

## TEST REPORT

Test report no.: 1-1276/16-07-04-A



Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-01

### Testing laboratory

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#### Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

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### Manufacturer

#### SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal / GERMANY

### Test standard/s

47 CFR Part 15

Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

RSS - 247 Issue 1

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices

For further applied test standards please refer to section 3 of this test report.

### Test Item

Kind of test item: Communication Unit

Model name: IND-10/IND-US-10

FCC ID: SVFINDUS10

IC: 9440A-INDUS10

Frequency: DTS band 2400 MHz to 2483.5 MHz

Technology tested: WLAN

Antenna: Integrated chip antenna

Power supply: 24.0 V DC by external power supply

Temperature range: -20°C to +60°C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

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## 1 Table of contents

|         |                                                                       |     |
|---------|-----------------------------------------------------------------------|-----|
| 1       | Table of contents .....                                               | 2   |
| 2       | General information .....                                             | 3   |
| 2.1     | Notes and disclaimer .....                                            | 3   |
| 2.2     | Application details .....                                             | 3   |
| 2.3     | Test laboratories sub-contracted .....                                | 3   |
| 3       | Test standard/s and references .....                                  | 4   |
| 4       | Test environment.....                                                 | 5   |
| 5       | Test item .....                                                       | 5   |
| 5.1     | General description .....                                             | 5   |
| 5.2     | Additional information .....                                          | 5   |
| 6       | Description of the test setup .....                                   | 6   |
| 6.1     | Shielded semi anechoic chamber.....                                   | 7   |
| 6.2     | Shielded fully anechoic chamber .....                                 | 8   |
| 6.3     | Radiated measurements > 18 GHz.....                                   | 9   |
| 6.4     | Conducted measurements with peak power meter & spectrum analyzer..... | 10  |
| 6.5     | AC conducted .....                                                    | 11  |
| 7       | Sequence of testing .....                                             | 12  |
| 7.1     | Sequence of testing radiated spurious 9 kHz to 30 MHz.....            | 12  |
| 7.2     | Sequence of testing radiated spurious 30 MHz to 1 GHz .....           | 13  |
| 7.3     | Sequence of testing radiated spurious 1 GHz to 18 GHz .....           | 14  |
| 7.4     | Sequence of testing radiated spurious above 18 GHz .....              | 15  |
| 8       | Measurement uncertainty .....                                         | 16  |
| 9       | Summary of measurement results .....                                  | 17  |
| 10      | Additional comments .....                                             | 18  |
| 11      | Measurement results .....                                             | 19  |
| 11.1    | Antenna gain .....                                                    | 19  |
| 11.2    | Identify worst case data rate.....                                    | 22  |
| 11.3    | Maximum output power.....                                             | 23  |
| 11.4    | Duty cycle .....                                                      | 24  |
| 11.5    | Peak power spectral density.....                                      | 31  |
| 11.6    | 6 dB DTS bandwidth .....                                              | 38  |
| 11.7    | Occupied bandwidth – 99% emission bandwidth.....                      | 45  |
| 11.8    | Occupied bandwidth – 20 dB bandwidth.....                             | 52  |
| 11.9    | Band edge compliance radiated .....                                   | 59  |
| 11.10   | Band edge compliance conducted .....                                  | 63  |
| 11.11   | Spurious emissions conducted.....                                     | 68  |
| 11.12   | Spurious emissions radiated below 30 MHz .....                        | 80  |
| 11.13   | Spurious emissions radiated 30 MHz to 1 GHz.....                      | 85  |
| 11.14   | Spurious emissions radiated above 1 GHz .....                         | 93  |
| 11.15   | Spurious emissions conducted below 30 MHz (AC conducted).....         | 109 |
| 12      | Observations .....                                                    | 112 |
| Annex A | Document history .....                                                | 112 |
| Annex B | Further information.....                                              | 112 |
| Annex C | Accreditation Certificate .....                                       | 113 |

## 2 General information

### 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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**This test report replaces the test report with the number 1-1276/16-07-04 and dated 2017-01-12**

### 2.2 Application details

|                                    |            |
|------------------------------------|------------|
| Date of receipt of order:          | 2016-11-30 |
| Date of receipt of test item:      | 2016-11-28 |
| Start of test:                     | 2016-11-30 |
| End of test:                       | 2016-12-05 |
| Person(s) present during the test: | -/-        |

### 2.3 Test laboratories sub-contracted

None

### 3 Test standard/s and references

| Test standard     | Date          | Description                                                                                                                                               |
|-------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 47 CFR Part 15    | June 2016     | Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices                                                                 |
| RSS - 247 Issue 1 | May 2015      | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices                            |
| RSS - Gen Issue 4 | November 2014 | Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus |

| Guidance            | Version | Description                                                                                                                                                         |
|---------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DTS: KDB 558074 D01 | v03r05  | Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247                                                       |
| ANSI C63.4-2014     | -/-     | American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz |
| ANSI C63.10-2013    | -/-     | American national standard of procedures for compliance testing of unlicensed wireless devices                                                                      |

## 4 Test environment

|                           |   |                                                          |                                                                                                                     |
|---------------------------|---|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Temperature               | : | T <sub>nom</sub><br>T <sub>max</sub><br>T <sub>min</sub> | +22 °C during room temperature tests<br>+60 °C during high temperature tests<br>-20 °C during low temperature tests |
| Relative humidity content | : |                                                          | 55 %                                                                                                                |
| Barometric pressure       | : |                                                          | 1021 hpa                                                                                                            |
| Power supply              | : | V <sub>nom</sub><br>V <sub>max</sub><br>V <sub>min</sub> | 24.0 V DC by external power supply<br>30.0 V<br>10.0 V                                                              |

## 5 Test item

### 5.1 General description

|                            |   |                                            |
|----------------------------|---|--------------------------------------------|
| Kind of test item          | : | Communication Unit                         |
| Type identification        | : | IND-10/IND-US-10                           |
| HMN                        | : | -/-                                        |
| PMN                        | : | SMA Industrial Manager                     |
| HVIN                       | : | IND-US-10                                  |
| FVIN                       | : | -/-                                        |
| S/N serial number          | : | Rad. 17<br>Cond. 16                        |
| HW hardware status         | : | P2                                         |
| SW software status         | : | Linux version 4.4.13-sma-160616-lguana-BSP |
| Frequency band             | : | DTS band 2400 MHz to 2483.5 MHz            |
| Type of radio transmission | : | DSSS, CCK, OFDM                            |
| Use of frequency spectrum  | : |                                            |
| Type of modulation         | : | BPSK, QPSK, 16 – QAM, 64 - QAM             |
| Number of channels         | : | 11                                         |
| Antenna                    | : | Integrated chip antenna                    |
| Power supply               | : | 24.0 V DC by external power supply         |
| Temperature range          | : | -20°C to +60°C                             |

### 5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report:

1-1276/16-07-01\_AnnexA  
 1-1276/16-07-01\_AnnexB  
 1-1276/16-07-01\_AnnexC

## 6 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

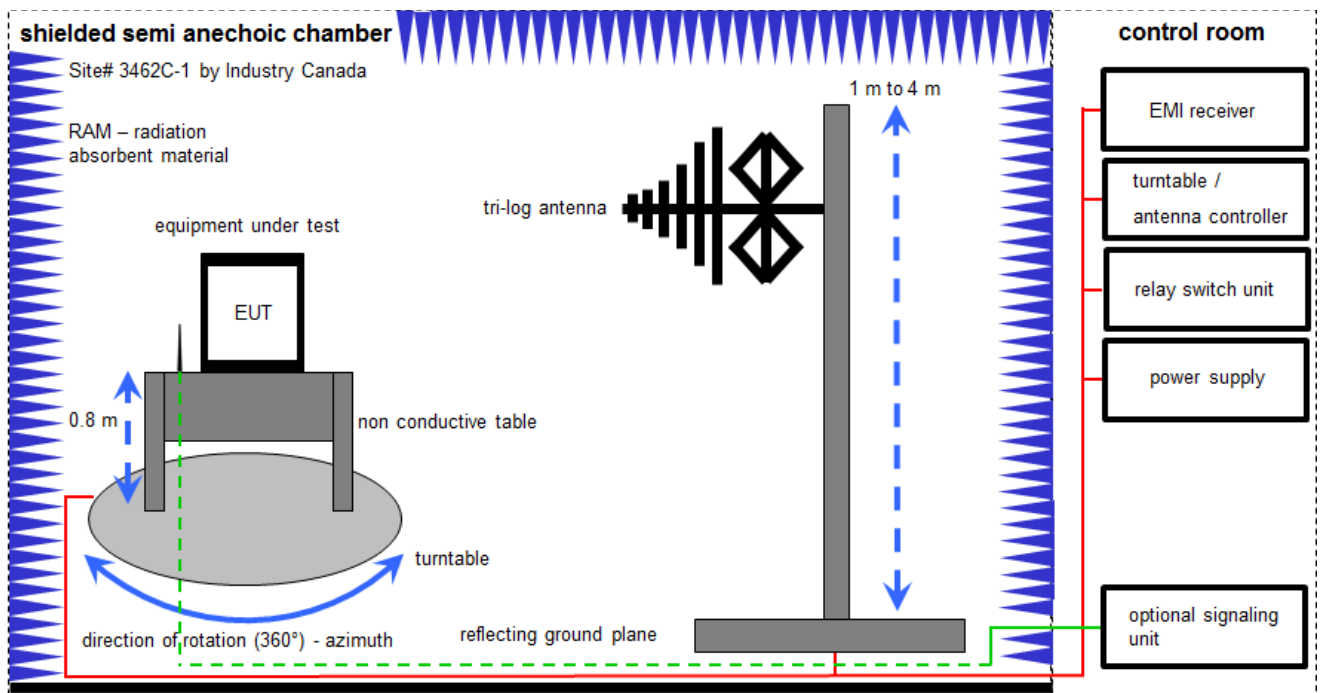
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

**Agenda:** Kind of Calibration

|      |                                            |     |                                                      |
|------|--------------------------------------------|-----|------------------------------------------------------|
| k    | calibration / calibrated                   | EK  | limited calibration                                  |
| ne   | not required (k, ev, izw, zw not required) | zw  | cyclical maintenance (external cyclical maintenance) |
| ev   | periodic self verification                 | izw | internal cyclical maintenance                        |
| Ve   | long-term stability recognized             | g   | blocked for accredited testing                       |
| vlk! | Attention: extended calibration interval   |     |                                                      |
| NK!  | Attention: not calibrated                  | *)  | next calibration ordered / currently in progress     |

## 6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

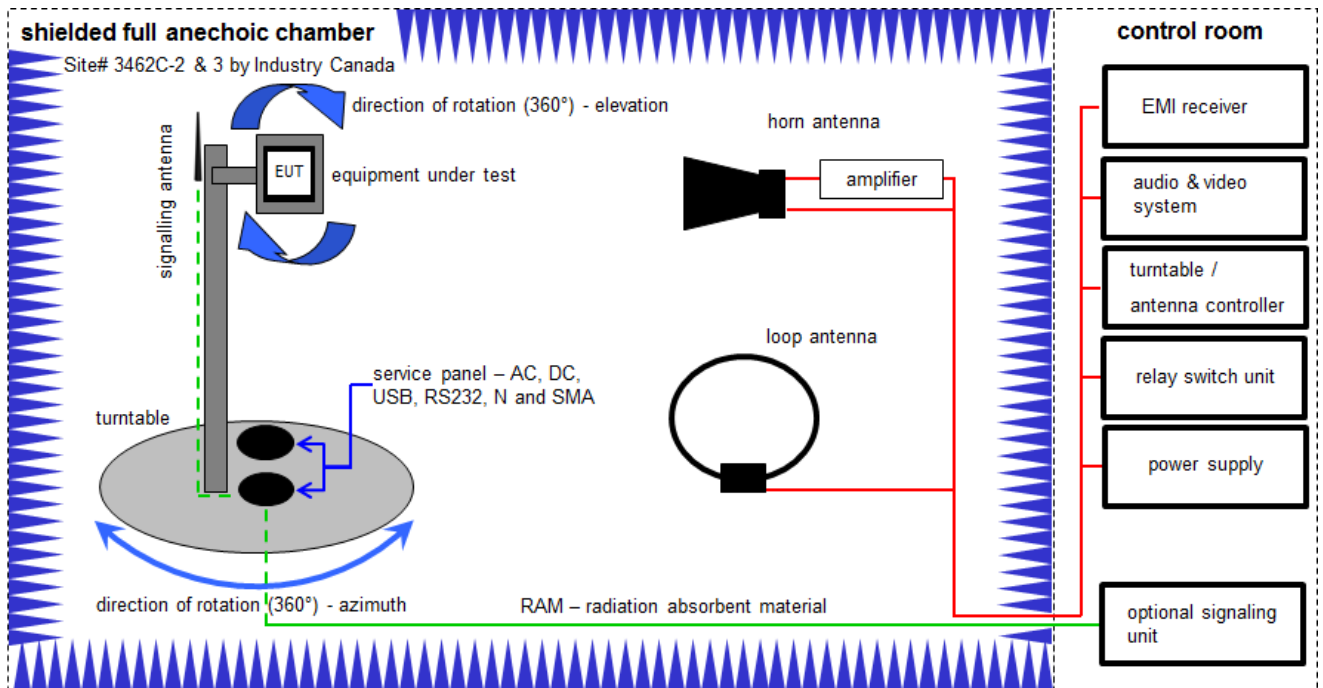
Example calculation:

$$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$$

### Equipment table:

| No. | Lab / Item | Equipment                                    | Type       | Manufacturer | Serial No. | INV. No.  | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|----------------------------------------------|------------|--------------|------------|-----------|---------------------|------------------|------------------|
| 1   | A          | Switch-Unit                                  | 3488A      | HP           | 2719A14505 | 300000368 | ev                  | -/-              | -/-              |
| 2   | A          | DC power supply, 60Vdc, 50A, 1200 W          | 6032A      | HP           | 2920A04466 | 300000580 | ne                  | -/-              | -/-              |
| 3   | A          | EMI Test Receiver                            | ESCI 3     | R&S          | 100083     | 300003312 | k                   | 08.03.2016       | 08.03.2017       |
| 4   | A          | Antenna Tower                                | Model 2175 | ETS-Lindgren | 64762      | 300003745 | izw                 | -/-              | -/-              |
| 5   | A          | Positioning Controller                       | Model 2090 | ETS-Lindgren | 64672      | 300003746 | izw                 | -/-              | -/-              |
| 6   | A          | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163   | Schwarzbeck  | 295        | 300003787 | k                   | 25.04.2016       | 25.04.2018       |

## 6.2 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter / 1 meter

$$FS = UR + CA + AF$$

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

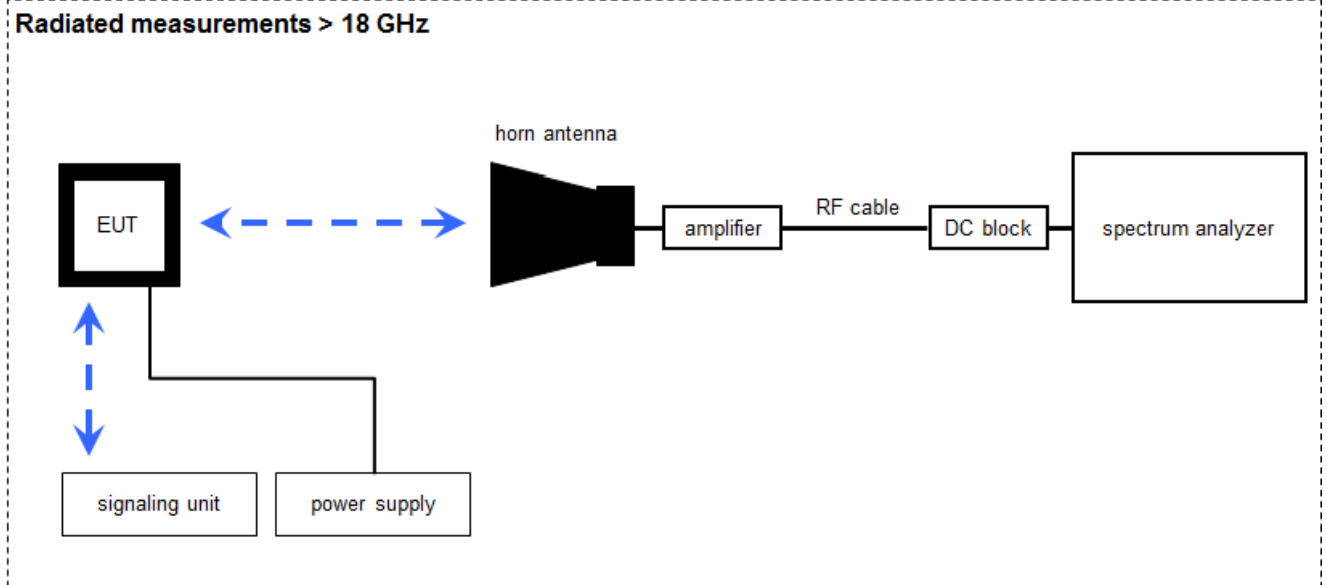
Example calculation:

$$FS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V/m]} + (-35.8) \text{ [dB]} + 32.9 \text{ [dB/m]} = 37.1 \text{ [dB}\mu\text{V/m]} (71.61 \mu\text{V/m})$$

### Equipment table:

| No. | Lab / Item | Equipment                                      | Type                            | Manufacturer         | Serial No. | INV. No.  | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|------------------------------------------------|---------------------------------|----------------------|------------|-----------|---------------------|------------------|------------------|
| 1   | A          | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115                            | EMCO                 | 8812-3088  | 300001032 | v/KI!               | 20.05.2015       | 20.05.2017       |
| 2   | A          | Anechoic chamber                               | FAC 3/5m                        | MWB / TDK            | 87400/02   | 300000996 | ev                  | -/-              | -/-              |
| 3   | A          | Switch / Control Unit                          | 3488A                           | HP                   | *          | 300000199 | ne                  | -/-              | -/-              |
| 4   | A          | Active Loop Antenna 10 kHz to 30 MHz           | 6502                            | EMCO/2               | 8905-2342  | 300000256 | k                   | 24.06.2015       | 24.06.2017       |
| 5   | A          | Band Reject filter                             | WRCG2400/2483-2375/2505-50/10SS | Wainwright           | 11         | 300003351 | ev                  | -/-              | -/-              |
| 6   | A          | EMI Test Receiver 20Hz- 26,5GHz                | ESU26                           | R&S                  | 100037     | 300003555 | k                   | 02.02.2016       | 02.02.2017       |
| 7   | A          | Highpass Filter                                | WHKX7.0/18G-8SS                 | Wainwright           | 18         | 300003789 | ne                  | -/-              | -/-              |
| 8   | A          | Broadband Amplifier 0.5-18 GHz                 | CBLU5184540                     | CERNEX               | 22049      | 300004481 | ev                  | -/-              | -/-              |
| 9   | A          | 4U RF Switch Platform                          | L4491A                          | Agilent Technologies | MY50000037 | 300004509 | ne                  | -/-              | -/-              |

### 6.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

$$FS = U_R + CA + AF$$

(FS-field strength;  $U_R$ -voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

Example calculation:

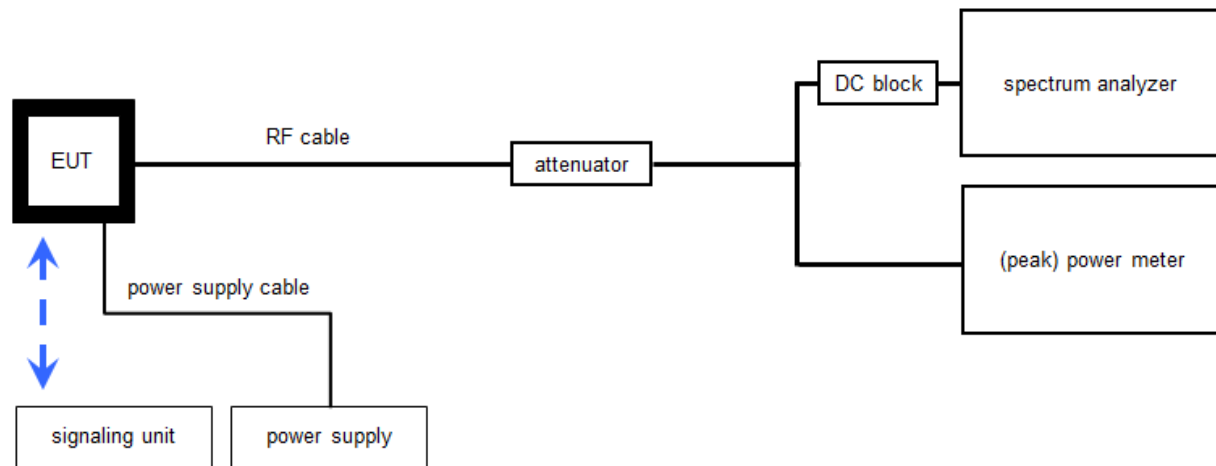
$$FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dB\mu V/m] (6.79 \mu V/m)$$

#### Equipment table:

| No. | Lab / Item | Equipment                               | Type                | Manufacturer   | Serial No.       | INV. No.  | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|-----------------------------------------|---------------------|----------------|------------------|-----------|---------------------|------------------|------------------|
| 1   | A          | Std. Gain Horn Antenna 18.0 to 26.5 GHz | 638                 | Narda          | -/-              | 300000486 | k                   | 10.09.2015       | 10.09.2017       |
| 2   | A          | Amplifier 2-40 GHz                      | JS32-02004000-57-5P | MITEQ          | 1777200          | 300004541 | ev                  | -/-              | -/-              |
| 3   | A          | Signal Analyzer 40 GHz                  | FSV40               | R&S            | 101353           | 300004819 | k                   | 19.09.2016       | 19.09.2017       |
| 4   | A          | RF-Cable                                | ST18/SMAm/SMAm/48   | Huber & Suhner | Batch no. 600918 | 400001182 | ev                  | -/-              | -/-              |
| 5   | A          | RF-Cable                                | ST18/SMAm/SMm/48    | Huber & Suhner | Batch no. 127377 | 400001183 | ev                  | -/-              | -/-              |

## 6.4 Conducted measurements with peak power meter & spectrum analyzer

### Conducted measurements normal conditions



$$OP = AV + CA$$

(OP-output power; AV-analyzer value; CA-loss signal path)

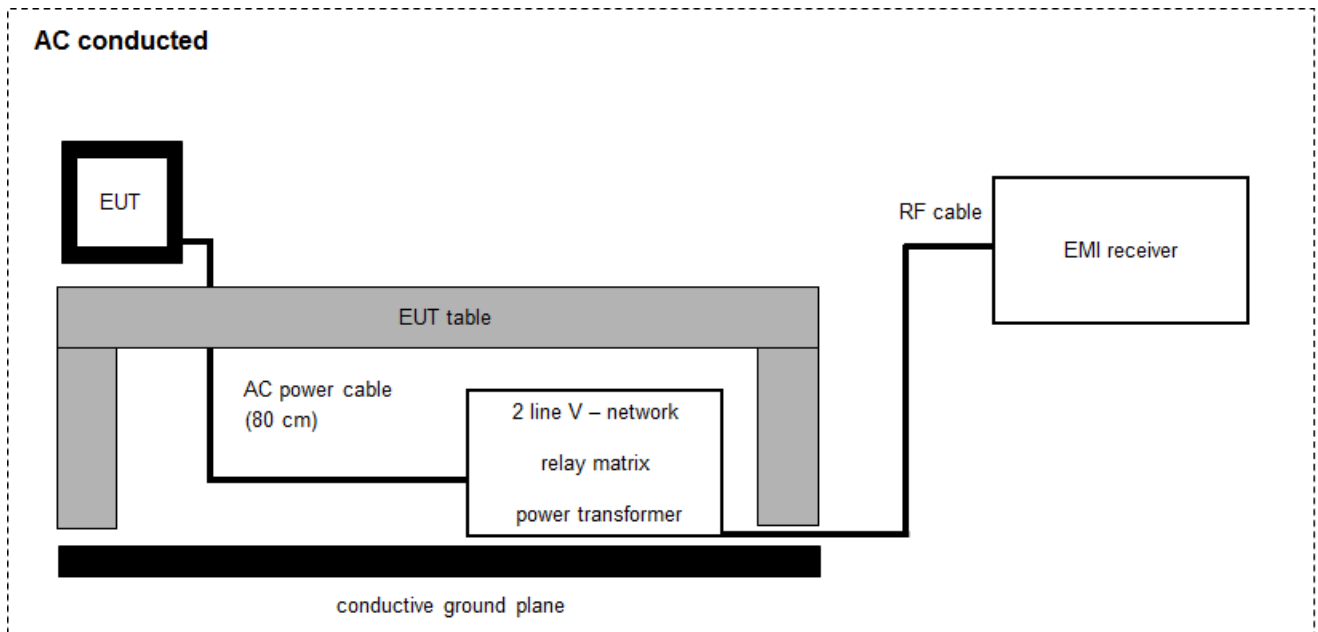
#### Example calculation:

$$OP \text{ [dBm]} = 6.0 \text{ [dBm]} + 11.7 \text{ [dB]} = 17.7 \text{ [dBm]} \text{ (58.88 mW)}$$

#### Equipment table:

| No. | Lab / Item | Equipment             | Type              | Manufacturer   | Serial No.       | INV. No Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|-----------------------|-------------------|----------------|------------------|-----------------|---------------------|------------------|------------------|
| 1   | A          | Switch / Control Unit | 3488A             | HP             | -/-              | 300000929       | ne                  | -/-              | -/-              |
| 2   | A          | Power Supply          | NGSM 32/10        | R&S            | 3939             | 400000192       | vKII                | 22.01.2015       | 22.01.2017       |
| 3   | A          | Signal Analyzer 30GHz | FSV30             | R&S            | 103170           | 300004855       | k                   | 25.01.2016       | 25.01.2017       |
| 4   | A          | Power Sensor          | NRP-Z81           | R&S            | 100010           | 300003780       | k                   | 25.01.2016       | 25.01.2017       |
| 5   | A          | Directional Coupler   | 101020010         | Krytar         | 70215            | 300002840       | ev                  | -/-              | -/-              |
| 6   | A          | DC-Blocker            | 8143              | Inmet Corp.    | none             | 300002842       | ne                  | -/-              | -/-              |
| 7   | A          | Powersplitter         | 6005-3            | Inmet Corp.    | none             | 300002841       | ev                  | -/-              | -/-              |
| 8   | A          | RF-Cable              | ST18/SMAM/SMAM/72 | Huber & Suhner | Batch no. 605505 | 400001187       | ev                  | -/-              | -/-              |
| 9   | A          | RF-Cable              | Sucoflex 104      | Huber & Suhner | 147636/4         | 400001188       | ev                  | -/-              | -/-              |

## 6.5 AC conducted



$$FS = UR + CF + VC$$

(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

*Example calculation:*

$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] (244.06 \mu V/m)$$

### Equipment table:

| No. | Lab / Item | Equipment                                 | Type       | Manufacturer         | Serial No. | INV. No.  | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|-------------------------------------------|------------|----------------------|------------|-----------|---------------------|------------------|------------------|
| 1   | A          | Two-line V-Network (LISN) 9 kHz to 30 MHz | ESH3-Z5    | R&S                  | 893045/004 | 300000584 | k                   | 02.02.2016       | 01.02.2017       |
| 2   | A          | Power Supply                              | NGSM 32/10 | R&S                  | 3939       | 400000192 | vKI!                | 22.01.2015       | 22.01.2017       |
| 3   | A          | RF-Filter-section                         | 85420E     | HP                   | 3427A00162 | 300002214 | k                   | 27.11.2006       | -/-              |
| 4   | A          | Hochpass 150 kHz                          | EZ-25      | R&S                  | 100010     | 300003798 | ev                  | 08.04.2008       | -/-              |
| 5   | A          | MXE EMI Receiver 20 Hz to 26,5 GHz        | N9038A     | Agilent Technologies | MY51210197 | 300004405 | k                   | 16.08.2016       | 16.08.2017       |

## 7 Sequence of testing

### 7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

#### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

#### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

#### Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

## 7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

### Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position  $\pm 45^\circ$  and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

### 7.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

#### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

#### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

#### Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

## 7.4 Sequence of testing radiated spurious above 18 GHz

### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

### Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

### Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

**8 Measurement uncertainty**

| Measurement uncertainty                                  |                                     |
|----------------------------------------------------------|-------------------------------------|
| Test case                                                | Uncertainty                         |
| Antenna gain                                             | ± 3 dB                              |
| Power spectral density                                   | ± 1.5 dB                            |
| DTS bandwidth                                            | ± 100 kHz (depends on the used RBW) |
| Occupied bandwidth                                       | ± 100 kHz (depends on the used RBW) |
| Maximum output power                                     | ± 1.5 dB                            |
| Detailed spurious emissions @ the band edge - conducted  | ± 1.5 dB                            |
| Band edge compliance radiated                            | ± 3 dB                              |
| Spurious emissions conducted                             | ± 3 dB                              |
| Spurious emissions radiated below 30 MHz                 | ± 3 dB                              |
| Spurious emissions radiated 30 MHz to 1 GHz              | ± 3 dB                              |
| Spurious emissions radiated 1 GHz to 12.75 GHz           | ± 3.7 dB                            |
| Spurious emissions radiated above 12.75 GHz              | ± 4.5 dB                            |
| Spurious emissions conducted below 30 MHz (AC conducted) | ± 2.6 dB                            |

## 9 Summary of measurement results

|                                     |                                                                                                                          |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | No deviations from the technical specifications were ascertained                                                         |
| <input type="checkbox"/>            | There were deviations from the technical specifications ascertained                                                      |
| <input type="checkbox"/>            | This test report is only a partial test report.<br>The content and verdict of the performed test cases are listed below. |

| TC Identifier | Description                       | Verdict    | Date       | Remark |
|---------------|-----------------------------------|------------|------------|--------|
| RF-Testing    | CFR Part 15<br>RSS - 247, Issue 1 | See table! | 2017-03-06 | -/-    |

| Test specification clause                | Test case                                               | Guideline                                          | Temperature conditions | Power source voltages | Mode      | C                                   | NC                       | NA                       | NP                       | Remark |
|------------------------------------------|---------------------------------------------------------|----------------------------------------------------|------------------------|-----------------------|-----------|-------------------------------------|--------------------------|--------------------------|--------------------------|--------|
| §15.247(b)(4)<br>RSS - 247 / 5.4 (4)     | Antenna gain                                            | -/-                                                | Nominal                | Nominal               | DSSS      |                                     | -/-                      |                          |                          | -/-    |
| RSS - 247 / 6.0                          | Duty cycle                                              | -/-                                                | Nominal                | Nominal               | DSSS OFDM |                                     | -/-                      |                          |                          | -/-    |
| §15.247(e)<br>RSS - 247 / 5.2 (2)        | Power spectral density                                  | KDB 558074<br>DTS clause: 10.2                     | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.247(a)(2)<br>RSS - 247 / 5.2 (1)     | DTS bandwidth                                           | KDB 558074<br>DTS clause: 8.1                      | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| RSS Gen clause 4.6.1                     | Occupied bandwidth                                      | -/-                                                | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.247(b)(3)<br>RSS - 247 / 5.4 (4)     | Maximum output power                                    | KDB 558074<br>DTS clause: 9.1.2                    | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.247(d)<br>RSS - 247 / 5.5            | Detailed spurious emissions @ the band edge - conducted | -/-                                                | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.205<br>RSS - 247 / 5.5<br>RSS - Gen  | Band edge compliance conducted and radiated             | KDB 558074<br>DTS clause: 13.3.2 and clause 12.2.2 | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.247(d)<br>RSS - 247 / 5.5            | TX spurious emissions conducted                         | KDB 558074<br>DTS clause: 11.1 & 11.2 11.3         | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.209(a)<br>RSS-Gen                    | TX spurious emissions radiated below 30 MHz             | -/-                                                | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.247(d)<br>RSS - 247 / 5.5<br>RSS-Gen | TX spurious emissions radiated 30 MHz to 1 GHz          | -/-                                                | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.247(d)<br>RSS - 247 / 5.5<br>RSS-Gen | TX spurious emissions radiated above 1 GHz              | -/-                                                | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.109<br>RSS-Gen                       | RX spurious emissions radiated 30 MHz to 1 GHz          | -/-                                                | Nominal                | Nominal               | RX / idle | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.109<br>RSS-Gen                       | RX spurious emissions radiated above 1 GHz              | -/-                                                | Nominal                | Nominal               | RX / idle | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |
| §15.107(a)<br>§15.207                    | Conducted emissions < 30 MHz                            | -/-                                                | Nominal                | Nominal               | DSSS OFDM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/-    |

**Note:** C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

**10 Additional comments**

Reference documents: None

Special test descriptions: None

Configuration descriptions: Power settings versus modulation (data rate):

| Modulation     | Power setting |
|----------------|---------------|
| b-mode (1Mbit) | 13000         |
| g-mode (6Mbit) | 18000         |
| n-mode (MCS0)  | 18000         |

Test mode: ☐ No test mode available.  
Iperf was used to ping another device with the largest support packet size

☒ Special software is used.  
EUT is transmitting pseudo random data by itself

Antennas and transmit  
operating modes:

- ☒ Operating mode 1 (single antenna)
- Equipment with 1 antenna,
  - Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,
  - Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)
- ☐ Operating mode 2 (multiple antennas, no beamforming)
- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.
- ☐ Operating mode 3 (multiple antennas, with beamforming)
- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming.  
In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.

## 11 Measurement results

### 11.1 Antenna gain

#### Measurement:

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the DSSS mode is used.

#### Measurement parameters:

| Measurement parameter    |                                 |
|--------------------------|---------------------------------|
| Detector:                | Peak                            |
| Sweep time:              | Auto                            |
| Resolution bandwidth:    | 3 MHz                           |
| Video bandwidth:         | 3 MHz                           |
| Trace mode:              | Max hold                        |
| Test setup:              | See sub clause 6.2 – A; 6.4 - A |
| Measurement uncertainty: | See sub clause 8                |

#### Limits:

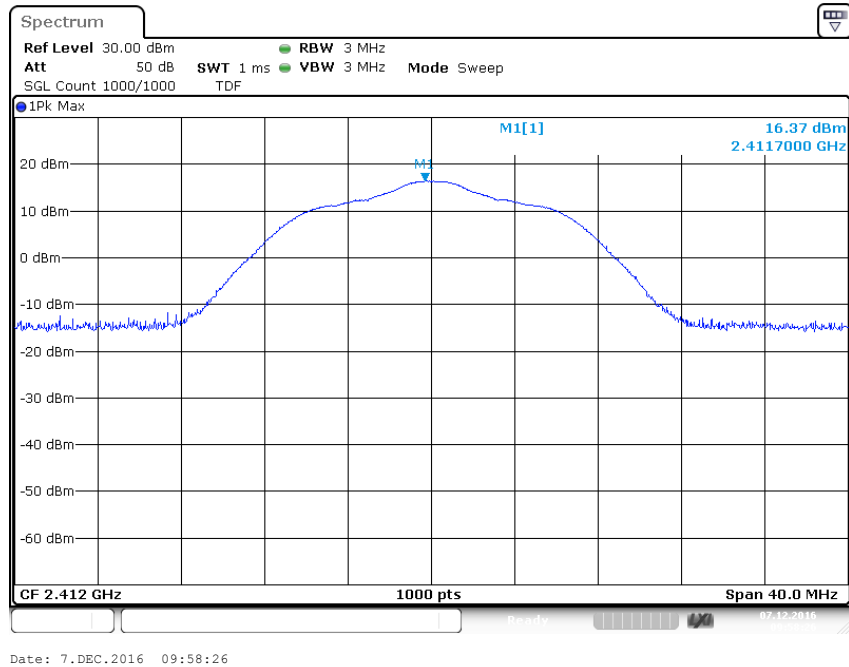
| FCC                                                               | IC |
|-------------------------------------------------------------------|----|
| 6 dBi / > 6 dBi output power and power density reduction required |    |

#### Results:

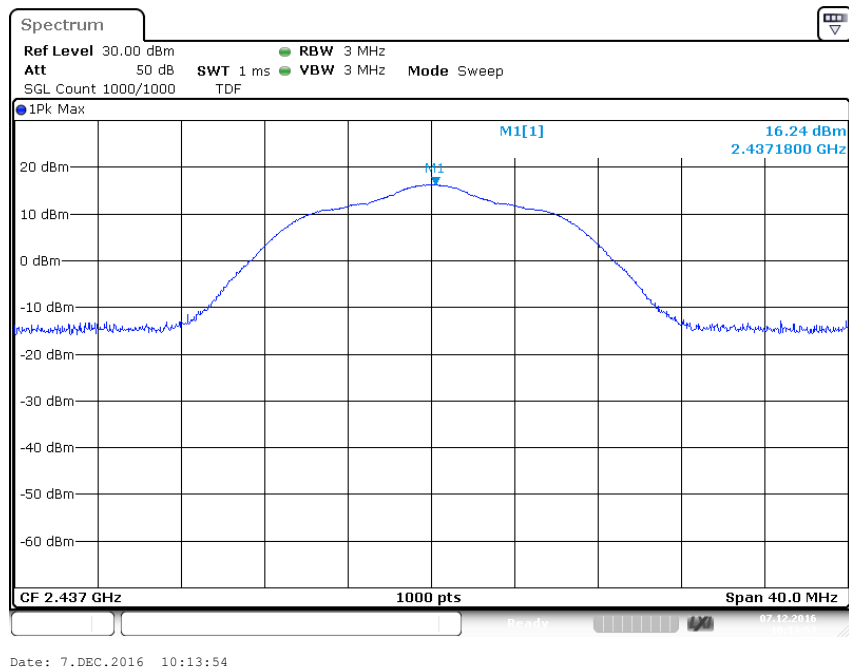
| T <sub>nom</sub>                                       | V <sub>nom</sub> | lowest<br>channel<br>2412 MHz | middle<br>channel<br>2437 MHz | highest<br>channel<br>2462 MHz |
|--------------------------------------------------------|------------------|-------------------------------|-------------------------------|--------------------------------|
| Conducted power [dBm]<br>Measured with DSSS modulation |                  | 16.4                          | 16.2                          | 15.7                           |
| Radiated power [dBm]<br>Measured with DSSS modulation  |                  | 17.8                          | 17.9                          | 17.6                           |
| Gain [dBi]<br>Calculated                               |                  | 1.4                           | 1.7                           | 1.9                            |

**Plots:** DSSS / b – mode

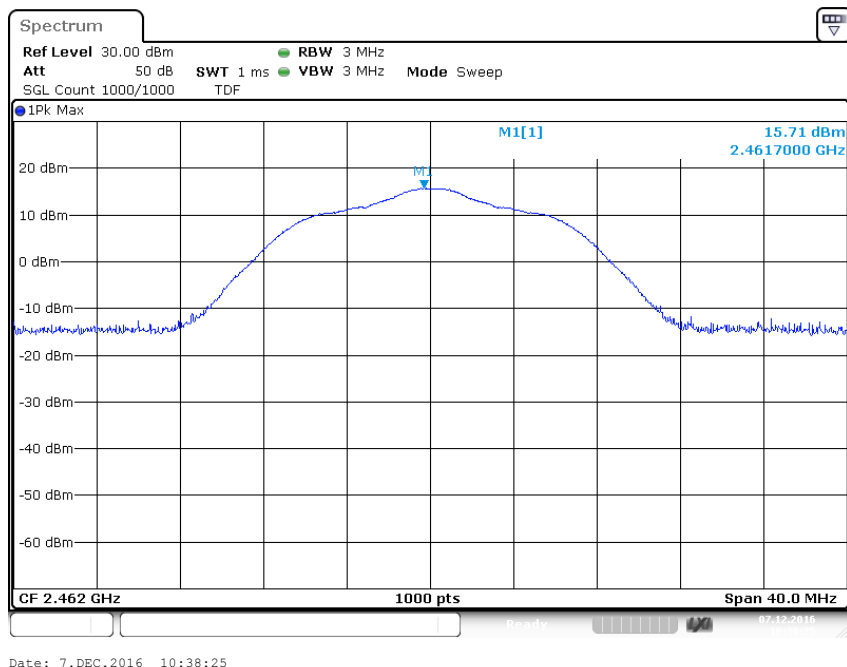
**Plot 1:** Lowest channel



**Plot 2:** Middle channel



**Plot 3: Highest channel**



## 11.2 Identify worst case data rate

### Results:

| Modulation           | Modulation scheme / bandwidth |
|----------------------|-------------------------------|
| DSSS / b – mode      | 1 Mbit/s                      |
| OFDM / g – mode      | 6 Mbit/s                      |
| OFDM / n HT20 – mode | MCS0                          |

### 11.3 Maximum output power

#### Description:

Measurement of the maximum output power conducted and radiated. The measurements are performed using the data rate producing the highest conducted output power.

#### Measurement:

| Measurement parameter          |                        |
|--------------------------------|------------------------|
| According to DTS clause: 9.1.2 |                        |
| Peak power meter               |                        |
| Test setup:                    | See sub clause 6.4 – A |
| Measurement uncertainty        | See sub clause 8       |

#### Limits:

| FCC                                             | IC |
|-------------------------------------------------|----|
| Conducted: 1.0 W – Antenna gain with max. 6 dBi |    |

#### Results:

| Frequency                                      | Maximum Output Power [dBm] |          |          |
|------------------------------------------------|----------------------------|----------|----------|
|                                                | 2412 MHz                   | 2437 MHz | 2462 MHz |
| Output power conducted<br>DSSS / b – mode      | 18.8                       | 19.1     | 18.6     |
| Output power conducted<br>OFDM / g – mode      | 21.5                       | 21.7     | 21.1     |
| Output power conducted<br>OFDM / n HT20 – mode | 21.5                       | 21.7     | 21.1     |

## 11.4 Duty cycle

### Measurement:

### Measurement parameters:

| Measurement parameter    |                                |
|--------------------------|--------------------------------|
| Detector:                | Peak                           |
| Sweep time:              | Depends on the signal see plot |
| Resolution bandwidth:    | 10 MHz                         |
| Video bandwidth:         | 10 MHz                         |
| Trace mode:              | Max hold                       |
| Test setup:              | See sub clause 6.4 - A         |
| Measurement uncertainty: | See sub clause 8               |

### Limits:

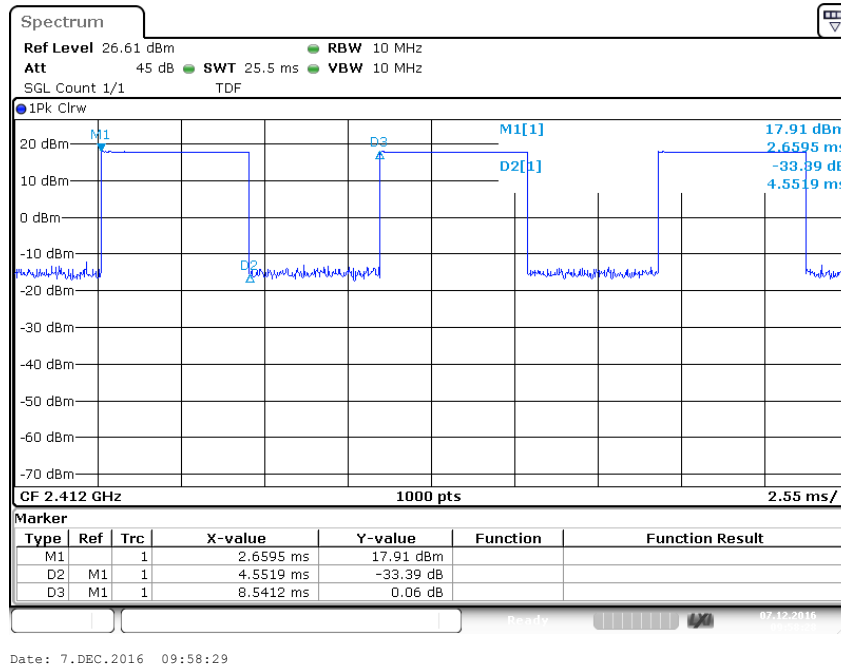
| FCC | IC |
|-----|----|
| -/- |    |

### Results:

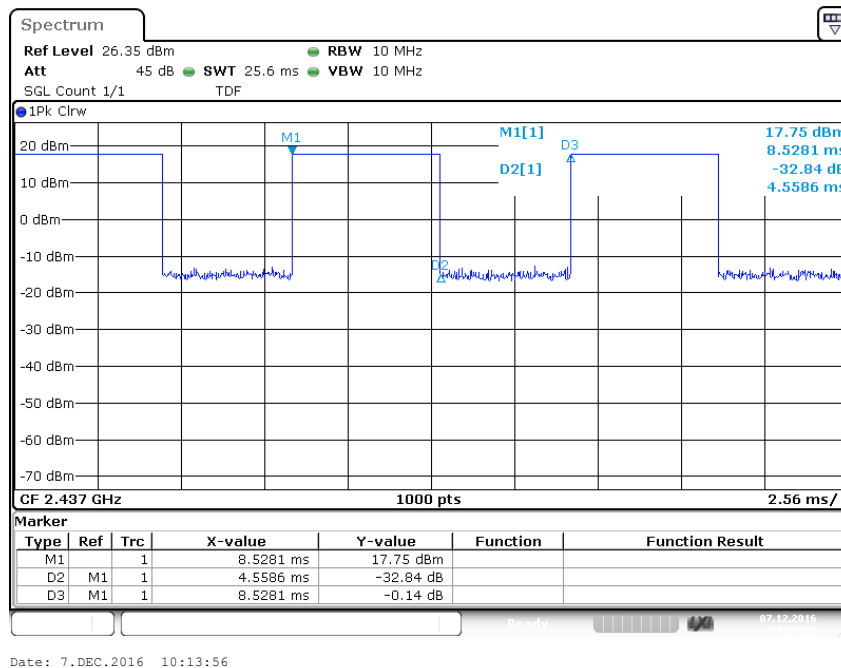
| T <sub>nom</sub>     | V <sub>nom</sub> | lowest<br>channel<br>2412 MHz | middle<br>channel<br>2437 MHz | highest<br>channel<br>2462 MHz |
|----------------------|------------------|-------------------------------|-------------------------------|--------------------------------|
| DSSS / b – mode      |                  | 53.3 % / 2.73 dB              | 53.5 % / 2.72 dB              | 53.5 % / 2.72 dB               |
| OFDM / g – mode      |                  | 16.2 % / 7.90 dB              | 15.9 % / 7.98 dB              | 16.0 % / 7.97 dB               |
| OFDM / n HT20 – mode |                  | 15.3 % / 8.15 dB              | 15.3 % / 8.15 dB              | 15.4 % / 8.14 dB               |

**Plots:** DSSS / b – mode

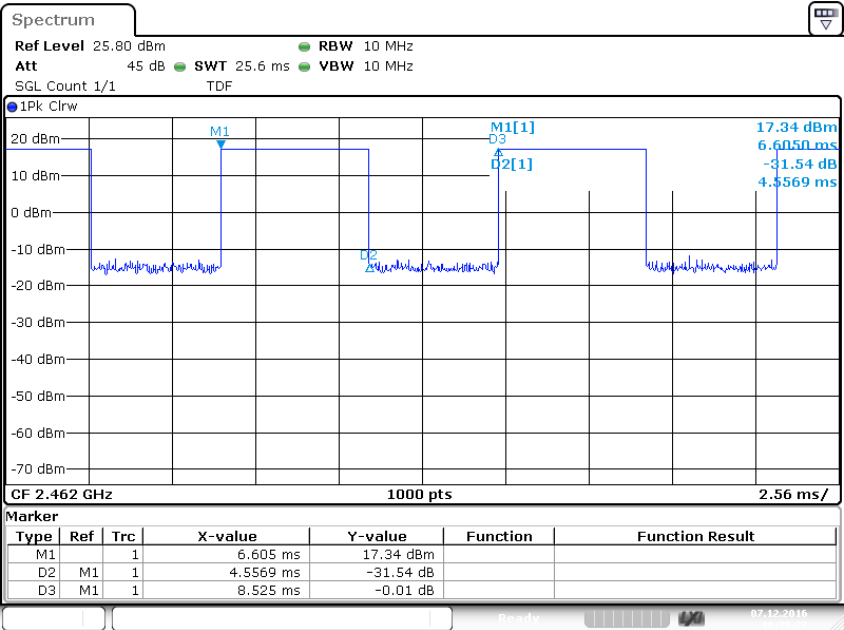
**Plot 1:** Lowest channel



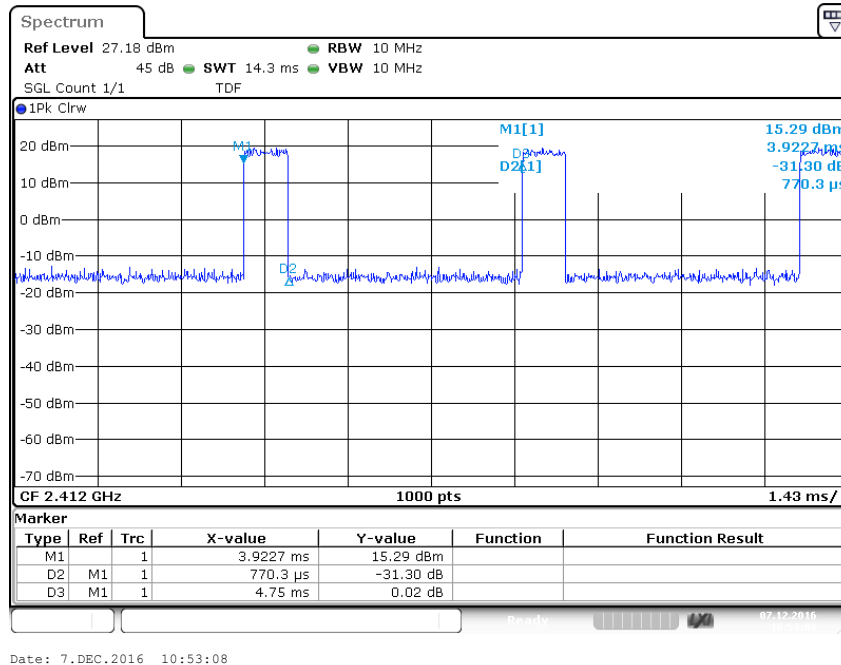
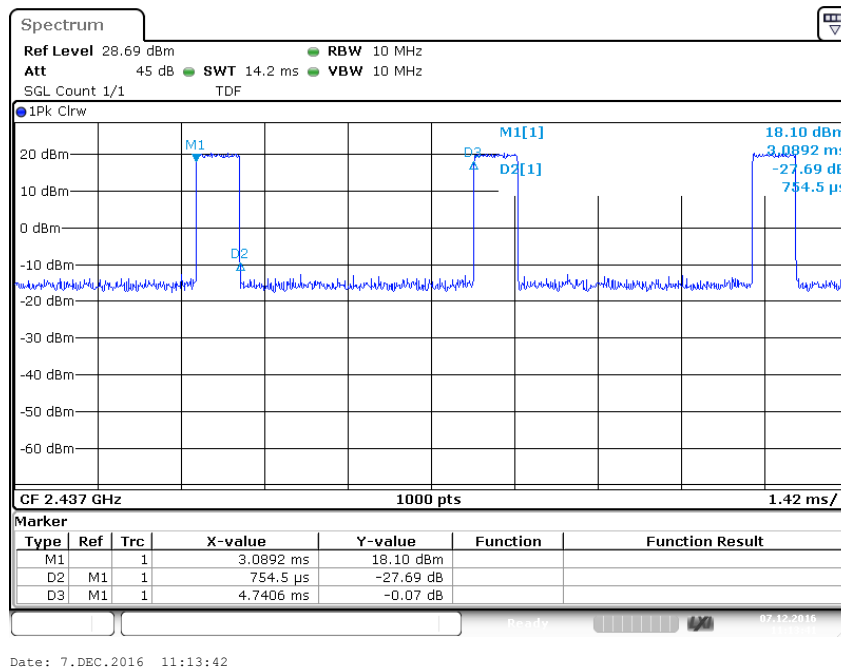
**Plot 2:** Middle channel



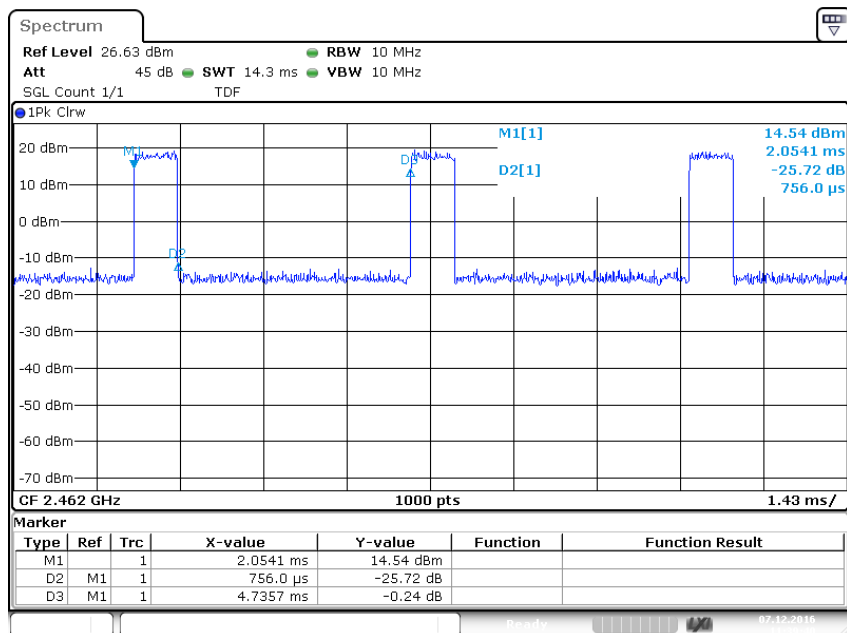
Plot 3: Highest channel



Date: 7.DEC.2016 10:38:28

**Plots:** OFDM / g – mode**Plot 1:** Lowest channel**Plot 2:** Middle channel

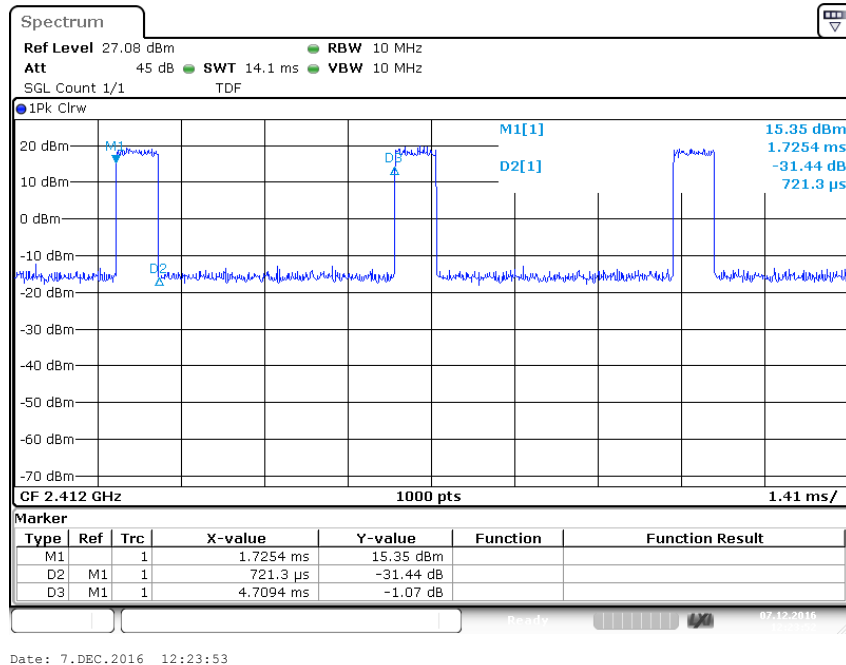
**Plot 3: Highest channel**



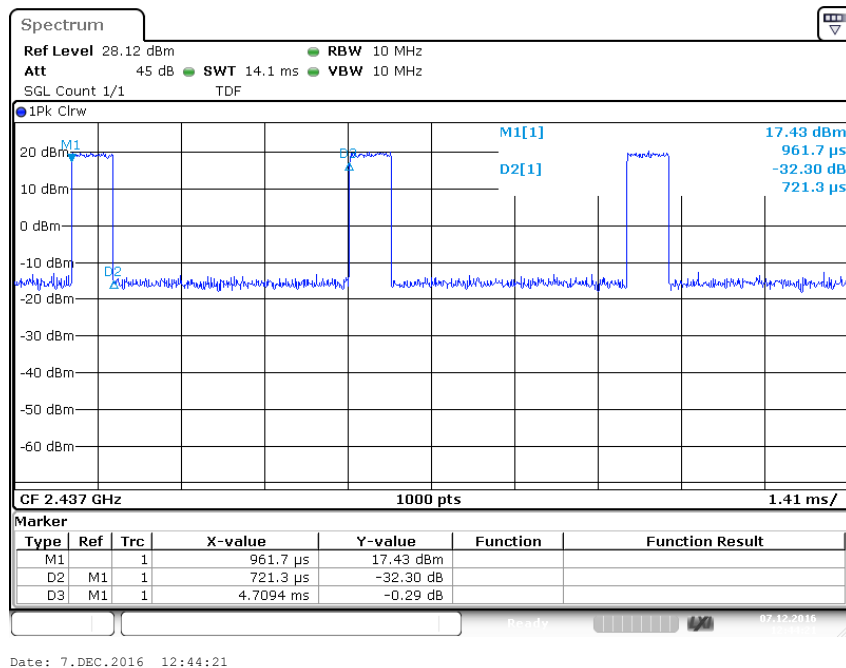
Date: 7.DEC.2016 11:39:40

**Plots:** OFDM / n HT20 – mode

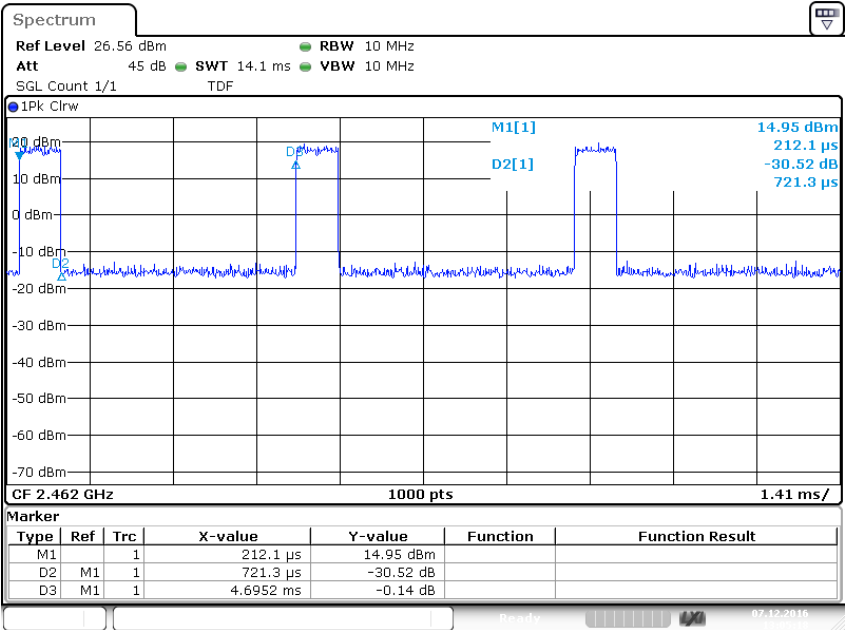
**Plot 1:** Lowest channel



**Plot 2:** Middle channel



Plot 3: Highest channel



Date: 7.DEC.2016 13:05:18

## 11.5 Peak power spectral density

### Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated for both modulations at the lowest, middle and highest channel.

### Measurement:

| Measurement parameter         |                                           |
|-------------------------------|-------------------------------------------|
| According to DTS clause: 10.2 |                                           |
| Detector:                     | Positive Peak                             |
| Sweep time:                   | Auto                                      |
| Resolution bandwidth:         | 100 kHz                                   |
| Video bandwidth:              | 300 kHz                                   |
| Span:                         | 30 MHz                                    |
| Trace mode:                   | Max hold (allow trace to fully stabilize) |
| Test setup:                   | See sub clause 6.4 – A                    |
| Measurement uncertainty       | See sub clause 8                          |

### Limits:

| FCC                      | IC |
|--------------------------|----|
| 8 dBm / 3kHz (conducted) |    |

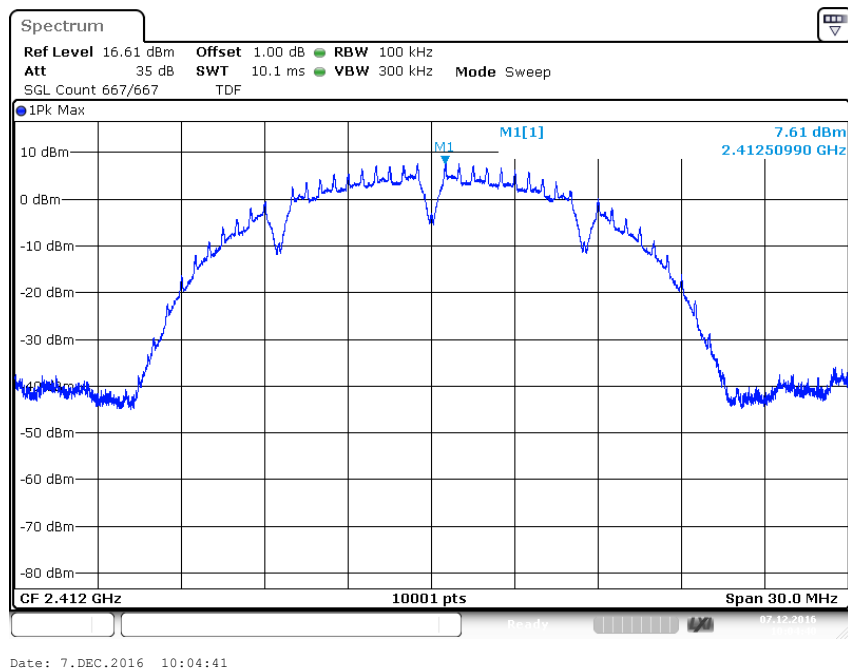
**Results:**

| Modulation<br><br>Frequency | Peak power spectral density [dBm] |          |          |
|-----------------------------|-----------------------------------|----------|----------|
|                             | 2412 MHz                          | 2437 MHz | 2462 MHz |
| DSSS / b – mode             | 7.6                               | 7.9      | 7.5      |
| OFDM / g – mode             | 3.8                               | 6.7      | 3.2      |
| OFDM / n HT20 – mode        | 4.1                               | 6.3      | 3.6      |

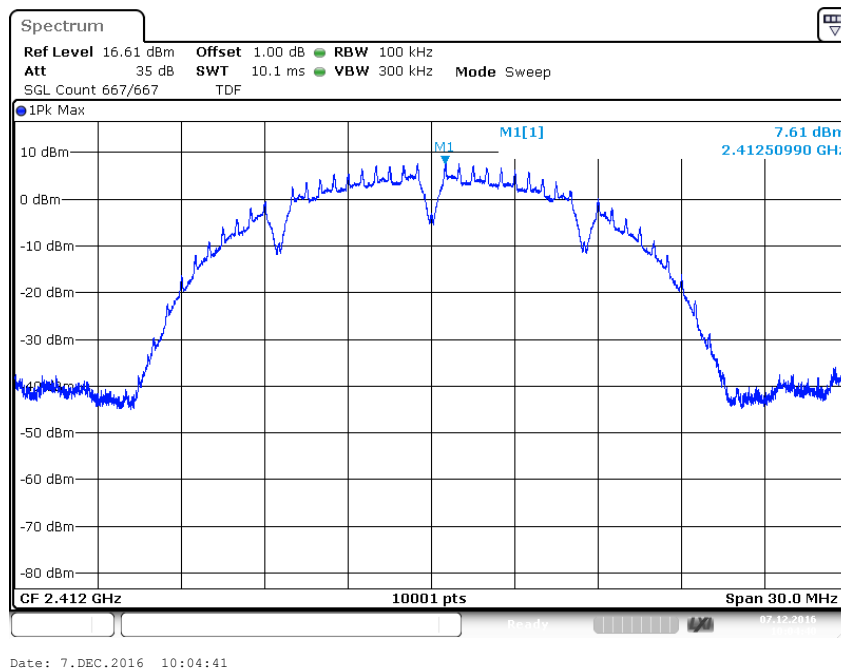
Note 1: Measured worst case with 100 kHz RBW instead of 3 kHz RBW.

**Plots:** DSSS / b – mode

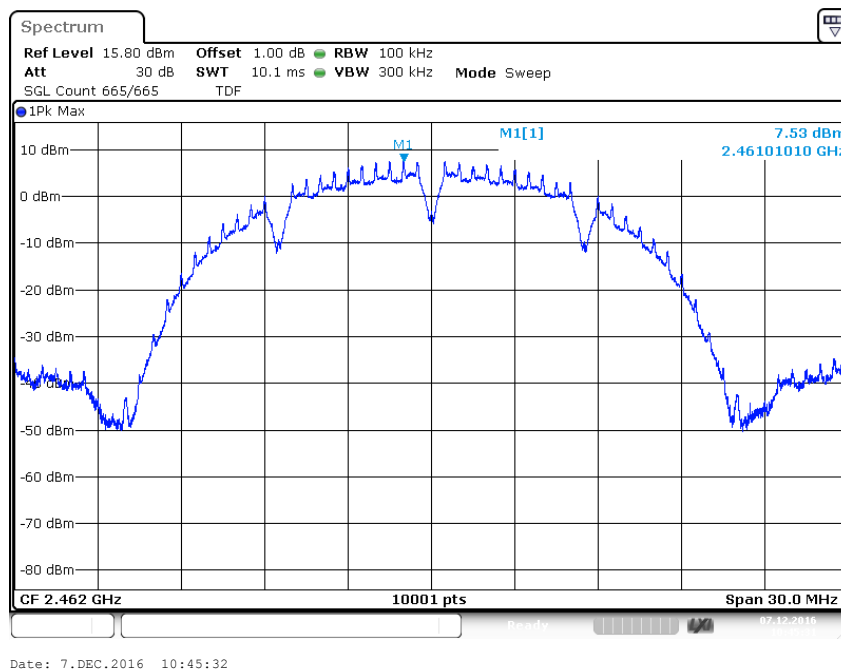
**Plot 1:** Lowest channel



**Plot 2: Middle channel**

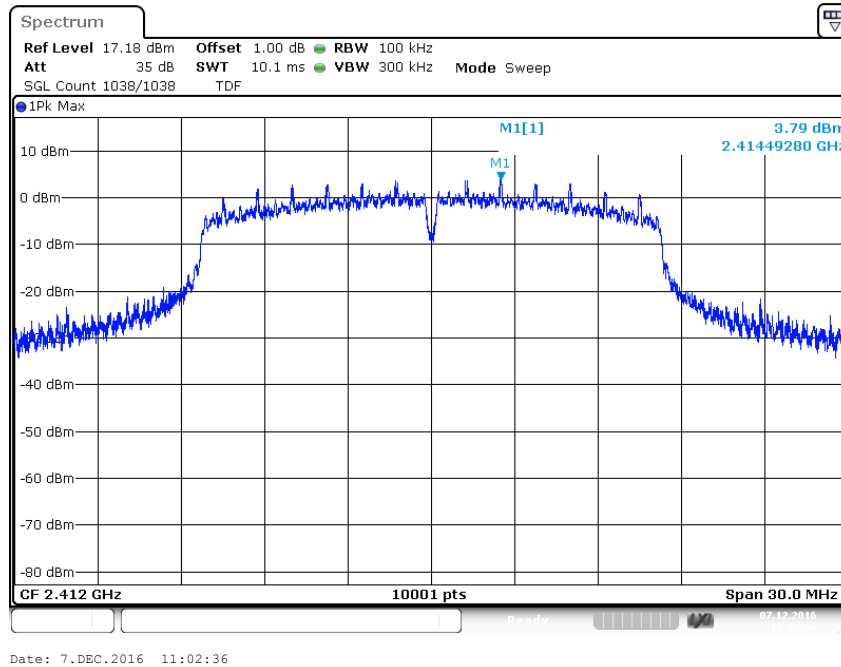


**Plot 3: Highest channel**

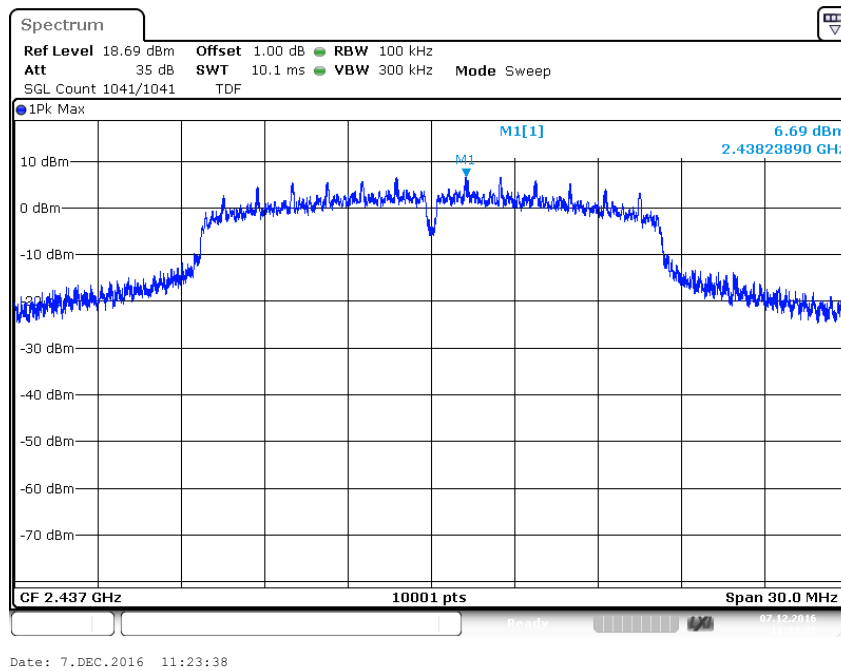


**Plots:** OFDM / g – mode

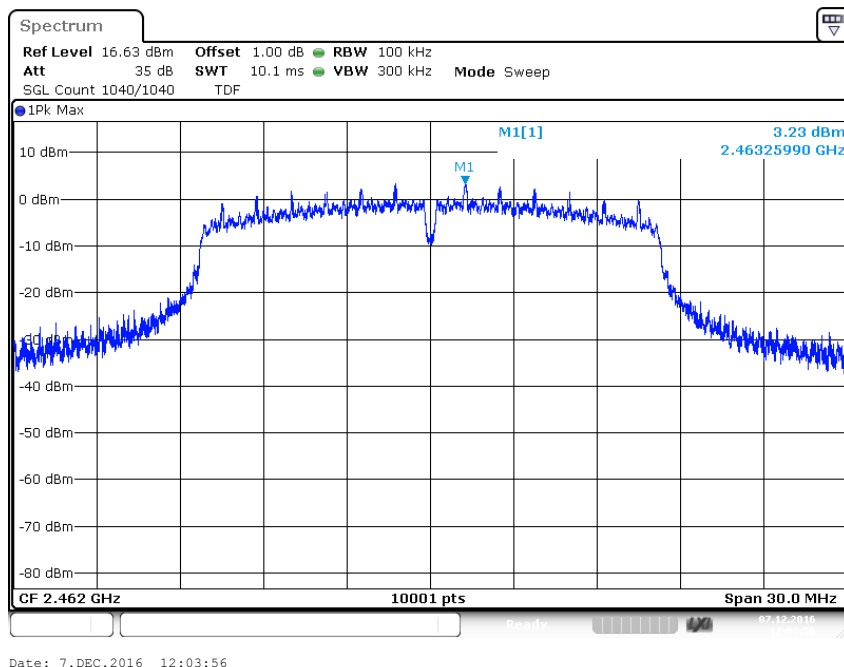
**Plot 1:** Lowest channel



**Plot 2:** Middle channel

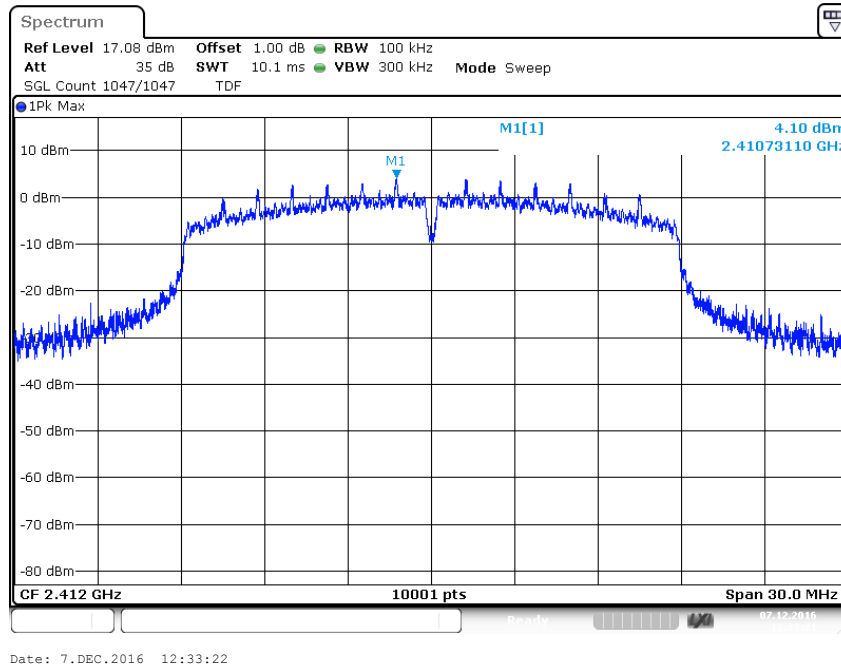


**Plot 3: Highest channel**

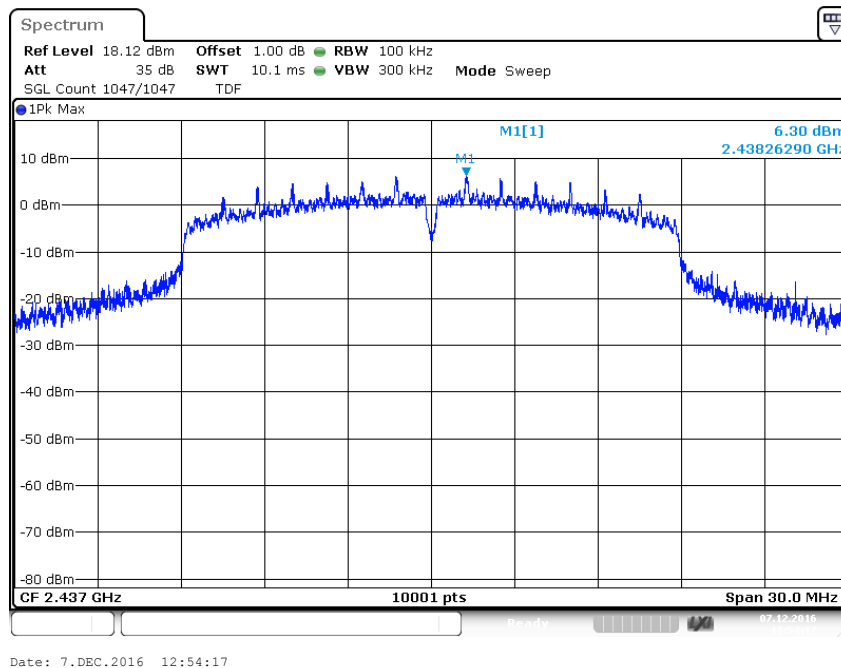


**Plots:** OFDM / n HT20 – mode

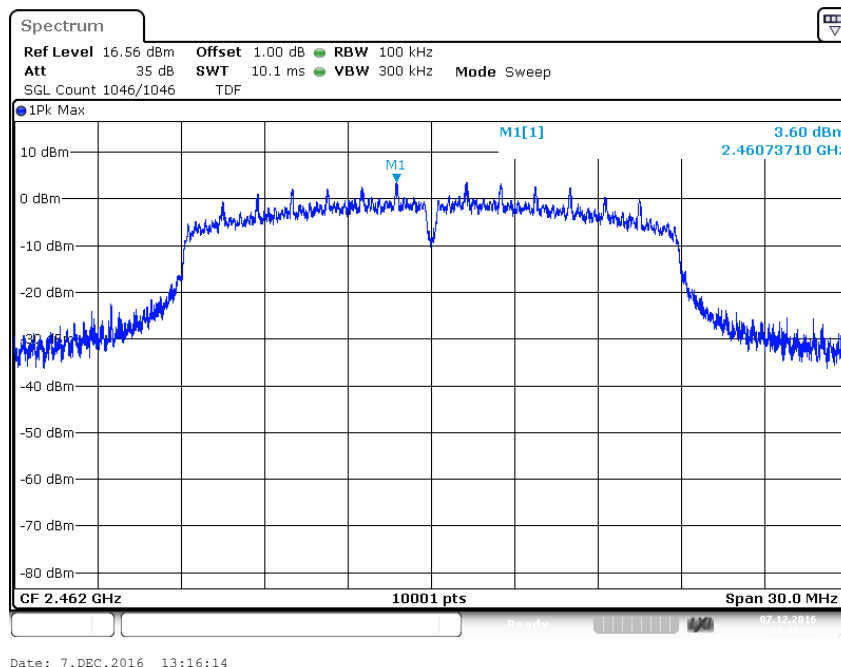
**Plot 1:** Lowest channel



**Plot 2:** Middle channel



**Plot 3: Highest channel**



## 11.6 6 dB DTS bandwidth

### Description:

Measurement of the 6 dB bandwidth of the modulated signal.

### Measurement:

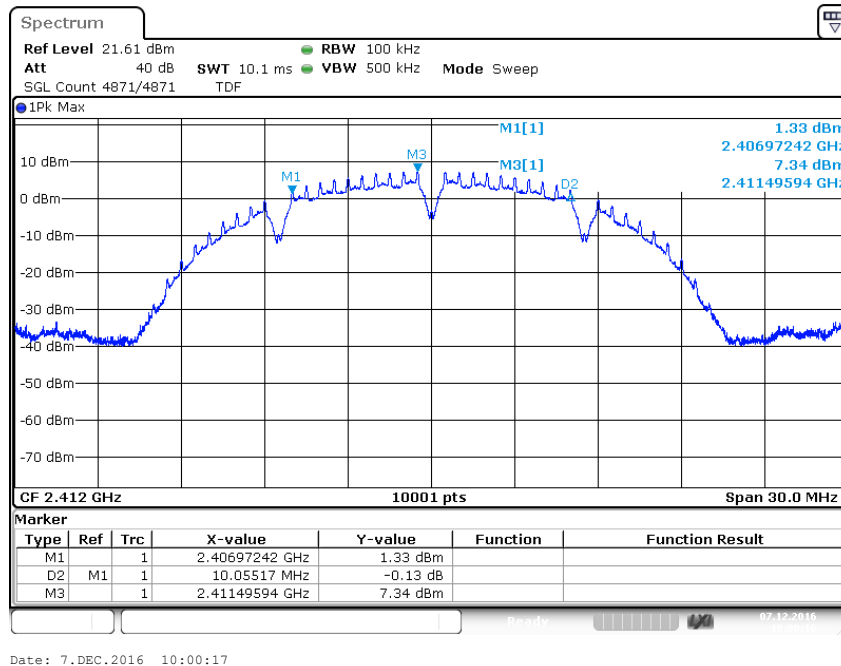
| Measurement parameter        |                              |
|------------------------------|------------------------------|
| According to DTS clause: 8.1 |                              |
| Detector:                    | Peak                         |
| Sweep time:                  | Auto                         |
| Resolution bandwidth:        | 100 kHz                      |
| Video bandwidth:             | 500 kHz                      |
| Span:                        | 30 MHz / 50 MHz              |
| Trace mode:                  | Single count with 200 counts |
| Test setup:                  | See sub clause 6.4 – A       |
| Measurement uncertainty      | See sub clause 8             |

### Limits:

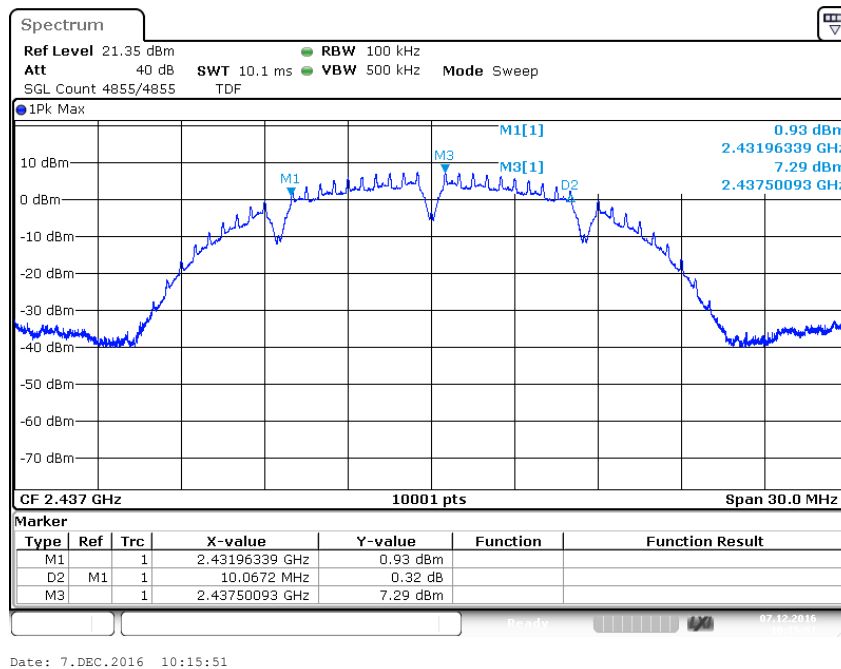
| FCC                                                                                                                                           | IC |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----|
| Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band.<br>The minimum 6 dB bandwidth shall be at least 500 kHz. |    |

**Results:**

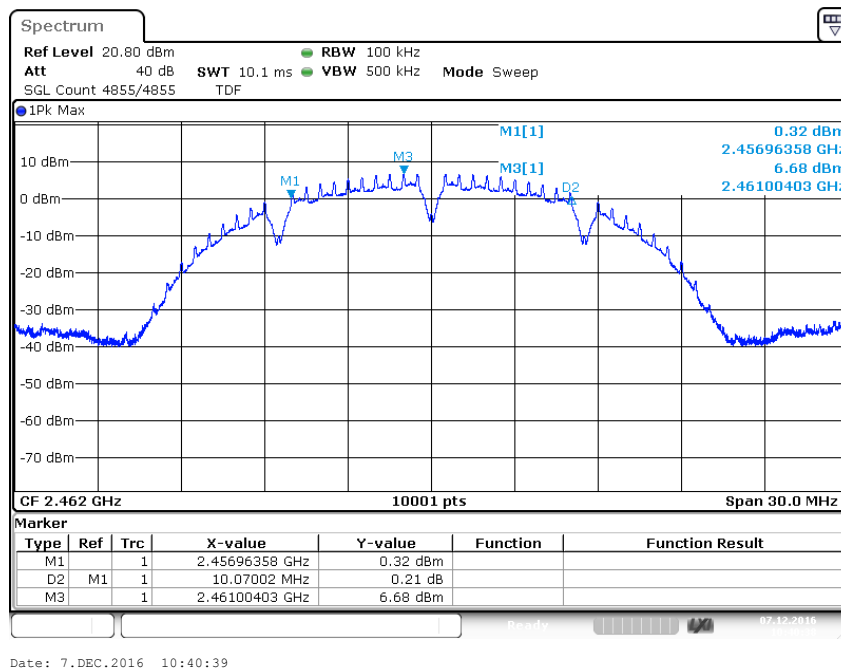
| Frequency            | 6 dB DTS bandwidth [kHz] |          |          |
|----------------------|--------------------------|----------|----------|
|                      | 2412 MHz                 | 2437 MHz | 2462 MHz |
| DSSS / b – mode      | 10055                    | 10067    | 10070    |
| OFDM / g – mode      | 15100                    | 15100    | 15106    |
| OFDM / n HT20 – mode | 15100                    | 15100    | 15101    |

**Plots:** DSSS / b – mode**Plot 1:** Lowest channel

## Plot 2: Middle channel

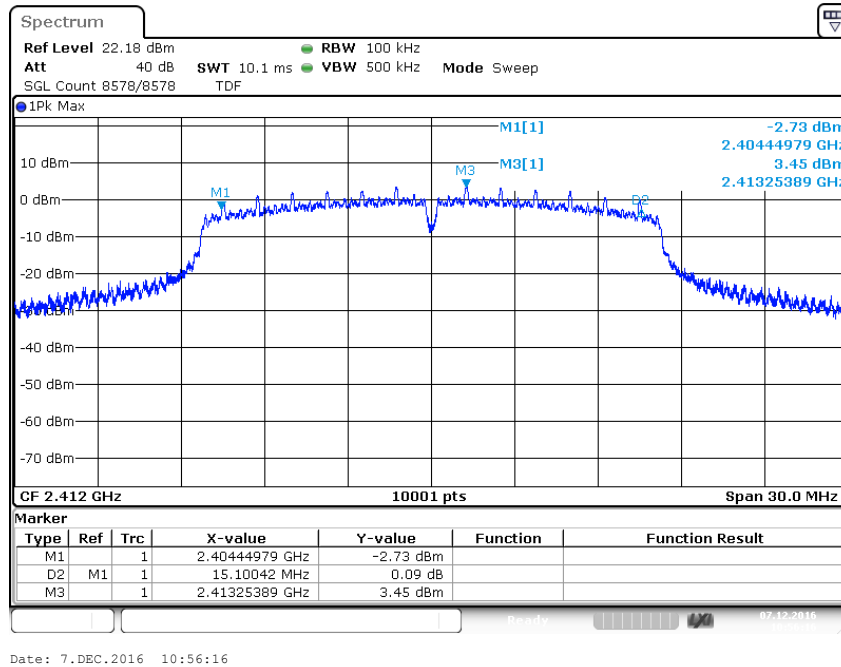


## Plot 3: Highest channel

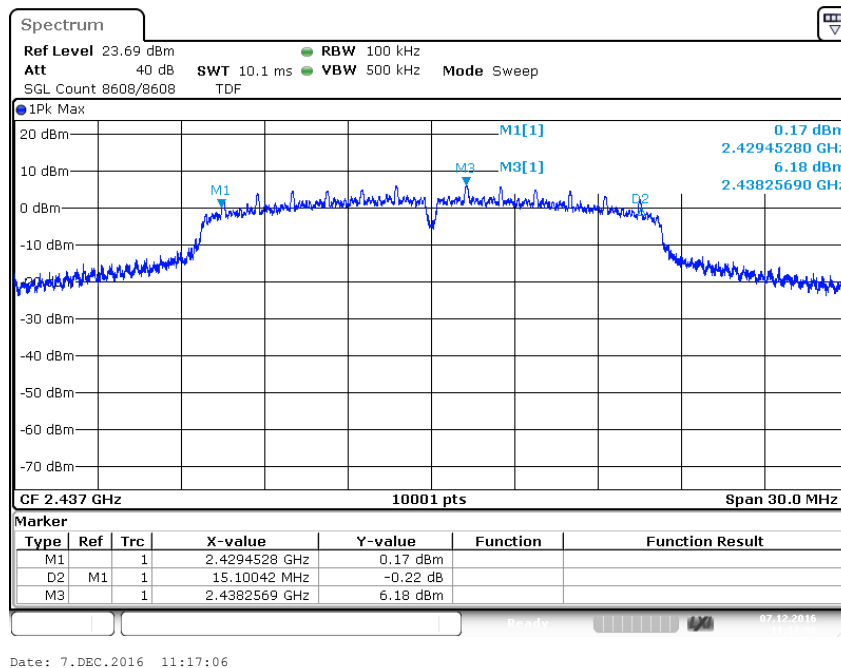


**Plots:** OFDM / g – mode

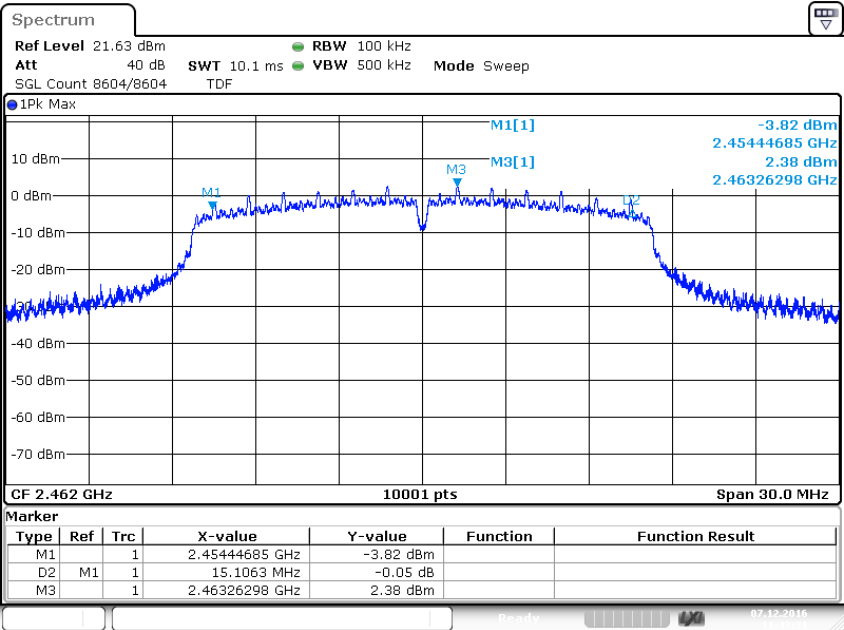
**Plot 1:** Lowest channel



**Plot 2:** Middle channel



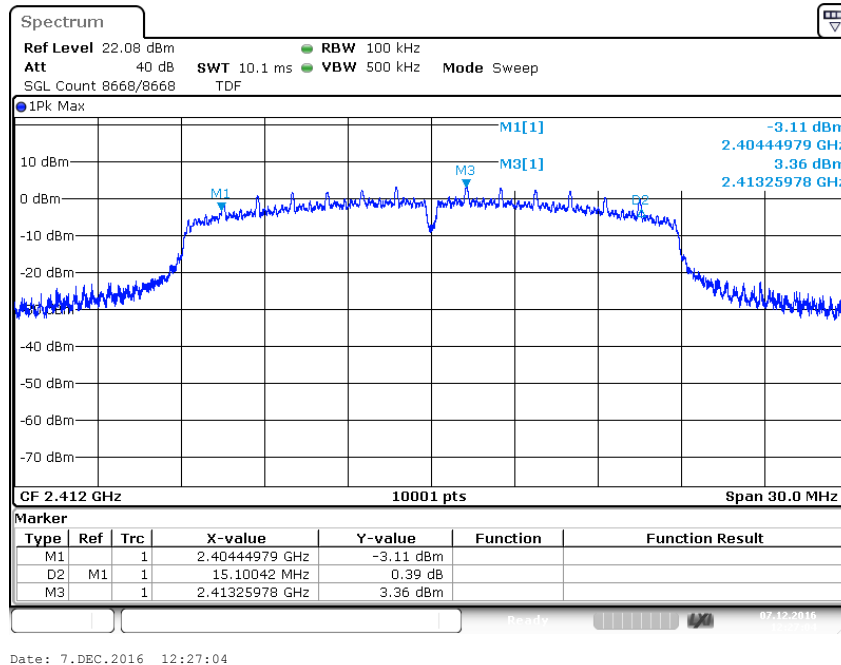
Plot 3: Highest channel



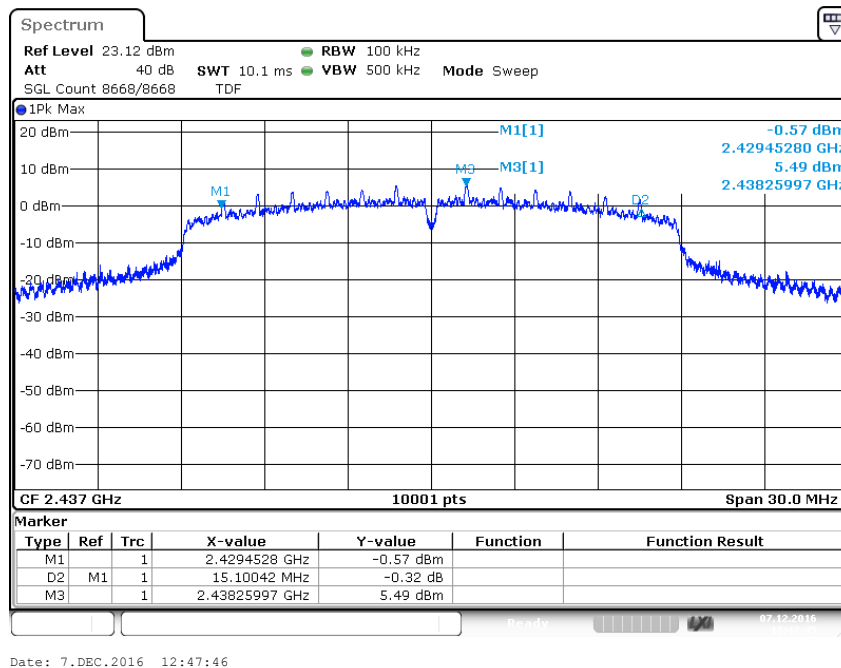
Date: 7.DEC.2016 11:43:32

**Plots:** OFDM / n HT20 – mode

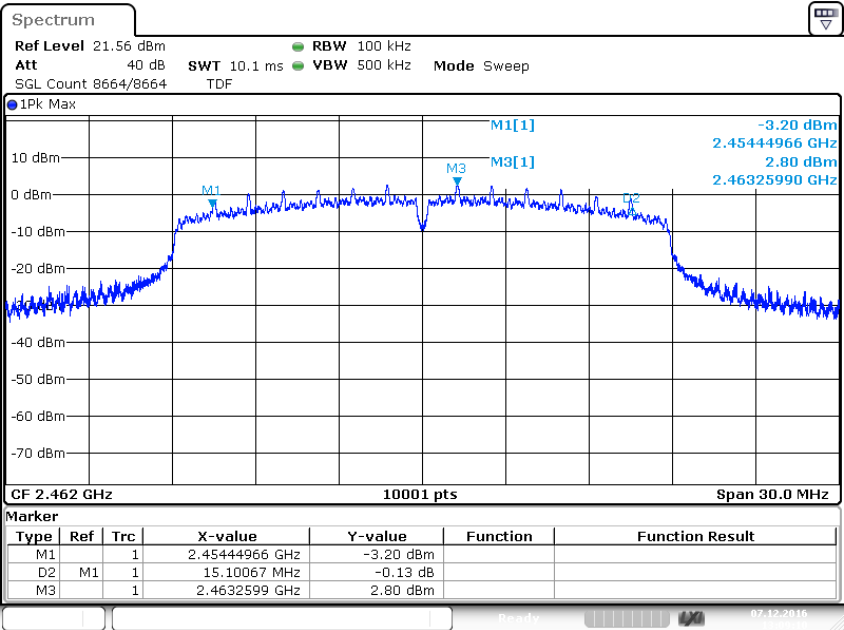
**Plot 1:** Lowest channel



**Plot 2:** Middle channel



Plot 3: Highest channel



Date: 7.DEC.2016 13:09:11

**11.7 Occupied bandwidth – 99% emission bandwidth****Description:**

Measurement of the 99% bandwidth of the modulated signal acc. RSS-GEN.

**Measurement:**

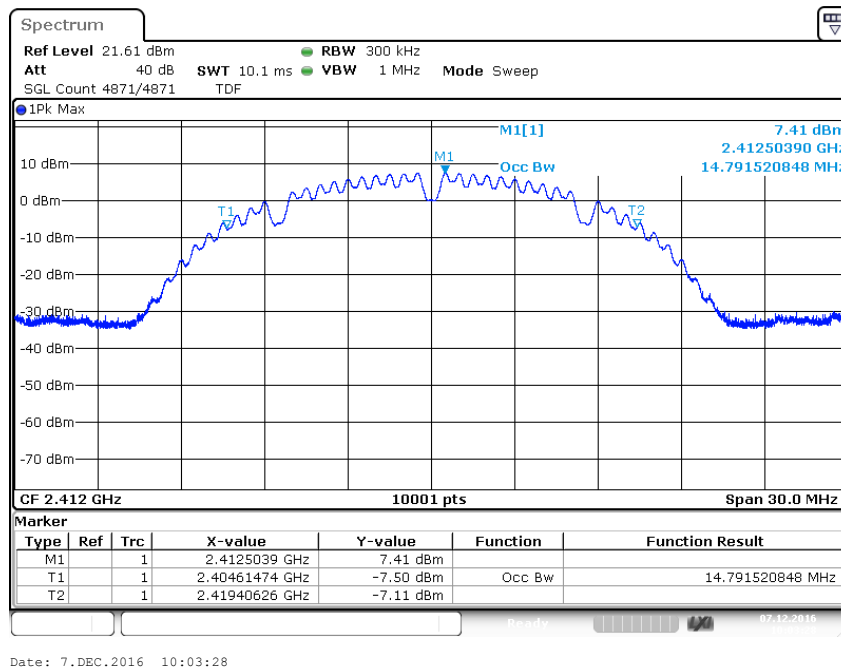
| Measurement parameter   |                                                                                 |
|-------------------------|---------------------------------------------------------------------------------|
| Detector:               | Peak                                                                            |
| Sweep time:             | Auto                                                                            |
| Resolution bandwidth:   | 300 kHz                                                                         |
| Video bandwidth:        | 1 MHz                                                                           |
| Span:                   | 30 MHz / 50 MHz                                                                 |
| Measurement procedure:  | Measurement of the 99% bandwidth using the integration function of the analyzer |
| Trace mode:             | Single count with 200 counts                                                    |
| Test setup:             | See sub clause 6.4 – A                                                          |
| Measurement uncertainty | See sub clause 8                                                                |

**Usage:**

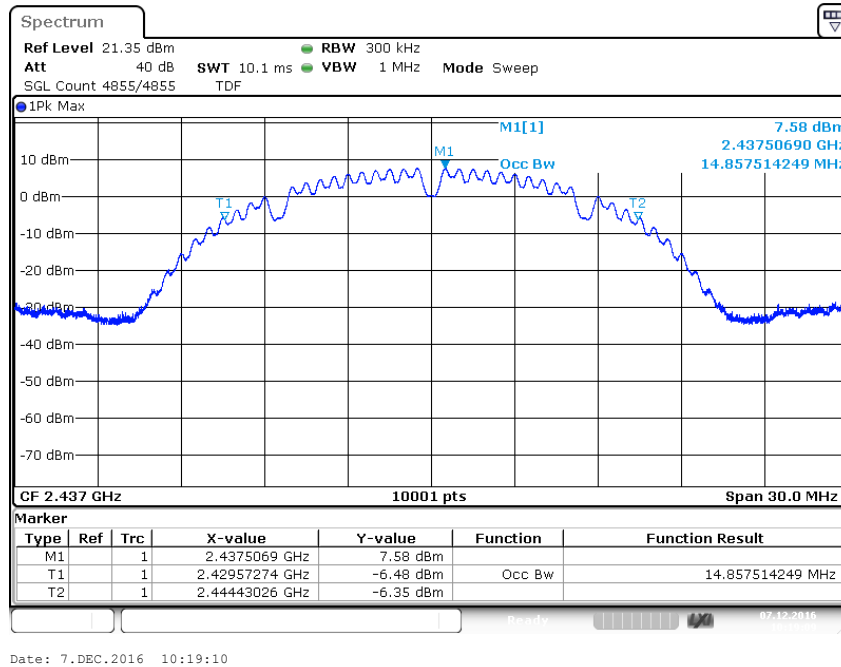
| -/-                                      | IC |
|------------------------------------------|----|
| OBW is necessary for Emission Designator |    |

**Results:**

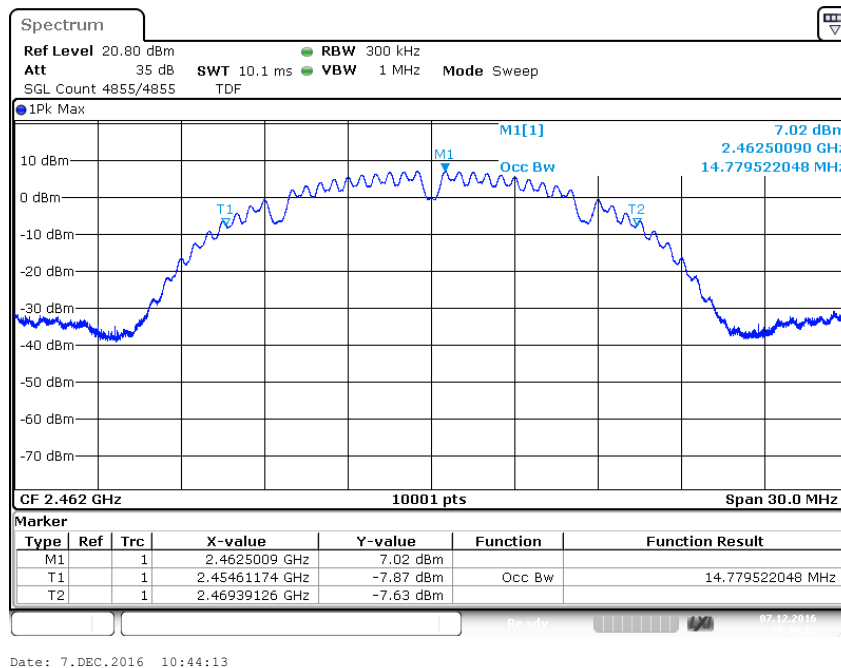
| Modulation<br><br>Frequency | 99% bandwidth [kHz] |          |          |
|-----------------------------|---------------------|----------|----------|
|                             | 2412 MHz            | 2437 MHz | 2462 MHz |
| DSSS / b – mode             | 14792               | 14858    | 14780    |
| OFDM / g – mode             | 16561               | 18592    | 16474    |
| OFDM / n HT20 – mode        | 17620               | 18364    | 17596    |

**Plots:** DSSS / b – mode**Plot 1:** Lowest channel

Plot 2: Middle channel

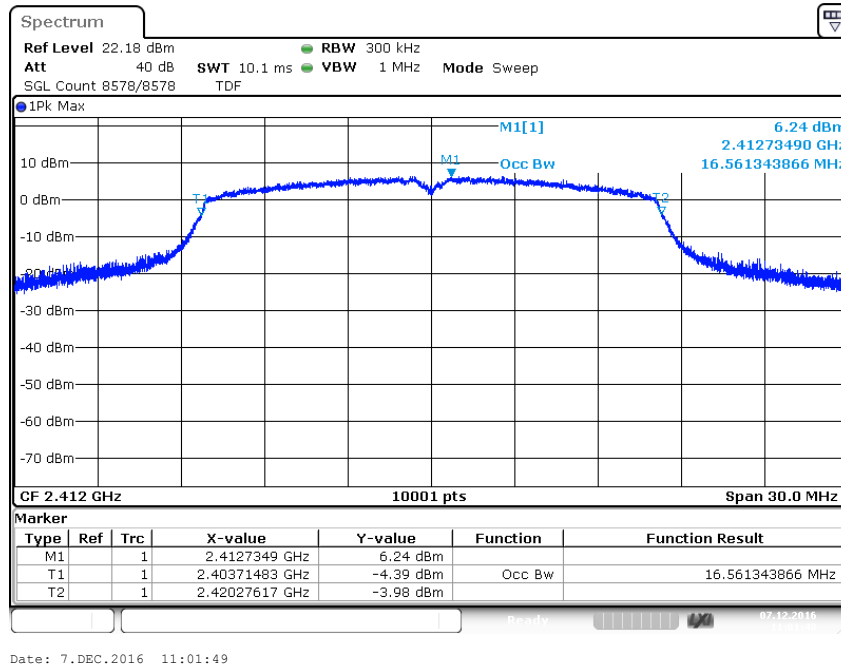


Plot 3: Highest channel

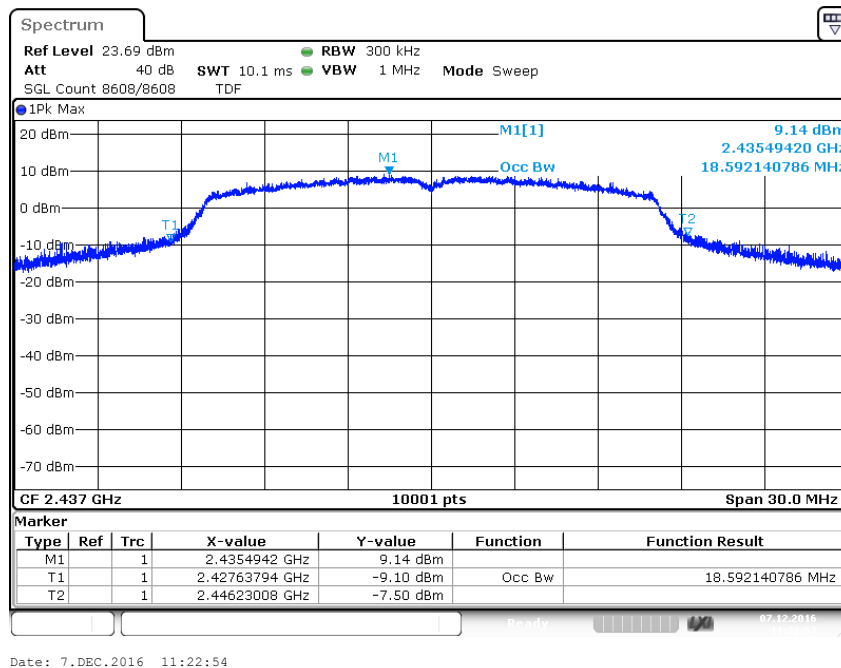


**Plots:** OFDM / g – mode

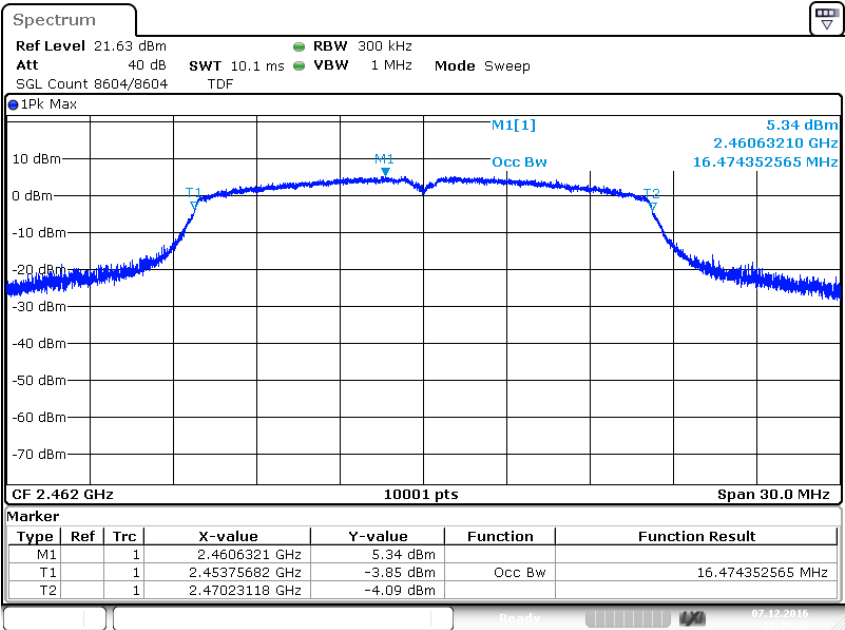
**Plot 1:** Lowest channel



**Plot 2:** Middle channel



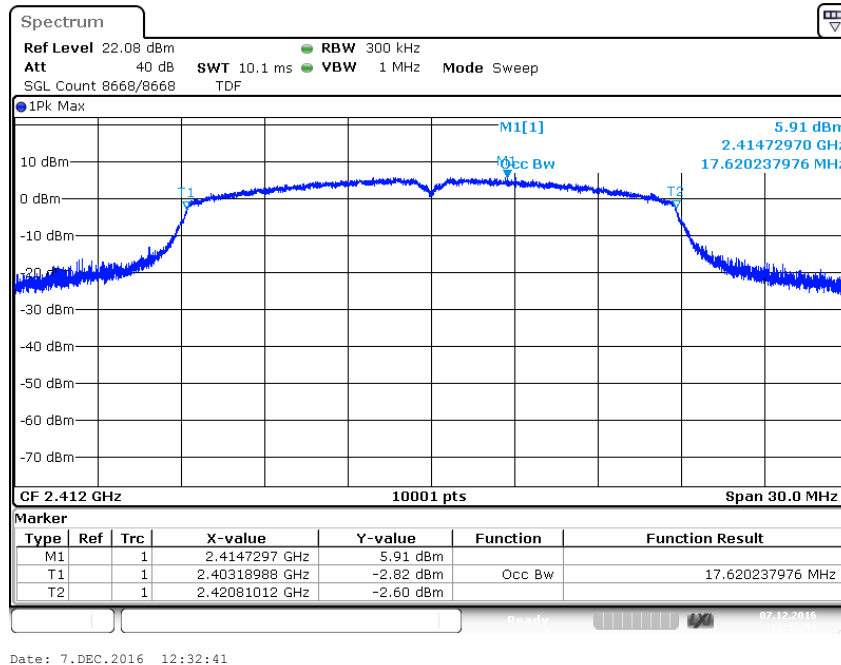
Plot 3: Highest channel



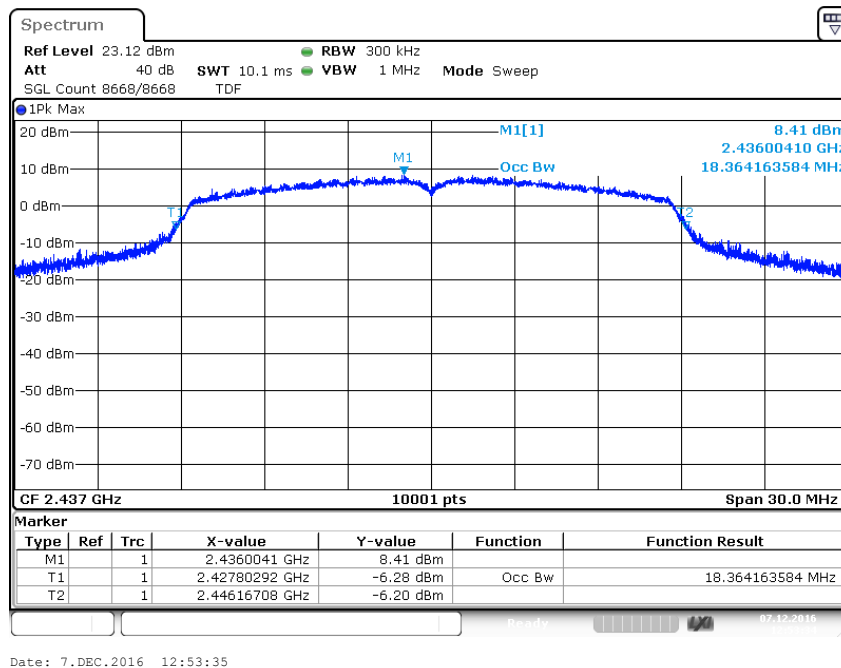
Date: 7.DEC.2016 11:49:47

**Plots:** OFDM / n HT20 – mode

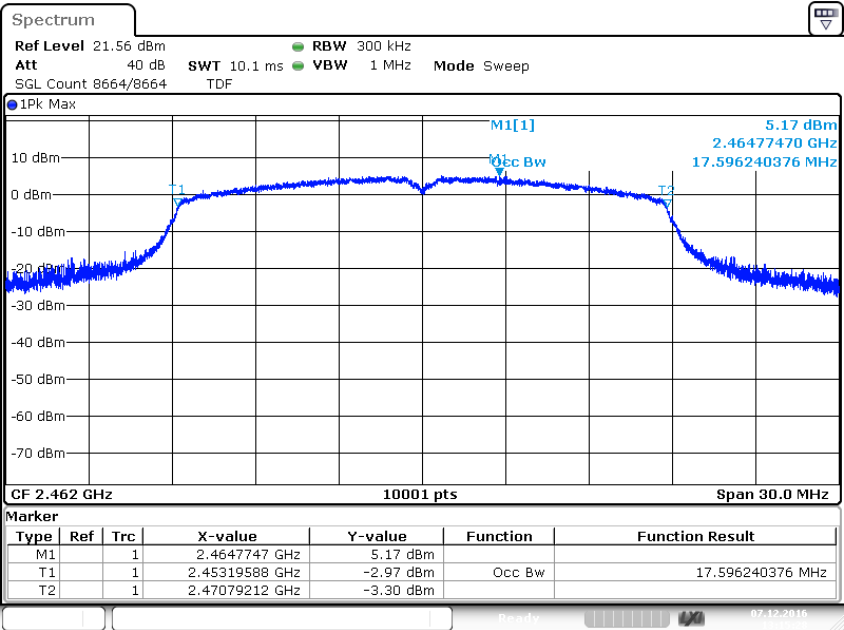
**Plot 1:** Lowest channel



**Plot 2:** Middle channel



Plot 3: Highest channel



Date: 7.DEC.2016 13:15:28

## 11.8 Occupied bandwidth – 20 dB bandwidth

### Description:

Measurement of the 20 dB bandwidth of the modulated carrier.

### Measurement:

| Measurement parameter   |                                   |
|-------------------------|-----------------------------------|
| Detector:               | Peak                              |
| Sweep time:             | Auto                              |
| Resolution bandwidth:   | 100 kHz                           |
| Video bandwidth:        | 500 kHz                           |
| Span:                   | 30 MHz / 50 MHz                   |
| Trace mode:             | Single count with min. 200 counts |
| Test setup:             | See sub clause 6.4 – A            |
| Measurement uncertainty | See sub clause 8                  |

### Usage:

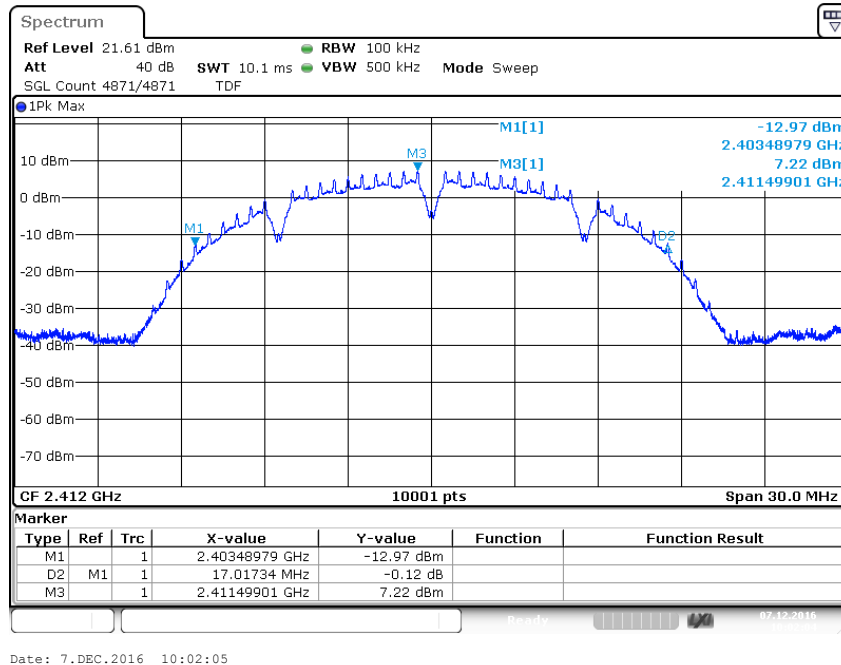
| -/-                   | IC |
|-----------------------|----|
| Within the used band! |    |

### Results:

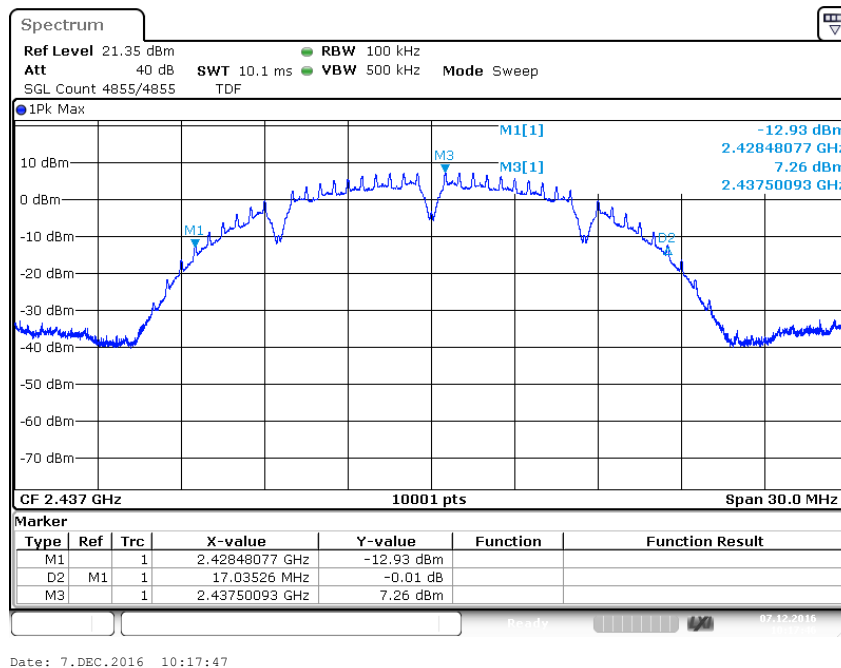
| Modulation<br>Frequency | 20 dB bandwidth [MHz] |          |          |
|-------------------------|-----------------------|----------|----------|
|                         | 2412 MHz              | 2437 MHz | 2462 MHz |
| DSSS / b – mode         | 17.02                 | 17.04    | 17.04    |
| OFDM / g – mode         | 17.17                 | 19.76    | 17.13    |
| OFDM / n HT20 – mode    | 18.33                 | 18.73    | 18.33    |

**Plots:** DSSS / b – mode

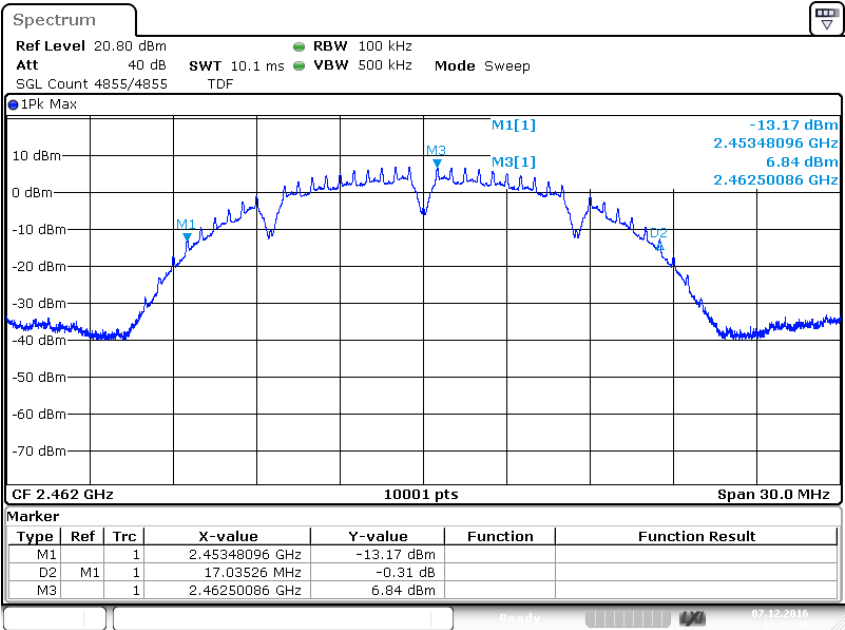
**Plot 1:** Lowest channel



**Plot 2:** Middle channel



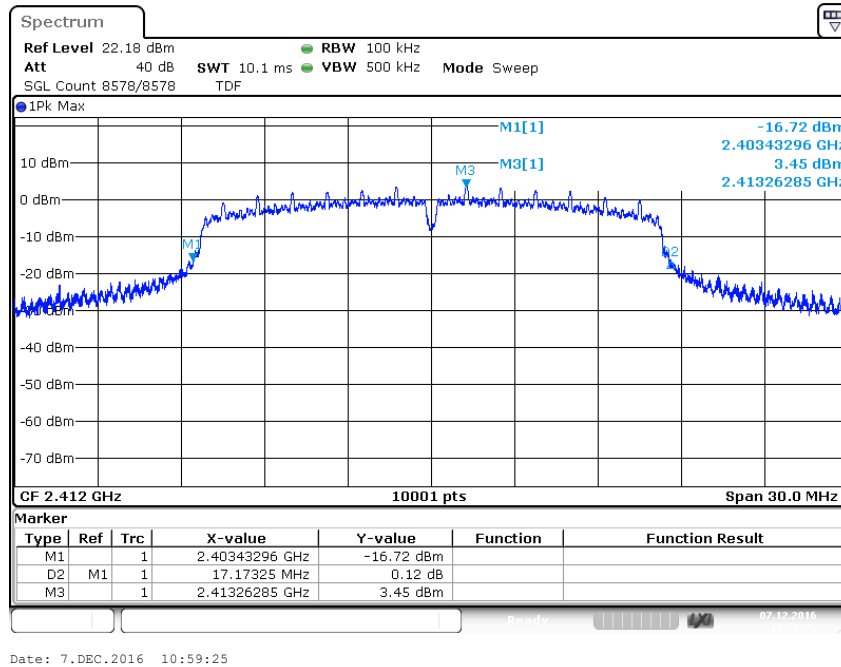
Plot 3: Highest channel



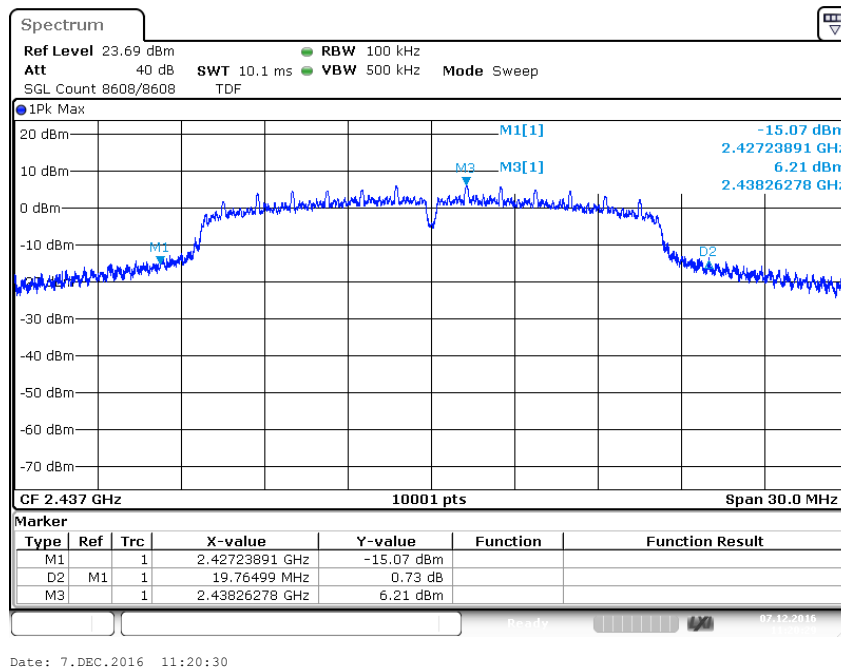
Date: 7.DEC.2016 10:42:50

**Plots:** OFDM / g – mode

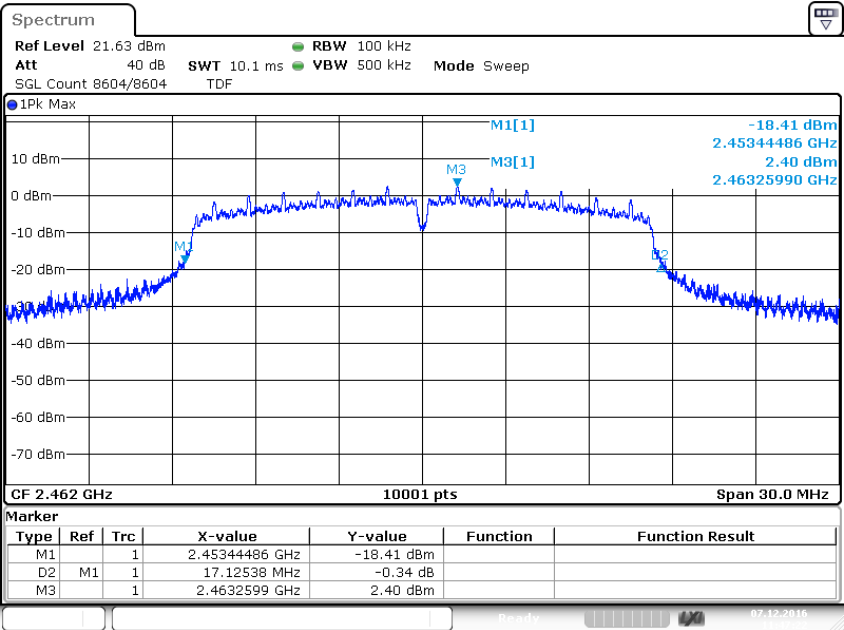
**Plot 1:** Lowest channel



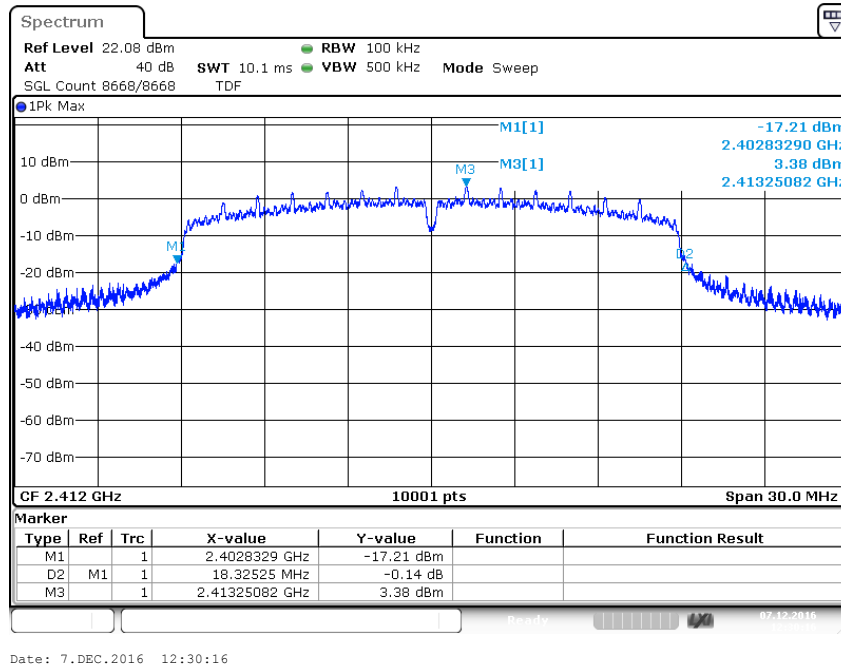
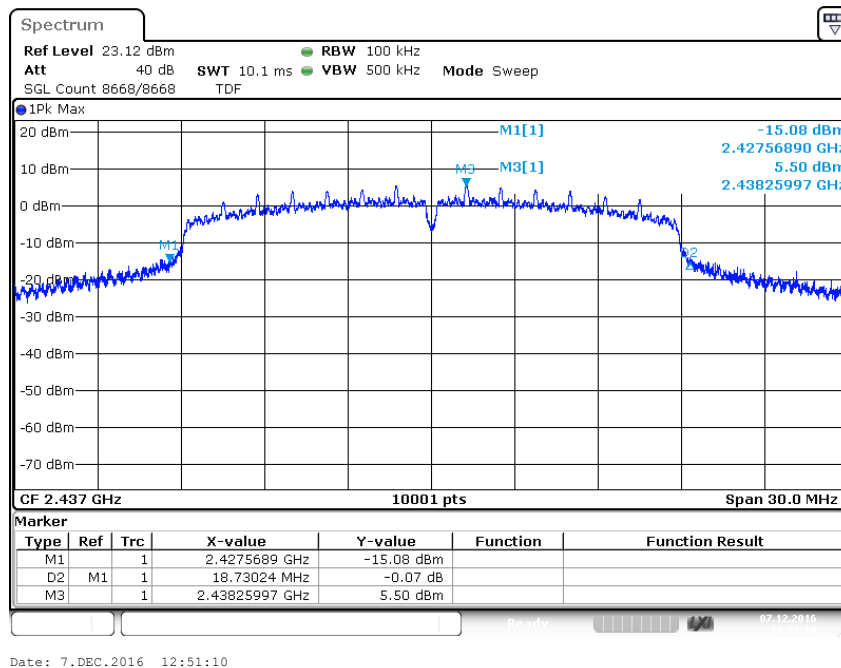
**Plot 2:** Middle channel



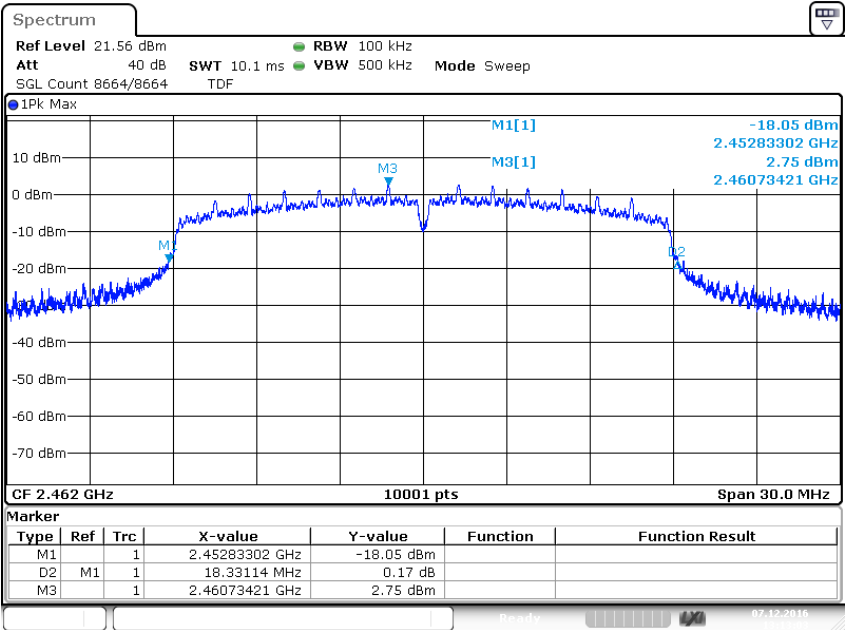
Plot 3: Highest channel



Date: 7.DEC.2016 11:47:22

**Plots:** OFDM / n HT20 – mode**Plot 1:** Lowest channel**Plot 2:** Middle channel

Plot 3: Highest channel



Date: 7.DEC.2016 13:13:03

## 11.9 Band edge compliance radiated

### Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to channel 1 for the lower restricted band and to channel 11 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3 m.

### Measurement:

| Measurement parameter for peak measurements |                        |
|---------------------------------------------|------------------------|
| Detector:                                   | Peak / RMS             |
| Sweep time:                                 | Auto                   |
| Resolution bandwidth:                       | 1 MHz                  |
| Video bandwidth:                            | 1 MHz                  |
| Span:                                       | See plot!              |
| Trace mode:                                 | Max Hold               |
| Test setup:                                 | See sub clause 6.2 - A |
| Measurement uncertainty                     | See sub clause 8       |

| Measurement parameter for average measurements |                             |
|------------------------------------------------|-----------------------------|
| According to DTS clause: 13.3.2                |                             |
| Detector:                                      | RMS                         |
| Sweep time:                                    | Auto                        |
| Resolution bandwidth:                          | 100 kHz                     |
| Video bandwidth:                               | 300 kHz                     |
| Span:                                          | 2 MHz                       |
| Trace mode:                                    | RMS Average over 101 sweeps |
| Test setup:                                    | See sub clause 6.2 - A      |
| Measurement uncertainty                        | See sub clause 8            |

### Limits:

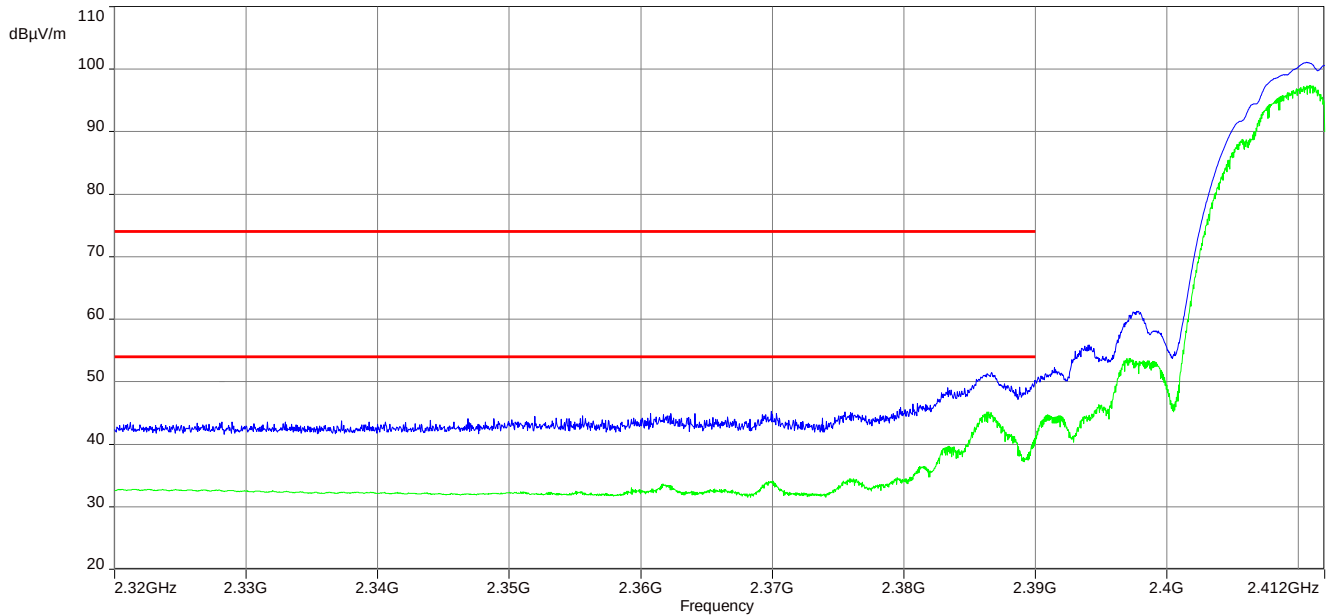
| FCC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | IC |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <p>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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).</p> |    |
| <p>74 dBμV/m Peak<br/>54 dBμV/m AVG</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |

**Results:**

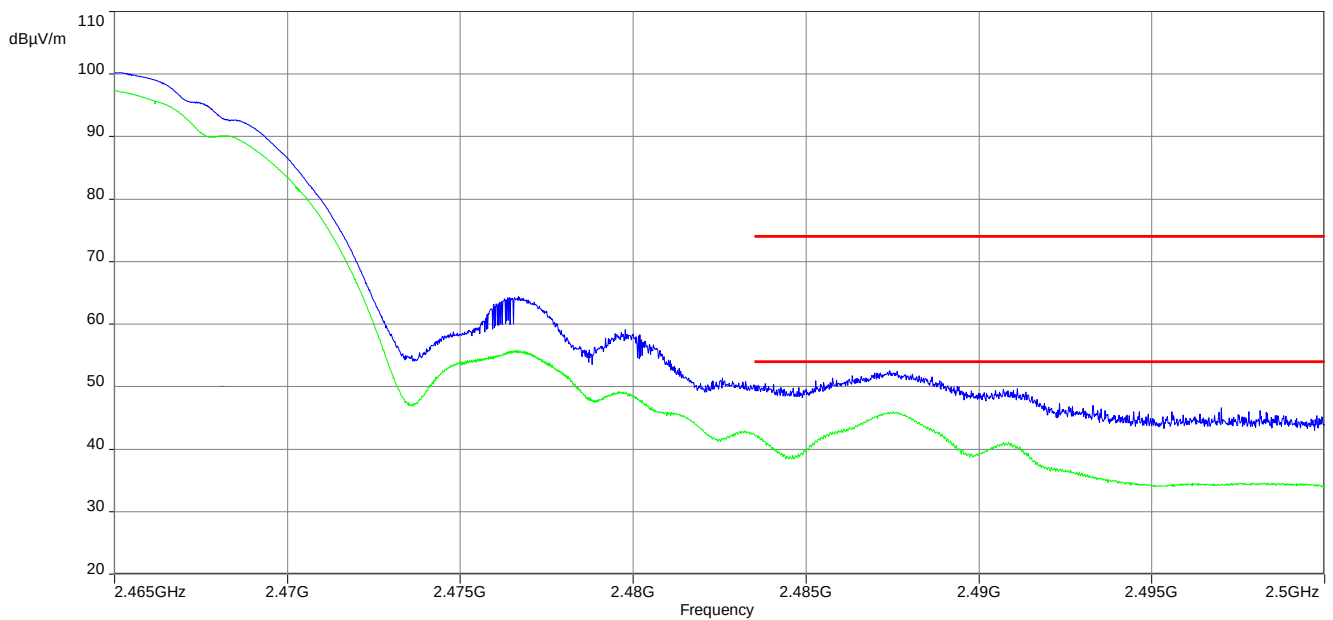
| Scenario<br>Modulation | Band edge compliance radiated [dB] |                                 |                            |
|------------------------|------------------------------------|---------------------------------|----------------------------|
|                        | DSSS                               | OFDM<br>(20 MHz bandwidth)      | OFDM<br>(40 MHz bandwidth) |
| Lower band edge        | > 20 dB (Peak)<br>> 20 dB (AVG)    | > 20 dB (Peak)<br>> 20 dB (AVG) | -/-                        |
| Upper band edge        | > 20 dB (Peak)<br>> 20 dB (AVG)    | > 20 dB (Peak)<br>> 20 dB (AVG) | -/-                        |

**Plots:** DSSS - peak / average

**Plot 1:** TX mode, lower band edge, vertical & horizontal polarization

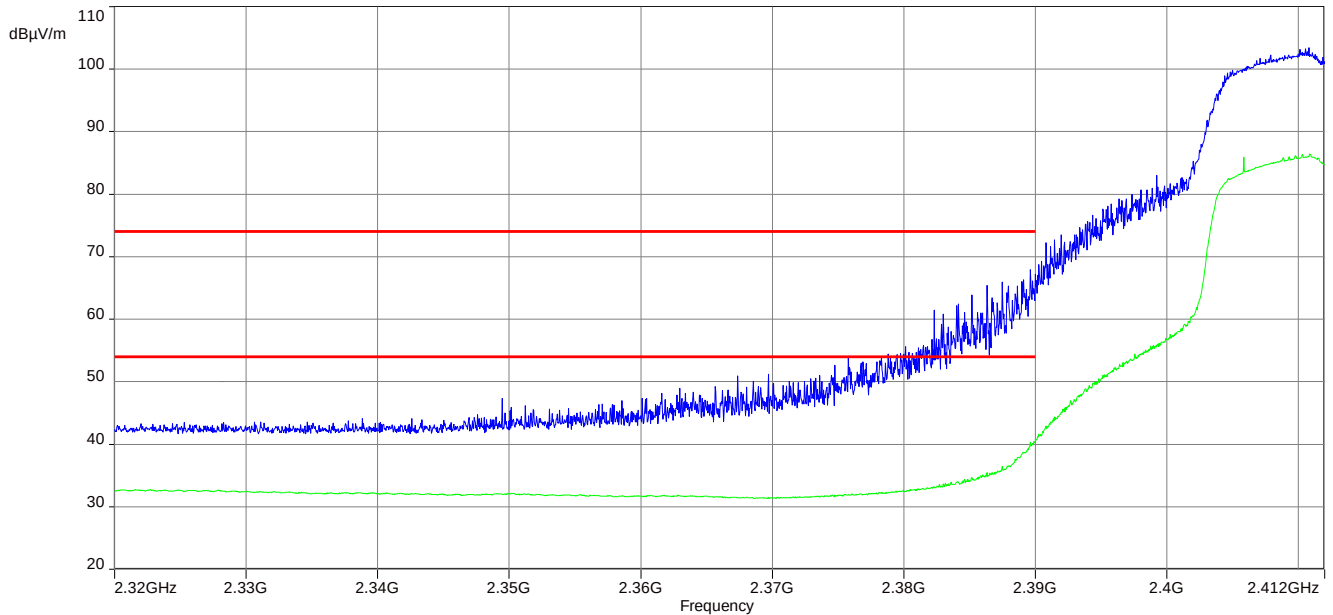


**Plot 2:** TX mode, upper band edge, vertical & horizontal polarization

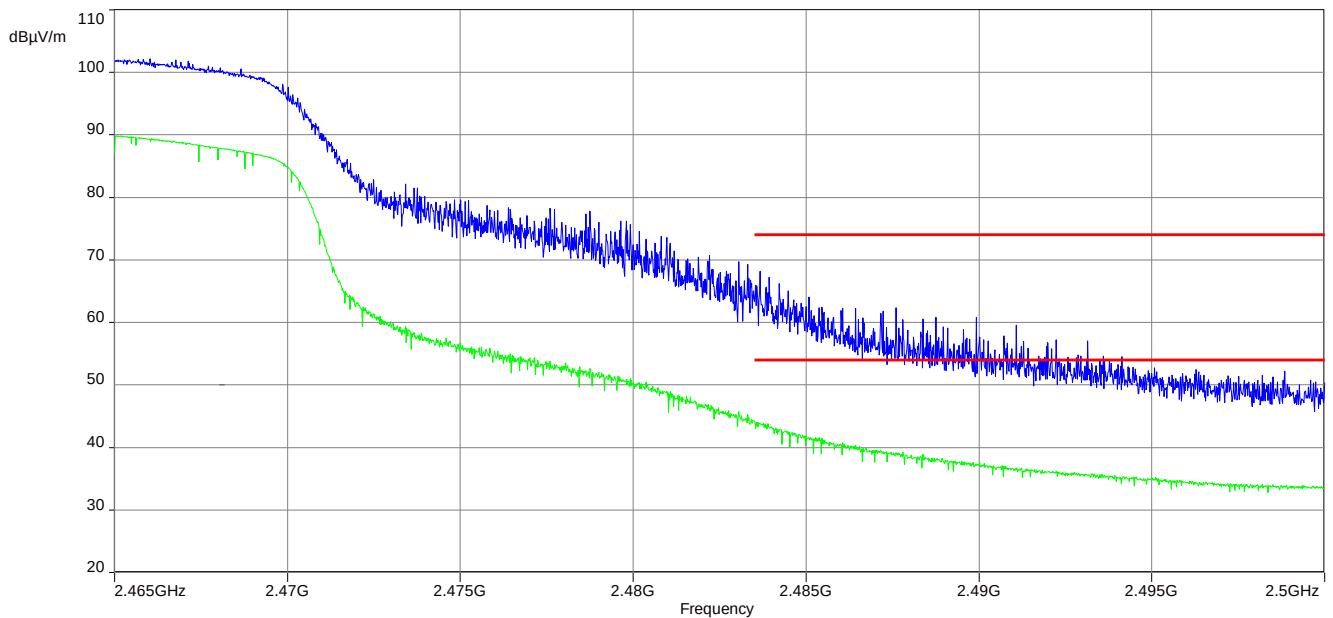


**Plots:** OFDM (20 MHz bandwidth) - peak / average

**Plot 1:** TX mode, lower band edge, vertical & horizontal polarization



**Plot 2:** TX mode, upper band edge, vertical & horizontal polarization



### 11.10 Band edge compliance conducted

#### Description:

Measurement of the radiated band edge compliance with a conducted test setup.

#### Measurement:

| Measurement parameter for measurements            |                                                                                                          |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| According to DTS clause: 13.3.2 and clause 12.2.2 |                                                                                                          |
| Detector:                                         | RMS                                                                                                      |
| Sweep time:                                       | Auto                                                                                                     |
| Resolution bandwidth:                             | 100 kHz                                                                                                  |
| Video bandwidth:                                  | 300 kHz                                                                                                  |
| Span:                                             | Lower band edge:<br>2388 MHz to 2390 MHz (2 MHz)<br>Upper band edge:<br>2483.5 MHz to 2485.5 MHz (2 MHz) |
| Trace mode:                                       | Trace average with 200 counts                                                                            |
| Test setup:                                       | See sub clause 6.4 – A                                                                                   |
| Measurement uncertainty                           | See sub clause 8                                                                                         |

#### Limits:

| FCC        | IC |
|------------|----|
| -41.26 dBm |    |

**Results:**

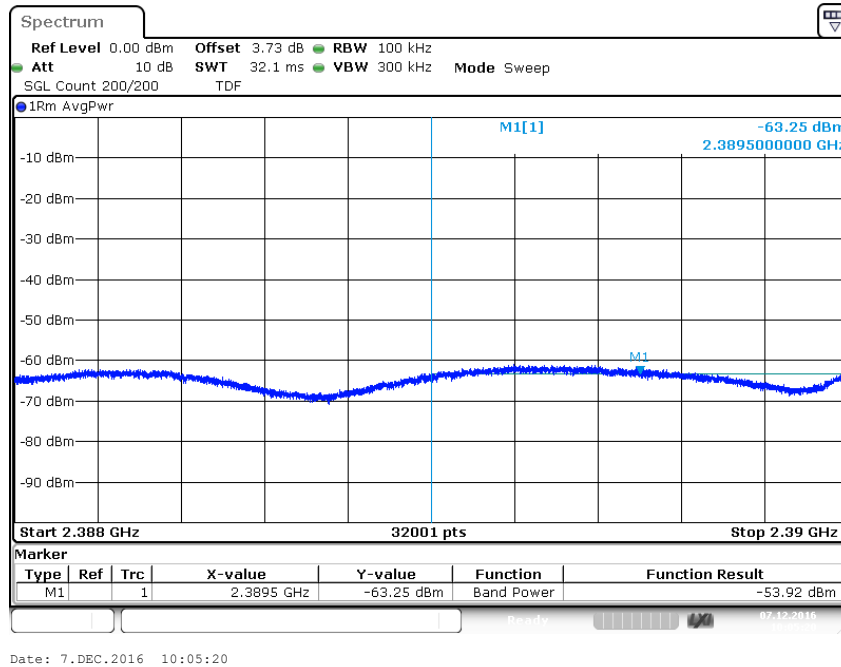
| Scenario<br>Modulation     | Band edge compliance [dBm] (included antenna gain) |                    |                         |                         |
|----------------------------|----------------------------------------------------|--------------------|-------------------------|-------------------------|
|                            | DSSS /<br>b – mode                                 | OFDM /<br>g – mode | OFDM / n<br>HT20 – mode | OFDM / n<br>HT40 – mode |
| Max. lower band edge power | -61.65                                             | -51.30             | -49.78                  | -/-                     |
| Max. upper band edge power | -58.80                                             | -55.24             | -52.20                  | -/-                     |

**Results:**

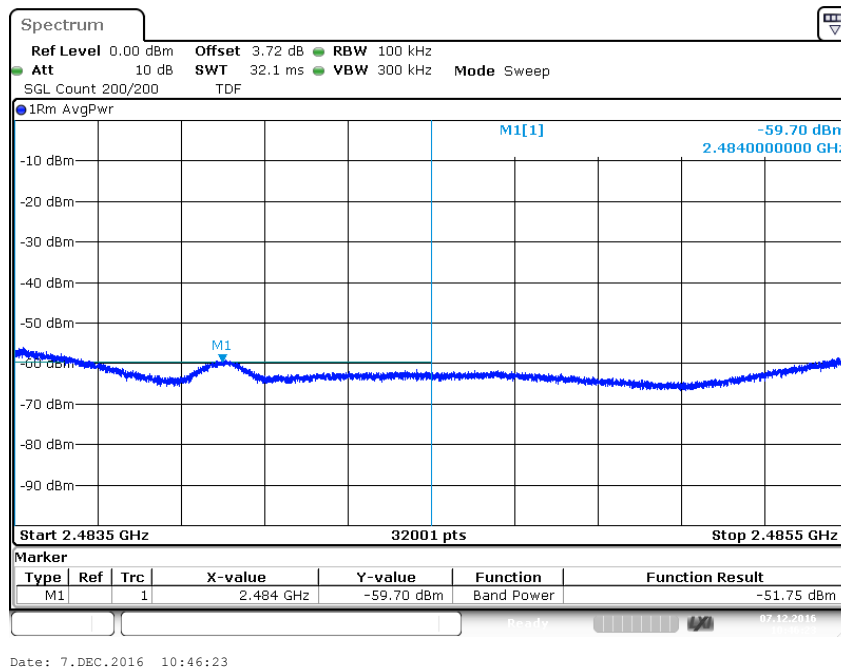
| Scenario<br>Modulation                  | Band edge compliance [dBm] (gain calculation) |                    |                         |                         |
|-----------------------------------------|-----------------------------------------------|--------------------|-------------------------|-------------------------|
|                                         | DSSS /<br>b – mode                            | OFDM /<br>g – mode | OFDM / n<br>HT20 – mode | OFDM / n<br>HT40 – mode |
| Max. lower band edge power<br>conducted | -63.25                                        | -52.90             | -51.38                  | -/-                     |
| Antenna gain                            | 1.6                                           |                    |                         |                         |
| Max. lower band edge power<br>radiated  | -61.65                                        | -51.30             | -49.78                  | -/-                     |
| Max. upper band edge power<br>conducted | -59.70                                        | -56.14             | -53.10                  | -/-                     |
| Antenna gain                            | 0.9                                           |                    |                         |                         |
| Max. upper band edge power<br>radiated  | -58.80                                        | -55.24             | -52.20                  | -/-                     |

**Plots:** DSSS / b – mode

**Plot 1:** Lower band edge

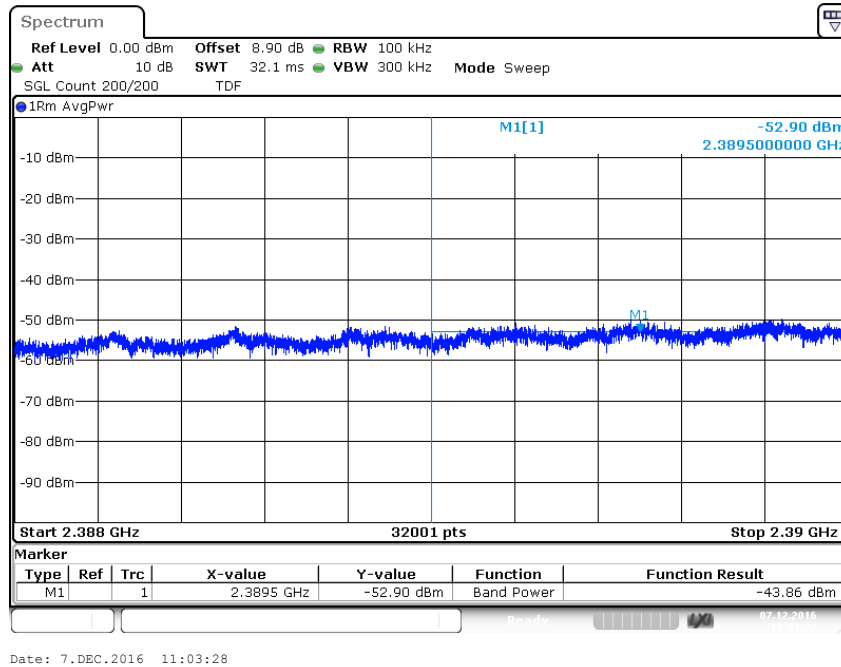


**Plot 2:** Upper band edge

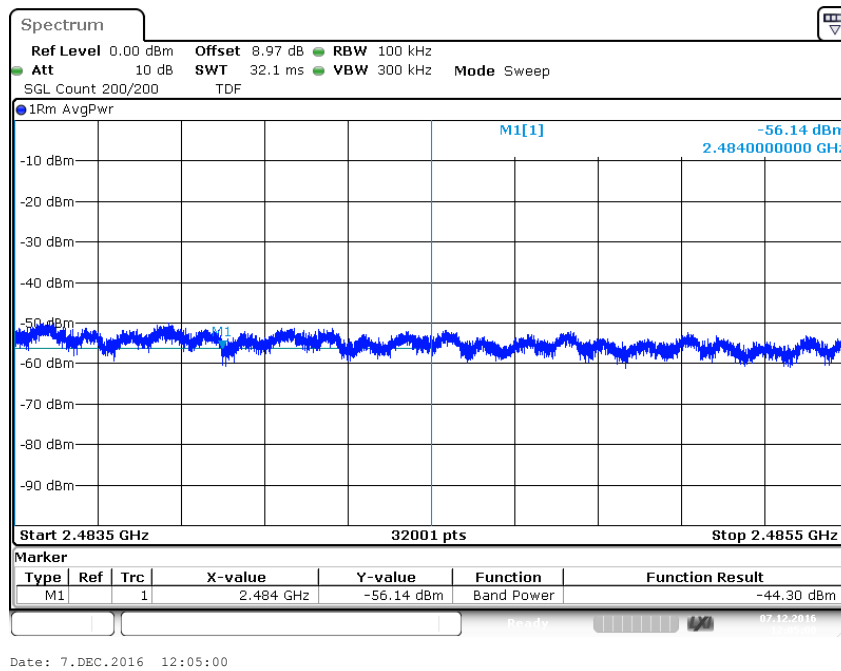


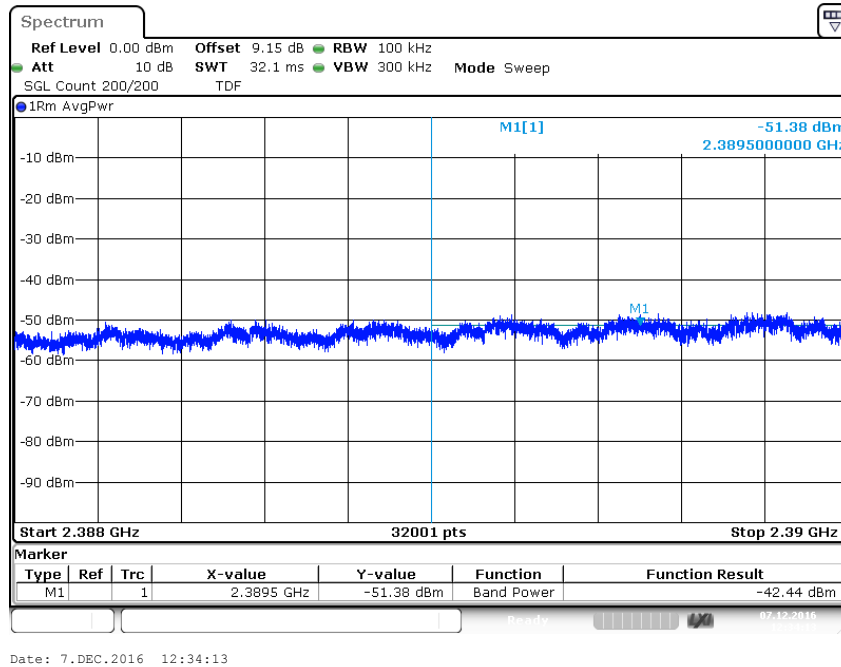
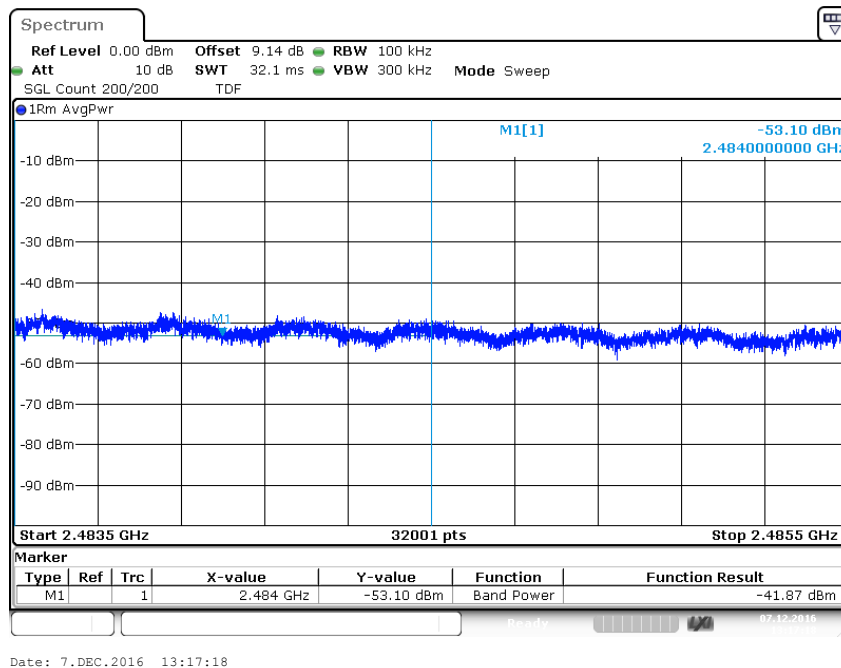
**Plots:** OFDM / g – mode

**Plot 1:** Lower band edge



**Plot 2:** Upper band edge



**Plots:** OFDM / n HT20 – mode**Plot 1:** Lower band edge**Plot 2:** Upper band edge

### 11.11 Spurious emissions conducted

#### Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at channel 1, 6 and 11. The measurement is repeated for all modulations.

#### Measurement:

| Measurement parameter   |                        |
|-------------------------|------------------------|
| Detector:               | Peak                   |
| Sweep time:             | Auto                   |
| Resolution bandwidth:   | 100 kHz                |
| Video bandwidth:        | 500 kHz                |
| Span:                   | 9 kHz to 25 GHz        |
| Trace mode:             | Max Hold               |
| Test setup:             | See sub clause 6.4 – A |
| Measurement uncertainty | See sub clause 8       |

#### Limits:

| FCC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | IC |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 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 30 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. Attenuation below the general limits specified in Section 15.209(a) is not required |    |

**Results:** DSSS / b – mode

| TX Spurious Emissions Conducted |  |                             |                                     |                                                      |                     |
|---------------------------------|--|-----------------------------|-------------------------------------|------------------------------------------------------|---------------------|
| DSSS / b – mode                 |  |                             |                                     |                                                      |                     |
| f [MHz]                         |  | amplitude of emission [dBm] | limit max. allowed emission power   | actual attenuation below frequency of operation [dB] | results             |
| 2412                            |  | 7.6                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |
| 2437                            |  | 7.2                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |
| 2462                            |  | 7.3                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |

**Results:** OFDM / g – mode

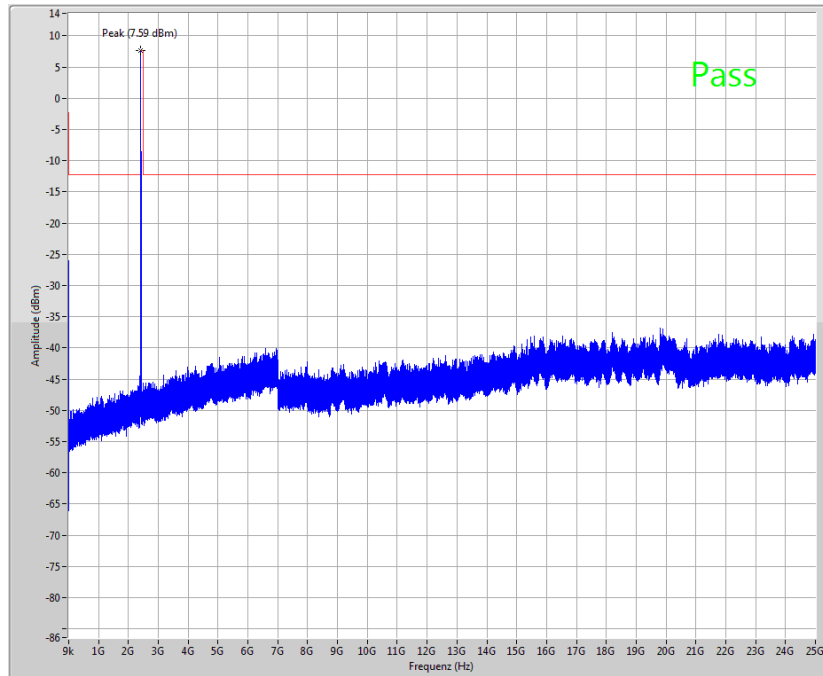
| TX Spurious Emissions Conducted |  |                             |                                     |                                                      |                     |
|---------------------------------|--|-----------------------------|-------------------------------------|------------------------------------------------------|---------------------|
| OFDM / g – mode                 |  |                             |                                     |                                                      |                     |
| f [MHz]                         |  | amplitude of emission [dBm] | limit max. allowed emission power   | actual attenuation below frequency of operation [dB] | results             |
| 2412                            |  | 4.6                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |
| 2437                            |  | 5.7                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |
| 2462                            |  | 2.3                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |

**Results:** OFDM / n HT20 – mode

| TX Spurious Emissions Conducted |  |                             |                                     |                                                      |                     |
|---------------------------------|--|-----------------------------|-------------------------------------|------------------------------------------------------|---------------------|
| OFDM / n HT20 – mode            |  |                             |                                     |                                                      |                     |
| f [MHz]                         |  | amplitude of emission [dBm] | limit max. allowed emission power   | actual attenuation below frequency of operation [dB] | results             |
| 2412                            |  | 4.3                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |
| 2437                            |  | 4.9                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |
| 2462                            |  | 2.5                         | 30 dBm                              | >20 dB                                               | Operating frequency |
| No peaks detected               |  |                             | -20 dBc (peak)<br>-30 dBc (average) |                                                      | compliant           |
|                                 |  |                             |                                     |                                                      |                     |
|                                 |  |                             |                                     |                                                      |                     |

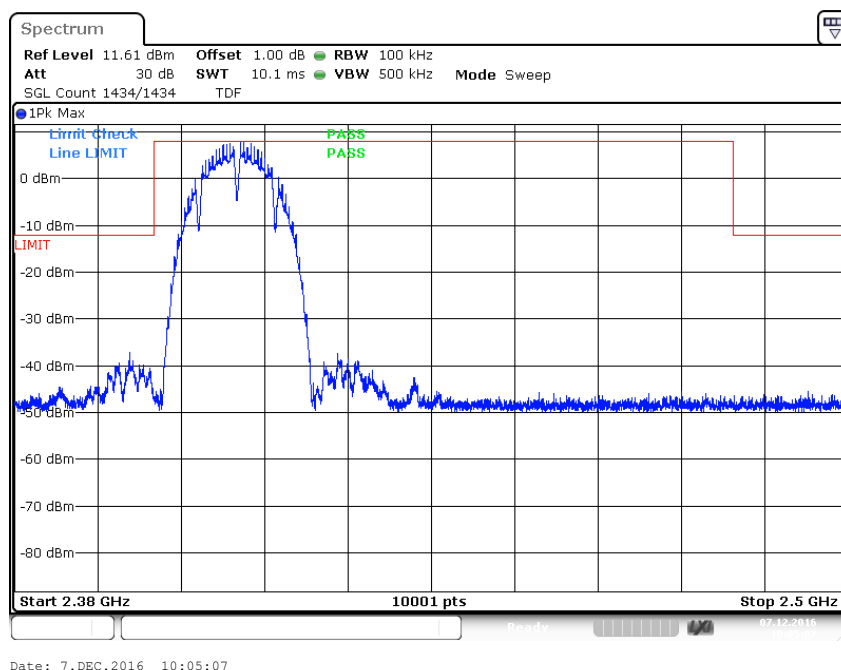
**Plots:** DSSS / b – mode

**Plot 1:** Lowest channel, up to 25 GHz

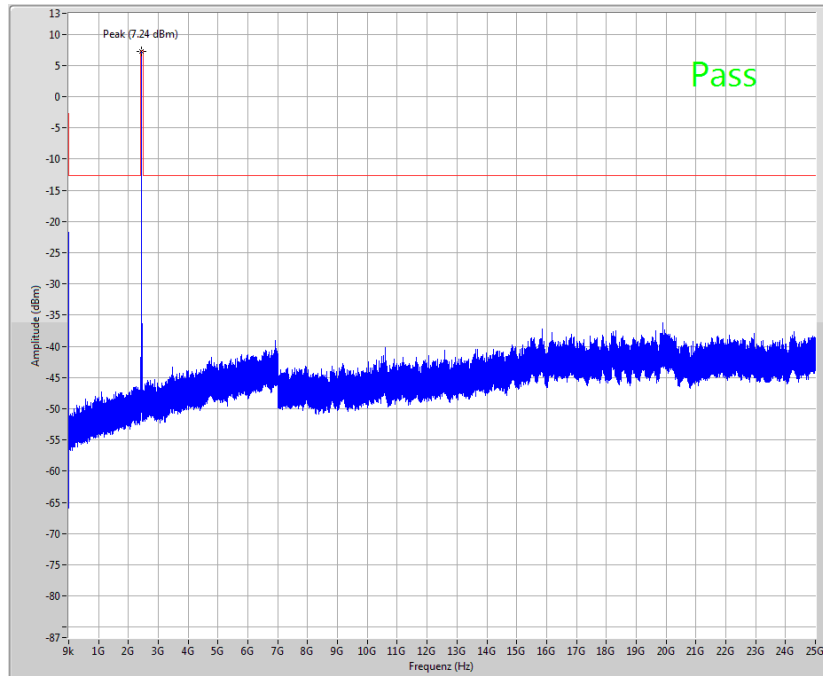


The peak at the beginning of the plot is the LO from the SA.

**Plot 2:** Lowest channel, zoomed carrier

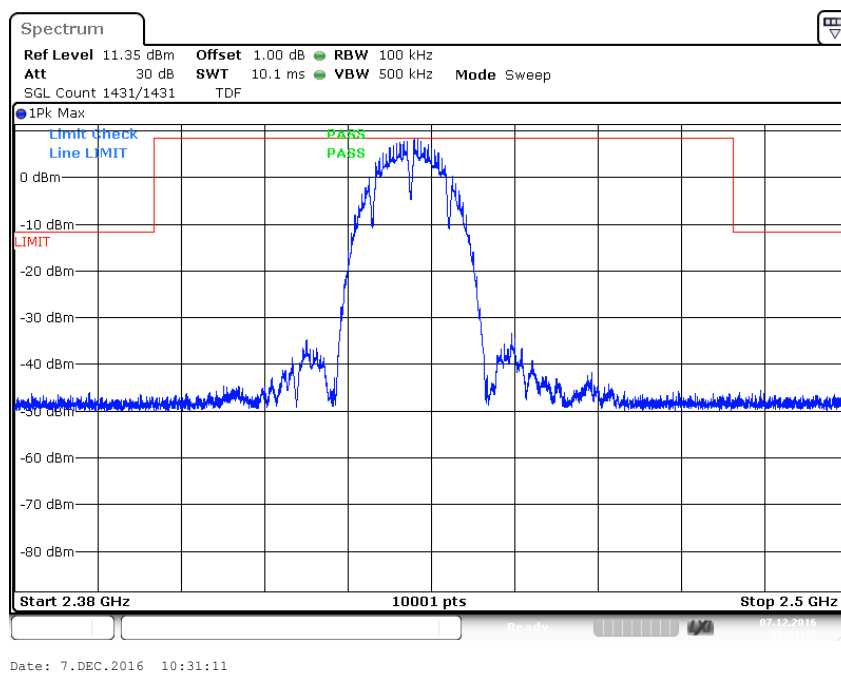


**Plot 3:** Middle channel, up to 25 GHz

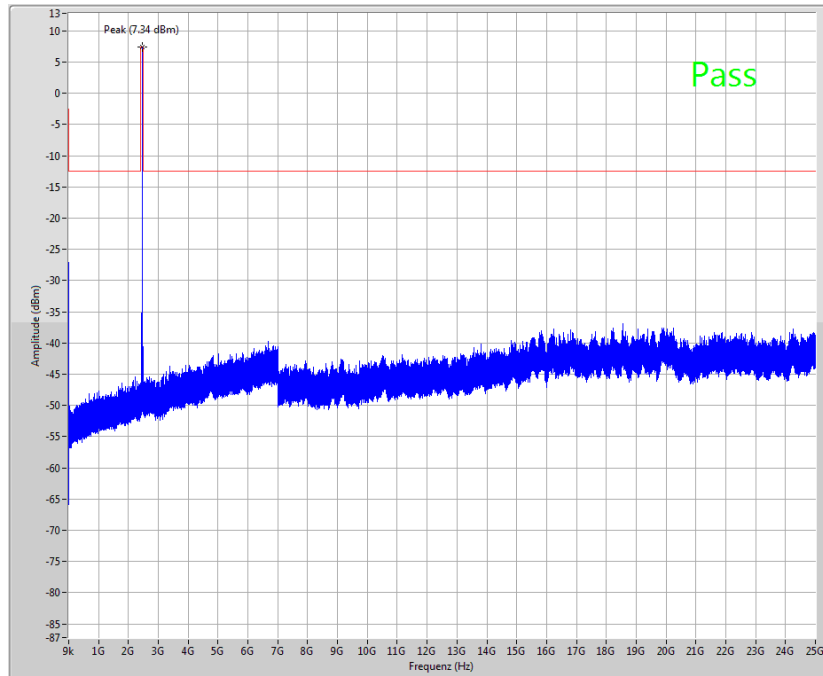


The peak at the beginning of the plot is the LO from the SA.

**Plot 4:** Middle channel, zoomed carrier

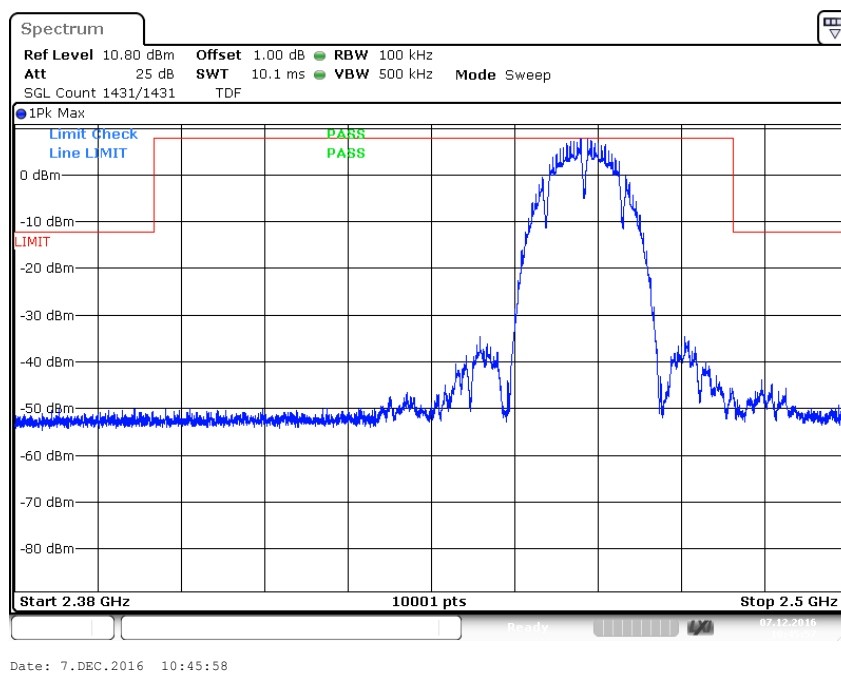


**Plot 5:** Highest channel, up to 25 GHz



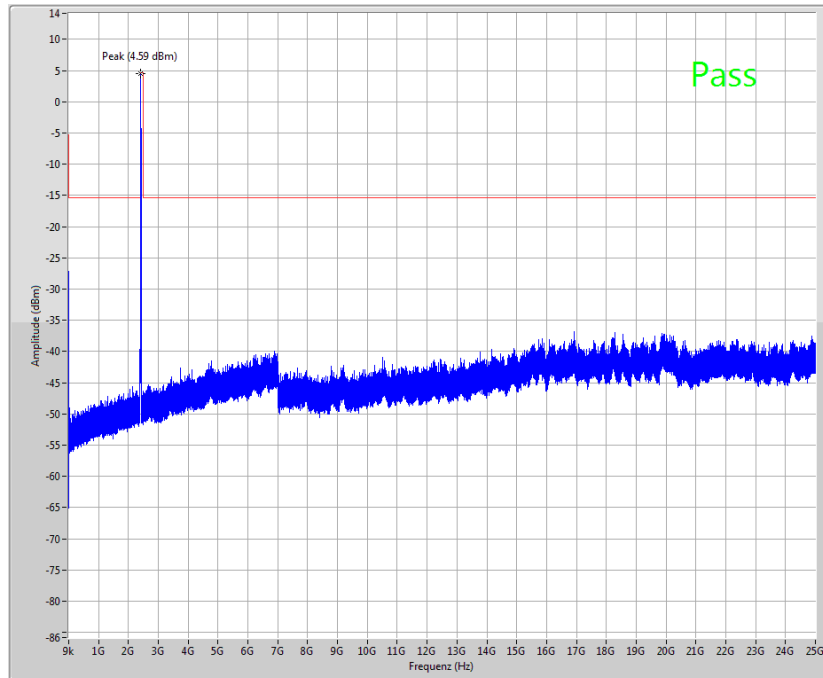
The peak at the beginning of the plot is the LO from the SA.

**Plot 6:** Highest channel, zoomed carrier



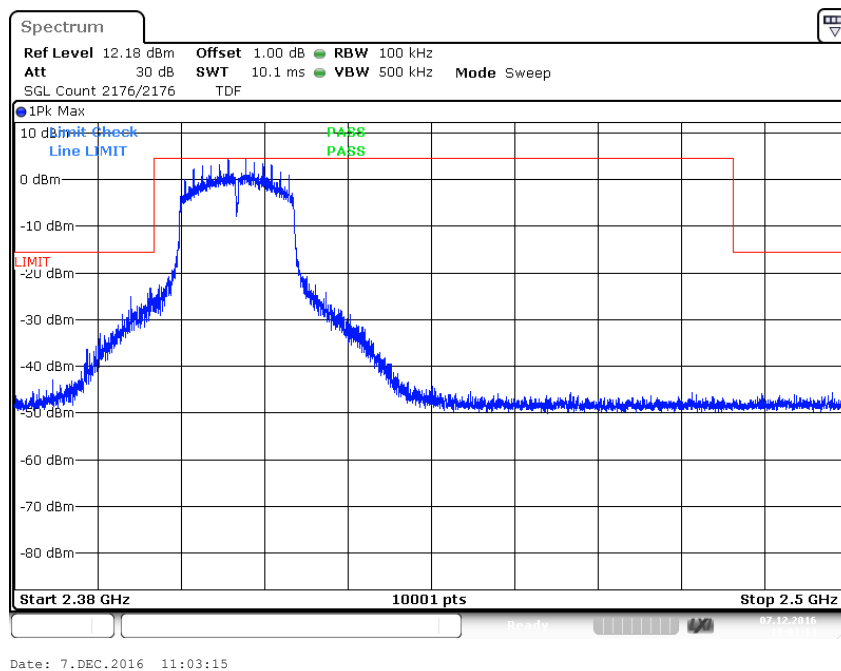
**Plots:** OFDM / g – mode

**Plot 1:** Lowest channel, up to 25 GHz

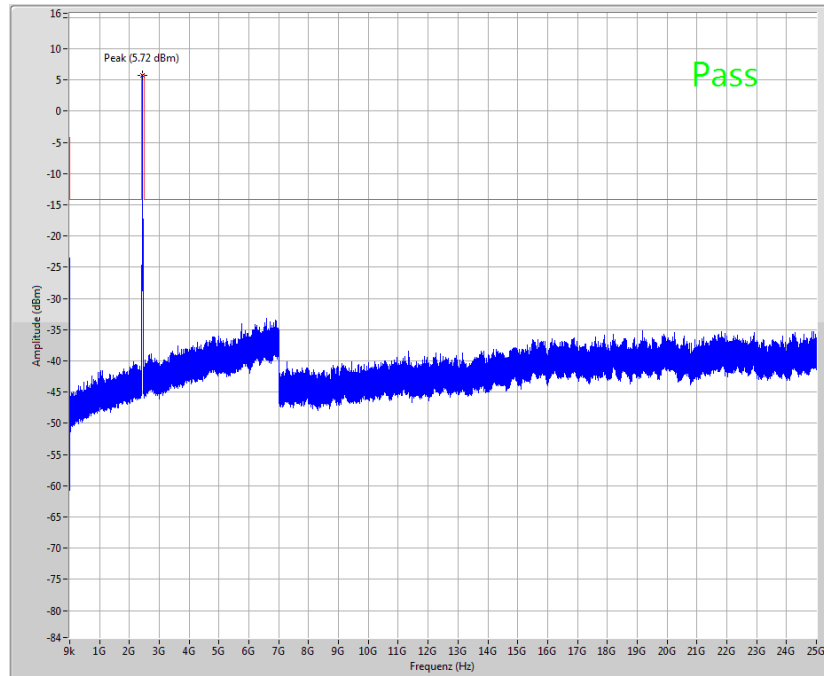


The peak at the beginning of the plot is the LO from the SA.

**Plot 2:** Lowest channel, zoomed carrier

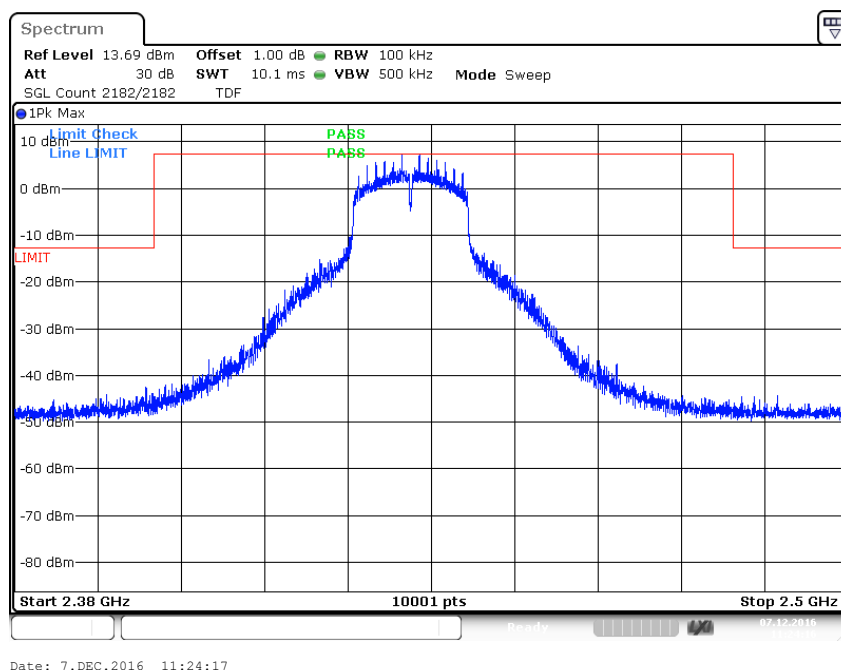


**Plot 3:** Middle channel, up to 25 GHz

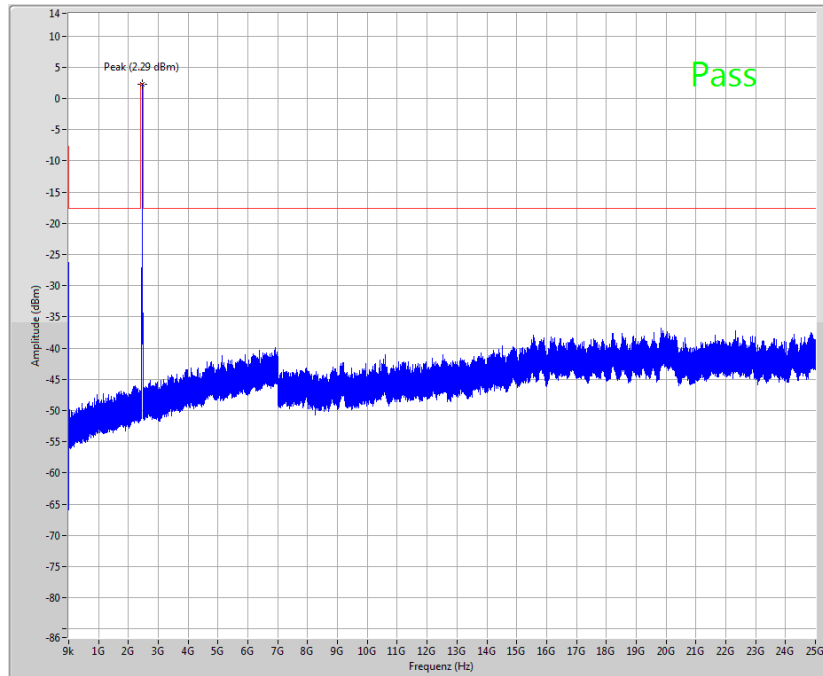


The peak at the beginning of the plot is the LO from the SA.

**Plot 4:** Middle channel, zoomed carrier

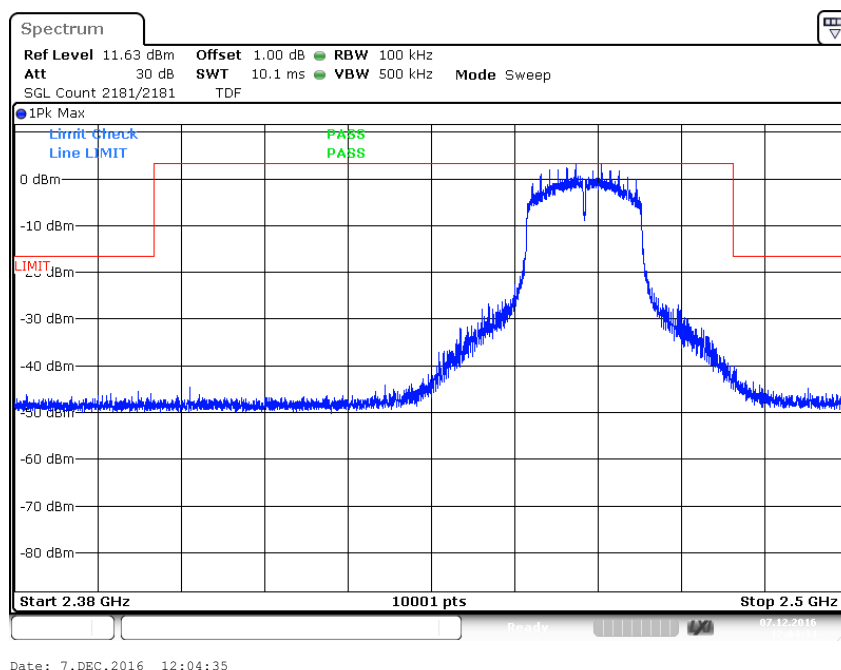


**Plot 5:** Highest channel, up to 25 GHz



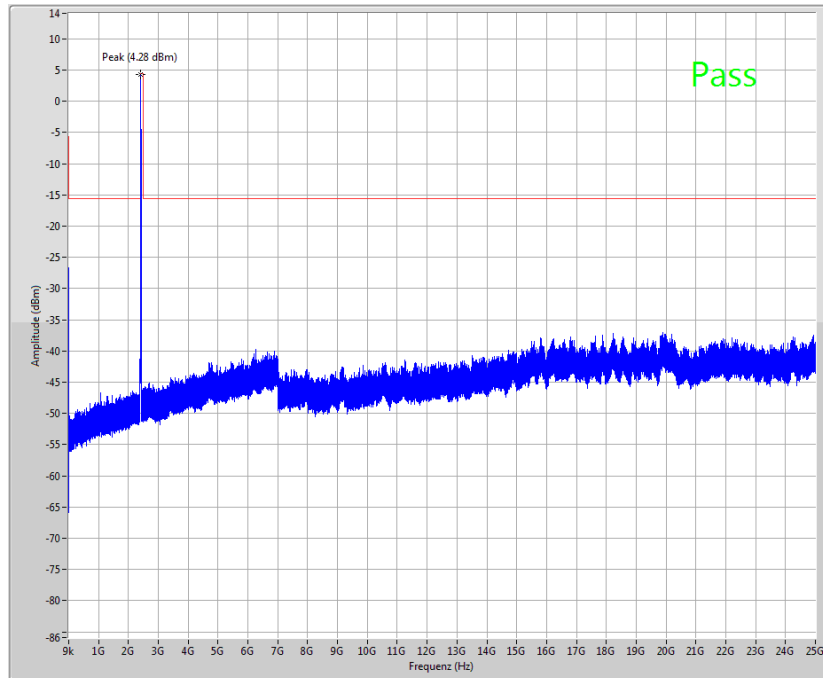
The peak at the beginning of the plot is the LO from the SA.

**Plot 6:** Highest channel, zoomed carrier



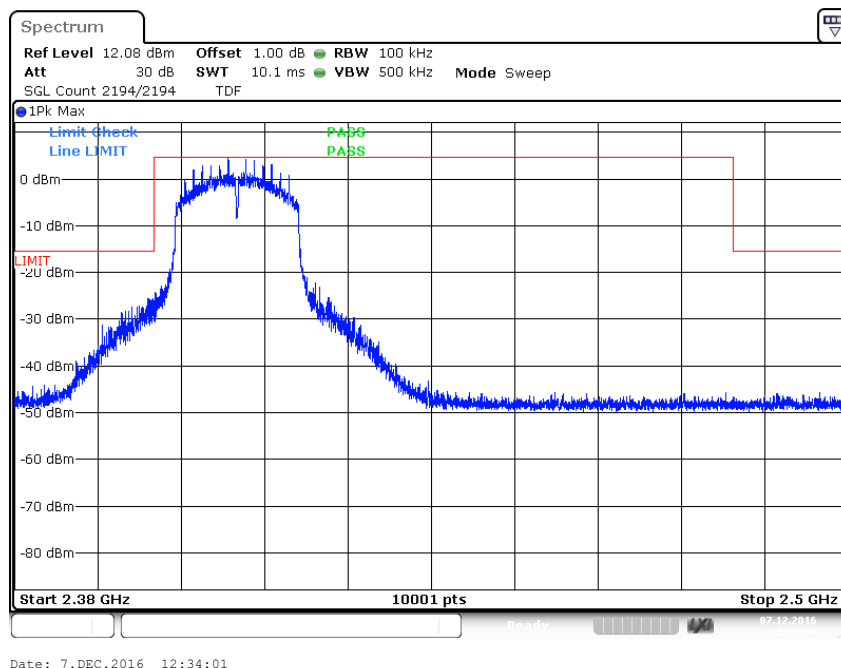
**Plots:** OFDM / n HT 20 – mode

**Plot 1:** Lowest channel, up to 25 GHz

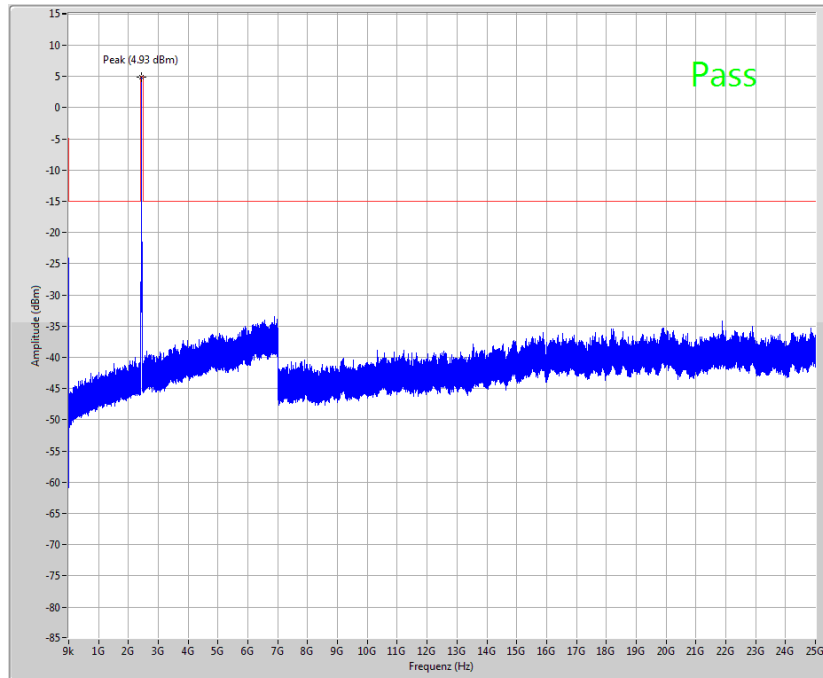


The peak at the beginning of the plot is the LO from the SA.

**Plot 2:** Lowest channel, zoomed carrier

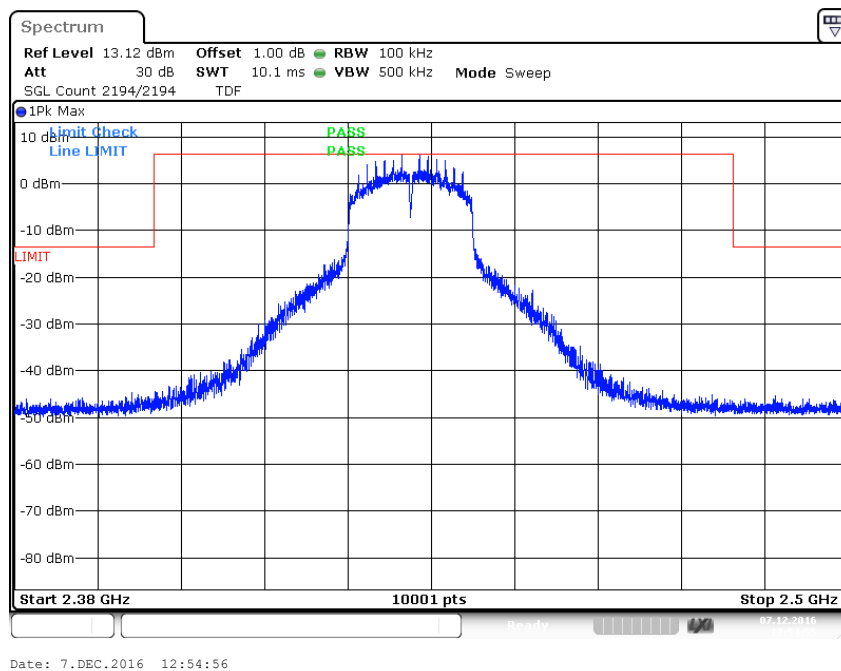


**Plot 3:** Middle channel, up to 25 GHz

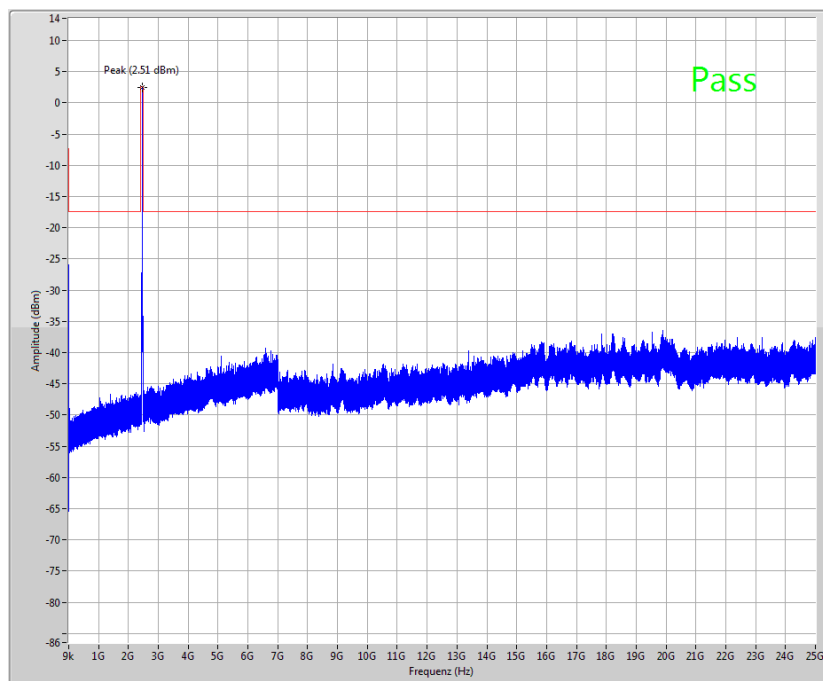


The peak at the beginning of the plot is the LO from the SA.

**Plot 4:** Middle channel, zoomed carrier

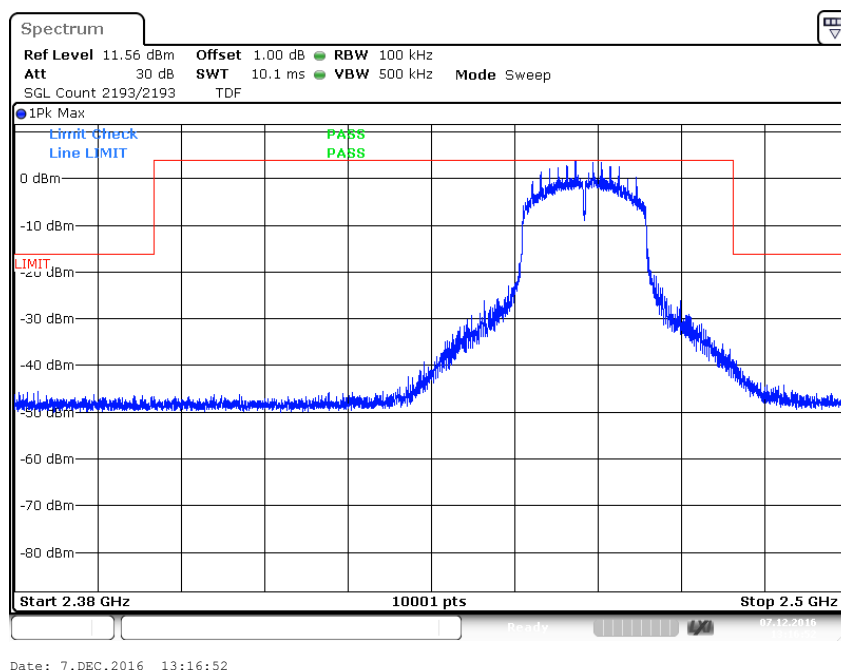


**Plot 5:** Highest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

**Plot 6:** Highest channel, zoomed carrier



## 11.12 Spurious emissions radiated below 30 MHz

### Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is representative for all channels and modes. If peaks are found channel 1 and channel 11 will be measured too. The measurement is performed with the data rate producing the highest output power. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

### Measurement:

| Measurement parameter   |                                                                                                                                                       |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Detector:               | Peak / Quasi Peak                                                                                                                                     |
| Sweep time:             | Auto                                                                                                                                                  |
| Resolution bandwidth:   | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz                                                                                                             |
| Video bandwidth:        | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz                                                                                                            |
| Span:                   | 9 kHz to 30 MHz                                                                                                                                       |
| Trace mode:             | Max Hold                                                                                                                                              |
| Measured modulation     | <input checked="" type="checkbox"/> DSSS b – mode<br><input checked="" type="checkbox"/> OFDM g – mode<br><input type="checkbox"/> OFDM n HT20 – mode |
| Test setup:             | See sub clause 6.2 - A                                                                                                                                |
| Measurement uncertainty | See sub clause 8                                                                                                                                      |

### Limits:

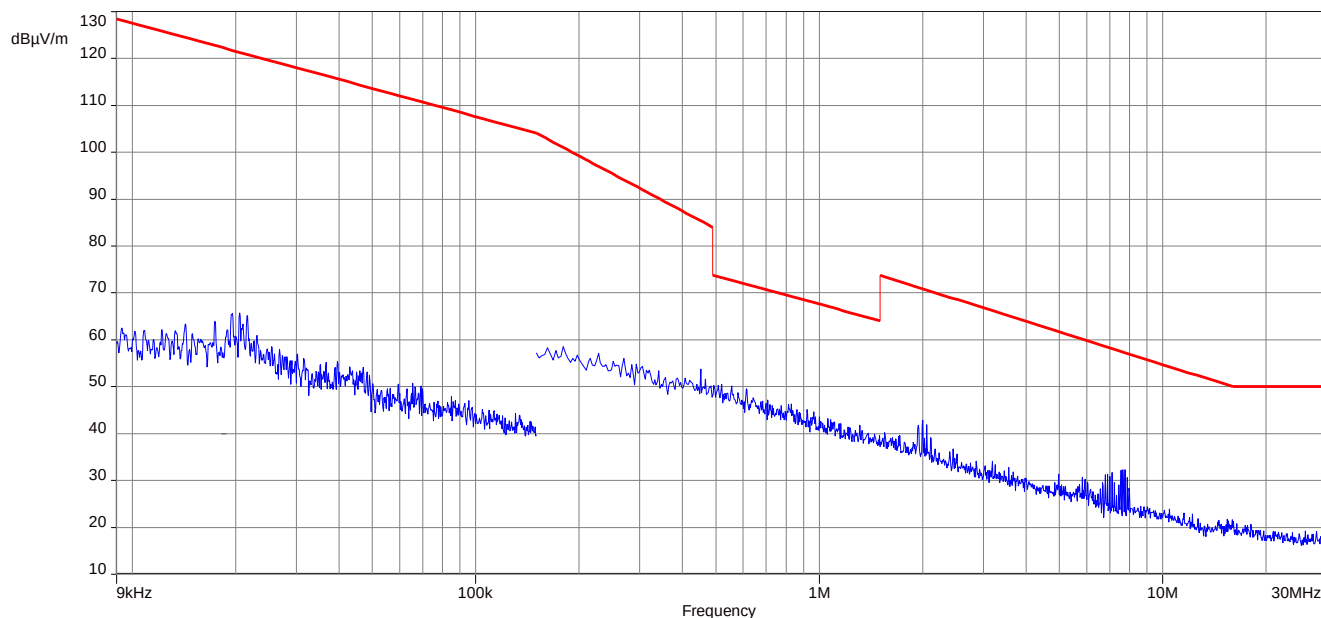
| FCC             |                               | IC                   |
|-----------------|-------------------------------|----------------------|
| Frequency (MHz) | Field Strength (dB $\mu$ V/m) | Measurement distance |
| 0.009 – 0.490   | 2400/F(kHz)                   | 300                  |
| 0.490 – 1.705   | 24000/F(kHz)                  | 30                   |
| 1.705 – 30.0    | 30                            | 30                   |

### Results:

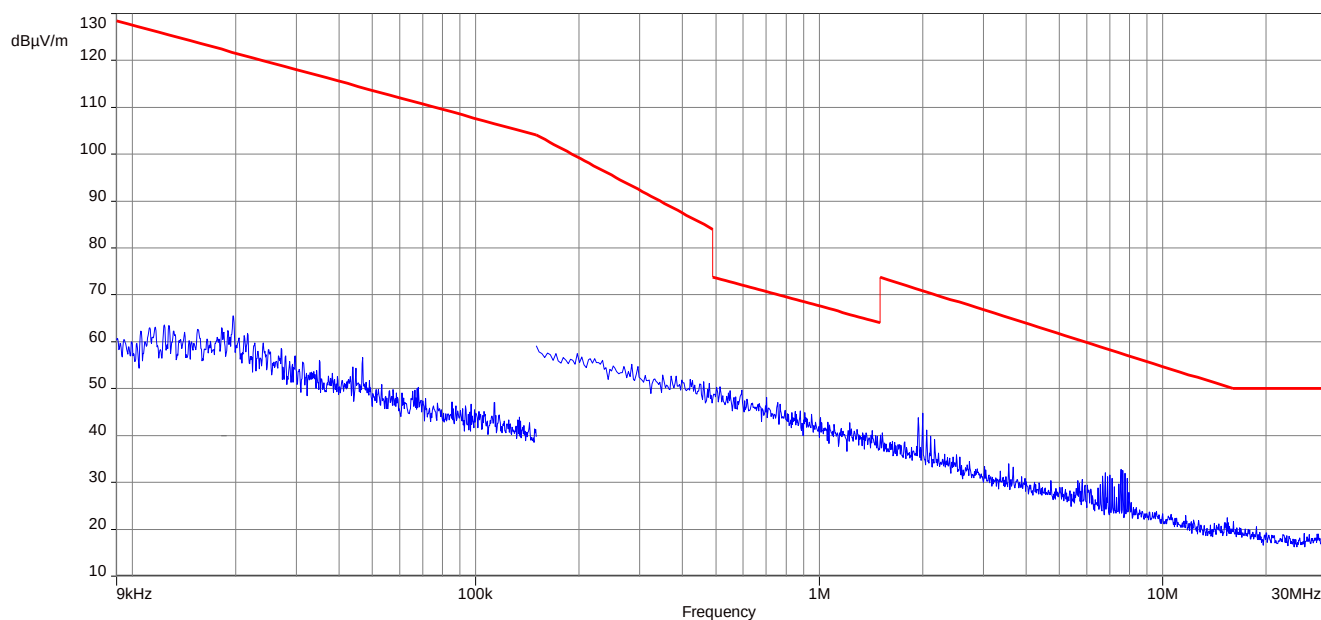
| TX Spurious Emissions Radiated < 30 MHz [dB $\mu$ V/m]  |          |                      |
|---------------------------------------------------------|----------|----------------------|
| F [MHz]                                                 | Detector | Level [dB $\mu$ V/m] |
| All detected peaks are more than 20 dB below the limit. |          |                      |
|                                                         |          |                      |

**Plots:** DSSS

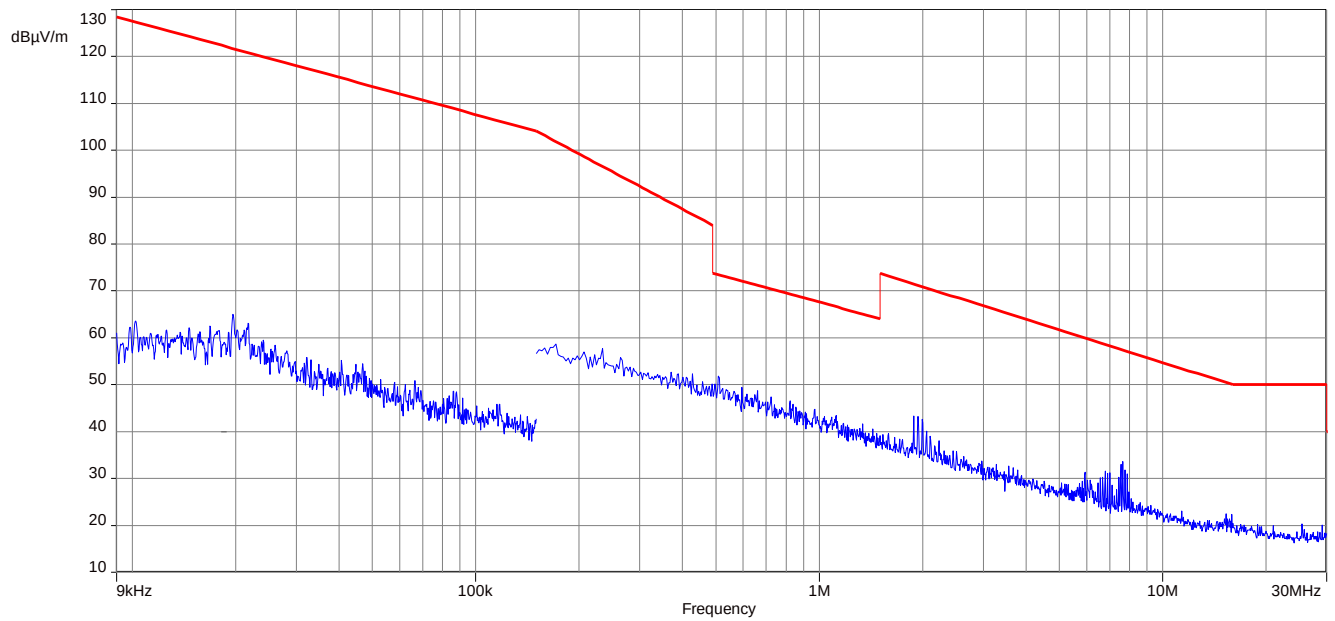
**Plot 1:** 9 kHz to 30 MHz, low channel



**Plot 2:** 9 kHz to 30 MHz, mid channel

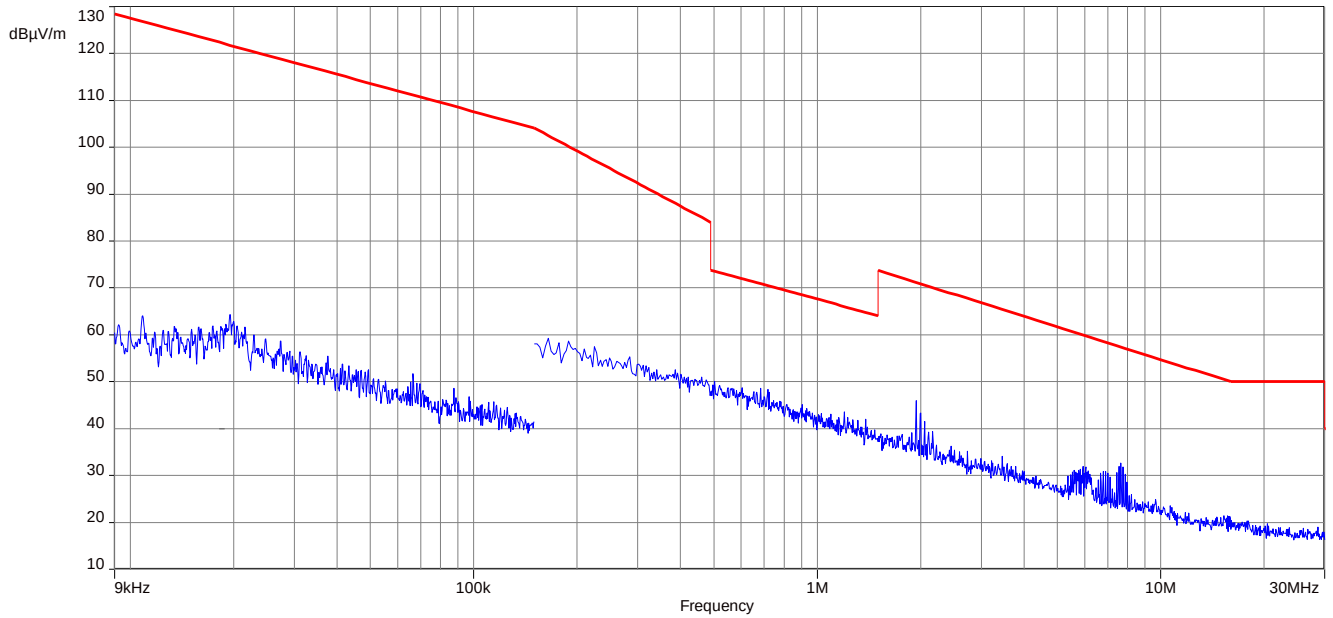


**Plot 3:** 9 kHz to 30 MHz, high channel

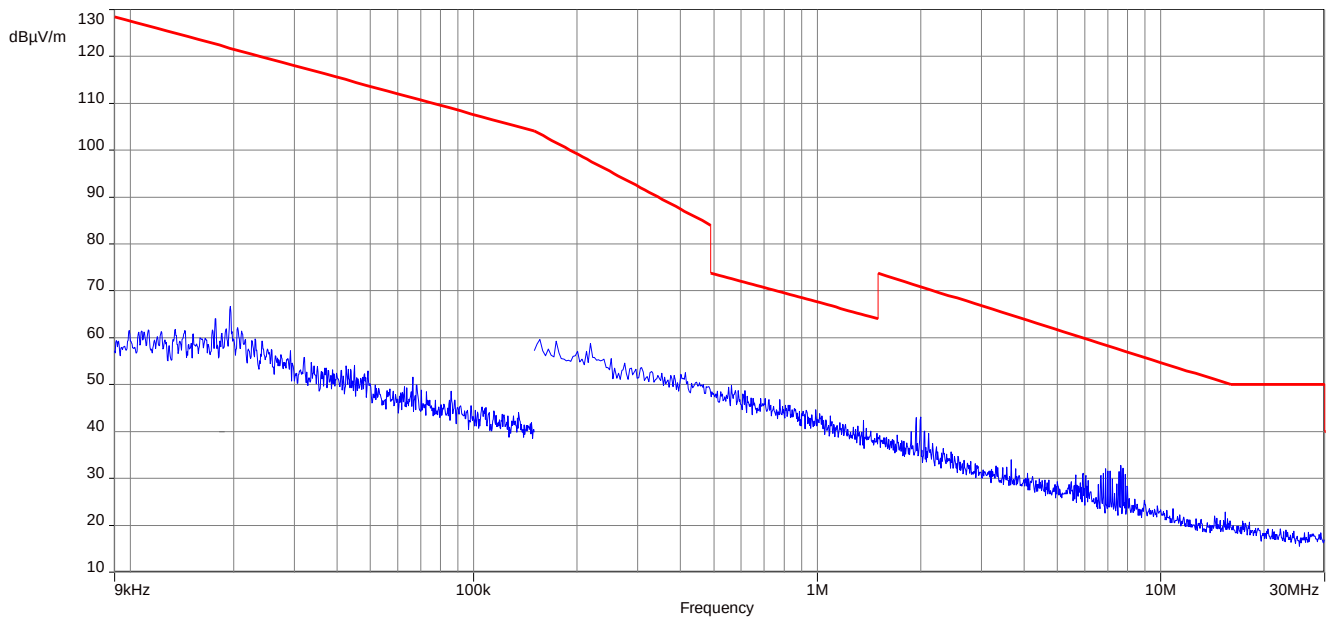


**Plots:** OFDM (20 MHz bandwidth)

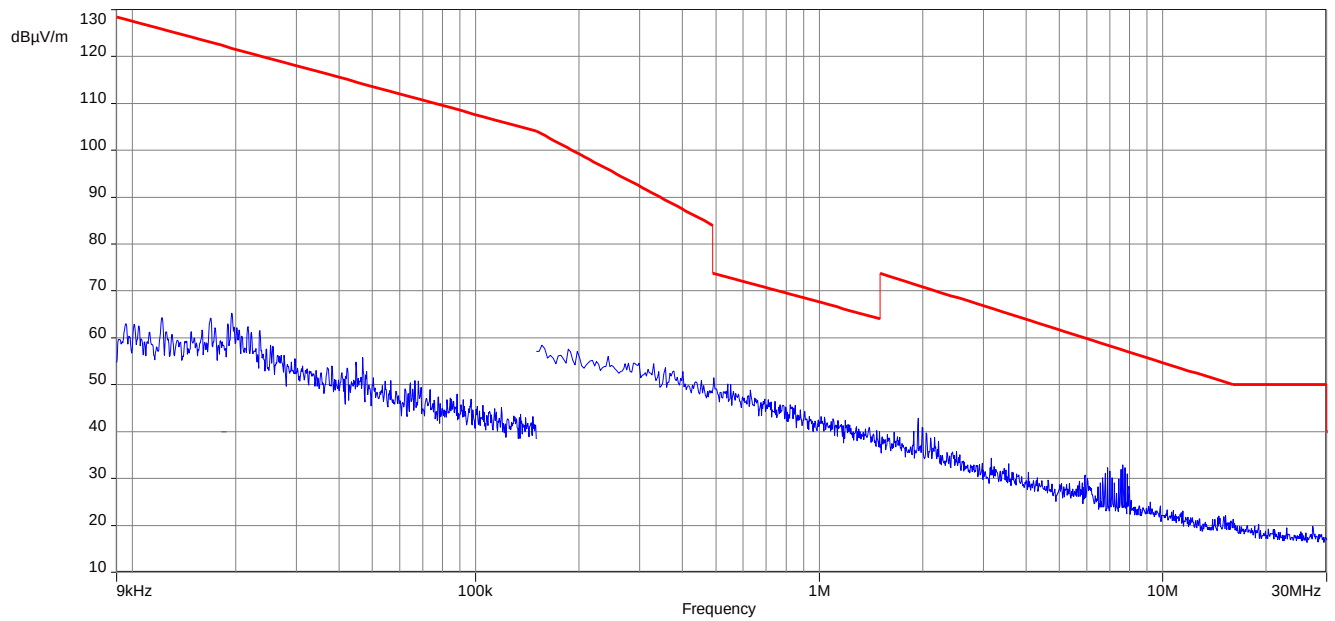
**Plot 1:** 9 kHz to 30 MHz, low channel



**Plot 2:** 9 kHz to 30 MHz, mid channel



**Plot 3:** 9 kHz to 30 MHz, high channel



### 11.13 Spurious emissions radiated 30 MHz to 1 GHz

#### Description:

Measurement of the radiated spurious emissions and cabinet radiations below 1 GHz.

#### Measurement:

| Measurement parameter   |                                                                                                                                                                                                               |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Detector:               | Peak / Quasi Peak                                                                                                                                                                                             |
| Sweep time:             | Auto                                                                                                                                                                                                          |
| Resolution bandwidth:   | 120 kHz                                                                                                                                                                                                       |
| Video bandwidth:        | 3 x RBW                                                                                                                                                                                                       |
| Span:                   | 30 MHz to 1 GHz                                                                                                                                                                                               |
| Trace mode:             | Max Hold                                                                                                                                                                                                      |
| Measured modulation     | <input checked="" type="checkbox"/> DSSS b – mode<br><input checked="" type="checkbox"/> OFDM g – mode<br><input type="checkbox"/> OFDM n HT20 – mode<br><input checked="" type="checkbox"/> RX / Idle – mode |
| Test setup:             | See sub clause 6.1 - A                                                                                                                                                                                        |
| Measurement uncertainty | See sub clause 8                                                                                                                                                                                              |

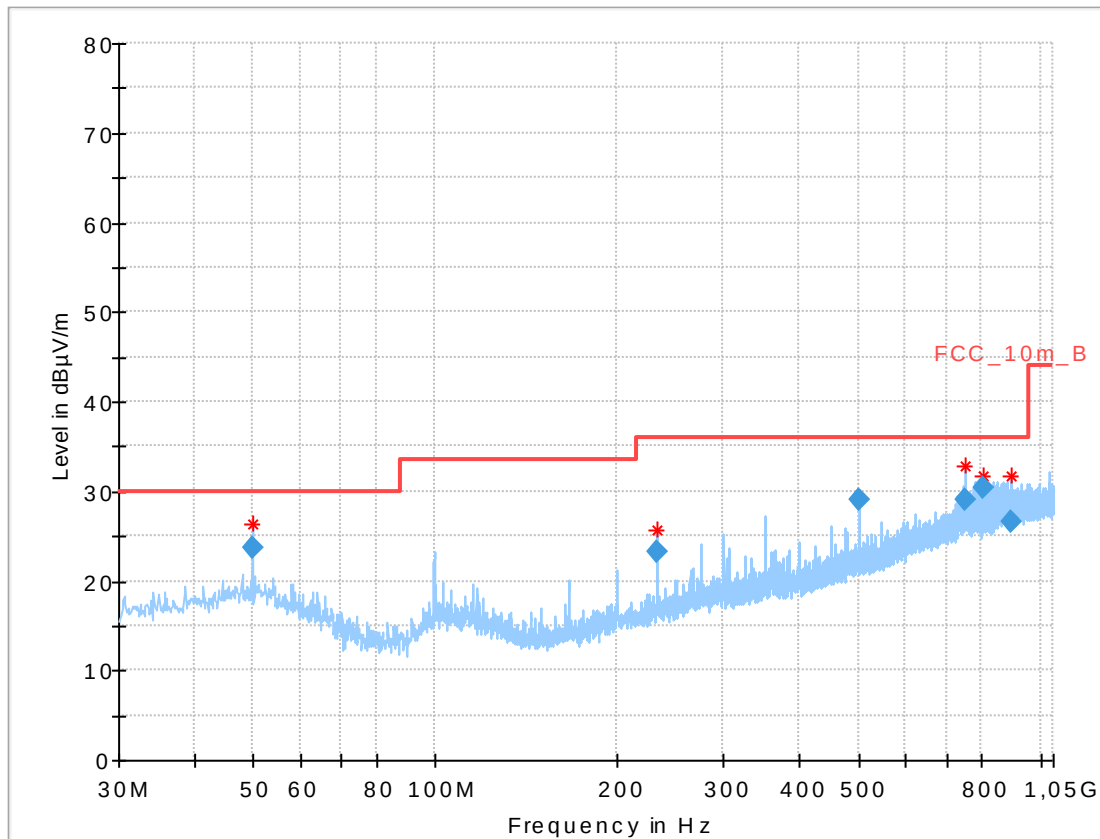
The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

#### Limits:

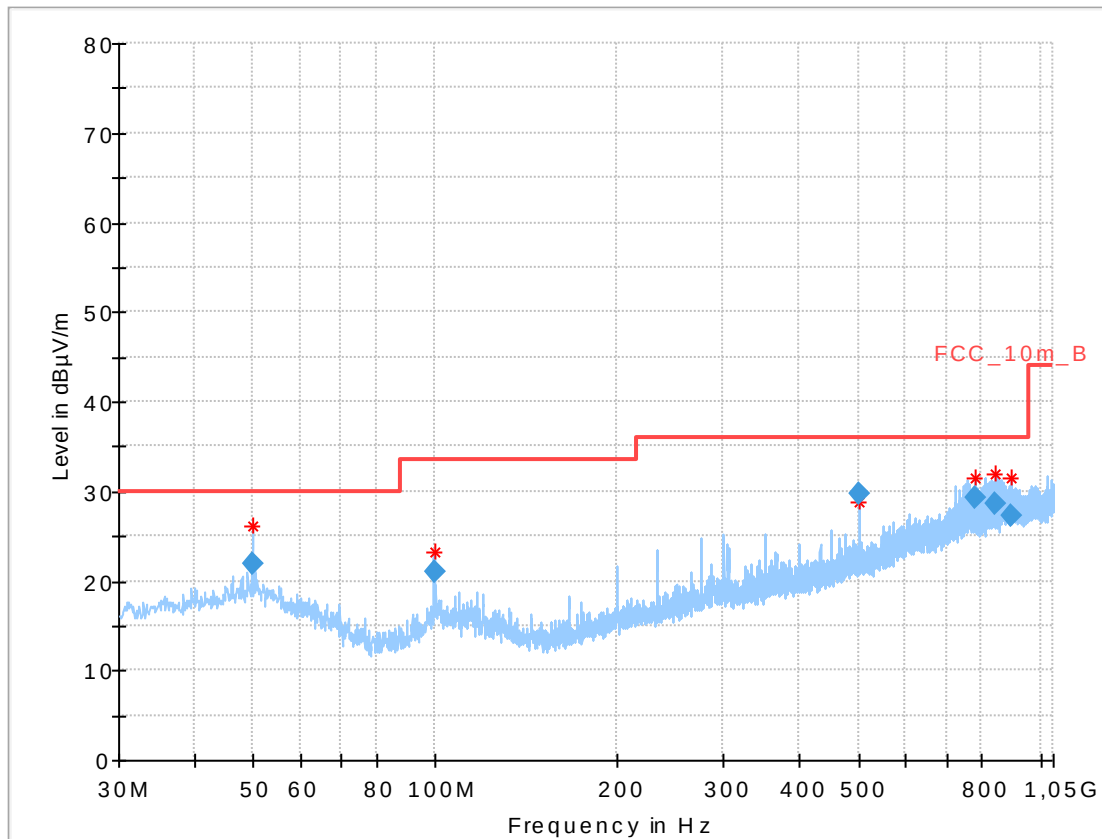
| FCC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                         | IC                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------|
| 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). |                         |                      |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Field Strength (dBμV/m) | Measurement distance |
| 30 - 88                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30.0                    | 10                   |
| 88 – 216                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 33.5                    | 10                   |
| 216 – 960                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 36.0                    | 10                   |

**Plot:** DSSS

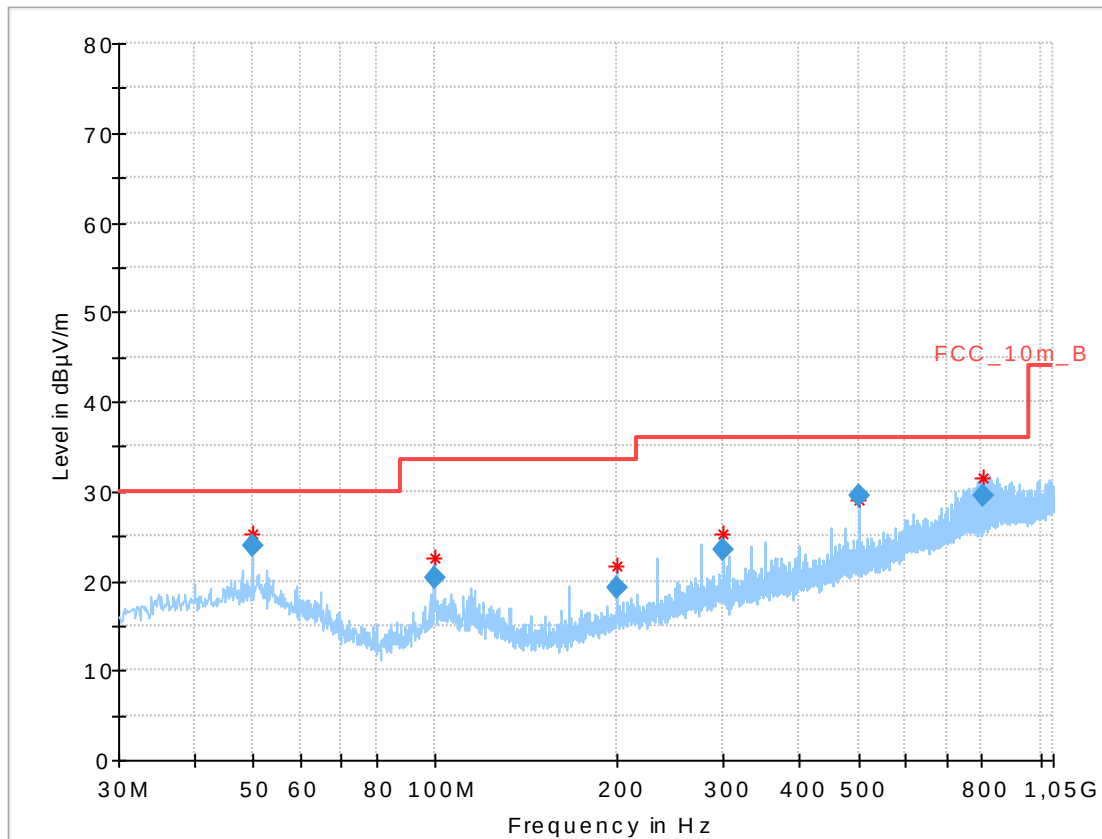
**Plot 1:** 30 MHz to 1 GHz, vertical & horizontal polarization, low channel



| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 50.000250       | 23.79              | 30.00          | 6.21        | 1000.0          | 120.000         | 98.0        | V   | 275.0         | 13.7       |
| 232.797300      | 23.31              | 36.00          | 12.69       | 1000.0          | 120.000         | 98.0        | V   | 153.0         | 12.9       |
| 500.002650      | 28.96              | 36.00          | 7.04        | 1000.0          | 120.000         | 177.0       | H   | 185.0         | 18.7       |
| 751.897950      | 29.05              | 36.00          | 6.95        | 1000.0          | 120.000         | 101.0       | H   | 212.0         | 22.7       |
| 804.031950      | 30.28              | 36.00          | 5.72        | 1000.0          | 120.000         | 98.0        | H   | 0.0           | 22.8       |
| 894.436800      | 26.67              | 36.00          | 9.33        | 1000.0          | 120.000         | 100.0       | H   | 19.0          | 24.1       |

**Plot 2:** 30 MHz to 1 GHz, vertical & horizontal polarization, mid channel

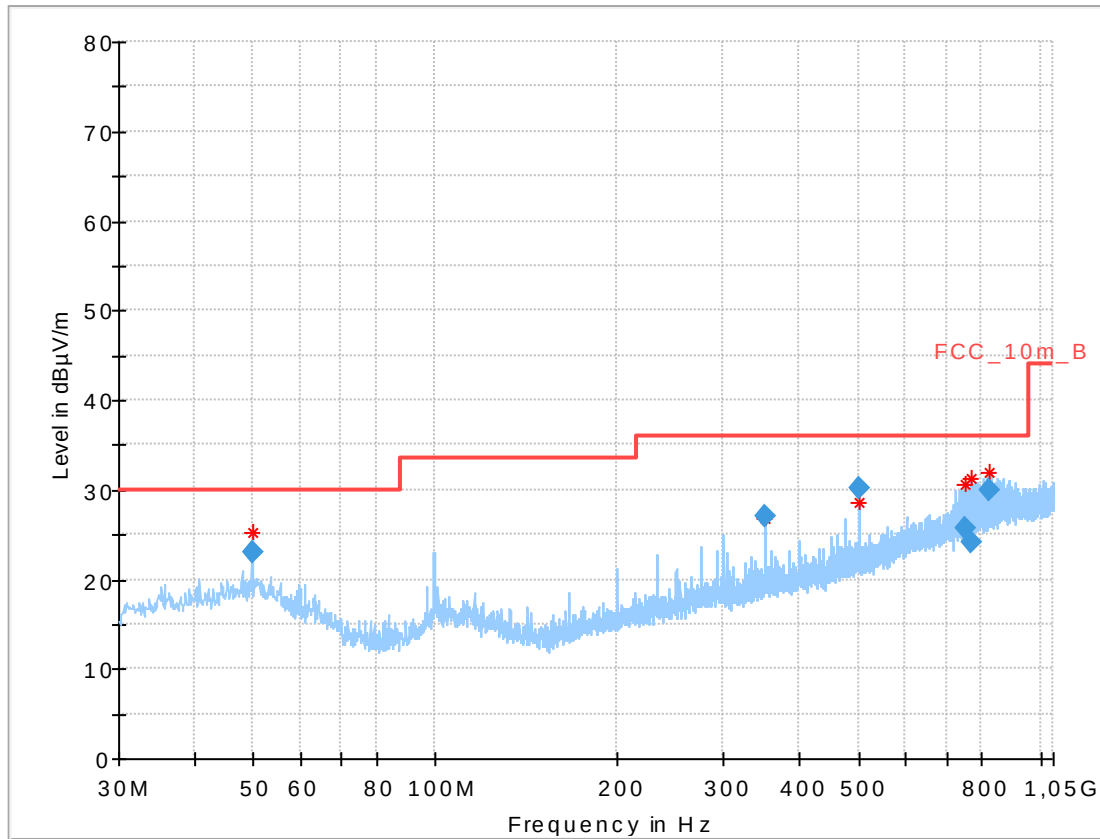
| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 50.037450       | 21.91              | 30.00          | 8.09        | 1000.0          | 120.000         | 101.0       | V   | 1.0           | 13.7       |
| 99.769500       | 21.09              | 33.50          | 12.41       | 1000.0          | 120.000         | 98.0        | V   | 69.0          | 12.1       |
| 499.996800      | 29.79              | 36.00          | 6.21        | 1000.0          | 120.000         | 185.0       | H   | 76.0          | 18.7       |
| 781.834050      | 29.20              | 36.00          | 6.80        | 1000.0          | 120.000         | 101.0       | H   | 352.0         | 22.7       |
| 839.600850      | 28.52              | 36.00          | 7.48        | 1000.0          | 120.000         | 98.0        | H   | 352.0         | 23.4       |
| 894.018300      | 27.31              | 36.00          | 8.69        | 1000.0          | 120.000         | 101.0       | H   | 14.0          | 24.1       |

**Plot 3:** 30 MHz to 1 GHz, vertical & horizontal polarization, high channel

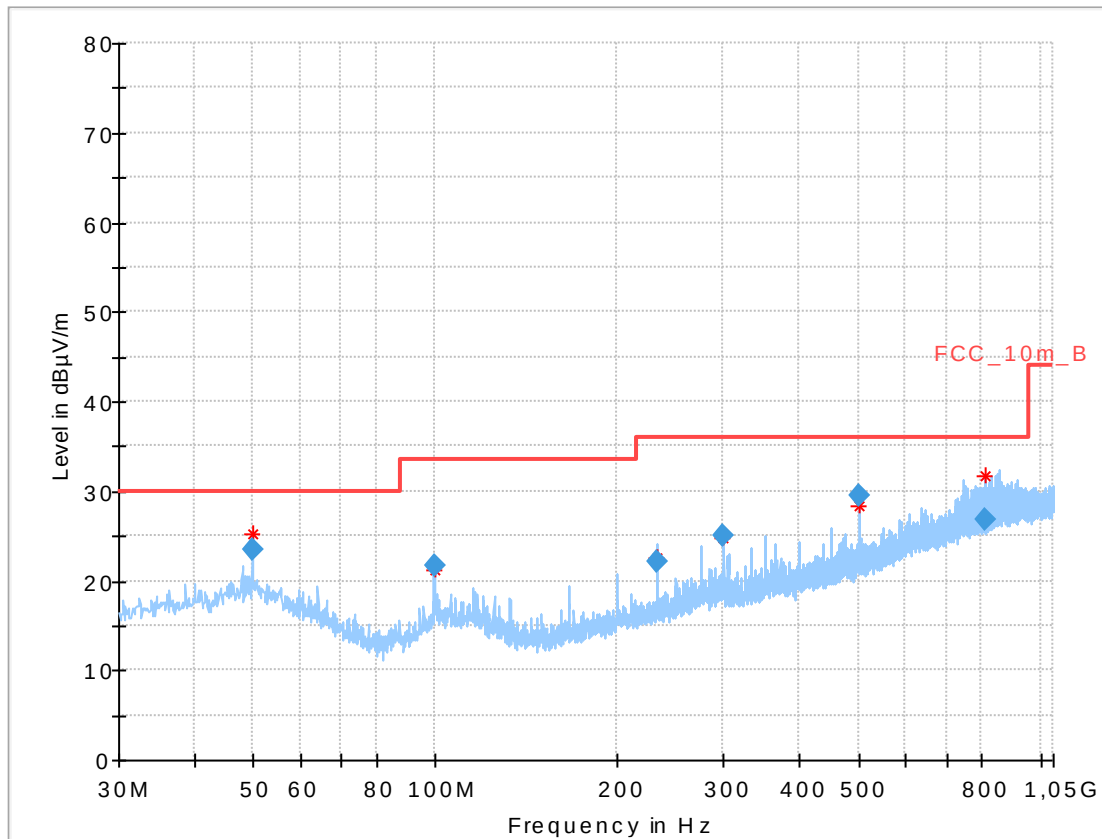
| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 50.006550       | 23.93              | 30.00          | 6.07        | 1000.0          | 120.000         | 98.0        | V   | 24.0          | 13.7       |
| 99.764700       | 20.27              | 33.50          | 13.23       | 1000.0          | 120.000         | 98.0        | V   | 0.0           | 12.1       |
| 199.983300      | 19.24              | 33.50          | 14.26       | 1000.0          | 120.000         | 98.0        | V   | 206.0         | 11.9       |
| 299.336400      | 23.38              | 36.00          | 12.62       | 1000.0          | 120.000         | 101.0       | V   | 175.0         | 14.4       |
| 499.988100      | 29.59              | 36.00          | 6.41        | 1000.0          | 120.000         | 185.0       | H   | 195.0         | 18.7       |
| 802.761300      | 29.49              | 36.00          | 6.51        | 1000.0          | 120.000         | 98.0        | H   | 206.0         | 22.8       |

**Plot:** OFDM (20 MHz bandwidth)

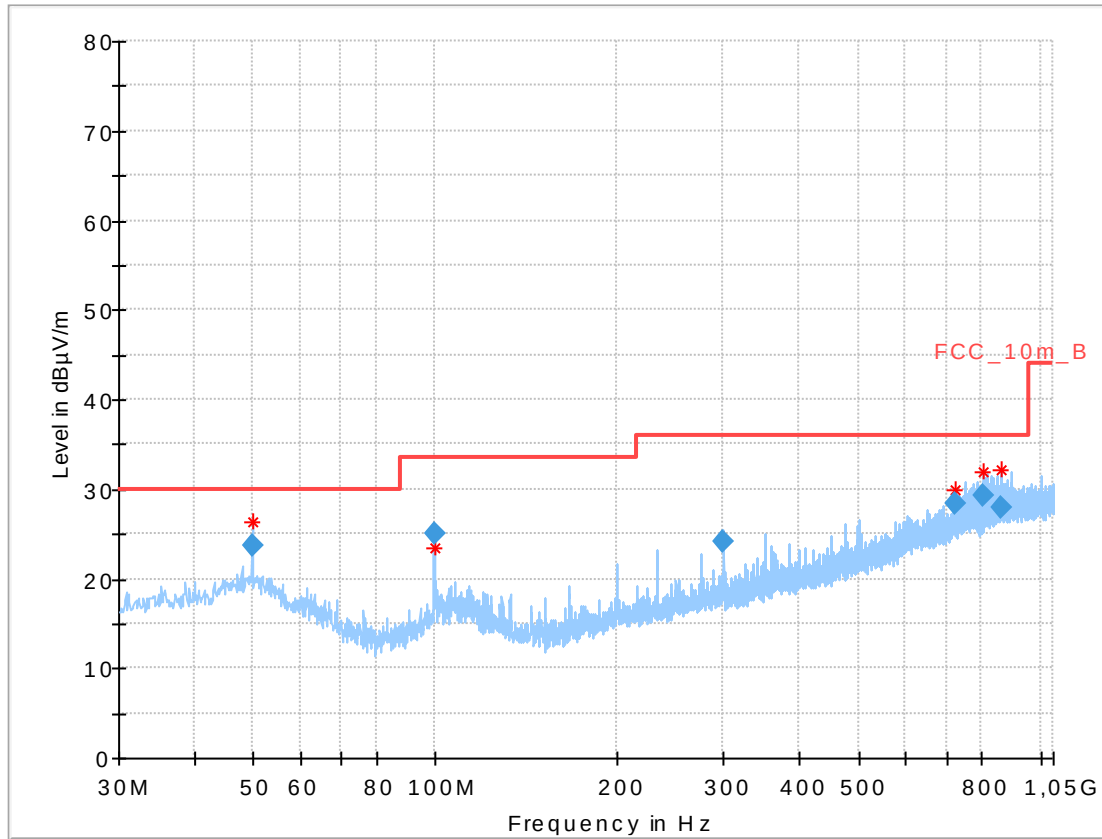
**Plot 1:** 30 MHz to 1 GHz, vertical & horizontal polarization, low channel



| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 50.016300       | 23.10              | 30.00          | 6.90        | 1000.0          | 120.000         | 101.0       | V   | 248.0         | 13.7       |
| 350.010900      | 27.00              | 36.00          | 9.00        | 1000.0          | 120.000         | 185.0       | H   | 197.0         | 16.0       |
| 500.004450      | 30.07              | 36.00          | 5.93        | 1000.0          | 120.000         | 179.0       | H   | 72.0          | 18.7       |
| 752.352900      | 25.67              | 36.00          | 10.33       | 1000.0          | 120.000         | 98.0        | H   | 225.0         | 22.7       |
| 771.102600      | 24.17              | 36.00          | 11.83       | 1000.0          | 120.000         | 98.0        | H   | 349.0         | 22.7       |
| 824.739750      | 29.97              | 36.00          | 6.03        | 1000.0          | 120.000         | 101.0       | H   | 197.0         | 23.1       |

**Plot 2:** 30 MHz to 1 GHz, vertical & horizontal polarization, mid channel

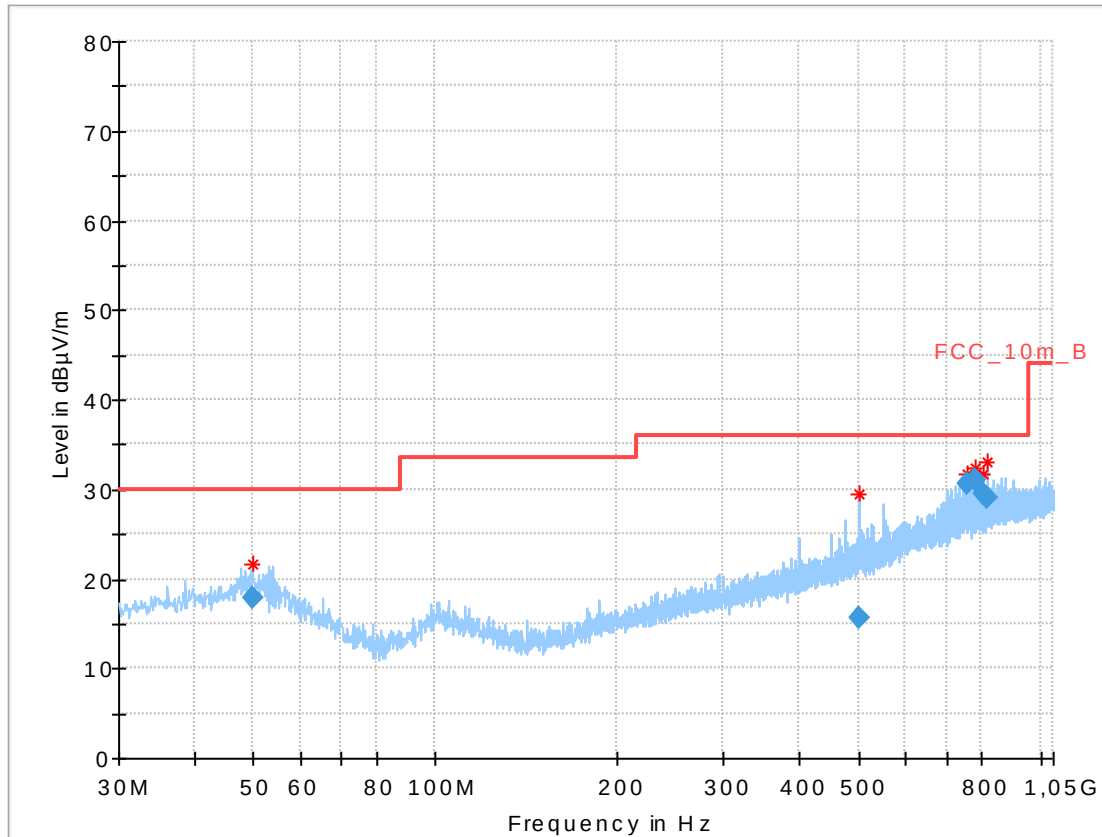
| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 49.984050       | 23.53              | 30.00          | 6.47        | 1000.0          | 120.000         | 98.0        | V   | 353.0         | 13.7       |
| 99.743100       | 21.64              | 33.50          | 11.86       | 1000.0          | 120.000         | 100.0       | V   | 21.0          | 12.1       |
| 232.803900      | 22.22              | 36.00          | 13.78       | 1000.0          | 120.000         | 98.0        | V   | 164.0         | 12.9       |
| 300.002550      | 24.92              | 36.00          | 11.08       | 1000.0          | 120.000         | 98.0        | V   | 180.0         | 14.4       |
| 500.007900      | 29.47              | 36.00          | 6.53        | 1000.0          | 120.000         | 185.0       | H   | 196.0         | 18.7       |
| 808.903800      | 26.84              | 36.00          | 9.16        | 1000.0          | 120.000         | 98.0        | H   | 212.0         | 22.9       |

**Plot 3:** 30 MHz to 1 GHz, vertical & horizontal polarization, high channel

| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 49.981950       | 23.77              | 30.00          | 6.23        | 1000.0          | 120.000         | 98.0        | V   | 350.0         | 13.7       |
| 99.611850       | 25.12              | 33.50          | 8.38        | 1000.0          | 120.000         | 98.0        | V   | 58.0          | 12.0       |
| 300.015600      | 24.07              | 36.00          | 11.93       | 1000.0          | 120.000         | 98.0        | V   | 350.0         | 14.4       |
| 724.993800      | 28.31              | 36.00          | 7.69        | 1000.0          | 120.000         | 101.0       | H   | 218.0         | 22.1       |
| 801.626850      | 29.29              | 36.00          | 6.71        | 1000.0          | 120.000         | 98.0        | H   | 198.0         | 22.8       |
| 862.486050      | 27.84              | 36.00          | 8.16        | 1000.0          | 120.000         | 98.0        | H   | 198.0         | 23.7       |

**Plot:** RX / Idle mode

**Plot 1:** 30 MHz to 1 GHz, vertical & horizontal polarization



| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 49.979550       | 17.84              | 30.00          | 12.16       | 1000.0          | 120.000         | 101.0       | V   | 153.0         | 13.7       |
| 499.981500      | 15.61              | 36.00          | 20.39       | 1000.0          | 120.000         | 185.0       | H   | 1.0           | 18.7       |
| 756.920550      | 30.71              | 36.00          | 5.29        | 1000.0          | 120.000         | 98.0        | H   | 172.0         | 22.7       |
| 780.205500      | 31.10              | 36.00          | 4.90        | 1000.0          | 120.000         | 98.0        | H   | 178.0         | 22.7       |
| 803.418600      | 29.60              | 36.00          | 6.40        | 1000.0          | 120.000         | 98.0        | H   | 190.0         | 22.8       |
| 815.067900      | 29.02              | 36.00          | 6.98        | 1000.0          | 120.000         | 98.0        | H   | 172.0         | 23.0       |

### 11.14 Spurious emissions radiated above 1 GHz

#### Description:

Measurement of the radiated spurious emissions above 1 GHz in transmit mode and receiver / idle mode.

#### Measurement:

| Measurement parameter   |                                                                                                                                                                                                               |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Detector:               | Peak / RMS                                                                                                                                                                                                    |
| Sweep time:             | Auto                                                                                                                                                                                                          |
| Resolution bandwidth:   | 1 MHz                                                                                                                                                                                                         |
| Video bandwidth:        | 3 x RBW                                                                                                                                                                                                       |
| Span:                   | 1 GHz to 26 GHz                                                                                                                                                                                               |
| Trace mode:             | Max Hold                                                                                                                                                                                                      |
| Measured modulation     | <input checked="" type="checkbox"/> DSSS b – mode<br><input checked="" type="checkbox"/> OFDM g – mode<br><input type="checkbox"/> OFDM n HT20 – mode<br><input checked="" type="checkbox"/> RX / Idle – mode |
| Test setup:             | See sub clause 6.2 - A                                                                                                                                                                                        |
| Measurement uncertainty | See sub clause 8                                                                                                                                                                                              |

#### Limits:

| FCC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               | IC                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------|
| 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 30 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). |                               |                      |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Field Strength (dB $\mu$ V/m) | Measurement distance |
| Above 960                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 54.0                          | 3                    |

**Results:** DSSS

| TX Spurious Emissions Radiated [dB $\mu$ V/m] |          |                      |          |          |                      |          |          |                      |
|-----------------------------------------------|----------|----------------------|----------|----------|----------------------|----------|----------|----------------------|
| 2412 MHz                                      |          |                      | 2437 MHz |          |                      | 2462 MHz |          |                      |
| F [MHz]                                       | Detector | Level [dB $\mu$ V/m] | F [MHz]  | Detector | Level [dB $\mu$ V/m] | F [MHz]  | Detector | Level [dB $\mu$ V/m] |
| 1437.5                                        | Peak     | 38.2                 | 4874.0   | Peak     | 43.9                 | 17950.4  | Peak     | 55.9                 |
|                                               | AVG      | -/-                  |          | AVG      | -/-                  |          | AVG      | 44.8                 |
| 4824.1                                        | Peak     | 44.0                 | -/-      | Peak     | -/-                  | -/-      | Peak     | -/-                  |
|                                               | AVG      | -/-                  |          | AVG      | -/-                  |          | AVG      | -/-                  |

**Results:** OFDM (20 MHz bandwidth)

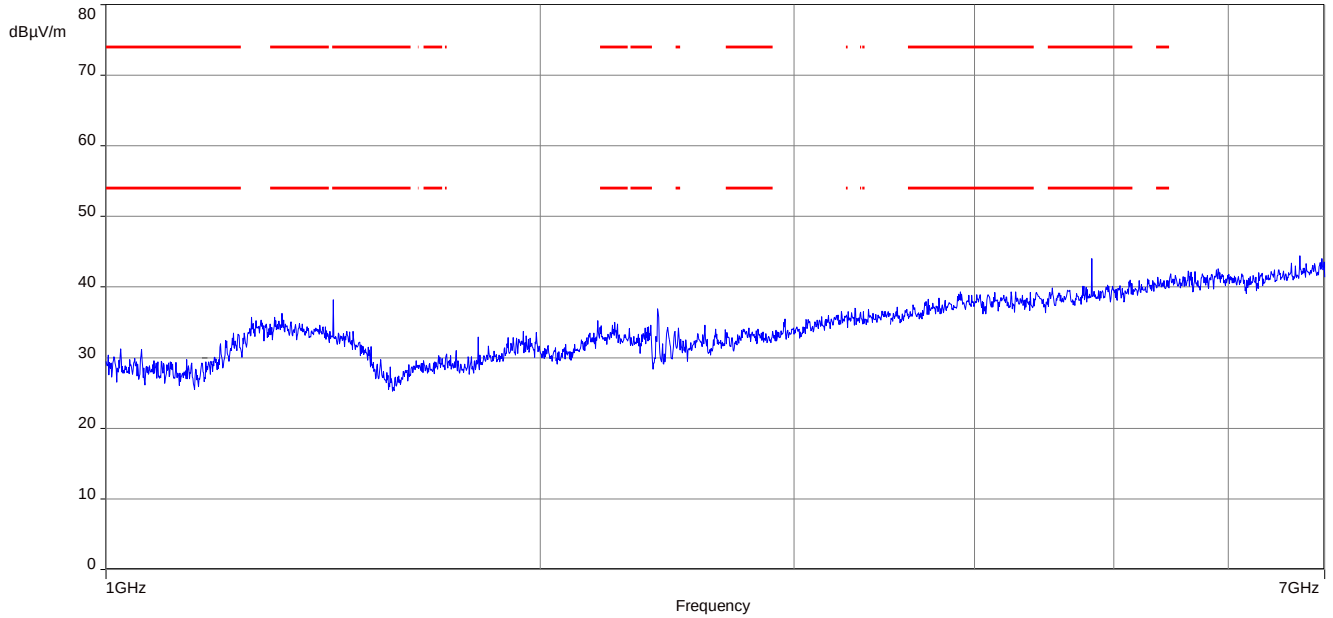
| TX Spurious Emissions Radiated [dB $\mu$ V/m] |          |                      |          |          |                      |          |          |                      |
|-----------------------------------------------|----------|----------------------|----------|----------|----------------------|----------|----------|----------------------|
| 2412 MHz                                      |          |                      | 2437 MHz |          |                      | 2462 MHz |          |                      |
| F [MHz]                                       | Detector | Level [dB $\mu$ V/m] | F [MHz]  | Detector | Level [dB $\mu$ V/m] | F [MHz]  | Detector | Level [dB $\mu$ V/m] |
| 1437.5                                        | Peak     | 38.2                 | 4874.0   | Peak     | 43.9                 | 17951.8  | Peak     | 56.1                 |
|                                               | AVG      | -/-                  |          | AVG      | -/-                  |          | AVG      | 44.8                 |
| 4824.1                                        | Peak     | 44.0                 | -/-      | Peak     | -/-                  | -/-      | Peak     | -/-                  |
|                                               | AVG      | -/-                  |          | AVG      | -/-                  |          | AVG      | -/-                  |

**Results:** RX / idle – mode

| TX Spurious Emissions Radiated [dB $\mu$ V/m] |          |                      |
|-----------------------------------------------|----------|----------------------|
| F [MHz]                                       | Detector | Level [dB $\mu$ V/m] |
| 17951                                         | Peak     | 56.2                 |
|                                               | AVG      | 44.9                 |
| -/-                                           | Peak     | -/-                  |
|                                               | AVG      | -/-                  |

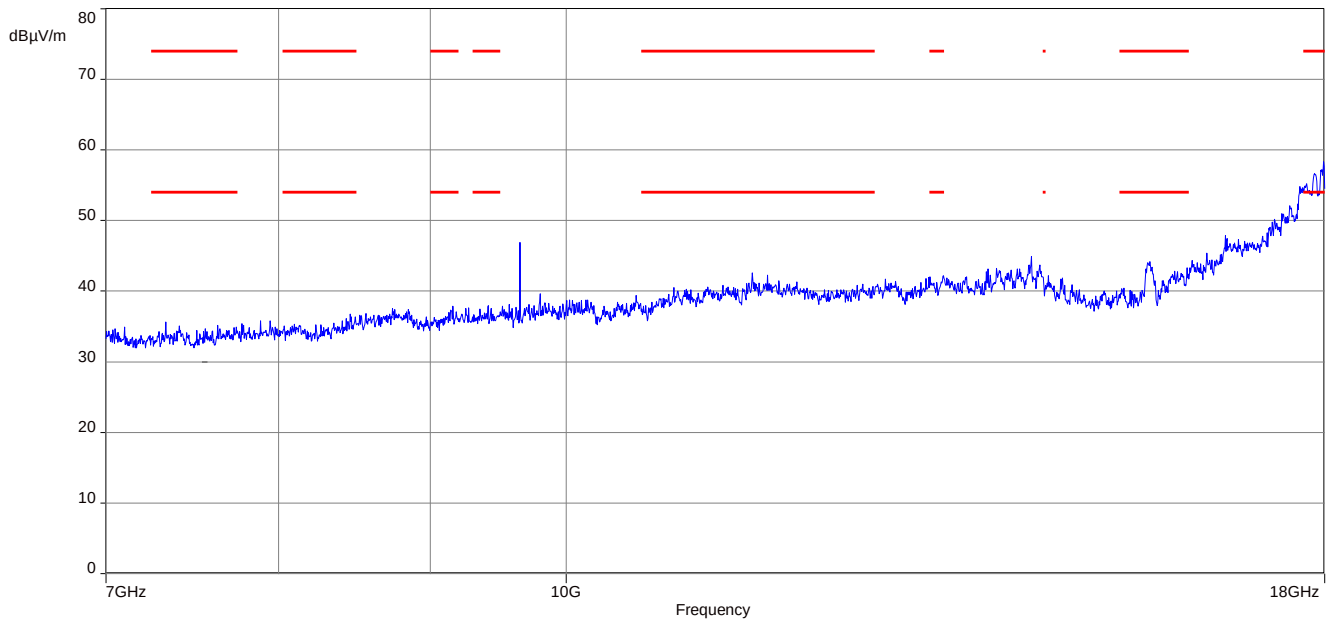
**Plots:** DSSS

**Plot 1:** Lowest channel, 1 GHz to 7 GHz, vertical & horizontal polarization

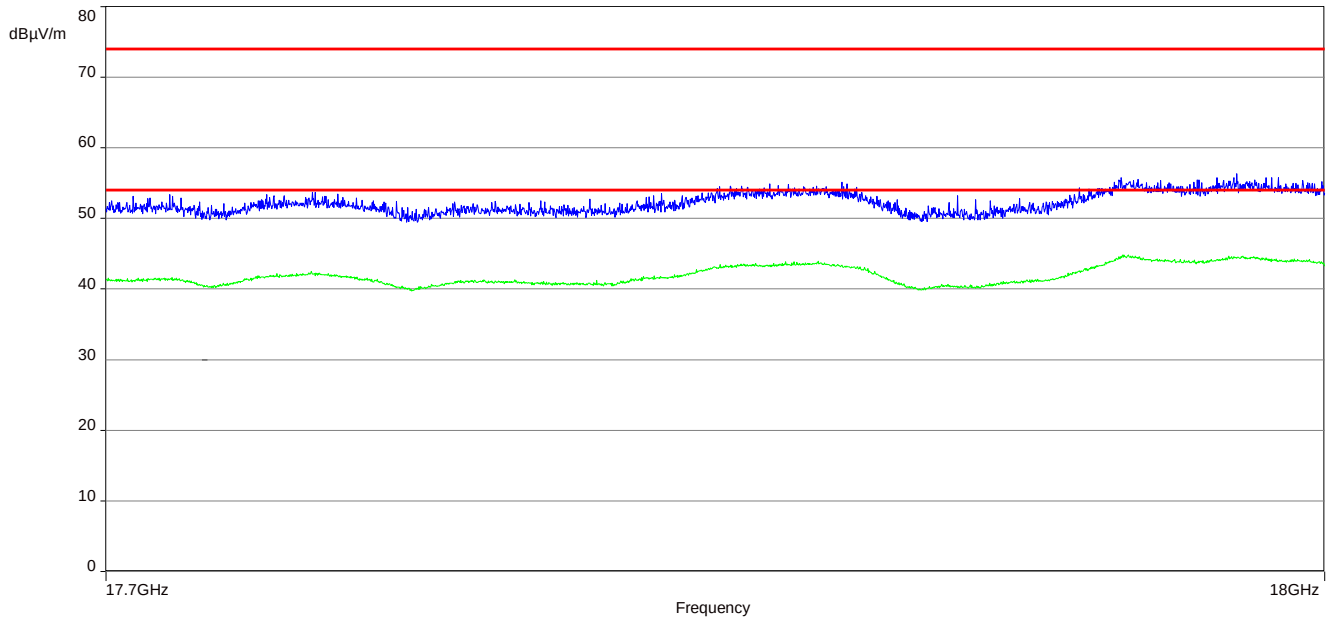


The carrier signal is notched with a 2.4 GHz band rejection filter.

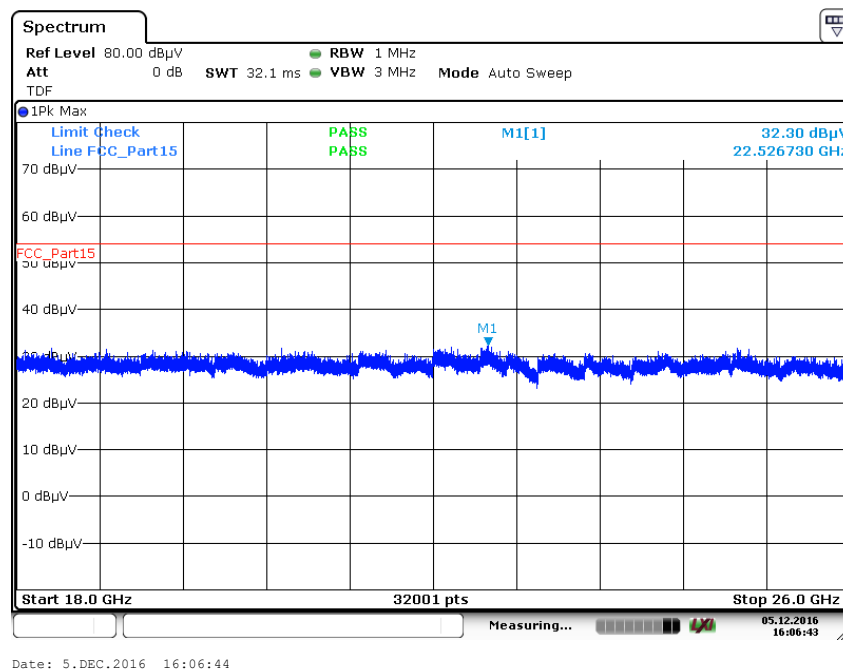
**Plot 2:** Lowest channel, 7 GHz to 18 GHz, vertical & horizontal polarization, peak & average



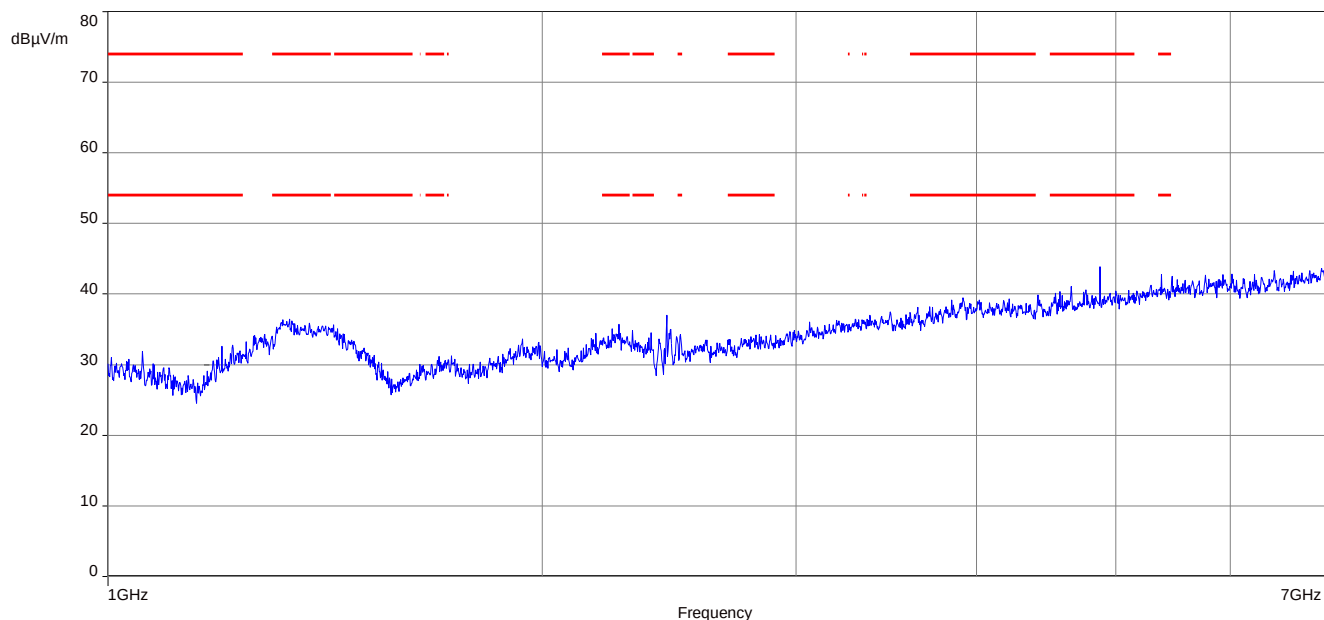
**Plot 3:** Lowest channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization, peak & average



**Plot 4:** Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

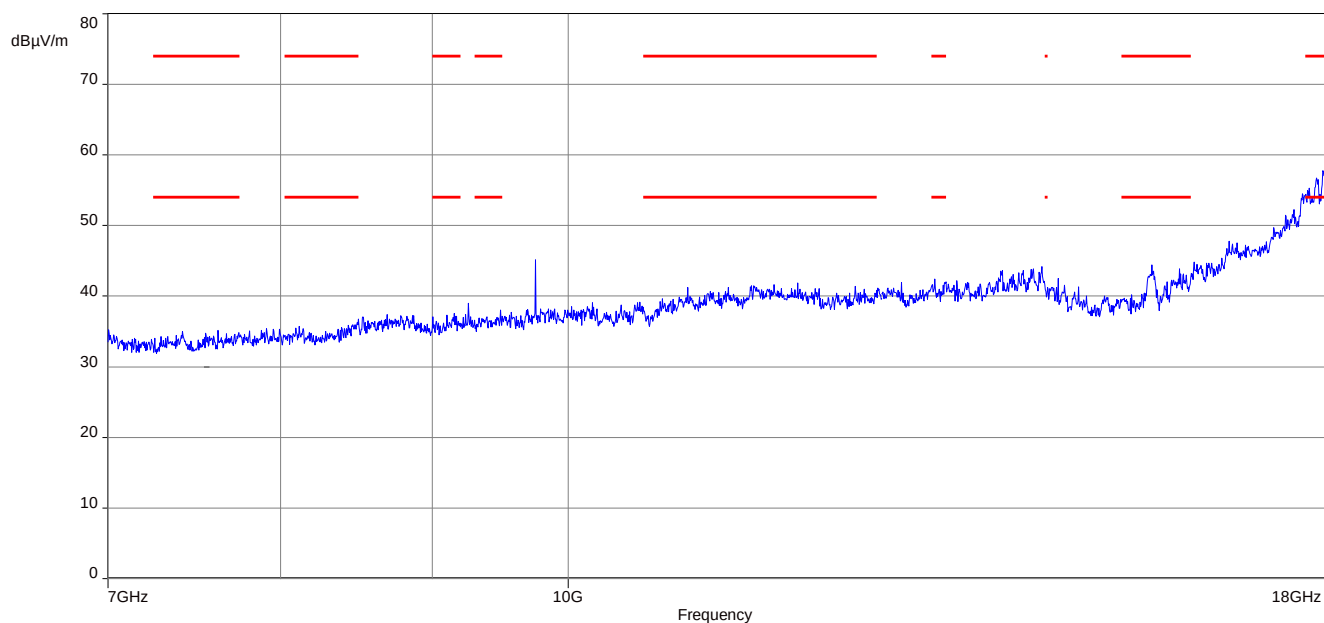


**Plot 5:** Middle channel, 1 GHz to 7 GHz, vertical & horizontal polarization

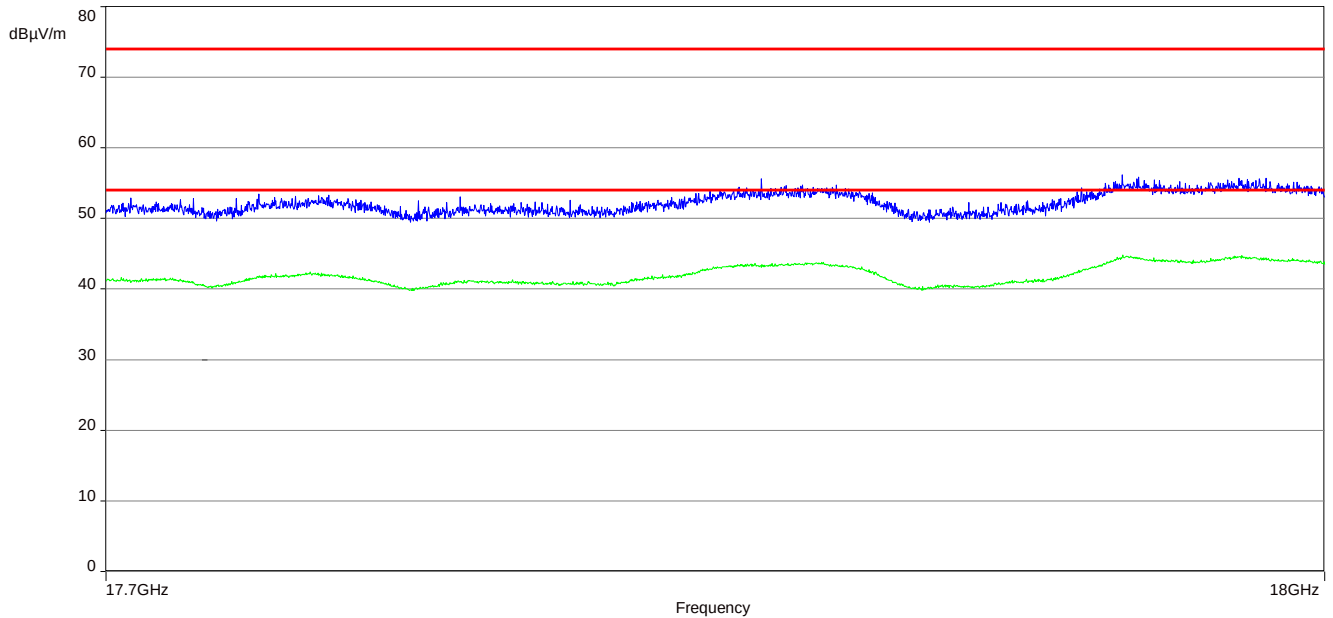


The carrier signal is notched with a 2.4 GHz band rejection filter.

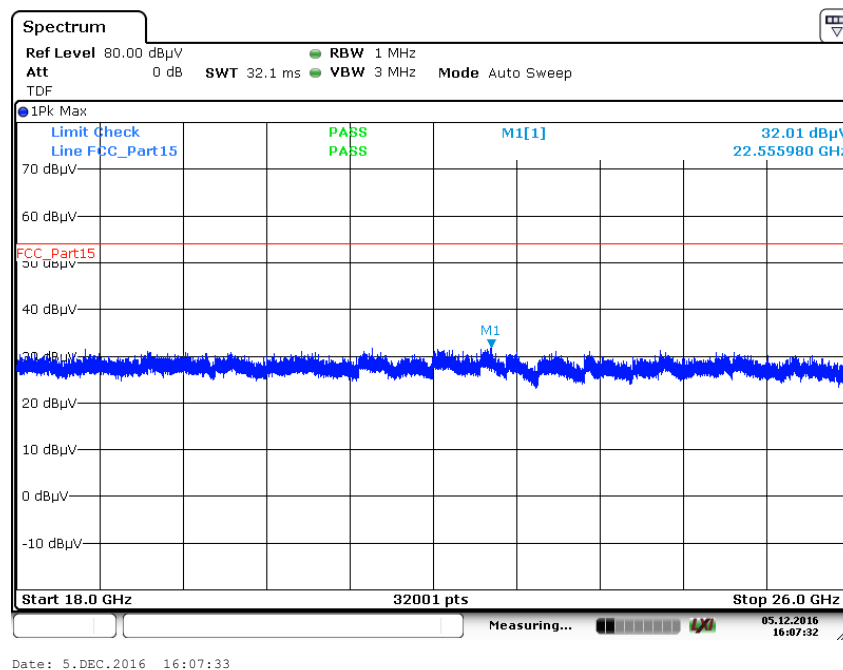
**Plot 6:** Middle channel, 7 GHz to 18 GHz, vertical & horizontal polarization



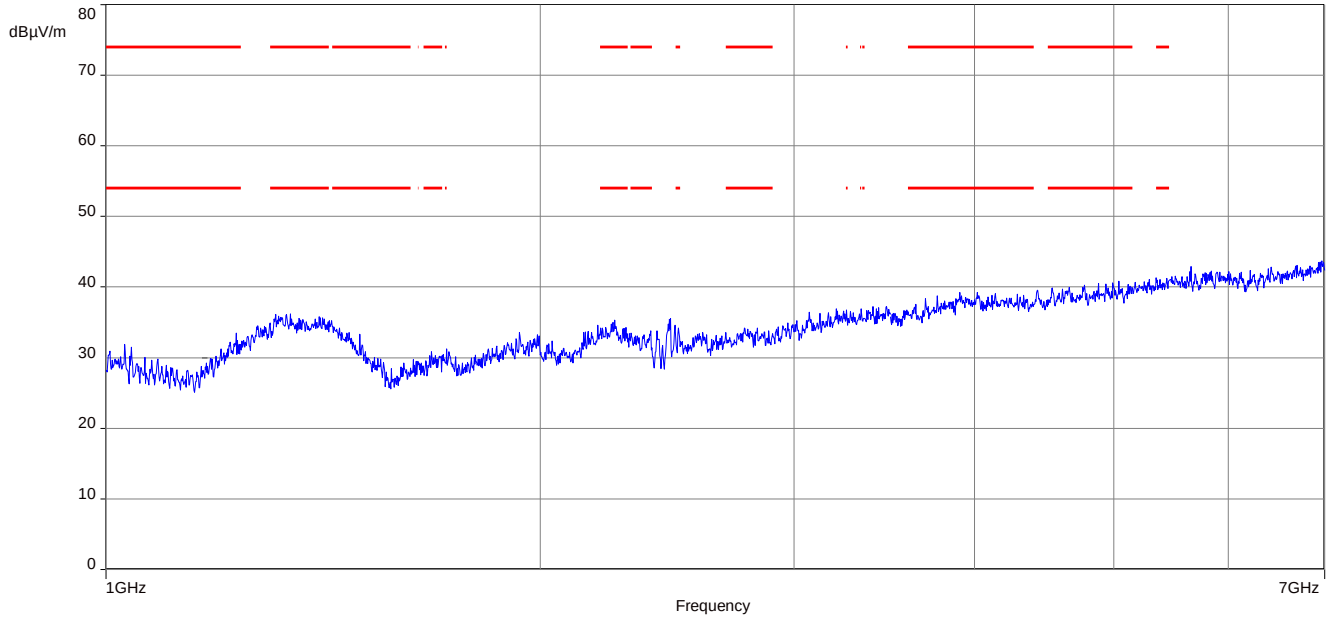
**Plot 7:** Middle channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization, peak & average



**Plot 8:** Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization

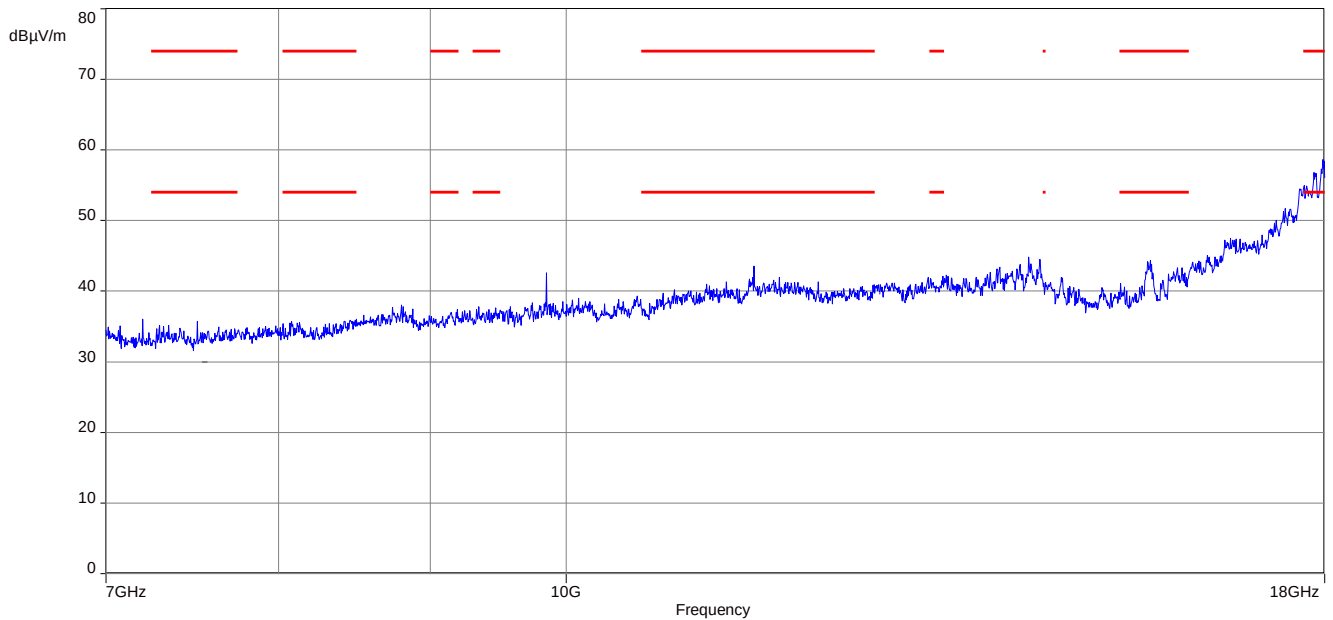


**Plot 9:** Highest channel, 1 GHz to 7 GHz, vertical & horizontal polarization

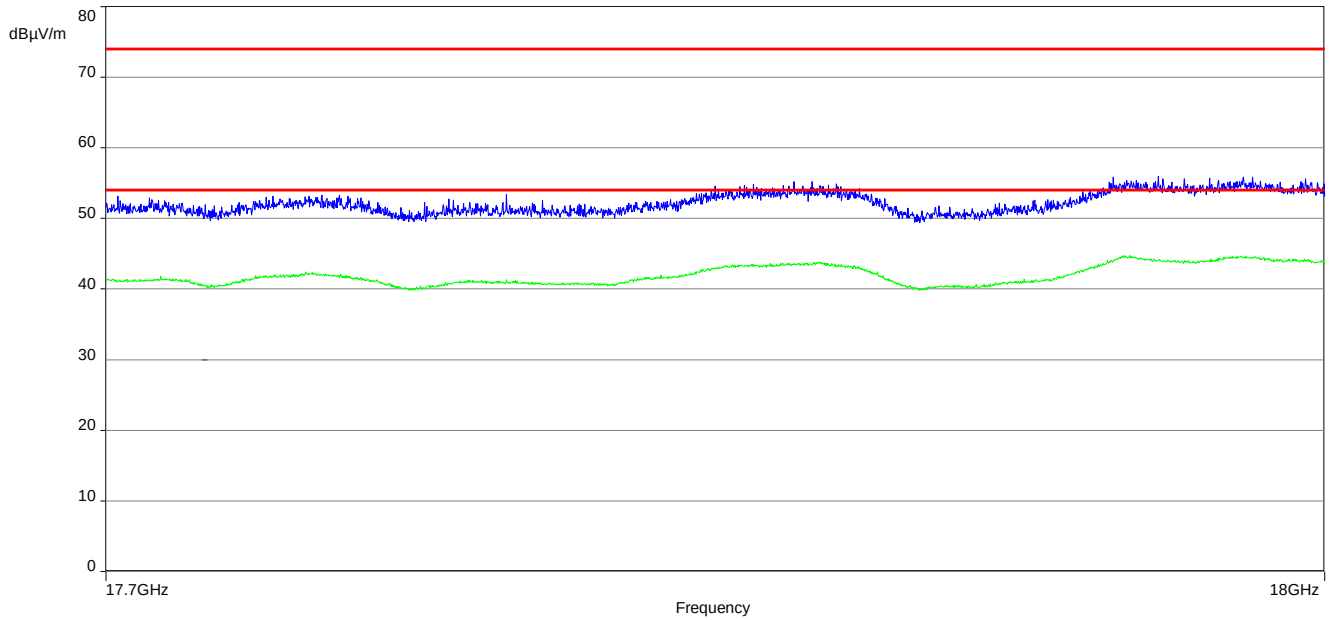


The carrier signal is notched with a 2.4 GHz band rejection filter.

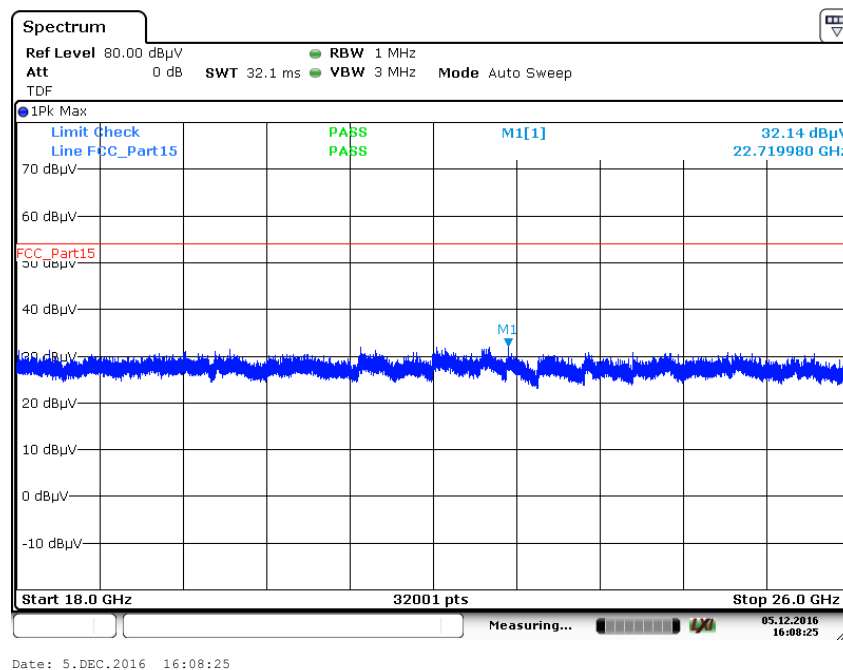
**Plot 10:** Highest channel, 7 GHz to 18 GHz, vertical & horizontal polarization



**Plot 11:** Highest channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization, peak & average

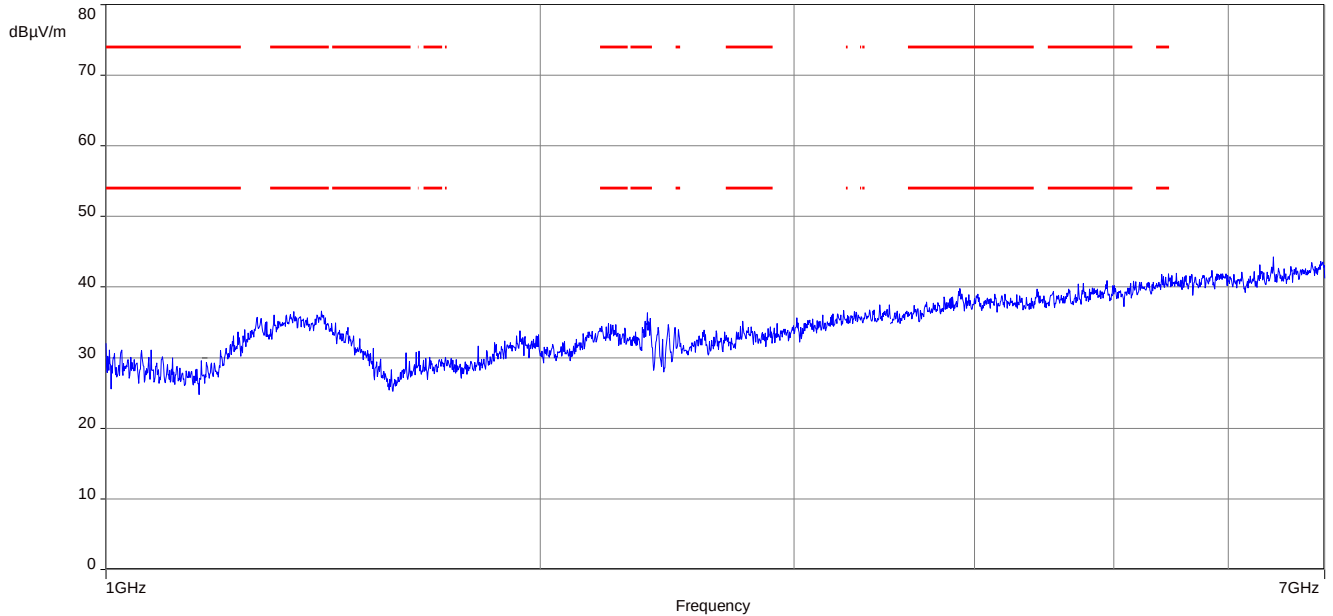


**Plot 12:** Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



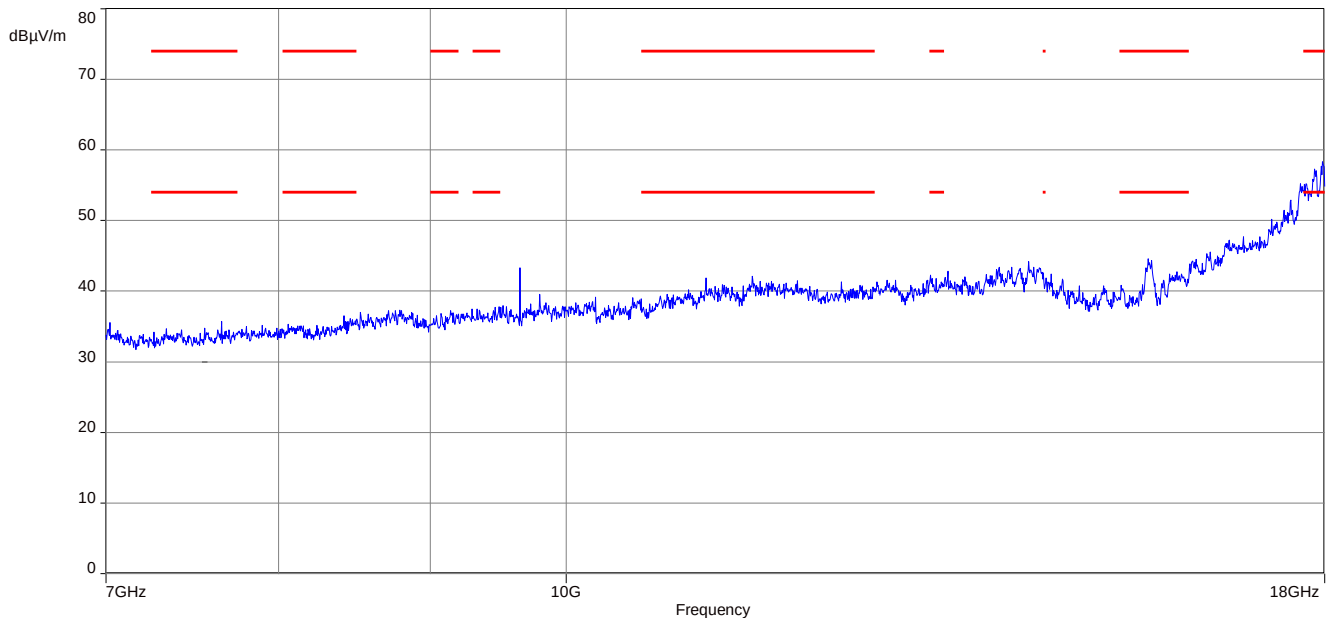
**Plots:** OFDM (20 MHz bandwidth)

**Plot 1:** Lowest channel, 1 GHz to 7 GHz, vertical & horizontal polarization

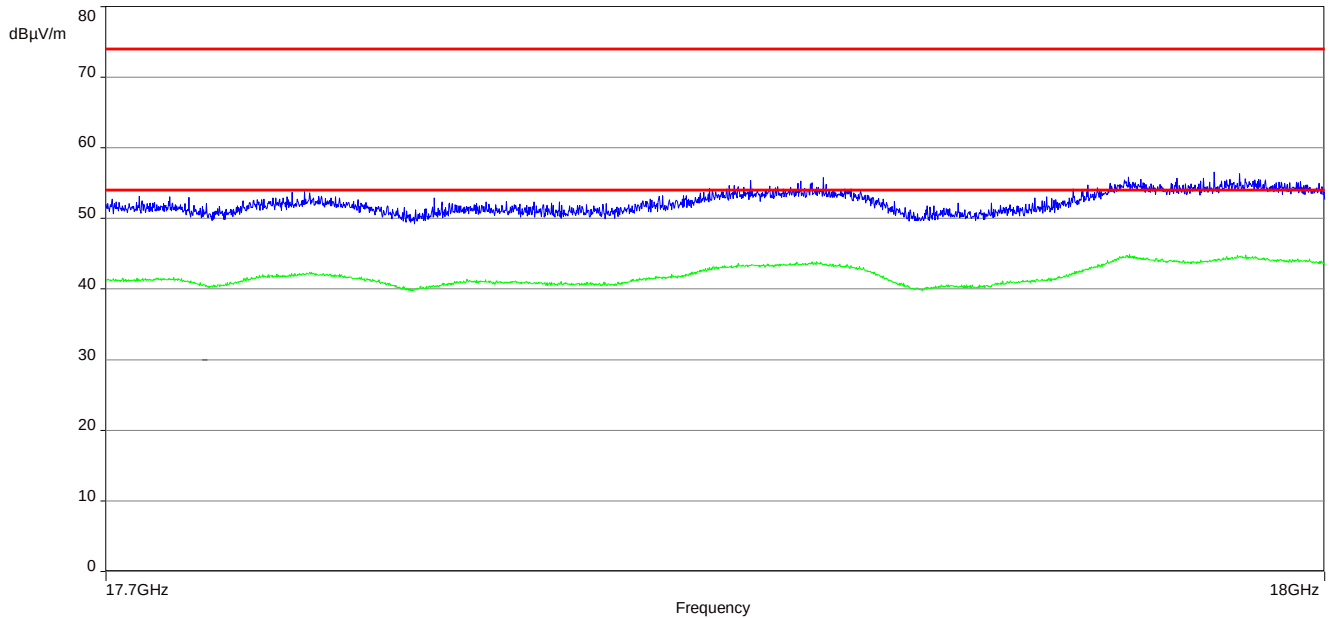


The carrier signal is notched with a 2.4 GHz band rejection filter.

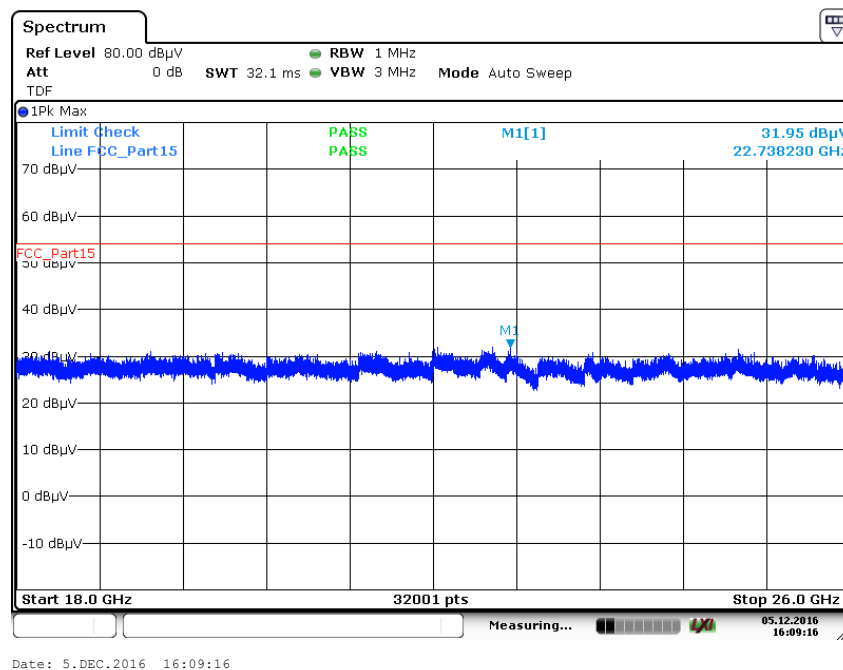
**Plot 2:** Lowest channel, 7 GHz to 18 GHz, vertical & horizontal polarization, peak & average



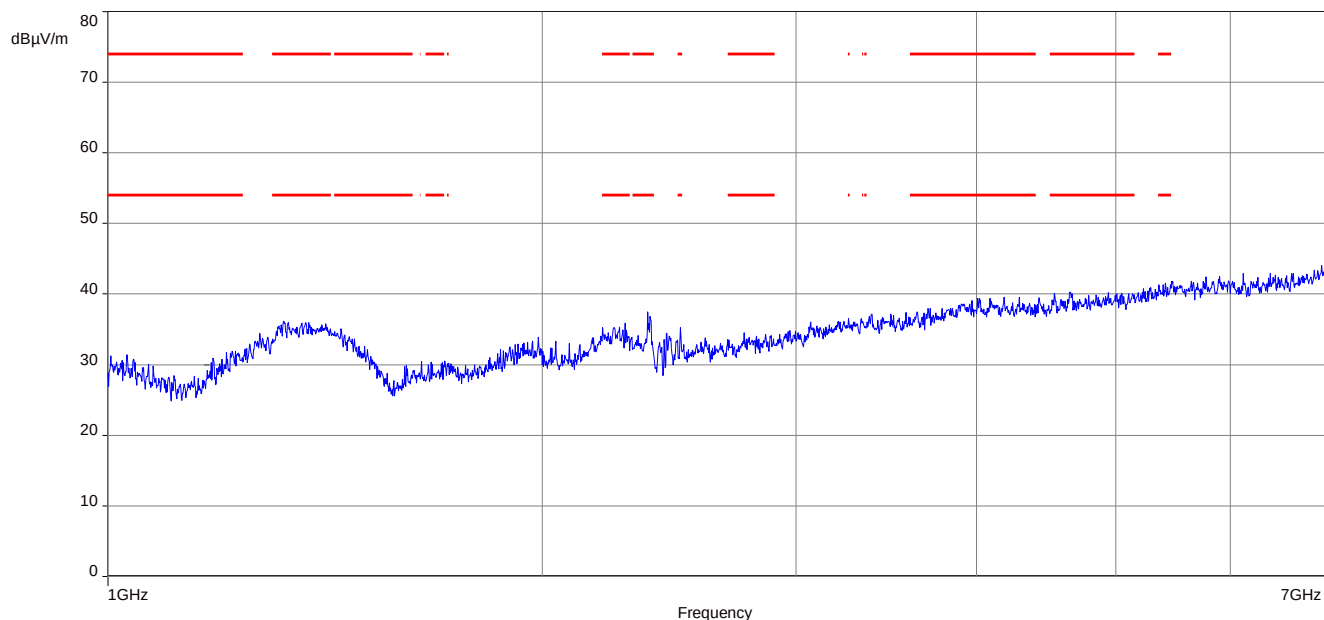
**Plot 3:** Lowest channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization, peak & average



**Plot 4:** Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

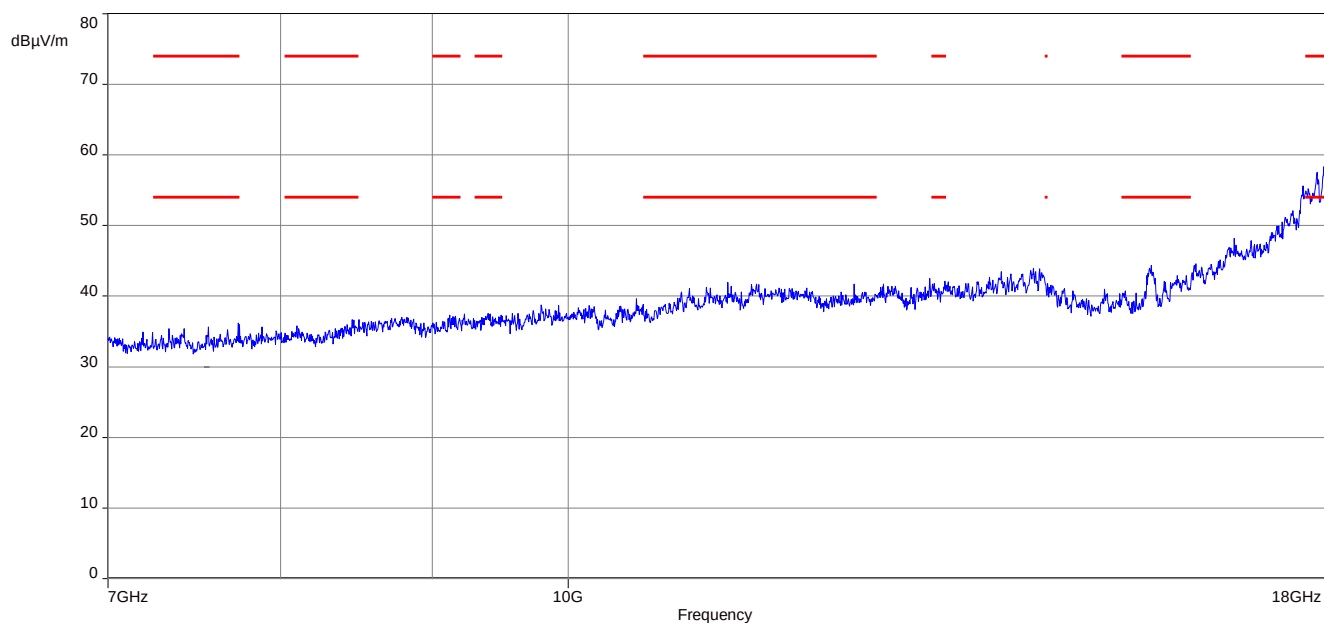


**Plot 5:** Middle channel, 1 GHz to 7 GHz, vertical & horizontal polarization

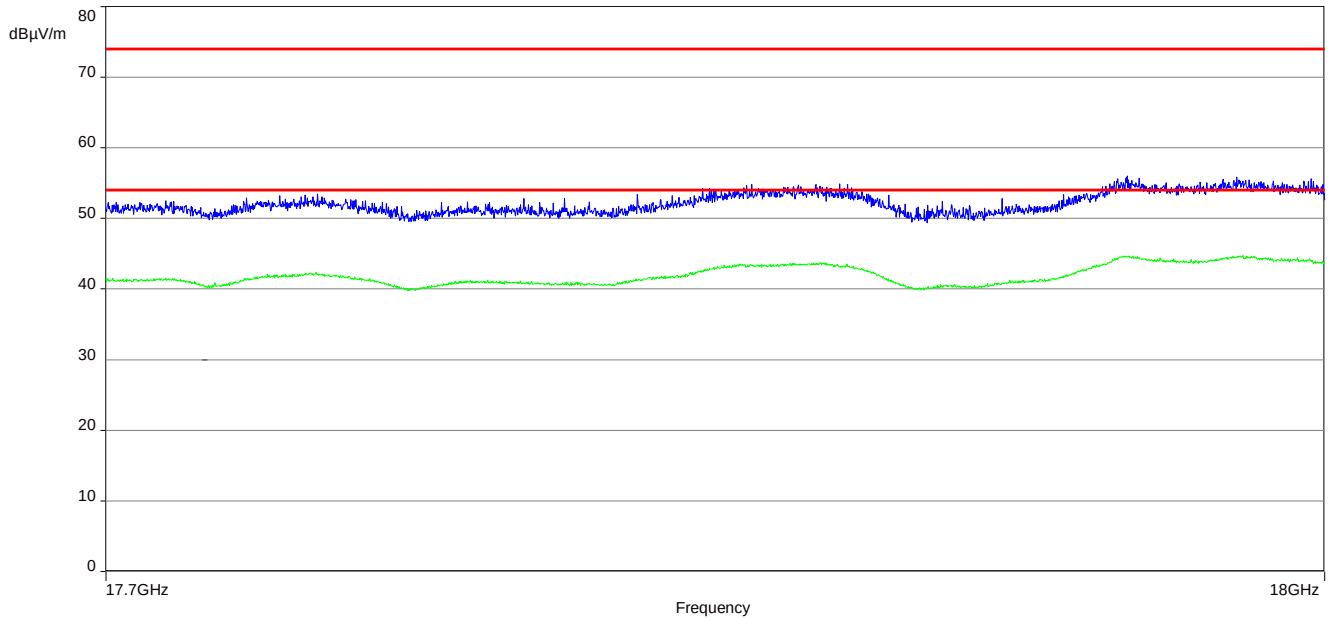


The carrier signal is notched with a 2.4 GHz band rejection filter.

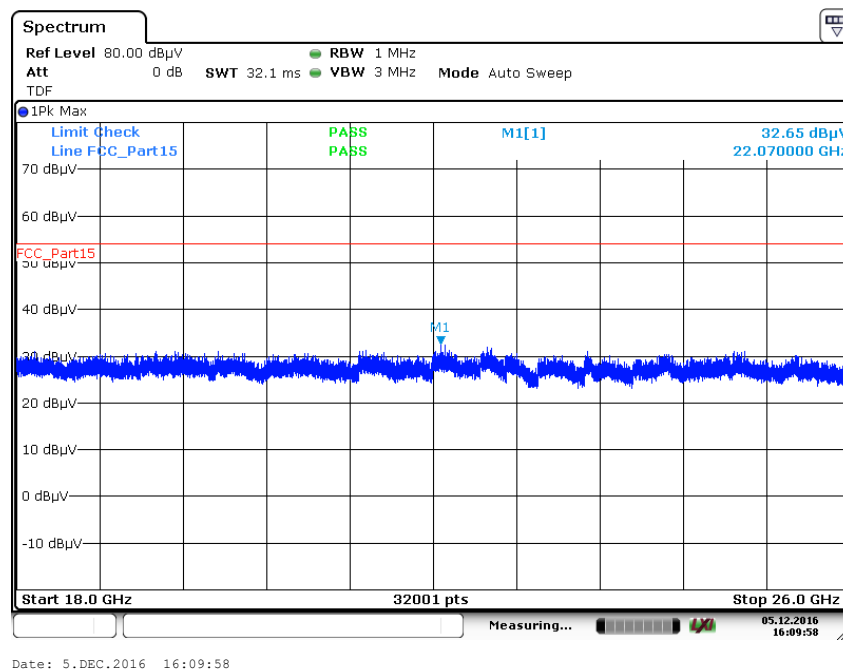
**Plot 6:** Middle channel, 7 GHz to 18 GHz, vertical & horizontal polarization



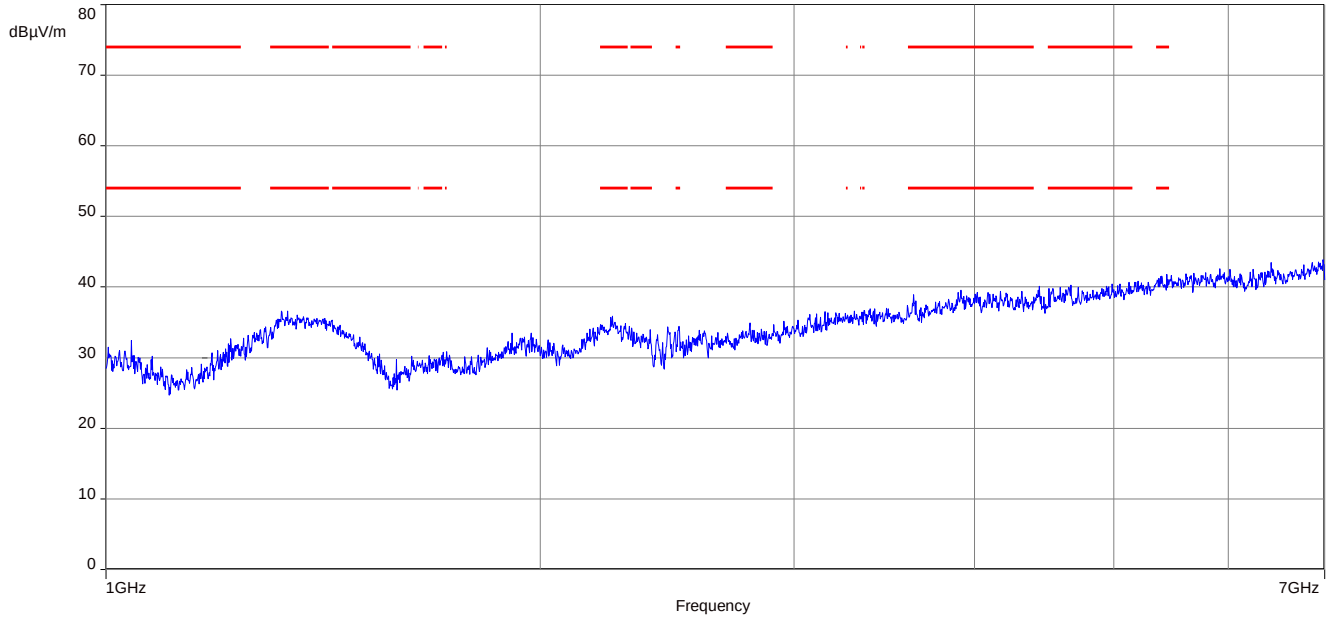
**Plot 7:** Middle channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization, peak & average



**Plot 8:** Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization

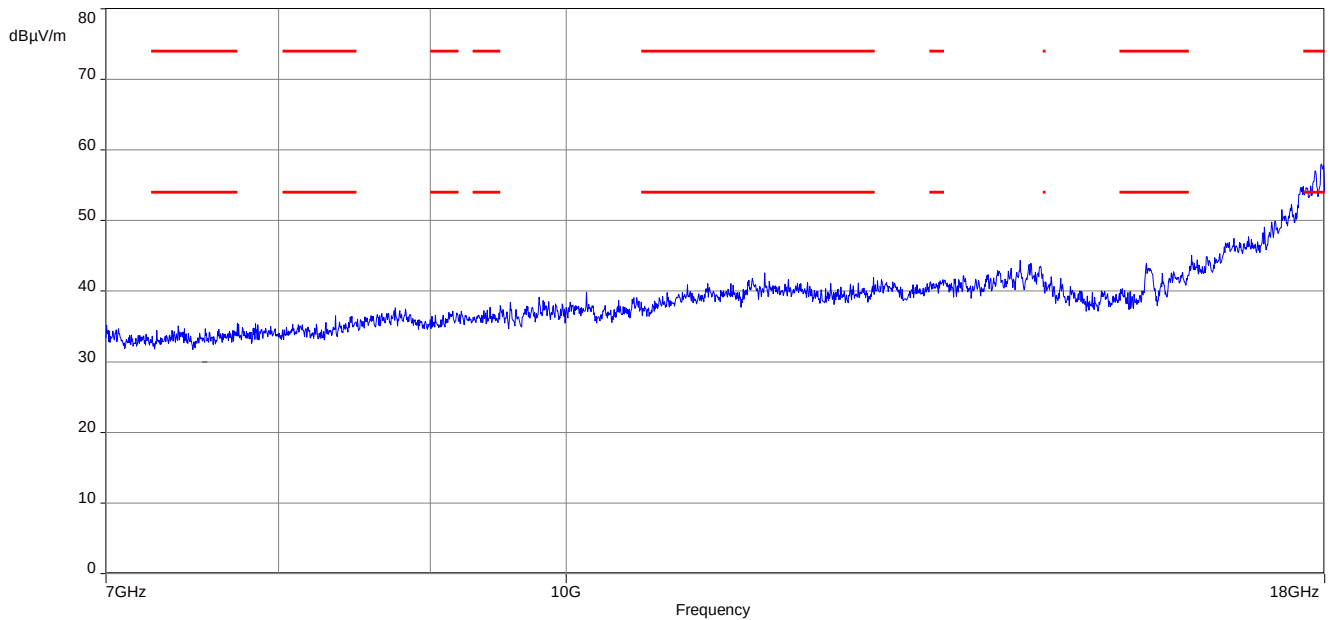


**Plot 9:** Highest channel, 1 GHz to 7 GHz, vertical & horizontal polarization

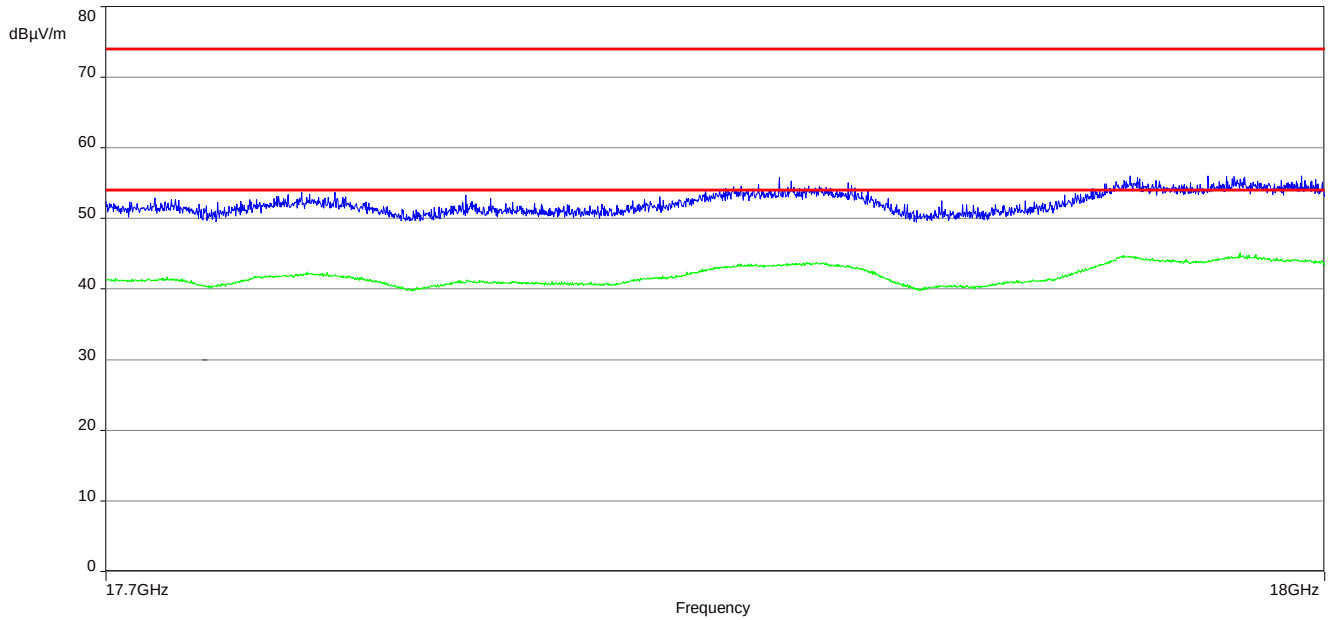


The carrier signal is notched with a 2.4 GHz band rejection filter.

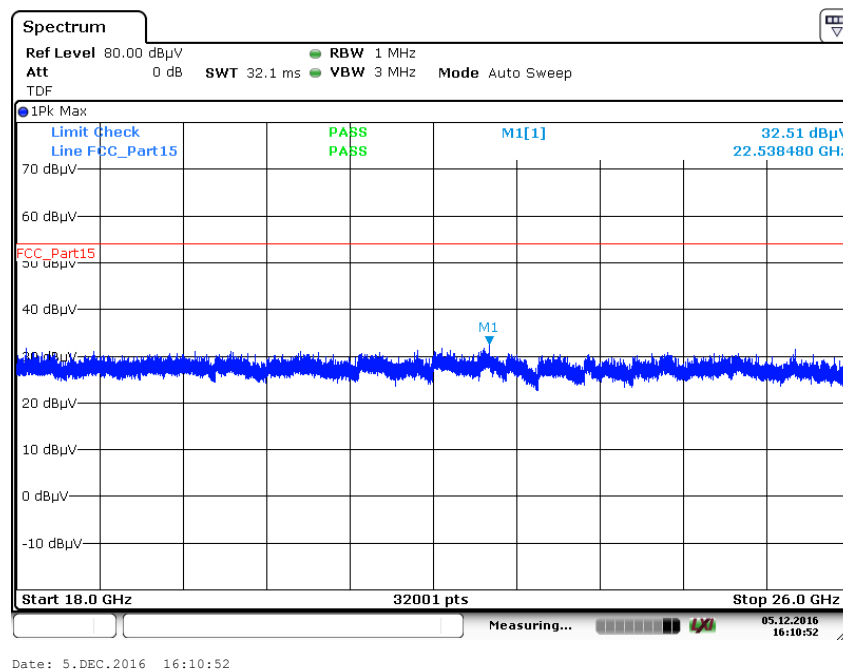
**Plot 10:** Highest channel, 7 GHz to 18 GHz, vertical & horizontal polarization



**Plot 11:** Highest channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization, peak & average

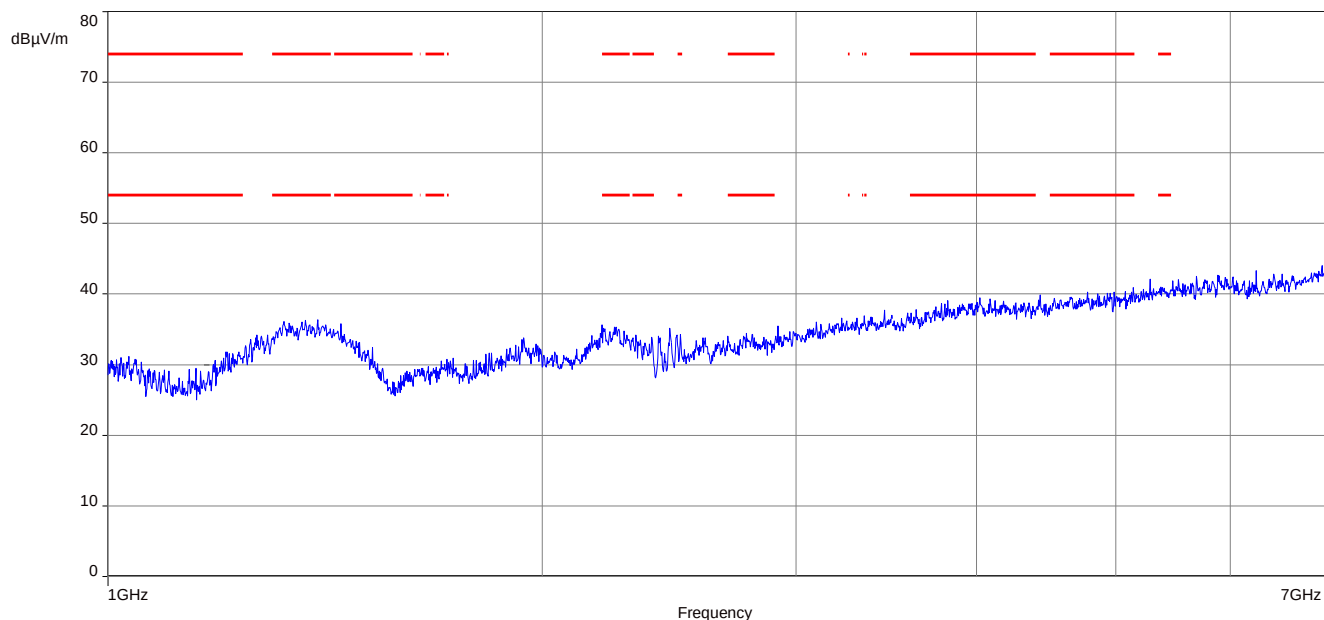


**Plot 12:** Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

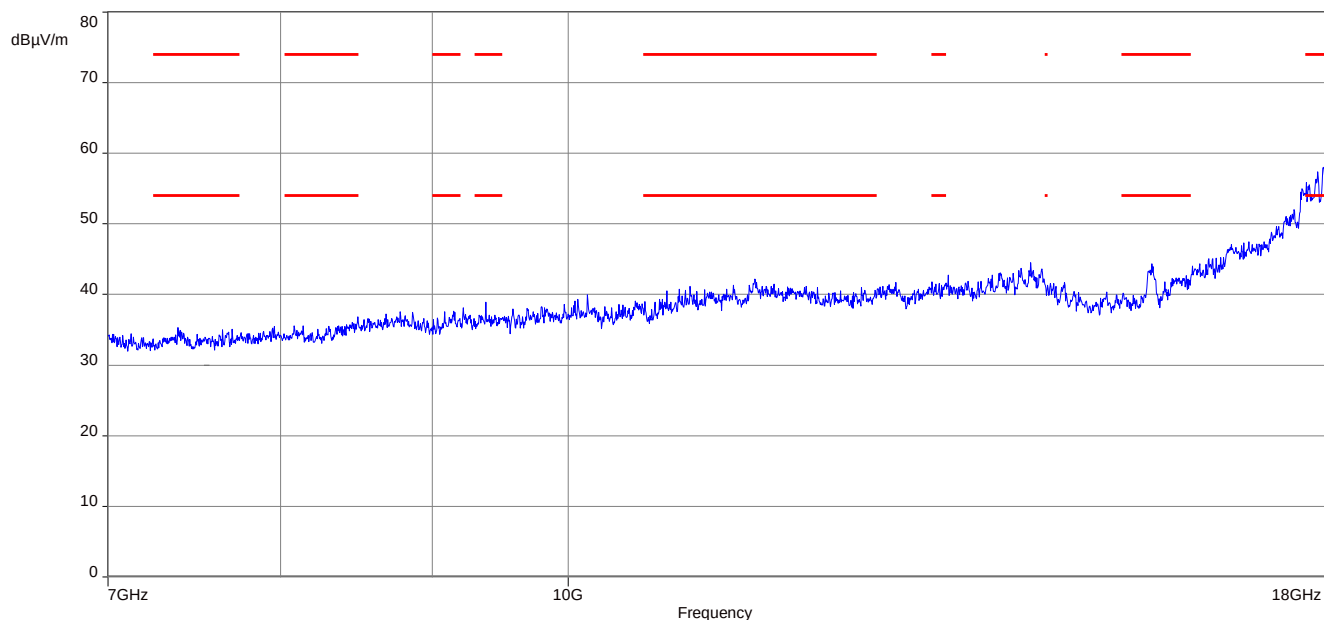


**Plots:** RX / idle mode

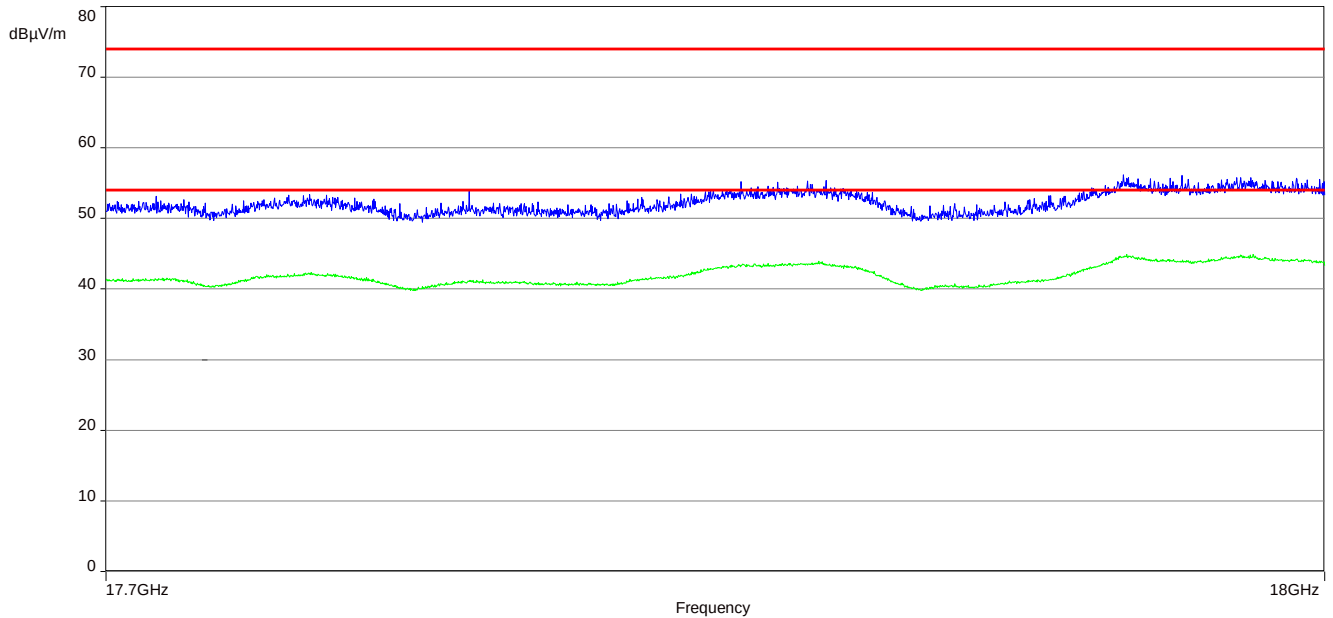
**Plot 1:** 1 GHz to 7 GHz, vertical & horizontal polarization



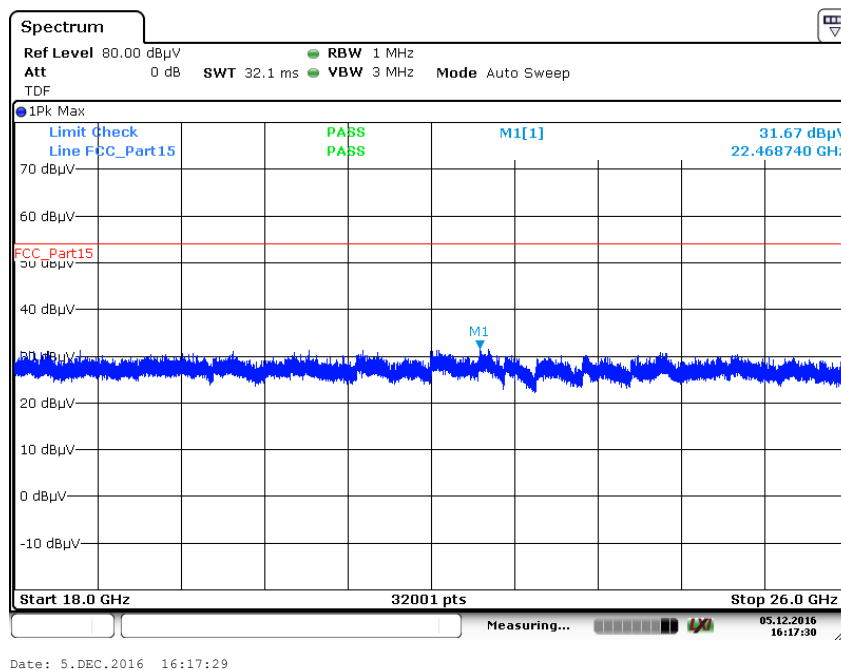
**Plot 2:** 7 GHz to 18 GHz, vertical & horizontal polarization



**Plot 2:** 17.7 GHz to 18 GHz, vertical & horizontal polarization



**Plot 3:** 18 GHz to 26 GHz, vertical & horizontal polarization



### 11.15 Spurious emissions conducted below 30 MHz (AC conducted)

#### Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is repeated for DSSS and OFDM modulation. If peaks are found channel 1 and channel 11 will be measured too. The measurement is performed with the data rate producing the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

#### Measurement:

| Measurement parameter    |                                            |
|--------------------------|--------------------------------------------|
| Detector:                | Peak - Quasi Peak / Average                |
| Sweep time:              | Auto                                       |
| Resolution bandwidth:    | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz  |
| Video bandwidth:         | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz |
| Span:                    | 9 kHz to 30 MHz                            |
| Trace mode:              | Max Hold                                   |
| Test setup:              | See sub clause 6.5 - A                     |
| Measurement uncertainty: | See sub clause 8                           |

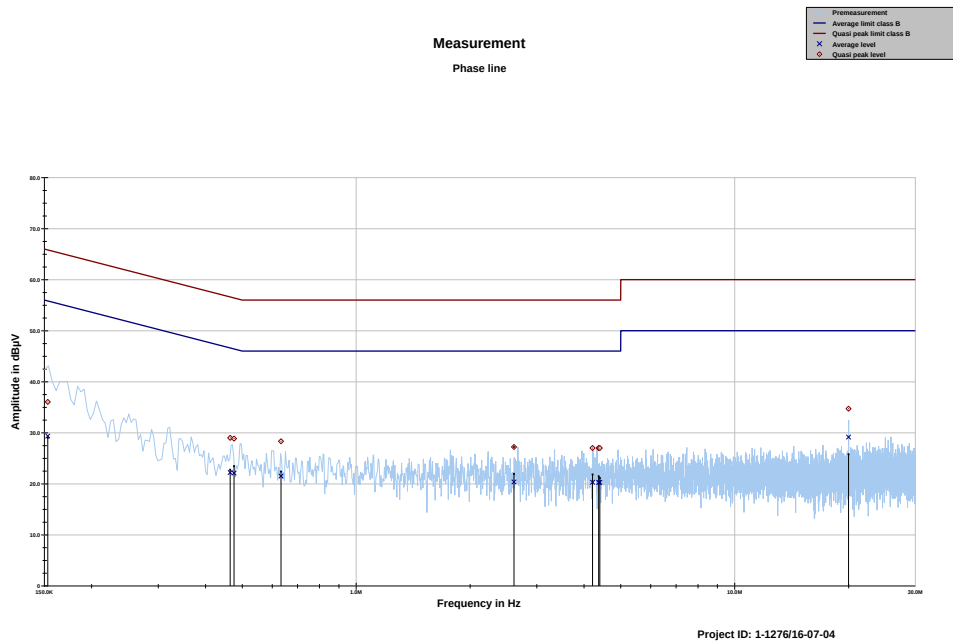
#### Limits:

| FCC             |                           | IC                     |
|-----------------|---------------------------|------------------------|
| Frequency (MHz) | Quasi-Peak (dB $\mu$ V/m) | Average (dB $\mu$ V/m) |
| 0.15 – 0.5      | 66 to 56*                 | 56 to 46*              |
| 0.5 – 5         | 56                        | 46                     |
| 5 – 30.0        | 60                        | 50                     |

\*Decreases with the logarithm of the frequency

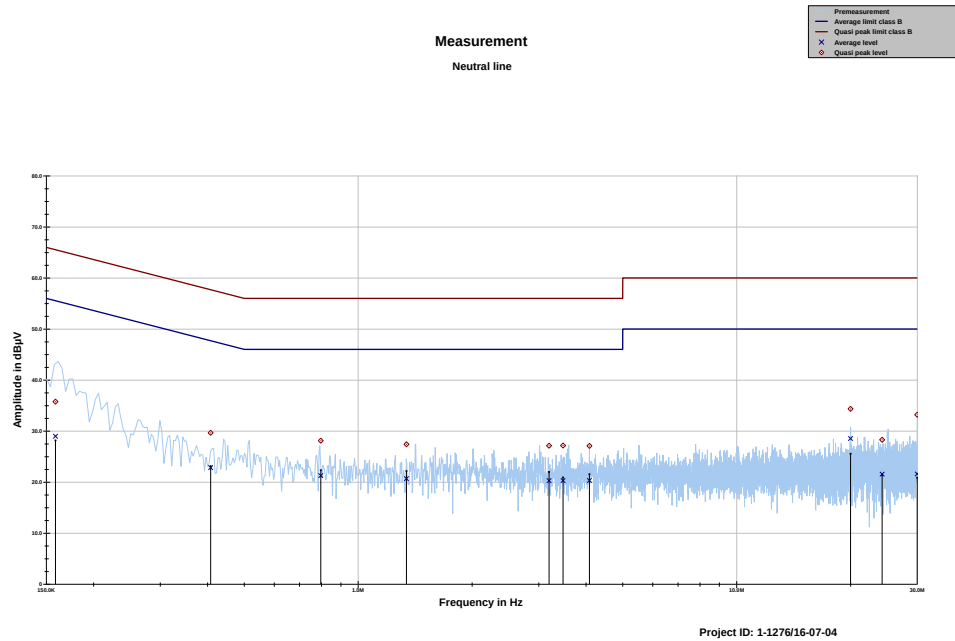
#### Results:

| TX Spurious Emissions Conducted < 30 MHz [dB $\mu$ V/m] |          |                      |
|---------------------------------------------------------|----------|----------------------|
| F [MHz]                                                 | Detector | Level [dB $\mu$ V/m] |
| All detected peaks are more than 20 dB below the limit. |          |                      |
|                                                         |          |                      |

**Plots:****Plot 1:** 150 kHz to 30 MHz, phase line

| Frequency | Quasi peak level | Margin quasi peak | Limit QP | Average level | Margin average | Limit AV |
|-----------|------------------|-------------------|----------|---------------|----------------|----------|
| MHz       | dBµV             | dB                | dBµV     | dBµV          | dB             | dBµV     |
| 0.153221  | 36.05            | 29.77             | 65.824   | 29.37         | 26.54          | 55.908   |
| 0.464674  | 29.00            | 27.61             | 56.609   | 22.21         | 24.80          | 47.009   |
| 0.475686  | 28.86            | 27.56             | 56.414   | 22.10         | 24.60          | 46.695   |
| 0.633024  | 28.33            | 27.67             | 56.000   | 21.51         | 24.49          | 46.000   |
| 2.612268  | 27.21            | 28.79             | 56.000   | 20.38         | 25.62          | 46.000   |
| 4.212442  | 27.02            | 28.98             | 56.000   | 20.32         | 25.68          | 46.000   |
| 4.372908  | 27.02            | 28.98             | 56.000   | 20.27         | 25.73          | 46.000   |
| 4.404116  | 27.01            | 28.99             | 56.000   | 20.27         | 25.73          | 46.000   |
| 19.998050 | 34.72            | 25.28             | 60.000   | 29.15         | 20.85          | 50.000   |

Plot 2: 150 kHz to 30 MHz, neutral line



| Frequency | Quasi peak level | Margin quasi peak | Limit QP | Average level | Margin average | Limit AV |
|-----------|------------------|-------------------|----------|---------------|----------------|----------|
| MHz       | dBµV             | dB                | dBµV     | dBµV          | dB             | dBµV     |
| 0.158598  | 35.76            | 29.77             | 65.537   | 28.99         | 26.76          | 55.754   |
| 0.407709  | 29.66            | 28.03             | 57.695   | 22.84         | 25.80          | 48.637   |
| 0.796422  | 28.11            | 27.89             | 56.000   | 21.27         | 24.73          | 46.000   |
| 1.341543  | 27.42            | 28.58             | 56.000   | 20.69         | 25.31          | 46.000   |
| 3.194609  | 27.13            | 28.87             | 56.000   | 20.29         | 25.71          | 46.000   |
| 3.478554  | 27.17            | 28.83             | 56.000   | 20.31         | 25.69          | 46.000   |
| 4.083421  | 27.11            | 28.89             | 56.000   | 20.32         | 25.68          | 46.000   |
| 19.997515 | 34.35            | 25.65             | 60.000   | 28.55         | 21.45          | 50.000   |
| 24.232431 | 28.30            | 31.70             | 60.000   | 21.57         | 28.43          | 50.000   |
| 29.998950 | 33.21            | 26.79             | 60.000   | 21.60         | 28.40          | 50.000   |

## 12 Observations

No observations except those reported with the single test cases have been made.

## Annex A Document history

| Version | Applied changes | Date of release |
|---------|-----------------|-----------------|
|         | Initial release | 2017-01-12      |
| -A      | FCC ID change   | 2017-03-06      |

## Annex B Further information

### Glossary

|          |   |                                                |
|----------|---|------------------------------------------------|
| AVG      | - | Average                                        |
| DUT      | - | Device under test                              |
| EMC      | - | Electromagnetic Compatibility                  |
| EN       | - | European Standard                              |
| EUT      | - | Equipment under test                           |
| ETSI     | - | European Telecommunications Standard Institute |
| FCC      | - | Federal Communication Commission               |
| FCC ID   | - | Company Identifier at FCC                      |
| HW       | - | Hardware                                       |
| IC       | - | Industry Canada                                |
| Inv. No. | - | Inventory number                               |
| N/A      | - | Not applicable                                 |
| PP       | - | Positive peak                                  |
| QP       | - | Quasi peak                                     |
| S/N      | - | Serial number                                  |
| SW       | - | Software                                       |
| PMN      | - | Product marketing name                         |
| HMN      | - | Host marketing name                            |
| HVIN     | - | Hardware version identification number         |
| FVIN     | - | Firmware version identification number         |
| OBW      |   | Occupied Bandwidth                             |
| OC       |   | Operating Channel                              |
| OCW      |   | Operating Channel Bandwidth                    |
| OOB      |   | Out Of Band                                    |

## Annex C Accreditation Certificate

first page

last page



Deutsche Akkreditierungsstelle GmbH

Befähigung gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV  
 Unterzeichnerin der Multilateralen Abkommen  
 von EA, ILAC und IAF zur gegenseitigen Anerkennung

**Akkreditierung**



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

**CTC advanced GmbH**  
 Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

**Funk**  
 Mobilfunk (GSM / DCS) + OTA  
 Elektromagnetische Verträglichkeit (EMV)  
 Produktsicherheit  
 SAR / EMF  
 Umwelt  
 Smart Card Technology  
 Bluetooth®  
 Automotive  
 Wi-Fi-Services  
 Kanadische Anforderungen  
 US-Anforderungen  
 Akustik  
 Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 25.11.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-01

Frankfurt, 25.11.2016

Stelle Weisner auf der Rückseite

Im Auftrag Dipl.-Ing. Ralf Eigner  
 Abteilungsleiter

Deutsche Akkreditierungsstelle GmbH

Standort Berlin  
 Spittelmarkt 10  
 10117 Berlin

Standort Frankfurt am Main  
 Europa-Allee 52  
 60327 Frankfurt am Main

Standort Braunschweig  
 Bundesallee 100  
 38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAKKS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAKKS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30). Die DAKKS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:  
 EA: [www.european-accreditation.org](http://www.european-accreditation.org)  
 ILAC: [www.ilac.org](http://www.ilac.org)  
 IAF: [www.iaf.nu](http://www.iaf.nu)

### Note:

The current certificate including annex can be received from CTC advanced GmbH on request.