FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Smart Surge Protector

Model: PX31BW

Trade Name: i-BRIGHT 7

Issued to

Tri Cascade Inc
5020 Campus Drive , Newport Beach, CA 92660 , USA

Issued by

Compliance Certification Services Inc.
No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township,
Taoyuan County 33841, Taiwan, R.O.C.
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Testing Laboratory
1309

Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		April 24, 2014		Initial Issue	All	Landy Huang

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1 TEST RESULT CERTIFICATION

Applicant:	**Tri Cascade Inc** 5020 Campus Drive , Newport Beach, CA 92660 , USA
Manufacturer:	**Ahoku Techland Electronics Ltd.** No 5, DaBanDi 1 st Rd., ShaBen, ChangAn, DonGguan City, GuangDong, China
Equipment Under Test:	Smart Surge Protector
Trade Name:	i-BRIGHT 7
Model:	PX31BW
Date of Test:	October 23, 2013 ~ April 21, 2014

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

We hereby certify that:

Compliance Certification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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

Approved by: ***Reviewed by:***

Stan Lin
Section Manager

Angel Hu
Section Manager

2 EUT DESCRIPTION

Product	Smart Surge Protector		
Trade Name	i-BRIGHT 7		
Model Number	PX31BW		
Model Discrepancy	N/A		
EUT Power Rating	125VAC, 15A, 50-60Hz		
RF Module Manufacturer	Ralink	**Model**	WM101A
Frequency Range	IEEE 802.11b/g/ IEEE 802.11n HT20 mode: 2412~2462MHz IEEE 802.11n HT40 mode: 2422~2452MHz		
Transmit Power	IEEE 802.11b mode: 22.84 dBm (0.1923W) IEEE 802.11g mode: 22.88 dBm (0.1941W) IEEE 802.11n HT20 mode: 22.84 dBm (0.1924W) IEEE 802.11n HT40 mode: 23.15 dBm (0.2064W)		
Modulation Technique & Transmit Data Rate	IEEE 802.11b mode: DSSS (11, 5.5, 2, 1 Mbps) IEEE 802.11g mode: OFDM (54, 48, 36, 24, 18, 12, 11, 9, 6 Mbps) IEEE 802.11n HT20 mode: OFDM (6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps) IEEE 802.11n HT40 mode: OFDM (13.5, 27, 40.5, 54, 81, 108, 121.5, 135 Mbps)		
Number of Channels	IEEE 802.11b/g mode: 11 Channels IEEE 802.11n HT20 mode: 11 Channels IEEE 802.11n HT40 mode: 7 Channels		
Antenna Specification	PCB Antenna / Gain: 2.52dBi		

Remark:

1. The sample selected for test was production product and was provided by manufacturer.

*2. This submittal(s) (test report) is intended for FCC ID: **2ACARPX31BW01** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*

3. This report is compliance with the 558074 D01 DTS Meas Guidance v03r01 Requirement.

3 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2009 and FCC CFR 47 Part 15.207, 15.209, 15.247.

3.1 EUT CONFIGURATION

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

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 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 maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 - 13.41	322 - 335.4		

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.5 DESCRIPTION OF TEST MODES

The EUT is a 1Tx1R SISO transmitter.

Software used to control the EUT for staying in continuous transmitting and receiving mode was programmed.

The worst case data rate is determined as the data rate with highest output power.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode and receiving radiated spurious emission above 1GHz, which worst case was in CH Mid mode only.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Y axis), lie-down position (X, Z axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

IEEE 802.11b mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 1Mbps data rate was chosen for full testing.

IEEE 802.11g mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6Mbps data rate was chosen for full testing.

IEEE 802.11n HT20 mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT40 mode:

Channel Low (2422MHz), Channel Mid (2437MHz) and Channel High (2452MHz) with 13.5Mbps data rate were chosen for full testing.

4 INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY48250064	01/01/2015
Spectrum Analyzer	Agilent	N9010A	MY52220817	03/20/2015
Spectrum Analyzer	R&S	FSL	100837	11/11/2014
Power meter	Anritsu	ML2495A	1033009	09/29/2014
Power Sensor	Anritsu	MA2411B	0917221	09/29/2014

3M Semi Anechoic Chamber				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY48250064	01/01/2015
Spectrum Analyzer	R&S	FSL	100837	11/11/2014
Pre-Amplifier	HP	8447D	2944A06530	08/10/2014
Pre-Amplifier	EMEC	EM01M26G	060570	07/25/2014
Pre-Amplifier	MITEQ	AMF-6F-260400-40-8P	985646	08/08/2014
Pre-Amplifier	Agilent	8449B	3008A01738	08/10/2014
EMI Test Receiver	SCHAFFNER	SCR 3501	430	03/30/2015
Loop Antenna	EMCO	6502	2356	06/12/2014
Bilog Antenna	TESEQ	CBL 6112D	35378	09/11/2014
Horn Antenna	EMCO	3115	00022250	08/04/2014
Horn Antenna	EMCO	3116	00026370	12/29/2014
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R
Test S/W	EZ-EMC			

NOTE: *1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.*
2. N.C.R = No Calibration Request.

Powerline Conducted Emissions Test Site #B				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
TEST RECEIVER	R&S	ESCI	100234	06/10/2014
LISN (EUT)	SCHWARZBECK	NSLK 8127	8127691	09/10/2014
LISN	SCHWARZBECK	NSLK 8127	8127382	01/07/2015
BNC CABLE	EMCI	CFD300-NL	BNC B4	03/13/2015
Pulse Limiter	R&S	ESH3-Z2	100374	01/08/2015
THERMO-HYGRO METER	WISEWIND	201A	No. 05	06/10/2014
Test S/W	EZ-EMC			

NOTE: *1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.*
2. N.C.R = No Calibration Request.

4.3 MEASUREMENT UNCERTAINTY

Parameter	Uncertainty
Powerline Conducted Emission	±1.56
3M Chamber / 30~200MHz	±3.5921
3M Chamber / 200~1000MHz	±3.5657
3M Chamber / 1~8GHz	±2.5873
3M Chamber / 8~18GHz	±2.6646
3M Chamber / 18~26GHz	±2.9617
3M Chamber / 26~40GHz	±3.4250

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

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No. 163-1, Jhongsheng Rd., Sindien District, Taipei City 23151, Taiwan
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☐ No 11, Wugong 6th Rd, Wugu District, New Taipei City 24891, Taiwan (R.O.C)
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.2 LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by American Association for Laboratory Accreditation Program for the specific scope accreditation under Lab Code: 0824-01 to perform Electromagnetic Interference tests according to FCC Part 15 and CISPR 22 requirements. In addition, the test facilities are listed with Industry Canada, Certification and Engineering Bureau, IC 2324G-1 for 3M Semi Anechoic Chamber A, IC 2324G-2 for 3M Semi Anechoic Chamber B.

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	A2LA	CFR 47, FCC Part15/18, CISPR 22, EN 55022, ICES-003, AS/NZS CISPR 22, VCCI V-3, EN 55011, CISPR 11, IEC/EN 61000-4-2/3/4/5/6/8/11, EN 61000-6-1/2/3/4, EN 55024, CISPR 24, AS/NZS CISPR 24, AS/NZS 61000.6.2, EN 55014-1/-2, ETSI EN 300 386 v1.3.2/v1.3.3, IEC/EN 61000-3-2, AS/NZS 61000.3.2, IEC/EN 61000-3-3, AS/NZS 61000.3.3	ACCREDITED TESTING CERT #0824.01
USA	FCC MRA	3 meter Open Area Test Sites to perform FCC Part 15/18 measurements	TW1026
Japan	VCCI	3/10 meter Open Area Test Sites and conducted test sites to perform radiated/conducted measurements	VCCI R-2882/2541/2798/725/1868 C-402/747/912 T-1930/1646
Taiwan	TAF	EN 55014-1, CISPR 14, CNS 13781-1, EN 55013, CISPR 13, CNS 13439, EN 55011, CISPR 11, CNS 13803, PLMN09, IS2045-0, LP0002 FCC Part 27/90, Part 15B/C/D/E, RSS-192/193/210/310 ETSI EN 300 328/ 300 220-1/ 300 220-2/ 301 893/ 301 489-01/ 301 489-03/ 301 489-07 / 301 489-17/ 300 440-1/ 300 440-2 AS/NZS 4268, AS/NZS 4771 CISPR 22, EN 55022, CNS 13438, AS/NZS CISPR 22, VCCI, IEC/EN 61000-4-2/3/4/5/6/8/11, CNS 14676-2/3/4/5/6/8, CNS 14934-2/3, CNS 13783-1, CNS 13439, CNS 13803	ilac-MRA TAF Testing Laboratory 0363
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13439, CNS 14115	SL2-IS-E-0014 / IN-E-0014 /A1-E-0014 /R1-E-0014 /R2-E-0014 /L1-E-0014
Canada	Industry Canada	RSS-Gen Issue 3	Canada IC 2324C-5

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

6 SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

For Radiated Emissions(Below 1GHz)							
No.	**Device Type**	**Model**	**Series No.**	**FCC ID**	**Brand**	**Data Cable**	**Power Cord**
1	Load	N/A	N/A	N/A	N/A	N/A	Unshielded, 1.8m
2	FLASH (iPod shuffle)	A1373	N/A	FCC DoC	Apple	Shielded, 0.1m	N/A
3	FLASH (iPod shuffle)	A1373	N/A	FCC DoC	Apple	Shielded, 0.1m	N/A

For Radiated Emissions(Above 1GHz) and Conducted Emission							
No.	**Device Type**	**Model**	**Series No.**	**FCC ID**	**Brand**	**Data Cable**	**Power Cord**
1	Test Jig	N/A	N/A	N/A	N/A	Unshielded, 0.2m	N/A
2	Notebook PC (Remote)	ThinkPad T430u	PB-VZLGG 12/09	FCC DOC	LENOVO	LAN Cable: Unshielded, 10m	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

For Powerline Conducted Emission							
No.	**Device Type**	**Model**	**Series No.**	**FCC ID**	**Brand**	**Data Cable**	**Power Cord**
1	Load	N/A	N/A	N/A	N/A	N/A	Unshielded, 1.8m
2	ipod nano	A1137	N/A	N/A	Apple	Shielded, 0.1m	N/A
3	ipod nano	A1137	N/A	N/A	Apple	Shielded, 0.1m	N/A

Remark: *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

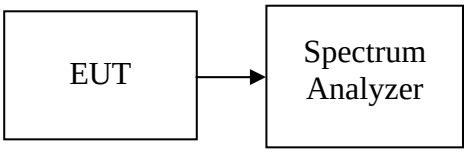
7 FCC PART 15 REQUIREMENTS

7.1 6DB BANDWIDTH

LIMIT

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 6dB bandwidth shall be at least 500 kHz.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the 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 = 100kHz, VBW = 300kHz, Sweep = auto, Span = 30MHz (IEEE 802.11b, IEEE 802.11g, IEEE 802.11n HT20) or Span = 50MHz (IEEE 802.11n HT40).
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	12.09	>500	PASS
Mid	2437	12.09		PASS
High	2462	12.09		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	16.05	>500	PASS
Mid	2437	16.05		PASS
High	2462	16.11		PASS

Test mode: IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	16.05	>500	PASS
Mid	2437	16.05		PASS
High	2462	16.56		PASS

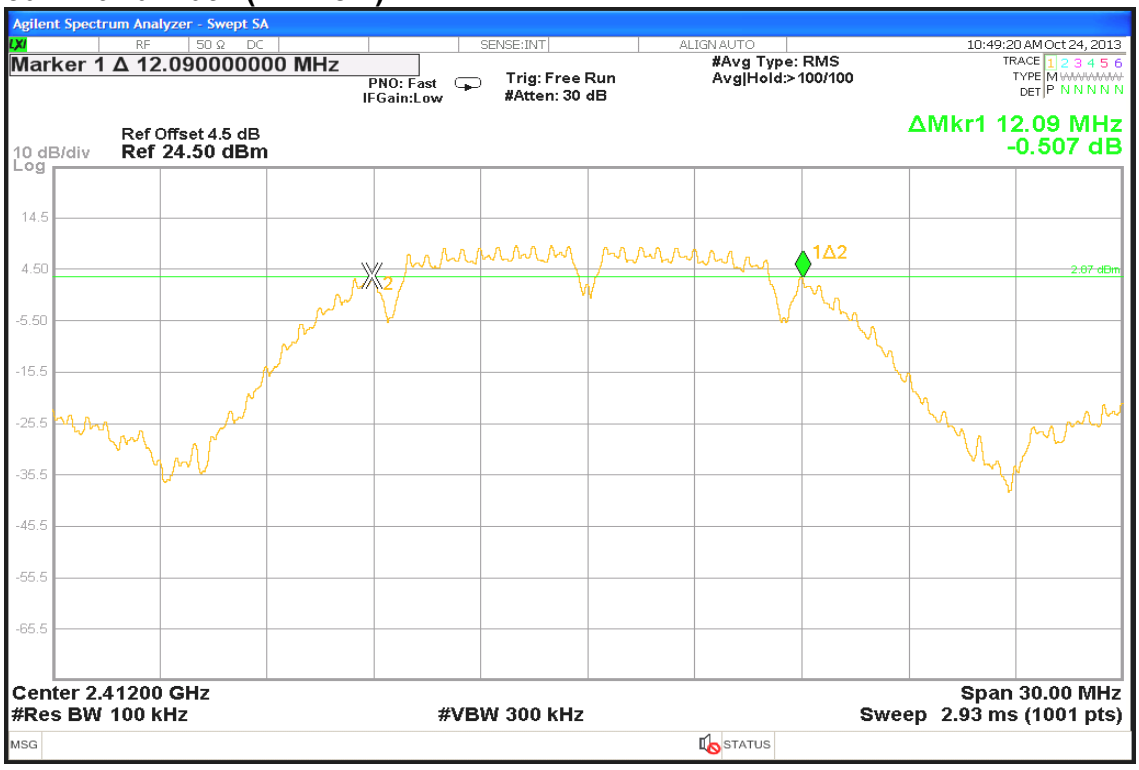
Test mode: IEEE 802.11n HT40 mode

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2422	35.15	>500	PASS
Mid	2437	35.15		PASS
High	2452	35.15		PASS

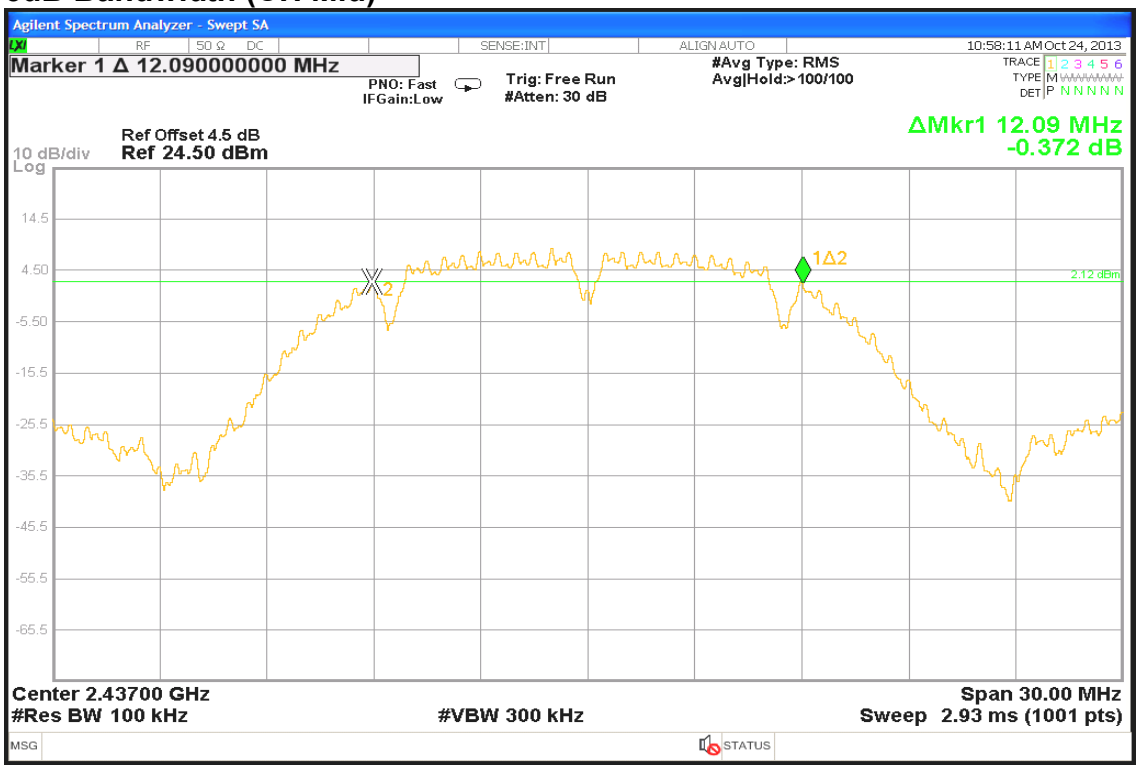
Test Plot

IEEE 802.11b mode

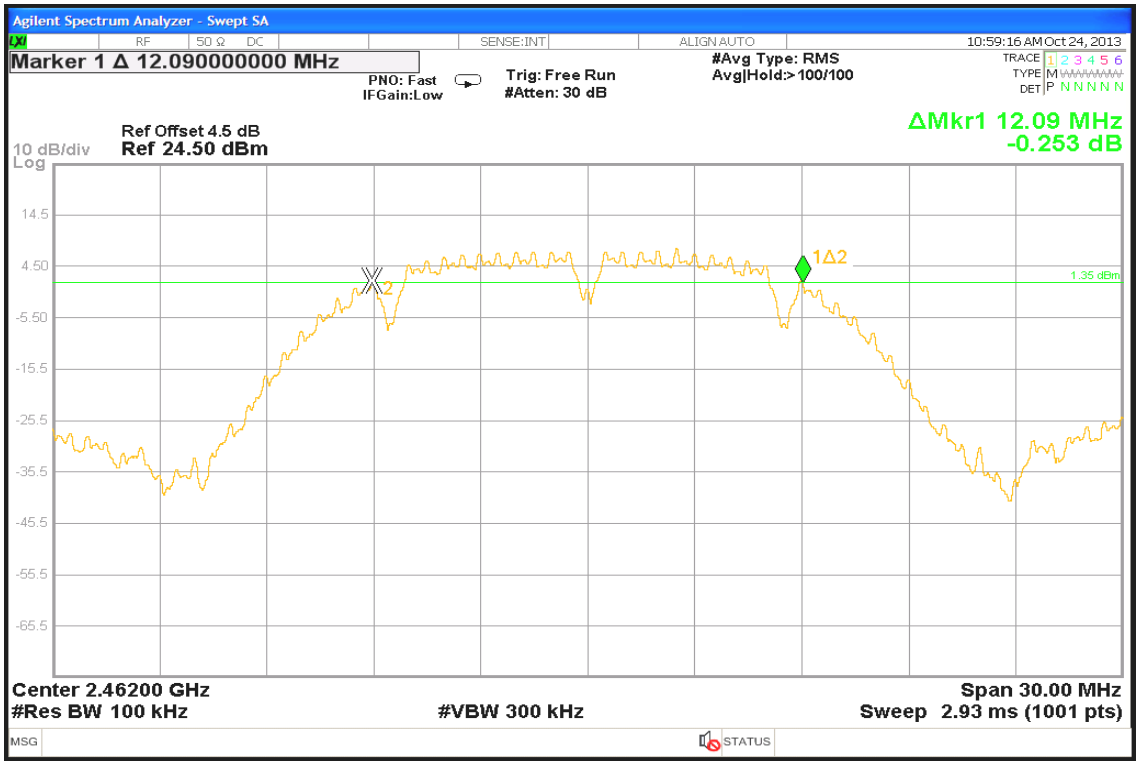
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

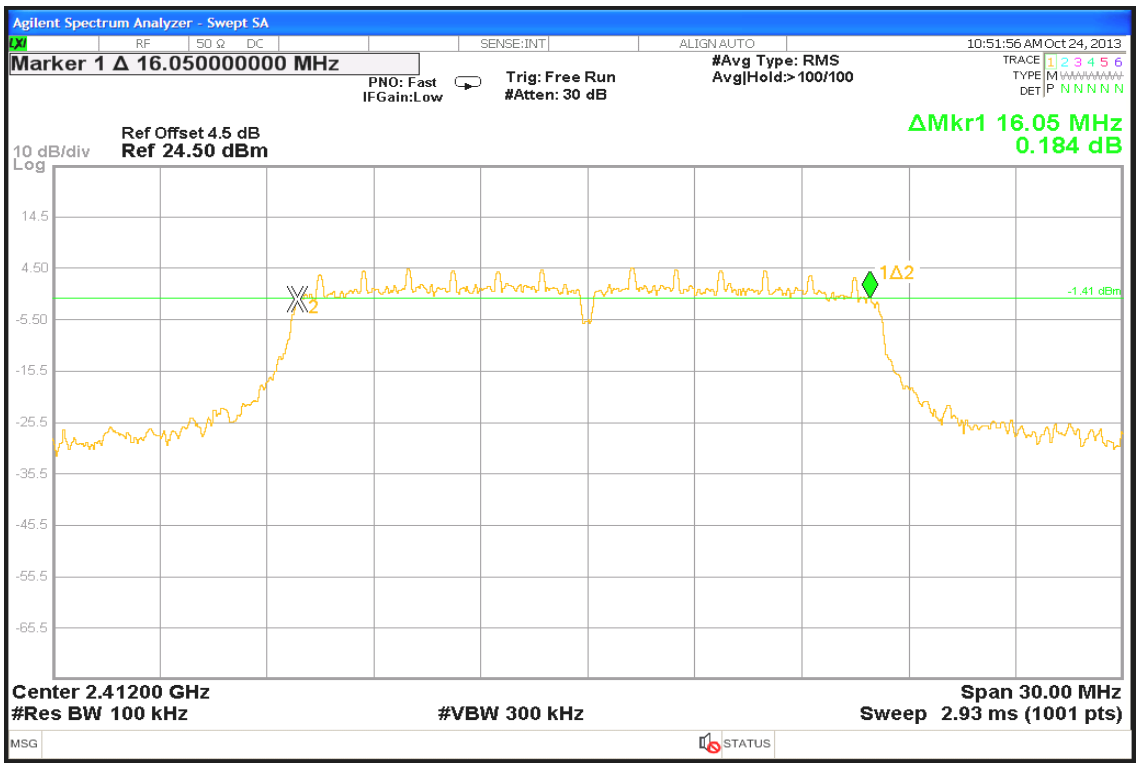


6dB Bandwidth (CH High)



IEEE 802.11g mode

6dB Bandwidth (CH Low)



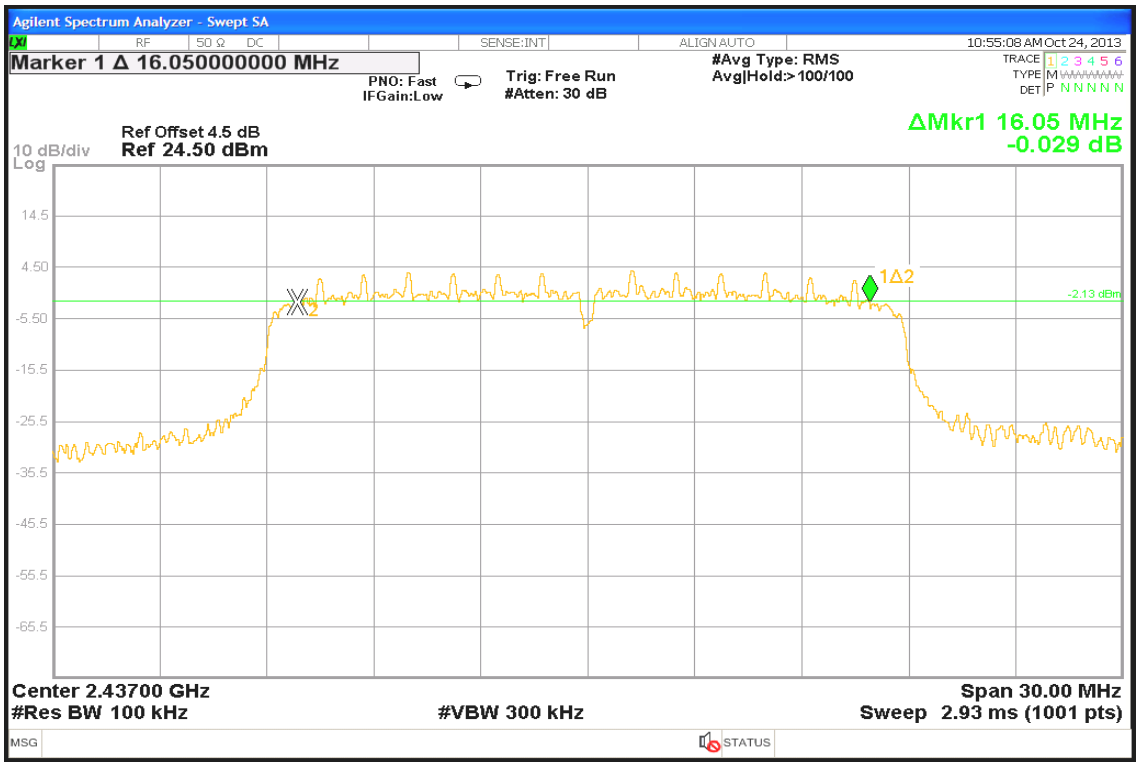
6dB Bandwidth (CH Mid)

6dB 6dB Bandwidth (CH High)

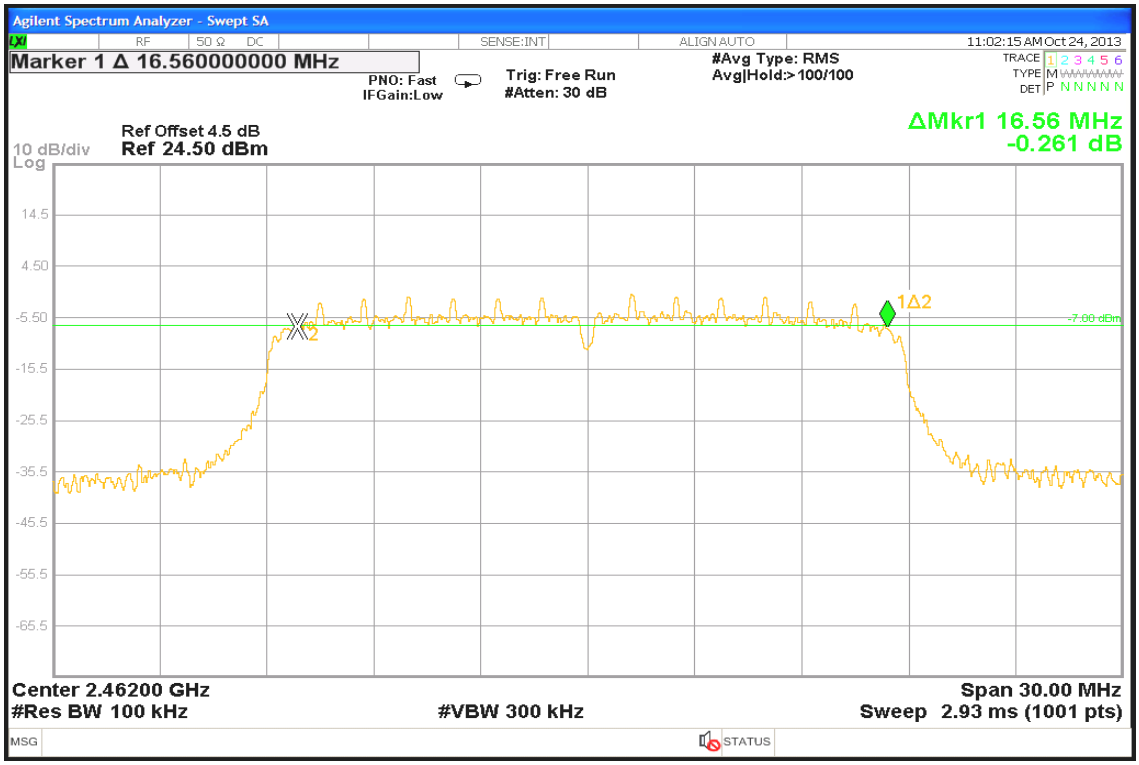
IEEE 802.11n HT20 mode

6dB Bandwidth (CH Low)

6dB Bandwidth (CH Mid)

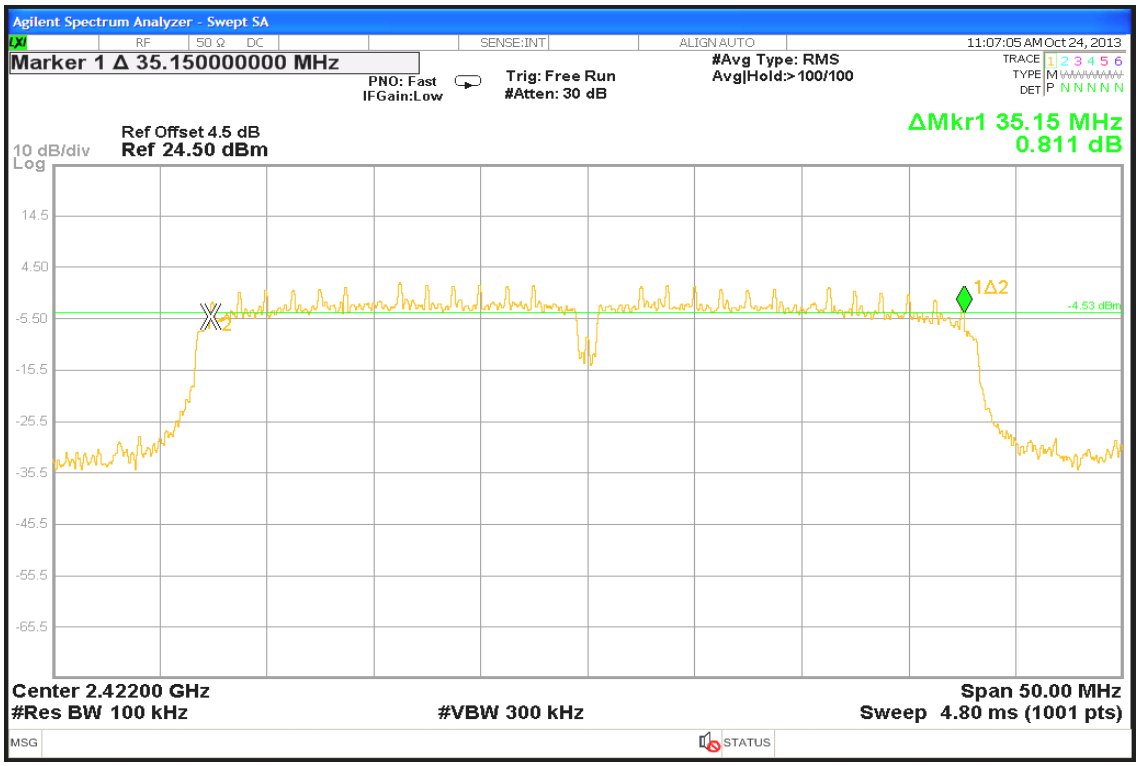


6dB Bandwidth (CH High)

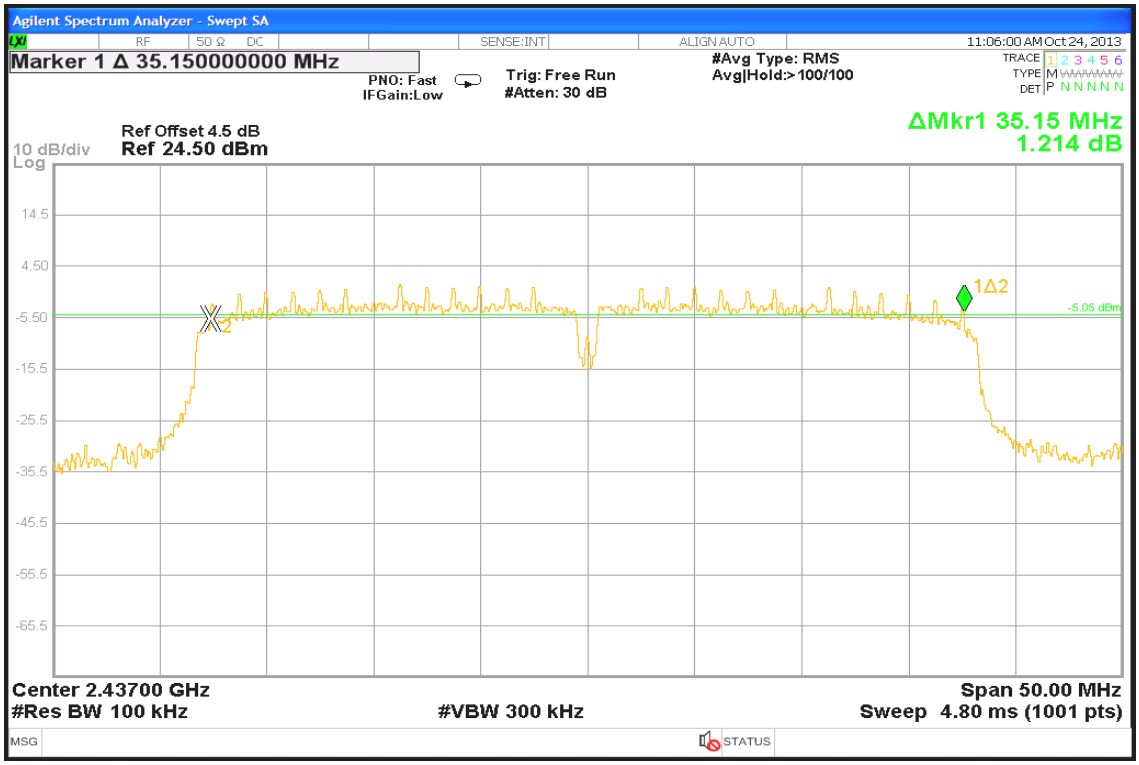


IEEE 802.11n HT40 mode

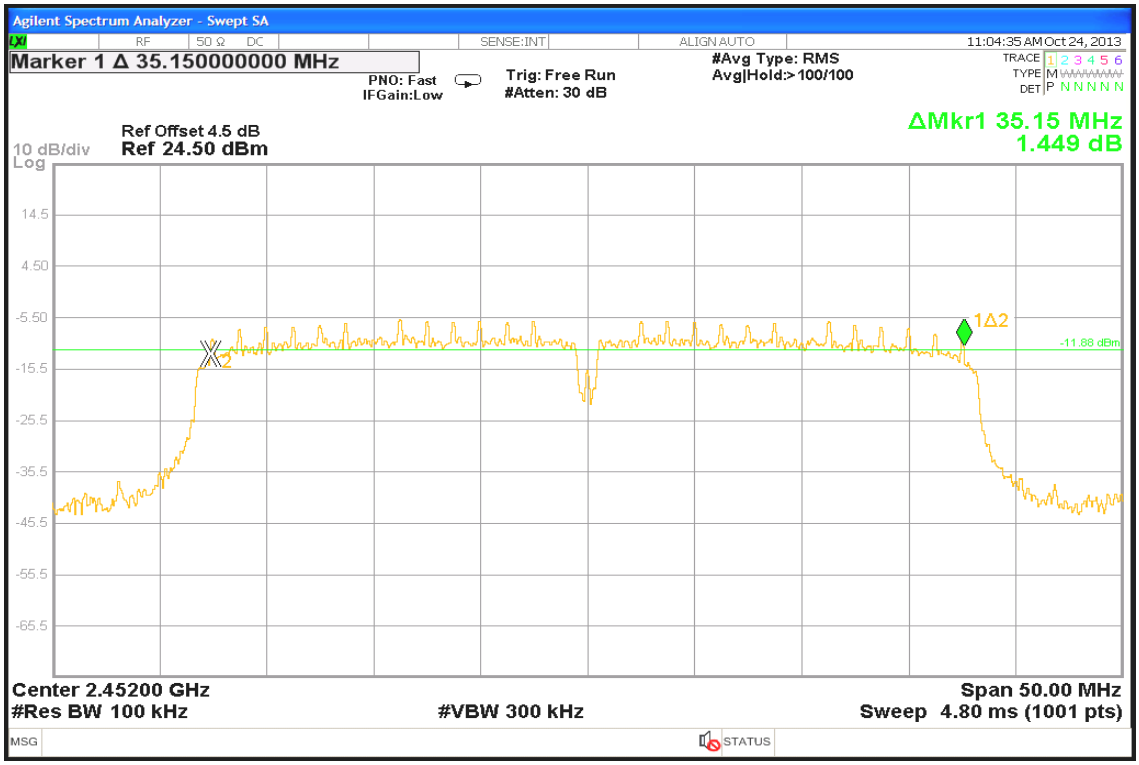
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High)



7.2 PEAK POWER

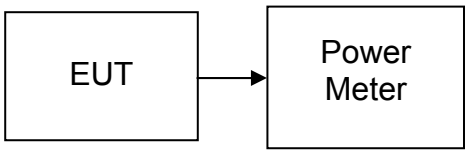
LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.

2. According to §15.247(b)(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.

Test Configuration



TEST PROCEDURE

Per KDB 558074 v03r01

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Test Result
Low	2412	22.84	0.1923	1	PASS
Mid	2437	22.01	0.1589		PASS
High	2462	21.20	0.1318		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Test Result
Low	2412	22.88	0.1941	1	PASS
Mid	2437	22.20	0.1660		PASS
High	2462	17.82	0.0605		PASS

Test mode: IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Test Result
Low	2412	22.84	0.1924	1	PASS
Mid	2437	22.41	0.1743		PASS
High	2462	17.37	0.0546		PASS

Test mode: IEEE 802.11n HT40 mode

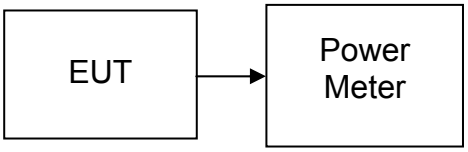
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Test Result
Low	2422	23.15	0.2064	1	PASS
Mid	2437	22.59	0.1814		PASS
High	2452	16.08	0.0405		PASS

7.3 AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

Per KDB 558074 v03r01

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2412	19.70	0.0933
Mid	2437	19.08	0.0809
High	2462	18.81	0.0760

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2412	15.35	0.0343
Mid	2437	14.70	0.0295
High	2462	10.34	0.0108

Test mode: IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2412	15.22	0.0333
Mid	2437	14.92	0.0311
High	2462	10.16	0.0104

Test mode: IEEE 802.11n HT40 mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2422	15.55	0.0359
Mid	2437	15.40	0.0346
High	2452	8.69	0.0074

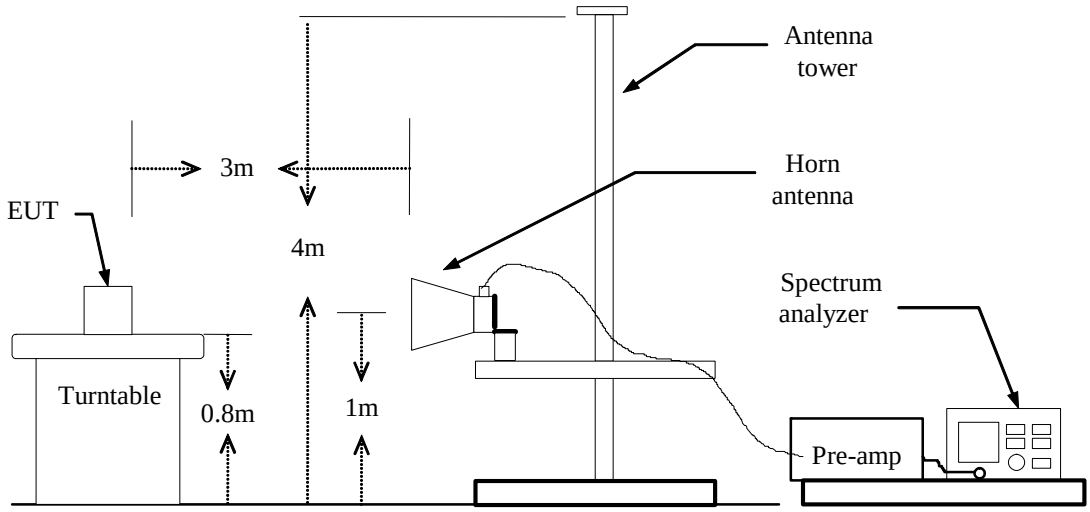
7.4 BAND EDGES MEASUREMENT

LIMIT

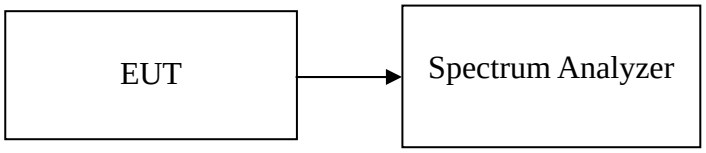
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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. 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 Section 15.205(c)).

Test Configuration

For Radiated



For Conducted



TEST PROCEDURE

For Radiated

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW=300Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

For Conducted

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

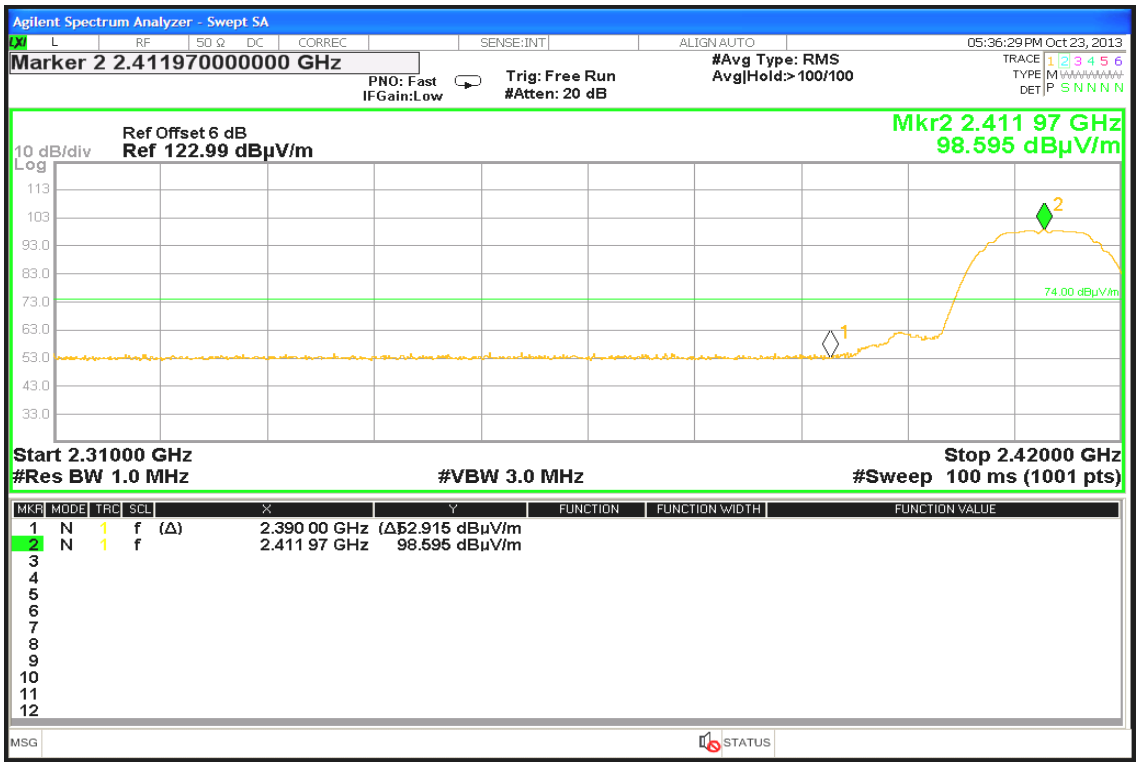
TEST RESULTS

Refer to attach spectrum analyzer data chart.

TEST DATA

Band Edges (IEEE 802.11b mode / CH Low)

Detector mode: Peak Polarity: Vertical



Detector mode: Average Polarity: Vertical

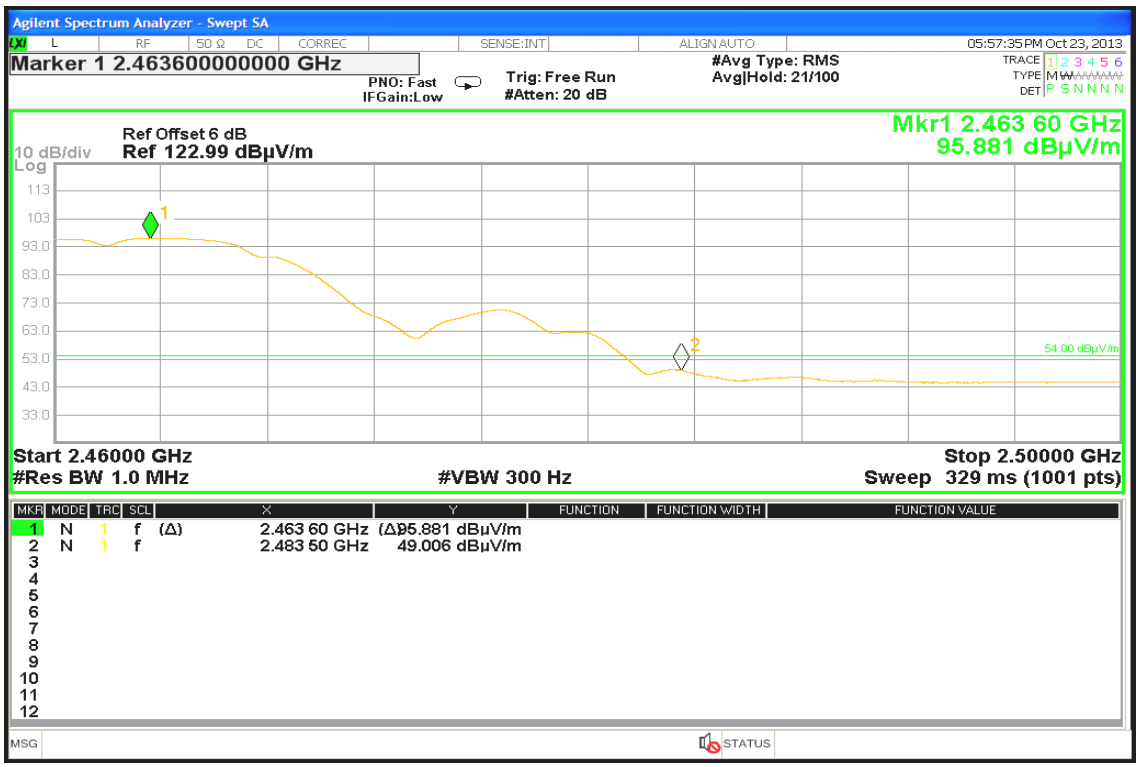
Detector mode: Peak Polarity: Horizontal

Detector mode: Average Polarity: Horizontal

Band Edges (IEEE 802.11b mode / CH High)

Detector mode: Peak Polarity: Vertical

Detector mode: Average Polarity: Vertical

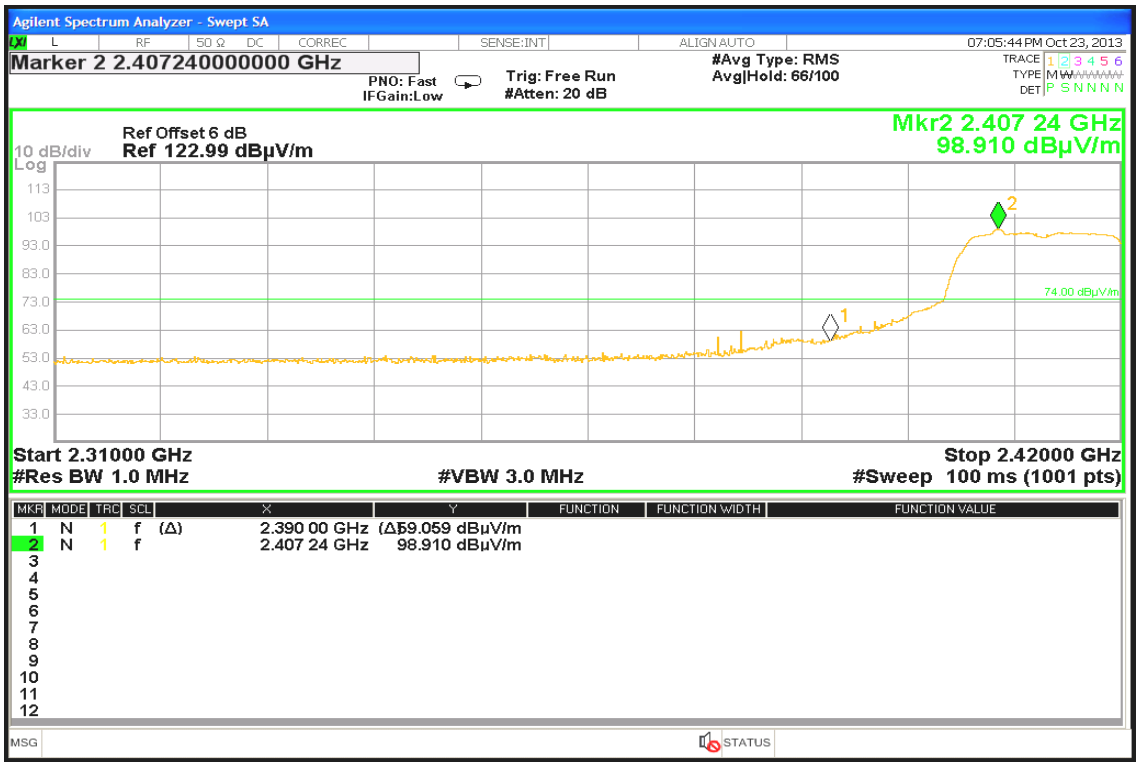


Detector mode: Peak Polarity: Horizontal

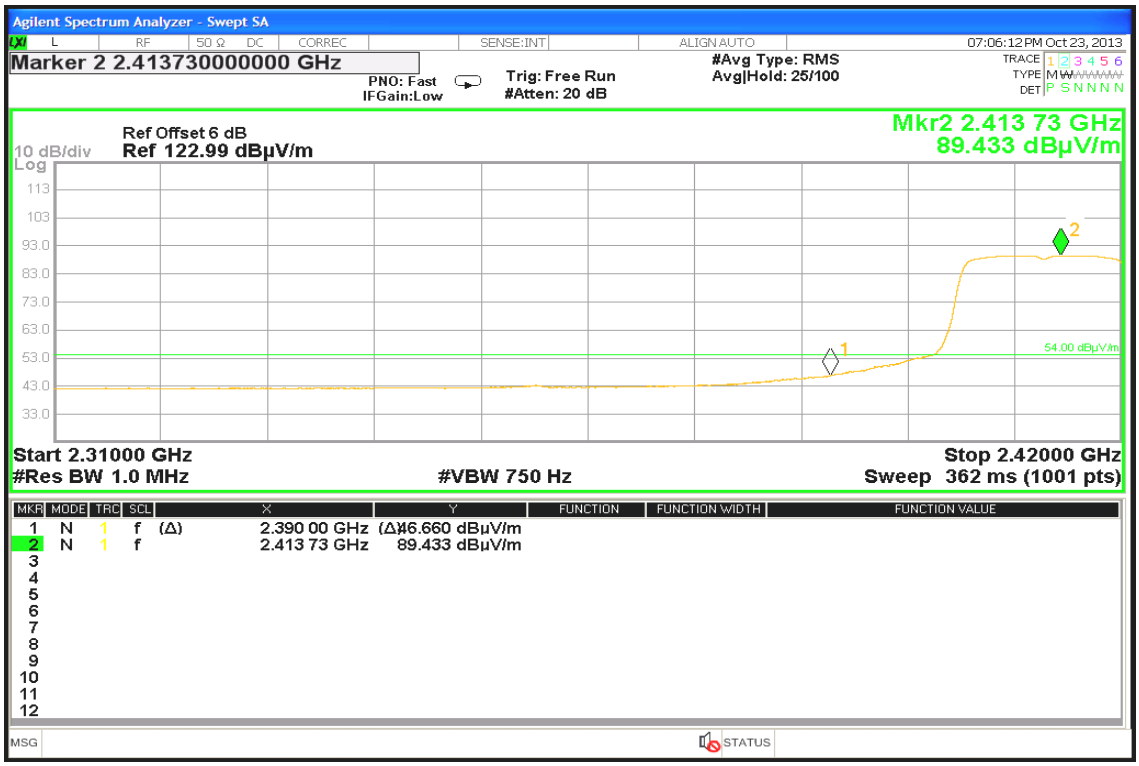
Detector mode: Average Polarity: Horizontal

Band Edges (IEEE 802.11g mode / CH Low)

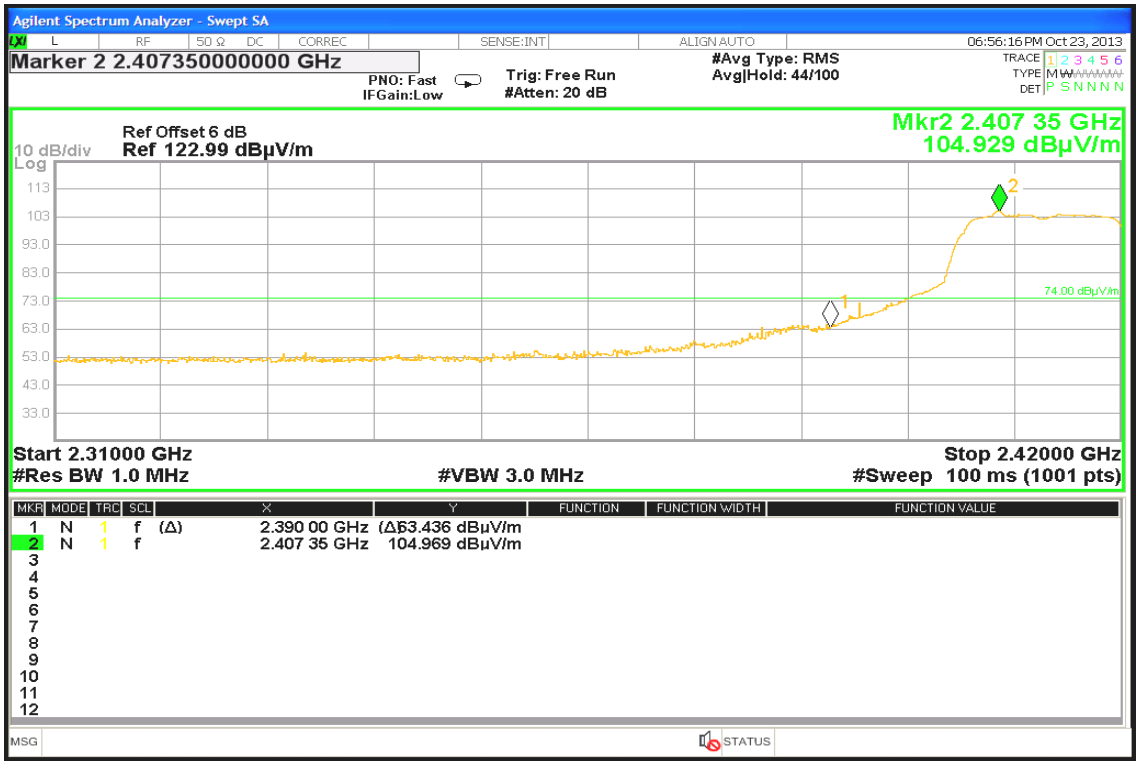
Detector mode: Peak Polarity: Vertical



Detector mode: Average Polarity: Vertical



Detector mode: Peak Polarity: Horizontal

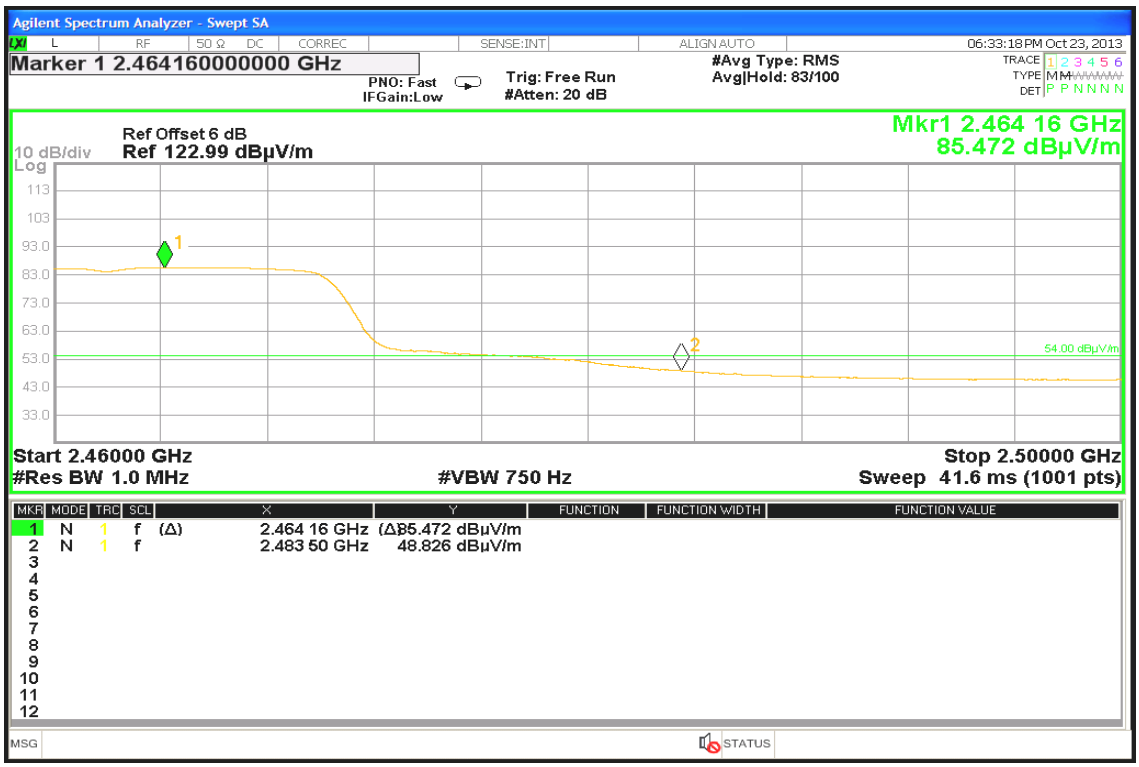


Detector mode: Average Polarity: Horizontal

Band Edges (IEEE 802.11g mode / CH High)

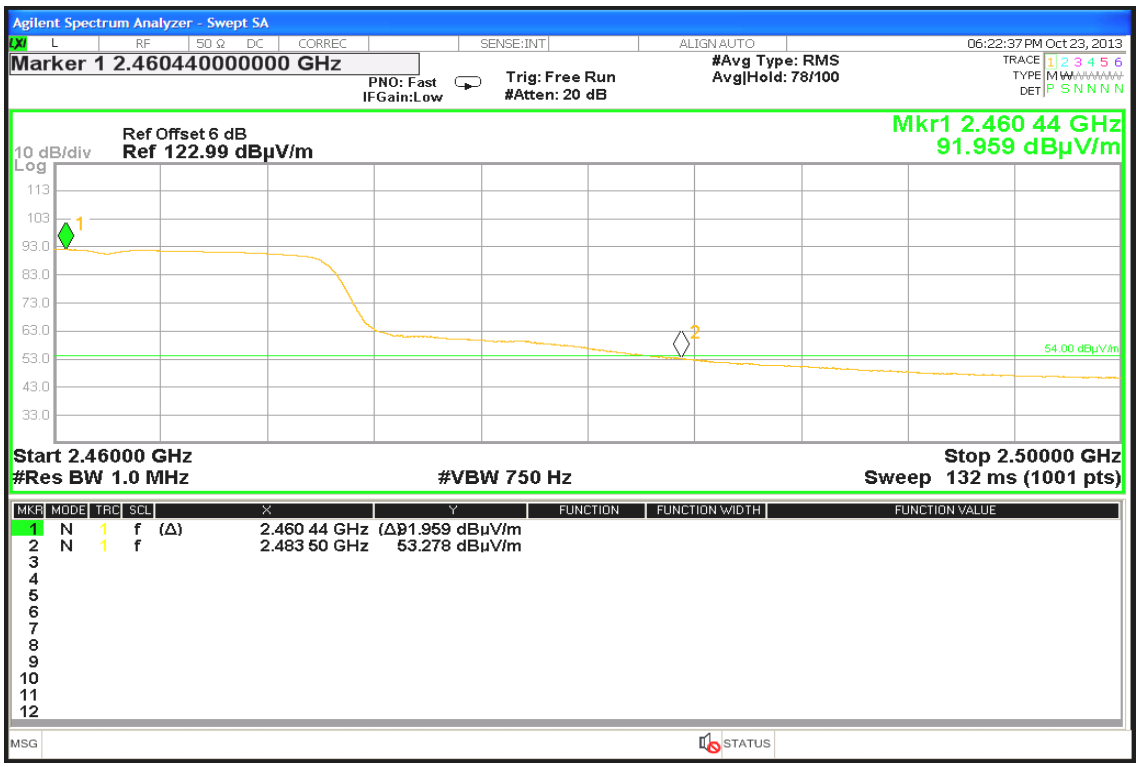
Detector mode: Peak Polarity: Vertical

Detector mode: Average Polarity: Vertical



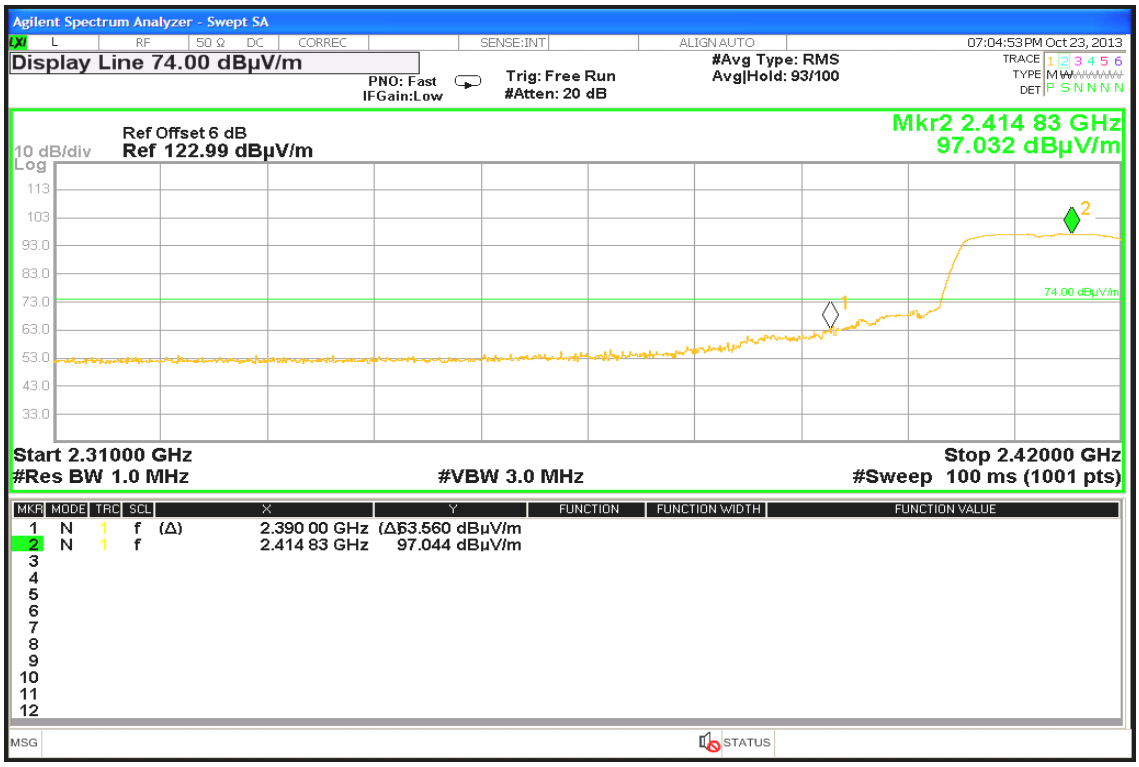
Detector mode: Peak Polarity: Horizontal

Detector mode: Average Polarity: Horizontal



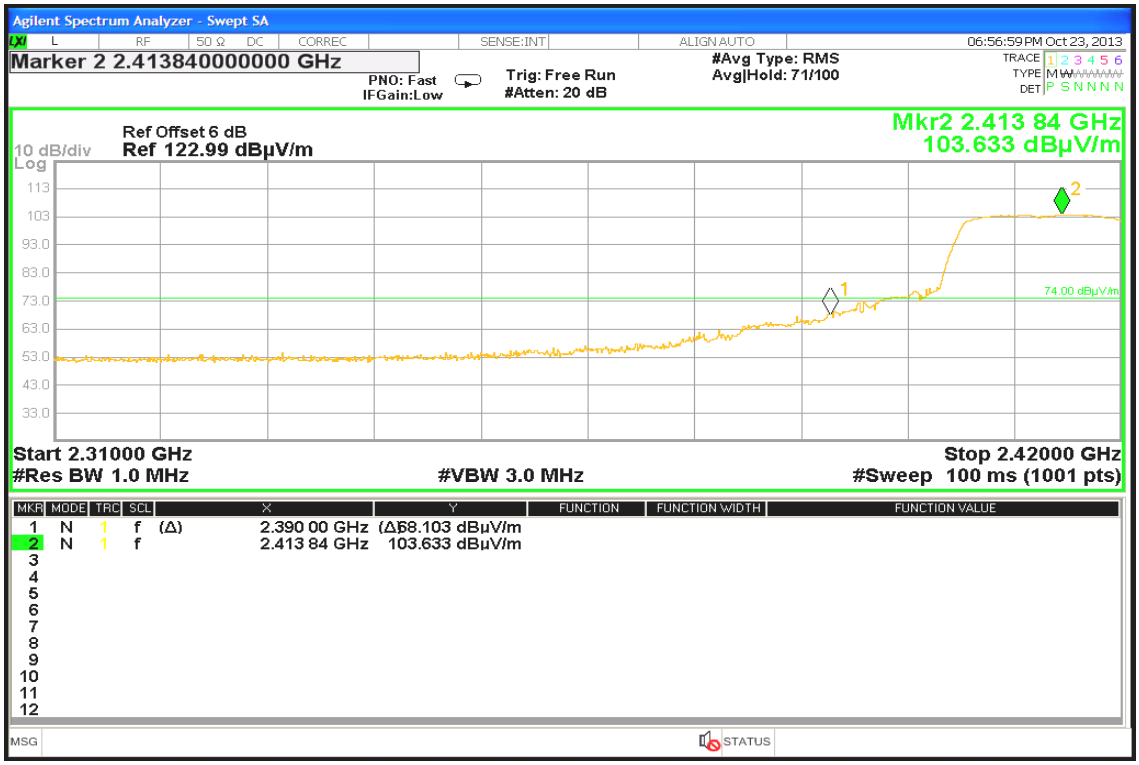
Band Edges (IEEE 802.11n HT20 mode / CH Low)

Detector mode: Peak Polarity: Vertical

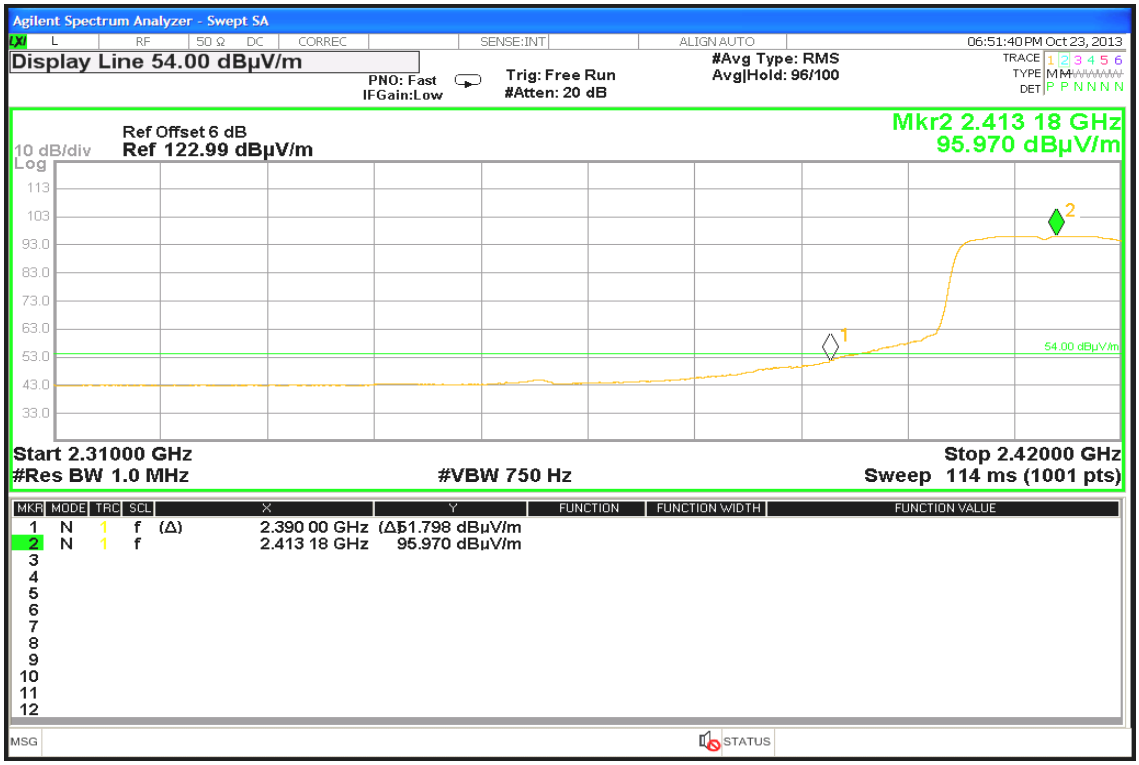


Detector mode: Average Polarity: Vertical

Detector mode: Peak Polarity: Horizontal

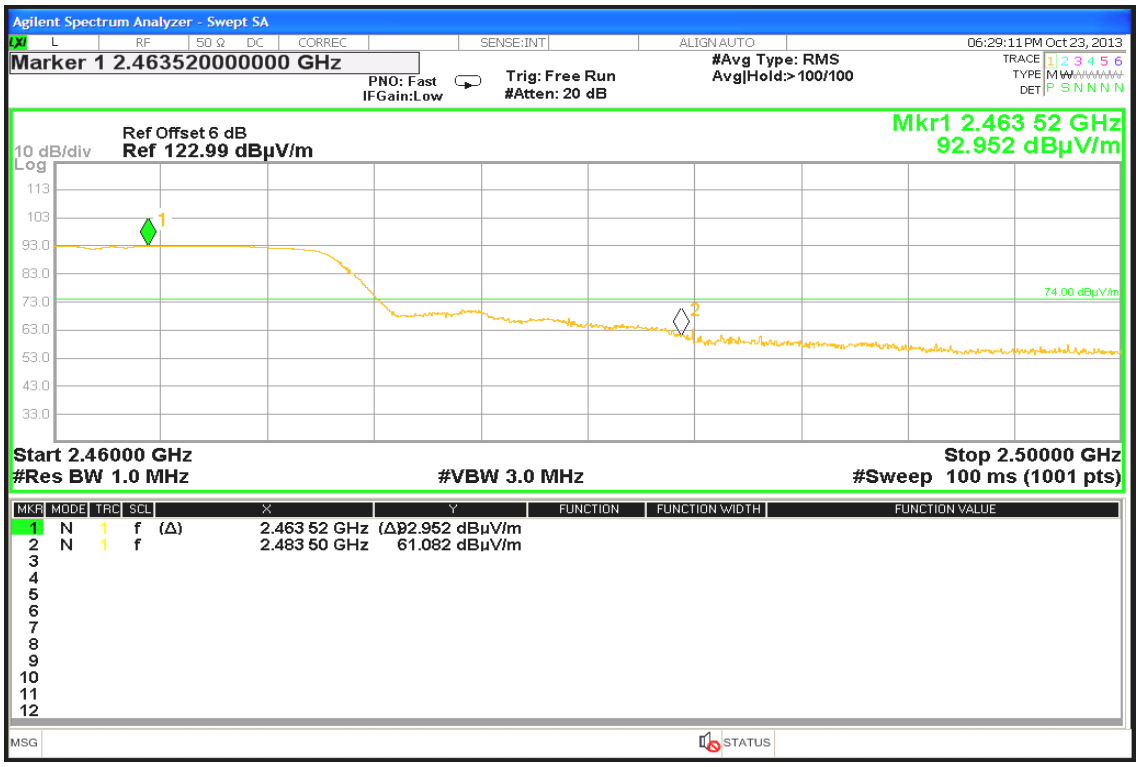


Detector mode: Average Polarity: Horizontal

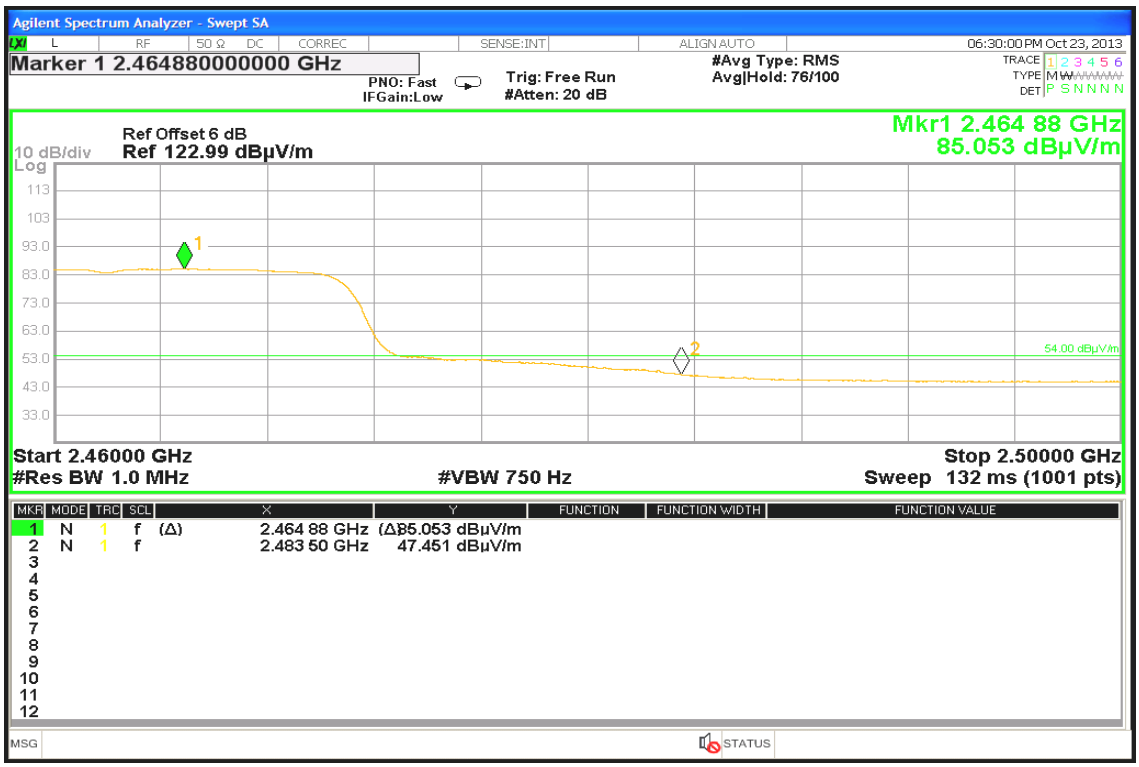


Band Edges (IEEE 802.11n HT20 mode / CH High)

Detector mode: Peak Polarity: Vertical



Detector mode: Average Polarity: Vertical

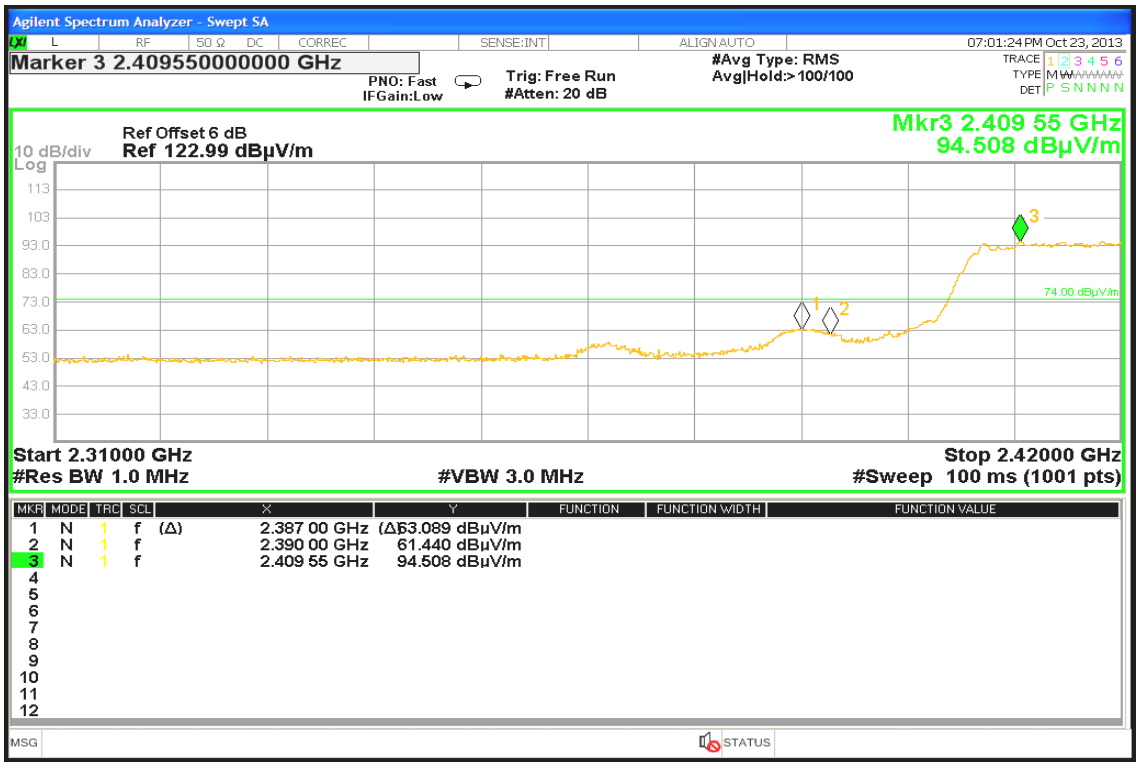


Detector mode: Peak Polarity: Horizontal

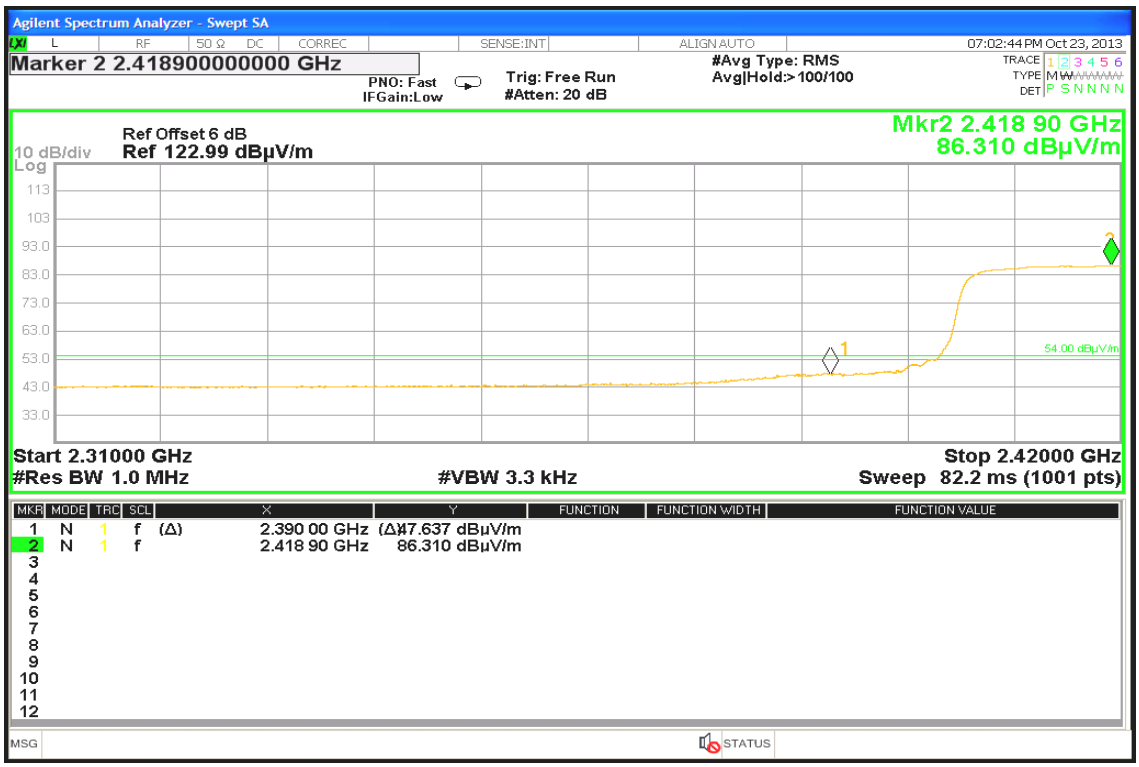
Detector mode: Average Polarity: Horizontal

Band Edges (IEEE 802.11n HT40 mode / CH Low)

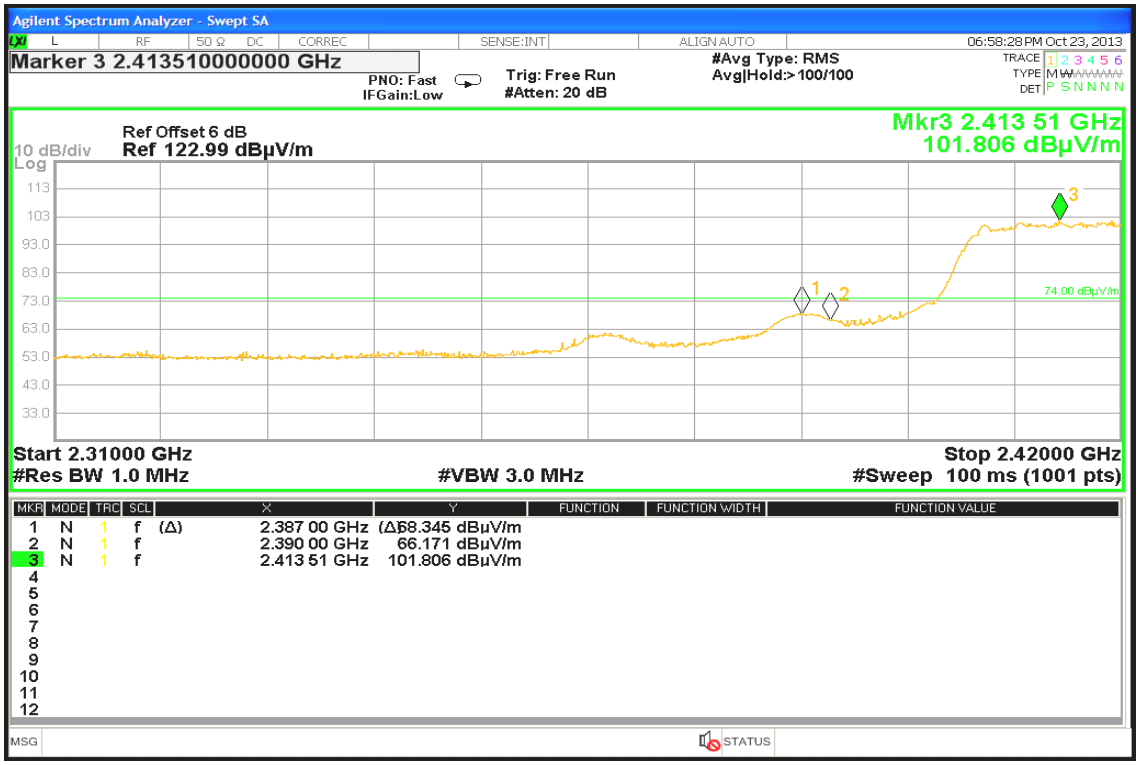
Detector mode: Peak Polarity: Vertical



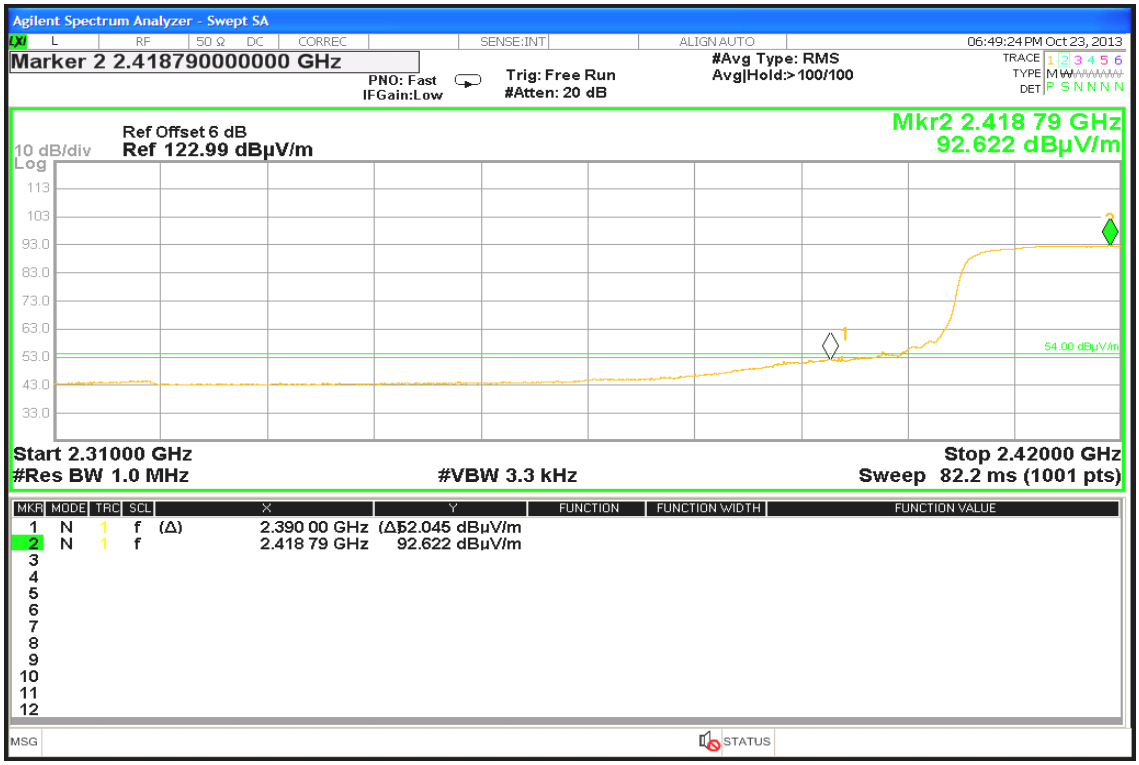
Detector mode: Average Polarity: Vertical



Detector mode: Peak Polarity: Horizontal



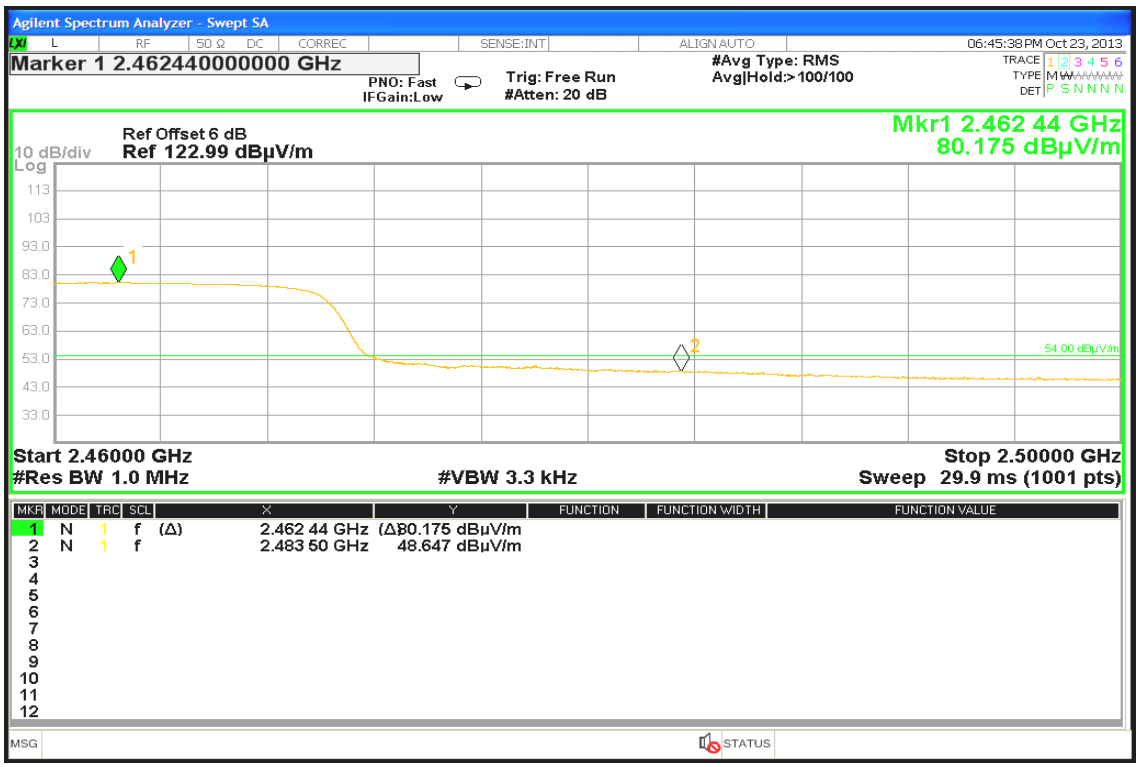
Detector mode: Average Polarity: Horizontal



Band Edges (IEEE 802.11n HT40 mode / CH High)

Detector mode: Peak Polarity: Vertical

Detector mode: Average Polarity: Vertical

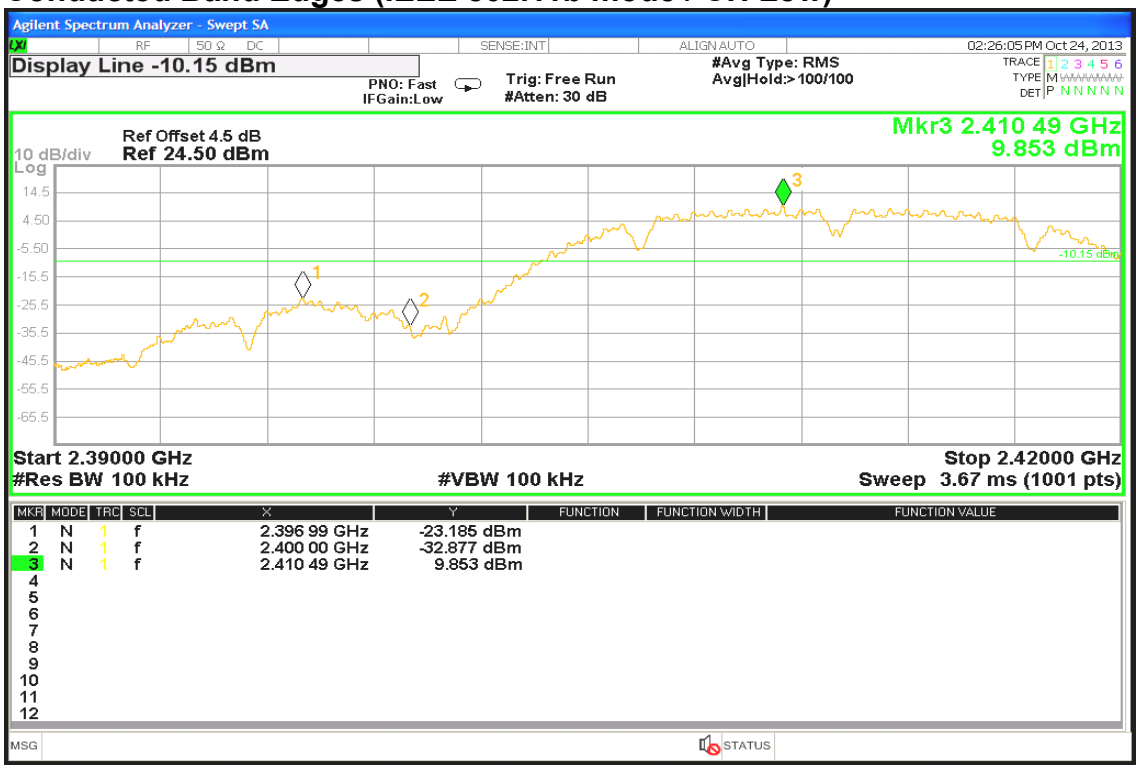


Detector mode: Peak Polarity: Horizontal

Detector mode: Average Polarity: Horizontal

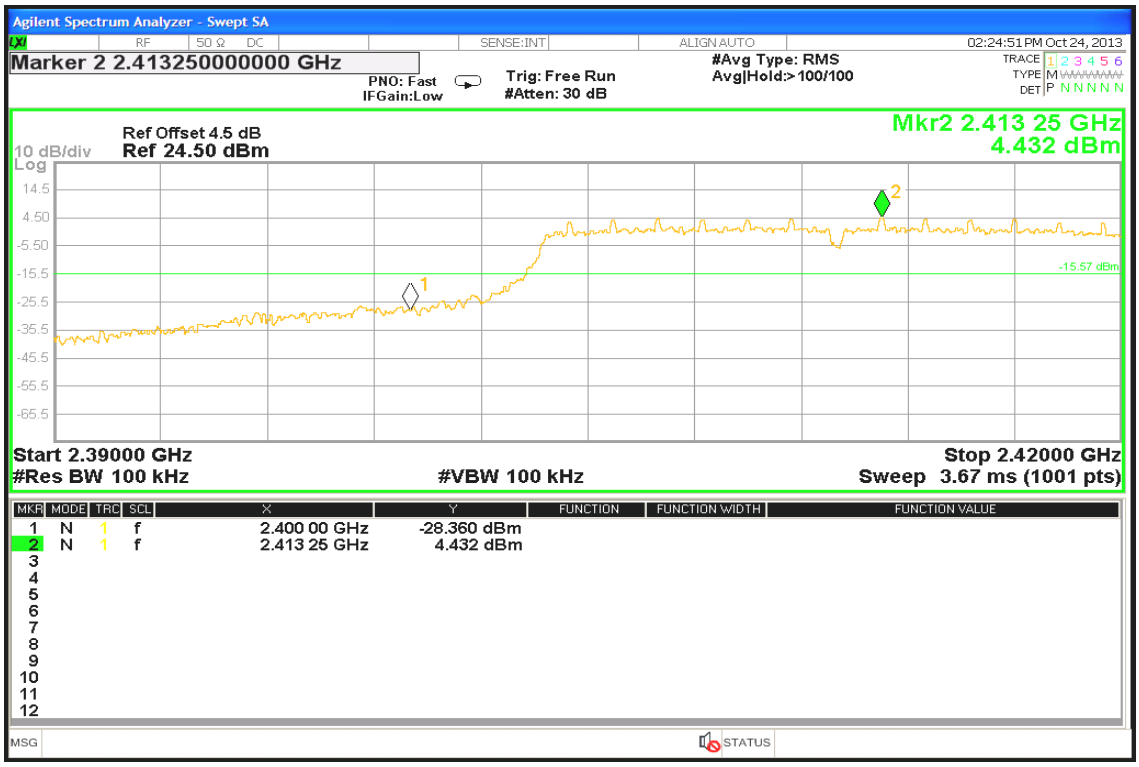
Test Plot

Conducted Band Edges (IEEE 802.11b mode / CH Low)

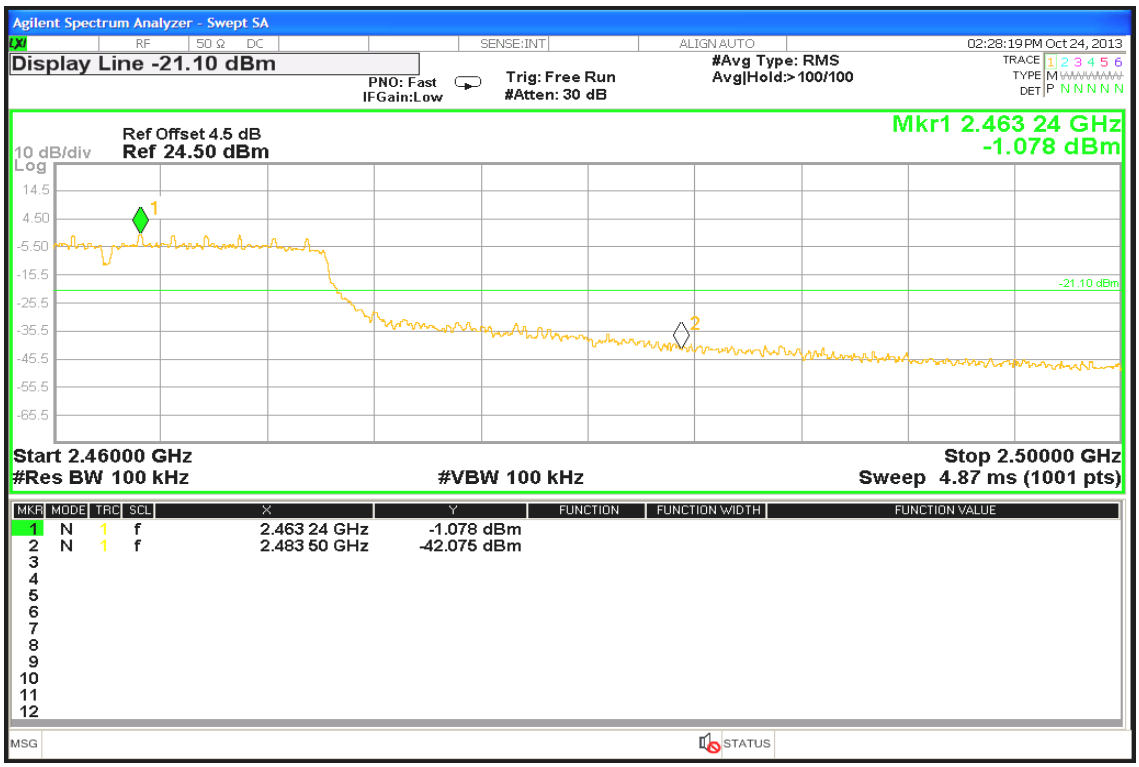


Conducted Band Edges (IEEE 802.11b mode / CH High)

Conducted Band Edges (IEEE 802.11g mode / CH Low)

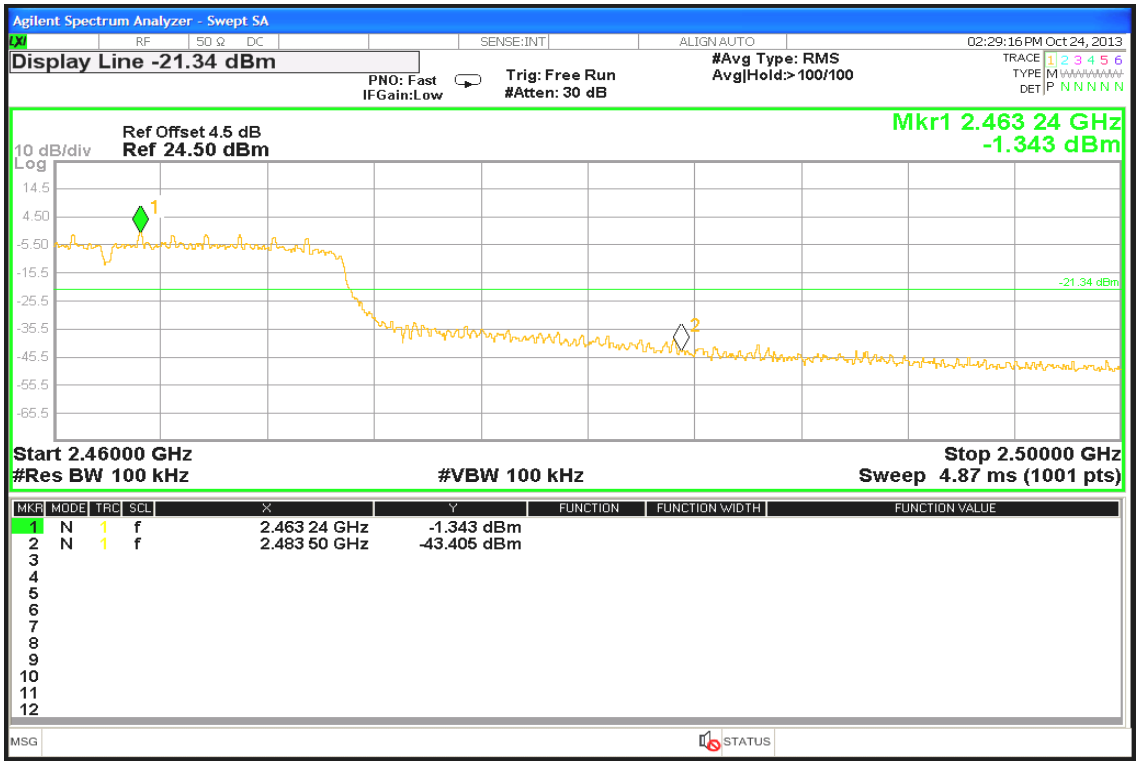


Conducted Band Edges (IEEE 802.11g mode / CH High)



Conducted Band Edges (IEEE 802.11n HT20 mode / CH Low)

Conducted Band Edges (IEEE 802.11n HT20 mode / CH High)



Conducted Band Edges (IEEE 802.11n HT40 mode / CH Low)

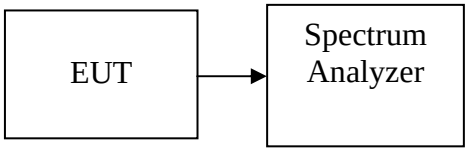
Conducted Band Edges (IEEE 802.11n HT40 mode / CH High)

7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

1. 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.
2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

Test Configuration



TEST PROCEDURE

Per KDB 558074 v03r01

This procedure must be used if maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit, and is optional if the maximum (average) conducted output power was used to demonstrate compliance.

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.

Use the peak marker function to determine the maximum amplitude level.
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-6.91	8.00	PASS
Mid	2437	-6.70		PASS
High	2462	-8.31		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-11.57	8.00	PASS
Mid	2437	-12.81		PASS
High	2462	-15.70		PASS

Test mode: IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-10.59	8.00	PASS
Mid	2437	-11.39		PASS
High	2462	-16.90		PASS

Test mode: IEEE 802.11n HT40 mode

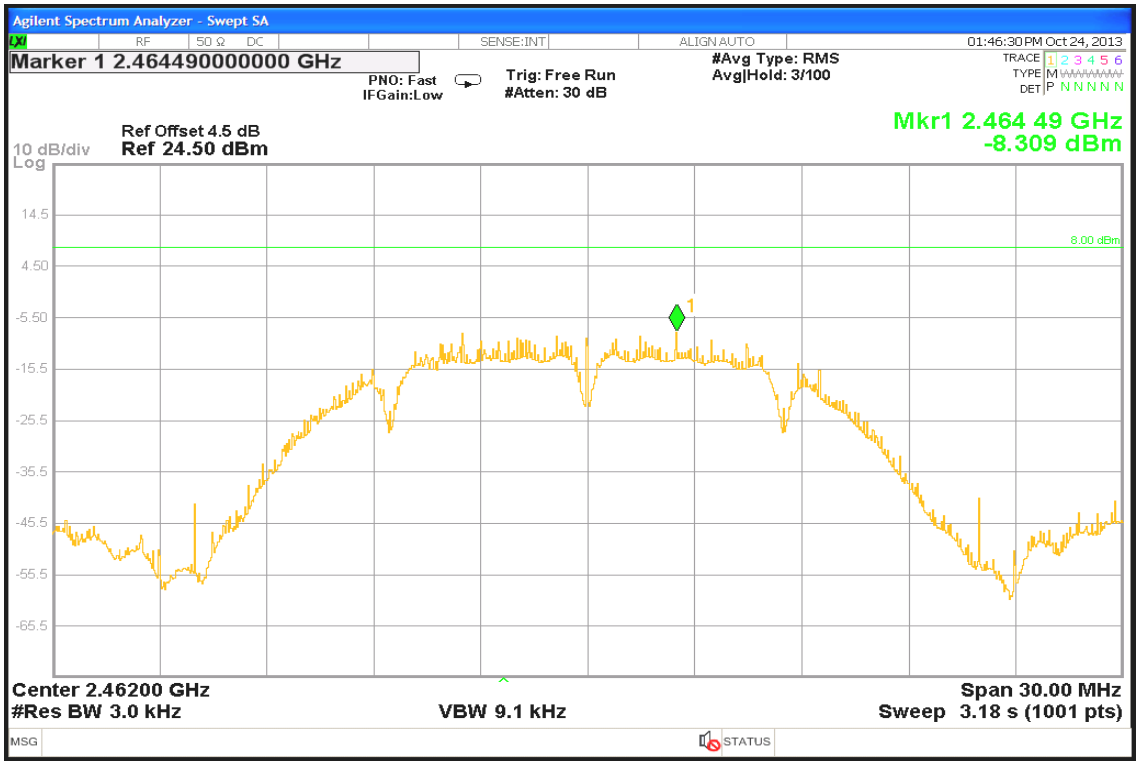
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2422	-12.40	8.00	PASS
Mid	2437	-12.19		PASS
High	2452	-19.09		PASS

Test Plot

IEEE 802.11b mode
PPSD (CH Low)

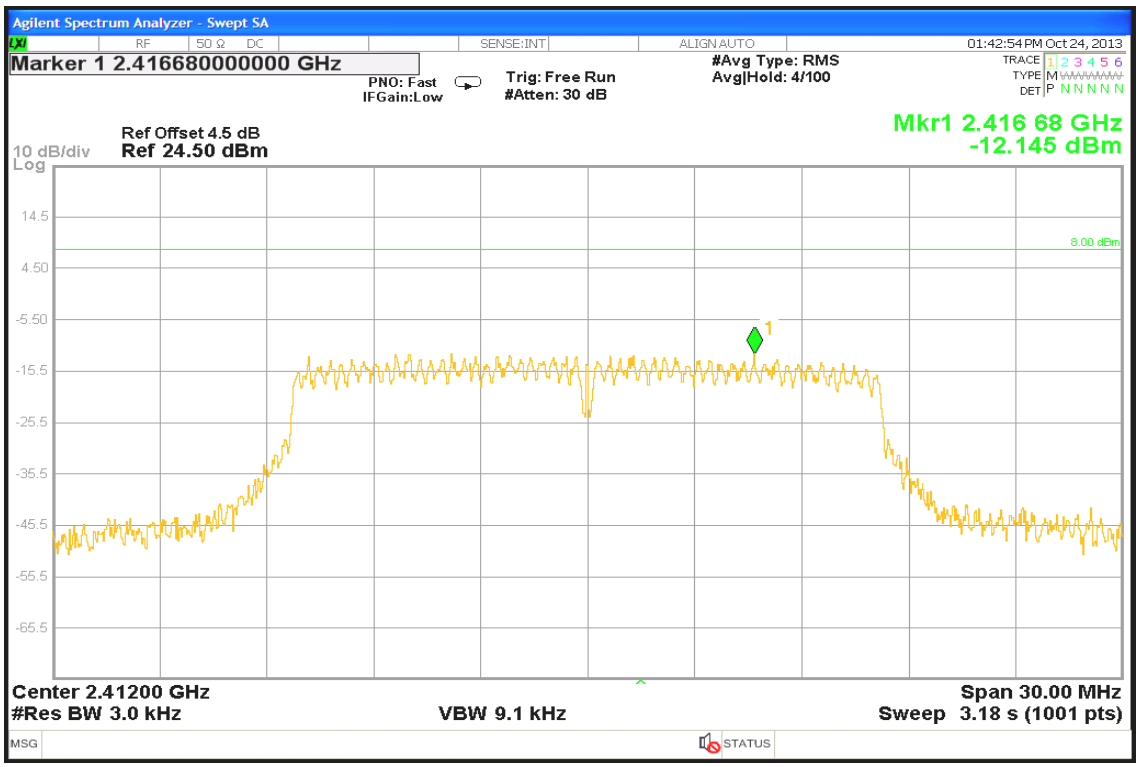
PPSD (CH Mid)

PPSD (CH High)

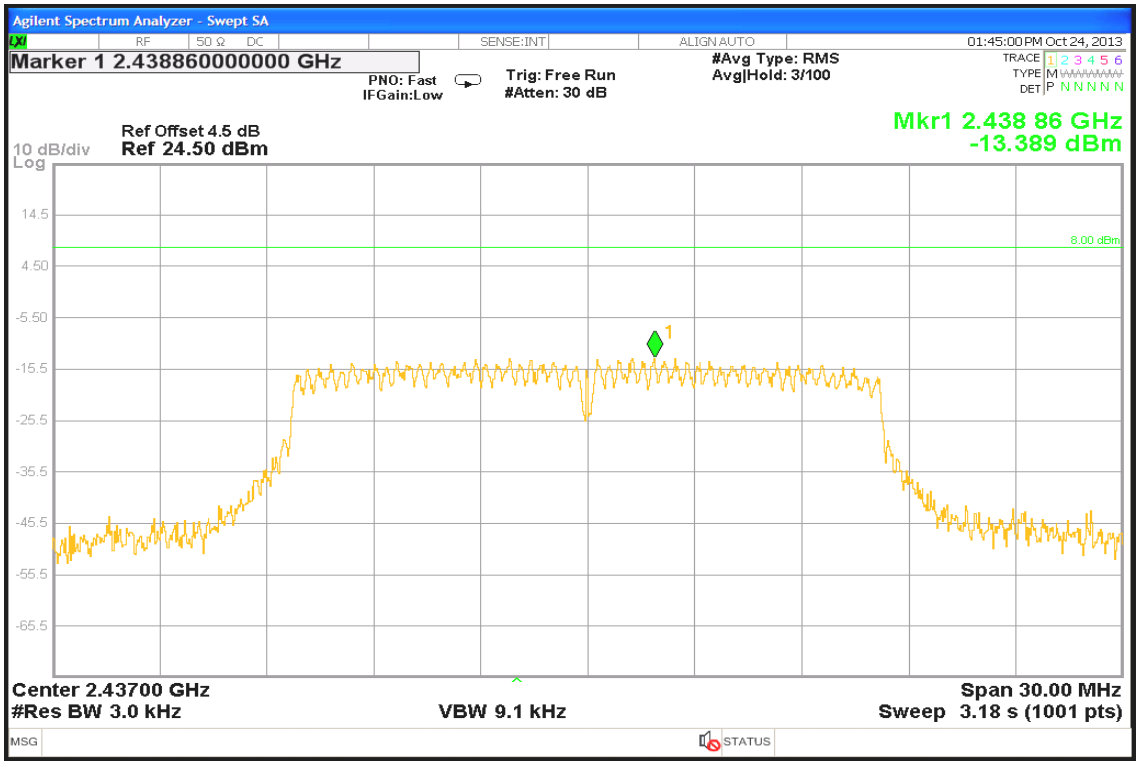


IEEE 802.11g mode

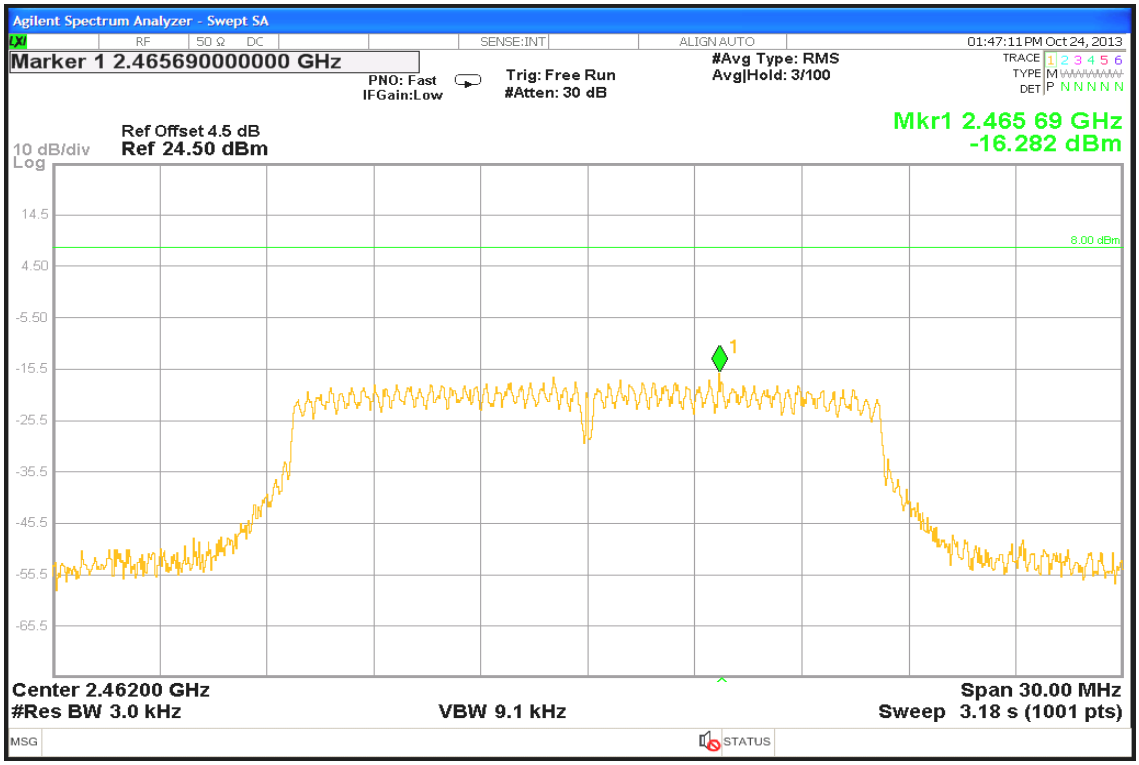
PPSD (CH Low)



PPSD (CH Mid)

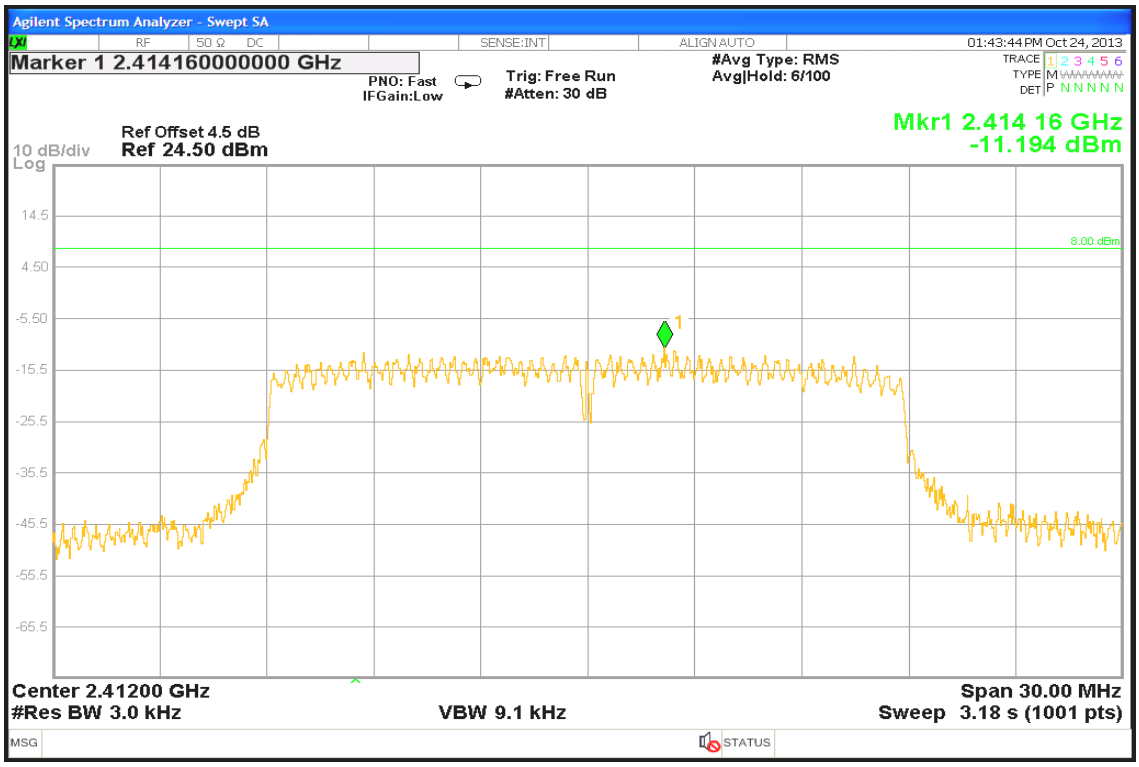


PPSD (CH High)

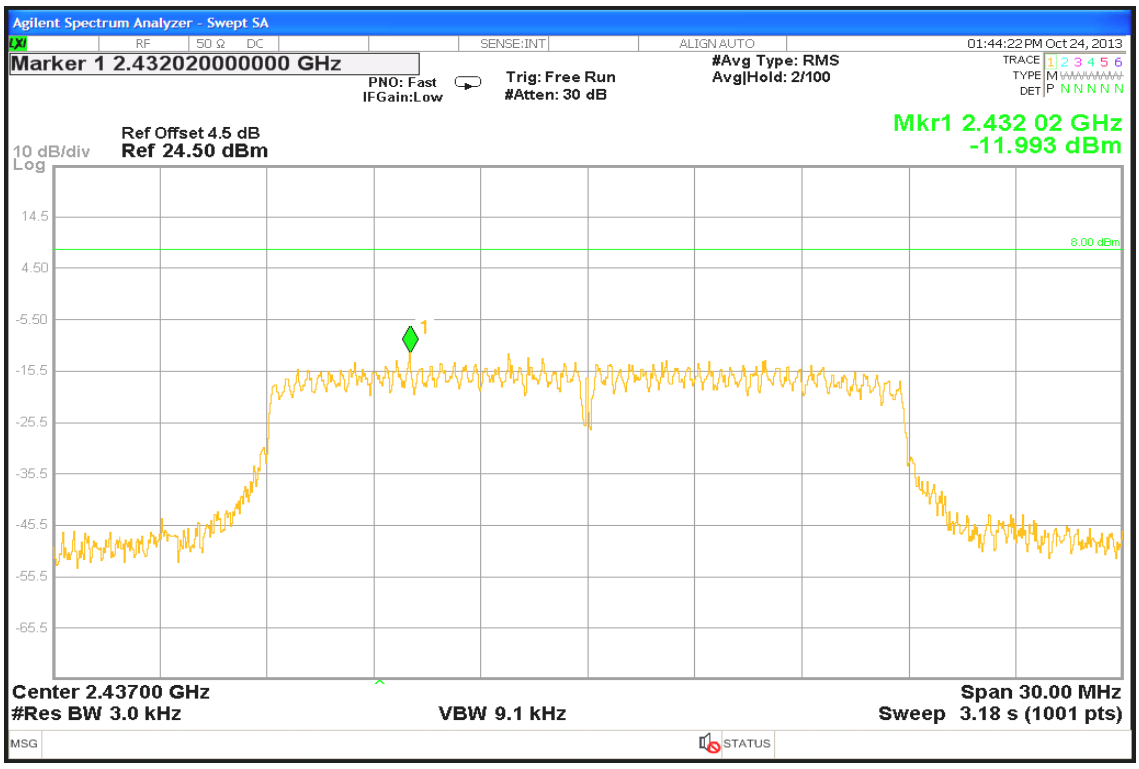


IEEE 802.11n HT20 mode

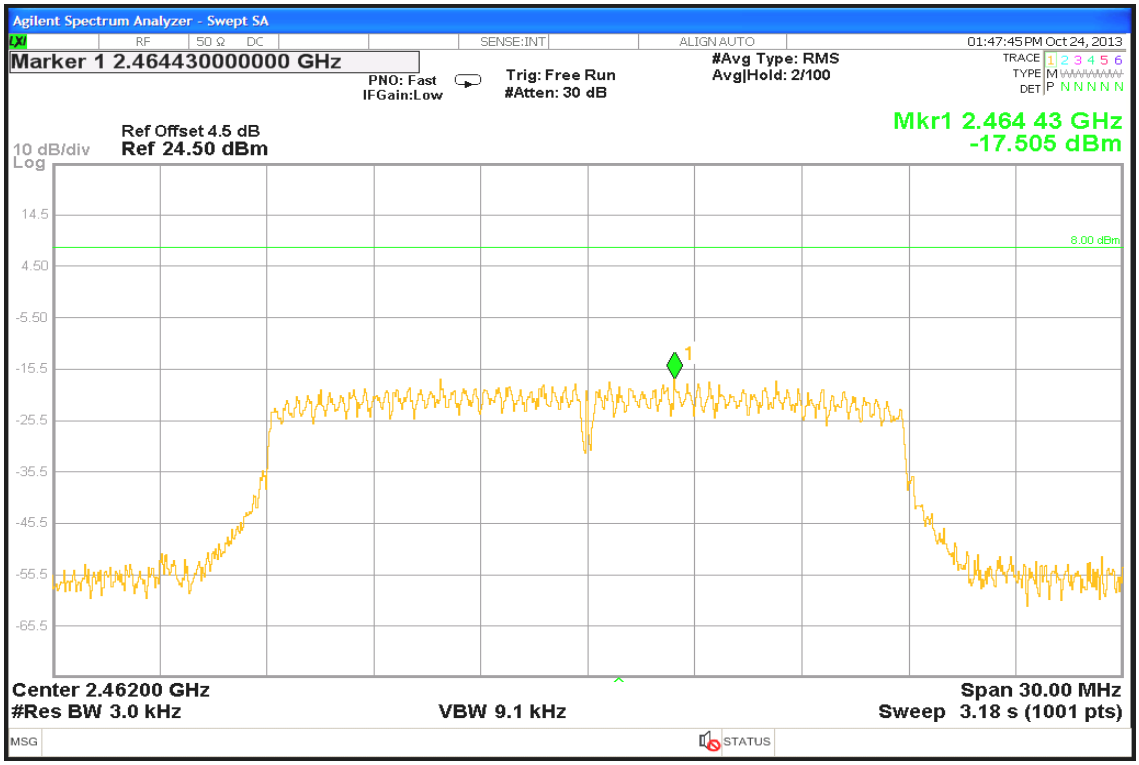
PPSD (CH Low)



PPSD (CH Mid)



PPSD (CH High)

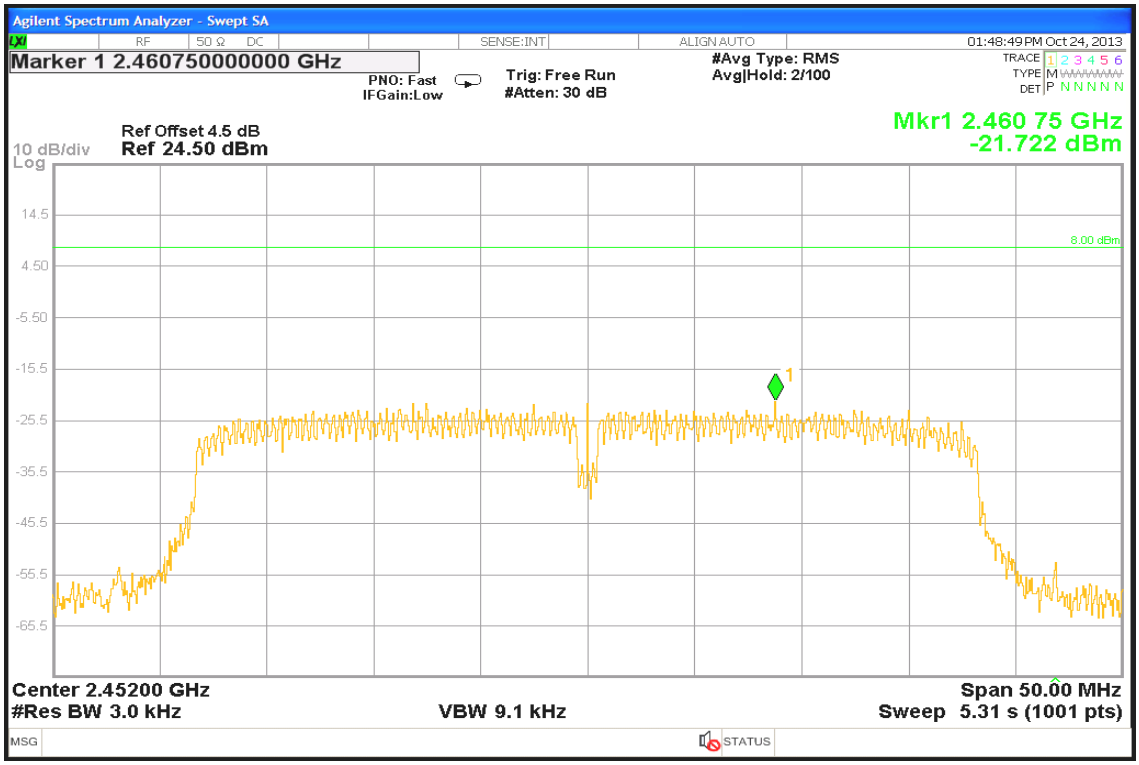


IEEE 802.11n HT40 mode

PPSD (CH Low)

PPSD (CH Mid)

PPSD (CH High)



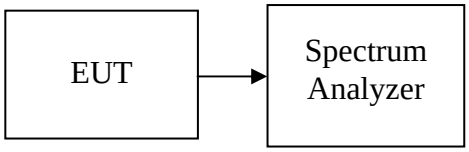
7.6 SPURIOUS EMISSIONS

7.6.1 Conducted Measurement

LIMIT

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 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. 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 Section 15.205(c)).

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

Measurements are made over the 30MHz to 26GHz range for IEEE 802.11b/g, 30MHz to 40GHz range for IEEE 802.11a with the transmitter set to the lowest, middle, and highest channels.

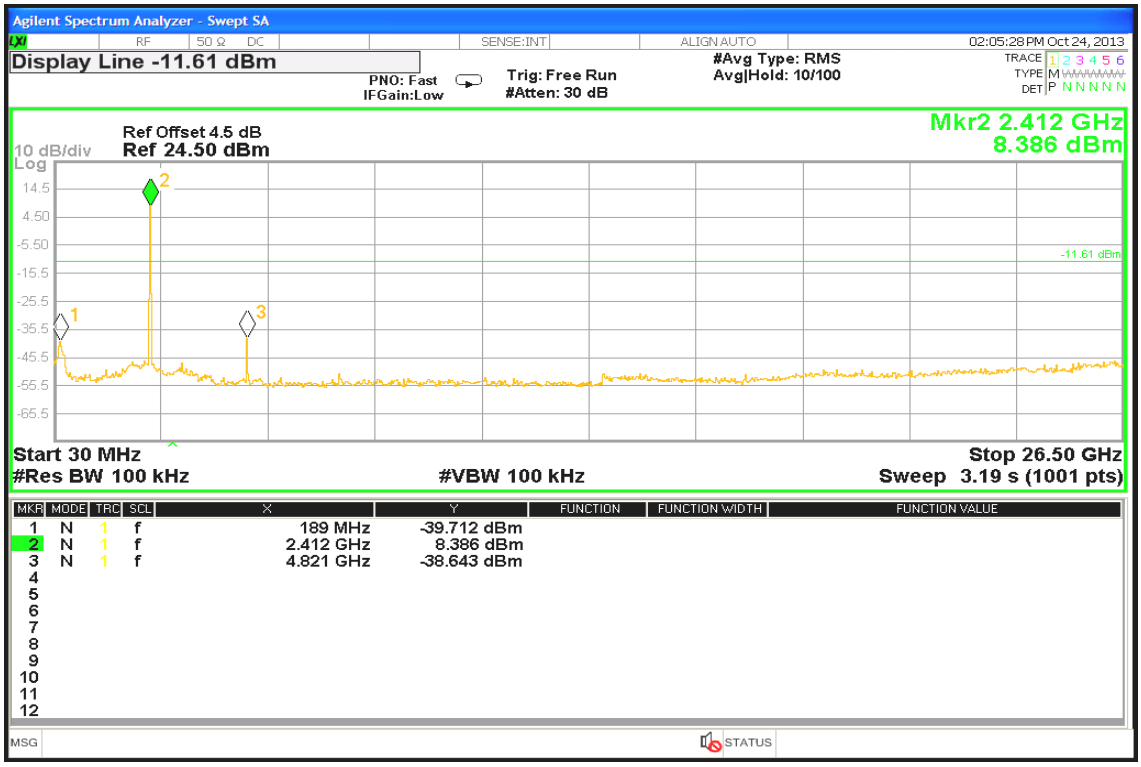
TEST RESULTS

No non-compliance noted

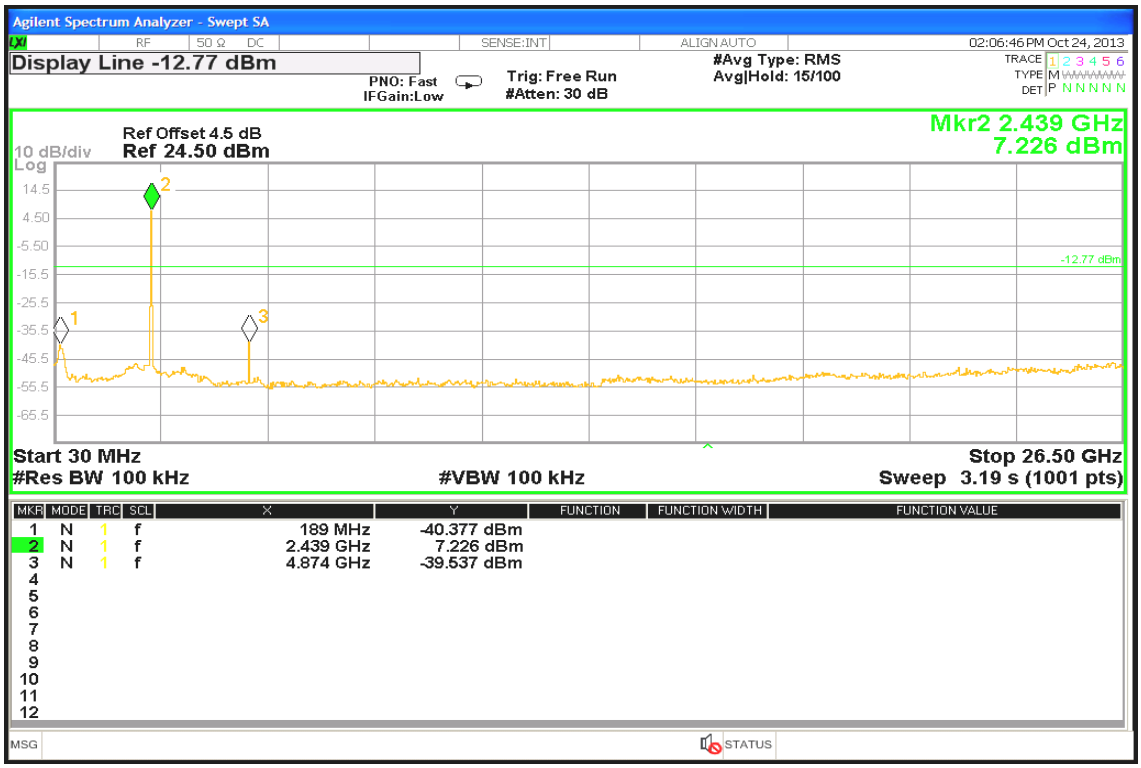
Test Plot

IEEE 802.11b mode

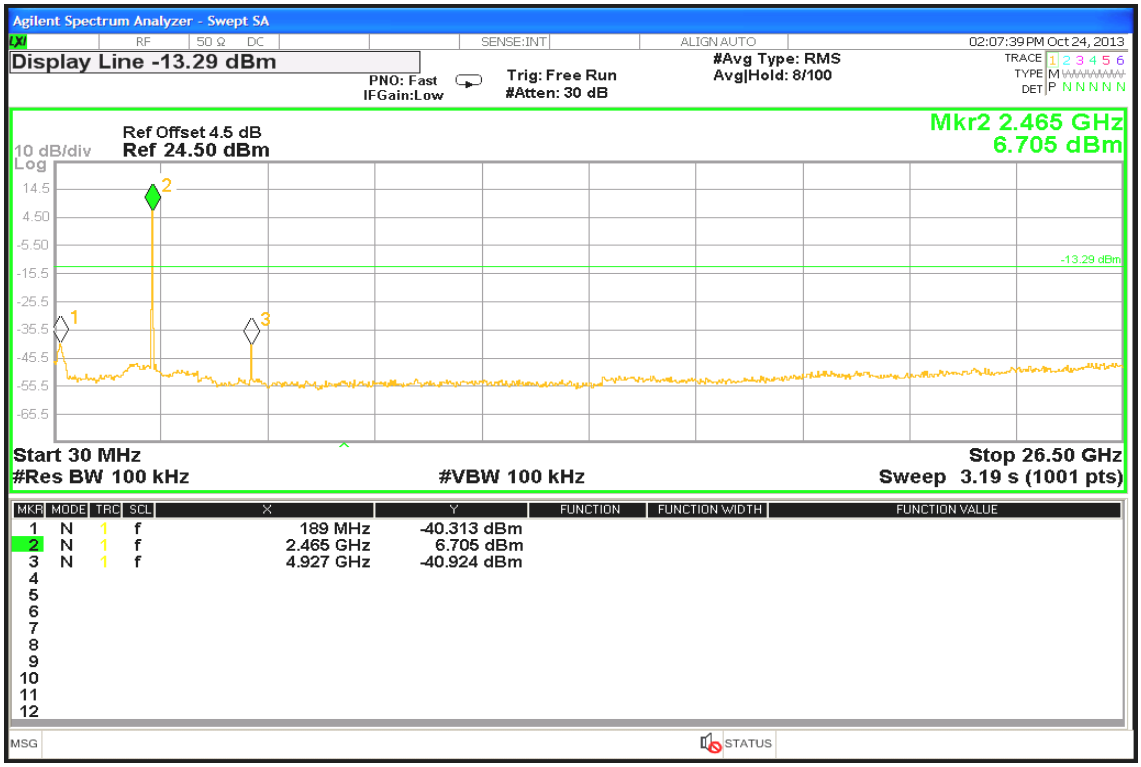
CH Low



CH Mid

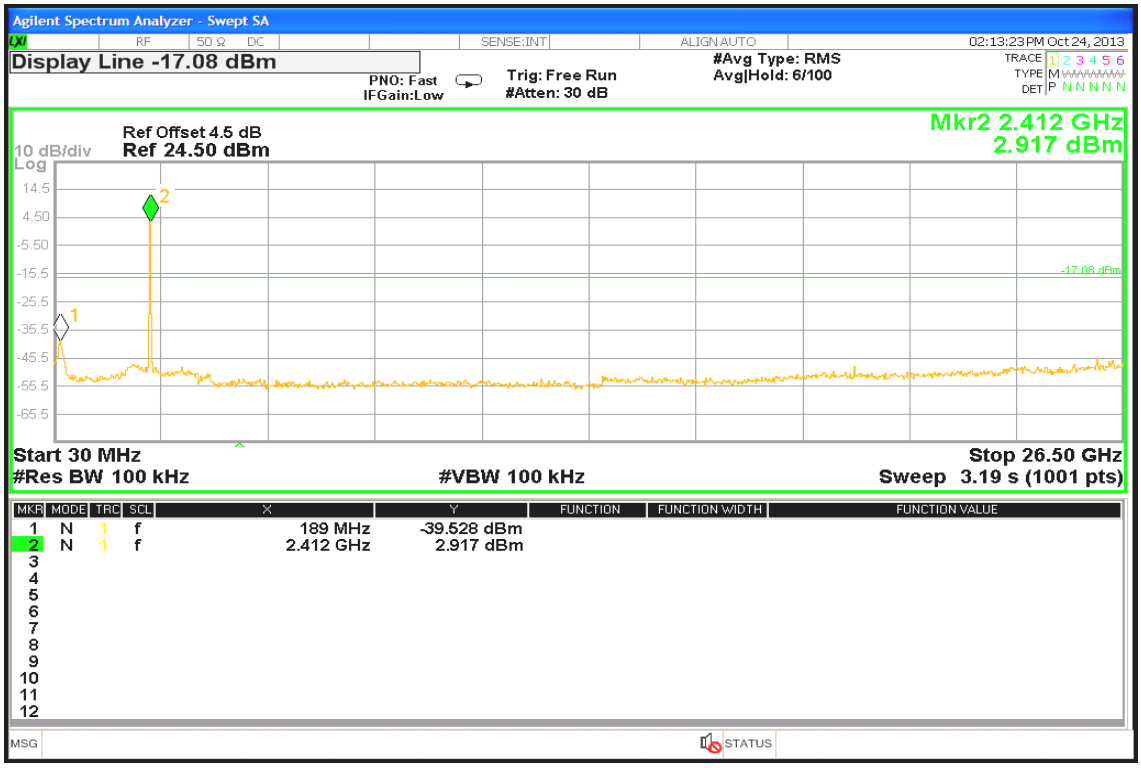


CH High

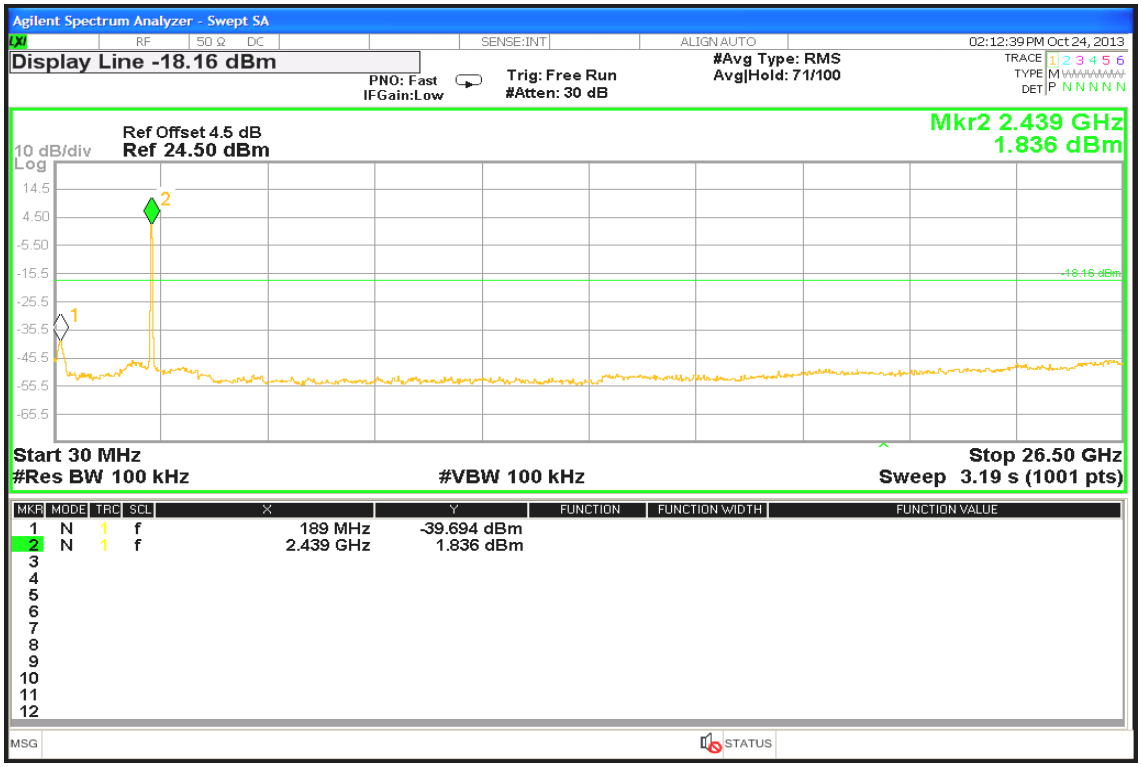


IEEE 802.11g mode

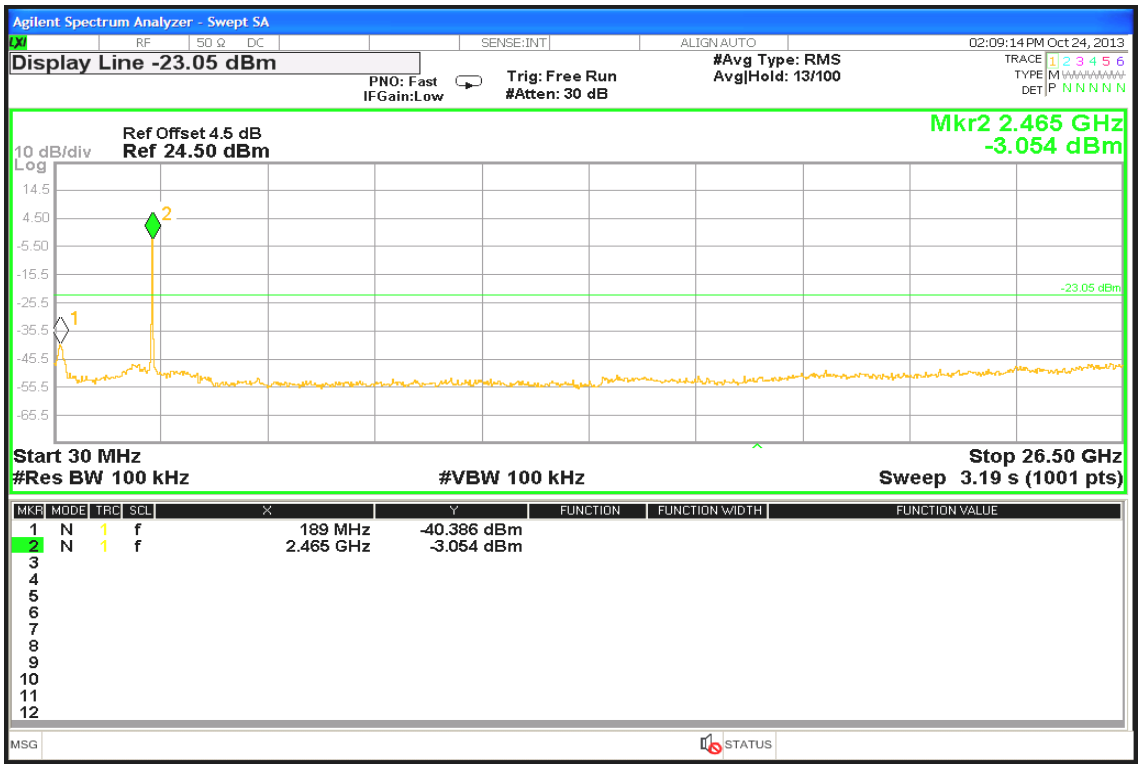
CH Low



CH Mid

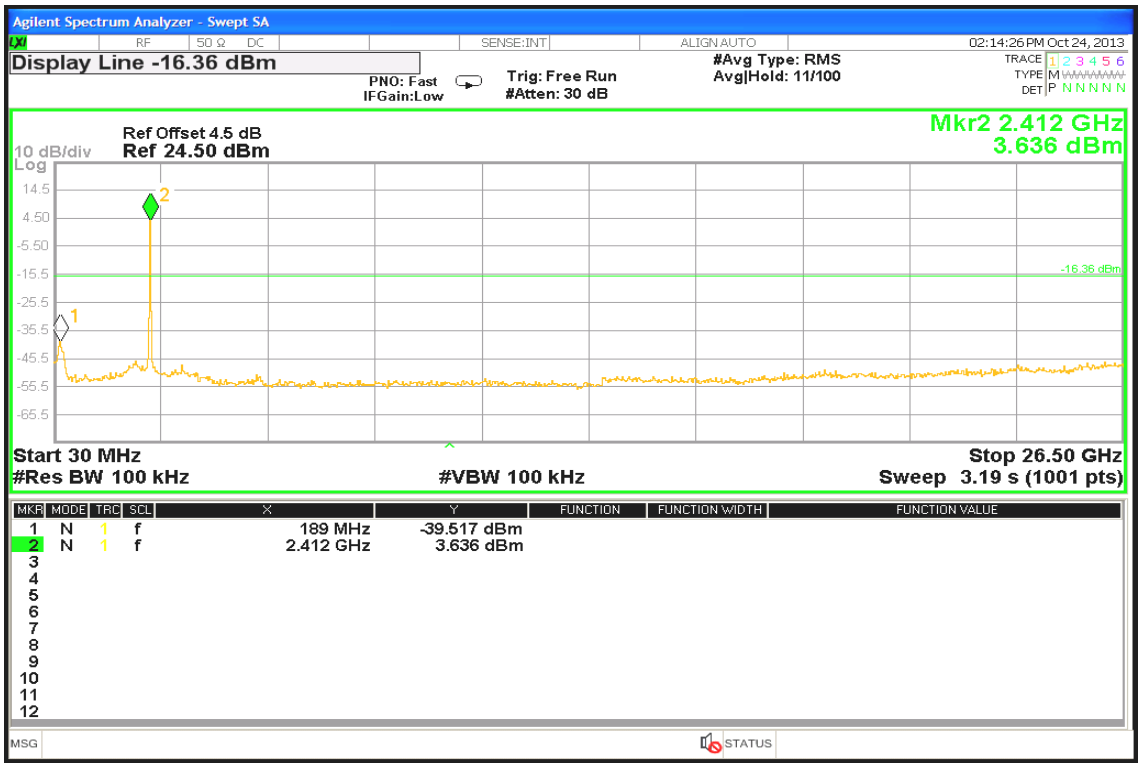


CH High

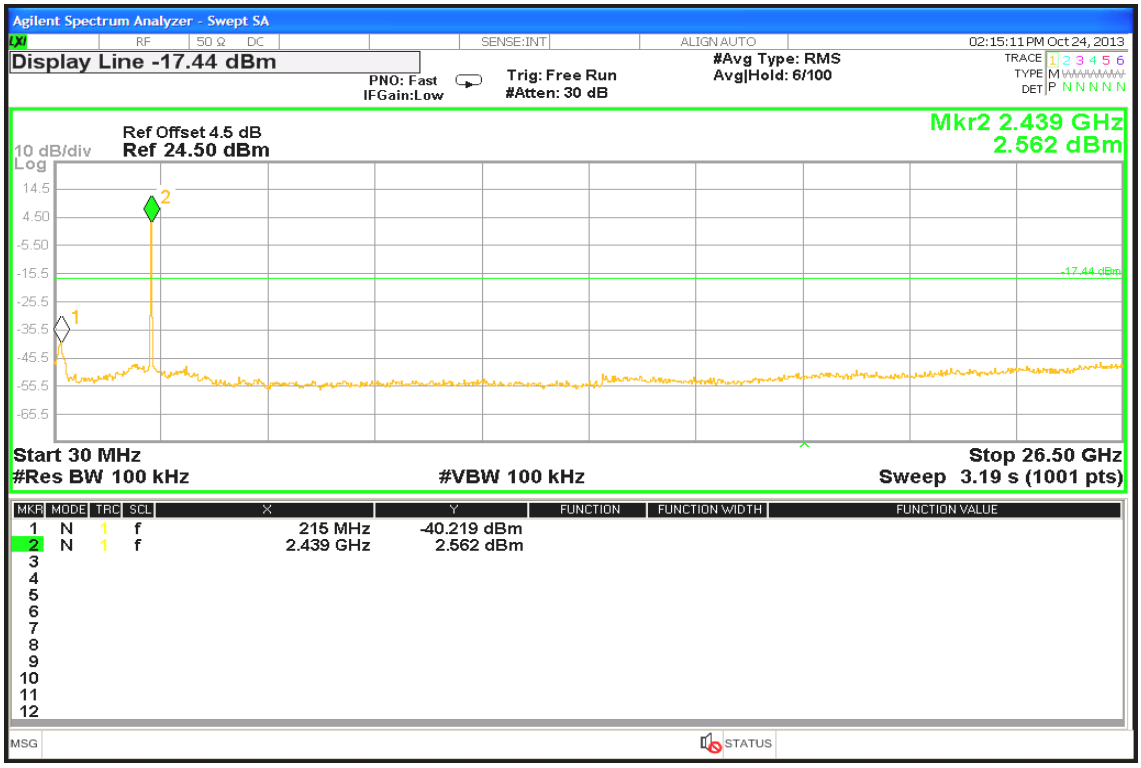


IEEE 802.11n HT20 mode

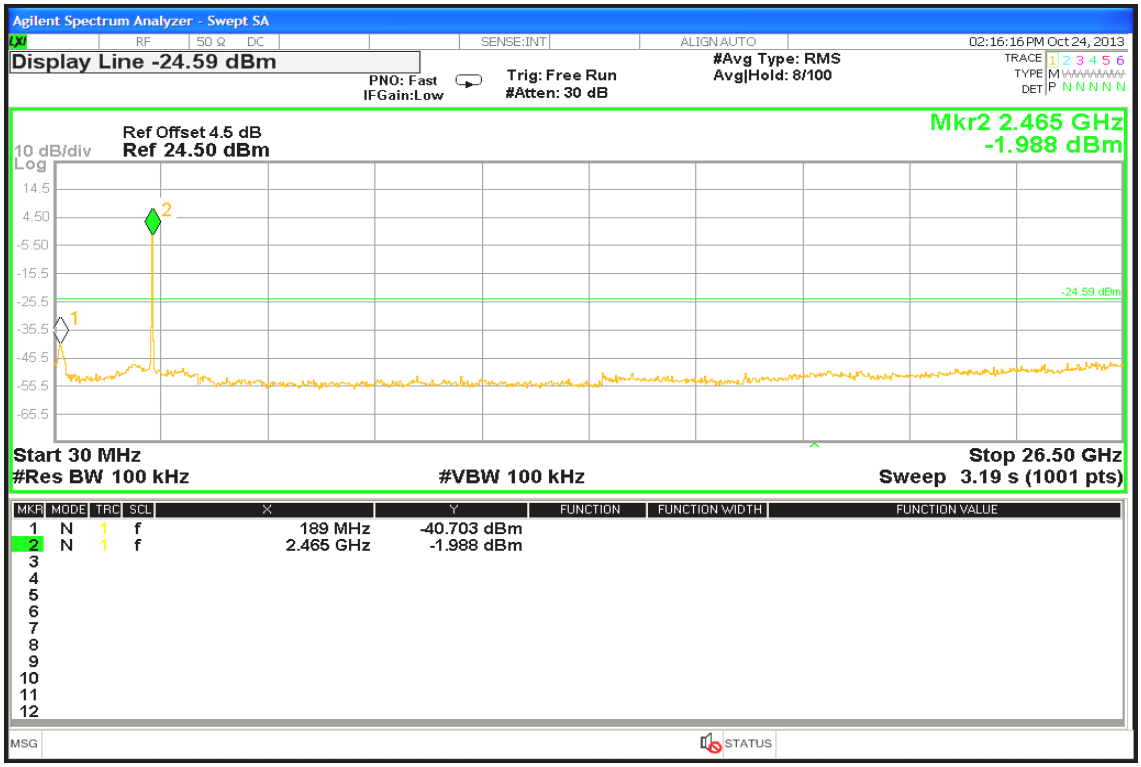
CH Low



CH Mid

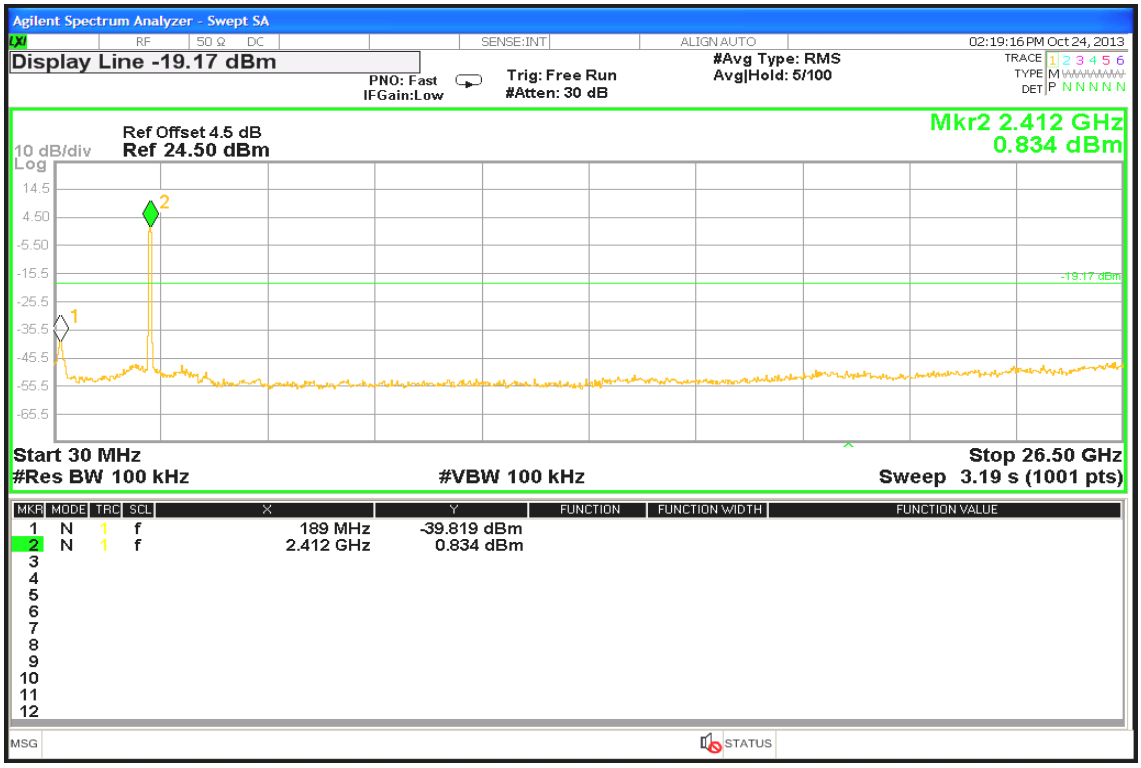


CH High

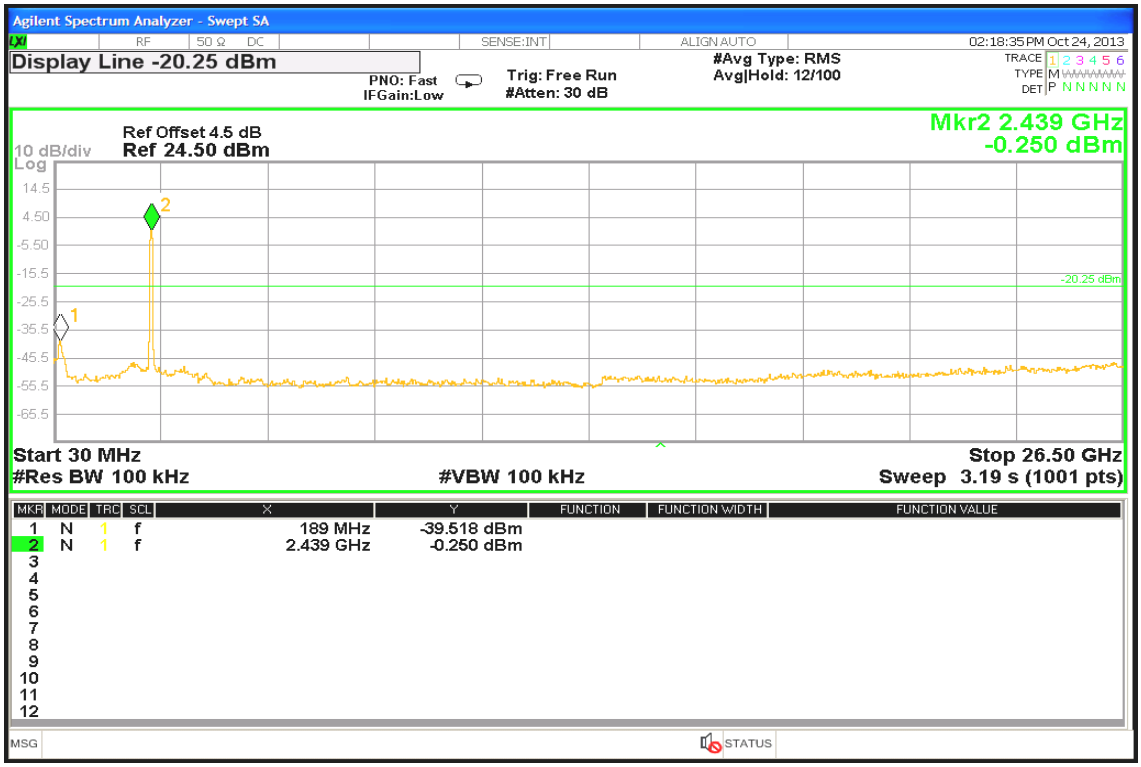


IEEE 802.11n HT40 mode

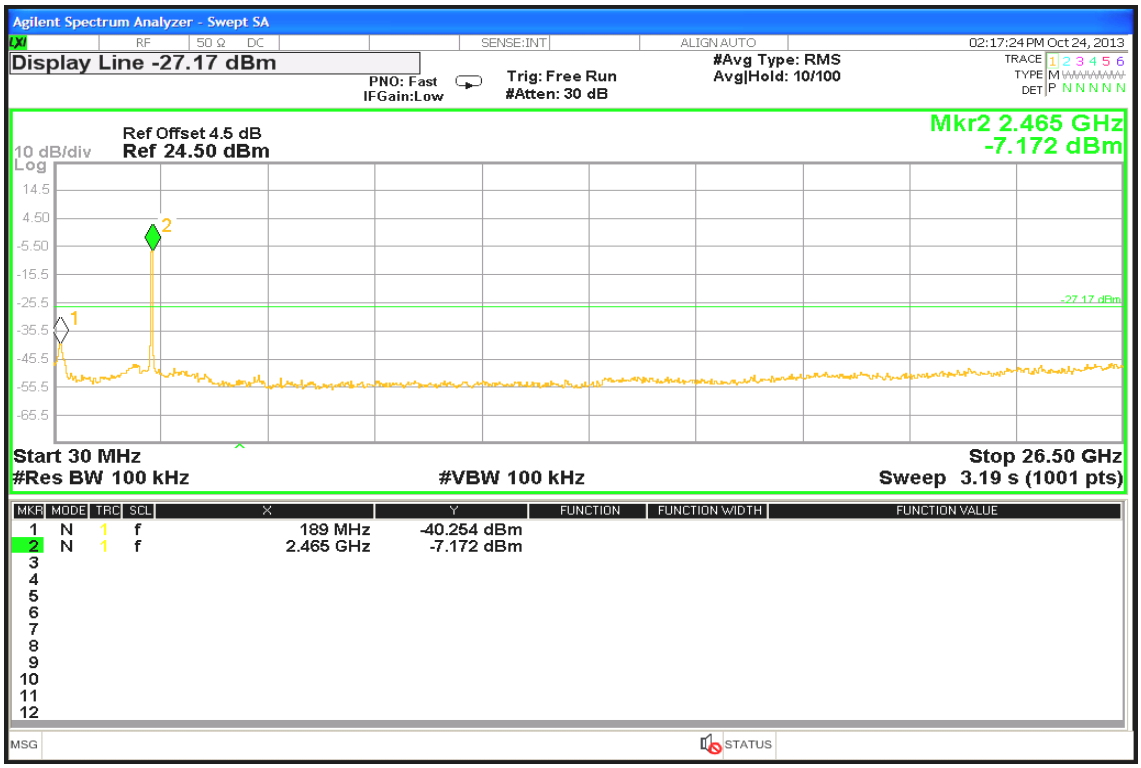
CH Low



CH Mid



CH High



7.6.2 Radiated Emissions

LIMIT

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

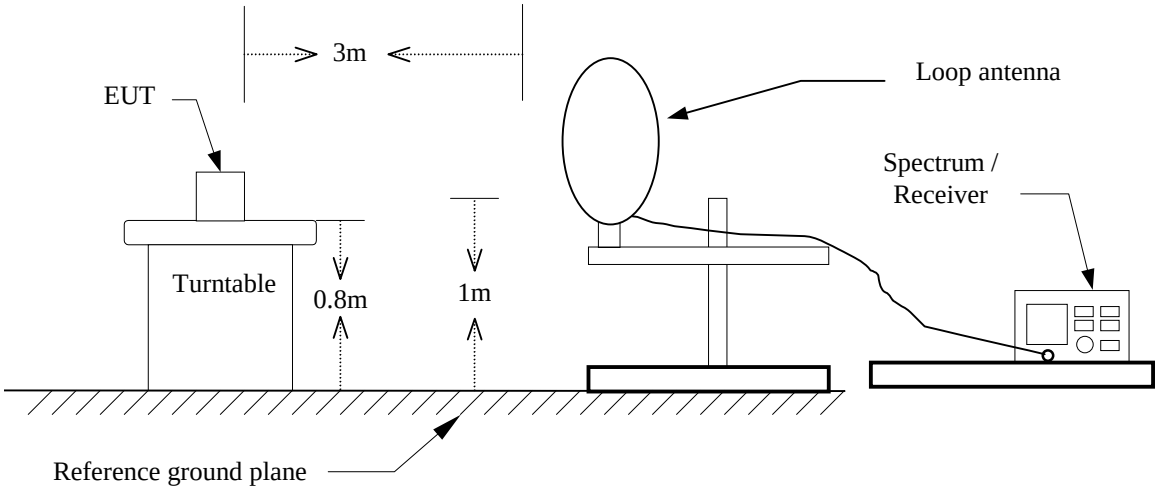
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

2. In the above emission table, the tighter limit applies at the band edges.

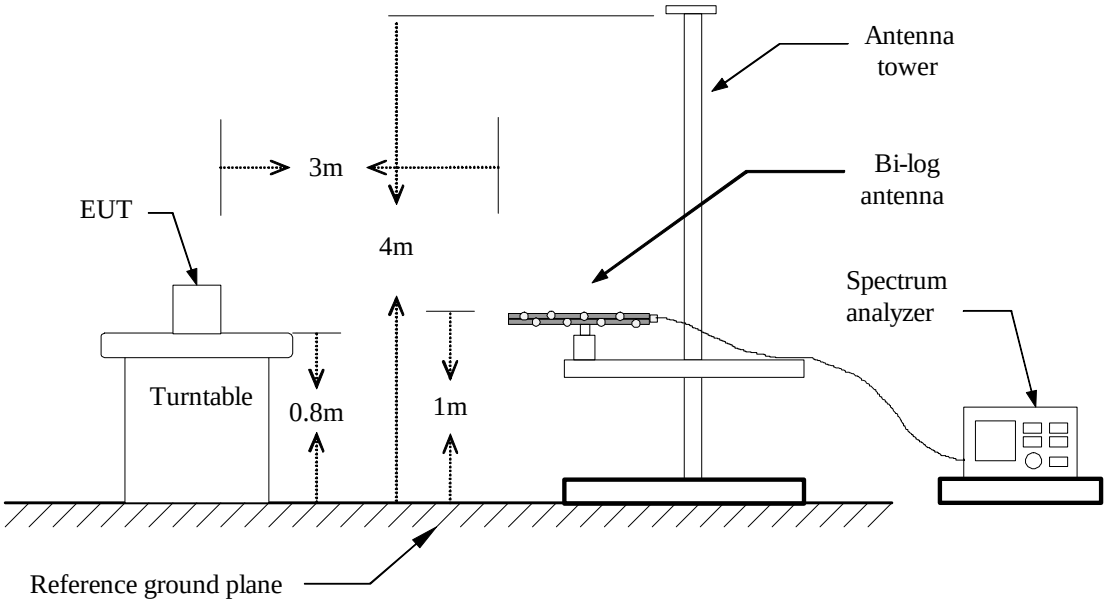
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
0.009 - 0.490	2400/F(kHz) +80	20LOG((2400/F(kHz))+80)
0.490 - 1.705	24000/F(kHz) +40	20LOG((24000/F(kHz))+40)
1.705 – 30.0	30	69.54
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

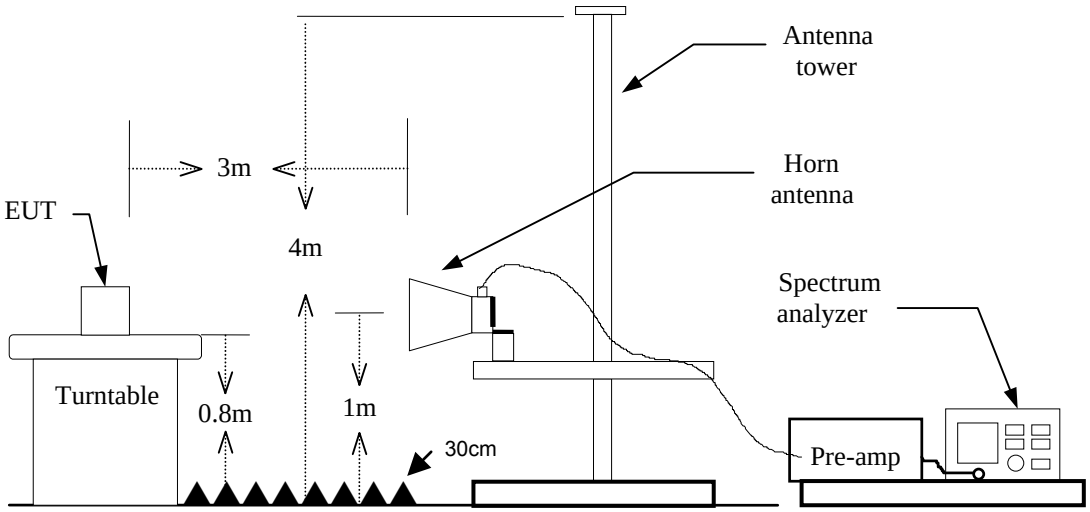
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 30MHz

   RBW=10kHz / VBW=30kHz / Sweep=AUTO

   30 ~ 1000MHz:

   RBW=100kHz / VBW=300KHz / Sweep=AUTO

   Above 1GHz:

   a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO

   b) AVERAGE: RBW=1MHz / VBW=300Hz / Sweep=AUTO

7. Repeat above procedures until the measurements for all frequencies are complete.

DATA SAMPLE

Below 1 GHz

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol. (H/V)	Remark
x.xx	43.20	-20.71	22.49	40.00	-17.51	V	QP

Frequency (MHz) = Emission frequency in MHz
Reading (dBuV) = Uncorrected Analyzer / Receiver reading
Correction Factor (dB/m) = Antenna factor – Amplifier gain + Cable loss
Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
Limit (dBuV/m) = Limit stated in standard
Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)
Q.P. = Quasi-Peak

Above 1 GHz

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
x.xx	45.25	6.91	52.16	74.00	-21.84	H	peak
x.xx	32.33	6.91	39.24	54.00	-14.76	H	AVG

Frequency (MHz) = Emission frequency in MHz
Reading (dBuV) = Uncorrected Analyzer / Receiver reading
Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
Limit (dBuV/m) = Limit stated in standard
Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)

TEST RESULTS

No non-compliance noted.

Below 1 GHz

Operation Mode:	Normal Link	**Test Date:**	2014/4/21
Temperature:	26°C	**Tested by:**	Louis Shen
Humidity:	56% RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol. (H/V)	Remark
49.3998	57.50	-19.00	38.50	40.00	-1.50	V	QP
80.4398	47.90	-19.88	28.02	40.00	-11.98	V	QP
95.9599	45.00	-17.22	27.78	43.50	-15.72	V	QP
359.8000	52.90	-10.91	41.99	46.00	-4.01	V	QP
600.3600	48.10	-8.00	40.10	46.00	-5.90	V	QP
839.9500	42.25	-4.79	37.46	46.00	-8.54	V	QP
94.9900	48.60	-17.39	31.21	43.50	-12.29	H	QP
359.8000	55.70	-10.91	44.79	46.00	-1.21	H	QP
480.0800	48.30	-9.51	38.79	46.00	-7.21	H	QP
600.3600	43.20	-8.00	35.20	46.00	-10.80	H	QP
719.6700	42.70	-6.71	35.99	46.00	-10.01	H	QP
839.9500	44.90	-4.79	40.11	46.00	-5.89	H	QP
960.2300	42.10	-3.38	38.72	54.00	-15.28	H	QP

Remark:

1. *No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

Above 1 GHz

Operation Mode: TX / IEEE 802.11b mode / CH Low **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
2132.000	54.30	-2.85	51.45	74.00	-22.55	V	peak
2284.000	55.06	-1.51	53.55	74.00	-20.45	V	peak
2284.000	39.48	-1.51	37.97	54.00	-16.03	V	AVG
2640.000	52.48	-1.89	50.59	74.00	-23.41	V	peak
3800.000	36.63	3.69	40.32	74.00	-33.68	V	peak
4825.000	52.47	2.68	55.15	74.00	-18.85	V	peak
4825.000	50.80	2.68	53.48	54.00	-0.52	V	AVG
5645.000	35.39	5.92	41.31	74.00	-32.69	V	peak
1080.000	57.48	-10.43	47.05	74.00	-26.95	H	peak
1680.000	54.12	-8.01	46.11	74.00	-27.89	H	peak
2266.000	57.26	-5.40	51.86	74.00	-22.14	H	peak
3895.000	36.98	5.21	42.19	74.00	-31.81	H	peak
4825.000	47.03	5.88	52.91	74.00	-21.09	H	peak
4825.000	44.31	5.88	50.19	54.00	-3.81	H	AVG
6030.000	35.95	8.79	44.74	74.00	-29.26	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11b mode / CH Mid **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
1970.000	53.31	-1.77	51.54	74.00	-22.46	V	peak
2134.000	53.78	-2.81	50.97	74.00	-23.03	V	peak
2640.000	52.85	-1.89	50.96	74.00	-23.04	V	peak
3790.000	36.77	3.57	40.34	74.00	-33.66	V	peak
4875.000	49.11	3.81	52.92	74.00	-21.08	V	peak
4875.000	46.69	3.81	50.50	54.00	-3.50	V	AVG
6420.000	35.73	6.66	42.39	74.00	-31.61	V	peak
1904.000	51.54	-5.83	45.71	74.00	-28.29	H	peak
2276.000	57.05	-5.68	51.37	74.00	-22.63	H	peak
2880.000	49.92	-1.88	48.04	74.00	-25.96	H	peak
4310.000	35.57	7.59	43.16	74.00	-30.84	H	peak
4875.000	44.28	6.73	51.01	74.00	-22.99	H	peak
5570.000	34.87	9.10	43.97	74.00	-30.03	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11b mode / CH High **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
1920.000	52.31	-2.56	49.75	74.00	-24.25	V	peak
2340.000	52.78	-1.60	51.18	74.00	-22.82	V	peak
2640.000	52.47	-1.89	50.58	74.00	-23.42	V	peak
3750.000	37.67	3.08	40.75	74.00	-33.25	V	peak
4925.000	49.53	4.61	54.14	74.00	-19.86	V	peak
4925.030	48.15	4.61	52.76	54.00	-1.24	V	AVG
6180.000	36.49	6.09	42.58	74.00	-31.42	V	peak
1718.000	54.69	-7.47	47.22	74.00	-26.78	H	peak
2276.000	56.27	-5.68	50.59	74.00	-23.41	H	peak
2880.000	50.25	-1.88	48.37	74.00	-25.63	H	peak
4330.000	36.02	7.44	43.46	74.00	-30.54	H	peak
4925.000	45.58	7.26	52.84	74.00	-21.16	H	peak
4925.000	41.98	7.26	49.24	54.00	-4.76	H	AVG
7305.000	34.63	11.79	46.42	74.00	-27.58	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11g mode / CH Low **Test Date:** 2013/10/23
Temperature: 26℃ **Tested by:** Louis Shen
Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
2004.000	51.52	-1.39	50.13	74.00	-23.87	V	peak
2134.000	52.85	-2.81	50.04	74.00	-23.96	V	peak
2880.000	51.13	-0.95	50.18	74.00	-23.82	V	peak
3825.000	36.97	3.13	40.10	74.00	-33.90	V	peak
4825.000	43.59	2.68	46.27	74.00	-27.73	V	peak
5480.000	35.07	6.26	41.33	74.00	-32.67	V	peak
1920.000	52.00	-5.93	46.07	74.00	-27.93	H	peak
2160.000	52.07	-3.65	48.42	74.00	-25.58	H	peak
2902.000	49.70	-1.71	47.99	74.00	-26.01	H	peak
4825.000	38.73	5.88	44.61	74.00	-29.39	H	peak
5600.000	35.21	9.20	44.41	74.00	-29.59	H	peak
7265.000	35.51	11.35	46.86	74.00	-27.14	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11g mode / CH Mid **Test Date:** 2013/10/23
Temperature: 26℃ **Tested by:** Louis Shen
Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
1970.000	51.64	-1.77	49.87	74.00	-24.13	V	peak
2134.000	52.40	-2.81	49.59	74.00	-24.41	V	peak
2640.000	52.05	-1.89	50.16	74.00	-23.84	V	peak
3785.000	37.27	3.51	40.78	74.00	-33.22	V	peak
4870.000	44.74	3.70	48.44	74.00	-25.56	V	peak
5695.000	36.30	5.94	42.24	74.00	-31.76	V	peak
1920.000	52.07	-5.93	46.14	74.00	-27.86	H	peak
2198.000	51.12	-3.56	47.56	74.00	-26.44	H	peak
2864.000	49.89	-2.00	47.89	74.00	-26.11	H	peak
4315.000	36.43	7.55	43.98	74.00	-30.02	H	peak
4870.000	38.16	6.64	44.80	74.00	-29.20	H	peak
5535.000	35.06	8.98	44.04	74.00	-29.96	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11g mode / CH High **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
2034.000	51.23	-2.07	49.16	74.00	-24.84	V	peak
2134.000	54.23	-2.81	51.42	74.00	-22.58	V	peak
2880.000	51.26	-0.95	50.31	74.00	-23.69	V	peak
3765.000	37.26	3.26	40.52	74.00	-33.48	V	peak
5020.000	36.60	5.13	41.73	74.00	-32.27	V	peak
6340.000	36.19	6.81	43.00	74.00	-31.00	V	peak
1920.000	51.86	-5.93	45.93	74.00	-28.07	H	peak
2160.000	51.25	-3.65	47.60	74.00	-26.40	H	peak
2966.000	50.20	-1.02	49.18	74.00	-24.82	H	peak
4275.000	35.92	7.24	43.16	74.00	-30.84	H	peak
4910.000	36.11	7.19	43.30	74.00	-30.70	H	peak
5495.000	36.09	8.84	44.93	74.00	-29.07	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11n HT20 mode / CH Low **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
2004.000	50.92	-1.39	49.53	74.00	-24.47	V	peak
2198.000	50.98	-1.37	49.61	74.00	-24.39	V	peak
2640.000	52.35	-1.89	50.46	74.00	-23.54	V	peak
3800.000	37.34	3.69	41.03	74.00	-32.97	V	peak
4830.000	44.30	2.79	47.09	74.00	-26.91	V	peak
5600.000	36.76	5.91	42.67	74.00	-31.33	V	peak
1680.000	54.40	-8.01	46.39	74.00	-27.61	H	peak
2160.000	51.29	-3.65	47.64	74.00	-26.36	H	peak
2920.000	50.31	-1.52	48.79	74.00	-25.21	H	peak
4305.000	37.36	7.62	44.98	74.00	-29.02	H	peak
4825.000	37.72	5.88	43.60	74.00	-30.40	H	peak
5550.000	35.74	9.03	44.77	74.00	-29.23	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	TX / IEEE 802.11n HT20 mode / CH Mid	**Test Date:**	2013/10/23
Temperature:	26℃	**Tested by:**	Louis Shen
Humidity:	56%RH	**Polarity:**	Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
1974.000	50.67	-1.71	48.96	74.00	-25.04	V	peak
2640.000	51.98	-1.89	50.09	74.00	-23.91	V	peak
2884.000	50.68	-0.89	49.79	74.00	-24.21	V	peak
3795.000	36.36	3.63	39.99	74.00	-34.01	V	peak
4875.000	45.88	3.81	49.69	74.00	-24.31	V	peak
5565.000	35.96	6.02	41.98	74.00	-32.02	V	peak
1080.000	57.45	-10.43	47.02	74.00	-26.98	H	peak
2160.000	51.62	-3.65	47.97	74.00	-26.03	H	peak
2966.000	49.55	-1.02	48.53	74.00	-25.47	H	peak
4330.000	36.30	7.44	43.74	74.00	-30.26	H	peak
4875.000	39.01	6.73	45.74	74.00	-28.26	H	peak
5570.000	35.69	9.10	44.79	74.00	-29.21	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11n HT20 mode / CH High **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
1920.000	52.05	-2.56	49.49	74.00	-24.51	V	peak
2218.000	50.68	-1.37	49.31	74.00	-24.69	V	peak
2640.000	52.46	-1.89	50.57	74.00	-23.43	V	peak
3765.000	37.15	3.26	40.41	74.00	-33.59	V	peak
5000.000	35.54	5.32	40.86	74.00	-33.14	V	peak
5490.000	34.62	6.25	40.87	74.00	-33.13	V	peak
1920.000	51.72	-5.93	45.79	74.00	-28.21	H	peak
2160.000	51.19	-3.65	47.54	74.00	-26.46	H	peak
2886.000	49.79	-1.83	47.96	74.00	-26.04	H	peak
3815.000	37.26	5.12	42.38	74.00	-31.62	H	peak
4310.000	35.93	7.59	43.52	74.00	-30.48	H	peak
5470.000	34.52	8.72	43.24	74.00	-30.76	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11n HT40 mode / CH Low **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
1998.000	50.87	-1.33	49.54	74.00	-24.46	V	peak
2290.000	51.23	-1.53	49.70	74.00	-24.30	V	peak
2640.000	51.80	-1.89	49.91	74.00	-24.09	V	peak
3765.000	36.94	3.26	40.20	74.00	-33.80	V	peak
4835.000	39.64	2.91	42.55	74.00	-31.45	V	peak
5560.000	35.70	6.04	41.74	74.00	-32.26	V	peak
1080.000	57.65	-10.43	47.22	74.00	-26.78	H	peak
2160.000	52.60	-3.65	48.95	74.00	-25.05	H	peak
2968.000	51.26	-1.00	50.26	74.00	-23.74	H	peak
3855.000	36.65	5.17	41.82	74.00	-32.18	H	peak
4335.000	35.89	7.40	43.29	74.00	-30.71	H	peak
5570.000	35.49	9.10	44.59	74.00	-29.41	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11n HT40 mode / CH Mid **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
2046.000	51.36	-2.34	49.02	74.00	-24.98	V	peak
2264.000	51.43	-1.47	49.96	74.00	-24.04	V	peak
2640.000	52.84	-1.89	50.95	74.00	-23.05	V	peak
3800.000	36.76	3.69	40.45	74.00	-33.55	V	peak
4870.000	41.09	3.70	44.79	74.00	-29.21	V	peak
5670.000	35.60	5.93	41.53	74.00	-32.47	V	peak
1080.000	57.41	-10.43	46.98	74.00	-27.02	H	peak
2268.000	53.49	-5.46	48.03	74.00	-25.97	H	peak
2930.000	49.78	-1.41	48.37	74.00	-25.63	H	peak
3720.000	38.02	2.71	40.73	74.00	-33.27	H	peak
4880.000	39.42	3.92	43.34	74.00	-30.66	H	peak
5575.000	35.87	5.99	41.86	74.00	-32.14	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11n HT40 mode / CH High **Test Date:** 2013/10/23

Temperature: 26℃ **Tested by:** Louis Shen

Humidity: 56%RH **Polarity:** Ver. / Hor.

Freq. (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Pol H/V	Remark
1988.000	51.31	-1.49	49.82	74.00	-24.18	V	peak
2248.000	52.14	-1.44	50.70	74.00	-23.30	V	peak
2950.000	51.64	-0.98	50.66	74.00	-23.34	V	peak
3775.000	37.18	3.38	40.56	74.00	-33.44	V	peak
5005.000	35.67	5.27	40.94	74.00	-33.06	V	peak
5630.000	35.67	5.92	41.59	74.00	-32.41	V	peak
1920.000	51.98	-5.93	46.05	74.00	-27.95	H	peak
2134.000	51.73	-3.71	48.02	74.00	-25.98	H	peak
2850.000	50.83	-2.10	48.73	74.00	-25.27	H	peak
4325.000	36.74	7.47	44.21	74.00	-29.79	H	peak
5015.000	36.28	7.40	43.68	74.00	-30.32	H	peak
5605.000	35.43	9.14	44.57	74.00	-29.43	H	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement 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. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

7.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dBμV)	
	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

***** *Decreases with the logarithm of the frequency.*

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST 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.

TEST RESULTS

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.

Test Data

Operation Mode:	Normal Link	**Test Date:**	2014/4/11
Temperature:	24℃	**Tested by:**	Bonny Tsai
Humidity:	60% RH		

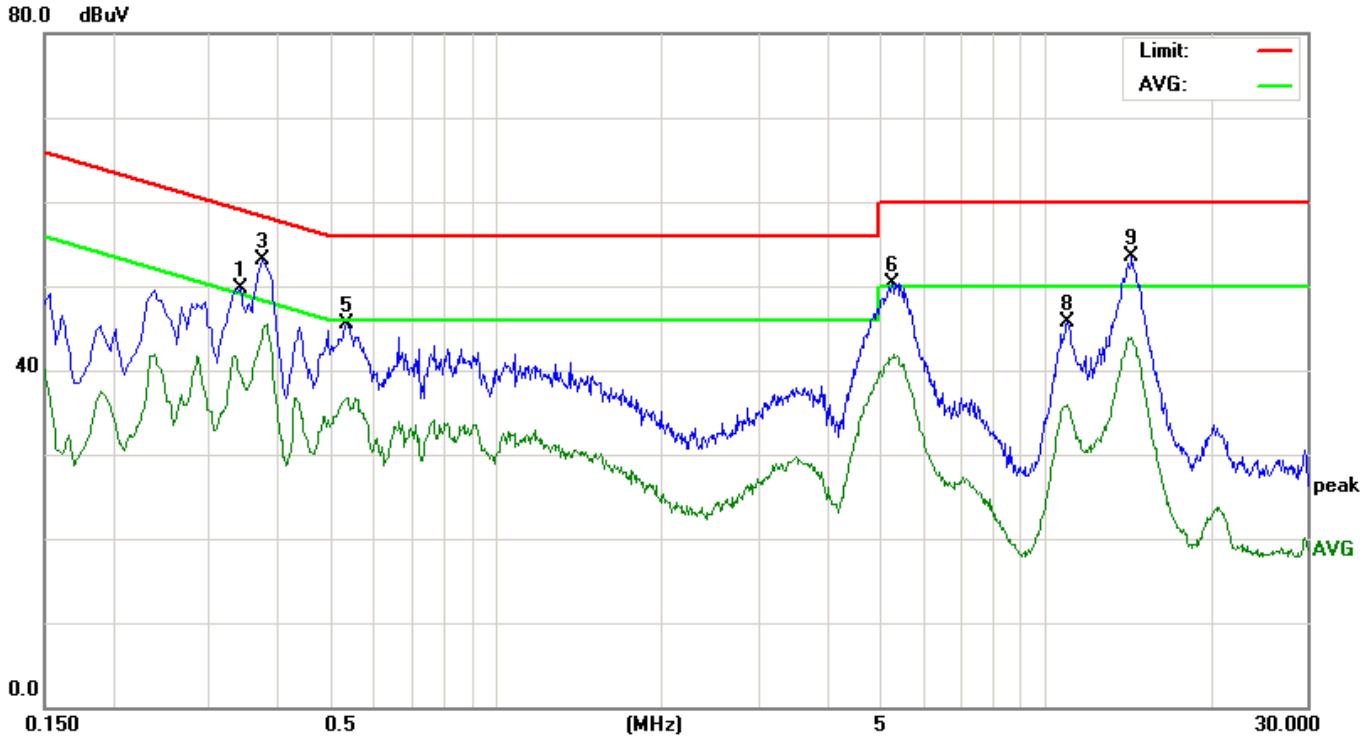
Frequency (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Note
0.3420	39.87	9.91	49.78	59.15	-9.37	peak	L1
0.3420	29.40	9.91	39.31	49.15	-9.84	AVG	L1
0.3740	43.16	9.92	53.08	58.41	-5.33	peak	L1
0.3740	33.74	9.92	43.66	48.41	-4.75	AVG	L1
0.5340	35.57	9.93	45.50	56.00	-10.50	peak	L1
5.2619	40.20	10.20	50.40	60.00	-9.60	peak	L1
5.2619	30.82	10.20	41.02	50.00	-8.98	AVG	L1
10.9900	35.34	10.36	45.70	60.00	-14.30	peak	L1
14.3780	43.03	10.48	53.51	60.00	-6.49	peak	L1
14.3780	32.76	10.48	43.24	50.00	-6.76	AVG	L1
0.3339	43.40	9.92	53.32	59.35	-6.03	peak	L2
0.3339	36.33	9.92	46.25	49.35	-3.10	AVG	L2
0.3740	43.71	9.93	53.64	58.41	-4.77	peak	L2
0.3740	34.63	9.93	44.56	48.41	-3.85	AVG	L2
0.4420	36.65	9.92	46.57	57.02	-10.45	peak	L2
5.3300	42.14	10.21	52.35	60.00	-7.65	peak	L2
5.3300	32.33	10.21	42.54	50.00	-7.46	AVG	L2
10.9620	34.76	10.36	45.12	60.00	-14.88	peak	L2
14.3580	42.90	10.48	53.38	60.00	-6.62	peak	L2
14.3580	32.57	10.48	43.05	50.00	-6.95	AVG	L2

Remark:

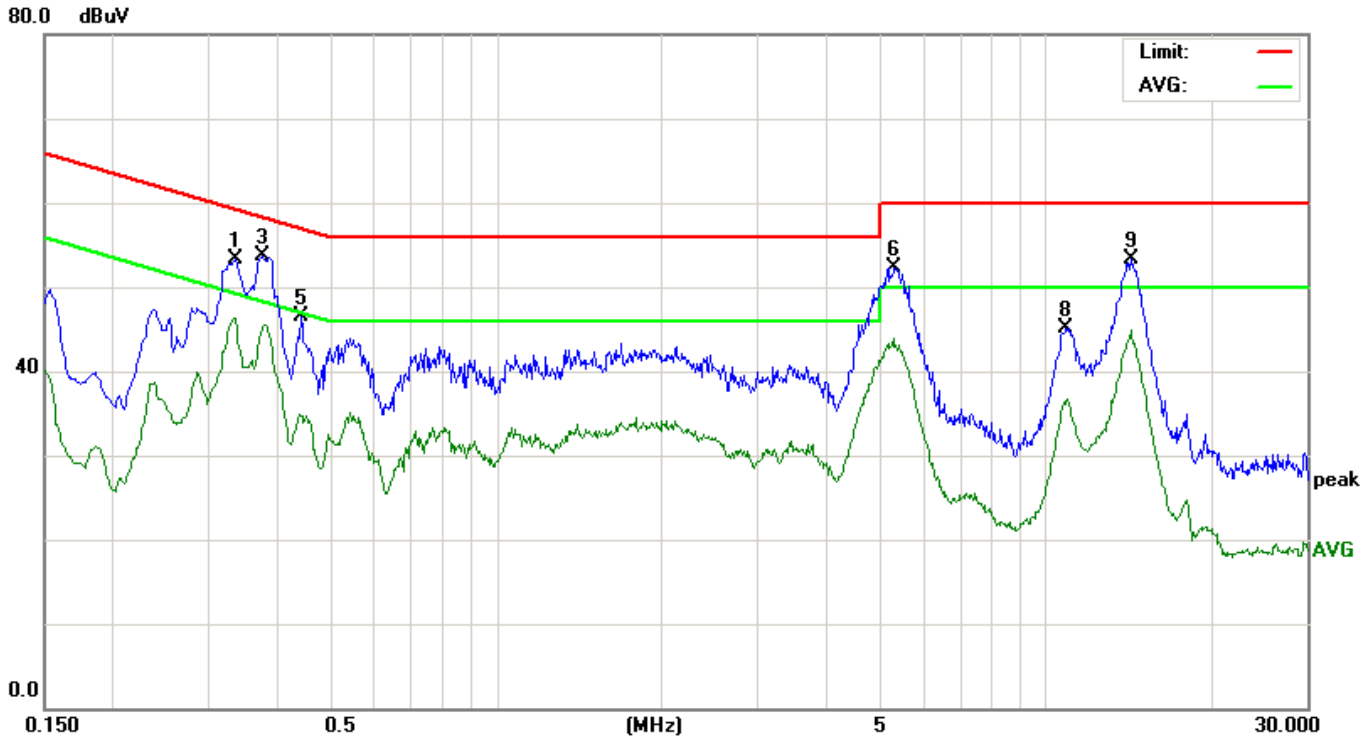
1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)

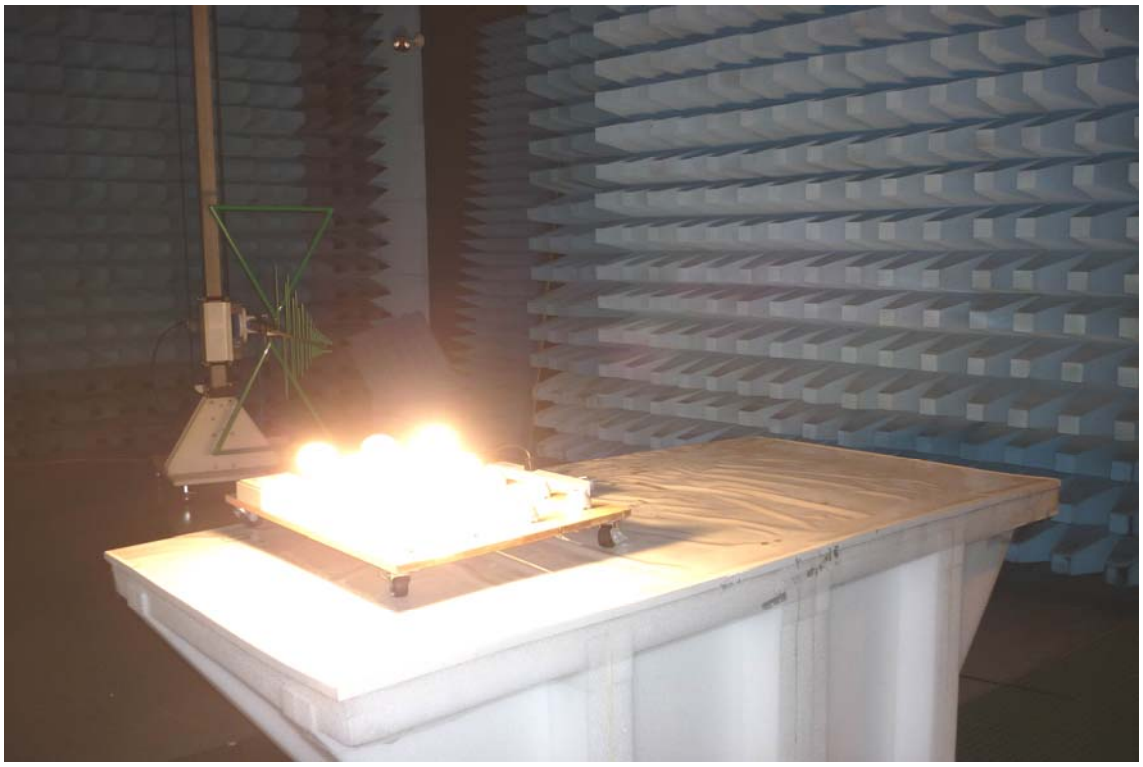


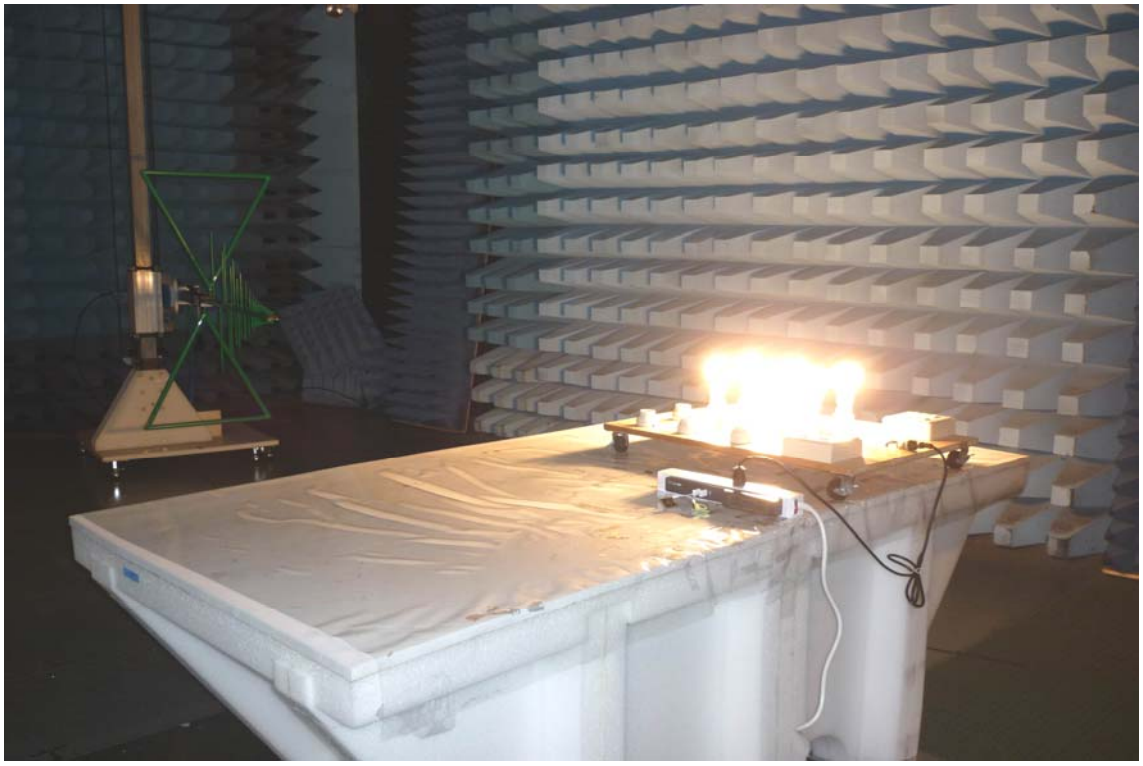
Conducted emissions (Line 2)



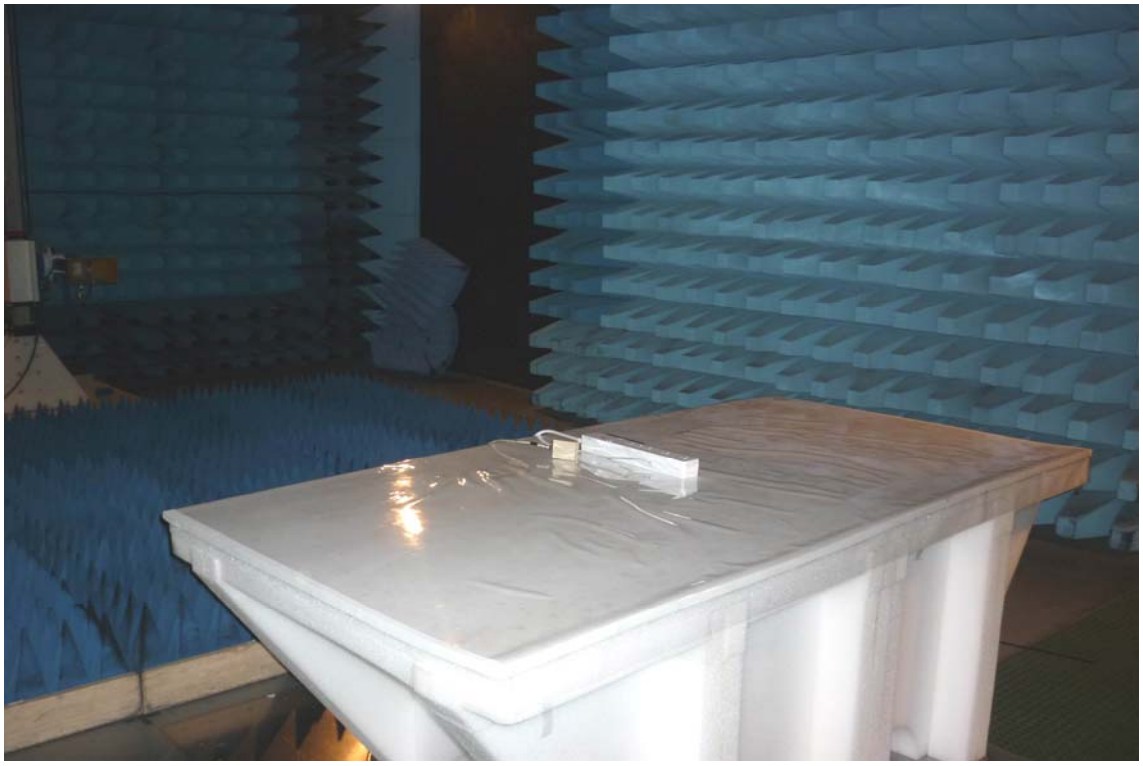
8 APPENDIX I
PHOTOGRAPHS OF TEST SETUP

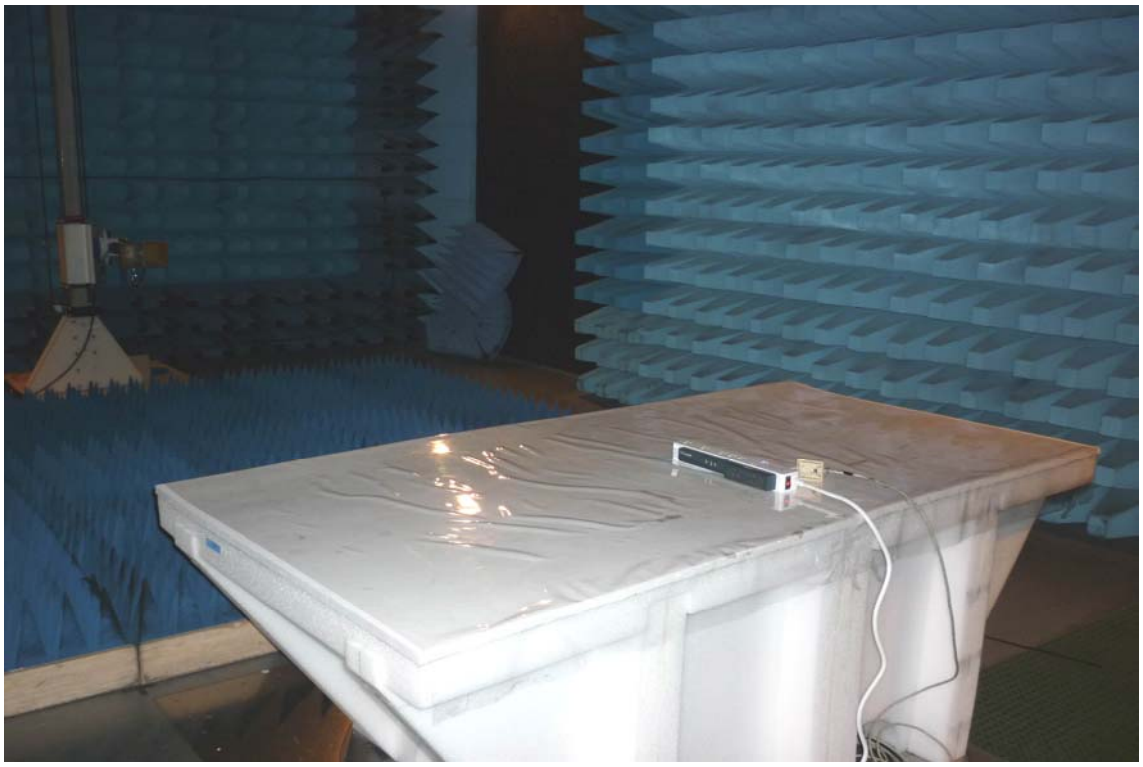
Radiated Emissions Setup Photos
Below 1GHz



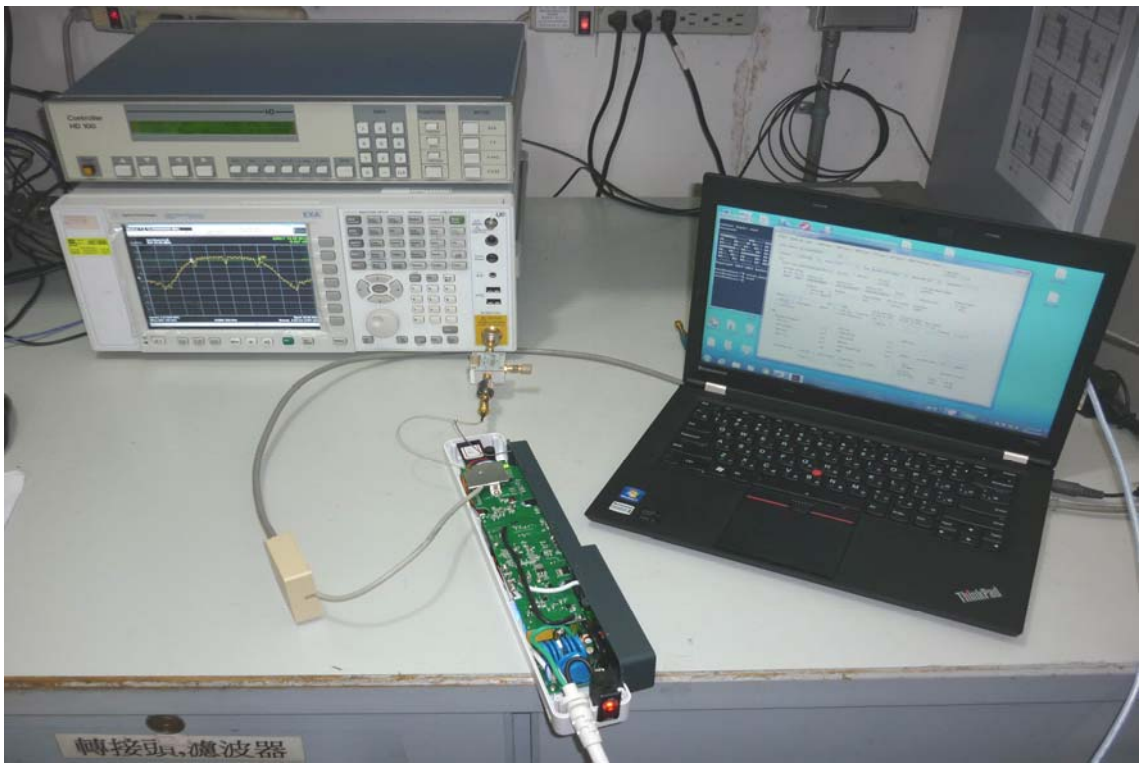


Above 1GHz





Conducted Emissions Setup Photo



Powerline Conducted Emissions Setup Photos

9 APPENDIX II: PHOTOGRAPHS OF EUT

Refer to T130902D04 Photographs.