CERTIFICATION TEST REPORT

Report Number. : 11792137-E3V2

Applicant	:	APPLE, INC. 1 INFINITE LOOP CUPERTINO, CA 95014, U.S.A.
Model	:	A1901
FCC ID	:	BCG-E3175A
IC	:	579C-E3175A
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C INDUSTRY CANADA RSS - 247 ISSUE 2

Date Of Issue:
August 17, 2017

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/10/2017	Initial Issue	Francisco Guarnero
V2	8/17/2017	Addressed TCB Questions	Francisco Guarnero

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: SMARTPHONE

MODEL: A1901

SERIAL NUMBER: C39TX016J8QN

DATE TESTED: MAY 02, 2017 – JULY 26, 2017

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 2	Pass
INDUSTRY CANADA RSS-GEN Issue 4	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.

Approved & Released For
UL Verification Services Inc. By:

Chin Pang
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Prepared By:

Francisco Guarnero
PROJECT ENGINEER
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, KDB 558074 D01 v04, ANSI C63.10-2013, MIMO KDB 662911, RSS-GEN Issue 4, and RSS-247 Issue 2.

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 (IC:2324B-1)	☐ Chamber D (IC: 22541-1)
☐ Chamber B (IC:2324B-2)	☒ Chamber E (IC: 22541-2)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC: 22541-3)
	☒ Chamber G (IC: 22541-4)
	☒ Chamber H (IC: 22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

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
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB
Occupied Channel Bandwidth	±0.39 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The equipment under test is a mobile phone with GSM, GPRS, EGPRS, UMTS, LTE and TD-SCDMA technologies. It also supports IEEE 802.11a/b/g/n/ac, Bluetooth®, GPS and NFC. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not user accessible.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted peak output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11b 1TX	25.3	338.84
2412 - 2472	802.11g 1TX	Covered by HT20 1TX	
2412 - 2472	802.11g 2TX	Covered by HT20 2TX CDD	
2412 - 2472	802.11n HT20 1TX	27.87	612.35
2412 - 2472	802.11n HT20 2TX CDD	29.84	963.83

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)	
	UAT 1	LAT 3
2.4	-1.67	-4.42

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was version 13.10.452.12

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated band edge, harmonic, and spurious emissions from 1GHz to 18GHz were performed with the EUT set to transmit at highest power on Low/Middle/High channels.

Radiated emissions below 30MHz, below 1GHz, above 18GHz and power line conducted emissions were performed with the EUT transmits at the channel with the highest output power as worst-case scenario.

For g and HT20 modes, radiated harmonics spurious and power line conducted emissions were performed with the EUT set at the CDD mode among the CDD/STBC/SDM modes with power setting equal or higher than SISO modes as worst-case scenario

The fundamental of the EUT was investigated in three orthogonal orientations, X (Flatbed), Y (Landscape), and Z (Portrait), on both UAT 1 and LAT 3 antennas. In addition, the EUT was also investigated with and without AC/DC charger, headphones & laptop. It was determined that Y (Landscape) orientation was worst-case orientation for both antennas without AC/DC charger, headphones, or laptop; therefore, all final radiated testing was performed with EUT only in Y orientation for 1 - 18GHz and 18 – 26GHz. EUT was tested with AC/DC charger for 30MHz – 1000MHz testing.

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 following modes have the same target power and use the same modulation (OFDM). Therefore, 802.11g 1TX and 802.11g 2TX are covered by 802.11n HT20 1TX and 802.11n HT20 2TX CDD respectively.

- 802.11g and 802.11n HT20 1TX
- 802.11g 2TX and 802.11n HT20 2TX CDD

For Radiated emissions, HT20 2TX CDD band edge and harmonic was used to cover HT20 1TX since both power are the same.

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
Laptop AC/DC adapter	Apple	A1344	T1580	NA
Laptop	Apple	A1278	C02HJ0A7DTY4	NA
DC power supply	Lambda	GEN 60-25	SCPV56329	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	Shielded	1	N/A
2	USB	1	USB	Shielded	1	Laptop to EUT
3	AC	1	AC	Un-shielded	3	N/A
4	Aligator clip	1	minigrabber	Un-Shielded	1	DC power supply to EUT

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
NA						

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	AC	Un-shielded	3	N/A

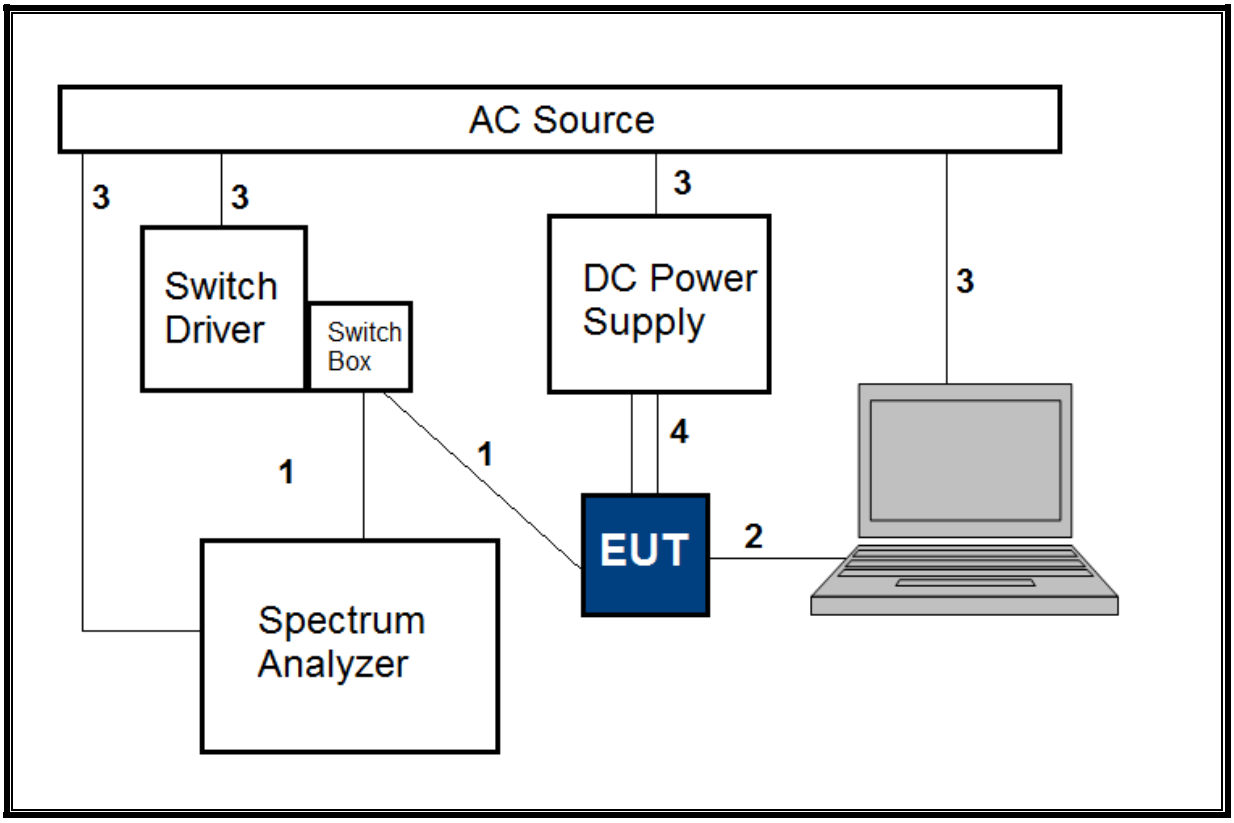
I/O CABLES (AC LINE CONDUCTED: LAPTOP CONFIGUARTION)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	3	N/A
2	USB	1	USB	Shielded	1	N/A

TEST SETUP

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

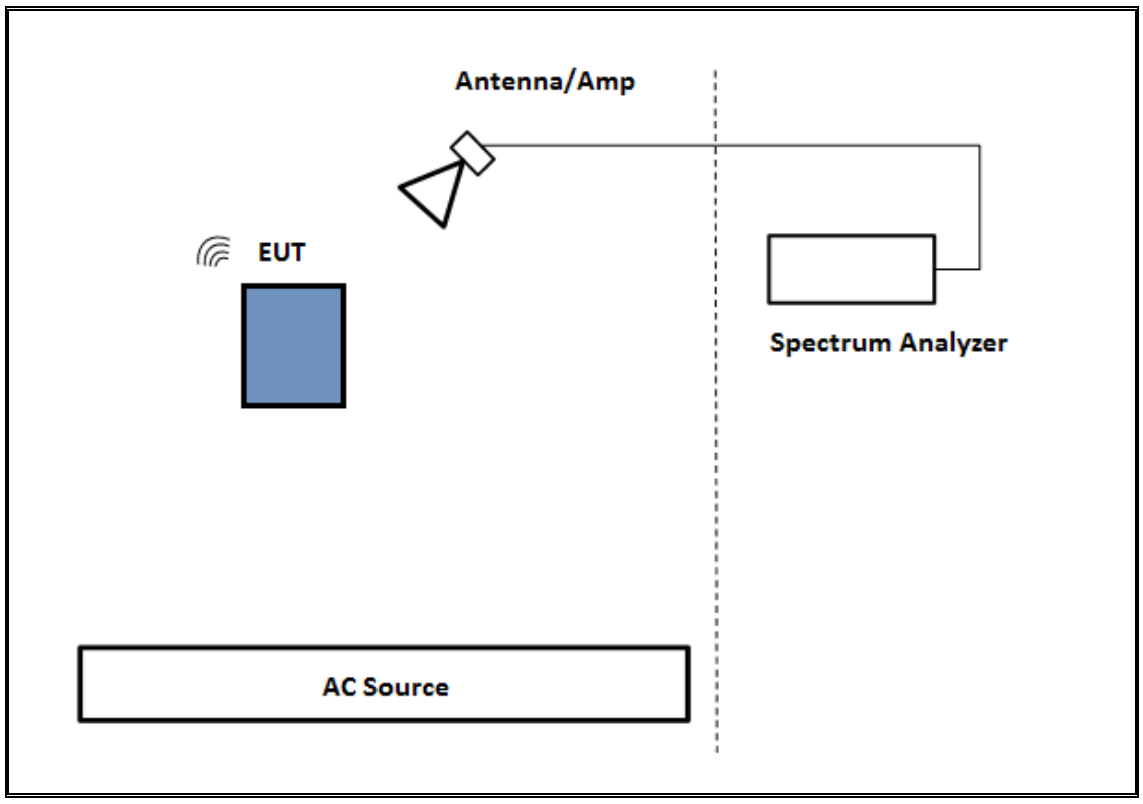
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

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

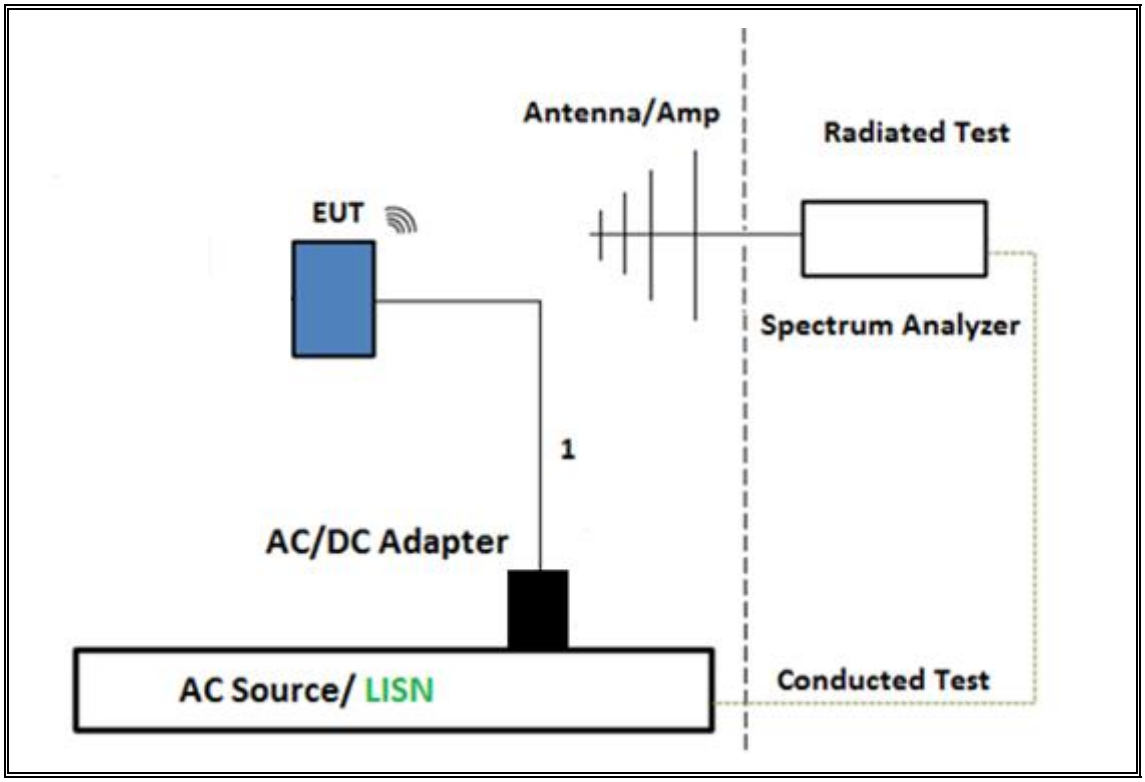
SETUP DIAGRAM



TEST SETUP- BELOW 1GHZ & AC LINE CONDUCTED TESTS

The EUT was powered by AC/DC adapter. Test software exercised the EUT.

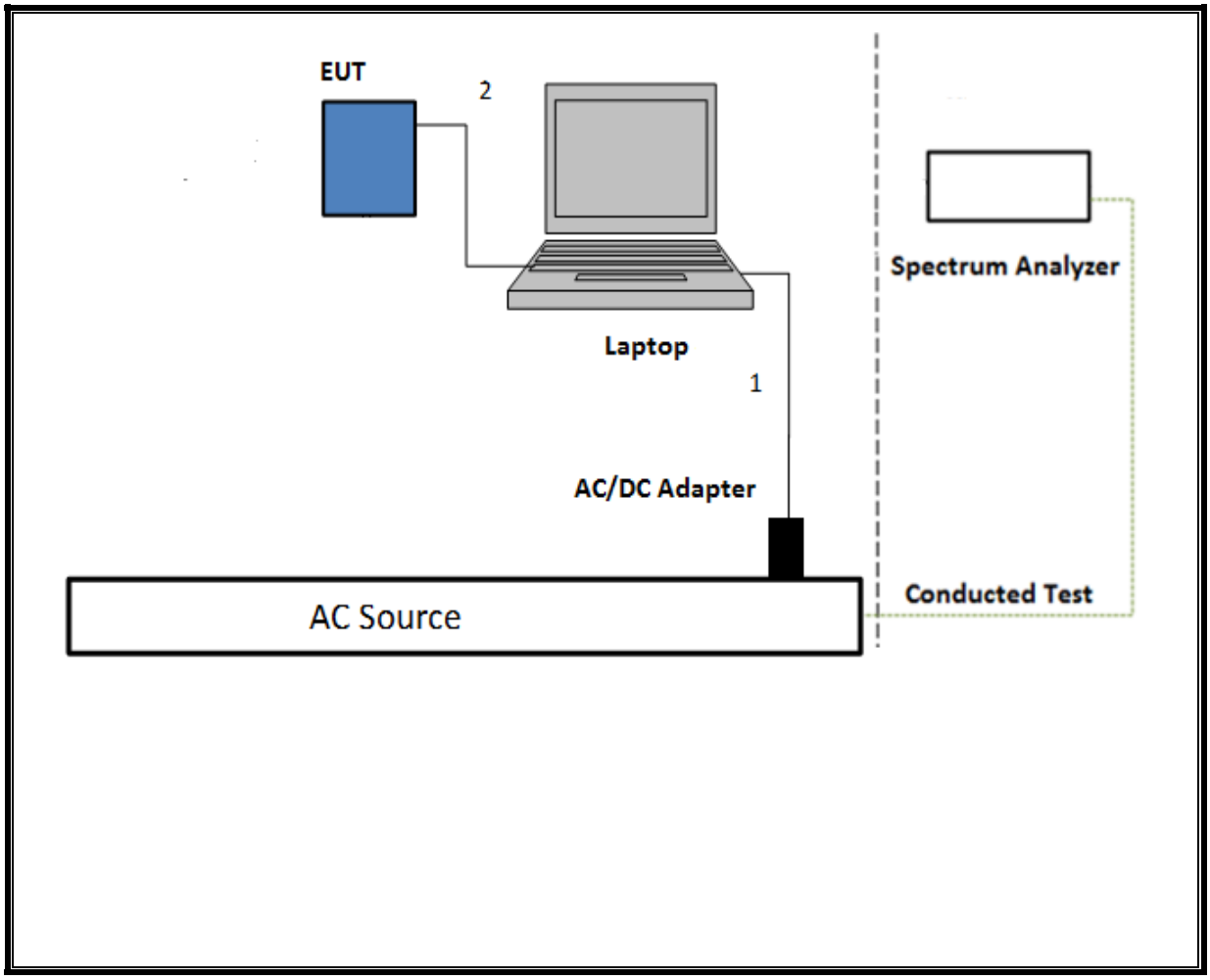
SETUP DIAGRAM



TEST SETUP- AC LINE CONDUCTED TEST (LAPTOP CONFIGURATION)

The EUT was tested connected to a host Laptop via USB cable. 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 1-18GHz	ETS Lindgren	3117	T344	4/20/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T407	4/14/2018
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T173	6/17/2017
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T740	11/29/17
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T340	12/14/2017
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T300	11/10/17
*Antenna, Horn 1-18GHz	ETS Lindgren	3117	T136	5/4/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T426	9/23/2017
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T243	10/11/2017
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T285	6/20/2017
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1113	12/20/2017
Antenna Horn, 18 to 26GHz	ARA	MWH-1826	T447	6/16/2017
Spectrum Analyzer, 40GHz	Agilent	8564E	T106	9/7/2017
Power Sensor	Keysight	N1921A	T1224	1/31/2018
Power Meter, P-series single channel	Keysight	N1912A	T1245	1/05/2018
*Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	7/5/2017
AC Line Conducted				
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T1436	01/06/2018
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T1124	10/07/2017
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T212	09/13/2017
*LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/08/2017
Power Cable, Line Conducted Emissions	UL	PG1	T861	9/1/2017
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, April 26, 2016	
Conducted Software	UL	UL EMC	Ver 5.4, October 13, 2016	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

NOTE: Equipment that calibrated during the testing period was set for test after the calibration.
*Testing is completed before equipment expiration date.

7. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v04, Section 8.1.

Output Power: KDB 558074 D01 v04, Section 9.1.3.

Power Spectral Density: KDB 558074 D01 v04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

Band-edge: KDB 558074 D01 v04, Section 12.1.

Conducted line emissions: C63.10, Clause 6.2

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

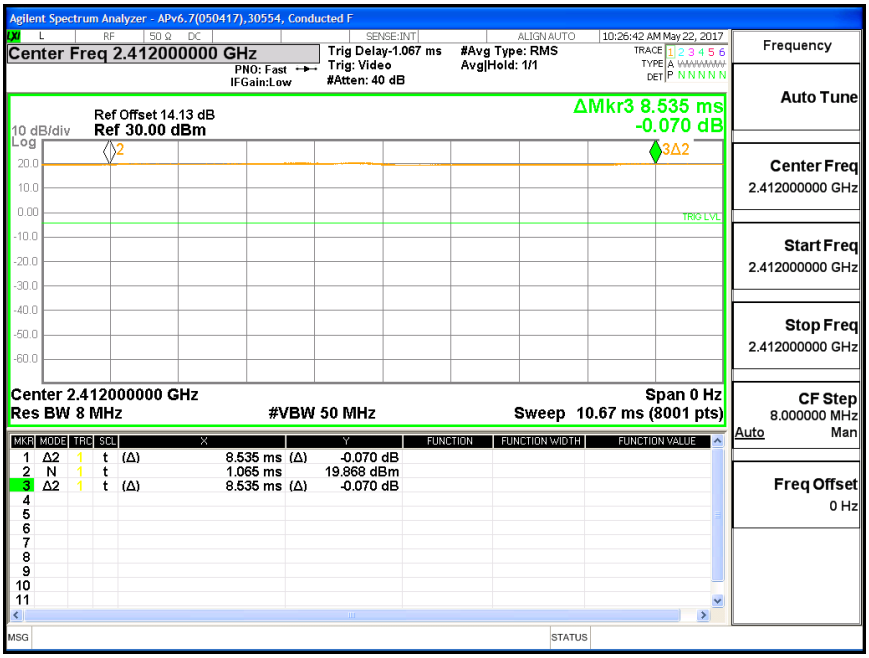
KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

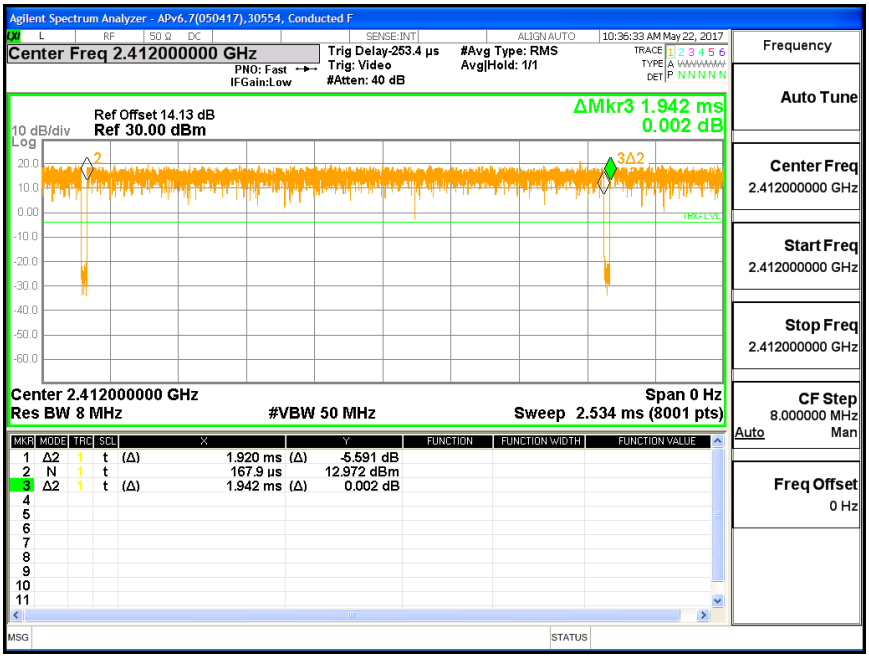
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11b 1TX	8.535	8.535	1.000	100.00%	0.00	0.010
802.11n HT20 1TX	1.920	1.942	0.989	98.87%	0.00	0.010
802.11n HT20 2TX CDD	1.920	1.942	0.989	98.87%	0.00	0.010

DUTY CYCLE PLOTS

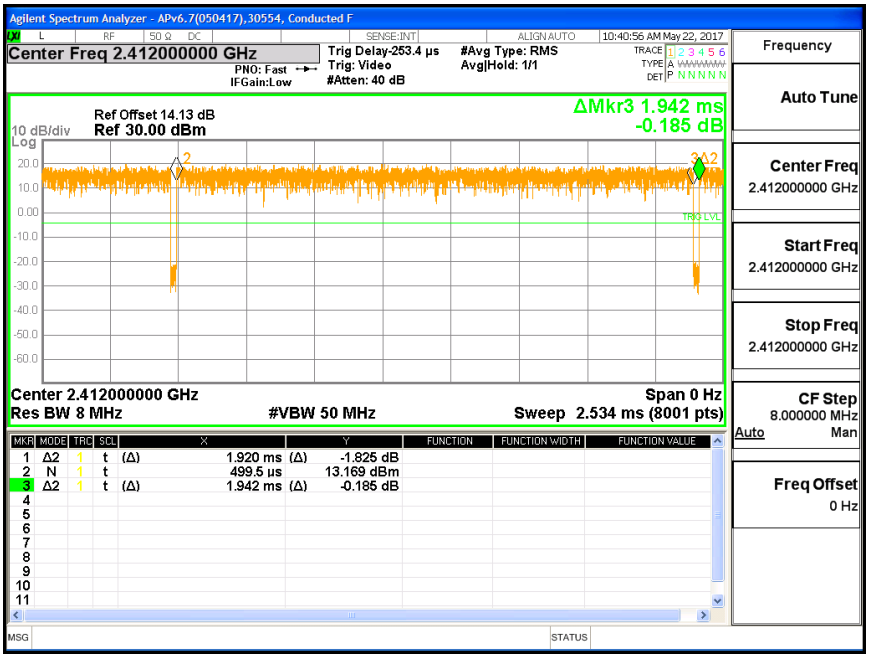
DUTY CYCLE 802.11b 1TX MODE



DUTY CYCLE 802.11n HT20 SISO



DUTY CYCLE 802.11n HT20 2TX



8.2. 11b UAT 1 SISO MODE IN THE 2.4GHz BAND

8.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

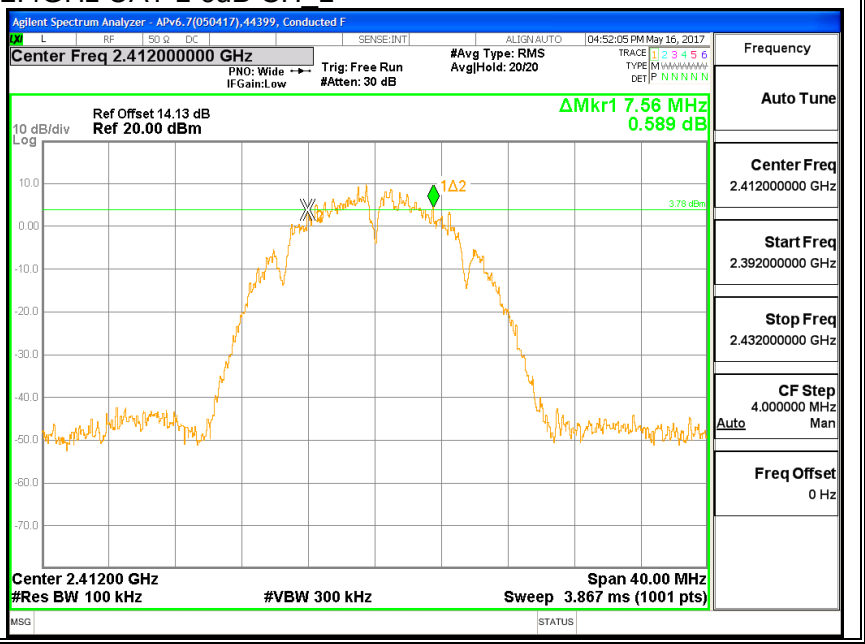
IC RSS-247 (5.2) (a)

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

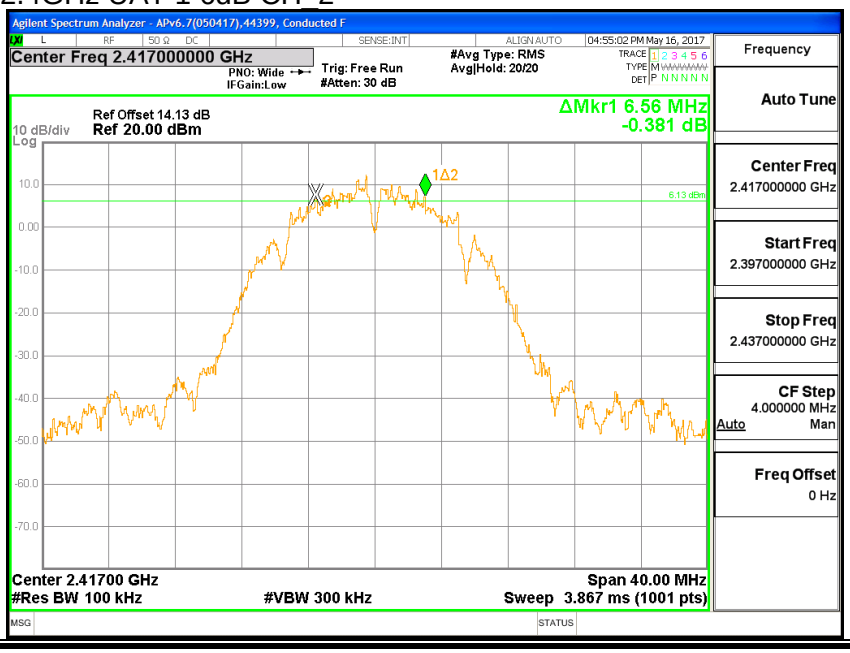
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low_1	2412	7.560	0.5
Low_2	2417	6.560	0.5
Middle_6	2437	8.560	0.5
High_10	2457	7.000	0.5
High_11	2462	8.160	0.5
High_12	2467	5.800	0.5
High_13	2472	8.600	0.5

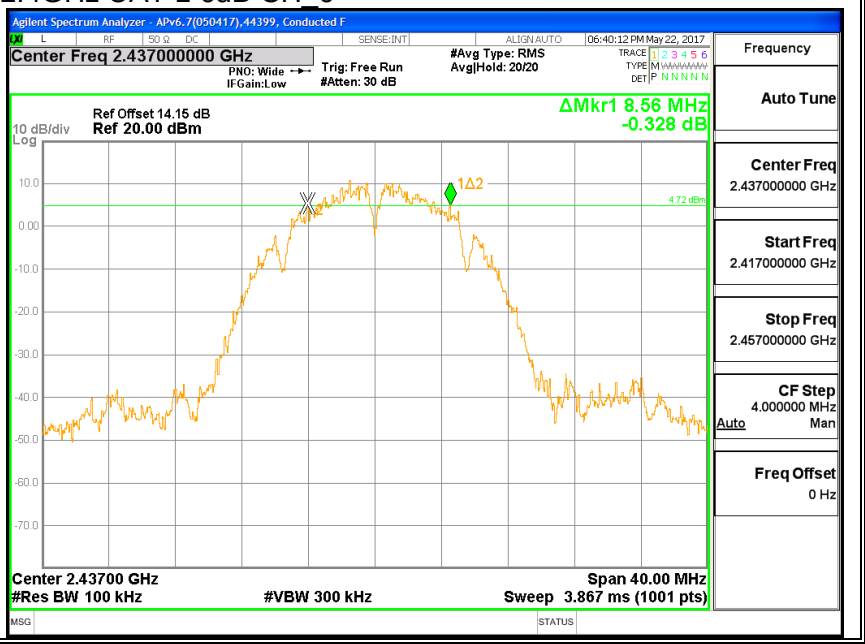
2.4GHz UAT 1 6dB CH_1



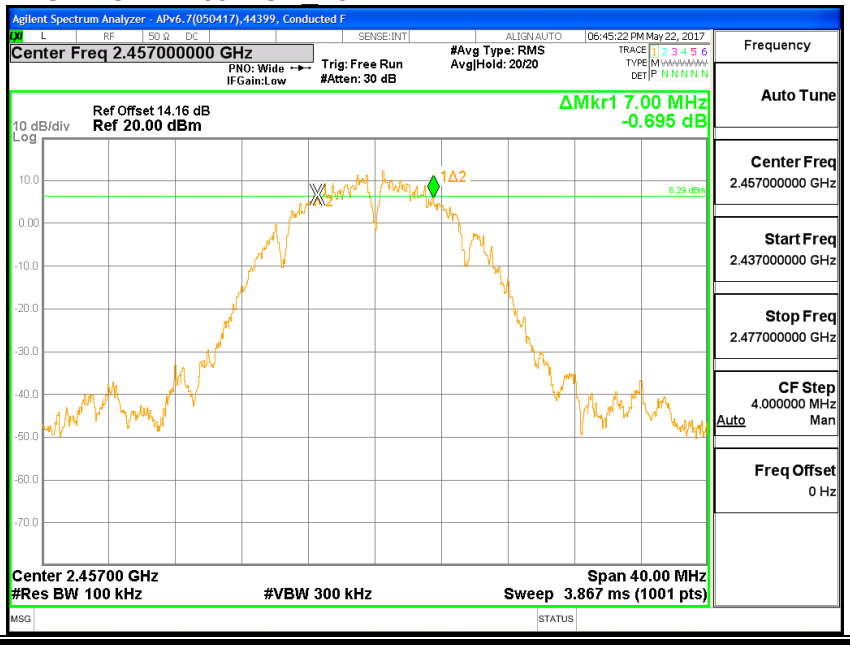
2.4GHz UAT 1 6dB CH_2



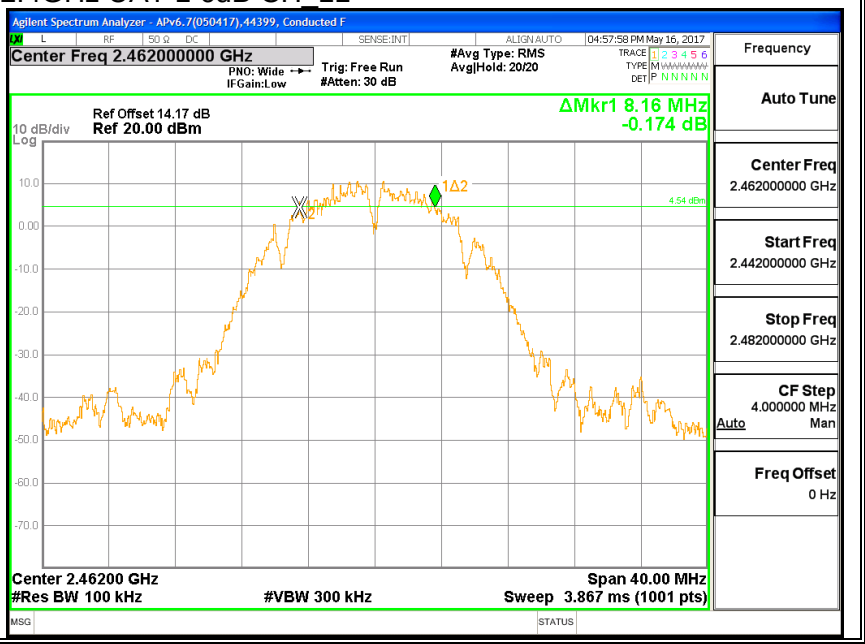
2.4GHz UAT 1 6dB CH_6



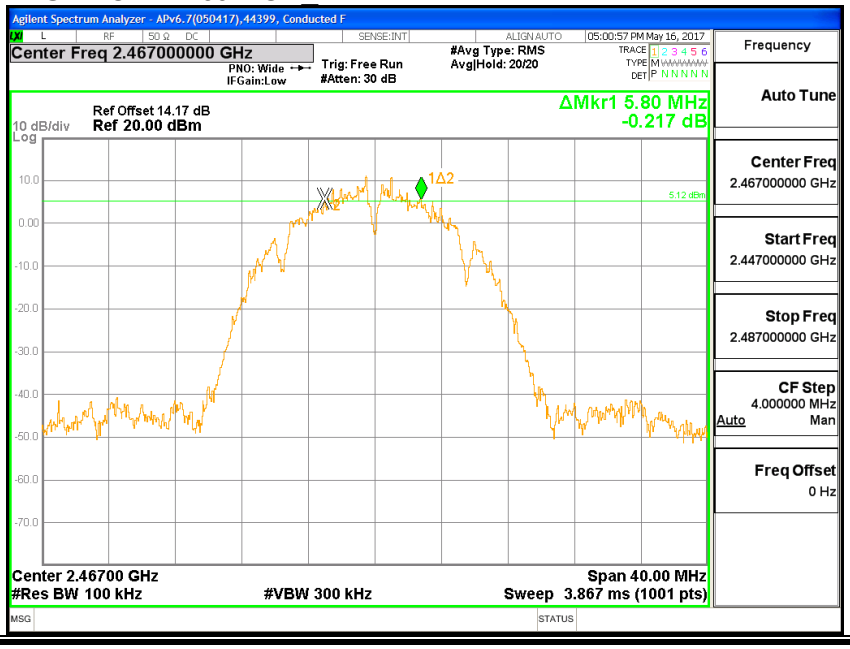
2.4GHz UAT 1 6dB CH_10



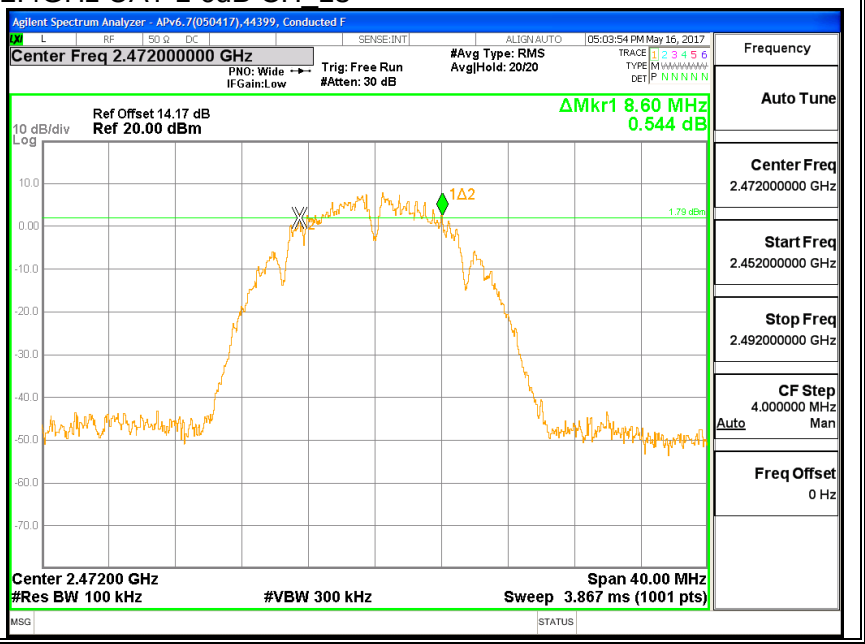
2.4GHz UAT 1 6dB CH_11



2.4GHz UAT 1 6dB CH_12



2.4GHz UAT 1 6dB CH_13



8.2.2. 99% BANDWIDTH

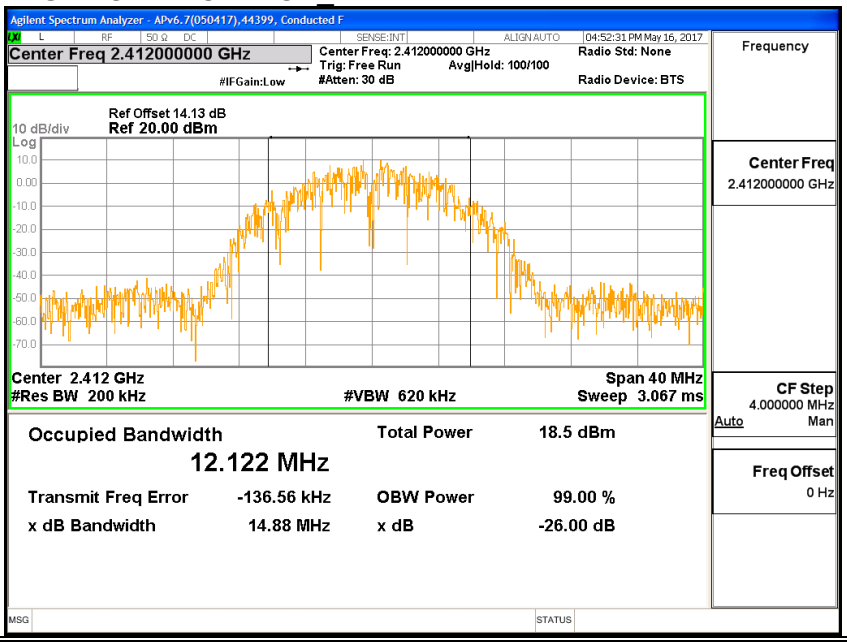
LIMITS

None; for reporting purposes only.

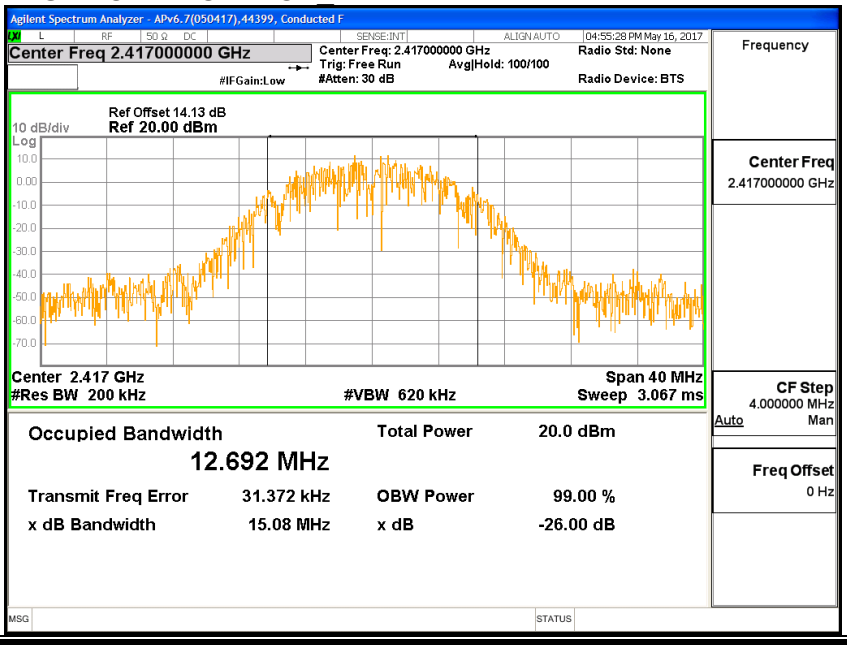
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low_1	2412	12.122
Low_2	2417	12.692
Middle_6	2437	12.825
High_10	2457	12.570
High_11	2462	12.671
High_12	2467	12.551
High_13	2472	12.659

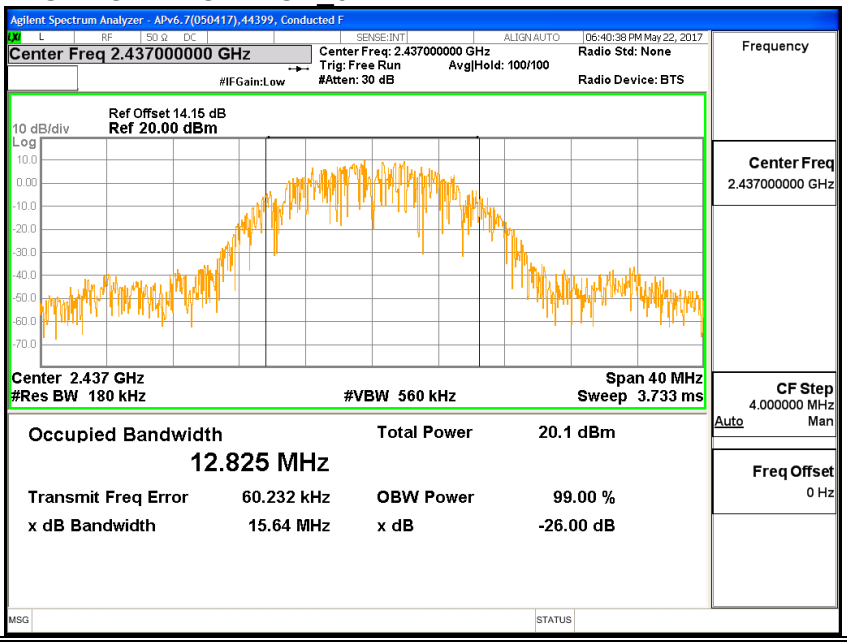
2.4GHz UAT 1 OBW CH_1



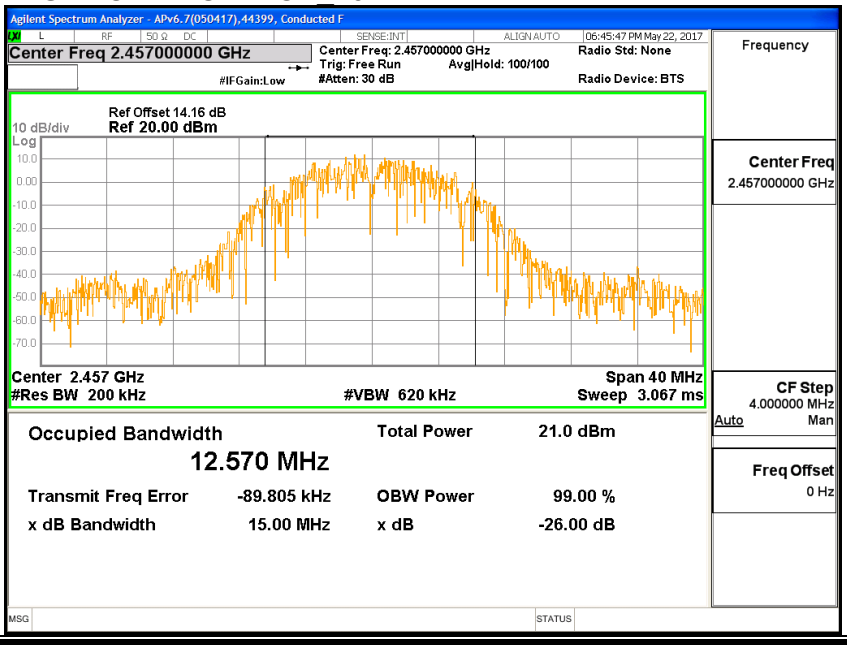
2.4GHz UAT 1 OBW CH_2



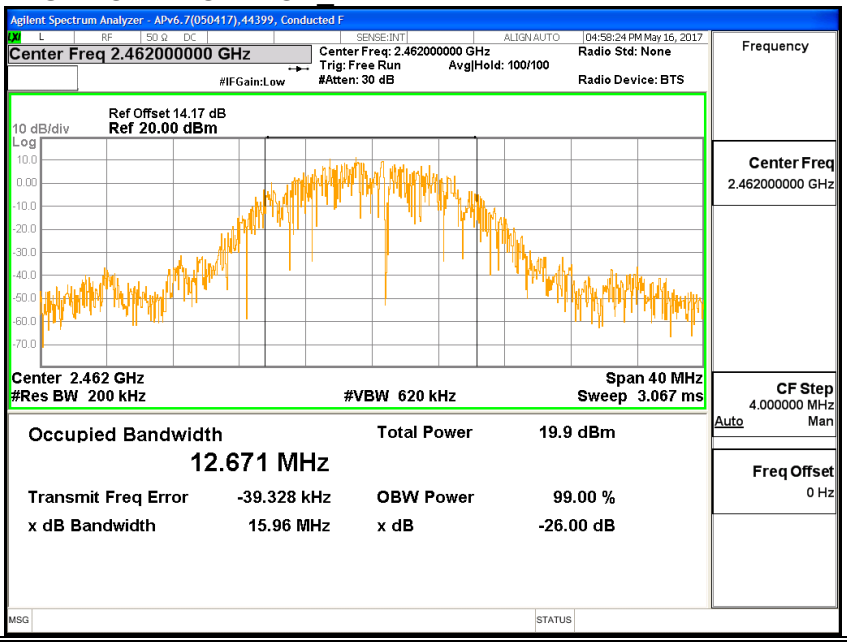
2.4GHz UAT 1 OBW CH_6



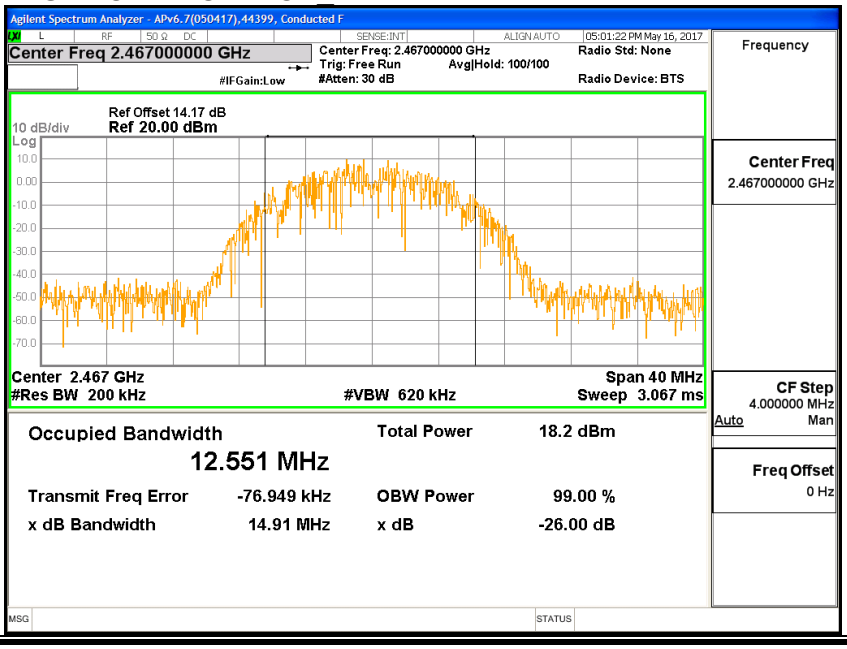
2.4GHz UAT 1 OBW CH_10



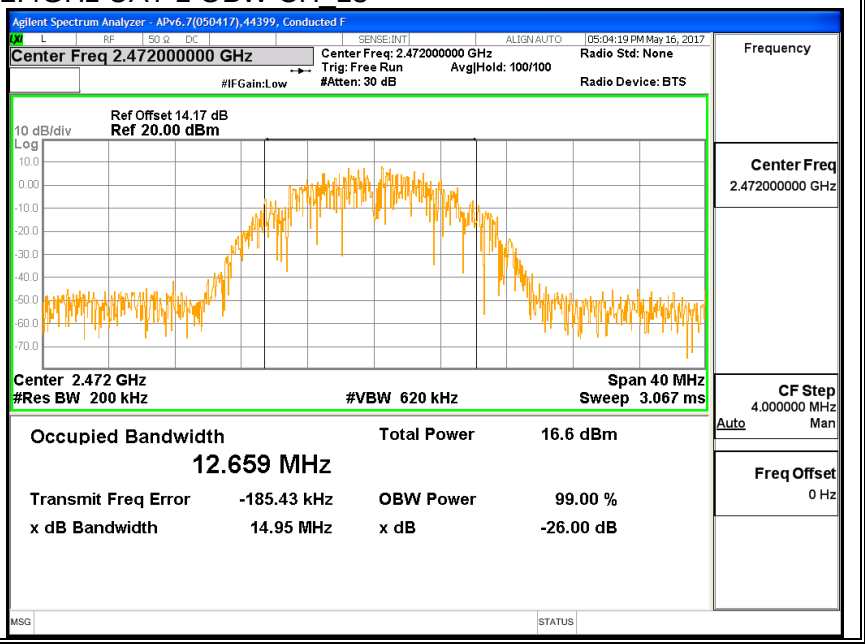
2.4GHz UAT 1 OBW CH_11



2.4GHz UAT 1 OBW CH_12



2.4GHz UAT 1 OBW CH_13



8.2.3. AVERAGE POWER

ID:	44366	Date:	7/25/17

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low_1	2412	20.28
Low_2	2417	21.77
Middle_6	2437	21.83
High_10	2457	21.84
High_11	2462	21.95
High_12	2467	20.32
High_13	2472	18.84

8.2.4. OUTPUT POWER

ID:	44366	Date:	7/25/17

LIMITS

FCC §15.247

IC RSS-247 (5.4) (d)

For systems using digital modulation in the 2400–2483.5 MHz, and 5725–5850 MHz bands: 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.

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-1.67	30.00	30	36	30.00
Low_2	2417	-1.67	30.00	30	36	30.00
Middle_6	2437	-1.67	30.00	30	36	30.00
High_10	2457	-1.67	30.00	30	36	30.00
High_11	2462	-1.67	30.00	30	36	30.00
High_12	2467	-1.67	30.00	30	36	30.00
High_13	2472	-1.67	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power

Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	23.75	23.75	30.00	-6.25
Low_2	2417	25.14	25.14	30.00	-4.86
Middle_6	2437	24.97	24.97	30.00	-5.03
High_10	2457	25.05	25.05	30.00	-4.95
High_11	2462	25.14	25.14	30.00	-4.86
High_12	2467	23.55	23.55	30.00	-6.45
High_13	2472	21.98	21.98	30.00	-8.02

8.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

IC RSS-247 (5.2) (b)

For digitally modulated systems, the power spectral density conducted form the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmissions.

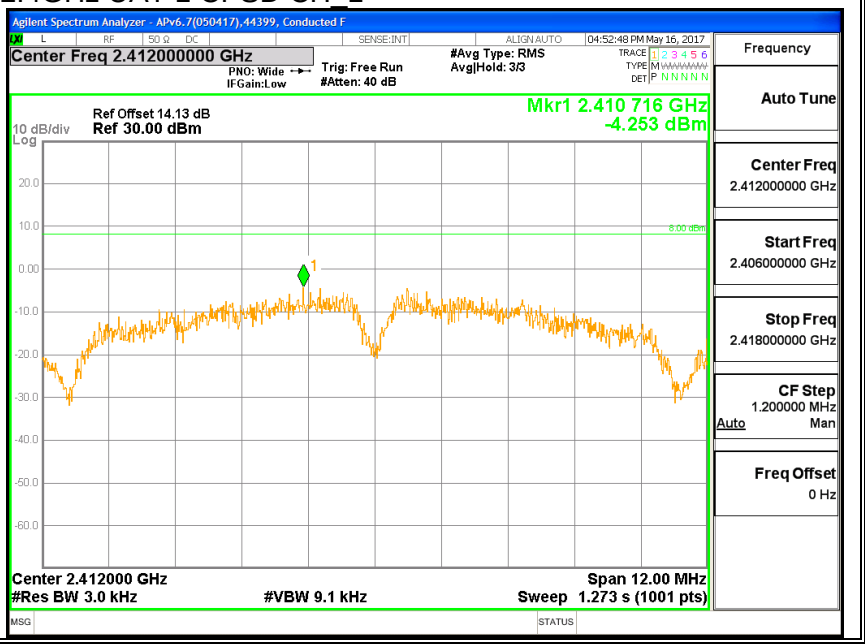
RESULTS

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

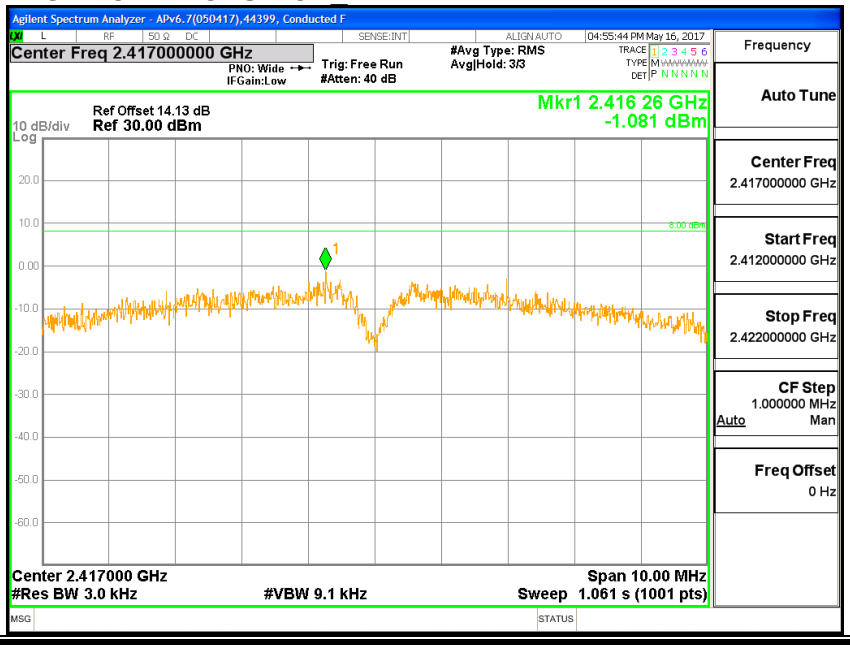
PSD Results

Channel	Frequency (MHz)	Meas (dBm)	Total Corr'd PSD (dBm/3KHz)	Limit (dBm)	Margin (dB)
Low_1	2412	-4.253	-4.253	8.0	-12.3
Low_2	2417	-1.081	-1.081	8.0	-9.1
Middle_6	2437	-2.419	-2.419	8.0	-10.4
High_10	2457	-0.934	-0.934	8.0	-8.9
High_11	2462	-2.558	-2.558	8.0	-10.6
High_12	2467	-3.024	-3.024	8.0	-11.0
High_13	2472	-3.425	-3.425	8.0	-11.4

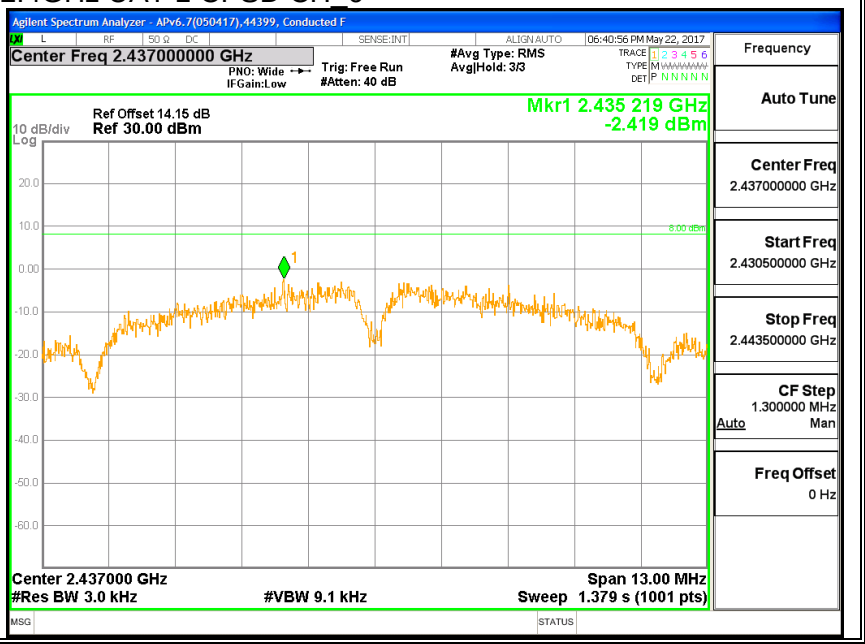
2.4GHz UAT 1 CPSD CH_1



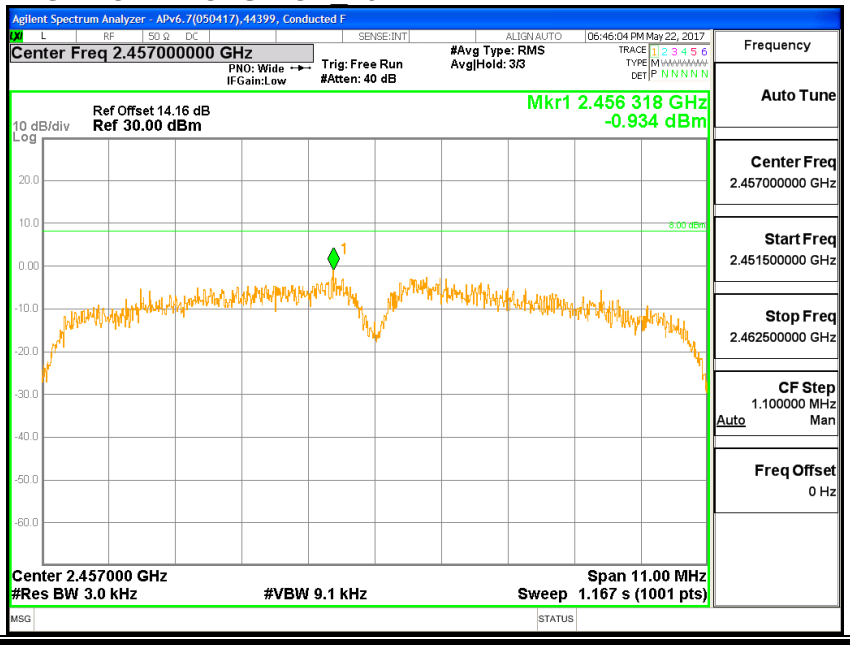
2.4GHz UAT 1 CPSD CH_2



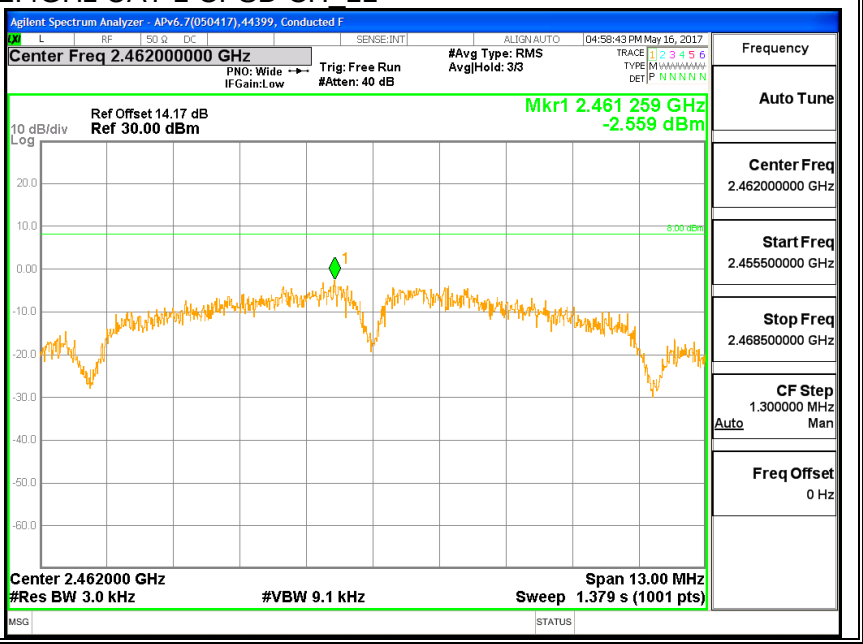
2.4GHz UAT 1 CPSD CH_6



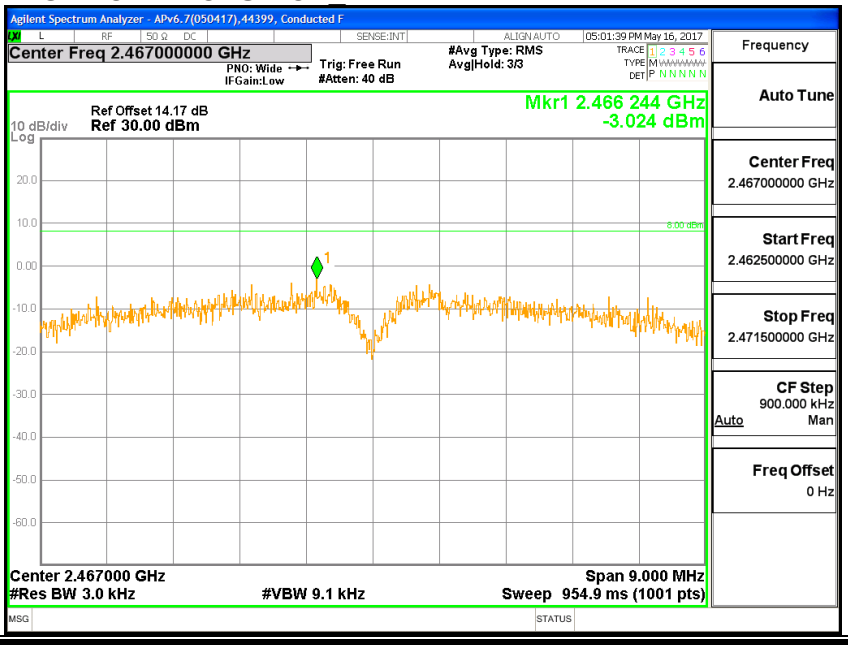
2.4GHz UAT 1 CPSD CH_10



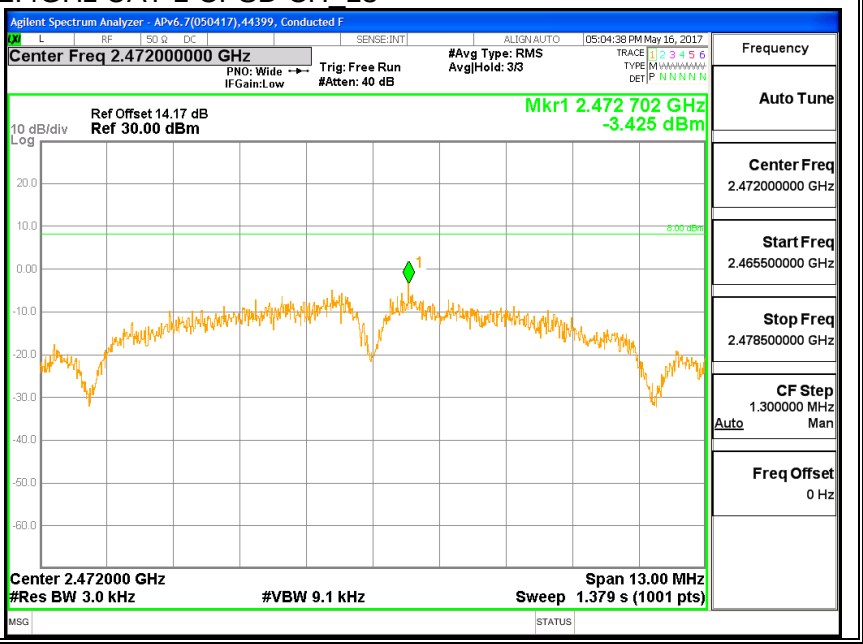
2.4GHz UAT 1 CPSD CH_11



2.4GHz UAT 1 CPSD CH_12



2.4GHz UAT 1 CPSD CH_13



8.2.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

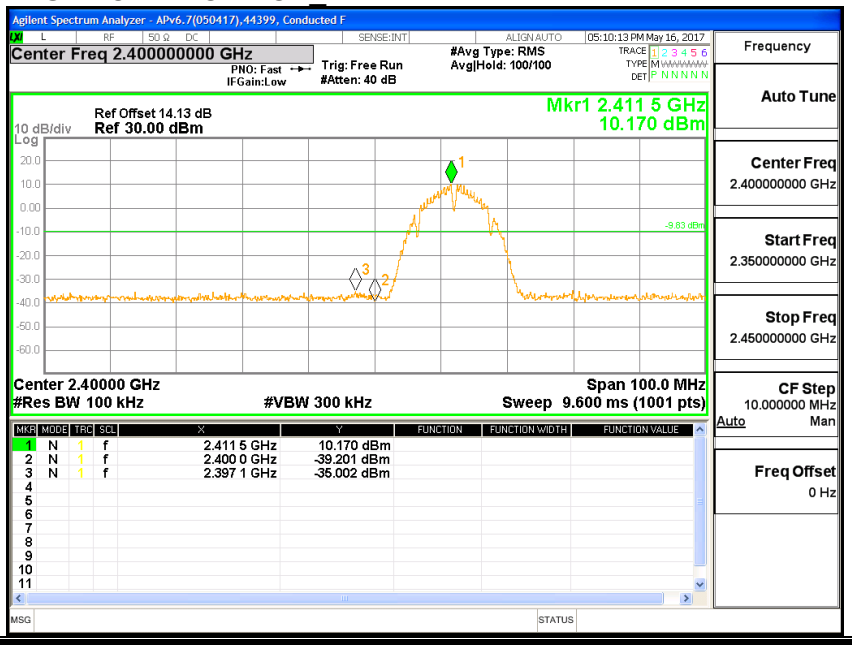
FCC §15.247 (d)

IC RSS-247 (5.5)

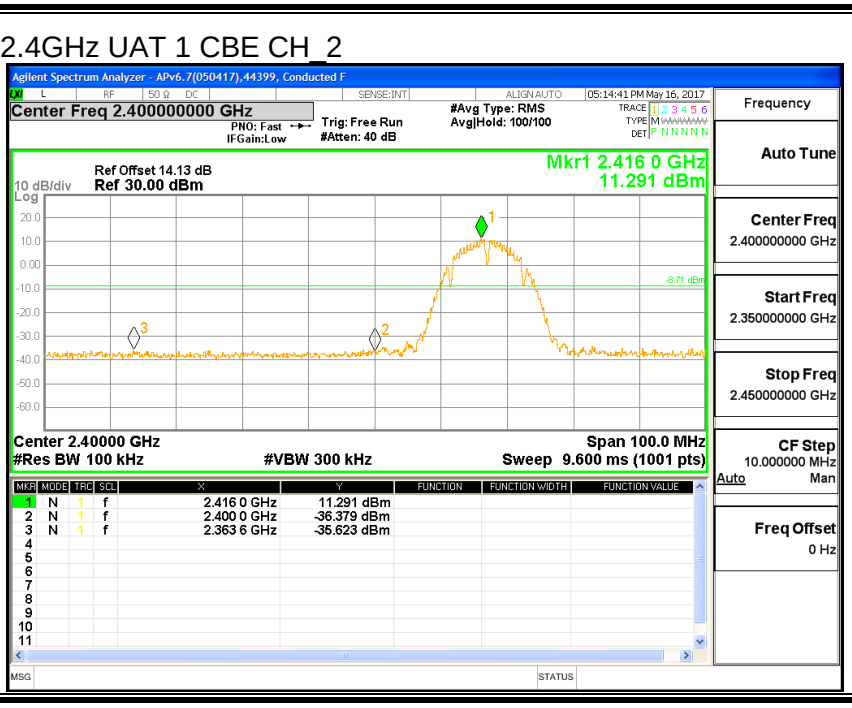
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.

CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

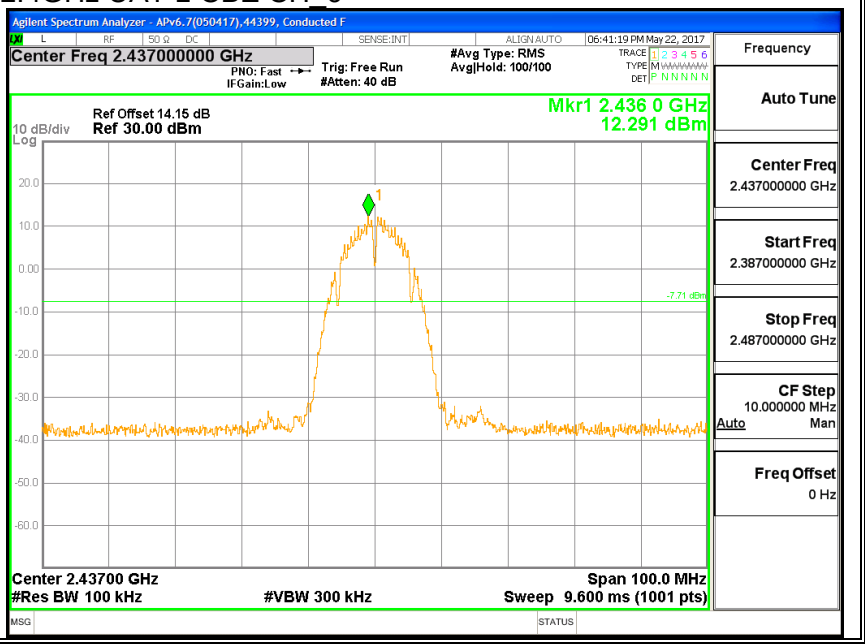
2.4GHz UAT 1 CBE CH_1



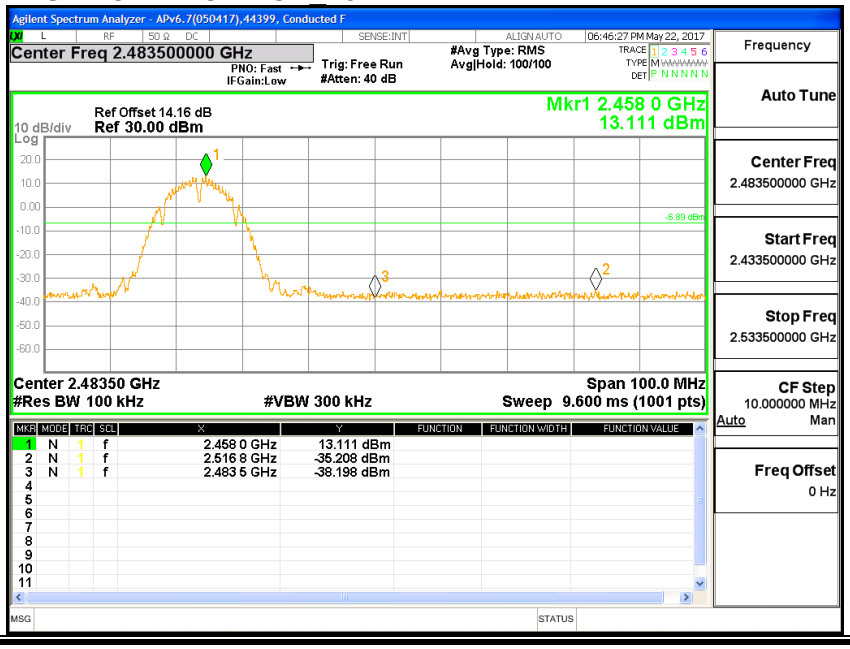
2.4GHz UAT 1 CBE CH_2



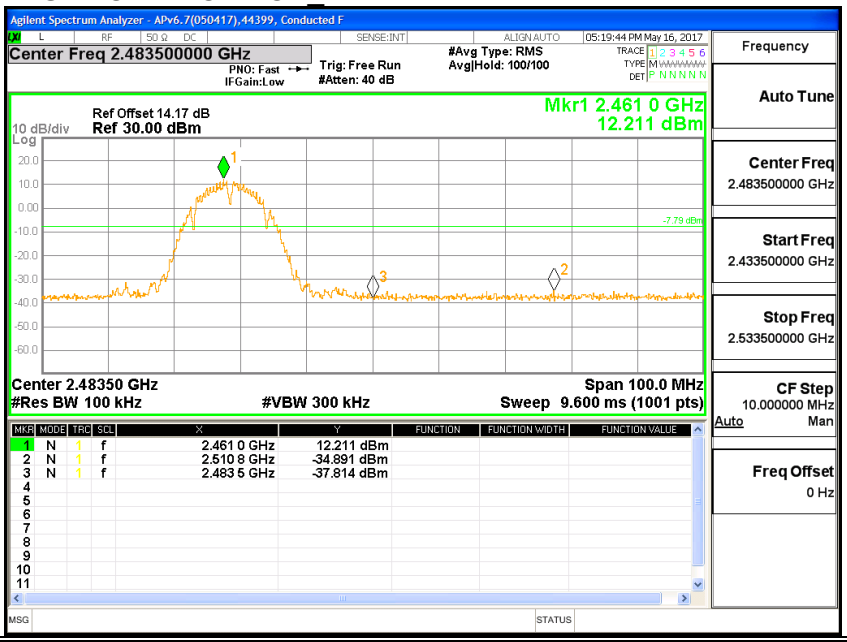
2.4GHz UAT 1 CBE CH_6



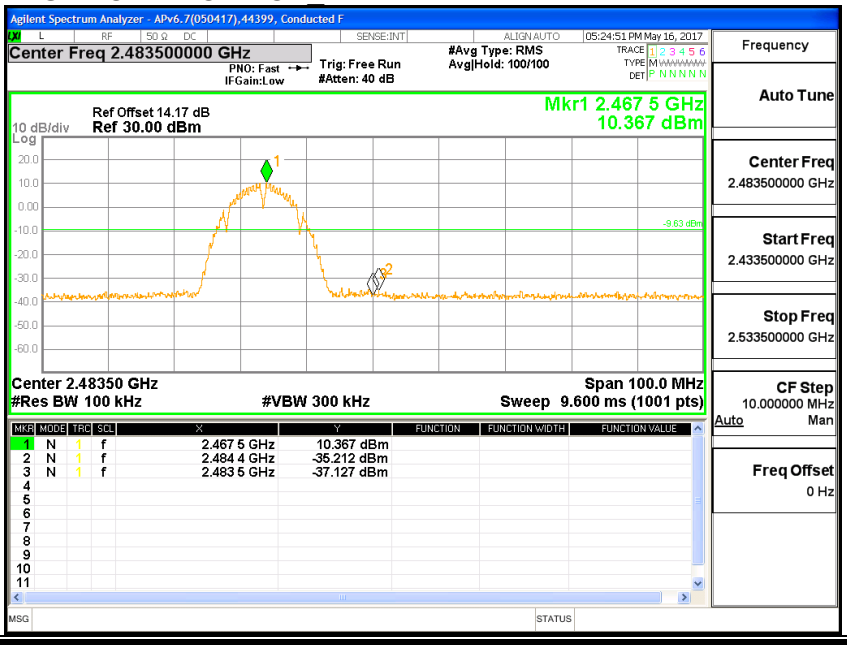
2.4GHz UAT 1 CBE CH_10



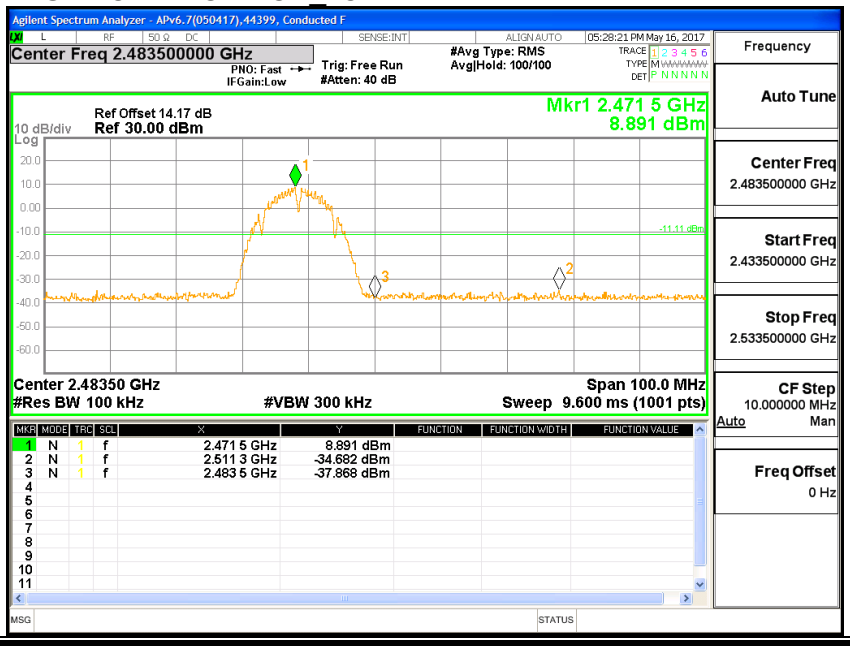
2.4GHz UAT 1 CBE CH_11



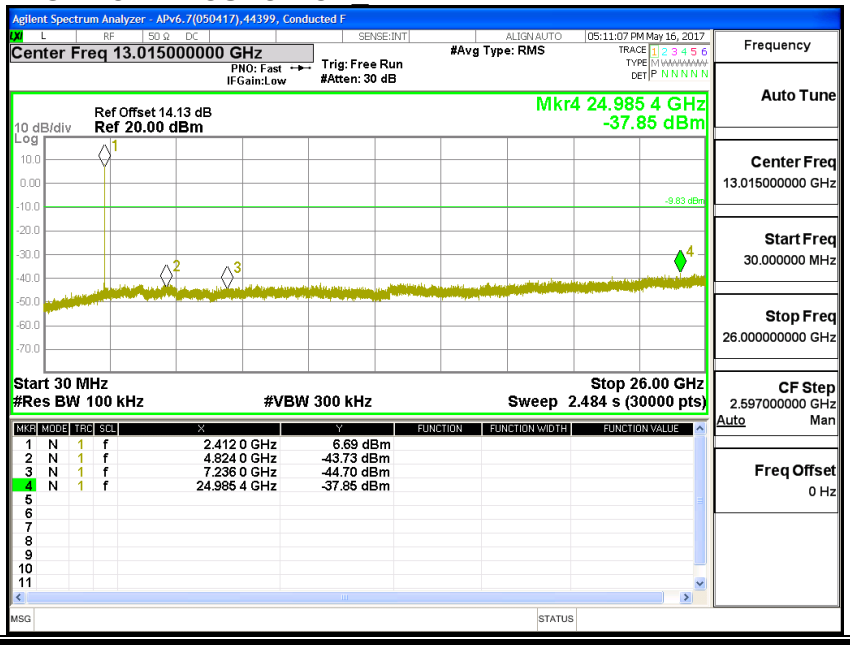
2.4GHz UAT 1 CBE CH_12



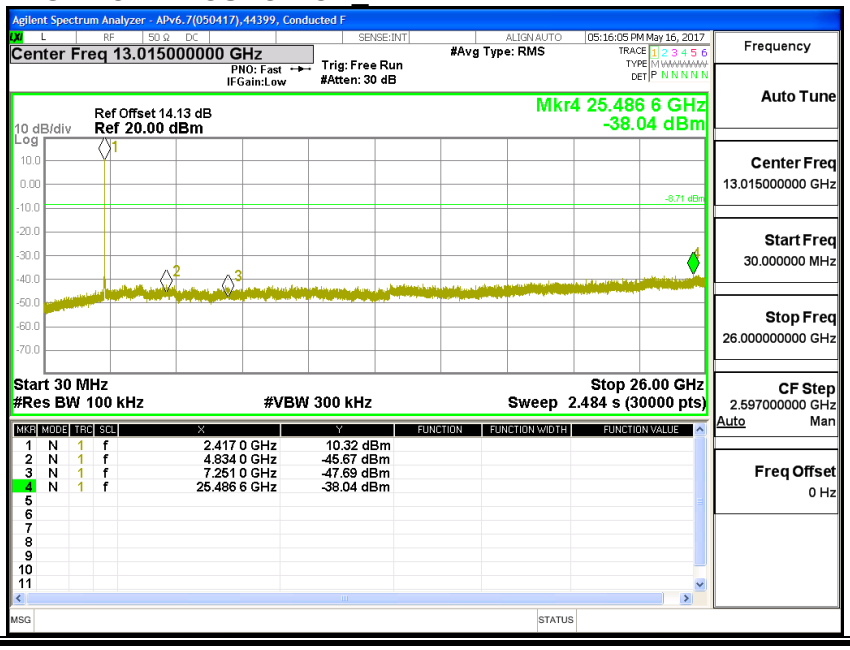
2.4GHz UAT 1 CBE CH_13



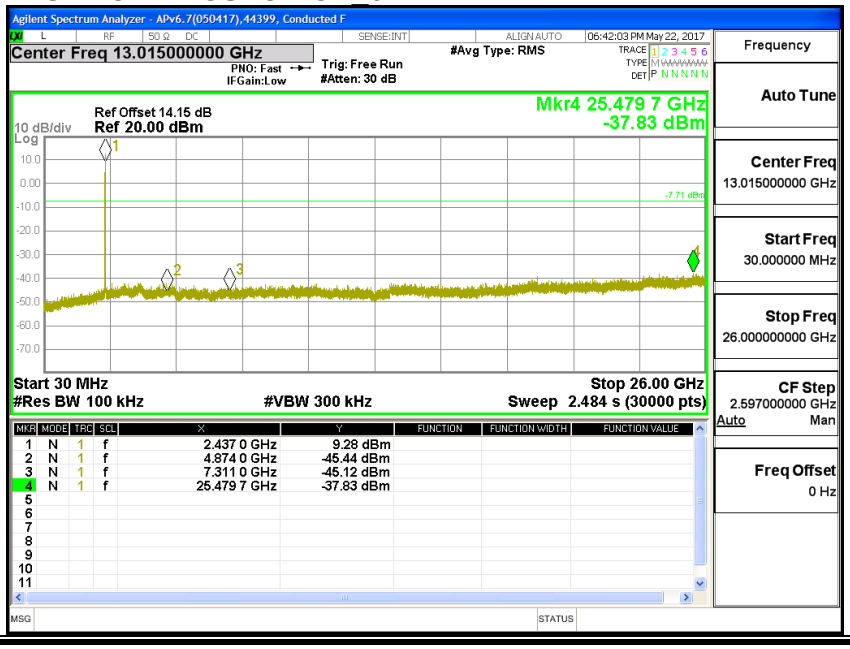
2.4GHz UAT 1 CSPUR CH_1



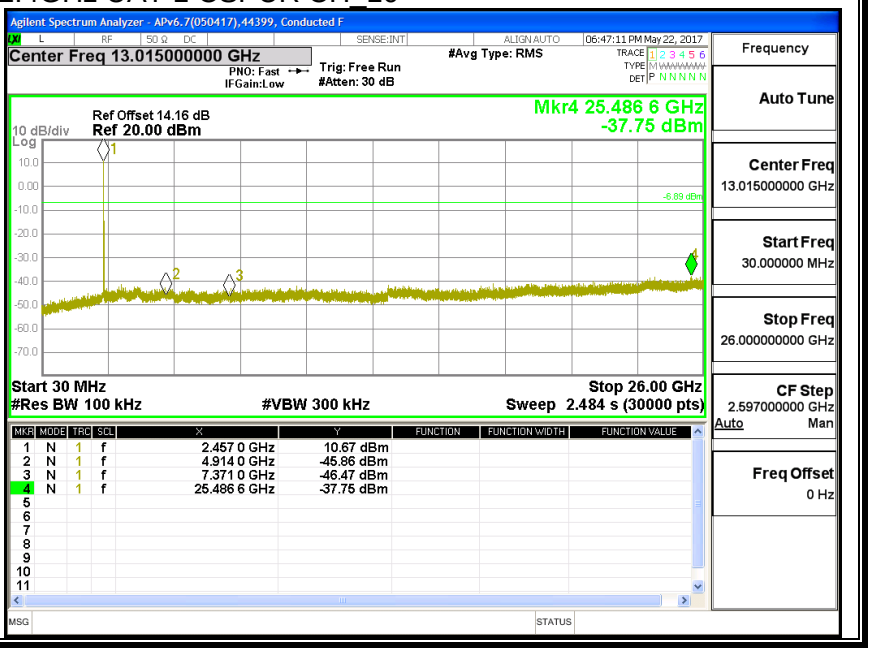
2.4GHz UAT 1 CSPUR CH_2



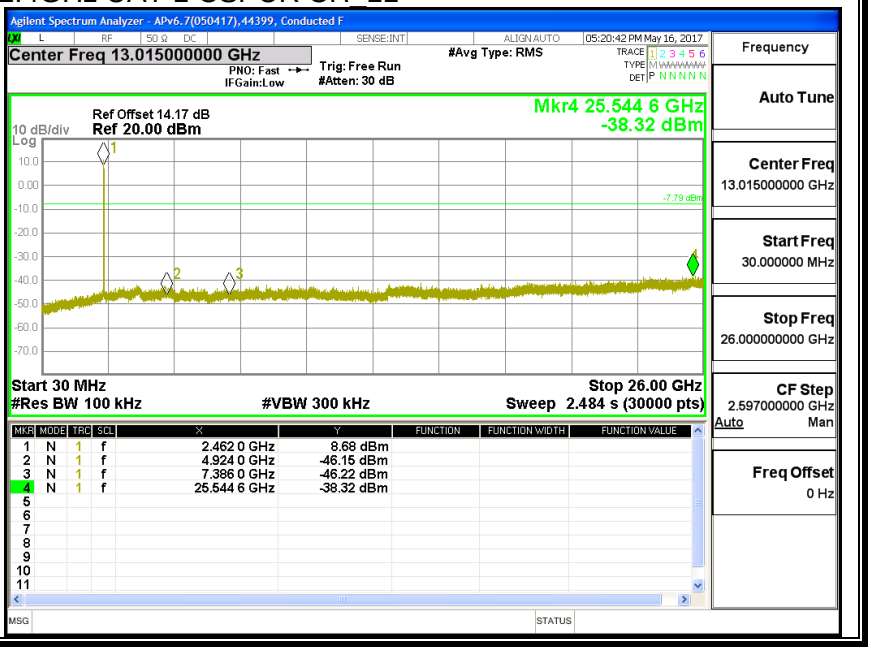
2.4GHz UAT 1 CSPUR CH_6



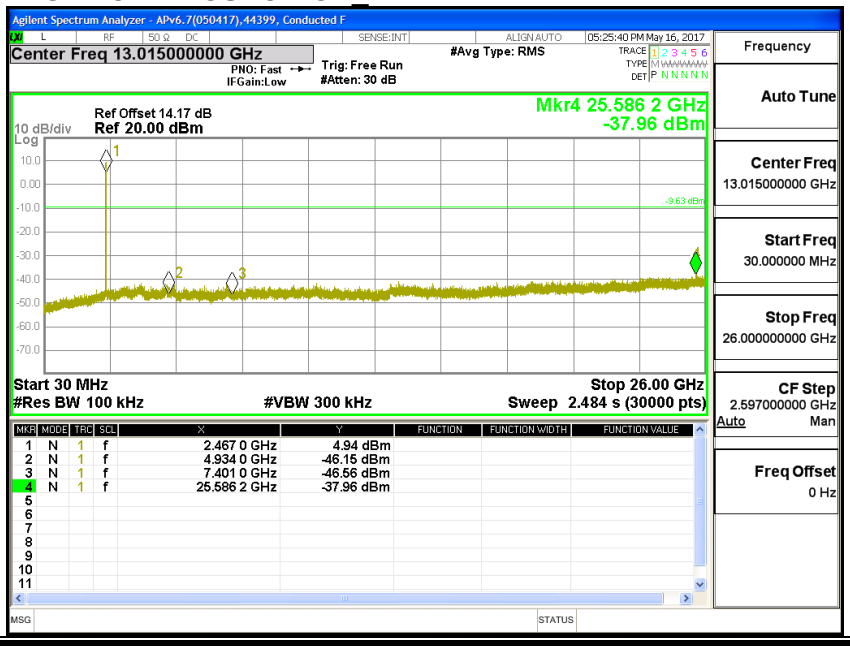
2.4GHz UAT 1 CSPUR CH_10



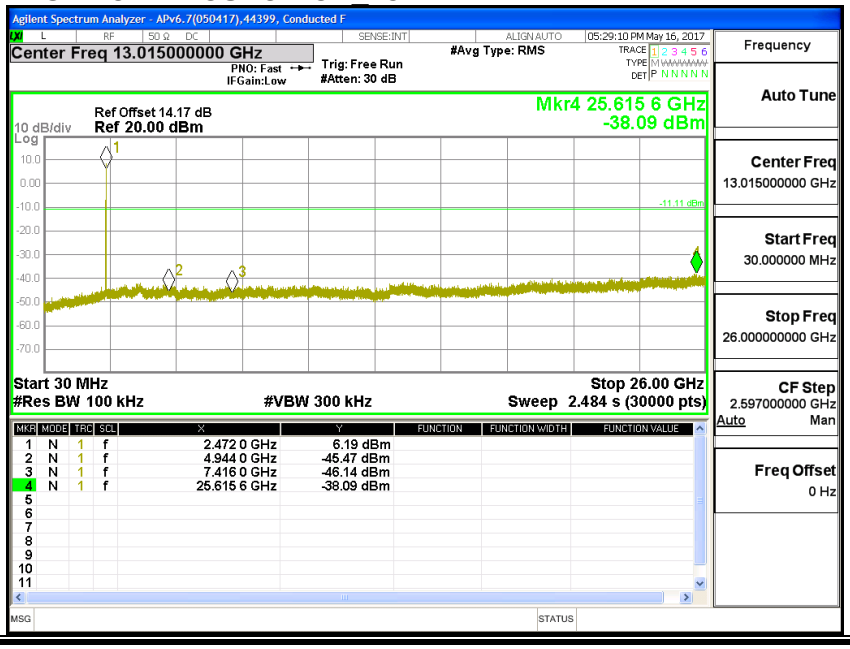
2.4GHz UAT 1 CSPUR CH_11



2.4GHz UAT 1 CSPUR CH_12



2.4GHz UAT 1 CSPUR CH_13



8.3. 11b LAT 3 SISO MODE IN THE 2.4GHz BAND

8.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

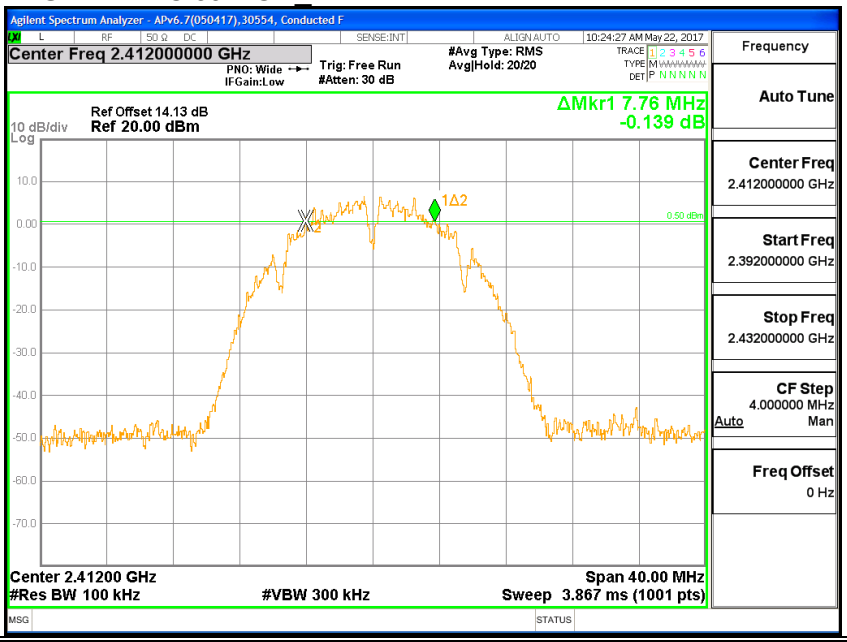
IC RSS-247 (5.2) (a)

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

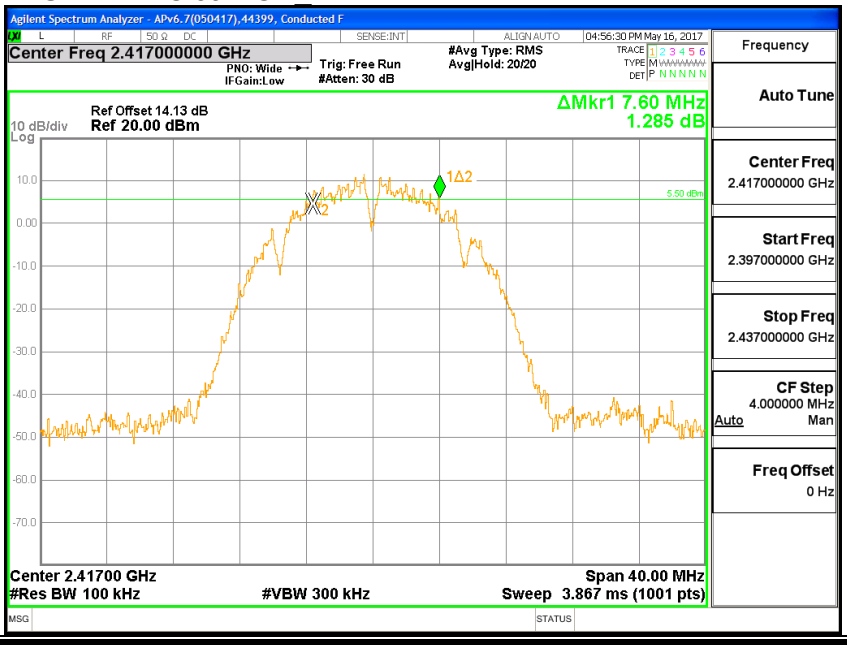
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low_1	2412	7.760	0.5
Low_2	2417	7.600	0.5
Middle_6	2437	7.080	0.5
High_10	2457	8.080	0.5
High_11	2462	8.600	0.5
High_12	2467	7.080	0.5
High_13	2472	7.600	0.5

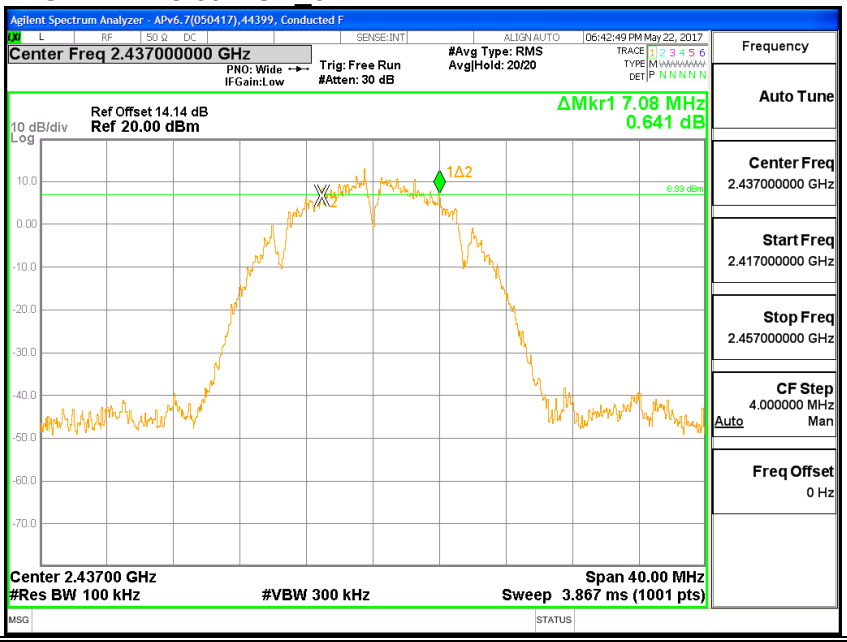
2.4GHz LAT 3 6dB CH_1



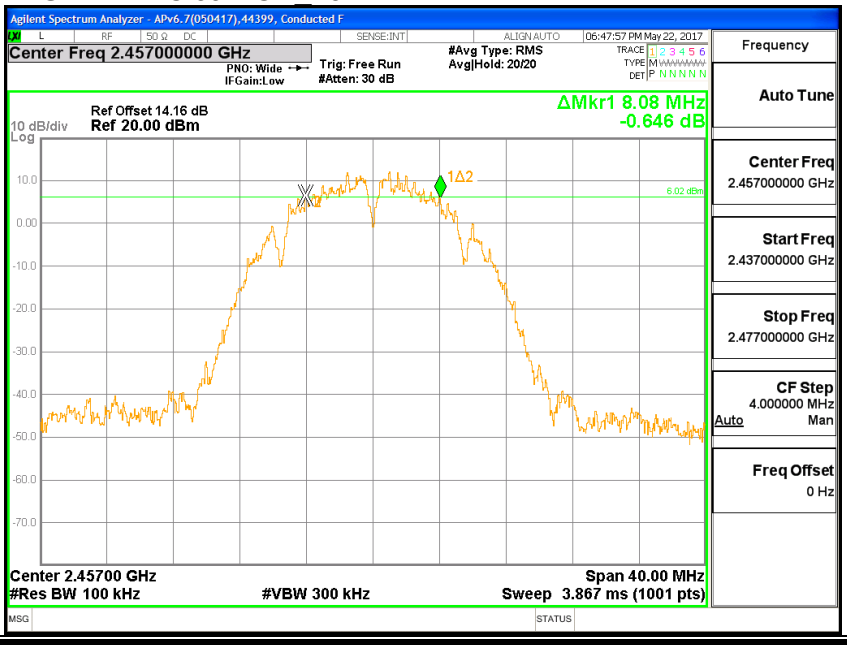
2.4GHz LAT 3 6dB CH_2



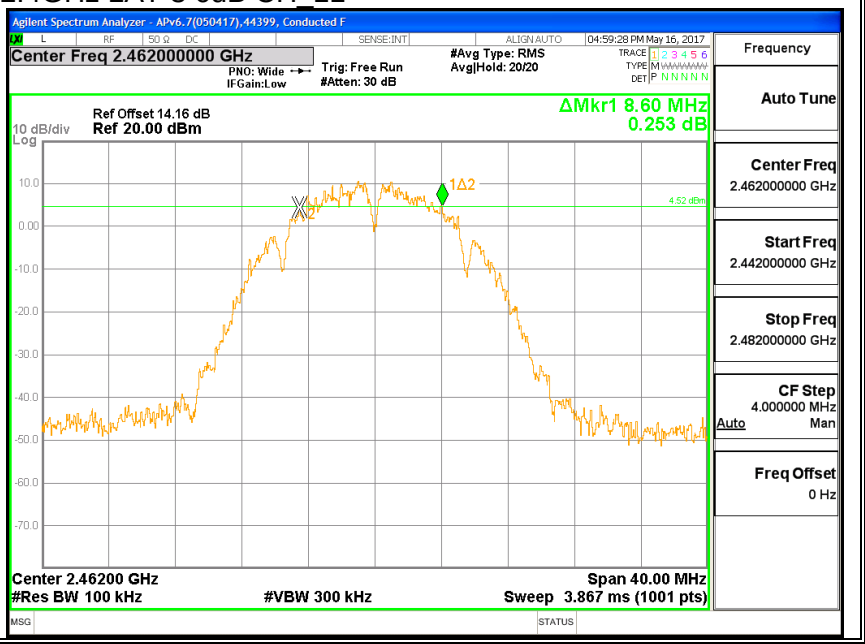
2.4GHz LAT 3 6dB CH_6



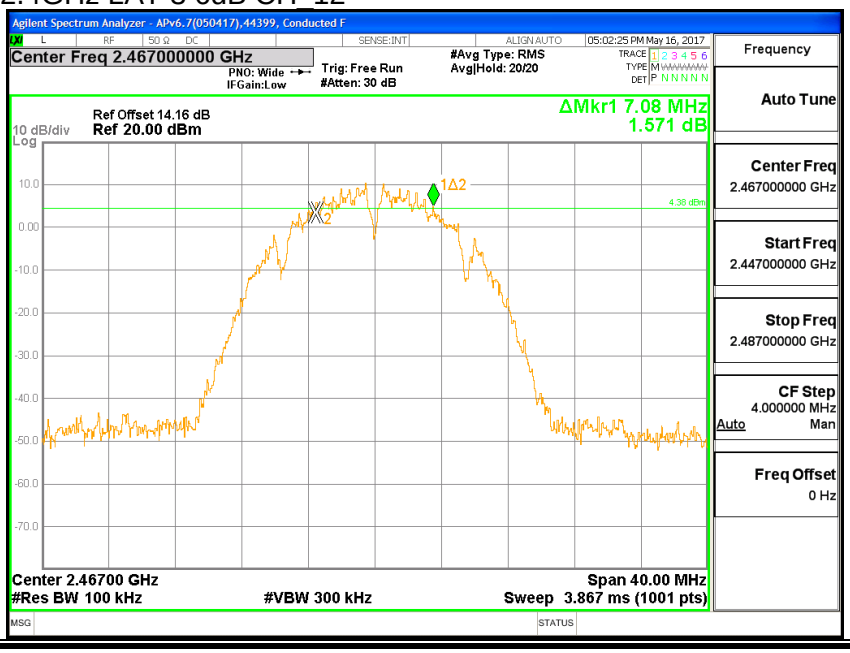
2.4GHz LAT 3 6dB CH_10



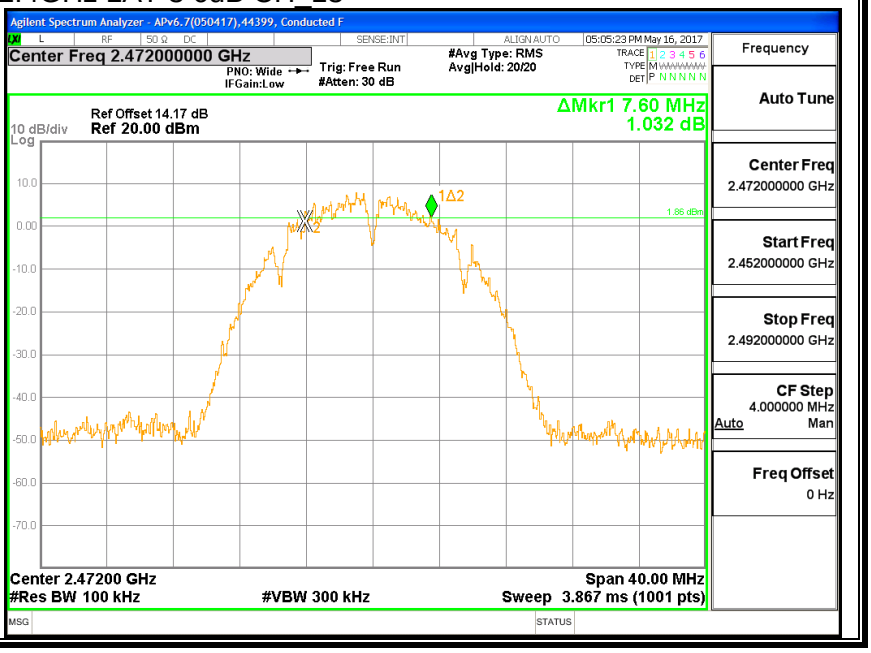
2.4GHz LAT 3 6dB CH_11



2.4GHz LAT 3 6dB CH_12



2.4GHz LAT 3 6dB CH_13



8.3.2. 99% BANDWIDTH

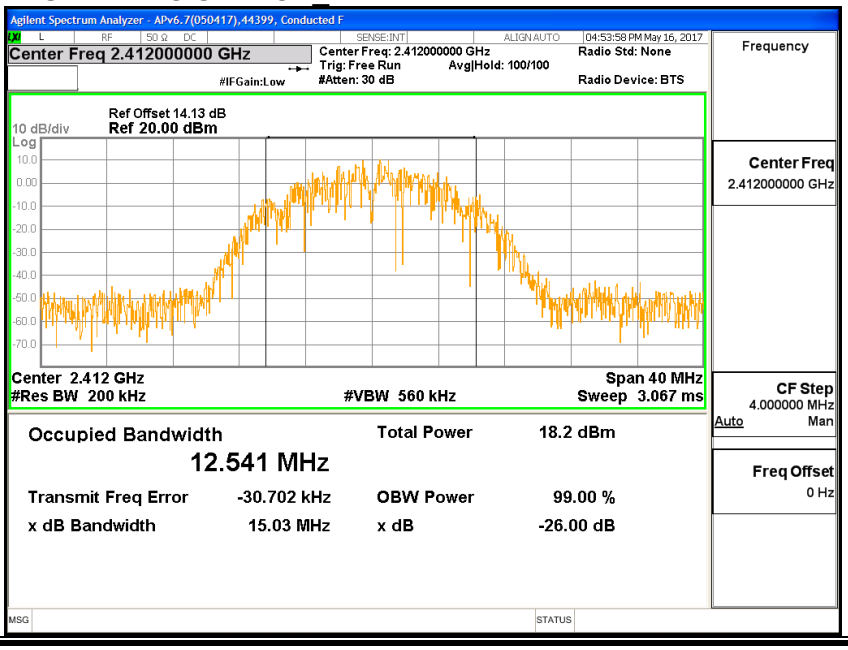
LIMITS

None; for reporting purposes only.

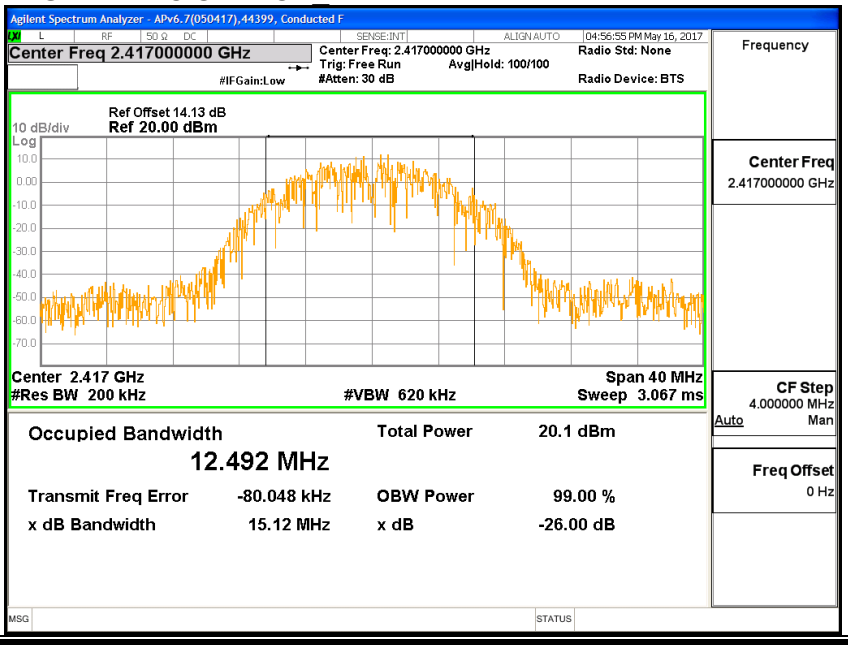
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low_1	2412	12.541
Low_2	2417	12.492
Middle_6	2437	12.194
High_10	2457	12.719
High_11	2462	12.764
High_12	2467	12.853
High_13	2472	12.741

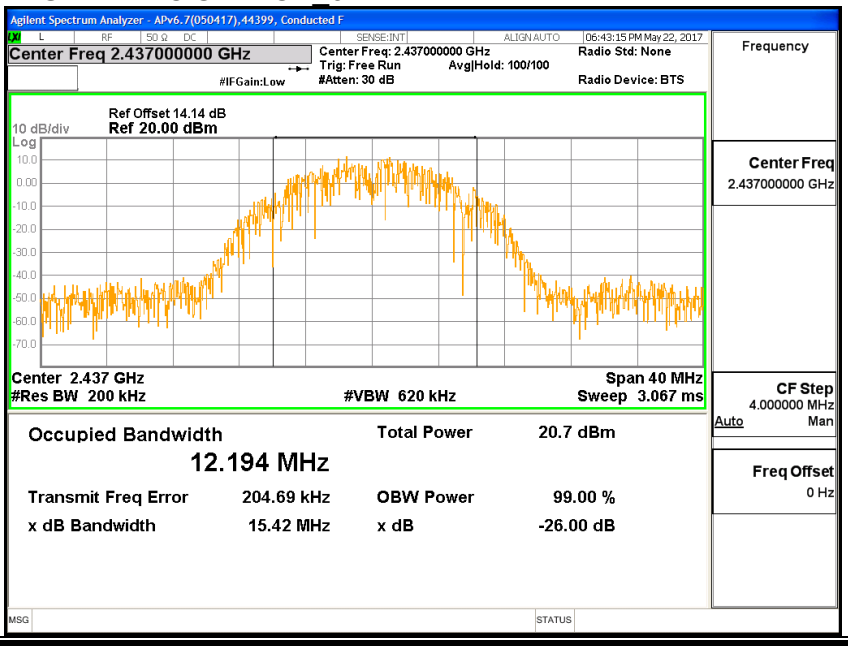
2.4GHz LAT 3 OBW CH_1



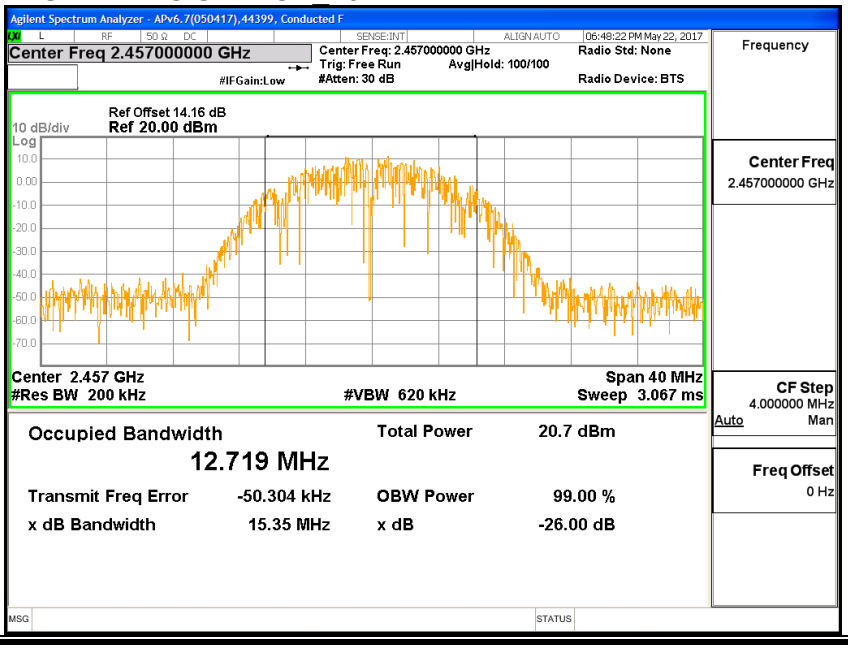
2.4GHz LAT 3 OBW CH_2



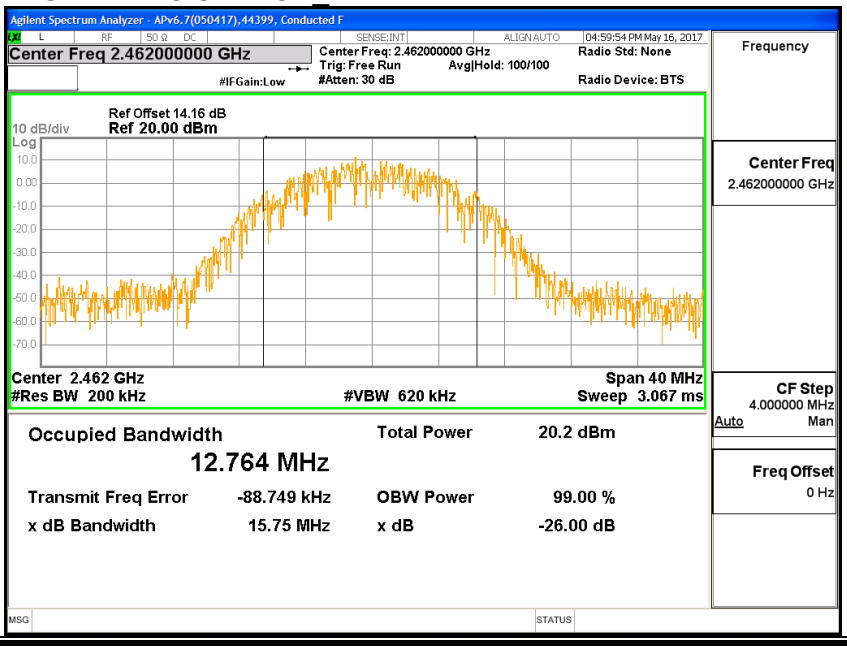
2.4GHz LAT 3 OBW CH_6



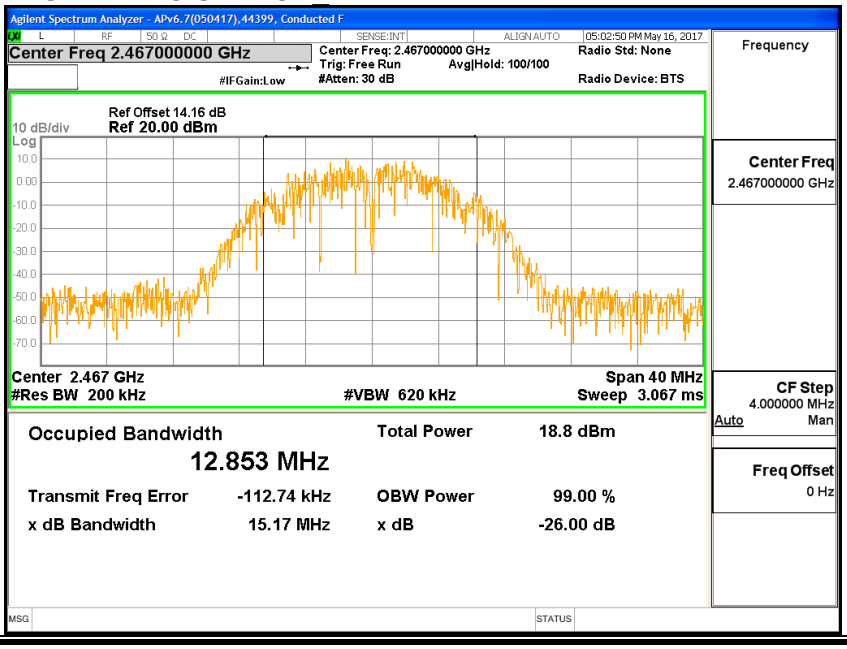
2.4GHz LAT 3 OBW CH_10



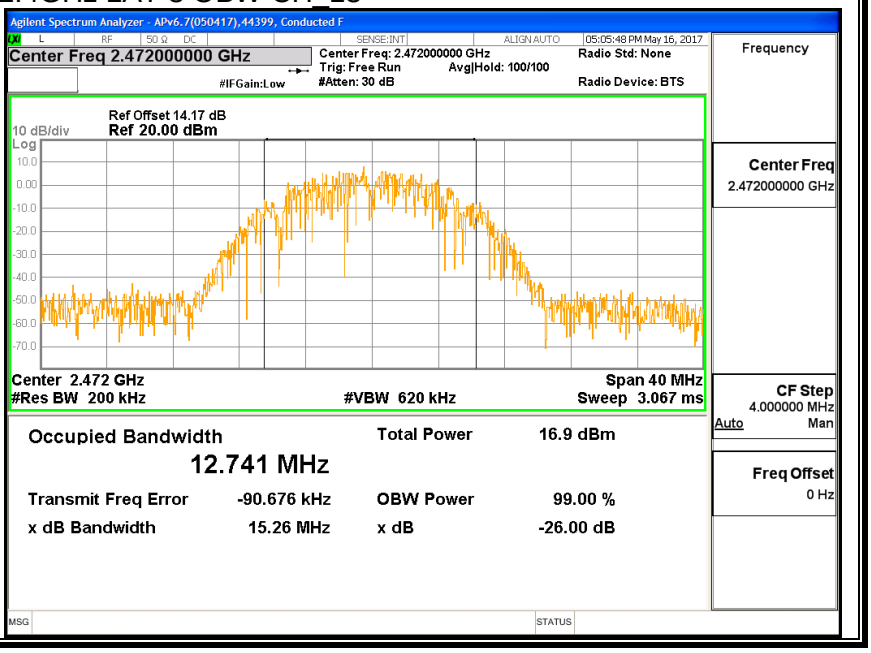
2.4GHz LAT 3 OBW CH_11



2.4GHz LAT 3 OBW CH_12



2.4GHz LAT 3 OBW CH_13



8.3.3. AVERAGE POWER

ID:	44366	Date:	7/25/17

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low_1	2412	20.22
Low_2	2417	21.87
Middle_6	2437	21.82
High_10	2457	21.84
High_11	2462	21.94
High_12	2467	20.29
High_13	2472	18.92

8.3.4. OUTPUT POWER

ID:	44366	Date:	7/25/17

LIMITS

FCC §15.247

IC RSS-247 (5.4) (d)

For systems using digital modulation in the 2400–2483.5 MHz, and 5725–5850 MHz bands: 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.

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-4.42	30.00	30	36	30.00
Low_2	2417	-4.42	30.00	30	36	30.00
Middle_6	2437	-4.42	30.00	30	36	30.00
High_10	2457	-4.42	30.00	30	36	30.00
High_11	2462	-4.42	30.00	30	36	30.00
High_12	2467	-4.42	30.00	30	36	30.00
High_13	2472	-4.42	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power

Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	23.61	23.61	30.00	-6.39
Low_2	2417	25.33	25.33	30.00	-4.67
Middle_6	2437	25.26	25.26	30.00	-4.74
High_10	2457	25.25	25.25	30.00	-4.75
High_11	2462	25.30	25.30	30.00	-4.70
High_12	2467	23.71	23.71	30.00	-6.29
High_13	2472	22.28	22.28	30.00	-7.72

8.3.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

IC RSS-247 (5.2) (b)

For digitally modulated systems, the power spectral density conducted form the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmissions.

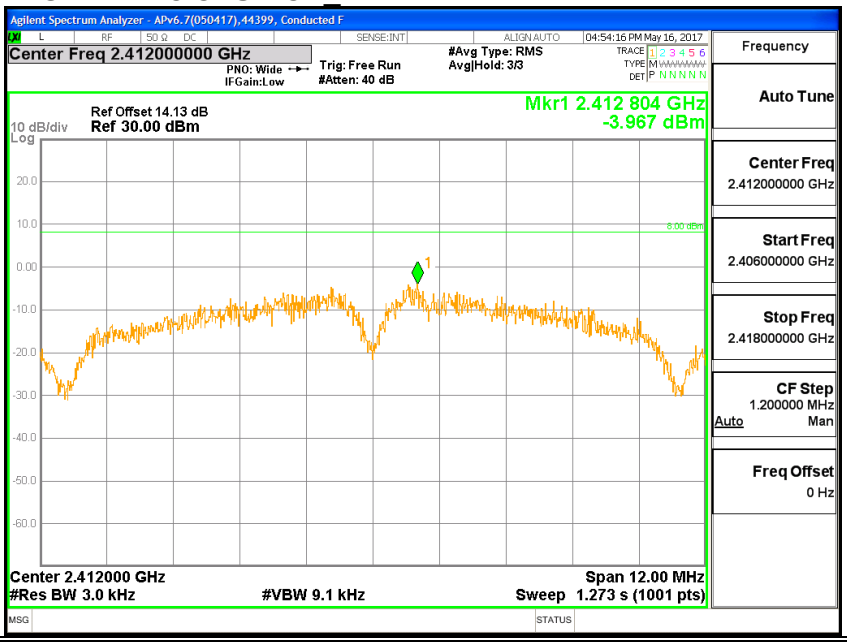
RESULTS

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

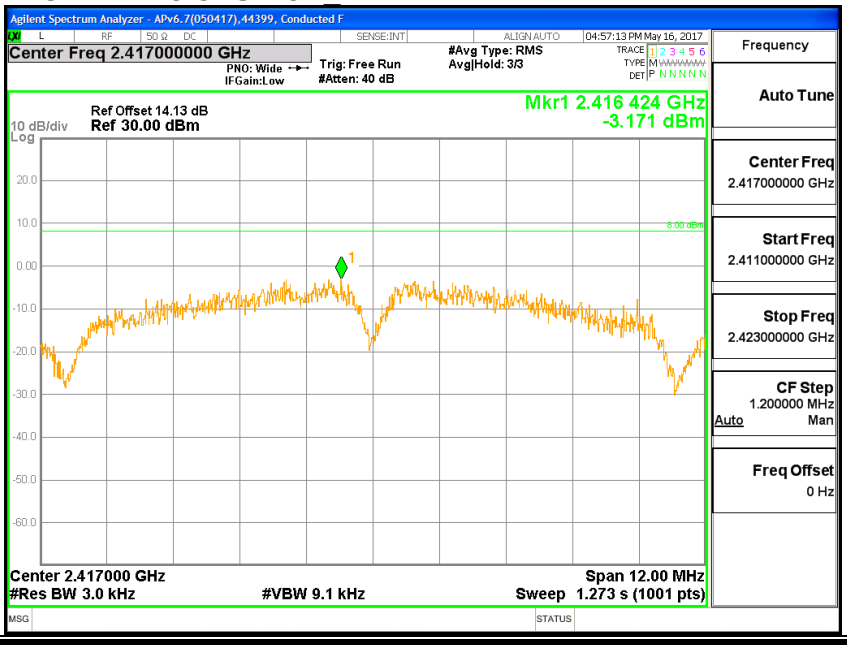
PSD Results

Channel	Frequency (MHz)	Meas (dBm)	Total Corr'd PSD (dBm/3KHz)	Limit (dBm)	Margin (dB)
Low_1	2412	-3.967	-3.967	8.0	-12.0
Low_2	2417	-3.171	-3.171	8.0	-11.2
Middle_6	2437	-1.317	-1.317	8.0	-9.3
High_10	2457	-1.314	-1.314	8.0	-9.3
High_11	2462	-2.224	-2.224	8.0	-10.2
High_12	2467	-3.150	-3.150	8.0	-11.2
High_13	2472	-4.219	-4.219	8.0	-12.2

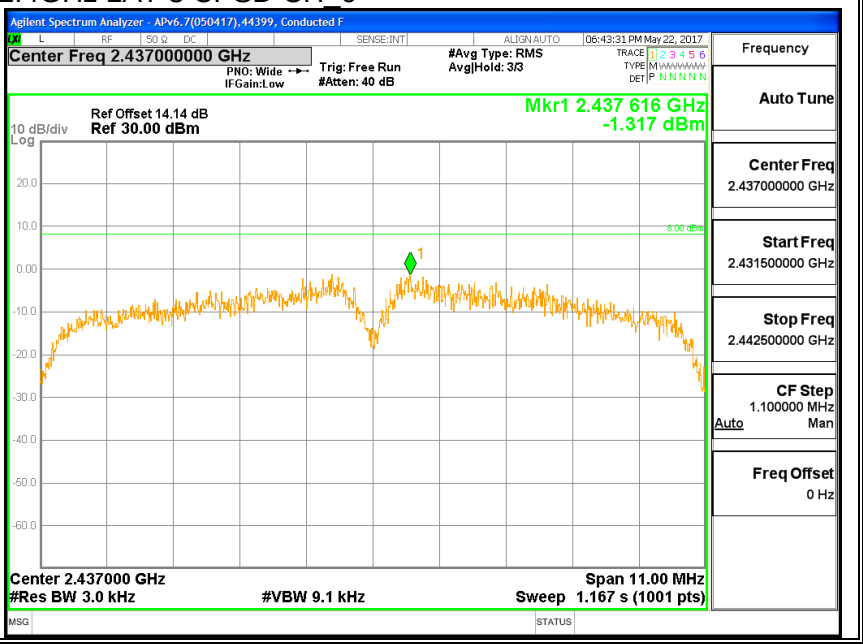
2.4GHz LAT 3 CPSD CH_1



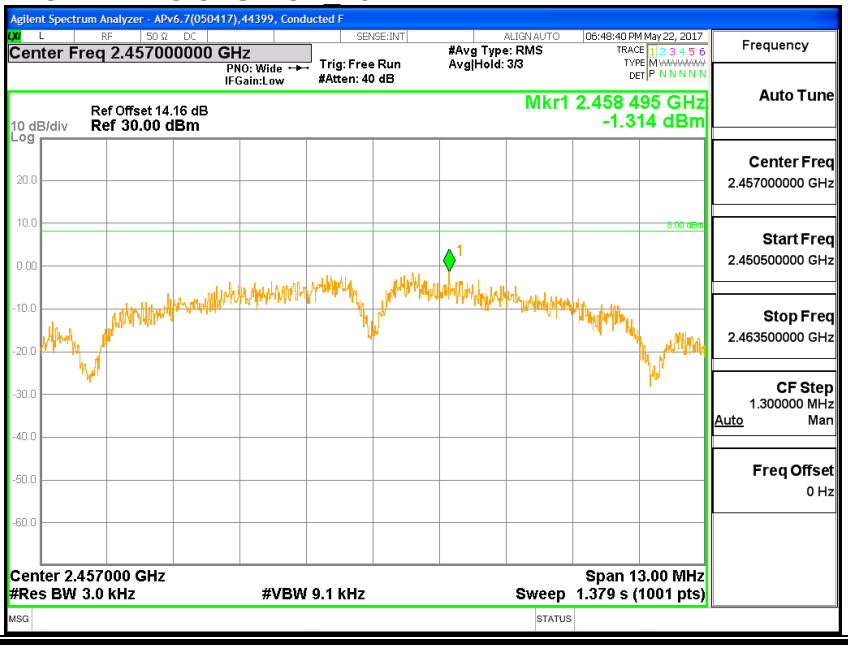
2.4GHz LAT 3 CPSD CH_2



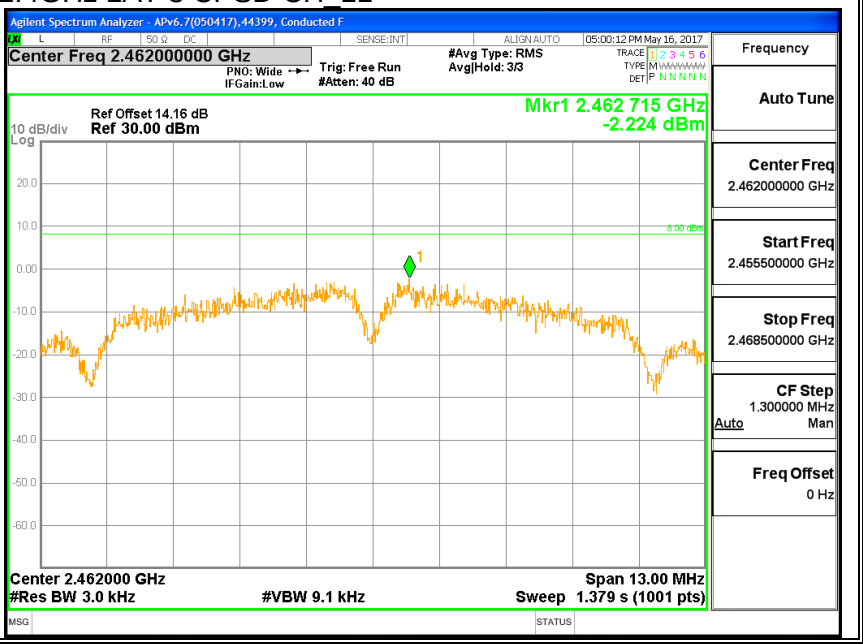
2.4GHz LAT 3 CPSD CH_6



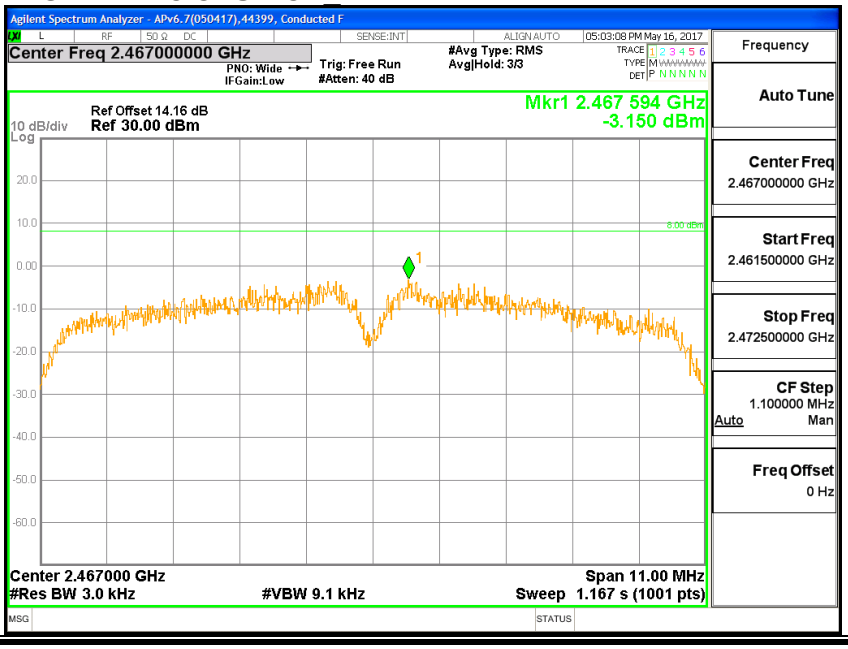
2.4GHz LAT 3 CPSD CH_10



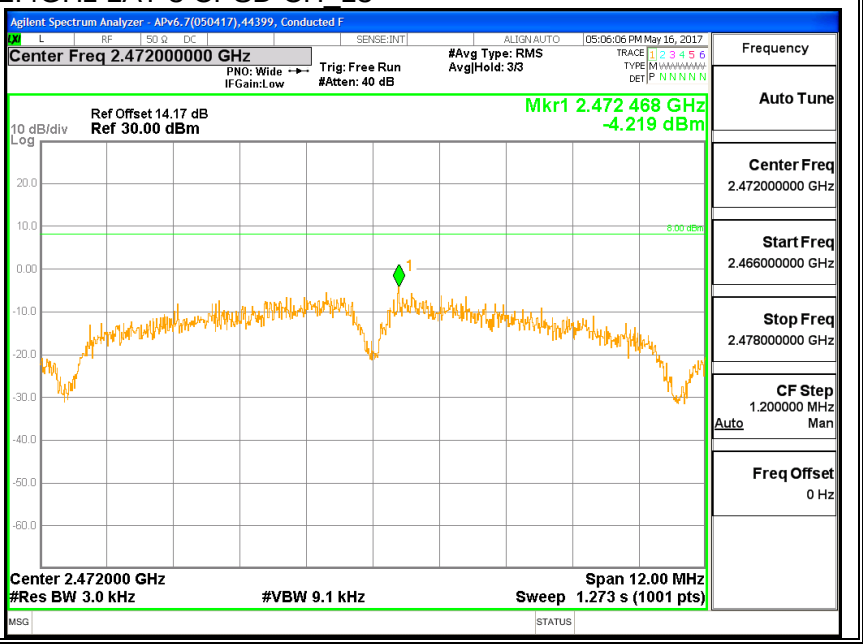
2.4GHz LAT 3 CPSD CH_11



2.4GHz LAT 3 CPSD CH_12



2.4GHz LAT 3 CPSD CH_13



8.3.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

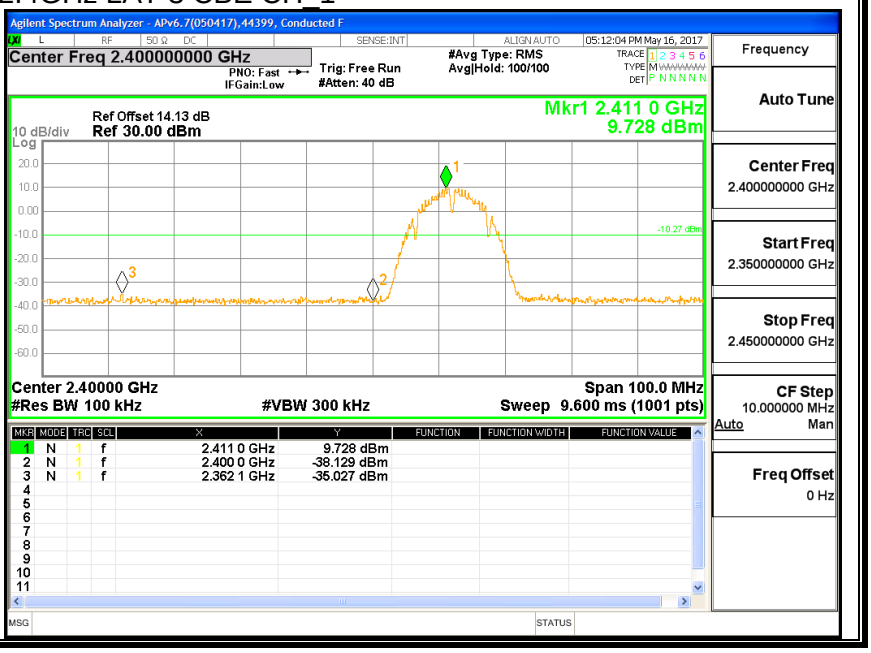
FCC §15.247 (d)

IC RSS-247 (5.5)

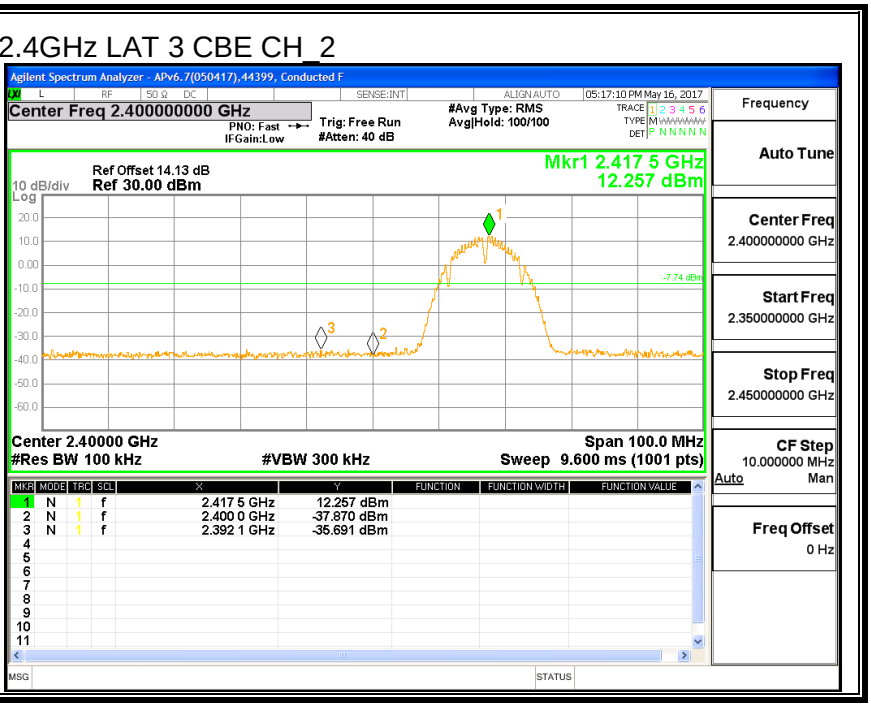
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.

CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

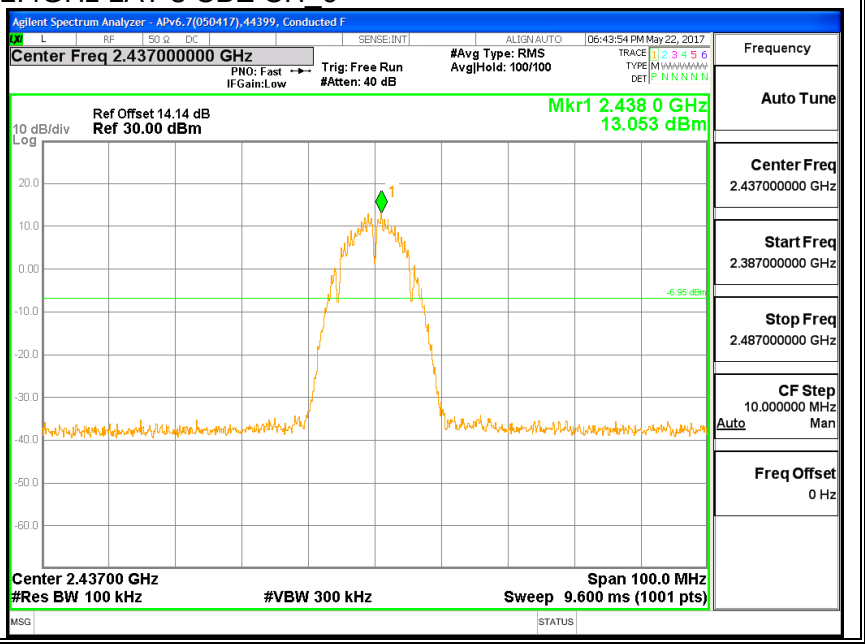
2.4GHz LAT 3 CBE CH_1



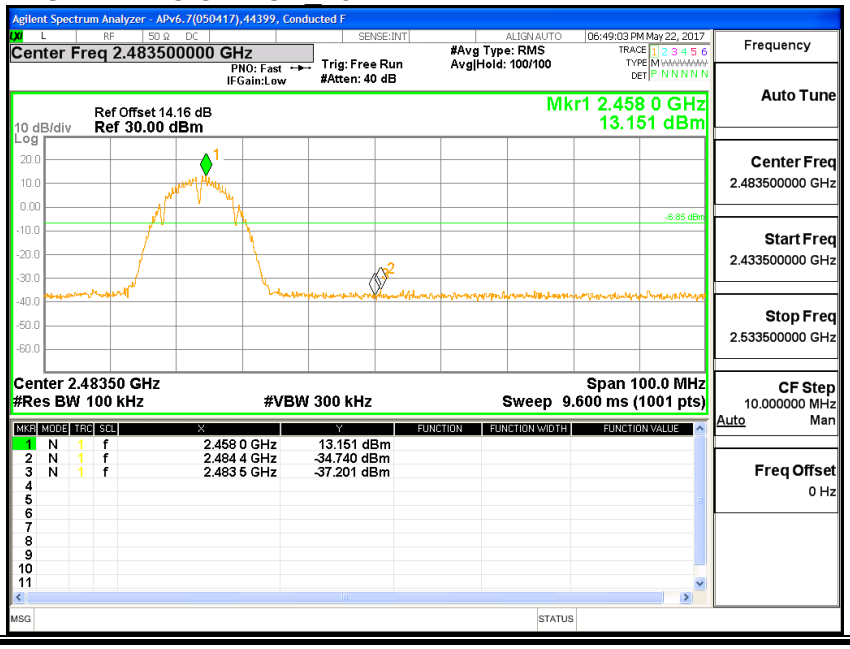
2.4GHz LAT 3 CBE CH_2



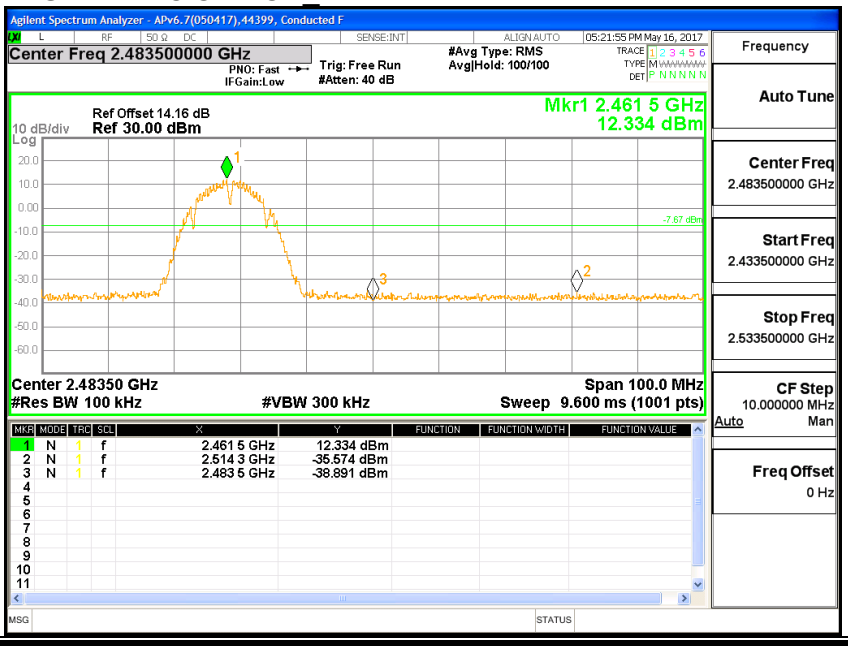
2.4GHz LAT 3 CBE CH_6



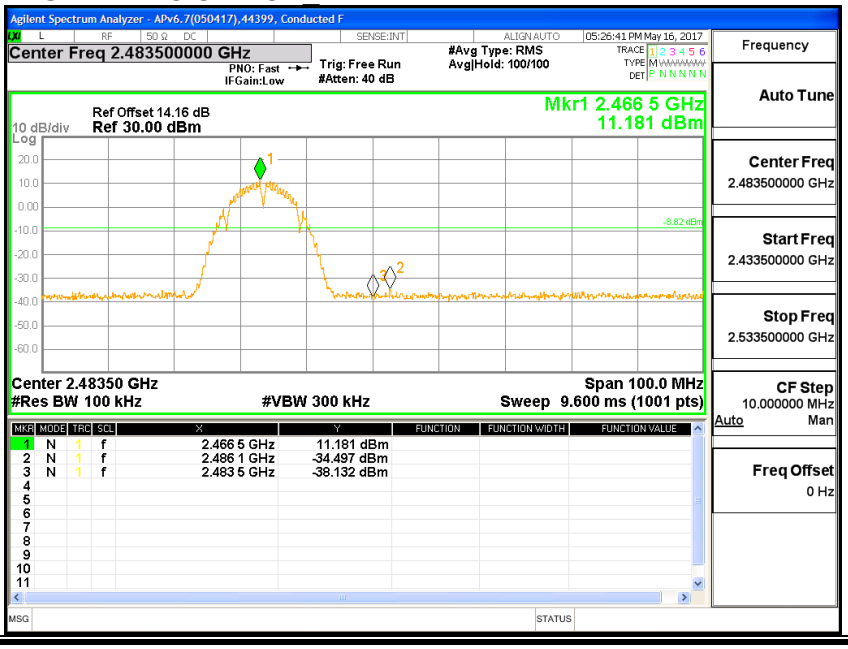
2.4GHz LAT 3 CBE CH_10



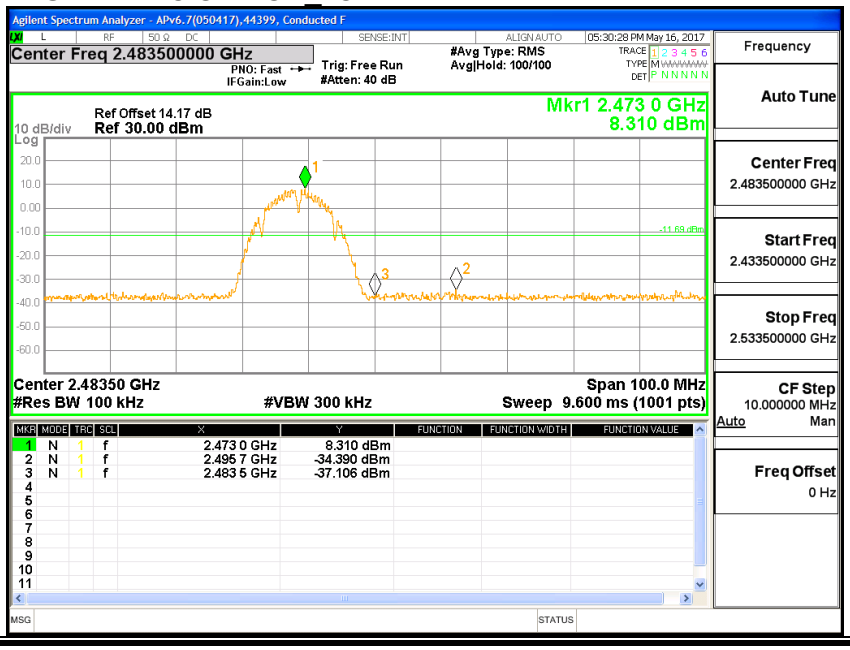
2.4GHz LAT 3 CBE CH_11



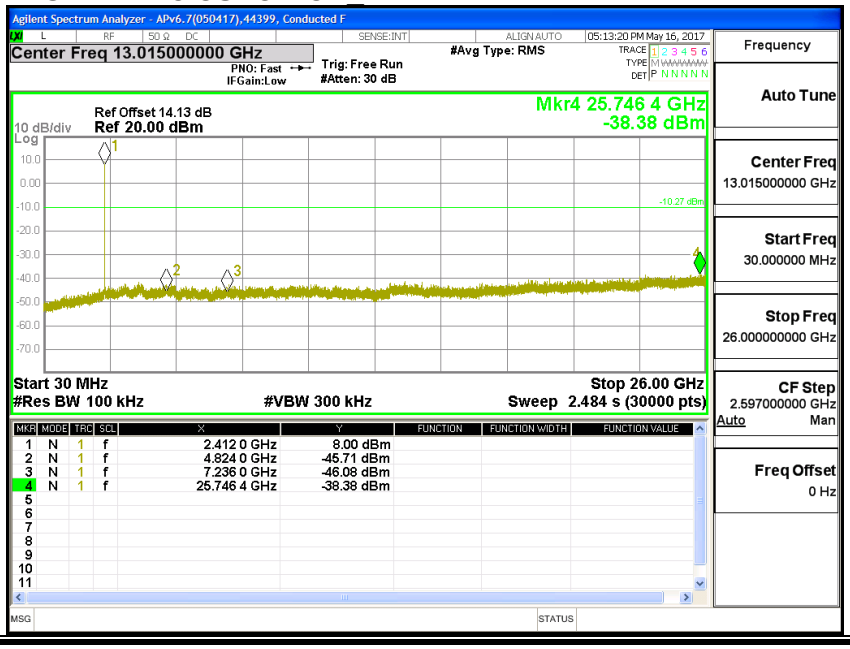
2.4GHz LAT 3 CBE CH_12



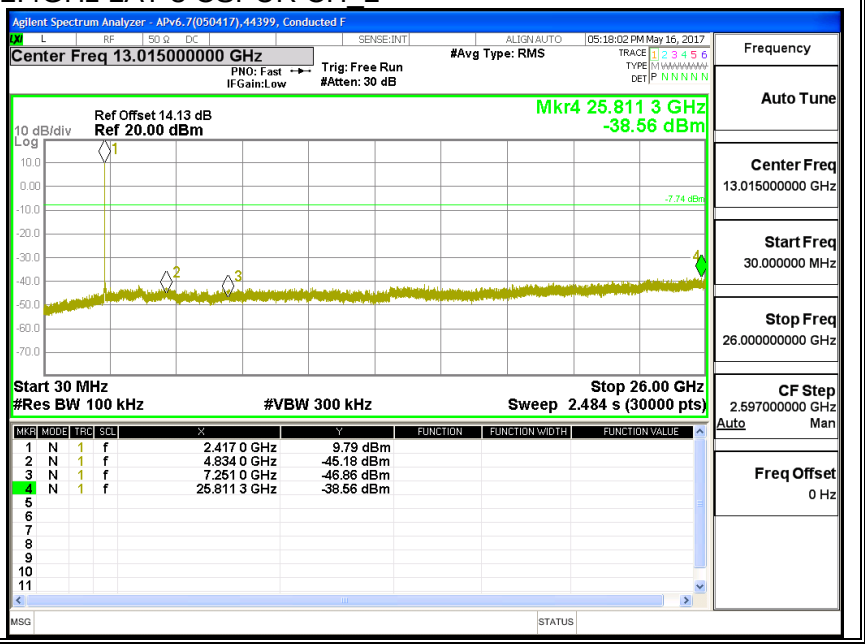
2.4GHz LAT 3 CBE CH_13



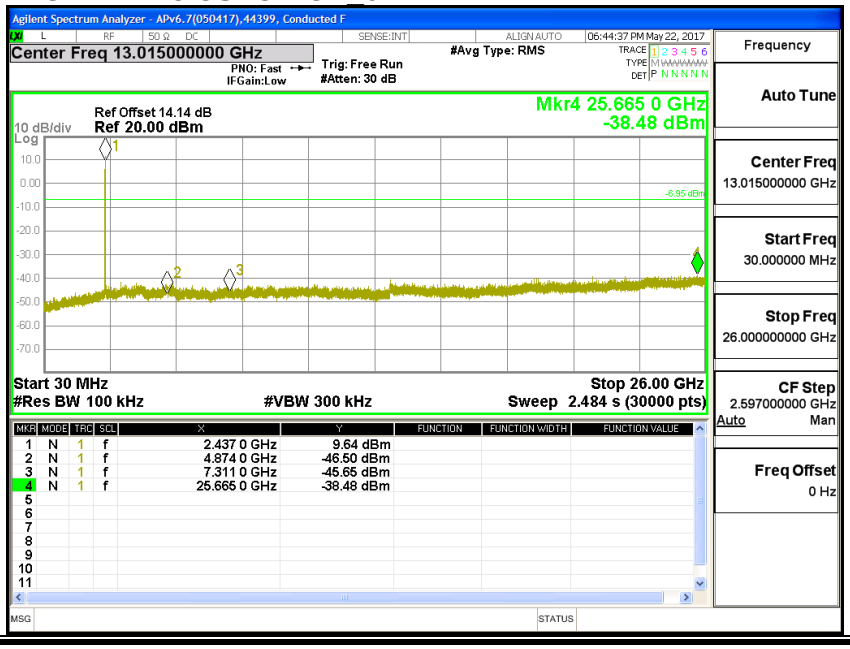
2.4GHz LAT 3 CSPUR CH_1



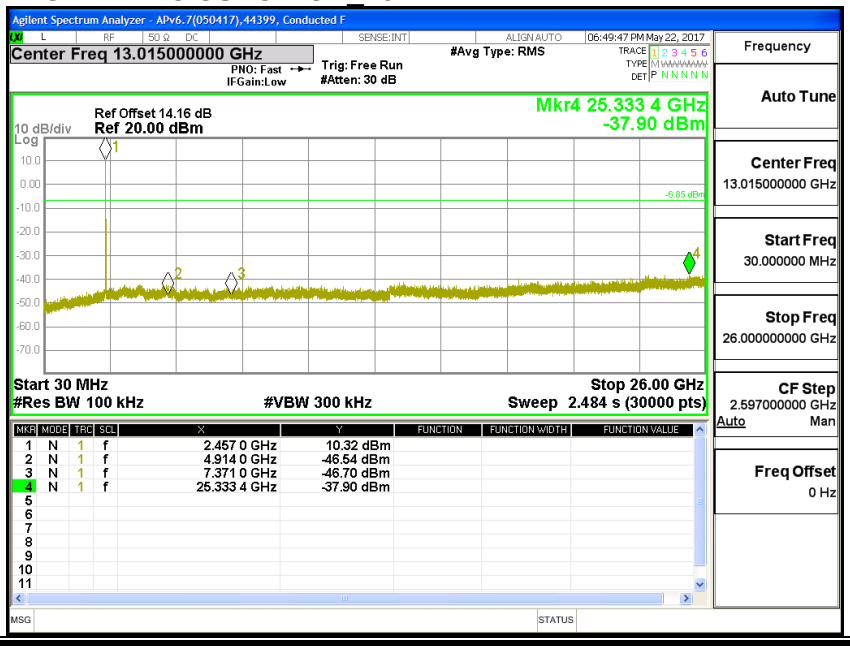
2.4GHz LAT 3 CSPUR CH_2



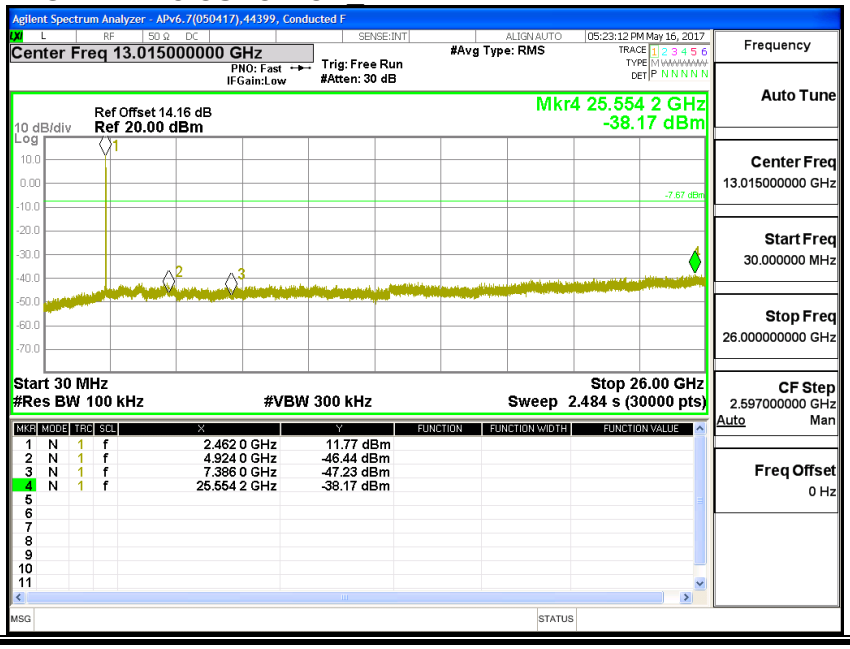
2.4GHz LAT 3 CSPUR CH_6



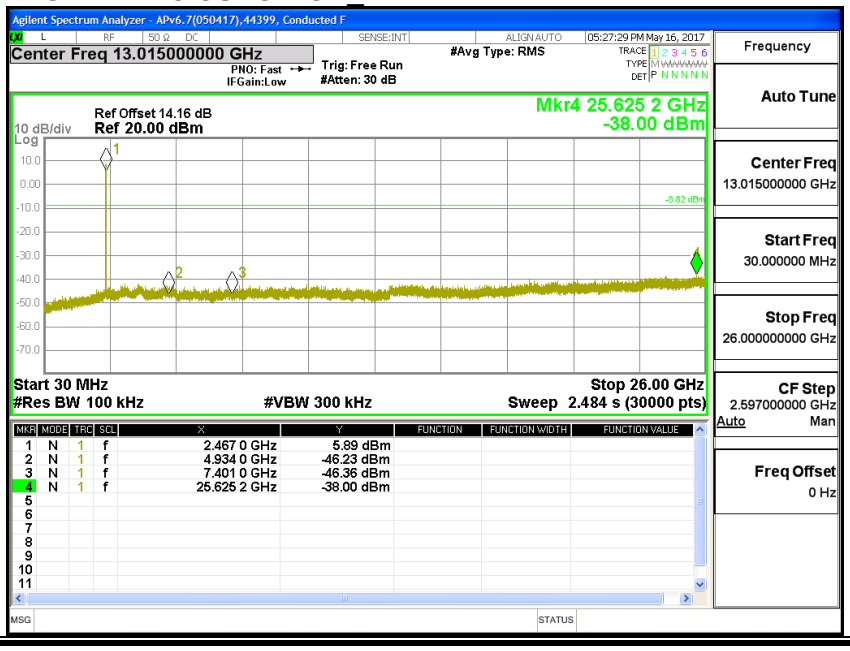
2.4GHz LAT 3 CSPUR CH_10



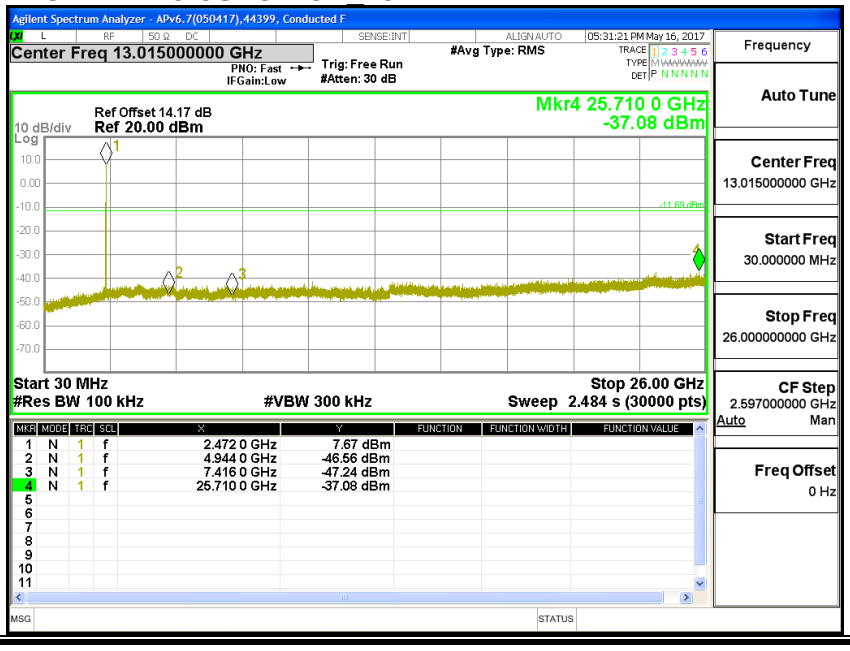
2.4GHz LAT 3 CSPUR CH_11



2.4GHz LAT 3 CSPUR CH_12



2.4GHz LAT 3 CSPUR CH_13



8.4. 11n HT20 UAT 1 SISO MODE IN THE 2.4GHz BAND

8.4.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

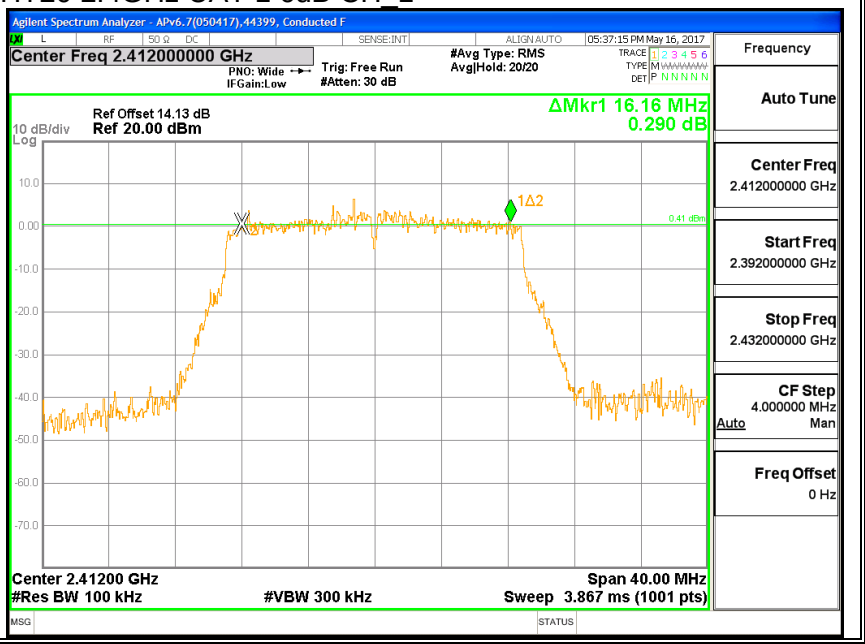
IC RSS-247 (5.2) (a)

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

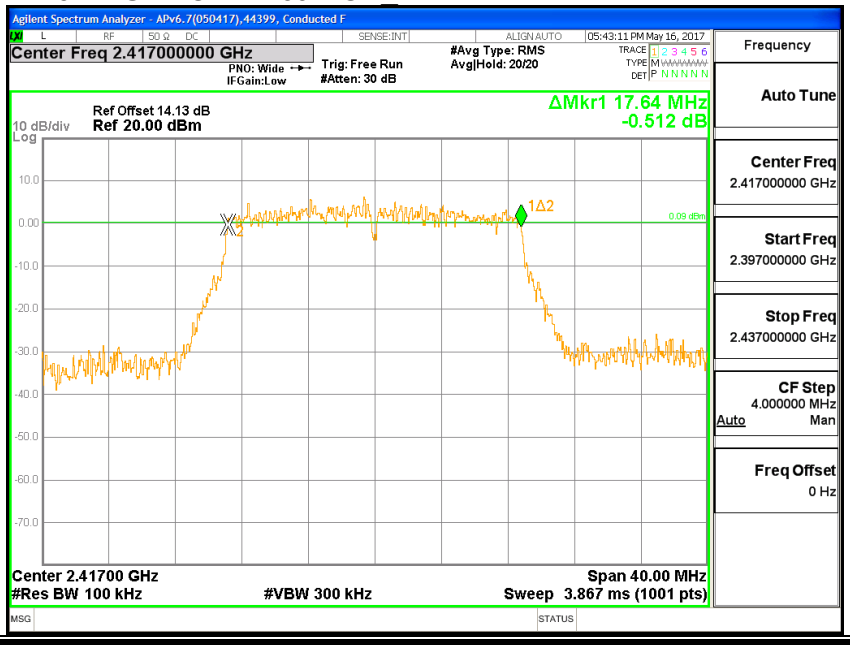
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low_1	2412	16.160	0.5
Low_2	2417	17.640	0.5
Low_3	2422	17.640	0.5
Low_4	2427	17.680	0.5
Middle_6	2437	17.640	0.5
High_9	2452	17.640	0.5
High_10	2457	16.840	0.5
High_11	2462	16.280	0.5
High_12	2467	17.640	0.5
High_13	2472	17.160	0.5

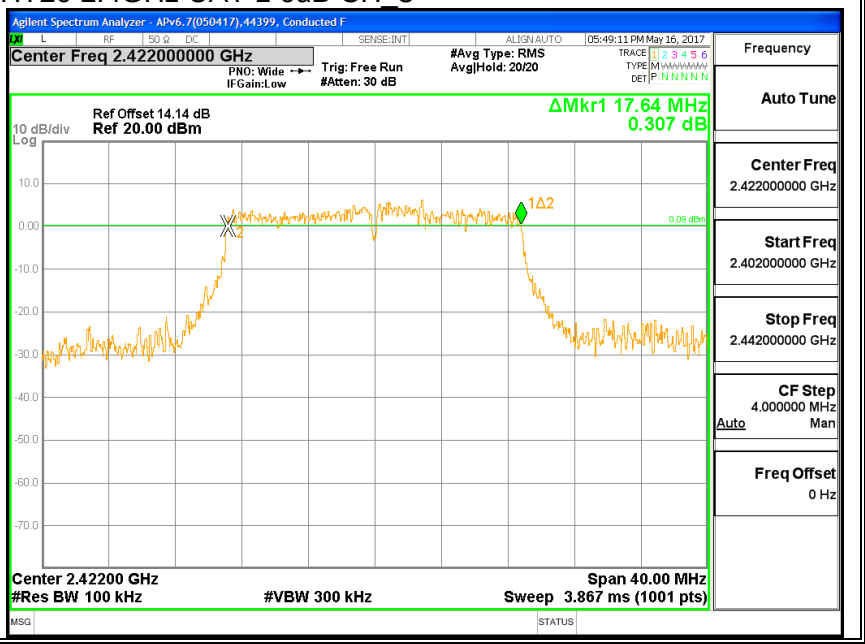
HT20 2.4GHz UAT 1 6dB CH_1



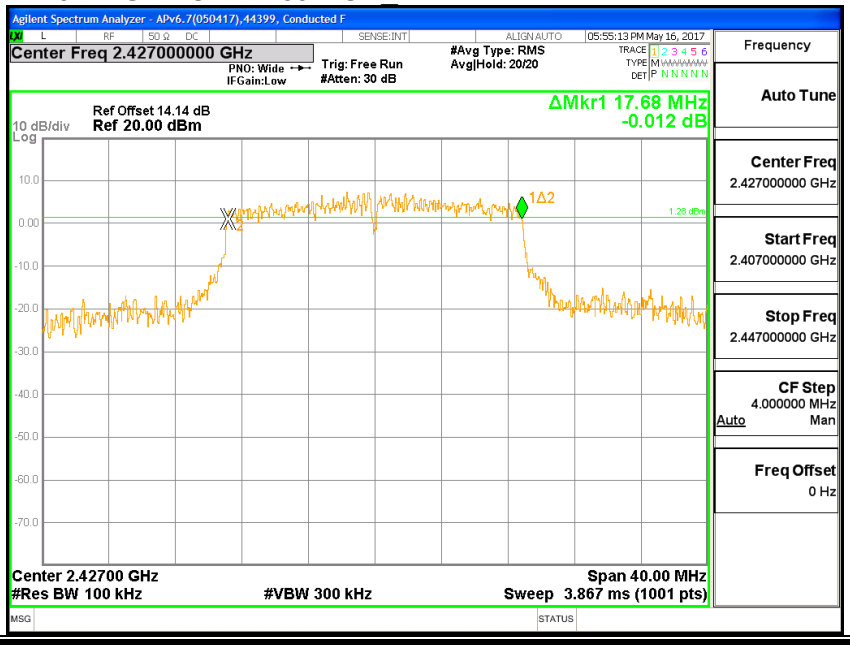
HT20 2.4GHz UAT 1 6dB CH_2



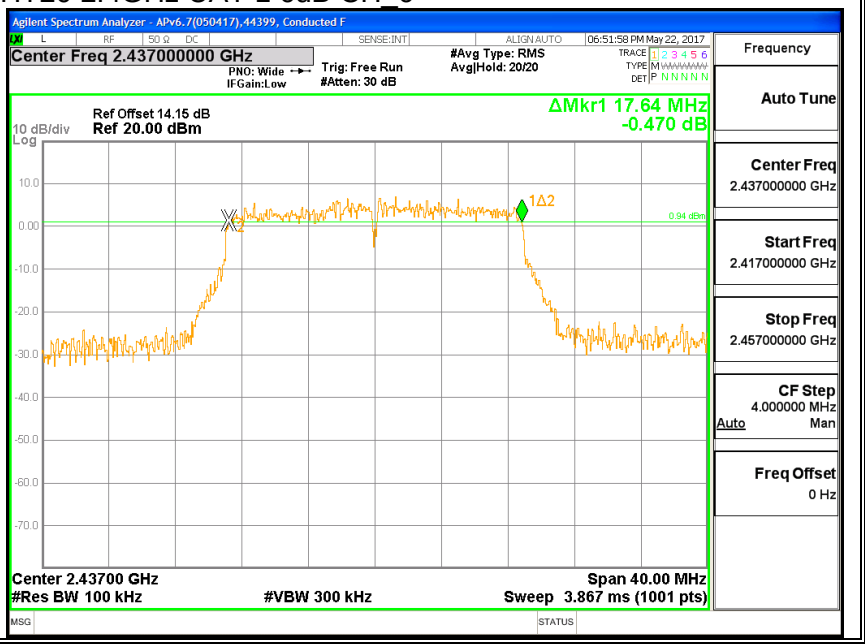
HT20 2.4GHz UAT 1 6dB CH_3



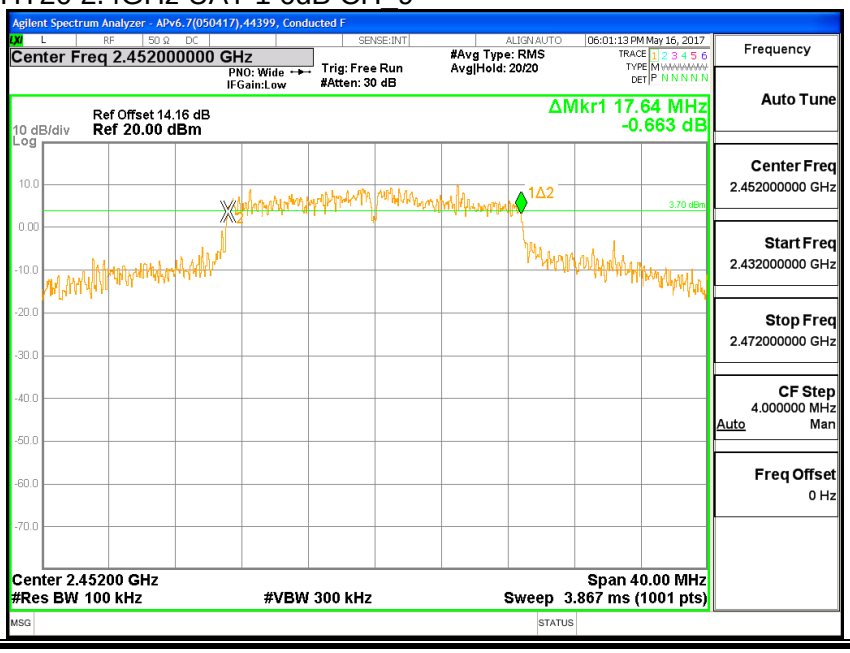
HT20 2.4GHz UAT 1 6dB CH_4



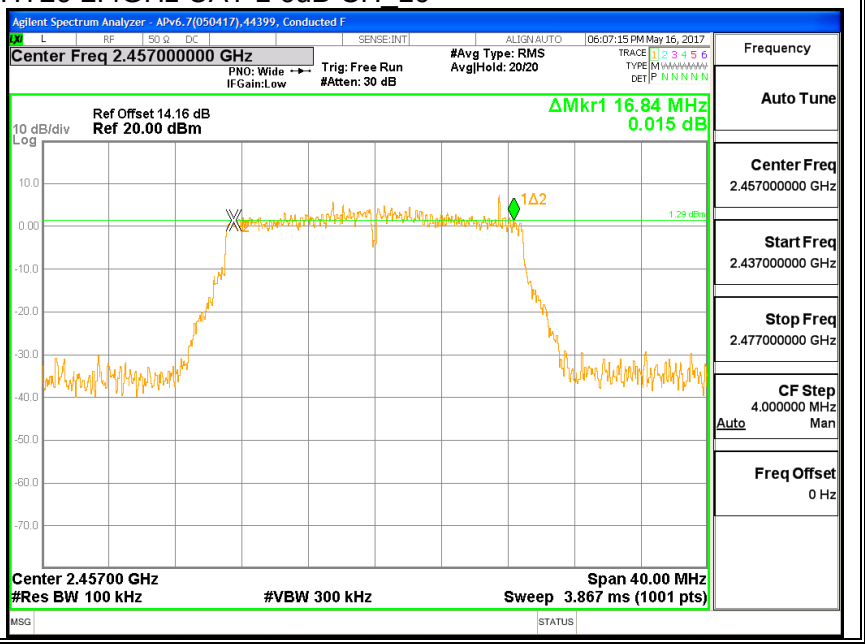
HT20 2.4GHz UAT 1 6dB CH_6



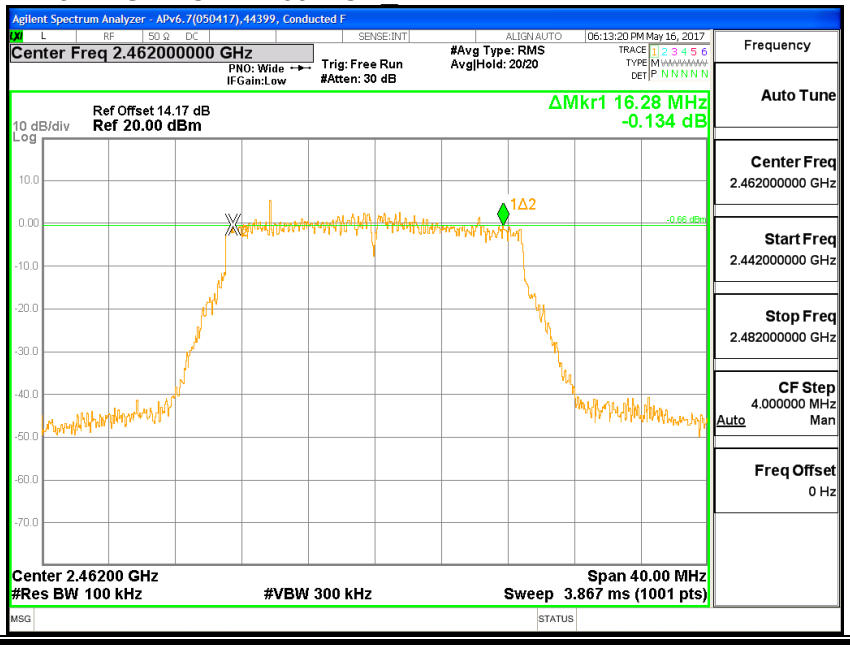
HT20 2.4GHz UAT 1 6dB CH_9



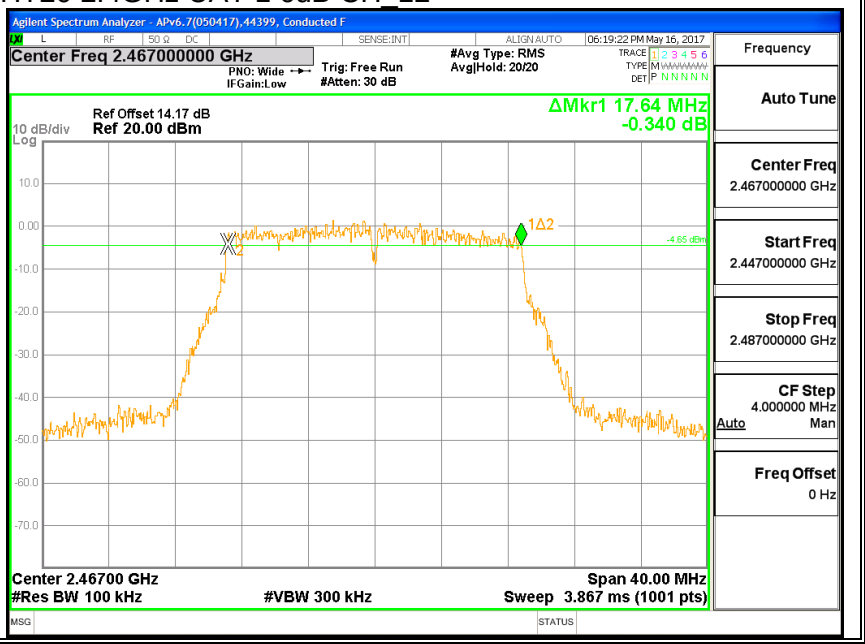
HT20 2.4GHz UAT 1 6dB CH_10



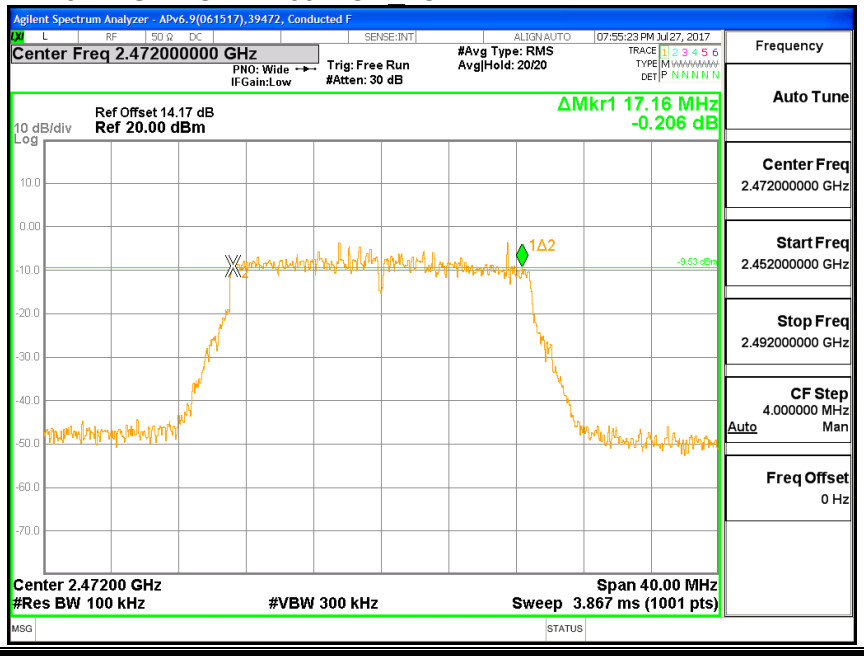
HT20 2.4GHz UAT 1 6dB CH_11



HT20 2.4GHz UAT 1 6dB CH_12



HT20 2.4GHz UAT 1 6dB CH_13



8.4.2. 99% BANDWIDTH

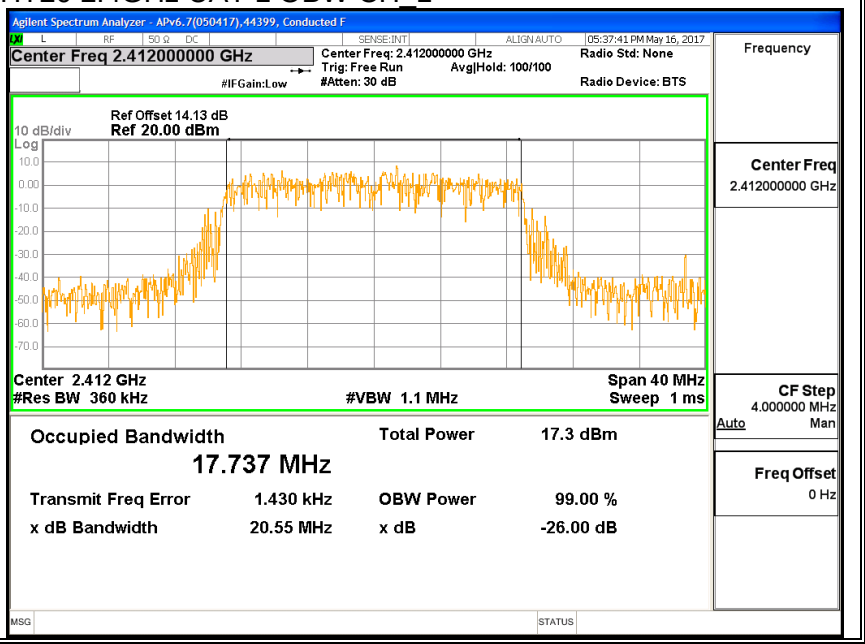
LIMITS

None; for reporting purposes only.

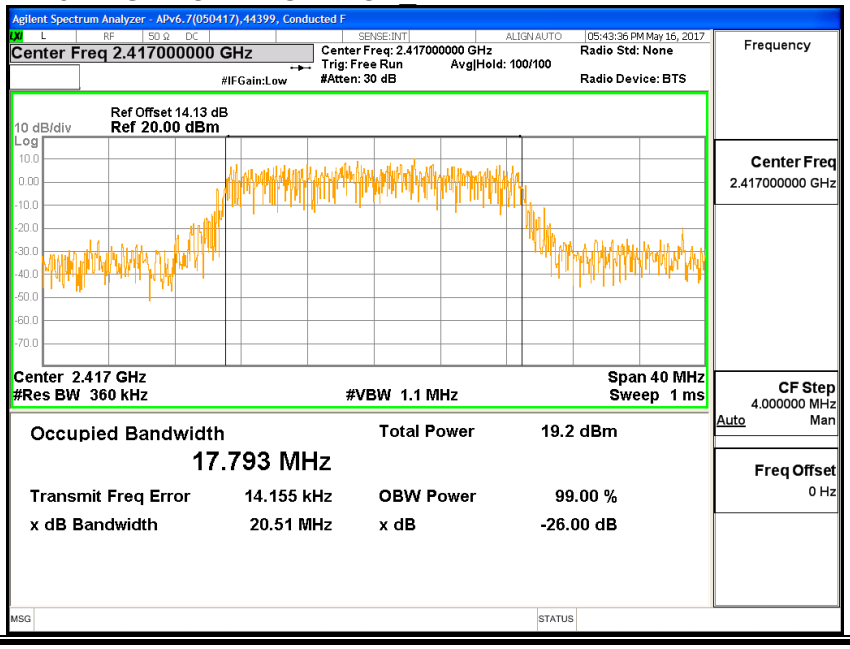
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low_1	2412	17.737
Low_2	2417	17.793
Low_3	2422	17.785
Low_4	2427	17.803
Middle_6	2437	17.751
High_9	2452	17.633
High_10	2457	17.688
High_11	2462	17.844
High_12	2467	17.792
High_13	2472	17.765

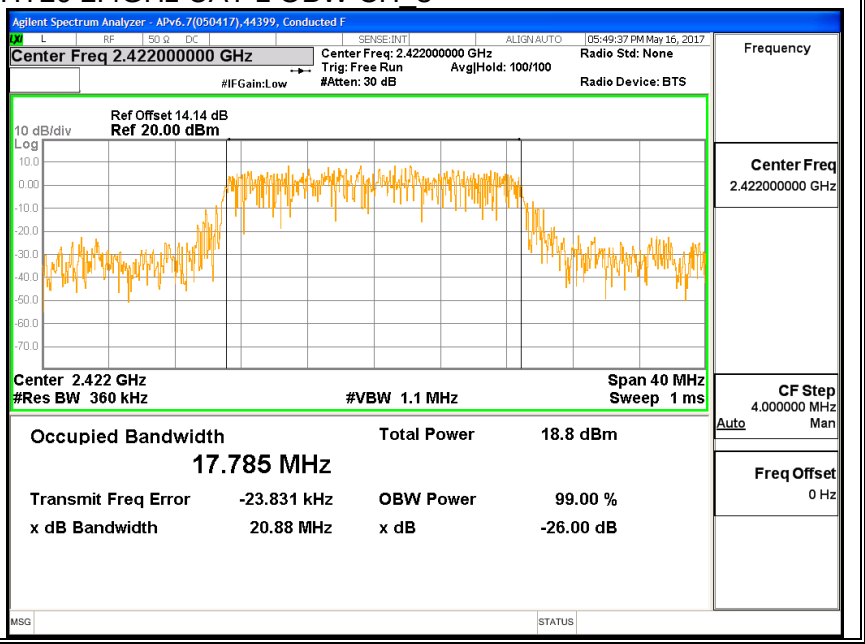
HT20 2.4GHz UAT 1 OBW CH_1



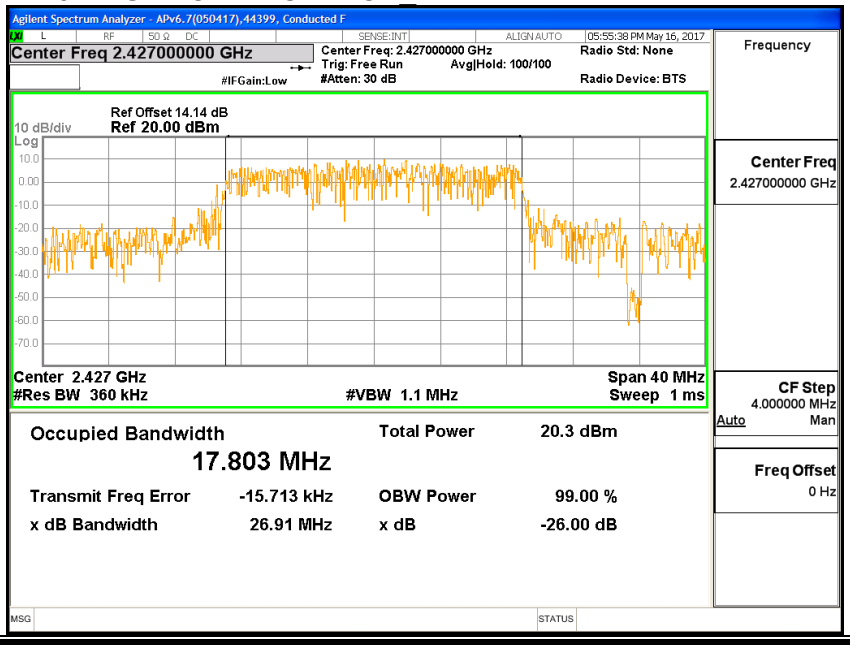
HT20 2.4GHz UAT 1 OBW CH_2



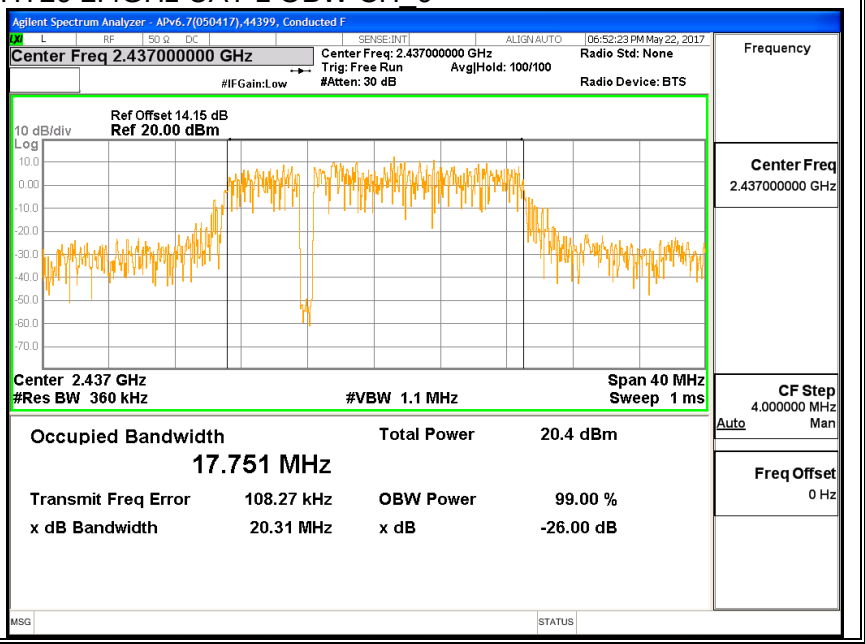
HT20 2.4GHz UAT 1 OBW CH_3



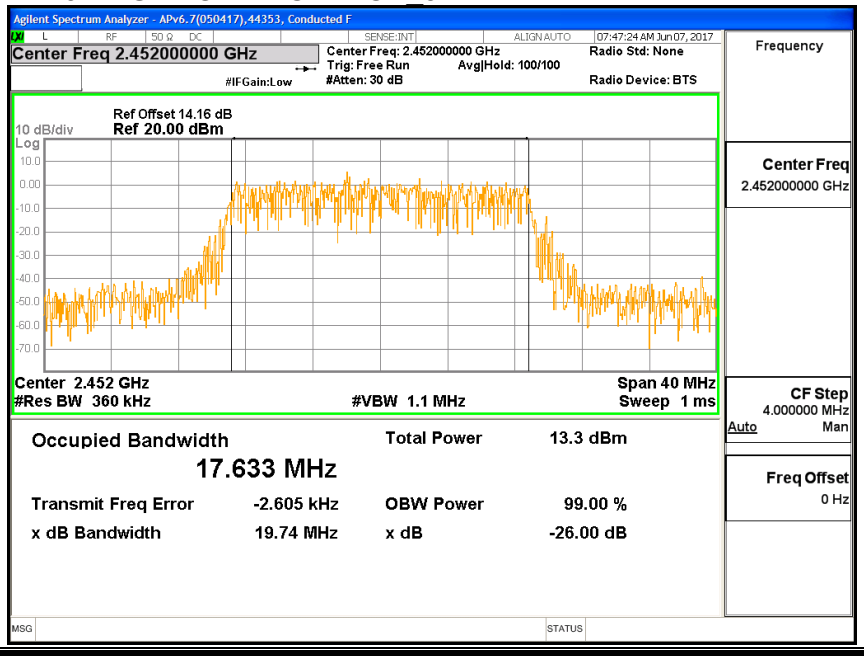
HT20 2.4GHz UAT 1 OBW CH_4



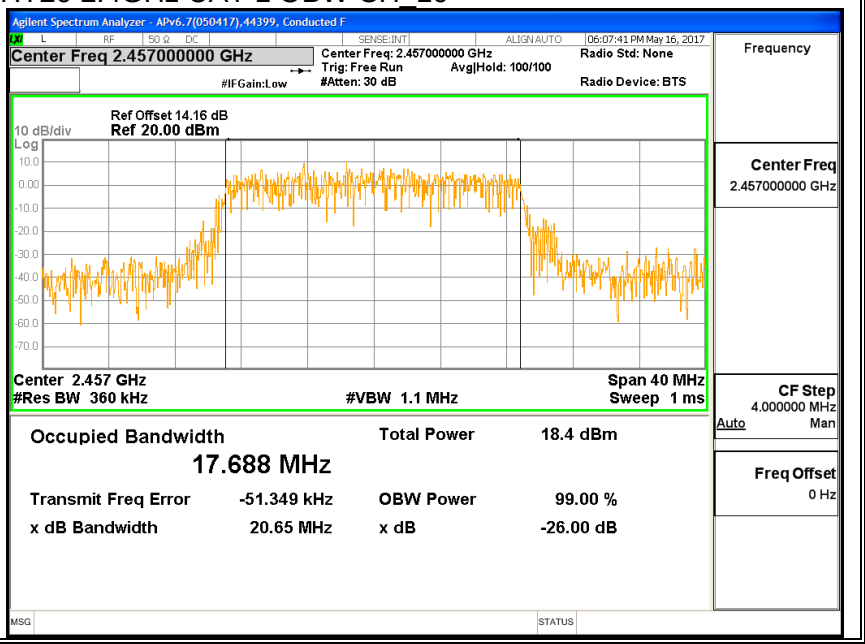
HT20 2.4GHz UAT 1 OBW CH_6



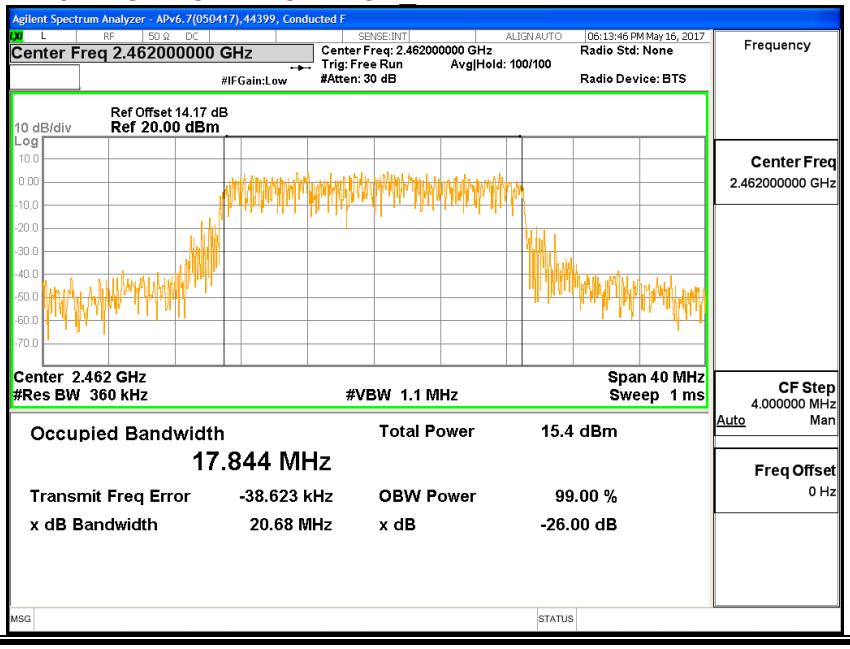
HT20 2.4GHz UAT 1 OBW CH_9



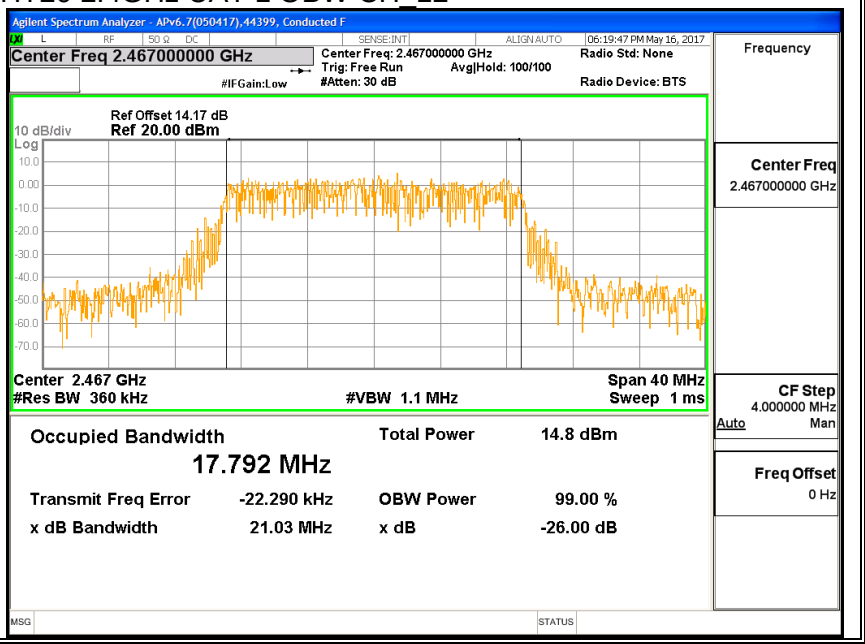
HT20 2.4GHz UAT 1 OBW CH_10



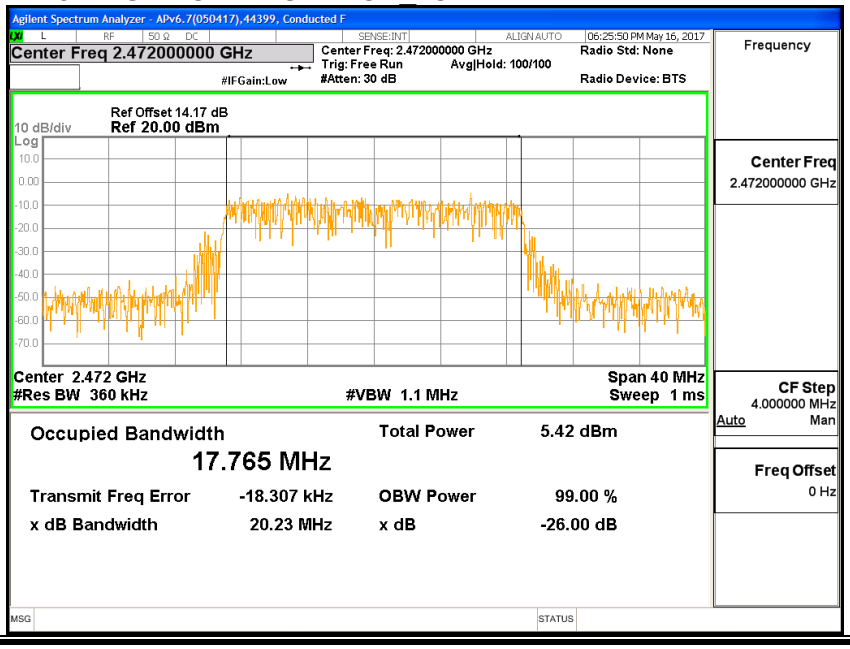
HT20 2.4GHz UAT 1 OBW CH_11



HT20 2.4GHz UAT 1 OBW CH_12



HT20 2.4GHz UAT 1 OBW CH_13



8.4.3. AVERAGE POWER

ID:	44366	Date:	7/25/17

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low_1	2412	17.17
Low_2	2417	19.23
Low_3	2422	21.39
Low_4	2427	21.48
Middle_6	2437	21.20
High_9	2452	21.46
High_10	2457	19.12
High_11	2462	17.24
High_12	2467	15.18
High_13	2472	7.96

8.4.4. OUTPUT POWER

ID:	44366	Date:	7/25/17

LIMITS

FCC §15.247

IC RSS-247 (5.4) (d)

For systems using digital modulation in the 2400–2483.5 MHz, and 5725–5850 MHz bands: 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.

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-1.67	30.00	30	36	30.00
Low_2	2417	-1.67	30.00	30	36	30.00
Low_3	2422	-1.67	30.00	30	36	30.00
Low_4	2427	-1.67	30.00	30	36	30.00
Middle_6	2437	-1.67	30.00	30	36	30.00
High_9	2452	-1.67	30.00	30	36	30.00
High_10	2457	-1.67	30.00	30	36	30.00
High_11	2462	-1.67	30.00	30	36	30.00
High_12	2467	-1.67	30.00	30	36	30.00
High_13	2472	-1.67	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power

Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	23.42	23.42	30.00	-6.58
Low_2	2417	25.45	25.45	30.00	-4.55
Low_3	2422	27.84	27.84	30.00	-2.16
Low_4	2427	27.81	27.81	30.00	-2.19
Middle_6	2437	27.60	27.60	30.00	-2.40
High_9	2452	27.71	27.71	30.00	-2.29
High_10	2457	25.39	25.39	30.00	-4.61
High_11	2462	23.44	23.44	30.00	-6.56
High_12	2467	21.49	21.49	30.00	-8.51
High_13	2472	14.45	14.45	30.00	-15.55

8.4.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

IC RSS-247 (5.2) (b)

For digitally modulated systems, the power spectral density conducted form the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmissions.

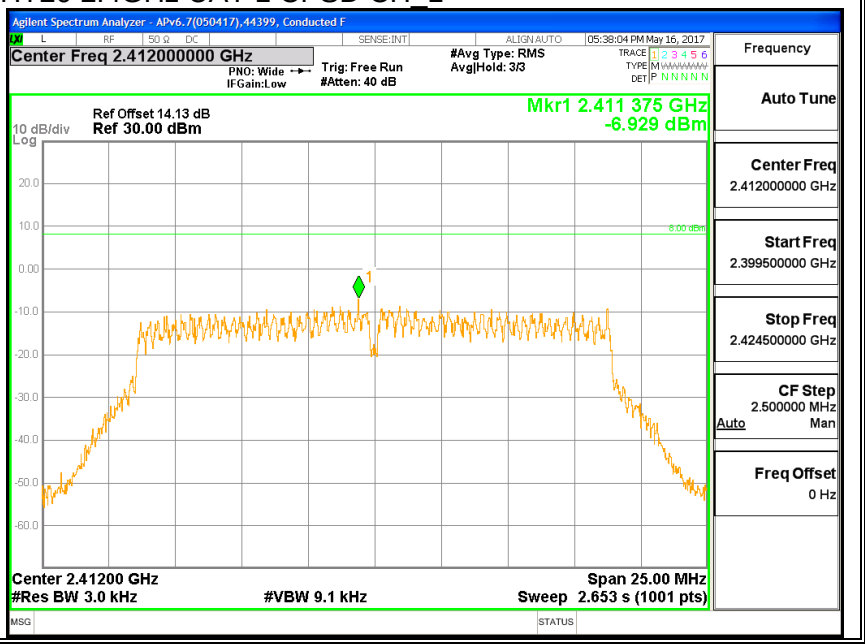
RESULTS

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

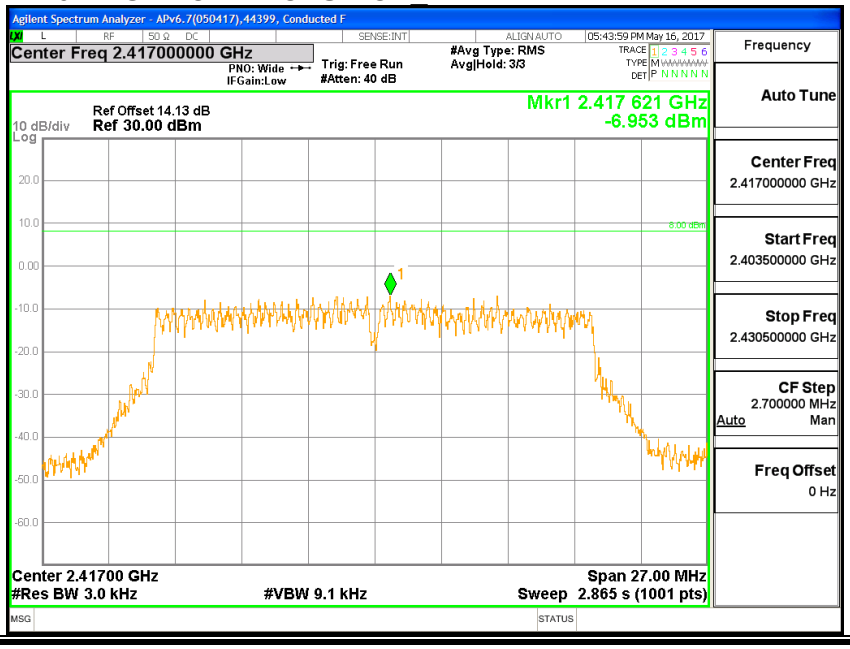
PSD Results

Channel	Frequency (MHz)	Meas (dBm)	Total Corr'd PSD (dBm/3KHz)	Limit (dBm)	Margin (dB)
Low_1	2412	-6.929	-6.929	8.0	-14.9
Low_2	2417	-6.953	-6.953	8.0	-15.0
Low_3	2422	-6.161	-6.161	8.0	-14.2
Low_4	2427	-7.018	-7.018	8.0	-15.0
Middle_6	2437	-6.278	-6.278	8.0	-14.3
High_9	2452	-3.405	-3.405	8.0	-11.4
High_10	2457	-5.394	-5.394	8.0	-13.4
High_11	2462	-9.792	-9.792	8.0	-17.8
High_12	2467	-10.070	-10.070	8.0	-18.1
High_13	2472	-18.950	-18.950	8.0	-27.0

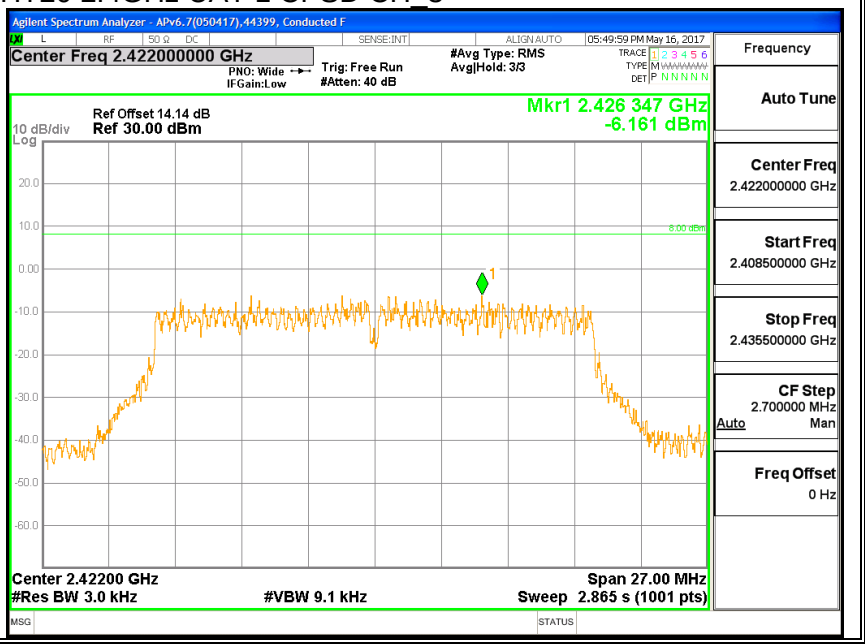
HT20 2.4GHz UAT 1 CPSD CH_1



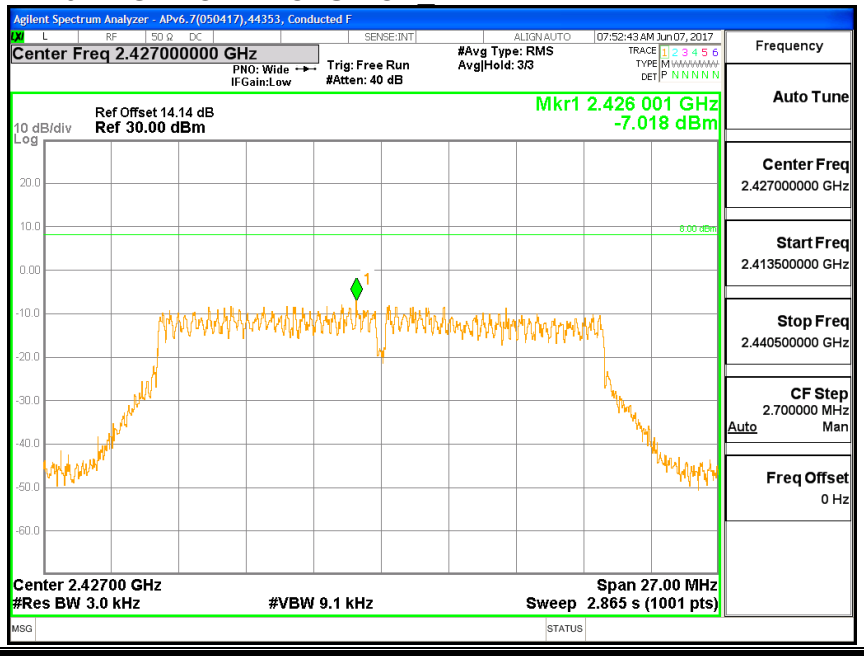
HT20 2.4GHz UAT 1 CPSD CH_2



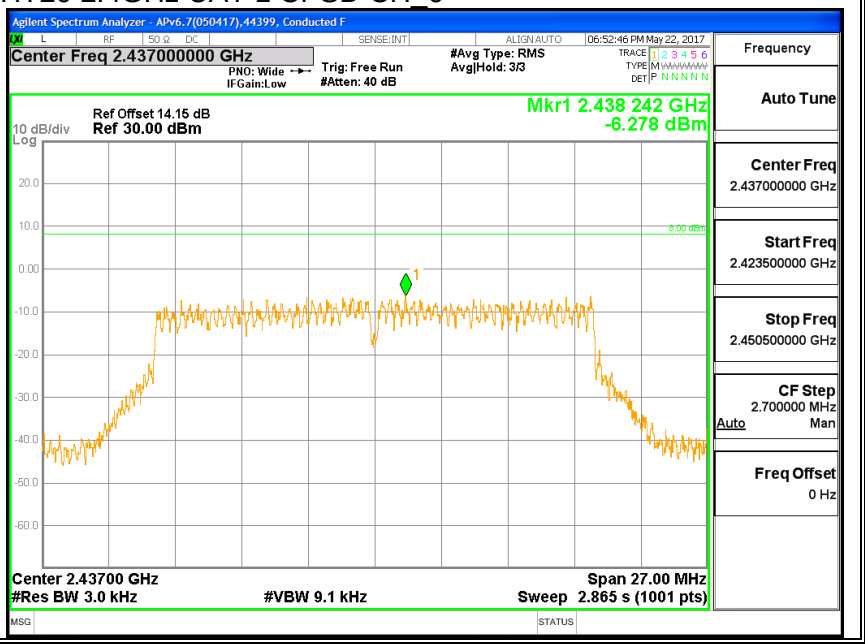
HT20 2.4GHz UAT 1 CPSD CH_3



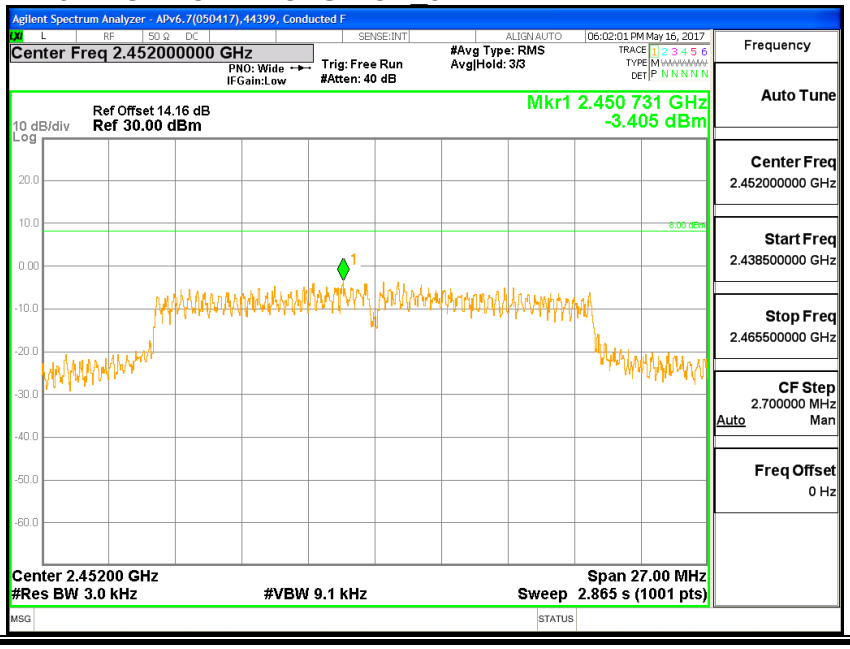
HT20 2.4GHz UAT 1 CPSD CH_4



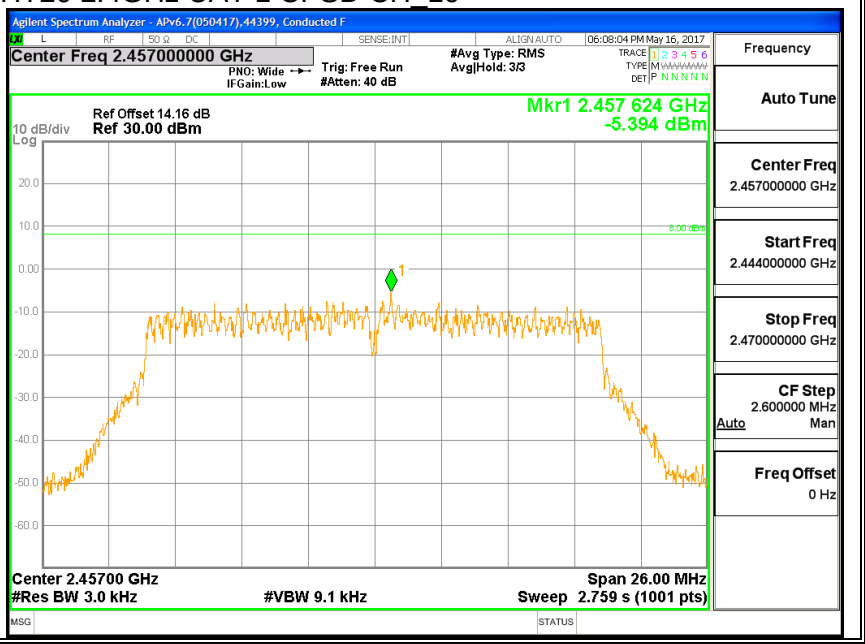
HT20 2.4GHz UAT 1 CPSD CH_6



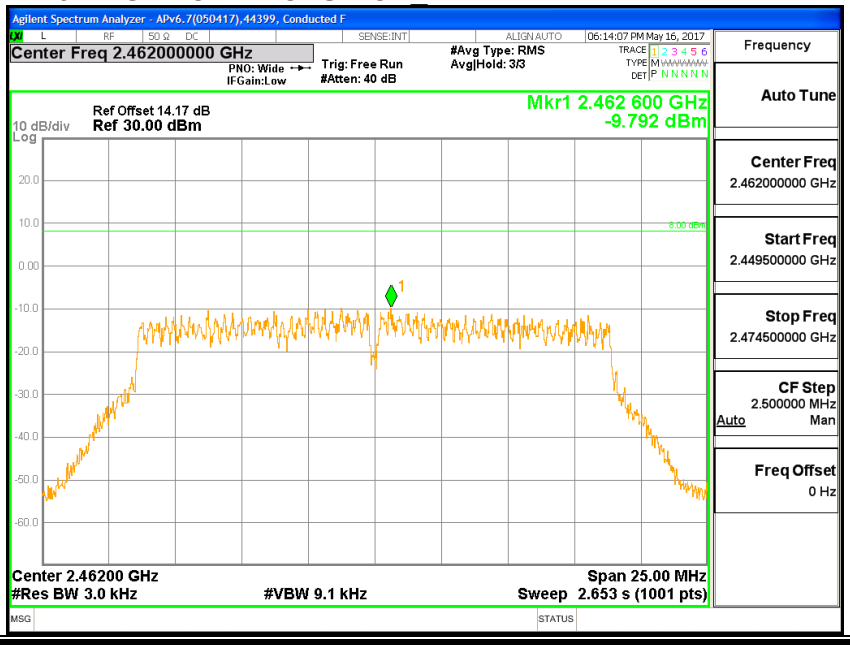
HT20 2.4GHz UAT 1 CPSD CH_9



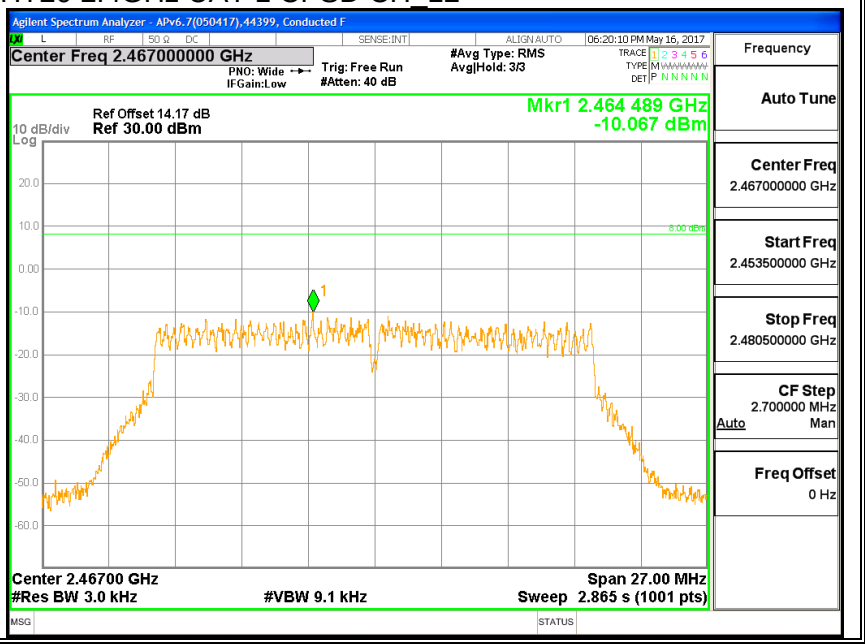
HT20 2.4GHz UAT 1 CPSD CH_10



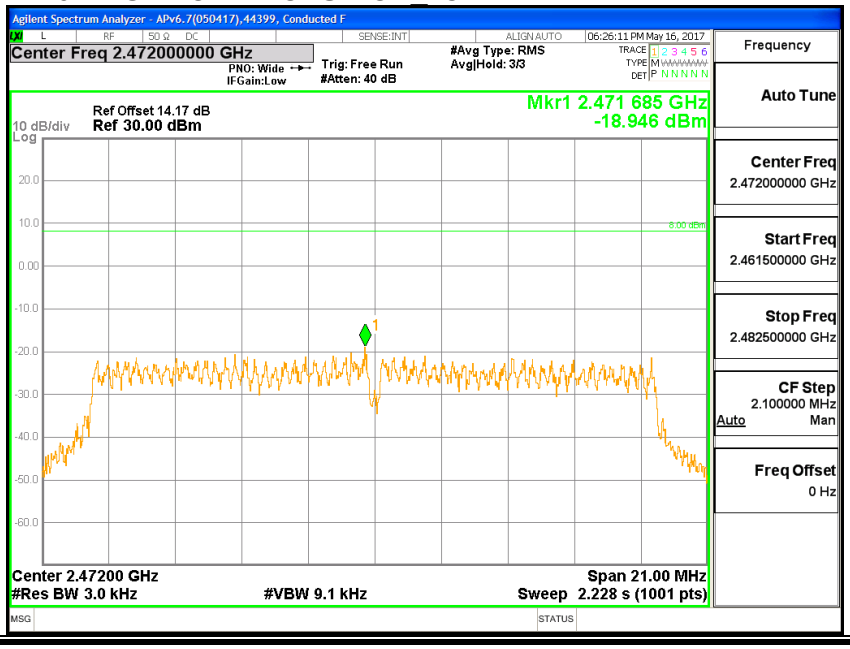
HT20 2.4GHz UAT 1 CPSD CH_11



HT20 2.4GHz UAT 1 CPSD CH_12



HT20 2.4GHz UAT 1 CPSD CH_13



8.4.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

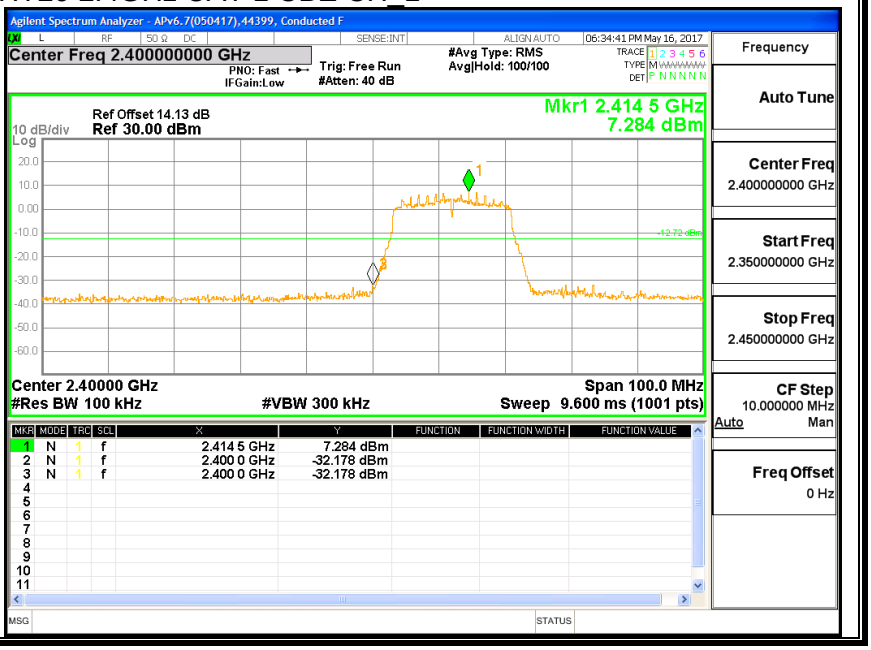
FCC §15.247 (d)

IC RSS-247 (5.5)

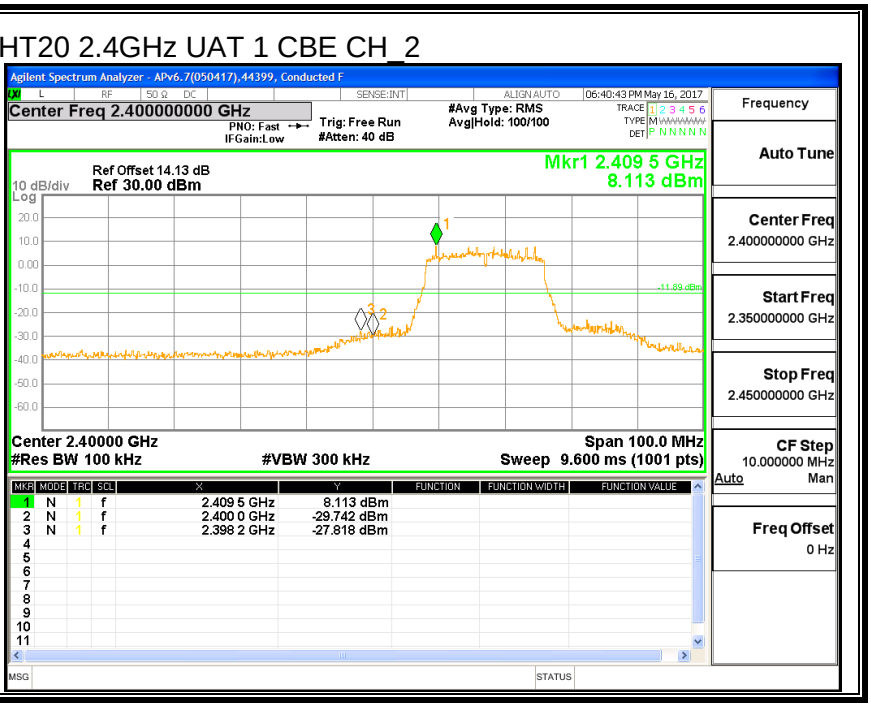
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.

CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

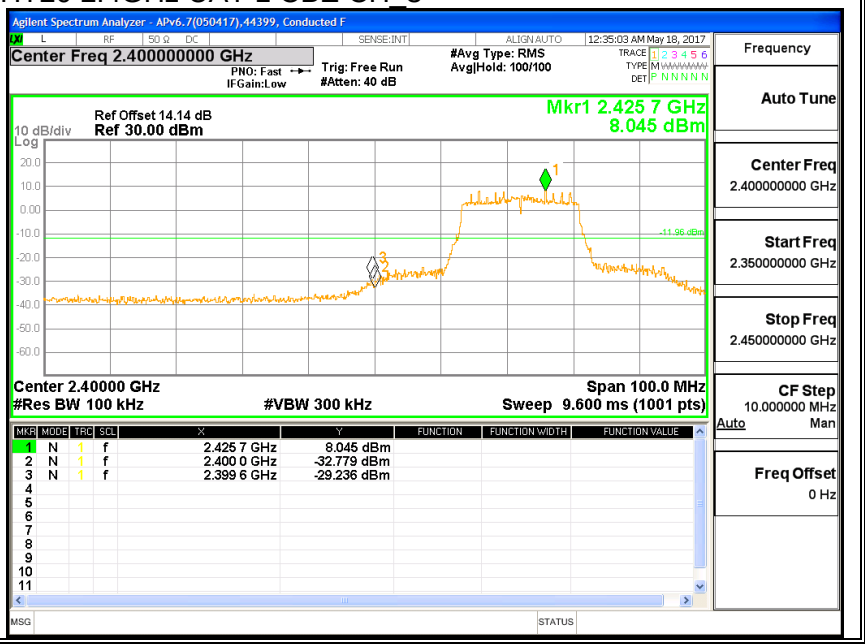
HT20 2.4GHz UAT 1 CBE CH_1



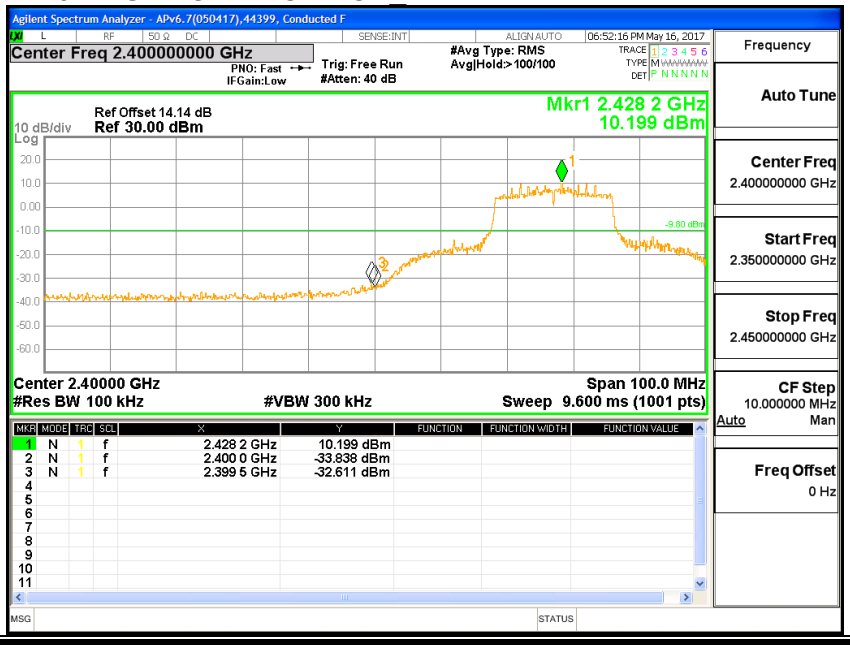
HT20 2.4GHz UAT 1 CBE CH_2



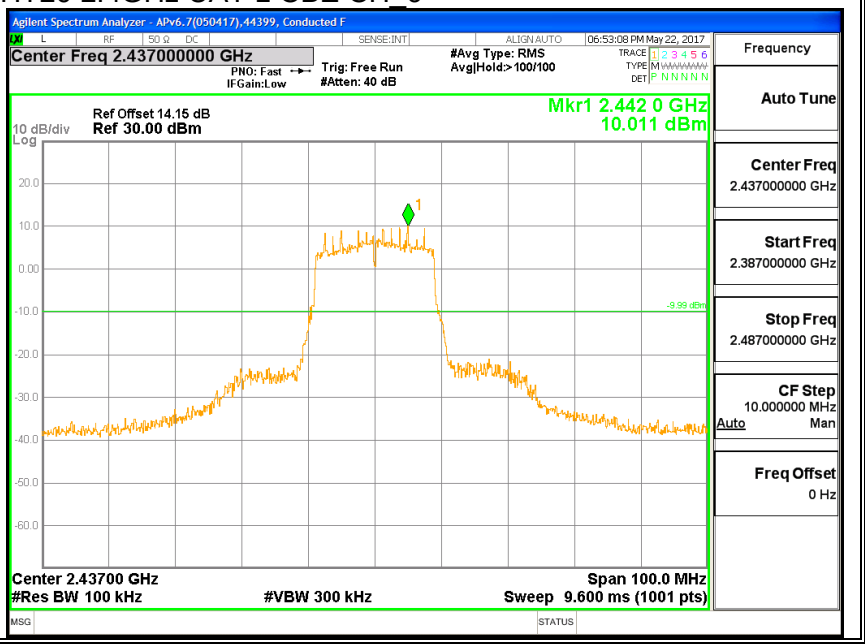
HT20 2.4GHz UAT 1 CBE CH_3



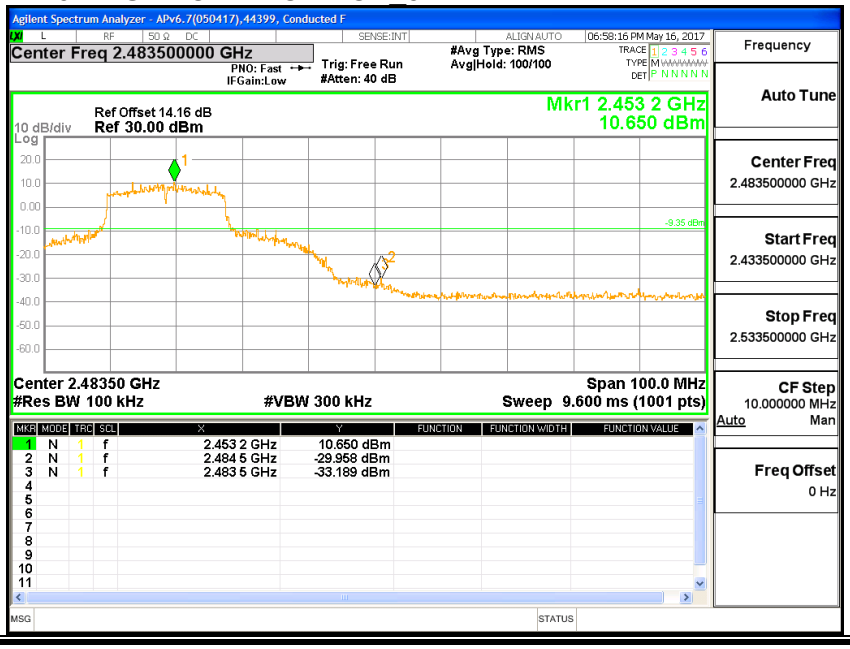
HT20 2.4GHz UAT 1 CBE CH_4



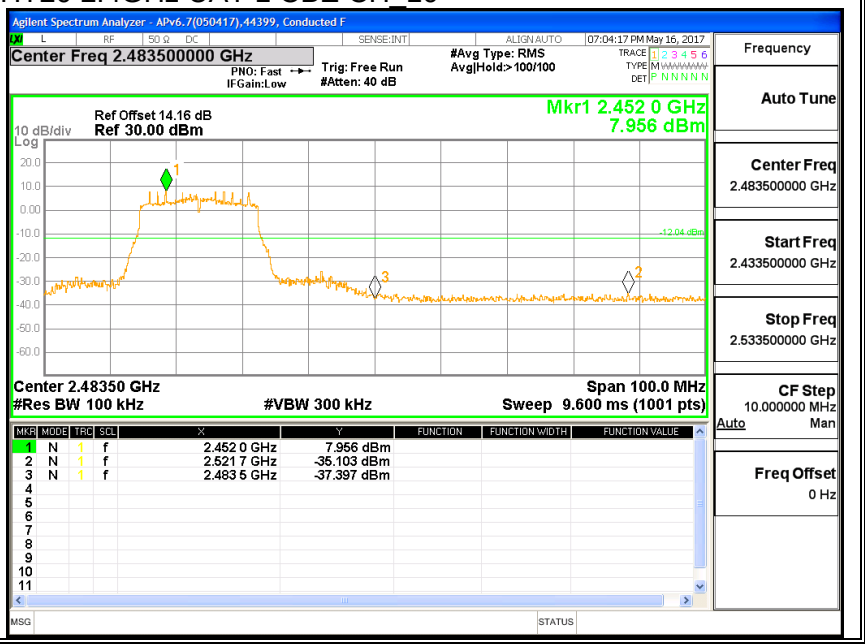
HT20 2.4GHz UAT 1 CBE CH_6



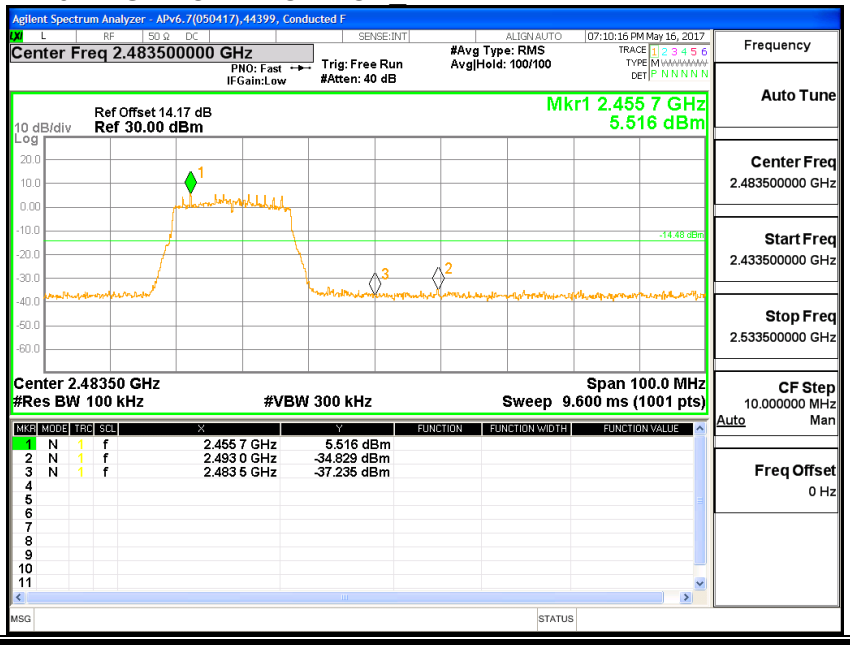
HT20 2.4GHz UAT 1 CBE CH_9



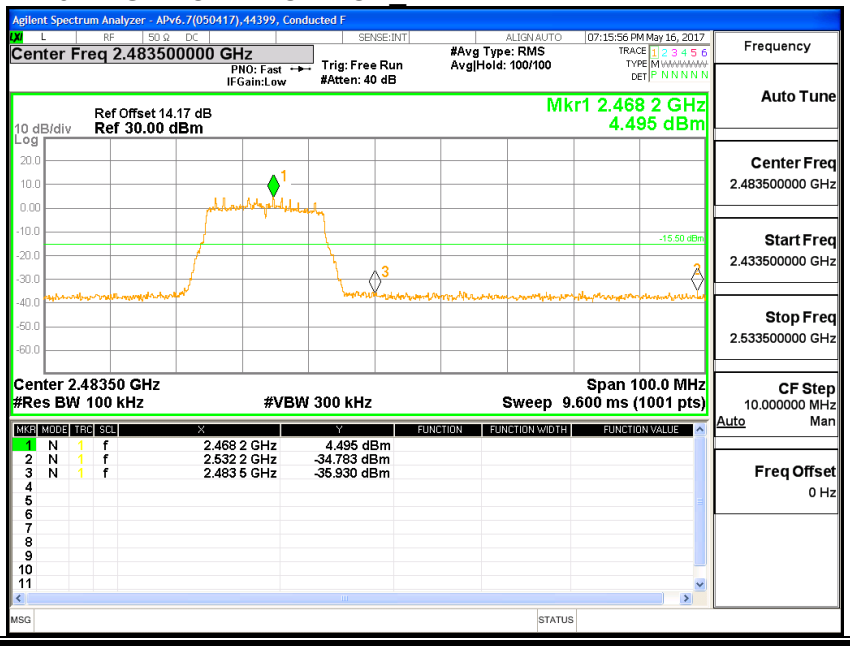
HT20 2.4GHz UAT 1 CBE CH_10



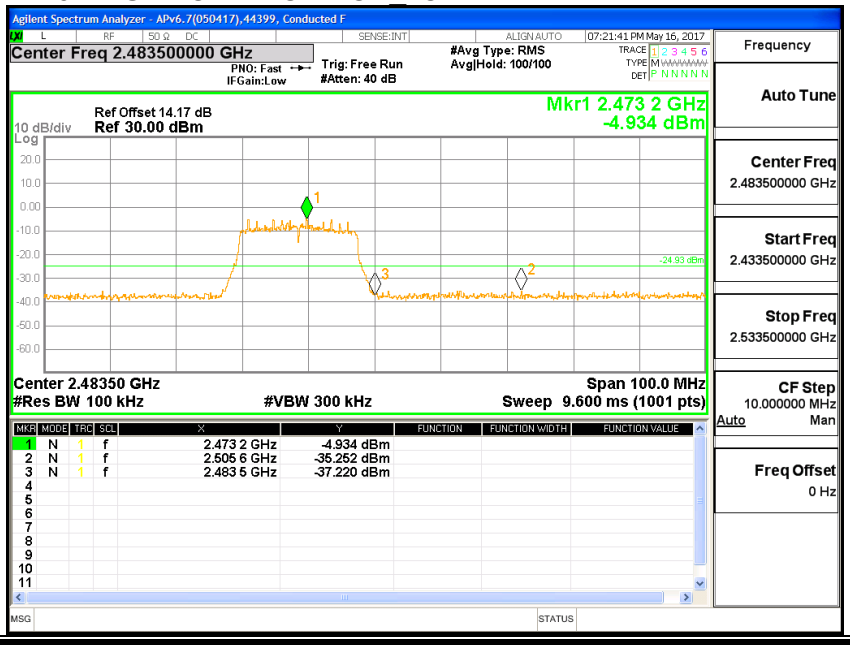
HT20 2.4GHz UAT 1 CBE CH_11



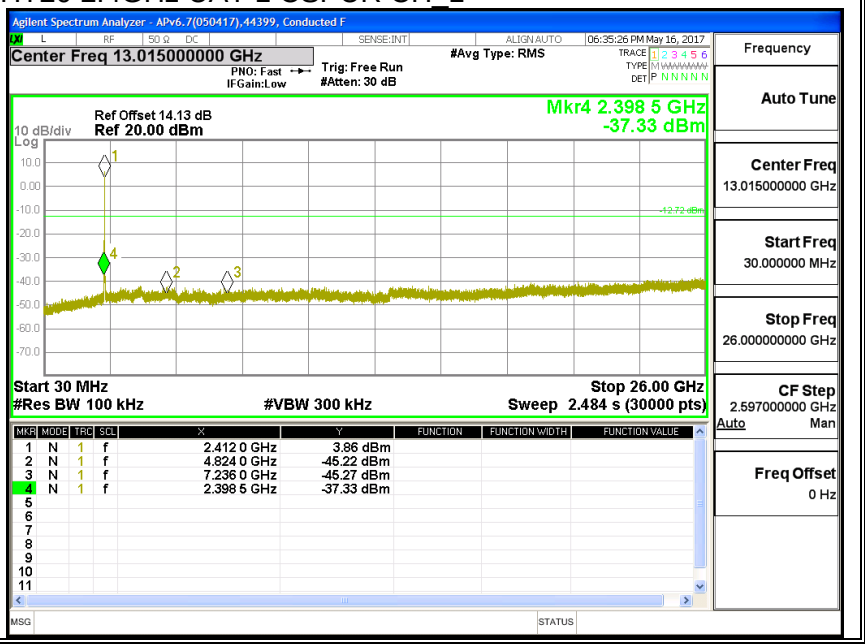
HT20 2.4GHz UAT 1 CBE CH_12



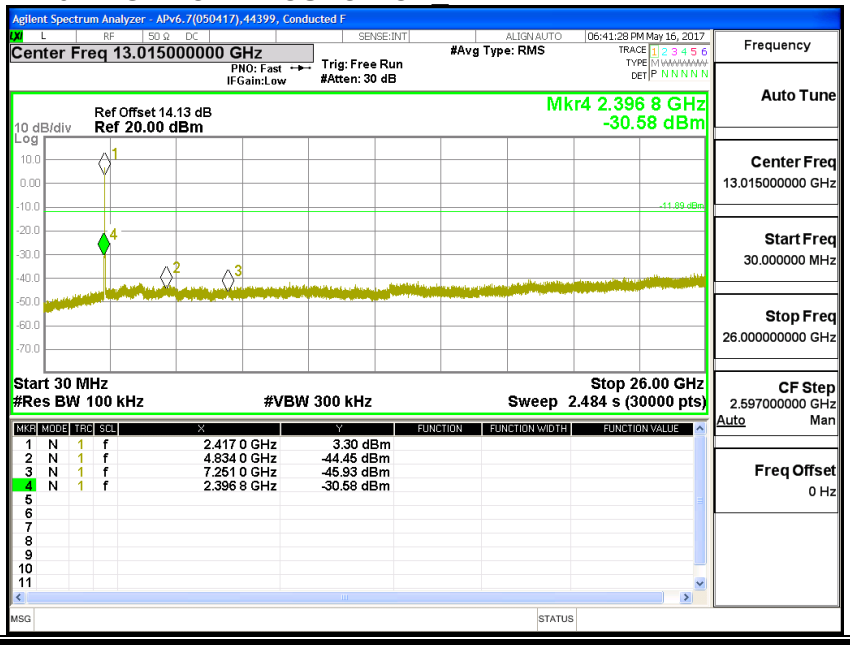
HT20 2.4GHz UAT 1 CBE CH_13



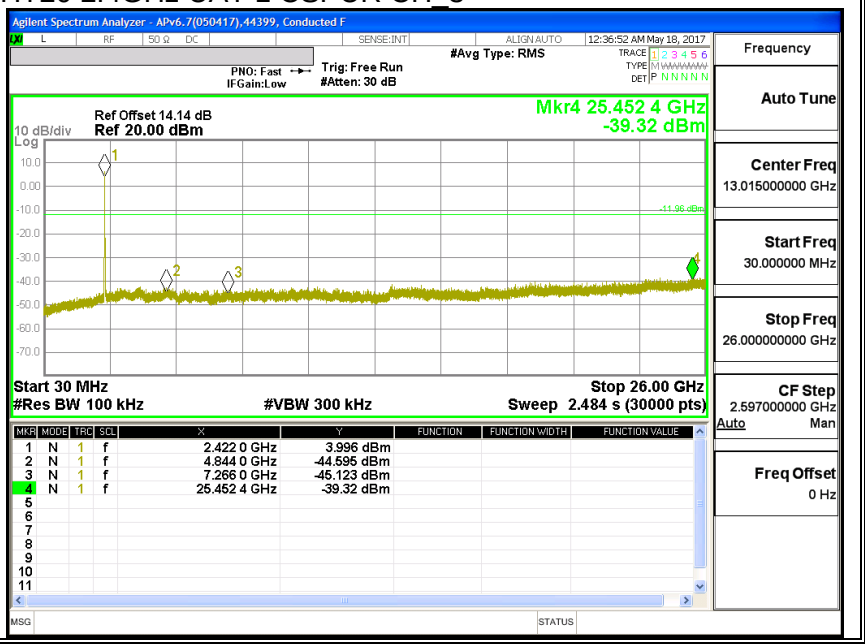
HT20 2.4GHz UAT 1 CSPUR CH_1



HT20 2.4GHz UAT 1 CSPUR CH_2



HT20 2.4GHz UAT 1 CSPUR CH_3



HT20 2.4GHz UAT 1 CSPUR CH_4