
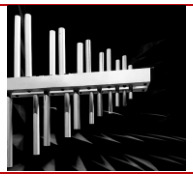
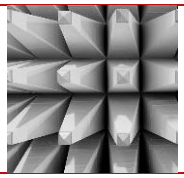

CETECOM™
CETECOM ICT Services
consulting - testing - certification

# TEST REPORT

**Test report no.: 1-9521/15-01-02-A**

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-00

## Testing laboratory


**CETECOM ICT Services GmbH**
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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-12076-01-00

## Applicant


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## Manufacturer


**Gemalto M2M GmbH**
St.-Martin-Str. 60
81541 München / GERMANY


## Test standard/s

| | |
|---|---|
| 47 CFR Part 22 | Title 47 of the Code of Federal Regulations; Chapter I; Part 22 - Public mobile services |
| RSS - 132 Issue 3 | Spectrum Management and Telecommunications Radio Standards Specification - Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz |

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

## Test Item

| | |
|---|---|
| **Kind of test item:** | **LTE SMT module (multi-carrier, data-only)** |
| **Model name:** | **PLS8-X** |
| **FCC ID:** | **QIPPLS8-X** |
| **IC:** | **7830A-PLS8X** |
| Frequency: | LTE Band 5 FDD 824 MHz to 849 MHz |
| Technology tested: | LTE FDD |
| Antenna: | External antenna |
| Power supply: | 3.8 V DC by external power supply |
| Temperature range: | -30°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.

**Test report authorised:**

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2015.08.04 08:08:38 +02'00'

Andreas Luckenbill
Lab Manager
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**Test performed:**

p.o.

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Testing Manager
Radio Communications & EMC

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# 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. CETECOM ICT Services 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 is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

**This test report replaces the test report with the number 1-9521/15-01-02 and dated 2015-06-23**

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2015-03-12 |
| Date of receipt of test item: | 2015-03-16 |
| Start of test: | 2015-03-17 |
| End of test: | 2015-07-31 |
| Person(s) present during the test: | -/- |

# 3 Test standard/s

| Test standard | Date | Test standard description |
|---|---|---|
| 47 CFR Part 22 | -/- | Title 47 of the Code of Federal Regulations; Chapter I; Part 22 - Public mobile services |
| RSS - 132 Issue 3 | 01.01.2013 | Spectrum Management and Telecommunications Radio Standards Specification - Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz |

## 3.1 Measurement guidance

| Guidance | Version | Description |
|---|---|---|
| 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 |

## 4 Test environment

| | | | |
|---|---|---|---|
| Temperature: | $T_{nom}$ | +22 °C | during room temperature tests |
| | $T_{max}$ | +60 °C | during high temperature tests |
| | $T_{min}$ | -30 °C | during low temperature tests |
| Relative humidity content: | | 55 % | |
| Barometric pressure: | | not relevant for this kind of testing | |
| Power supply: | $V_{nom}$ | 3.8 V | DC by external power supply |
| | $V_{max}$ | 4.2 V | |
| | $V_{min}$ | 3.3 V | |

## 5 Test item

| | | |
|---|---|---|
| **Kind of test item** | : | LTE SMT module (multi-carrier, data-only) |
| **Type identification** | : | PLS8-X |
| **FCC ID** | : | QIPPLS8-X |
| **IC** | : | 7830A-PLS8X |
| **PMN** | : | Cinterion PLS8-X |
| **HVIN** | : | PLS8-X |
| **FVIN** | : | -/- |
| **HMN** | : | -/- |
| **S/N serial number** | : | No information available |
| **HW hardware status** | : | Rev. 2.3 |
| **SW software status** | : | Rev. 02.502 |
| **Frequency band** | : | LTE Band 5 FDD 824 MHz to 849 MHz |
| **Type of radio transmission**<br>**Use of frequency spectrum** | :<br>: | OFDM |
| **Type of modulation** | : | QPSK, 16 – QAM |
| **Antenna** | : | External antenna |
| **Power supply** | : | 3.8 V DC by external power supply |
| **Temperature range** | : | -30°C to +60°C |

### 5.1 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: 1-9521/15-01-01_AnnexA
1-9521/15-01-01_AnnexC

## 6 Test laboratories sub-contracted

None

## 7 Description of the test setup, test equipment and ancillaries used for tests

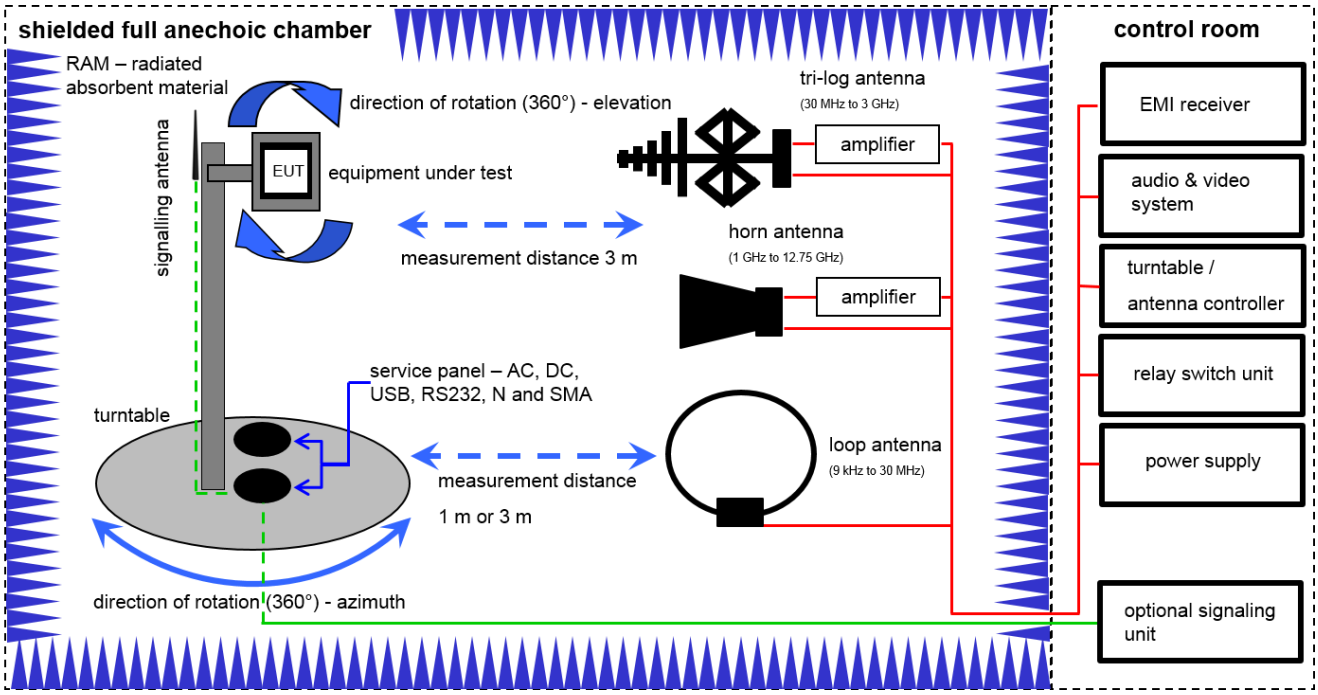
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling 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 |
| vlkl! | Attention: extended calibration interval | | |
| NK! | Attention: not calibrated | *) | next calibration ordered / currently in progress |

## 7.1 Radiated measurements chamber C



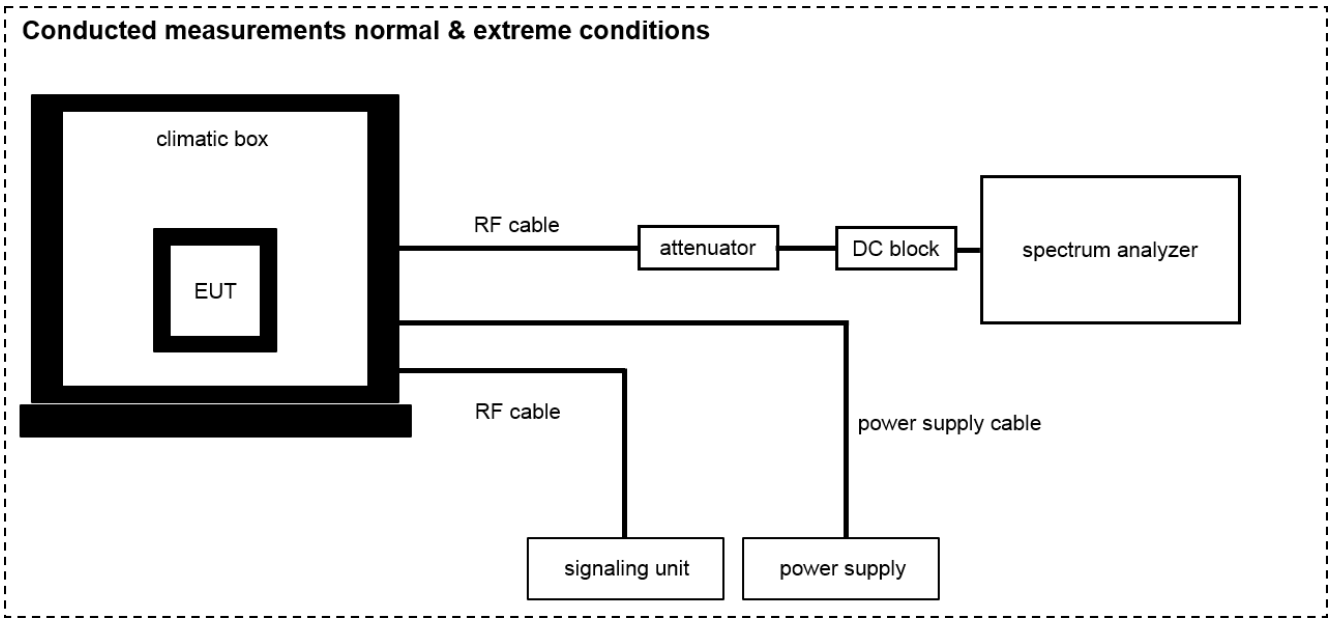

OP = AV + D - G + CA
(OP-output power; AV-analyzer value; D-distance; G-antenna gain+amplifier gain; CA-loss signal path)

*Example calculation:*
OP [dBm] = -11.0 [dBm] + 47 [dB] - 8 [dB] + 5 [dB] = 33 [dBm] (2 W)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufact. | Serial No. | INV. No Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP | 2818A03450 | 300001040 | Ve | 20.01.2015 | 20.01.2018 |
| 2 | A | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 8812-3088 | 300001032 | vlKl! | 08.05.2013 | 08.05.2015 |
| 3 | A | Anechoic chamber | FAC 3/5m | MWB / TDK | 87400/02 | 300000996 | ev | | |
| 4 | A | Switch / Control Unit | 3488A | HP | * | 300000199 | ne | | |
| 5 | A | Active Loop Antenna 10 kHz to 30 MHz | 6502 | Kontron Psychotech | 8905-2342 | 300000256 | k | 13.06.2013 | 13.06.2015 |
| 6 | A | Amplifier | js42-00502650-28-5a | Parzich GMBH | 928979 | 300003143 | ne | | |
| 7 | A | Highpass Filter | WHKX7.0/18G-8SS | Wainwright | 18 | 300003789 | ne | | |
| 8 | A | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 371 | 300003854 | vlKl! | 29.10.2014 | 29.10.2017 |
| 9 | A | MXE EMI Receiver 20 Hz to 26,5 GHz | N9038A | Agilent Technologies | MY51210197 | 300004405 | k | 06.03.2015 | 06.03.2016 |
| 10 | A | 4U RF Switch Platform | L4491A | Agilent Technologies | MY50000037 | 300004509 | ne | | |
| 11 | A | Wideband Radio Communication Tester | CMW500 | R&S | 102375 | 300004187 | vlKl! | 28.01.2015 | 28.01.2017 |

## 7.2 Conducted measurements




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

*Example calculation:*
OP [dBm] = 6.0 [dBm] + (11.7) [dB] = 17.7 [dBm] (58.88 mW)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufact. | Serial No. | INV. No Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A, B | Switch / Control Unit | 3488A | HP | 2605e08770 | 300001443 | ne | | |
| 2 | A | Signal Analyzer 40 GHz | FSV40 | R&S | 101042 | 300004517 | k | 22.01.2015 | 22.01.2016 |
| 3 | A, B | Power Supply 0-20V; 0-5A | 6632B | HP | US37478366 | 400000117 | vlKl! | 20.01.2015 | 20.01.2017 |
| 4 | A, B | Wideband Radio Communication Tester | CMW500 | R&S | 102375 | 300004187 | vlKl! | 28.01.2015 | 28.01.2017 |
| 5 | B | Temperature Test Chamber | VT 4002 | Heraeus Voetsch | 521/83761 | 300002326 | Ve | 26.09.2013 | 26.09.2015 |
| 6 | A, B | RF-Cable | ST18/SMAm/SMAm/72 | Huber & Suhner | Batch no. 699714 | 400001184 | ev | | |
| 7 | A | DC-Blocker 0.1-40 GHz | 8141A | Inmet | | 400001185 | ev | | |
| 8 | A | Coax Attenuator 10 dB 2W 0-40 GHz | MCL BW-K10-2W44+ | Mini Circuits | | 400001186 | ev | | |

## 8 Measurement uncertainty

| Measurement uncertainty | |
|---|---|
| **Test case** | **Uncertainty** |
| RF output power conducted | ± 1 dB |
| RF output power radiated | ± 3 dB |
| Frequency stability | ± 20 Hz |
| 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 | ± 3 dB |
| Block edge compliance | ± 3 dB |
| Occupied bandwidth | ± RBW |

# 9 Sequence of testing

## 9.1 Sequence of testing 9 kHz to 30 MHz

**Setup**

- The equipment was set up to simulate a typical usage like descripted in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were 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.
- The measurement distance is 3 meter (see ANSI C 63.4) – see each test details
- The EUT was set into operation.

**Premeasurement**

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

**Final measurement**

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axces (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with RMS (RMS / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

## 9.2 Sequence of testing 30 MHz to 1 GHz

**Setup**

- The equipment was set up to simulate a typical usage like descripted in the user manual or described by 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 were 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.
- The measurement distance is 10 or 3 meter (see ANSI C 63.4) – see each test details
- The EUT was 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 to 3 meter.
- 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 will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.
- The final measurement will be done with RMS (RMS / see ANSI C 63.4) detector with an EMI receiver
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

## 9.3 Sequence of testing 1 GHz to 12.75 GHz

### Setup

- The equipment was set up to simulate a typical usage like descripted in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were 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.
- The measurement distance is 3 meter (see ANSI C 63.4) – see each test details
- The EUT was 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 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions

### Final measurement

- The final measurement will be performed with minimum the six highest peaks according the requirements of the ANSI C63.4.
- According to the maximum found antenna polarization and turntable position of the premeasurement the software maximizes the peaks by rotating the turntable position (0° to 360°). This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps). This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS (RMS / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

## 10 Summary of measurement results

☒ No deviations from the technical specifications were ascertained

☐ There were deviations from the technical specifications ascertained

☐ This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

| TC identifier | Description | verdict | date | Remark |
|---|---|---|---|---|
| RF-Testing | CFR Part 22<br>RSS 132 | See table | 2015-08-04 | -/- |

## 10.1 LTE band V

| Test Case | temperature conditions | power source voltages | C | NC | NA | NP | Remark |
|---|---|---|---|---|---|---|---|
| RF Output Power | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | -/- |
| Frequency Stability | Extreme | Extreme | ☒ | ☐ | ☐ | ☐ | -/- |
| Spurious Emissions Radiated | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | -/- |
| Spurious Emissions Conducted | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | -/- |
| Block Edge Compliance | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | -/- |
| Occupied Bandwidth | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | -/- |

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

# 11 RF measurements

## 11.1 Results LTE band V

The EUT was set to transmit the maximum power.

### 11.1.1 RF output power

**Description:**

This paragraph contains average power, peak output power, PAPR and ERP measurements for the mobile station.

The plots in this test report represents only an example of the measurements. All plots of this chapter are available on request.
The red line in the measurements indicates the ideal Gaussian distribution for the measured amplitude range.

**Measurement:**

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

| Measurement parameters | |
|---|---|
| Detector: | Sample |
| AQT: | 15.6 ms |
| Resolution bandwidth: | 40 MHz |
| Used equipment: | see chapter 7.1 – A and chapter 7.2 – A |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.913<br>CFR Part 2.1046 | RSS 132 |
| Nominal Peak Output Power | |
| +38.45 dBm<br>In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB. | |

**Results:**

| Output Power (conducted) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Bandwidth (MHz)** | **Frequency (MHz)** | **Resource block allocation** | **Peak Output Power (dBm) QPSK** | **Average Output Power (dBm) QPSK** | **Peak to Average Ratio (dB) CCDF** | **Peak Output Power (dBm) 16-QAM** | **Average Output Power (dBm) 16-QAM** | **Peak to Average Ratio (dB) CCDF** |
| 1.4 | 824.7 | 1 RB low | 27.4 | 22.5 | 4.8 | 27.6 | 21.5 | 5.8 |
| | | 1 RB high | 27.2 | 22.4 | 4.7 | 27.5 | 21.4 | 5.7 |
| | | 50% RB | 27.5 | 22.4 | 4.6 | 27.4 | 21.3 | 5.7 |
| | | 100% RB | 27.1 | 21.4 | 5.3 | 26.8 | 20.4 | 5.9 |
| | 836.5 | 1 RB low | 28.0 | 22.4 | 5.4 | 27.8 | 21.1 | 6.3 |
| | | 1 RB high | 27.9 | 22.3 | 5.4 | 27.7 | 20.9 | 6.3 |
| | | 50% RB | 28.0 | 22.3 | 5.3 | 28.0 | 21.4 | 6.2 |
| | | 100% RB | 27.6 | 21.4 | 5.6 | 27.6 | 20.4 | 6.5 |
| | 848.3 | 1 RB low | 27.7 | 22.4 | 5.0 | 27.6 | 21.1 | 6.1 |
| | | 1 RB high | 27.5 | 22.0 | 5.1 | 27.6 | 21.0 | 6.2 |
| | | 50% RB | 27.7 | 22.2 | 5.2 | 27.6 | 21.2 | 6.2 |
| | | 100% RB | 27.7 | 21.3 | 5.6 | 27.3 | 20.3 | 6.4 |
| 3 | 825.5 | 1 RB low | 27.2 | 22.3 | 4.8 | 27.3 | 21.2 | 5.8 |
| | | 1 RB high | 27.2 | 22.2 | 4.8 | 27.3 | 21.2 | 5.7 |
| | | 50% RB | 27.0 | 21.3 | 5.2 | 27.0 | 20.3 | 6.1 |
| | | 100% RB | 27.0 | 21.2 | 5.2 | 27.2 | 20.3 | 6.1 |
| | 836.5 | 1 RB low | 27.9 | 22.2 | 5.4 | 27.6 | 20.8 | 6.2 |
| | | 1 RB high | 27.8 | 22.2 | 5.3 | 27.6 | 21.0 | 6.1 |
| | | 50% RB | 27.9 | 21.3 | 5.6 | 27.5 | 20.3 | 6.5 |
| | | 100% RB | 27.7 | 21.3 | 5.6 | 27.8 | 20.2 | 6.4 |
| | 847.5 | 1 RB low | 27.7 | 22.2 | 5.1 | 27.6 | 21.2 | 6.1 |
| | | 1 RB high | 27.6 | 22.0 | 5.2 | 27.5 | 20.9 | 6.2 |
| | | 50% RB | 27.4 | 21.2 | 5.6 | 27.3 | 20.2 | 6.3 |
| | | 100% RB | 27.4 | 21.2 | 5.5 | 27.3 | 20.2 | 6.4 |
| 5 | 826.5 | 1 RB low | 27.3 | 22.3 | 4.7 | 27.1 | 21.1 | 5.8 |
| | | 1 RB high | 27.4 | 22.2 | 4.8 | 27.3 | 21.1 | 5.9 |
| | | 50% RB | 26.9 | 21.3 | 5.2 | 27.0 | 20.4 | 6.1 |
| | | 100% RB | 27.2 | 21.1 | 5.3 | 27.1 | 20.2 | 6.1 |
| | 836.5 | 1 RB low | 28.0 | 22.2 | 5.4 | 27.8 | 21.2 | 6.4 |
| | | 1 RB high | 27.9 | 22.3 | 5.2 | 27.7 | 21.1 | 6.3 |
| | | 50% RB | 27.7 | 21.2 | 5.7 | 27.5 | 20.2 | 6.3 |
| | | 100% RB | 27.9 | 21.3 | 5.6 | 27.8 | 20.2 | 6.4 |
| | 846.5 | 1 RB low | 27.7 | 22.2 | 5.0 | 27.6 | 21.1 | 6.1 |
| | | 1 RB high | 27.6 | 22.1 | 5.1 | 27.5 | 21.0 | 6.3 |
| | | 50% RB | 27.5 | 21.2 | 5.6 | 27.3 | 20.2 | 6.3 |
| | | 100% RB | 27.5 | 21.1 | 5.6 | 27.4 | 20.3 | 6.2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10 | 829 | 1 RB low | 27.0 | 22.1 | 4.8 | 27.2 | 21.2 | 5.7 |
| | | 1 RB high | 27.6 | 22.0 | 5.3 | 27.7 | 21.1 | 6.3 |
| | | 50% RB | 27.3 | 21.2 | 5.4 | 27.3 | 20.2 | 6.3 |
| | | 100% RB | 27.4 | 21.0 | 5.4 | 27.5 | 20.0 | 6.3 |
| | 836.5 | 1 RB low | 27.5 | 21.9 | 5.3 | 27.3 | 20.7 | 6.1 |
| | | 1 RB high | 27.8 | 22.2 | 5.3 | 27.6 | 21.0 | 6.1 |
| | | 50% RB | 27.7 | 21.2 | 5.6 | 27.7 | 20.3 | 6.4 |
| | | 100% RB | 27.8 | 21.1 | 5.6 | 27.8 | 20.1 | 6.4 |
| | 844 | 1 RB low | 27.7 | 22.1 | 5.2 | 27.6 | 21.2 | 6.1 |
| | | 1 RB high | 27.6 | 22.1 | 5.1 | 27.4 | 20.9 | 6.2 |
| | | 50% RB | 27.7 | 21.3 | 5.5 | 27.6 | 20.2 | 6.4 |
| | | 100% RB | 27.8 | 21.2 | 5.6 | 27.6 | 20.1 | 6.3 |

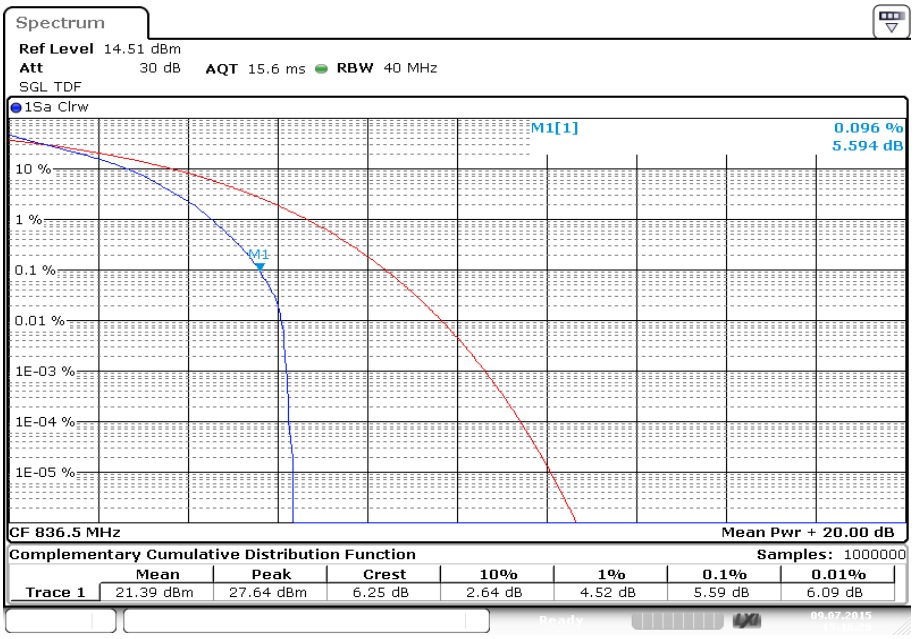
The radiated output power is measured in the mode with the highest conducted output power.

| Output Power (radiated) | | | |
|---|---|---|---|
| **Bandwidth (MHz)** | **Frequency (MHz)** | **Average Output Power (dBm) QPSK** | **Average Output Power (dBm) 16-QAM** |
| 1.4 | 824.7 | 12.06 | 12.26 |
| | 836.5 | 10.65 | 9.75 |
| | 848.3 | 13.63 | 12.73 |
| 3 | 825.5 | 11.96 | 11.06 |
| | 836.5 | 10.55 | 9.55 |
| | 847.5 | 13.53 | 12.63 |
| 5 | 826.5 | 11.86 | 10.86 |
| | 836.5 | 10.55 | 9.45 |
| | 846.5 | 13.63 | 12.53 |
| 10 | 829.0 | 11.76 | 11.46 |
| | 836.5 | 10.20 | 9.45 |
| | 844.0 | 13.43 | 12.43 |

**Verdict:** compliant

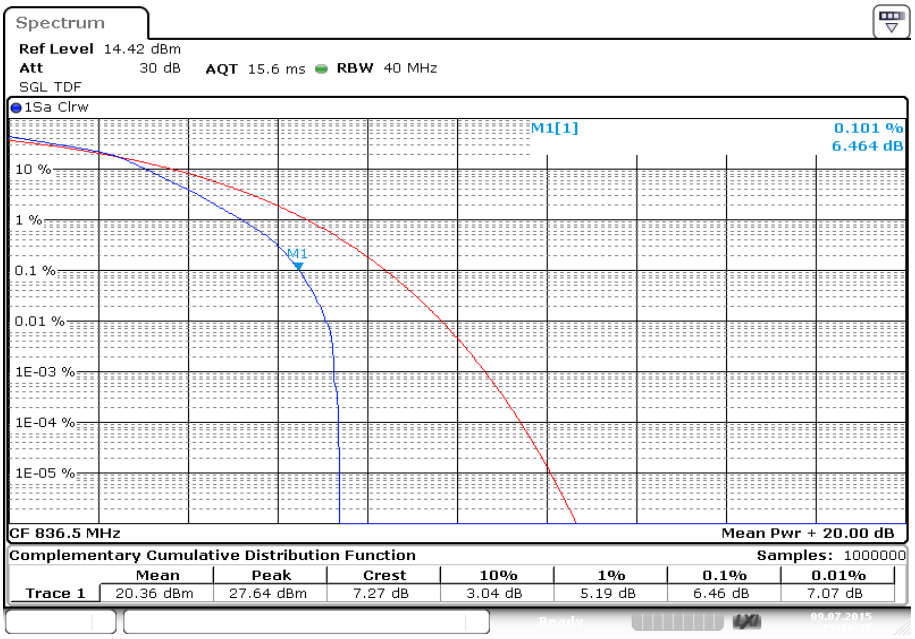
**Plots:**

**Plot 1:** 1.4 MHz cell bandwidth, mid channel, 100% #RB, QPSK



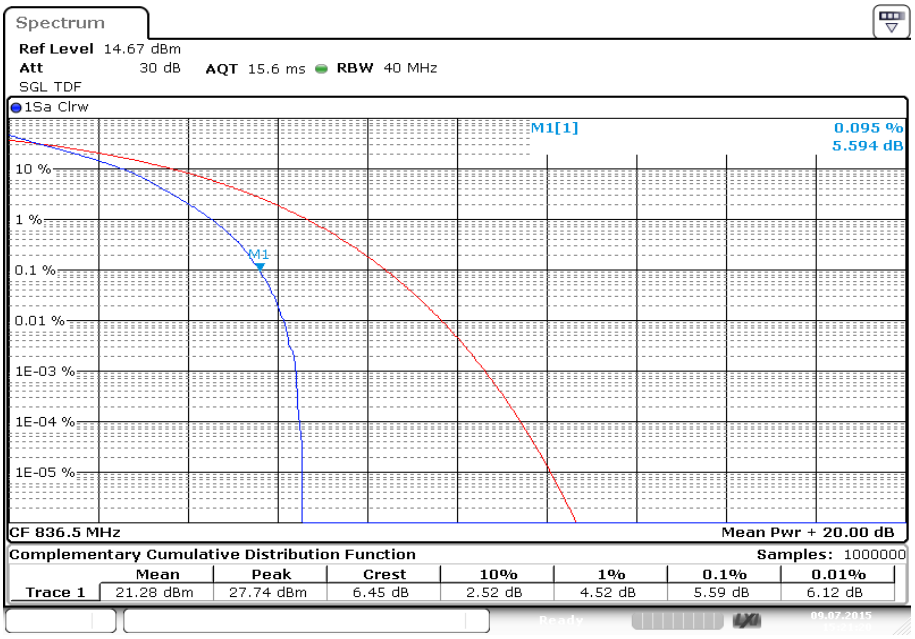

Date: 9.JUL.2015 15:16:29

**Plot 2:** 1.4 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



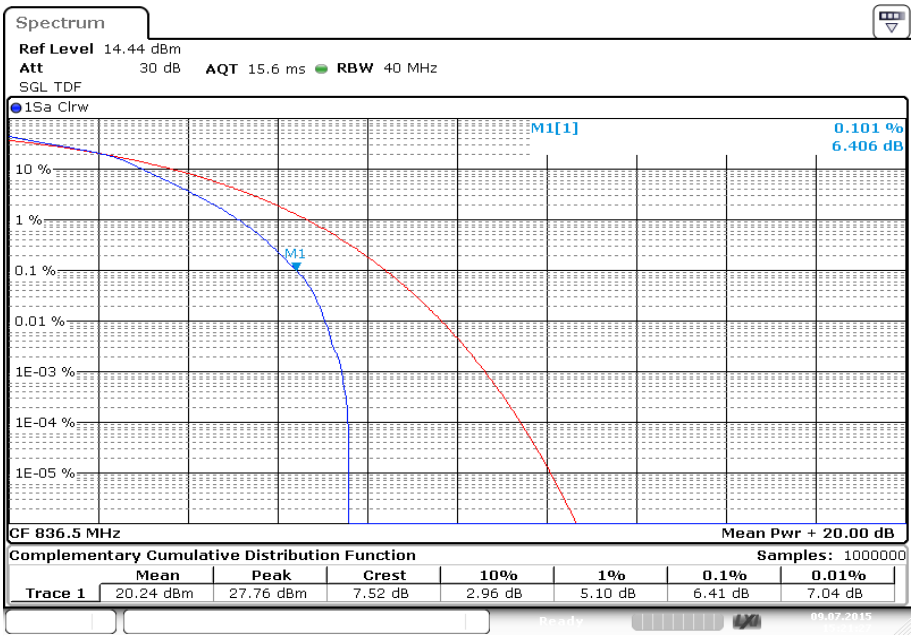

Date: 9.JUL.2015 15:16:35

**Plot 3:** 3 MHz cell bandwidth, mid channel, 100% #RB, QPSK



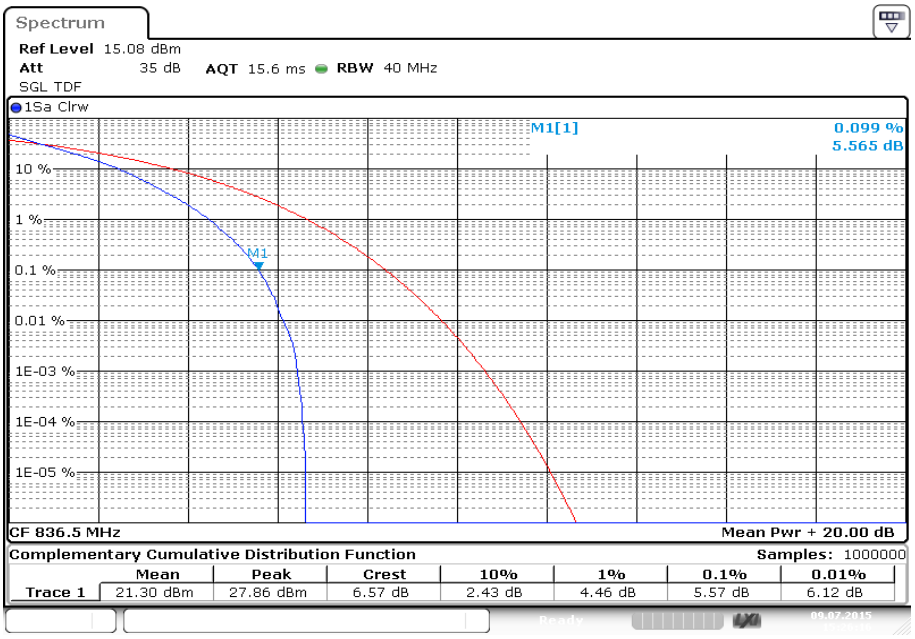

Date: 9.JUL.2015 15:21:20

**Plot 4:** 3 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



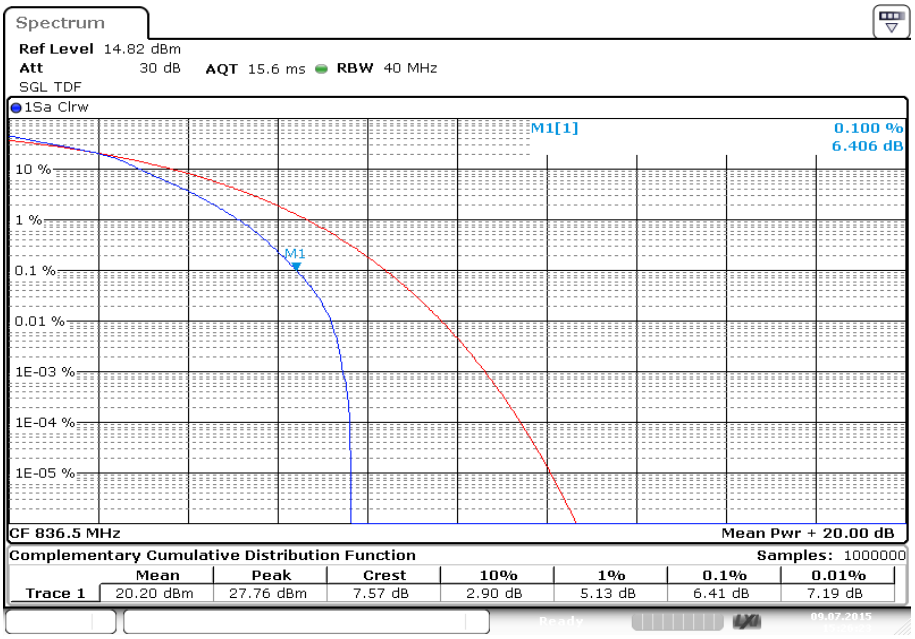

Date: 9.JUL.2015 15:21:27

**Plot 5:** 5 MHz cell bandwidth, mid channel, 100% #RB, QPSK



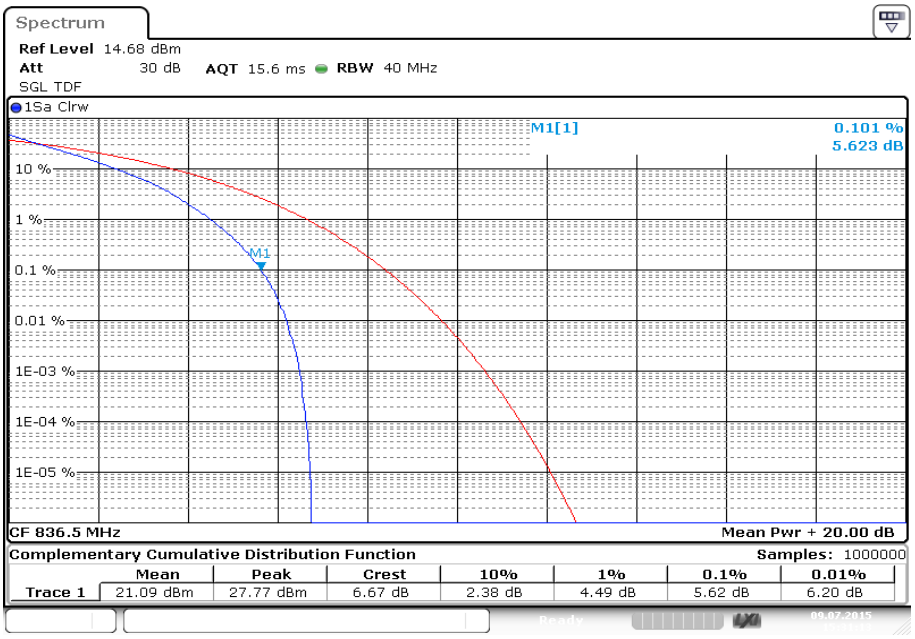

Date: 9.JUL.2015 15:26:16

**Plot 6:** 5 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



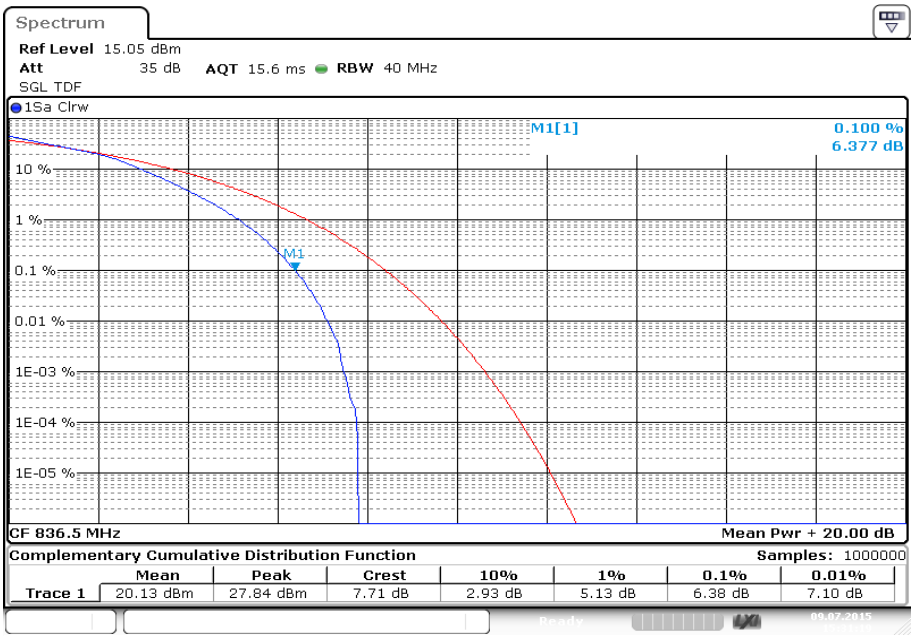

Date: 9.JUL.2015 15:26:23

**Plot 7:** 10 MHz cell bandwidth, mid channel, 100% #RB, QPSK




Date: 9.JUL.2015 15:31:13

**Plot 8:** 10 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM




Date: 9.JUL.2015 15:31:19

## 11.1.2 Frequency stability

**Description:**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station connected to CMW. This is accomplished with the use of a R&S CMW500 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with $V_{nom}$, connected to the CMW500 and a connection on centre channel, measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +60°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with $V_{nom}$. Vary supply voltage from $V_{min}$ to $V_{max}$. Pause at $V_{nom}$ for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Measured with CMW500 |
| Sweep time: | |
| Video bandwidth: | |
| Resolution bandwidth: | |
| Span: | |
| Trace-Mode: | |
| Used equipment: | see chapter chapter 7.2 – B |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.355<br>CFR Part 2.1055 | RSS 132 |
| Frequency Stability | |
| ± 0.1 ppm | |

**Results:**

**AFC FREQ ERROR versus VOLTAGE**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 13.8 | 5 | 0.00000036 | 0.0036 |
| 12.0 | 4 | 0.00000048 | 0.0048 |
| 10.2 | 4 | 0.00000048 | 0.0048 |

**AFC FREQ ERROR versus TEMPERATURE**

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | 4 | 0.00000048 | 0.0048 |
| -20 | 4 | 0.00000048 | 0.0048 |
| -10 | 2 | 0.00000024 | 0.0024 |
| ± 0 | 3 | 0.00000036 | 0.0036 |
| 10 | -4 | -0.00000048 | -0.0048 |
| 20 | 5 | 0.00000060 | 0.0060 |
| 30 | 4 | 0.00000048 | 0.0048 |
| 40 | 3 | 0.00000036 | 0.0036 |
| 50 | 4 | 0.00000048 | 0.0048 |
| 60 | 4 | 0.00000048 | 0.0048 |

**Verdict:** **compliant**

## 11.1.3 Spurious emissions radiated

**Description:**

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 9 kHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 848.3 MHz. Measurement made up to 12.75 GHz. The resolution bandwidth is set as outlined in Part 22.917. The spectrum was scanned with the mobile station transmitting at the middle carrier frequency of the LTE band V.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak / RMS |
| Sweep time: | 5 ms/MHz |
| Resolution bandwidth: | 100 kHz |
| Video bandwidth: | 300 kHz |
| Span: | different steps |
| Trace-Mode: | Max Hold |
| Used equipment: | see chapter 7.1 - A |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1053 | RSS 132 |
| Spurious Emissions Radiated | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

Radiated emissions measurements were made only at the center carrier frequency of the LTE band V (836.5 MHz). It was decided that measurements at this carrier frequency would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band V into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

As can be seen from this data, the emissions from the test item were within the specification limit.

**QPSK:**

| Spurious Emission Level (dBm) | | |
|---|---|---|
| Harmonic | Middle channel Freq. (MHz) | Level [dBm] |
| 2 | 1673.0 | - |
| 3 | 2509.5 | - |
| 4 | 3346.0 | - |
| 5 | 4182.5 | - |
| 6 | 5019.0 | - |
| 7 | 5855.5 | - |
| 8 | 6692.0 | - |
| 9 | 7528.5 | - |
| 10 | 8365.0 | - |
| | | |

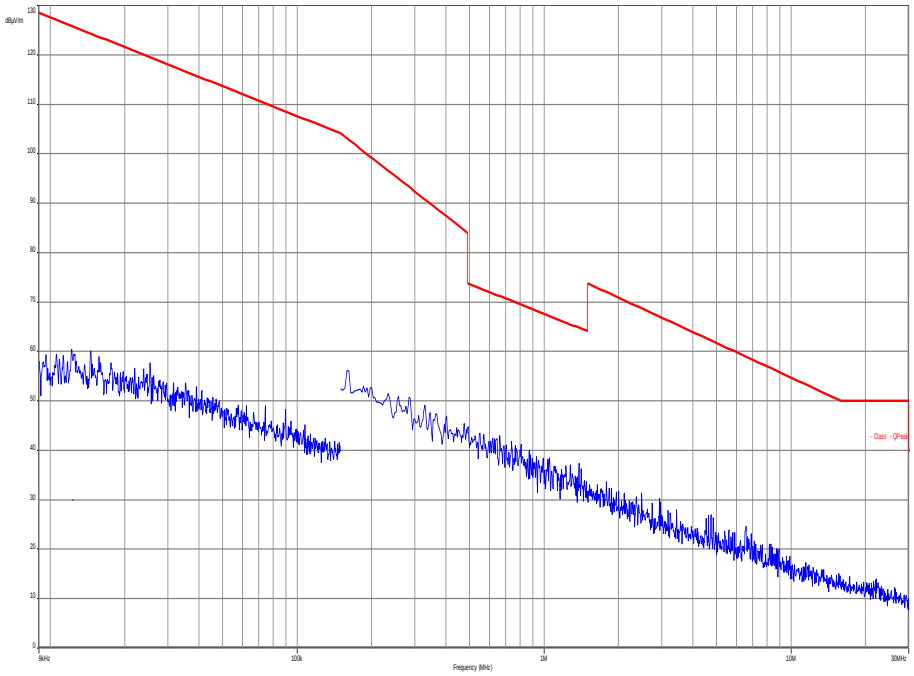
**16-QAM:**

| Spurious Emission Level (dBm) | | |
|---|---|---|
| Harmonic | Middle channel Freq. (MHz) | Level [dBm] |
| 2 | 1673.0 | - |
| 3 | 2509.5 | - |
| 4 | 3346.0 | - |
| 5 | 4182.5 | - |
| 6 | 5019.0 | - |
| 7 | 5855.5 | - |
| 8 | 6692.0 | - |
| 9 | 7528.5 | - |
| 10 | 8365.0 | - |
| | | |

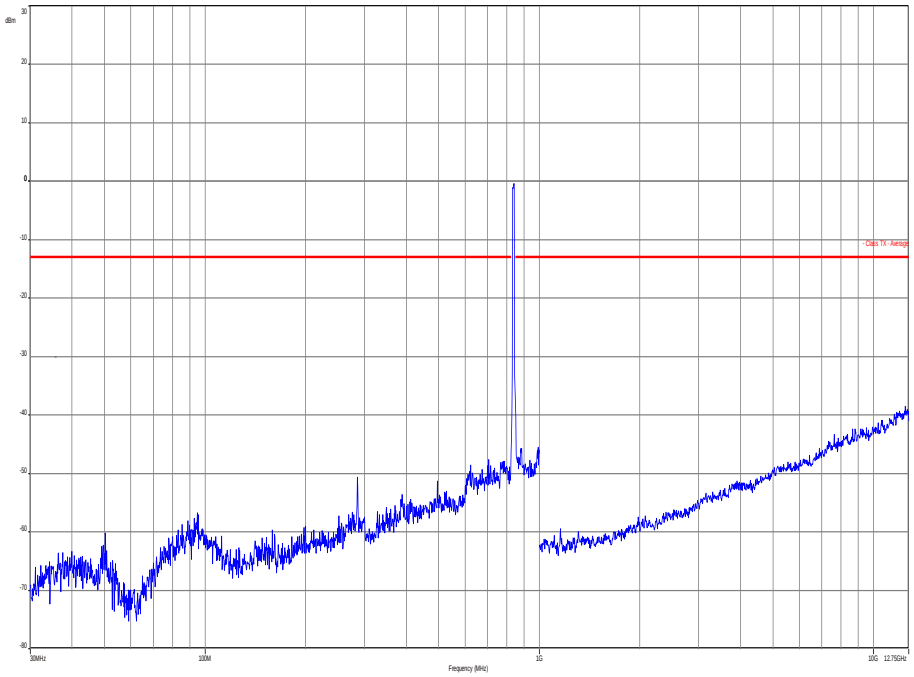
**Verdict:** compliant

**QPSK with 10 MHz channel bandwidth**

**Plot 1:** Channel 20525 (Traffic mode up to 30 MHz)

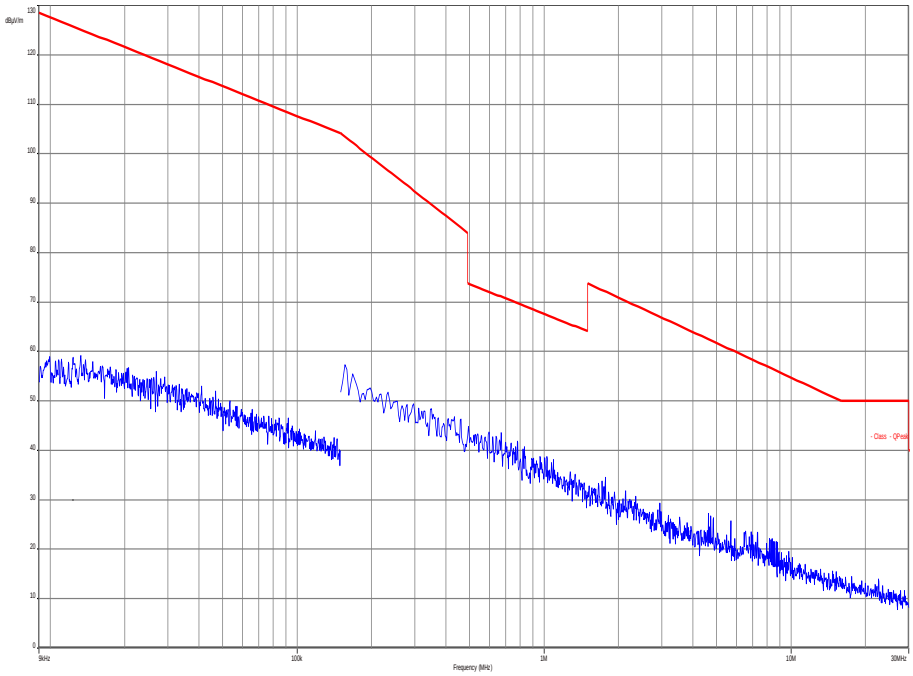


**Plot 2:** Channel 20525 (30 MHz – 12.75 GHz)

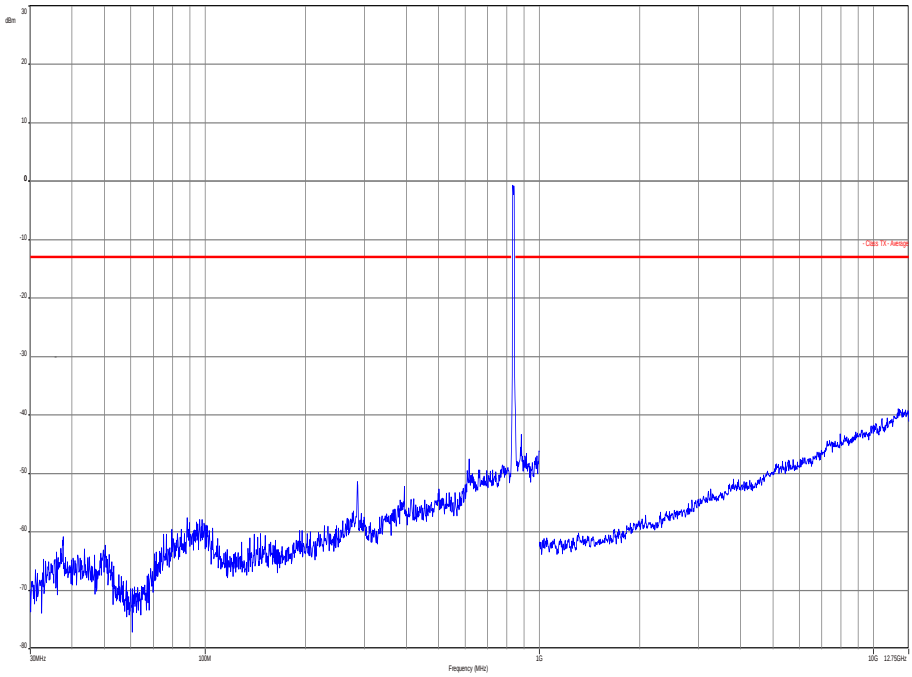


**16-QAM with 10 MHz channel bandwidth**

**Plot 3:** Channel 20525 (Traffic mode up to 30 MHz)



**Plot 4:** Channel 20525 (30 MHz – 12.75 GHz)



## 11.1.4 Spurious emissions conducted

**Description:**

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 26 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak / RMS |
| Sweep time: | Auto |
| Resolution bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement 100 kHz |
| Video bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement 300 kHz |
| Span: | 10 MHz – 26 GHz |
| Trace-Mode: | Max Hold |
| Used equipment: | see chapter 7.2 - A |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1051 | RSS 132 |
| Spurious Emissions Conducted | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:** for 1.4 MHz channel bandwidth

**QPSK**

| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Lowest channel Freq. (MHz) | Level [dBm] | Harmonic | Middle channel Freq. (MHz) | Level [dBm] | Harmonic | Highest channel Freq. (MHz) | Level [dBm] |
| 2 | 1649.4 | - | 2 | 1673.0 | - | 2 | 1696,6 | - |
| 3 | 2474.1 | - | 3 | 2509.5 | - | 3 | 2544,9 | - |
| 4 | 3298.8 | - | 4 | 3346.0 | - | 4 | 3393,2 | - |
| 5 | 4123.5 | - | 5 | 4182.5 | - | 5 | 4241,5 | - |
| 6 | 4948.2 | - | 6 | 5019.0 | - | 6 | 5089,8 | - |
| 7 | 5772.9 | - | 7 | 5855.5 | - | 7 | 5938,1 | - |
| 8 | 6597.6 | - | 8 | 6692.0 | - | 8 | 6786,4 | - |
| 9 | 7422.3 | - | 9 | 7258.5 | - | 9 | 7634,7 | - |
| 10 | 8247.0 | - | 10 | 8365.0 | - | 10 | 8483 | - |
| | | | | | | | | |

**16-QAM**

| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Lowest channel Freq. (MHz) | Level [dBm] | Harmonic | Middle channel Freq. (MHz) | Level [dBm] | Harmonic | Highest channel Freq. (MHz) | Level [dBm] |
| 2 | 1649.4 | - | 2 | 1673.0 | - | 2 | 1696.6 | - |
| 3 | 2474.1 | - | 3 | 2509.5 | - | 3 | 2544.9 | - |
| 4 | 3298.8 | - | 4 | 3346.0 | - | 4 | 3393.2 | - |
| 5 | 4123.5 | - | 5 | 4182.5 | - | 5 | 4241.5 | - |
| 6 | 4948.2 | - | 6 | 5019.0 | - | 6 | 5089.8 | - |
| 7 | 5772.9 | - | 7 | 5855.5 | - | 7 | 5938.1 | - |
| 8 | 6597.6 | - | 8 | 6692.0 | - | 8 | 6786.4 | - |
| 9 | 7422.3 | - | 9 | 7258.5 | - | 9 | 7634.7 | - |
| 10 | 8247.0 | - | 10 | 8365.0 | - | 10 | 8483.0 | - |
| | | | | | | | | |

**Results:** for 3 MHz channel bandwidth

**QPSK**

| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Lowest channel Freq. (MHz) | Level [dBm] | Harmonic | Middle channel Freq. (MHz) | Level [dBm] | Harmonic | Highest channel Freq. (MHz) | Level [dBm] |
| 2 | 1651.0 | - | 2 | 1673.0 | - | 2 | 1695.0 | - |
| 3 | 2476.5 | - | 3 | 2509.5 | - | 3 | 2542.5 | - |
| 4 | 3302.0 | - | 4 | 3346.0 | - | 4 | 3390.0 | - |
| 5 | 4127.5 | - | 5 | 4182.5 | - | 5 | 4237.5 | - |
| 6 | 4953.0 | - | 6 | 5019.0 | - | 6 | 5085.0 | - |
| 7 | 5778.5 | - | 7 | 5855.5 | - | 7 | 5932.5 | - |
| 8 | 6604.0 | - | 8 | 6692.0 | - | 8 | 6780.0 | - |
| 9 | 7429.5 | - | 9 | 7258.5 | - | 9 | 7627.5 | - |
| 10 | 8255.0 | - | 10 | 8365.0 | - | 10 | 8475.0 | - |
| | | | | | | | | |

**16-QAM**

| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Lowest channel Freq. (MHz) | Level [dBm] | Harmonic | Middle channel Freq. (MHz) | Level [dBm] | Harmonic | Highest channel Freq. (MHz) | Level [dBm] |
| 2 | 1651.0 | - | 2 | 1673.0 | - | 2 | 1695.0 | - |
| 3 | 2476.5 | - | 3 | 2509.5 | - | 3 | 2542.5 | - |
| 4 | 3302.0 | - | 4 | 3346.0 | - | 4 | 3390.0 | - |
| 5 | 4127.5 | - | 5 | 4182.5 | - | 5 | 4237.5 | - |
| 6 | 4953.0 | - | 6 | 5019.0 | - | 6 | 5085.0 | - |
| 7 | 5778.5 | - | 7 | 5855.5 | - | 7 | 5932.5 | - |
| 8 | 6604.0 | - | 8 | 6692.0 | - | 8 | 6780.0 | - |
| 9 | 7429.5 | - | 9 | 7258.5 | - | 9 | 7627.5 | - |
| 10 | 8255.0 | - | 10 | 8365.0 | - | 10 | 8475.0 | - |
| | | | | | | | | |

**Results:** **for 5 MHz channel bandwidth**

**QPSK**

| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Lowest channel Freq. (MHz) | Level [dBm] | Harmonic | Middle channel Freq. (MHz) | Level [dBm] | Harmonic | Highest channel Freq. (MHz) | Level [dBm] |
| 2 | 1653.0 | - | 2 | 1673.0 | - | 2 | 1693.0 | - |
| 3 | 2479.5 | - | 3 | 2509.5 | - | 3 | 2539.5 | - |
| 4 | 3306.0 | - | 4 | 3346.0 | - | 4 | 3386.0 | - |
| 5 | 4132.5 | - | 5 | 4182.5 | - | 5 | 4232.5 | - |
| 6 | 4959.0 | - | 6 | 5019.0 | - | 6 | 5079.0 | - |
| 7 | 5785.5 | - | 7 | 5855.5 | - | 7 | 5925.5 | - |
| 8 | 6612.0 | - | 8 | 6692.0 | - | 8 | 6772.0 | - |
| 9 | 7438.5 | - | 9 | 7528.5 | - | 9 | 7618.5 | - |
| 10 | 8265.0 | - | 10 | 8365.0 | - | 10 | 8465.0 | - |
| | | | | | | | | |

**16-QAM**

| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Lowest channel Freq. (MHz) | Level [dBm] | Harmonic | Middle channel Freq. (MHz) | Level [dBm] | Harmonic | Highest channel Freq. (MHz) | Level [dBm] |
| 2 | 1653.0 | - | 2 | 1673.0 | - | 2 | 1693.0 | - |
| 3 | 2479.5 | - | 3 | 2509.5 | - | 3 | 2539.5 | - |
| 4 | 3306.0 | - | 4 | 3346.0 | - | 4 | 3386.0 | - |
| 5 | 4132.5 | - | 5 | 4182.5 | - | 5 | 4232.5 | - |
| 6 | 4959.0 | - | 6 | 5019.0 | - | 6 | 5079.0 | - |
| 7 | 5785.5 | - | 7 | 5855.5 | - | 7 | 5925.5 | - |
| 8 | 6612.0 | - | 8 | 6692.0 | - | 8 | 6772.0 | - |
| 9 | 7438.5 | - | 9 | 7528.5 | - | 9 | 7618.5 | - |
| 10 | 8265.0 | - | 10 | 8365.0 | - | 10 | 8465.0 | - |
| | | | | | | | | |

**Results:** for 10 MHz channel bandwidth

**QPSK**

| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Lowest channel Freq. (MHz) | Level [dBm] | Harmonic | Middle channel Freq. (MHz) | Level [dBm] | Harmonic | Highest channel Freq. (MHz) | Level [dBm] |
| 2 | 1658.0 | - | 2 | 1673.0 | - | 2 | 1688.0 | - |
| 3 | 2487.0 | - | 3 | 2509.5 | - | 3 | 2532.0 | - |
| 4 | 3316.0 | - | 4 | 3346.0 | - | 4 | 3376.0 | - |
| 5 | 4145.0 | - | 5 | 4182.5 | - | 5 | 4220.0 | - |
| 6 | 4974.0 | - | 6 | 5019.0 | - | 6 | 5064.0 | - |
| 7 | 5803.0 | - | 7 | 5855.5 | - | 7 | 5908.0 | - |
| 8 | 6632.0 | - | 8 | 6692.0 | - | 8 | 6752.0 | - |
| 9 | 7461.0 | - | 9 | 7528.5 | - | 9 | 7596.0 | - |
| 10 | 8290.0 | - | 10 | 8365.0 | - | 10 | 8440.0 | - |
| | | | | | | | | |

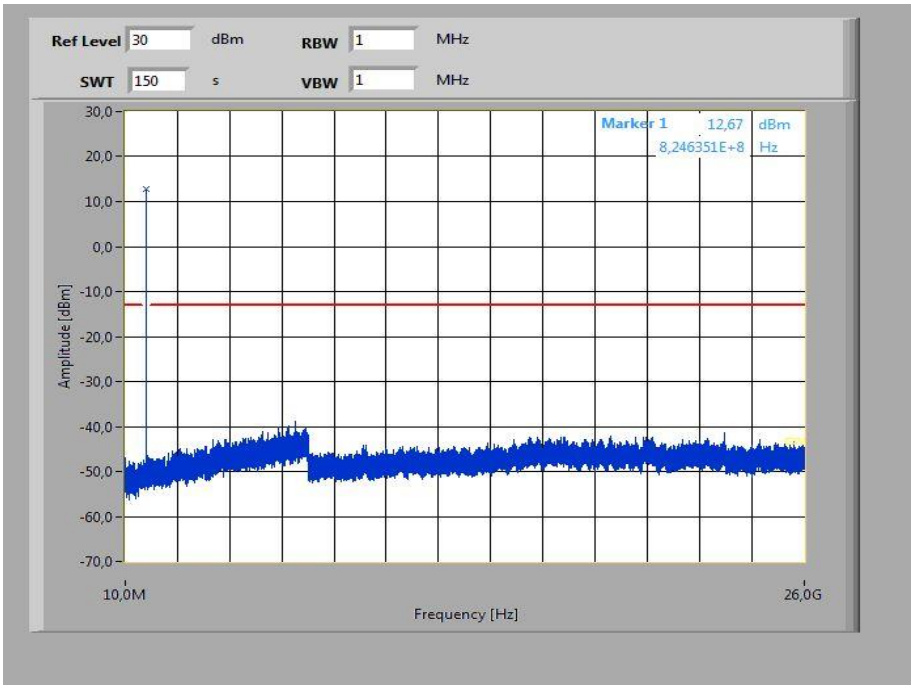
**16-QAM**

| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Lowest channel Freq. (MHz) | Level [dBm] | Harmonic | Middle channel Freq. (MHz) | Level [dBm] | Harmonic | Highest channel Freq. (MHz) | Level [dBm] |
| 2 | 1658.0 | - | 2 | 1673.0 | - | 2 | 1688.0 | - |
| 3 | 2487.0 | - | 3 | 2509.5 | - | 3 | 2532.0 | - |
| 4 | 3316.0 | - | 4 | 3346.0 | - | 4 | 3376.0 | - |
| 5 | 4145.0 | - | 5 | 4182.5 | - | 5 | 4220.0 | - |
| 6 | 4974.0 | - | 6 | 5019.0 | - | 6 | 5064.0 | - |
| 7 | 5803.0 | - | 7 | 5855.5 | - | 7 | 5908.0 | - |
| 8 | 6632.0 | - | 8 | 6692.0 | - | 8 | 6752.0 | - |
| 9 | 7461.0 | - | 9 | 7528.5 | - | 9 | 7596.0 | - |
| 10 | 8290.0 | - | 10 | 8365.0 | - | 10 | 8440.0 | - |
| | | | | | | | | |

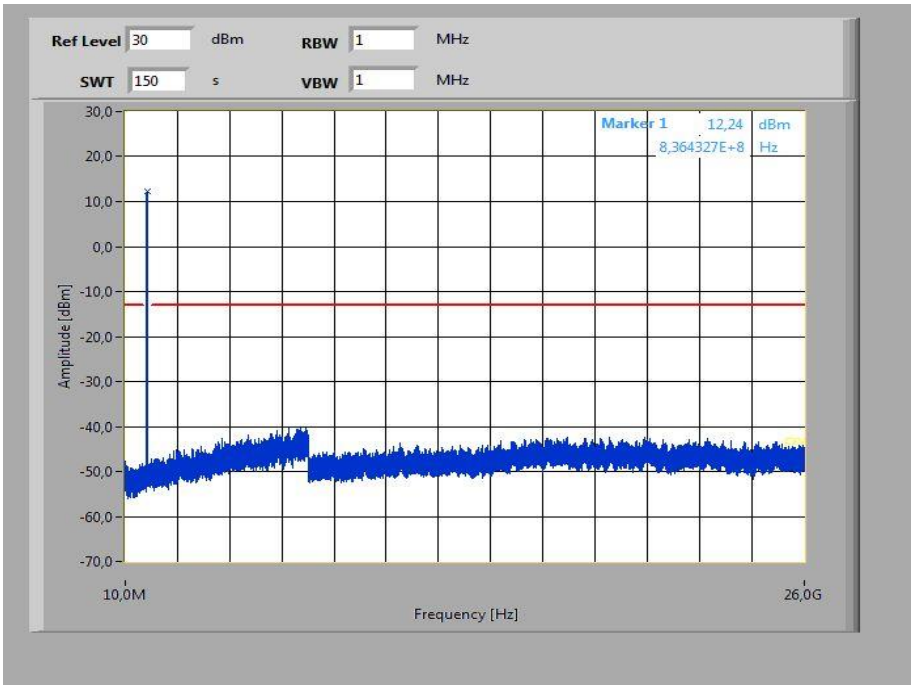
**Verdict:** compliant

**Plots: QPSK with 1.4 MHz channel bandwidth**

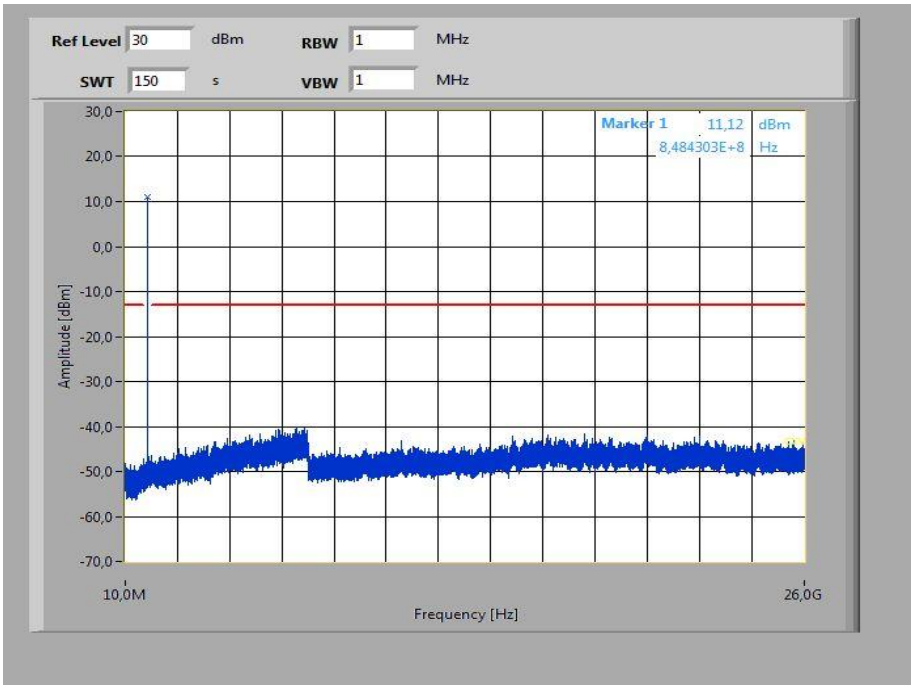
**Plot 1:** Lowest Channel (10 MHz - 26 GHz)




**Plot 2:** Middle Channel (10 MHz - 26 GHz)

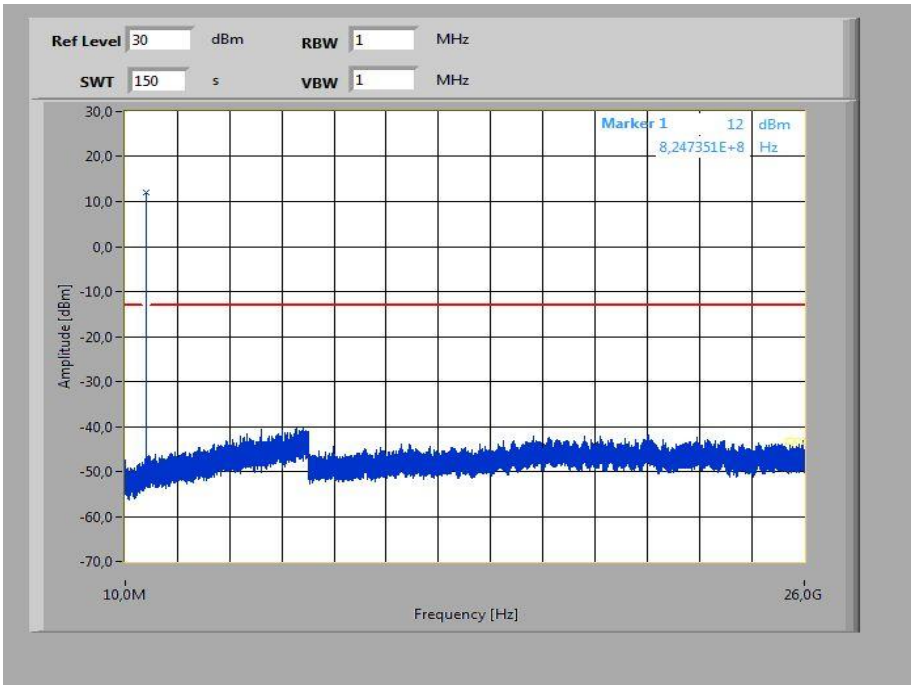


**Plot 3:** Highest Channel (10 MHz - 26 GHz)

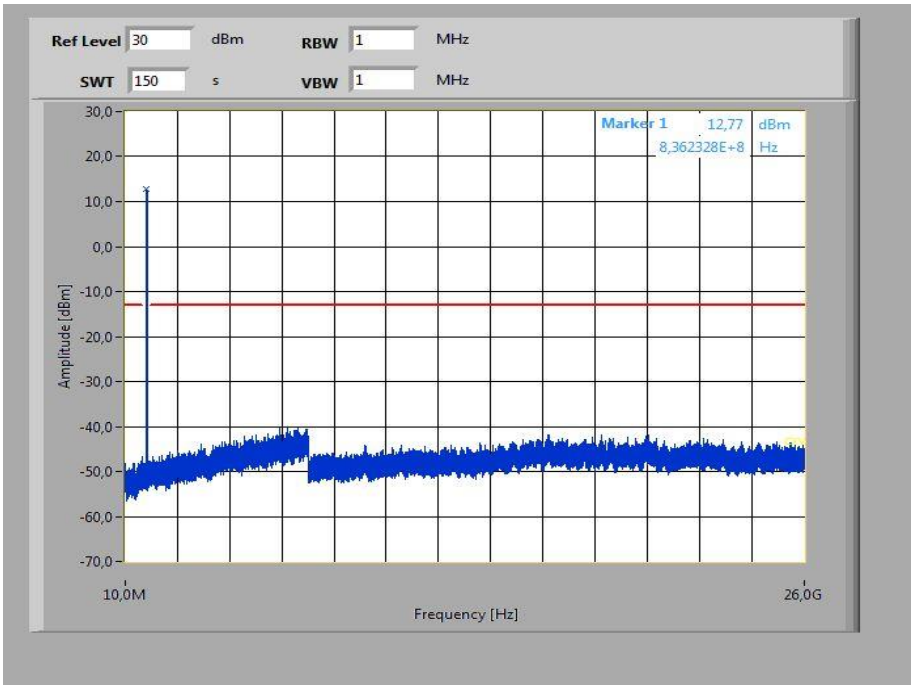


**Plots: 16-QAM with 1.4 MHz channel bandwidth**

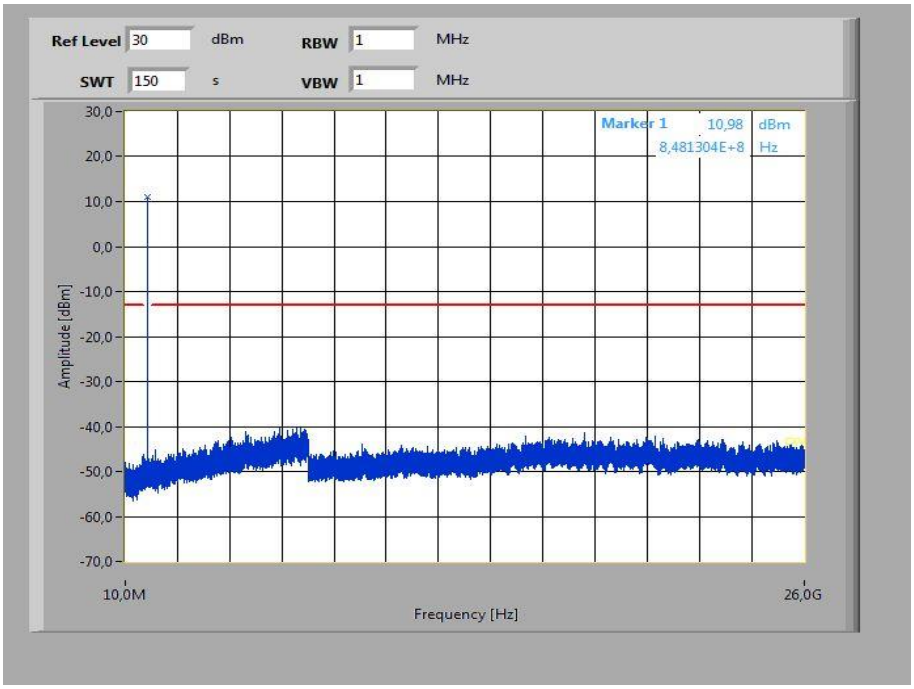
**Plot 4:** Lowest Channel (10 MHz - 26 GHz)




**Plot 5:** Middle Channel (10 MHz - 26 GHz)

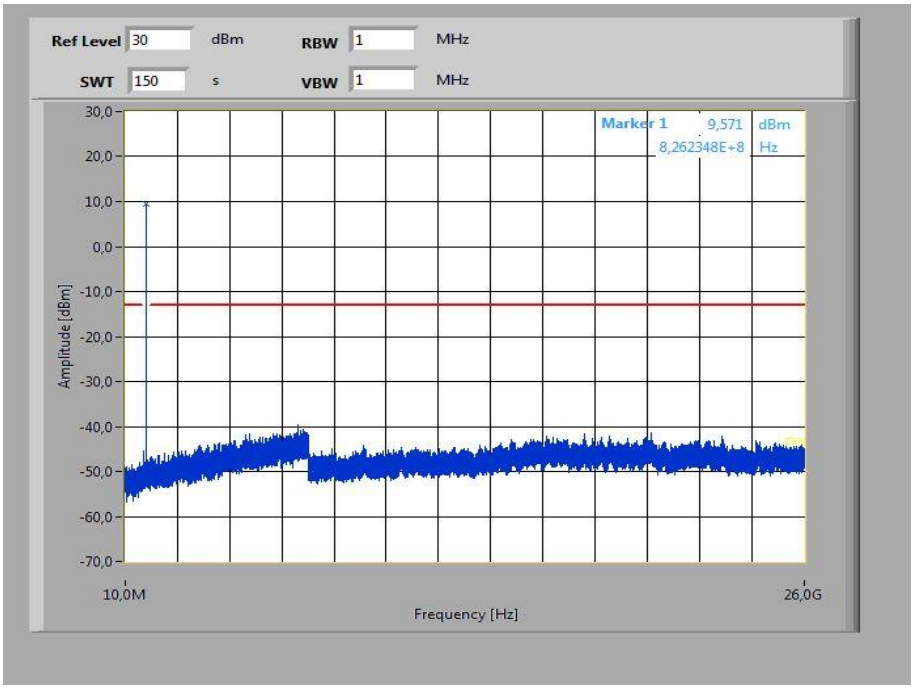


**Plot 6:** Highest Channel (10 MHz - 26 GHz)

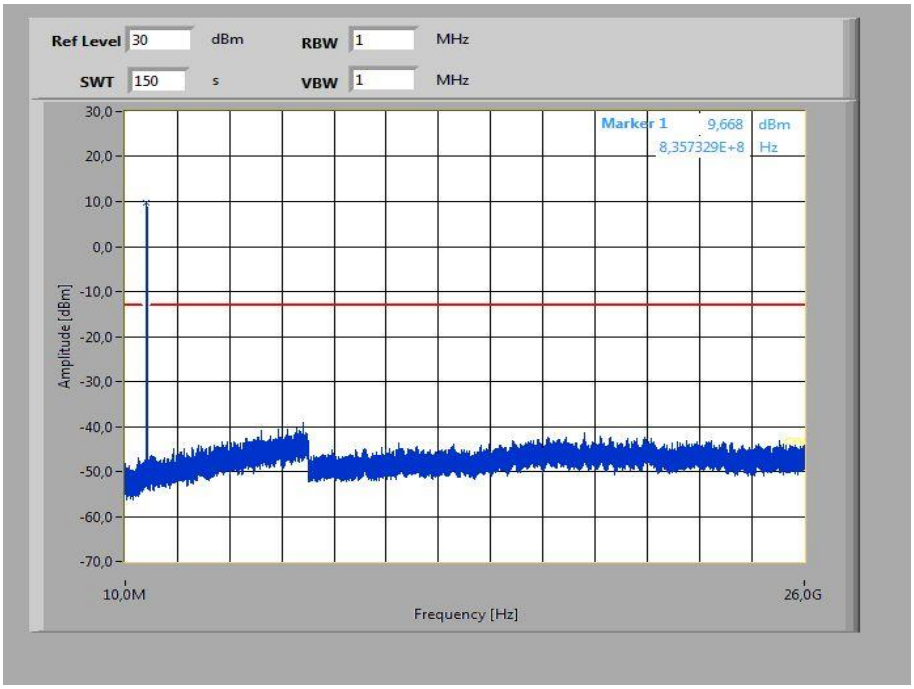


**Plots: QPSK with 3 MHz channel bandwidth**

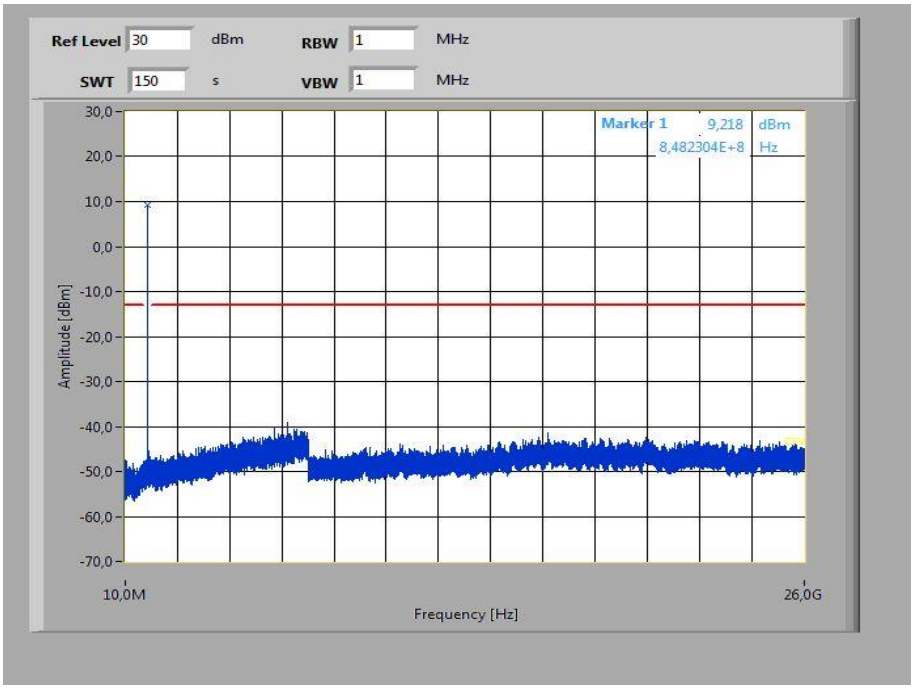
**Plot 1:** Lowest Channel (10 MHz - 26 GHz)




**Plot 2:** Middle Channel (10 MHz - 26 GHz)

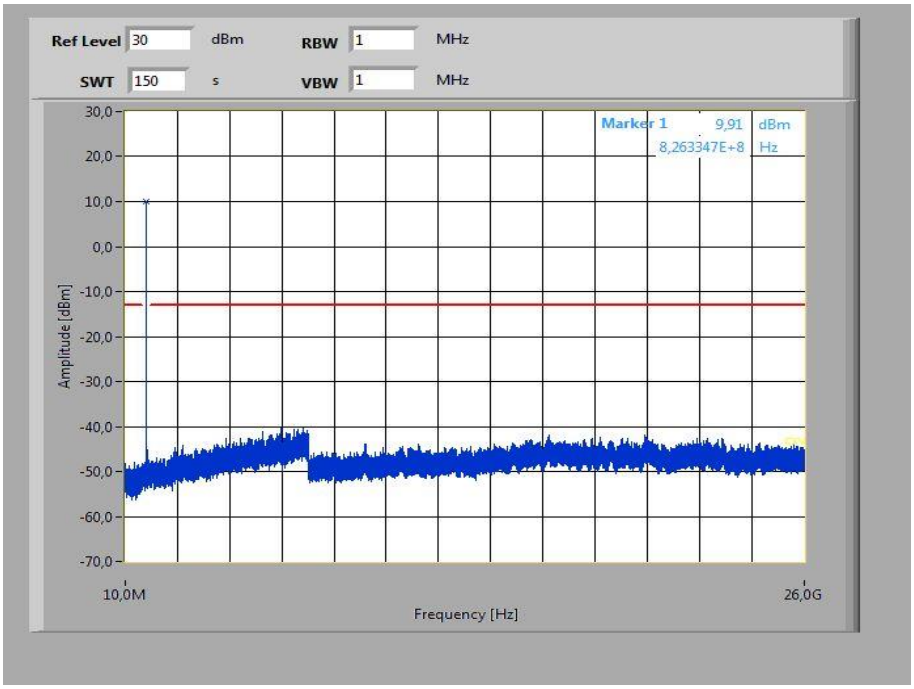


**Plot 3:** Highest Channel (10 MHz - 26 GHz)

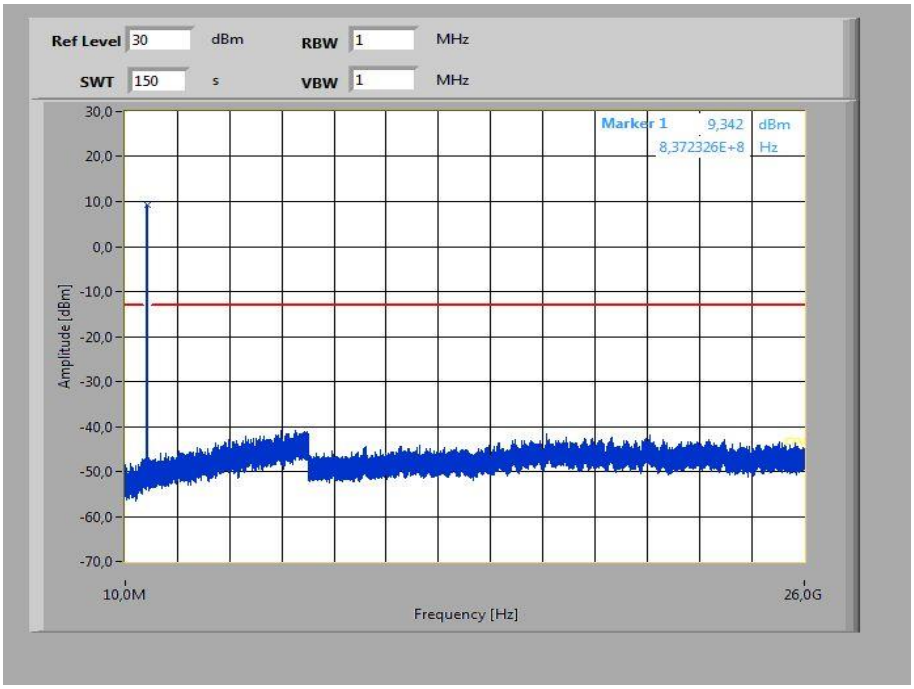


**Plots: 16-QAM with 3 MHz channel bandwidth**

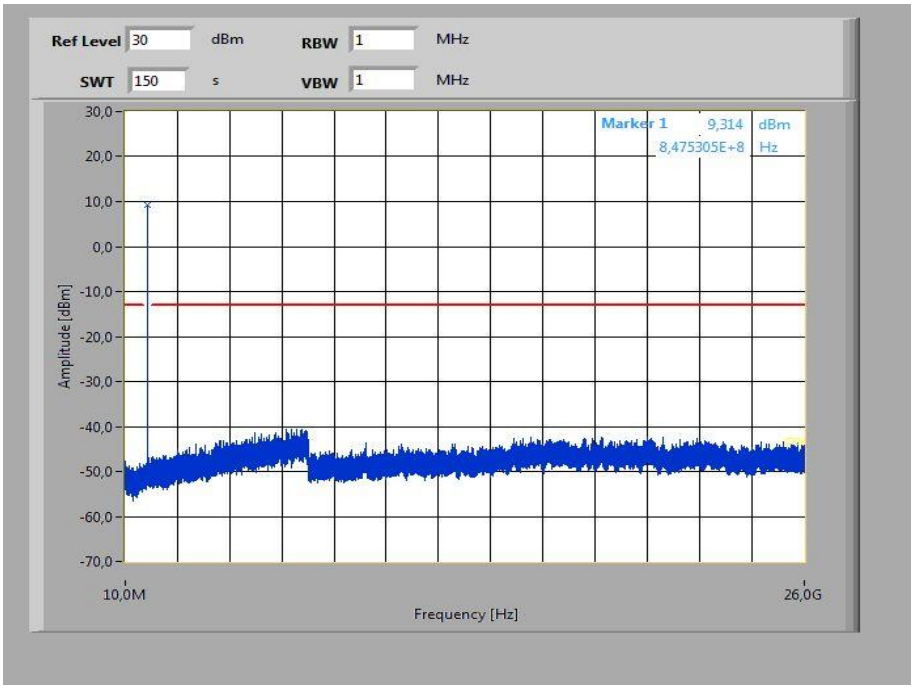
**Plot 4:** Lowest Channel (10 MHz - 26 GHz)




**Plot 5:** Middle Channel (10 MHz - 26 GHz)

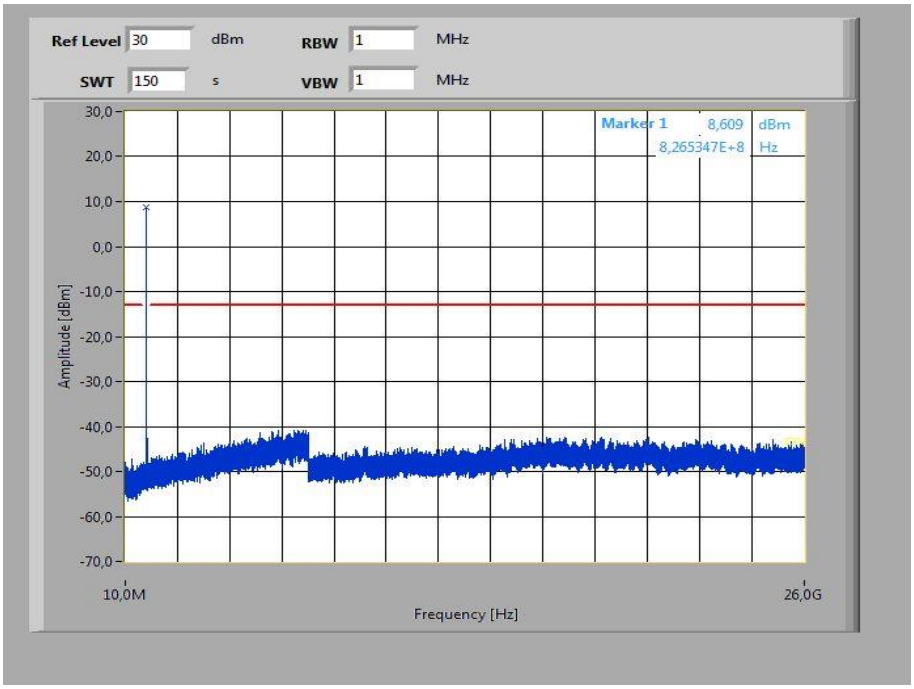


**Plot 6:** Highest Channel (10 MHz - 26 GHz)

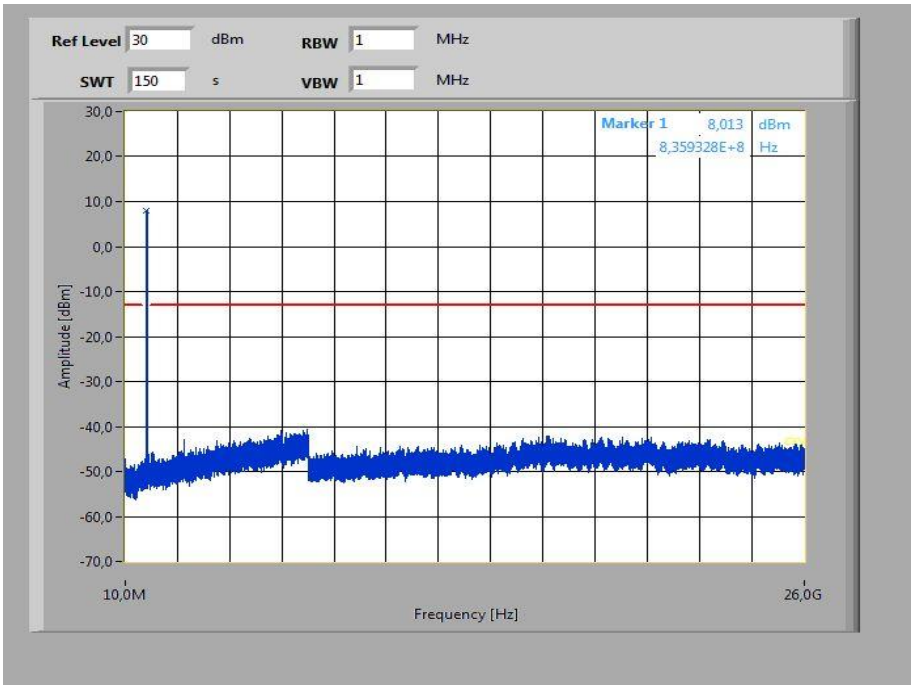


**Plots: QPSK with 5 MHz channel bandwidth**

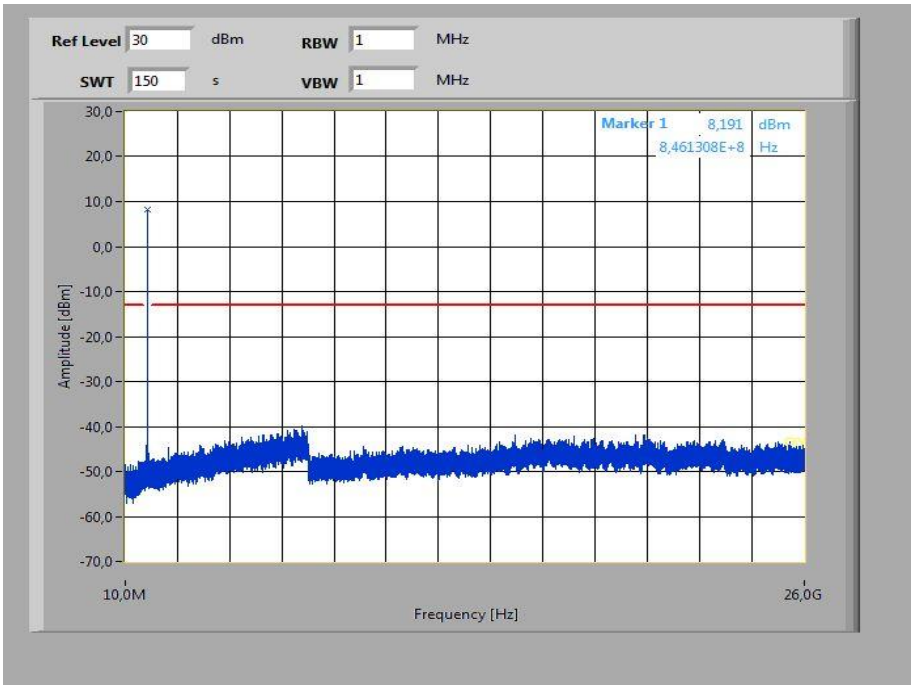
**Plot 1:** Lowest Channel (10 MHz - 26 GHz)




**Plot 2:** Middle Channel (10 MHz - 26 GHz)

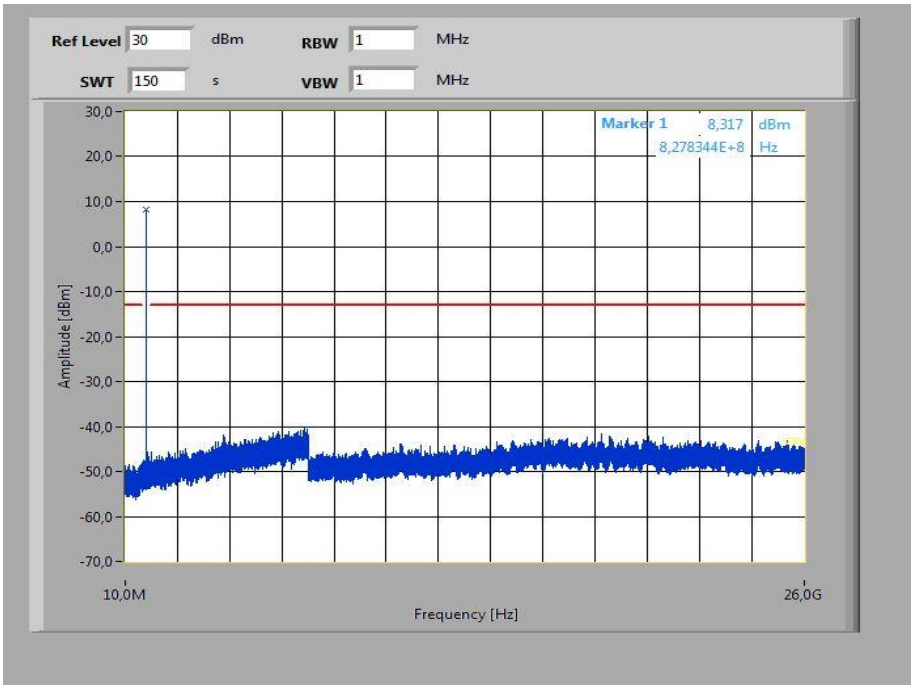


**Plot 3:** Highest Channel (10 MHz - 26 GHz)

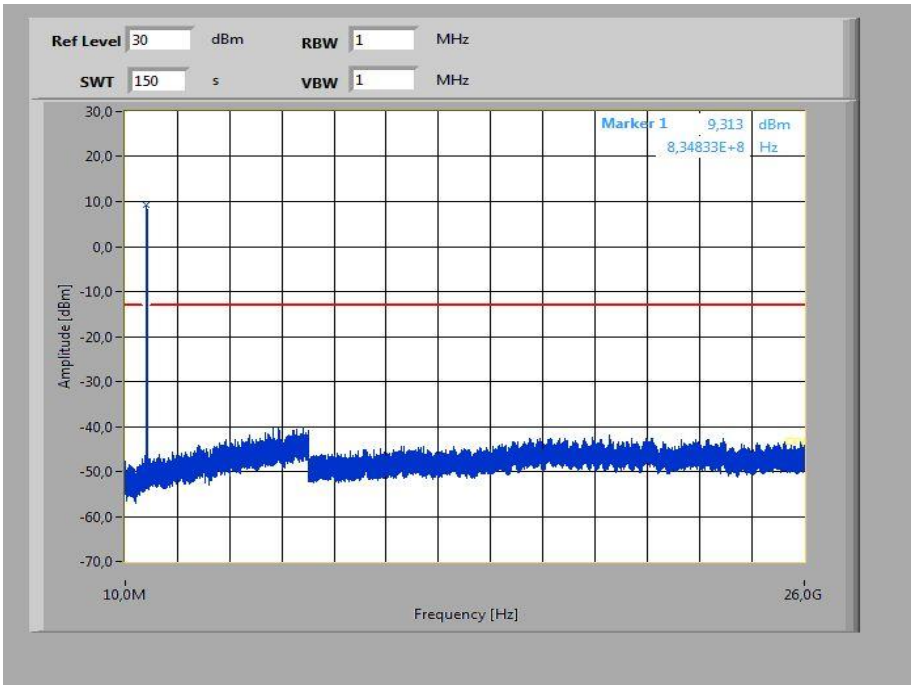


**Plots: 16-QAM with 5 MHz channel bandwidth**

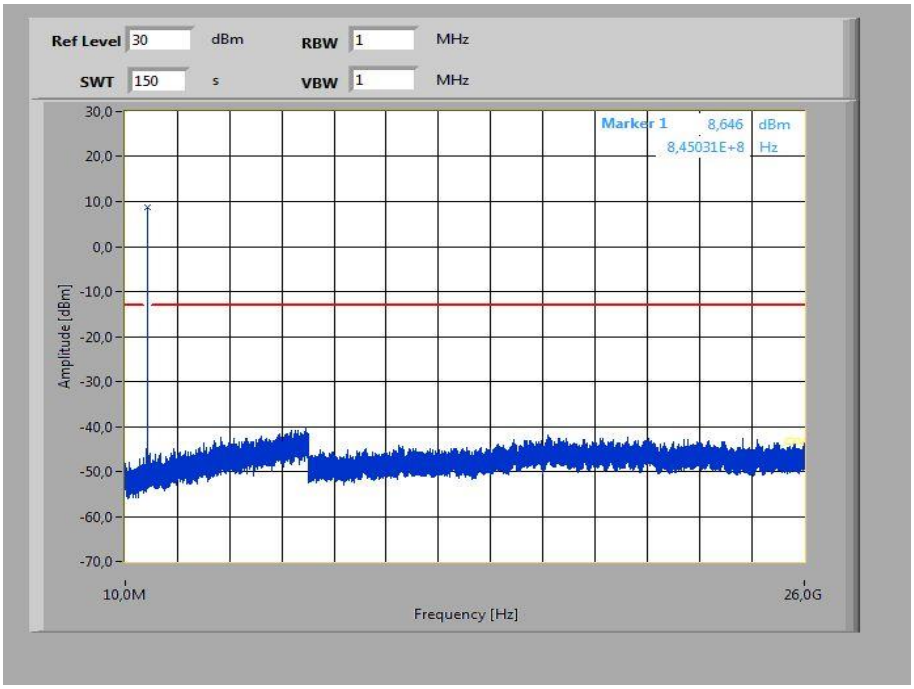
**Plot 4:** Lowest Channel (10 MHz - 26 GHz)




**Plot 5:** Middle Channel (10 MHz - 26 GHz)

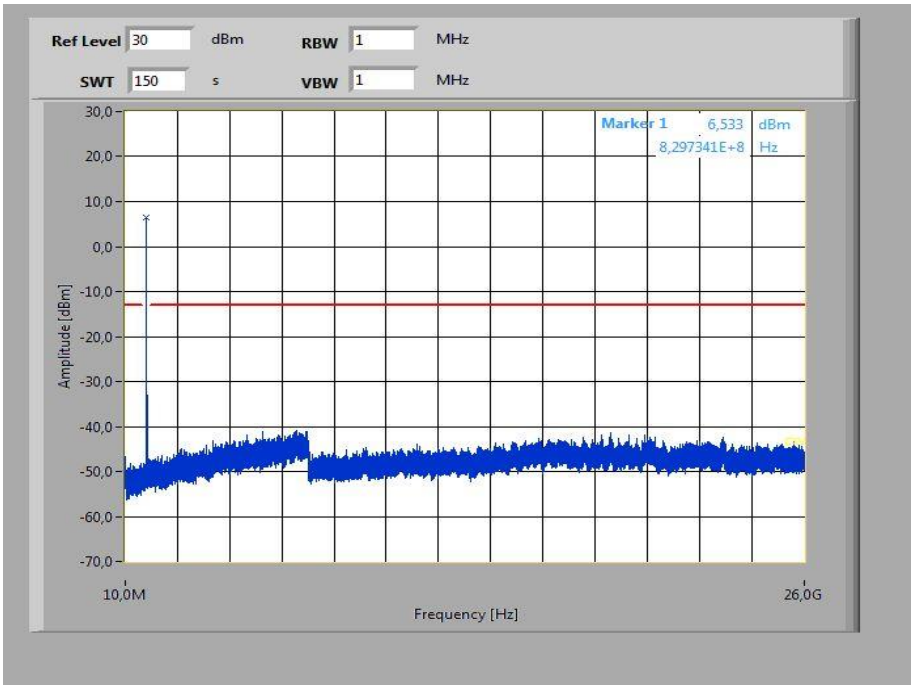


**Plot 6:** Highest Channel (10 MHz - 26 GHz)

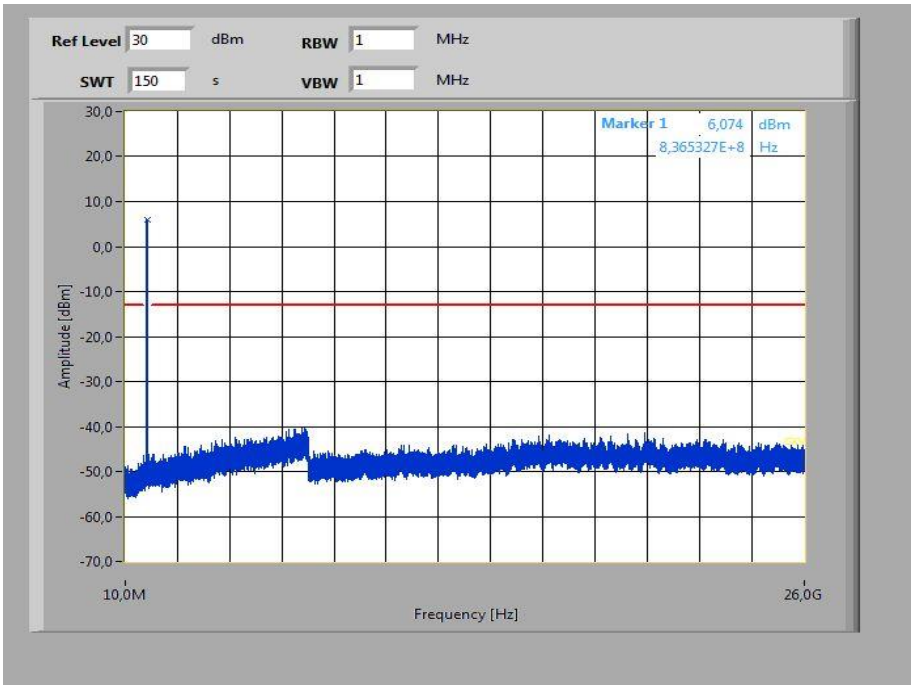


**Plots: QPSK with 10 MHz channel bandwidth**

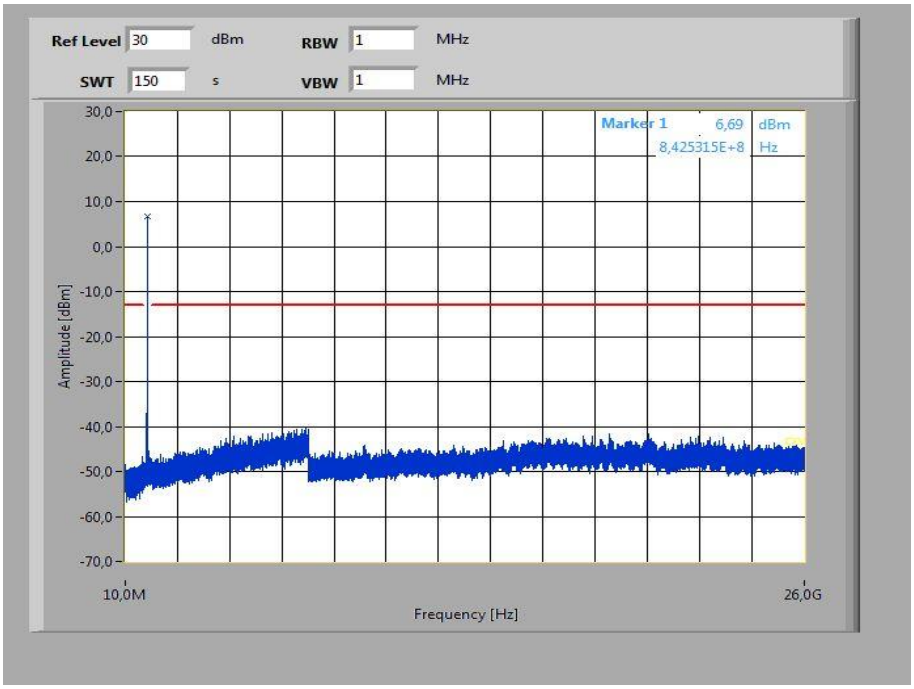
**Plot 1:** Lowest Channel (10 MHz - 26 GHz)




**Plot 2:** Middle Channel (10 MHz - 26 GHz)

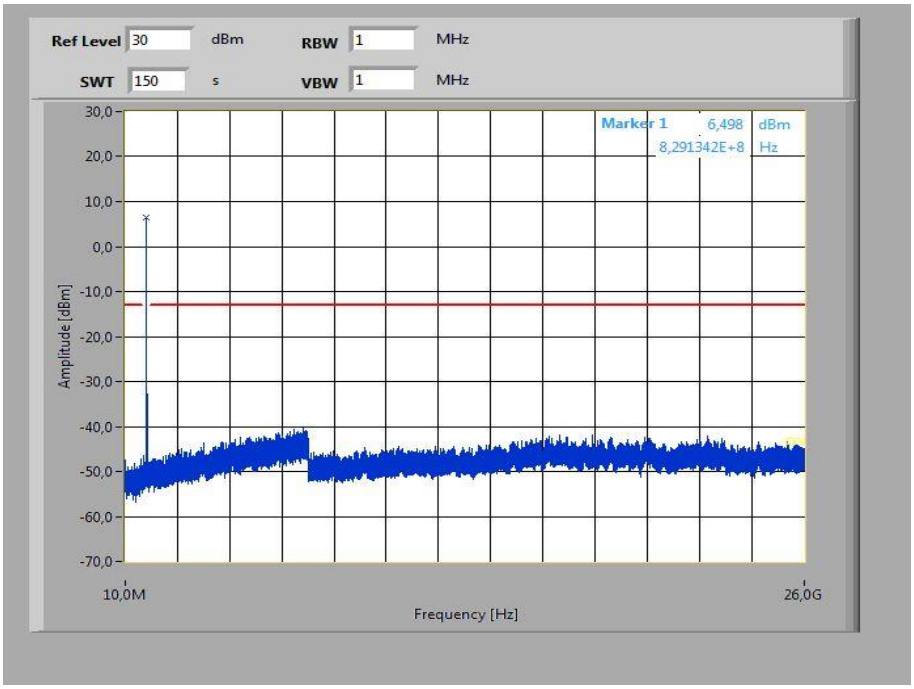


**Plot 3:** Highest Channel (10 MHz - 26 GHz)

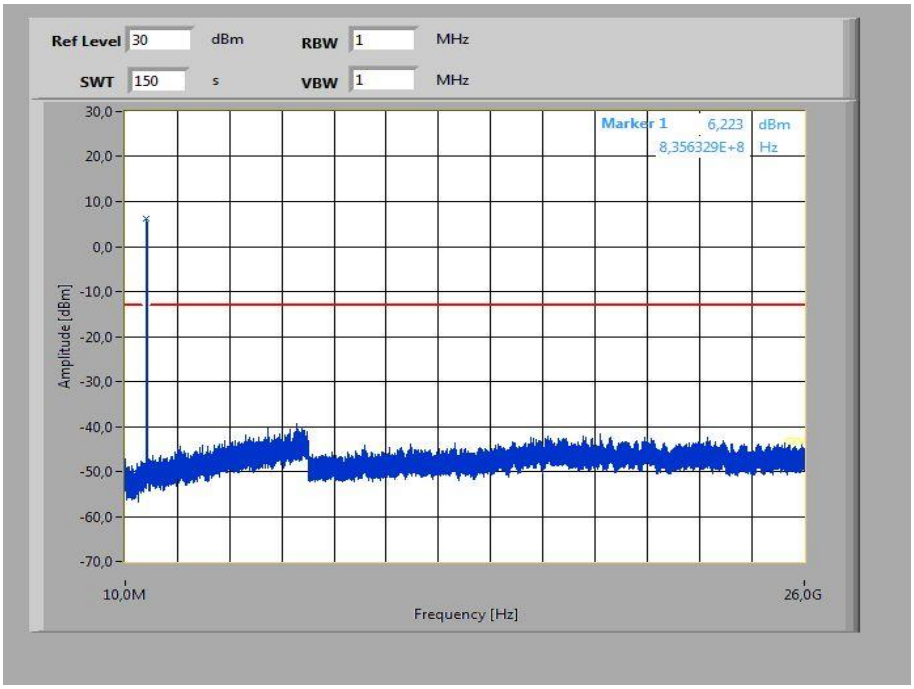


**Plots: 16-QAM with 10 MHz channel bandwidth**

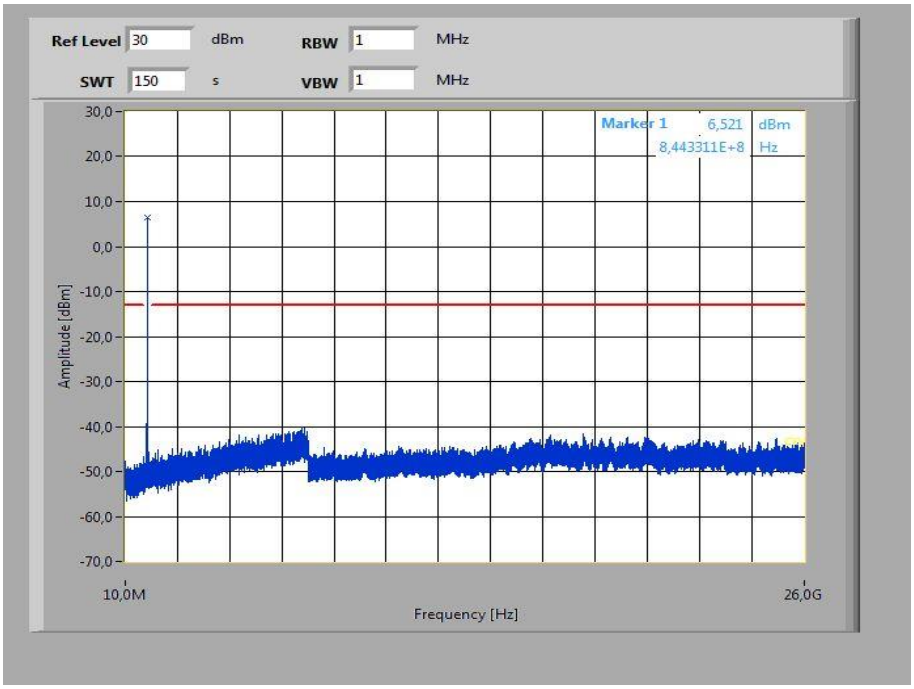
**Plot 4:** Lowest Channel (10 MHz - 26 GHz)




**Plot 5:** Middle Channel (10 MHz - 26 GHz)



**Plot 6:** Highest Channel (10 MHz - 26 GHz)



## 11.1.5 Block edge compliance

**Description:**

The spectrum at the band edges must comply with the spurious emissions limits.

**Measurement:**

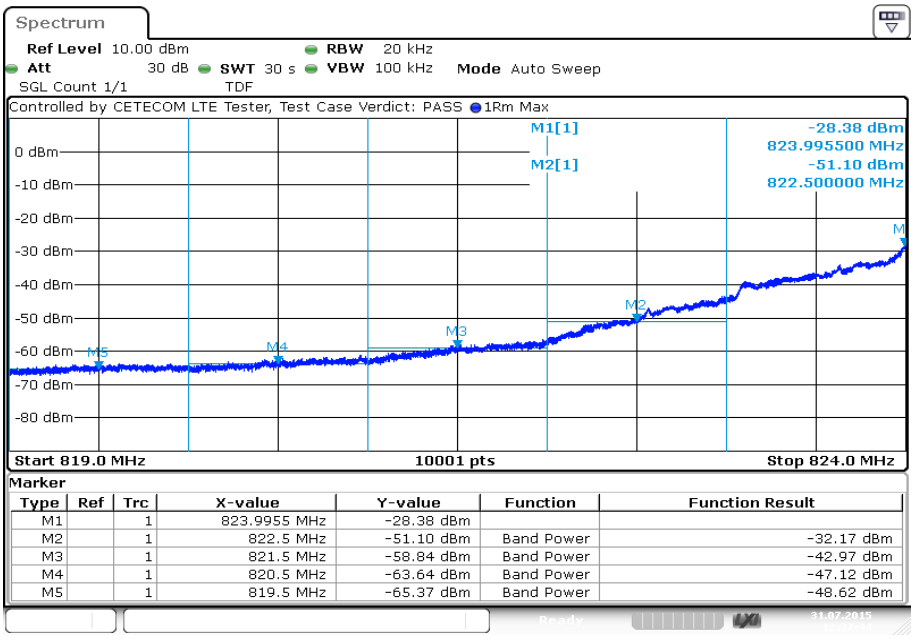
| Measurement parameters | |
|---|---|
| Detector: | RMS |
| Sweep time: | 30 s |
| Resolution bandwidth: | 1% - 5% of the OBW |
| Video bandwidth: | ≥ 3xRBW |
| Span: | 5 MHz |
| Trace-Mode: | Max Hold |
| Used equipment: | see chapter 7.2 - A |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1051 | RSS 132 |
| Block Edge Compliance | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:** **1.4 MHz channel bandwidth**

**Plot 1:** Lowest channel – QPSK

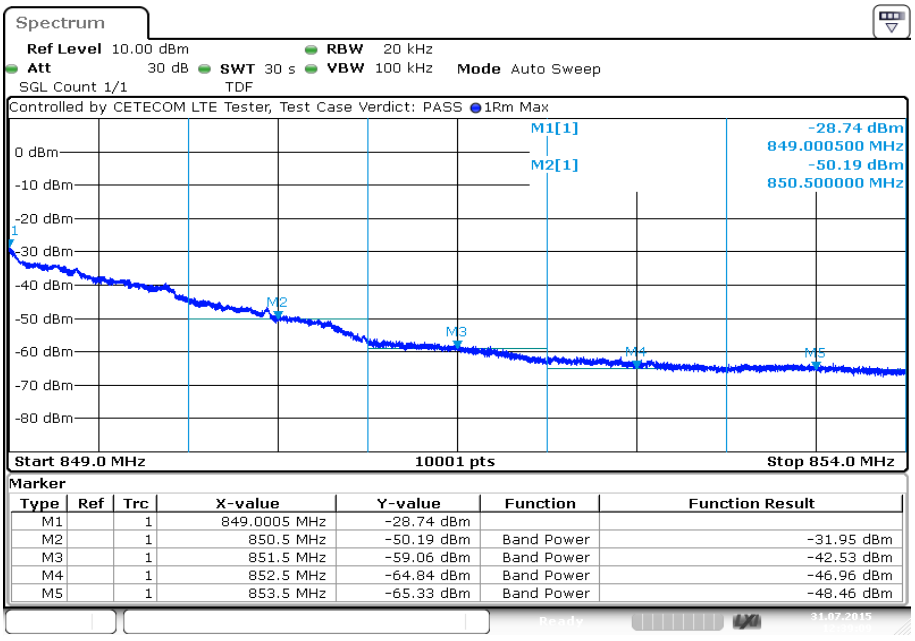



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 823.9955 MHz | -28.38 dBm | | |
| M2 | | 1 | 822.5 MHz | -51.10 dBm | Band Power | -32.17 dBm |
| M3 | | 1 | 821.5 MHz | -58.84 dBm | Band Power | -42.97 dBm |
| M4 | | 1 | 820.5 MHz | -63.64 dBm | Band Power | -47.12 dBm |
| M5 | | 1 | 819.5 MHz | -65.37 dBm | Band Power | -48.62 dBm |

Date: 31.JUL.2015 12:37:44

**Plot 2:** Highest channel – QPSK




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 849.0005 MHz | -28.74 dBm | | |
| M2 | | 1 | 850.5 MHz | -50.19 dBm | Band Power | -31.95 dBm |
| M3 | | 1 | 851.5 MHz | -59.06 dBm | Band Power | -42.53 dBm |
| M4 | | 1 | 852.5 MHz | -64.84 dBm | Band Power | -46.96 dBm |
| M5 | | 1 | 853.5 MHz | -65.33 dBm | Band Power | -48.46 dBm |

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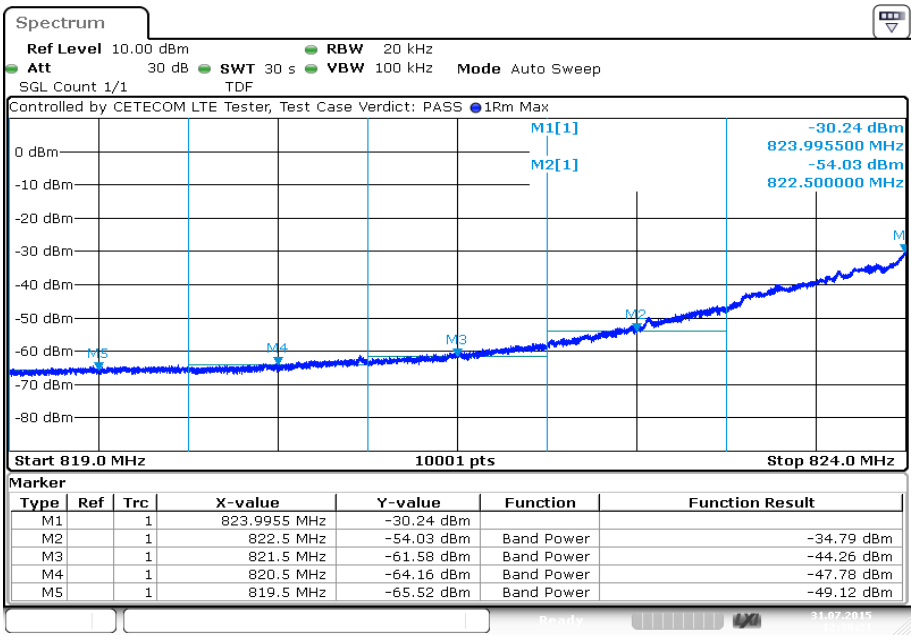
**Plot 3:** Lowest channel – 16-QAM




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 823.9955 MHz | -30.24 dBm | | |
| M2 | | 1 | 822.5 MHz | -54.03 dBm | Band Power | -34.79 dBm |
| M3 | | 1 | 821.5 MHz | -61.58 dBm | Band Power | -44.26 dBm |
| M4 | | 1 | 820.5 MHz | -64.16 dBm | Band Power | -47.78 dBm |
| M5 | | 1 | 819.5 MHz | -65.52 dBm | Band Power | -49.12 dBm |

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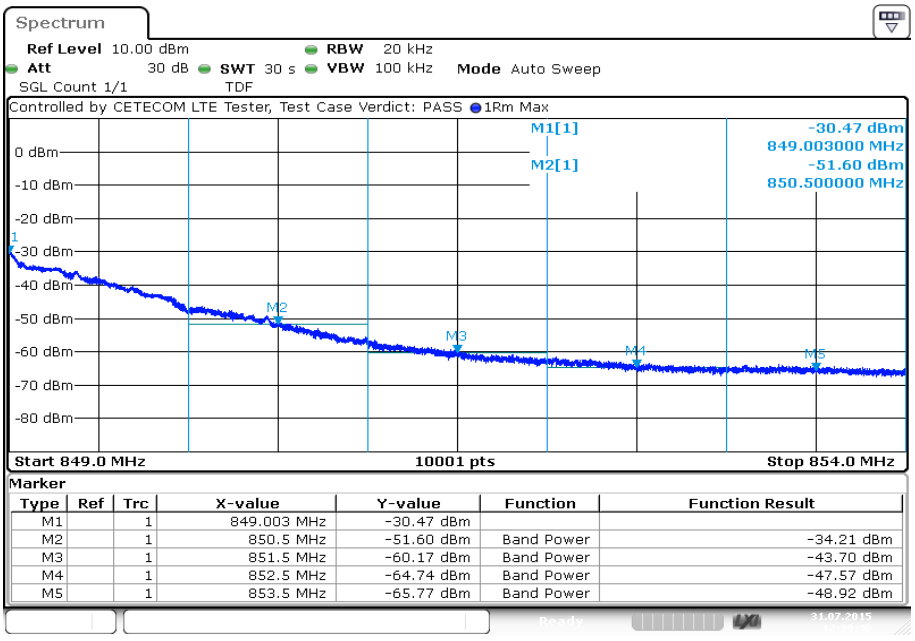
**Plot 4:** Highest channel – 16-QAM



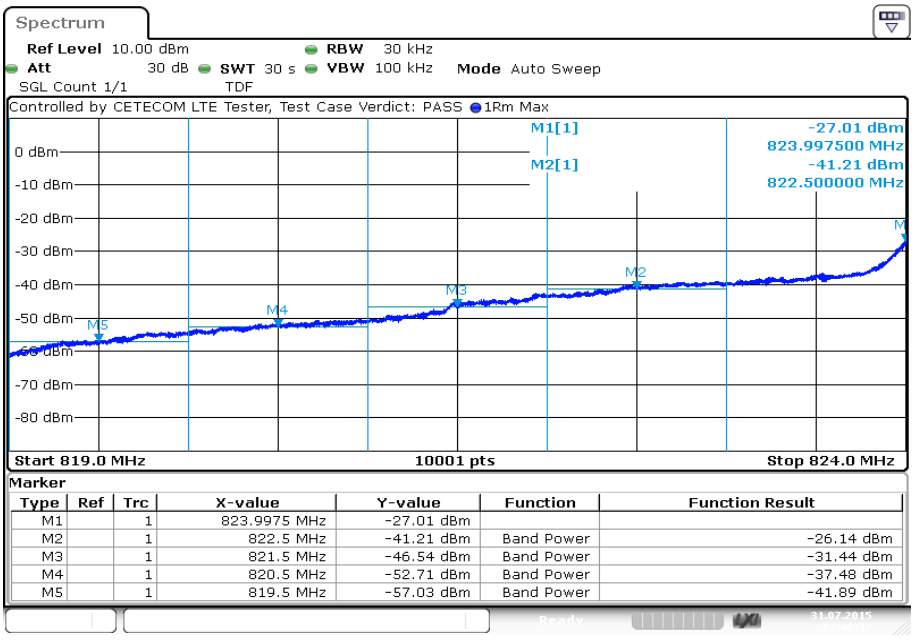

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 849.003 MHz | -30.47 dBm | | |
| M2 | | 1 | 850.5 MHz | -51.60 dBm | Band Power | -34.21 dBm |
| M3 | | 1 | 851.5 MHz | -60.17 dBm | Band Power | -43.70 dBm |
| M4 | | 1 | 852.5 MHz | -64.74 dBm | Band Power | -47.57 dBm |
| M5 | | 1 | 853.5 MHz | -65.77 dBm | Band Power | -48.92 dBm |

Date: 31.JUL.2015 12:39:46

**Results:** **3 MHz channel bandwidth**

**Plot 1:** Lowest channel – QPSK




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 823.9975 MHz | -27.01 dBm | | |
| M2 | | 1 | 822.5 MHz | -41.21 dBm | Band Power | -26.14 dBm |
| M3 | | 1 | 821.5 MHz | -46.54 dBm | Band Power | -31.44 dBm |
| M4 | | 1 | 820.5 MHz | -52.71 dBm | Band Power | -37.48 dBm |
| M5 | | 1 | 819.5 MHz | -57.03 dBm | Band Power | -41.89 dBm |

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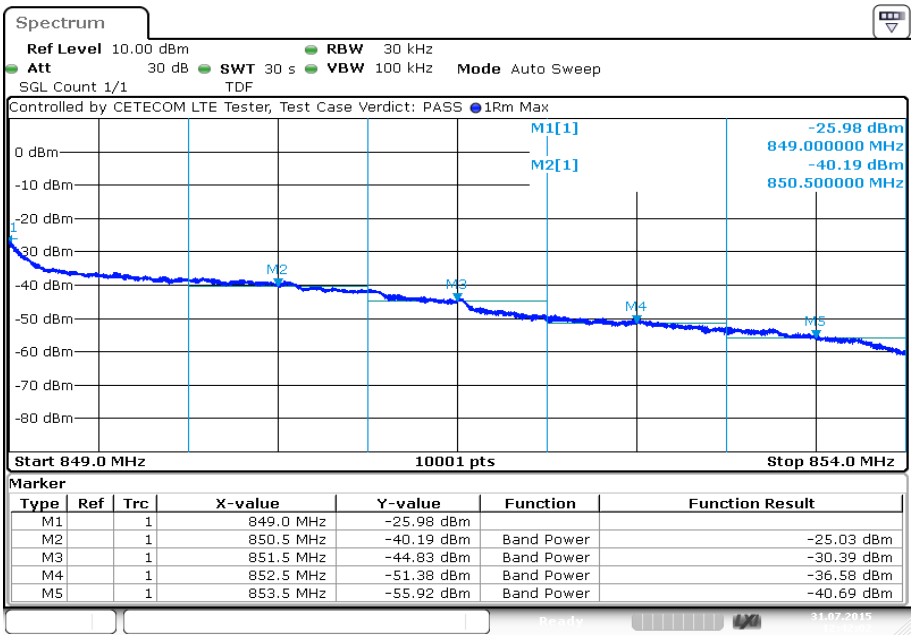
**Plot 2:** Highest channel – QPSK




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 849.0 MHz | -25.98 dBm | | |
| M2 | | 1 | 850.5 MHz | -40.19 dBm | Band Power | -25.03 dBm |
| M3 | | 1 | 851.5 MHz | -44.83 dBm | Band Power | -30.39 dBm |
| M4 | | 1 | 852.5 MHz | -51.38 dBm | Band Power | -36.58 dBm |
| M5 | | 1 | 853.5 MHz | -55.92 dBm | Band Power | -40.69 dBm |

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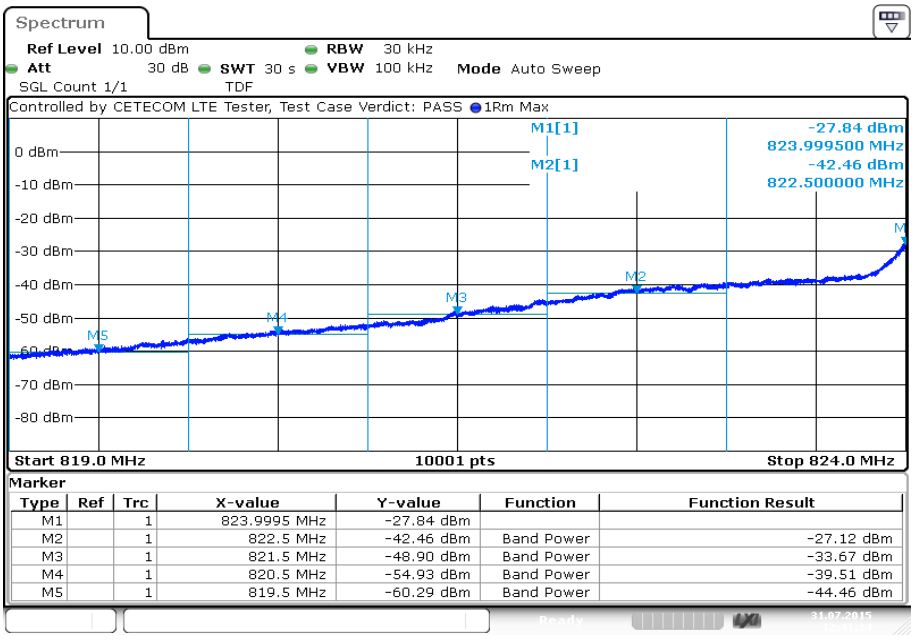
**Plot 3:** Lowest channel – 16-QAM

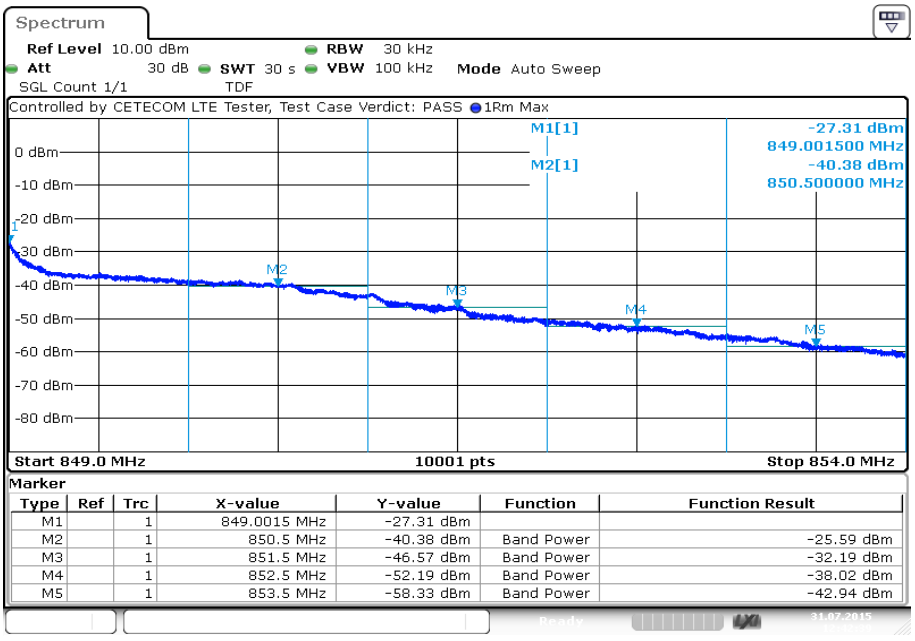



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 823.9995 MHz | -27.84 dBm | | |
| M2 | | 1 | 822.5 MHz | -42.46 dBm | Band Power | -27.12 dBm |
| M3 | | 1 | 821.5 MHz | -48.90 dBm | Band Power | -33.67 dBm |
| M4 | | 1 | 820.5 MHz | -54.93 dBm | Band Power | -39.51 dBm |
| M5 | | 1 | 819.5 MHz | -60.29 dBm | Band Power | -44.46 dBm |

Date: 31.JUL.2015 12:41:15

**Plot 4:** Highest channel – 16-QAM



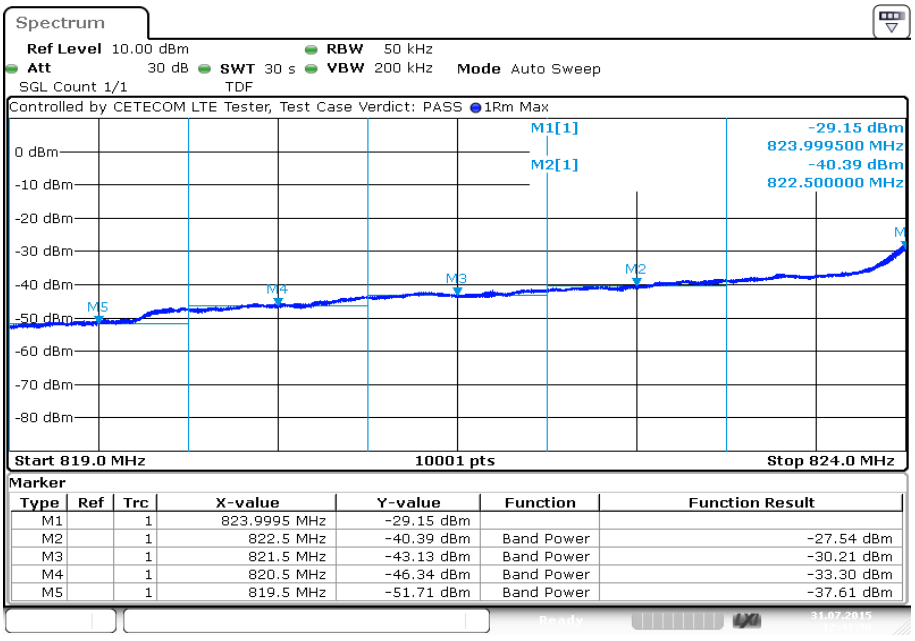

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 849.0015 MHz | -27.31 dBm | | |
| M2 | | 1 | 850.5 MHz | -40.38 dBm | Band Power | -25.59 dBm |
| M3 | | 1 | 851.5 MHz | -46.57 dBm | Band Power | -32.19 dBm |
| M4 | | 1 | 852.5 MHz | -52.19 dBm | Band Power | -38.02 dBm |
| M5 | | 1 | 853.5 MHz | -58.33 dBm | Band Power | -42.94 dBm |

Date: 31.JUL.2015 12:42:39

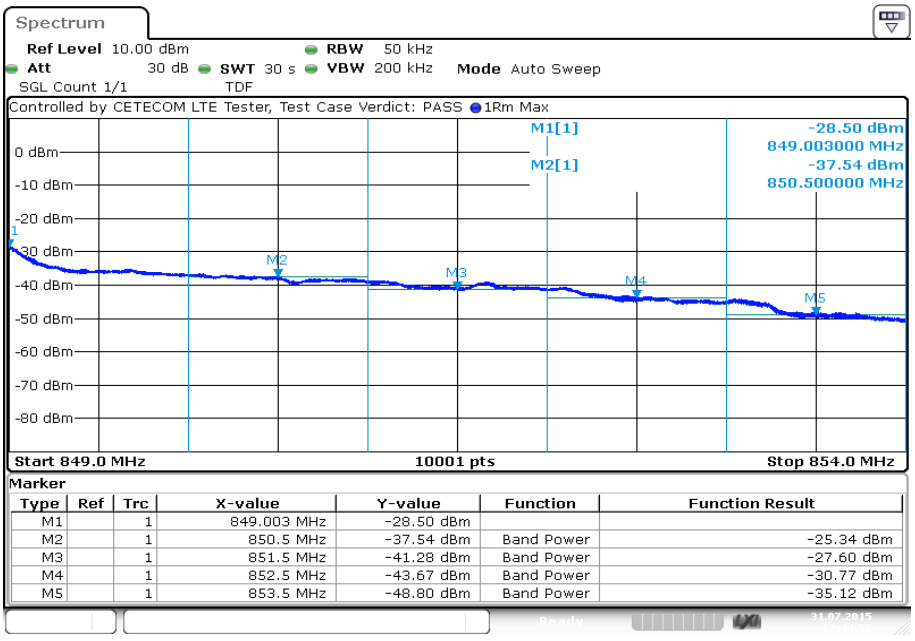
**Results:** **5 MHz channel bandwidth**

**Plot 1:** Lowest channel – QPSK



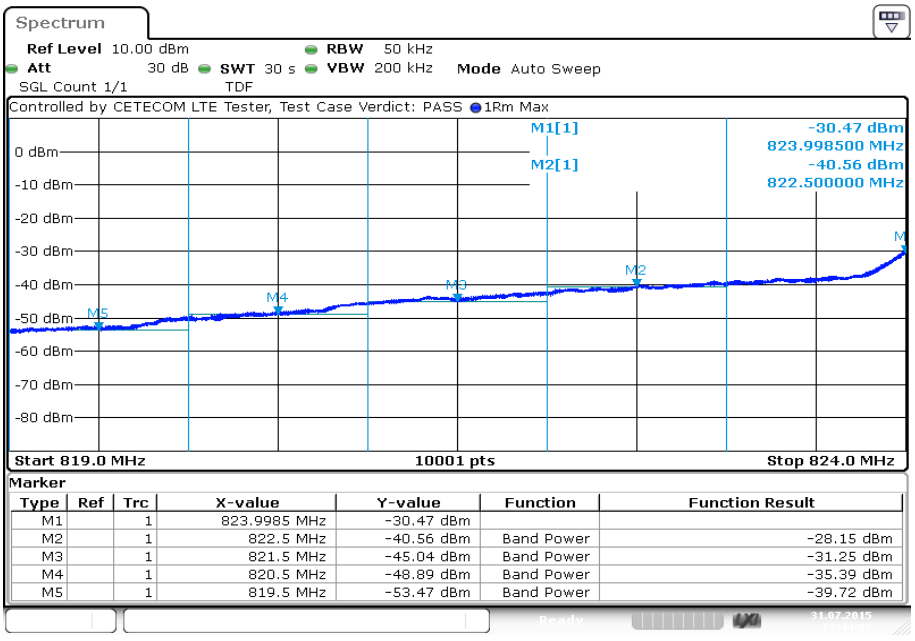

Date: 31.JUL.2015 12:43:30

**Plot 2:** Highest channel – QPSK




Date: 31.JUL.2015 12:44:55

**Plot 3:** Lowest channel – 16-QAM

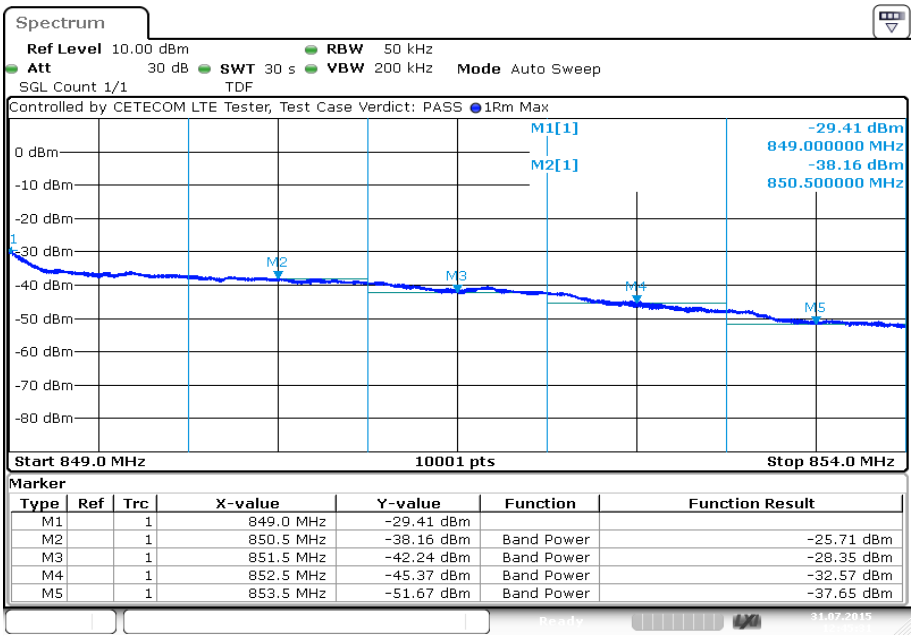



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 823.9985 MHz | -30.47 dBm | | |
| M2 | | 1 | 822.5 MHz | -40.56 dBm | Band Power | -28.15 dBm |
| M3 | | 1 | 821.5 MHz | -45.04 dBm | Band Power | -31.25 dBm |
| M4 | | 1 | 820.5 MHz | -48.89 dBm | Band Power | -35.39 dBm |
| M5 | | 1 | 819.5 MHz | -53.47 dBm | Band Power | -39.72 dBm |

Date: 31.JUL.2015 12:44:08

**Plot 4:** Highest channel – 16-QAM



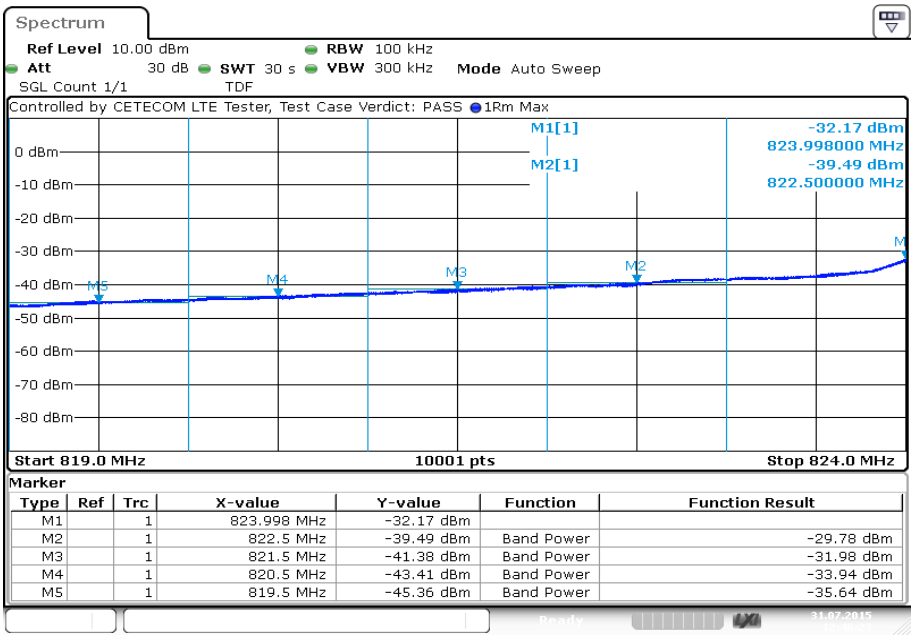

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 849.0 MHz | -29.41 dBm | | |
| M2 | | 1 | 850.5 MHz | -38.16 dBm | Band Power | -25.71 dBm |
| M3 | | 1 | 851.5 MHz | -42.24 dBm | Band Power | -28.35 dBm |
| M4 | | 1 | 852.5 MHz | -45.37 dBm | Band Power | -32.57 dBm |
| M5 | | 1 | 853.5 MHz | -51.67 dBm | Band Power | -37.65 dBm |

Date: 31.JUL.2015 12:45:32

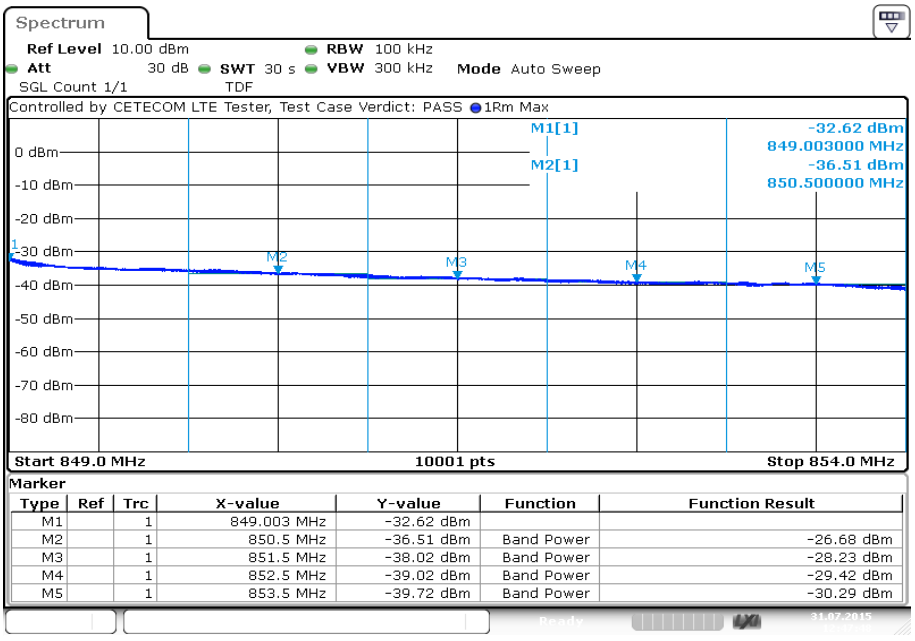
**Results:** **10 MHz channel bandwidth**

**Plot 1:** Lowest channel – QPSK



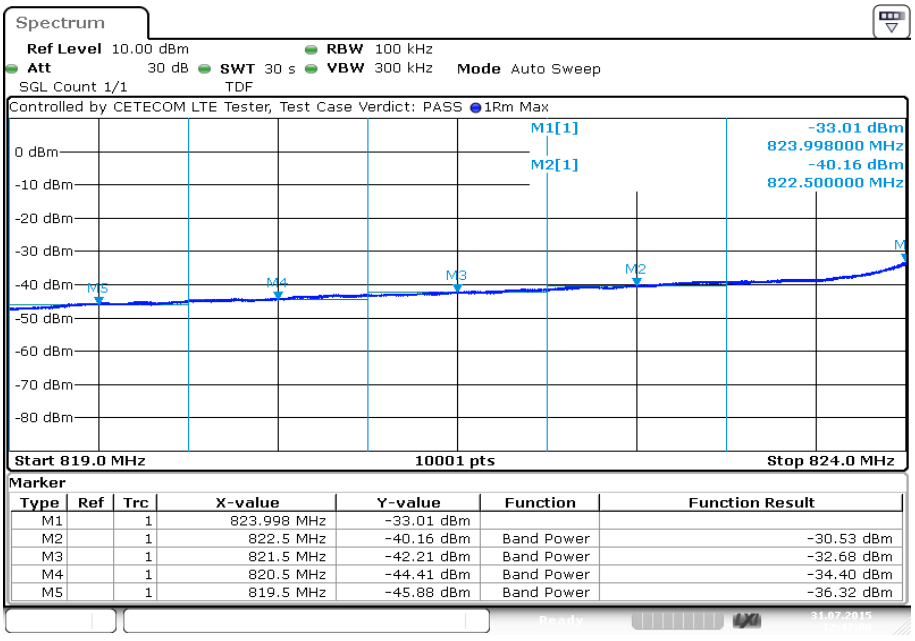

Date: 31.JUL.2015 12:46:23

**Plot 2:** Highest channel – QPSK




Date: 31.JUL.2015 12:47:48

**Plot 3:** Lowest channel – 16-QAM

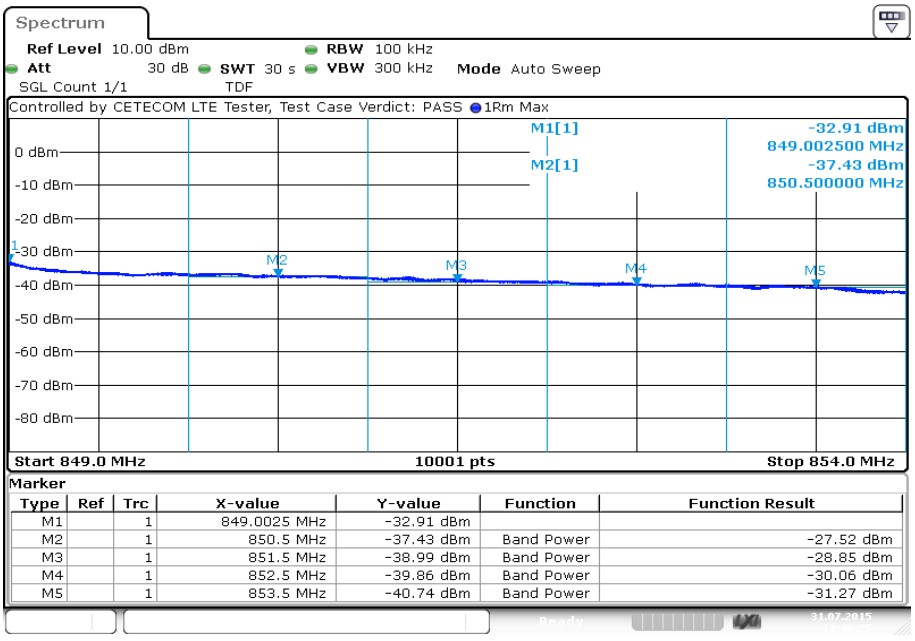



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 823.998 MHz | -33.01 dBm | | |
| M2 | | 1 | 822.5 MHz | -40.16 dBm | Band Power | -30.53 dBm |
| M3 | | 1 | 821.5 MHz | -42.21 dBm | Band Power | -32.68 dBm |
| M4 | | 1 | 820.5 MHz | -44.41 dBm | Band Power | -34.40 dBm |
| M5 | | 1 | 819.5 MHz | -45.88 dBm | Band Power | -36.32 dBm |

Date: 31.JUL.2015 12:47:00

**Plot 4:** Highest channel – 16-QAM




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 849.0025 MHz | -32.91 dBm | | |
| M2 | | 1 | 850.5 MHz | -37.43 dBm | Band Power | -27.52 dBm |
| M3 | | 1 | 851.5 MHz | -38.99 dBm | Band Power | -28.85 dBm |
| M4 | | 1 | 852.5 MHz | -39.86 dBm | Band Power | -30.06 dBm |
| M5 | | 1 | 853.5 MHz | -40.74 dBm | Band Power | -31.27 dBm |

Date: 31.JUL.2015 12:48:25

**Verdict:** compliant

## 11.1.6 Occupied bandwidth

**Description:**

Measurement of the occupied bandwidth of the transmitted signal.

**Measurement:**

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the LTE band V. The table below lists the measured 99% power and -26 dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 1% - 5% of the OBW |
| Video bandwidth: | ≥ 3xRBW |
| Span: | 2 x nominal BW |
| Trace-Mode: | Max Hold |
| Used equipment: | see chapter 7.2 |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1049 | RSS 132 |
| Occupied Bandwidth | |
| Spectrum must fall completely in the specified band | |

**Results:**

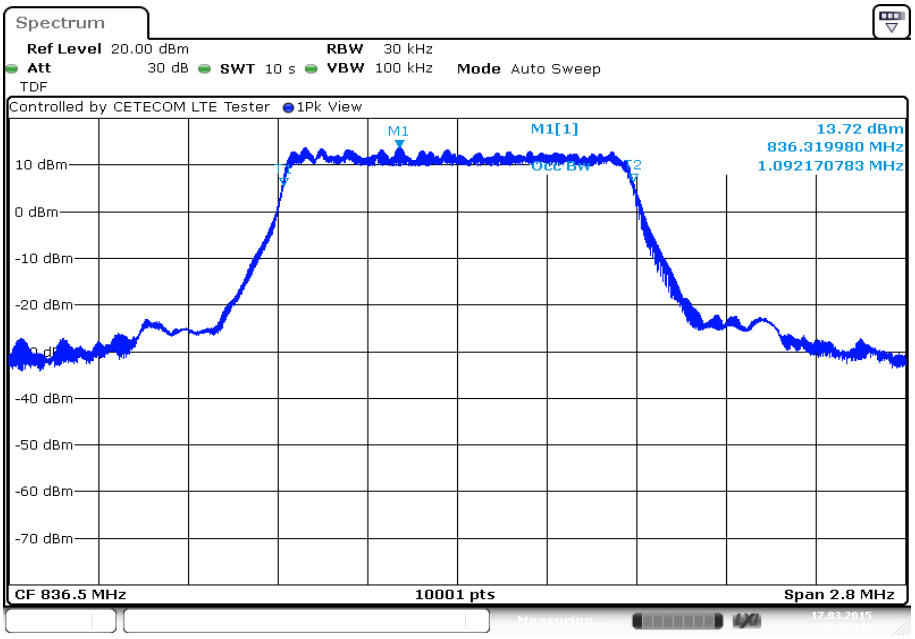
| Occupied Bandwidth – QPSK | | |
|---|---|---|
| **Bandwidth (MHz)** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| 1.4 | 1092 | 1306 |
| 3.0 | 2732 | 3109 |
| 5.0 | 4501 | 5030 |
| 10.0 | 9055 | 10193 |
| | | |

| Occupied Bandwidth – 16-QAM | | |
|---|---|---|
| **Bandwidth (MHz)** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| 1.4 | 1097 | 1310 |
| 3.0 | 2730 | 3132 |
| 5.0 | 4492 | 5011 |
| 10.0 | 9051 | 10081 |
| | | |

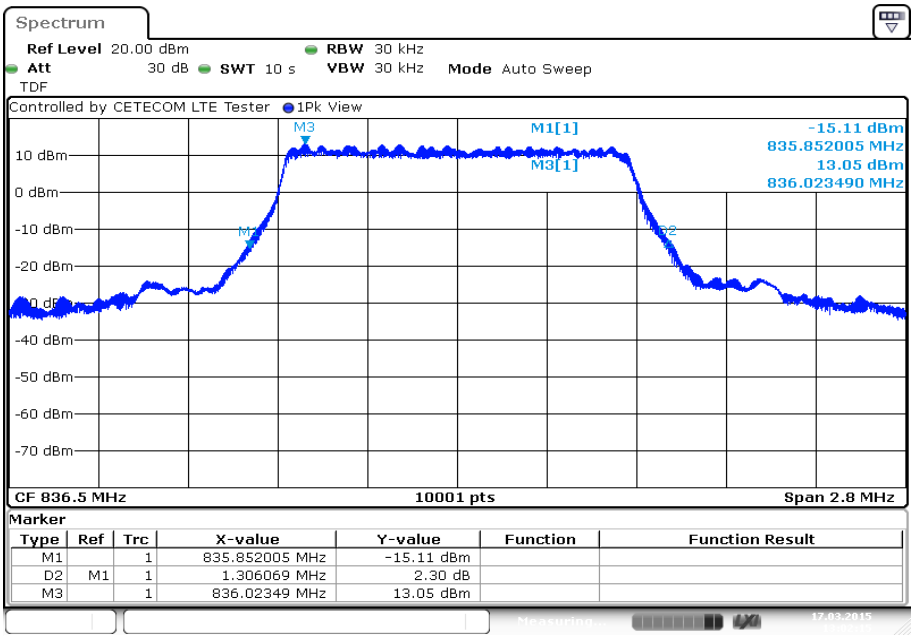
**Verdict:** compliant

## Plots: QPSK

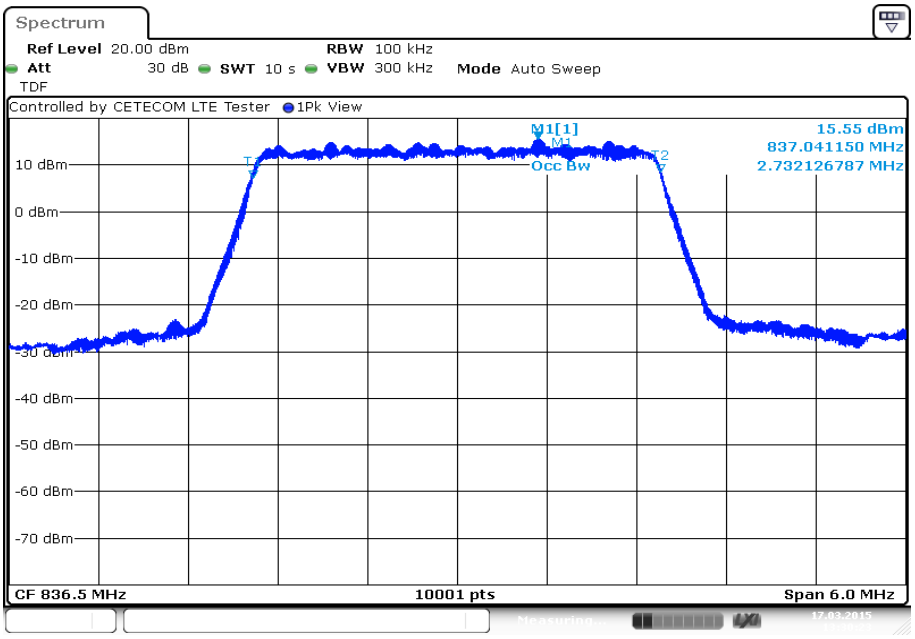
**Plot 1:** 1.4 MHz (99% - OBW)




**Plot 2:** 1.4 MHz (-26 dBc BW)

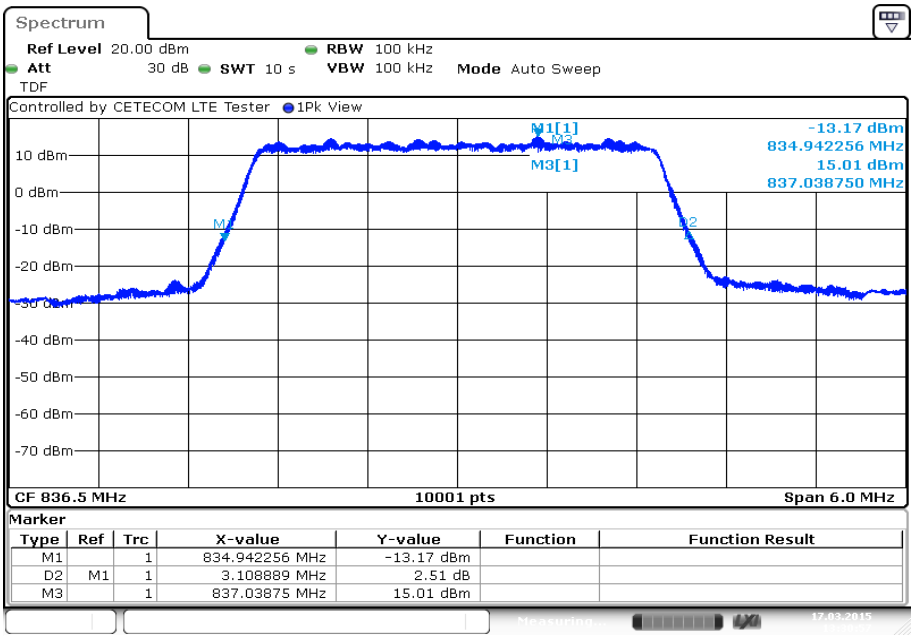


**Plot 3:** 3 MHz (99% - OBW)



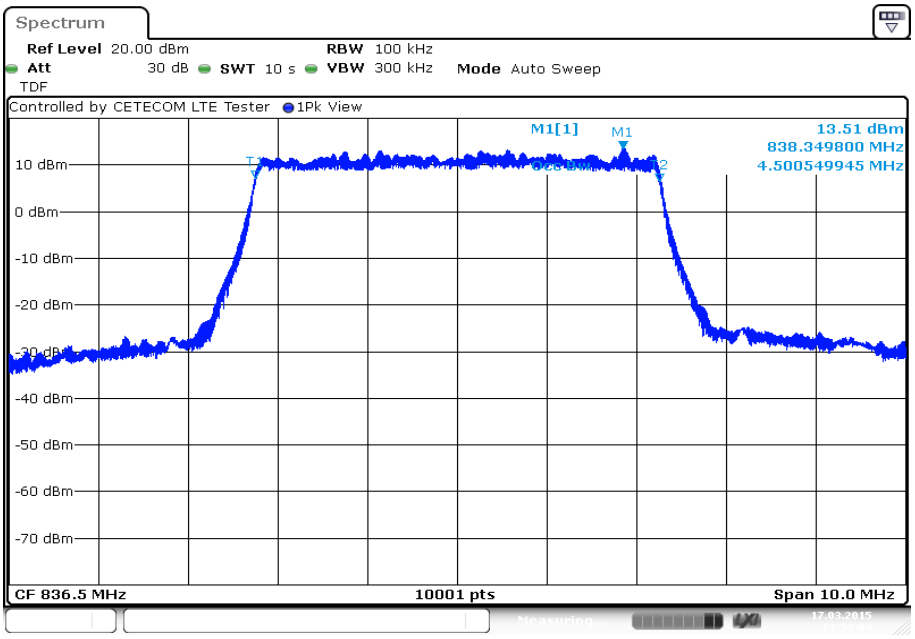

Date: 17.MAR.2015 13:30:23

**Plot 4:** 3 MHz (-26 dBc BW)



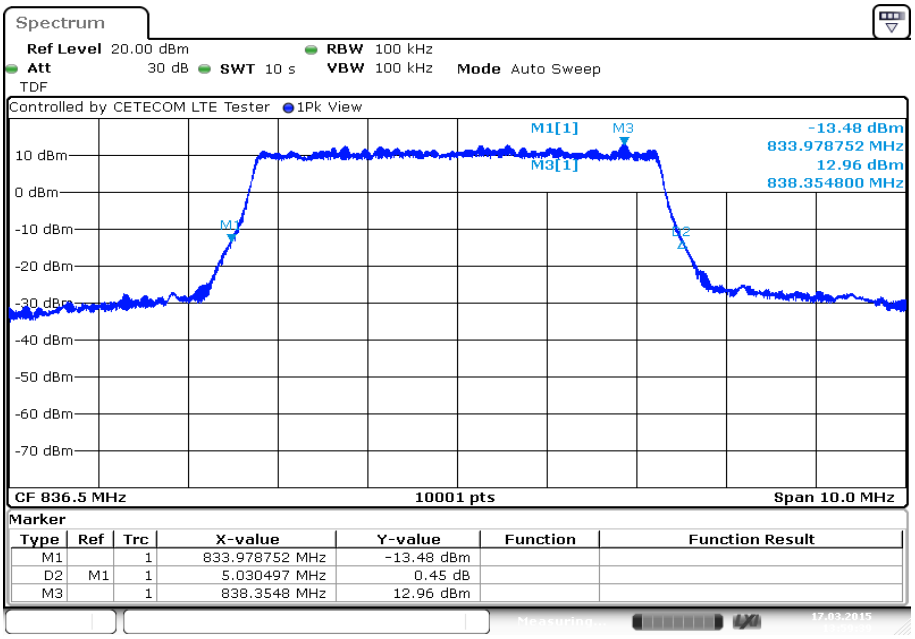

Date: 17.MAR.2015 13:30:58

**Plot 5:** 5 MHz (99% - OBW)



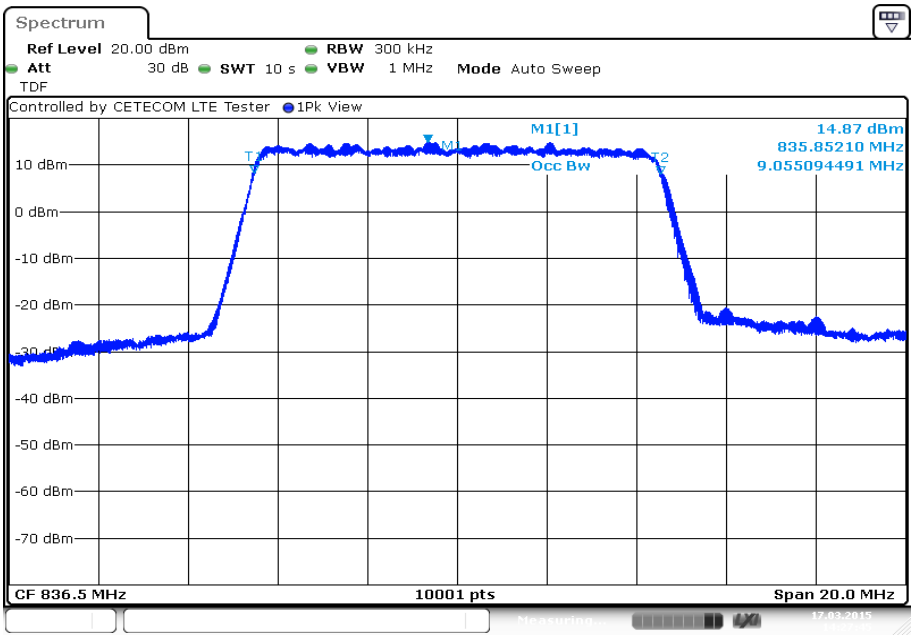

Date: 17.MAR.2015 13:59:05

**Plot 6:** 5 MHz (-26 dBc BW)



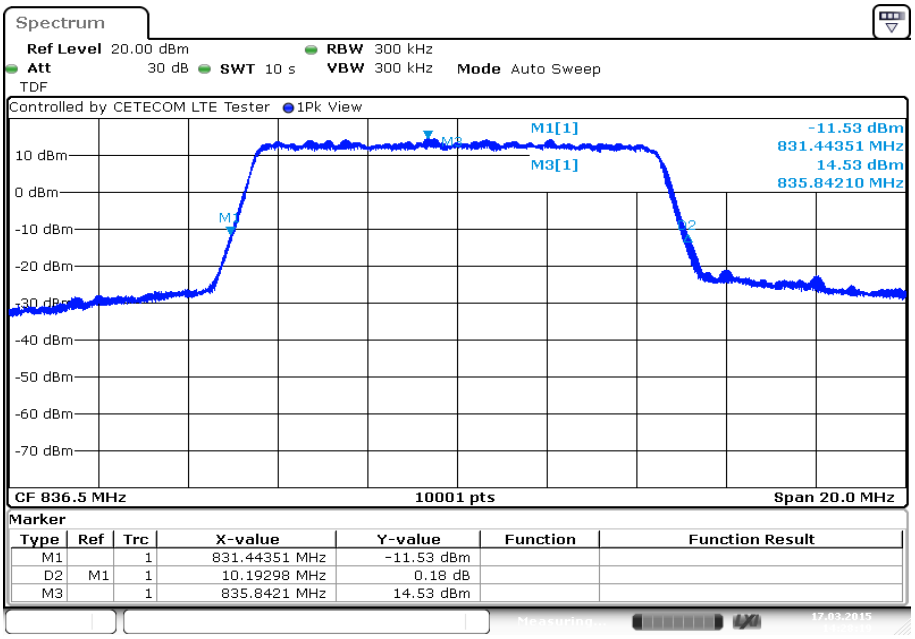

Date: 17.MAR.2015 13:59:39

**Plot 7:** 10 MHz (99% - OBW)




Date: 17.MAR.2015 14:27:46

**Plot 8:** 10 MHz (-26 dBc BW)



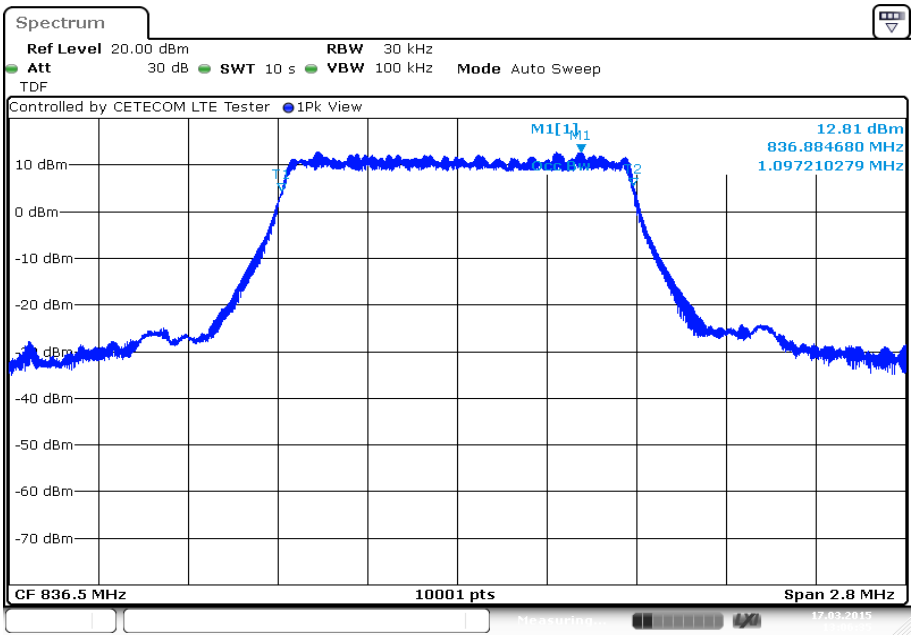

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 831.44351 MHz | -11.53 dBm | | |
| D2 | M1 | 1 | 10.19298 MHz | 0.18 dB | | |
| M3 | | 1 | 835.8421 MHz | 14.53 dBm | | |

Date: 17.MAR.2015 14:28:20

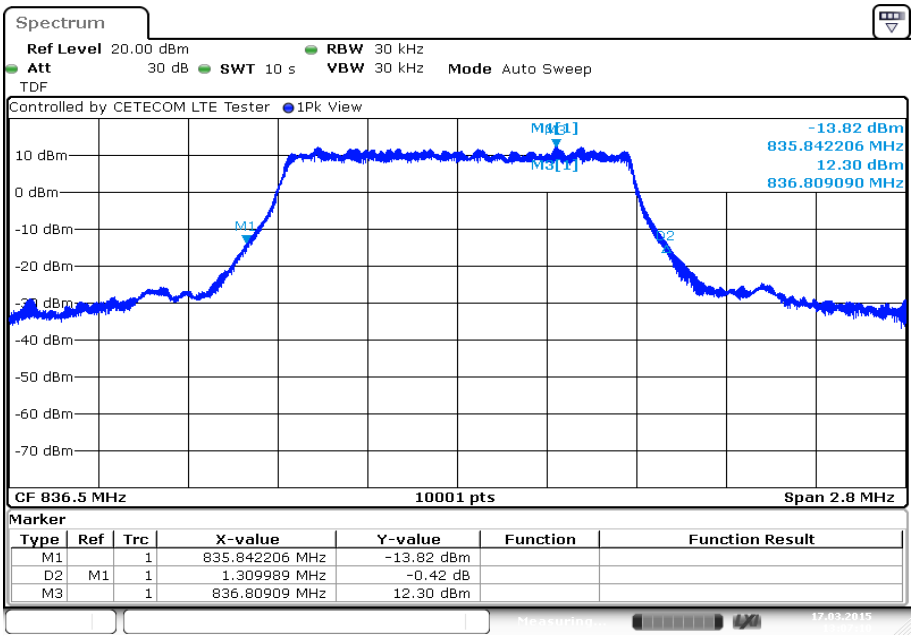
## Plots: 16-QAM

**Plot 1:** 1.4 MHz (99% - OBW)



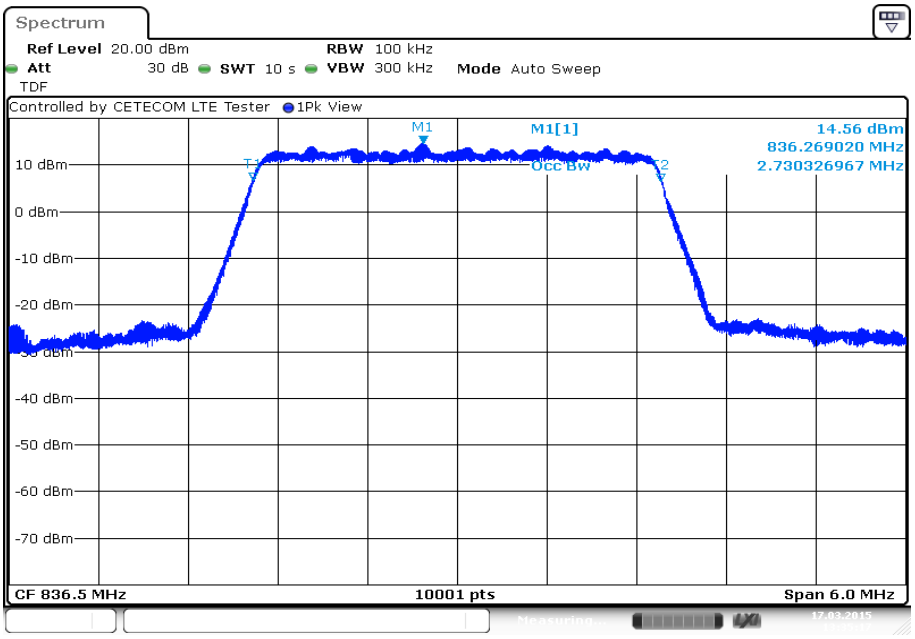

Date: 17.MAR.2015 13:06:36

**Plot 2:** 1.4 MHz (-26 dBc BW)



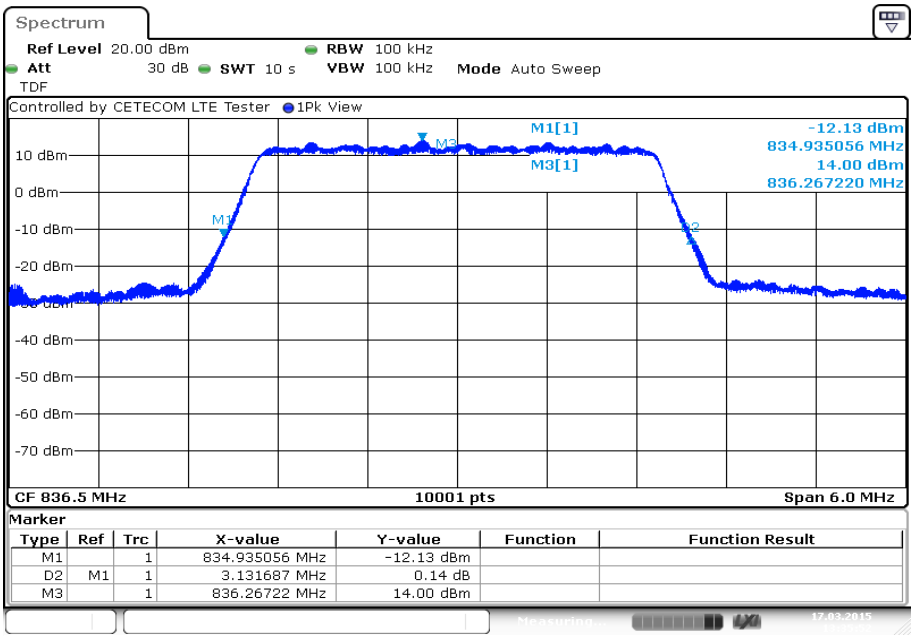

Date: 17.MAR.2015 13:07:11

**Plot 3:** 3 MHz (99% - OBW)



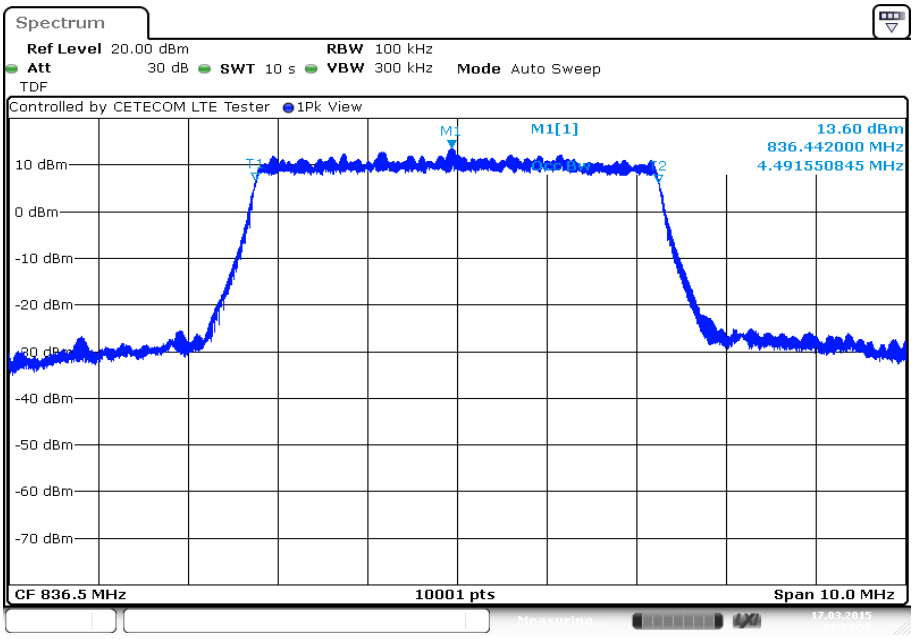

Date: 17.MAR.2015 13:35:18

**Plot 4:** 3 MHz (-26 dBc BW)



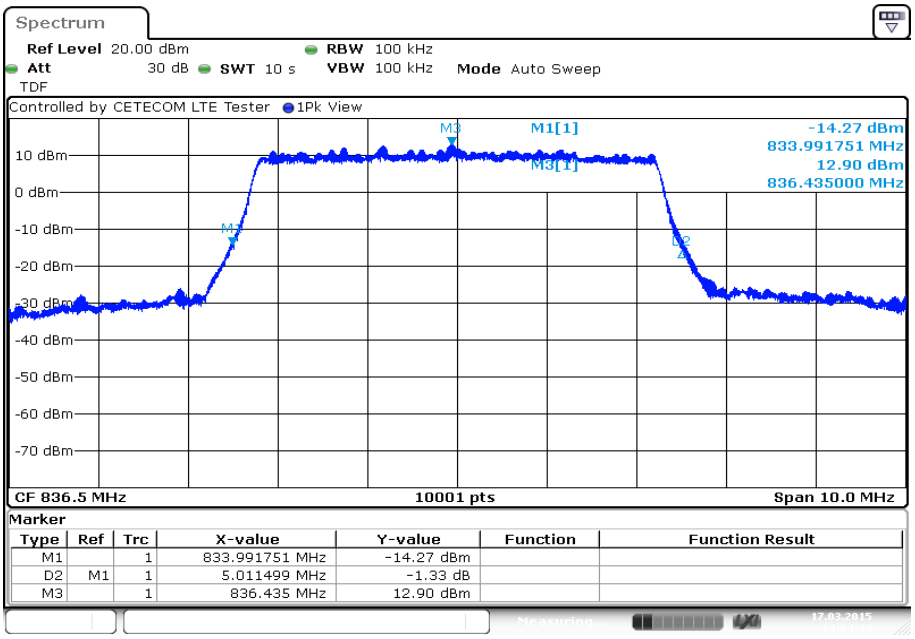

Date: 17.MAR.2015 13:35:53

**Plot 5:** 5 MHz (99% - OBW)




Date: 17.MAR.2015 14:04:00

**Plot 6:** 5 MHz (-26 dBc BW)

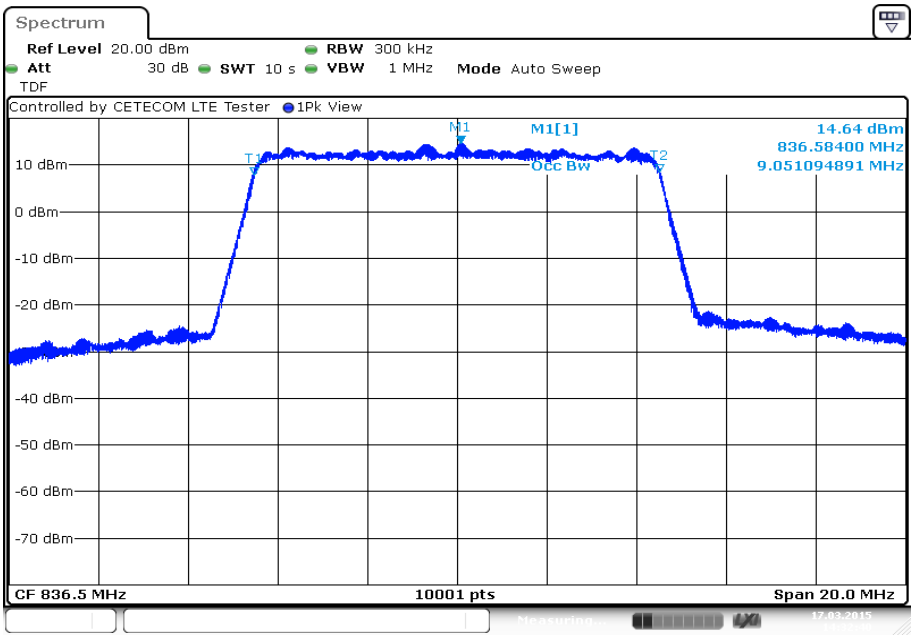



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 833.991751 MHz | -14.27 dBm | | |
| D2 | M1 | 1 | 5.011499 MHz | -1.33 dB | | |
| M3 | | 1 | 836.435 MHz | 12.90 dBm | | |

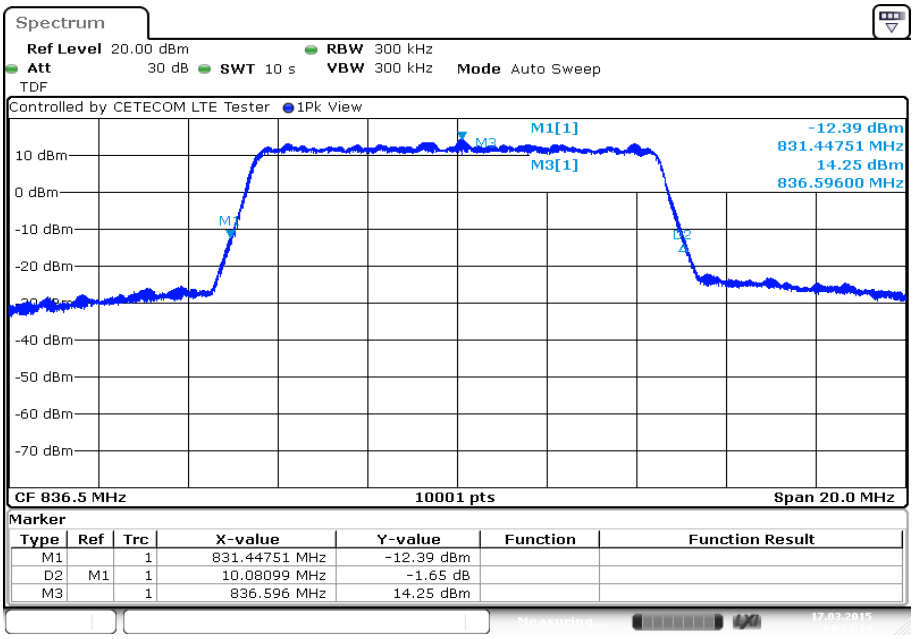
Date: 17.MAR.2015 14:04:34

**Plot 7:** 10 MHz (99% - OBW)




Date: 17.MAR.2015 14:32:40

**Plot 8:** 10 MHz (-26 dBc BW)




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 831.44751 MHz | -12.39 dBm | | |
| D2 | M1 | 1 | 10.08099 MHz | -1.65 dB | | |
| M3 | | 1 | 836.596 MHz | 14.25 dBm | | |

Date: 17.MAR.2015 14:33:15

## 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 | 2015-06-23 |
| A | Editorial changes | 2015-08-04 |

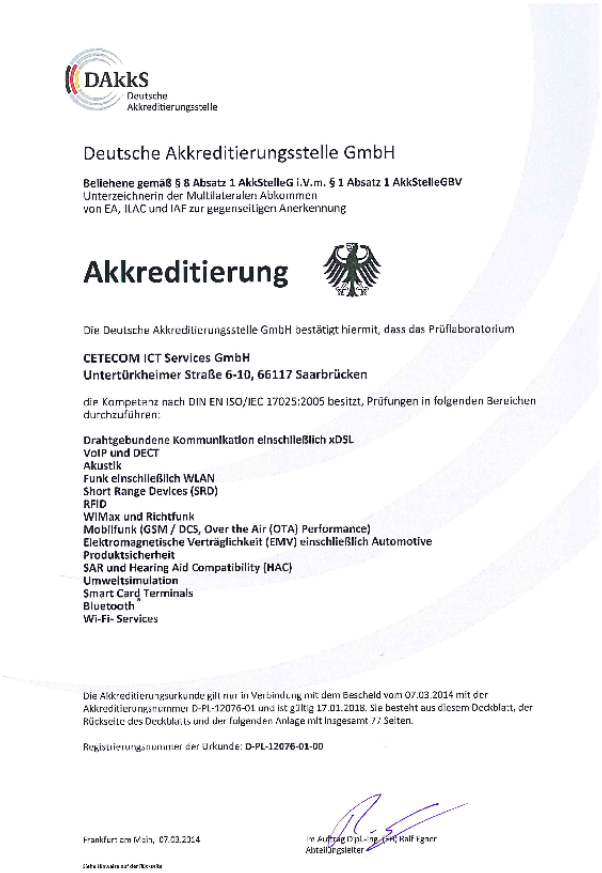
## Annex B Further information

**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

## Annex C Accreditation Certificate

Front side of certificate



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**CETECOM ICT Services GmbH**
**Untertürkheimer Straße 6-10, 66117 Saarbrücken**

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**VoIP und DECT**
**Akustik**
**Funk einschließlich WLAN**
**Short Range Devices (SRD)**
**RFID**
**WiMax und Richtfunk**
**Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)**
**Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive**
**Produktsicherheit**
**SAR und Hearing Aid Compatibility (HAC)**
**Umweltsimulation**
**Smart Card Terminals**
**Bluetooth**
**Wi-Fi- Services**

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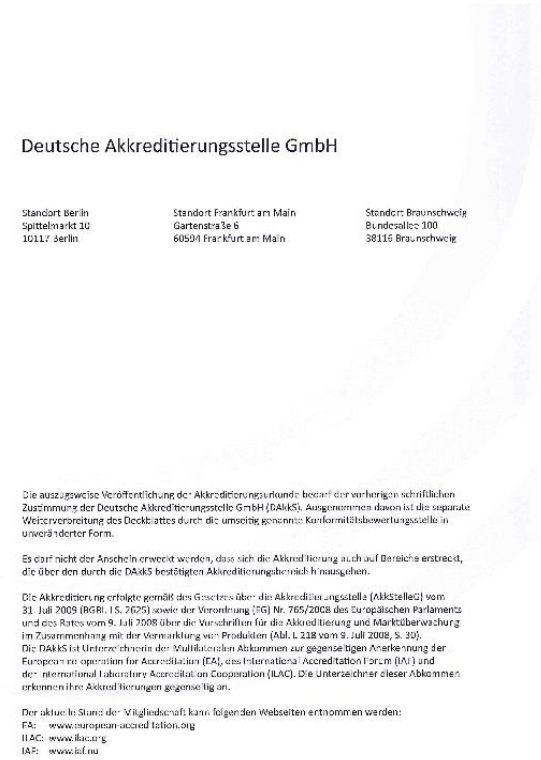
Frankfurt am Main, 07.03.2014

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
Abteilungsleiter

Back side of certificate



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Bundesallee 100
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ILAC: www.ilac.org
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**Note:**

**The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.**

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