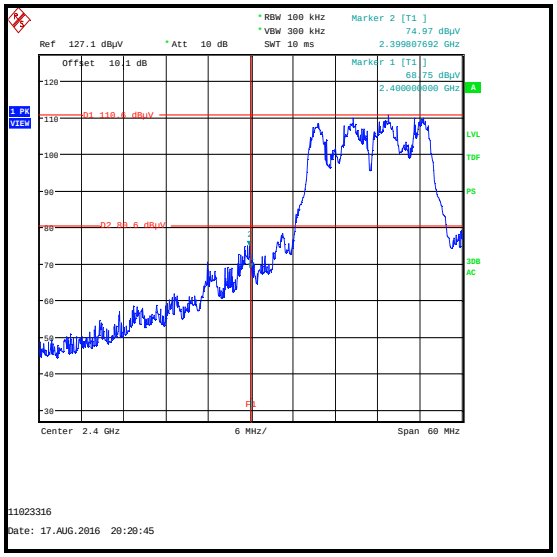
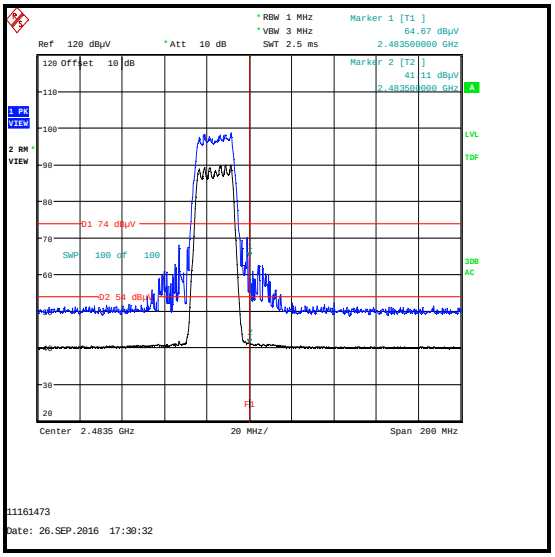
## Transmitter Band Edge Radiated Emissions (continued)

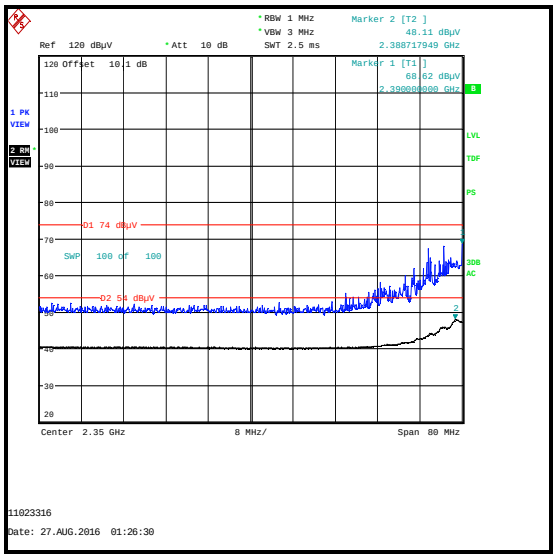
## Results: 802.11n HT20 / MCS0 / MIMO (2Tx CDD) on Ports 2 & 3




**Lower Band Edge Peak Measurement**
**Channel 2**



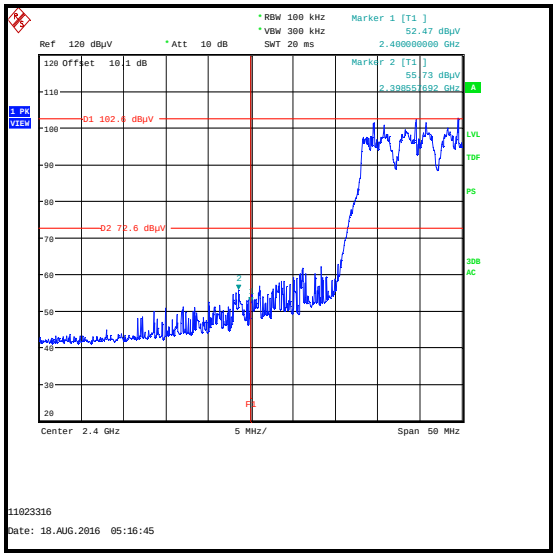

**Upper Band Edge Peak & Average Measurements**
**Channel 12**



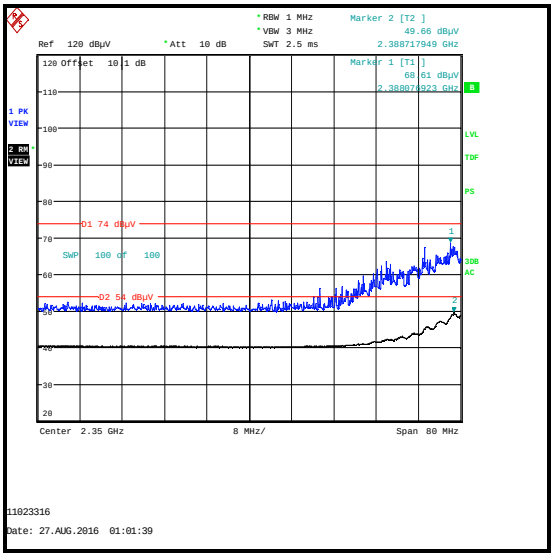

**2310 MHz to 2390 MHz Restricted Band**
**Channel 2**

## Transmitter Band Edge Radiated Emissions (continued)

## Results: 802.11n HT20 / MCS0 / MIMO (2Tx CDD) on Ports 2 & 3




**Lower Band Edge Peak Measurement**
**Channel 3**




**2310 MHz to 2390 MHz Restricted Band**
**Channel 3**

## Transmitter Band Edge Radiated Emissions (continued)

## Results: 802.11n HT20 / MCS0 / MIMO (3Tx CDD) on Ports 1, 2 & 3

### Results: Lower Band Edge

| Transmit Channel | Frequency (MHz) | Level (dBµV/m) | -30 dBc Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 1 | 2397.276 | 64.2 | 71.4 | 7.2 | Complied |
| 2 | 2399.519 | 63.2 | 74.1 | 10.9 | Complied |
| 3 | 2398.878 | 65.5 | 76.4 | 10.9 | Complied |

### Results: Restricted Band / Lower Band Edge / Peak

| Transmit Channel | Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 1 | 2388.333 | 67.3 | 74.0 | 6.7 | Complied |
| 2 | 2387.949 | 68.9 | 74.0 | 5.1 | Complied |
| 3 | 2389.615 | 68.4 | 74.0 | 5.6 | Complied |

### Results: Restricted Band / Lower Band Edge / Average

| Transmit Channel | Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 1 | 2387.436 | 46.6 | 54.0 | 7.4 | Complied |
| 2 | 2389.103 | 45.7 | 54.0 | 8.3 | Complied |
| 3 | 2389.487 | 48.3 | 54.0 | 5.7 | Complied |

### Results: Upper Band Edge / Restricted Band / Peak

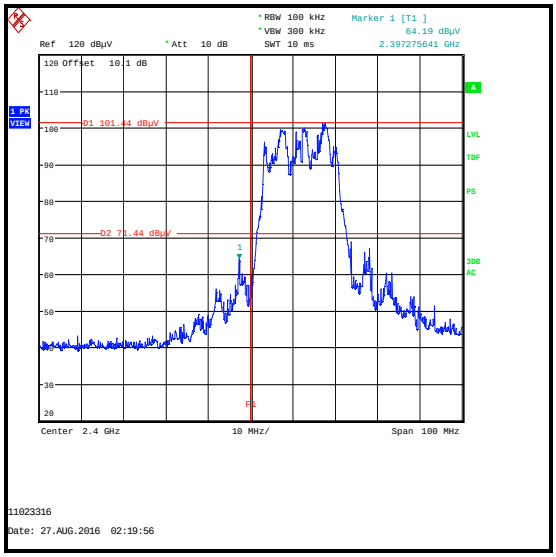
| Transmit Channel | Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 11 | 2486.385 | 68.2 | 74.0 | 5.8 | Complied |
| 12 | 2484.141 | 68.2 | 74.0 | 5.8 | Complied |

### Results: Upper Band Edge / Restricted Band / Average

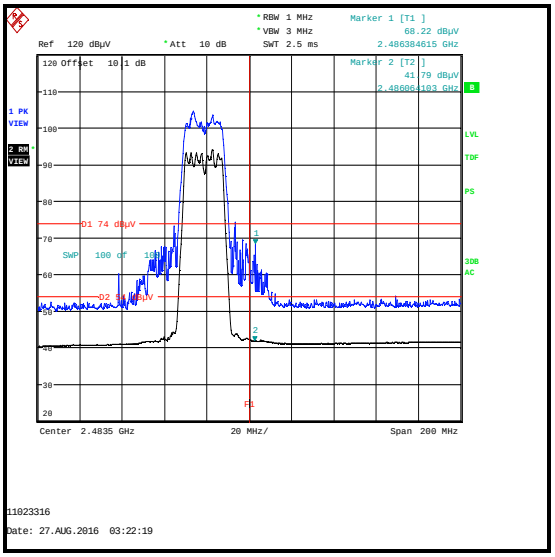
| Transmit Channel | Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 11 | 2486.064 | 41.8 | 54.0 | 12.2 | Complied |
| 12 | 2486.064 | 42.2 | 54.0 | 11.8 | Complied |

## Transmitter Band Edge Radiated Emissions (continued)

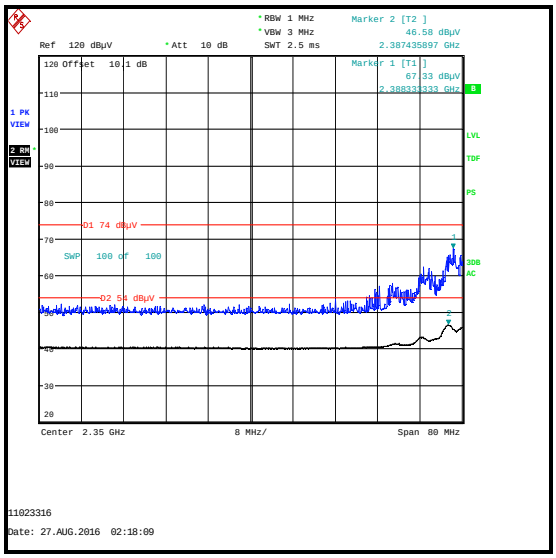
## Results: 802.11n HT20 / MCS0 / MIMO (3Tx CDD) on Ports 1, 2 & 3




**Lower Band Edge Peak Measurement**
**Channel 1**



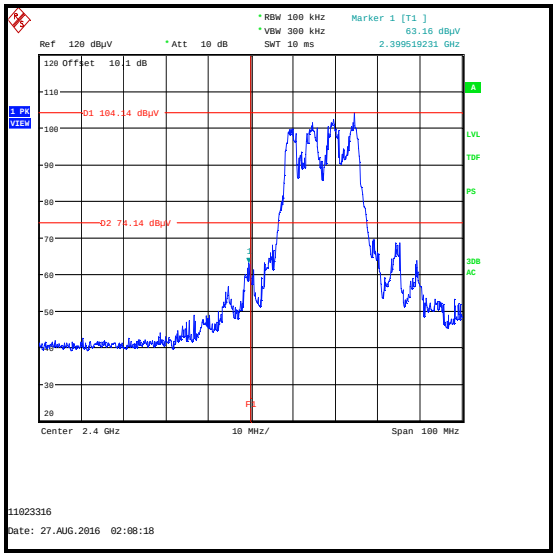

**Upper Band Edge Peak & Average Measurements**
**Channel 11**



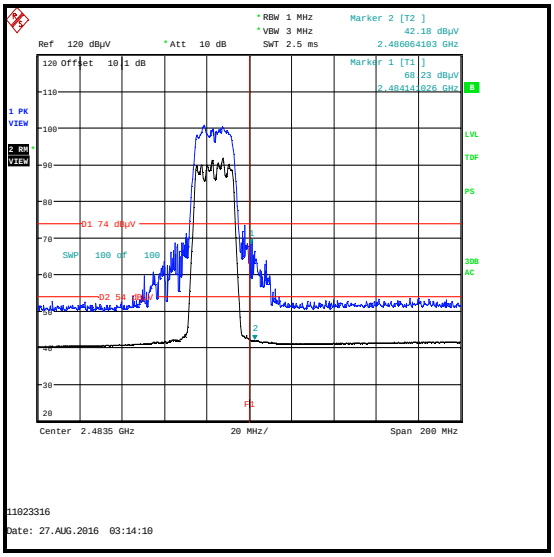

**2310 MHz to 2390 MHz Restricted Band**
**Channel 1**

## Transmitter Band Edge Radiated Emissions (continued)

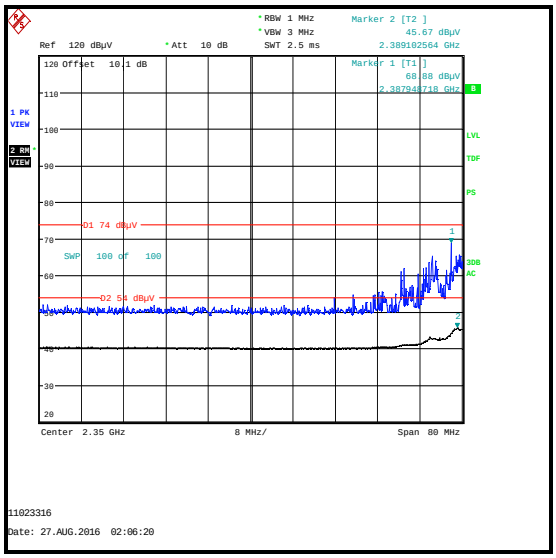
## Results: 802.11n HT20 / MCS0 / MIMO (3Tx CDD) on Ports 1, 2 & 3




**Lower Band Edge Peak Measurement**
**Channel 2**



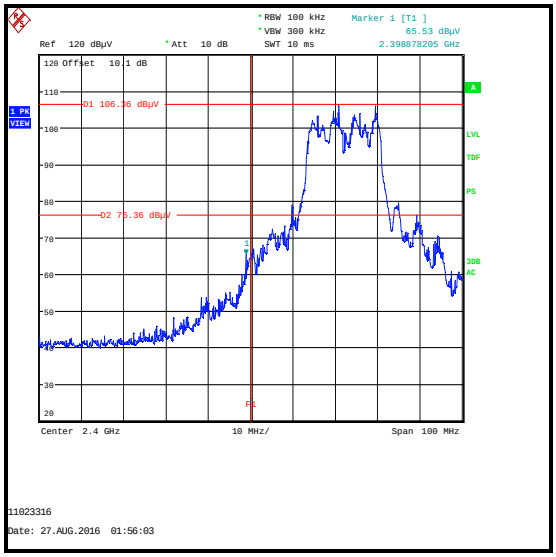

**Upper Band Edge Peak & Average Measurements**
**Channel 12**



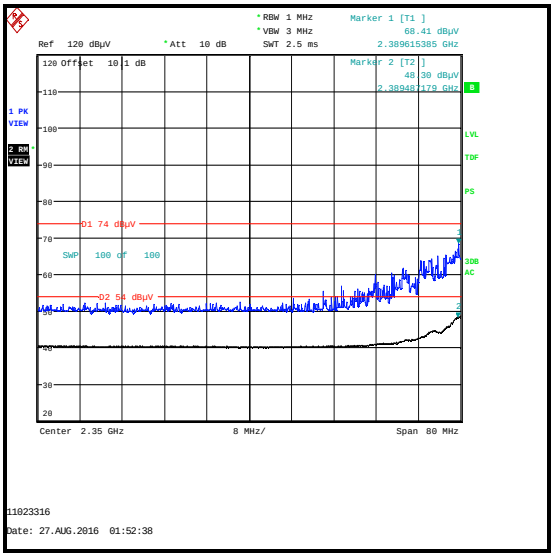

**2310 MHz to 2390 MHz Restricted Band**
**Channel 2**

## Transmitter Band Edge Radiated Emissions (continued)

## Results: 802.11n HT20 / MCS0 / MIMO (3Tx CDD) on Ports 1, 2 & 3




**Lower Band Edge Peak Measurement**
**Channel 3**




**2310 MHz to 2390 MHz Restricted Band**
**Channel 3**

## Test Equipment Used:

| Asset No. | Instrument | Manufacturer | Type No. | Serial No. | Date Calibration Due | Cal. Interval (Months) |
|---|---|---|---|---|---|---|
| M2003 | Thermohygrometer | Testo | 608-H1 | 45046641 | 22 Apr 2017 | 12 |
| K0017 | 3m RSE Chamber | Rainford EMC | N/A | N/A | 19 May 2017 | 12 |
| M1995 | Test Receiver | Rohde & Schwarz | ESU40 | 100428 | 21 Mar 2017 | 12 |
| A2890 | Antenna | Schwarzbeck | HWRD 750 | 014 | 06 May 2017 | 12 |
| A2891 | Pre Amplifier | Schwarzbeck | BBV 9718 | 9718-306 | 07 Apr 2017 | 12 |
| M1656 | Thermohygrometer | JM Handelspunkt | 30.5015.13 | Not stated | 07 Apr 2017 | 12 |
| K0002 | 3m RSE Chamber | Rainford EMC | N/A | N/A | 21 Dec 2016 | 12 |
| M1886 | Test Receiver | Rohde & Schwarz | ESU26 | 100554 | 21 Mar 2017 | 12 |
| A1534 | Pre Amplifier | Hewlett Packard | 8449B | 3008A00405 | 19 Dec 2016 | 12 |
| A1818 | Antenna | EMCO | 3115 | 00075692 | 17 Dec 2016 | 12 |
| A1396 | Attenuator | Huber & Suhner | 6810.17.B | 757987 | 26 Apr 2017 | 12 |

# 6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| Measurement Type | Range | Confidence Level (%) | Calculated Uncertainty |
|---|---|---|---|
| Minimum 6 dB Bandwidth | 2.4 GHz to 2.4835 GHz | 95% | ±4.59% |
| Duty Cycle | 2.4 GHz to 2.4835 GHz | 95% | ±1.14% |
| Spectral Power Density | 2.4 GHz to 2.4835 GHz | 95% | ±1.13 dB |
| Conducted Maximum Output Power | 2.4 GHz to 2.4835 GHz | 95% | ±1.13 dB |
| Radiated Spurious Emissions | 30 MHz to 1 GHz | 95% | ±5.65 dB |
| Radiated Spurious Emissions | 1 GHz to 25 GHz | 95% | ±2.94 dB |

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

# 7. Report Revision History

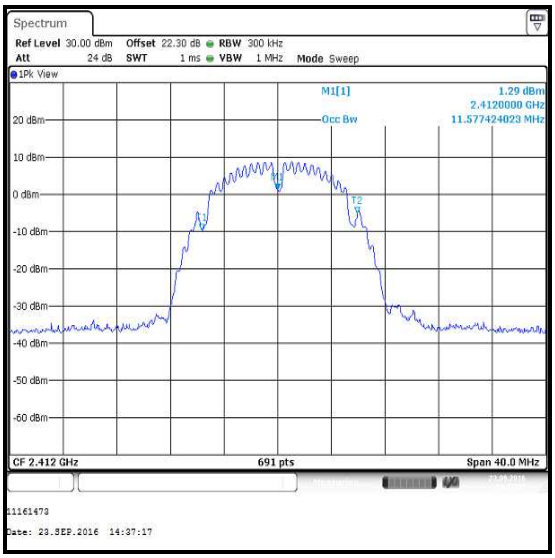
| Version Number | Revision Details | | |
|---|---|---|---|
| | Page No(s) | Clause | Details |
| 1.0 | - | - | Initial Version |

# 8. Appendix 1

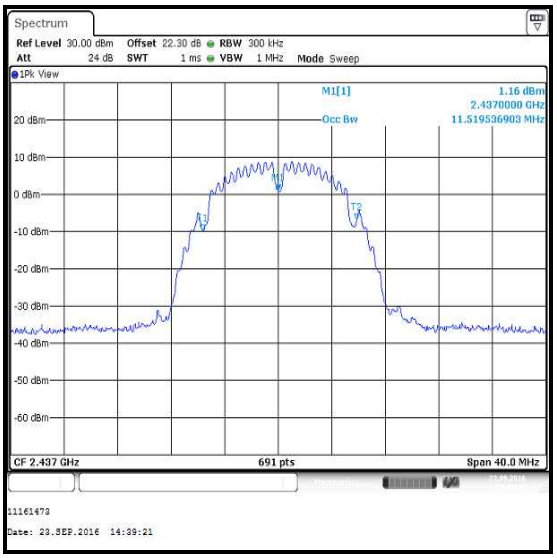
## Transmitter 99% Emission Bandwidth Reference Plots

## Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Port 2

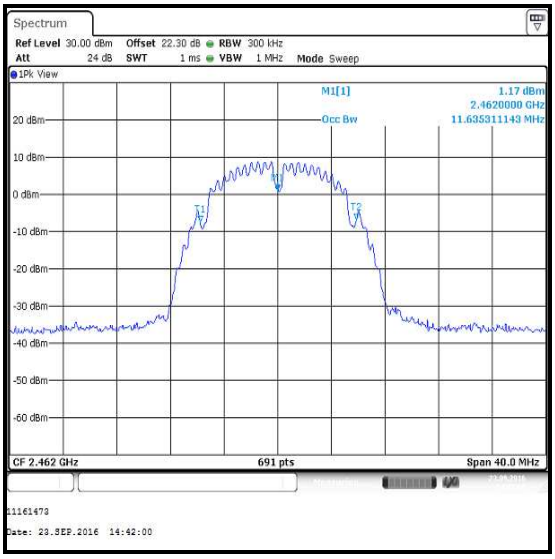
| Channel | Frequency (MHz) | 99% Emission Bandwidth (MHz) |
|---|---|---|
| 1 | 2412 | 11.577 |
| 6 | 2437 | 11.520 |
| 11 | 2462 | 11.635 |




**Channel 1**




**Channel 6**

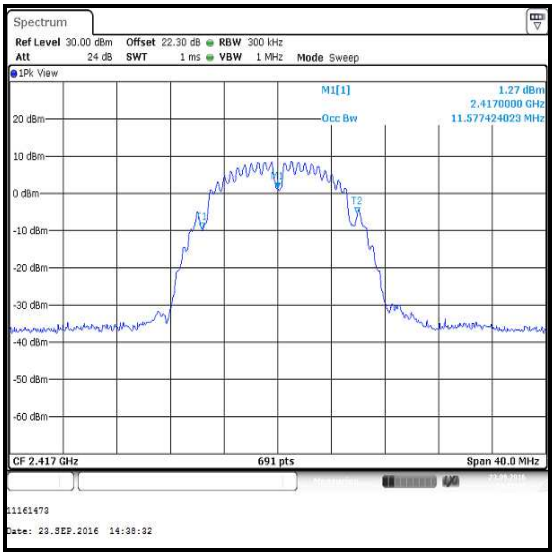



**Channel 11**

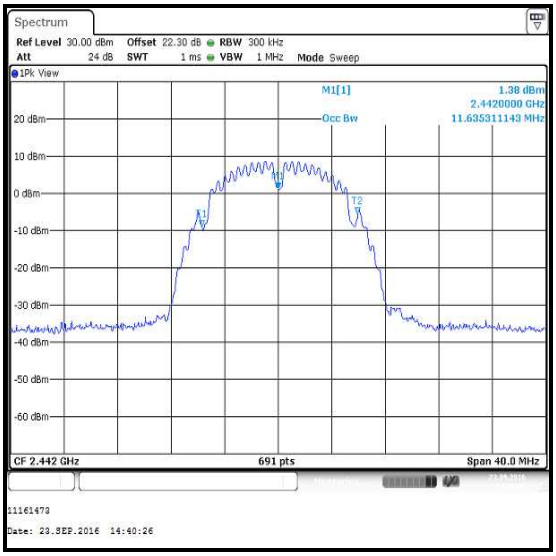
## Transmitter 99% Bandwidth (continued)

## Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Port 2

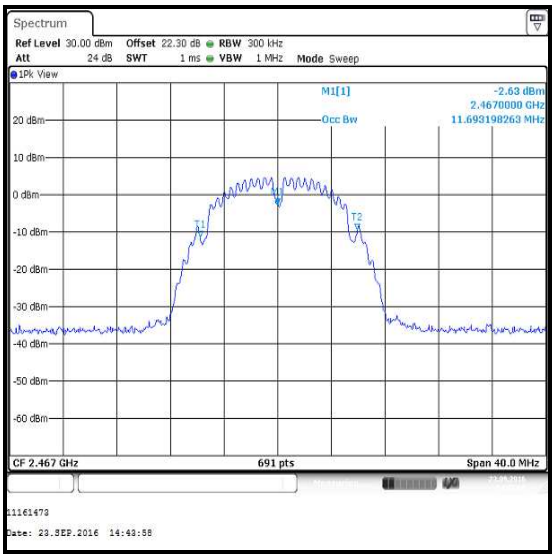
| Channel | Frequency (MHz) | 99% Emission Bandwidth (MHz) |
|---|---|---|
| 2 | 2417 | 11.577 |
| 7 | 2442 | 11.635 |
| 12 | 2467 | 11.693 |
| 13 | 2472 | 11.693 |



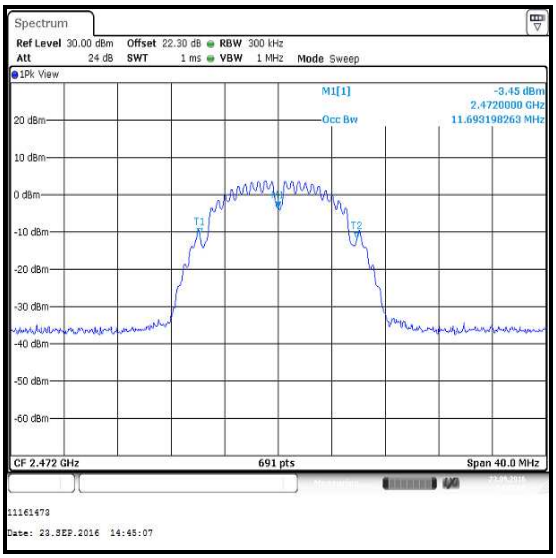

**Channel 2**




**Channel 7**




**Channel 12**

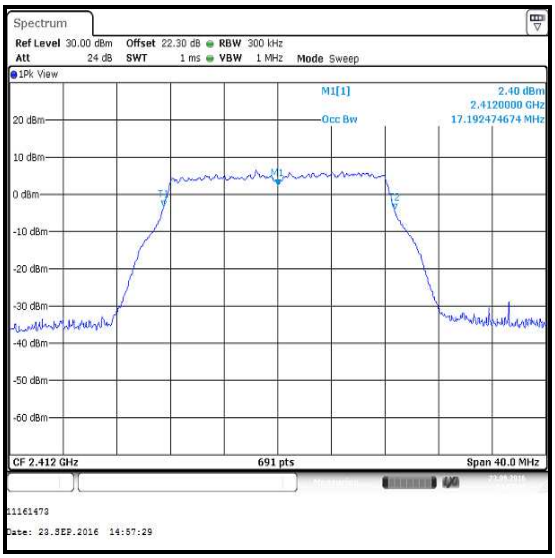



**Channel 13**

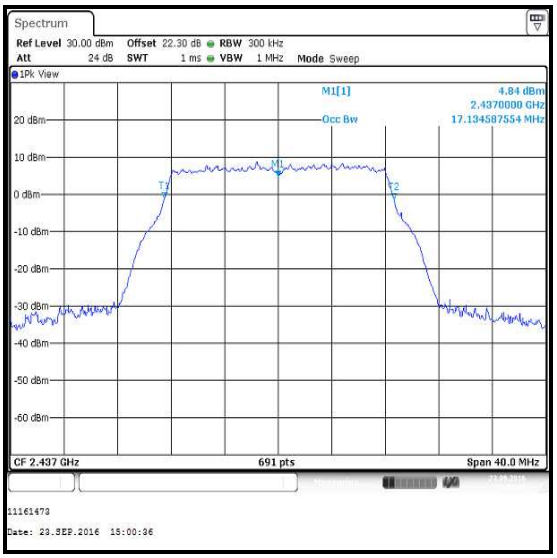
## Transmitter 99% Bandwidth (continued)

## Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Port 2

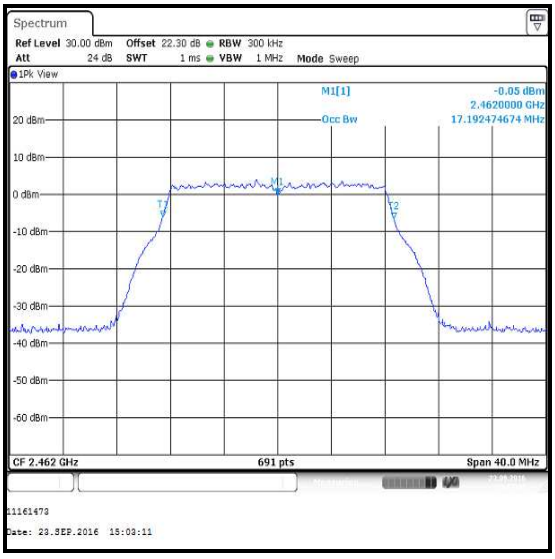
| Channel | Frequency (MHz) | 99% Emission Bandwidth (MHz) |
|---|---|---|
| 1 | 2412 | 17.192 |
| 6 | 2437 | 17.135 |
| 11 | 2462 | 17.192 |




Channel 1




Channel 6

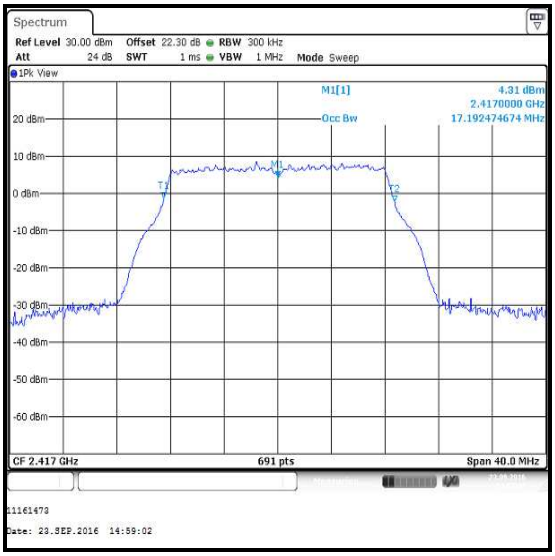



Channel 11

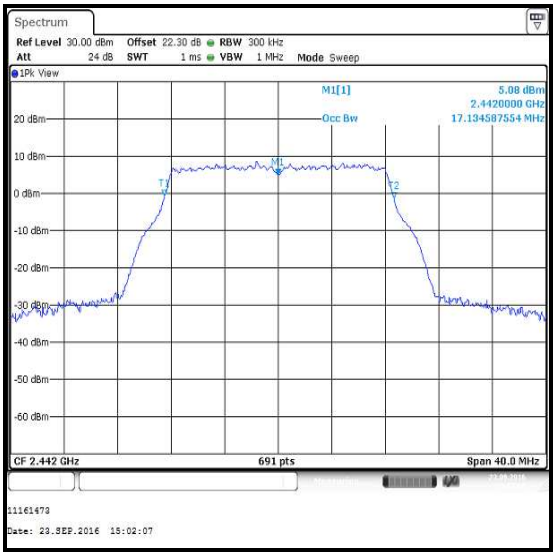
## Transmitter 99% Bandwidth (continued)

## Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Port 2

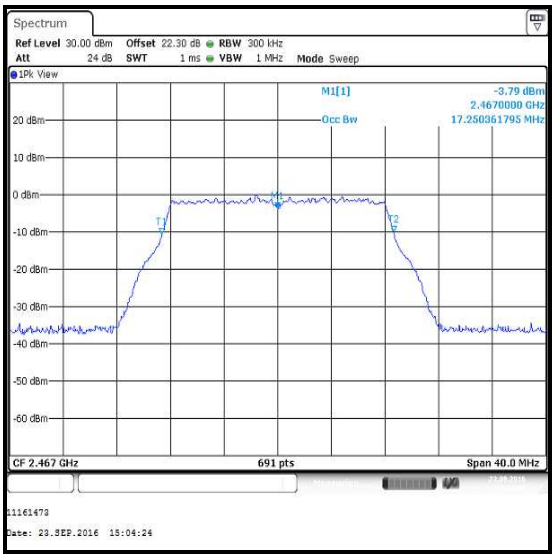
| Channel | Frequency (MHz) | 99% Emission Bandwidth (MHz) |
|---|---|---|
| 2 | 2417 | 17.192 |
| 7 | 2442 | 17.135 |
| 12 | 2467 | 17.250 |
| 13 | 2472 | 17.424 |



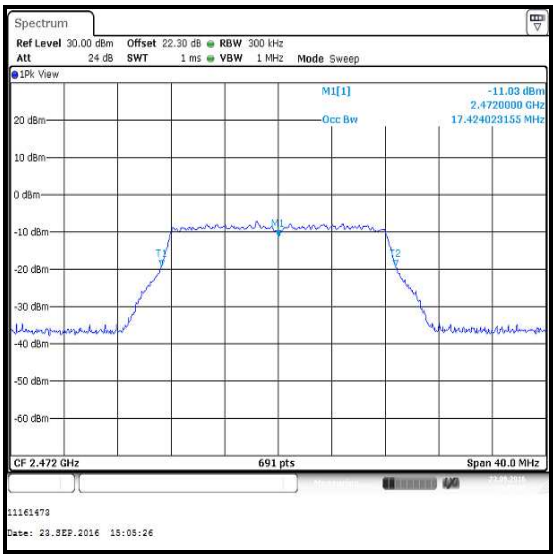

Channel 2




Channel 7




Channel 12

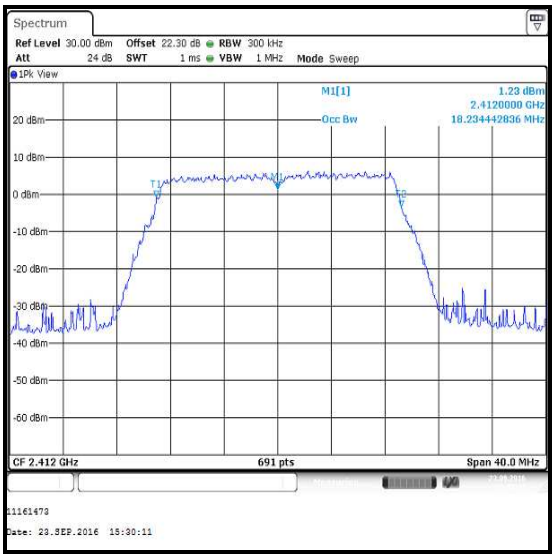



Channel 13

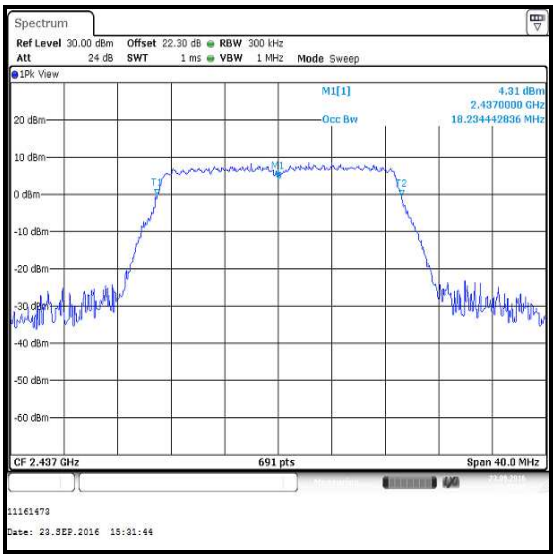
## Transmitter 99% Bandwidth (continued)

## Results: 802.11n / 20 MHz / BPSK / MCS0 / Port 2

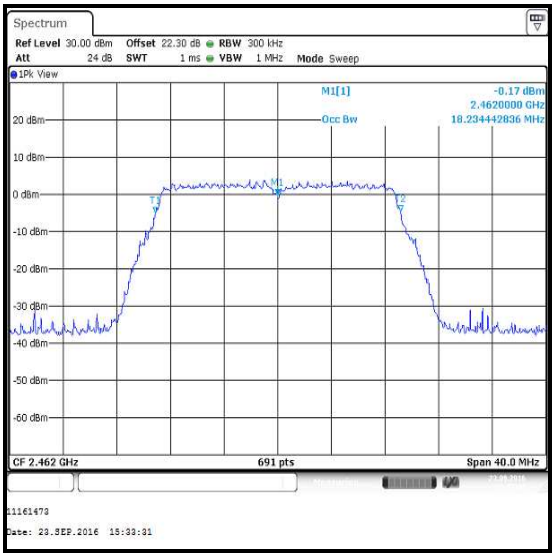
| Channel | Frequency (MHz) | 99% Emission Bandwidth (MHz) |
|---|---|---|
| 1 | 2412 | 18.234 |
| 6 | 2437 | 18.234 |
| 11 | 2462 | 18.234 |




Channel 1




Channel 6

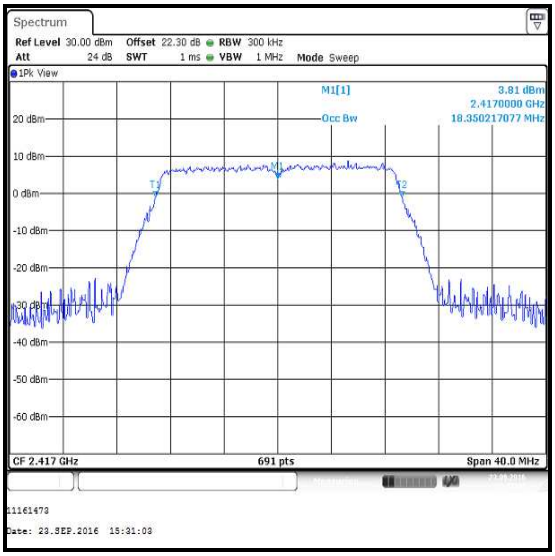



Channel 11

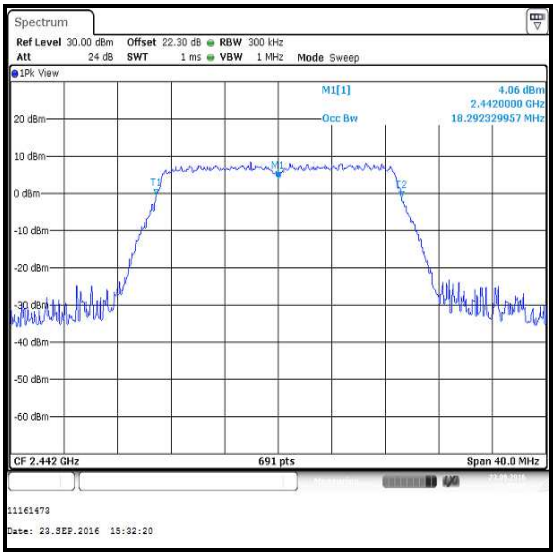
## Transmitter 99% Bandwidth (continued)

## Results: 802.11n / 20 MHz / BPSK / MCS0 / Port 2

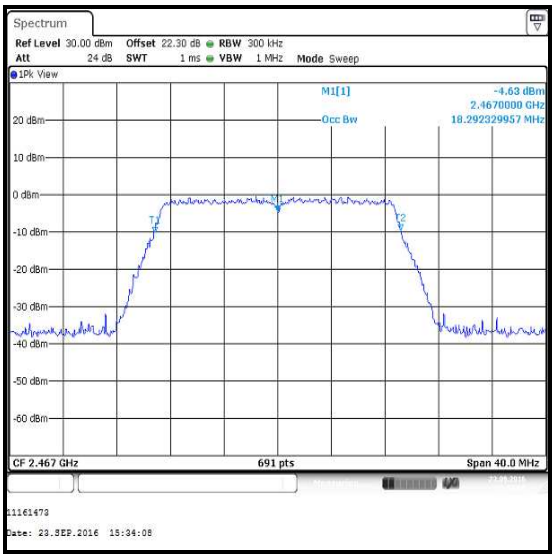
| Channel | Frequency (MHz) | 99% Emission Bandwidth (MHz) |
|---|---|---|
| 2 | 2417 | 18.350 |
| 7 | 2442 | 18.292 |
| 12 | 2467 | 18.292 |
| 13 | 2472 | 18.350 |



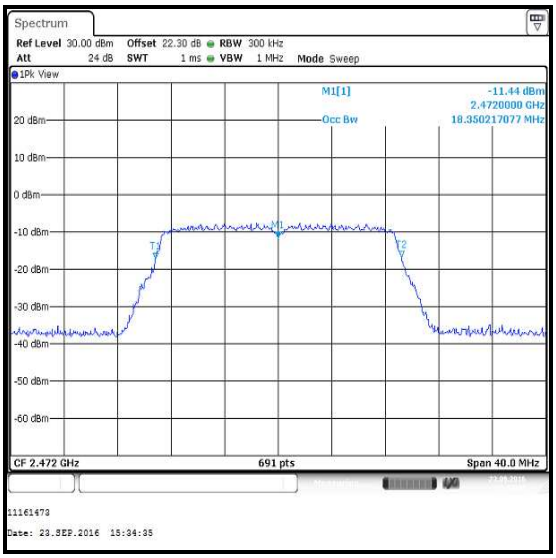

Channel 2




Channel 7




Channel 12




Channel 13

# 9. Appendix 2.

## Directional Antenna Gain Calculations

For 2Tx CDD modes, in accordance with KDB 662911 D01 v02r01 Section F)2)f)(ii) and for $N_{SS}$=1, $N_{ANT}$=2,
$G_1 = G_{ANTENNA\ 2}$ = 3.3 dBi, $G_2 = G_{ANTENNA\ 3}$ = 2.3 dBi:

$$\text{Directional Gain} = 10\log\left[\frac{\sum_{j=1}^{N_{SS}}\left(\sum_{k=1}^{N_{ANT}} g_{j,k}\right)^2}{N_{ANT}}\right] = 10\log\left[\frac{\sum_{j=1}^{1}\left(\sum_{k=1}^{3} g_{j,k}\right)^2}{2}\right] =$$

$$= 10\log\left[\frac{\left(g_{1,1}+g_{1,2}\right)^2}{2}\right] = 10\log\left[\frac{\left(10^{\frac{G_1}{20}}+10^{\frac{G_2}{20}}\right)^2}{2}\right] = 10\log\left[\frac{\left(10^{\frac{3.3}{20}}+10^{\frac{2.3}{20}}\right)^2}{2}\right] = 5.8\ \text{dBi}$$

For 3Tx CDD modes, in accordance with KDB 662911 D01 v02r01 Section F)2)f)(ii) and for $N_{SS}$=1, $N_{ANT}$=3,
$G_1 = G_{ANTENNA\ 1}$ = 2.0 dBi, $G_2 = G_{ANTENNA\ 2}$ = 3.3 dBi, $G_3 = G_{ANTENNA\ 3}$ = 2.3 dBi:

$$\text{Directional Gain} = 10\log\left[\frac{\sum_{j=1}^{N_{SS}}\left(\sum_{k=1}^{N_{ANT}} g_{j,k}\right)^2}{N_{ANT}}\right] = 10\log\left[\frac{\sum_{j=1}^{1}\left(\sum_{k=1}^{3} g_{j,k}\right)^2}{3}\right] =$$

$$= 10\log\left[\frac{\left(g_{1,1}+g_{1,2}+g_{1,3}\right)^2}{3}\right] = 10\log\left[\frac{\left(10^{\frac{G_1}{20}}+10^{\frac{G_2}{20}}+10^{\frac{G_3}{20}}\right)^2}{3}\right] = 10\log\left[\frac{\left(10^{\frac{2.0}{20}}+10^{\frac{3.3}{20}}+10^{\frac{2.3}{20}}\right)^2}{3}\right]$$

$$= 7.3\ \text{dBi}$$

**--- END OF REPORT ---**