



**FCC CFR47 PART 15 SUBPART C**

**DTS Wireless LAN**

**CERTIFICATION TEST REPORT**

**FOR**

**GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n, ANT+ and NFC**

**MODEL NUMBER : SM-A510F/DS, SM-A510F**

**FCC ID: A3LSMA510F**

**REPORT NUMBER: 15K22047-E1**

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Revision History

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SAMSUNG ELECTRONICS CO., LTD.  
**EUT DESCRIPTION:** GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n, ANT+ and NFC  
**MODEL NUMBER:** SM-A510F/DS  
**SERIAL NUMBER:** R38FA0JNM9W , 330091e6a336920d (RADIATED);  
3300228292a67257 (CONDUCTED)  
**DATE TESTED:** OCT 19, 2015 - NOV 26, 2015

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

UL Korea, Ltd. 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 Korea, Ltd. 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 Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For  
UL Korea, Ltd. By:



CY Choi  
Suwon Lab Engineer  
UL Korea, Ltd.

Tested By:



SungGil Park  
Suwon Lab Engineer  
UL Korea, Ltd.

## 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.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 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.

| 218 Maeyeong-ro                               |
|-----------------------------------------------|
| <input checked="" type="checkbox"/> Chamber 1 |
| <input checked="" type="checkbox"/> Chamber 2 |

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

## 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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 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 | 2.32 dB     |
| Radiated Disturbance, Below 1GHz      | 4.14 dB     |
| Radiated Disturbance, Above 1 GHz     | 5.97 dB     |

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n, ANT+ and NFC.  
This test report addresses the DTS (WLAN) operational mode.

### 5.2. MAXIMUM OUTPUT POWER

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

| Frequency Range<br>[MHz] | Mode         | Output Power<br>[dBm] | Output Power<br>[mW] |
|--------------------------|--------------|-----------------------|----------------------|
| 2412 - 2472              | 802.11b      | 16.68                 | 46.56                |
|                          | 802.11g      | 14.46                 | 27.93                |
|                          | 802.11n HT20 | 13.18                 | 20.80                |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antennas, with a antenna's maximum gain of -1.19 dBi.

### 5.4. WORST-CASE CONFIGURATION AND MODE

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

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

Based on the baseline scan, the worst-case data rates were:

802.11b mode: 1 Mbps  
802.11g mode: 6 Mbps  
802.11n HT20 mode: MCS0

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |             |                |        |
|------------------------|--------------|-------------|----------------|--------|
| Description            | Manufacturer | Model       | Serial Number  | FCC ID |
| Charger                | SAMSUNG      | EP-TA20UWE  | R37G9EN04S1DK3 | N/A    |
| Data Cable             | SAMSUNG      | ECB-DU4AWE  | N/A            | N/A    |
| Earphone               | SAMSUNG      | GH59-11720H | N/A            | N/A    |

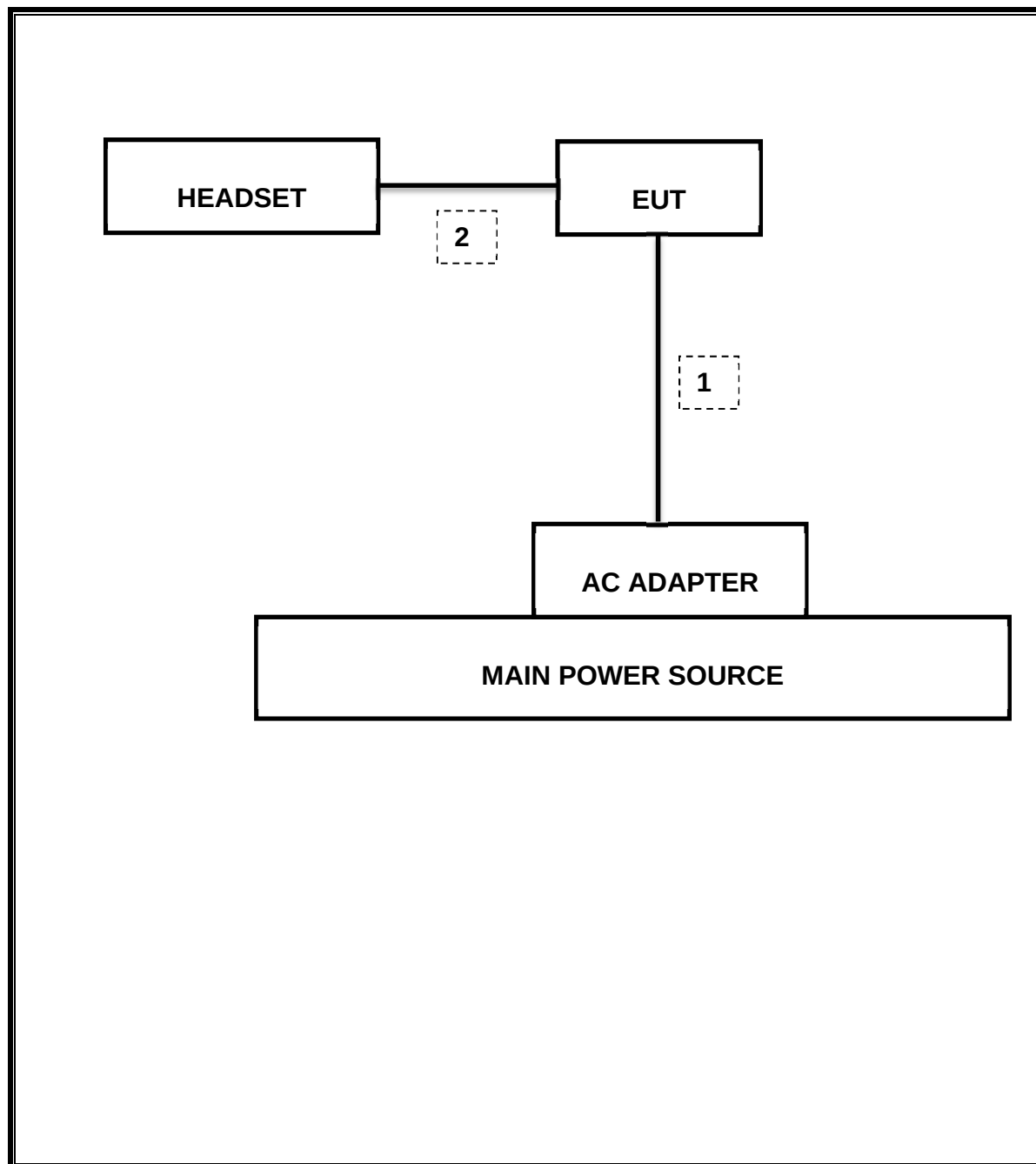
### I/O CABLES

| I/O Cable List |          |                      |                |            |                  |         |
|----------------|----------|----------------------|----------------|------------|------------------|---------|
| Cable No       | Port     | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1              | DC Power | 1                    | Mini-USB       | Shielded   | 0.8m             | N/A     |
| 2              | Audio    | 1                    | Mini-Jack      | Unshielded | 1.0m             | N/A     |

### TEST SETUP

The EUT is a stand-alone unit during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**



## 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                  | S/N         | Cal Due  |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK   | VULB9163               | 749         | 04-25-16 |
| Antenna, Horn, 18 GHz      | ETS           | 3115                   | 00161451    | 05-17-16 |
| Antenna, Horn, 18 GHz      | ETS           | 3117                   | 00168724    | 06-17-16 |
| Antenna, Horn, 18 GHz      | ETS           | 3117                   | 00168717    | 06-17-16 |
| Preamplifier, 1000 MHz     | Sonoma        | 310N                   | 341282      | 08-18-16 |
| Preamplifier, 1000 MHz     | Sonoma        | 310N                   | 351741      | 08-18-16 |
| Preamplifier, 18 GHz       | Miteq         | AFS42-00101800-25-S-42 | 1876511     | 08-18-16 |
| Preamplifier, 18 GHz       | Miteq         | AFS42-00101800-25-S-42 | 1896138     | 08-18-16 |
| Spectrum Analyzer, 44 GHz  | Agilent / HP  | N9030A                 | MY54170614  | 08-19-16 |
| Spectrum Analyzer, 44 GHz  | Agilent / HP  | N9030A                 | MY54490312  | 08-19-16 |
| Bluetooth Tester           | TESCOM        | TC-3000C               | 3000C000546 | 08-18-16 |
| Average Power Sensor       | R&S           | NRZ-Z91                | 102681      | 08-18-16 |
| Average Power Sensor       | Agilent / HP  | U2000                  | MY54270007  | 08-18-16 |
| EMI Test Receive, 40 GHz   | R&S           | ESU40                  | 100439      | 08-19-16 |
| EMI Test Receive, 40 GHz   | R&S           | ESU40                  | 100457      | 08-19-16 |
| EMI Test Receive, 3 GHz    | R&S           | ESR3                   | 101832      | 08-19-16 |
| Attenuator / Switch driver | HP            | 11713A                 | 3748A04272  | N/A      |
| Low Pass Filter 3GHz       | Micro-Tronics | LPS17541               | 009         | 08-18-16 |
| Low Pass Filter 3GHz       | Micro-Tronics | LPS17541               | 015         | 08-18-16 |
| High Pass Filter 5GHz      | Micro-Tronics | HPS17542               | 009         | 08-18-16 |
| High Pass Filter 6GHz      | Micro-Tronics | HPM17543               | 010         | 08-18-16 |
| High Pass Filter 5GHz      | Micro-Tronics | HPS17542               | 016         | 08-18-16 |
| High Pass Filter 6GHz      | Micro-Tronics | HPM17543               | 015         | 08-18-16 |
| LISN                       | R&S           | ENV-216                | 101836      | 08-19-16 |
| LISN                       | R&S           | ENV-216                | 101837      | 08-19-16 |

## 7. MEASUREMENT METHODS

KDB 558074 D01 DTS Meas Guidance v03r03: Measurement Procedure §9.2.3.1 AVGPM is used for average power and §10.2 AVGPS-2 is used for power spectral density.

Unwanted emissions within Restricted Bands are measured using traditional radiated procedures.

Band edge emissions within Restricted Bands are measured using RMS with duty cycle factor offset method.

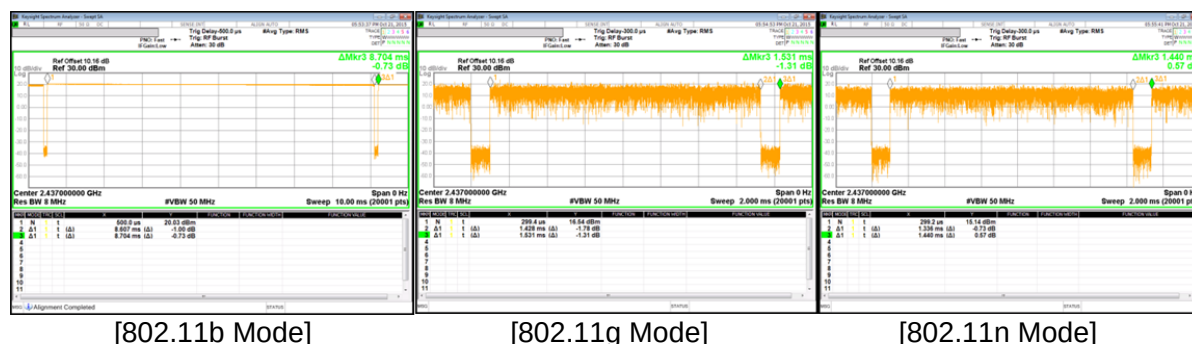
## 8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

### LIMITS

None; for reporting purposes only.

### 8.1. ON TIME AND DUTY CYCLE RESULTS

| Mode                 | ON Time<br>B<br>[msec] | Period<br>[msec] | Duty Cycle<br>x<br>[linear] | Duty<br>Cycle<br>[%] | Duty Cycle<br>Correction Factor<br>[dB] | 1/T<br>Minimum VBW<br>[kHz] |
|----------------------|------------------------|------------------|-----------------------------|----------------------|-----------------------------------------|-----------------------------|
| <b>2400MHz Bands</b> |                        |                  |                             |                      |                                         |                             |
| 802.11b              | 8.607                  | 8.704            | 0.989                       | 98.9%                | 0.00                                    | 0.010                       |
| 802.11g              | 1.428                  | 1.531            | 0.933                       | 93.3%                | 0.30                                    | 0.700                       |
| 802.11n HT20         | 1.336                  | 1.44             | 0.928                       | 92.8%                | 0.33                                    | 0.749                       |



[802.11b Mode]

[802.11g Mode]

[802.11n Mode]

## 9. SUMMARY TABLE

| FCC Part Section   | Test Description                        | Test Limit | Test Condition       | Test Result | Worst Case        |
|--------------------|-----------------------------------------|------------|----------------------|-------------|-------------------|
| 15.247 (a)(2)      | Occupied Band width (6dB)               | >500KHz    | Conducted            | Pass        | 8.083 MHz         |
| 2.1051, 15.247 (d) | Band Edge / Conducted Spurious Emission | -30dBc     |                      | Pass        | -28.695 dBm       |
| 15.247             | TX conducted output power               | <30dBm     |                      | Pass        | 16.68 dBm         |
| 15.247             | PSD                                     | <8dBm      |                      | Pass        | -14.641 dBm       |
| 15.207 (a)         | AC Power Line conducted emissions       | Section 10 | Power Line conducted | Pass        | 50.44 dBuV (QP)   |
| 15.205, 15.209     | Radiated Spurious Emission              | < 40dBuV/m | Radiated             | Pass        | 32.51 dBuV/m (QP) |

## 10. ANTENNA PORT TEST RESULTS

### 10.1. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

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

#### TEST PROCEDURE

Reference to KDB 558074 D01 DTS Meas Guidance v03r03: The transmitter output is connected to a spectrum analyzer with the RBW set to 100KHz, the VBW  $\geq 3 \times$  RBW, peak detector and max hold.

## RESULTS

### 10.1.1. 802.11b MODE IN THE 2.4 GHz BAND

| Channel | Frequency [MHz] | 6 dB Bandwidth [MHz] | Minimum Limit [MHz] |
|---------|-----------------|----------------------|---------------------|
| Low     | 2412            | 9.050                | 0.5                 |
| Mid     | 2437            | 8.550                | 0.5                 |
| High    | 2462            | 9.053                | 0.5                 |
| 12      | 2467            | 9.032                | 0.5                 |
| 13      | 2472            | 8.083                | 0.5                 |
| Worst   |                 | 8.083                | 0.5                 |

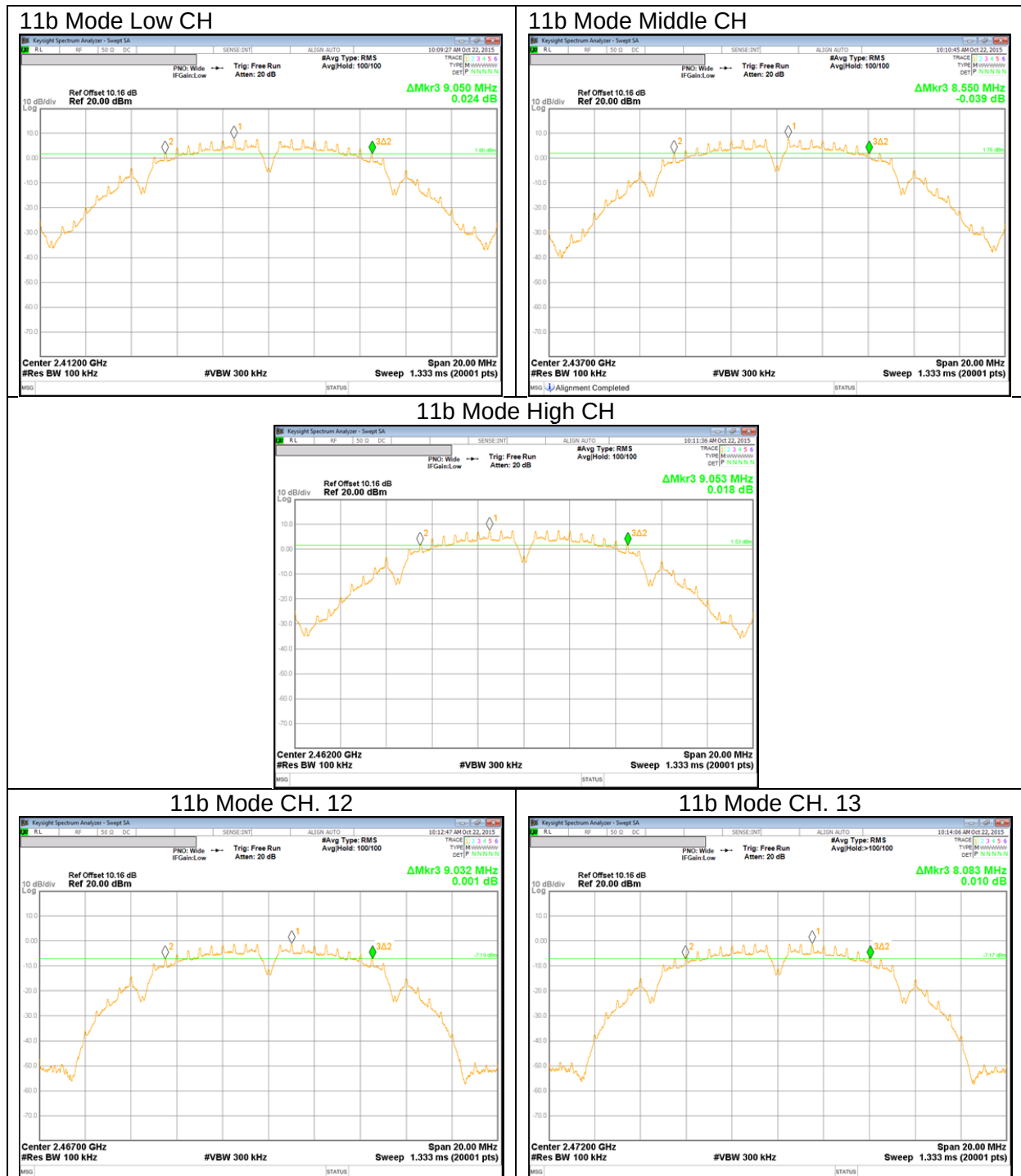
### 10.1.2. 802.11g MODE IN THE 2.4 GHz BAND

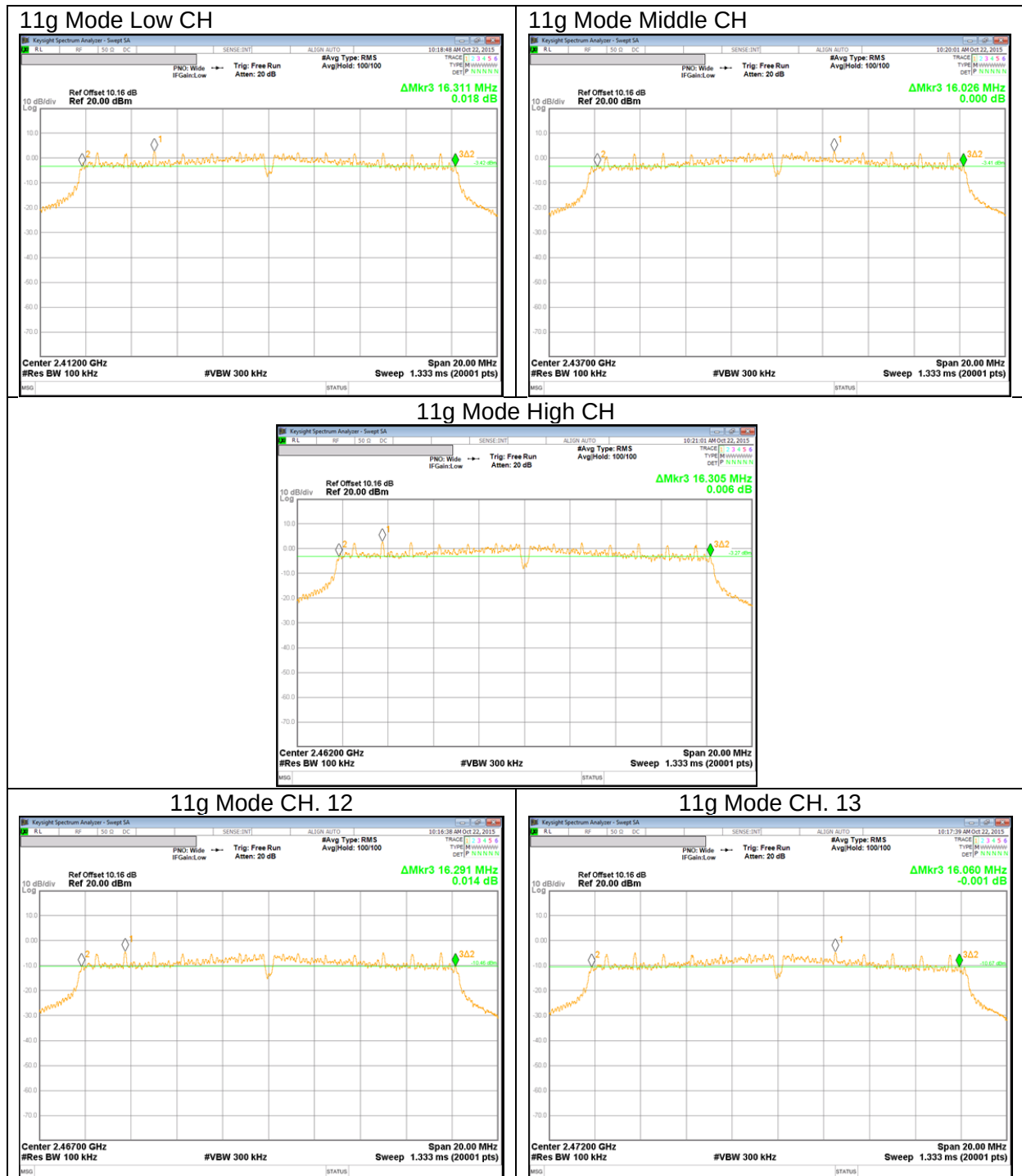
| Channel | Frequency [MHz] | 6 dB Bandwidth [MHz] | Minimum Limit [MHz] |
|---------|-----------------|----------------------|---------------------|
| Low     | 2412            | 16.311               | 0.5                 |
| Mid     | 2437            | 16.026               | 0.5                 |
| High    | 2462            | 16.305               | 0.5                 |
| 12      | 2467            | 16.291               | 0.5                 |
| 13      | 2472            | 16.060               | 0.5                 |
| Worst   |                 | 16.026               | 0.5                 |

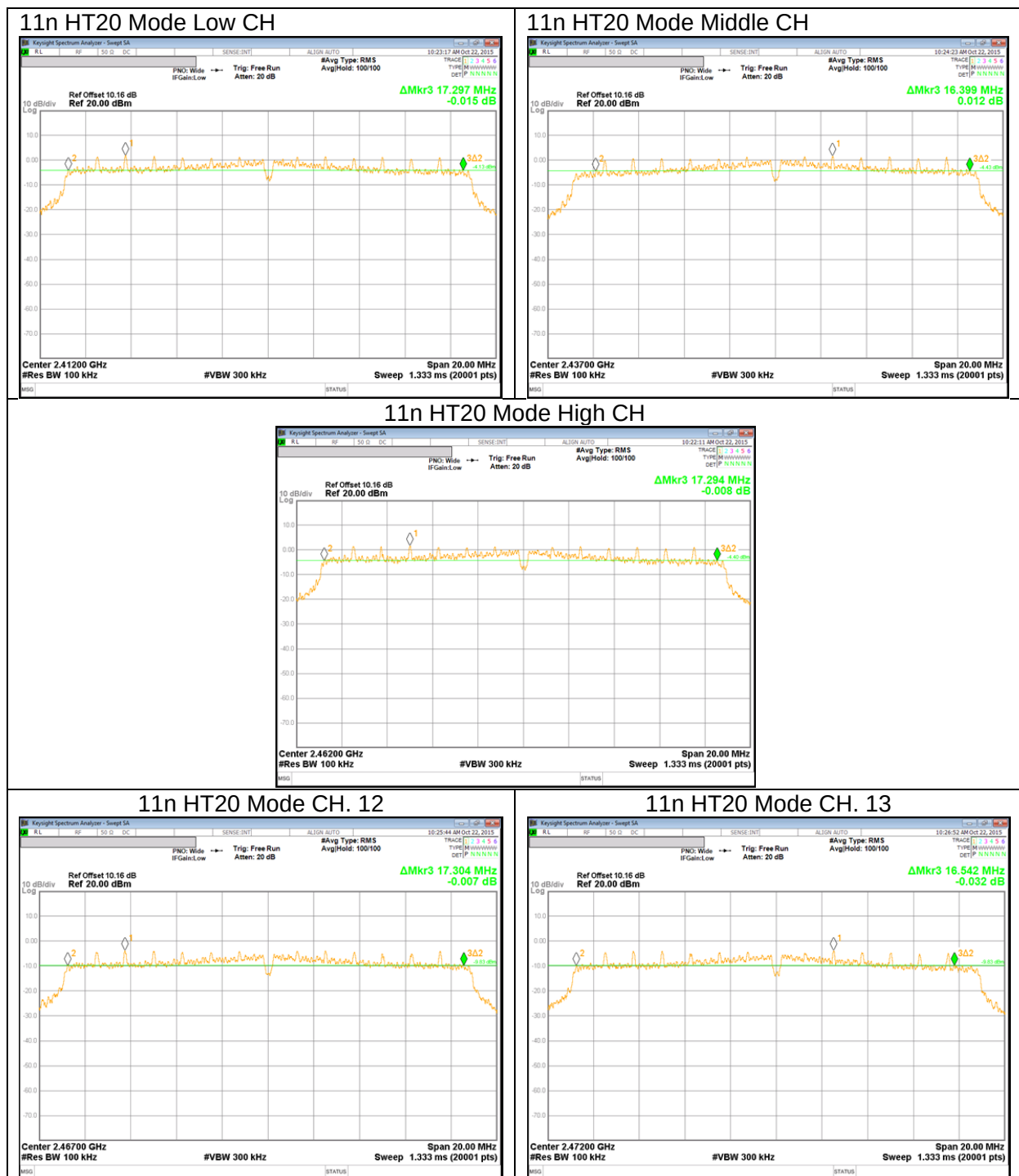
### 10.1.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

| Channel | Frequency [MHz] | 6 dB Bandwidth [MHz] | Minimum Limit [MHz] |
|---------|-----------------|----------------------|---------------------|
| Low     | 2412            | 17.297               | 0.5                 |
| Mid     | 2437            | 16.399               | 0.5                 |
| High    | 2462            | 17.294               | 0.5                 |
| 12      | 2467            | 17.304               | 0.5                 |
| 13      | 2472            | 16.542               | 0.5                 |
| Worst   |                 | 16.399               | 0.5                 |

## 10.1.4. 6 dB BANDWIDTH PLOTS







## 10.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

### RESULTS

#### 10.2.1. 802.11b MODE IN THE 2.4 GHz BAND

| Channel | Frequency [MHz] | 99% Bandwidth [MHz] |
|---------|-----------------|---------------------|
| Low     | 2412            | 12.230              |
| Mid     | 2437            | 12.005              |
| High    | 2462            | 12.208              |
| 12      | 2467            | 11.427              |
| 13      | 2472            | 10.875              |
| Worst   |                 | 12.230              |

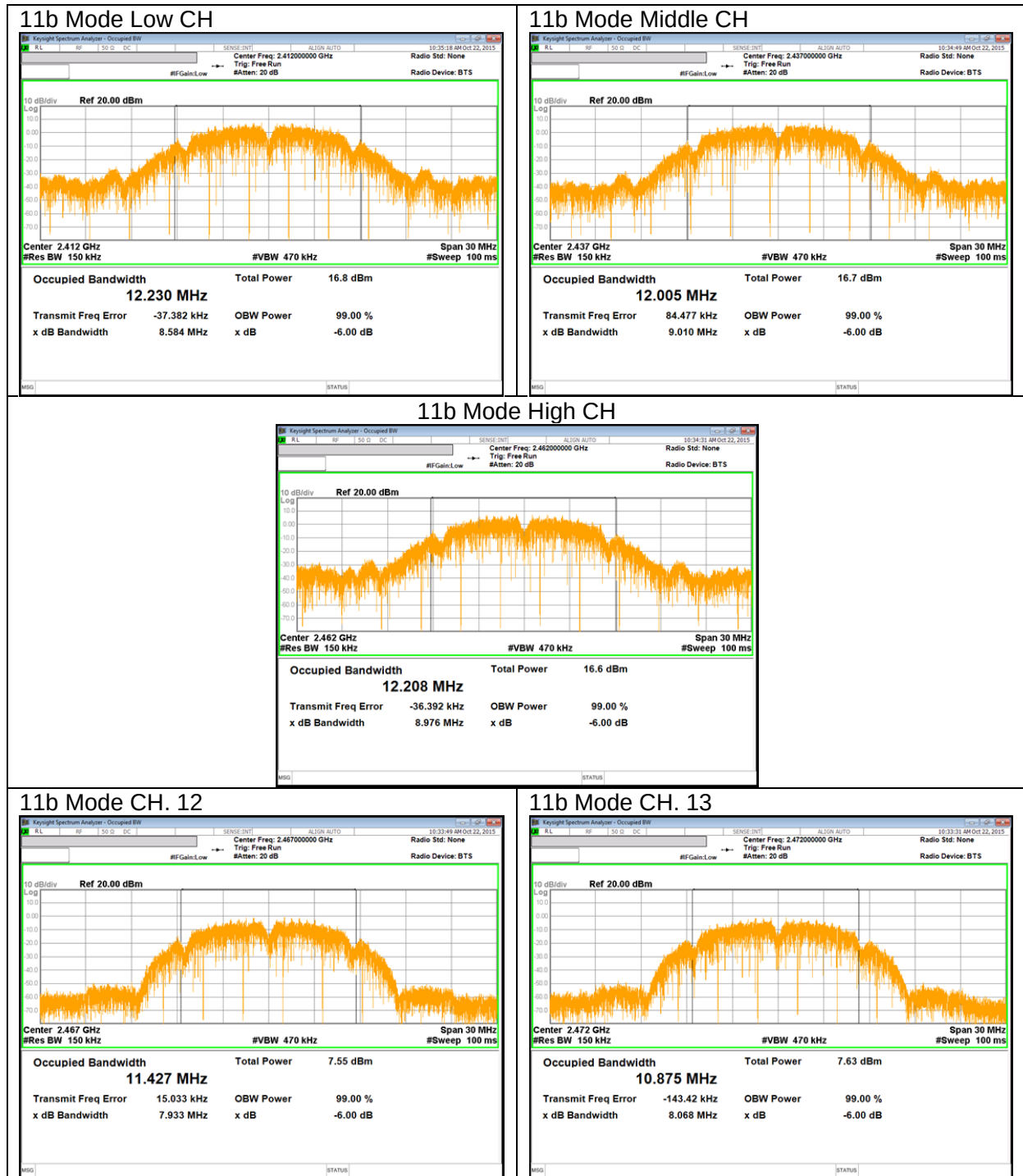
#### 10.2.2. 802.11g MODE IN THE 2.4 GHz BAND

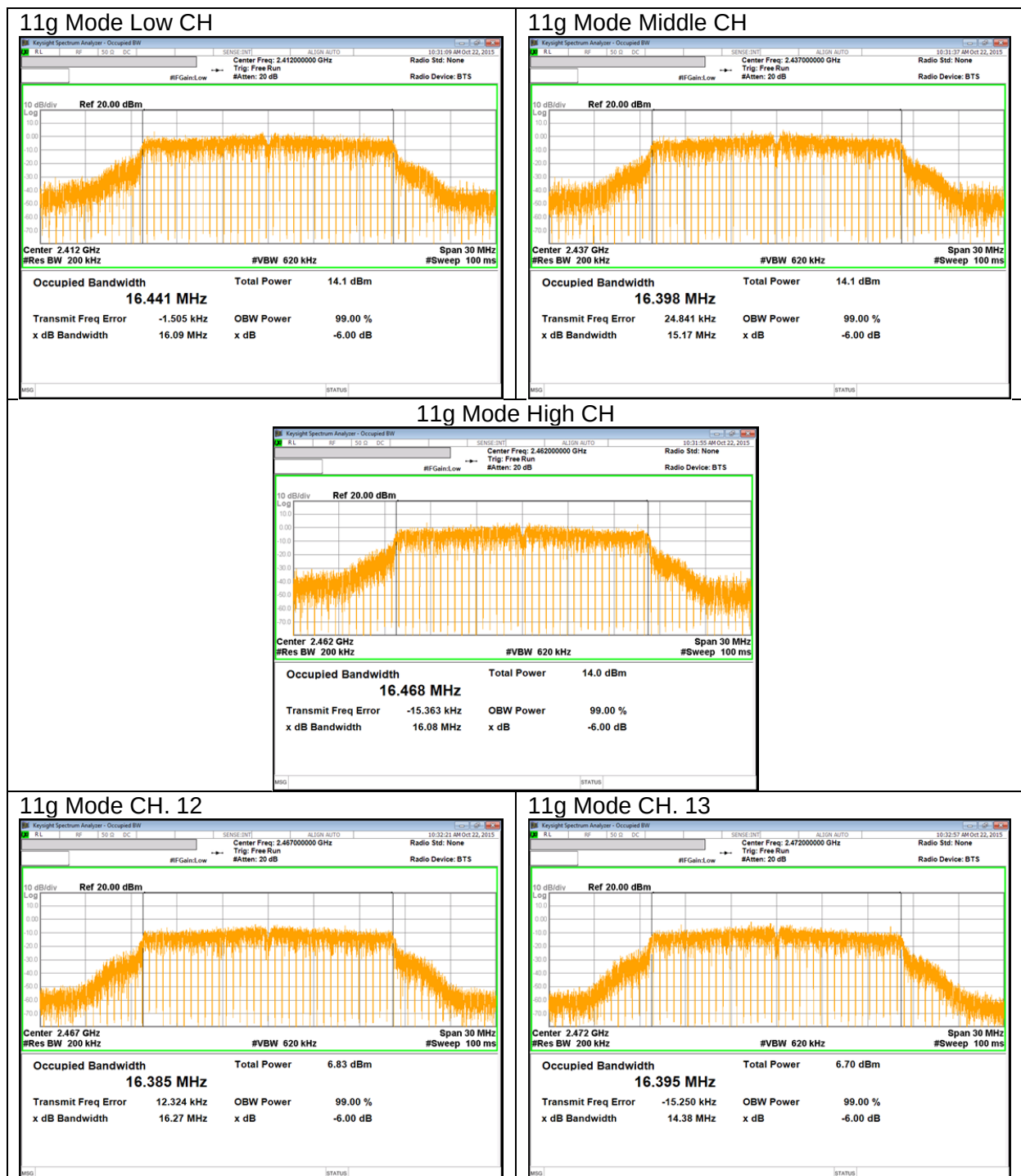
| Channel | Frequency [MHz] | 99% Bandwidth [MHz] |
|---------|-----------------|---------------------|
| Low     | 2412            | 16.441              |
| Mid     | 2437            | 16.398              |
| High    | 2462            | 16.468              |
| 12      | 2467            | 16.385              |
| 13      | 2472            | 16.395              |
| Worst   |                 | 16.468              |

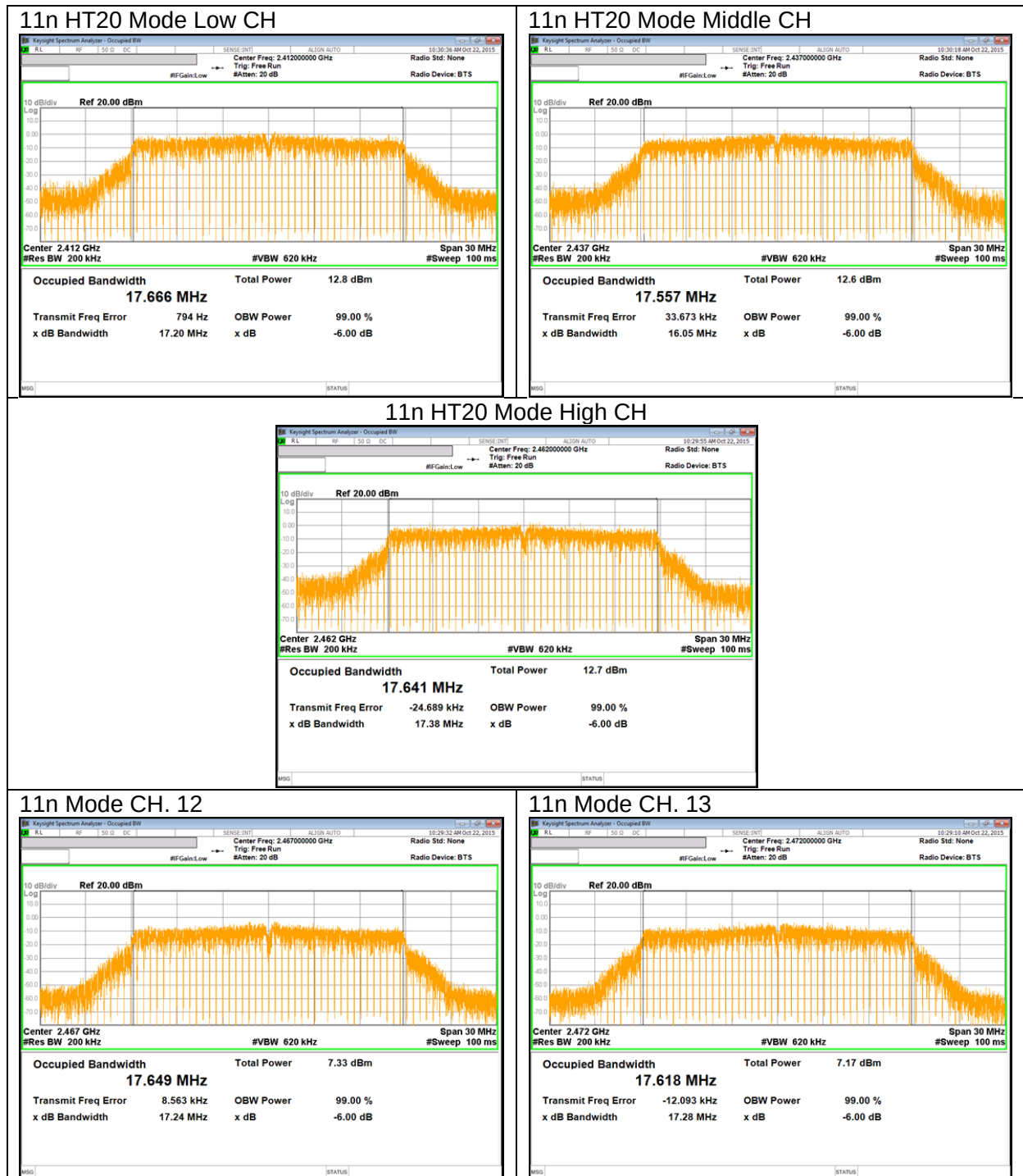
#### 10.2.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

| Channel | Frequency [MHz] | 99% Bandwidth [MHz] |
|---------|-----------------|---------------------|
| Low     | 2412            | 17.666              |
| Mid     | 2437            | 17.557              |
| High    | 2462            | 17.641              |
| 12      | 2467            | 17.649              |
| 13      | 2472            | 17.618              |
| Worst   |                 | 17.666              |

## 10.2.4. 99% BANDWIDTH PLOTS







### **10.3. OUTPUT POWER**

#### **LIMITS**

FCC §15.247

For systems using digital modulation in the 902–928 MHz, 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.

#### **TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.1 dB (including 10 dB pad and 0.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

## RESULTS

### 10.3.1. 802.11b MODE IN THE 2.4 GHz BAND

#### Limits

| Channel | Frequency<br>[MHz] | Directional<br>Gain<br>Primary<br>[dBi] | FCC<br>Power<br>Limit<br>[dBm] | IC<br>Power<br>Limit<br>[dBm] | IC<br>EIRP<br>Limit<br>[dBm] | Max<br>Power<br>[dBm] |
|---------|--------------------|-----------------------------------------|--------------------------------|-------------------------------|------------------------------|-----------------------|
| Low     | 2412               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| Mid     | 2437               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| High    | 2462               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| 12      | 2467               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| 13      | 2472               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |

#### Results

| Channel | Frequency<br>[MHz] | Primary<br>Meas<br>Power<br>[dBm] | Total<br>Corr'd<br>Power<br>[dBm] | Power<br>Limit<br>[dBm] | Margin<br>[dB] |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|----------------|
| Low     | 2412               | 16.68                             | 16.68                             | 36.00                   | -19.32         |
| Mid     | 2437               | 16.51                             | 16.51                             | 36.00                   | -19.49         |
| High    | 2462               | 16.64                             | 16.64                             | 36.00                   | -19.36         |
| 12      | 2467               | 7.75                              | 7.75                              | 36.00                   | -28.25         |
| 13      | 2472               | 7.71                              | 7.71                              | 36.00                   | -28.29         |
| Worst   |                    |                                   | 16.68                             | 36.00                   | -19.32         |

### 10.3.2. 802.11g MODE IN THE 2.4 GHz BAND

#### Limits

| Channel | Frequency<br>[MHz] | Directional<br>Gain<br>Primary<br>[dBi] | FCC<br>Power<br>Limit<br>[dBm] | IC<br>Power<br>Limit<br>[dBm] | IC<br>EIRP<br>Limit<br>[dBm] | Max<br>Power<br>[dBm] |
|---------|--------------------|-----------------------------------------|--------------------------------|-------------------------------|------------------------------|-----------------------|
| Low     | 2412               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| Mid     | 2437               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| High    | 2462               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| 12      | 2467               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| 13      | 2472               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |

#### Results

| Channel | Frequency<br>[MHz] | Primary<br>Meas<br>Power<br>[dBm] | Total<br>Corr'd<br>Power<br>[dBm] | Power<br>Limit<br>[dBm] | Margin<br>[dB] |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|----------------|
| Low     | 2412               | 14.46                             | 14.46                             | 36.00                   | -21.54         |
| Mid     | 2437               | 14.41                             | 14.41                             | 36.00                   | -21.59         |
| High    | 2462               | 14.33                             | 14.33                             | 36.00                   | -21.67         |
| 12      | 2467               | 7.40                              | 7.40                              | 36.00                   | -28.60         |
| 13      | 2472               | 7.27                              | 7.27                              | 36.00                   | -28.73         |
| Worst   |                    |                                   | 14.46                             | 36.00                   | -21.54         |

### 10.3.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

#### Limits

| Channel | Frequency<br>[MHz] | Directional<br>Gain<br>Primary<br>[dBi] | FCC<br>Power<br>Limit<br>[dBm] | IC<br>Power<br>Limit<br>[dBm] | IC<br>EIRP<br>Limit<br>[dBm] | Max<br>Power<br>[dBm] |
|---------|--------------------|-----------------------------------------|--------------------------------|-------------------------------|------------------------------|-----------------------|
| Low     | 2412               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| Mid     | 2437               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| High    | 2462               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| 12      | 2467               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |
| 13      | 2472               | -1.19                                   | 30.00                          | 30.00                         | 36.00                        | 30.00                 |

#### Results

| Channel | Frequency<br>[MHz] | Primary<br>Meas<br>Power<br>[dBm] | Total<br>Corr'd<br>Power<br>[dBm] | Power<br>Limit<br>[dBm] | Margin<br>[dB] |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|----------------|
| Low     | 2412               | 13.18                             | 13.18                             | 36.00                   | -22.82         |
| Mid     | 2437               | 13.05                             | 13.05                             | 36.00                   | -22.95         |
| High    | 2462               | 13.10                             | 13.10                             | 36.00                   | -22.90         |
| 12      | 2467               | 7.80                              | 7.80                              | 36.00                   | -28.20         |
| 13      | 2472               | 7.64                              | 7.64                              | 36.00                   | -28.36         |
| Worst   |                    |                                   | 13.18                             | 36.00                   | -22.82         |

## **10.4. PSD**

### **LIMITS**

FCC §15.247

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### **TEST PROCEDURE**

Power Spectral Density was performed utilizing the "Method AVGPSD-2" under KDB558074 D01 DTS Meas Guidance v03r03

## RESULTS

### 10.4.1. 802.11b MODE IN THE 2.4 GHz BAND

#### PSD Results

| Channel | Frequency [MHz] | PSD Meas [dBm] | Duty Factor [dB] | Final PSD [dBm] | Limit [dBm] | Margin [dB] |
|---------|-----------------|----------------|------------------|-----------------|-------------|-------------|
| Low     | 2412            | -14.844        | 0.00             | -14.844         | 8.00        | -22.844     |
| Mid     | 2437            | -14.727        | 0.00             | -14.727         | 8.00        | -22.727     |
| High    | 2462            | -14.840        | 0.00             | -14.840         | 8.00        | -22.840     |
| 12      | 2467            | -24.007        | 0.00             | -24.007         | 8.00        | -32.007     |
| 13      | 2472            | -24.079        | 0.00             | -24.079         | 8.00        | -32.079     |

### 10.4.2. 802.11g MODE IN THE 2.4 GHz BAND

#### PSD Results

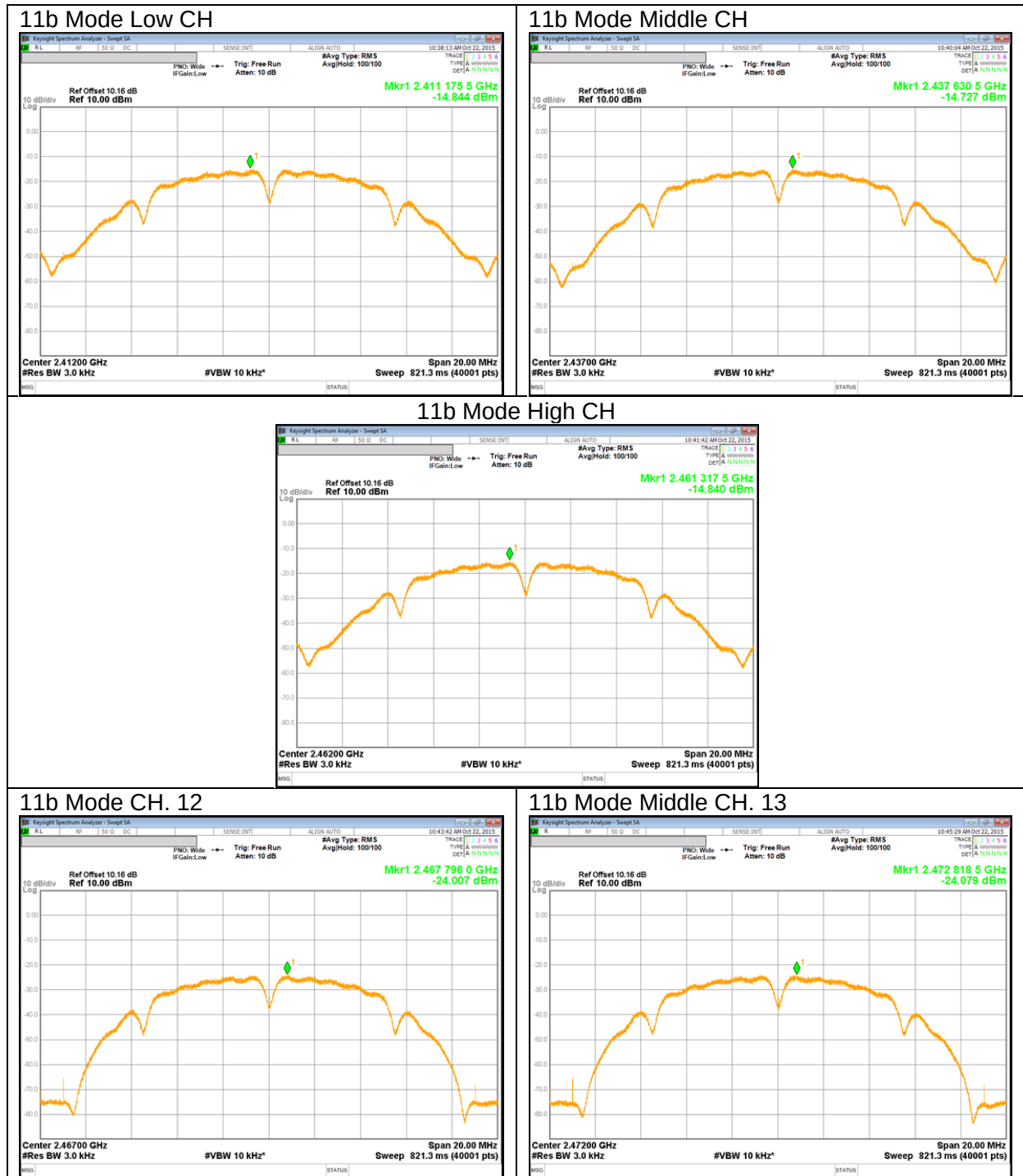
| Channel | Frequency [MHz] | PSD Meas [dBm] | Duty Factor [dB] | Final PSD [dBm] | Limit [dBm] | Margin [dB] |
|---------|-----------------|----------------|------------------|-----------------|-------------|-------------|
| Low     | 2412            | -15.232        | 0.30             | -14.932         | 8.00        | -23.232     |
| Mid     | 2437            | -14.941        | 0.30             | -14.641         | 8.00        | -22.941     |
| High    | 2462            | -15.237        | 0.30             | -14.937         | 8.00        | -23.237     |
| 12      | 2467            | -22.168        | 0.30             | -21.868         | 8.00        | -30.168     |
| 13      | 2472            | -22.572        | 0.30             | -22.272         | 8.00        | -30.572     |

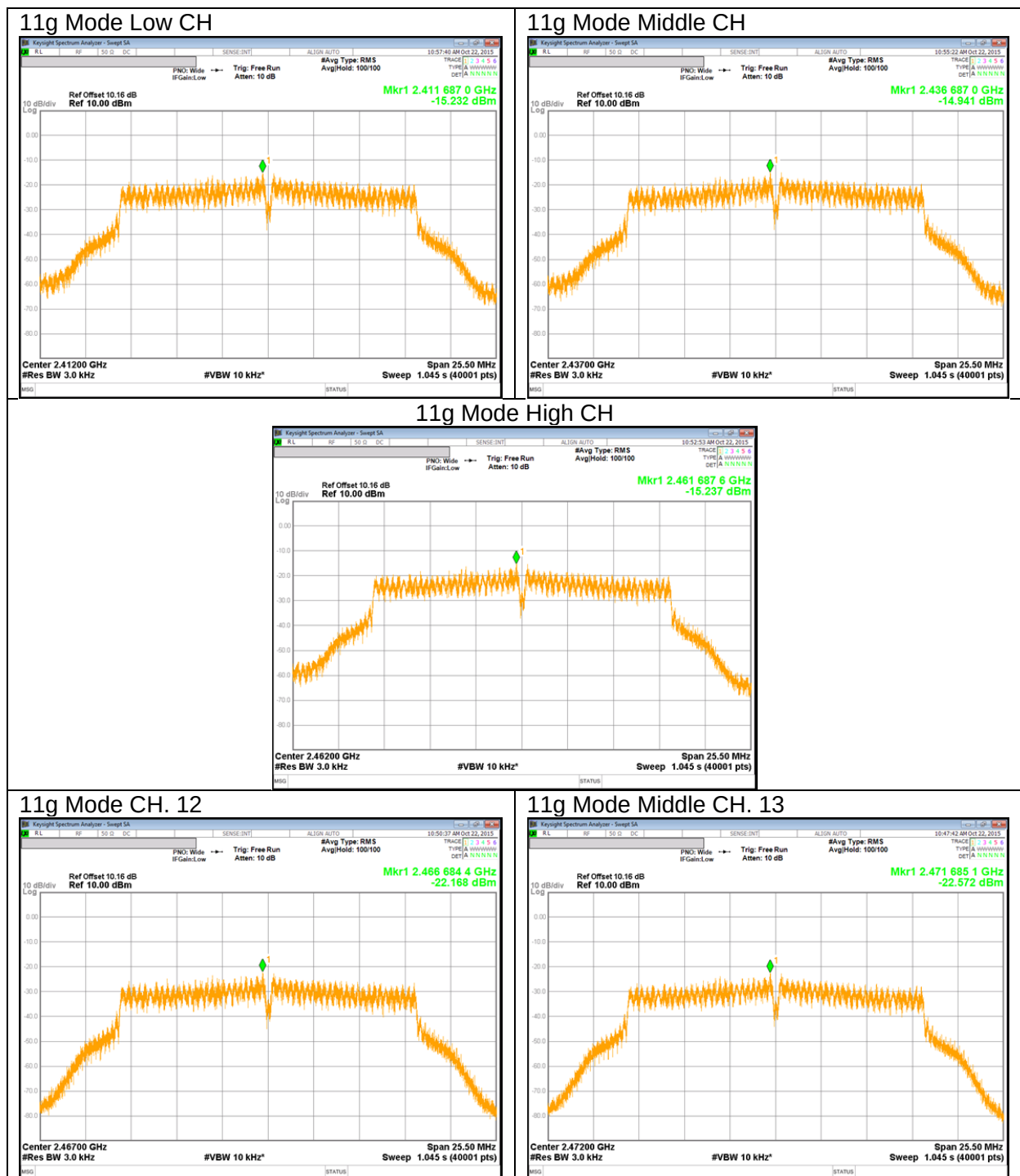
### 10.4.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

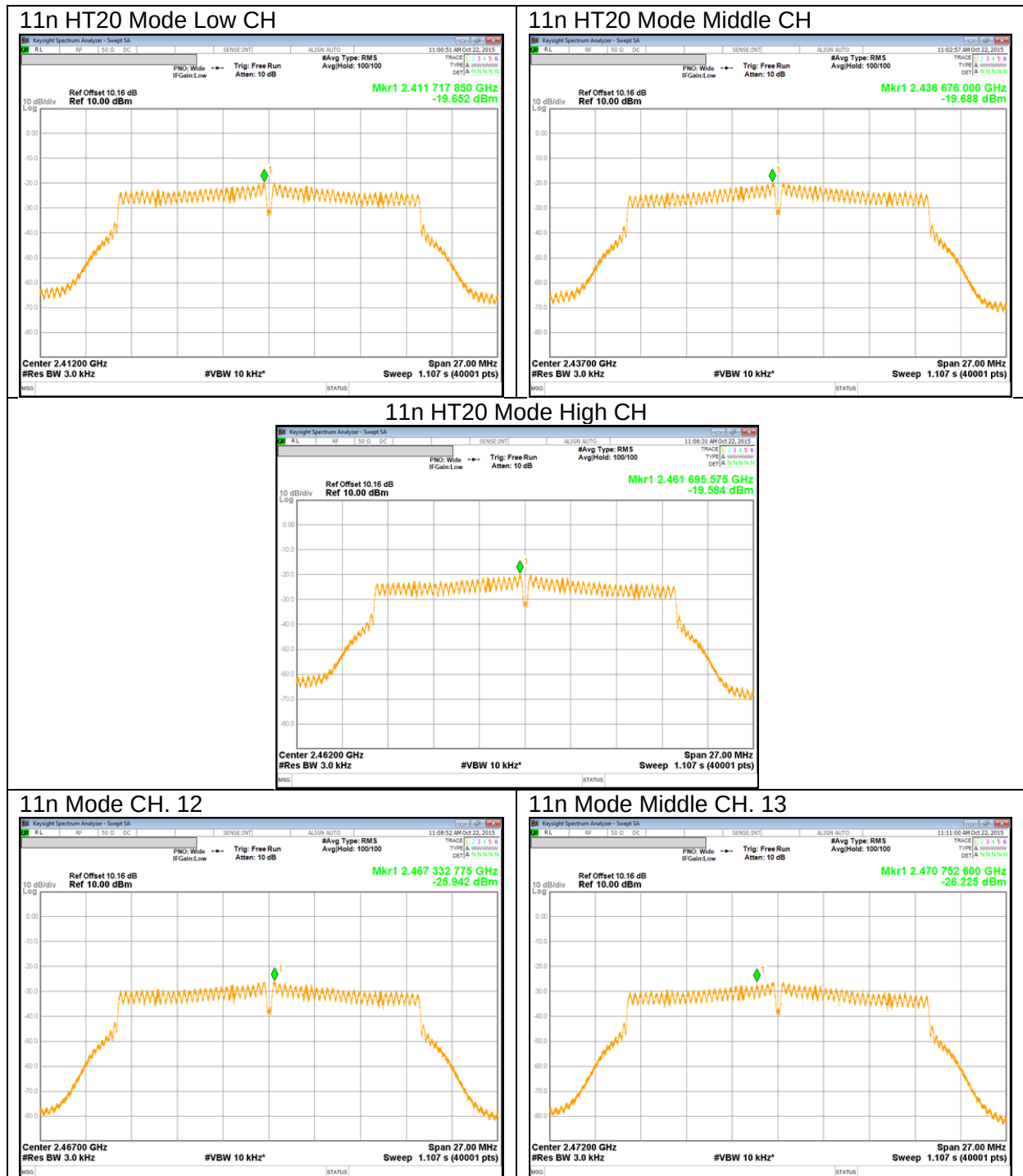
#### PSD Results

| Channel | Frequency [MHz] | PSD Meas [dBm] | Duty Factor [dB] | Final PSD [dBm] | Limit [dBm] | Margin [dB] |
|---------|-----------------|----------------|------------------|-----------------|-------------|-------------|
| Low     | 2412            | -19.652        | 0.33             | -19.322         | 8.00        | -27.652     |
| Mid     | 2437            | -19.688        | 0.33             | -19.358         | 8.00        | -27.688     |
| High    | 2462            | -19.584        | 0.33             | -19.254         | 8.00        | -27.584     |
| 12      | 2467            | -25.942        | 0.33             | -25.612         | 8.00        | -33.942     |
| 13      | 2472            | -26.225        | 0.33             | -25.895         | 8.00        | -34.225     |

## 10.4.4. PSD PLOTS







## **10.5. OUT-OF-BAND EMISSIONS**

### **LIMITS**

FCC §15.247 (d)

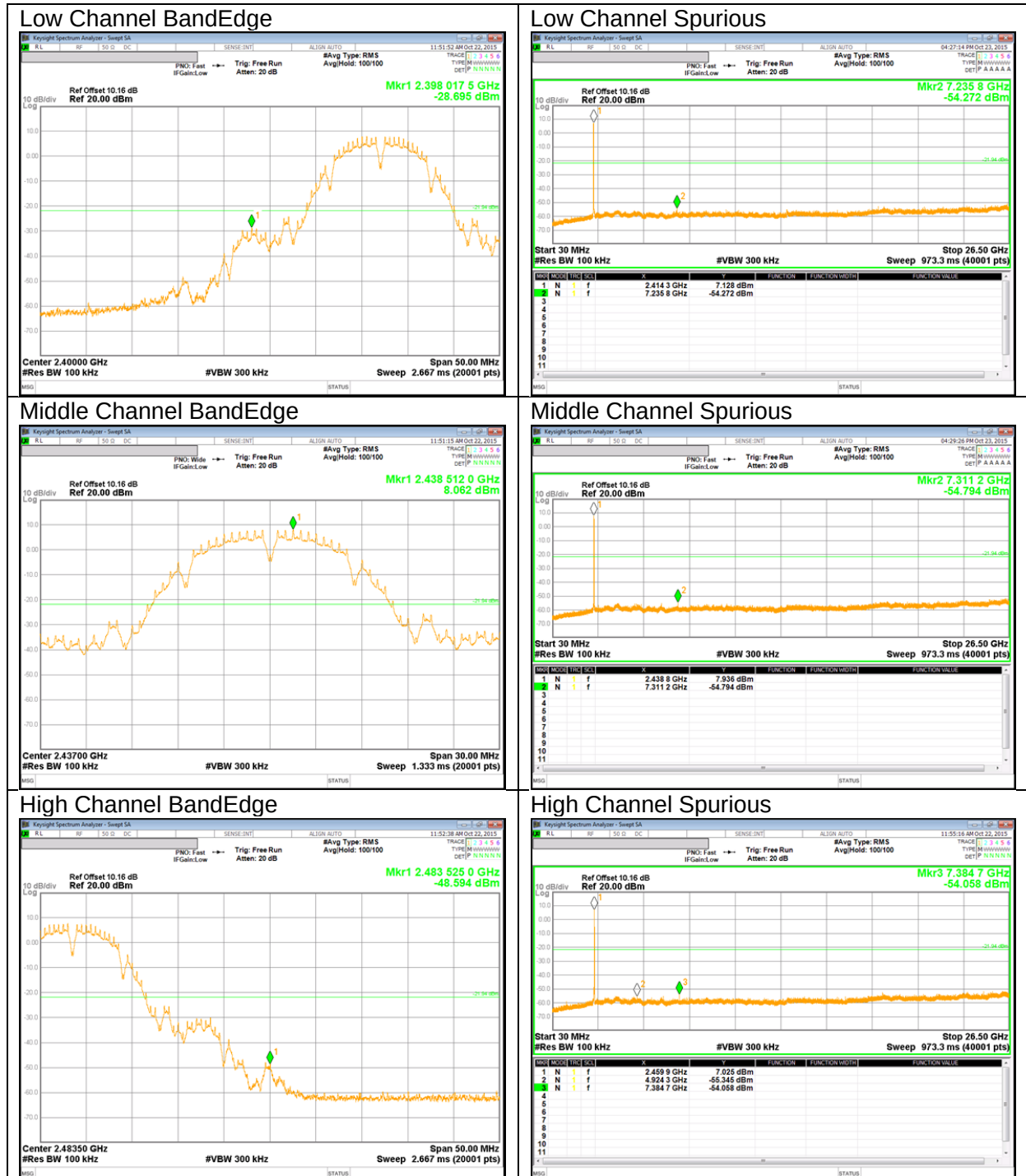
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

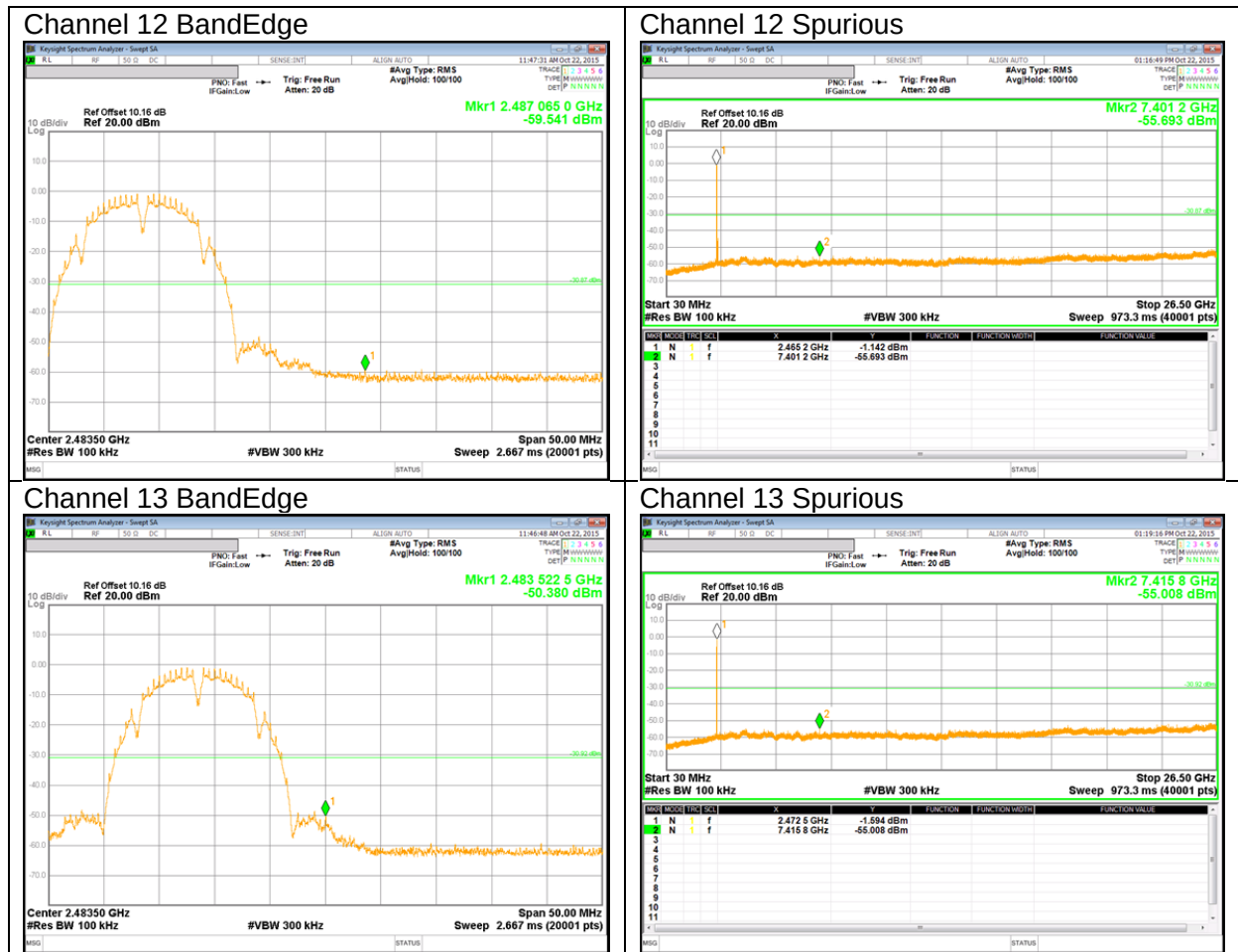
### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

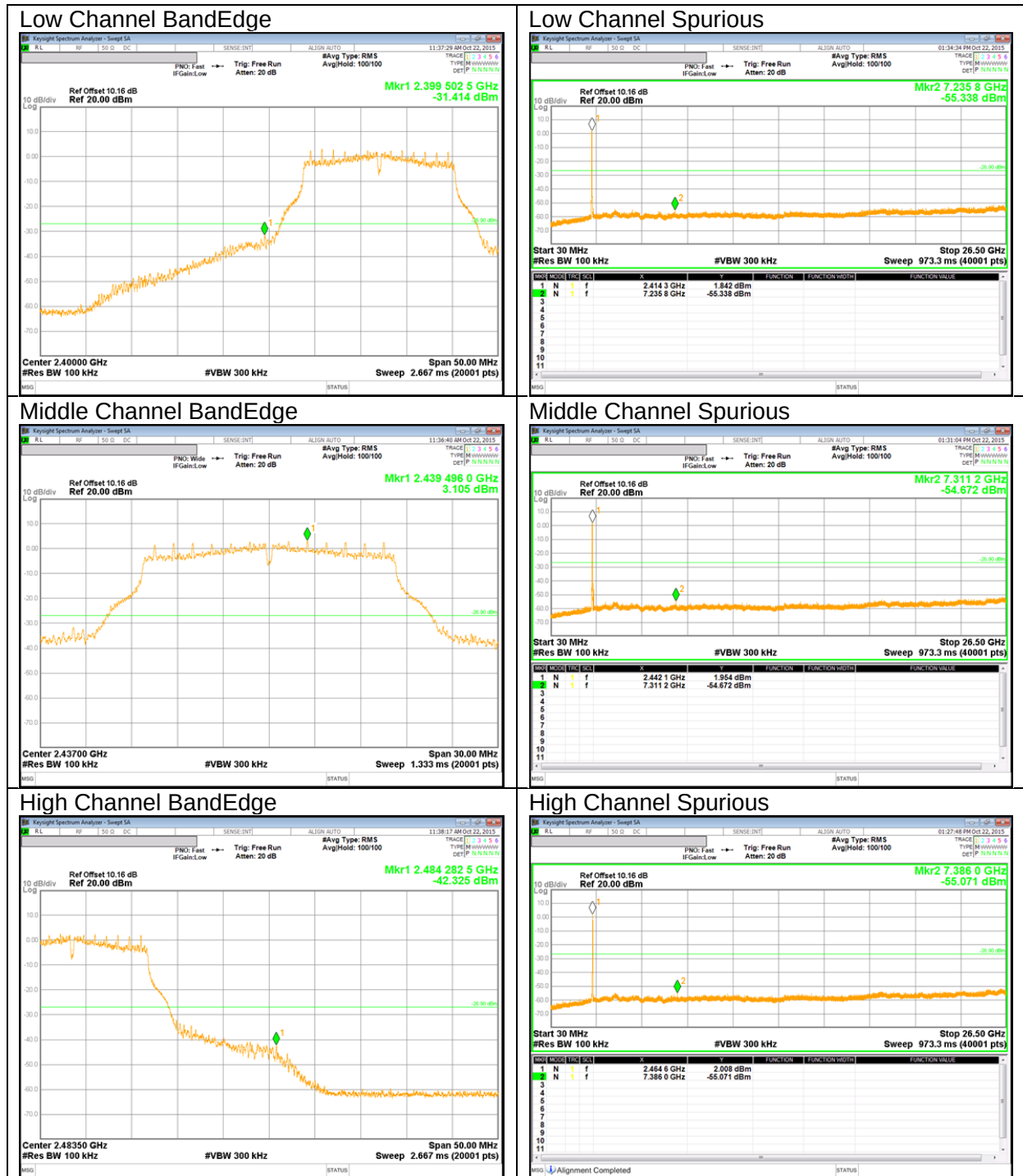
## RESULTS

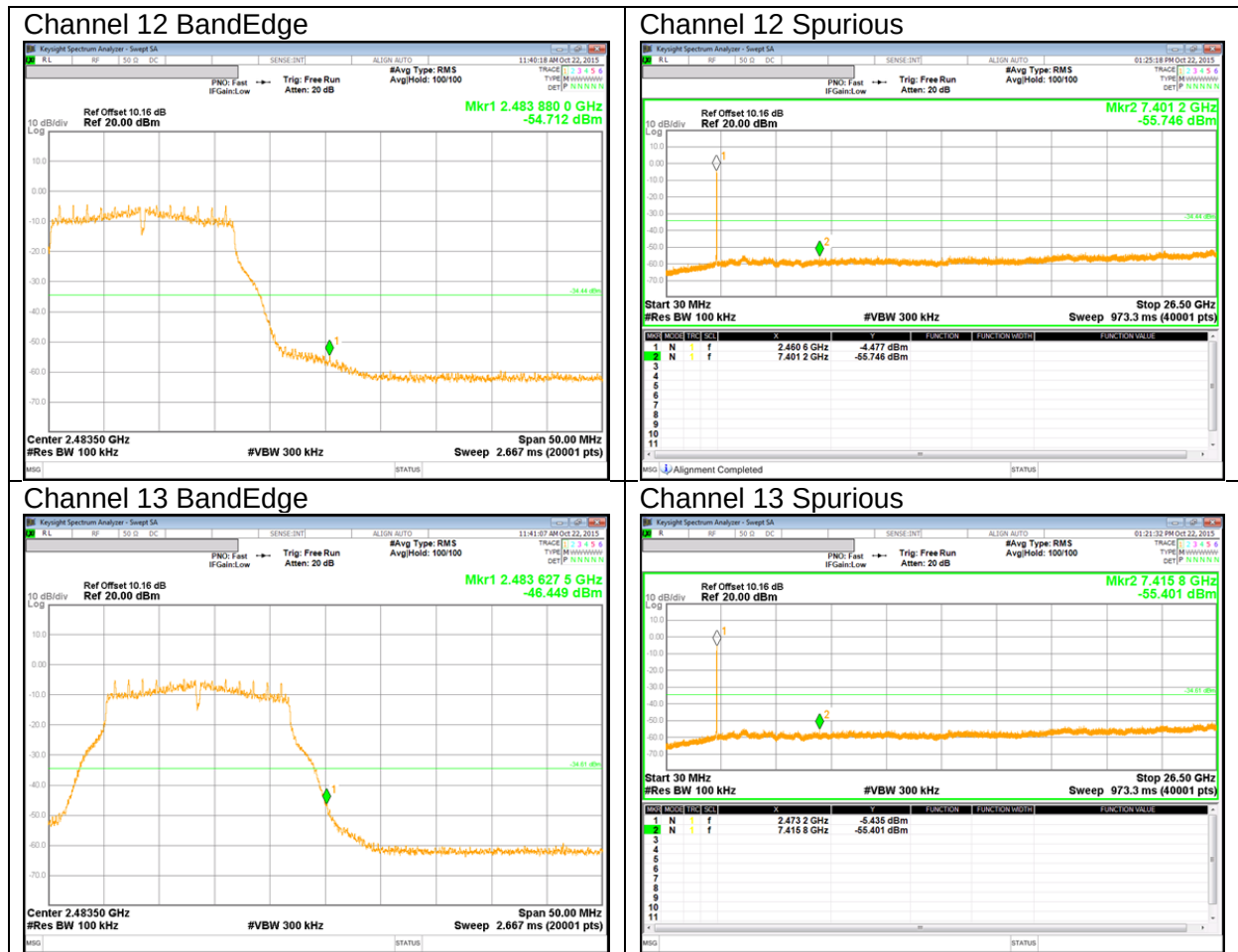
### 10.5.1. 802.11b MODE IN THE 2.4 GHz BAND



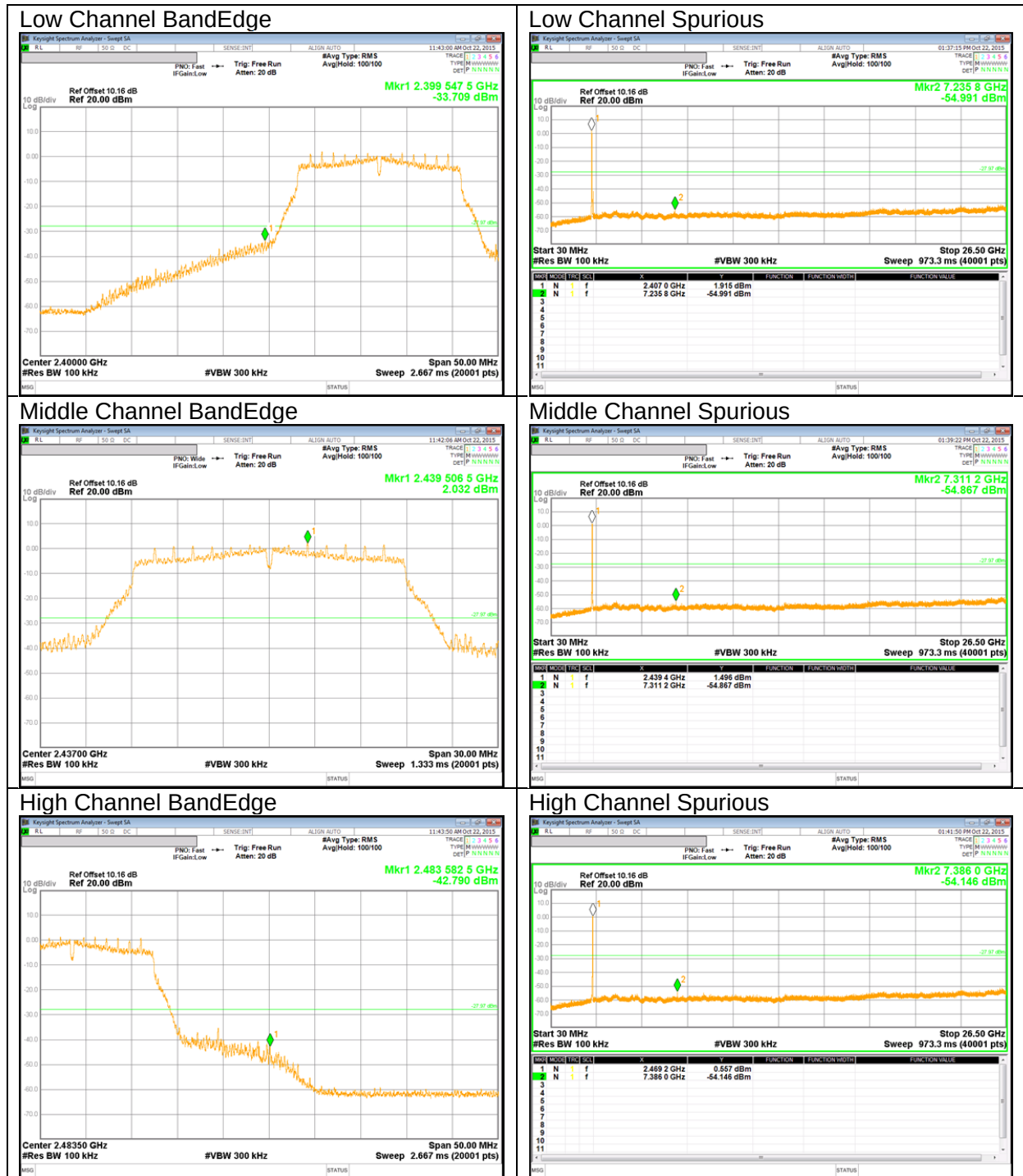


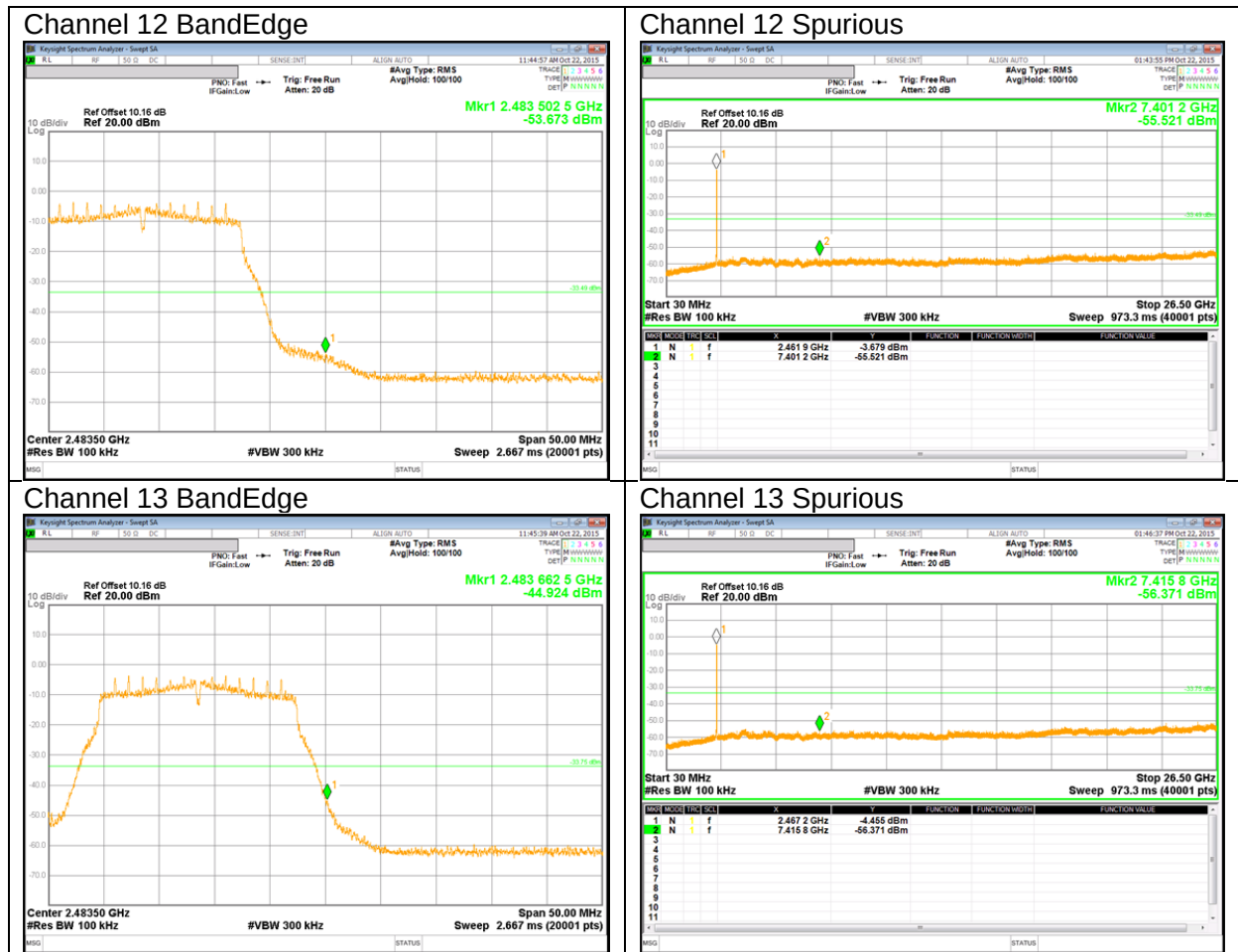
## 10.5.2. 802.11g MODE IN THE 2.4 GHz BAND





### 10.5.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND





## 11. RADIATED TEST RESULTS

### 11.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

| 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.

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; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. Duty cycle factor=  $10\log(1/x)$  For this sample B mode = 0dB (duty cycle >98%); G mode = 0.30dB; N mode = 0.33dB.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

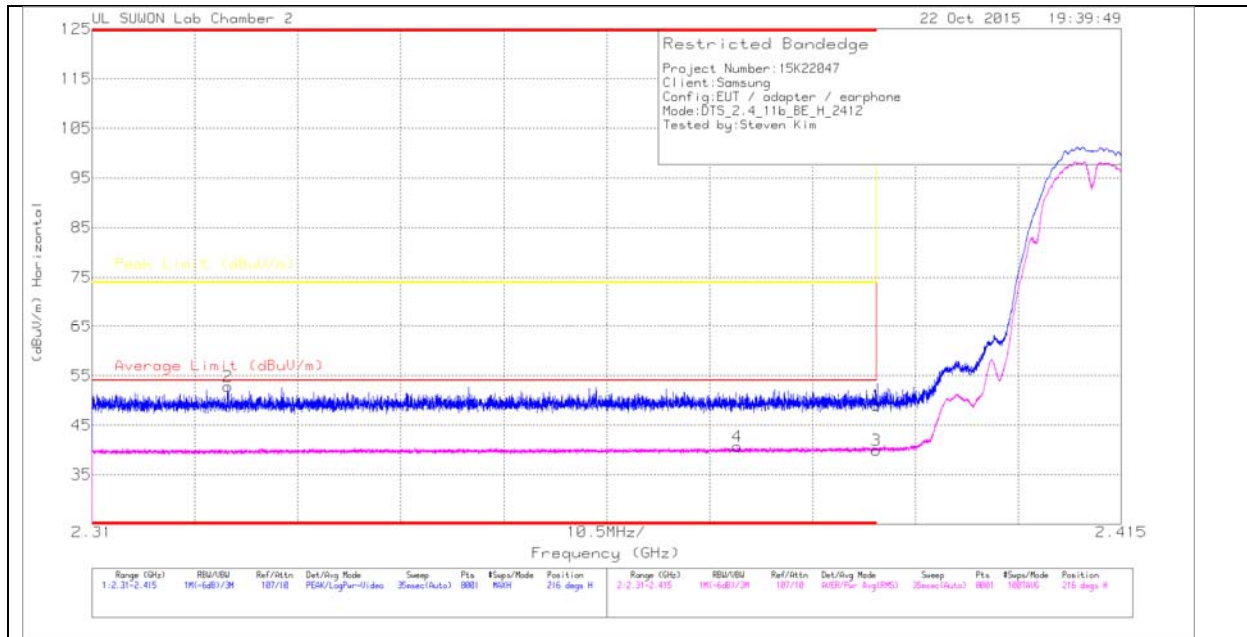
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 11.2. TRANSMITTER ABOVE 1 GHz

### 11.2.1. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND

#### RESTRICTED BANDEDGE (LOW CHANNEL)

##### HORIZONTAL PEAK AND AVERAGE PLOT



##### HORIZONTAL DATA

###### Trace Markers

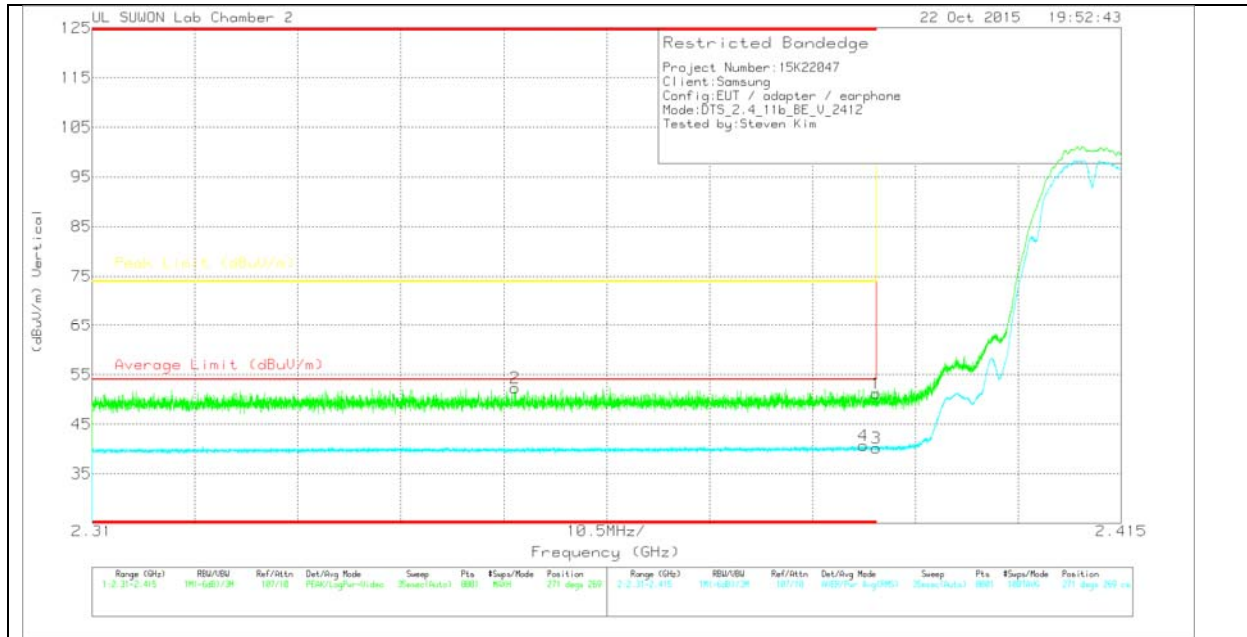
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(001687 24)_150619 | Path_2_10dB | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|------------------------|-------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.39          | 36.76                | Pk  | 31.7                   | -19.5       | 0            | 48.96                      | -                      | -           | 74                  | -25.04         | 216            | 291         | H        |
| 2      | * 2.324         | 40.9                 | Pk  | 31.6                   | -19.7       | 0            | 52.8                       | -                      | -           | 74                  | -21.2          | 216            | 291         | H        |
| 3      | * 2.39          | 27.71                | RMS | 31.7                   | -19.5       | 0            | 39.91                      | 54                     | -14.09      | -                   | -              | 216            | 291         | H        |
| 4      | * 2.376         | 28.55                | RMS | 31.7                   | -19.6       | 0            | 40.65                      | 54                     | -13.35      | -                   | -              | 216            | 291         | H        |

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

Pk - Peak detector

RMS - RMS detection

## VERTICAL PEAK AND AVERAGE PLOT



## VERTICAL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(001687 24)_150619 | Path_2_10dB | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|------------------------|-------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.39          | 39.01                | Pk  | 31.7                   | -19.5       | 0            | 51.21                      | -                      | -           | 74                  | -22.79         | 271            | 269         | V        |
| 2      | * 2.353         | 40.33                | Pk  | 31.6                   | -19.6       | 0            | 52.33                      | -                      | -           | 74                  | -21.67         | 271            | 269         | V        |
| 3      | * 2.39          | 27.98                | RMS | 31.7                   | -19.5       | 0            | 40.18                      | 54                     | -13.82      | -                   | -              | 271            | 269         | V        |
| 4      | * 2.389         | 28.46                | RMS | 31.7                   | -19.5       | 0            | 40.66                      | 54                     | -13.34      | -                   | -              | 271            | 269         | V        |

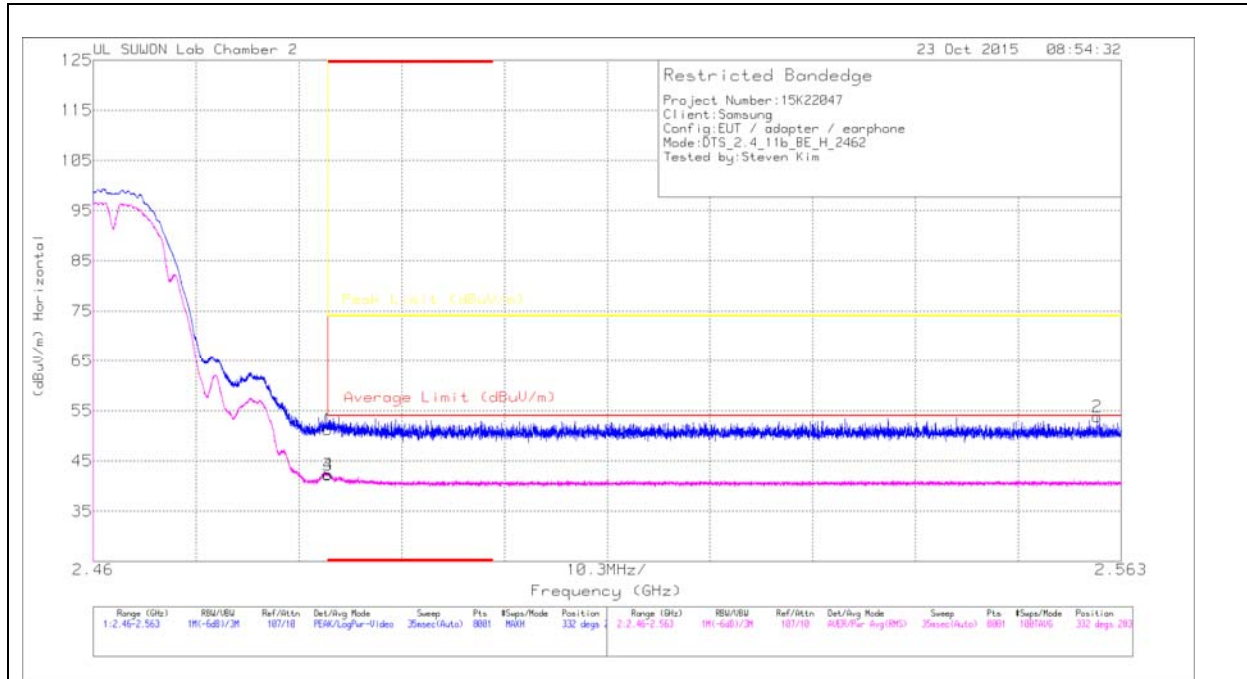
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

## AUTHORIZED BANDEDGE (HIGH CHANNEL)

### HORIZONTAL PEAK AND AVERAGE PLOT



### HORIZONTAL DATA

#### Trace Markers

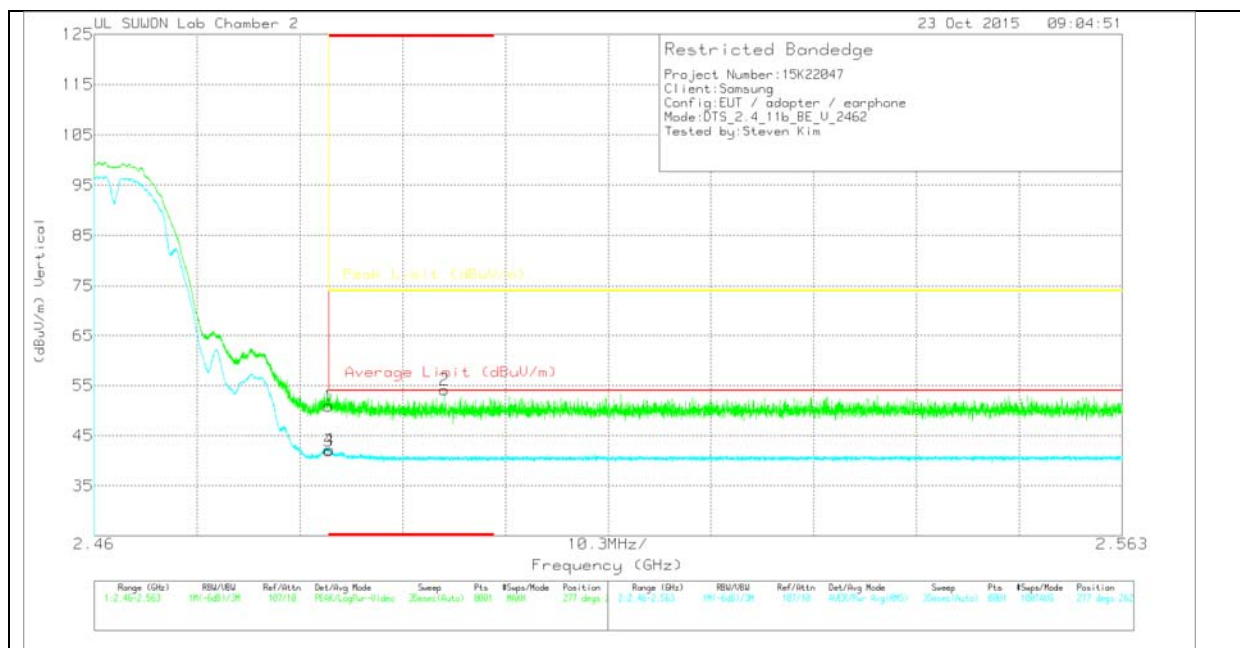
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(001687 24)_150619 | Path_2_10dB | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|------------------------|-------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 38.88                | Pk  | 31.8                   | -19.4       | 0            | 51.28                      | -                      | -           | 74                  | -22.72         | 332            | 283         | H        |
| 2      | 2.561           | 41.22                | Pk  | 31.9                   | -19.3       | 0            | 53.82                      | -                      | -           | 74                  | -20.18         | 332            | 283         | H        |
| 3      | * 2.484         | 29.84                | RMS | 31.8                   | -19.4       | 0            | 42.24                      | 54                     | -11.76      | -                   | -              | 332            | 283         | H        |
| 4      | * 2.484         | 29.96                | RMS | 31.8                   | -19.4       | 0            | 42.36                      | 54                     | -11.64      | -                   | -              | 332            | 283         | H        |

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

Pk - Peak detector

RMS - RMS detection

## VERTICAL PEAK AND AVERAGE PLOT



## VERTICAL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(001687 24)_150619 | Path_2_10dB | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|------------------------|-------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 38.53                | Pk  | 31.8                   | -19.4       | 50.93        | -                          | -                      | 74          | -23.07              | 277            | 262            | V           | 1        |
| 2      | * 2.495         | 41.66                | Pk  | 31.8                   | -19.3       | 54.16        | -                          | -                      | 74          | -19.84              | 277            | 262            | V           | 2        |
| 3      | * 2.484         | 29.59                | RMS | 31.8                   | -19.4       | 41.99        | 54                         | -12.01                 | -           | -                   | 277            | 262            | V           | 3        |
| 4      | * 2.484         | 29.82                | RMS | 31.8                   | -19.4       | 42.22        | 54                         | -11.78                 | -           | -                   | 277            | 262            | V           | 4        |

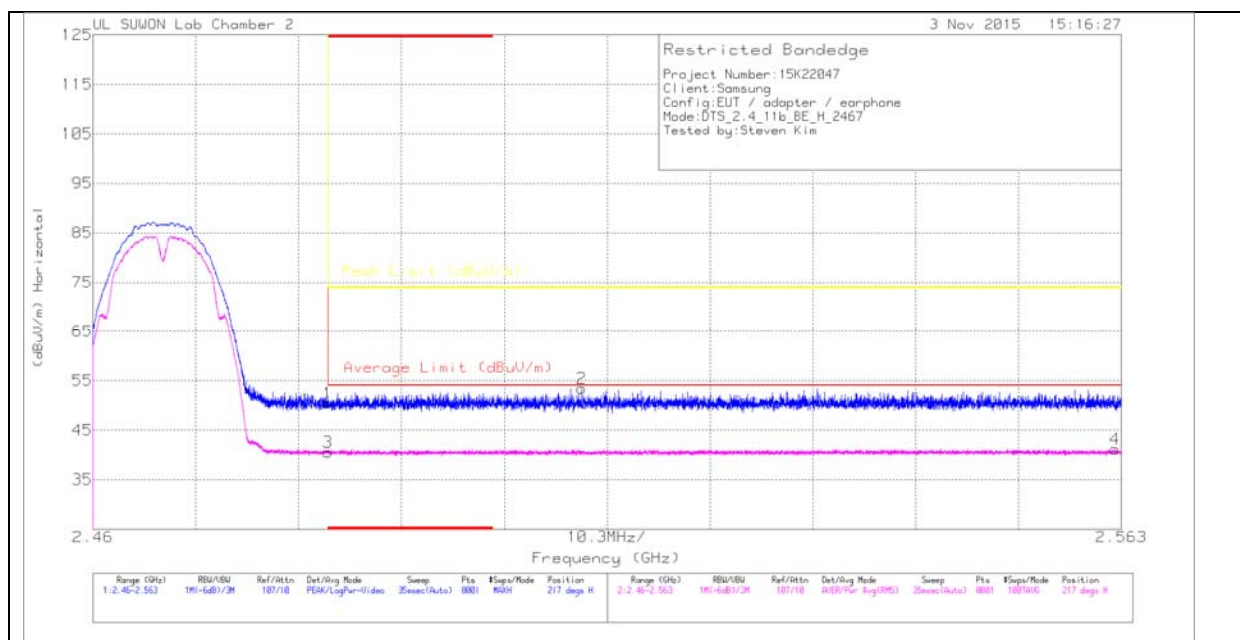
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

## AUTHORIZED BANDEDGE (12 CHANNEL)

### HORIZONTAL PEAK AND AVERAGE PLOT



### HORIZONTAL DATA

#### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(001687 24)_150619 | Path_2_10dB | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|------------------------|-------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 38.07                | Pk  | 31.8                   | -19.4       | 0            | 50.47                      | -                      | -           | 74                  | -23.53         | 217            | 281         | H        |
| 2      | 2.509           | 40.78                | Pk  | 31.9                   | -19.3       | 0            | 53.38                      | -                      | -           | 74                  | -20.62         | 217            | 281         | H        |
| 3      | * 2.484         | 28.2                 | RMS | 31.8                   | -19.4       | 0            | 40.6                       | 54                     | -13.4       | -                   | -              | 217            | 281         | H        |
| 4      | 2.562           | 28.61                | RMS | 31.9                   | -19.3       | 0            | 41.21                      | 54                     | -12.79      | -                   | -              | 217            | 281         | H        |

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

Pk - Peak detector

RMS - RMS detection