**FCC 47 CFR PART 15 SUBPART C**
**INDUSTRY CANADA RSS-210 ISSUE 8**

# CERTIFICATION TEST REPORT

**FOR**

**Cellular Phone with Bluetooth and WLAN Radios**

**MODEL NUMBER: A1586**

**FCC ID: BCG-E2816A**
**IC: 579C-E2816A**

**REPORT NUMBER: 14U17673-E1 Revision C**

**ISSUE DATE: AUGUST 02, 2014**

*Prepared for*
**APPLE, INC.**
**1 INFINITE LOOP**
**CUPERTINO, CA 95014, U.S.A.**

*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 |
|---|---|---|---|
| -- | 7/21/14 | Initial Issue | F. de Anda |
| A | 7/23/14 | EUT Description Updated | H.Lau |
| B | 7/29/14 | Update to referenced reports | F. de Anda |
| C | 08/02/14 | Address TCB Questions | T. Lee |


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# TABLE OF CONTENTS

**1. ATTESTATION OF TEST RESULTS ..... 5**

**2. TEST METHODOLOGY ..... 6**

**3. FACILITIES AND ACCREDITATION ..... 6**

**4. CALIBRATION AND UNCERTAINTY ..... 6**

*4.1. MEASURING INSTRUMENT CALIBRATION ..... 6*

*4.2. SAMPLE CALCULATION ..... 6*

*4.3. MEASUREMENT UNCERTAINTY ..... 7*

**5. EQUIPMENT UNDER TEST ..... 8**

*5.1. DESCRIPTION OF EUT ..... 8*

*5.2. MAXIMUM OUTPUT POWER ..... 8*

*5.3. DESCRIPTION OF AVAILABLE ANTENNAS ..... 8*

*5.4. SOFTWARE AND FIRMWARE ..... 8*

*5.5. WORST-CASE CONFIGURATION AND MODE ..... 9*

*5.6. DESCRIPTION OF TEST SETUP ..... 10*

**6. TEST AND MEASUREMENT EQUIPMENT ..... 14**

**7. MEASUREMENT METHODS ..... 15**

**8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS ..... 16**

*8.1. ON TIME AND DUTY CYCLE RESULTS ..... 16*

8.1.1. DUTY CYCLE PLOTS ..... 17

8.1.2. DUTY CYCLE PLOTS ..... 17

**9. ANTENNA PORT TEST RESULTS ..... 18**

*9.1. BASIC DATA RATE GFSK MODULATION ..... 18*

9.1.1. 20 dB AND 99% BANDWIDTH ..... 18

9.1.2. HOPPING FREQUENCY SEPARATION ..... 21

9.1.3. NUMBER OF HOPPING CHANNELS ..... 23

9.1.4. AVERAGE TIME OF OCCUPANCY ..... 26

9.1.5. OUTPUT POWER ..... 30

9.1.6. AVERAGE POWER ..... 33

9.1.7. CONDUCTED SPURIOUS EMISSIONS ..... 34

*9.2. ENHANCED DATA RATE 8PSK MODULATION ..... 39*

9.2.1. 20 dB AND 99% BANDWIDTH ..... 39

9.2.2. HOPPING FREQUENCY SEPARATION ..... 42

9.2.3. NUMBER OF HOPPING CHANNELS ..... 44

9.2.4. AVERAGE TIME OF OCCUPANCY ..... 47

9.2.5. OUTPUT POWER ..... 51

9.2.6. AVERAGE POWER ..... 54

9.2.7. CONDUCTED SPURIOUS EMISSIONS ..... 55



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47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

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**10. RADIATED TEST RESULTS .....60**

*10.1. LIMITS AND PROCEDURE.....60*

*10.2. TRANSMITTER ABOVE 1GHz.....61*

10.2.1. BASIC DATA RATE GFSK MODULATION .....61

10.2.2. ENHANCED DATA RATE 8PSK MODULATION.....71

*10.3. WORST-CASE ABOVE 18 GHz.....81*

*10.4. WORST-CASE BELOW 1 GHz .....82*

**11. AC POWER LINE CONDUCTED EMISSIONS .....84**

**12. SETUP PHOTOS .....88**


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# 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** Cellular Phone with Bluetooth and WLAN Radios

**MODEL:** A1586

**SERIAL NUMBER:** C39MF01KFY6W - Conducted, C39MD06FFY70 - Radiated

**DATE TESTED:** APRIL 10-JULY 21, 2014

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart C | Pass |
| INDUSTRY CANADA RSS-210 Issue 8 Annex 8 | Pass |
| INDUSTRY CANADA RSS-GEN Issue 3 | 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:

FRANCISCO DE ANDA
Project Lead
UL Verification Services Inc.

Tested By:

Oliver Su
Senior Engineer
UL Verification Services Inc.


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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

# 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


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## 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%.


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# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

Model A1586 is a mobile phone with multimedia functions (music, application support, and video), Cellular GSM/GPRS/EGPRS/CDMA2000/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, Bluetooth radio and NFC. The rechargeable battery is not user accessible.

## 5.2. MAXIMUM OUTPUT POWER

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

| Frequency Range (MHz) | Mode | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| 2402 - 2480 | Basic GFSK | 11.86 | 15.35 |
| 2402 - 2480 | Enhanced 8PSK | 11.33 | 13.58 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PiFA antenna, with a maximum gain of -.38dBi.

## 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Bluetool 1.8.5


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## 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was including headset, AC charger and the mode and channel with the highest output power.

The EUT is a portable device that has three orientations; therefore X, Y and Z orientations have been investigated with AC adapter and Headset. The worst case was found to be at X (Flatbed) position without AC adapter and headset (for above 1GHz).

Based on the manufacturer's attestation that the nominal output power is reduced as the data rate increases, the data rates tested represent the highest power and worst-case with respect to EMC performance.

Worst-case data rates were:

GFSK mode: DH1
8PSK mode: 3-DH5

There are three vendors of the WiFi/Bluetooth radio modules: variant 1, variant 2 and variant 3 and they have the same mechanical outline, same on board antenna, matching circuit, antenna structure and same specification. Baseline testing was performed on all three variants to determine the worst case on all conducted power and radiated emissions.


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## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | | |
|---|---|---|---|---|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| AC/DC adapter | Apple | A1401 | 60812 | NA |
| Earphone | Apple | NA | NA | NA |
| Laptop | Apple | A1278 | C02HJ0A7DTY4 | 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 | 0.1 | to spectrum Analyzer |
| 2 | USB | 1 | USB | Shielded | 1m | 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 |
| None used | | | | | | |

**I/O CABLES (BELOW 1GHZ & AC LINE CONDUCTED TESTS)**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | AC | 1 | US115 | Un-Shielded | 80cm | NA |
| 2 | DC | 1 | USB | Un-Shielded | 1m | NA |
| 3 | Audio | 1 | Jack | Un-Shielded | 0.5m | NA |


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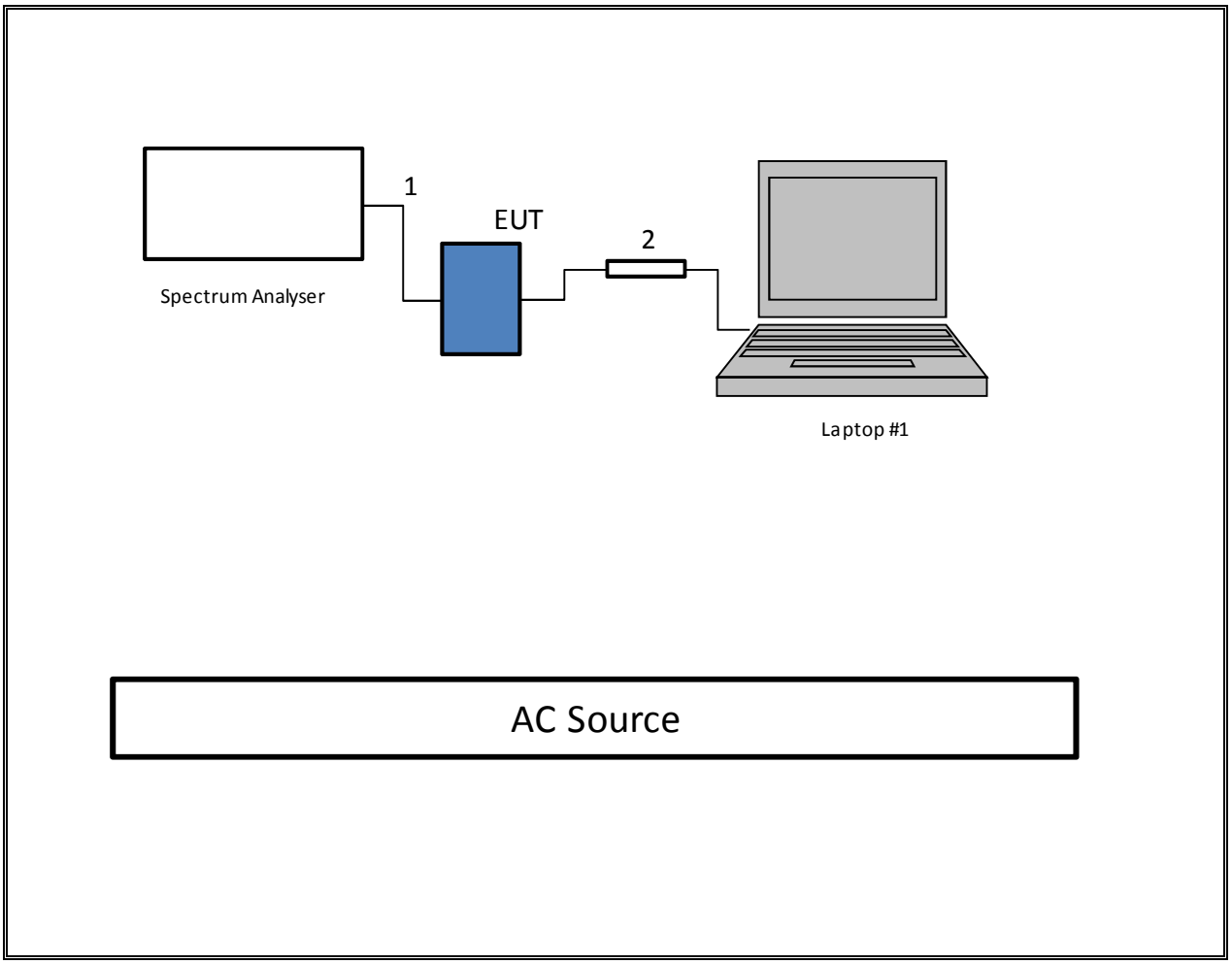
**TEST SETUP- CONDUCTED PORT**

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**





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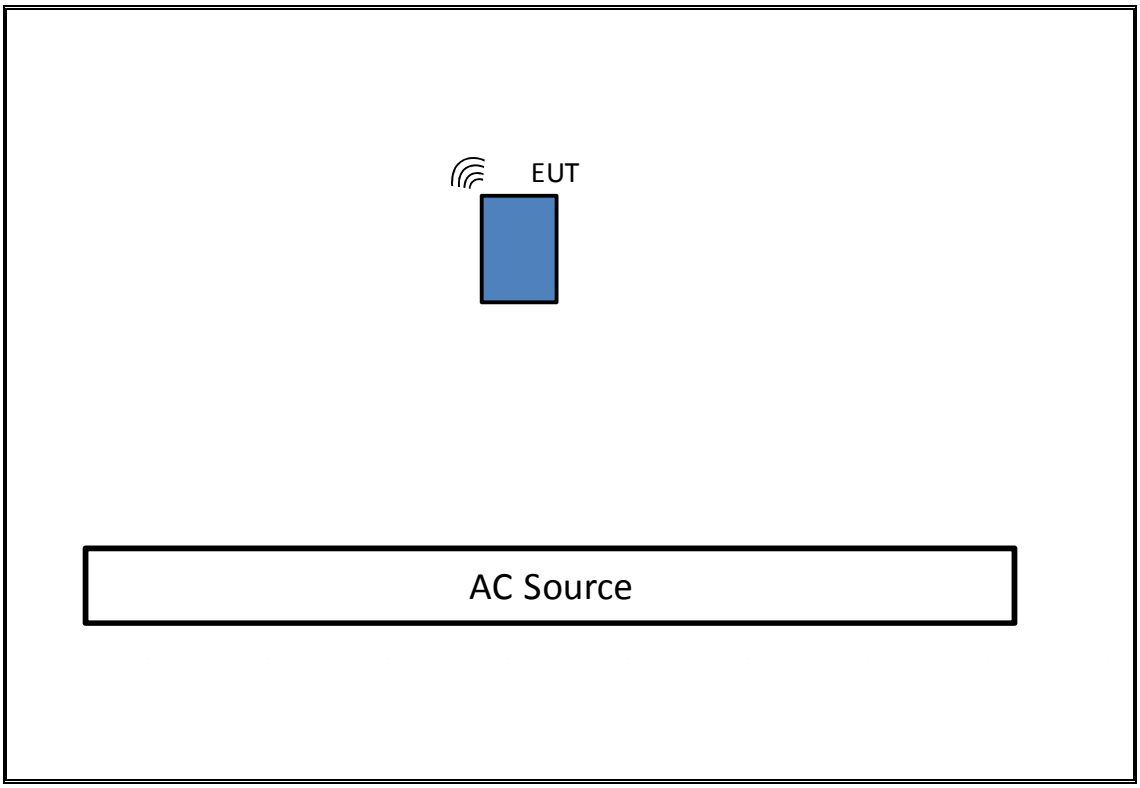
**TEST SETUP- RADIATED-ABOVE 1 GHZ**

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

**SETUP DIAGRAM**





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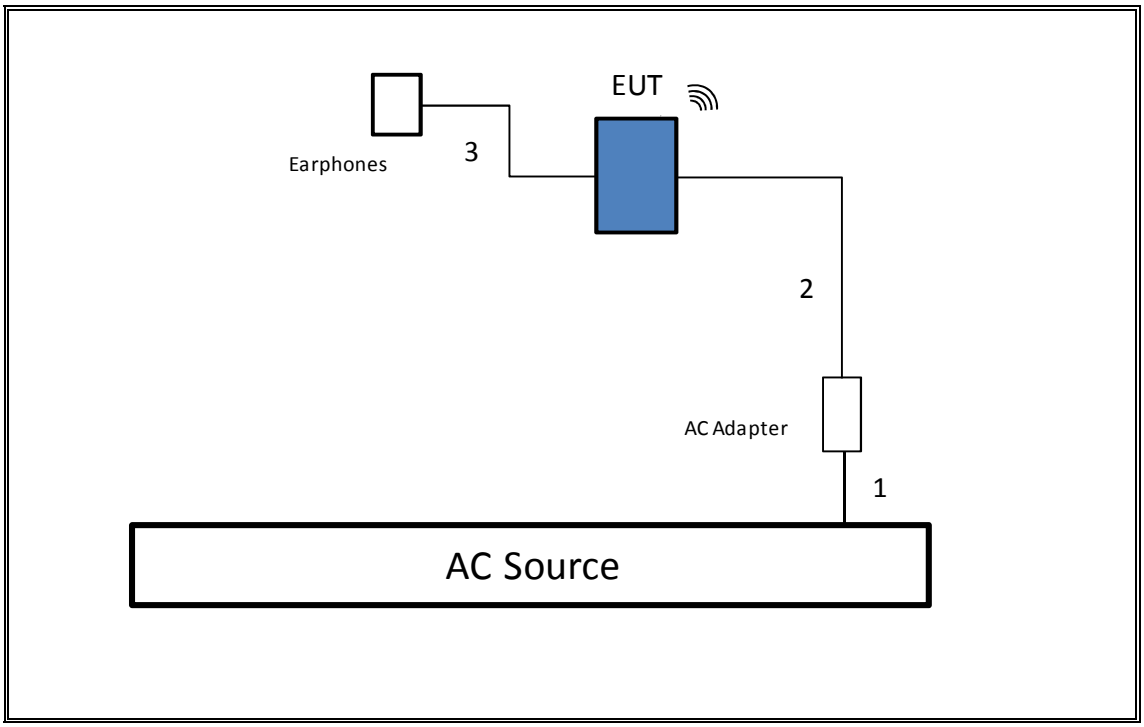
**TEST SETUP-** BELOW 1GHZ & AC LINE CONDUCTED TESTS

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

**SETUP DIAGRAM**





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# 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 | 02/18/15 |
| Antenna, Horn, 26.5 GHz | ARA | MWH-1826/B | C00589 | 11/26/14 |
| Antenna, Horn, 40 GHz | ARA | MWH-2640 | C00981 | 07/15/15 |
| Peak / Average Power Sensor | Agilent / HP | N1911A | F00153 | 03/06/15 |
| Wideband Power Sensor | Agilent | N1921A | F00361 | 10/02/14 |
| Peak Power Meter | Agilent / HP | E9323A | F00025 | 04/03/15 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | F00129 | 02/22/15 |
| Spectrum Analyzer, 40 GHz | Agilent | 8564E | C00951 | 07/29/14 |
| Antenna, Bilog, 2 GHz | Sunol Sciences | JB1 | F00168 | 03/28/15 |
| Preamplifier, 1300 MHz | Sonoma | 310 | F00008 | 05/27/15 |
| Preamplifier, 26.5 GHz | Agilent / HP | 8449B | F00165 | 03/25/15 |


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# 7. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01.

Output Power: KDB 558074 D01.

Power Spectral Density: KDB 558074 D01.

Out-of-band emissions in non-restricted bands: KDB 558074 D01.

Out-of-band emissions in restricted bands: KDB 558074 D01.


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# 8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

**LIMITS**

None; for reporting purposes only.

**PROCEDURE**

KDB 789033 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) |
|---|---|---|---|---|---|---|
| GFSK | 2.890 | 3.750 | 0.771 | 77.1% | 1.131 | 0.346 |
| 8PSK | 2.890 | 3.750 | 0.771 | 77.1% | 1.131 | 0.346 |


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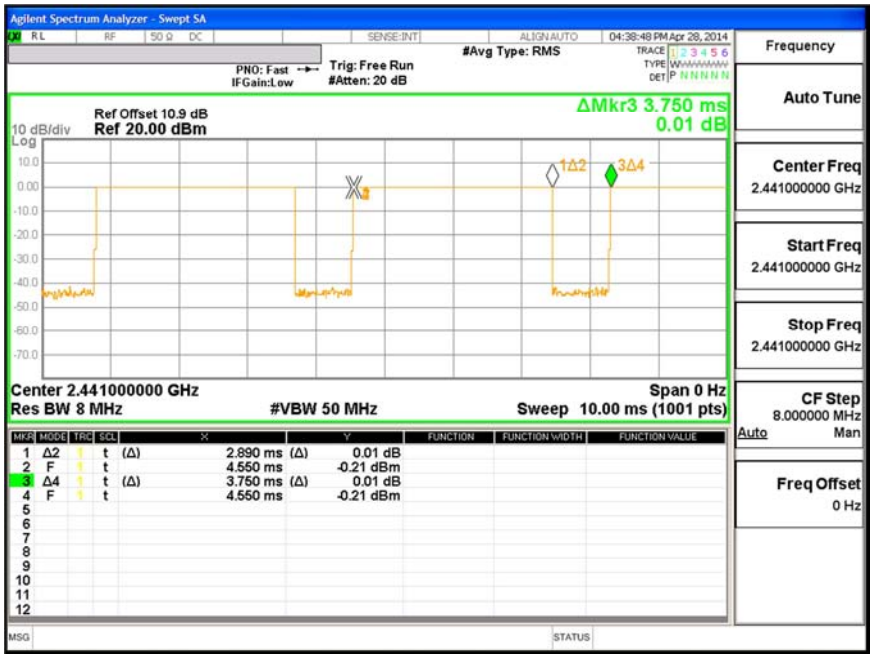
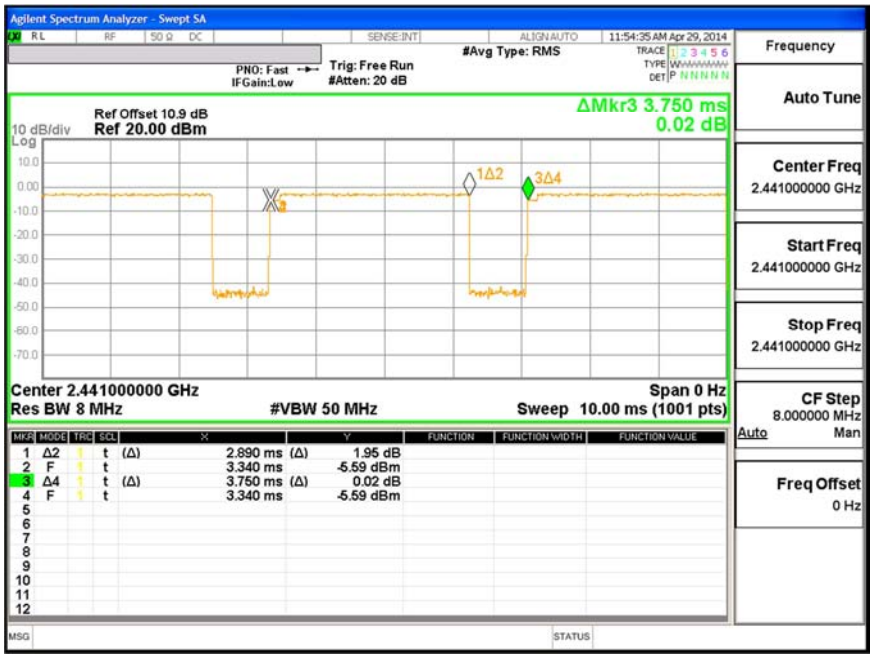
### 8.1.1. DUTY CYCLE PLOTS

DUTY CYCLE BLE MODE GFSK




### 8.1.2. DUTY CYCLE PLOTS

DUTY CYCLE BLE MODE 8PSK





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# 9. ANTENNA PORT TEST RESULTS

## 9.1. BASIC DATA RATE GFSK MODULATION

### 9.1.1. 20 dB AND 99% BANDWIDTH

**LIMIT**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

**RESULTS**

| Channel | Frequency (MHz) | 20 dB Bandwidth (kHz) | 99% Bandwidth (kHz) |
|---|---|---|---|
| Low | 2402 | 929.5 | 907.38 |
| Middle | 2441 | 952.7 | 910.51 |
| High | 2480 | 1049.0 | 922.16 |


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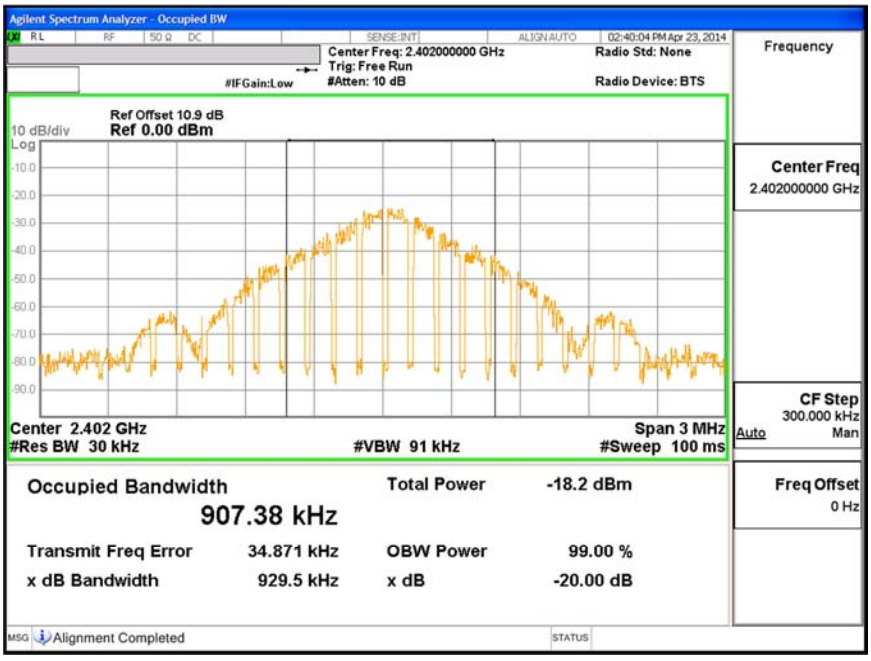
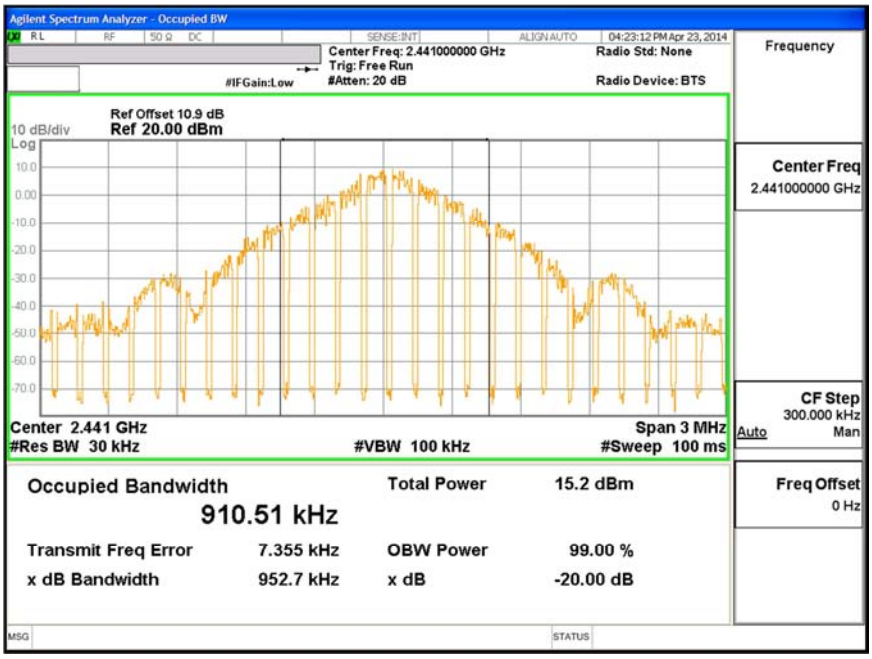
**20 dB AND 99% BANDWIDTH**

BANDWIDTH LOW CH




BANDWIDTH MID CH





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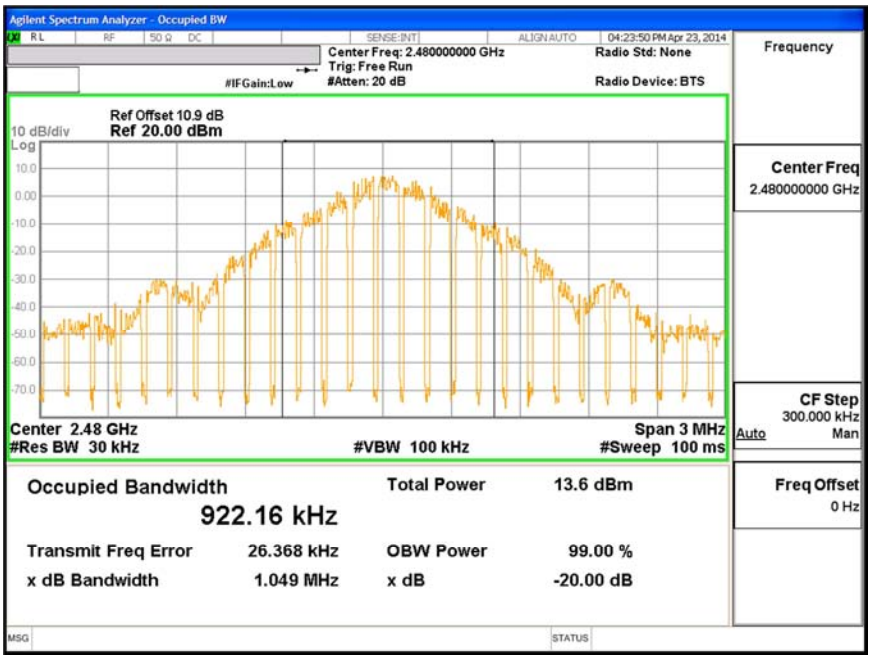
BANDWIDTH HIGH CH



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47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

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### 9.1.2. HOPPING FREQUENCY SEPARATION

**LIMIT**

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

**RESULTS**


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**HOPPING FREQUENCY SEPARATION**

HOPPING FREQUENCY SEPARATION

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### 9.1.3. NUMBER OF HOPPING CHANNELS

**LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

**RESULTS**

Normal Mode: 79 Channels observed.
.


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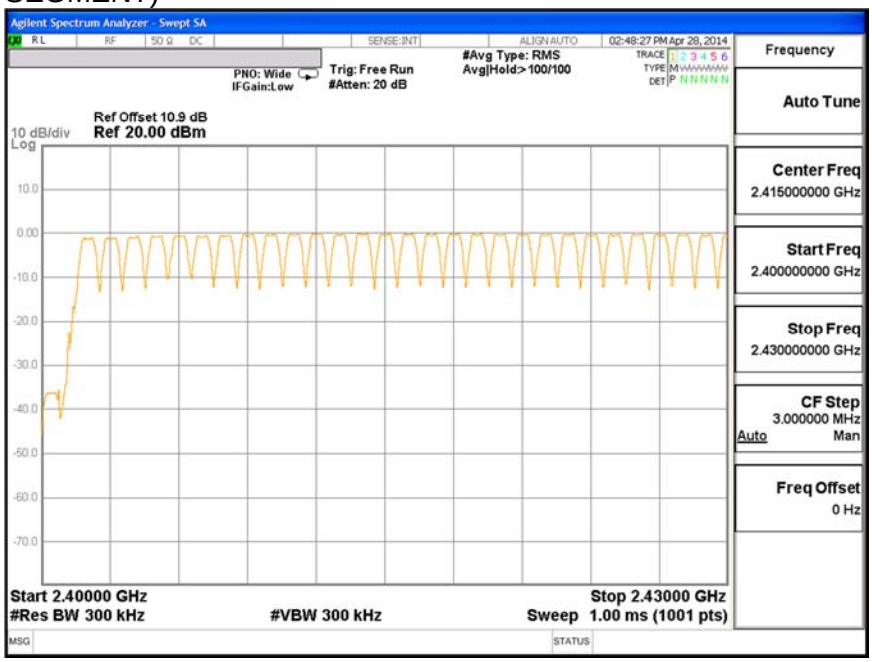
**NUMBER OF HOPPING CHANNELS**

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)

NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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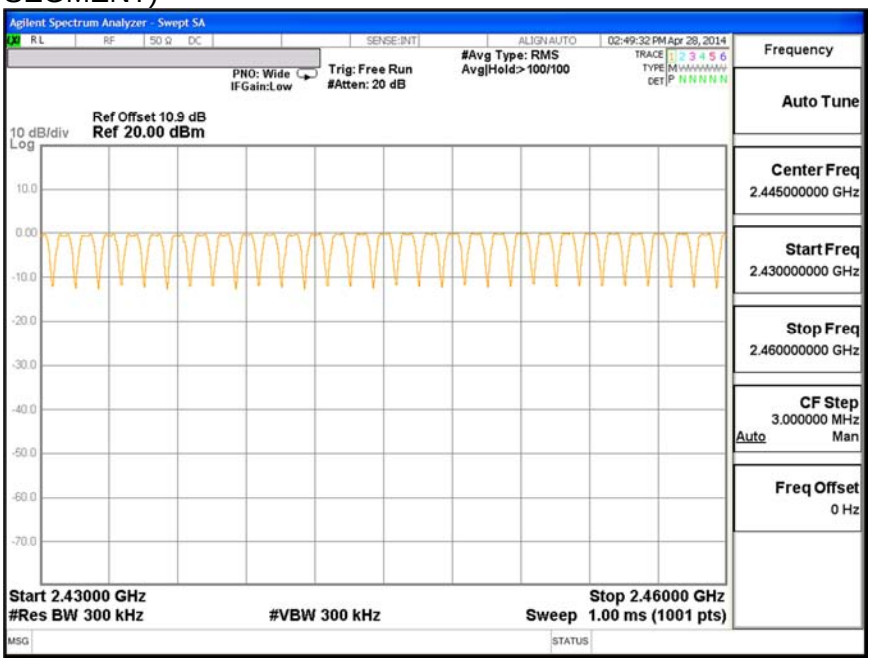
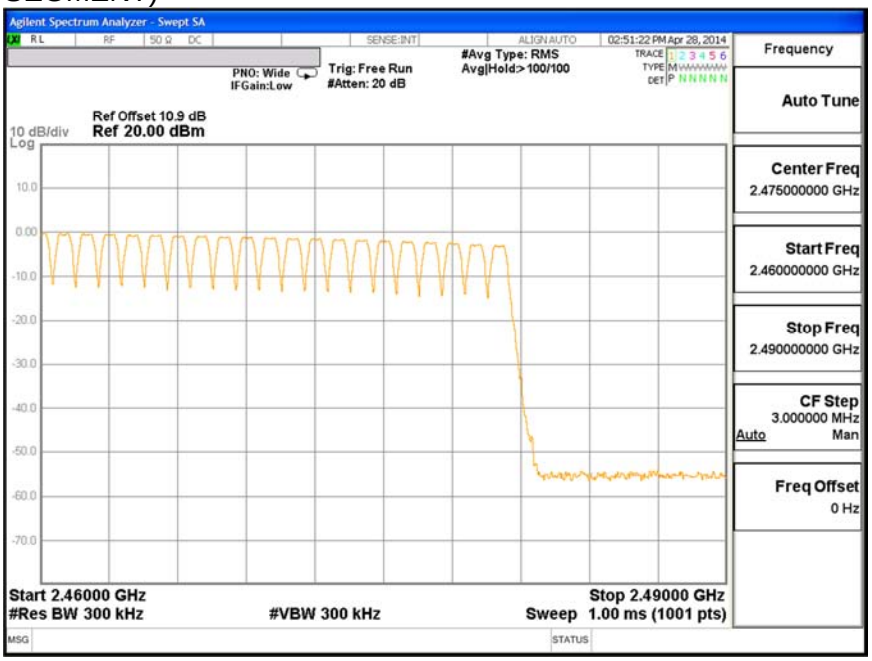
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)




NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)





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### 9.1.4. AVERAGE TIME OF OCCUPANCY

**LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

**RESULTS**

| DH Packet | Pulse Width (msec) | Number of Pulses in 3.16 seconds | Average Time of Occupancy (sec) | Limit (sec) | Margin (sec) |
|---|---|---|---|---|---|
| GFSK Normal Mode | | | | | |
| DH1 | 0.414 | 32 | 0.132 | 0.4 | -0.268 |
| DH3 | 1.674 | 19 | 0.318 | 0.4 | -0.082 |
| DH5 | 2.91 | 11 | 0.320 | 0.4 | -0.080 |


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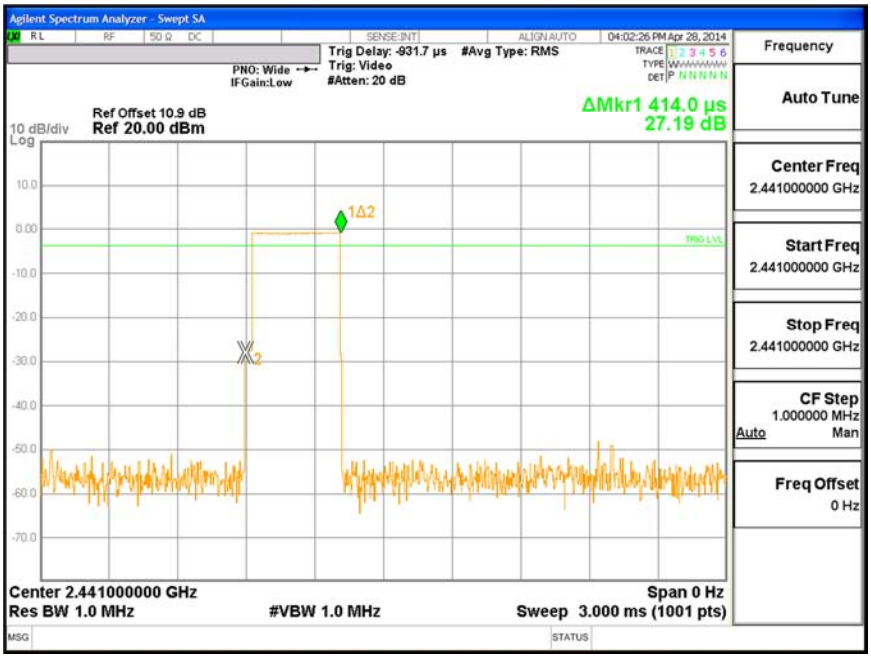
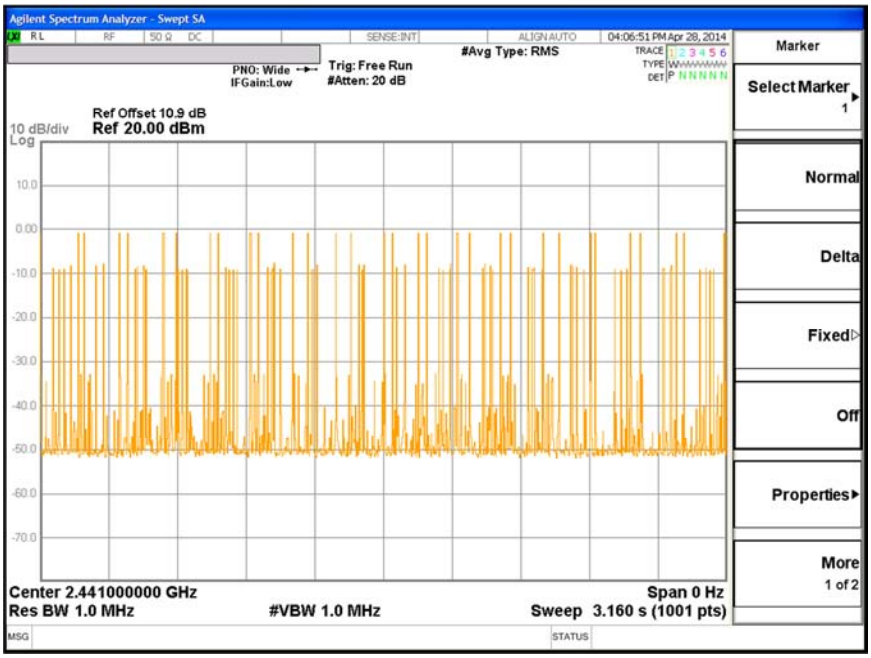
**PULSE WIDTH - DH1**

PULSE WIDTH – DH1




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**

NUMBER OF PULSES – DH1





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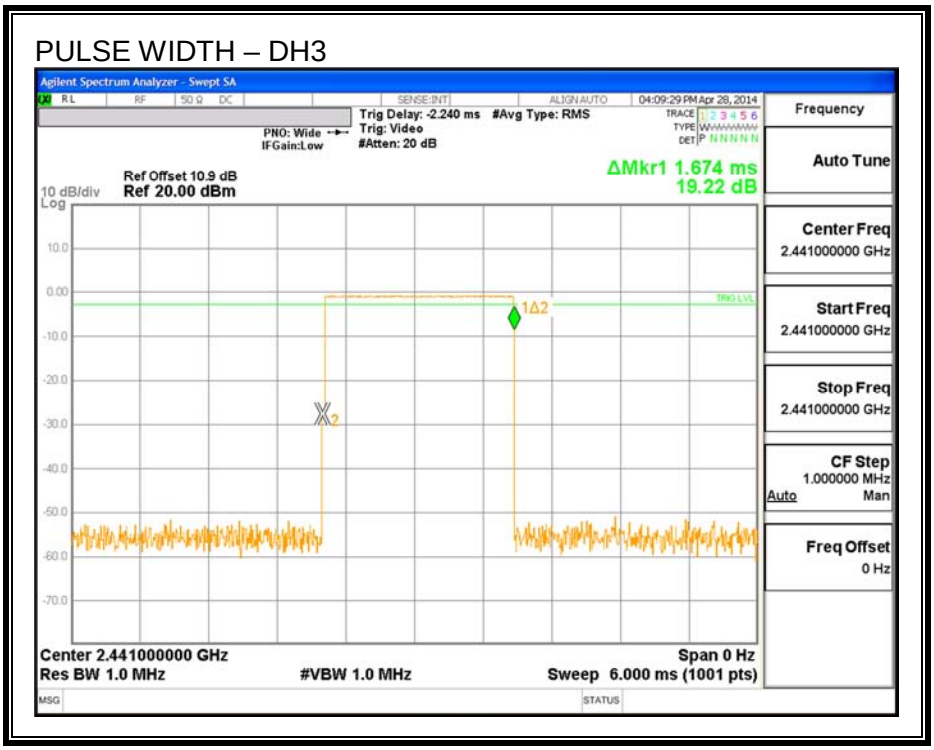
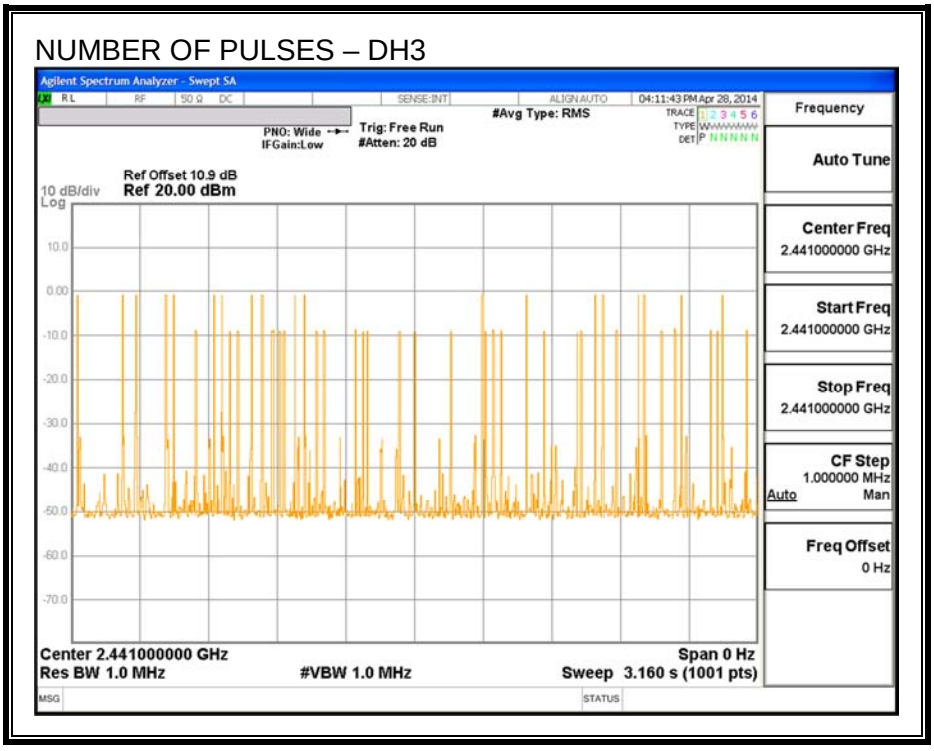
**PULSE WIDTH – DH3**




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**





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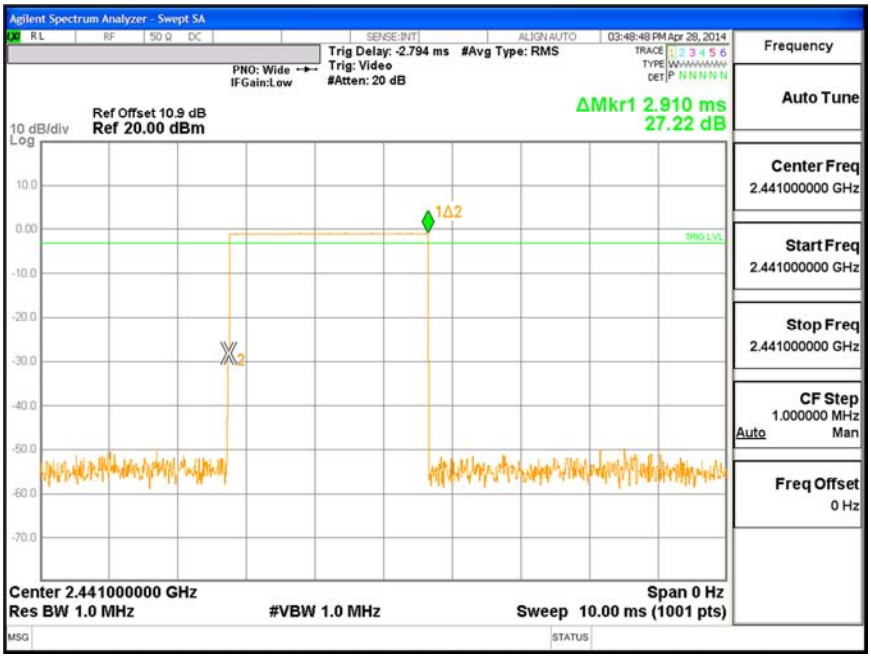
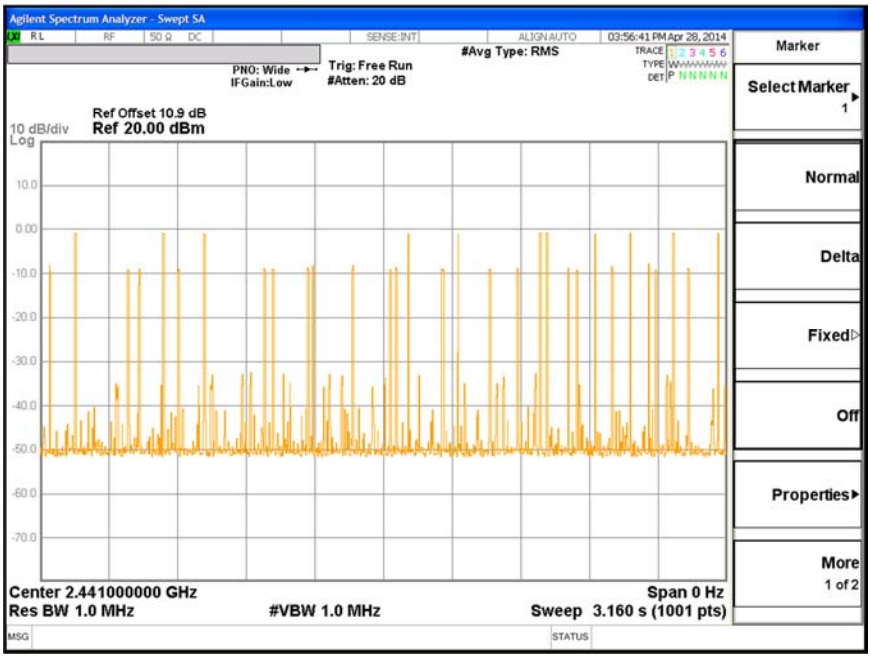
**PULSE WIDTH – DH5**

PULSE WIDTH – DH5




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**

NUMBER OF PULSES – DH5





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### 9.1.5. OUTPUT POWER

**LIMIT**

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

**RESULTS**

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2402 | 10.25 | 30 | -19.75 |
| Middle | 2441 | 11.86 | 30 | -18.14 |
| High | 2480 | 10.70 | 30 | -19.30 |


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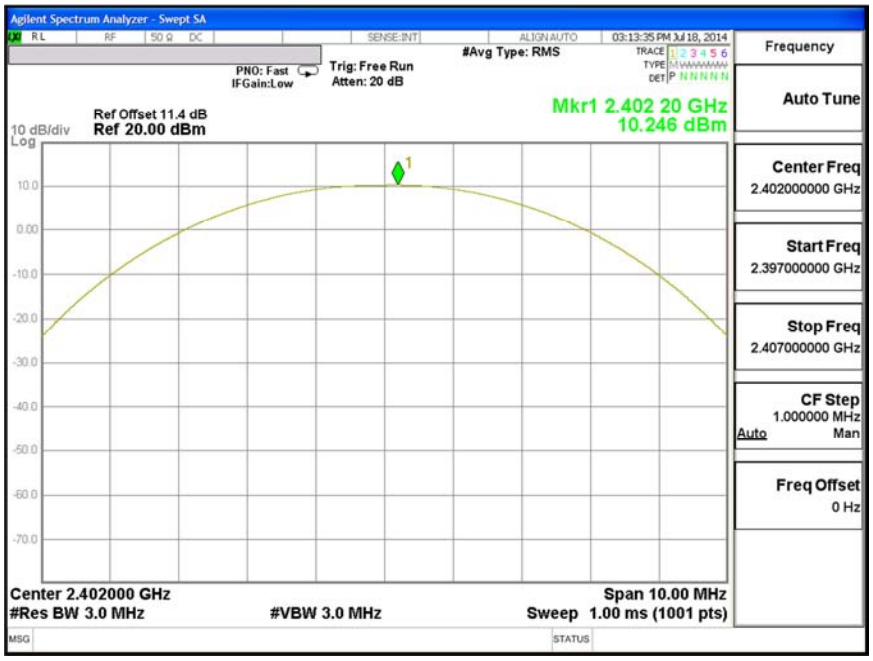
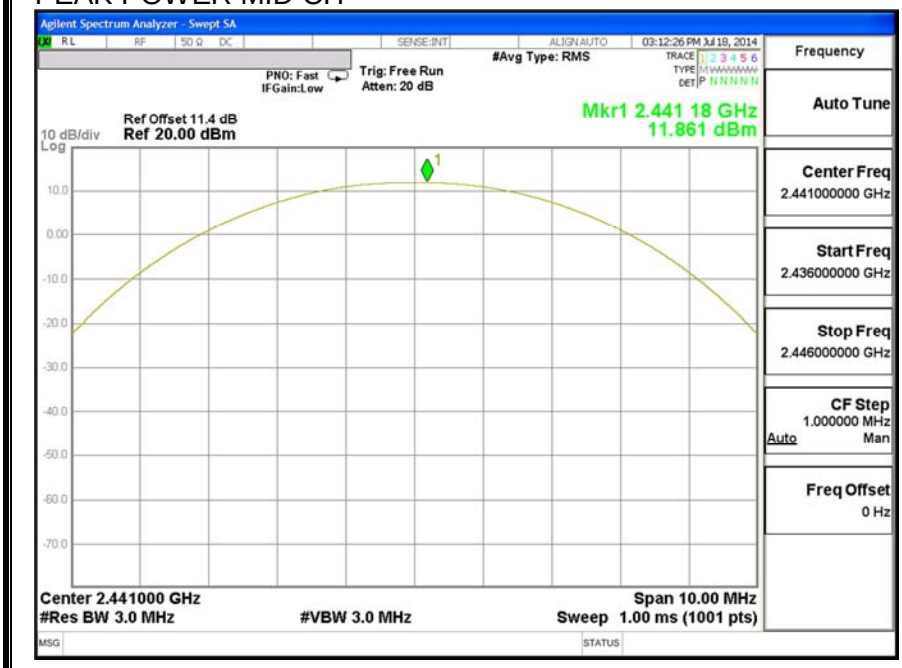
**OUTPUT POWER**

PEAK POWER LOW CH




PEAK POWER MID CH





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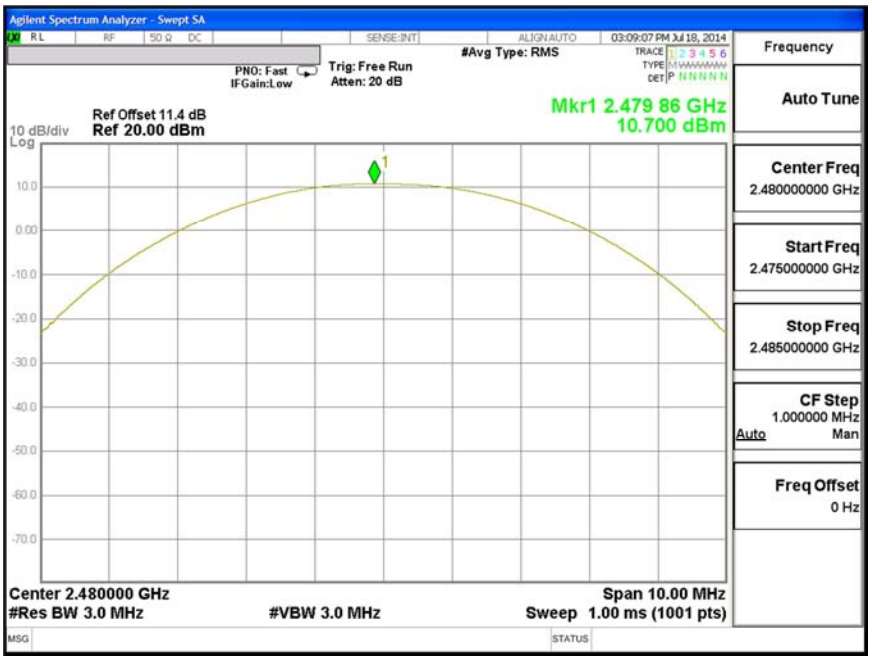
PEAK POWER HIGH CH



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### 9.1.6. AVERAGE POWER

**LIMIT**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss of 10.9 dB (including 10 dB pad and .9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency (MHz) | Average Power (dBm) |
|---|---|---|
| Low | 2402 | 10.12 |
| Middle | 2441 | 11.75 |
| High | 2480 | 10.55 |


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## 9.1.7. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

**RESULTS**


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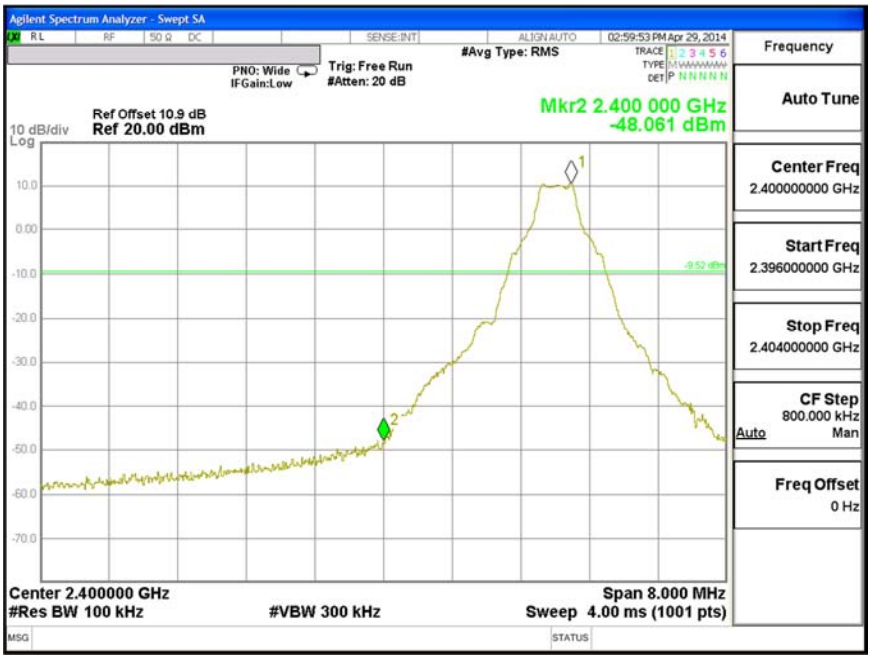
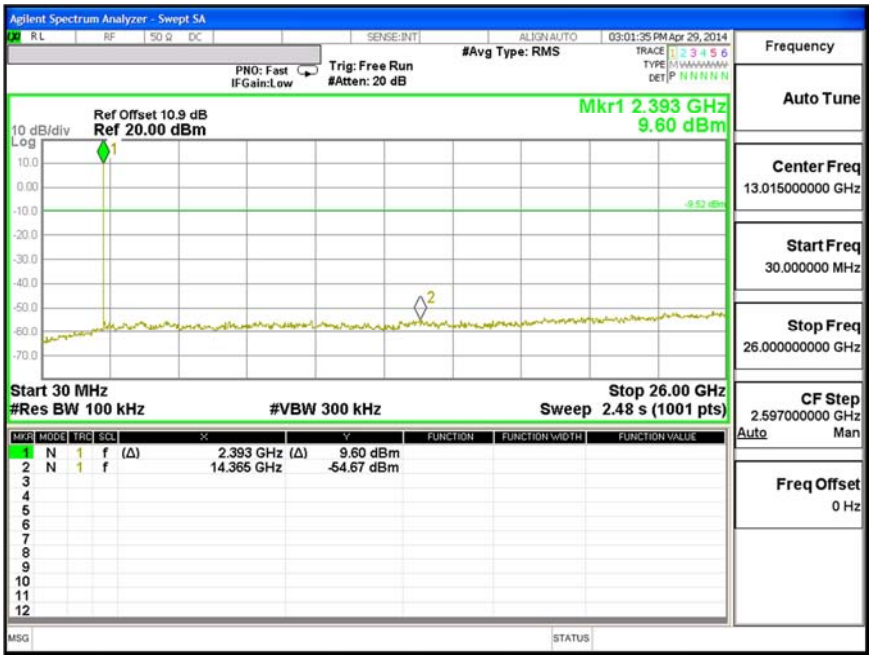
**SPURIOUS EMISSIONS, LOW CHANNEL**

LOW CHANNEL BANDEDGE




LOW CHANNEL SPURIOUS





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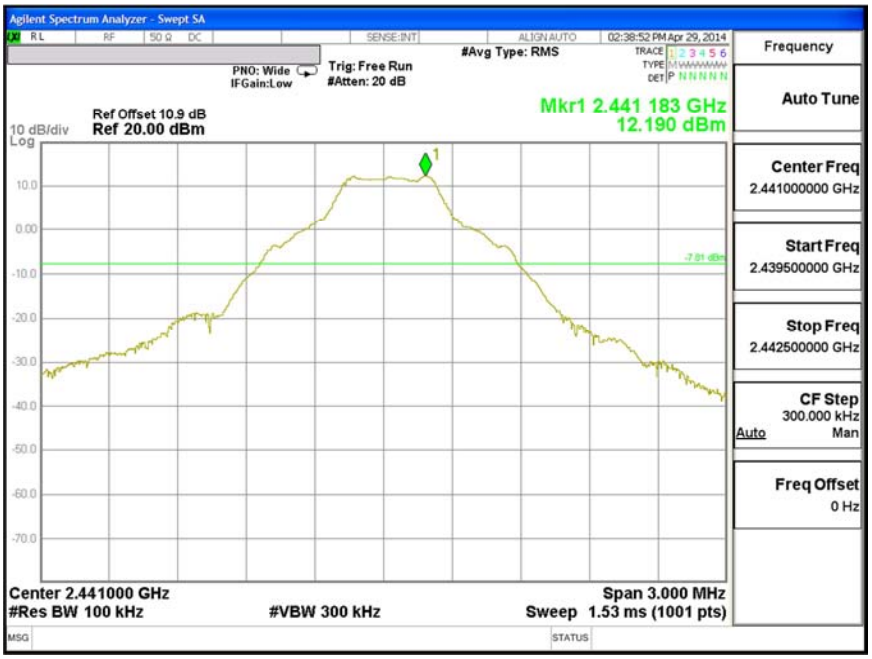
**SPURIOUS EMISSIONS, MID CHANNEL**

MID CHANNEL REFERENCE




MID CHANNEL SPURIOUS

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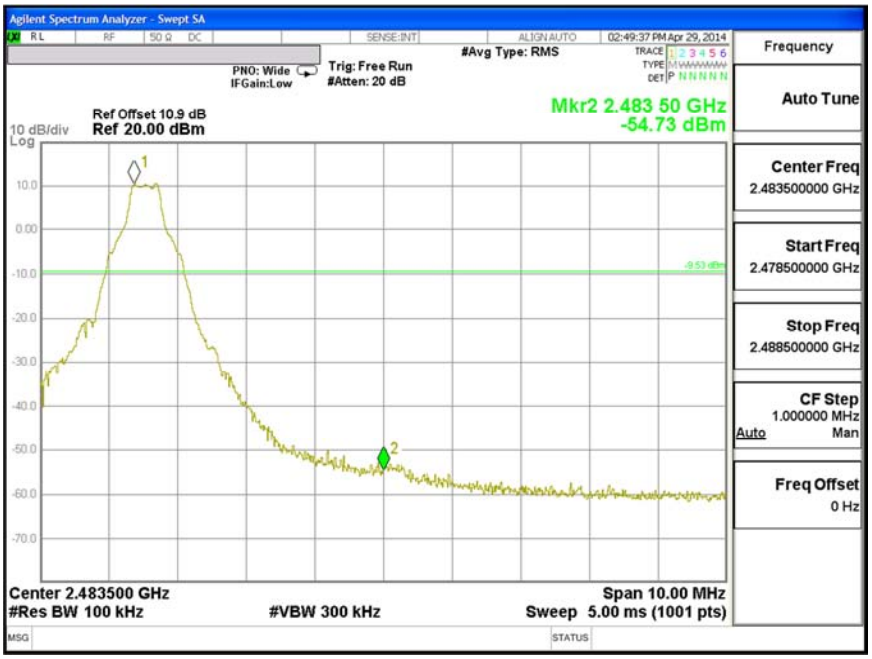
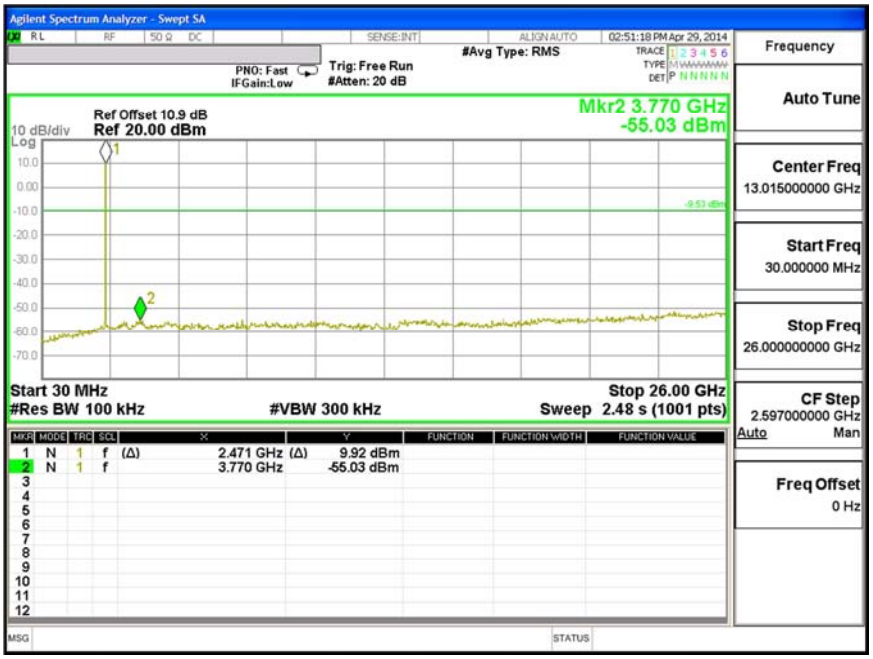
**SPURIOUS EMISSIONS, HIGH CHANNEL**

HIGH CHANNEL BANDEDGE




HIGH CHANNEL SPURIOUS





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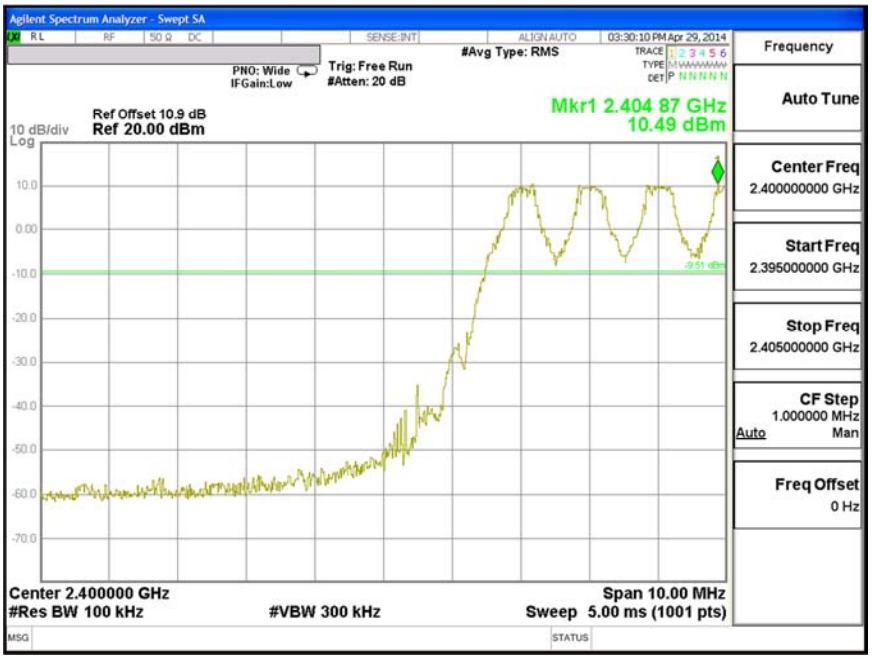
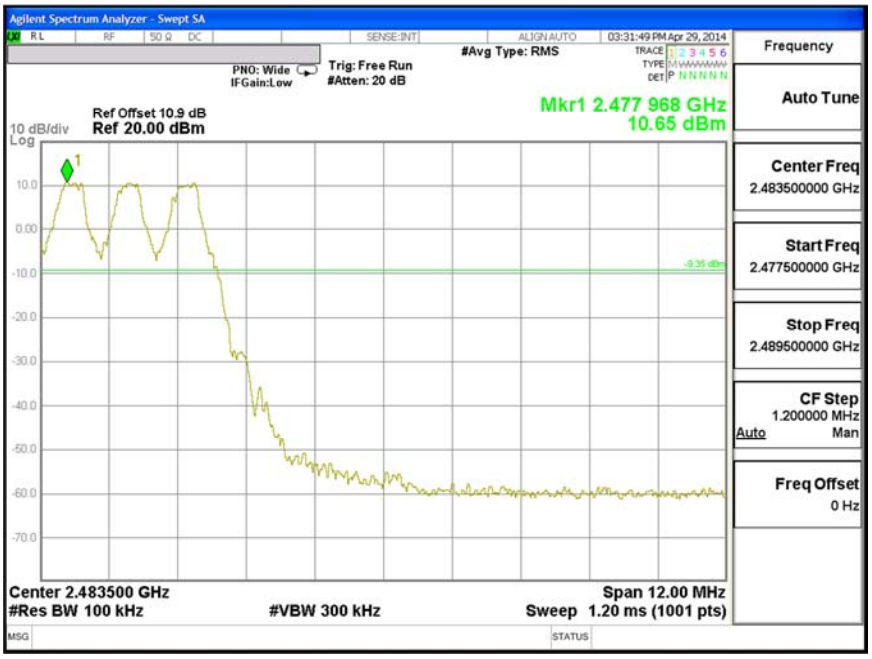
**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

LOW BANDEDGE WITH HOPPING ON




HIGH BANDEDGE WITH HOPPING ON





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## 9.2. ENHANCED DATA RATE 8PSK MODULATION

### 9.2.1. 20 dB AND 99% BANDWIDTH

**LIMIT**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

**RESULTS**

| Channel | Frequency (MHz) | 20 dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|
| Low | 2402 | 1.376 | 1.2437 |
| Middle | 2441 | 1.359 | 1.2517 |
| High | 2480 | 1.357 | 1.2493 |


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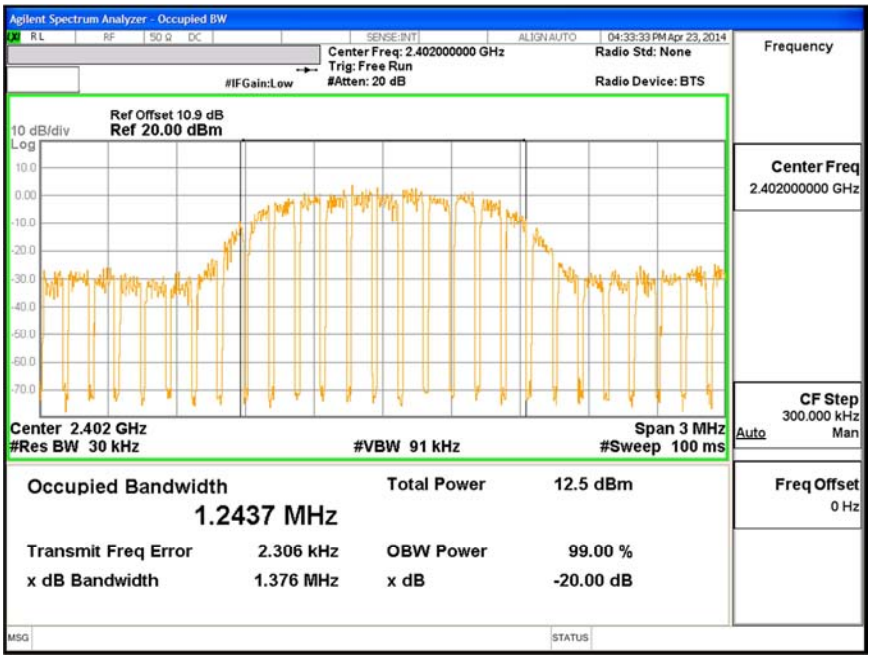
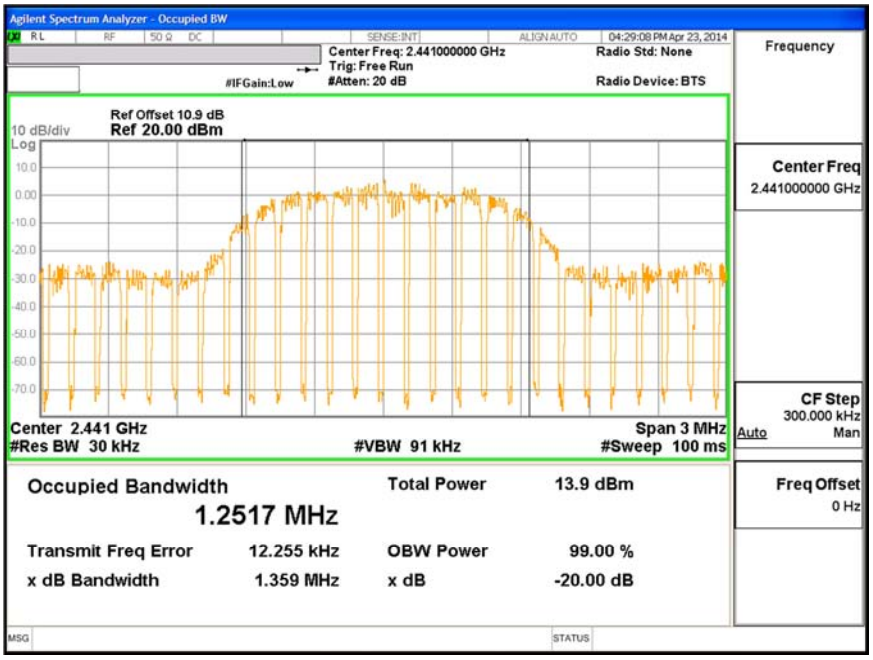
**20 dB AND 99% BANDWIDTH**

BANDWIDTH LOW CH




BANDWIDTH MID CH





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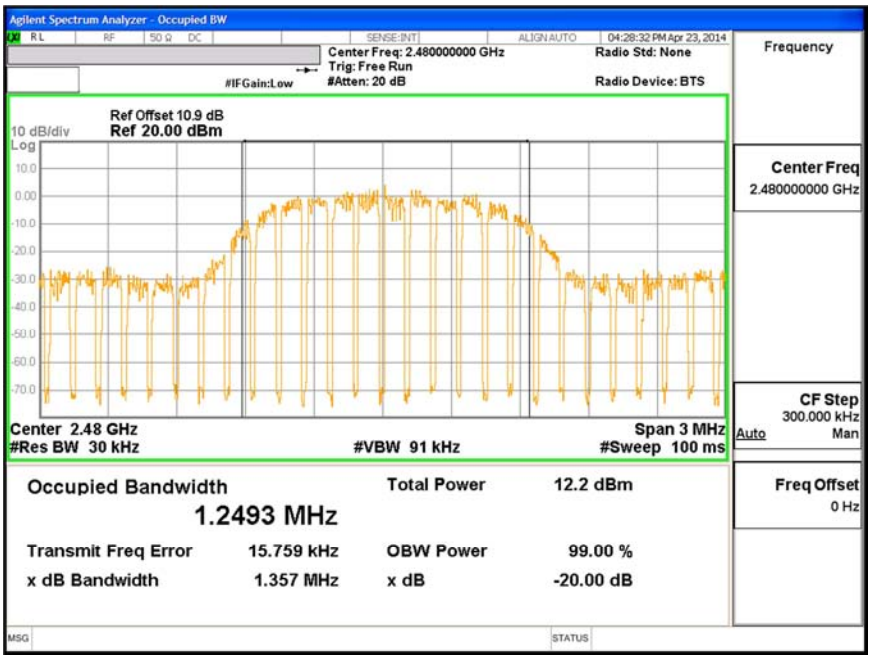
BANDWIDTH HIGH CH



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### 9.2.2. HOPPING FREQUENCY SEPARATION

**LIMIT**

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

**RESULTS**


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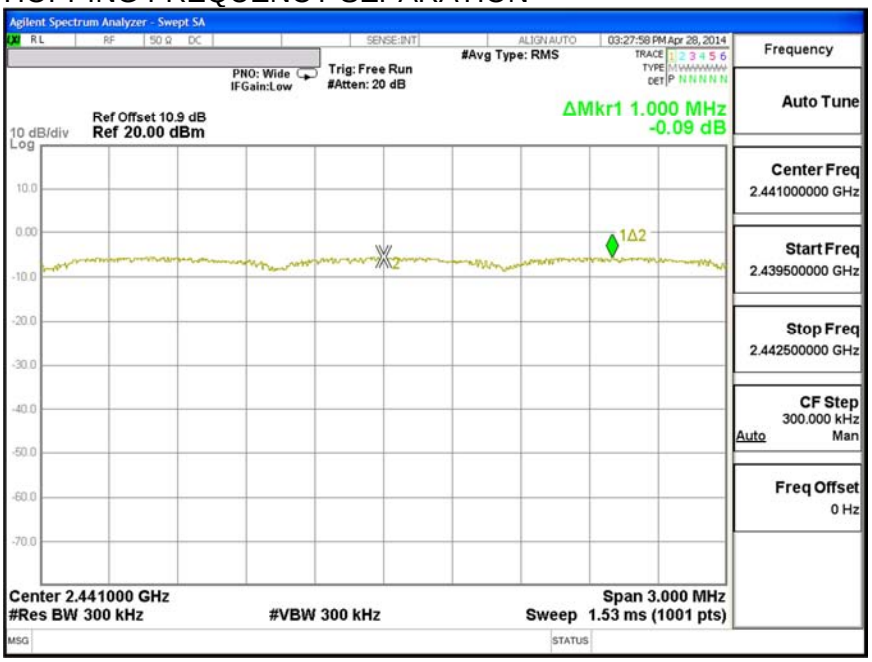
**HOPPING FREQUENCY SEPARATION**

HOPPING FREQUENCY SEPARATION





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### 9.2.3. NUMBER OF HOPPING CHANNELS

**LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

**RESULTS**

Normal Mode: 79 Channels observed.


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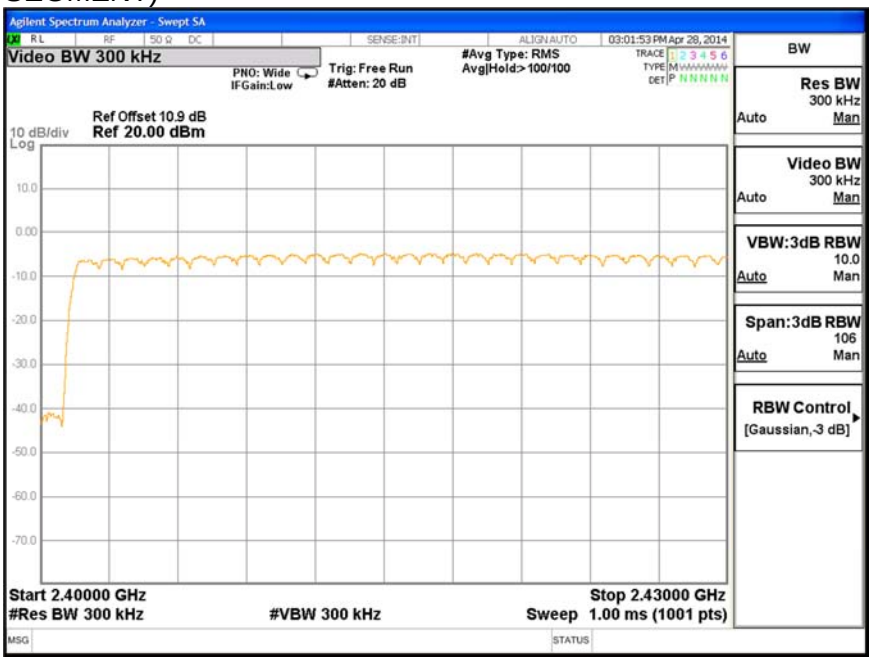
**NUMBER OF HOPPING CHANNELS**

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)

NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)





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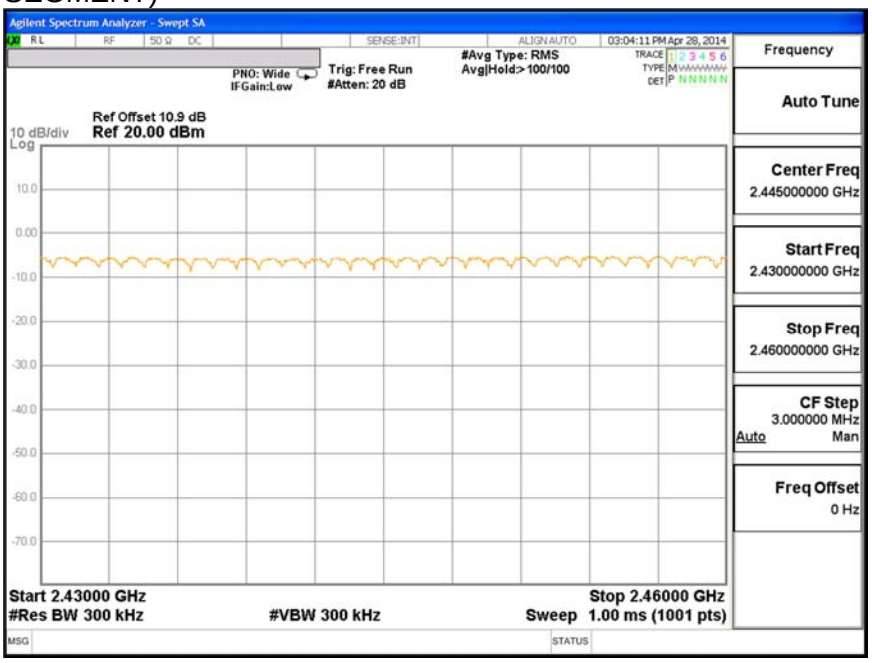
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)




NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)

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## 9.2.4. AVERAGE TIME OF OCCUPANCY

**LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

**RESULTS**

Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

8PSK (EDR) Mode

| DH Packet | Pulse Width (msec) | Number of Pulses in 3.16 seconds | Average Time of (sec) | Limit (sec) | Margin (sec) |
|---|---|---|---|---|---|
| 3DH1 | 0.423 | 32 | 0.135 | 0.4 | -0.265 |
| 3DH3 | 1.68 | 12 | 0.202 | 0.4 | -0.198 |
| 3DH5 | 2.93 | 12 | 0.352 | 0.4 | -0.048 |


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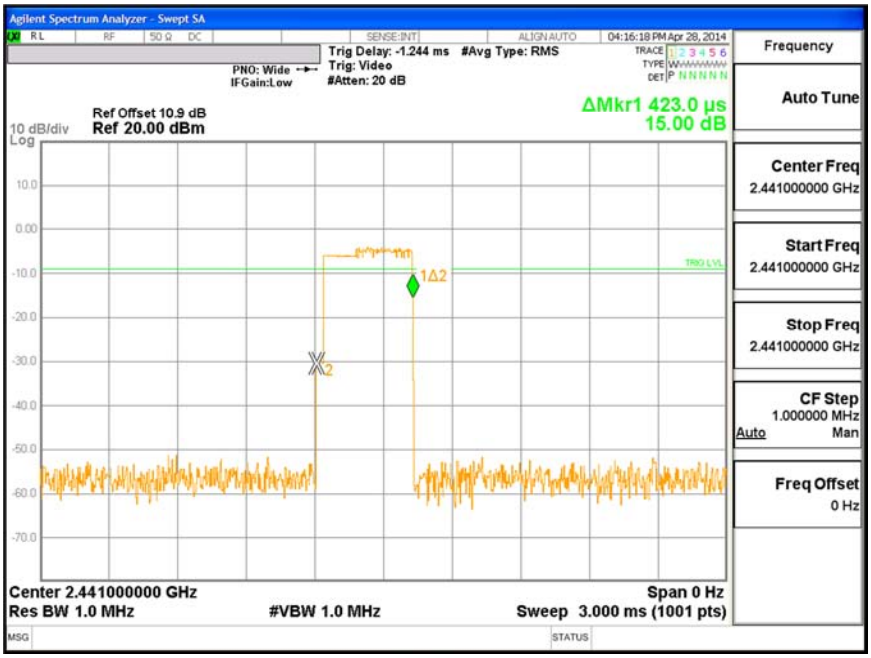
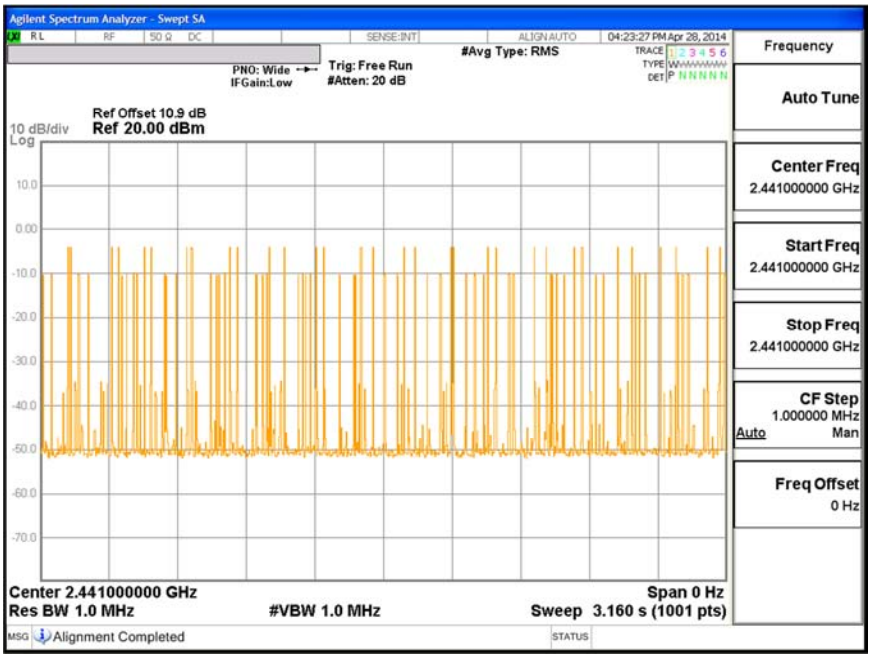
**PULSE WIDTH - DH1**

PULSE WIDTH – DH1




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**

NUMBER OF PULSES – DH1





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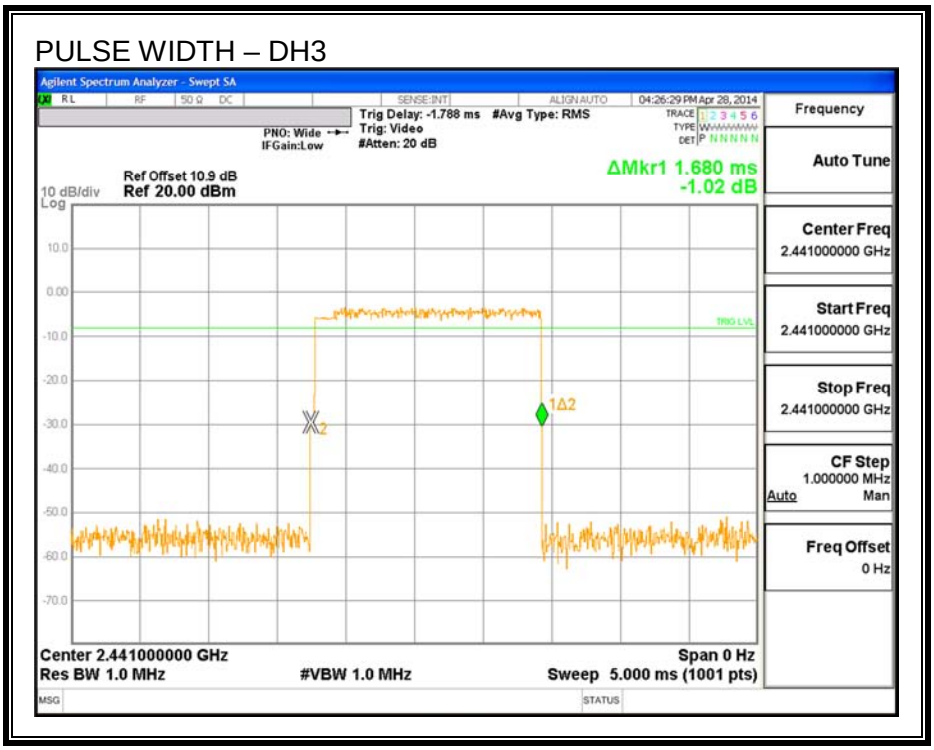
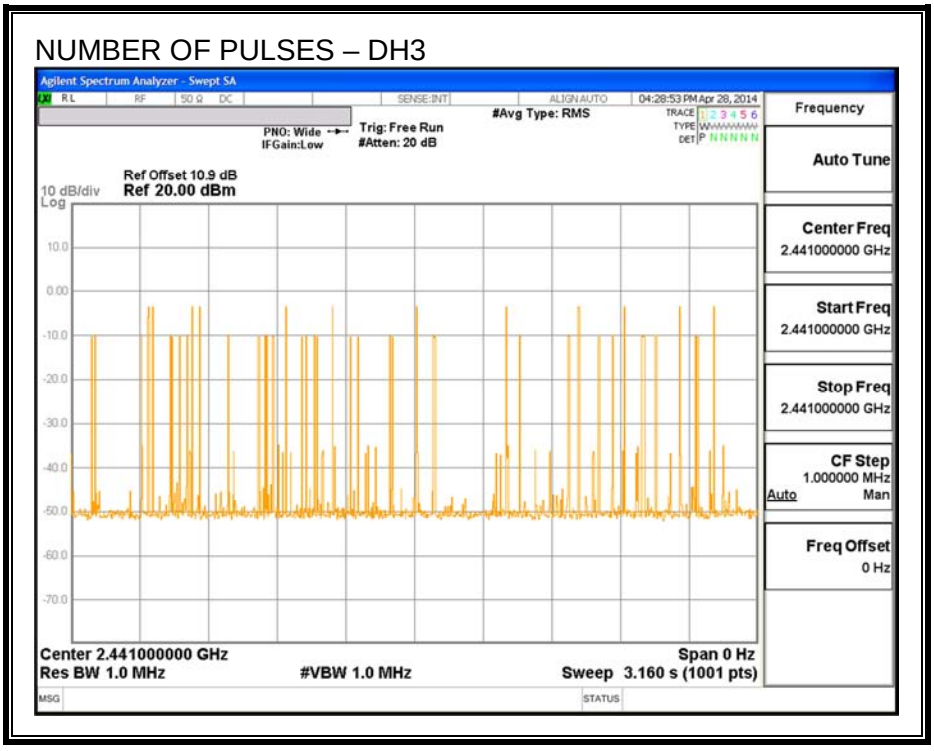
**PULSE WIDTH – DH3**




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**





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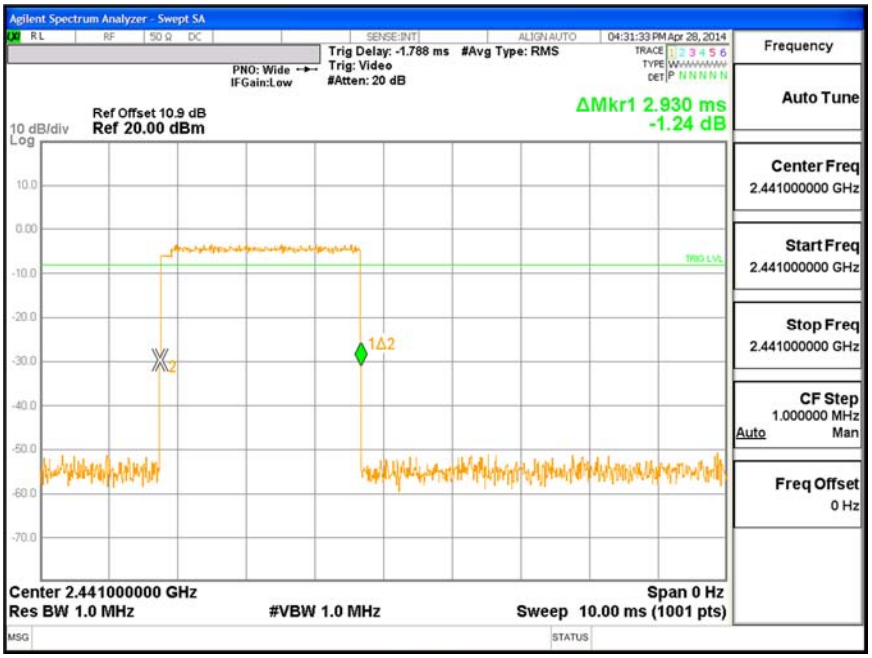
**PULSE WIDTH – DH5**

PULSE WIDTH – DH5




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**

NUMBER OF PULSES – DH5

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### 9.2.5. OUTPUT POWER

**LIMIT**

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

**RESULTS**

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2402 | 9.48 | 30 | -20.52 |
| Middle | 2441 | 11.33 | 30 | -18.68 |
| High | 2480 | 10.00 | 30 | -20.00 |


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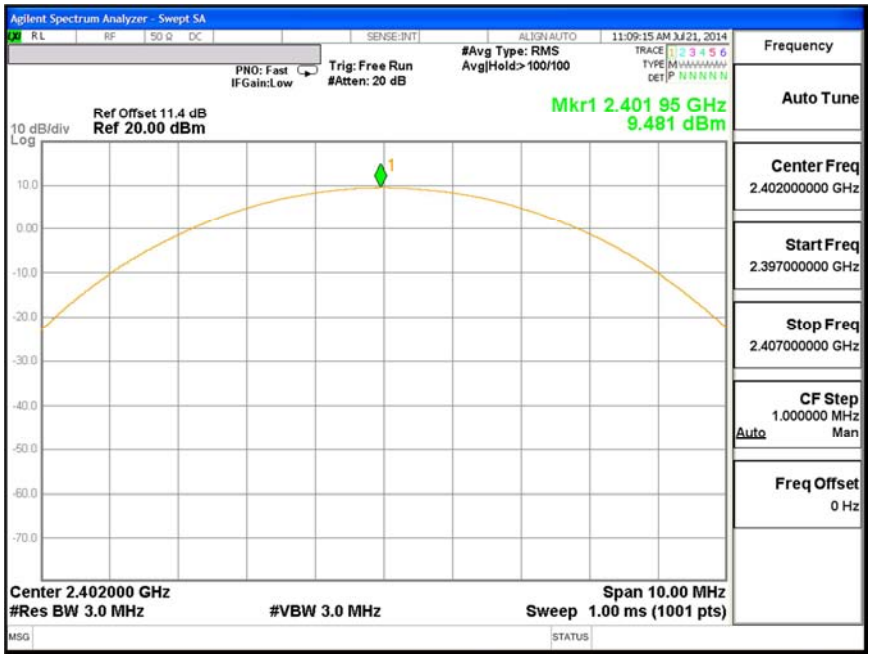
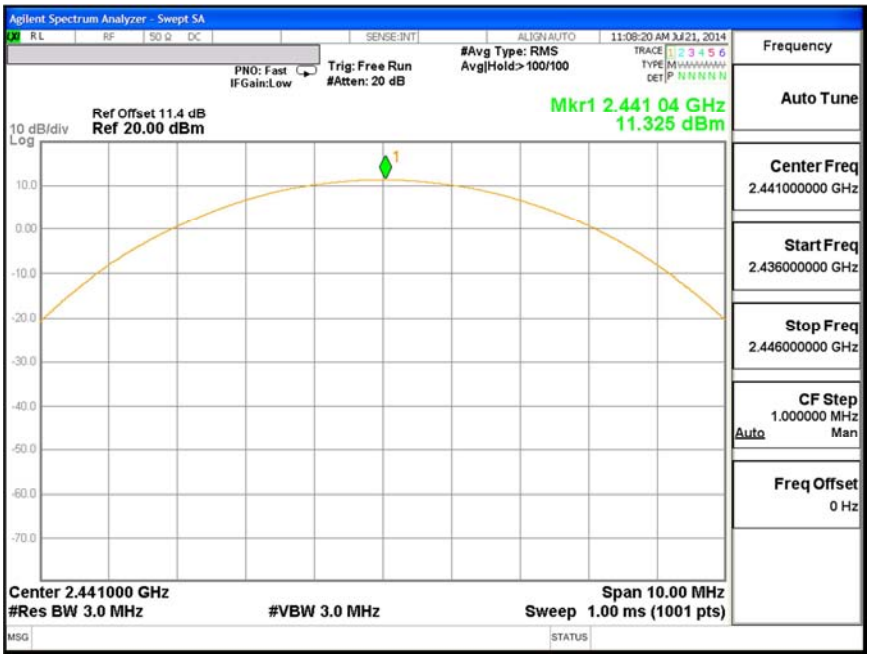
**OUTPUT POWER**

PEAK POWER LOW CH




PEAK POWER MID CH





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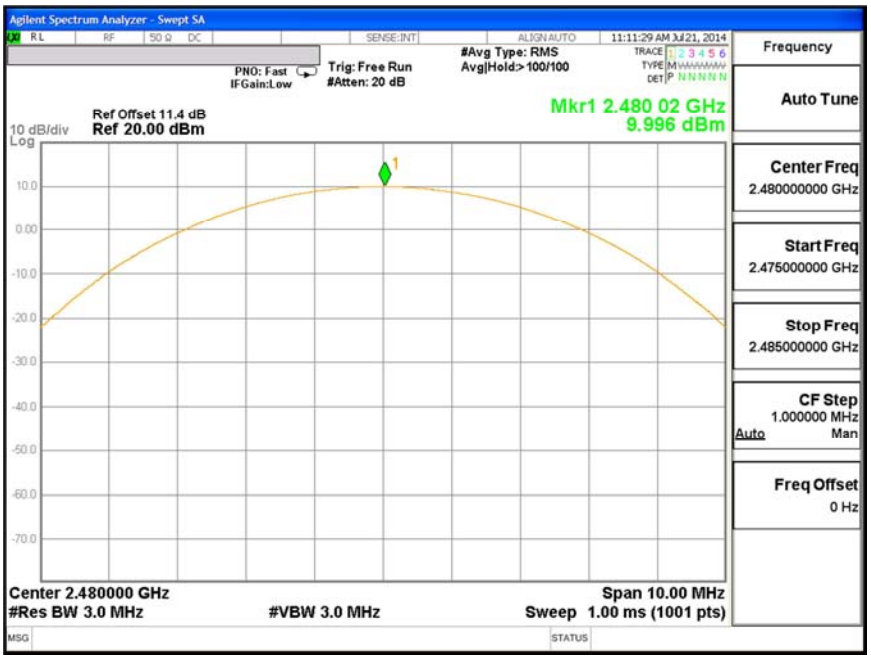
PEAK POWER HIGH CH



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### 9.2.6. AVERAGE POWER

**LIMIT**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss of 10.9 dB (including 10 dB pad and .9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency (MHz) | Average Power (dBm) |
|---|---|---|
| Low | 2402 | 8.00 |
| Middle | 2441 | 9.80 |
| High | 2480 | 8.50 |


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## 9.2.7. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

**RESULTS**


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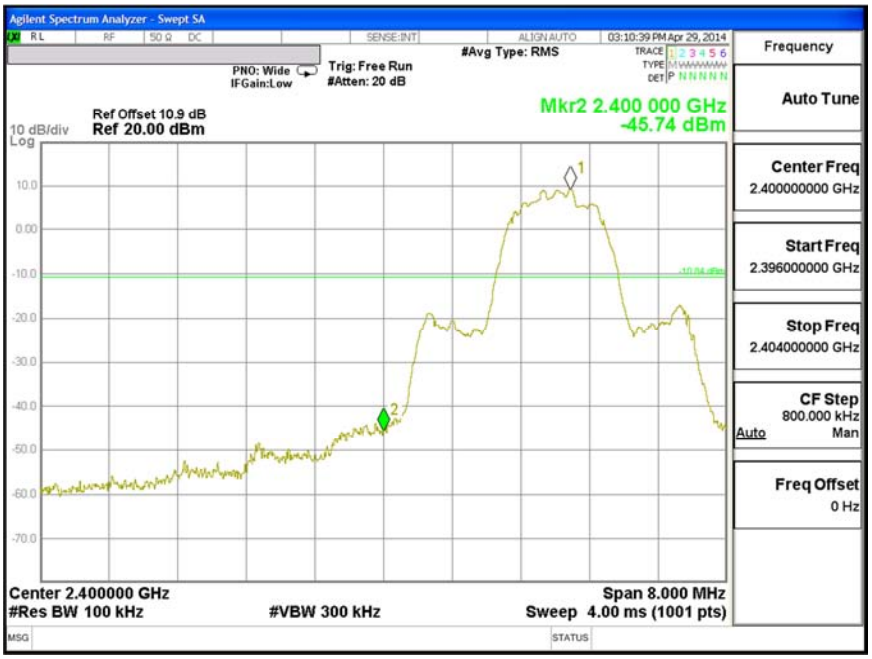
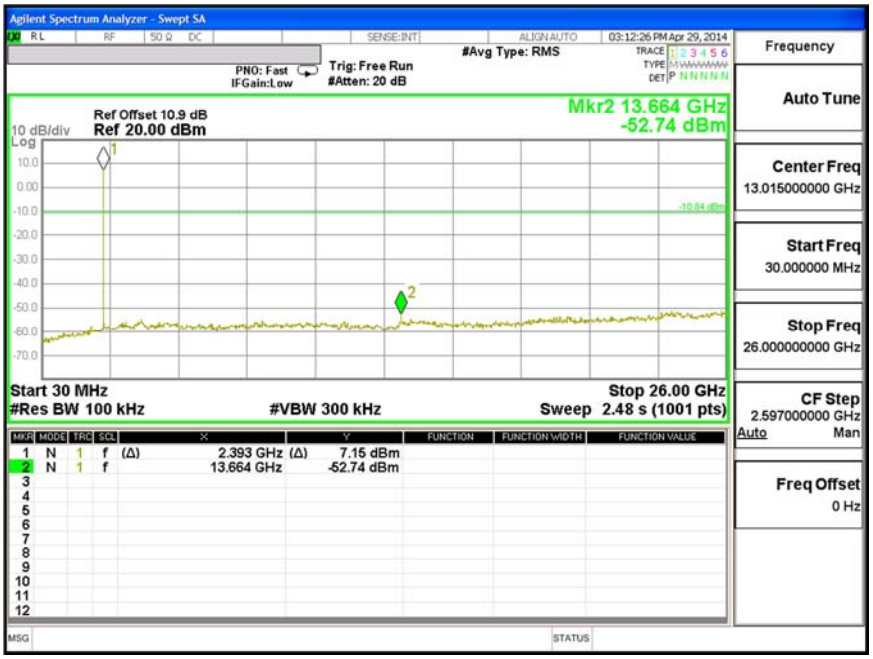
**SPURIOUS EMISSIONS, LOW CHANNEL**

LOW CHANNEL BANDEDGE




LOW CHANNEL SPURIOUS





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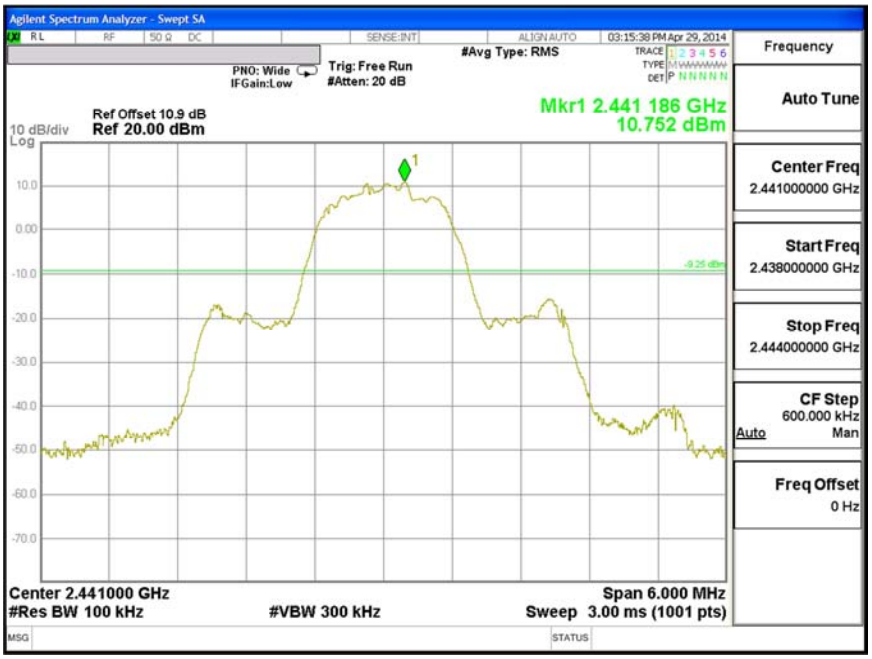
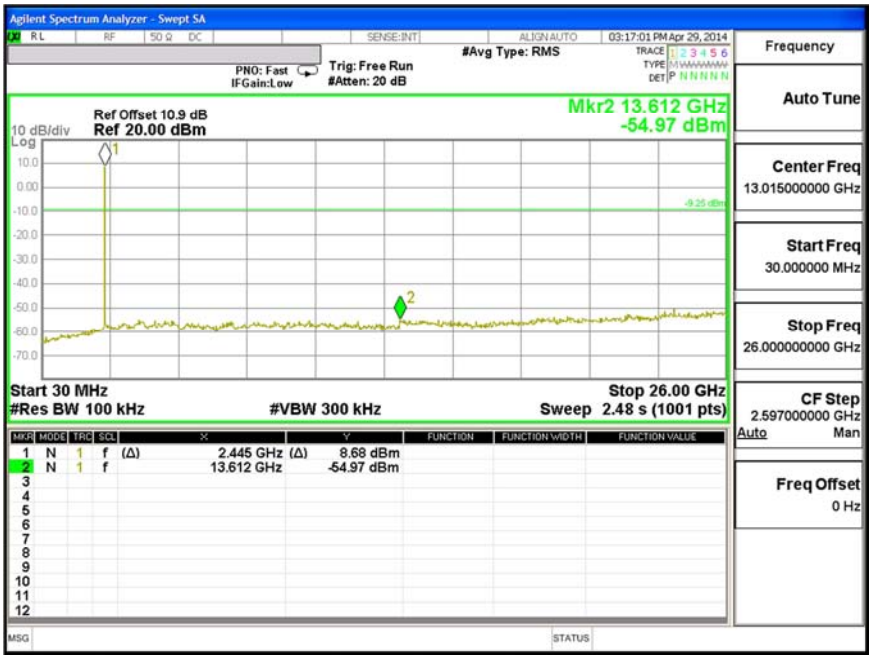
**SPURIOUS EMISSIONS, MID CHANNEL**

MID CHANNEL REFERENCE




MID CHANNEL SPURIOUS





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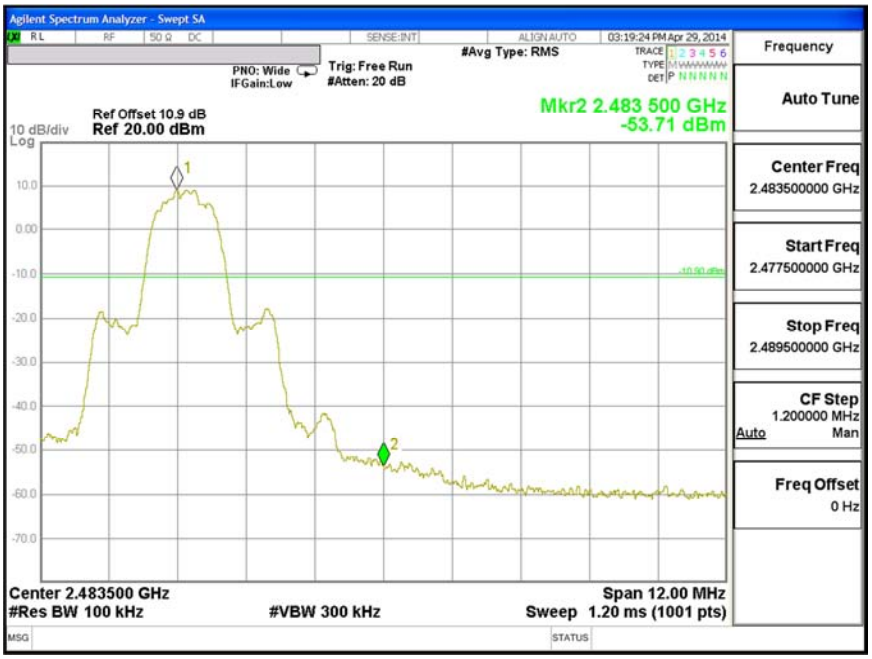
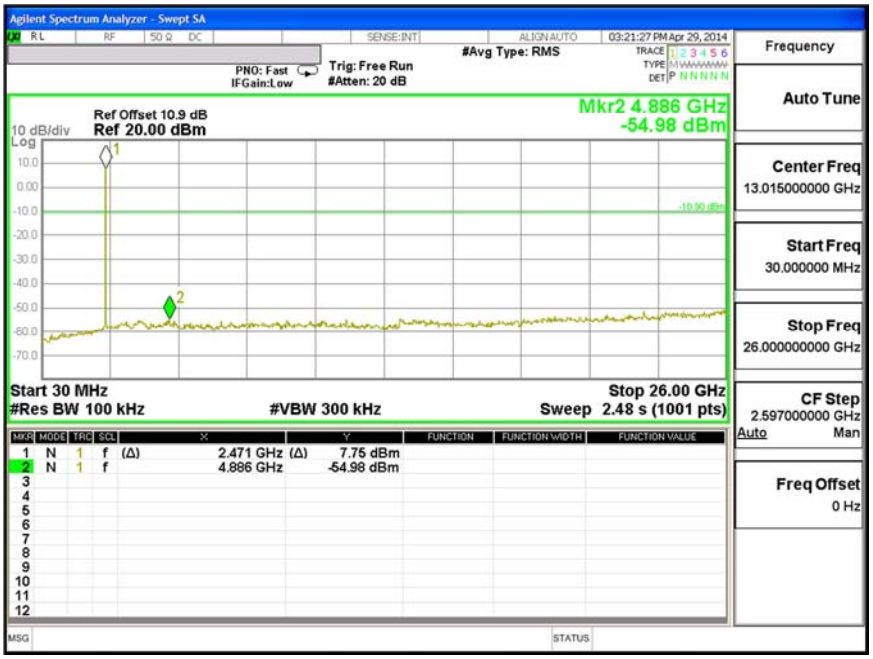
**SPURIOUS EMISSIONS, HIGH CHANNEL**

HIGH CHANNEL BANDEDGE




HIGH CHANNEL SPURIOUS





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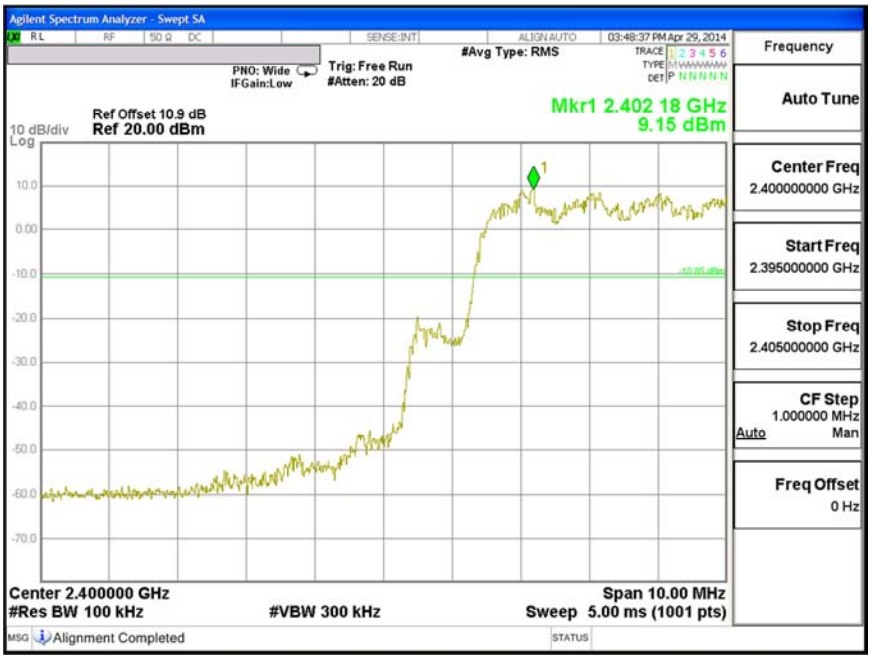
**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

LOW BANDEDGE WITH HOPPING ON




HIGH BANDEDGE WITH HOPPING ON

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# 10. RADIATED TEST RESULTS

## 10.1. LIMITS AND PROCEDURE

**LIMITS**

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
|---|---|---|
| 30 - 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46 |
| Above 960 | 500 | 54 |

**TEST PROCEDURE**

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.


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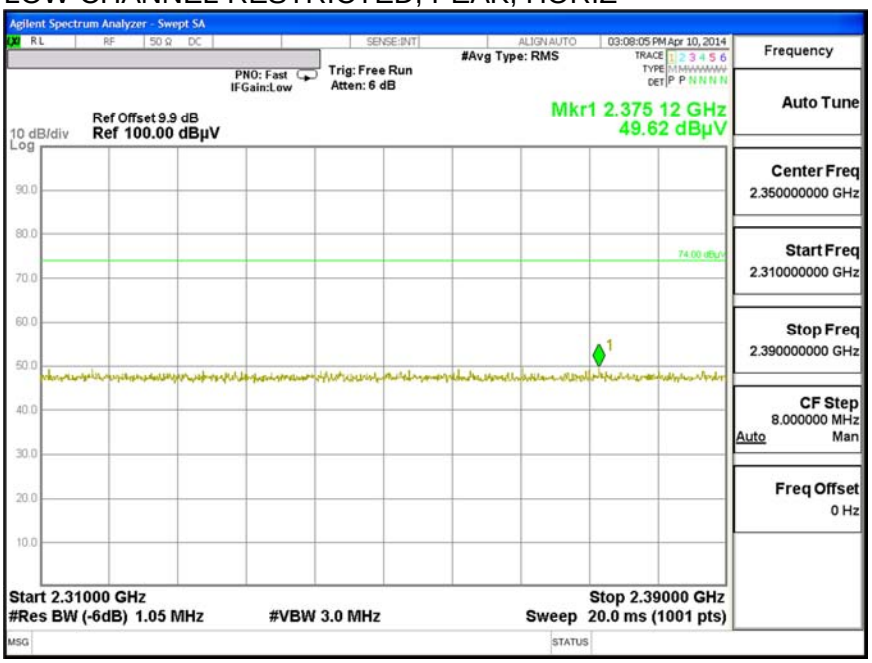
## 10.2. TRANSMITTER ABOVE 1GHz

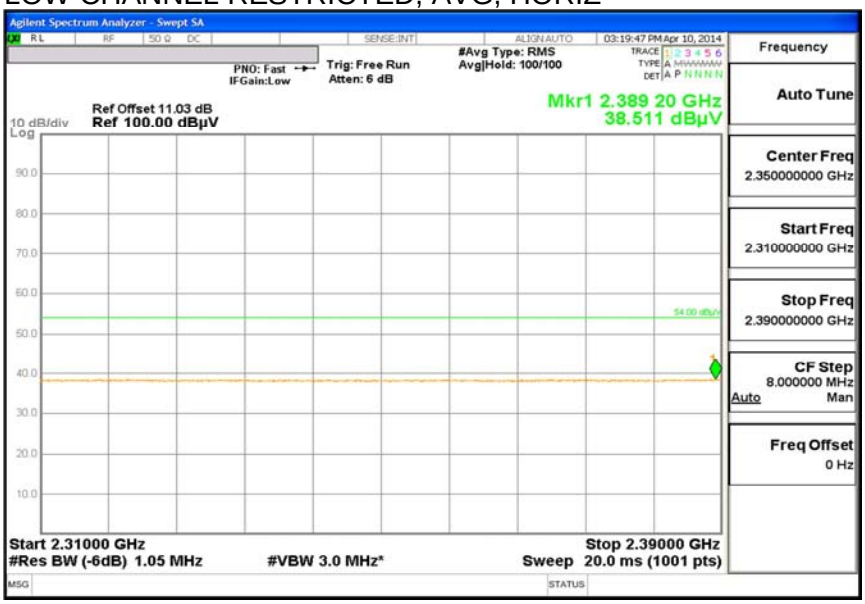
### 10.2.1. BASIC DATA RATE GFSK MODULATION

**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**

LOW CHANNEL RESTRICTED, PEAK, HORIZ




LOW CHANNEL RESTRICTED, AVG, HORIZ





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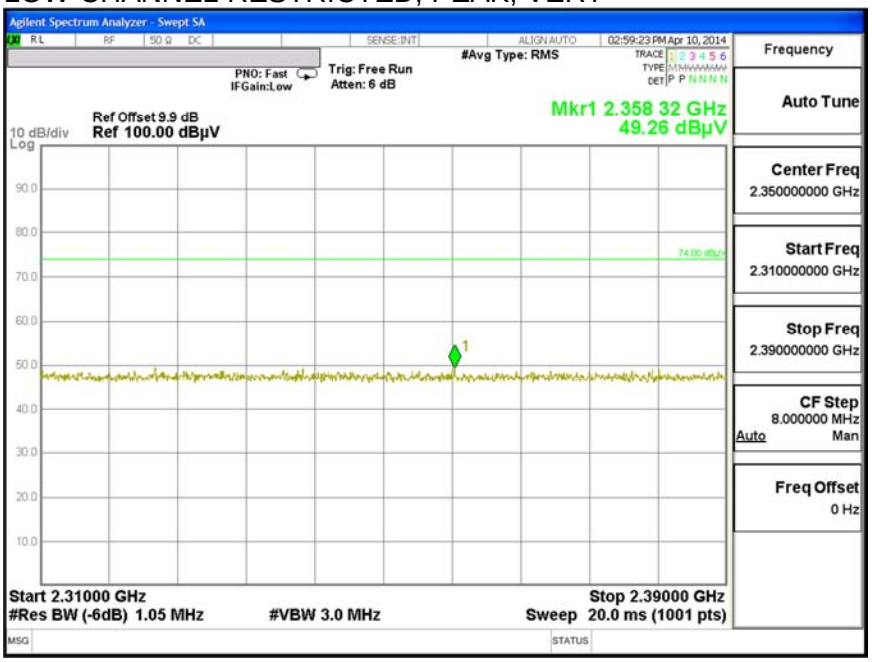
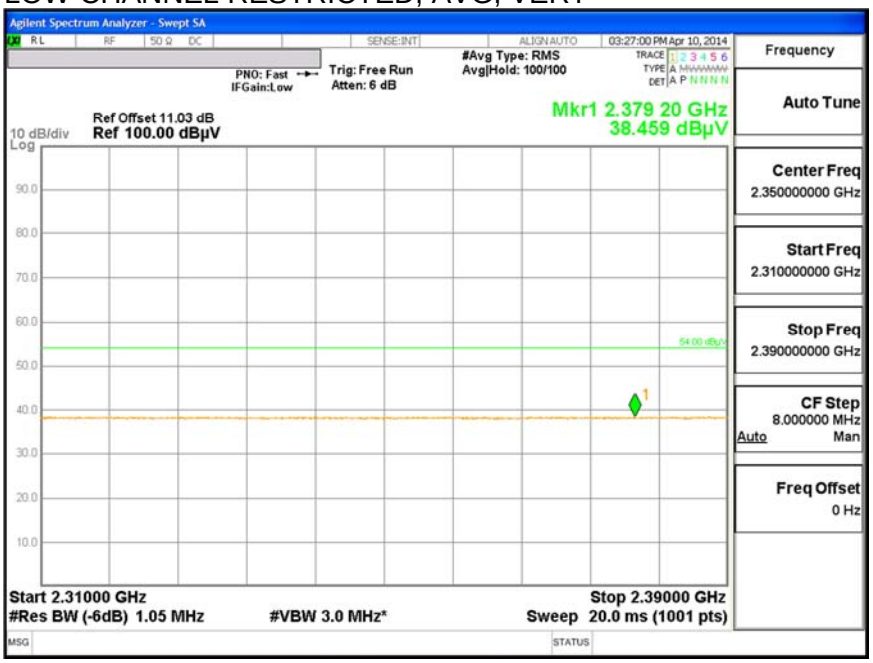
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

LOW CHANNEL RESTRICTED, PEAK, VERT




LOW CHANNEL RESTRICTED, AVG, VERT





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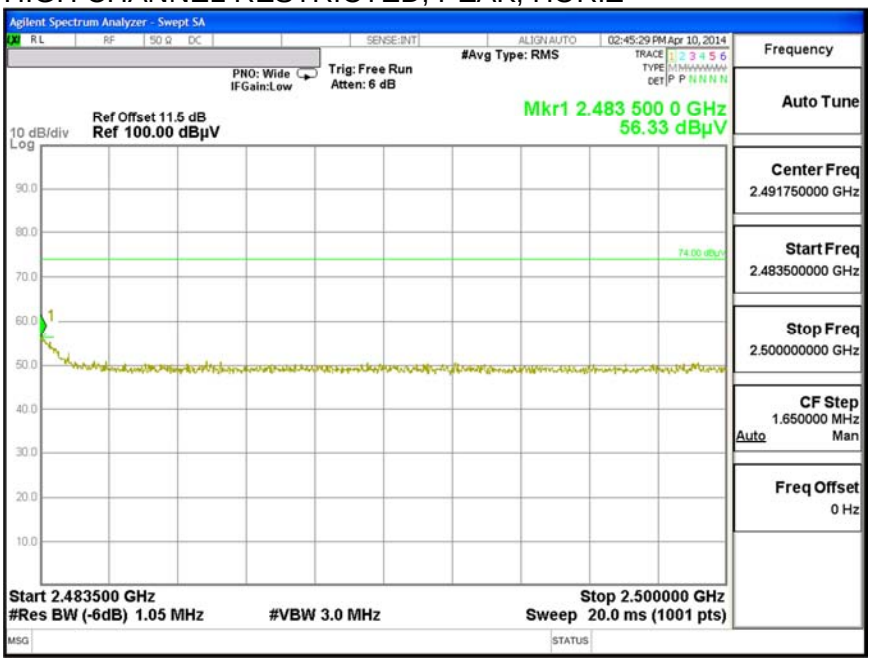
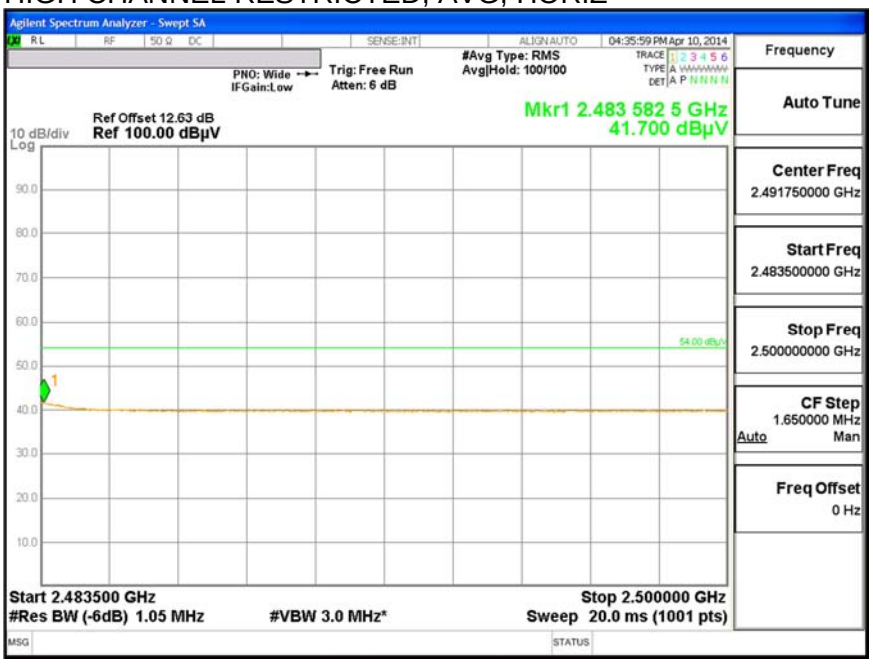
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

HIGH CHANNEL RESTRICTED, PEAK, HORIZ




HIGH CHANNEL RESTRICTED, AVG, HORIZ





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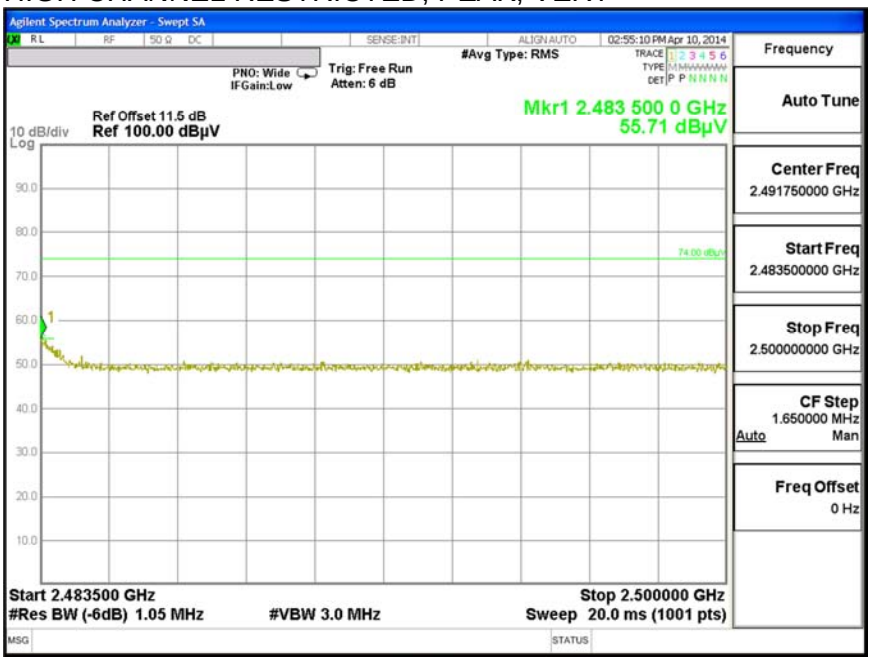
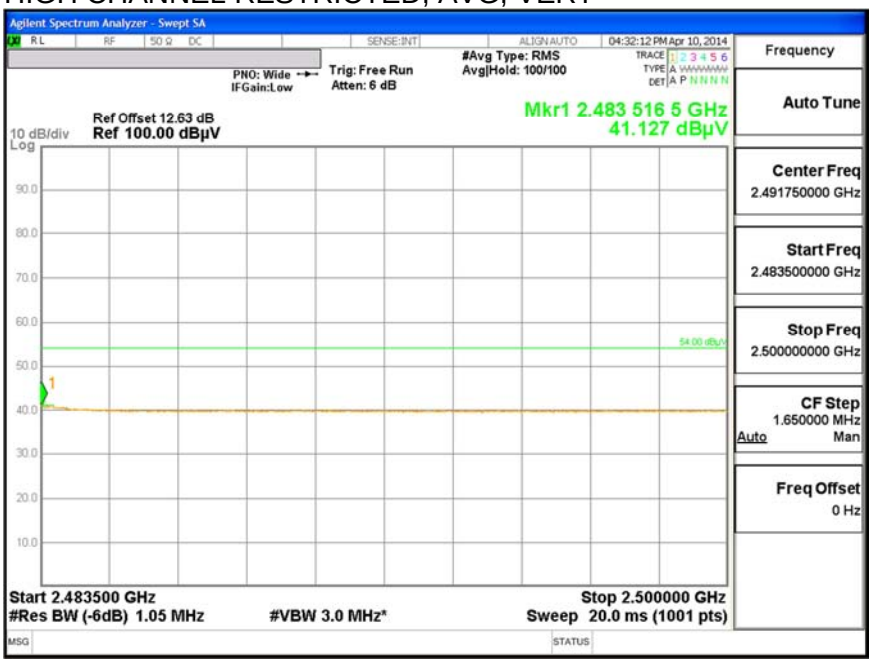
**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

HIGH CHANNEL RESTRICTED, PEAK, VERT




HIGH CHANNEL RESTRICTED, AVG, VERT





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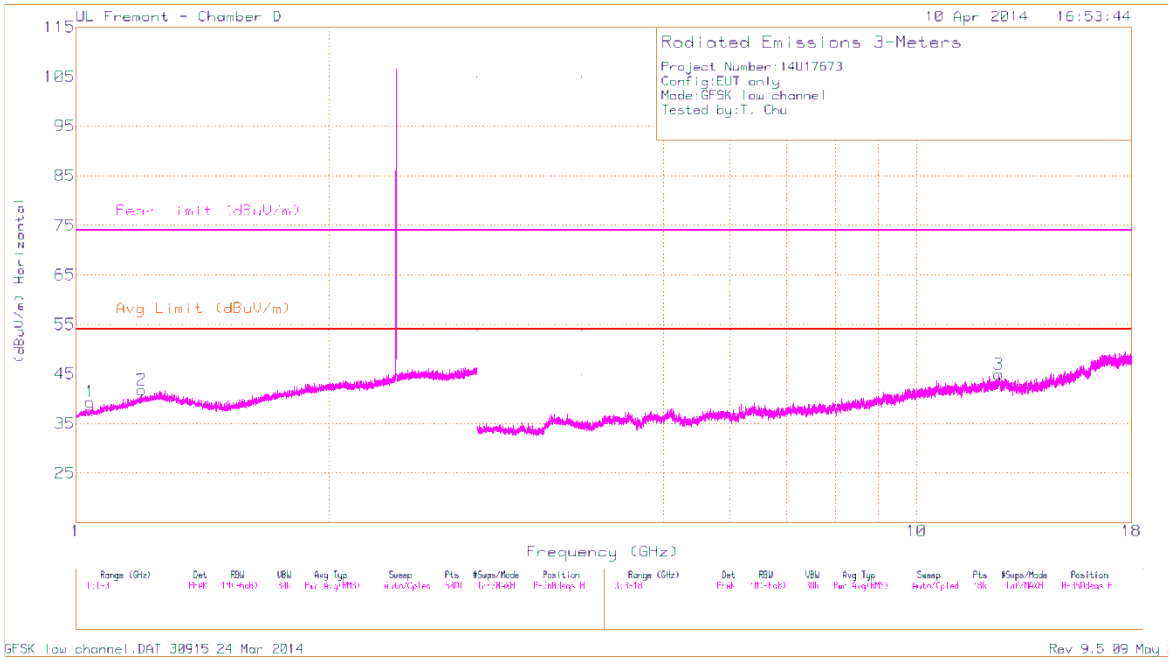
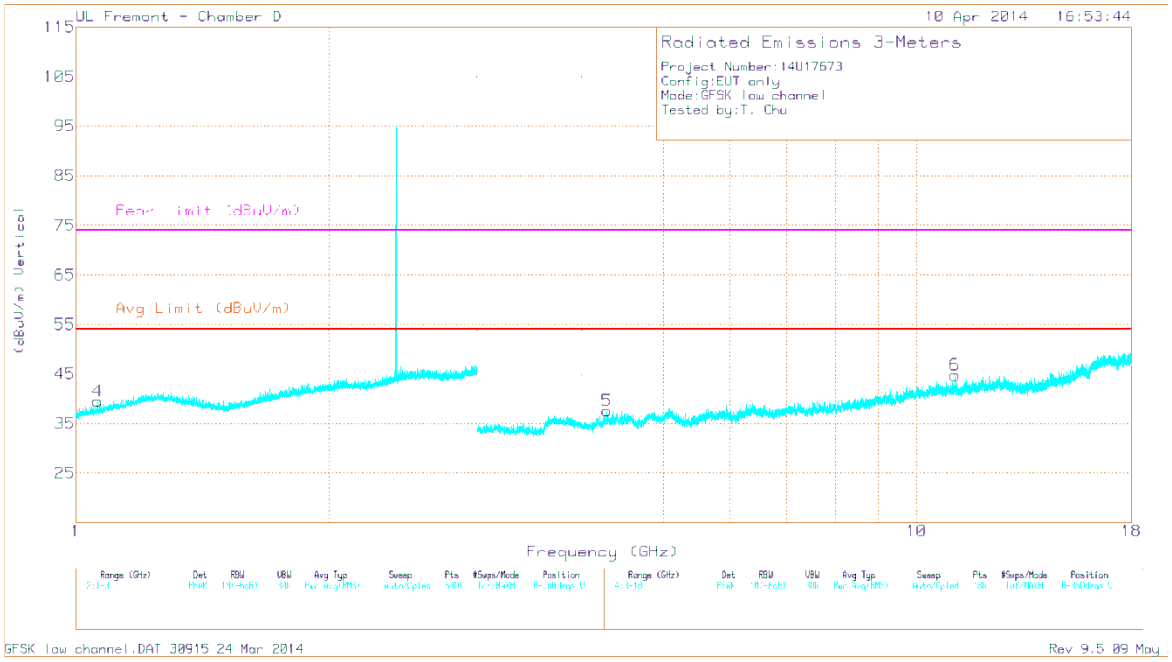
**LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS**

LOW CHANNEL HORIZONTAL PLOT




LOW CHANNEL VERTICAL PLOT





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**DATA**

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/ Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 1.041 | 41.86 | PK3 | 26.7 | -22.4 | 0 | 46.16 | - | - | 74 | -27.84 | 182 | 179 | H |
| | * 1.041 | 28.98 | VB1T | 26.6 | -22.4 | 1.2 | 34.38 | 54 | -19.62 | - | - | 182 | 179 | H |
| 2 | * 1.197 | 41.93 | PK3 | 28.9 | -22 | 0 | 48.83 | - | - | 74 | -25.17 | 182 | 179 | H |
| | * 1.197 | 28.89 | VB1T | 28.9 | -22 | 1.2 | 36.99 | 54 | -17.01 | - | - | 182 | 179 | H |
| 4 | * 1.06 | 42.17 | PK3 | 26.9 | -22.4 | 0 | 46.67 | - | - | 74 | -27.33 | 229 | 202 | V |
| | * 1.06 | 29.04 | VB1T | 27 | -22.4 | 1.2 | 34.84 | 54 | -19.16 | - | - | 229 | 202 | V |
| 3 | * 12.52 | 35.08 | PK3 | 38.5 | -20.8 | 0 | 52.78 | - | - | 74 | -21.22 | 262 | 100 | H |
| | * 12.52 | 22.14 | VB1T | 38.5 | -20.8 | 1.2 | 41.04 | 54 | -12.96 | - | - | 262 | 100 | H |
| 5 | * 4.281 | 38.03 | PK3 | 33 | -27.4 | 0 | 43.63 | - | - | 74 | -30.37 | 262 | 100 | V |
| | * 4.281 | 25.37 | VB1T | 33 | -27.4 | 1.2 | 32.17 | 54 | -21.83 | - | - | 262 | 100 | V |
| 6 | * 11.096 | 34.45 | PK3 | 37.5 | -21 | 0 | 50.95 | - | - | 74 | -23.05 | 262 | 100 | V |
| | * 11.096 | 22.17 | VB1T | 37.5 | -21 | 1.2 | 39.87 | 54 | -14.13 | - | - | 262 | 100 | V |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 24 Mar 2014

Rev 9.5 31 Mar 2014


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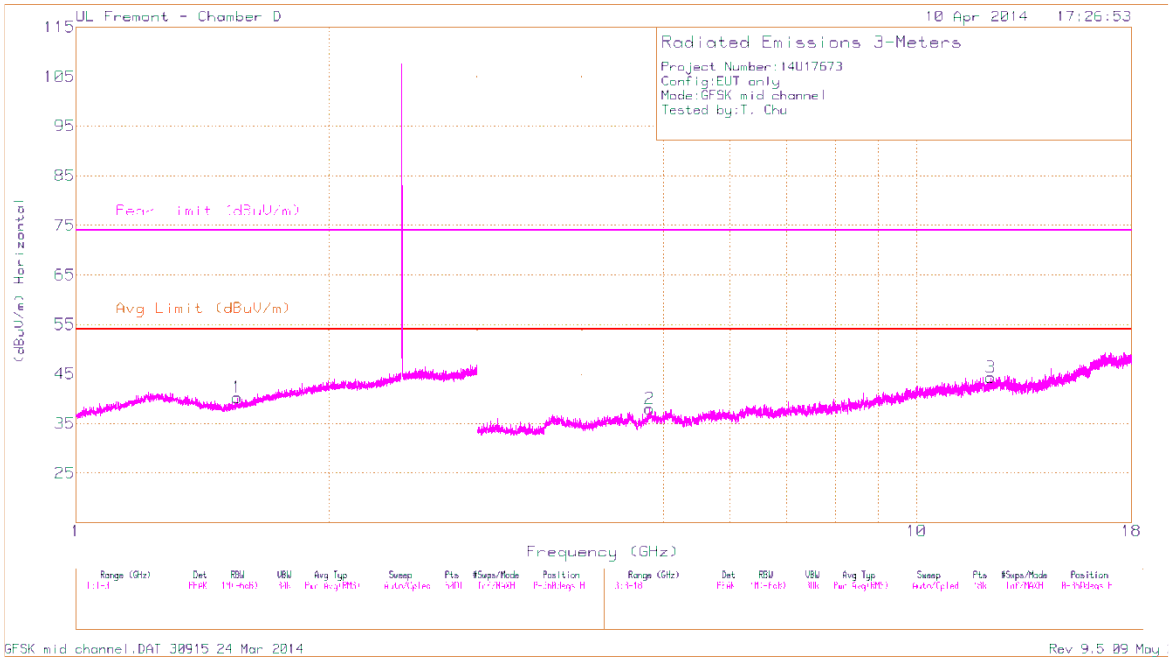
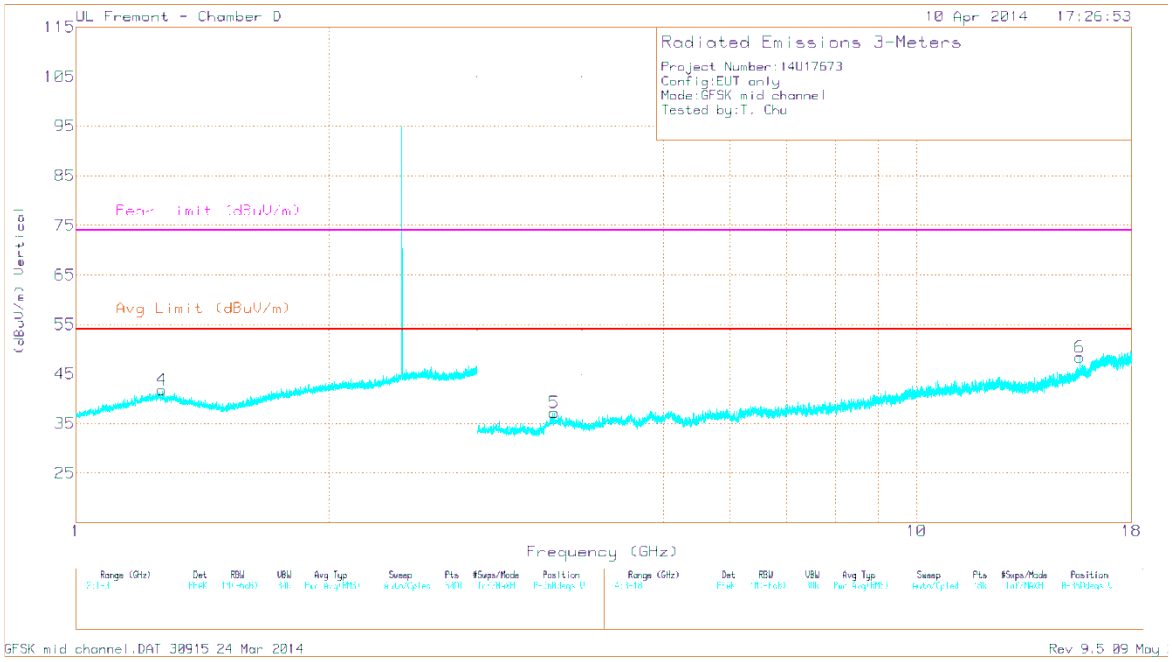
**MID CHANNEL HARMONICS AND SPURIOUS EMISSIONS**

MID CHANNEL HORIZONTAL PLOT




MID CHANNEL VERTICAL PLOT





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**DATA**

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/ Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 1.555 | 41.26 | PK3 | 27.5 | -21.6 | 0 | 47.16 | - | - | 74 | -26.84 | 262 | 100 | H |
| | * 1.554 | 28.59 | VB1T | 27.4 | -21.6 | 1.2 | 35.59 | 54 | -18.41 | - | - | 262 | 100 | H |
| 4 | * 1.267 | 41.74 | PK3 | 29.4 | -22 | 0 | 49.14 | - | - | 74 | -24.86 | 262 | 146 | V |
| | * 1.268 | 28.88 | VB1T | 29.4 | -22.1 | 1.2 | 37.38 | 54 | -16.62 | - | - | 262 | 146 | V |
| 2 | * 4.816 | 38.07 | PK3 | 33.5 | -26.8 | 0 | 44.77 | - | - | 74 | -29.23 | 299 | 100 | H |
| | * 4.814 | 24.95 | VB1T | 33.5 | -26.8 | 1.2 | 32.85 | 54 | -21.15 | - | - | 299 | 100 | H |
| 3 | * 12.238 | 34.67 | PK3 | 38.4 | -21.6 | 0 | 51.47 | - | - | 74 | -22.53 | 299 | 100 | H |
| | * 12.238 | 21.94 | VB1T | 38.4 | -21.6 | 1.2 | 39.94 | 54 | -14.06 | - | - | 299 | 100 | H |
| 5 | * 3.709 | 38.78 | PK3 | 32.6 | -27.9 | 0 | 43.48 | - | - | 74 | -30.52 | 272 | 202 | V |
| | * 3.711 | 25.71 | VB1T | 32.6 | -28 | 1.2 | 31.51 | 54 | -22.49 | - | - | 272 | 202 | V |
| 6 | * 15.623 | 35.05 | PK3 | 39.9 | -20.5 | 0 | 54.45 | - | - | 74 | -19.55 | 215 | 202 | V |
| | * 15.624 | 22.44 | VB1T | 39.9 | -20.5 | 1.2 | 43.04 | 54 | -10.96 | - | - | 215 | 202 | V |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 24 Mar 2014

Rev 9.5 31 Mar 2014


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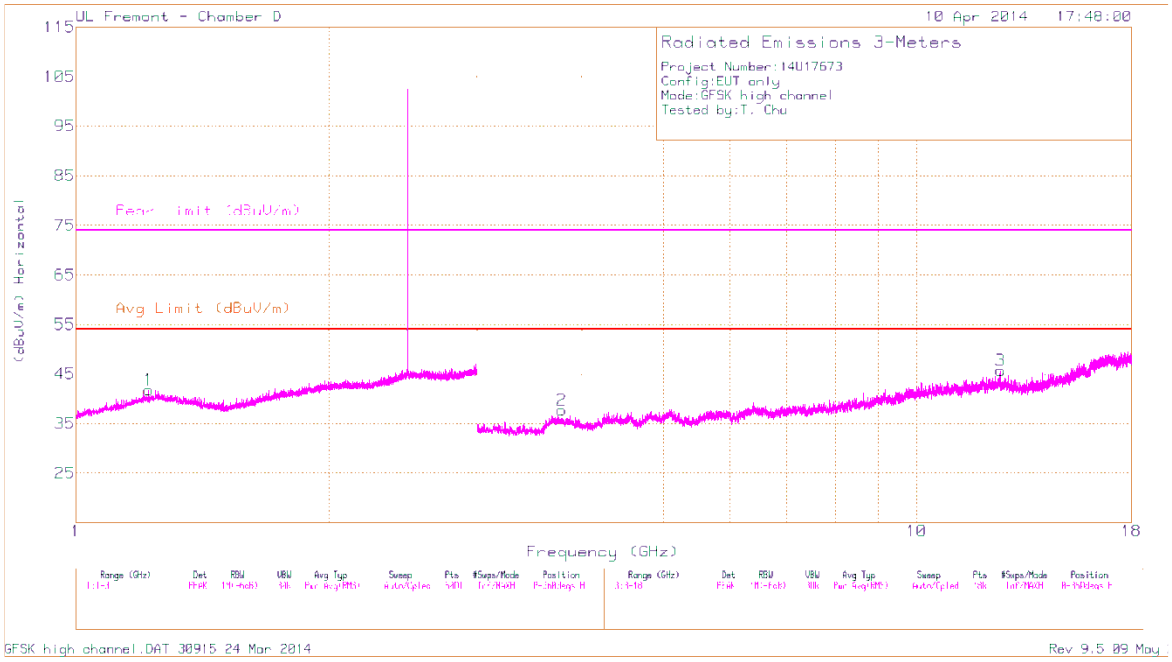
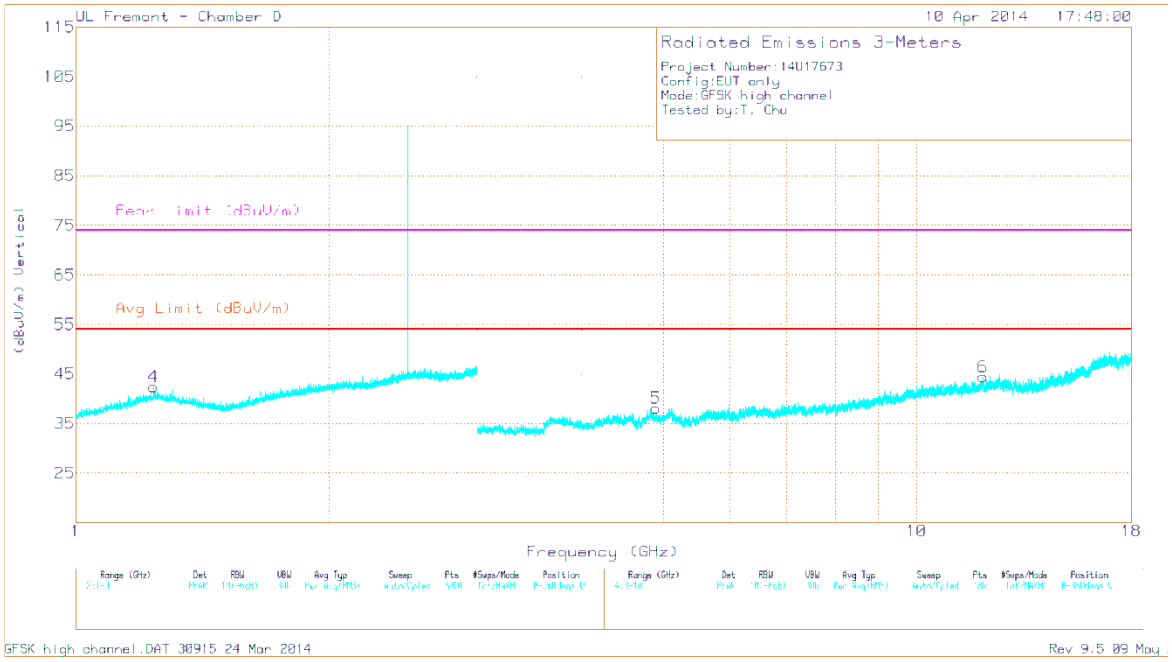
**HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS**

HIGH CHANNEL HORIZONTAL PLOT




HIGH CHANNEL VERTICAL PLOT





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**DATA**

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr /Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 1.219 | 42.11 | PK3 | 29.2 | -22 | 0 | 49.31 | - | - | 74 | -24.69 | 215 | 202 | H |
| | * 1.221 | 28.88 | VB1T | 29.2 | -22 | 1.2 | 37.28 | 54 | -16.72 | - | - | 215 | 202 | H |
| 4 | * 1.235 | 42.35 | PK3 | 29.4 | -22 | 0 | 49.75 | - | - | 74 | -24.25 | 215 | 172 | V |
| | * 1.236 | 28.86 | VB1T | 29.4 | -22 | 1.2 | 37.46 | 54 | -16.54 | - | - | 215 | 172 | V |
| 2 | * 3.782 | 39.23 | PK3 | 32.7 | -28.6 | 0 | 43.33 | - | - | 74 | -30.67 | 215 | 172 | H |
| | * 3.783 | 26.56 | VB1T | 32.7 | -28.6 | 1.2 | 31.86 | 54 | -22.14 | - | - | 215 | 172 | H |
| 3 | * 12.579 | 34.71 | PK3 | 38.6 | -21.7 | 0 | 51.61 | - | - | 74 | -22.39 | 215 | 156 | H |
| | * 12.578 | 21.97 | VB1T | 38.6 | -21.7 | 1.2 | 40.07 | 54 | -13.93 | - | - | 215 | 156 | H |
| 5 | * 4.895 | 37.19 | PK3 | 33.5 | -27.3 | 0 | 43.39 | - | - | 74 | -30.61 | 23 | 115 | V |
| | * 4.897 | 25.12 | VB1T | 33.5 | -27.4 | 1.2 | 32.42 | 54 | -21.58 | - | - | 23 | 115 | V |
| 6 | * 11.998 | 34.41 | PK3 | 38.2 | -20.7 | 0 | 51.91 | - | - | 74 | -22.09 | 133 | 122 | V |
| | * 11.995 | 22.06 | VB1T | 38.2 | -20.7 | 1.2 | 40.76 | 54 | -13.24 | - | - | 133 | 122 | V |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan. TST 30915 24 Mar 2014

Rev 9.5 31 Mar 2014


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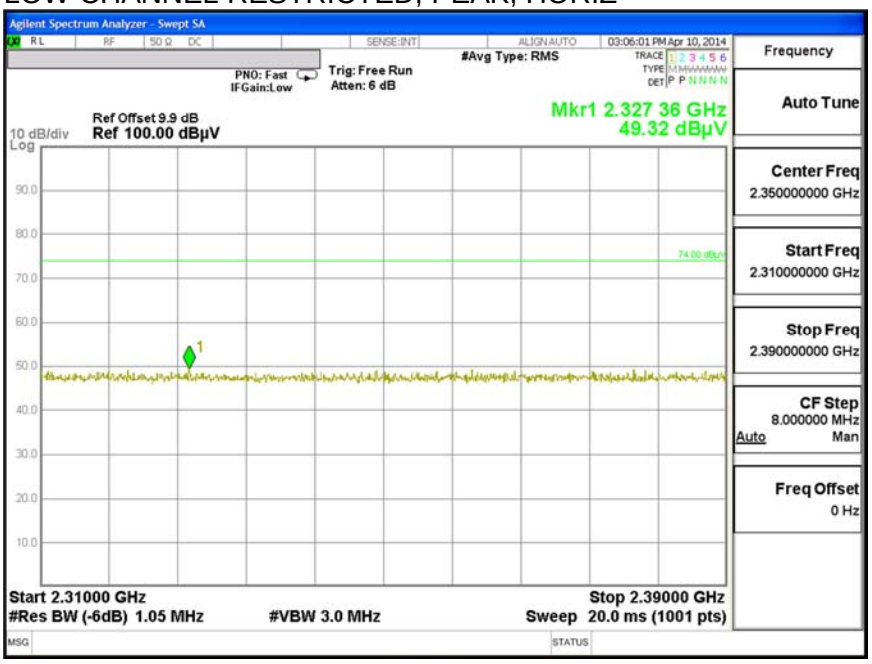
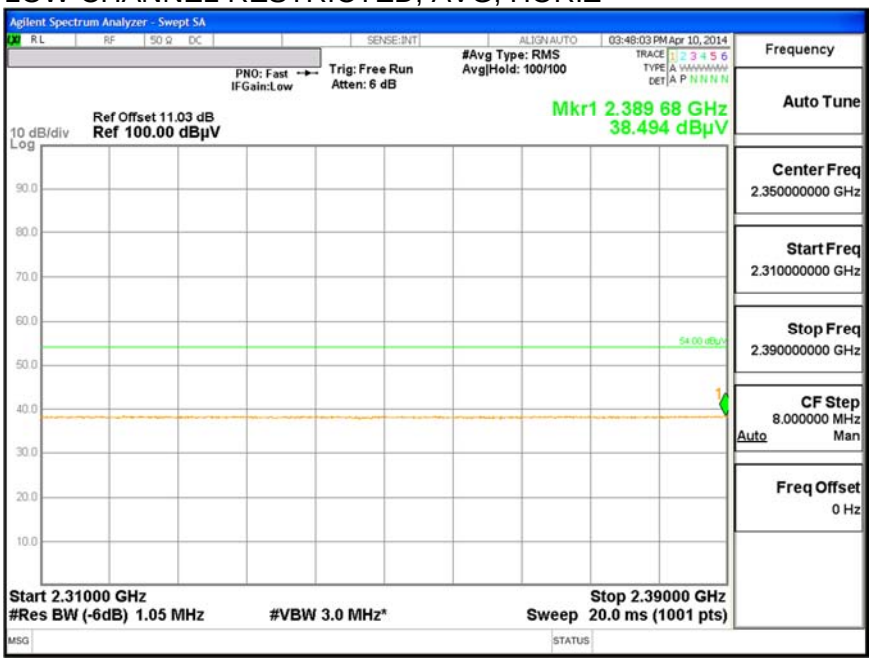
## 10.2.2. ENHANCED DATA RATE 8PSK MODULATION

**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**

LOW CHANNEL RESTRICTED, PEAK, HORIZ




LOW CHANNEL RESTRICTED, AVG, HORIZ





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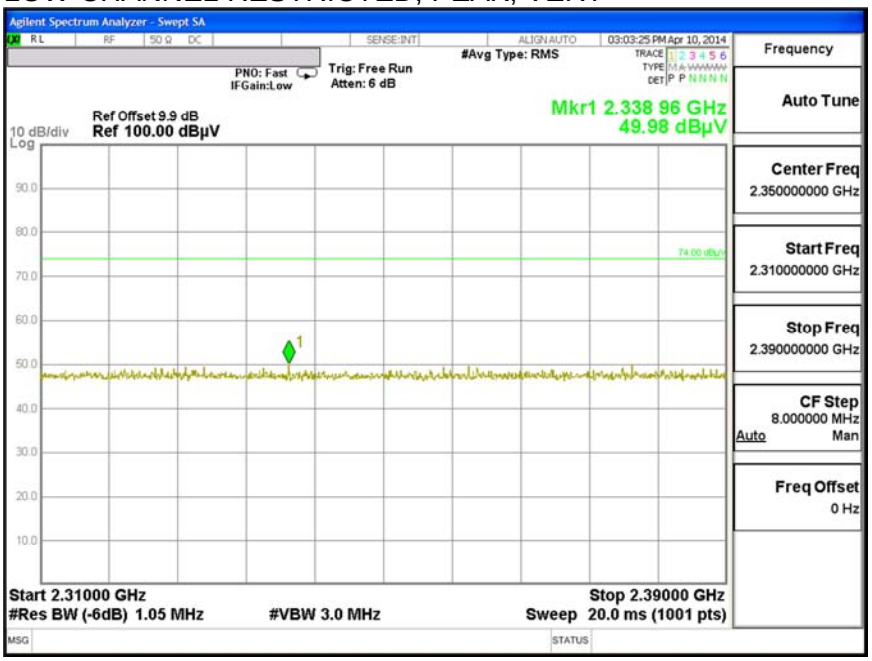
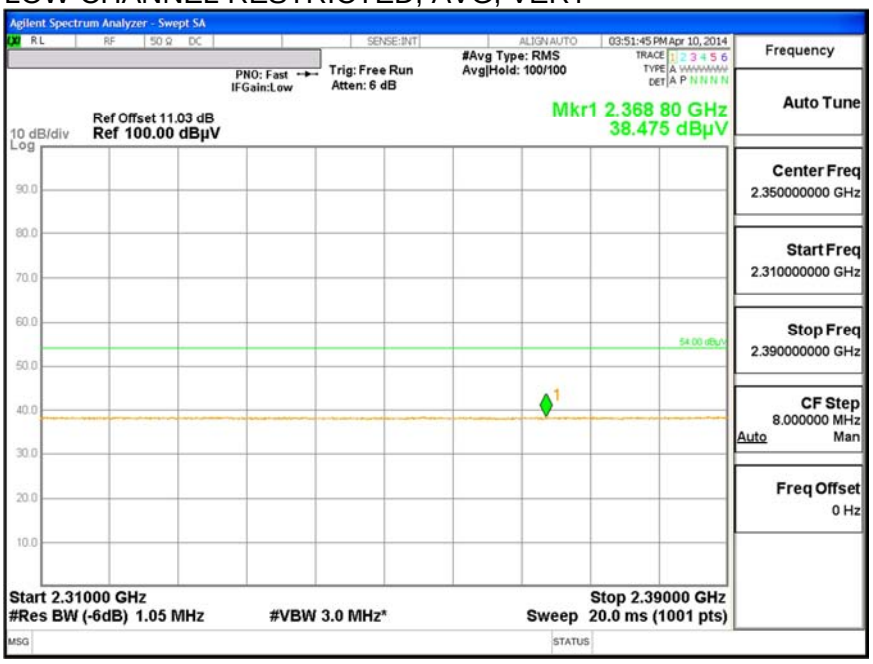
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

LOW CHANNEL RESTRICTED, PEAK, VERT




LOW CHANNEL RESTRICTED, AVG, VERT



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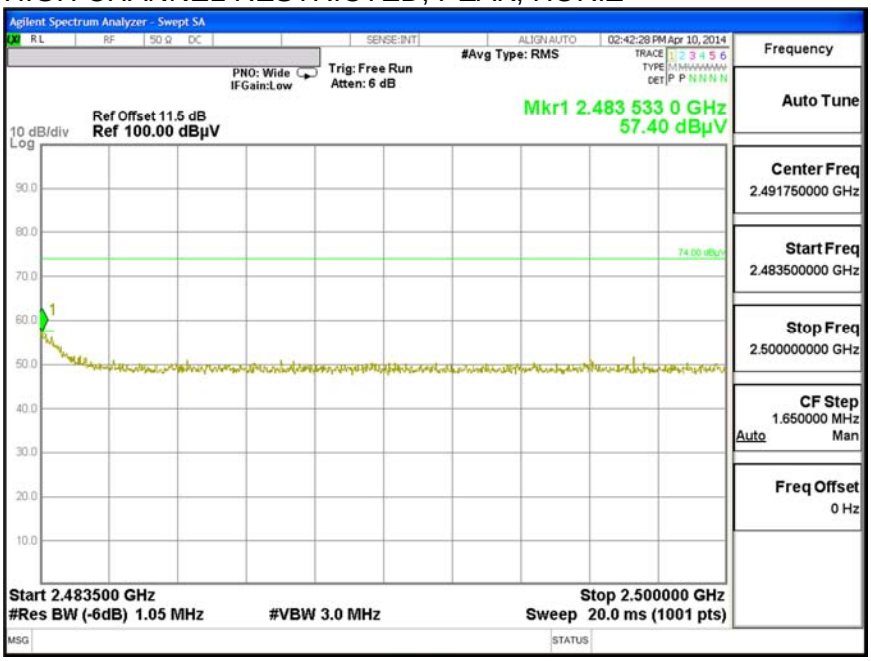
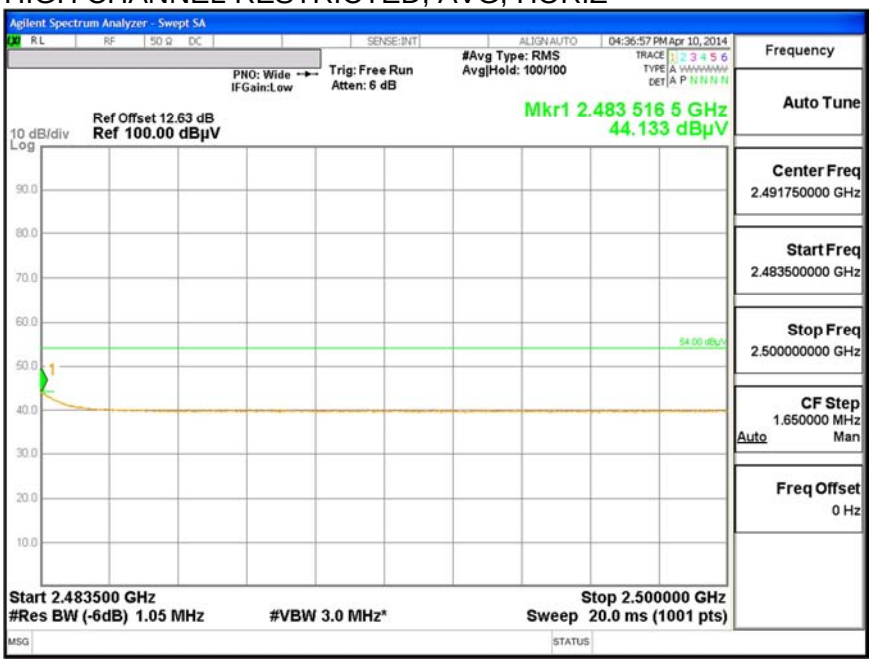
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL**

HIGH CHANNEL RESTRICTED, PEAK, HORIZ




HIGH CHANNEL RESTRICTED, AVG, HORIZ





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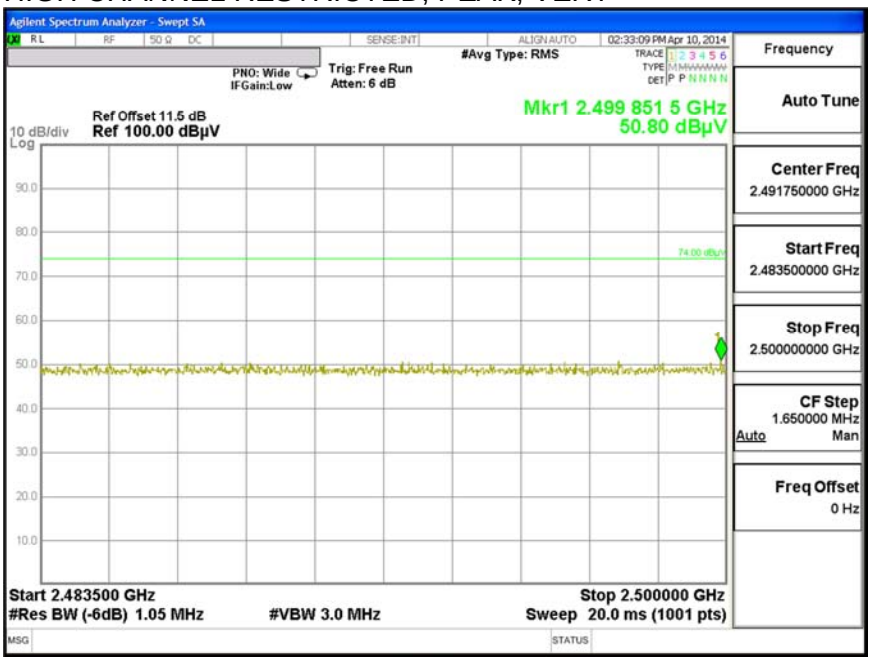
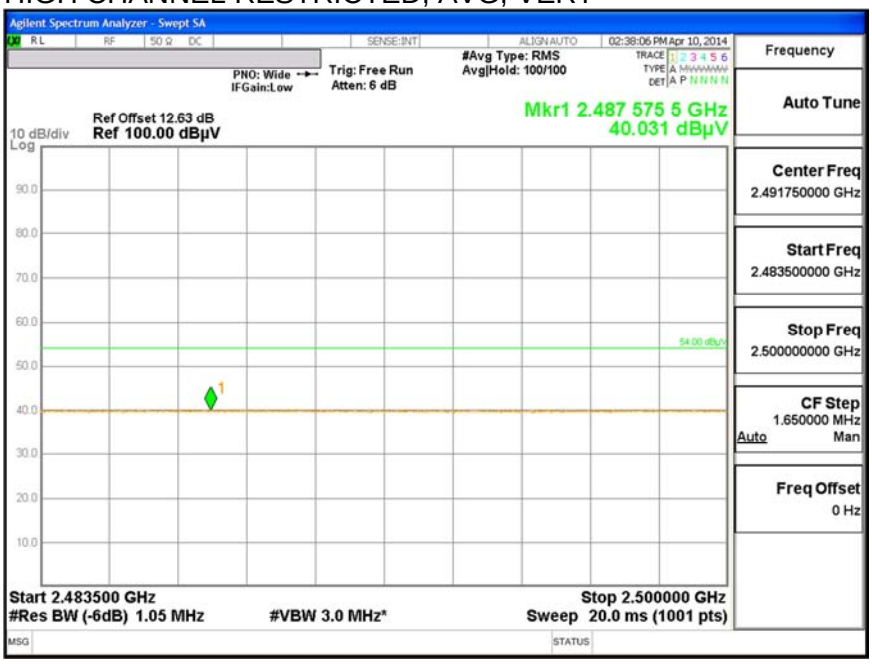
**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

HIGH CHANNEL RESTRICTED, PEAK, VERT




HIGH CHANNEL RESTRICTED, AVG, VERT





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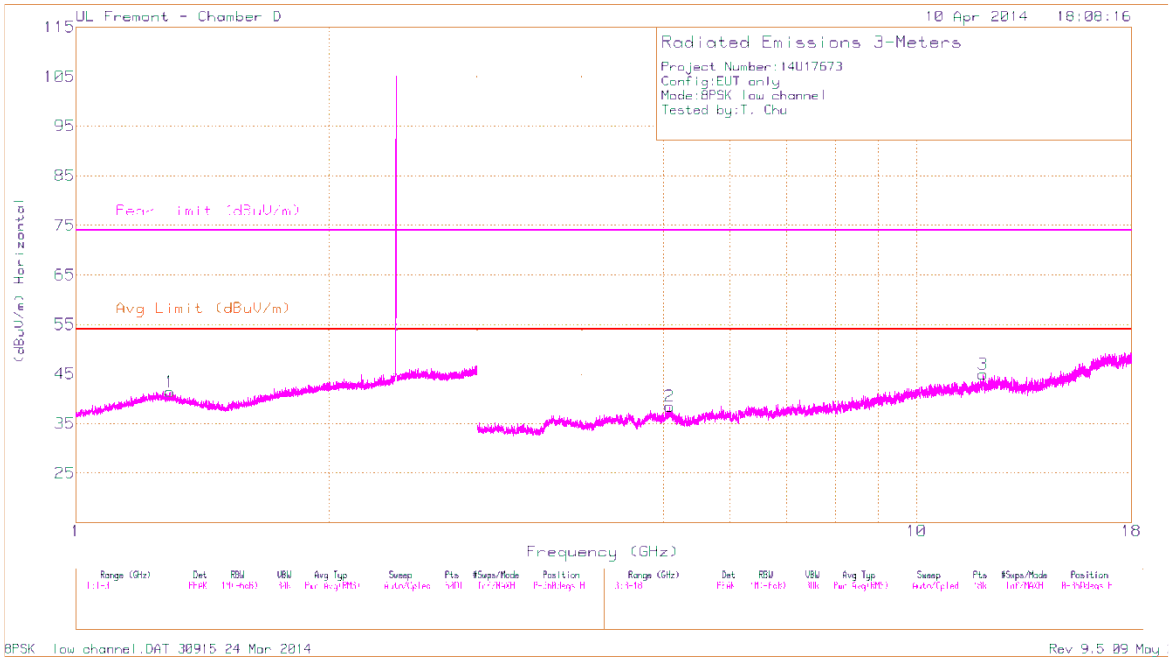
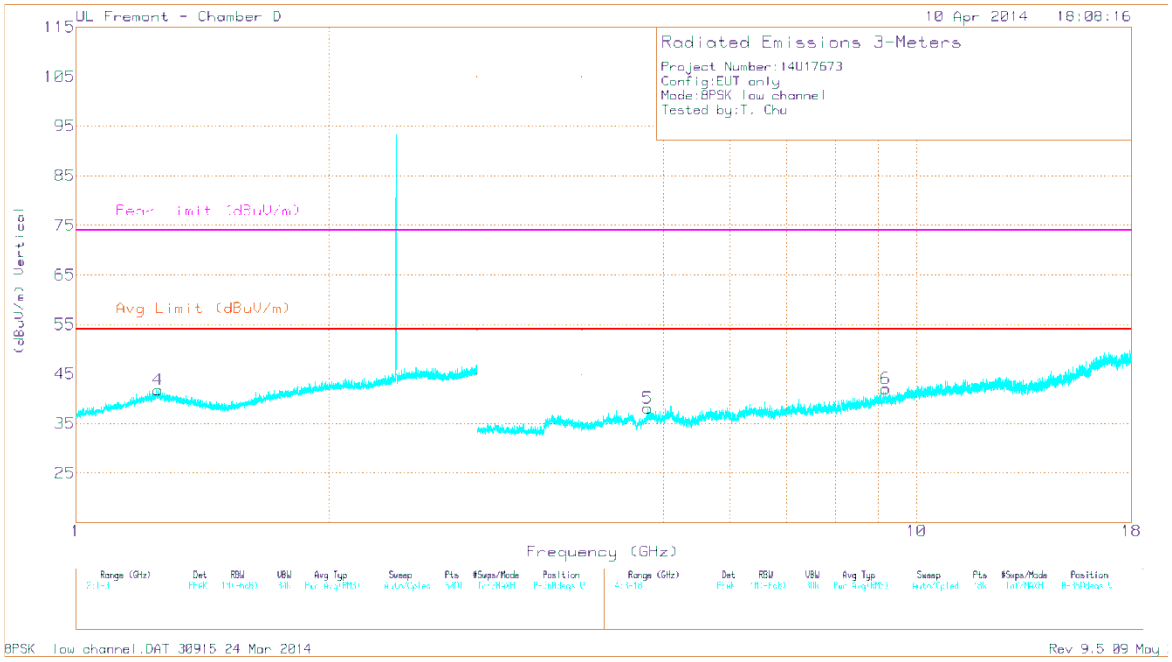
**LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS**

LOW CHANNEL HORIZONTAL PLOT




LOW CHANNEL VERTICAL PLOT





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**DATA**

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/ Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 1.297 | 41.45 | PK3 | 29.1 | -22 | 0 | 48.55 | - | - | 74 | -25.45 | 133 | 122 | H |
| | * 1.297 | 28.9 | VB1T | 29.1 | -22 | 1.1 | 37.1 | 54 | -16.9 | - | - | 133 | 122 | H |
| 4 | * 1.252 | 42.07 | PK3 | 29.6 | -22.1 | 0 | 49.57 | - | - | 74 | -24.43 | 154 | 139 | V |
| | * 1.25 | 28.92 | VB1T | 29.6 | -22.1 | 1.1 | 37.52 | 54 | -16.48 | - | - | 154 | 139 | V |
| 2 | * 5.089 | 37.58 | PK3 | 33.6 | -25.9 | 0 | 45.28 | - | - | 74 | -28.72 | 206 | 231 | H |
| | * 5.087 | 25.15 | VB1T | 33.6 | -26 | 1.1 | 33.85 | 54 | -20.15 | - | - | 206 | 231 | H |
| 3 | * 11.994 | 34.67 | PK3 | 38.2 | -20.7 | 0 | 52.17 | - | - | 74 | -21.83 | 206 | 111 | H |
| | * 11.994 | 22.12 | VB1T | 38.2 | -20.7 | 1.1 | 40.72 | 54 | -13.28 | - | - | 206 | 111 | H |
| 5 | * 4.786 | 38.84 | PK3 | 33.5 | -27.5 | 0 | 44.84 | - | - | 74 | -29.16 | 191 | 111 | V |
| | * 4.787 | 25.86 | VB1T | 33.5 | -27.4 | 1.1 | 33.06 | 54 | -20.94 | - | - | 191 | 111 | V |
| 6 | * 9.184 | 34.13 | PK3 | 35.9 | -21.2 | 0 | 48.83 | - | - | 74 | -25.17 | 191 | 111 | V |
| | * 9.18 | 22.03 | VB1T | 35.9 | -21.3 | 1.1 | 37.73 | 54 | -16.27 | - | - | 191 | 111 | V |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

8PSK low channel.DAT 30915 24 Mar 2014

Rev 9.5 31 Mar 2014



UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

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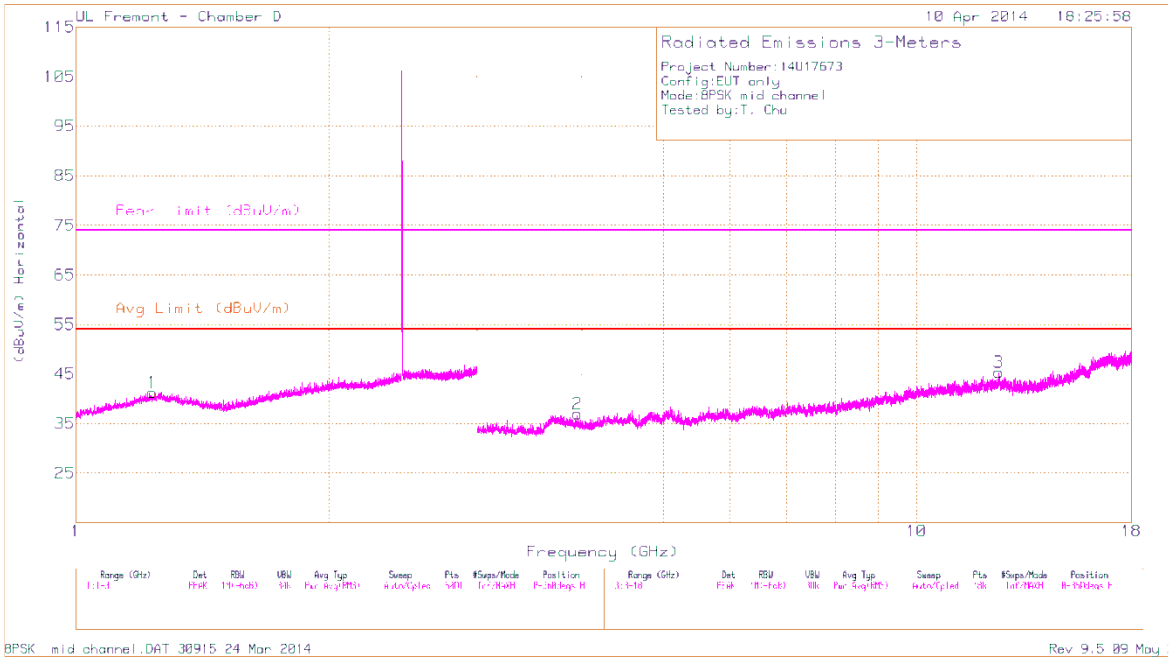
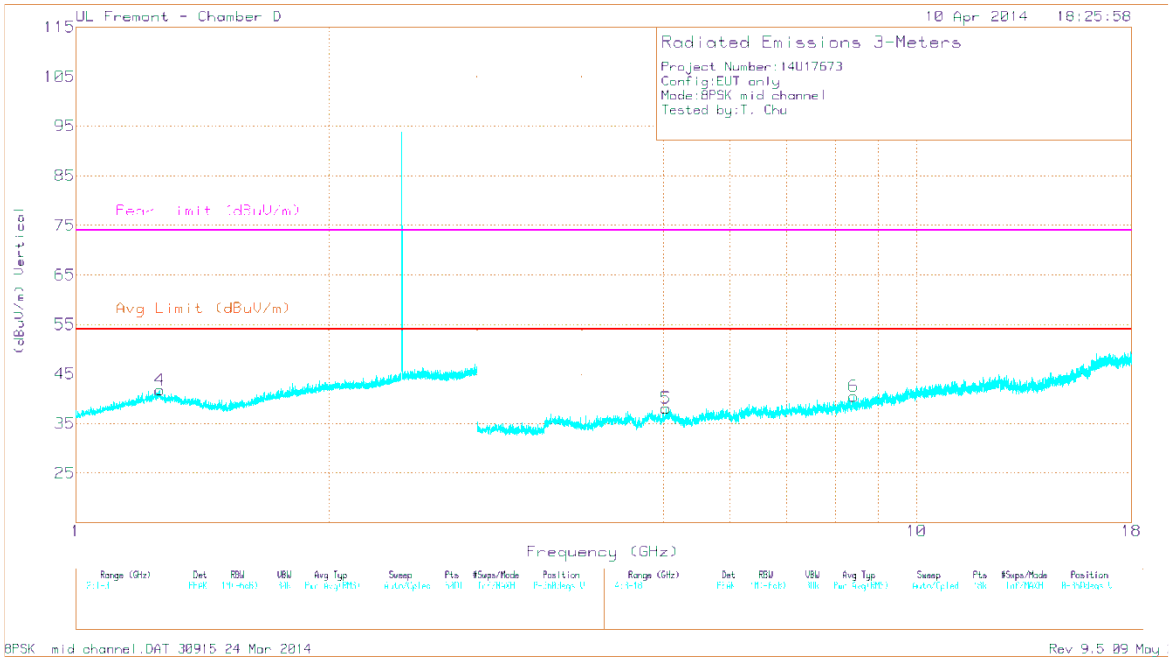
**MID CHANNEL HARMONICS AND SPURIOUS EMISSIONS**

MID CHANNEL HORIZONTAL PLOT




MID CHANNEL VERTICAL PLOT





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**DATA**

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/ Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 1.23 | 41.51 | PK3 | 29.3 | -22 | 0 | 48.81 | - | - | 74 | -25.19 | 191 | 111 | H |
| | * 1.23 | 28.9 | VB1T | 29.3 | -22 | 1.1 | 37.3 | 54 | -16.7 | - | - | 191 | 111 | H |
| 4 | * 1.261 | 41.77 | PK3 | 29.5 | -22 | 0 | 49.27 | - | - | 74 | -24.73 | 191 | 122 | V |
| | * 1.261 | 28.94 | VB1T | 29.5 | -22 | 1.1 | 37.54 | 54 | -16.46 | - | - | 191 | 122 | V |
| 2 | * 3.953 | 39.17 | PK3 | 32.9 | -28.2 | 0 | 43.87 | - | - | 74 | -30.13 | 211 | 143 | H |
| | * 3.951 | 26.16 | VB1T | 32.9 | -28.2 | 1.1 | 31.96 | 54 | -22.04 | - | - | 211 | 143 | H |
| 3 | * 12.525 | 34.53 | PK3 | 38.5 | -20.8 | 0 | 52.23 | - | - | 74 | -21.77 | 155 | 114 | H |
| | * 12.525 | 22.18 | VB1T | 38.5 | -20.8 | 1.1 | 40.98 | 54 | -13.02 | - | - | 155 | 114 | H |
| 5 | * 5.029 | 38.35 | PK3 | 33.5 | -27.3 | 0 | 44.55 | - | - | 74 | -29.45 | 209 | 183 | V |
| | * 5.029 | 25.71 | VB1T | 33.5 | -27.2 | 1.1 | 33.11 | 54 | -20.89 | - | - | 209 | 183 | V |
| 6 | * 8.415 | 35.6 | PK3 | 35.4 | -23.6 | 0 | 47.4 | - | - | 74 | -26.6 | 209 | 183 | V |
| | * 8.415 | 23.28 | VB1T | 35.4 | -23.6 | 1.1 | 36.18 | 54 | -17.82 | - | - | 209 | 183 | V |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 24 Mar 2014

Rev 9.5 31 Mar 2014


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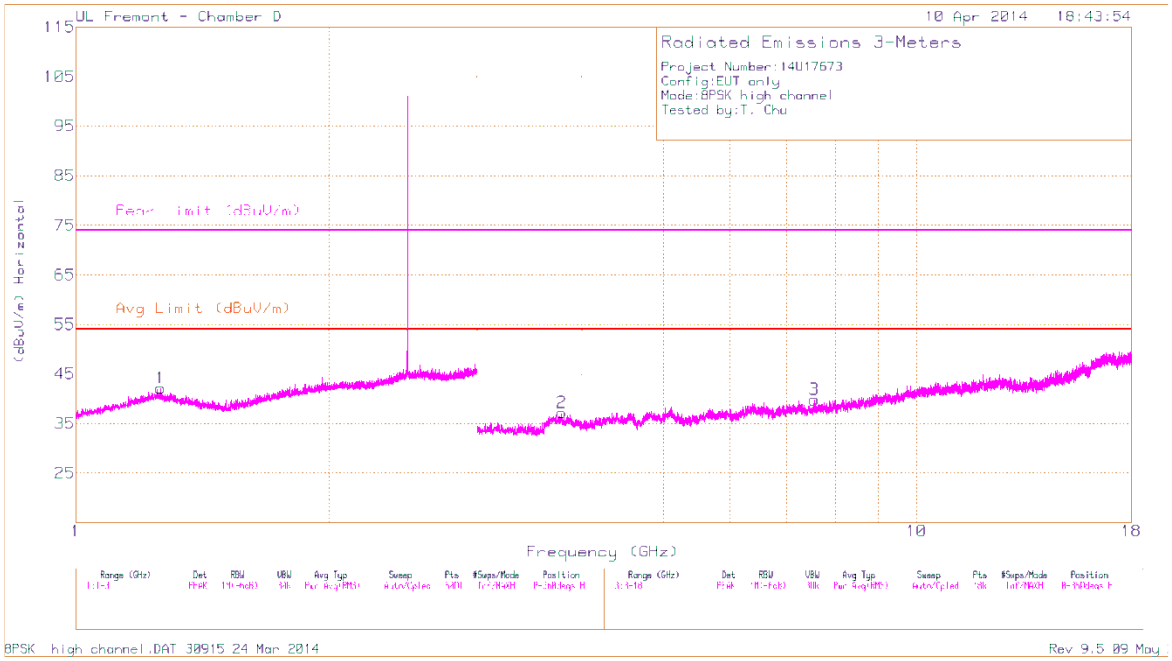
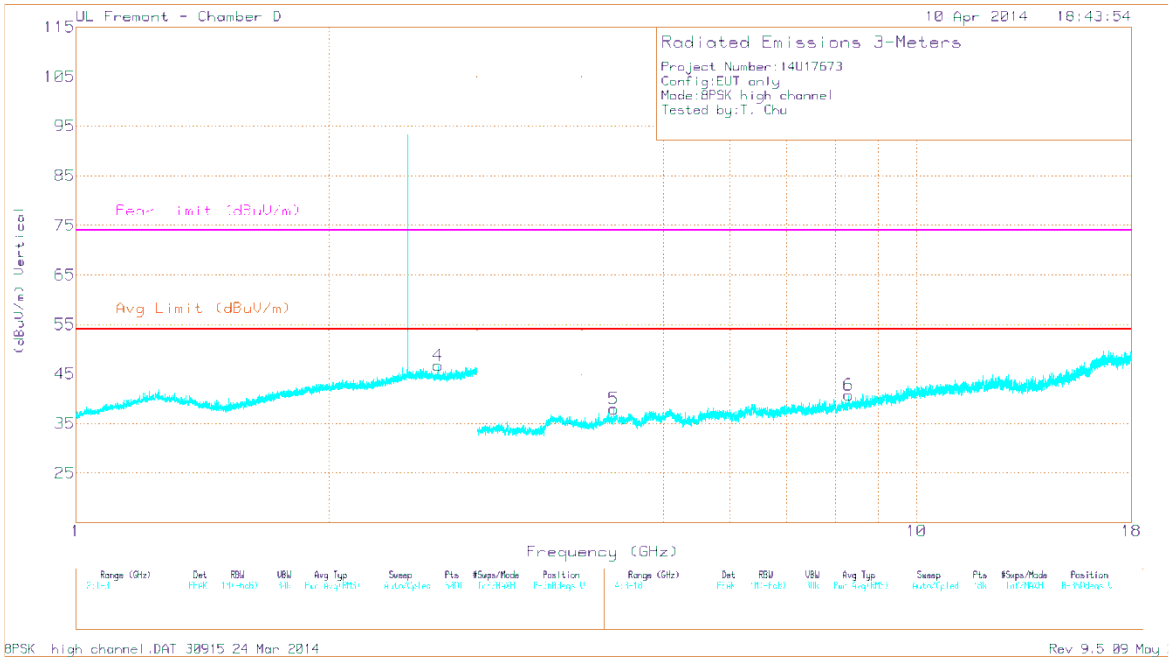
**HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS**

HIGH CHANNEL HORIZONTAL PLOT




HIGH CHANNEL VERTICAL PLOT





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## DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr /Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 1.262 | 41.78 | PK3 | 29.5 | -22 | 0 | 49.28 | - | - | 74 | -24.72 | 219 | 141 | H |
| | * 1.262 | 28.91 | VB1T | 29.5 | -22 | 1.1 | 37.51 | 54 | -16.49 | - | - | 219 | 141 | H |
| 4 | * 2.695 | 41.47 | PK3 | 31.7 | -20.1 | 0 | 53.07 | - | - | 74 | -20.93 | 225 | 151 | V |
| | * 2.695 | 28.76 | VB1T | 31.7 | -20.1 | 1.1 | 41.46 | 54 | -12.54 | - | - | 225 | 151 | V |
| 2 | * 3.784 | 40.11 | PK3 | 32.7 | -28.6 | 0 | 44.21 | - | - | 74 | -29.79 | 225 | 174 | H |
| | * 3.784 | 26.52 | VB1T | 32.7 | -28.6 | 1.1 | 31.72 | 54 | -22.28 | - | - | 225 | 174 | H |
| 3 | * 7.55 | 37.05 | PK3 | 35.2 | -25 | 0 | 47.25 | - | - | 74 | -26.75 | 205 | 150 | H |
| | * 7.55 | 24.24 | VB1T | 35.2 | -25.1 | 1.1 | 35.44 | 54 | -18.56 | - | - | 205 | 150 | H |
| 5 | * 4.362 | 37.87 | PK3 | 33.2 | -27.8 | 0 | 43.27 | - | - | 74 | -30.73 | 166 | 166 | V |
| | * 4.362 | 25.69 | VB1T | 33.2 | -27.9 | 1.1 | 32.09 | 54 | -21.91 | - | - | 166 | 166 | V |
| 6 | * 8.303 | 35.04 | PK3 | 35.3 | -23.6 | 0 | 46.74 | - | - | 74 | -27.26 | 166 | 155 | V |
| | * 8.303 | 23.23 | VB1T | 35.3 | -23.7 | 1.1 | 35.93 | 54 | -18.07 | - | - | 166 | 155 | V |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 24 Mar 2014

Rev 9.5 31 Mar 2014


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47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
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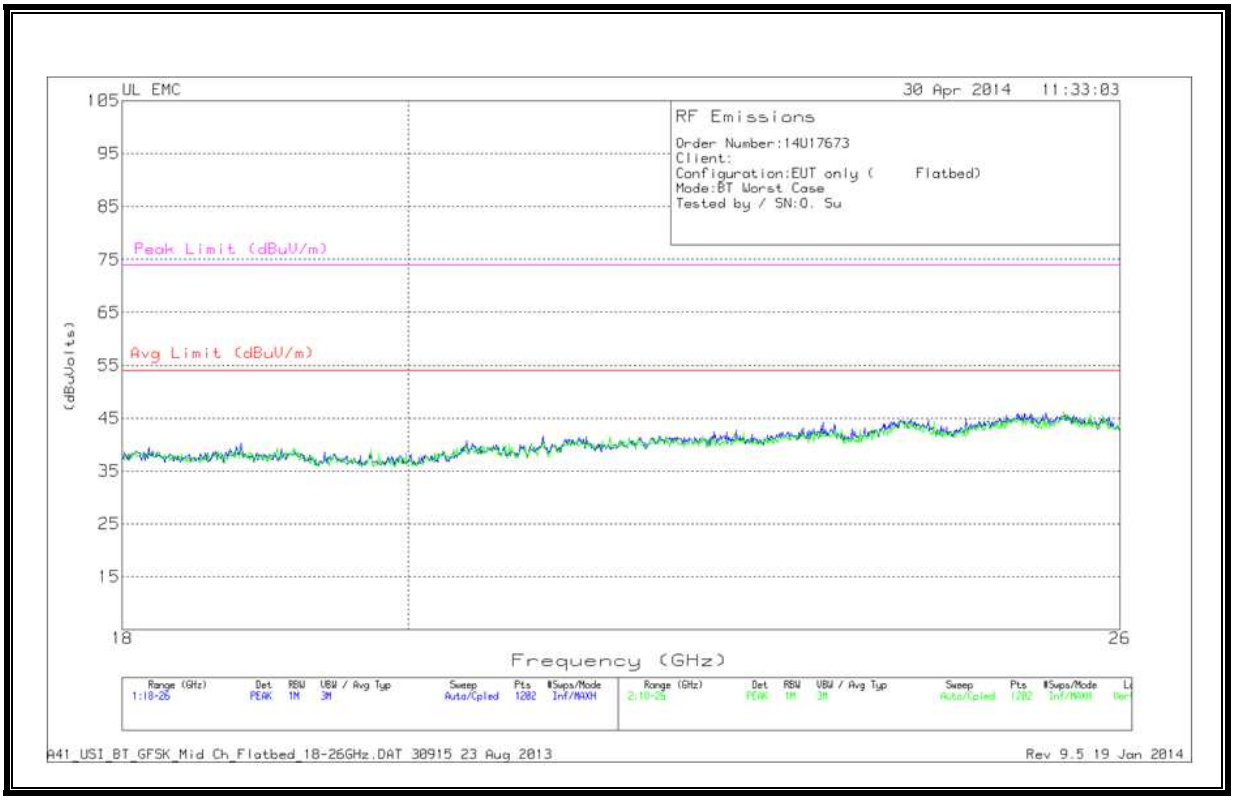
## 10.3. WORST-CASE ABOVE 18 GHz

**SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)**




Note: GFSK, highest power mode used for test.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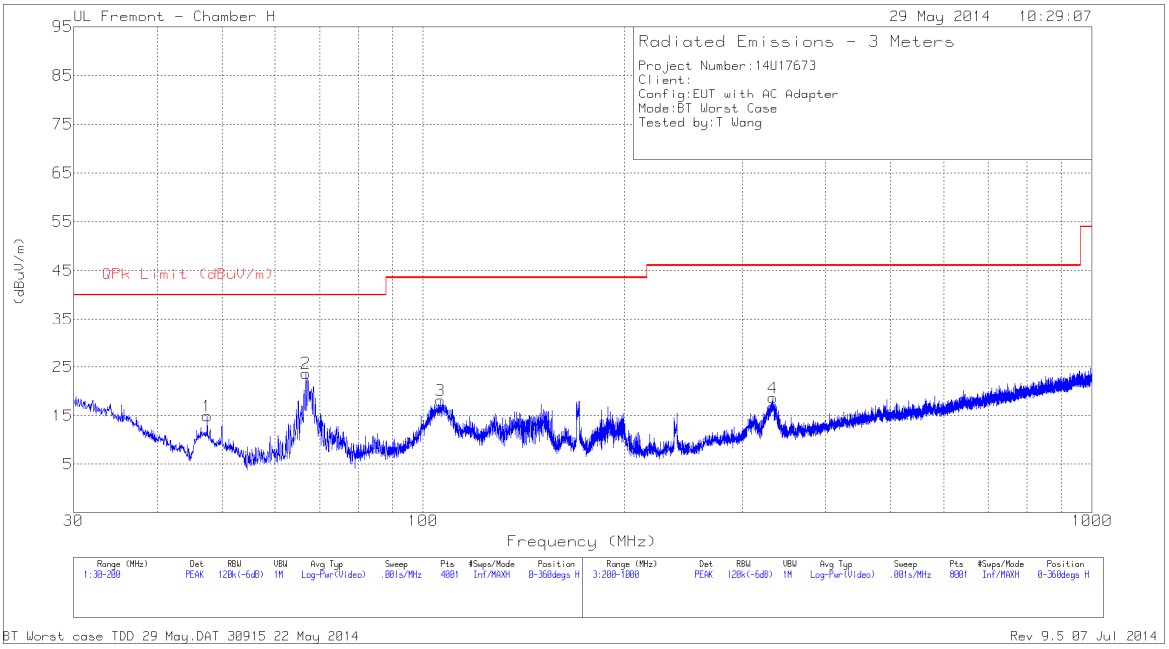
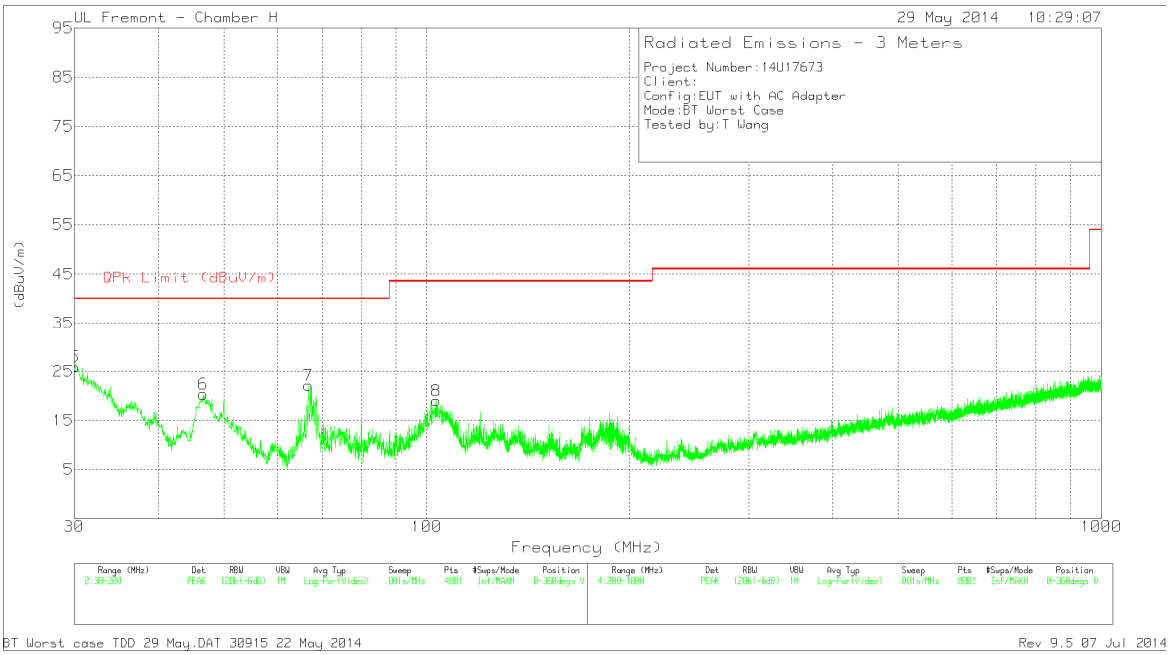
## 10.4. WORST-CASE BELOW 1 GHz

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)**

HORIZONTAL PLOT




VERTICAL PLOT





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## DATA

Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Hybrid | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | * 333.4 | 34.77 | PK | 14 | -30.1 | 18.67 | 46.02 | -27.35 | 0-360 | 100 | H |
| 5 | 30.085 | 36.33 | PK | 21.4 | -31.8 | 25.93 | 40 | -14.07 | 0-360 | 100 | V |
| 6 | 46.66 | 42.55 | PK | 9.5 | -31.7 | 20.35 | 40 | -19.65 | 0-360 | 100 | V |
| 1 | 47.5525 | 37.49 | PK | 9 | -31.6 | 14.89 | 40 | -25.11 | 0-360 | 201 | H |
| 2 | 66.7625 | 47.18 | PK | 8.1 | -31.6 | 23.68 | 40 | -16.32 | 0-360 | 201 | H |
| 7 | 66.7625 | 45.62 | PK | 8.1 | -31.6 | 22.12 | 40 | -17.88 | 0-360 | 100 | V |
| 8 | 103.2275 | 39.22 | PK | 11.1 | -31.3 | 19.02 | 43.52 | -24.5 | 0-360 | 100 | V |
| 3 | 106.16 | 37.62 | PK | 11.8 | -31.3 | 18.12 | 43.52 | -25.4 | 0-360 | 301 | H |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

FCC Part 15 Subpart C 30-1000MHz.TST 30915 18 Jan 2014

Rev 9.5 18 Apr 2014

Note: GFSK, highest power mode used for test.


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# 11. AC POWER LINE CONDUCTED EMISSIONS

**LIMITS**

FCC §15.207 (a)

RSS-Gen 7.2.2

| Frequency of Emission (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 * | 56 to 46 * |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

**TEST PROCEDURE**

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

**RESULTS**


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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## 6 WORST EMISSIONS

### Line-L1 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L1 (dB) | LC Cables 1&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .1725 | 49.47 | PK | 1.2 | 0 | 50.67 | 64.8 | -14.13 | - | - |
| 2 | .1725 | 29.62 | Av | 1.2 | 0 | 30.82 | - | - | 54.8 | -23.98 |
| 3 | .7845 | 44.42 | PK | .3 | 0 | 44.72 | 56 | -11.28 | - | - |
| 4 | .7845 | 31.84 | Av | .3 | 0 | 32.14 | - | - | 46 | -13.86 |
| 5 | 17.439 | 41.59 | PK | .3 | .2 | 42.09 | 60 | -17.91 | - | - |
| 6 | 17.439 | 27.51 | Av | .3 | .2 | 28.01 | - | - | 50 | -21.99 |

### Line-L2 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L2 (dB) | LC Cables 2&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | .1635 | 47.92 | PK | 1.3 | 0 | 49.22 | 65.3 | -16.08 | - | - |
| 8 | .1635 | 23.96 | Av | 1.3 | 0 | 25.26 | - | - | 55.3 | -30.04 |
| 9 | .78 | 44.18 | PK | .3 | 0 | 44.48 | 56 | -11.52 | - | - |
| 10 | .78 | 27.19 | Av | .3 | 0 | 27.49 | - | - | 46 | -18.51 |
| 11 | 17.664 | 40.17 | PK | .3 | .2 | 40.67 | 60 | -19.33 | - | - |
| 12 | 17.664 | 22.32 | Av | .3 | .2 | 22.82 | - | - | 50 | -27.18 |

PK - Peak detector

Av - average detection


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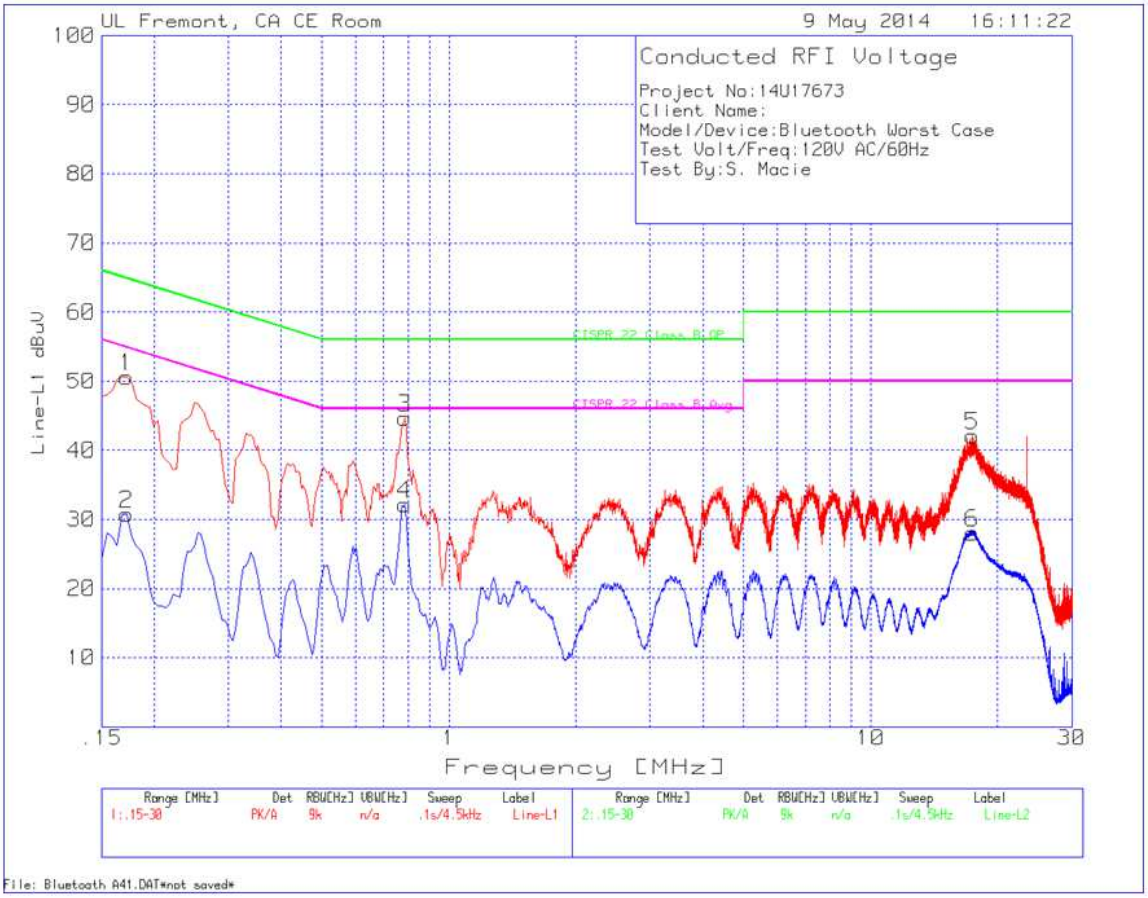
**LINE 1 RESULTS**





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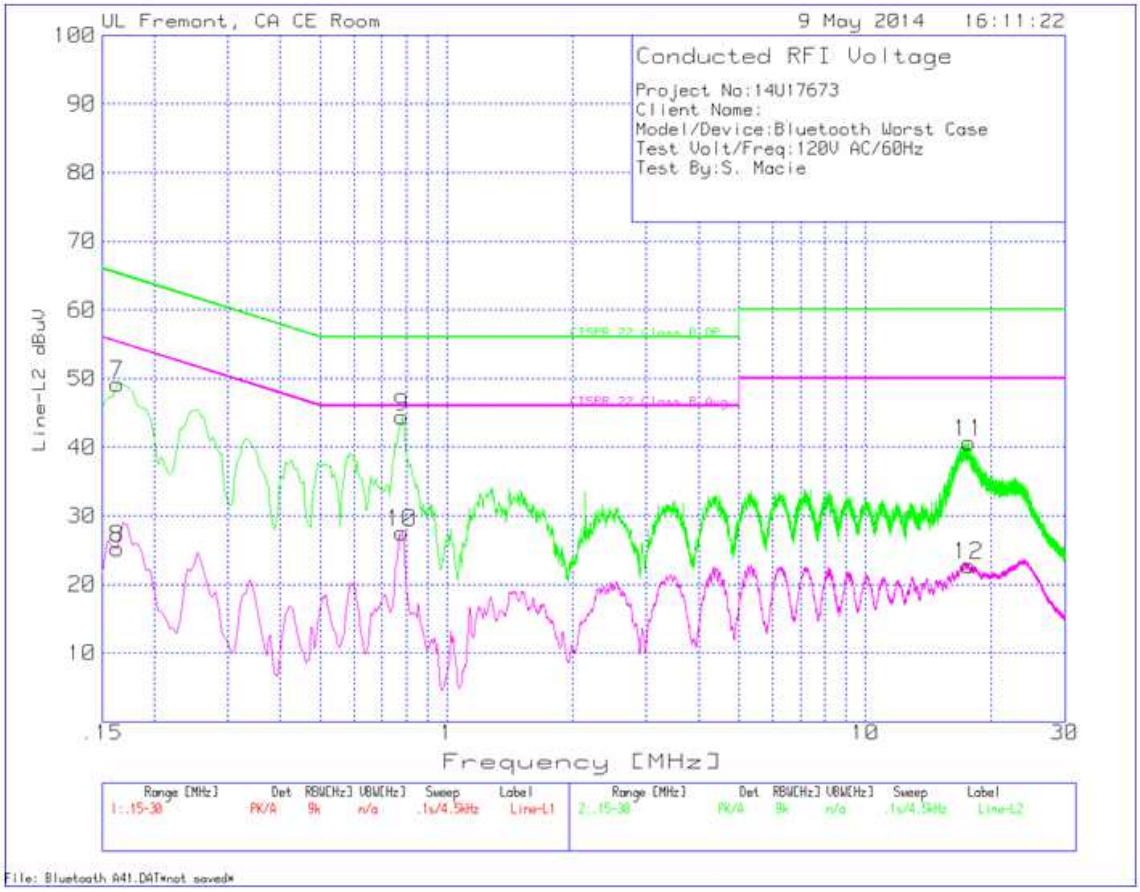
**LINE 2 RESULTS**





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