FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

TABLET DEVICE

MODEL NUMBER: A1567

FCC ID: BCGA1567

REPORT NUMBER: 14U18207-E10, Revision B

ISSUE DATE: SEPTEMBER 13, 2014

Prepared for
APPLE, INC.
1 INFINITE LOOP
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	09/02/14	Initial Issue	F. de Anda
A	09/13/14	Updated EUT description, sec. 5.3	F. de Anda
B	09/13/14	Updated sec. 5.5	F. de Anda

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: TABLET DEVICE

MODEL: A1567

SERIAL NUMBER: DLXMX08RG4M9 (Conducted); DLXMX00VG4MF (Radiated)

DATE TESTED: JULY 8, 2014 TO AUGUST 15, 2014

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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FRANCISCO DEANDA
PROJECT LEAD
UL VERIFICATION SERVICES INC.

Tested By:

FRANCISCO GUARNERO
EMC TECHNICIAN
UL VERIFICATION SERVICES INC.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB558074 and ANSI C63.10-2009.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☒ Chamber D
☐ Chamber B	☒ Chamber E
☐ Chamber C	☒ Chamber F
	☒ Chamber G
	☒ Chamber H

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	±3.52 dB
Radiated Disturbance, 30 to 1000 MHz	±4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a tablet with multimedia functions (music, application support, and video), Cellular GSM/GPRS/EGPRS/CDMA2000 1xRTT/1x Advanced/EVDO Rev.A/EVDO Rev.B /WCDMA /HSPA+/DC-HSDPA/LTE FDD & Carrier Aggregation/TDD/TD-SCDMA radio, IEEE 802.11a/b/g/n/ac radio, and Bluetooth radio. The rechargeable battery is not user accessible.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11b Antenna C	20.05	101.16
2412 - 2472	802.11b Antenna A	17.01	50.23
2412 - 2472	802.11b Antenna B	21.98	157.76
2412 - 2472	802.11g Antenna C	22.85	192.75
2412 - 2472	802.11g Antenna A	21.46	139.96
2412 - 2472	802.11g Antenna B	24.53	283.79
2412 - 2472	802.11g, 2TX CDD	Covered by 802.11n HT20 2TX CDD	
2412 - 2472	802.11n HT20 1TX	Covered by 802.11g	
2412 - 2472	802.11n HT20 CDD 2TX - Antenna A & Antenna B	26.06	403.65
2412 - 2472	802.11n HT20 CDD 2TX - Antenna A & Antenna C	24.83	304.09
2412 - 2472	802.11n HT20 STBC/SDM 2TX	Covered by 802.11n HT20 CDD 2TX	

Note: The output power on covered modes is equal to or less than one referenced.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PiFA antenna, with the following maximum gain;

Frequency Band (GHz)	Antenna Gain		
	Antenna A	Antenna B	Antenna C
2.4	2.00		-1.55
	2.00	-7.72	

Note: For SISO modes there are three transmission antennas, only one, A, B or C, operates at a time. For MIMO mode only two operate at a time, A&C or A&B.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 12B331.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X (Flatbed), Y (Landscape), Z (Portrait), it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X (Flatbed) orientation.

Worst-case data rates as provided by the client were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20mode: MCS0.
The target power for 802.11g and 802.11n HT20 1TX are the same and use the same modulation(OFDM).

Radiated emissions for EUT with antenna was performed and passed; therefore, antenna port spurious was not performed.

There are two vendors of the WiFi/Bluetooth radio modules: variant 1 and variant 2. The Wi-Fi/Bluetooth radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances.

Baseline testing was performed on the two variants to determine the worst case on all conducted power and radiated emissions.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC adapter	Apple	A1357	N/A	NA
Earphone	Apple	NA	NA	NA
Laptop	Apple	A1278	C02HJ0A7DTY4	NA
DC power supply	Sorensen	XT 15-4	1319A02780	NA

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	DC	1	DC	Un-shielded	0.8	N/A

I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
None used						

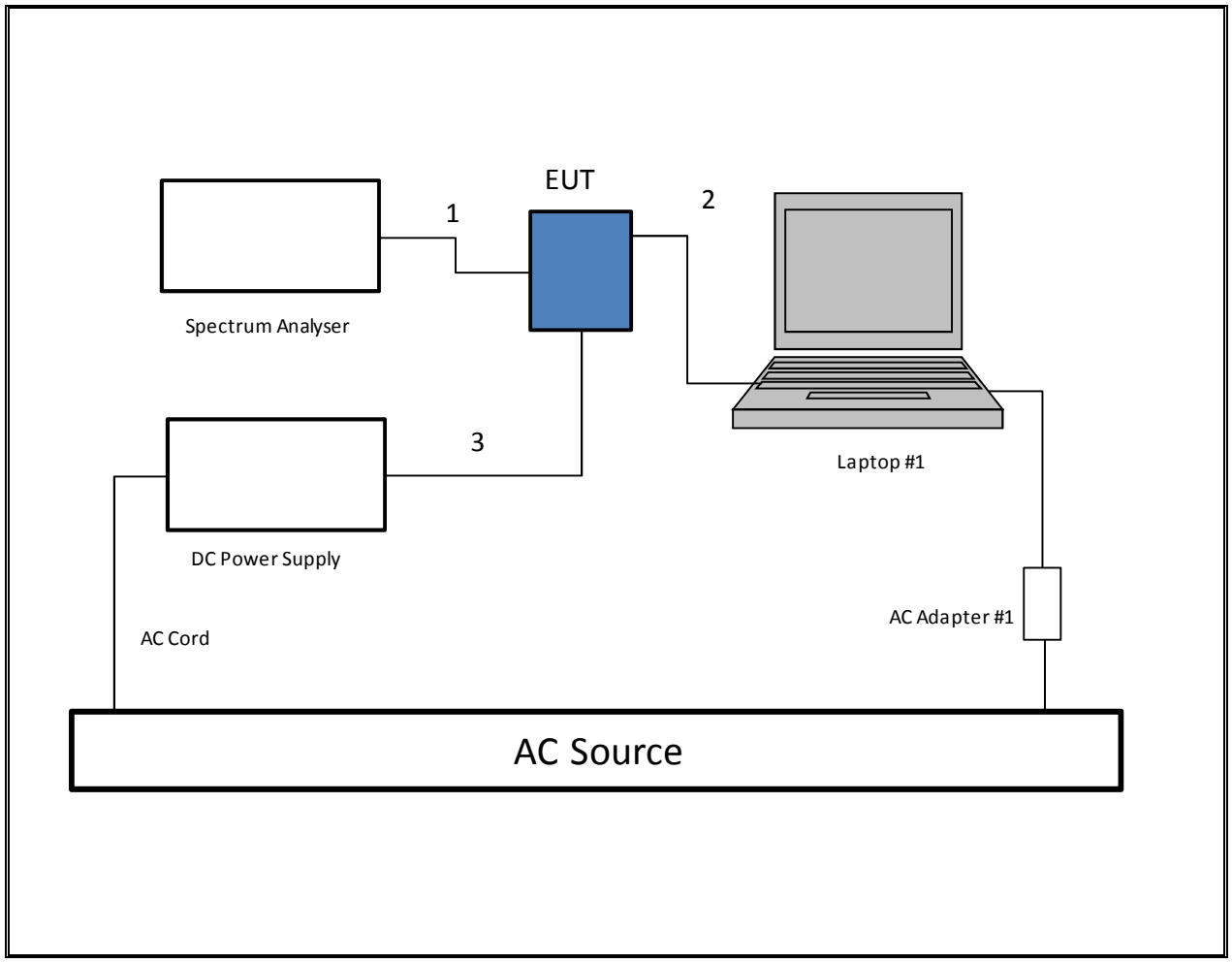
I/O CABLES (AC POWER CONDUCTED TEST and below 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	US115	Un-Shielded	0.8	NA
2	DC	1	lightning	Un-Shielded	1	NA
3	Audio	1	Jack	Un-Shielded	0.5	NA

TEST SETUP- CONDUCTED PORT

The EUT was tested connected to a host Laptop via USB cable adapter and spectrum analyzer to antenna port. Test software exercised the EUT.

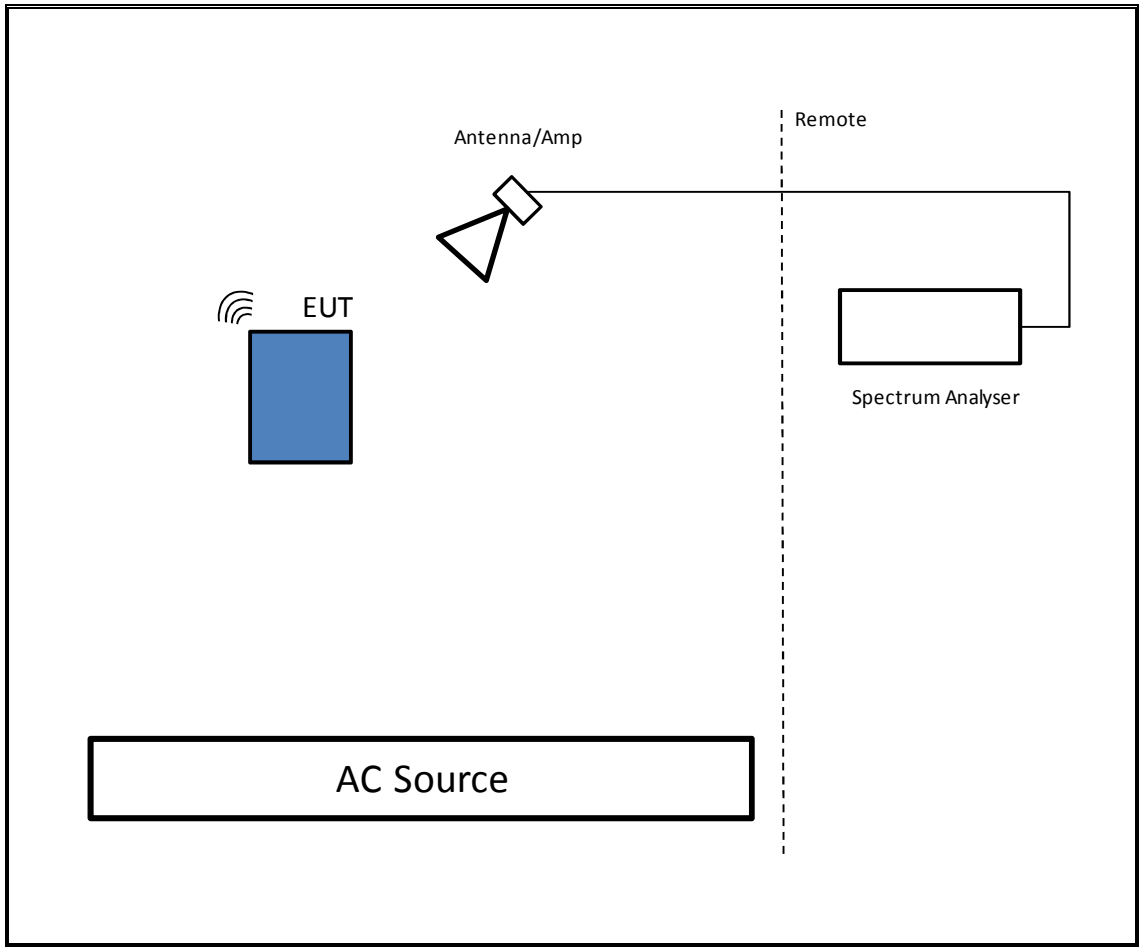
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

The EUT was tested battery powered. Test software exercised the EUT.

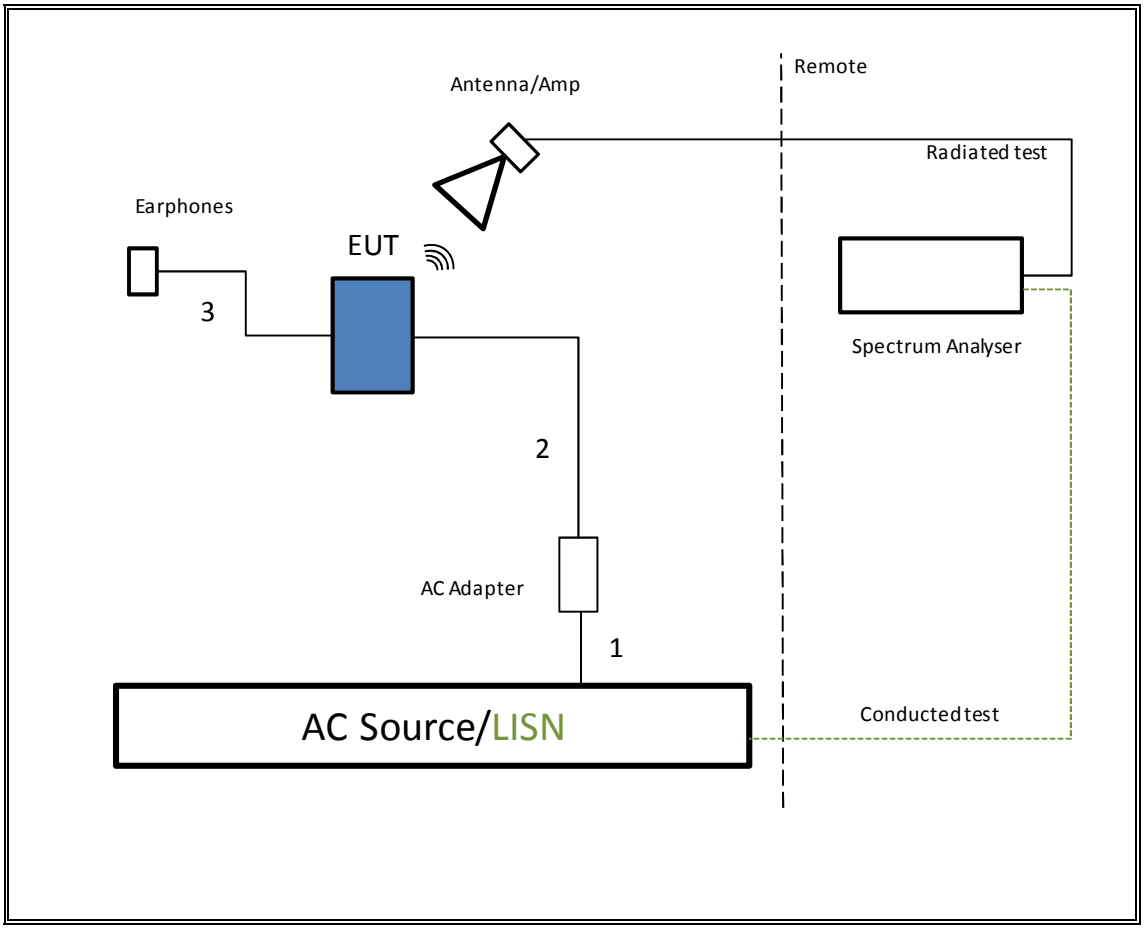
SETUP DIAGRAM



TEST SETUP- BELOW 1GHZ & AC LINE CONDUCTED TESTS

The EUT was tested with earphones connected and powered by AC adapter. Test software exercised the EUT.

SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Antenna, Horn, 18 GHz	ETS Lindgren	3117	F00131	2/18/2015
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	11/28/2014
Peak / Average Power Sensor	Agilent / HP	N1911A	F00153	3/6/2015
Wideband Power Sensor	Agilent	N1921A	F00361	10/2/2014
Peak Power Meter	Agilent / HP	E9323A	F00025	4/3/2015
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	F00129	2/22/2015
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	F00168	3/28/2015
Preamplifier, 1300 MHz	Sonoma	310	F00008	5/27/2015
Preamplifier, 26.5 GHz	Agilent / HP	8449B	F00165	3/25/2015
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	F00092	9/5/2014
LISN, 30 MHz	FCC	LISN-50/250-25-2	C00626	1/14/2015
Peak Power Sensor	Boonton	57006	C01202	07/17/15
Peak Power Meter	Boonton	4541	C01186	07/17/15
Spectrum Analyzer, 44 Ghz	Agilent	N9030A	N/A	05/17/15
Spectrum Analyzer, 40 Ghz	Agilent	8564E	C00951	08/06/15

7. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r02, Section 8.1.

Output Power: KDB 558074 D01 v03r02, Section 9.1.2.

Power Spectral Density: KDB 558074 D01 v03r02, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r02, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r02, Section 12.0.

8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

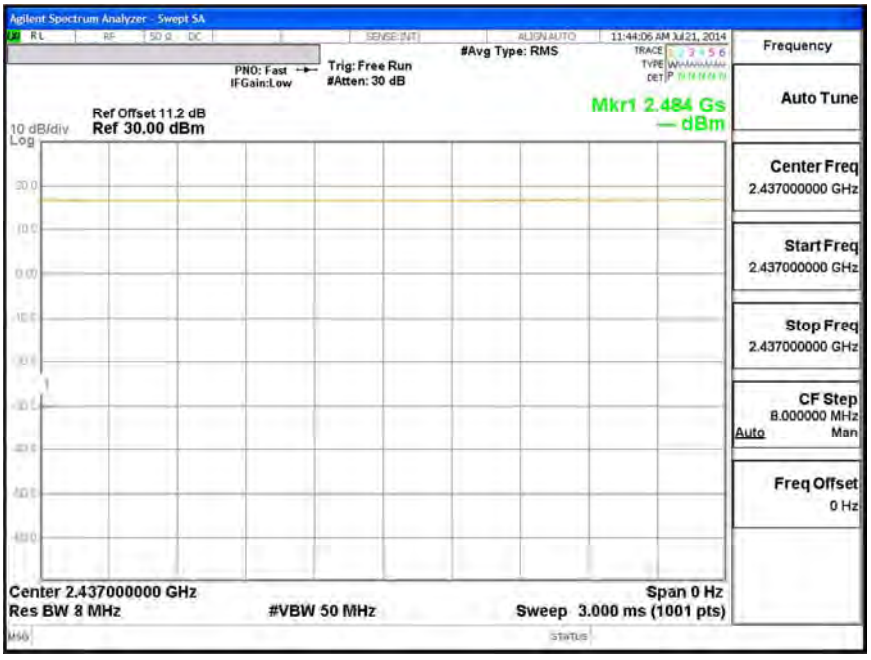
8.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.11b	1.000	1.000	1.000	100.00%	0.00	0.010
802.11g	2.064	2.085	0.990	98.99%	0.00	0.010
802.11n HT20	1.914	1.941	0.986	98.61%	0.00	0.010

8.2. DUTY CYCLE PLOTS

2.4 GHz BAND

DUTY CYCLE 802.11b MODE



DUTY CYCLE 802.11g MODE

DUTY CYCLE 802.11n HT20 MODE

9. ANTENNA PORT TEST RESULTS

9.1. 802.11b MODE IN THE 2.4 GHz BAND

9.1.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth Antenna C (MHz)	6 dB Bandwidth Antenna A (MHz)	6 dB Bandwidth Antenna B (MHz)	Minimum Limit (MHz)
Low	2412	8.670	8.606	8.625	0.5
Mid	2437	9.090	9.100	9.090	0.5
High	2462	8.595	9.128	9.150	0.5
High	2467	9.060	8.624	9.135	0.5
High	2472	8.595	8.652	9.135	0.5

ANTENNA C 6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH

6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH 11

6 dB BANDWIDTH HIGH CH 12

6 dB BANDWIDTH HIGH CH 13

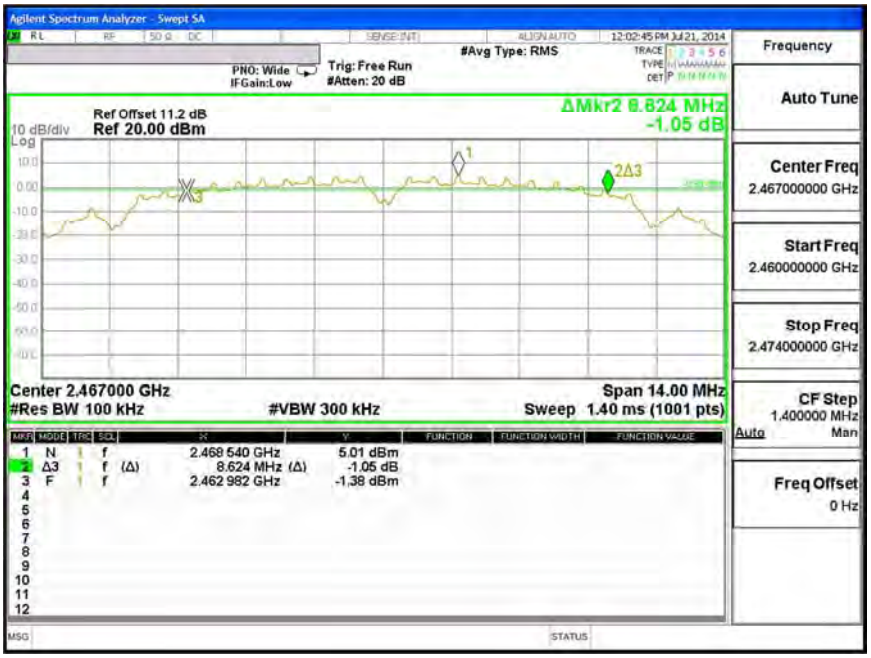
ANTENNA A 6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH

6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH 11

6 dB BANDWIDTH HIGH CH 12



6 dB BANDWIDTH HIGH CH 13

ANTENNA B 6 dB BANDWIDTH

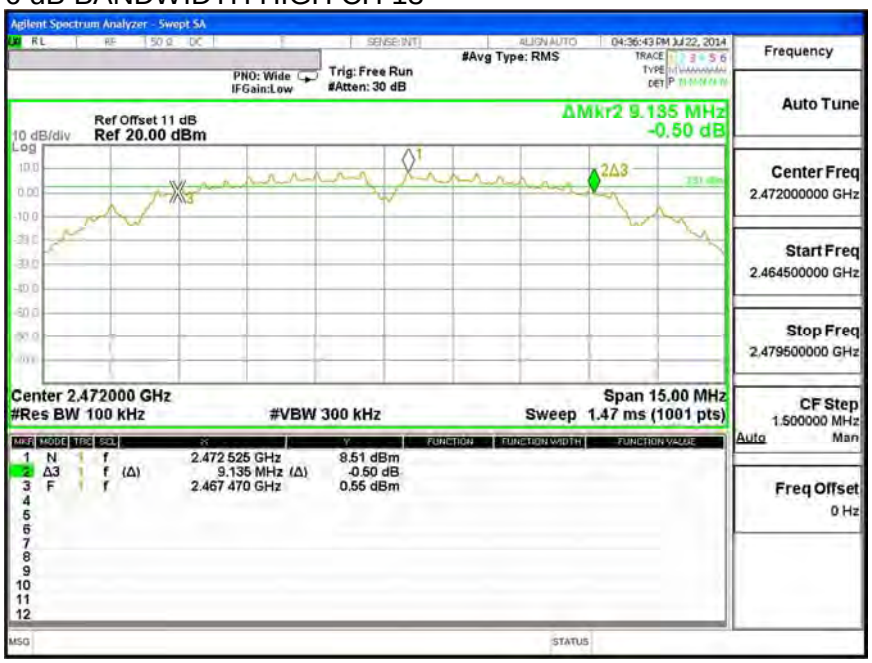
6 dB BANDWIDTH LOW CH

6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH 11

6 dB BANDWIDTH HIGH CH 12

6 dB BANDWIDTH HIGH CH 13



9.1.2. 99% BANDWIDTH

LIMITS

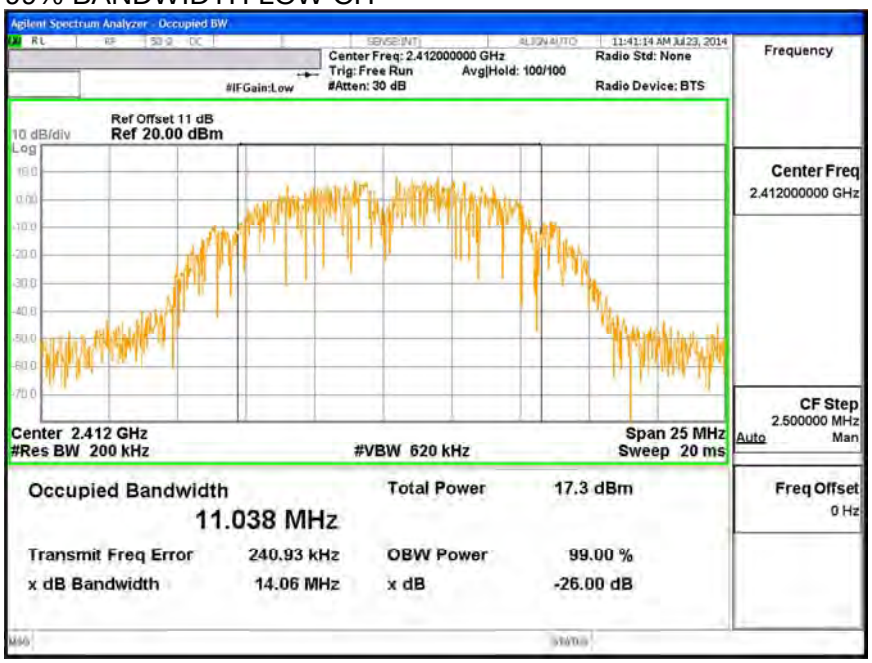
None; for reporting purposes only.

RESULTS

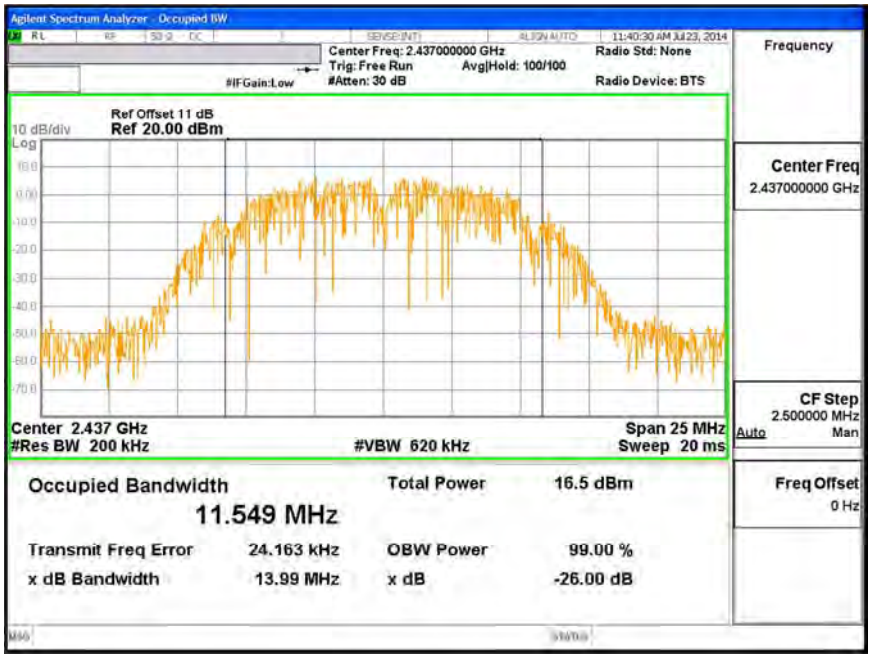
Channel	Frequency (MHz)	99% Bandwidth Antenna C (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Low	2412	11.038	11.094	11.131
Mid	2437	11.549	11.008	11.115
High	2462	10.529	11.088	10.989
High	2467	11.268	10.995	10.896
High	2472	10.625	11.570	10.812

ANTENNA C 99% BANDWIDTH

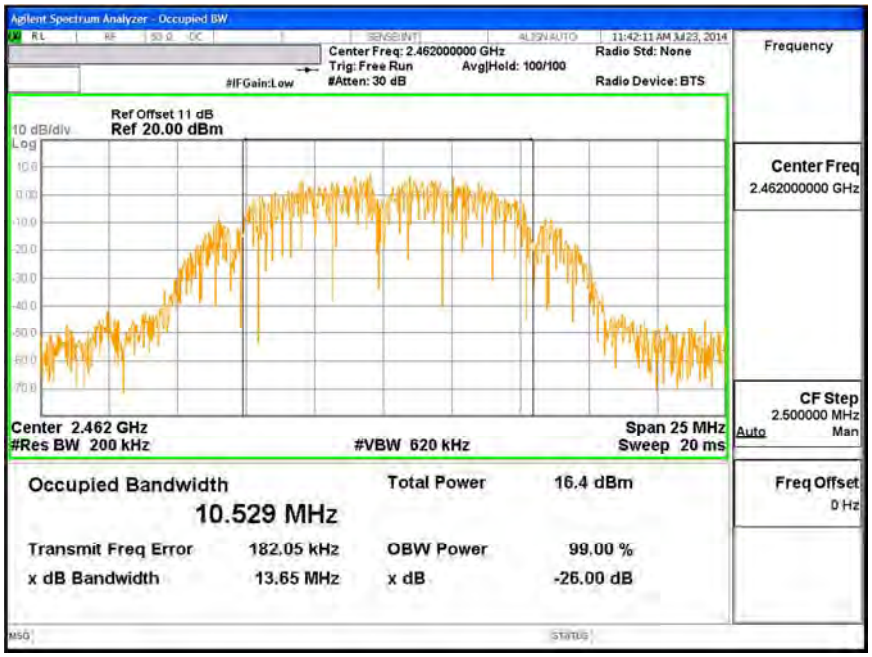
99% BANDWIDTH LOW CH



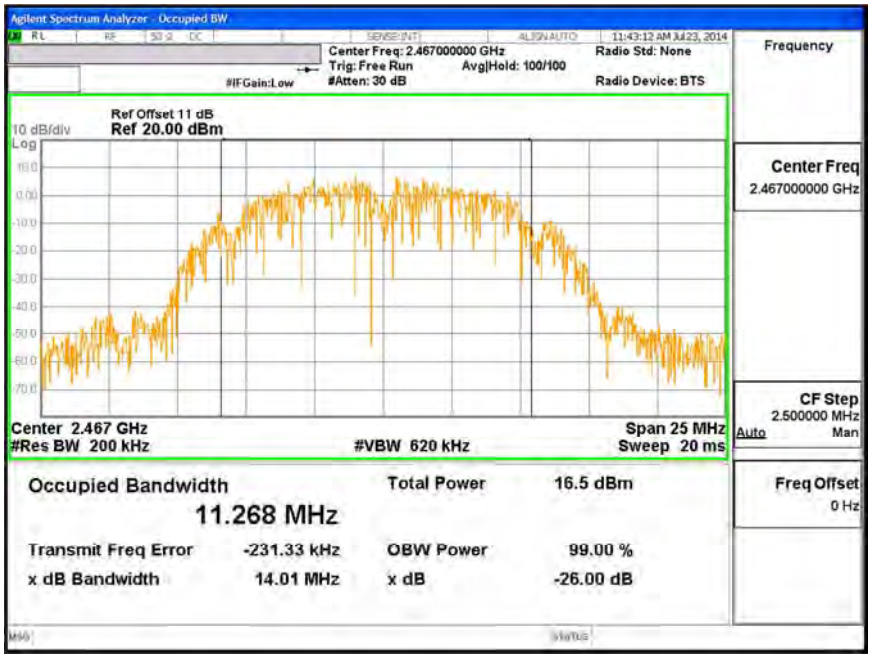
99% BANDWIDTH MID CH



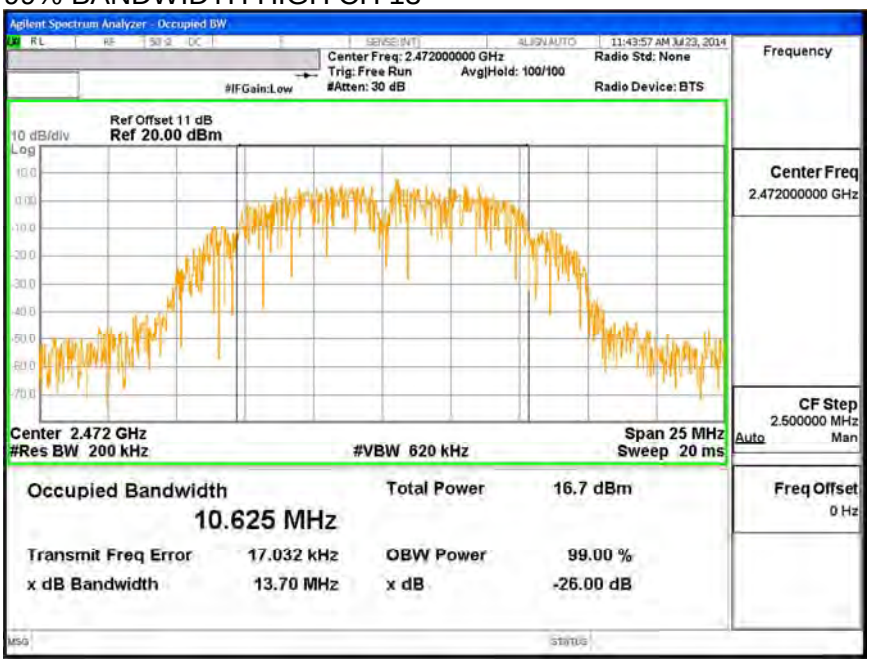
99% BANDWIDTH HIGH CH 11



99% BANDWIDTH HIGH CH 12

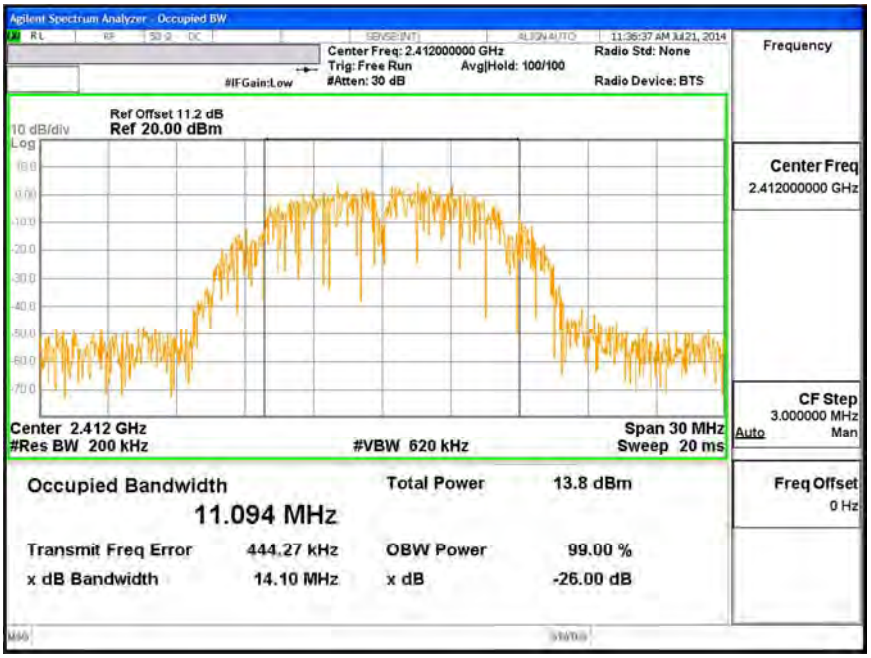


99% BANDWIDTH HIGH CH 13

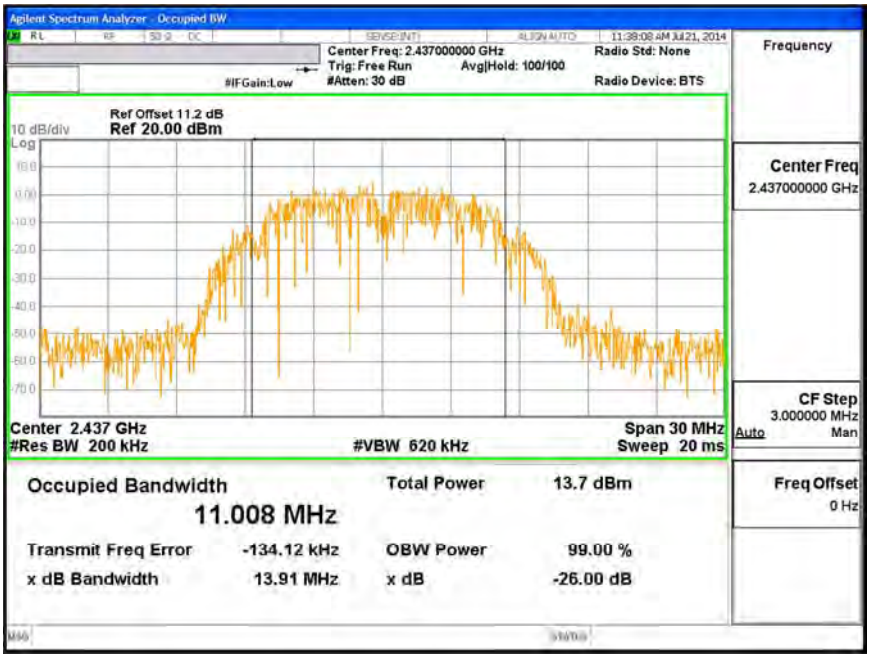


ANTENNA A 99% BANDWIDTH

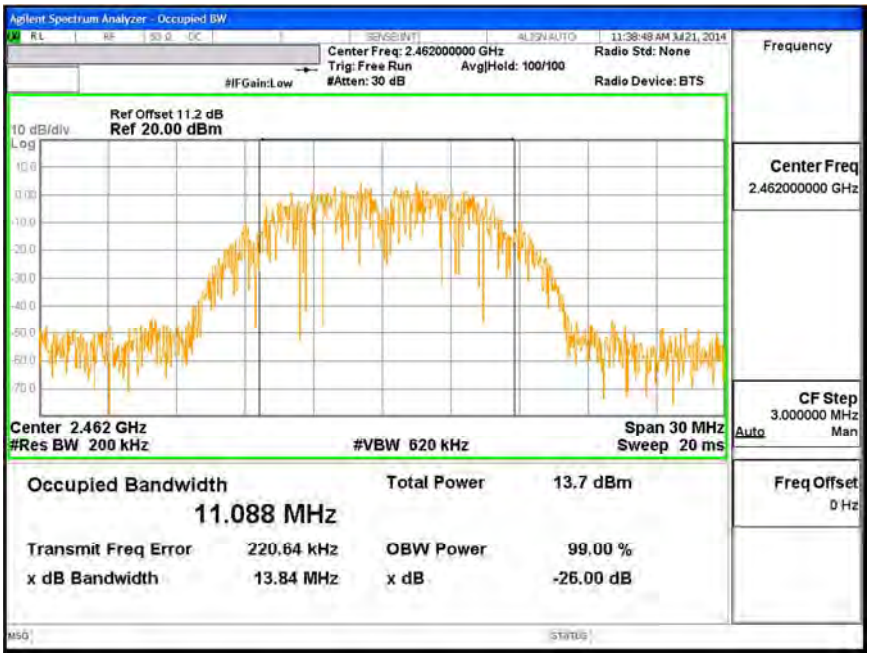
99% BANDWIDTH LOW CH



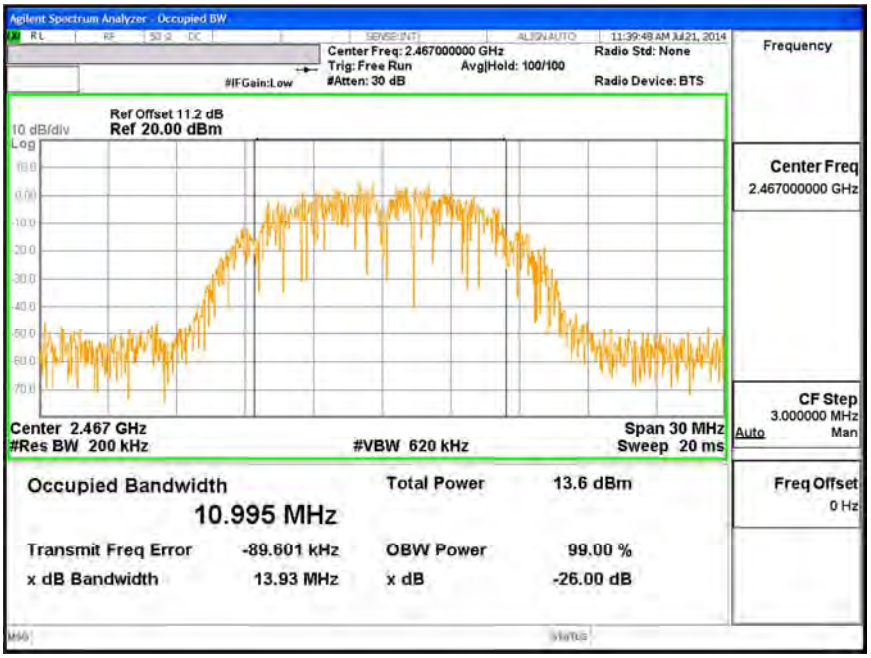
99% BANDWIDTH MID CH



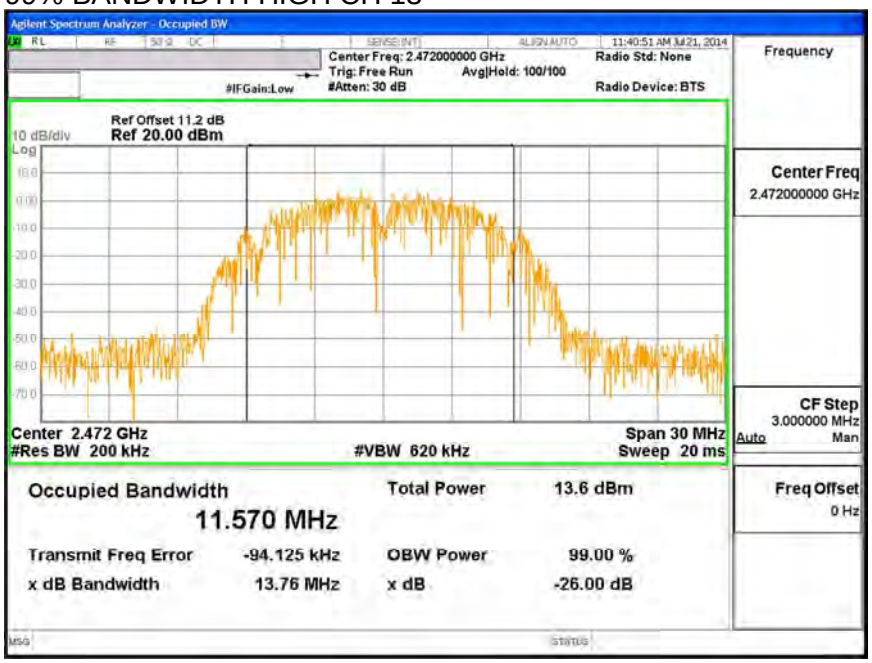
99% BANDWIDTH HIGH CH 11



99% BANDWIDTH HIGH CH 12

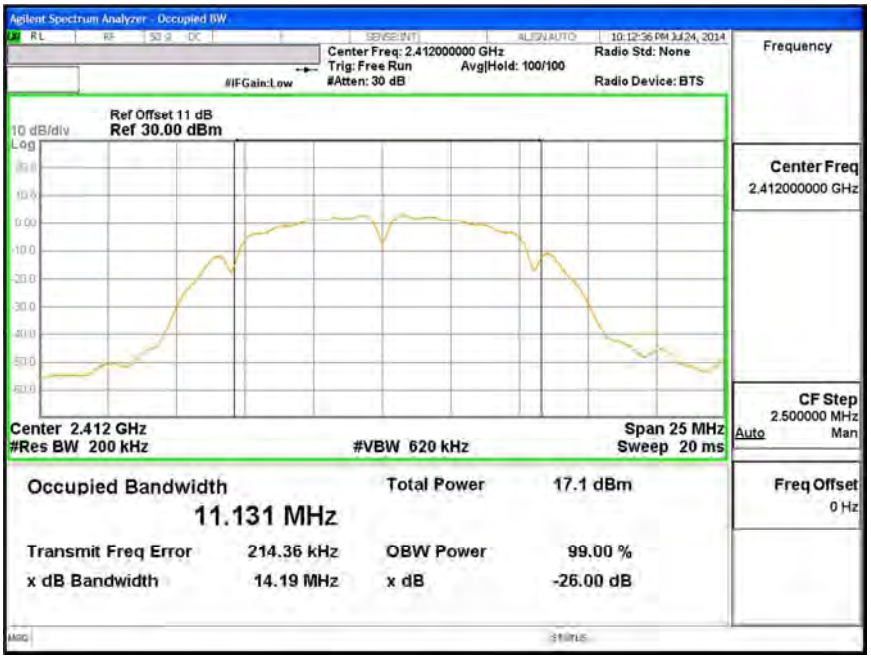


99% BANDWIDTH HIGH CH 13

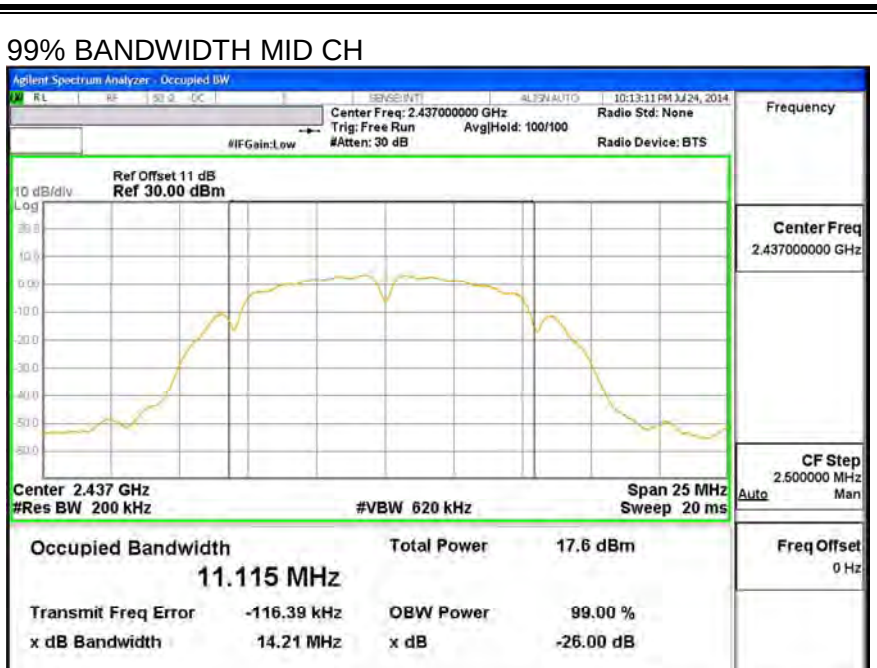


ANTENNA B 99% BANDWIDTH

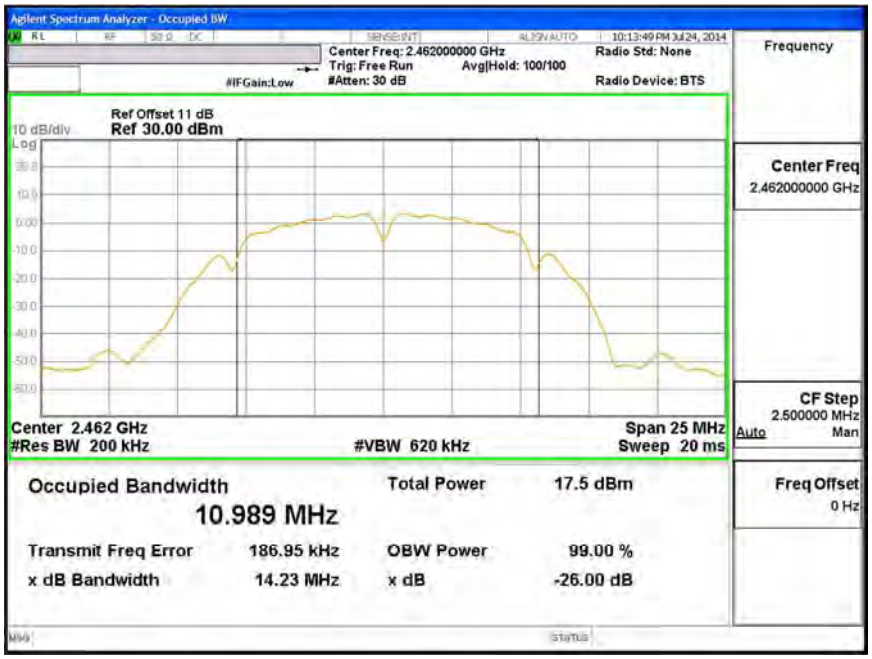
99% BANDWIDTH LOW CH



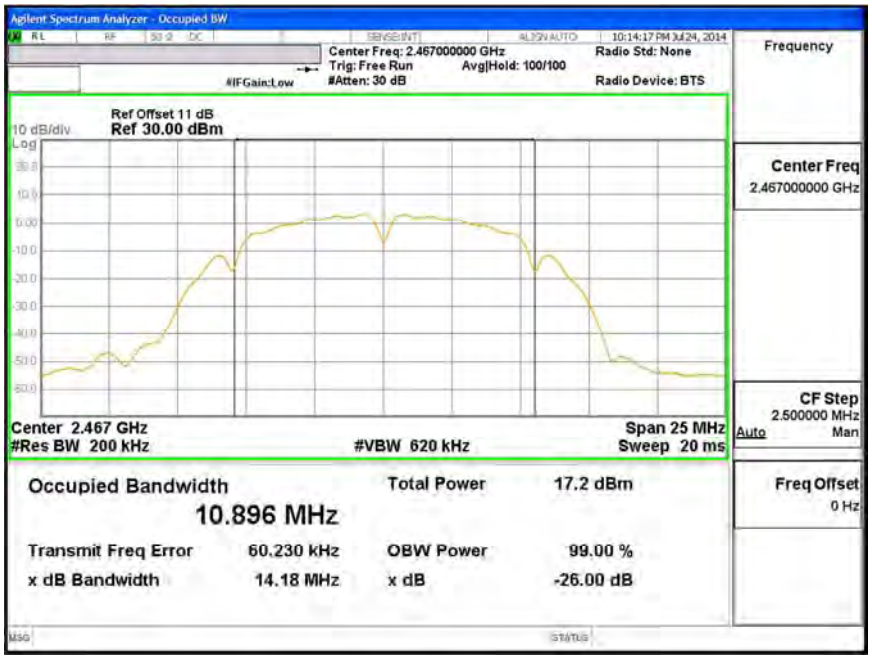
99% BANDWIDTH MID CH



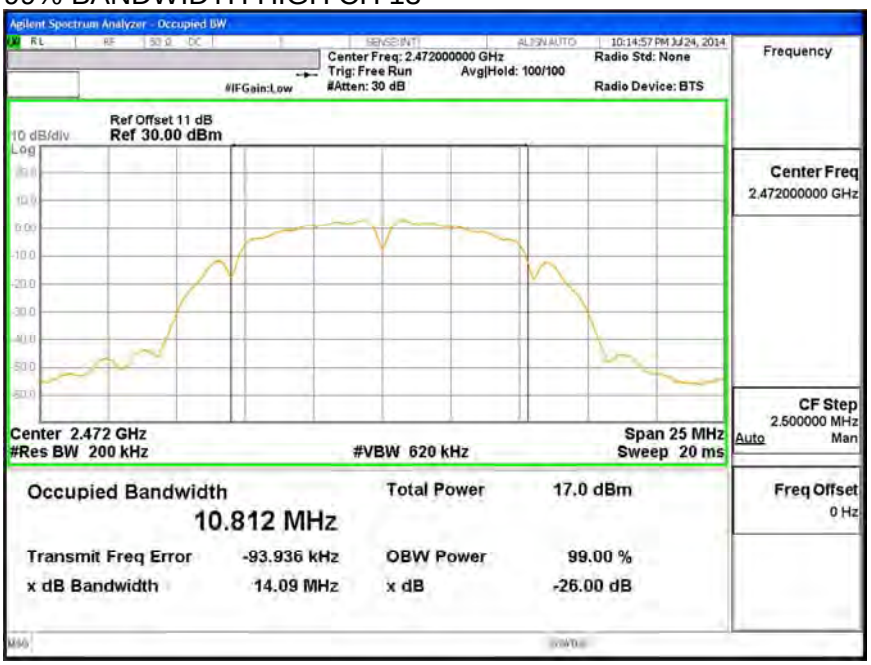
99% BANDWIDTH HIGH CH 11



99% BANDWIDTH HIGH CH 12



99% BANDWIDTH HIGH CH 13



9.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power Antenna C (dBm)	Power Antenna A (dBm)	Power Antenna B (dBm)
Low	2412	15.80	12.95	17.99
Mid	2437	15.99	12.98	17.97
High	2462	15.81	12.91	17.96
High	2467	14.98	12.96	14.73
High	2472	12.48	12.98	12.47

9.1.4. OUTPUT POWER

LIMITS

FCC §15.247

For systems using digital modulation in the 2400–2483.5 MHz, based on the use of antennas with directional gains that do not exceed 6dBi. If transmitting antennas of directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

ANTENNA C

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	-1.55	30.00	30	36	30.00
Mid	2437	-1.55	30.00	30	36	30.00
High	2462	-1.55	30.00	30	36	30.00
High	2467	-1.55	30.00	30	36	30.00
High	2472	-1.55	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	19.20	19.20	30.00	-10.80
Mid	2437	20.05	20.05	30.00	-9.95
High	2462	19.76	19.76	30.00	-10.24
High	2467	18.97	18.97	30.00	-11.04
High	2472	16.75	16.75	30.00	-13.25

Antenna A

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	2.01	30.00	30	36	30.00
Mid	2437	2.01	30.00	30	36	30.00
High	2462	2.01	30.00	30	36	30.00
High	2467	2.01	30.00	30	36	30.00
High	2472	2.01	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	16.97	16.97	30.00	-13.03
Mid	2437	17.01	17.01	30.00	-12.99
High	2462	16.78	16.78	30.00	-13.22
High	2467	16.83	16.83	30.00	-13.17
High	2472	16.75	16.75	30.00	-13.25

ANTENNA B

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	-7.72	30.00	30	36	30.00
Mid	2437	-7.72	30.00	30	36	30.00
High	2462	-7.72	30.00	30	36	30.00
High	2467	-7.72	30.00	30	36	30.00
High	2472	-7.72	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	21.98	21.98	30.00	-8.02
Mid	2437	21.52	21.52	30.00	-8.48
High	2462	21.34	21.34	30.00	-8.66
High	2467	18.72	18.72	30.00	-11.28
High	2472	16.42	16.42	30.00	-13.58

9.1.5. PSD

LIMITS

FCC §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.

RESULTS

ANTENNA C

PSD Results

Channel	Frequency (MHz)	Antenna C Meas (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-6.61	8.0	-14.6
Mid	2437	-5.07	8.0	-13.1
High	2462	-5.98	8.0	-14.0
High	2467	-6.25	8.0	-14.3
High	2472	-9.74	8.0	-17.7

ANTENNA A

PSD Results

Channel	Frequency (MHz)	Antenna A Meas (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-10.70	8.0	-18.7
Mid	2437	-9.36	8.0	-17.4
High	2462	-8.62	8.0	-16.6
High	2467	-7.78	8.0	-15.8
High	2472	-9.75	8.0	-17.8

ANTENNA B

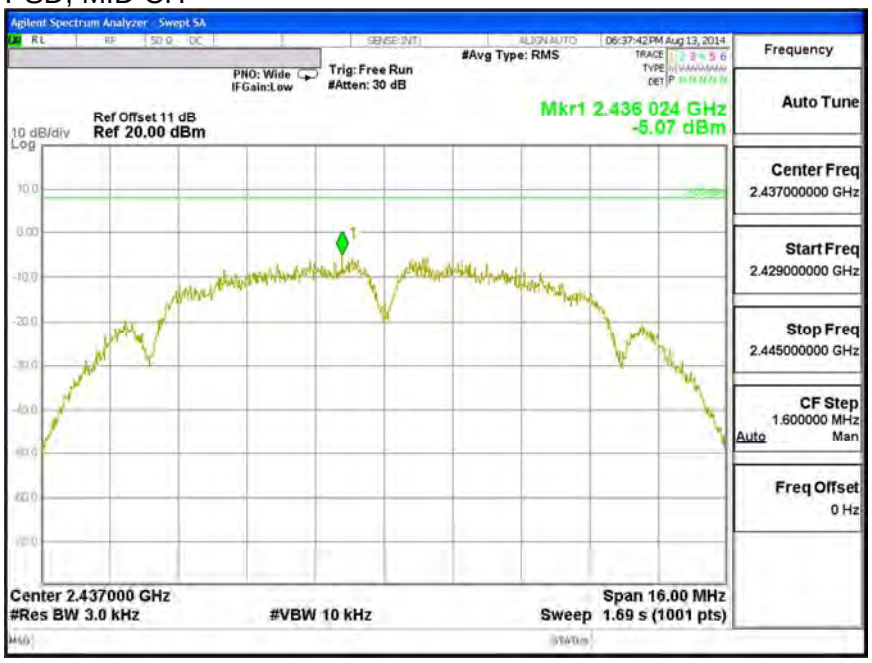
PSD Results

Channel	Frequency (MHz)	Antenna B Meas (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-6.02	8.0	-14.0
Mid	2437	-5.83	8.0	-13.8
High	2462	-6.23	8.0	-14.2
High	2467	-6.76	8.0	-14.8
High	2472	-8.61	8.0	-16.6

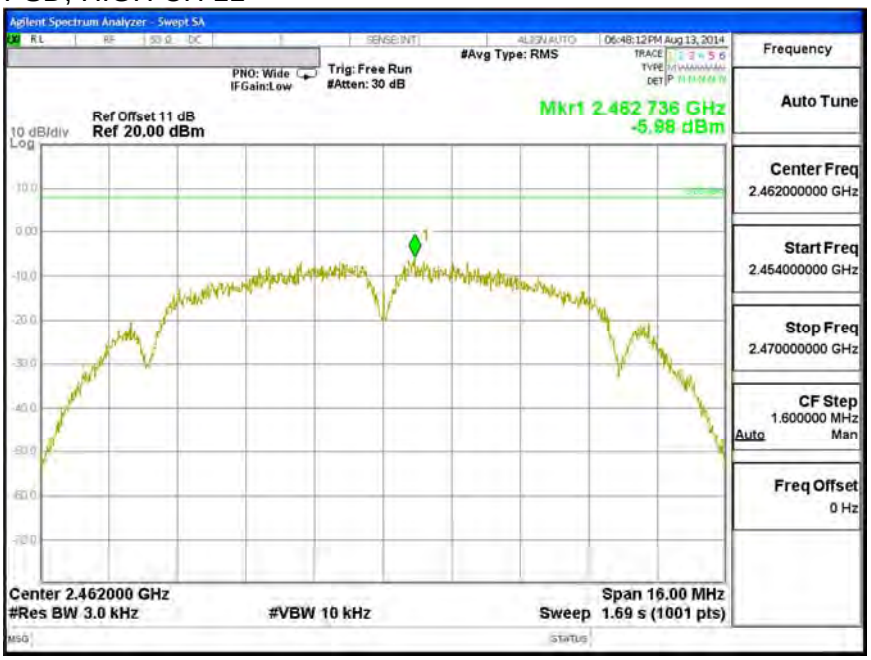
PSD, ANTENNA C

PSD, LOW CH

PSD, MID CH



PSD, HIGH CH 11

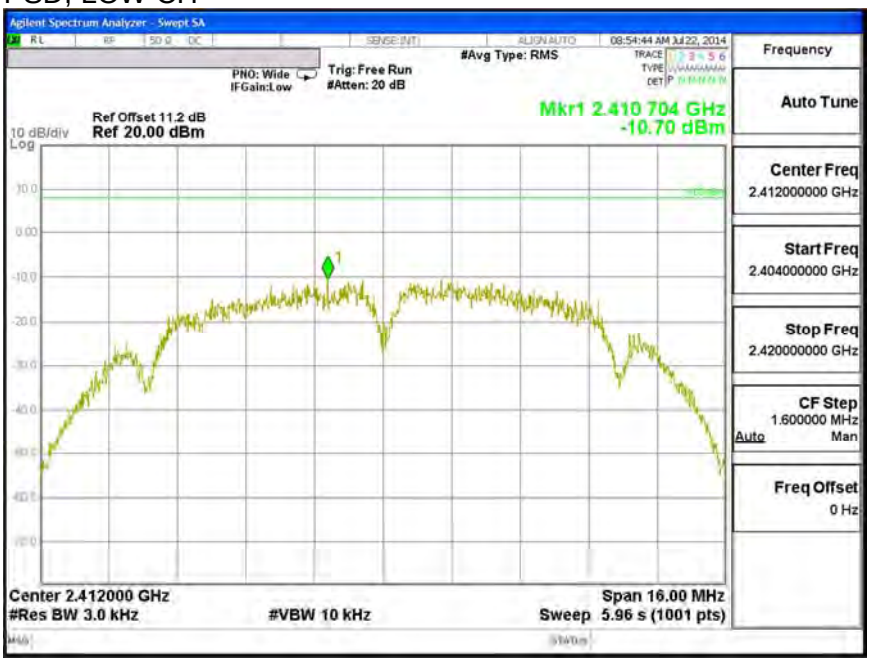


PSD, HIGH CH 12

PSD, HIGH CH 13

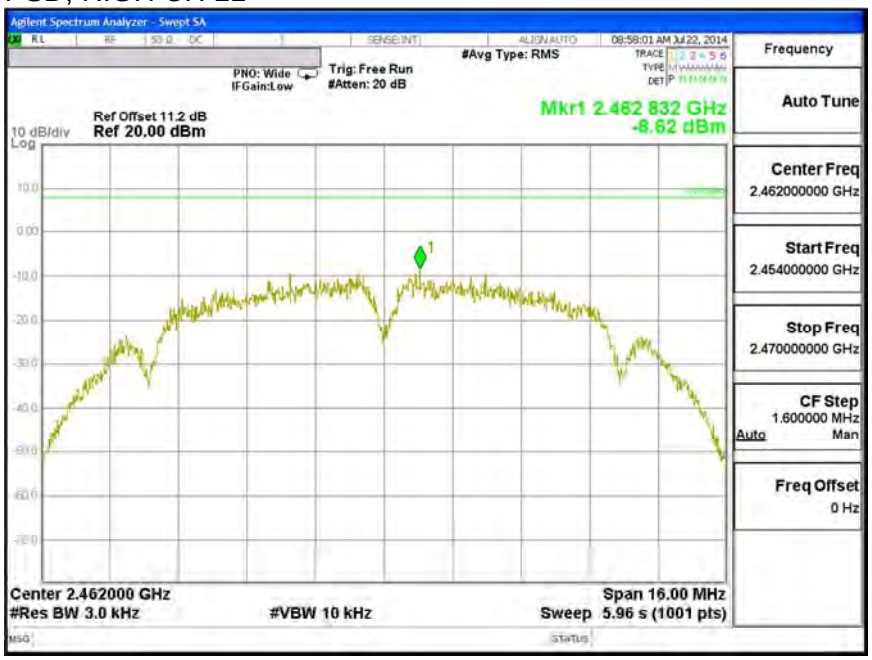
PSD, ANTENNA A

PSD, LOW CH

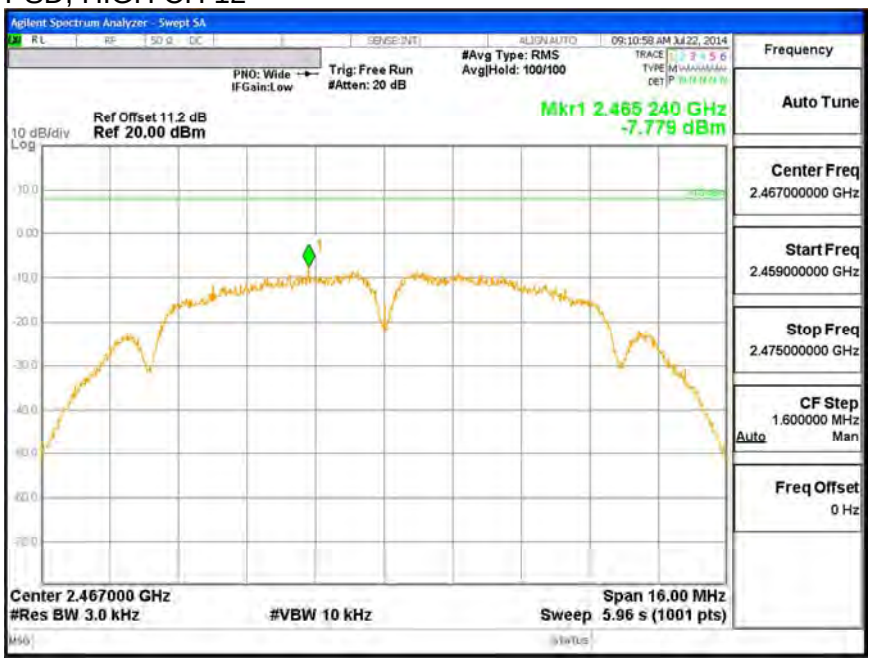


PSD, MID CH

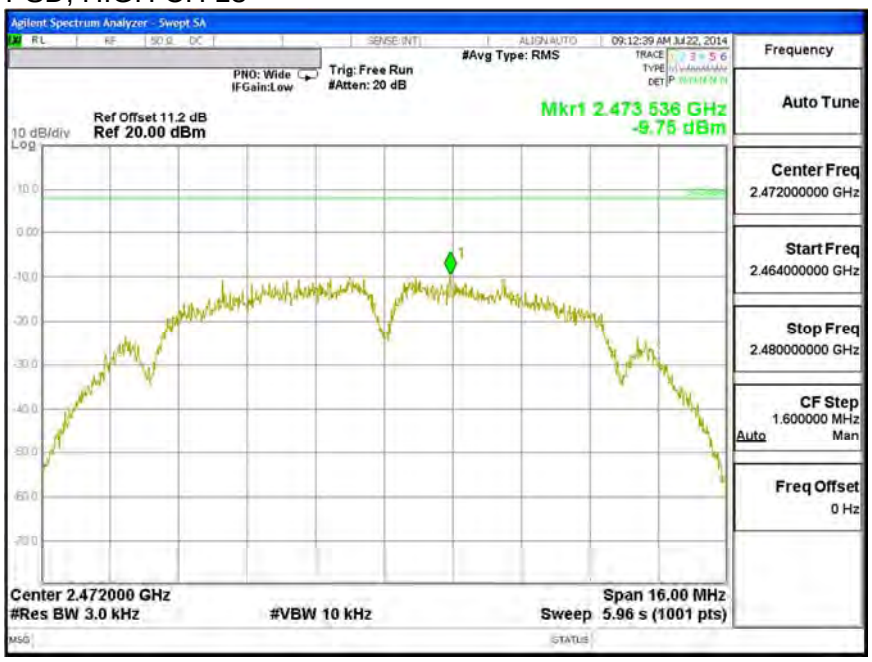
PSD, HIGH CH 11



PSD, HIGH CH 12

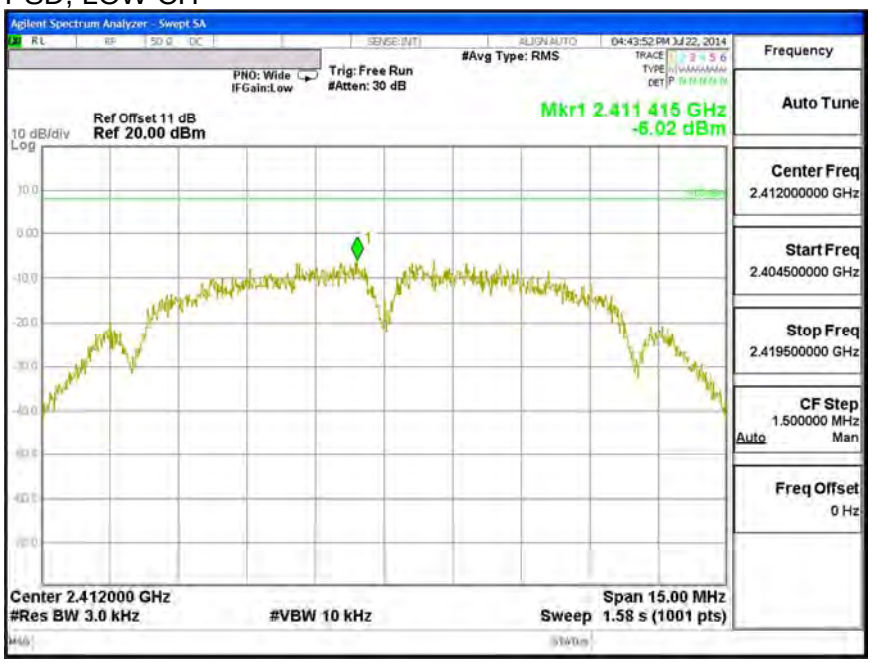


PSD, HIGH CH 13

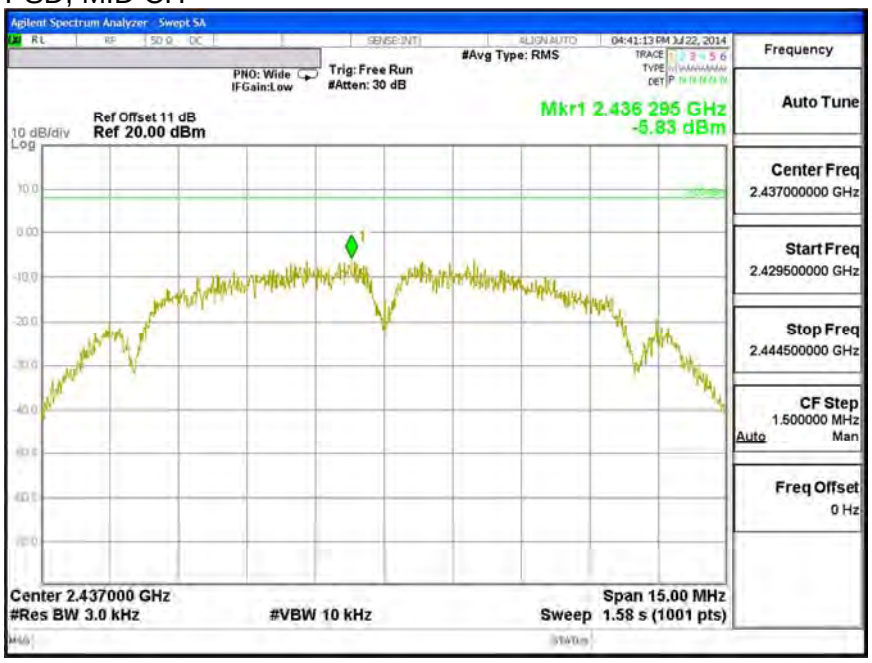


PSD, ANTENNA B

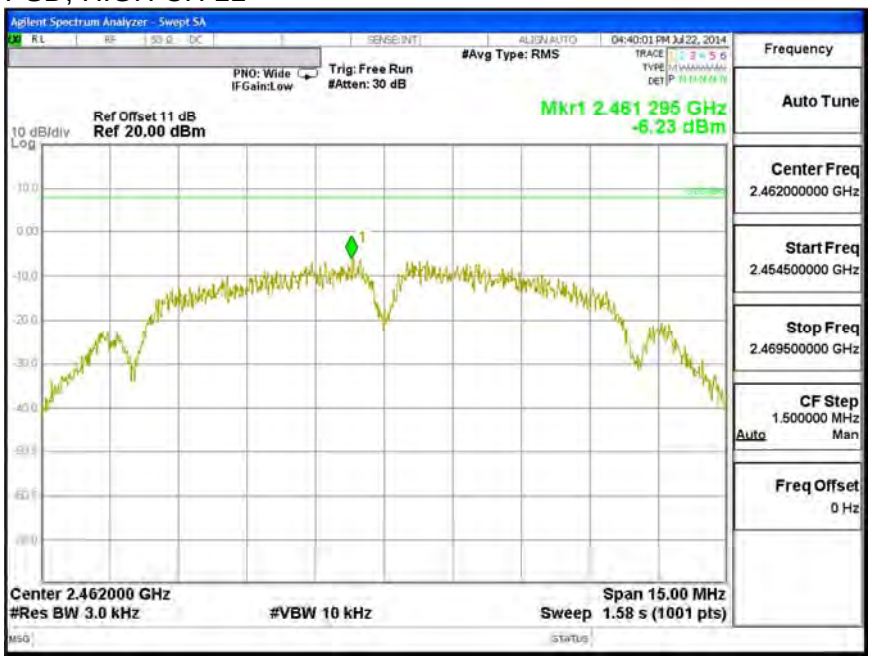
PSD, LOW CH



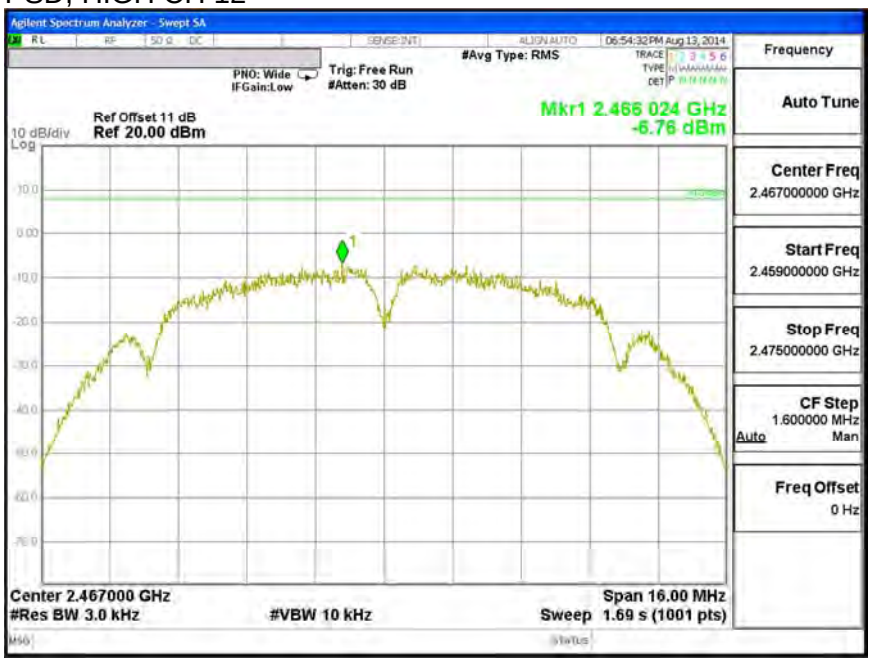
PSD, MID CH



PSD, HIGH CH 11



PSD, HIGH CH 12



PSD, HIGH CH 13

9.1.6. OUT-OF-BAND EMISSIONS

LIMITS

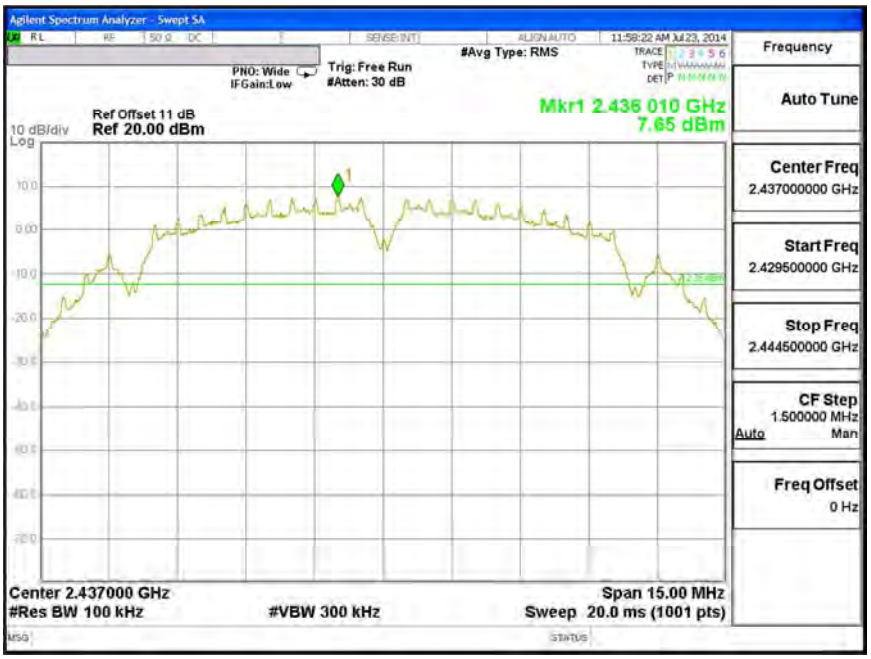
FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

RESULTS ANTENNA C

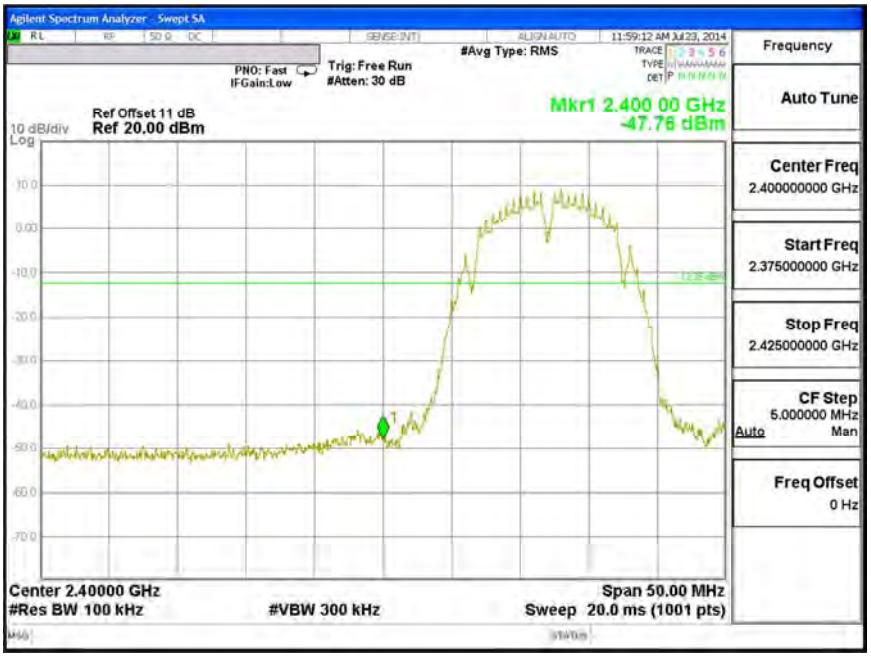
IN-BAND REFERENCE LEVEL

REFERENCE LEVEL MID CH



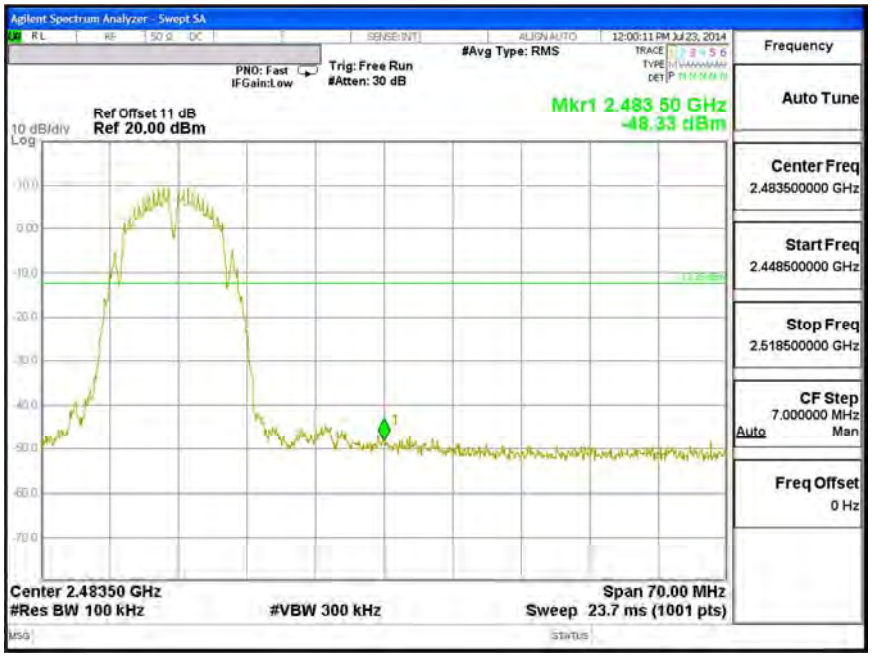
LOW CHANNEL BANDEDGE

AUTHORIZED BAND EDGE LOW CH

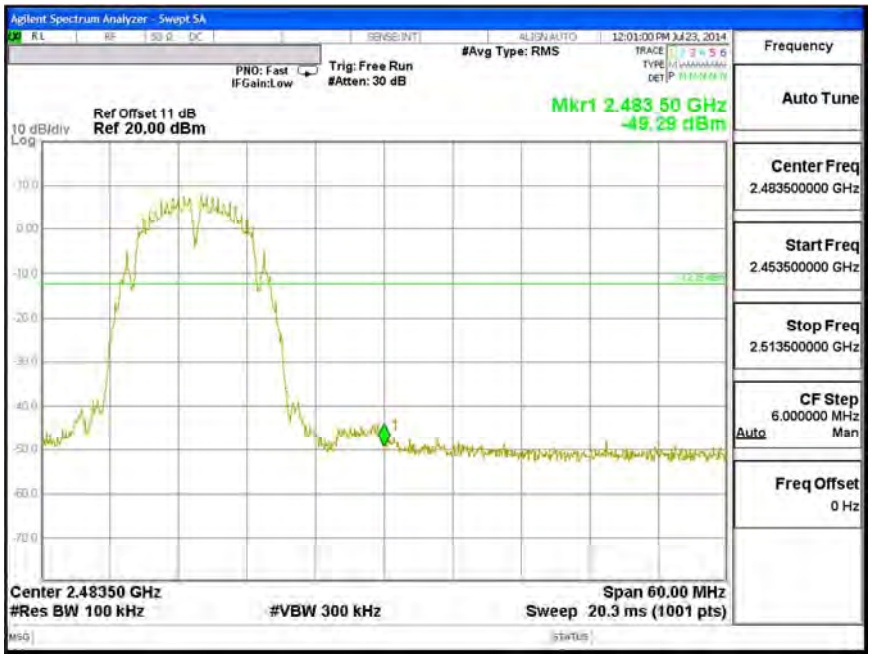


HIGH CHANNEL BANDEDGE

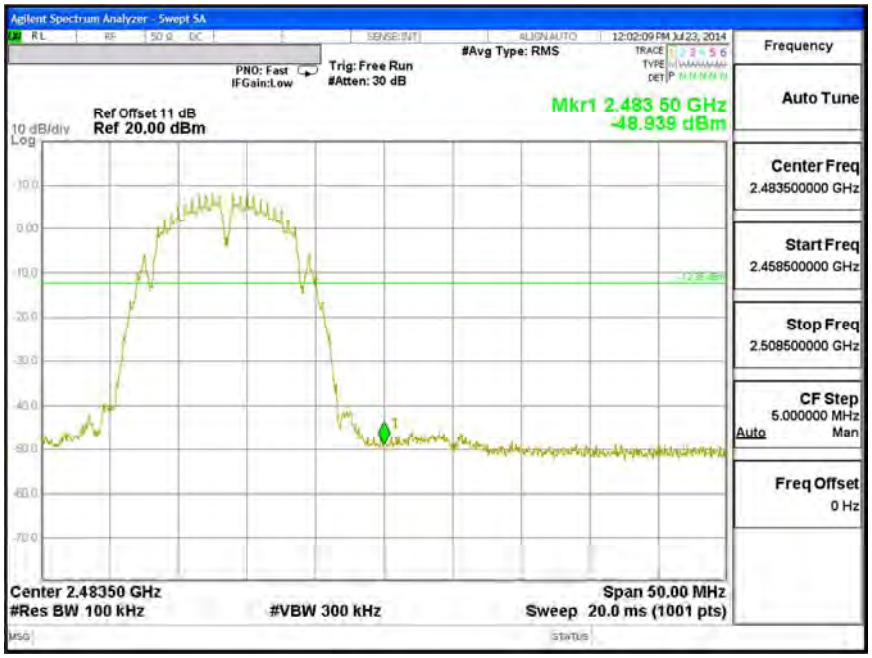
AUTHORIZED BAND EDGE HIGH CH 11



AUTHORIZED BAND EDGE HIGH CH 12



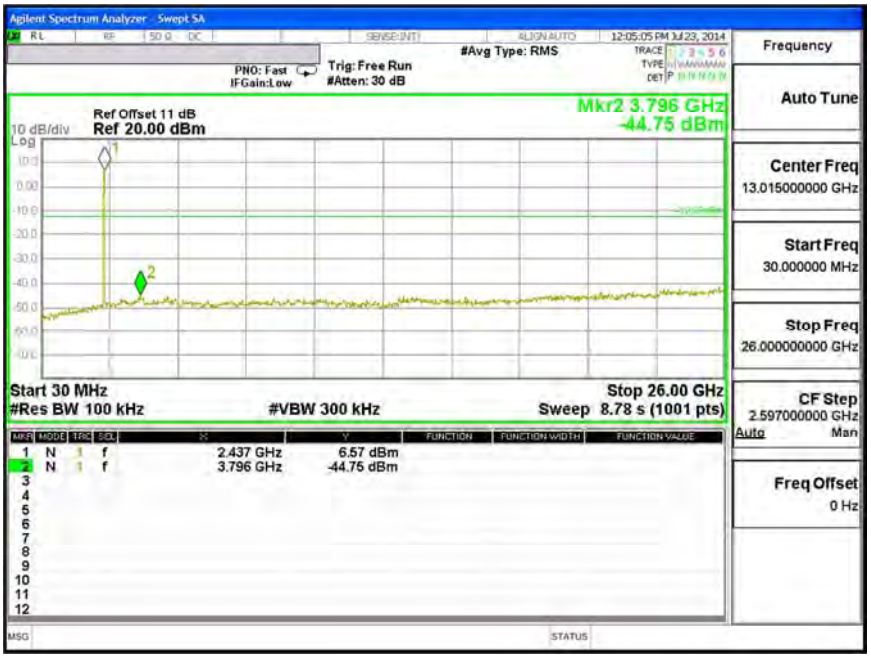
AUTHORIZED BAND EDGE HIGH CH 13



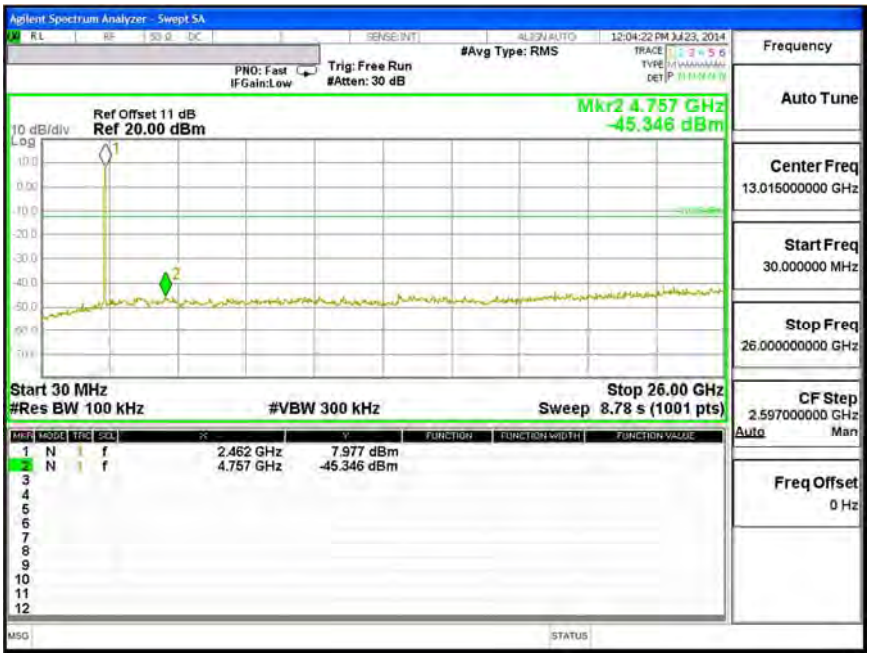
OUT-OF-BAND EMISSIONS

OUT OF BAND LOW CH

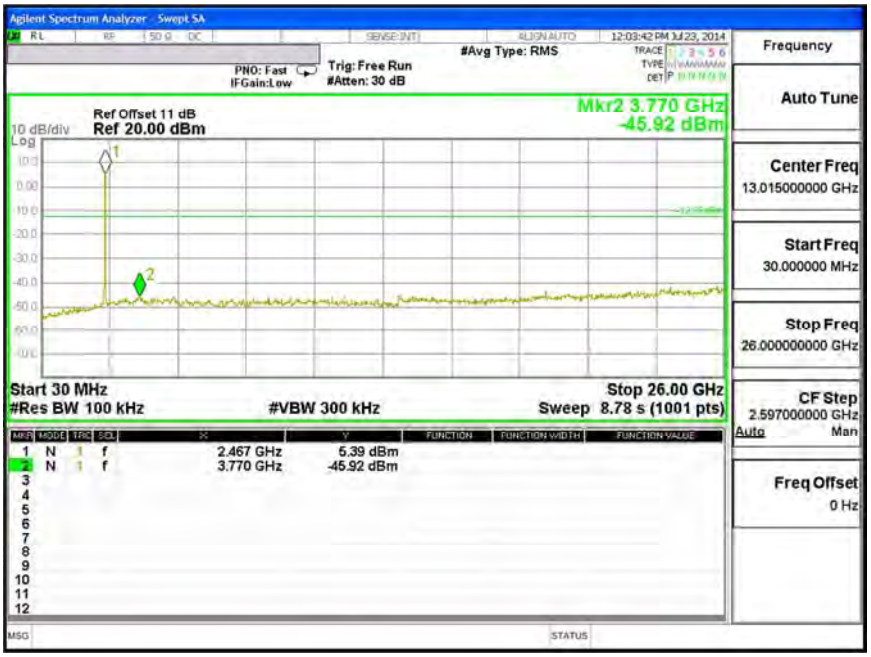
OUT OF BAND MID CH



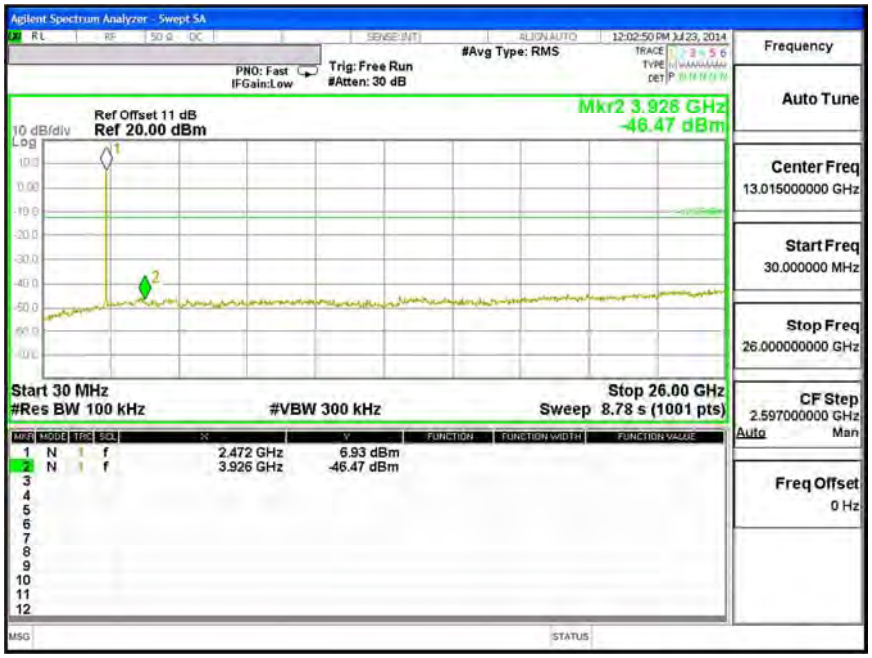
OUT OF BAND HIGH CH 11



OUT OF BAND HIGH CH 12



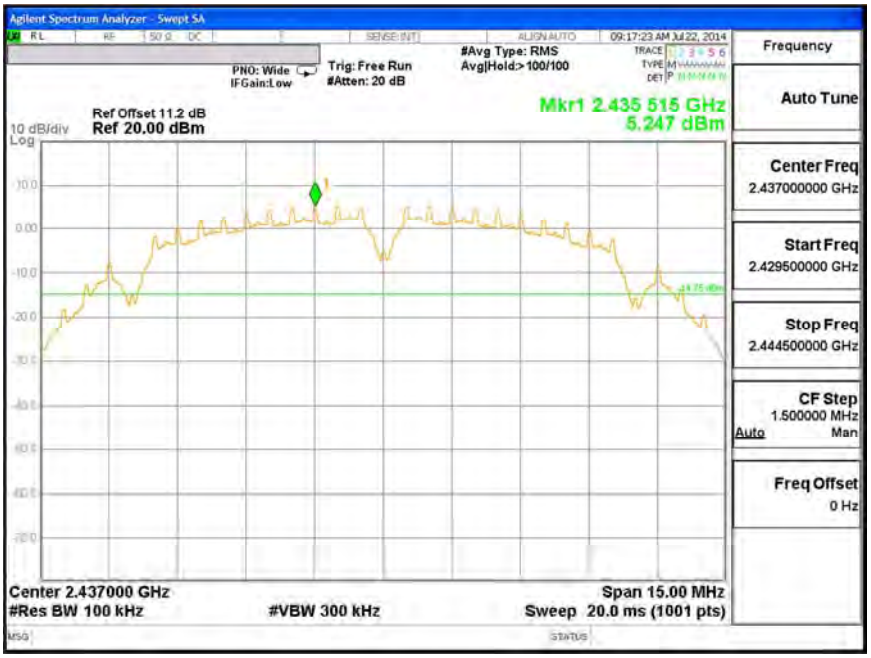
OUT OF BAND HIGH CH 13



RESULTS ANTENNA A

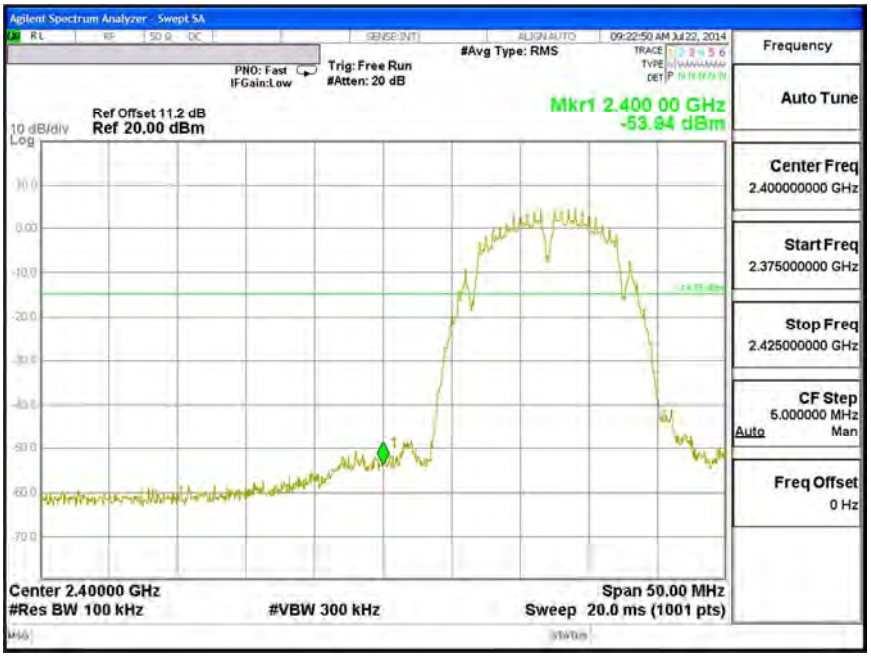
IN-BAND REFERENCE LEVEL

REFERENCE LEVEL MID CH



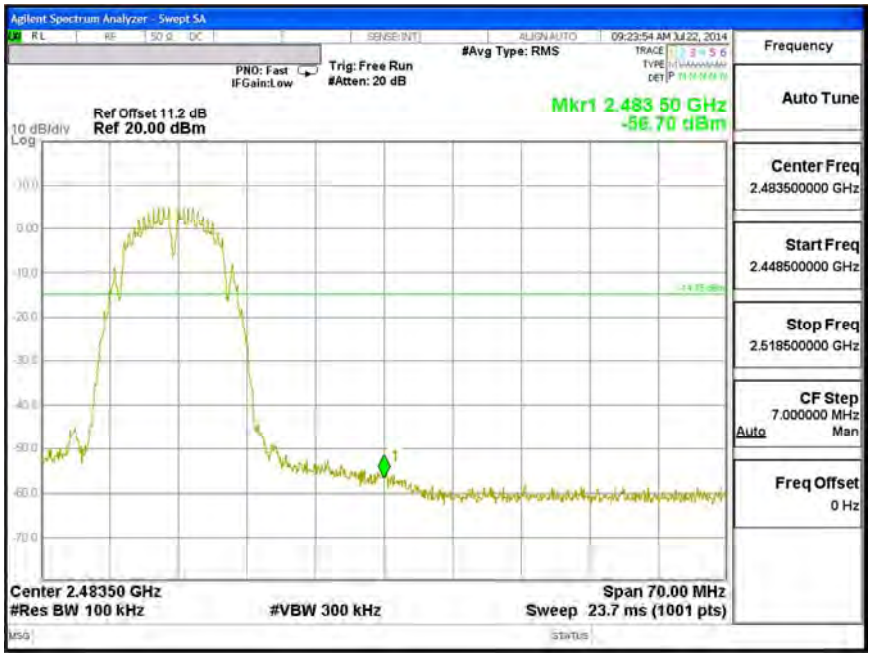
LOW CHANNEL BANDEDGE

AUTHORIZED BAND EDGE LOW CH

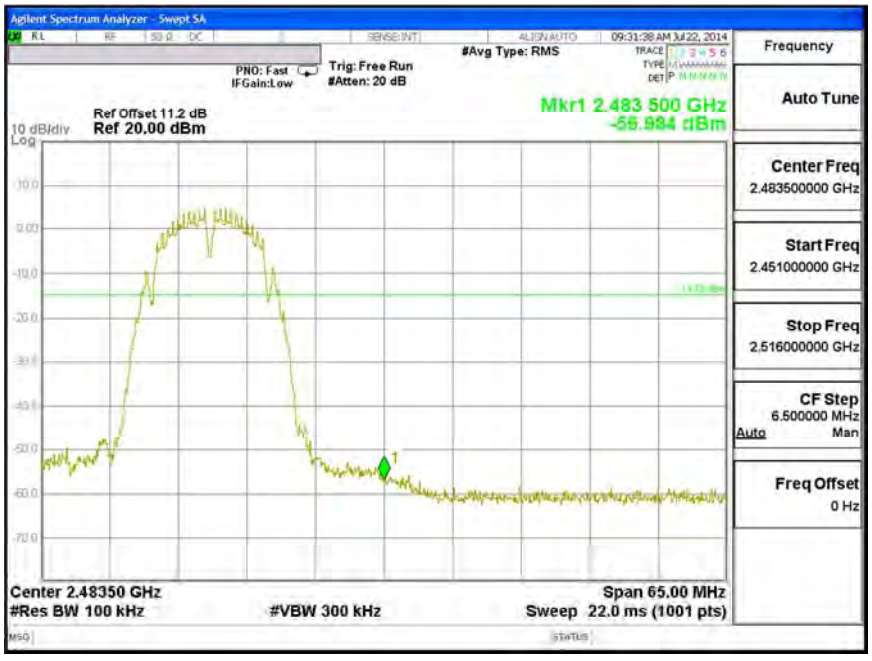


HIGH CHANNEL BANDEDGE

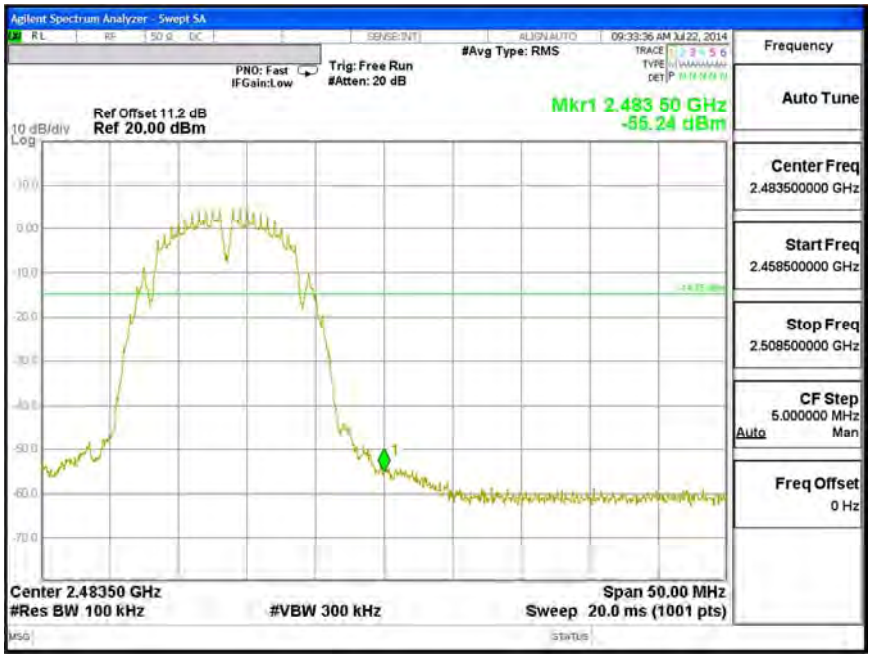
AUTHORIZED BAND EDGE HIGH CH 11



AUTHORIZED BAND EDGE HIGH CH 12



AUTHORIZED BAND EDGE HIGH CH 13



OUT-OF-BAND EMISSIONS

OUT OF BAND LOW CH

OUT OF BAND MID CH

OUT OF BAND HIGH CH 11

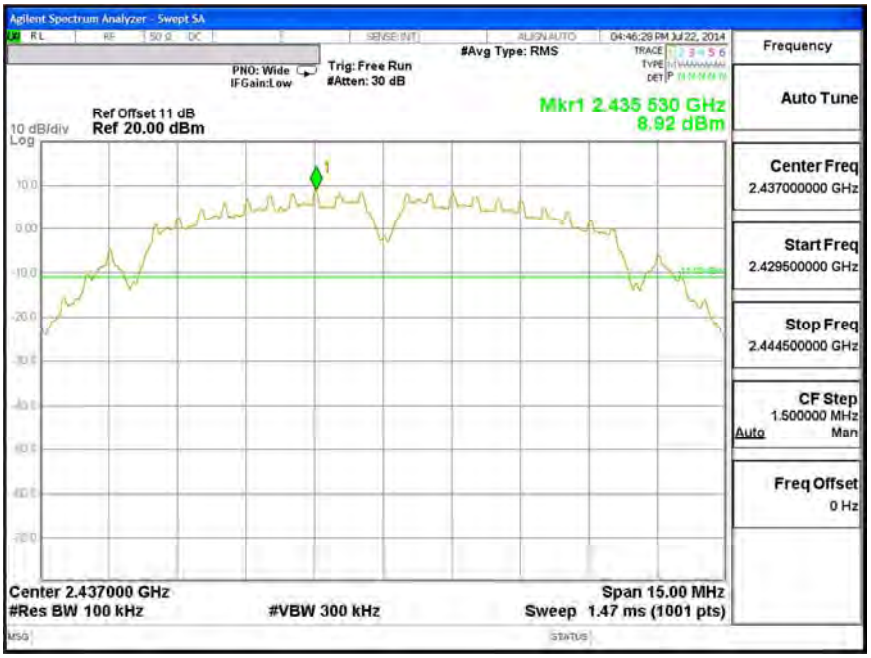
OUT OF BAND HIGH CH 12

OUT OF BAND HIGH CH 13

RESULTS ANTENNA B

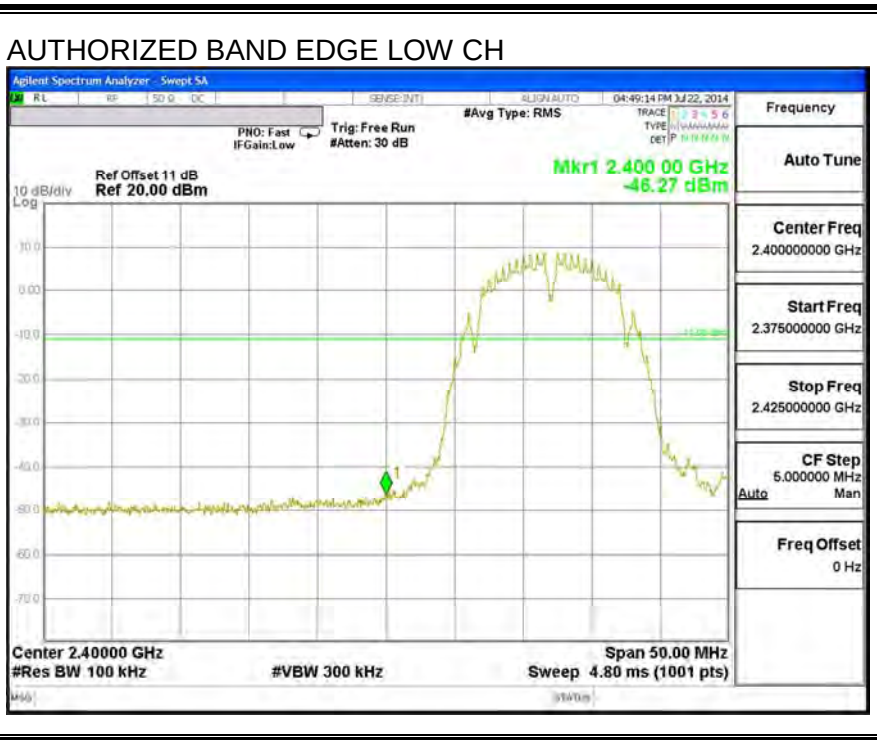
IN-BAND REFERENCE LEVEL

REFERENCE LEVEL MID CH



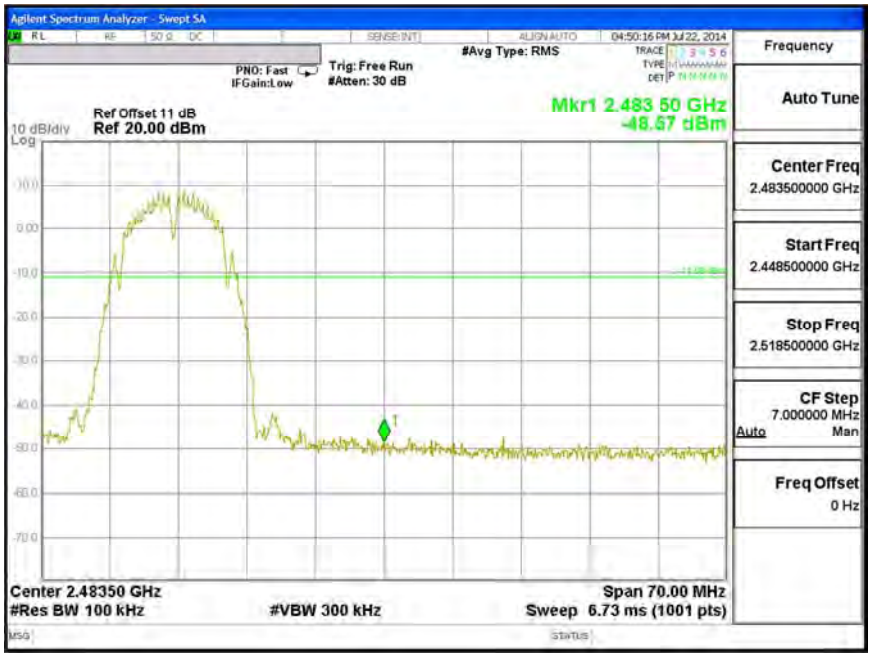
LOW CHANNEL BANDEDGE

AUTHORIZED BAND EDGE LOW CH

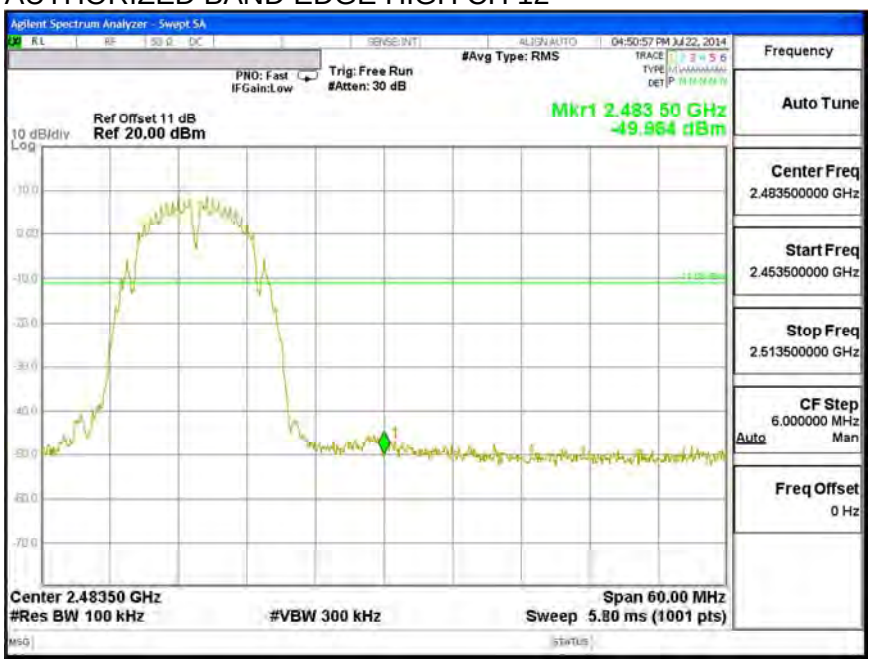


HIGH CHANNEL BANDEDGE

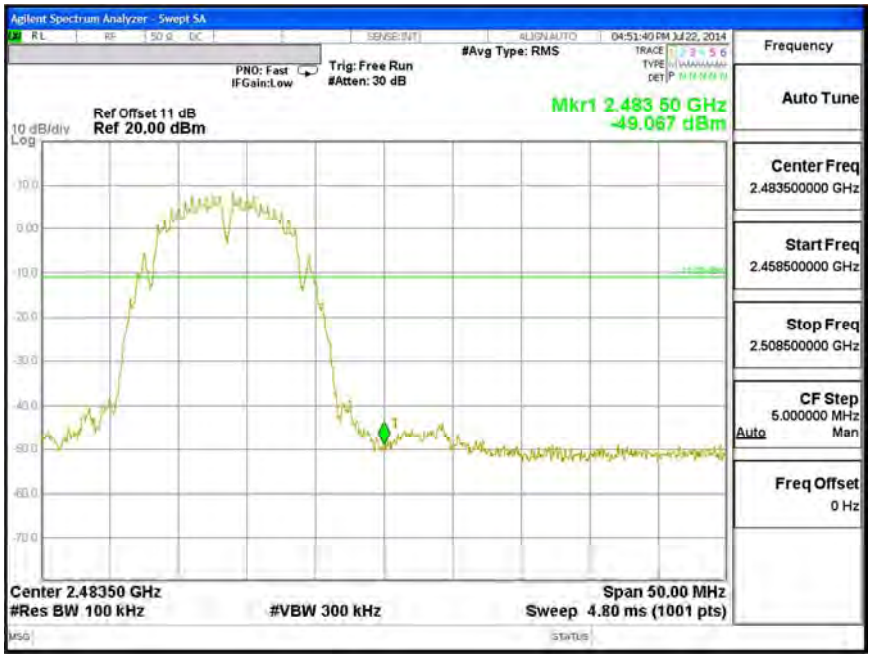
AUTHORIZED BAND EDGE HIGH CH 11



AUTHORIZED BAND EDGE HIGH CH 12

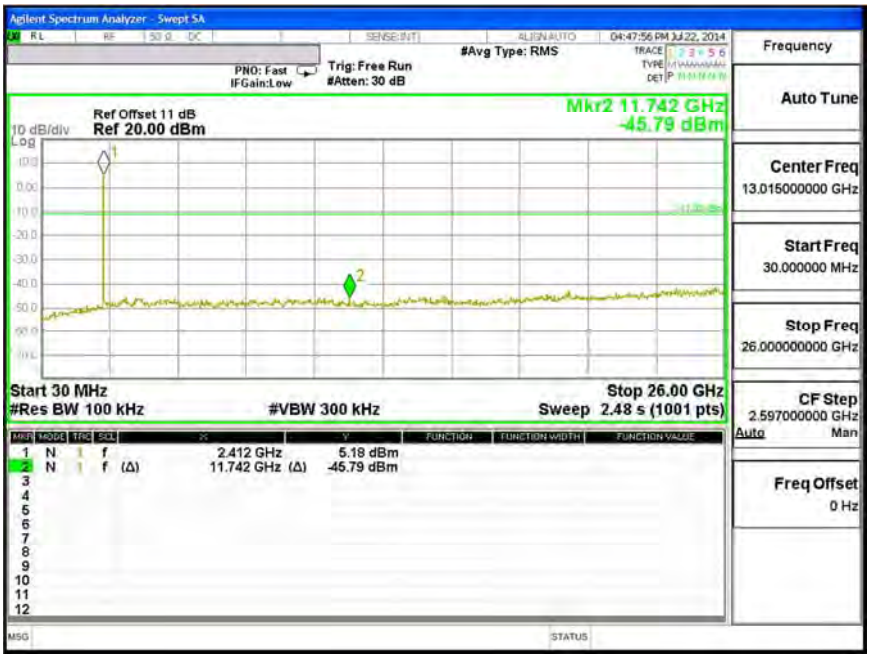


AUTHORIZED BAND EDGE HIGH CH 13



OUT-OF-BAND EMISSIONS

OUT OF BAND LOW CH



OUT OF BAND MID CH

OUT OF BAND HIGH CH 11

OUT OF BAND HIGH CH 12

OUT OF BAND HIGH CH 13

9.2. 802.11g MODE IN THE 2.4 GHz BAND

9.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

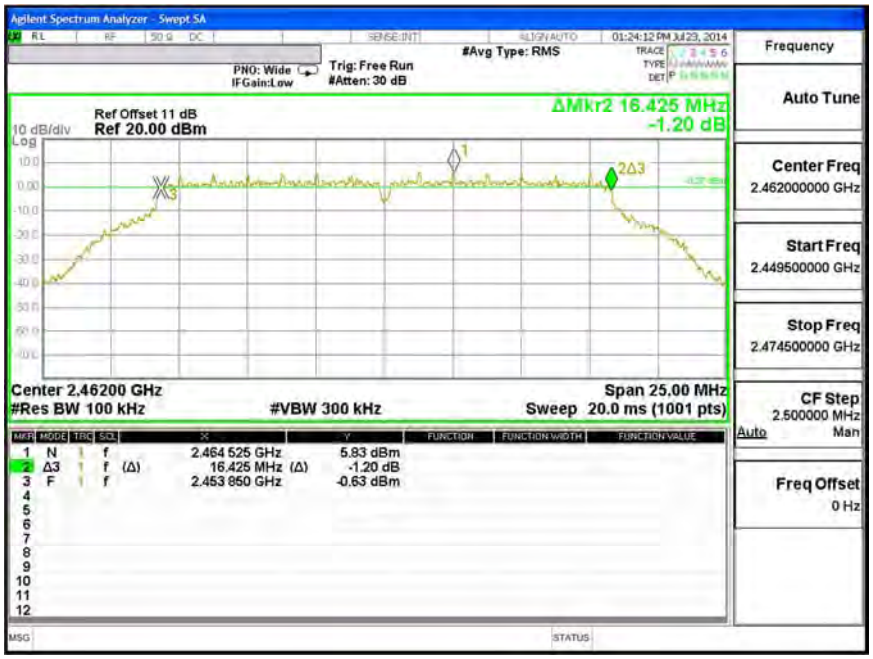
Channel	Frequency (MHz)	6 dB Bandwidth Antenna C (MHz)	6 dB Bandwidth Antenna A (MHz)	6 dB Bandwidth Antenna B (MHz)	Minimum Limit (MHz)
Low	2412	16.500	15.850	16.400	0.5
Mid	2437	16.500	16.450	16.375	0.5
High	2462	16.425	16.475	16.450	0.5
High	2467	16.475	16.375	16.425	0.5
High	2472	16.475	16.475	16.500	0.5

ANTENNA C 6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH

6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH 11



6 dB BANDWIDTH HIGH CH 12

6 dB BANDWIDTH HIGH CH 13

ANTENNA A 6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH

6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH 11

6 dB BANDWIDTH HIGH CH 12

6 dB BANDWIDTH HIGH CH 13

ANTENNA B 6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH

6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH 11

6 dB BANDWIDTH HIGH CH 12

6 dB BANDWIDTH HIGH CH 13

9.2.2. 99% BANDWIDTH

LIMITS

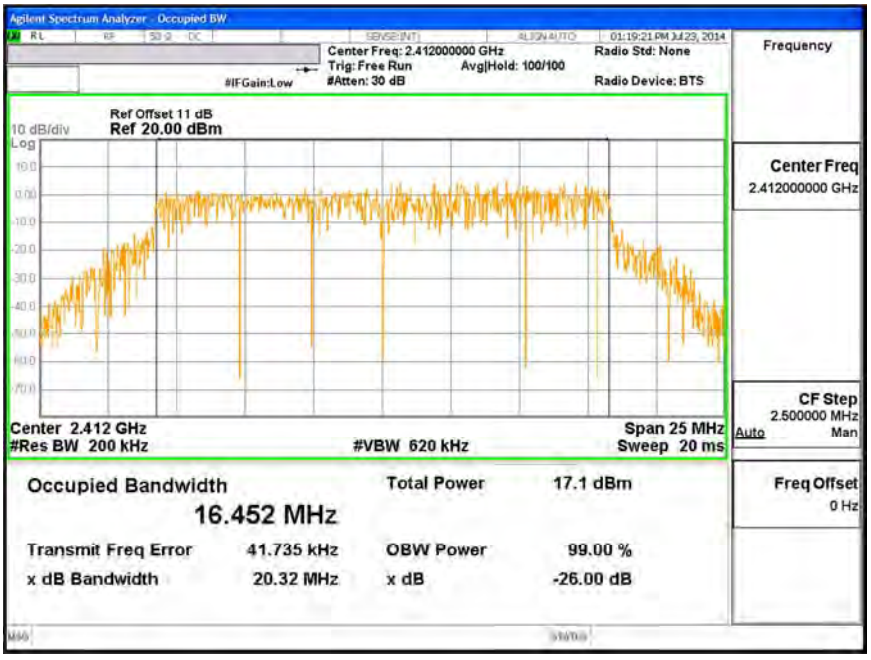
None; for reporting purposes only.

RESULTS

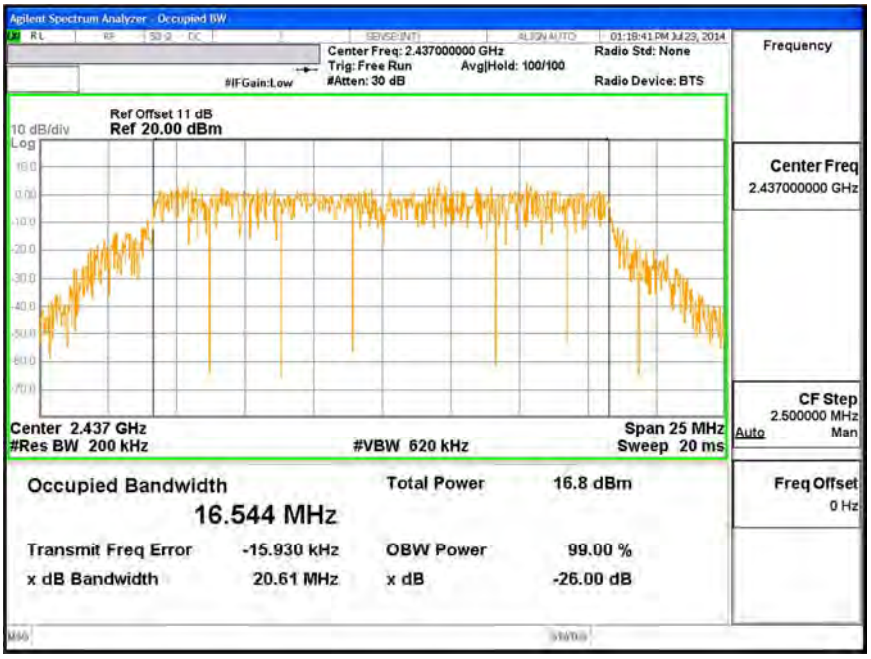
Channel	Frequency (MHz)	99% Bandwidth Antenna C (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Low	2412	16.452	16.485	16.416
Mid	2437	16.544	16.537	16.593
High	2462	16.453	16.599	16.489
High	2467	16.479	16.556	16.587
High	2472	16.439	16.483	16.662

ANTENNA C 99% BANDWIDTH

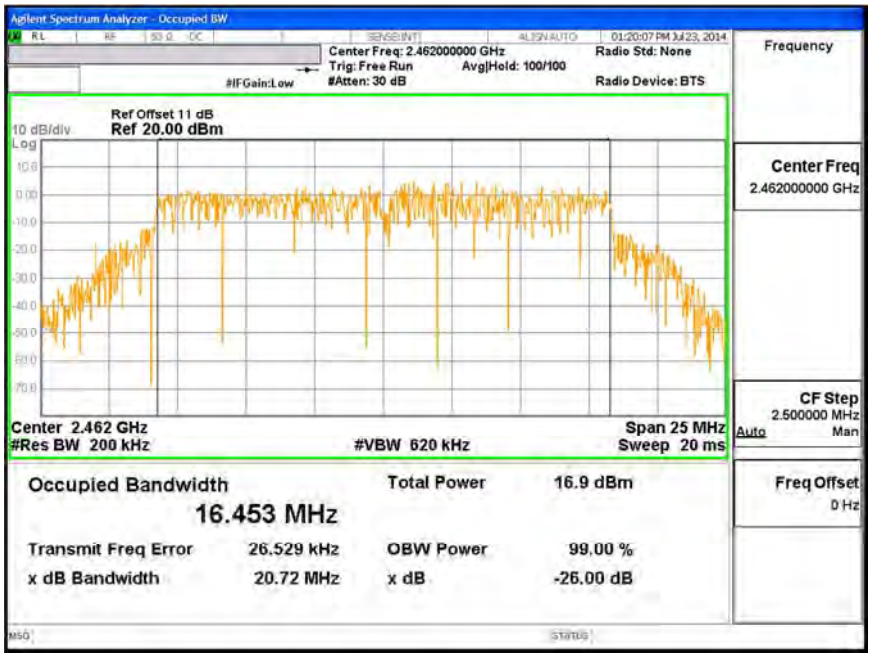
99% BANDWIDTH LOW CH



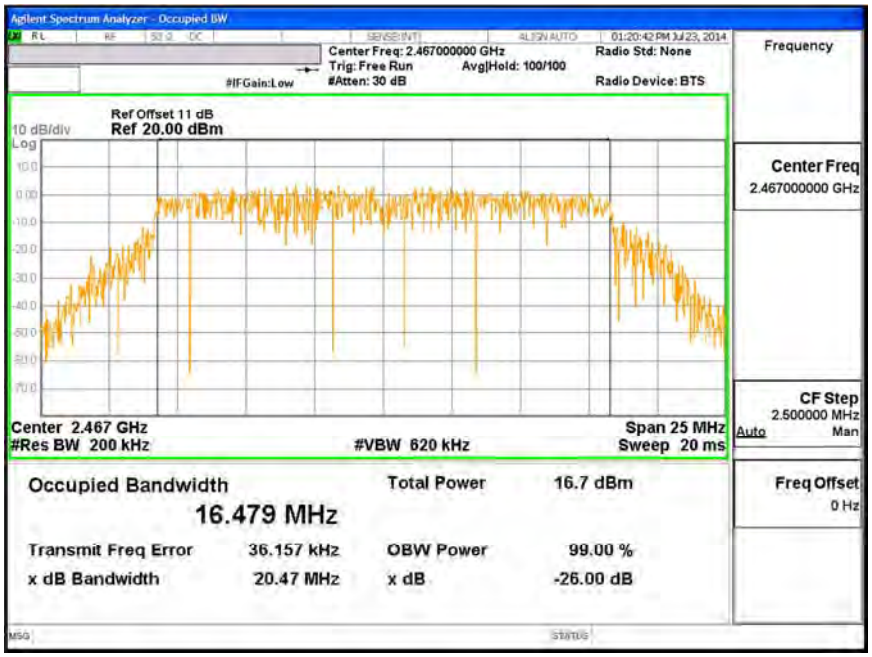
99% BANDWIDTH MID CH



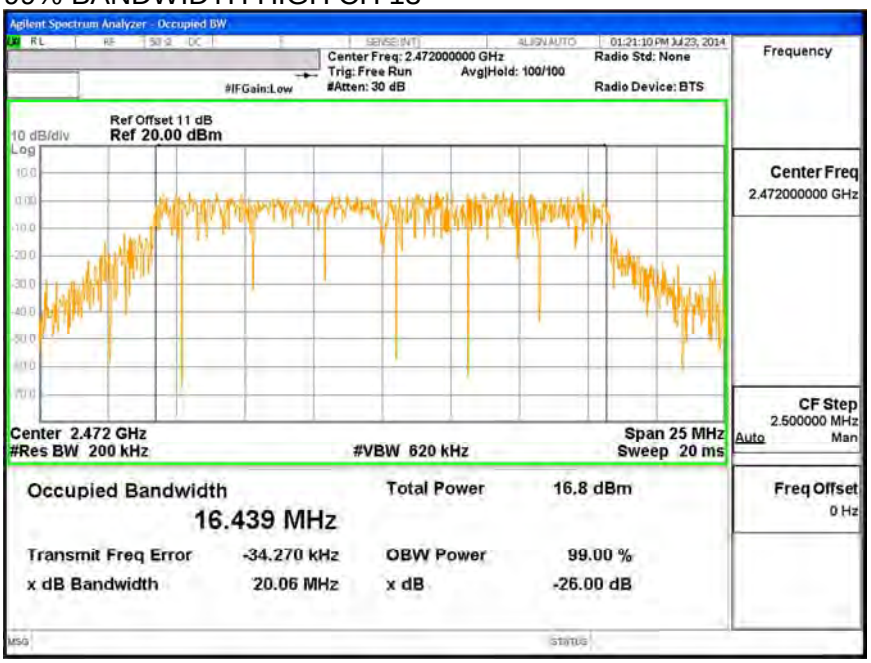
99% BANDWIDTH HIGH CH 11



99% BANDWIDTH HIGH CH 12



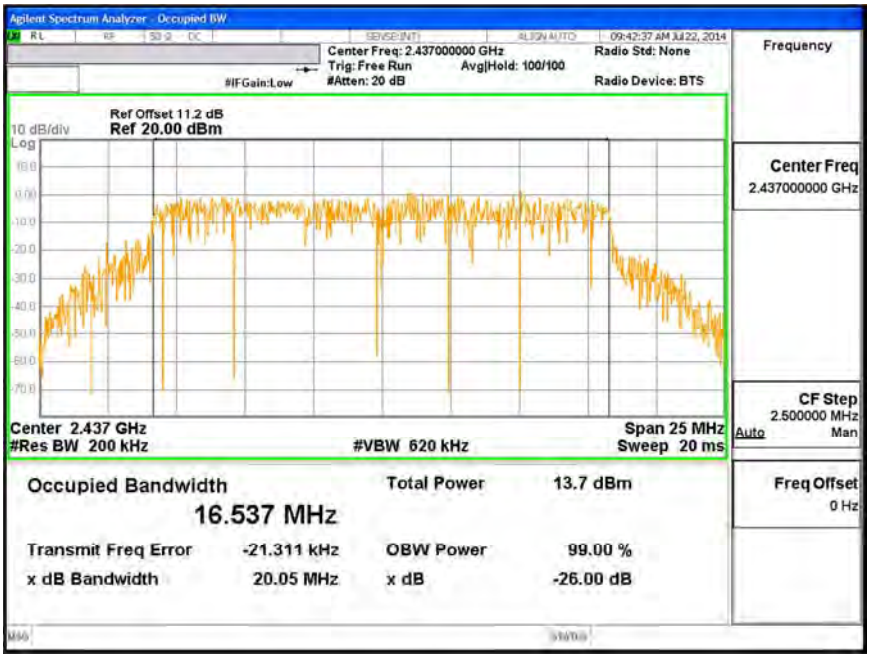
99% BANDWIDTH HIGH CH 13



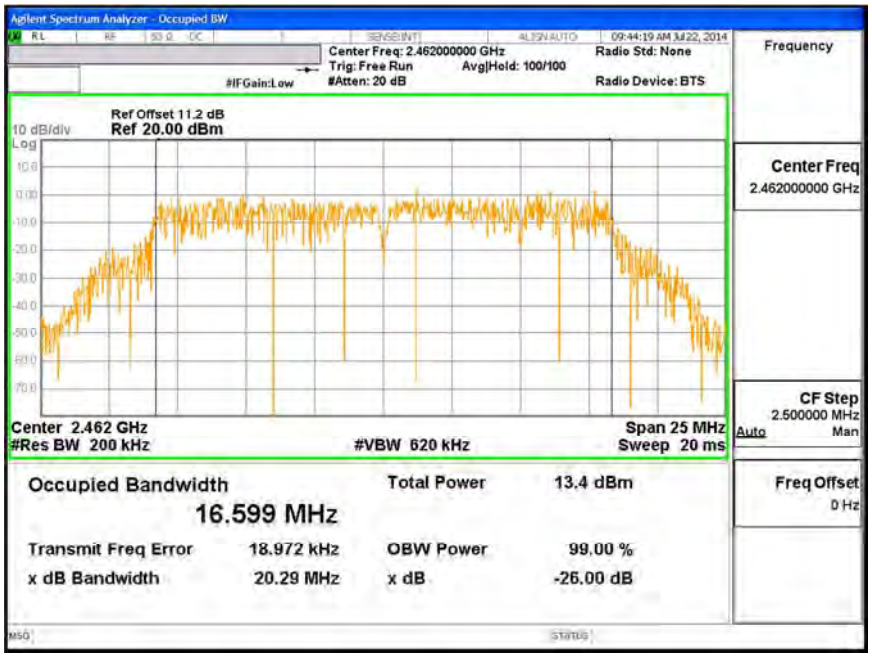
ANTENNA A 99% BANDWIDTH

99% BANDWIDTH LOW CH

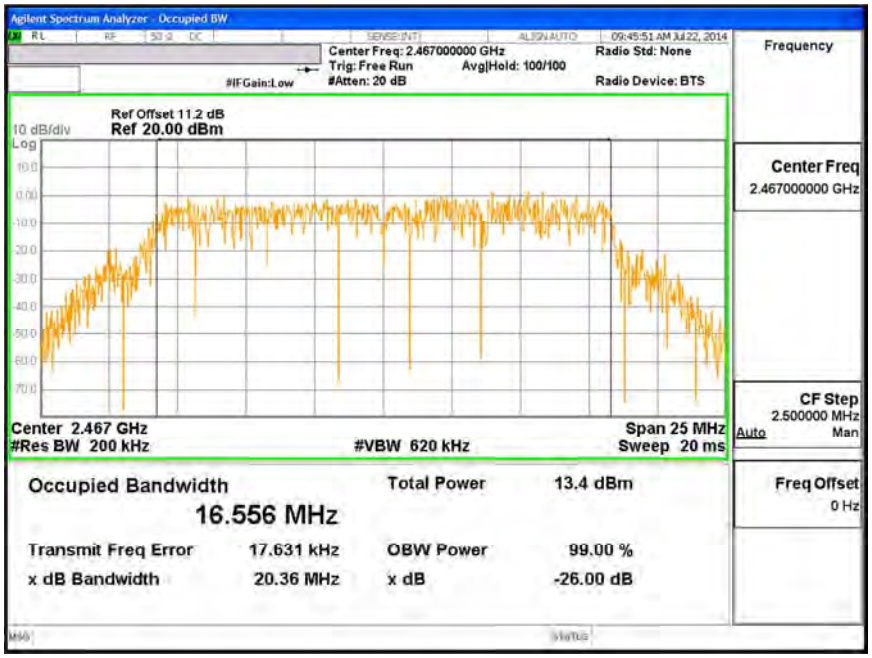
99% BANDWIDTH MID CH



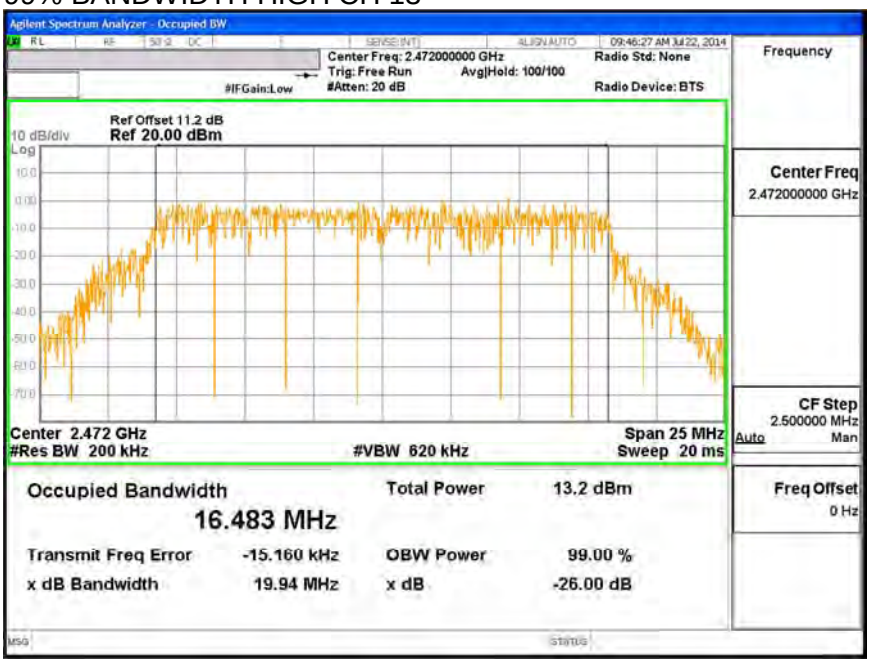
99% BANDWIDTH HIGH CH 11



99% BANDWIDTH HIGH CH 12

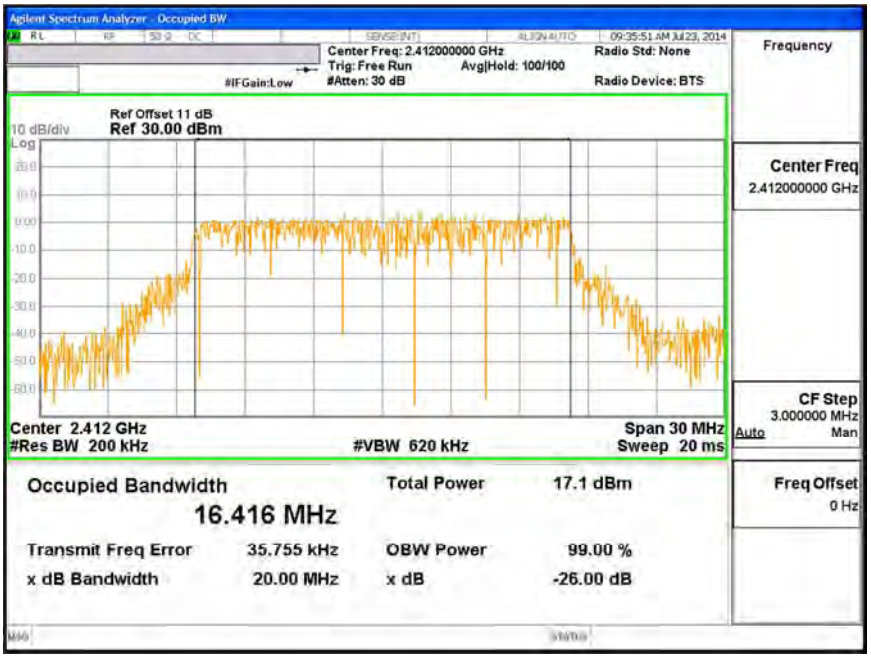


99% BANDWIDTH HIGH CH 13

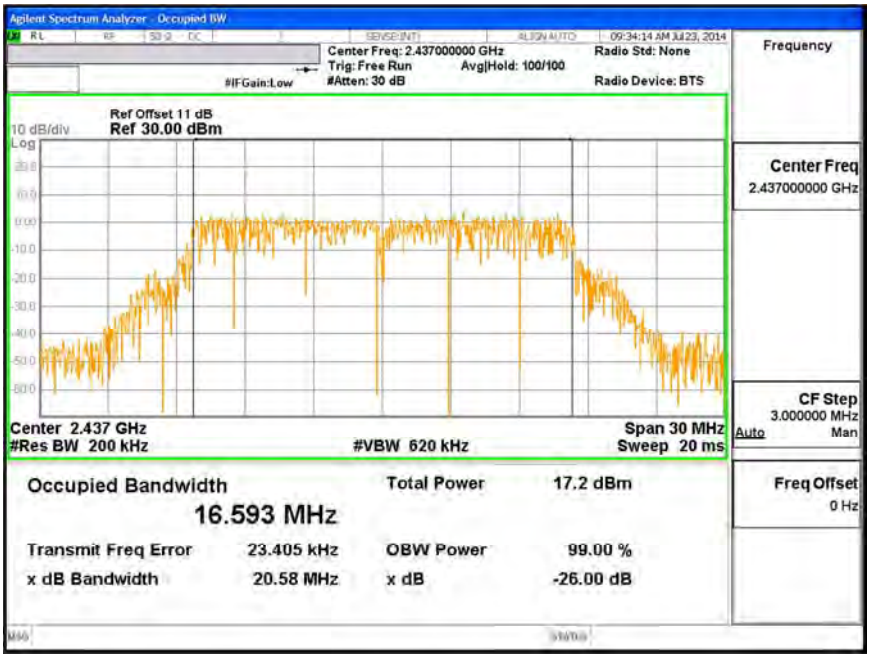


ANTENNA B 99% BANDWIDTH

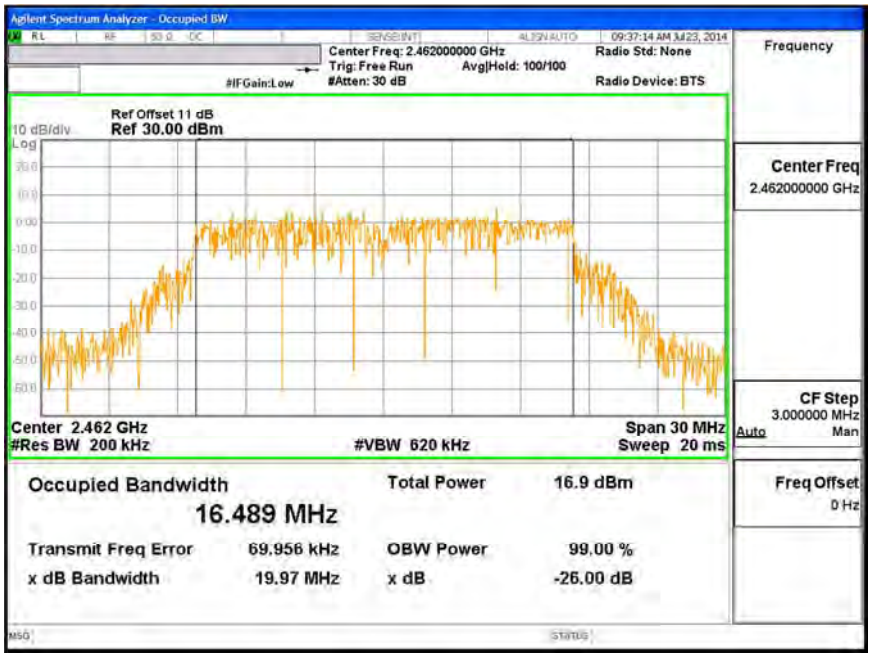
99% BANDWIDTH LOW CH



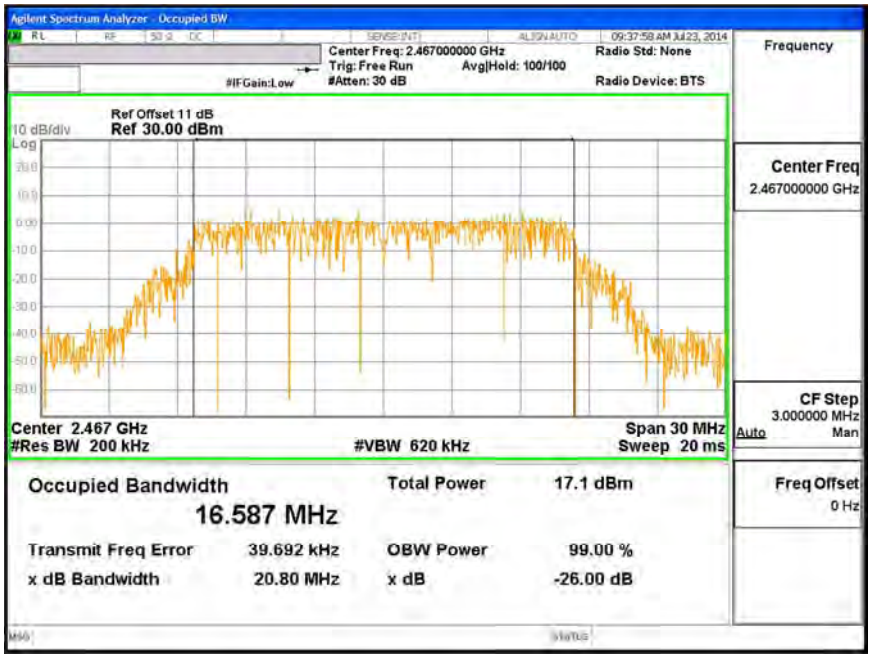
99% BANDWIDTH MID CH



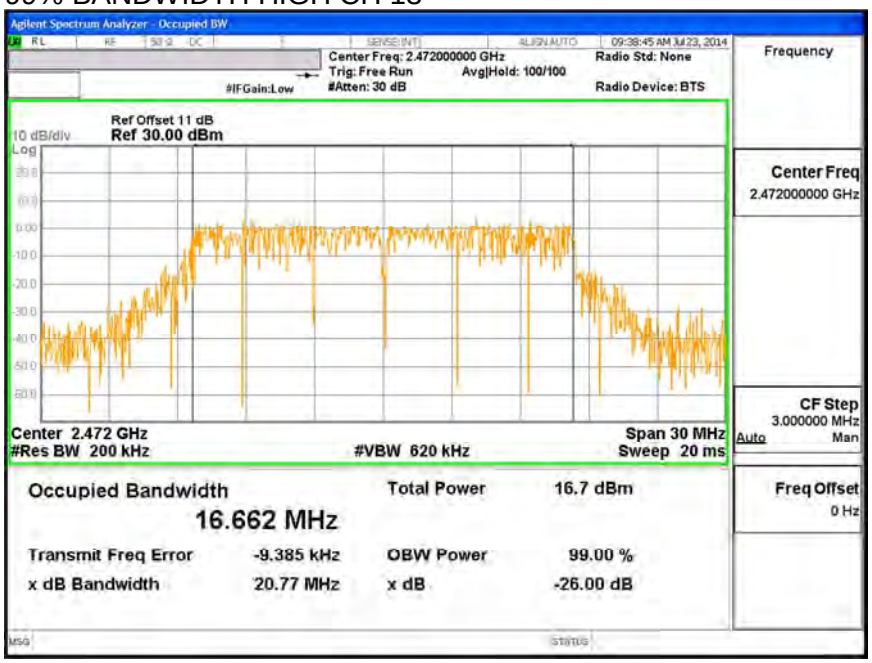
99% BANDWIDTH HIGH CH 11



99% BANDWIDTH HIGH CH 12



99% BANDWIDTH HIGH CH 13



9.2.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power Antenna C (dBm)	Power Antenna A (dBm)	Power Antenna B (dBm)
1	2412	15.75	12.92	17.98
6	2437	15.99	12.97	17.96
11	2462	13.99	12.99	13.98
12	2467	9.47	9.41	9.49
13	2472	2.98	2.85	2.95

9.2.4. OUTPUT POWER

LIMITS

FCC §15.247

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

ANTENNA C RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	-1.55	30.00	30	36	30.00
Mid	2437	-1.55	30.00	30	36	30.00
High	2462	-1.55	30.00	30	36	30.00
High	2467	-1.55	30.00	30	36	30.00
High	2472	-1.55	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Antenna C Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	22.41	22.41	30.00	-7.59
Mid	2437	22.85	22.85	30.00	-7.15
High	2462	18.68	18.68	30.00	-11.33
High	2467	13.58	13.58	30.00	-16.42
High	2472	7.01	7.01	30.00	-22.99

ANTENNA A RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	2.01	30.00	30	36	30.00
Mid	2437	2.01	30.00	30	36	30.00
High	2462	2.01	30.00	30	36	30.00
High	2467	2.01	30.00	30	36	30.00
High	2472	2.01	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Antenna A Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	21.46	21.46	30.00	-8.54
Mid	2437	21.18	21.18	30.00	-8.82
High	2462	21.14	21.14	30.00	-8.86
High	2467	16.37	16.37	30.00	-13.63
High	2472	12.52	12.52	30.00	-17.48

ANTENNA B RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	-7.72	30.00	30	36	30.00
Mid	2437	-7.72	30.00	30	36	30.00
High	2462	-7.72	30.00	30	36	30.00
High	2467	-7.72	30.00	30	36	30.00
High	2472	-7.72	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Antenna B Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	24.01	24.01	30.00	-5.99
Mid	2437	24.53	24.53	30.00	-5.47
High	2462	20.94	20.94	30.00	-9.06
High	2467	16.54	16.54	30.00	-13.46
High	2472	12.01	12.01	30.00	-17.99

9.2.5. PSD

LIMITS

FCC §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.

ANTENNA C RESULTS

PSD Results

Channel	Frequency (MHz)	Antenna C Meas (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-8.55	8.0	-16.6
Mid	2437	-8.07	8.0	-16.1
High	2462	-10.50	8.0	-18.5
High	2467	-15.60	8.0	-23.6
High	2472	-21.63	8.0	-29.6

ANTENNA A RESULTS

PSD Results

Channel	Frequency (MHz)	Antenna A Meas (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-11.66	8.0	-19.7
Mid	2437	-11.33	8.0	-19.3
High	2462	-11.35	8.0	-19.4
High	2467	-15.21	8.0	-23.2
High	2472	-21.90	8.0	-29.9

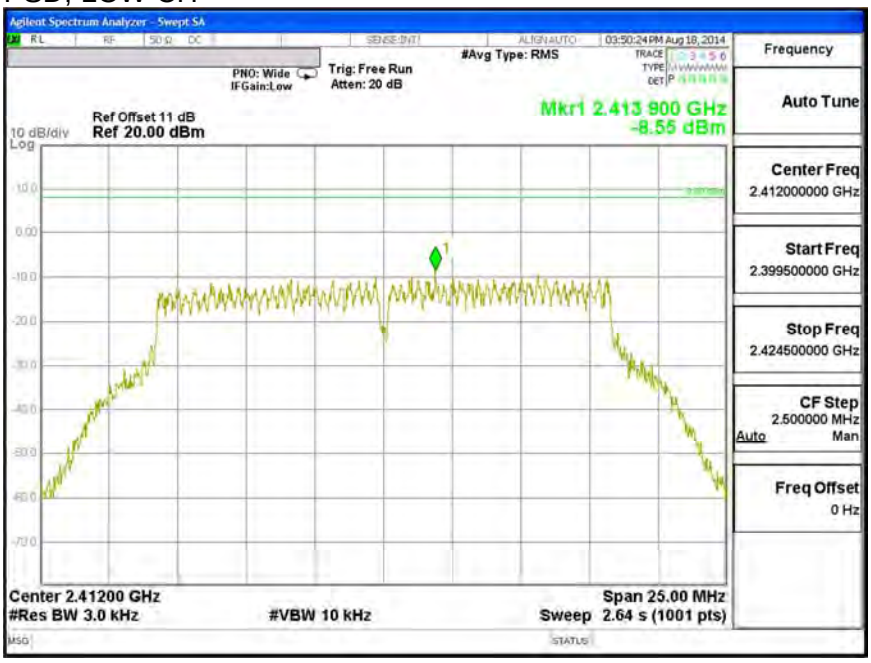
ANTENNA B RESULTS

PSD Results

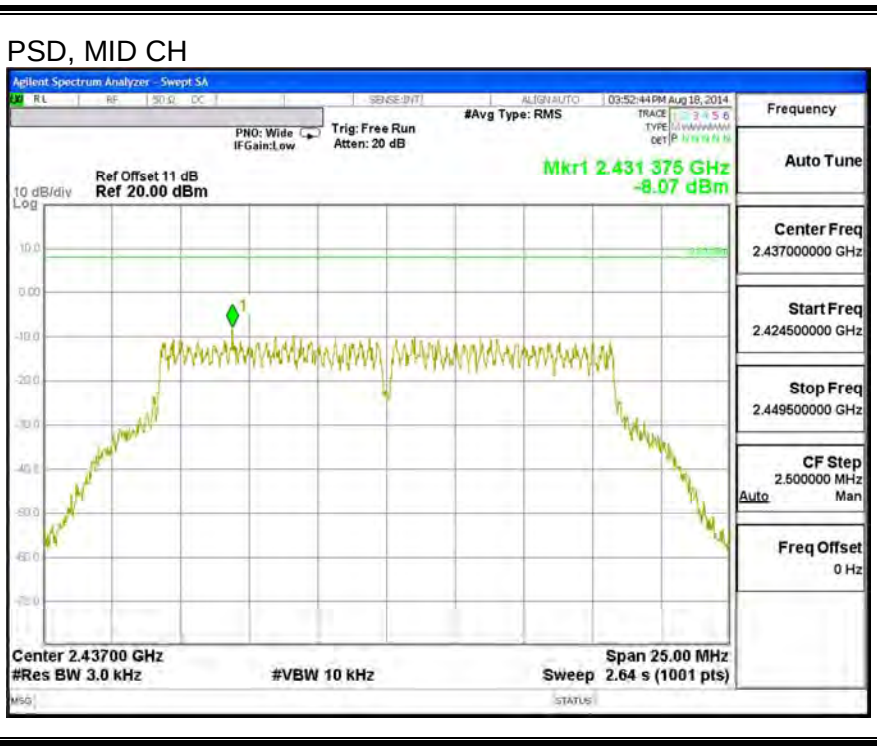
Channel	Frequency (MHz)	Antenna B Meas (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-8.70	8.0	-16.7
Mid	2437	-7.83	8.0	-15.8
High	2462	-10.33	8.0	-18.3
High	2467	-14.99	8.0	-23.0
High	2472	-22.08	8.0	-30.1

PSD, ANTENNA C

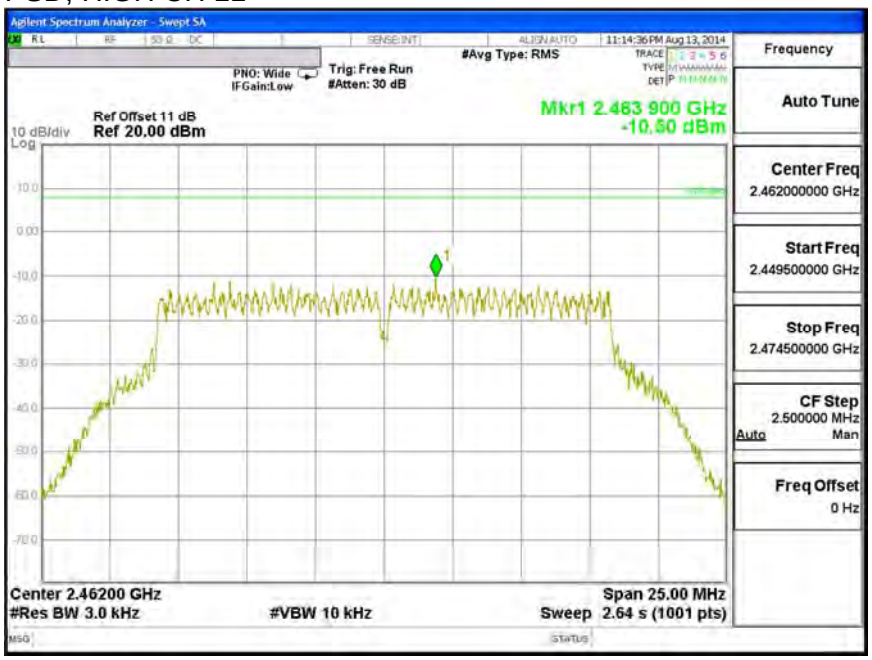
PSD, LOW CH



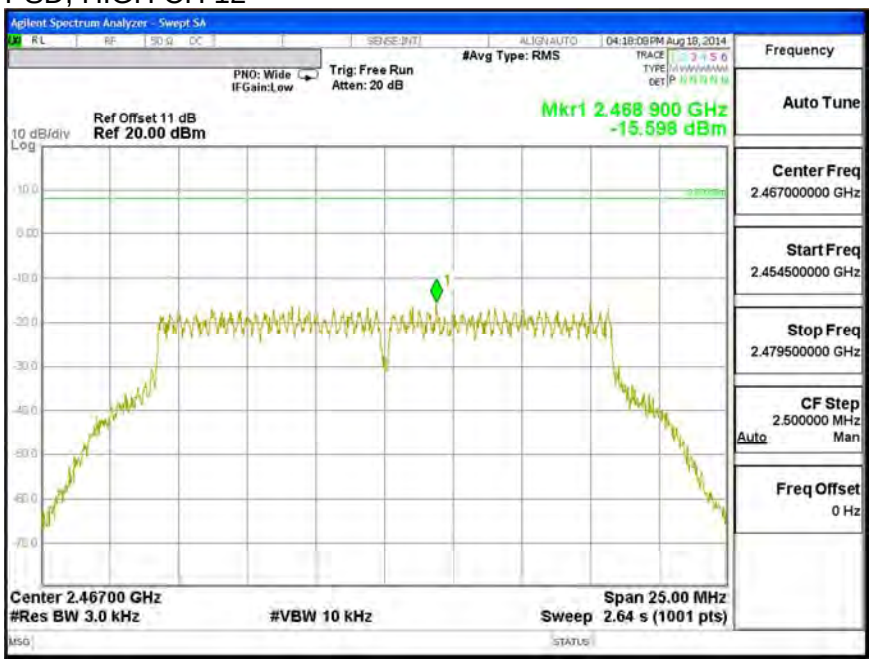
PSD, MID CH



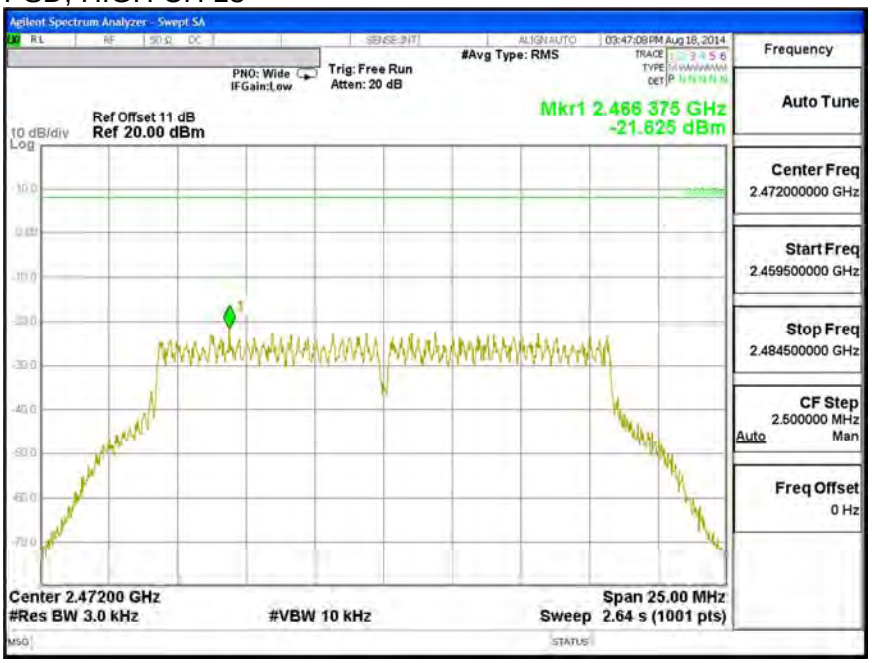
PSD, HIGH CH 11



PSD, HIGH CH 12

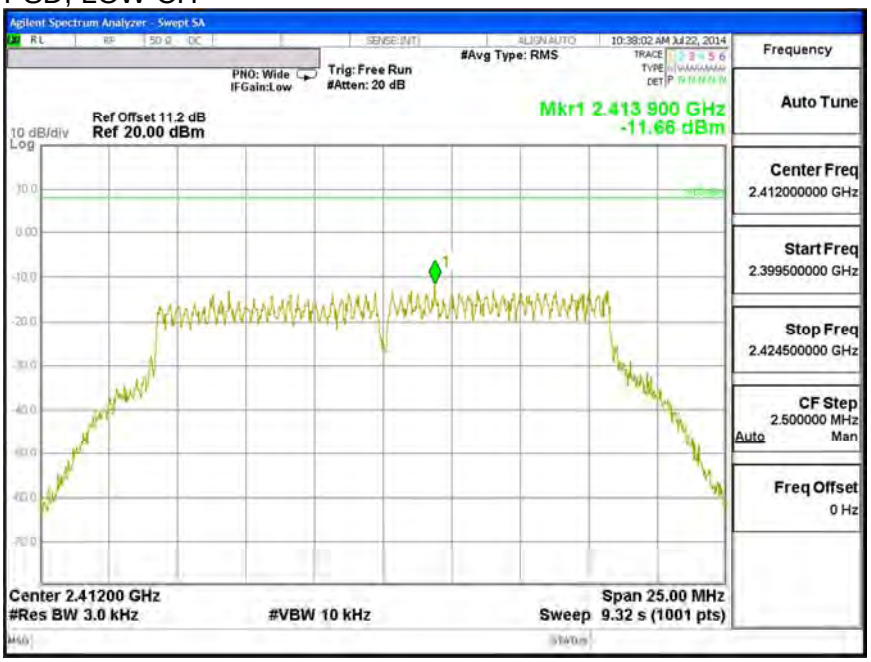


PSD, HIGH CH 13

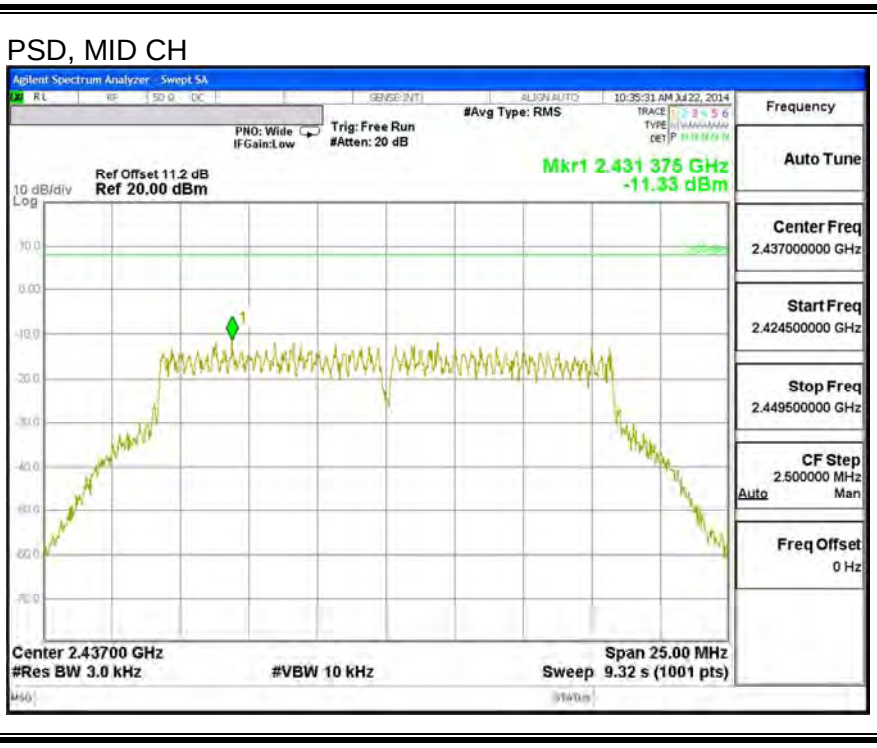


PSD, ANTENNA A

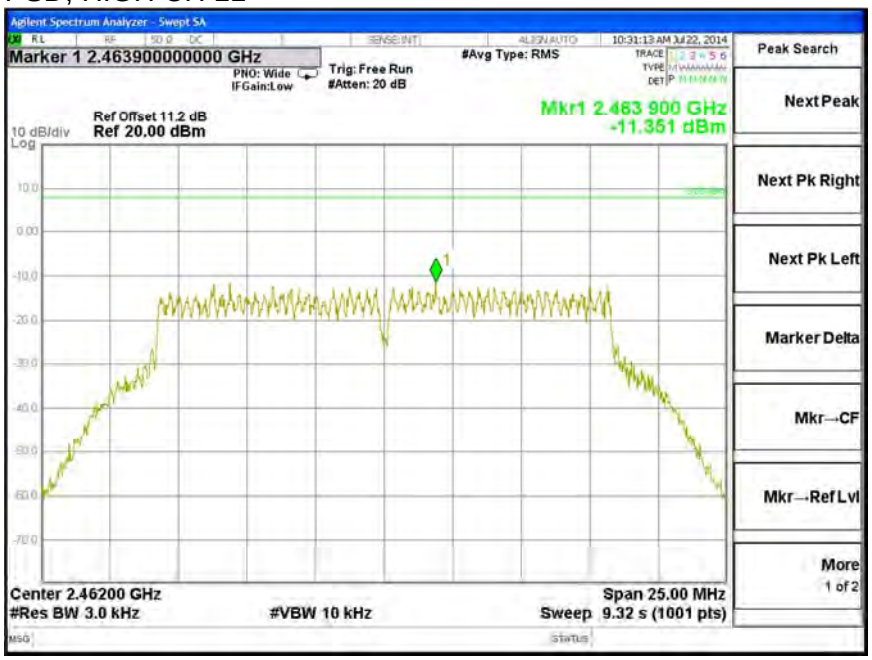
PSD, LOW CH



PSD, MID CH



PSD, HIGH CH 11



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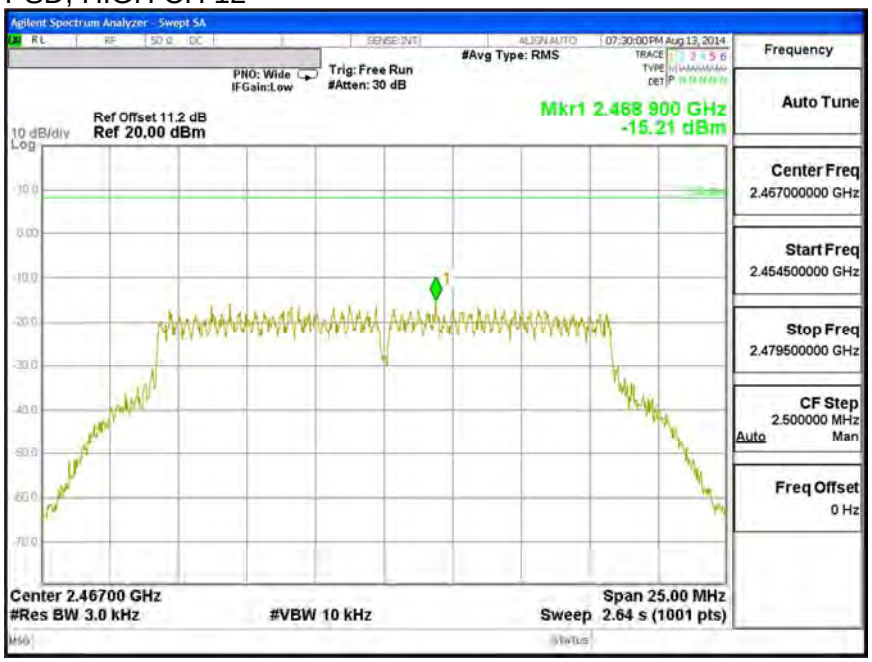
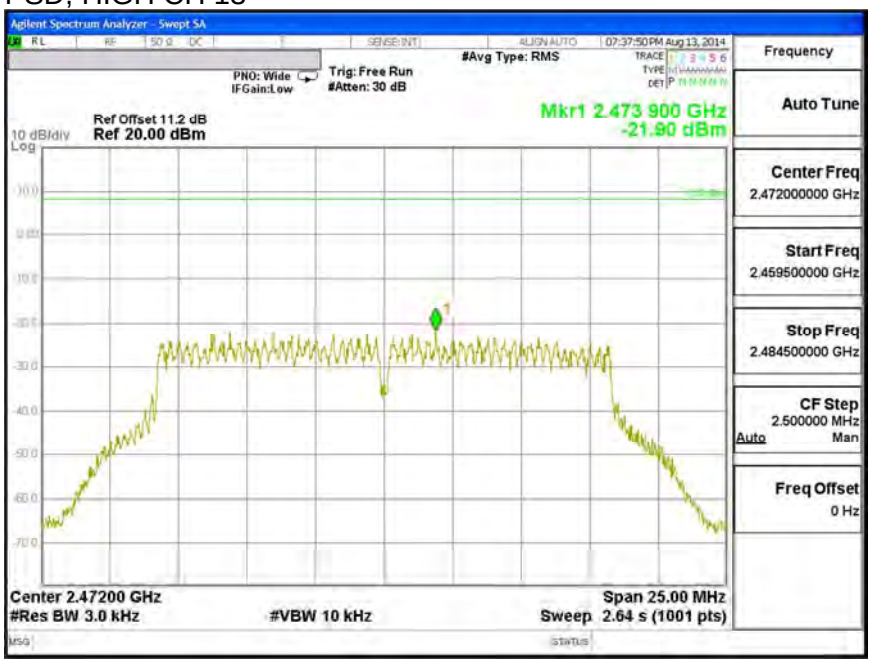
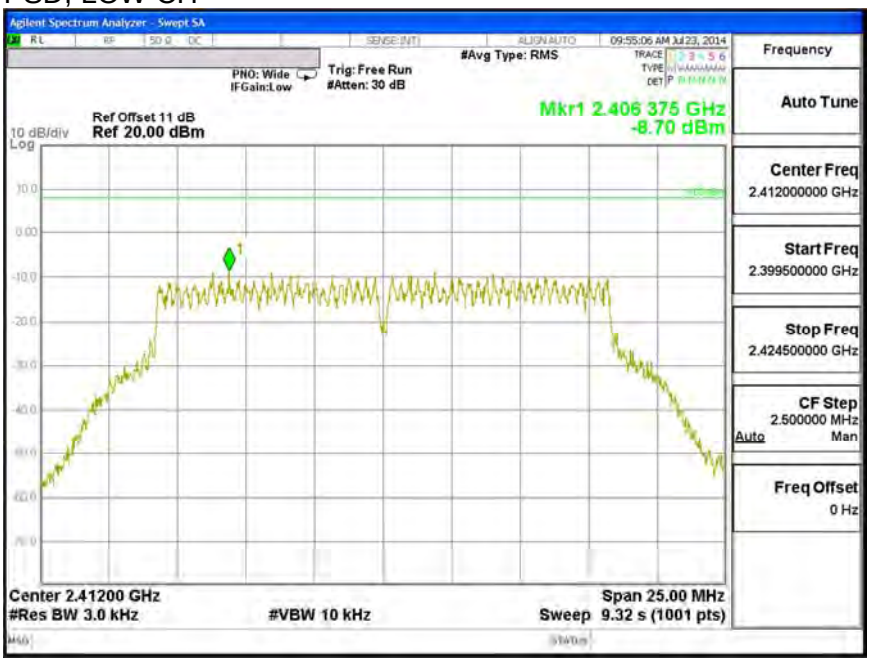


PSD, HIGH CH 13

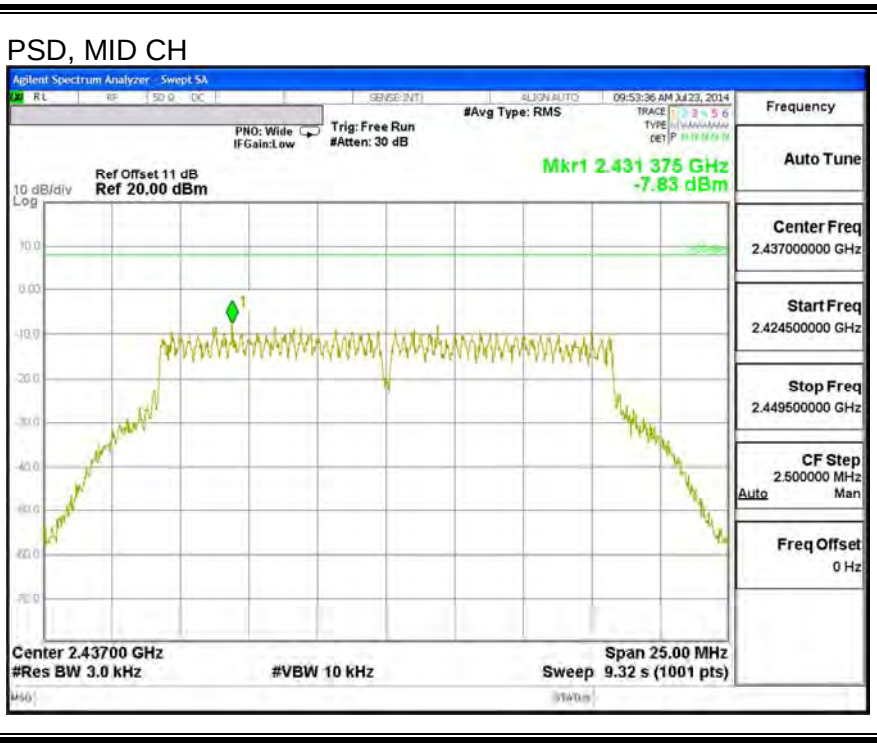


PSD, ANTENNA B

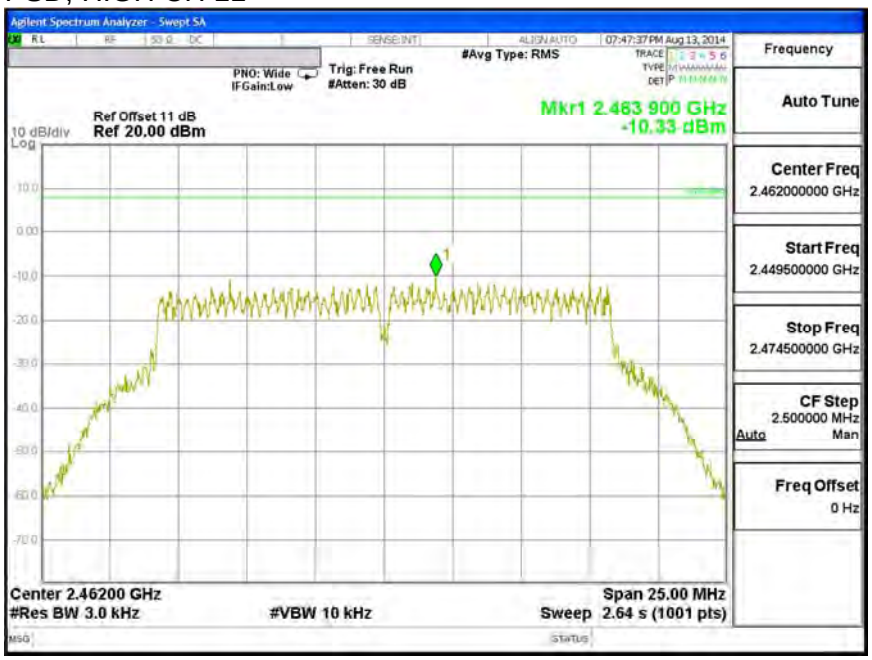
PSD, LOW CH



PSD, MID CH



PSD, HIGH CH 11



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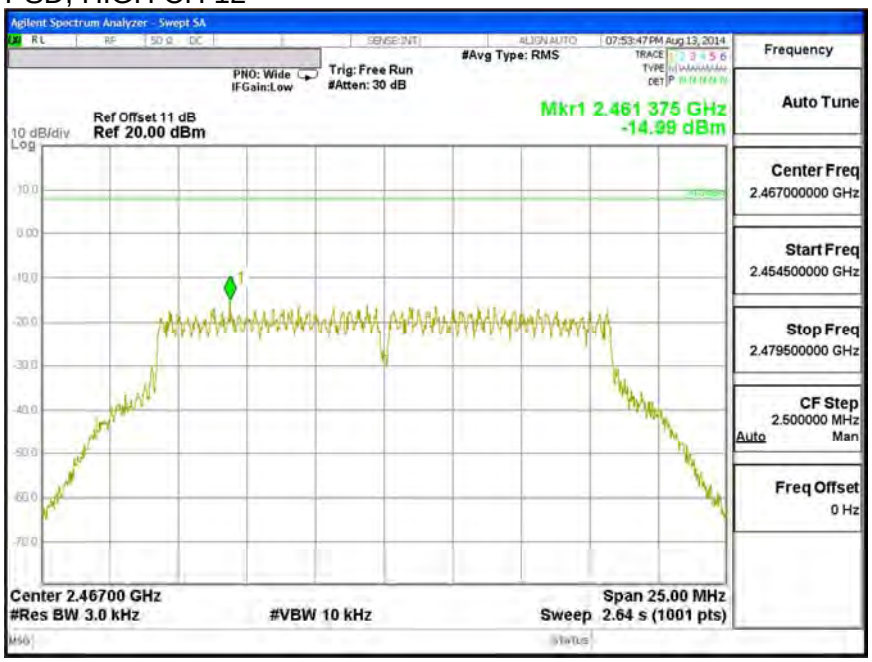
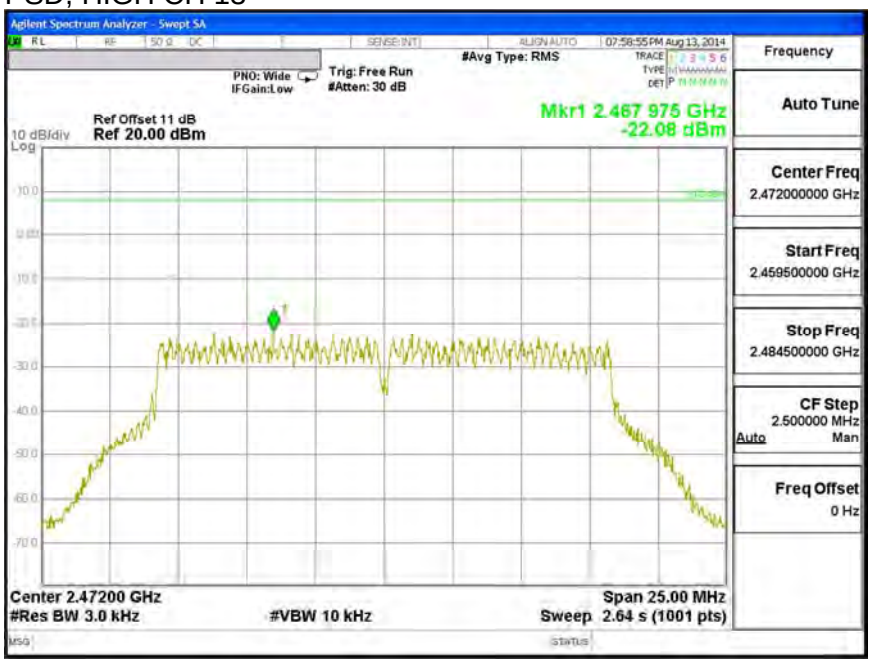


PSD, HIGH CH 13



9.2.6. OUT-OF-BAND EMISSIONS

LIMITS

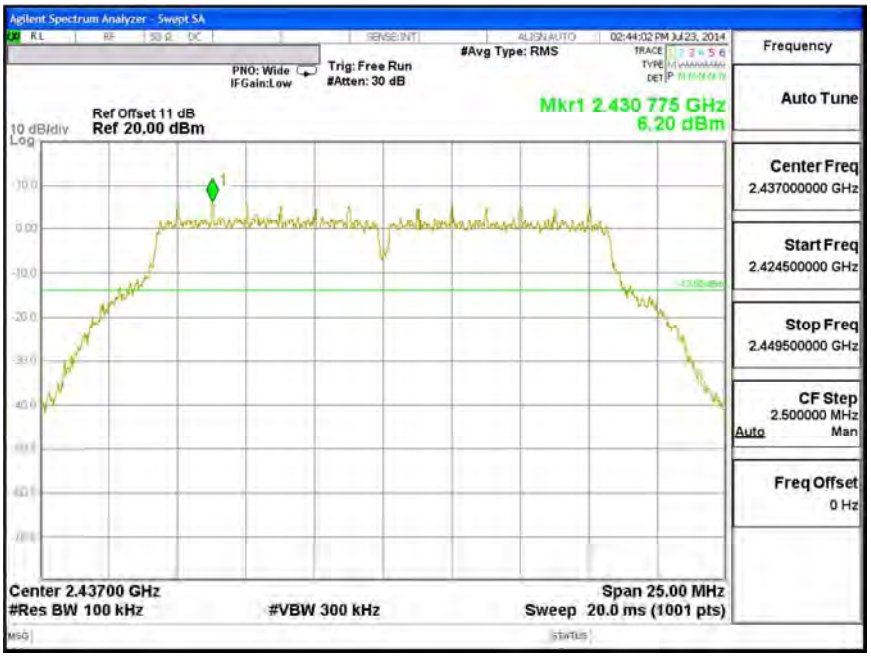
FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

ANTENNA C RESULTS

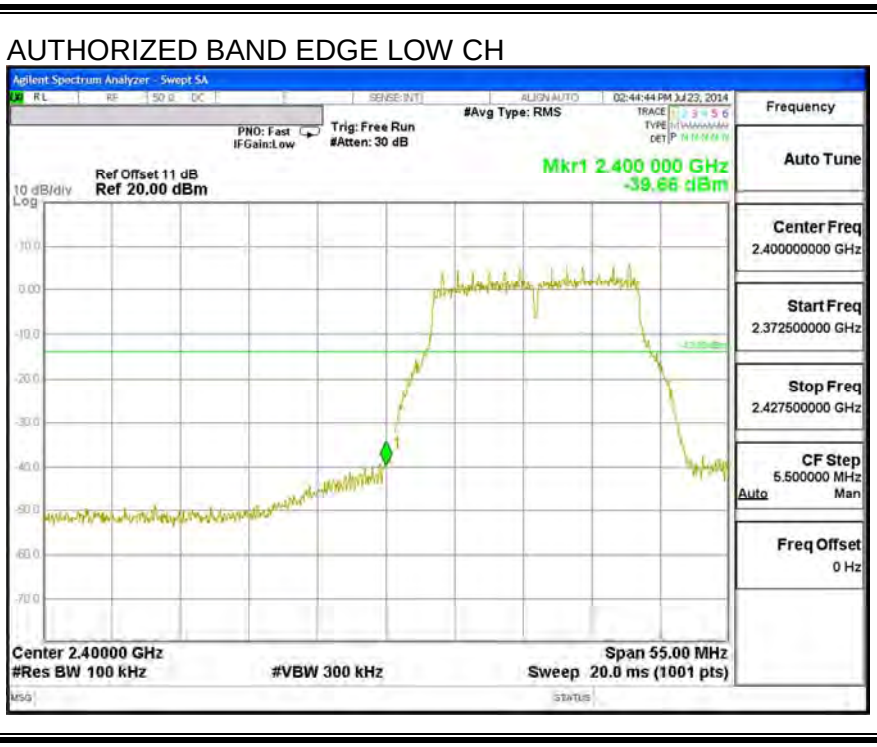
IN-BAND REFERENCE LEVEL

REFERENCE LEVEL MID CH



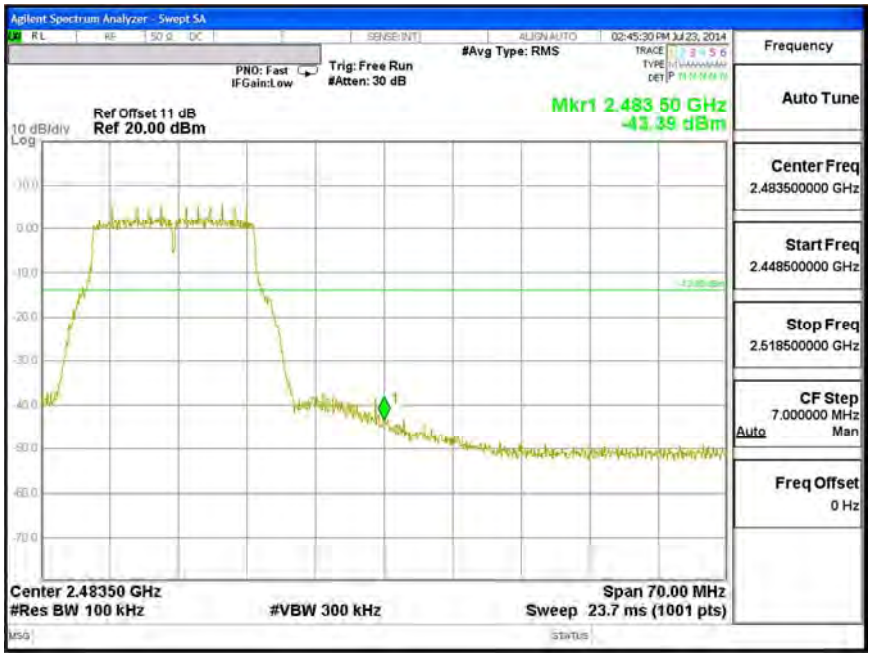
LOW CHANNEL BANDEDGE

AUTHORIZED BAND EDGE LOW CH

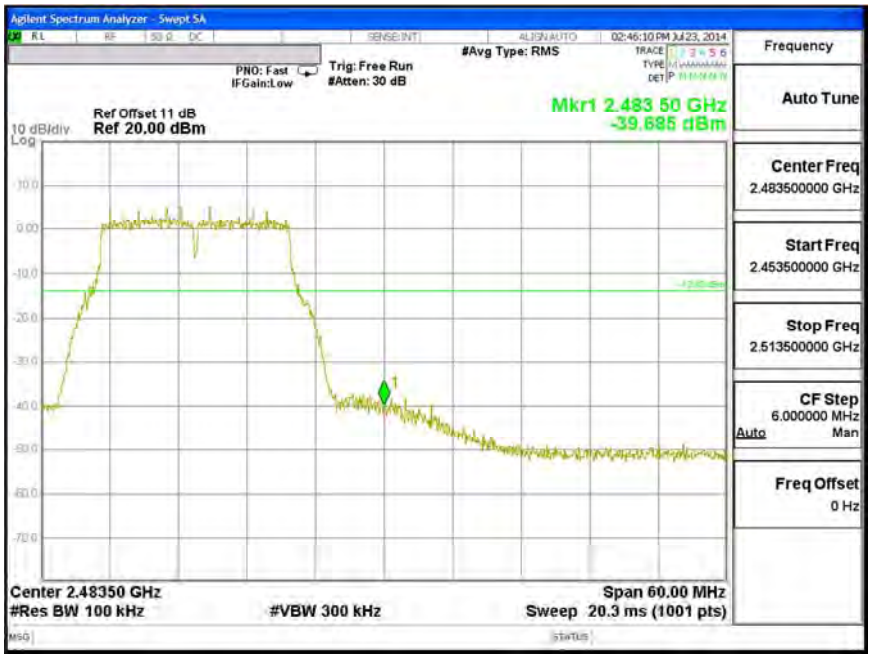


HIGH CHANNEL BANDEDGE

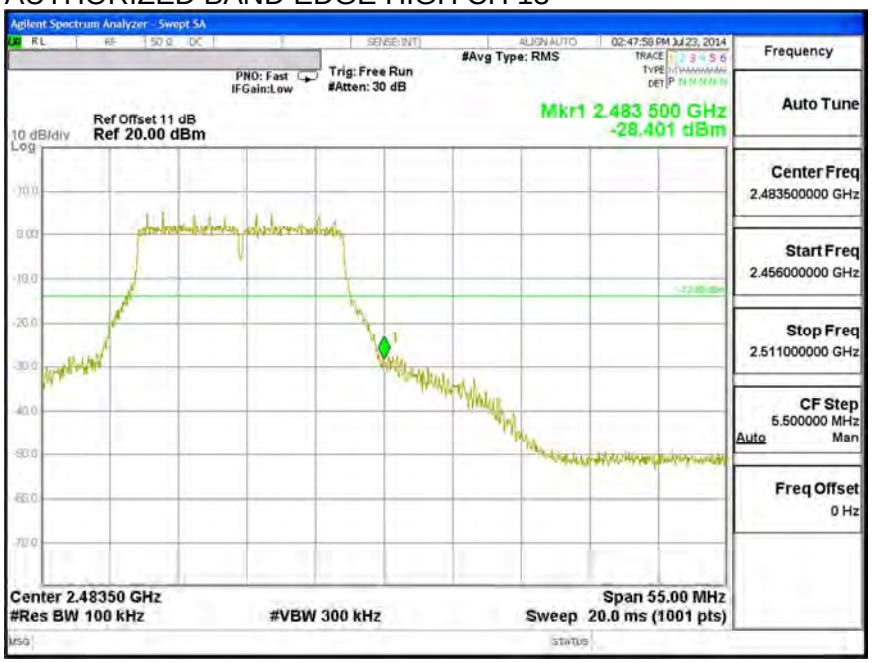
AUTHORIZED BAND EDGE HIGH CH 11



AUTHORIZED BAND EDGE HIGH CH 12



AUTHORIZED BAND EDGE HIGH CH 13



OUT-OF-BAND EMISSIONS

OUT OF BAND LOW CH

OUT OF BAND MID CH

OUT OF BAND HIGH CH 11

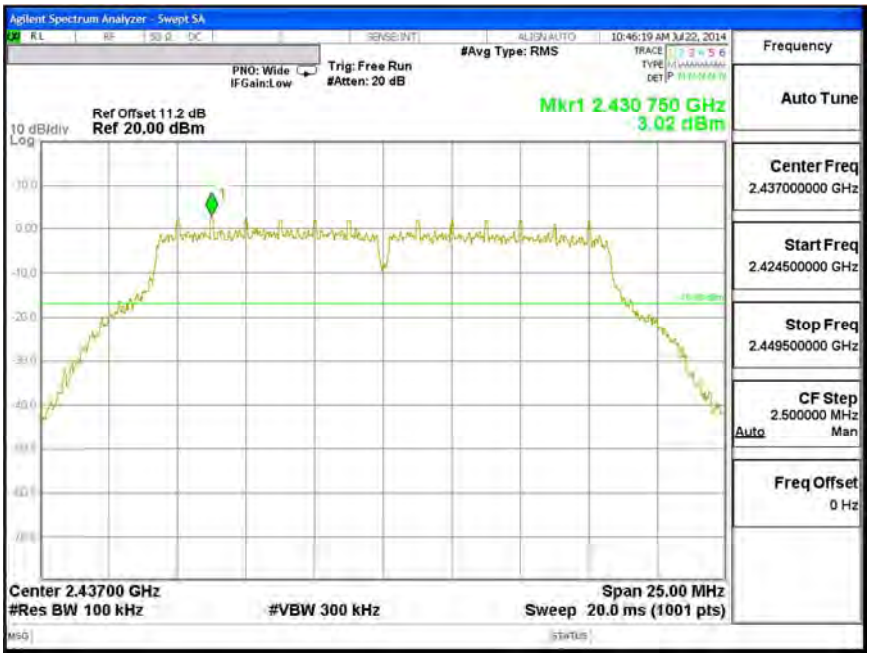
OUT OF BAND HIGH CH 12

OUT OF BAND HIGH CH 13

ANTENNA A RESULTS

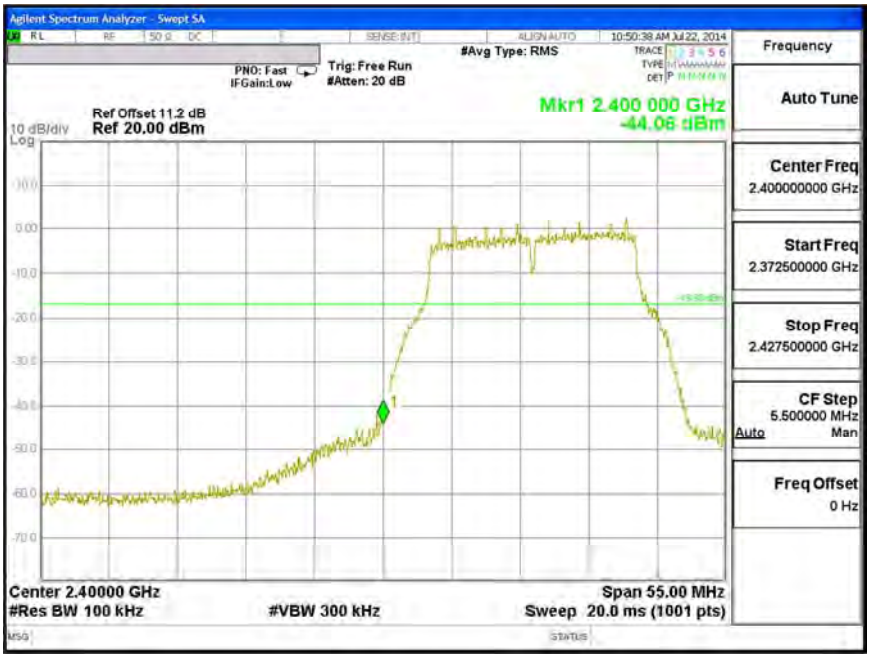
IN-BAND REFERENCE LEVEL

REFERENCE LEVEL MID CH



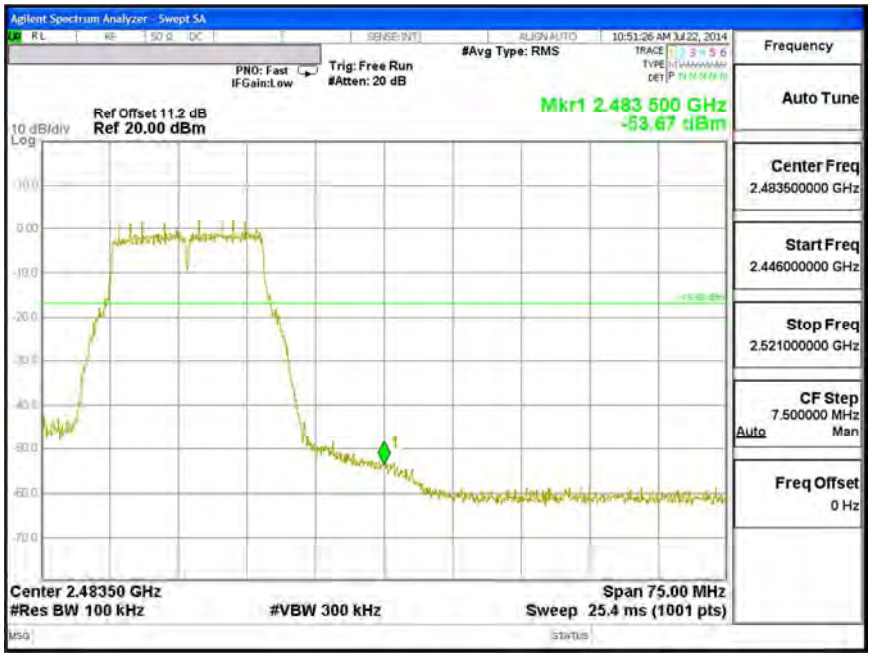
LOW CHANNEL BANDEDGE

AUTHORIZED BAND EDGE LOW CH

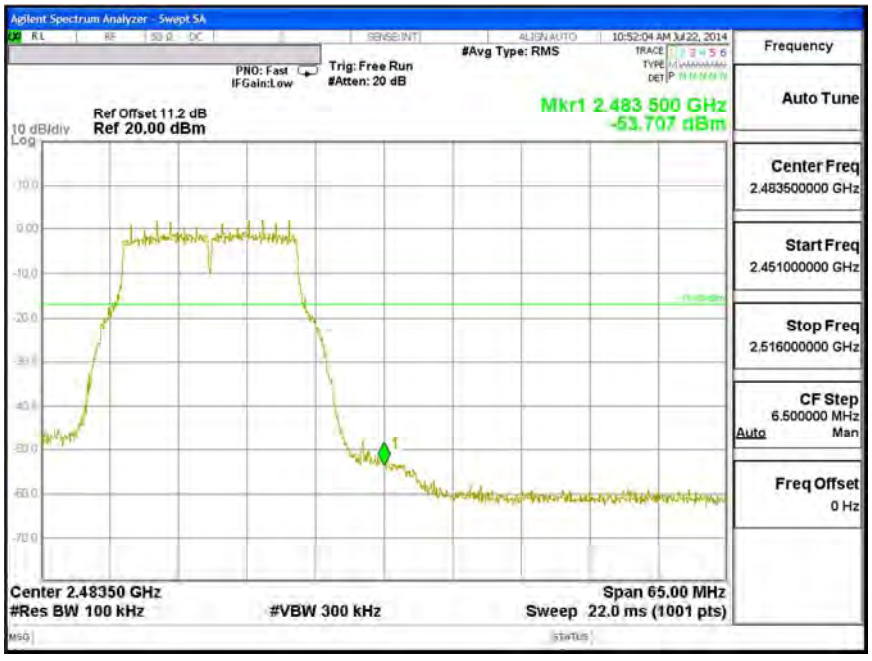


HIGH CHANNEL BANDEDGE

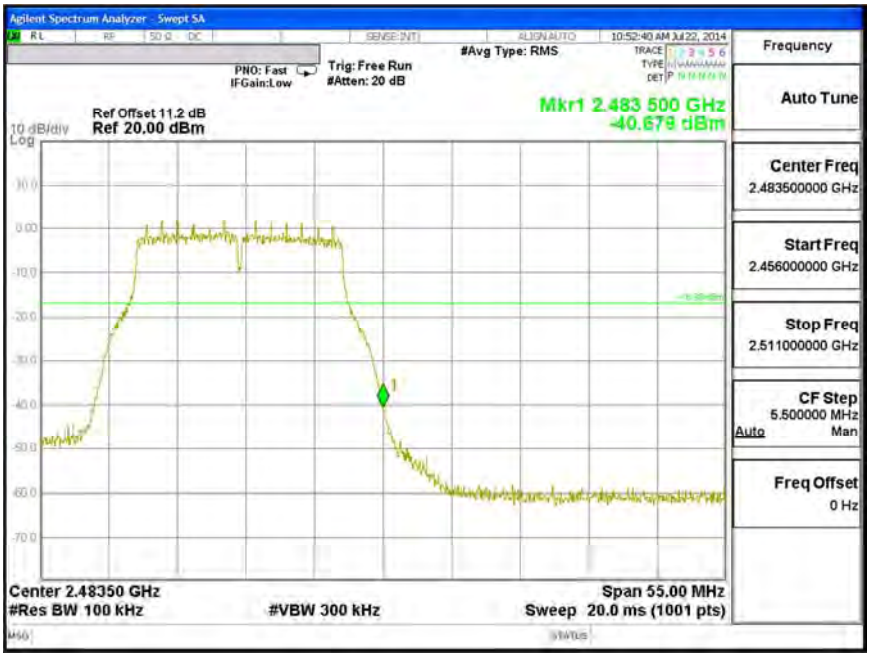
AUTHORIZED BAND EDGE HIGH CH 11



AUTHORIZED BAND EDGE HIGH CH 12



AUTHORIZED BAND EDGE HIGH CH 13



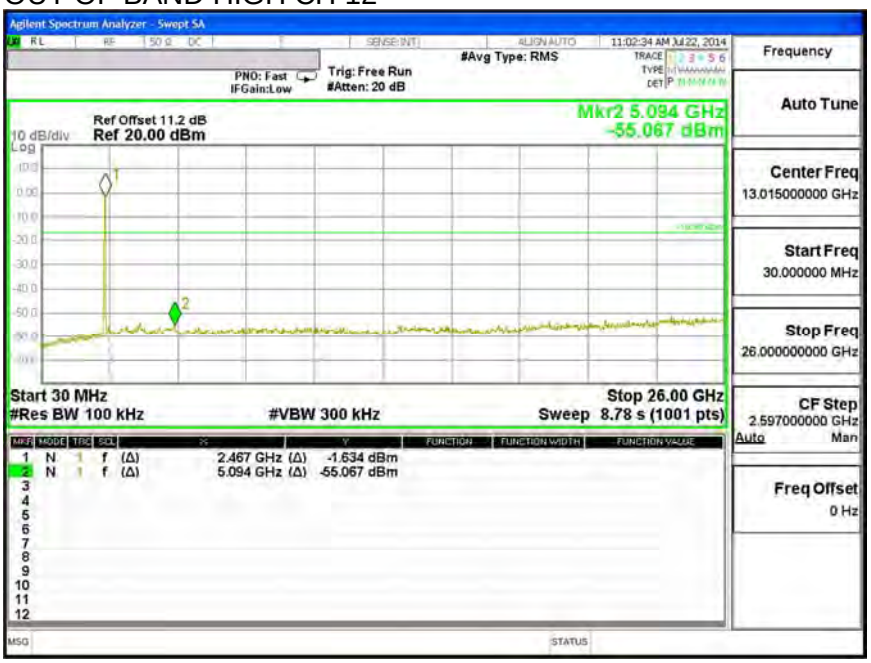
OUT-OF-BAND EMISSIONS

OUT OF BAND LOW CH

OUT OF BAND MID CH

OUT OF BAND HIGH CH 11

OUT OF BAND HIGH CH 12

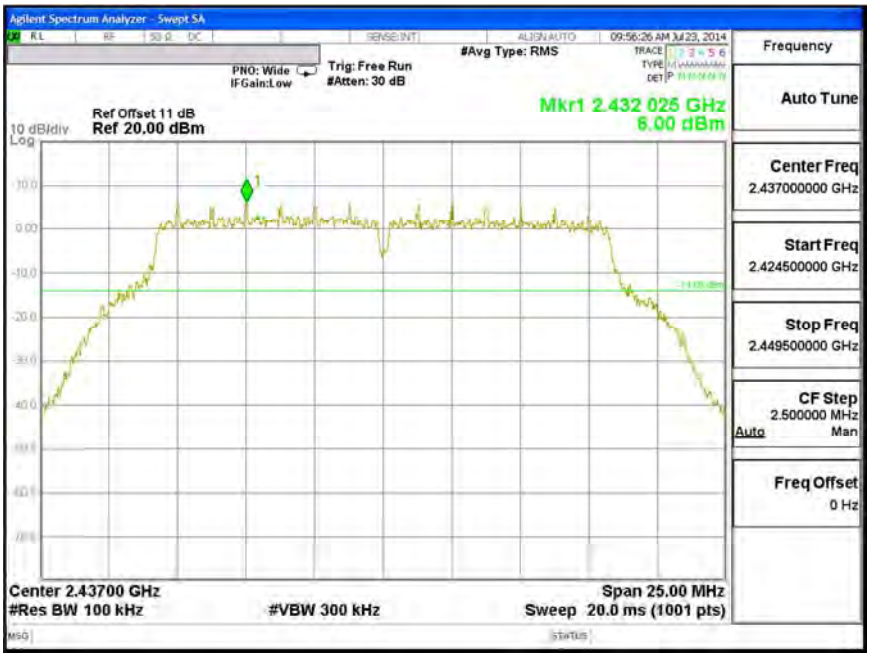


OUT OF BAND HIGH CH 13

ANTENNA B RESULTS

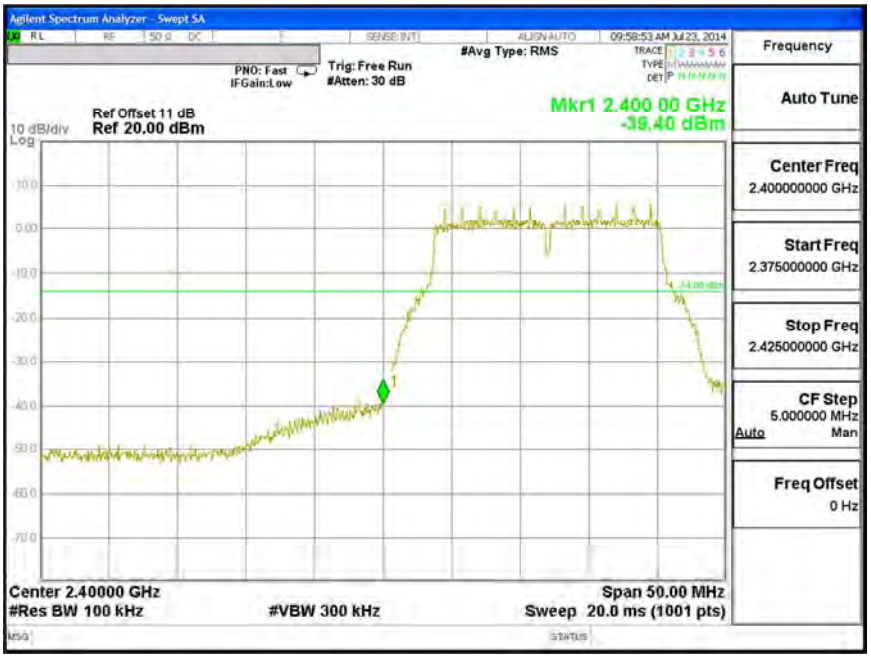
IN-BAND REFERENCE LEVEL

REFERENCE LEVEL MID CH



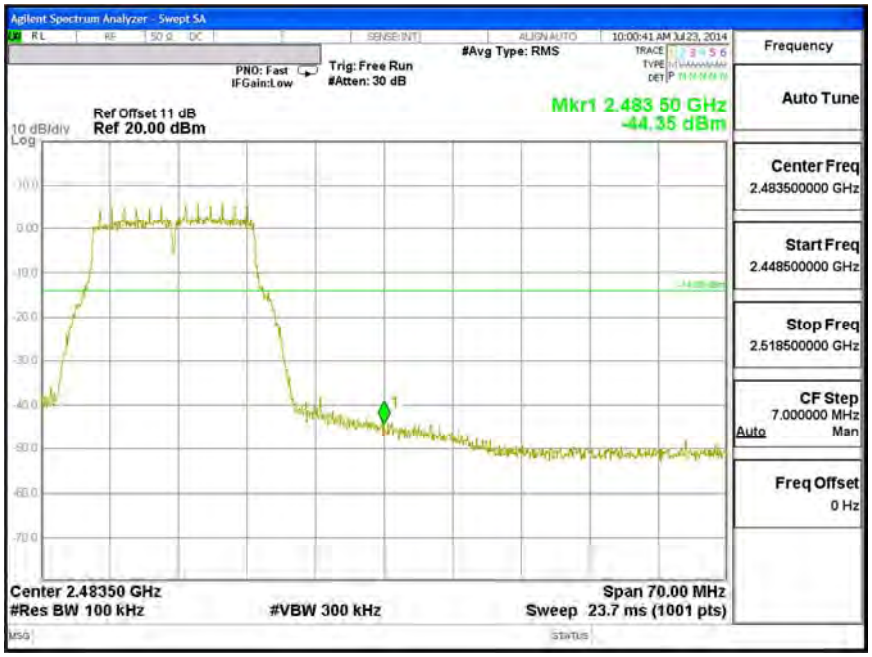
LOW CHANNEL BANDEDGE

AUTHORIZED BAND EDGE LOW CH

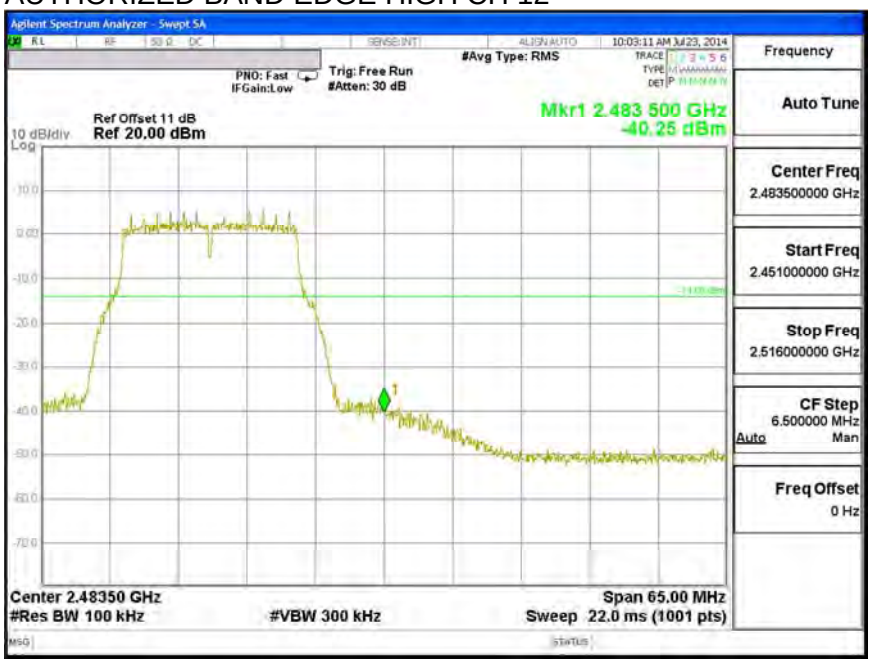


HIGH CHANNEL BANDEDGE

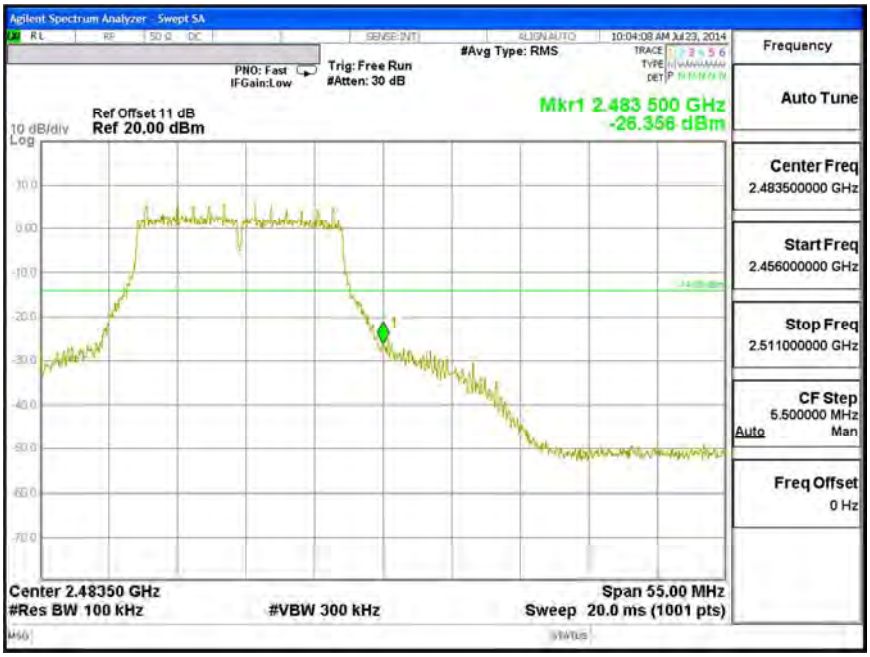
AUTHORIZED BAND EDGE HIGH CH 11



AUTHORIZED BAND EDGE HIGH CH 12

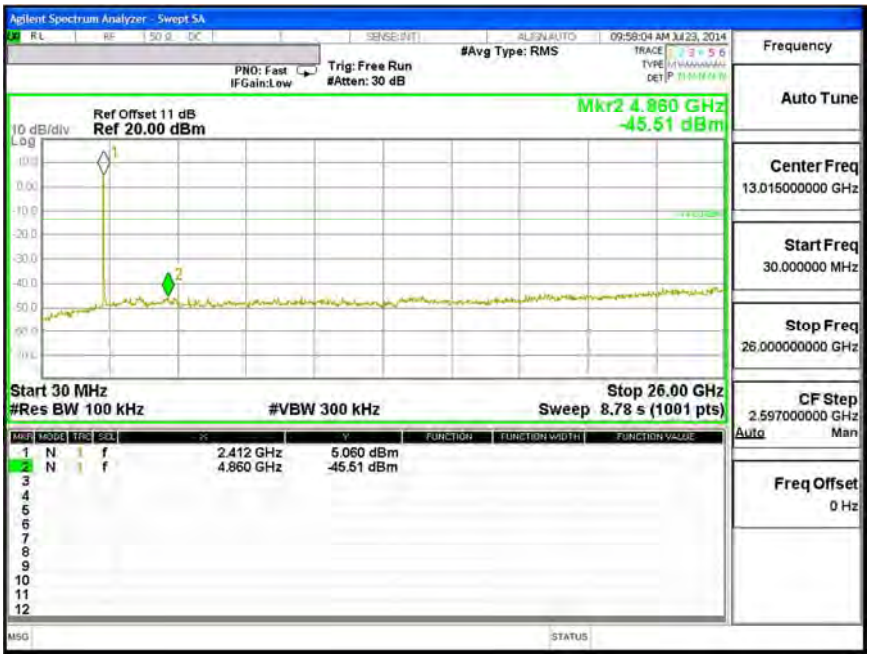


AUTHORIZED BAND EDGE HIGH CH 13



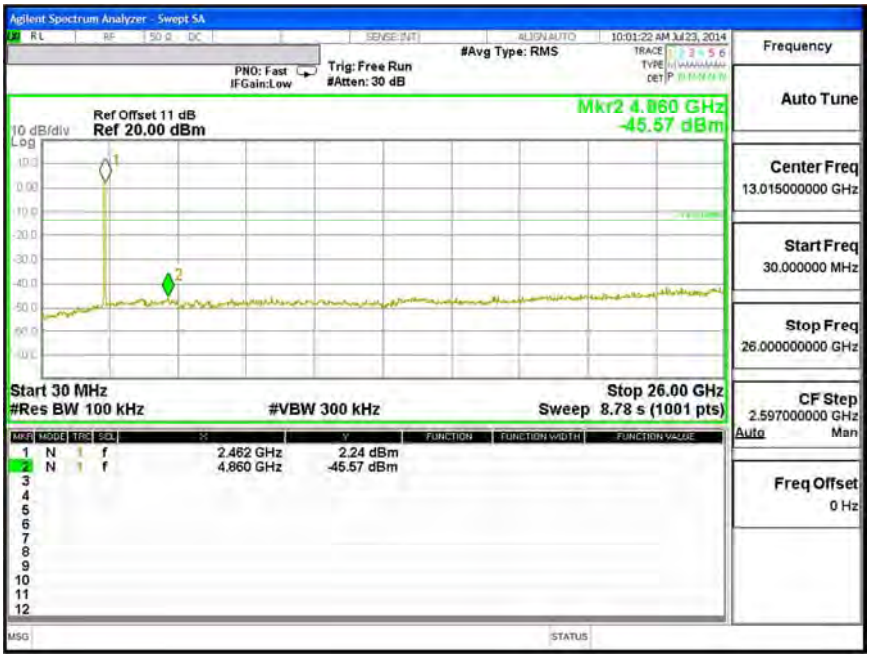
OUT-OF-BAND EMISSIONS

OUT OF BAND LOW CH



OUT OF BAND MID CH

OUT OF BAND HIGH CH 11



OUT OF BAND HIGH CH 12

OUT OF BAND HIGH CH 13

9.3. 802.11n HT20 2Tx (ANTENNA A & ANTENNA C) MIMO MODE IN THE 2.4 GHz BAND

9.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

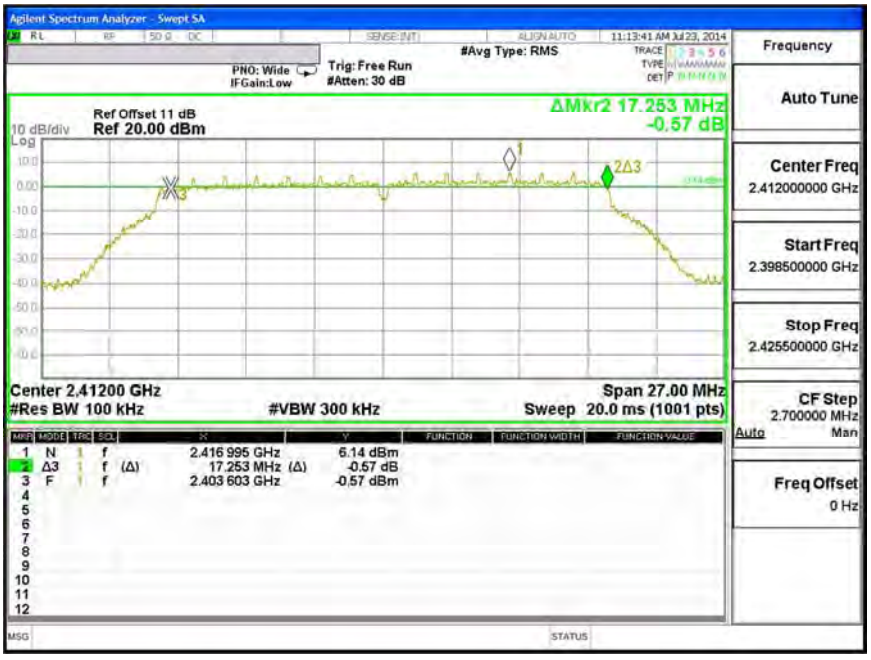
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth Antenna C (MHz)	6 dB Bandwidth Antenna A (MHz)	Minimum Limit (MHz)
Low	2412	17.253	17.037	0.5
Mid	2437	17.712	17.685	0.5
High	2462	17.712	17.739	0.5
High	2467	17.766	17.685	0.5
High	2472	17.604	17.712	0.5

ANTENNA C 6 dB BANDWIDTH

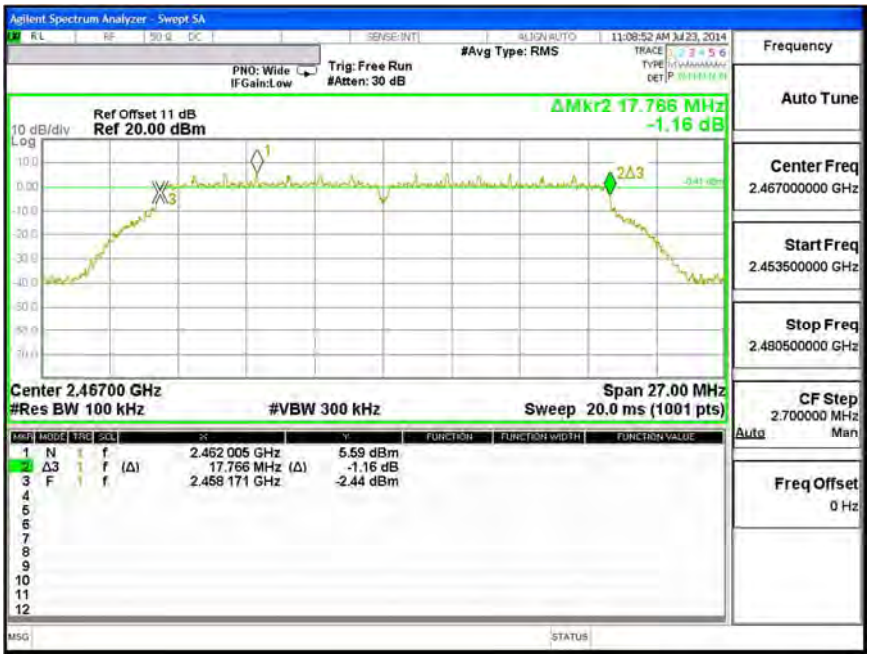
6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH 11

6 dB BANDWIDTH HIGH CH 12



6 dB BANDWIDTH HIGH CH 13

ANTENNA A 6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH

6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH 11

6 dB BANDWIDTH HIGH CH 12

6 dB BANDWIDTH HIGH CH 13

9.3.2. 99% BANDWIDTH

LIMITS

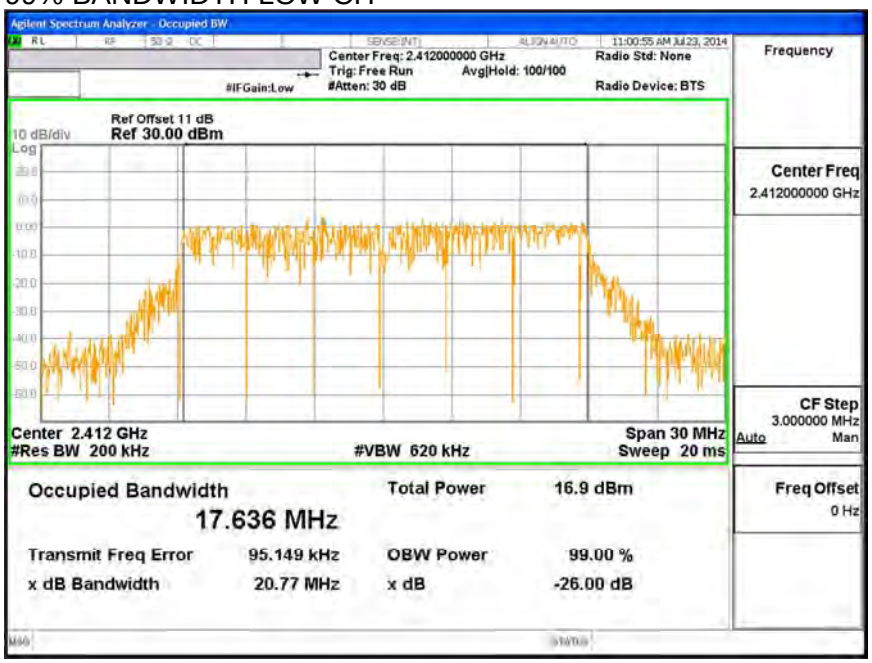
None; for reporting purposes only.

RESULTS

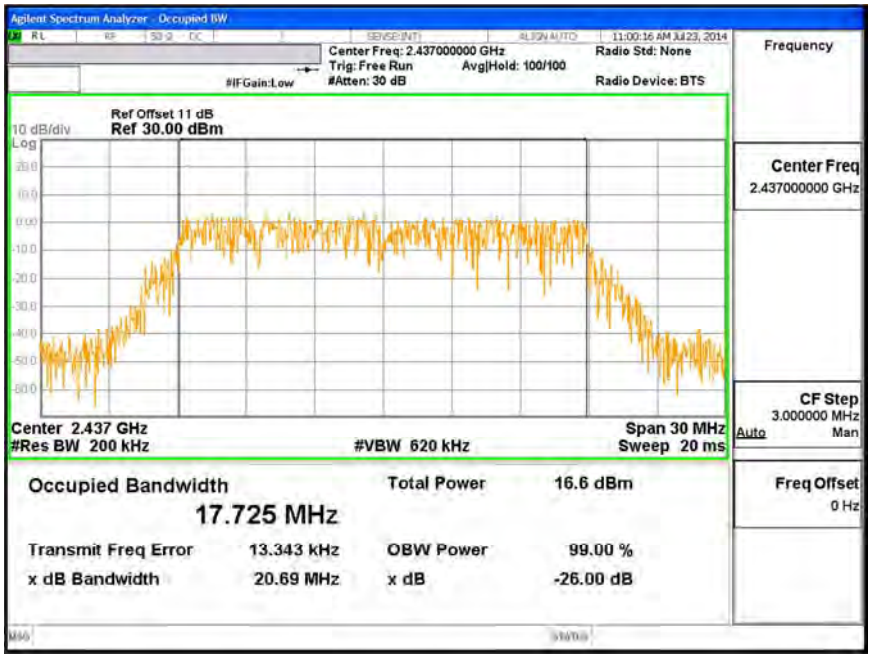
Channel	Frequency (MHz)	99% Bandwidth Antenna C (MHz)	99% Bandwidth Antenna A (MHz)
Low	2412	17.636	17.788
Mid	2437	17.725	17.749
High	2462	17.689	17.742
High	2467	17.798	17.661
High	2472	17.646	17.740

ANTENNA C 99% BANDWIDTH

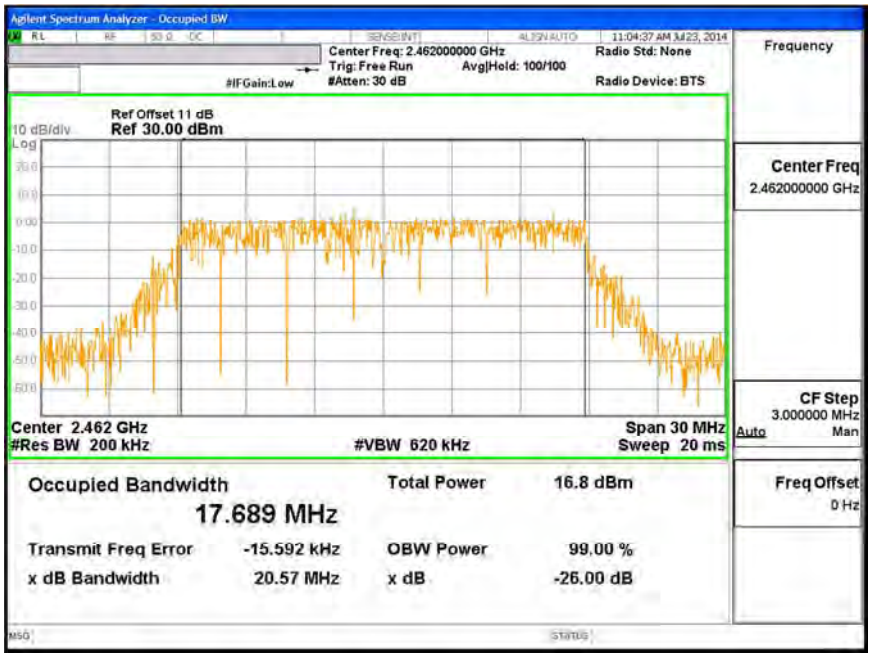
99% BANDWIDTH LOW CH



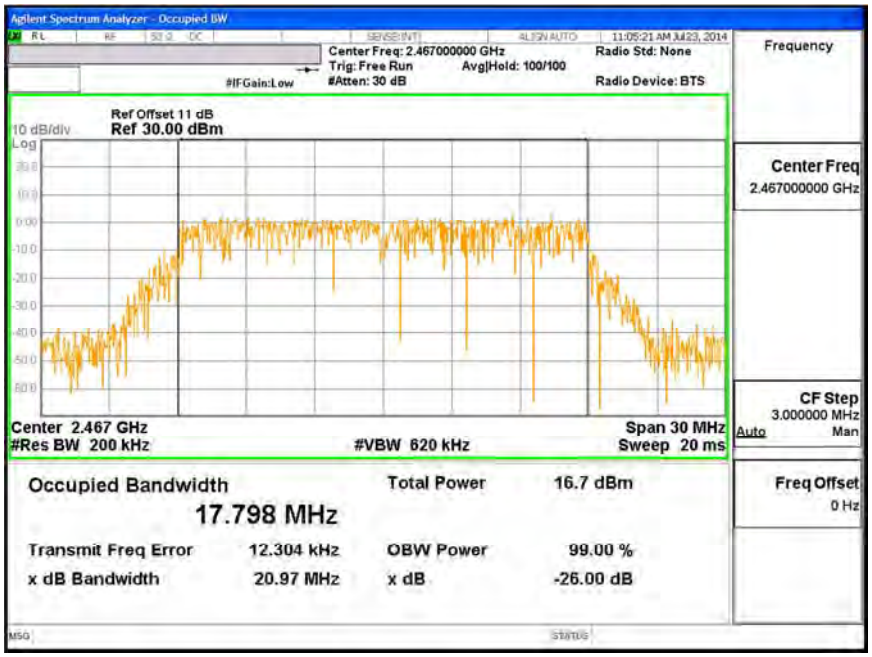
99% BANDWIDTH MID CH



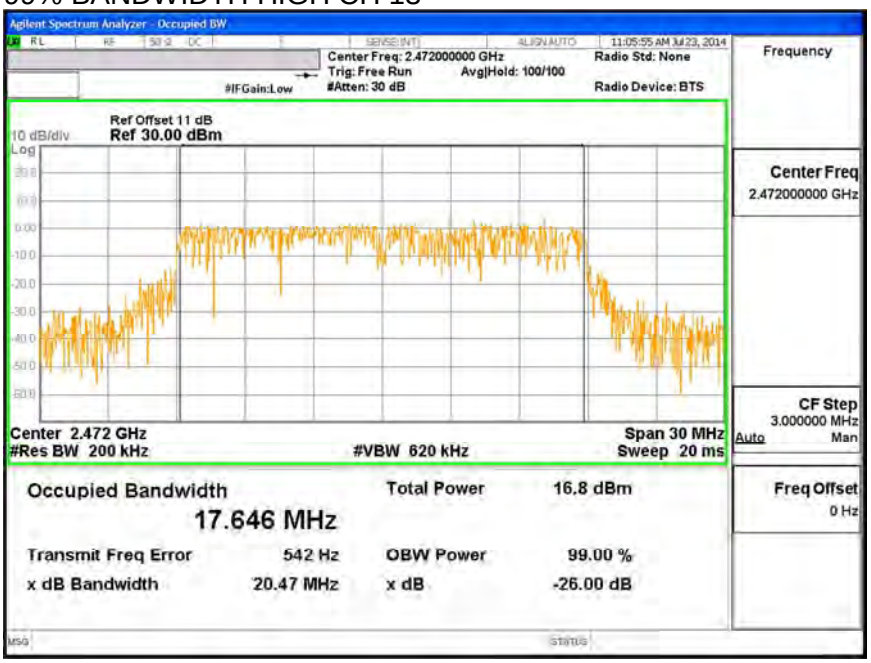
99% BANDWIDTH HIGH CH 11



99% BANDWIDTH HIGH CH 12

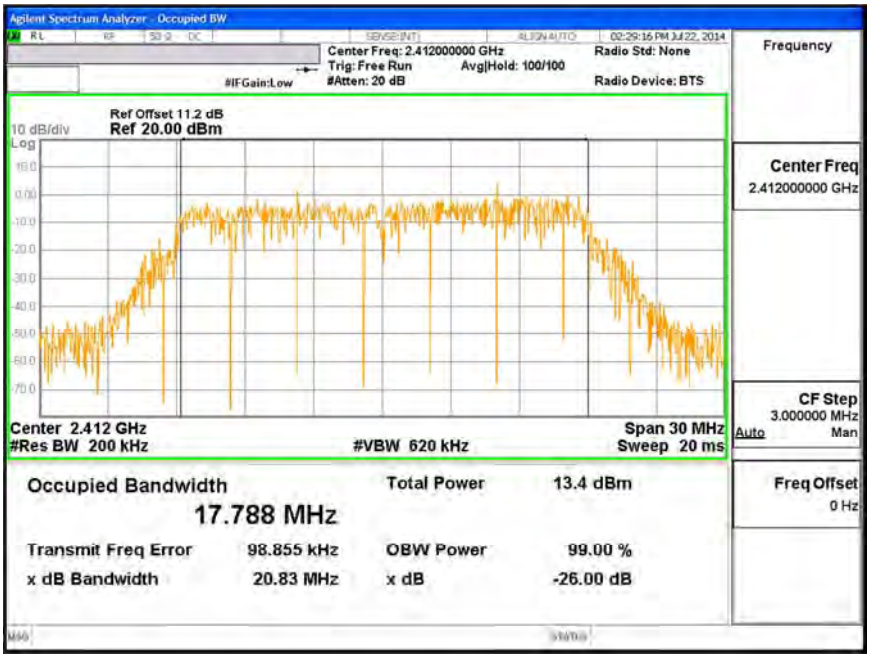


99% BANDWIDTH HIGH CH 13

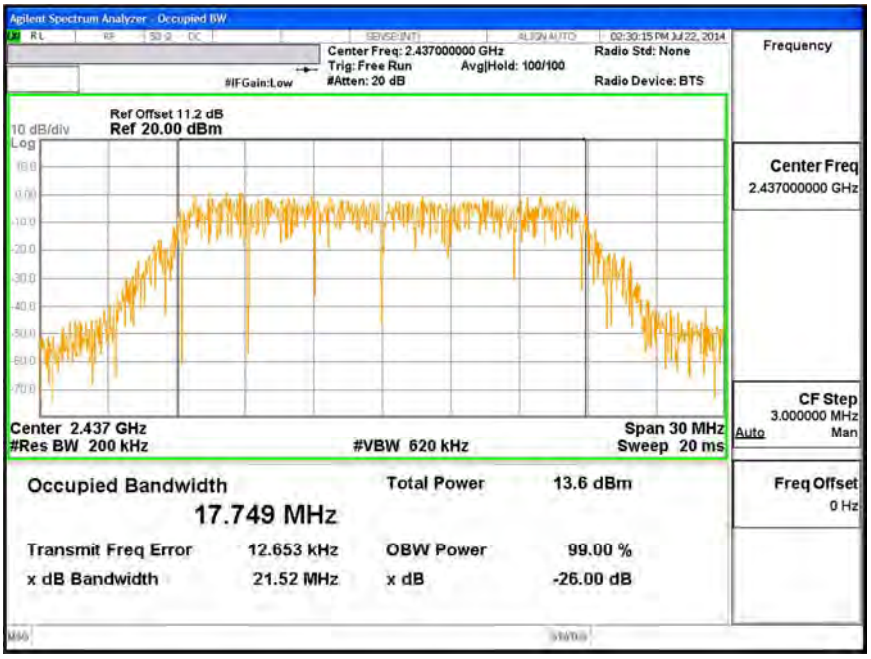


ANTENNA A 99% BANDWIDTH

99% BANDWIDTH LOW CH

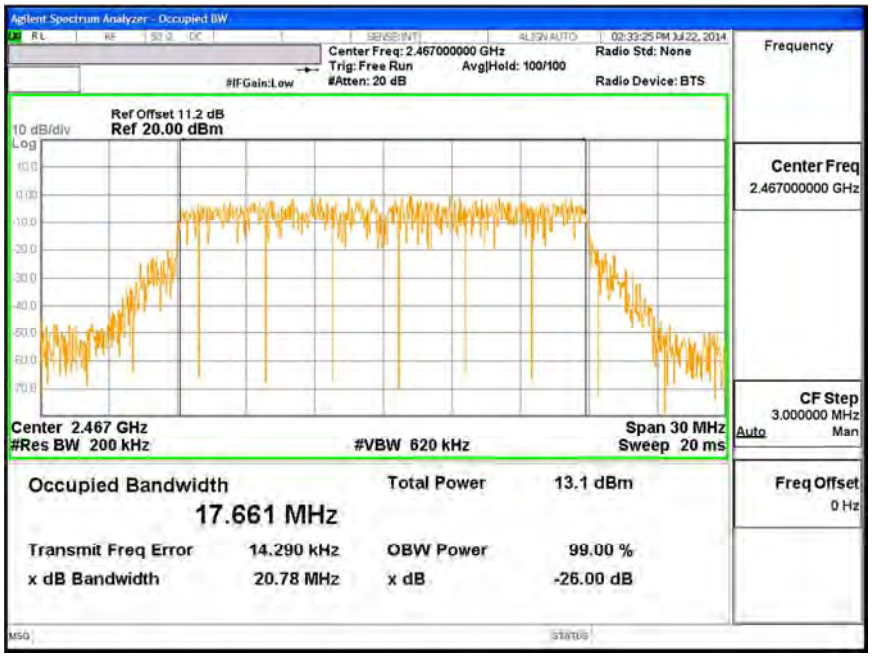


99% BANDWIDTH MID CH

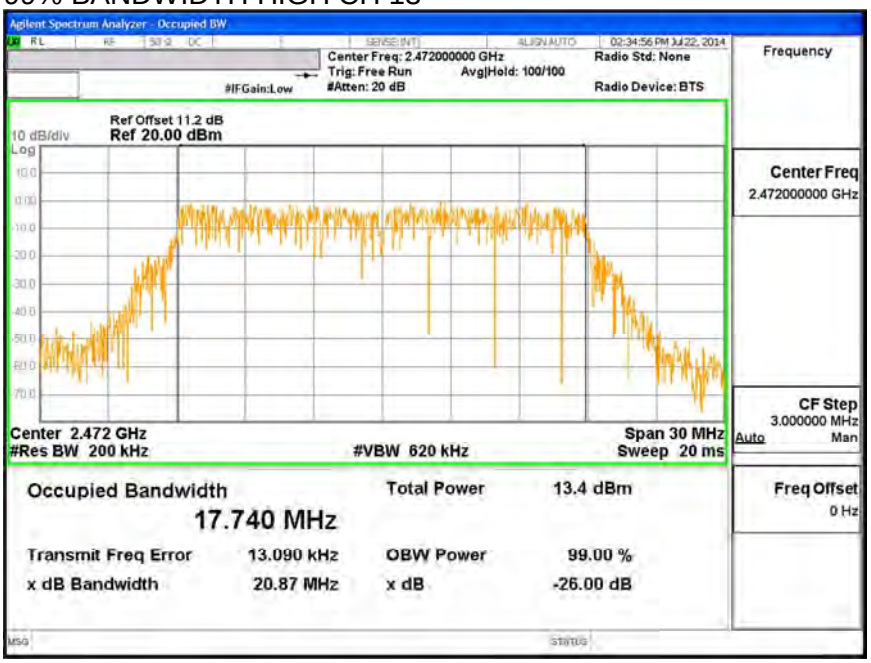


99% BANDWIDTH HIGH CH 11

99% BANDWIDTH HIGH CH 12



99% BANDWIDTH HIGH CH 13



9.3.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power Antenna C (dBm)	Power Antenna A (dBm)
Low	2412	15.97	12.90
Mid	2437	15.96	12.95
High	2462	12.93	12.96
High	2467	9.45	9.31
High	2472	2.93	2.96

9.3.4. OUTPUT POWER

LIMITS

FCC §15.247

For systems using digital modulation in the 2400–2483.5 MHz, band: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

Antenna C Antenna Gain (dBi)	Antenna A Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
-1.55	2.01	0.58

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	0.58	30.00	30	36	30.00
Mid	2437	0.58	30.00	30	36	30.00
High	2462	0.58	30.00	30	36	30.00
High	2467	0.58	30.00	30	36	30.00
High	2472	0.58	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Antenna C Meas Power (dBm)	Antenna A Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	22.41	20.61	24.61	30.00	-5.39
Mid	2437	22.48	21.04	24.83	30.00	-5.17
High	2462	19.74	20.39	23.09	30.00	-6.91
High	2467	17.02	16.41	19.74	30.00	-10.26
High	2472	9.43	9.47	12.46	30.00	-17.54

9.3.5. PSD

LIMITS

FCC §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.

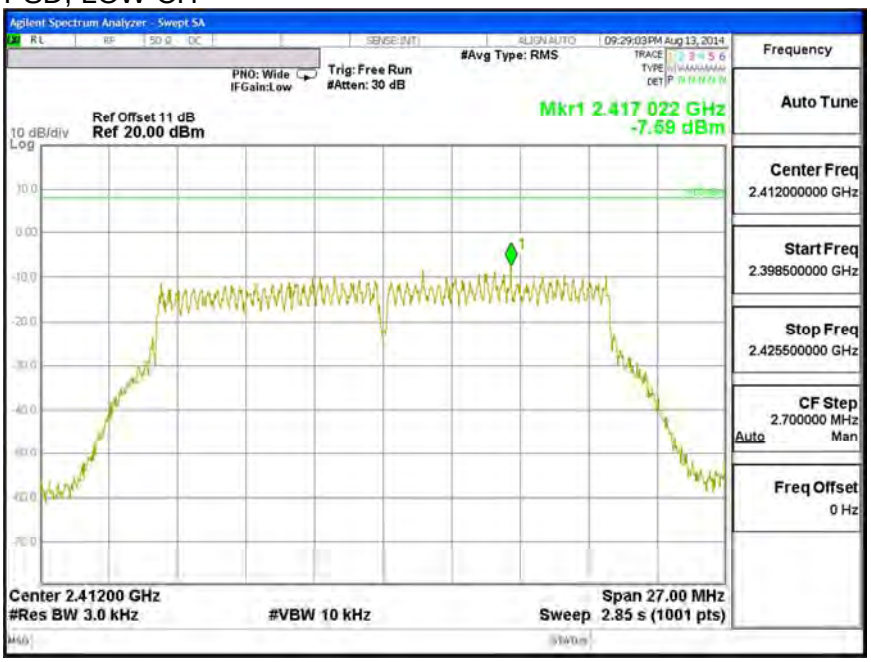
RESULTS

PSD Results

Channel	Frequency (MHz)	Antenna C Meas (dBm)	Antenna A Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-7.59	-11.66	-6.15	8.0	-14.2
Mid	2437	-9.05	-12.14	-7.32	8.0	-15.3
High	2462	-12.36	-11.88	-9.10	8.0	-17.1
High	2467	-15.64	-16.05	-12.83	8.0	-20.8
High	2472	-22.51	-22.56	-19.52	8.0	-27.5

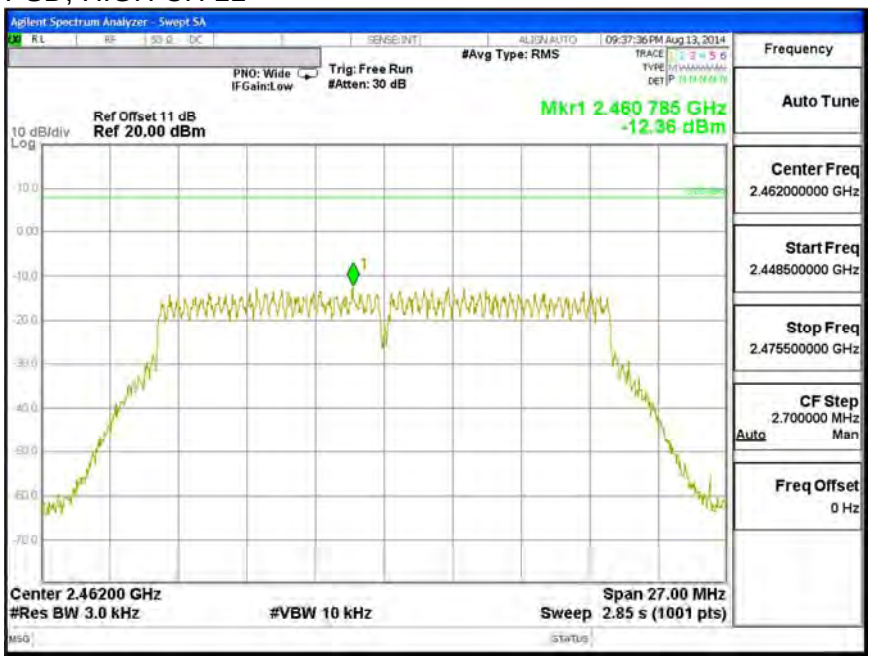
PSD, ANTENNA C

PSD, LOW CH

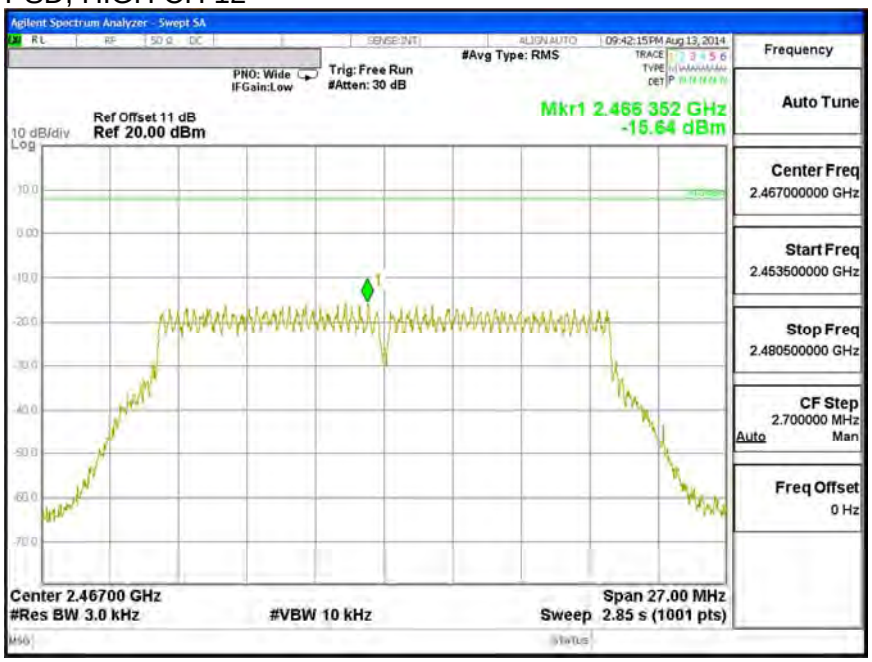


PSD, MID CH

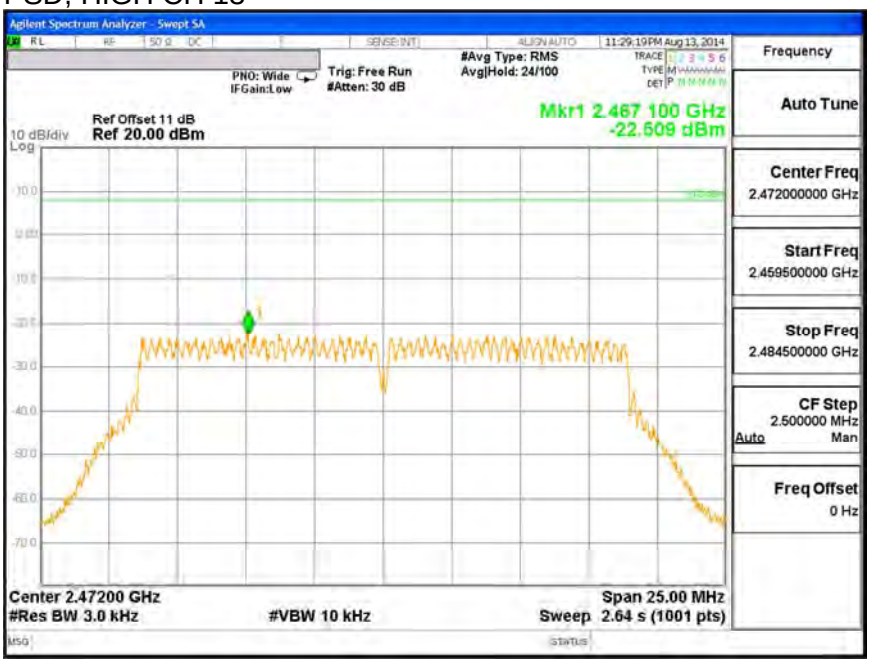
PSD, HIGH CH 11



PSD, HIGH CH 12

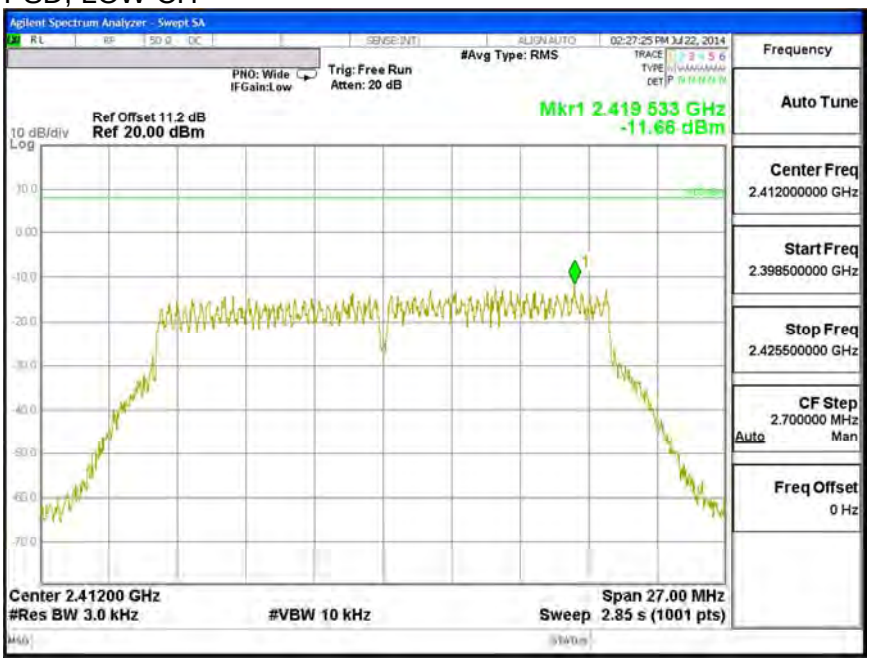


PSD, HIGH CH 13



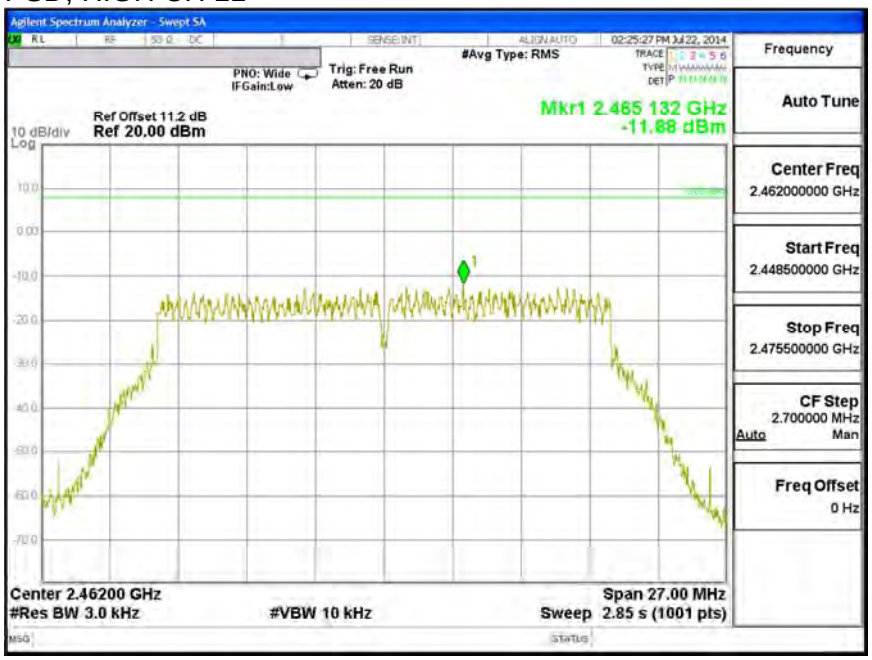
PSD, ANTENNA A

PSD, LOW CH

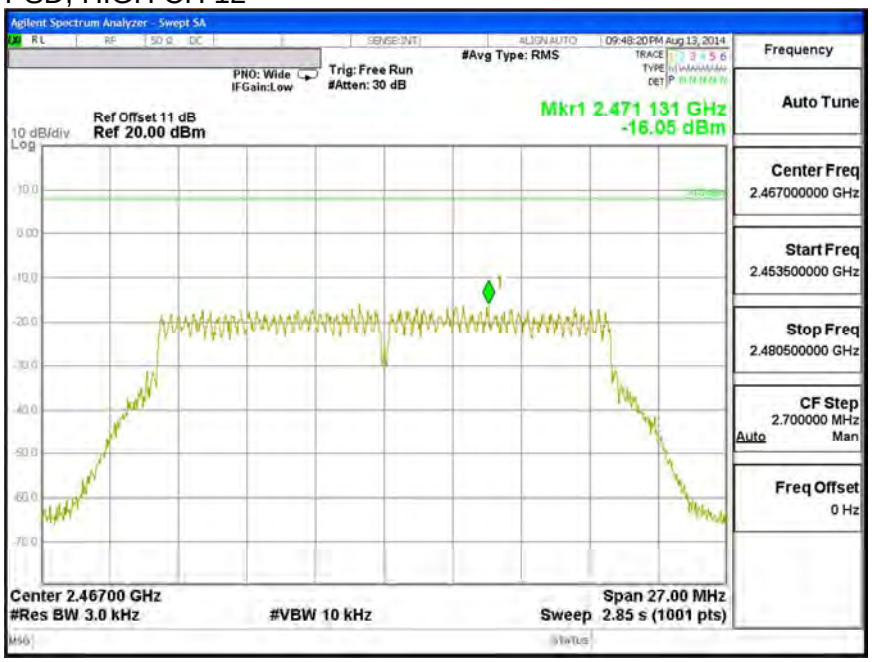


PSD, MID CH

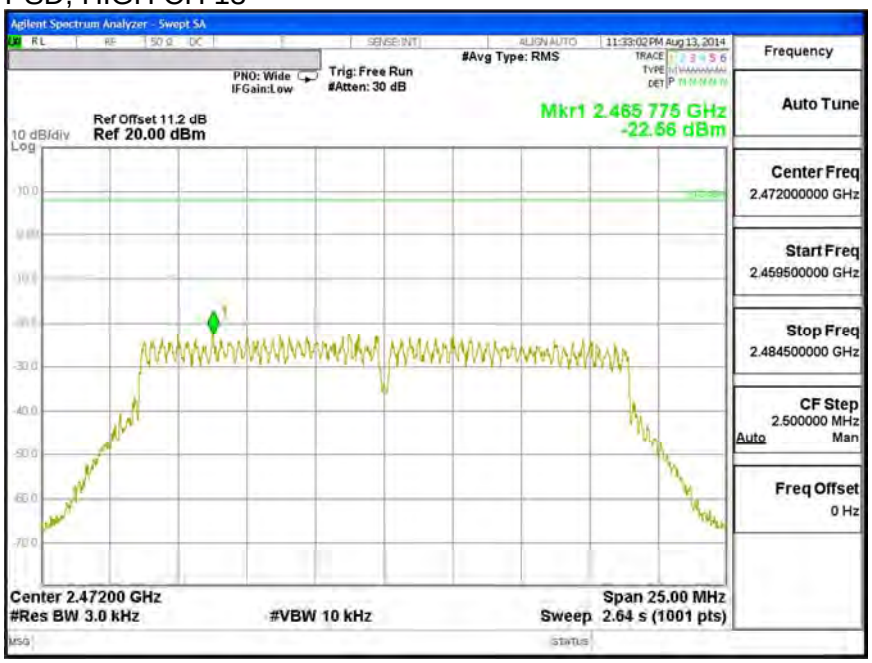
PSD, HIGH CH 11



PSD, HIGH CH 12



PSD, HIGH CH 13



9.3.6. OUT-OF-BAND EMISSIONS

LIMITS

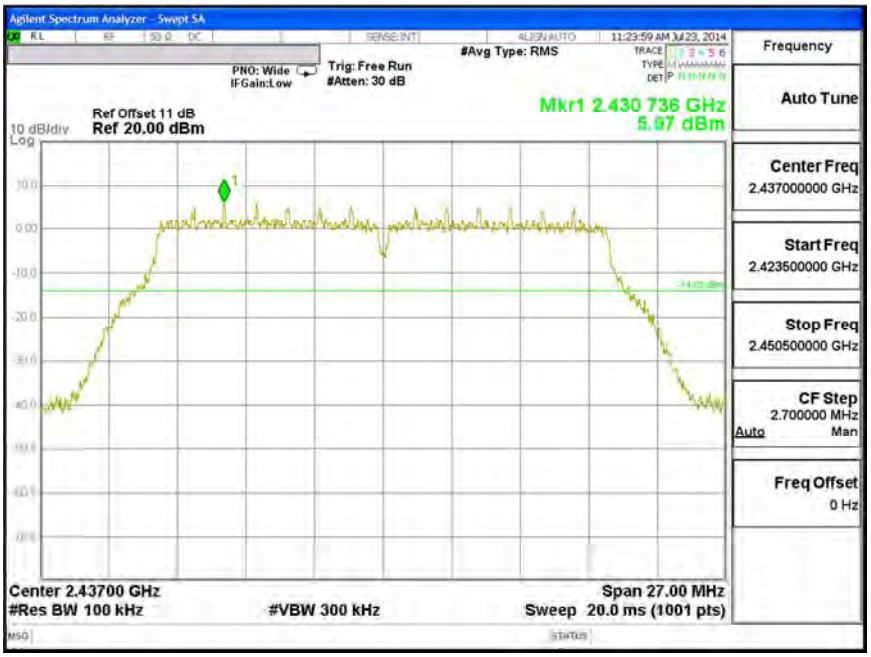
FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

ANTENNA C RESULTS

IN-BAND REFERENCE LEVEL

REFERENCE LEVEL MID CH



LOW CHANNEL BANDEDGE

AUTHORIZED BAND EDGE LOW CH