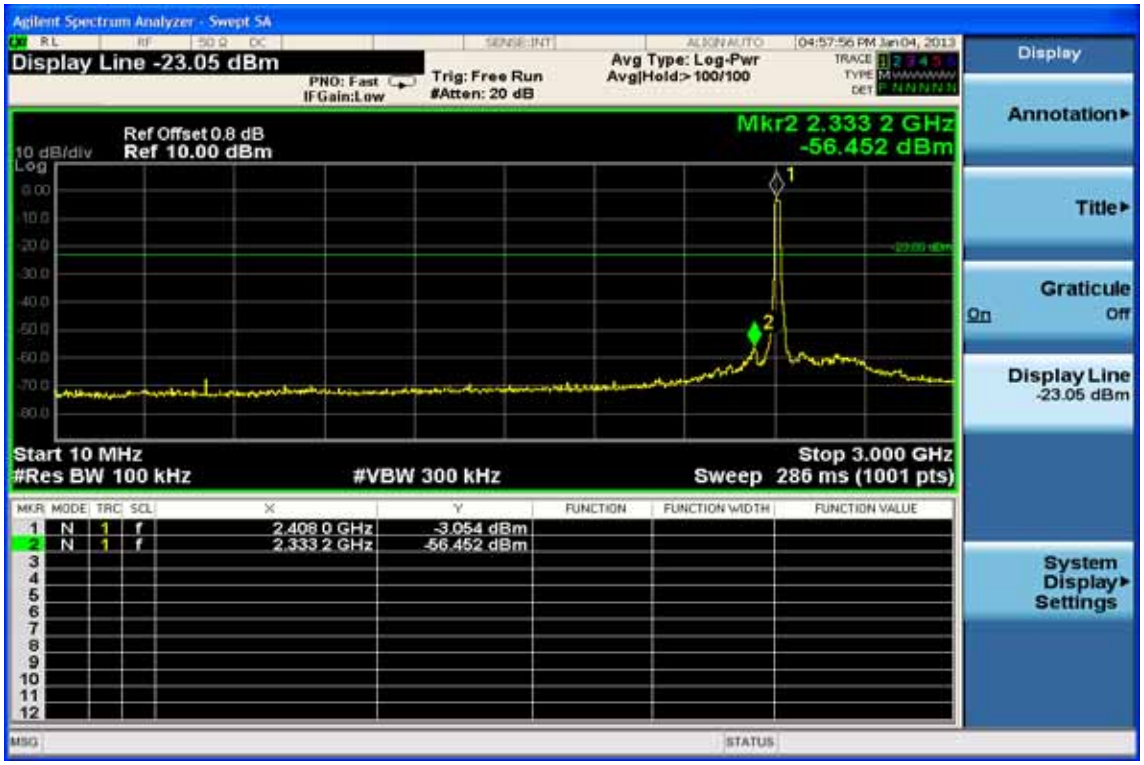


Ch High 3GHz – 26.5GHz

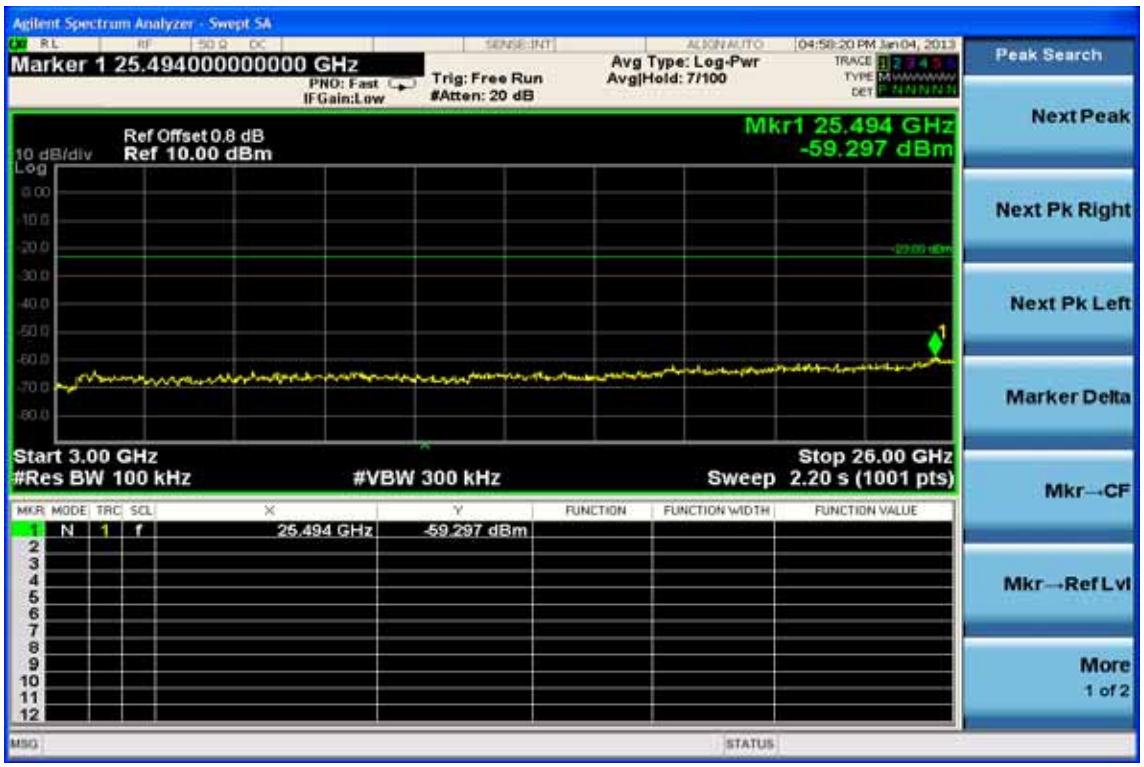


Conducted Spurious Emission Measurement Result
802.11n_20M for 2.4GHz (Antenna A Port)

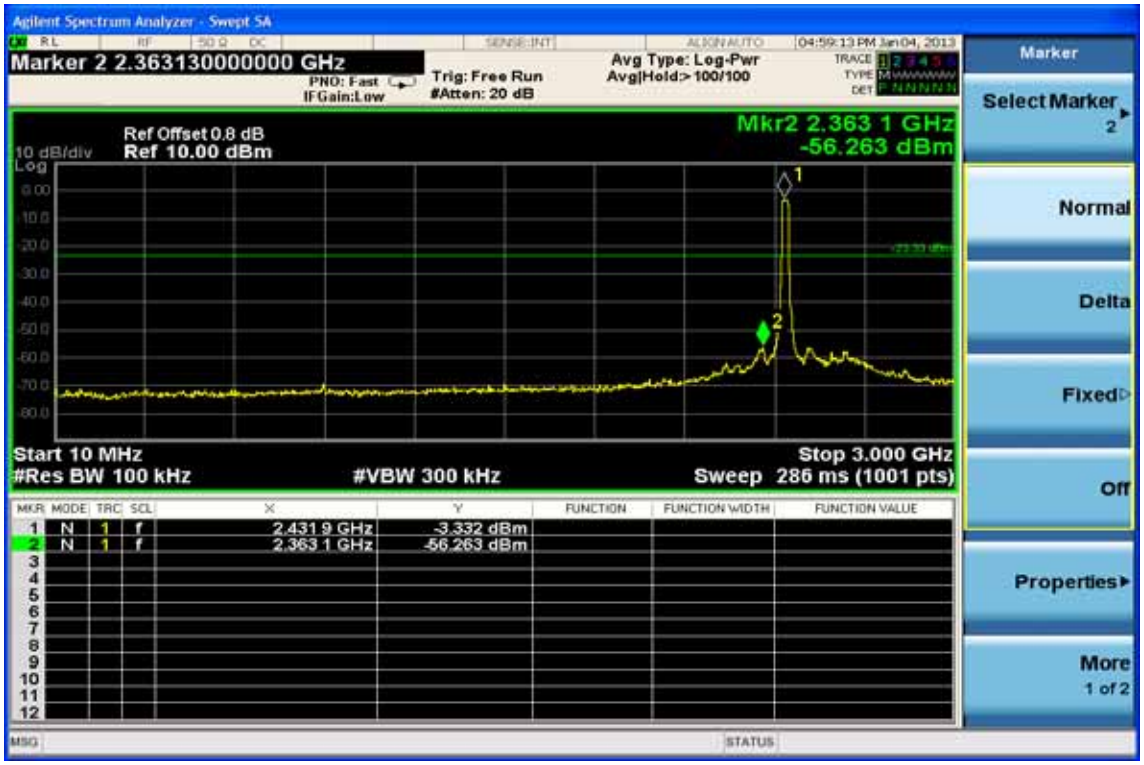
Ch Low 30MHz – 3GHz



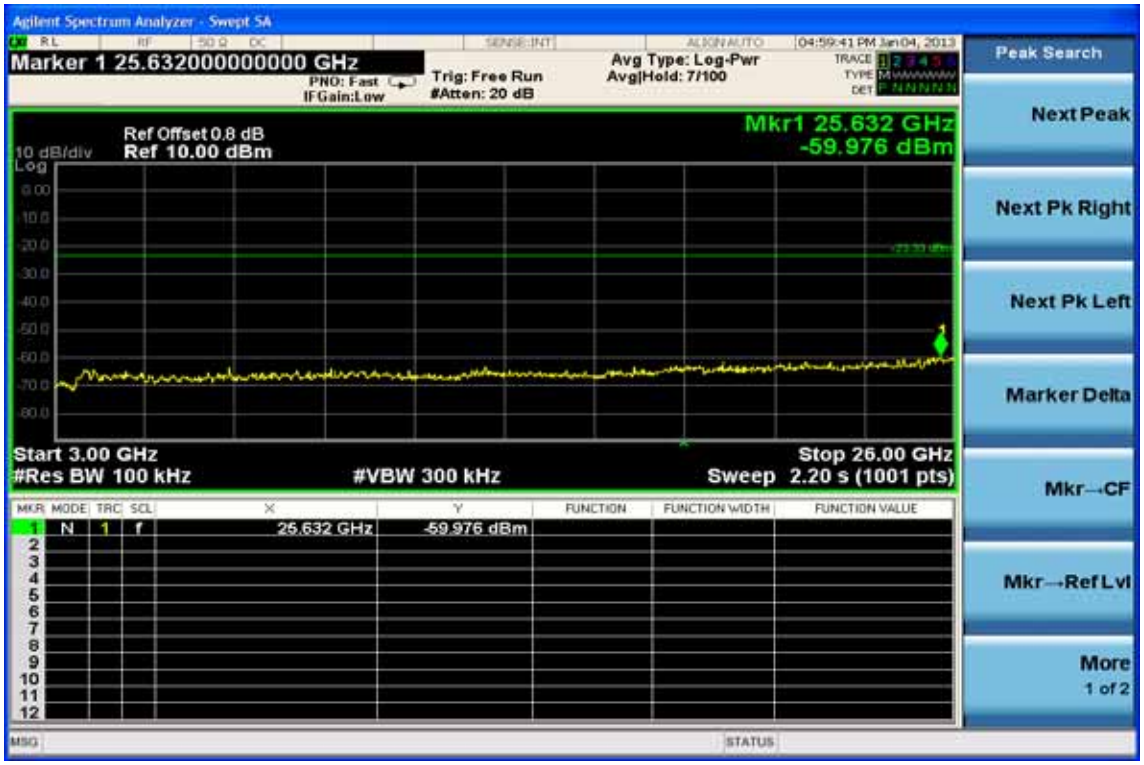
Ch Low 3GHz – 26.5GHz



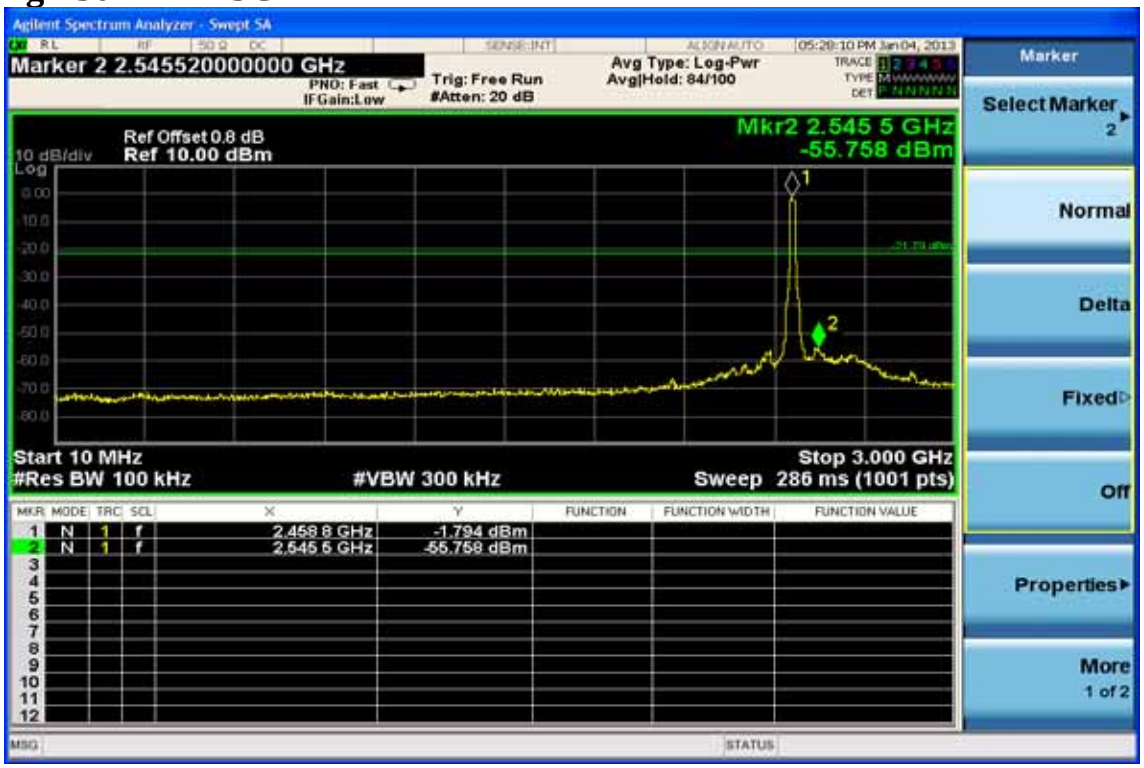
Ch Mid 30MHz – 3GHz



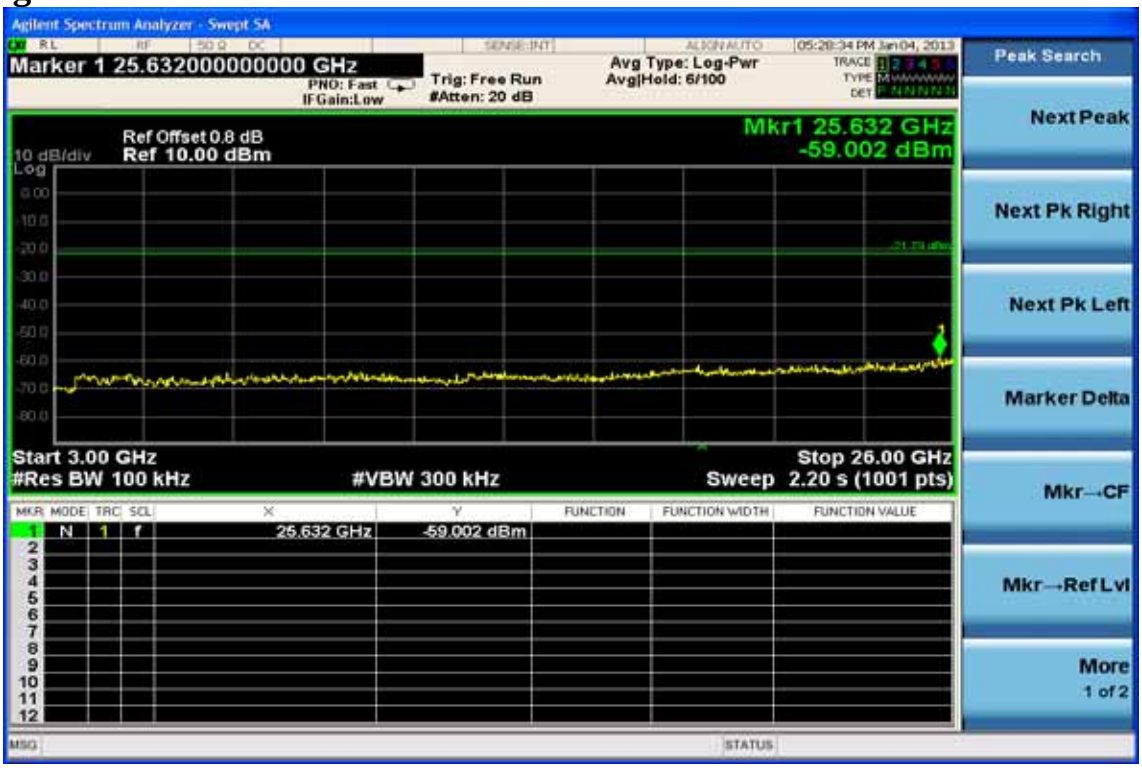
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

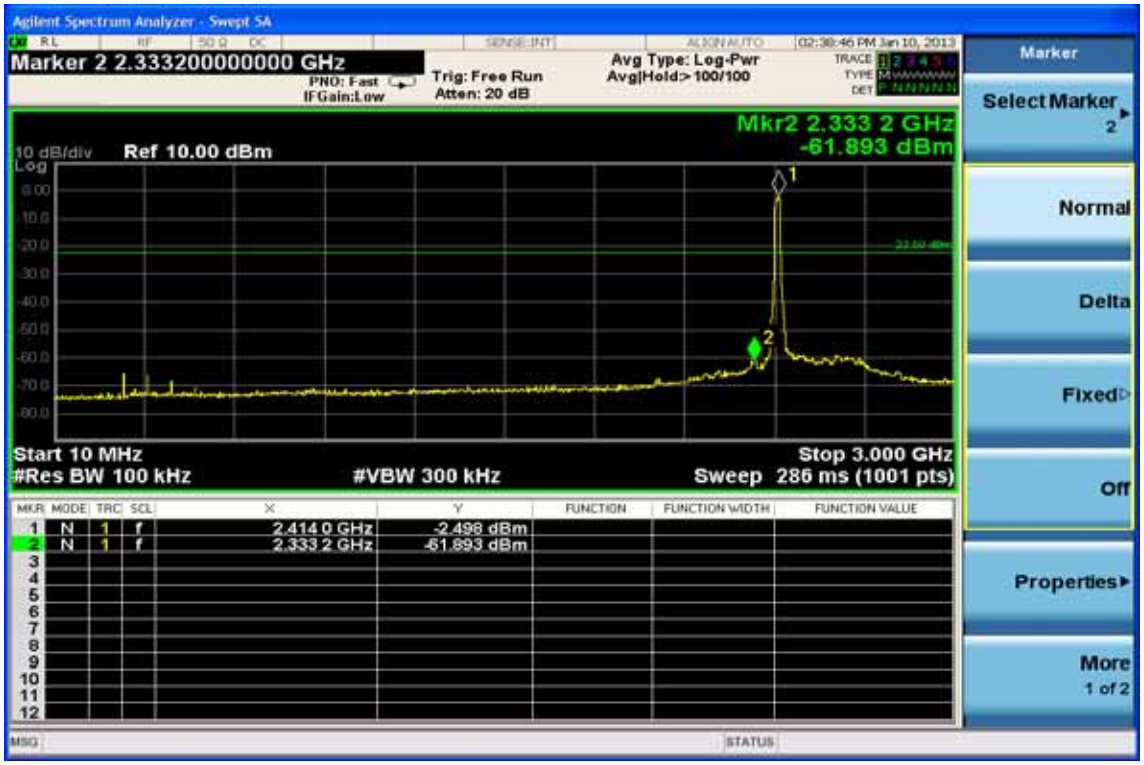


Ch High 3GHz – 26.5GHz

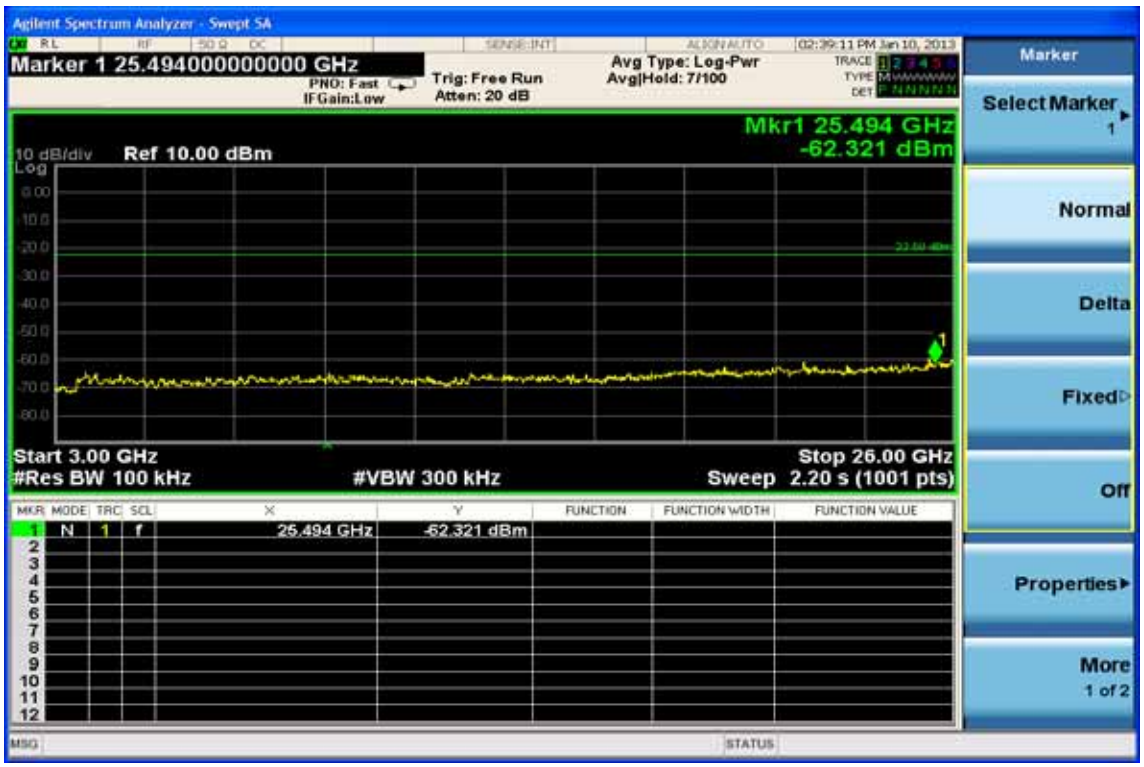


Conducted Spurious Emission Measurement Result
802.11n_20M for 2.4GHz (Antenna B Port)

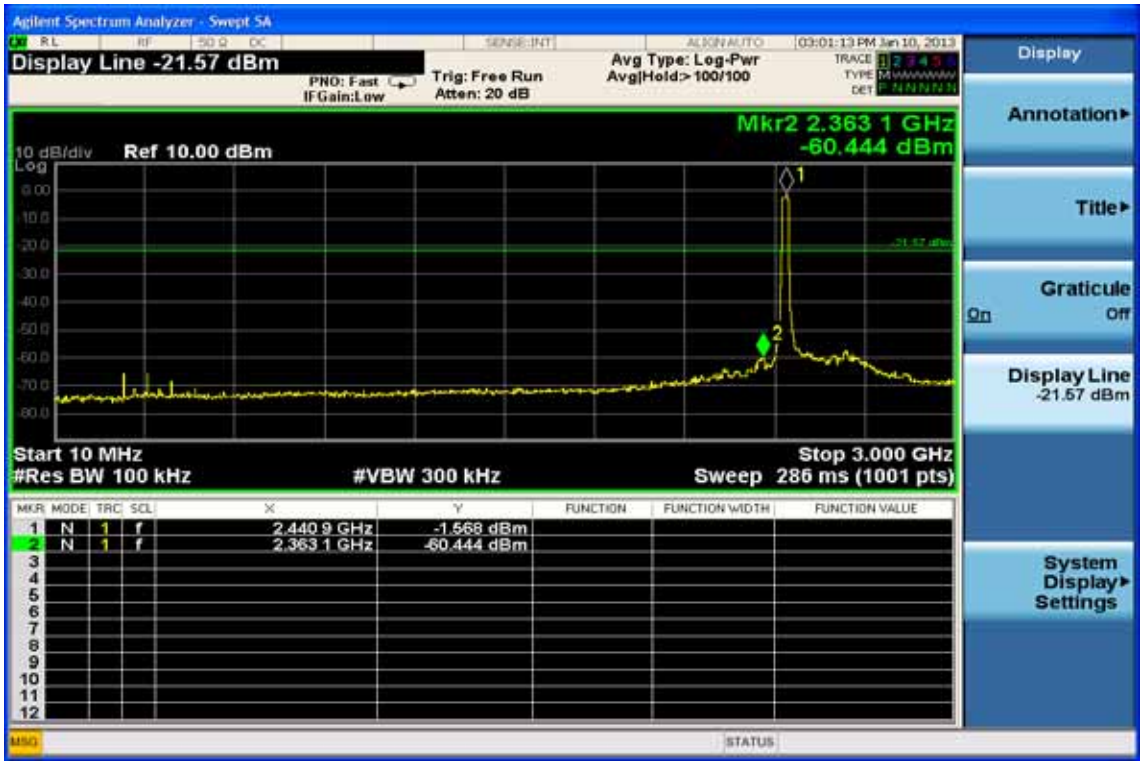
Ch Low 30MHz – 3GHz



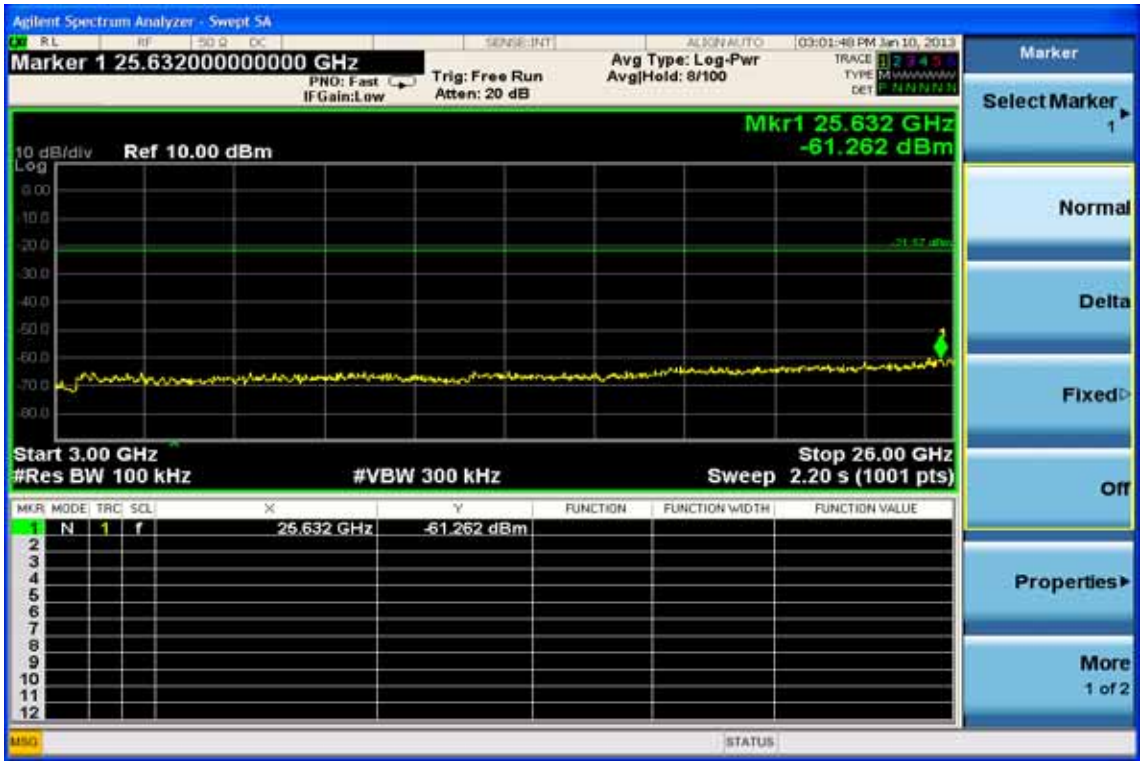
Ch Low 3GHz – 26.5GHz



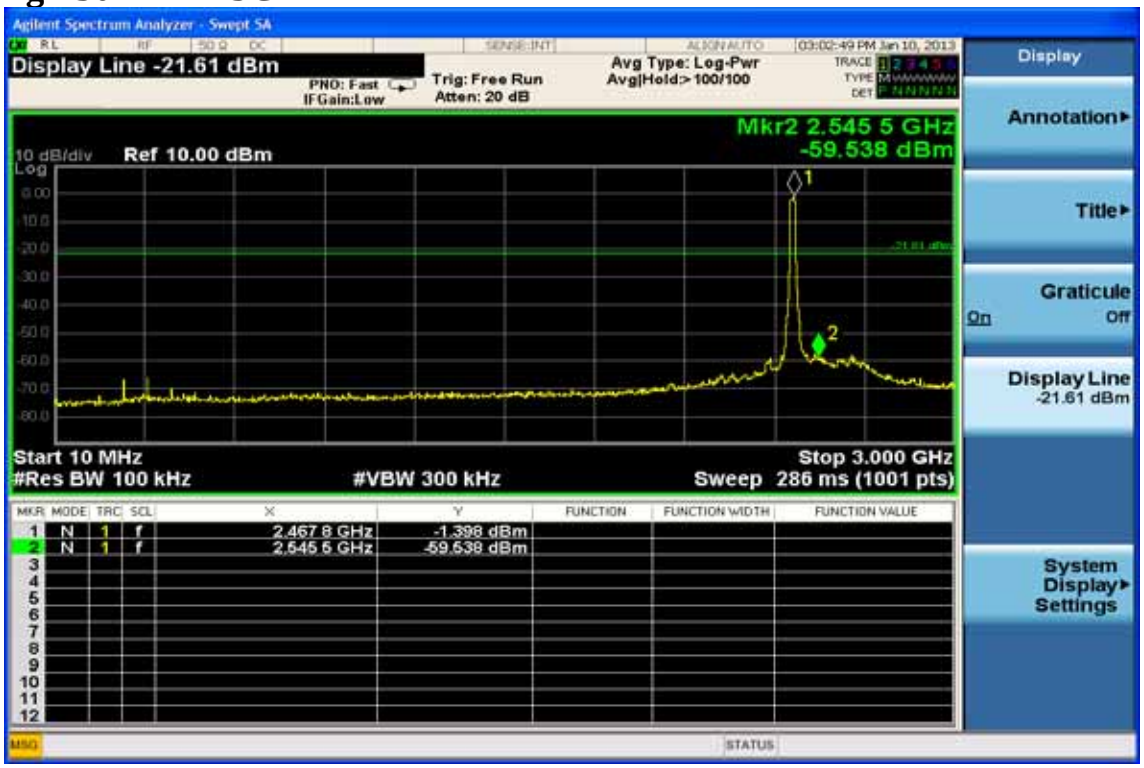
Ch Mid 30MHz – 3GHz



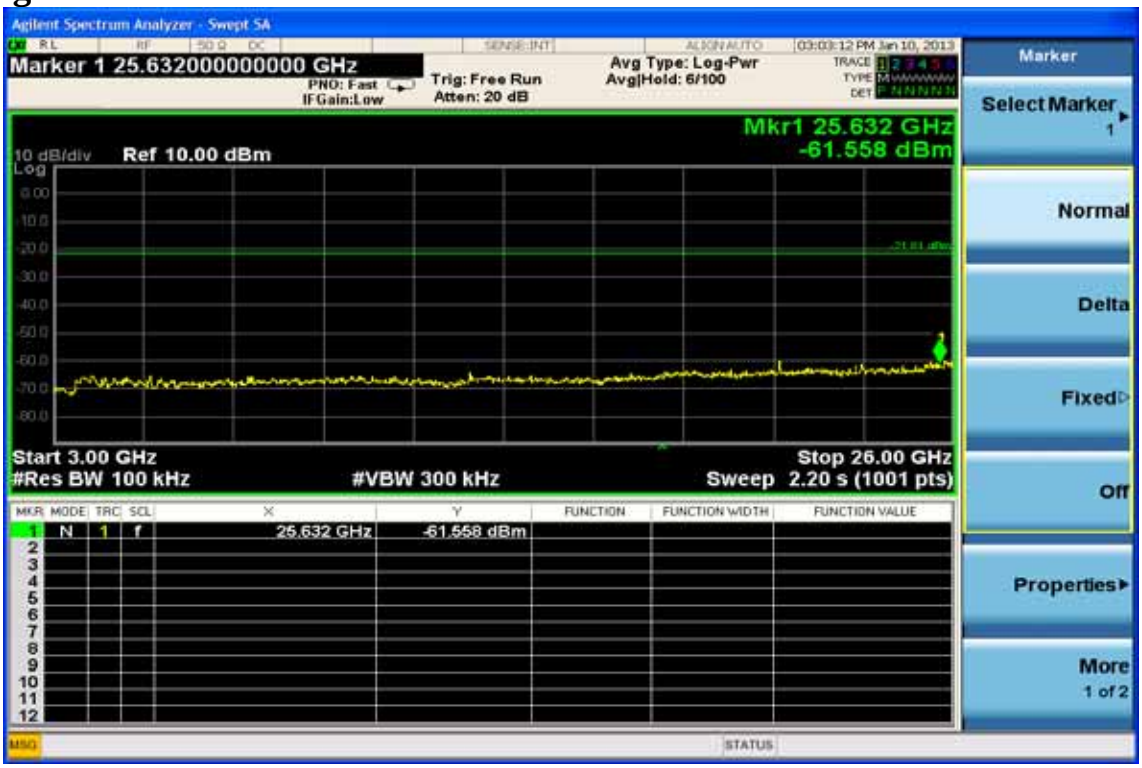
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

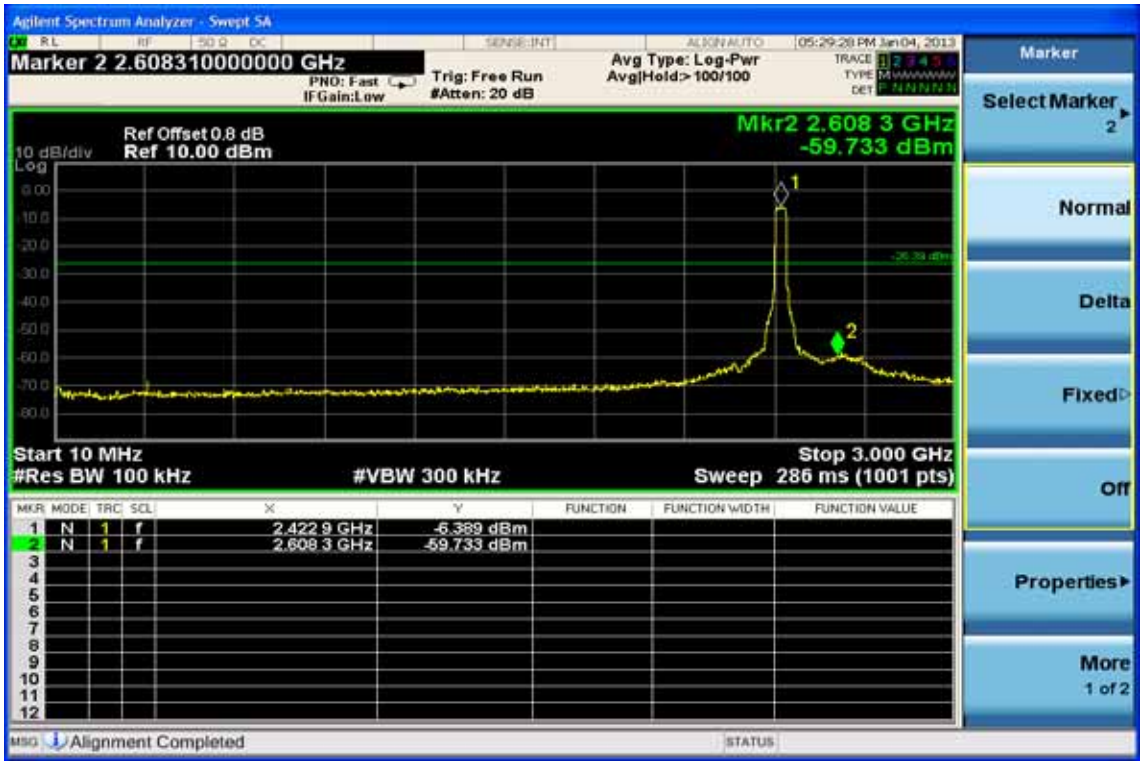


Ch High 3GHz – 26.5GHz

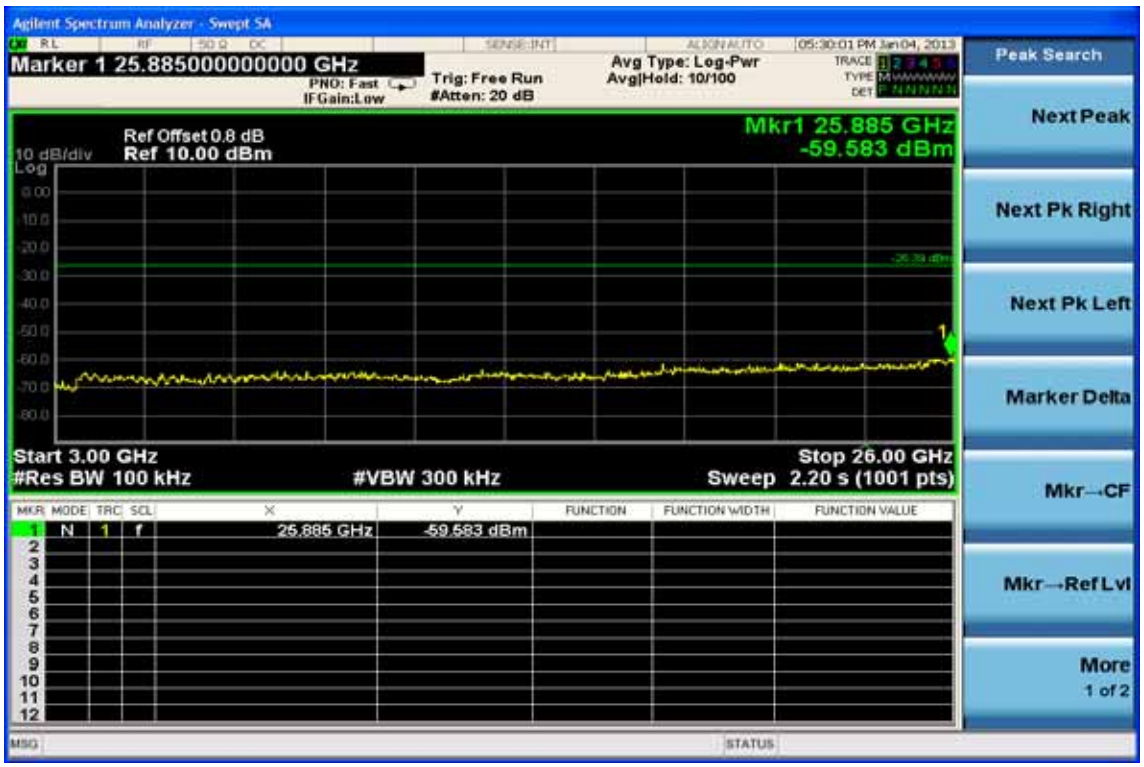


Conducted Spurious Emission Measurement Result
802.11n_40M for 2.4GHz (Antenna A Port)

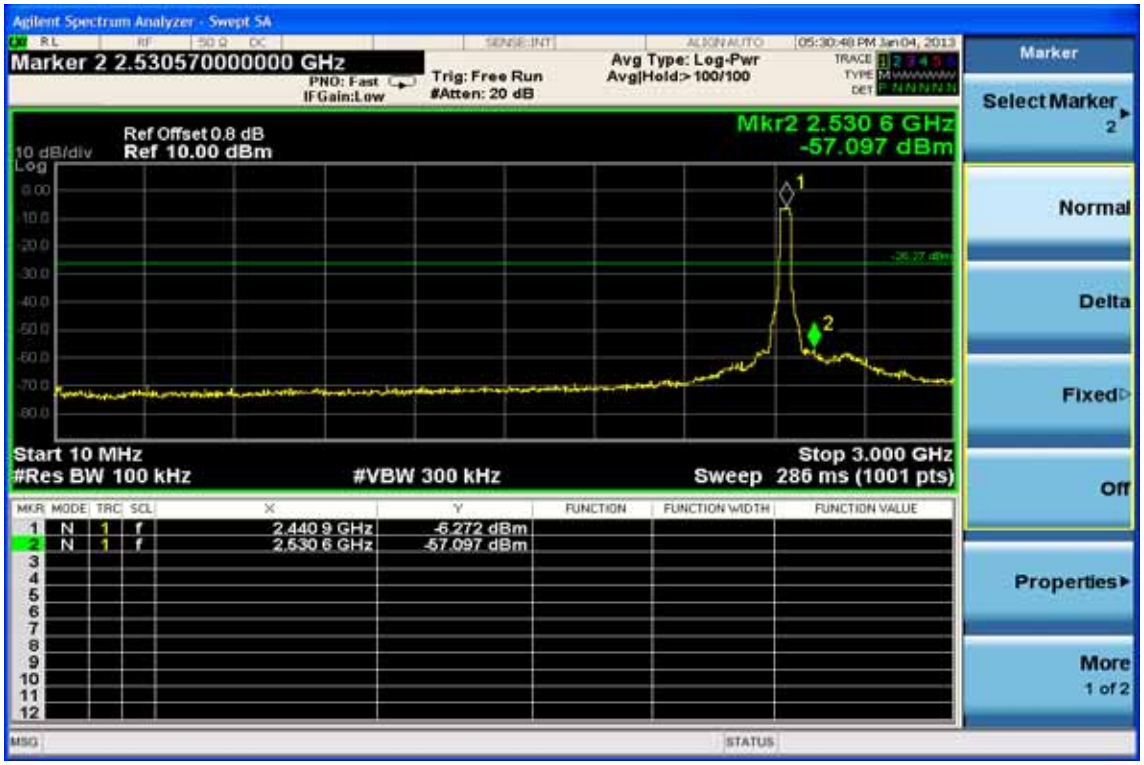
Ch Low 30MHz – 3GHz



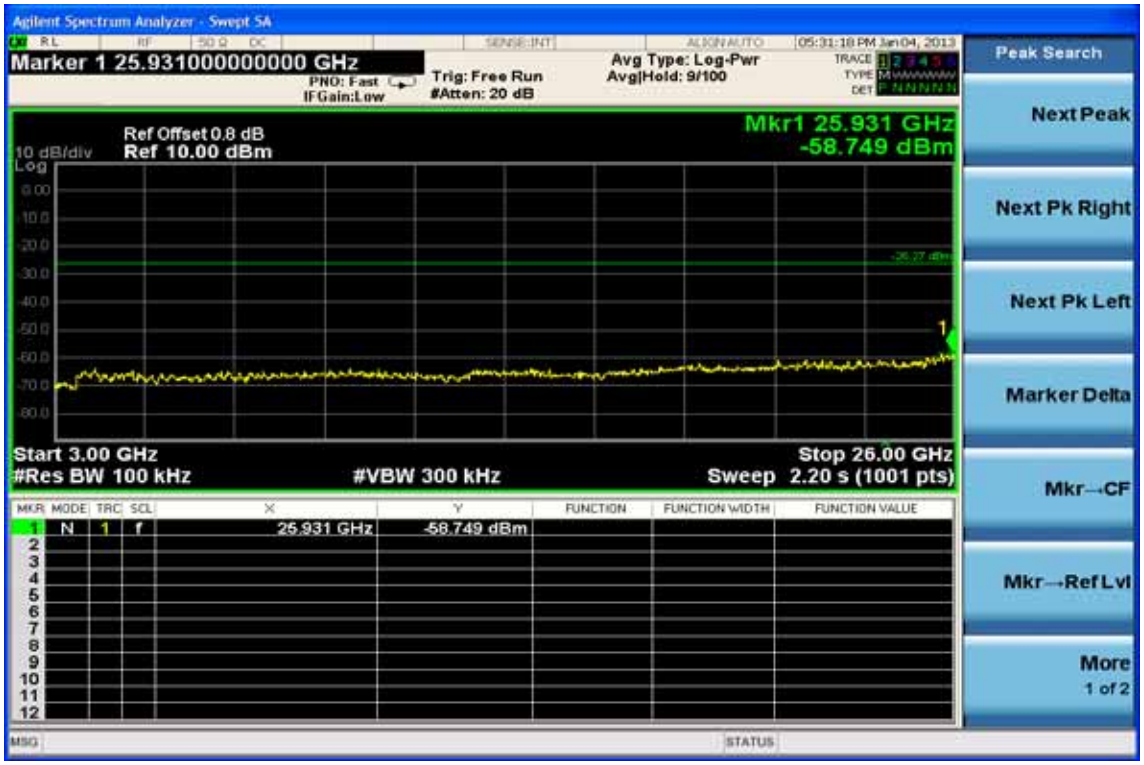
Ch Low 3GHz – 26.5GHz



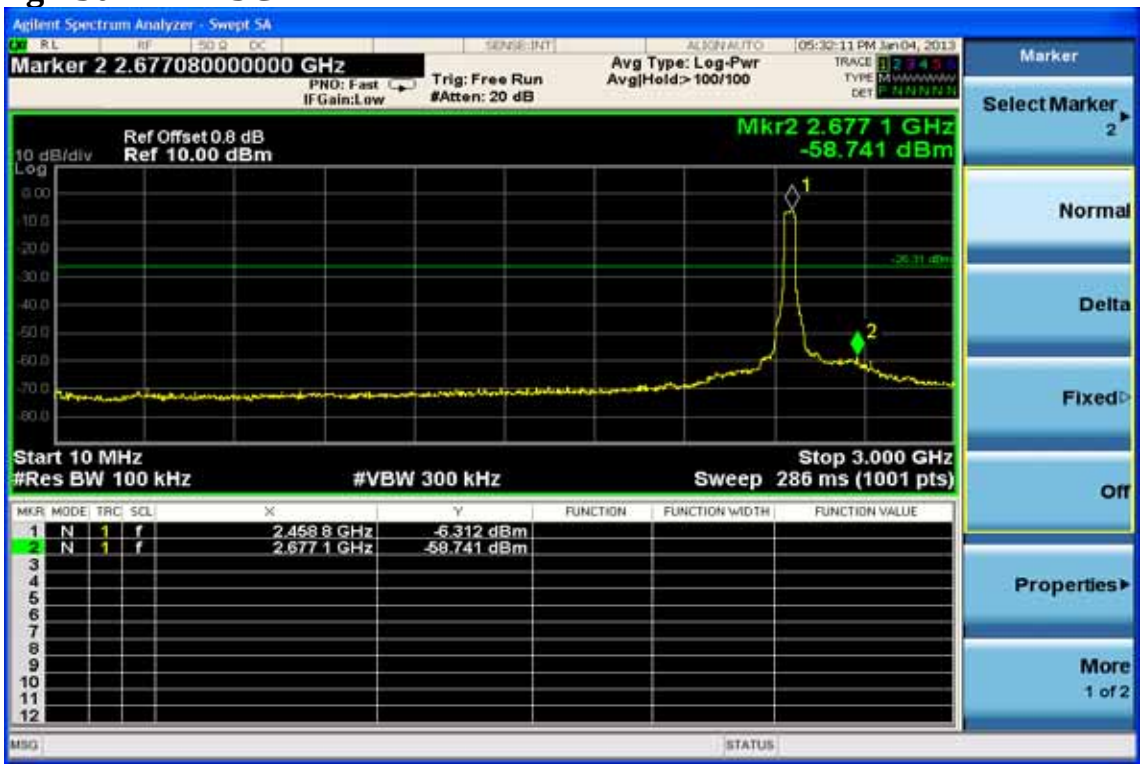
Ch Mid 30MHz – 3GHz



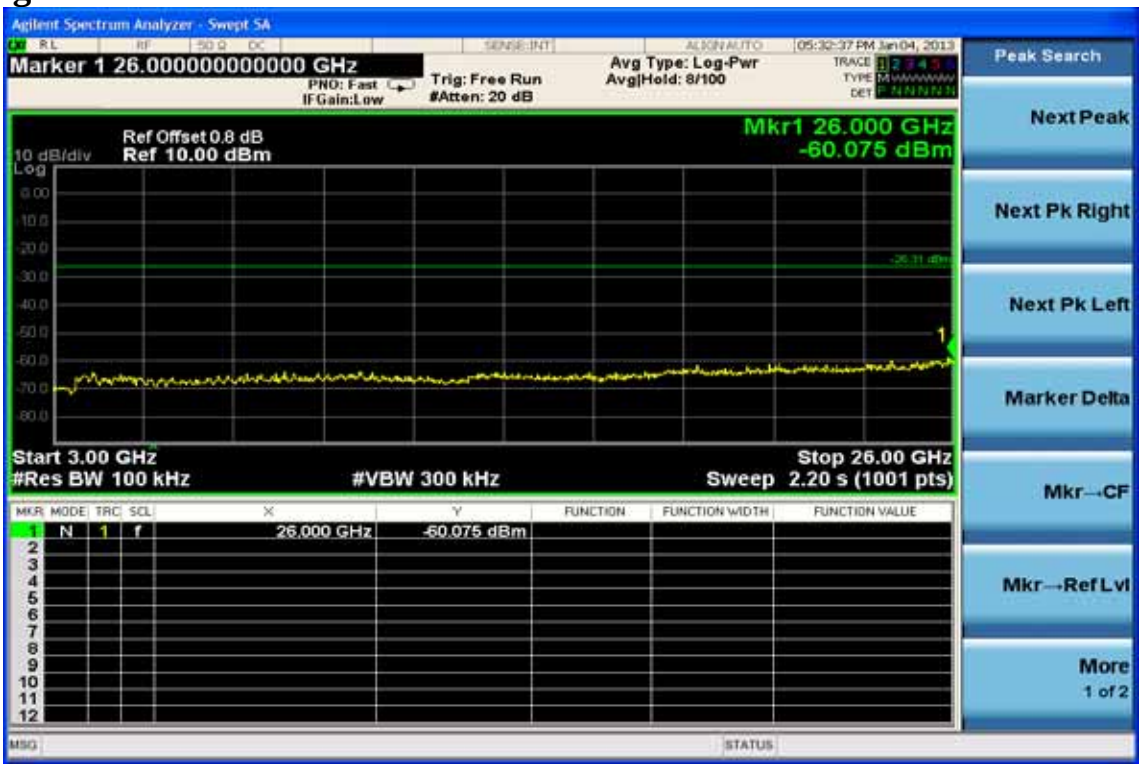
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

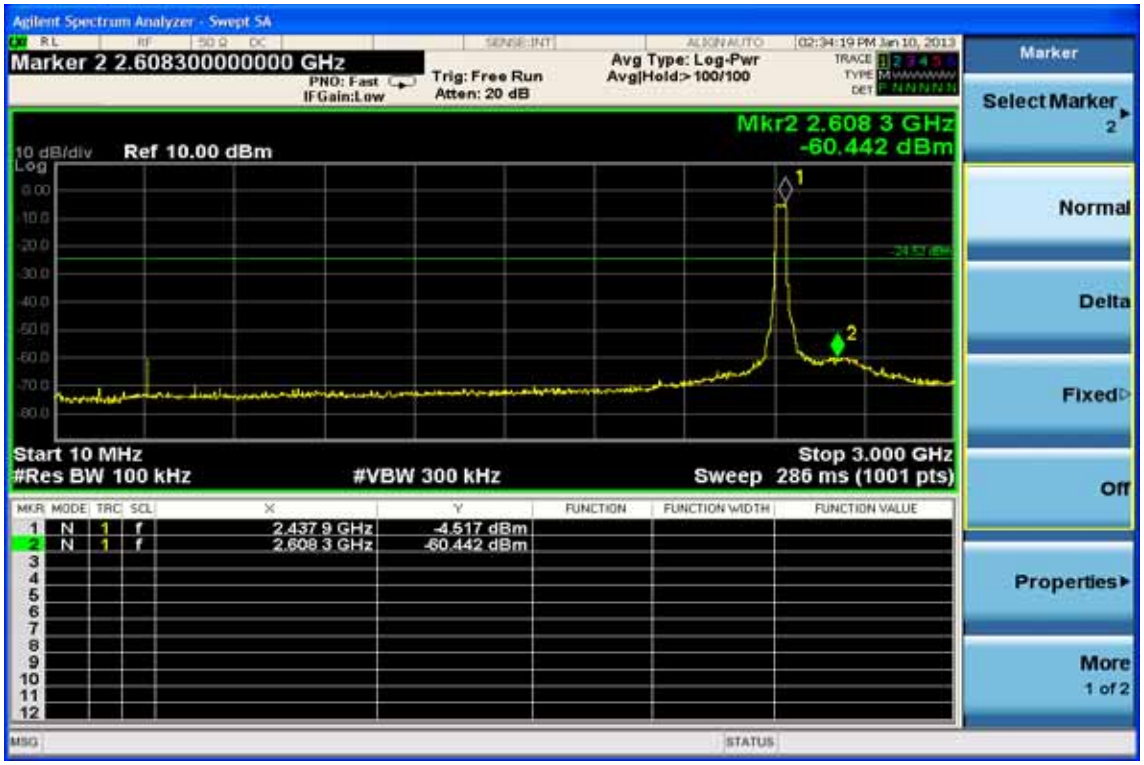


Ch High 3GHz – 26.5GHz

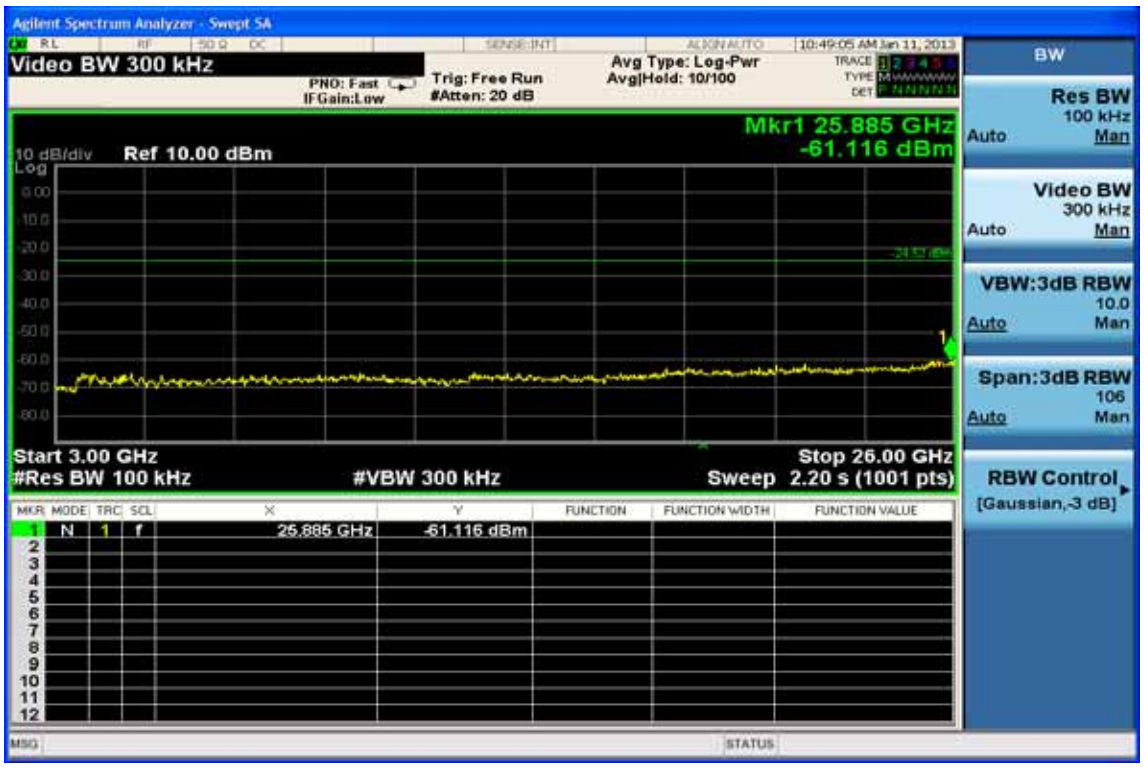


Conducted Spurious Emission Measurement Result
802.11n_40M for 2.4GHz (Antenna B Port)

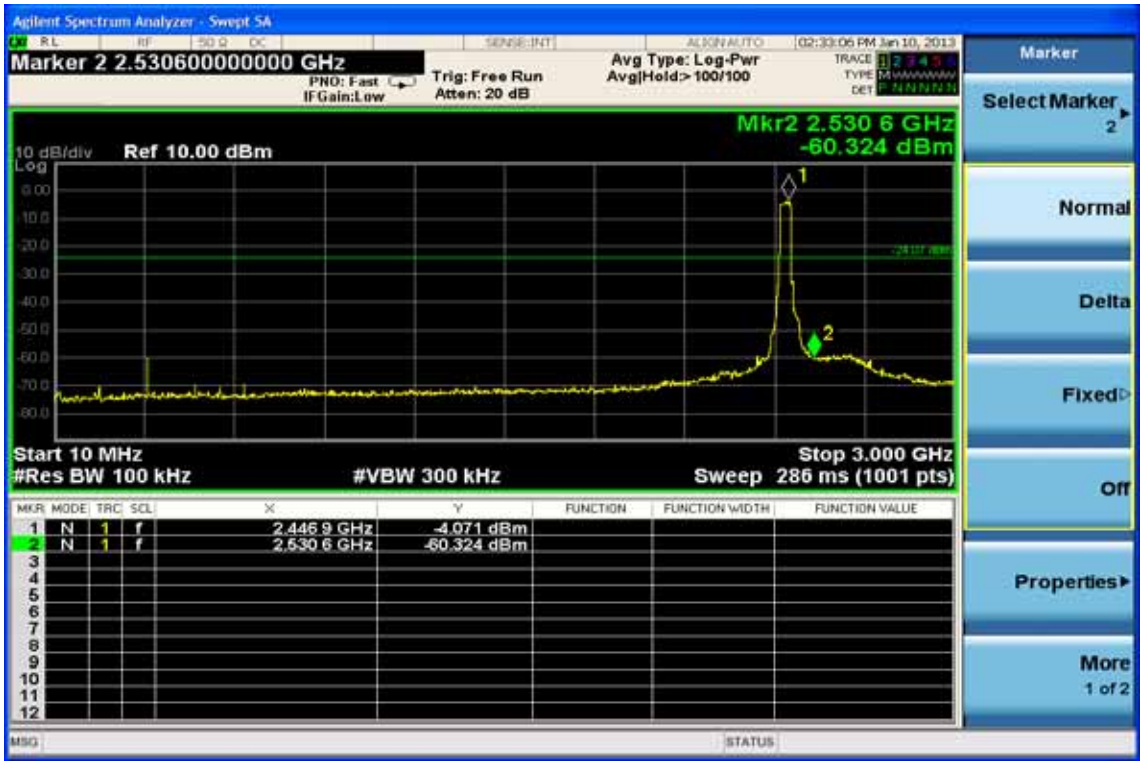
Ch Low 30MHz – 3GHz



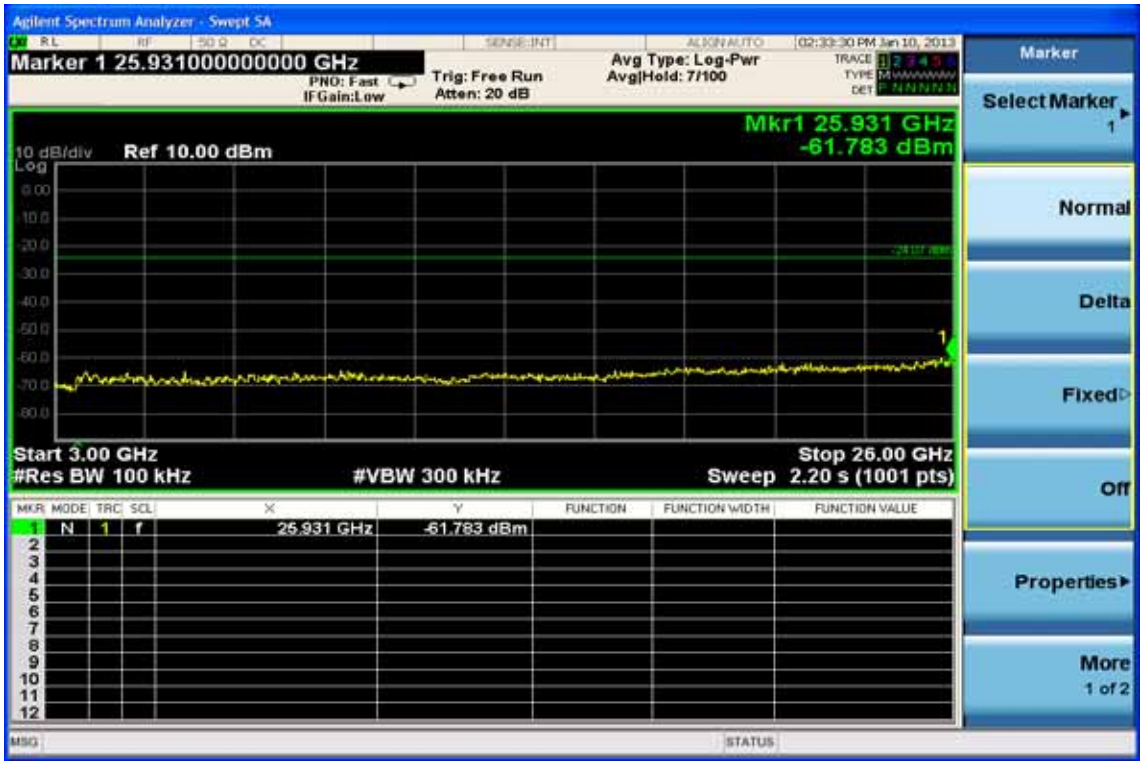
Ch Low 3GHz – 26.5GHz



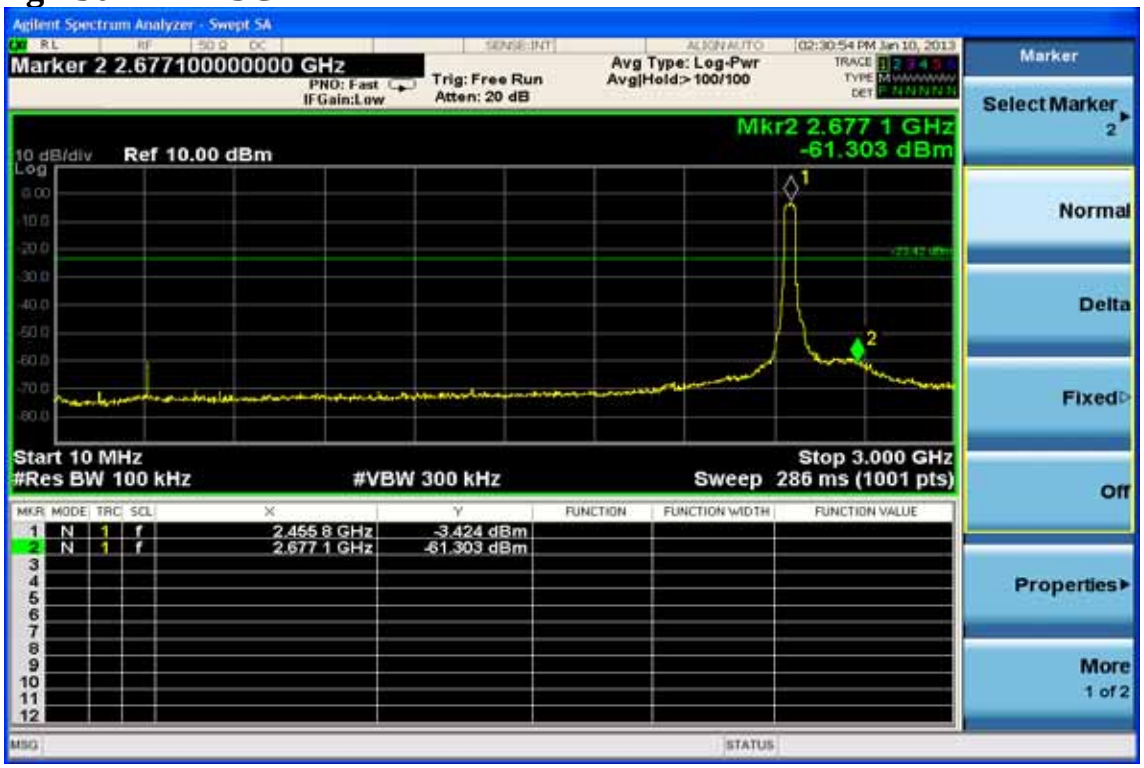
Ch Mid 30MHz – 3GHz



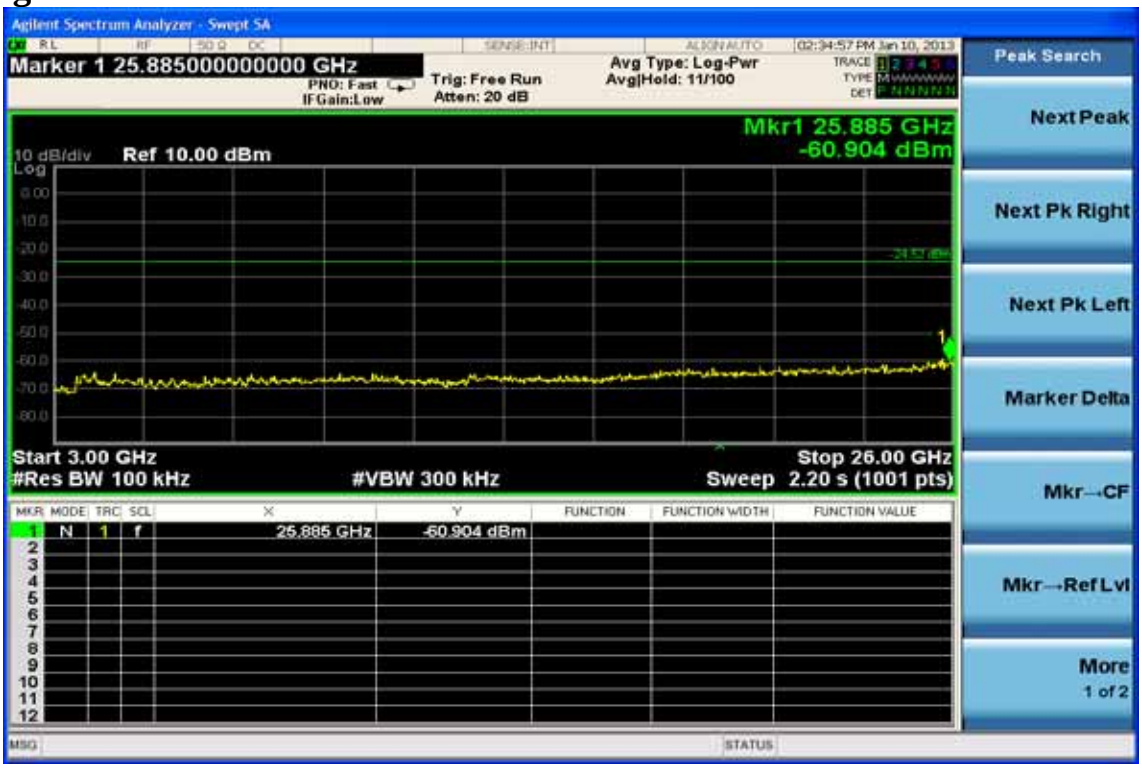
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

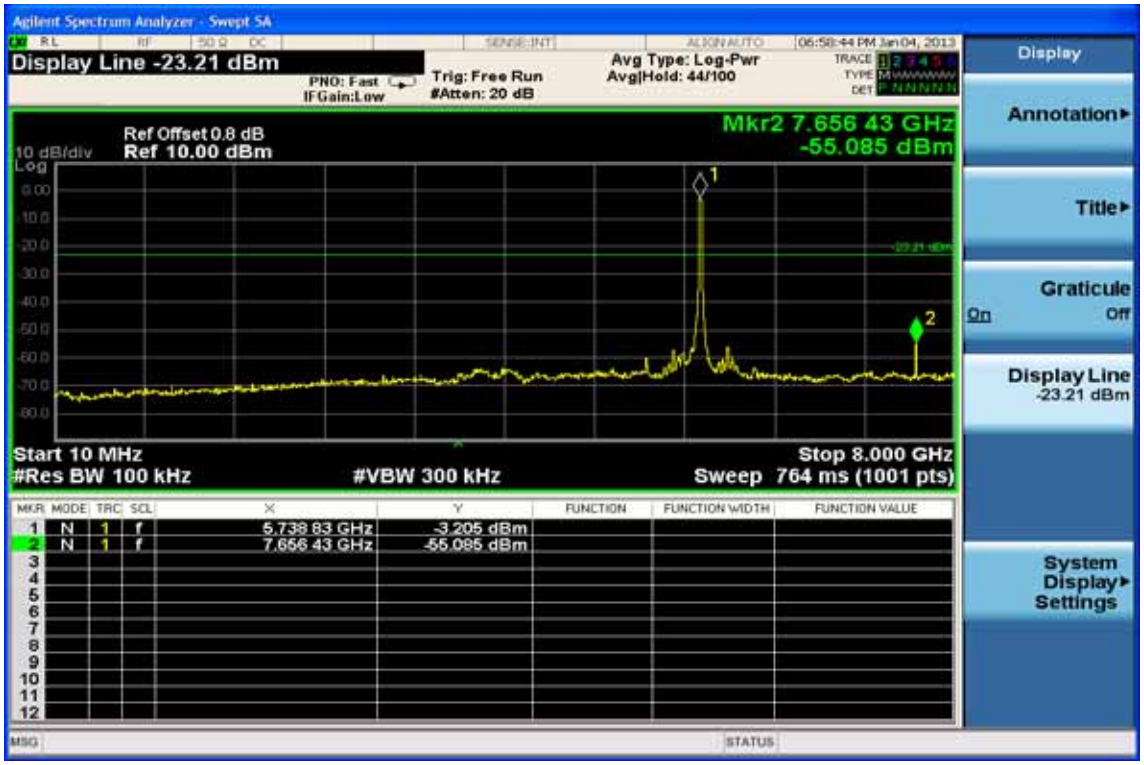


Ch High 3GHz – 26.5GHz

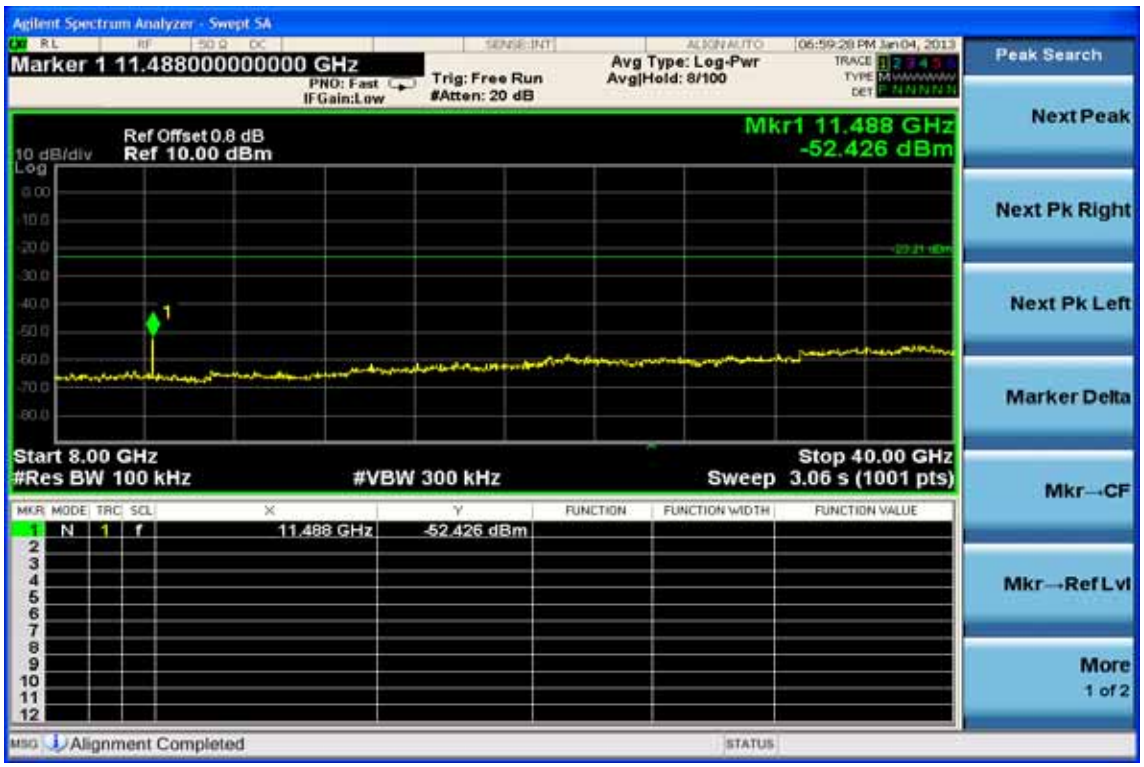


Conducted Spurious Emission Measurement Result
802.11a

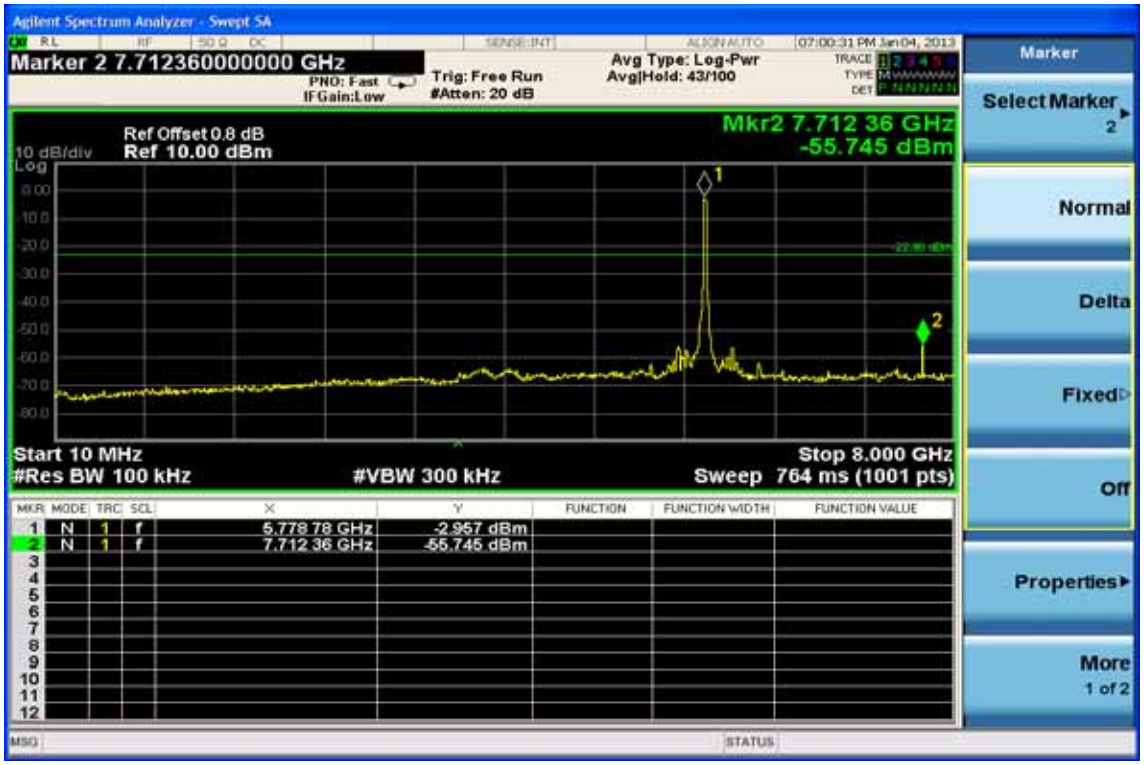
Ch Low 30MHz – 3GHz



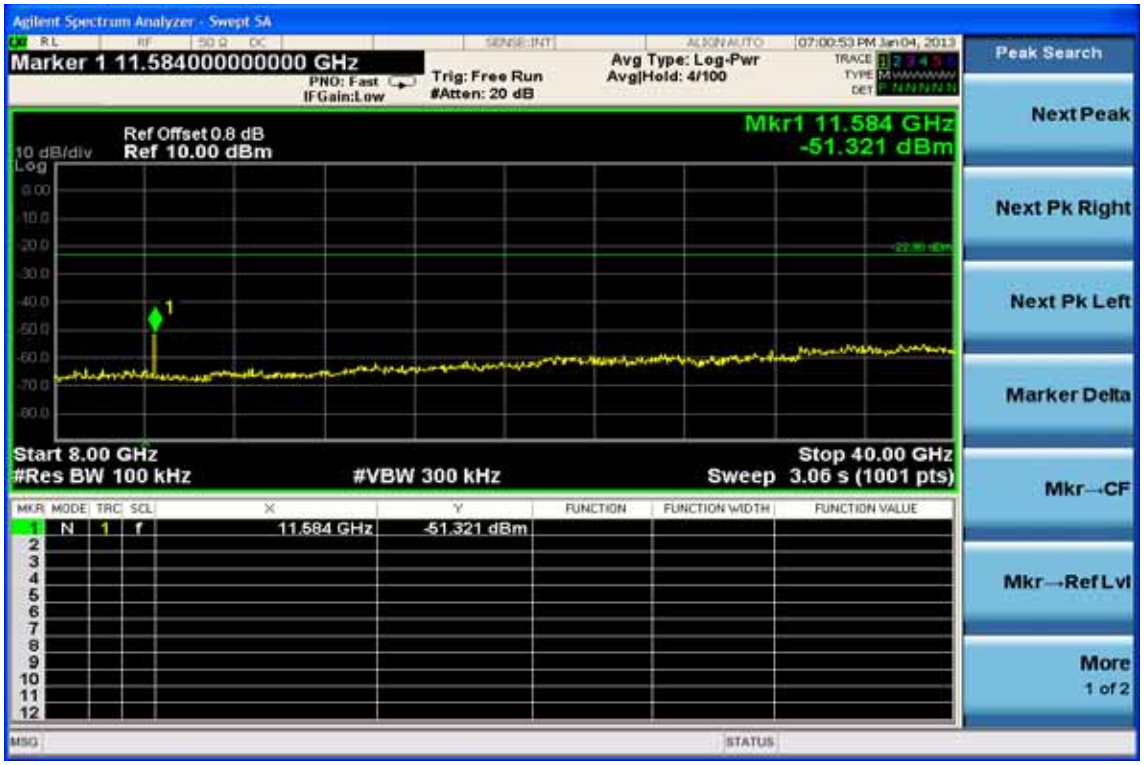
Ch Low 3GHz – 26.5GHz



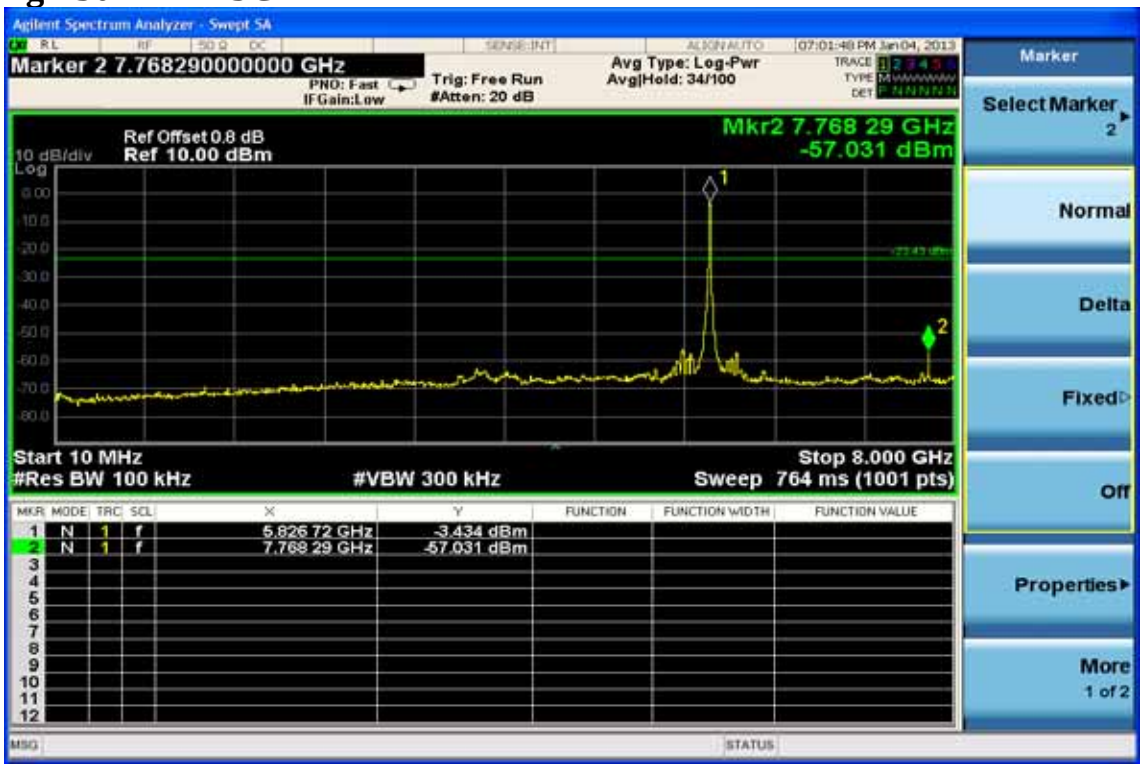
Ch Mid 30MHz – 3GHz



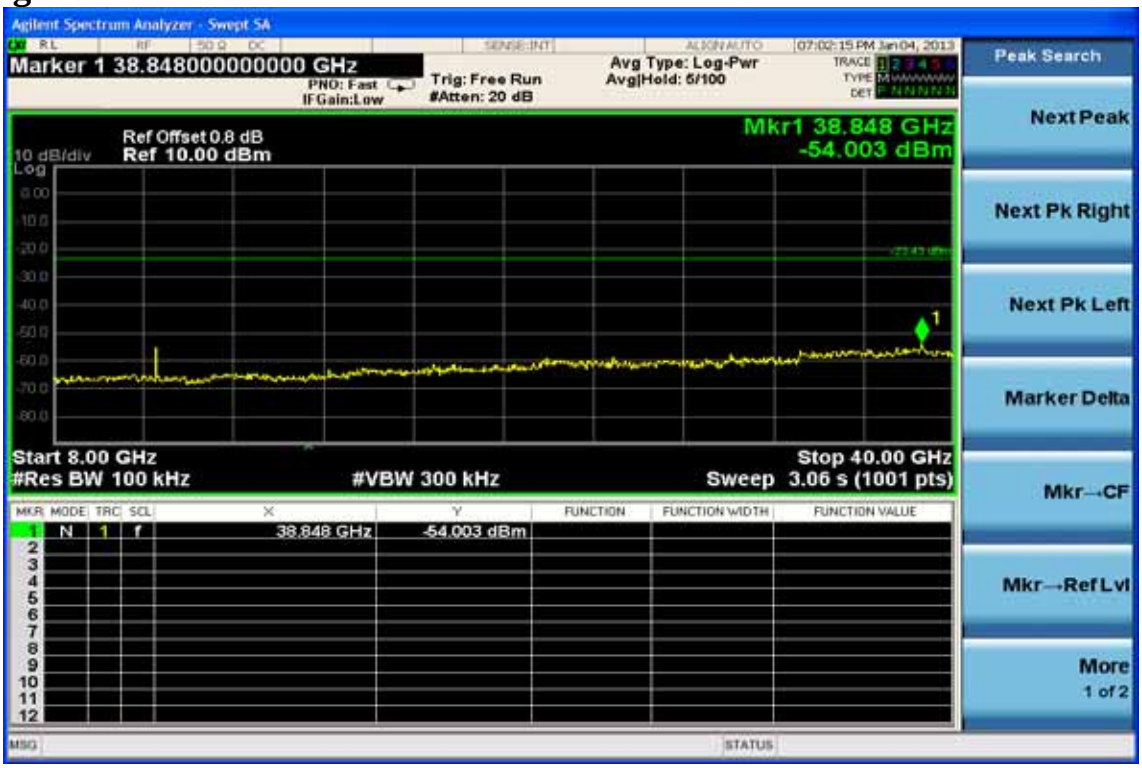
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

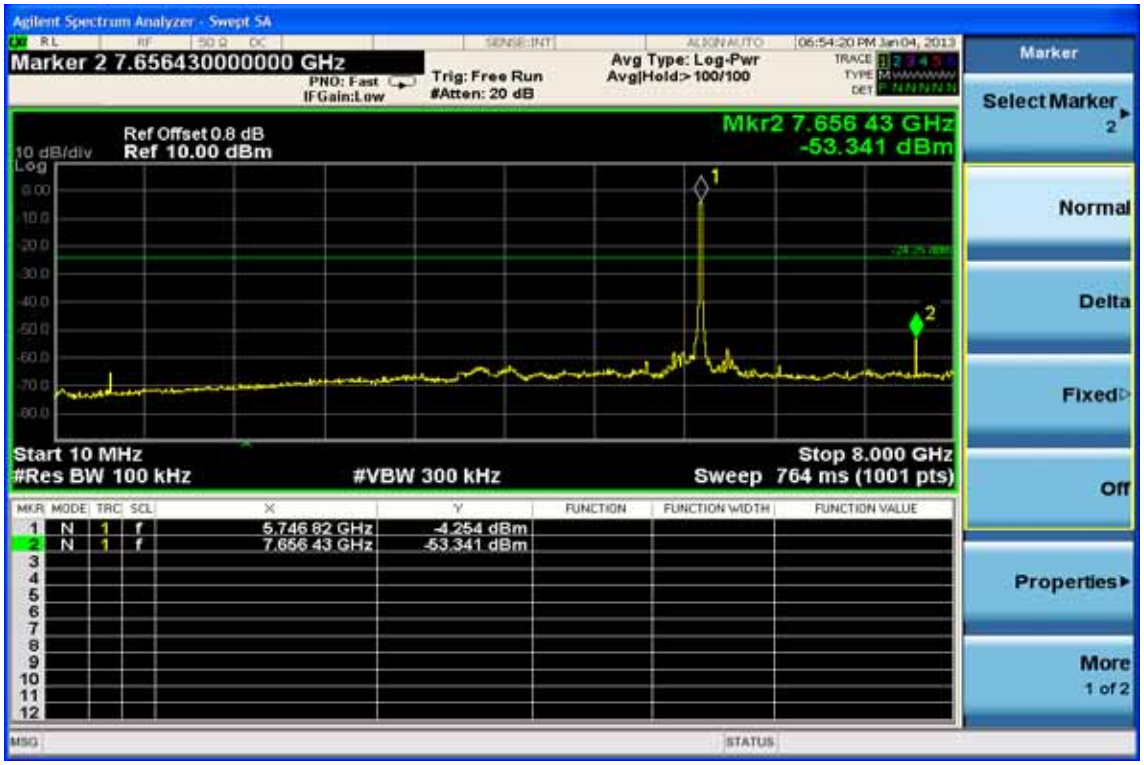


Ch High 3GHz – 26.5GHz

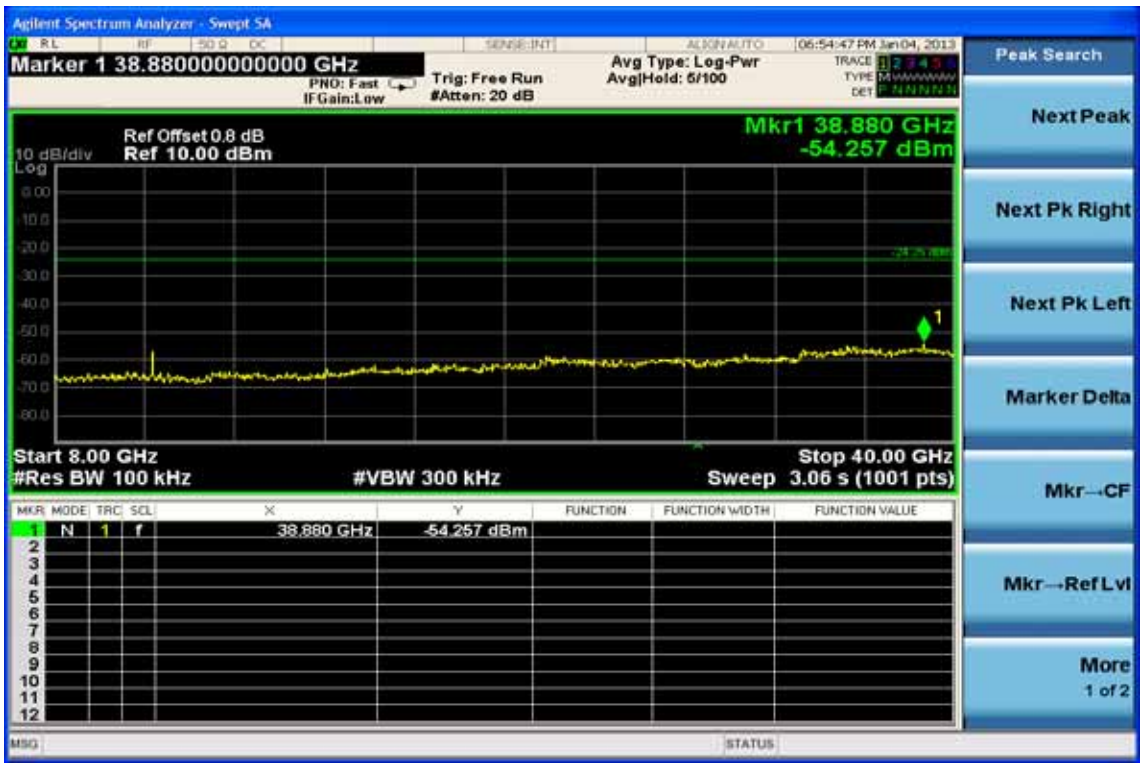


Conducted Spurious Emission Measurement Result
802.11n_20M for 5GHz (Antenna A Port)

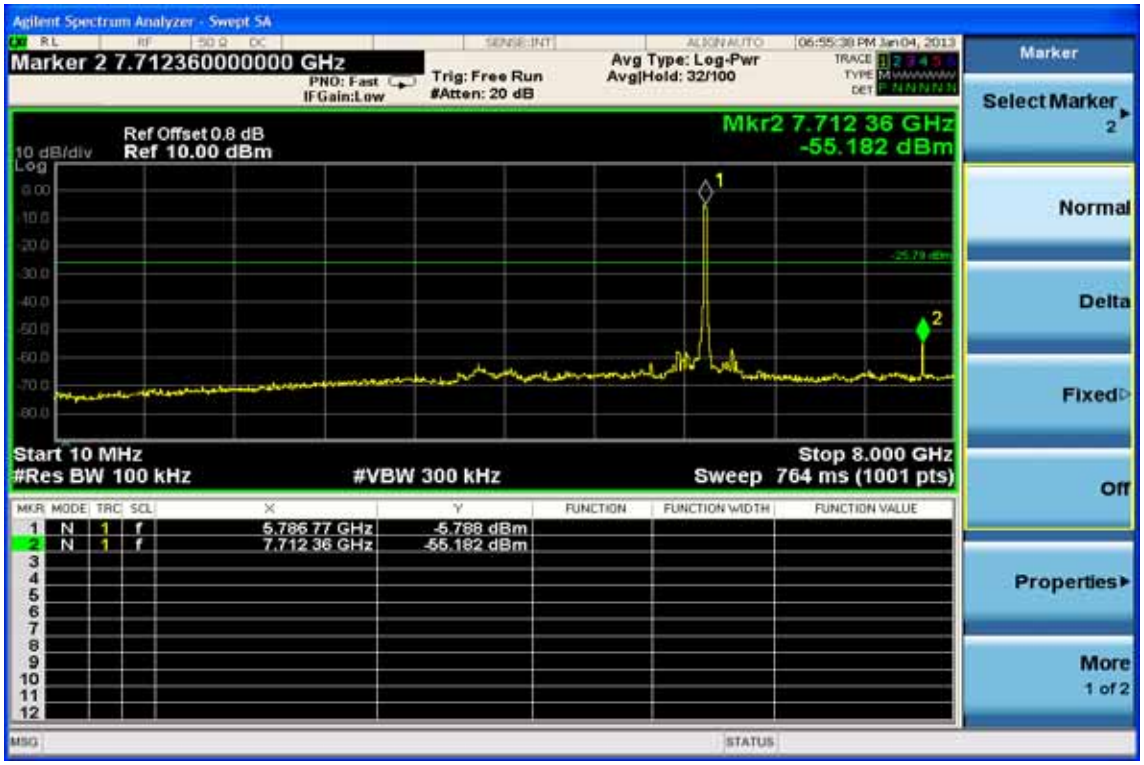
Ch Low 30MHz – 3GHz



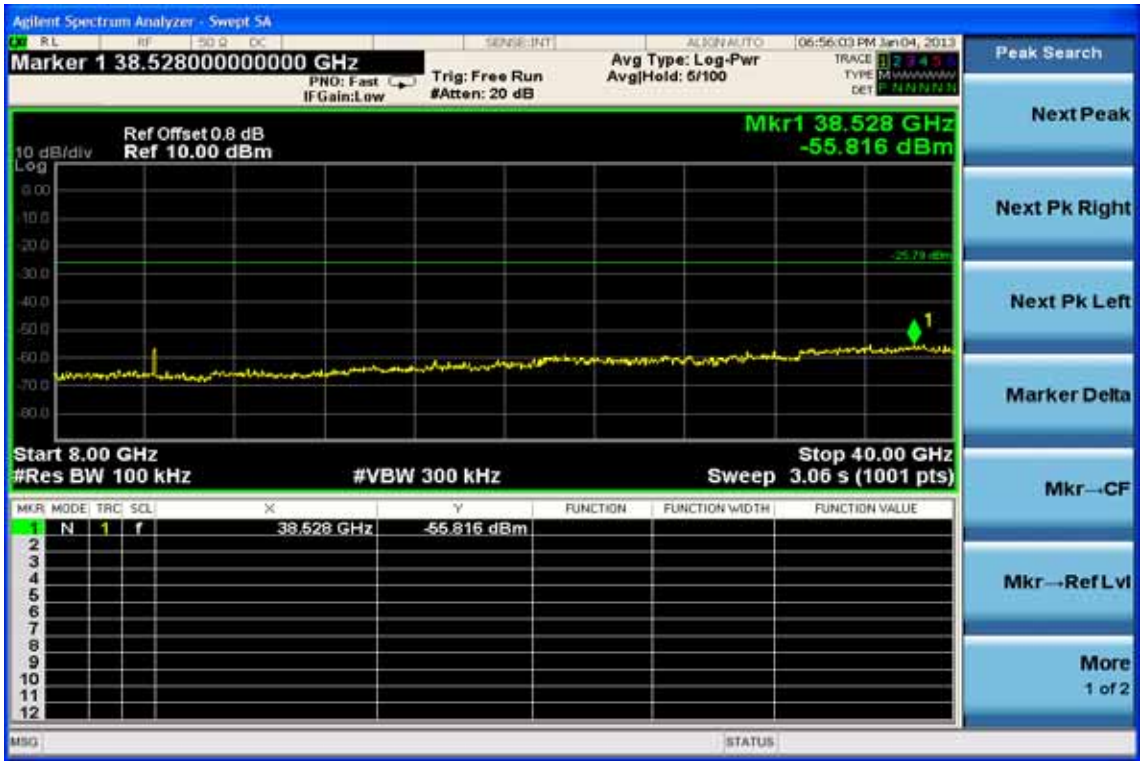
Ch Low 3GHz – 26.5GHz



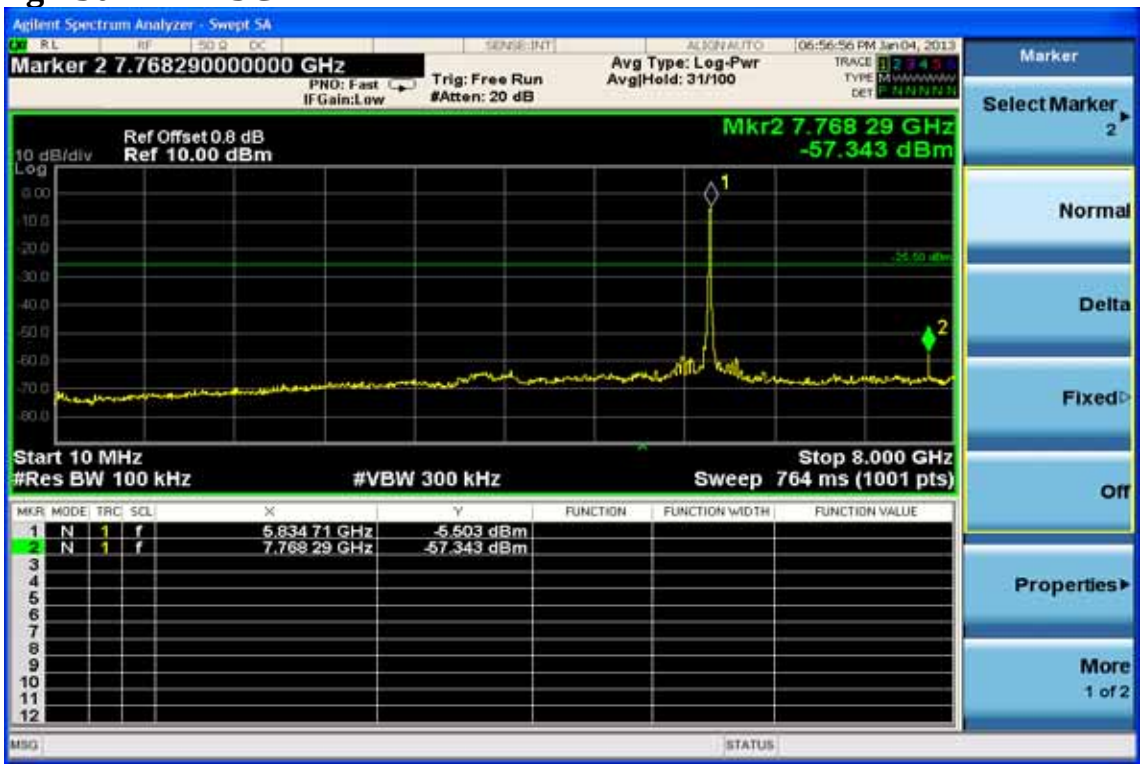
Ch Mid 30MHz – 3GHz



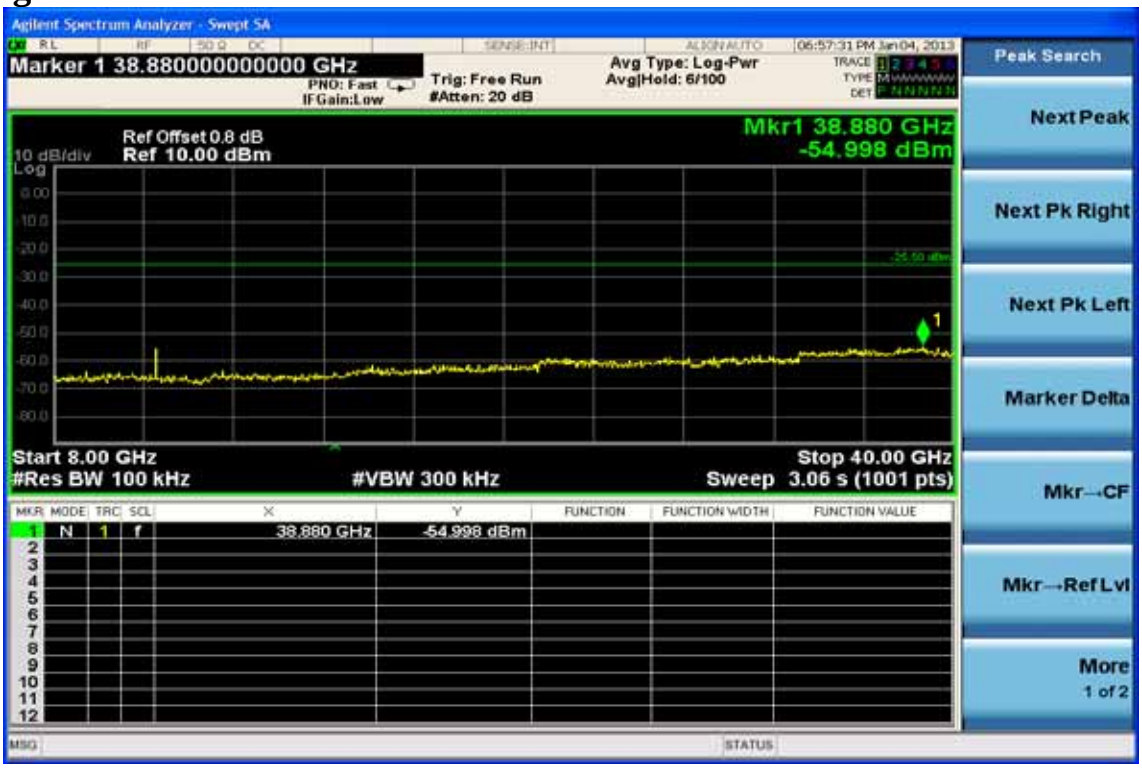
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

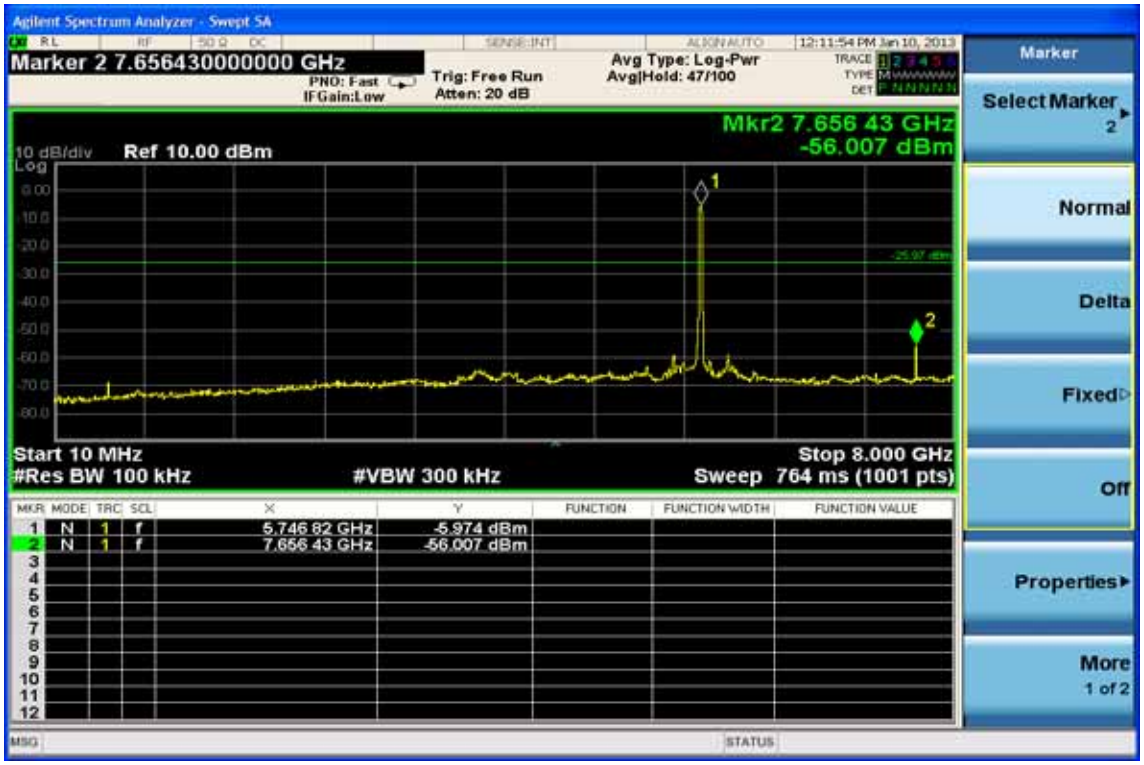


Ch High 3GHz – 26.5GHz

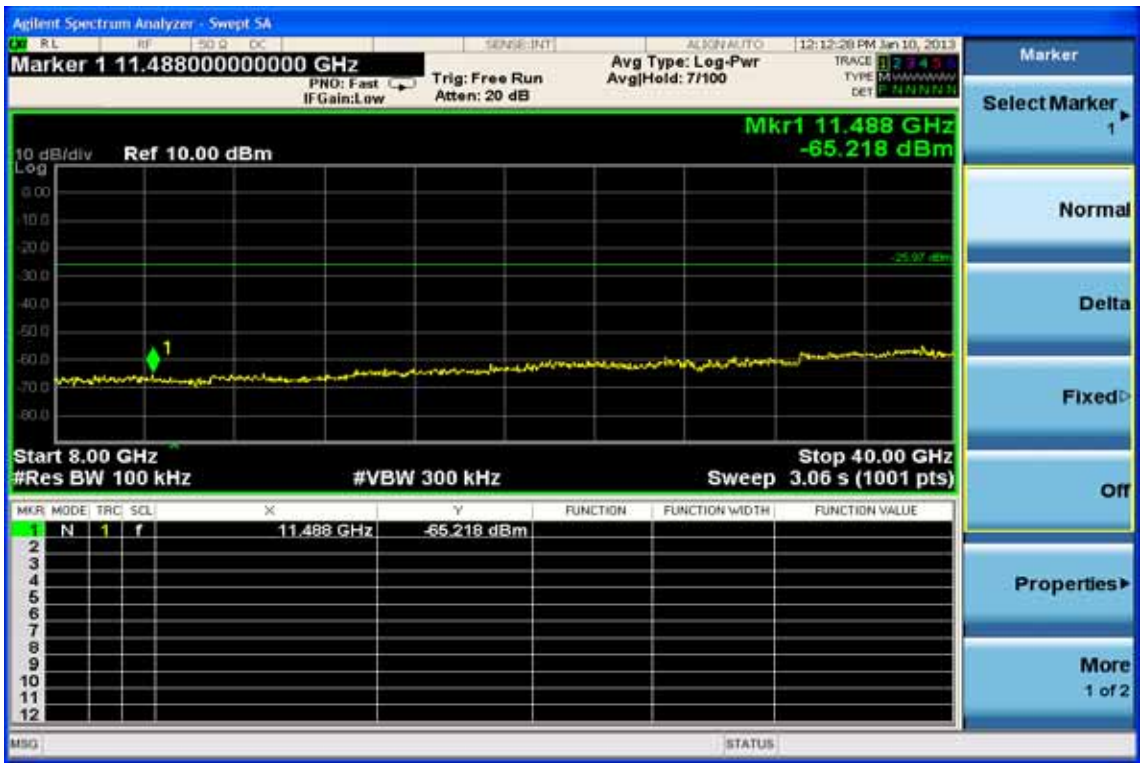


Conducted Spurious Emission Measurement Result
802.11n_20M for 5GHz (Antenna B Port)

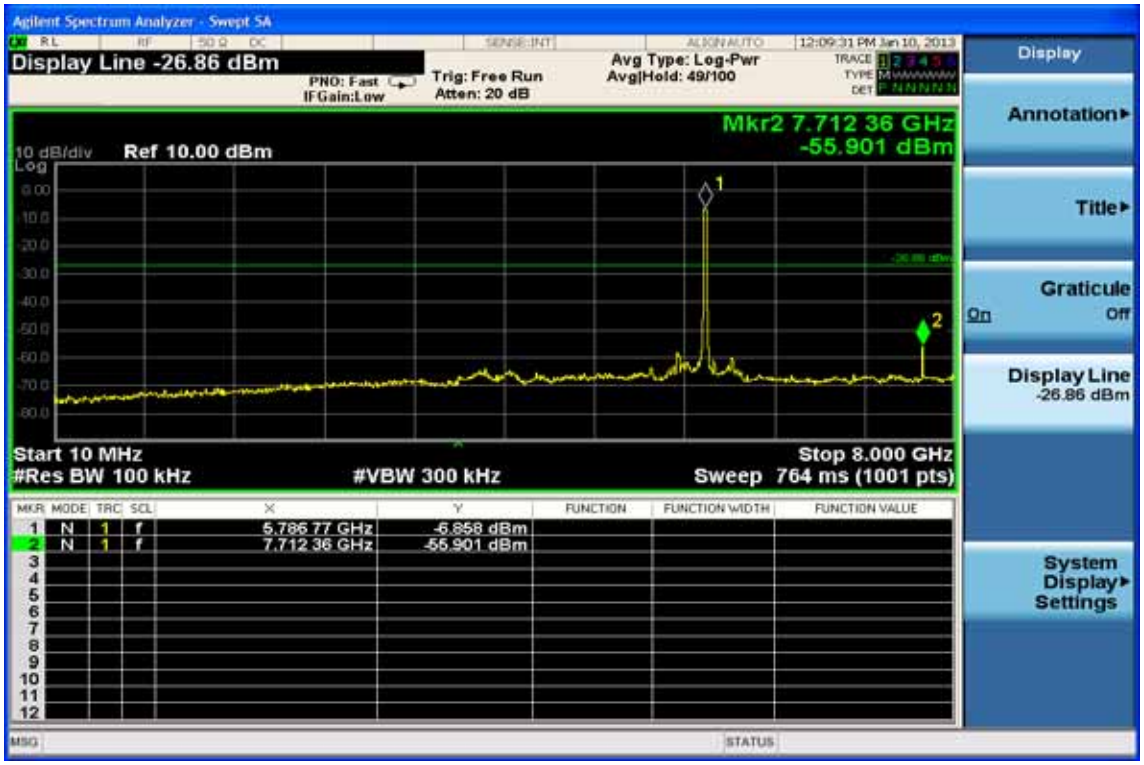
Ch Low 30MHz – 3GHz



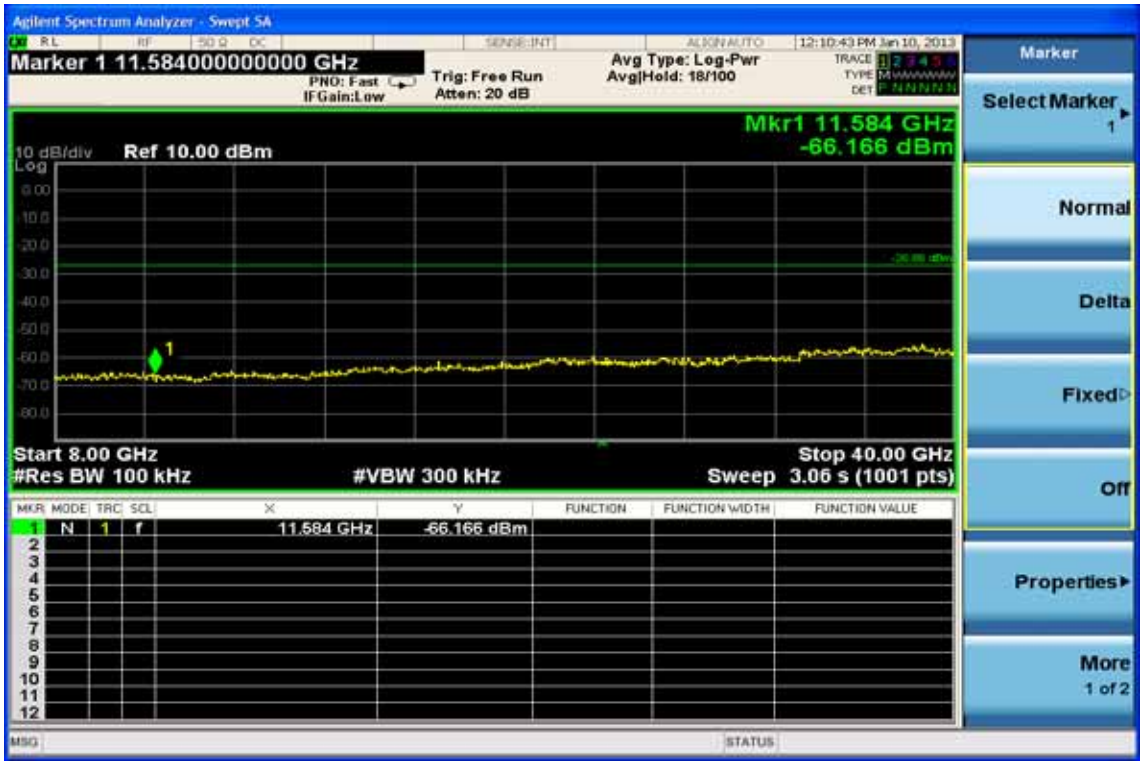
Ch Low 3GHz – 26.5GHz



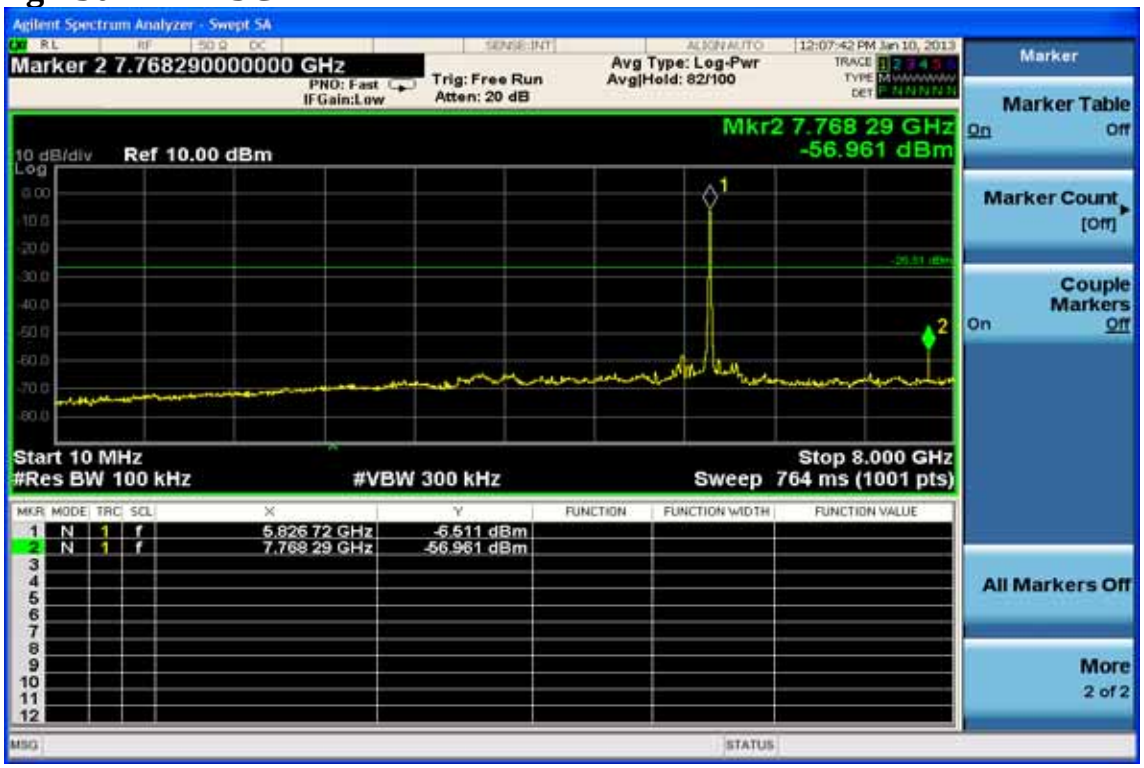
Ch Mid 30MHz – 3GHz



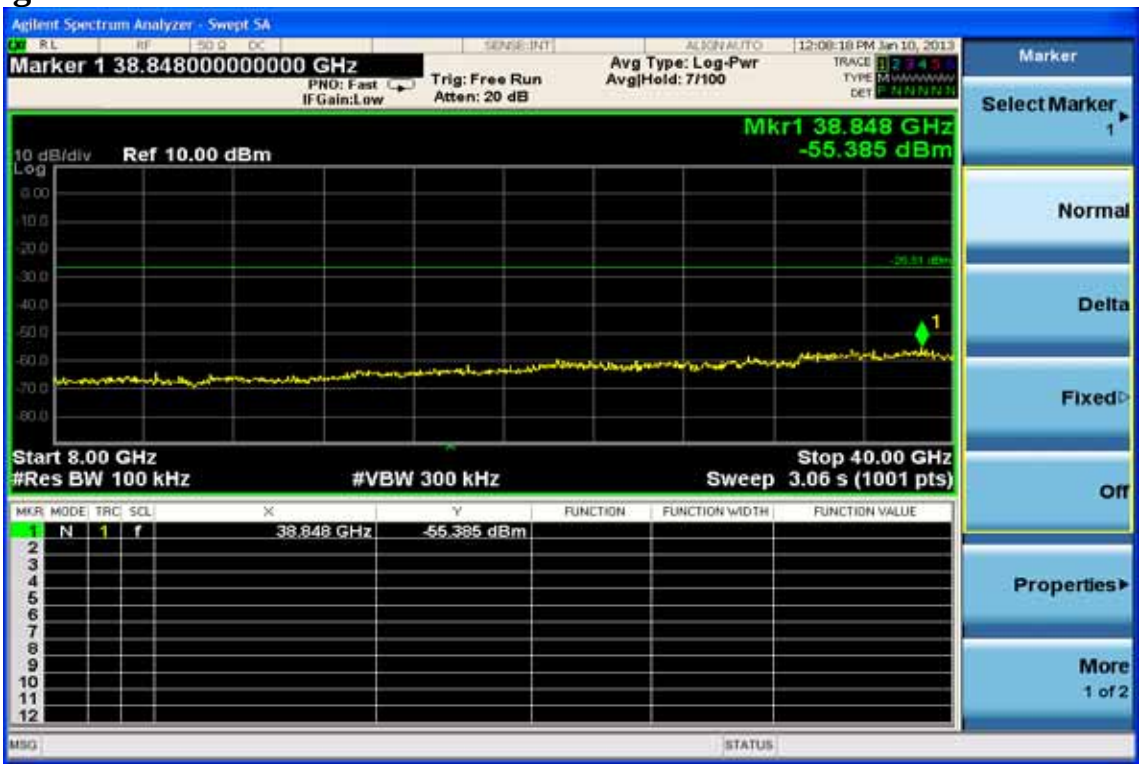
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

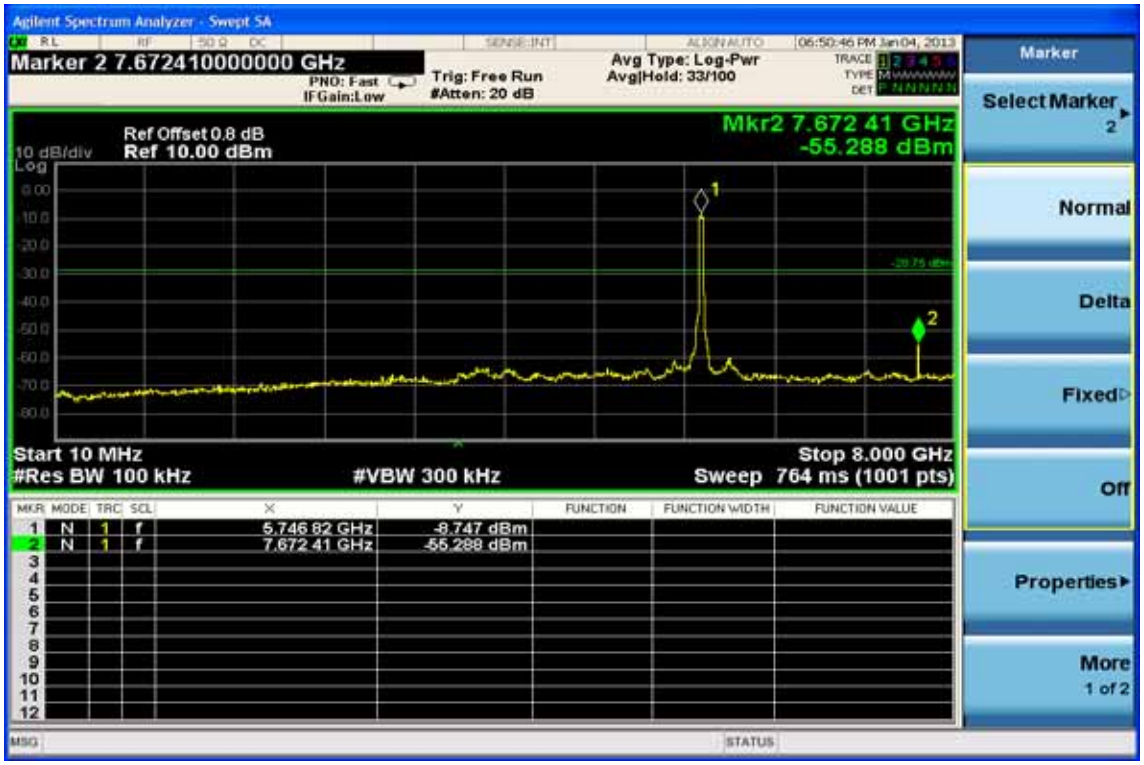


Ch High 3GHz – 26.5GHz

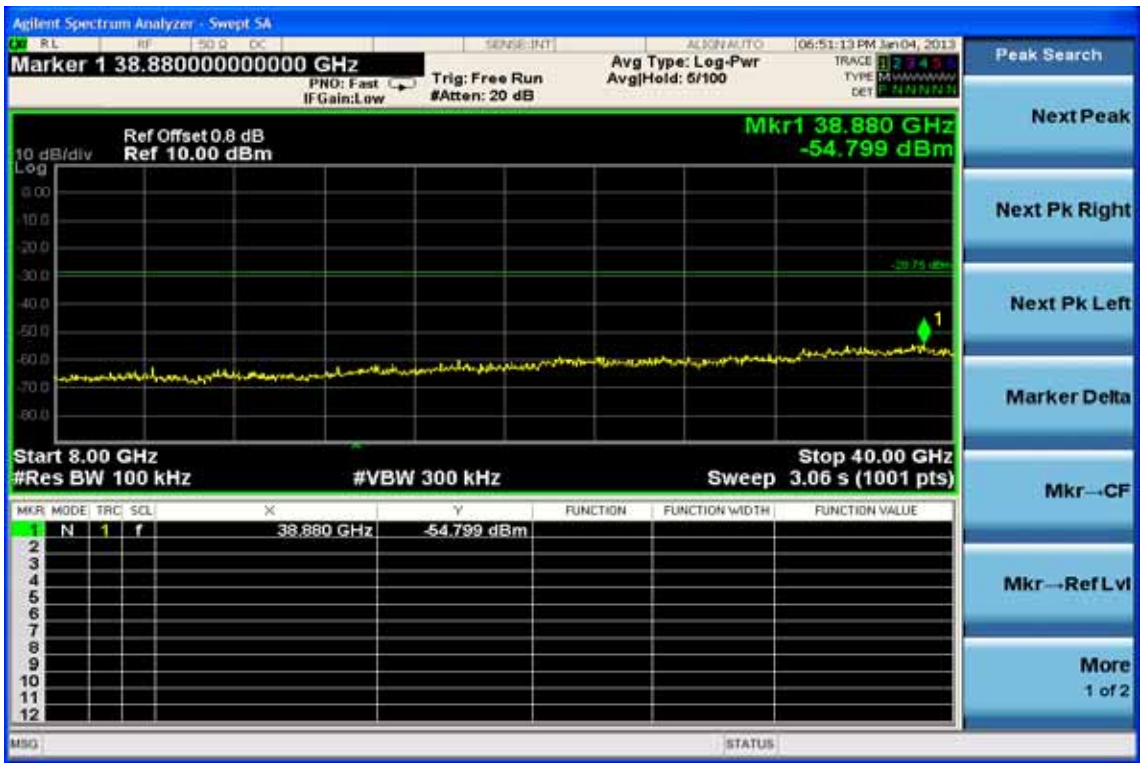


Conducted Spurious Emission Measurement Result
802.11n_40M for 5GHz (Antenna A Port)

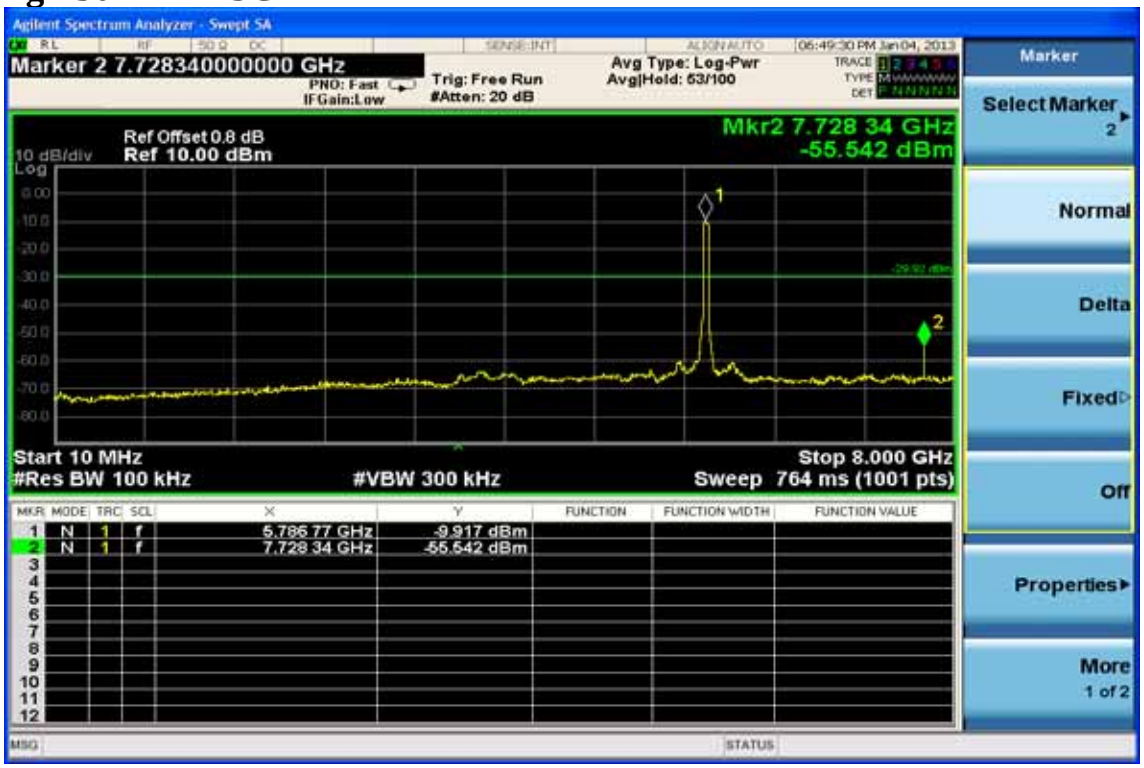
Ch Low 30MHz – 3GHz



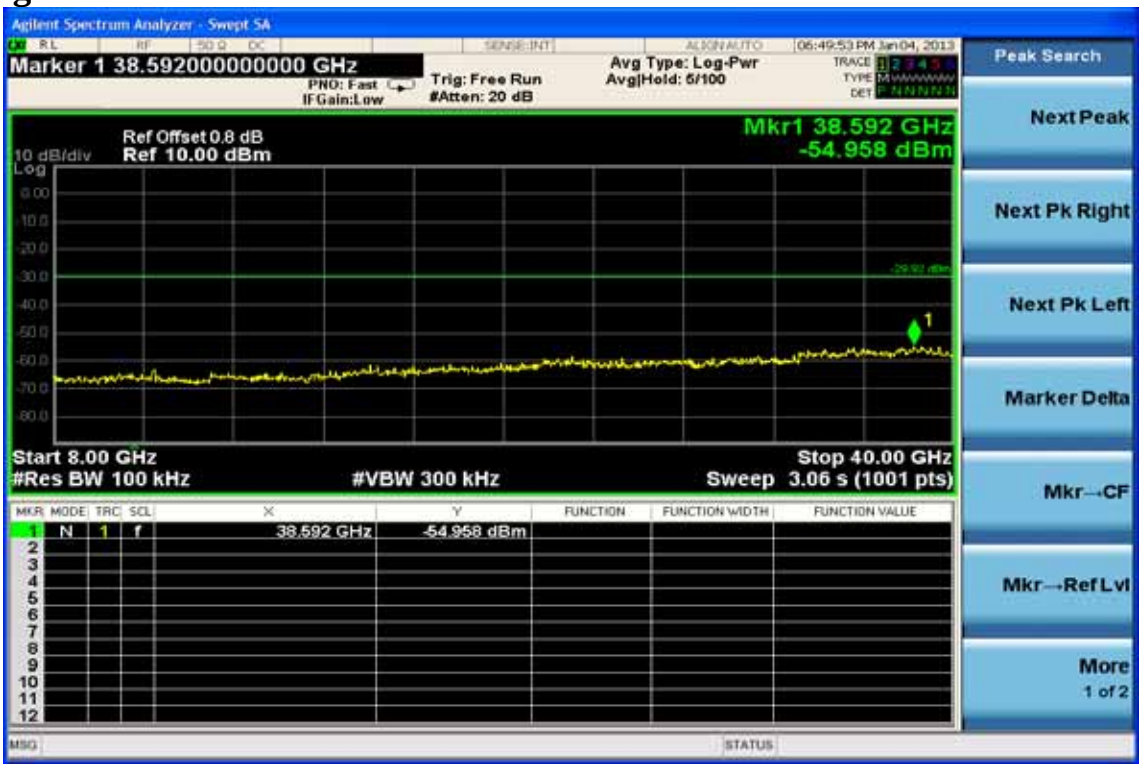
Ch Low 3GHz – 26.5GHz



Ch High 30MHz – 3GHz

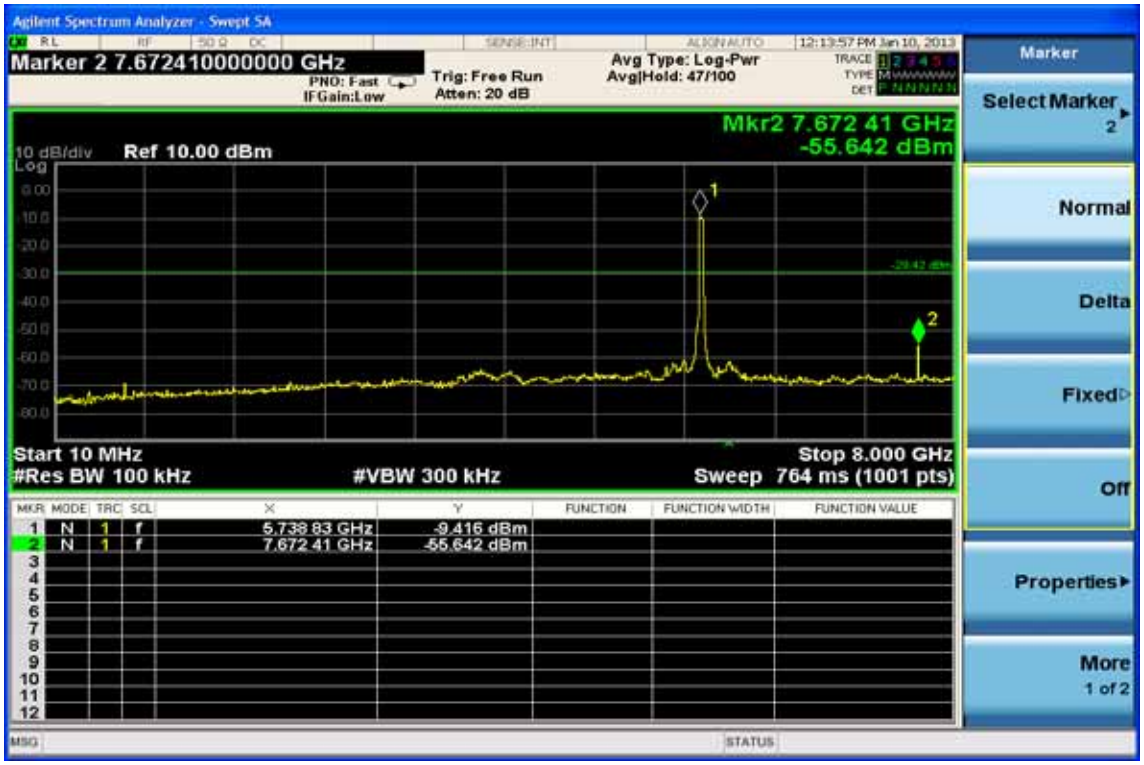


Ch High 3GHz – 26.5GHz

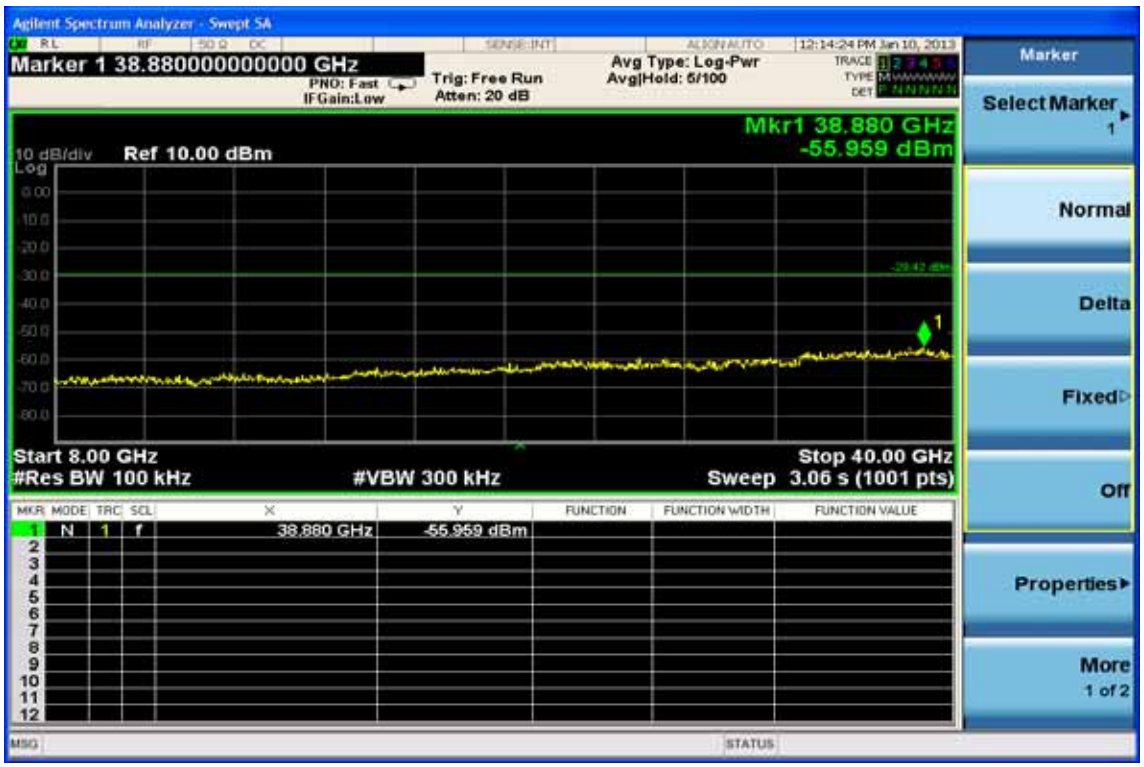


Conducted Spurious Emission Measurement Result
802.11n_40M for 5GHz (Antenna B Port)

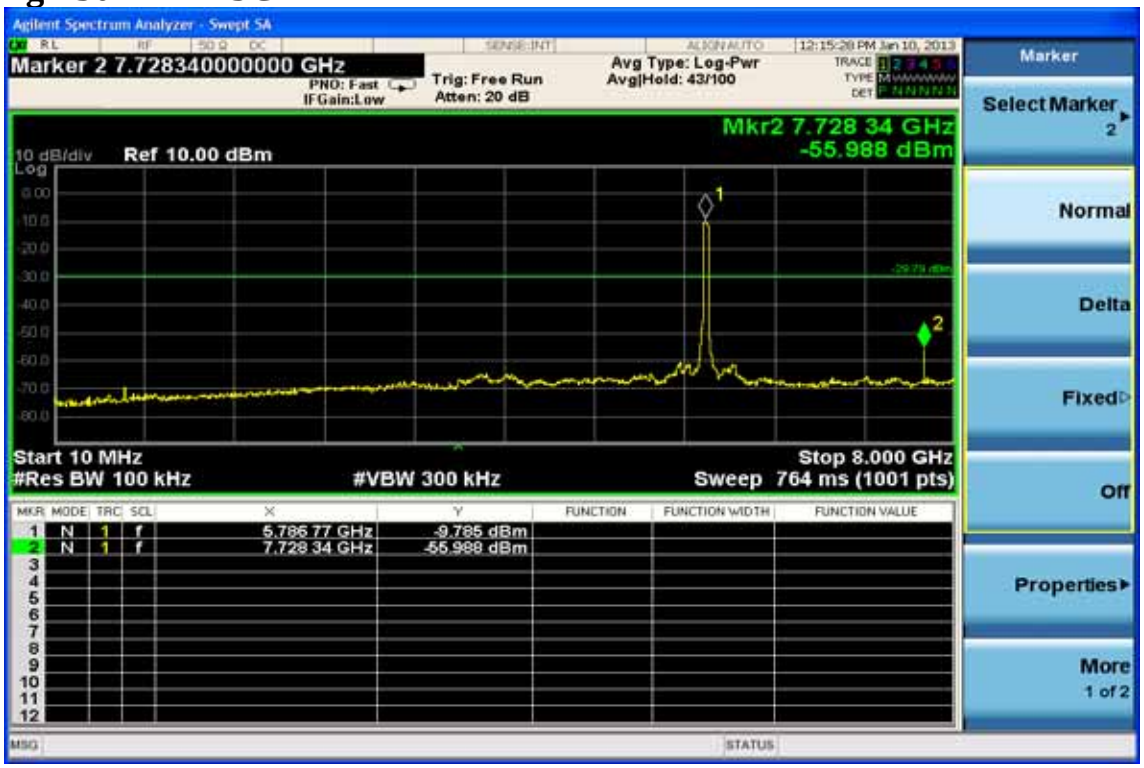
Ch Low 30MHz – 3GHz



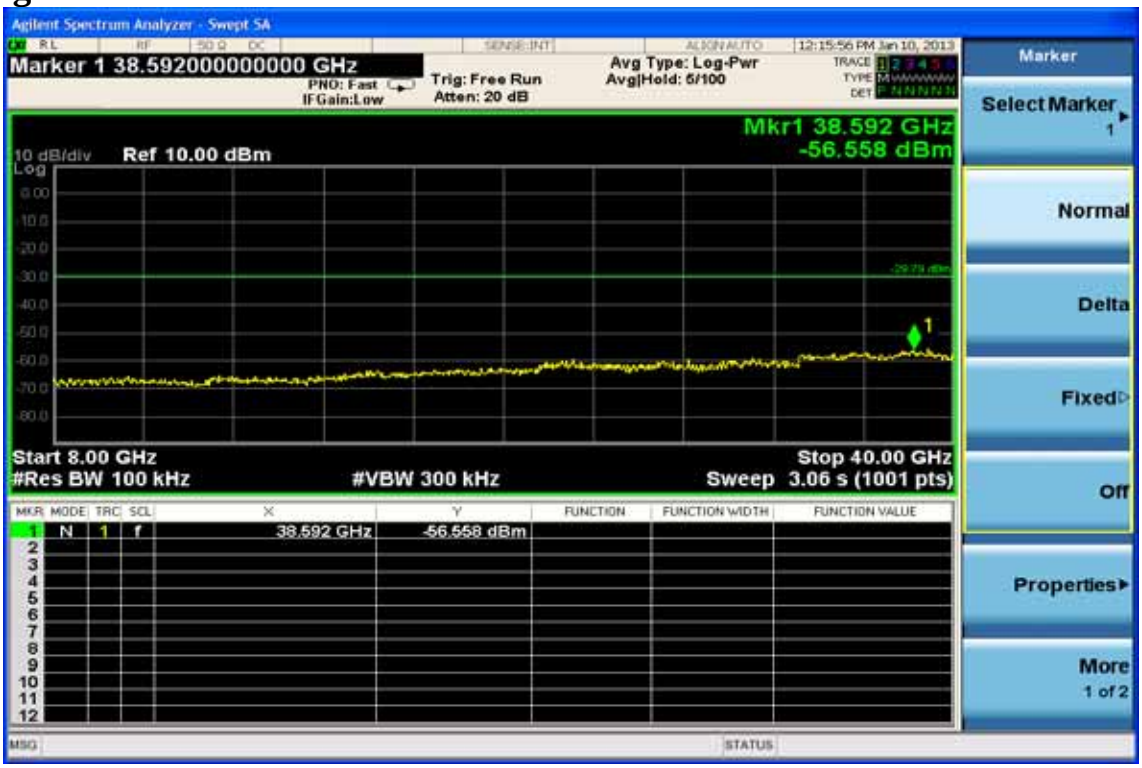
Ch Low 3GHz – 26.5GHz



Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



Radiated Spurious Emission Measurement Result (below 1GHz) (worst case)

Operation Mode	802.11 n_20M for 5GHz TX CH Low	Test Date	2013/01/14
Fundamental Frequency	5745MHz	Test By	Dino
Temperature	25 ℃	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	120.21	54.47	-15.34	39.13	43.50	-4.37	Peak	VERTICAL
2	312.27	54.42	-12.17	42.25	46.00	-3.75	Peak	VERTICAL
3	375.32	51.89	-10.88	41.01	46.00	-4.99	Peak	VERTICAL
4	500.45	50.01	-9.04	40.97	46.00	-5.03	Peak	VERTICAL
5	755.56	40.63	-3.81	36.82	46.00	-9.18	Peak	VERTICAL
6	860.32	35.56	-2.73	32.83	46.00	-13.17	Peak	VERTICAL
1	120.21	55.66	-15.34	40.32	43.50	-3.18	Peak	HORIZONTAL
2	199.75	53.96	-16.48	37.48	43.50	-6.02	Peak	HORIZONTAL
3	312.27	53.21	-12.17	41.04	46.00	-4.96	Peak	HORIZONTAL
4	399.57	51.36	-10.62	40.74	46.00	-5.26	Peak	HORIZONTAL
5	500.45	50.35	-9.04	41.31	46.00	-4.69	Peak	HORIZONTAL
6	749.74	35.72	-3.86	31.86	46.00	-14.14	Peak	HORIZONTAL

Remark:

1 No further spurious emissions detected from the lowest internal frequency and 30MHz.

2 Measuring frequencies from the lowest internal frequency to the 1GHz.

3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90KHz/110-490KHz using PK/AV and other Frequency Band using PK/QP

4 Measurement result within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (below 1GHz) (worst case)

Operation Mode	802.11 n_20M for 5GHz TX CH Mid	Test Date	2013/01/14
Fundamental Frequency	5785MHz	Test By	Dino
Temperature	25 ℃	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	120.21	55.00	-15.34	39.66	43.50	-3.84	Peak	VERTICAL
2	250.19	51.43	-14.13	37.30	46.00	-8.70	Peak	VERTICAL
3	312.27	54.57	-12.17	42.40	46.00	-3.60	Peak	VERTICAL
4	375.32	52.51	-10.88	41.63	46.00	-4.37	Peak	VERTICAL
5	450.01	49.63	-9.50	40.13	46.00	-5.87	Peak	VERTICAL
6	759.44	43.36	-3.77	39.59	46.00	-6.41	Peak	VERTICAL
1	120.21	55.52	-15.34	40.18	43.50	-3.32	Peak	HORIZONTAL
2	199.75	52.71	-16.48	36.23	43.50	-7.27	Peak	HORIZONTAL
3	324.88	52.53	-11.87	40.66	46.00	-5.34	Peak	HORIZONTAL
4	399.57	51.35	-10.62	40.73	46.00	-5.27	Peak	HORIZONTAL
5	500.45	48.91	-9.04	39.87	46.00	-6.13	Peak	HORIZONTAL
6	749.74	35.71	-3.86	31.85	46.00	-14.15	Peak	HORIZONTAL

Remark:

1 No further spurious emissions detected from the lowest internal frequency and 30MHz.

2 Measuring frequencies from the lowest internal frequency to the 1GHz.

3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90KHz/110-490KHz using PK/AV and other Frequency Band using PK/QP

4 Measurement result within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (below 1GHz) (worst case)

Operation Mode	802.11 n_20M for 5GHz TX CH High	Test Date	2013/01/14
Fundamental Frequency	5825MHz	Test By	Dino
Temperature	25 ℃	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	120.21	52.87	-15.34	37.53	43.50	-5.97	Peak	VERTICAL
2	312.27	54.13	-12.17	41.96	46.00	-4.04	Peak	VERTICAL
3	375.32	52.24	-10.88	41.36	46.00	-4.64	Peak	VERTICAL
4	500.45	48.76	-9.04	39.72	46.00	-6.28	Peak	VERTICAL
5	759.44	43.77	-3.77	40.00	46.00	-6.00	Peak	VERTICAL
6	937.92	34.15	-1.40	32.75	46.00	-13.25	Peak	VERTICAL
1	120.21	55.55	-15.34	40.21	43.50	-3.29	Peak	HORIZONTAL
2	199.75	54.14	-16.48	37.66	43.50	-5.84	Peak	HORIZONTAL
3	324.88	53.59	-11.87	41.72	46.00	-4.28	Peak	HORIZONTAL
4	399.57	51.84	-10.62	41.22	46.00	-4.78	Peak	HORIZONTAL
5	500.45	50.61	-9.04	41.57	46.00	-4.43	Peak	HORIZONTAL
6	749.74	34.88	-3.86	31.02	46.00	-14.98	Peak	HORIZONTAL

Remark:

1 No further spurious emissions detected from the lowest internal frequency and 30MHz.

2 Measuring frequencies from the lowest internal frequency to the 1GHz.

3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90KHz/110-490KHz using PK/AV and other Frequency Band using PK/QP

4 Measurement result within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (above 1GHz) (worst case)

Operation Mode	802.11n_20M TX CH Low	Test Date	2013/01/14
Fundamental Frequency	5745MHz	Test By	Dino
Temperature	25 ℃	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	7020.00	34.80	4.13	38.93	74.00	-35.07	Peak	VERTICAL
2	11490.00	30.87	7.52	38.39	74.00	-35.61	Peak	VERTICAL
1	7657.00	33.85	4.95	38.80	74.00	-35.20	Peak	HORIZONTAL
2	11490.00	30.41	7.52	37.93	74.00	-36.07	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Radiated Spurious Emission Measurement Result (above 1GHz) (worst case)

Operation Mode	802.11n_20M TX CH Mid	Test Date	2013/01/14
Fundamental Frequency	5785MHz	Test By	Dino
Temperature	25 ℃	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	7713.00	36.60	5.05	41.65	74.00	-32.35	Peak	VERTICAL
2	11570.00	30.69	7.55	38.24	74.00	-35.76	Peak	VERTICAL
1	7713.00	35.56	5.05	40.61	74.00	-33.39	Peak	HORIZONTAL
2	11570.00	31.62	7.55	39.17	74.00	-34.83	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Radiated Spurious Emission Measurement Result (above 1GHz) (worst case)

Operation Mode	802.11n_20M TX CH High	Test Date	2013/01/14
Fundamental Frequency	5825MHz	Test By	Dino
Temperature	25 ℃	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	7384.00	33.46	4.57	38.03	74.00	-35.97	Peak	VERTICAL
2	11650.00	30.71	7.60	38.31	74.00	-35.69	Peak	VERTICAL
1	7083.00	34.44	4.21	38.65	74.00	-35.35	Peak	HORIZONTAL
2	11650.00	30.53	7.60	38.13	74.00	-35.87	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

10 Peak Power Spectral Density

10.1 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 8 dBm 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.

10.2 Measurement Equipment Used:

Refer to section 6.2 for details.

10.3 Test Set-up:

Refer to section 6.3 for details.

10.4 Measurement Procedure:

Refer to section 9 Measurement Procedure PKPSD:of KDB Document: 558074 D01 DTS Meas Guidance v02

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ 300 kHz.
4. Set the span to 5-30 % greater than the EBW.
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 power level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log (3 kHz/100 kHz = -15.2 dB).
11. The resulting peak PSD level must be ≤ 8 dBm.

10.5 Measurement Result:

802.11b Mode

Frequency MHz	Power Density Reading (dBm)/100KHz	BWCF (dB)	Power Density Level (dBm)/3KHz	Maximum Limit (dBm)
2412	5.948	-15.2	-9.252	8
2437	5.954	-15.2	-9.246	8
2462	7.423	-15.2	-7.777	8

BWCF(bandwidth correction factor)=10log (3 kHz/100KHz)
kHz = -15.2 dB)

802.11g Mode

Frequency MHz	Power Density Reading (dBm)/100KHz	BWCF (dB)	Power Density Level (dBm)/3KHz	Maximum Limit (dBm)
2412	1.38	-15.2	-13.82	8
2437	2.795	-15.2	-12.405	8
2462	1.436	-15.2	-13.764	8

BWCF(bandwidth correction factor)=10log (3 kHz/100KHz)
kHz = -15.2 dB)

802.11n for 2.4GHz
2*2 MIMO

	Frequency (MHz)	Output Chain (dBm/100KHz)		BWCF	Combine Power Density (dBm) /3KHz	Limit (dBm)	Result
		Chain A	chain B				
AN HT20	2412	-3.152	-2.079	-15.2	-14.77	8	Pass
	2437	-3.286	-2.21	-15.2	-14.90	8	Pass
	2462	-3.198	-2.247	-15.2	-14.89	8	Pass
AN HT40	2422	-5.746	-5.052	-15.2	-17.57	8	Pass
	2437	-6.345	-5.239	-15.2	-17.95	8	Pass
	2452	-5.386	-5.343	-15.2	-17.55	8	Pass

802.11a Mode

Frequency MHz	Power Density Reading (dBm)/100KHz	BWCF (dB)	Power Density Level (dBm)/3KHz	Maximum Limit (dBm)
5745	-0.937	-15.2	-16.137	8
5785	-1.352	-15.2	-16.552	8
5825	0.56	-15.2	-14.64	8

BWCF(bandwidth correction factor)=10log (3 kHz/100KHz)
kHz = -15.2 dB)

802.11n for 5GHz
2*2 MIMO

	Frequency (MHz)	Output Chain (dBm/100KHz)		BWCF	Combine Power Density (dBm) /3KHz	Limit (dBm)	Result
		Chain A	chain B				
AN HT20	5745	-3.15	-3.746	-15.2	-15.63	8	Pass
	5785	-3.335	-4.047	-15.2	-15.87	8	Pass
	5825	-4.083	-4.847	-15.2	-16.64	8	Pass
AN HT40	5755	-7.299	-6.461	-15.2	-19.05	8	Pass
	5795	-8.66	-5.633	-15.2	-19.08	8	Pass

802.11b

Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11g

Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11n_20M for 2.4GHz (Antenna A Port)
Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11n_20M for 2.4GHz (Antenna B Port)
Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11n_40M for 2.4GHz (Antenna A Port)
Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11n_40M for 2.4GHz (Antenna B Port)
Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11a

Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11n_20M for 5GHz (Antenna A Port)
Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11n_20M for 5GHz (Antenna B Port)
Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-Mid)

Power Spectral Density Test Plot (CH-High)

802.11n_40M for 5GHz (Antenna A Port)
Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-High)

802.11n_40M for 5GHz (Antenna B Port)
Power Spectral Density Test Plot (CH-Low)

Power Spectral Density Test Plot (CH-High)

11 ANTENNA REQUIREMENT

11.1 Standard Applicable:

According to §15.203, Antenna requirement.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

11.2 Antenna Connected Construction:

The directional gins of antenna used for transmitting please refer to below table, 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.

Antenna Designation:

	Manufacturer	Model No.	Connector Type	Type	Gain (2.4GHz)	Gain (5GHz)
Ant 1	Airwave Technologies INC.	EDA-8709-25GR2-A4-RM	Revise SMA, unique	Dipole Ant	2 dBi	2 dBi
Ant 2	ARISTRTLE	RFA-25-C2S1-70-90	unique	Dipole Ant	2 dBi	2 dBi
Ant 3	Tranwo technology corp.	SD001-201003-A101	Revise SMA, unique	Dipole Ant	2dBi	2 dBi
Ant 3-1	Tranwo technology corp.	RFA-05-2-L14M3-B70-1	Revise SMA, unique	Dipole Ant	2dBi	2 dBi
Ant 3-2	Tranwo technology corp.	202-000442-00	unique	Patch Ant	0 dBi	-1 dBi
Ant 3-3	Tranwo technology corp.	202-000441-00	unique	Patch Ant	0.5 dBi	-0.5 dBi
Ant 4	UDM Group Technology Co., Ltd	26-52-01800G	unique	PCB Ant (Green)	2.5 dBi	4 dBi
Ant 5	Unictron Technologies Corporation	H2P566WKBA0100	unique	PCB Ant (Blue)	2.3 dBi	4dBi

12 Maximum Permissible Exposure (MPE)

12.1 Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

12.2 Maximum Permissible Exposure (MPE) Evaluation

The worst case of Average power: refer to section 6.5 for detail measurement date.

802.11b

Cable loss = 0		Output Power		Limit (dBm)
CH	Frequency (MHz)	Detector		
		PK (dBm)	AV (dBm)	
1	2412	19.20	17.13	30
6	2437	19.29	17.15	
11	2462	19.52	17.31	

MPE Prediction (802.11b)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	17.31	(dBm)
Maximum Average output power at antenna input	53.82697825	(mW)
Duty cycle:	100	(%)
Maximum Pav :	53.82697825	(mW)
Antenna gain (typical):	2.5	(dBi)
Maximum antenna gain:	1.77827941	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0190524	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0191 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 2462MHz.

The worst case of Average power: refer to section 6.5 for detail measurement date.

802.11a(5G)

Cable loss = 0		Output Power		Limit (dBm)
CH	Frequency (MHz)	Detector		
		PK (dBm)	AV (dBm)	
149	5745	23.15	14.28	30
153	5765	23.08	14.11	
157	5785	23.88	14.01	
161	5805	23.42	13.84	
165	5825	20.93	10.63	

MPE Prediction (802.11b)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	14.28	(dBm)
Maximum Average output power at antenna input	26.79168325	(mW)
Duty cycle:	100	(%)
Maximum Pav :	26.79168325	(mW)
Antenna gain (typical):	4	(dBi)
Maximum antenna gain:	2.511886432	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5745	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0133952	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0134 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5745MHz.