
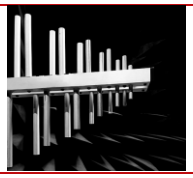
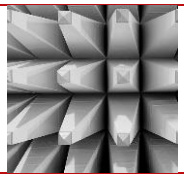

CETECOM™
CETECOM ICT Services
consulting - testing - certification

# TEST REPORT

**Test report no.: 1-9521/15-01-04-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


**Gemalto M2M GmbH**
Siemensdamm 50
13629 Berlin / GERMANY
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Fax: +49 30311028305
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e-mail: Thorsten.liebig@gemalto.com
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## Manufacturer


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

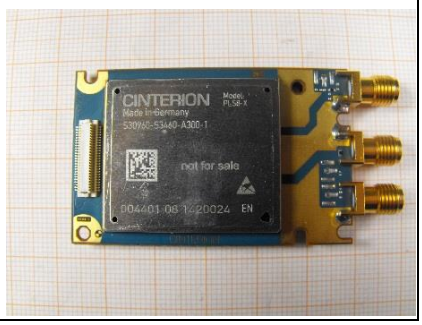

## Test standard/s

| | |
|---|---|
| 47 CFR Part 27 | Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services |
| RSS - 130 Issue 1 | Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz |
| RSS - 139 Issue 3 | Spectrum Management and Telecommunications Radio Standards Specification - Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 MHz |

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

## Test Item

| | |
|---|---|
| **Kind of test item:** | **LTE SMT module (data only)** |
| **Model name:** | **PLS8-X** |
| **FCC ID:** | **QIPPLS8-X** |
| **IC:** | **7830A-PLS8X** |
| Frequency: | LTE Band 4;13 and 17 |
| Technology tested: | LTE |
| 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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2015.08.05 09:39:10 +02'00'

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

**Test performed:**

p.o.

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2015.08.05 09:37:40 +02'00'

Tobias Wittenmeier
Testing Manager
Radio Communications & EMC

# 1 Table of contents

# 2 General information

## 2.1 Notes and disclaimer

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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 1-9521/15-01-04 and dated 2015-06-24**

## 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: | 2015-08-04 |
| Person(s) present during the test: | -/- |

# 3 Test standard/s

| Test standard | Date | Test standard description |
|---|---|---|
| 47 CFR Part 27 | -/- | Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services |
| RSS - 130 Issue 1 | October 2013 | Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz |
| RSS - 139 Issue 3 | July 2015 | Spectrum Management and Telecommunications Radio Standards Specification - Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 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 (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 [MHz]** | : | LTE Band 4;13 and 17 |
| **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

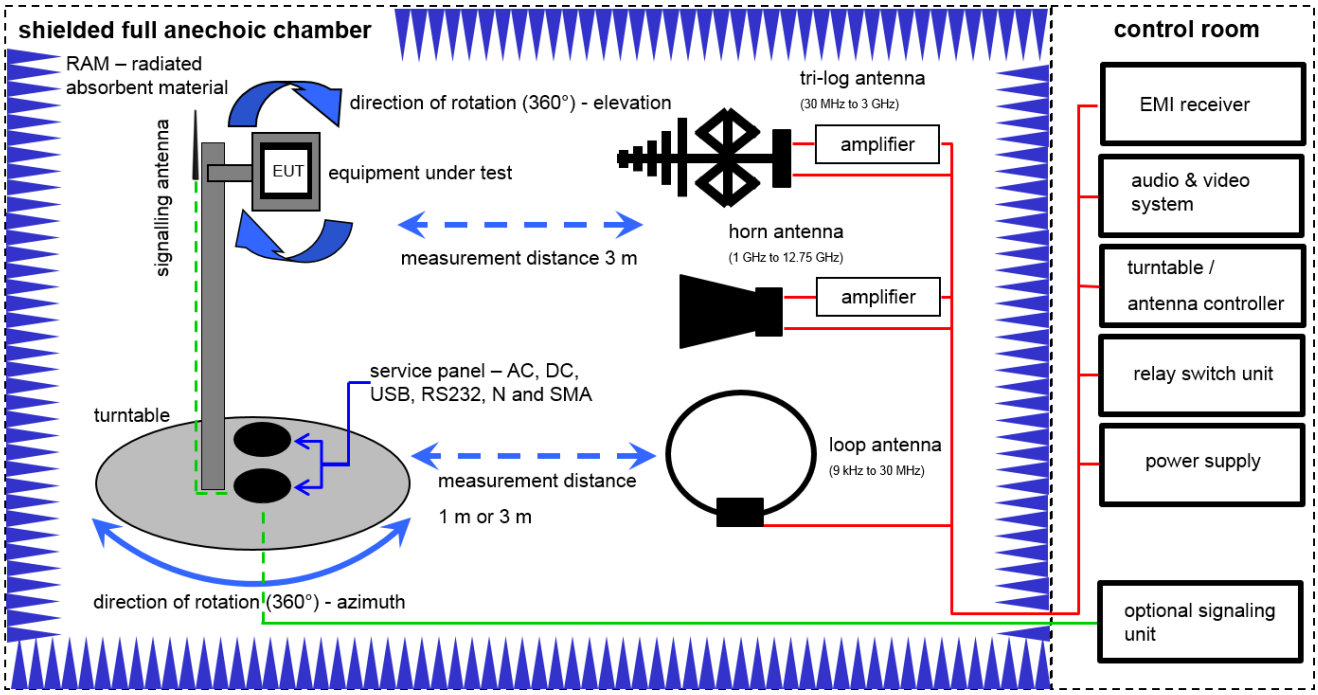
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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



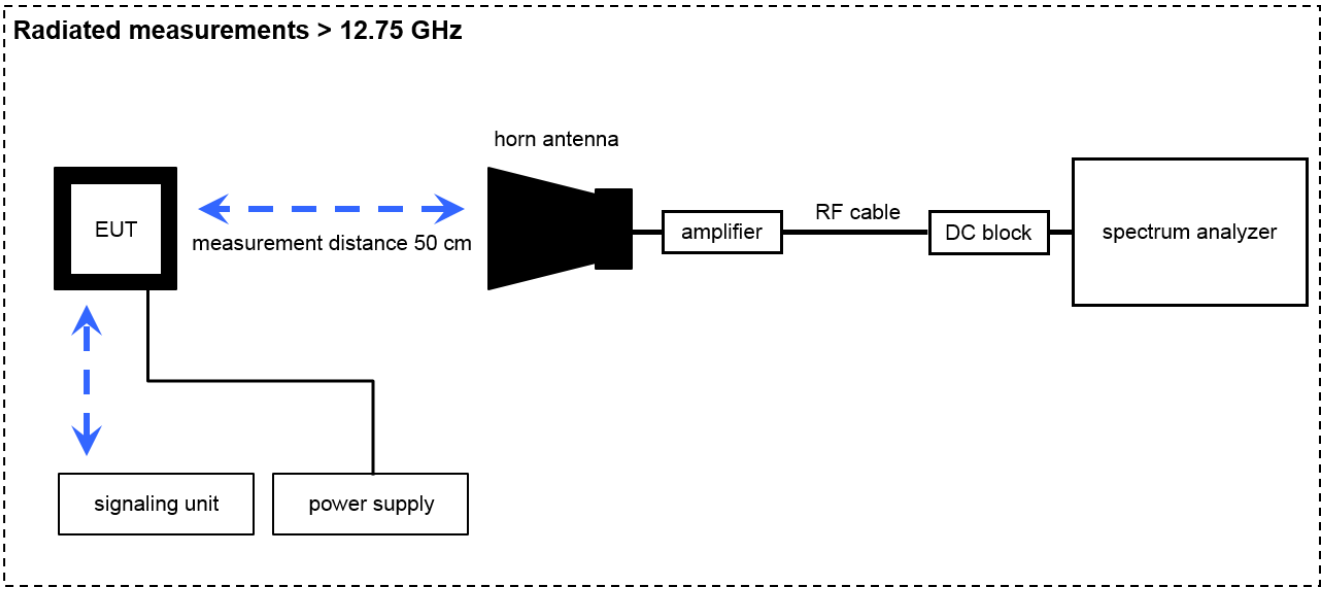

OP = AV + D - G + CA
(OP-output power; AV-analyzer value; D-distance; G-antenna gain+amplifier gain; CA-loss signal path)

*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 Radiated measurements > 12.75 GHz




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

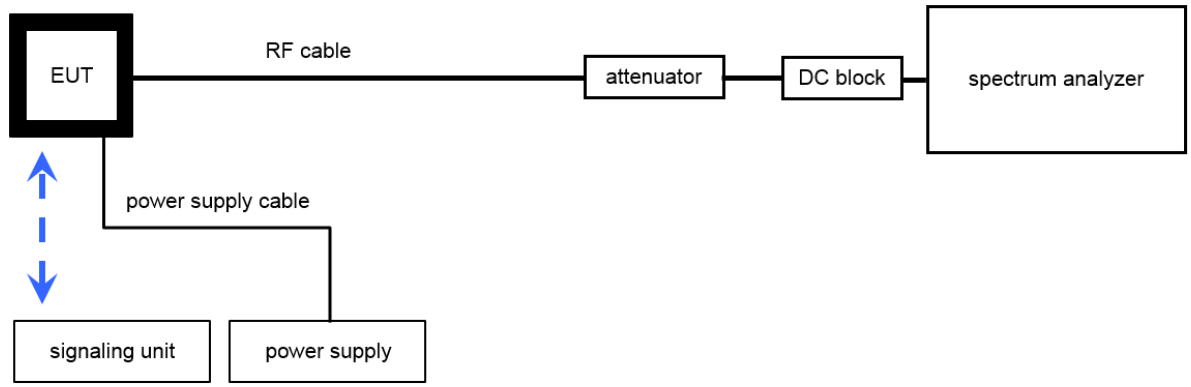
*Example calculation:*
OP [dBm] = -41.0 [dBm] + 26 [dB] - 20 [dB] + 5 [dB] = -30 [dBm] (1 µW)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufact. | Serial No. | INV. No Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Std. Gain Horn Antenna 12.4 to 18.0 GHz | 639 | Narda | 8402 | 300000786 | ne | | |
| 2 | A | Std. Gain Horn Antenna 18.0 to 26.5 GHz | 638 | Narda | 8402 | 300000486 | ne | | |
| 3 | A | Signal Analyzer 40 GHz | FSV40 | R&S | 101042 | 300004517 | k | 22.01.2015 | 22.01.2016 |
| 4 | A | Amplifier 2-40 GHz | JS32-02004000-57-5P | MITEQ | 1777200 | 300004541 | ev | | |
| 5 | A | RF-Cable | ST18/SMAm/SMAm/48 | Huber & Suhner | Batch no. 600918 | 400001182 | ev | | |
| 6 | A | RF-Cable | ST18/SMAm/SMm/48 | Huber & Suhner | Batch no. 127377 | 400001183 | ev | | |
| 7 | A | DC-Blocker 0.1-40 GHz | 8141A | Inmet | | 400001185 | ev | | |
| 8 | A | Power Supply 0-20V; 0-5A | 6632B | HP | US37478366 | 400000117 | vIKI! | 20.01.2015 | 20.01.2017 |
| 9 | A | Wideband Radio Communication Tester | CMW500 | R&S | 102375 | 300004187 | vIKI! | 28.01.2015 | 28.01.2017 |

## 7.3 Conducted measurements

**Conducted measurements normal conditions**




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.

## 9.4 Sequence of testing above 12.75 GHz

### Setup

- The equipment was set up to simulate a typical usage like descripted in the user manual or described by manufacturer.
- 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 0.5 meter
- The EUT was set into operation.

### Premeasurement

- The antenna is moved spherical over the EUT in different polarisations of the antenna.

### Final measurement

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and RMS (RMS / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, 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.

## 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.<br>The content and verdict of the performed test cases are listed below. |

| TC identifier | Description | verdict | date | Remark |
|---|---|---|---|---|
| RF-Testing | CFR Part 27<br>RSS-130, RSS 139 | See table | 2015-08-05 | -/- |

### 10.1 LTE – Band 4

| 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

### 10.2 LTE – Band 13

| 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

## 10.3 LTE – Band 17

| 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 LTE technologies supported by EUT

**Channel bandwidth**

| | Band 4 | Band 13 | Band 17 |
|---|---|---|---|
| [MHz] | | | |
| 1.4 | ☒ | ☐ | ☐ |
| 3 | ☒ | ☐ | ☐ |
| 5 | ☒ | ☒ | ☒ |
| 10 | ☒ | ☒ | ☒ |
| 15 | ☒ | ☐ | ☐ |
| 20 | ☒ | ☐ | ☐ |

## 11.2 Results LTE – Band 4

The EUT was set to transmit the maximum power.

### 11.2.1 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 |
|---|---|
| Average E.I.R.P. Output Power | |
| +30.00 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 | 1710.7 | 1 RB low | 27.1 | 22.5 | 4.4 | 26.6 | 21.5 | 5.0 |
| | | 1 RB high | 27.2 | 22.4 | 4.6 | 26.7 | 21.5 | 5.0 |
| | | 50% RB | 27.3 | 22.4 | 4.5 | 26.6 | 21.5 | 5.0 |
| | | 100% RB | 27.1 | 21.5 | 5.3 | 26.6 | 20.5 | 5.7 |
| | 1732.5 | 1 RB low | 27.3 | 22.4 | 4.8 | 27.3 | 21.2 | 5.8 |
| | | 1 RB high | 27.2 | 22.3 | 4.8 | 27.2 | 21.0 | 5.8 |
| | | 50% RB | 27.3 | 22.3 | 4.8 | 27.4 | 21.5 | 5.6 |
| | | 100% RB | 27.3 | 21.6 | 5.2 | 26.5 | 20.6 | 5.6 |
| | 1754.3 | 1 RB low | 27.8 | 22.6 | 5.0 | 27.5 | 21.7 | 5.6 |
| | | 1 RB high | 27.7 | 22.5 | 5.0 | 27.4 | 21.5 | 5.7 |
| | | 50% RB | 27.9 | 22.4 | 5.0 | 27.5 | 21.5 | 5.7 |
| | | 100% RB | 27.8 | 21.5 | 5.6 | 27.3 | 20.7 | 6.2 |
| 3 | 1711.5 | 1 RB low | 27.1 | 22.5 | 4.5 | 26.6 | 21.5 | 5.0 |
| | | 1 RB high | 27.3 | 22.6 | 4.6 | 26.9 | 21.5 | 5.2 |
| | | 50% RB | 27.2 | 21.6 | 5.2 | 26.6 | 20.4 | 5.8 |
| | | 100% RB | 27.3 | 21.4 | 5.2 | 26.7 | 20.5 | 5.7 |
| | 1732.5 | 1 RB low | 27.4 | 22.8 | 4.4 | 27.3 | 21.4 | 5.6 |
| | | 1 RB high | 27.2 | 22.1 | 4.9 | 27.2 | 21.1 | 5.7 |
| | | 50% RB | 27.3 | 21.5 | 5.2 | 26.5 | 20.6 | 5.5 |
| | | 100% RB | 27.3 | 21.4 | 5.3 | 26.5 | 20.4 | 5.6 |
| | 1753.5 | 1 RB low | 28.0 | 22.7 | 4.9 | 27.5 | 21.7 | 5.6 |
| | | 1 RB high | 27.8 | 22.5 | 5.0 | 27.3 | 21.4 | 5.8 |
| | | 50% RB | 27.8 | 21.7 | 5.6 | 27.4 | 20.7 | 6.2 |
| | | 100% RB | 27.8 | 21.6 | 5.5 | 27.5 | 20.6 | 6.3 |
| 5 | 1712.5 | 1 RB low | 27.2 | 22.5 | 4.5 | 26.6 | 21.3 | 5.0 |
| | | 1 RB high | 27.6 | 22.6 | 4.7 | 27.1 | 21.5 | 5.4 |
| | | 50% RB | 26.7 | 21.5 | 4.9 | 26.8 | 20.6 | 5.8 |
| | | 100% RB | 27.5 | 21.5 | 5.2 | 26.9 | 20.4 | 5.9 |
| | 1732.5 | 1 RB low | 27.6 | 23.0 | 4.3 | 27.5 | 22.0 | 5.4 |
| | | 1 RB high | 27.3 | 22.3 | 4.8 | 27.2 | 21.2 | 5.9 |
| | | 50% RB | 27.3 | 21.5 | 5.2 | 26.4 | 20.6 | 5.4 |
| | | 100% RB | 27.4 | 21.4 | 5.3 | 26.6 | 20.5 | 5.6 |
| | 1752.5 | 1 RB low | 28.0 | 22.3 | 5.2 | 27.5 | 21.3 | 6.0 |
| | | 1 RB high | 27.9 | 22.6 | 5.0 | 27.3 | 21.5 | 5.7 |
| | | 50% RB | 27.8 | 21.6 | 5.5 | 27.3 | 20.5 | 6.3 |
| | | 100% RB | 27.5 | 21.7 | 5.3 | 27.5 | 20.6 | 6.1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10 | 1715.0 | 1 RB low | 27.1 | 22.4 | 4.6 | 26.8 | 21.3 | 5.2 |
| | | 1 RB high | 27.7 | 22.4 | 5.2 | 27.4 | 21.3 | 5.9 |
| | | 50% RB | 27.2 | 21.6 | 5.1 | 27.2 | 20.5 | 6.1 |
| | | 100% RB | 27.2 | 21.4 | 5.2 | 27.2 | 20.4 | 6.1 |
| | 1732.5 | 1 RB low | 27.3 | 22.4 | 4.8 | 27.2 | 21.1 | 5.8 |
| | | 1 RB high | 27.7 | 23.0 | 4.5 | 27.3 | 21.8 | 5.3 |
| | | 50% RB | 27.4 | 21.6 | 5.2 | 26.5 | 20.5 | 5.6 |
| | | 100% RB | 27.5 | 21.5 | 5.2 | 26.6 | 20.5 | 5.6 |
| | 1750.0 | 1 RB low | 28.0 | 22.5 | 5.1 | 27.5 | 21.4 | 5.8 |
| | | 1 RB high | 27.8 | 22.5 | 5.1 | 27.4 | 21.5 | 5.7 |
| | | 50% RB | 27.4 | 21.4 | 5.4 | 27.5 | 20.4 | 6.3 |
| | | 100% RB | 27.5 | 21.3 | 5.5 | 27.4 | 20.3 | 6.3 |
| 15 | 1717.5 | 1 RB low | 26.9 | 22.1 | 4.6 | 26.6 | 21.1 | 5.3 |
| | | 1 RB high | 27.5 | 22.4 | 5.0 | 27.3 | 21.3 | 5.7 |
| | | 50% RB | 27.5 | 21.4 | 5.4 | 27.4 | 20.4 | 6.2 |
| | | 100% RB | 27.4 | 21.3 | 5.4 | 27.3 | 20.4 | 6.1 |
| | 1732.5 | 1 RB low | 27.1 | 22.0 | 4.8 | 27.1 | 20.8 | 6.1 |
| | | 1 RB high | 27.1 | 22.2 | 4.6 | 27.2 | 21.0 | 6.0 |
| | | 50% RB | 27.5 | 21.5 | 5.2 | 26.6 | 20.5 | 5.6 |
| | | 100% RB | 27.3 | 21.4 | 5.4 | 26.7 | 20.5 | 5.6 |
| | 1747.5 | 1 RB low | 27.4 | 21.9 | 5.1 | 26.9 | 20.9 | 5.7 |
| | | 1 RB high | 27.7 | 22.3 | 5.0 | 27.1 | 21.1 | 5.8 |
| | | 50% RB | 27.6 | 21.4 | 5.4 | 27.6 | 20.4 | 6.3 |
| | | 100% RB | 27.5 | 21.2 | 5.7 | 27.4 | 20.2 | 6.3 |
| 20 | 1720.0 | 1 RB low | 26.8 | 21.9 | 4.7 | 26.6 | 21.0 | 5.4 |
| | | 1 RB high | 26.9 | 22.2 | 4.5 | 27.1 | 21.3 | 5.6 |
| | | 50% RB | 27.7 | 21.5 | 5.4 | 27.7 | 20.5 | 6.2 |
| | | 100% RB | 27.5 | 21.3 | 5.2 | 27.6 | 20.4 | 6.1 |
| | 1732.5 | 1 RB low | 27.0 | 22.1 | 4.6 | 26.9 | 21.0 | 5.7 |
| | | 1 RB high | 27.0 | 21.8 | 4.8 | 26.9 | 20.9 | 5.8 |
| | | 50% RB | 27.4 | 21.5 | 5.2 | 26.5 | 20.6 | 5.5 |
| | | 100% RB | 27.5 | 21.3 | 5.3 | 26.7 | 20.4 | 5.6 |
| | 1745.0 | 1 RB low | 27.0 | 22.3 | 4.5 | 26.6 | 21.2 | 5.2 |
| | | 1 RB high | 27.6 | 22.5 | 4.8 | 26.9 | 21.0 | 5.7 |
| | | 50% RB | 27.5 | 21.4 | 5.4 | 27.6 | 20.3 | 6.3 |
| | | 100% RB | 27.5 | 21.3 | 5.4 | 27.6 | 20.4 | 6.2 |

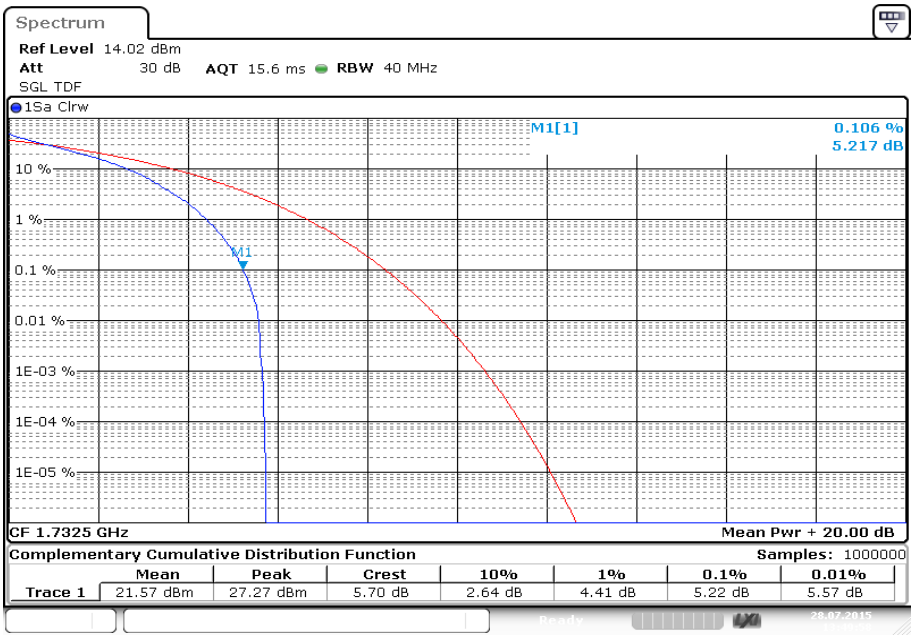
The output power is measured with configuration of maximum conducted output power.

| Output Power (radiated) | | | |
|---|---|---|---|
| **Bandwidth (MHz)** | **Frequency (MHz)** | **Average Output Power (dBm) QPSK** | **Average Output Power (dBm) 16-QAM** |
| 1.4 | 1710.7 | 20.28 | 19.18 |
| | 1732.5 | 21.52 | 20.62 |
| | 1754.3 | 20.85 | 19.75 |
| 3 | 1711.5 | 20.28 | 19.38 |
| | 1732.5 | 21.42 | 20.32 |
| | 1753.5 | 20.85 | 19.85 |
| 5 | 1712.5 | 20.38 | 19.38 |
| | 1732.5 | 21.32 | 20.42 |
| | 1752.5 | 20.75 | 19.75 |
| 10 | 1715.0 | 20.08 | 19.08 |
| | 1732.5 | 21.42 | 20.52 |
| | 1750.0 | 20.45 | 19.45 |
| 15 | 1717.5 | 19.98 | 19.08 |
| | 1732.5 | 21.42 | 19.75 |
| | 1747.5 | 20.45 | 19.35 |
| 20 | 1720.0 | 20.08 | 19.18 |
| | 1732.5 | 20.08 | 20.32 |
| | 1745.0 | 20.65 | 19.35 |
| Measurement uncertainty | | ± 3.0 dB | |

**Verdict:** **compliant**

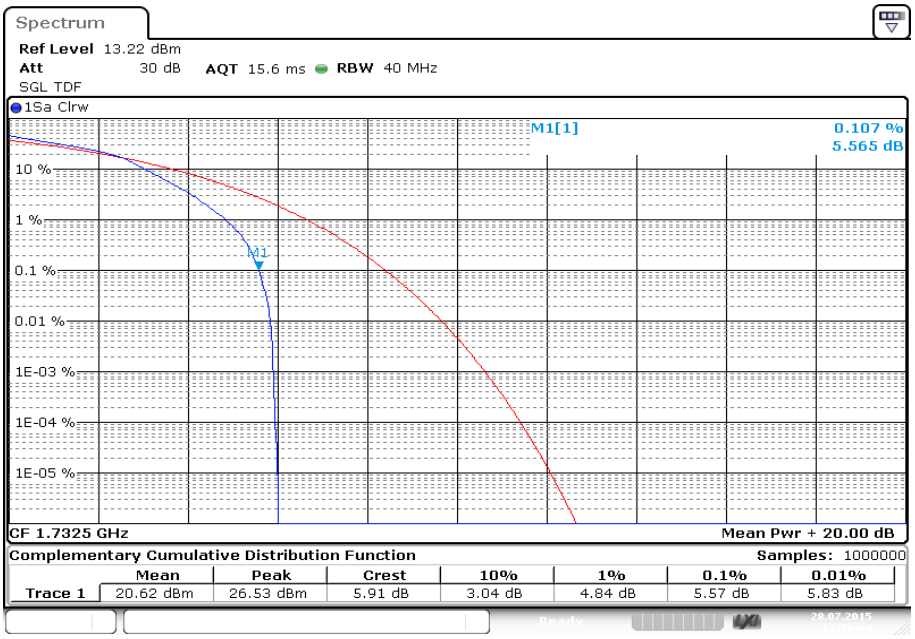
**Plots:**

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



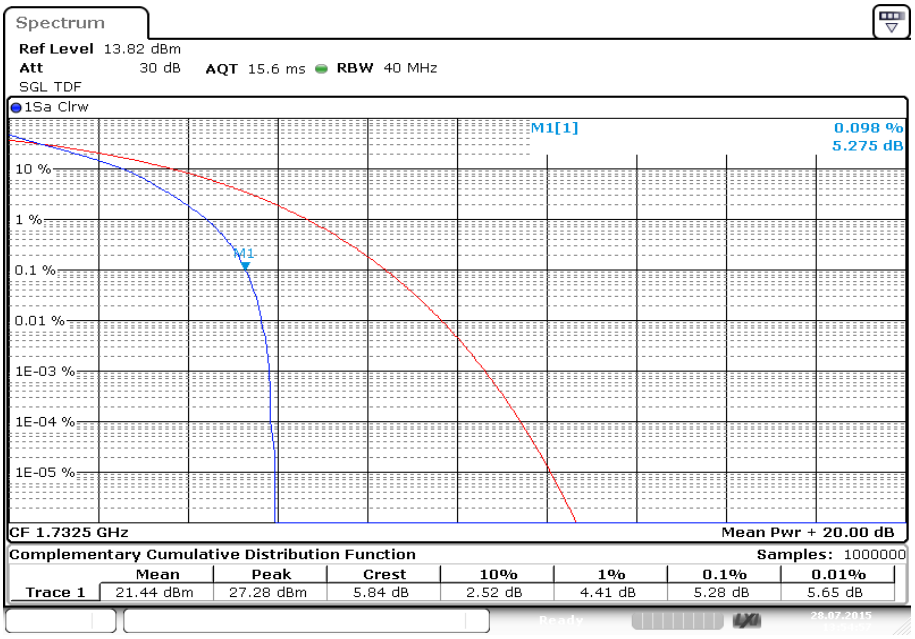

Date: 28.JUL.2015 13:49:58

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



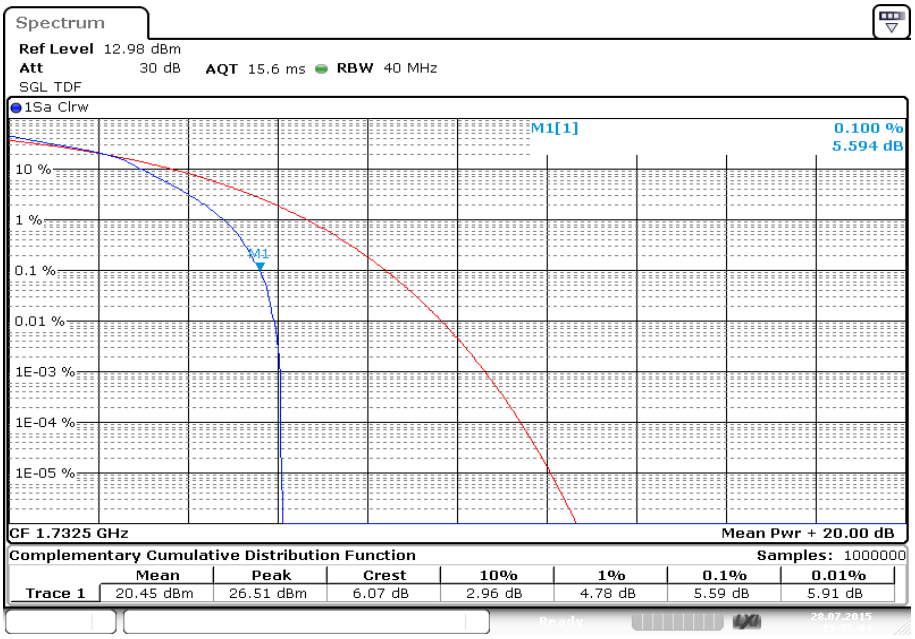

Date: 28.JUL.2015 13:50:04

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



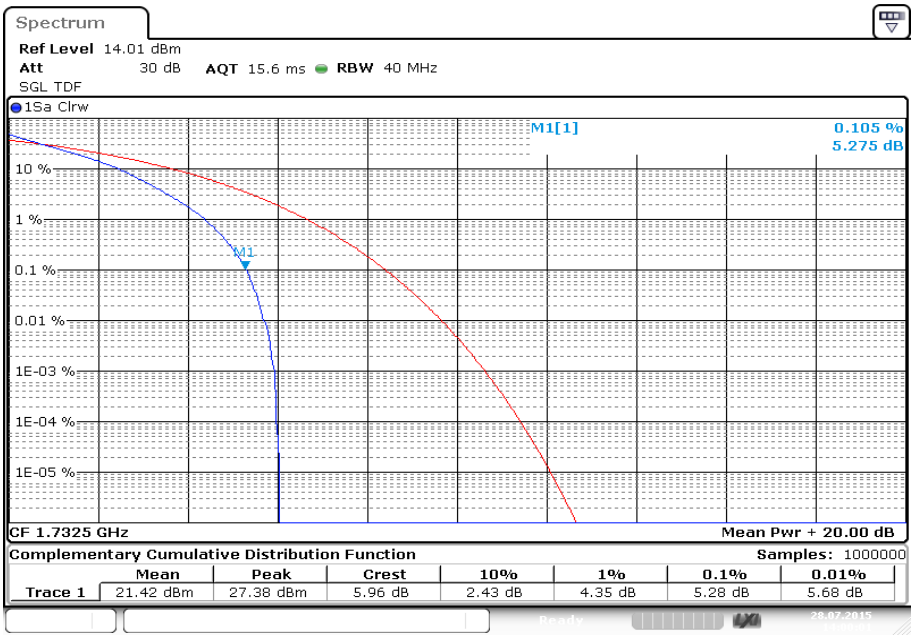

Date: 28.JUL.2015 13:54:57

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



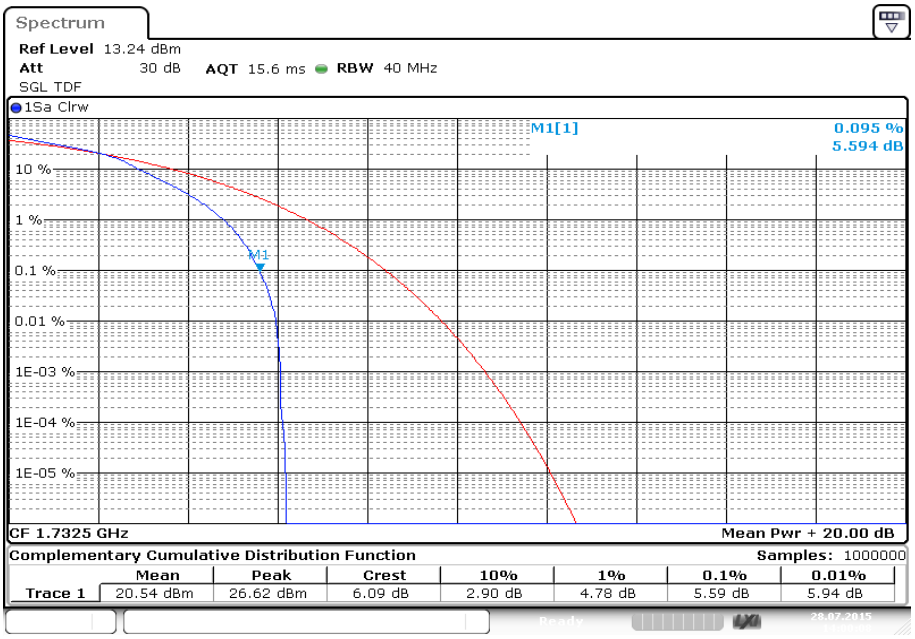

Date: 28.JUL.2015 13:55:04

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



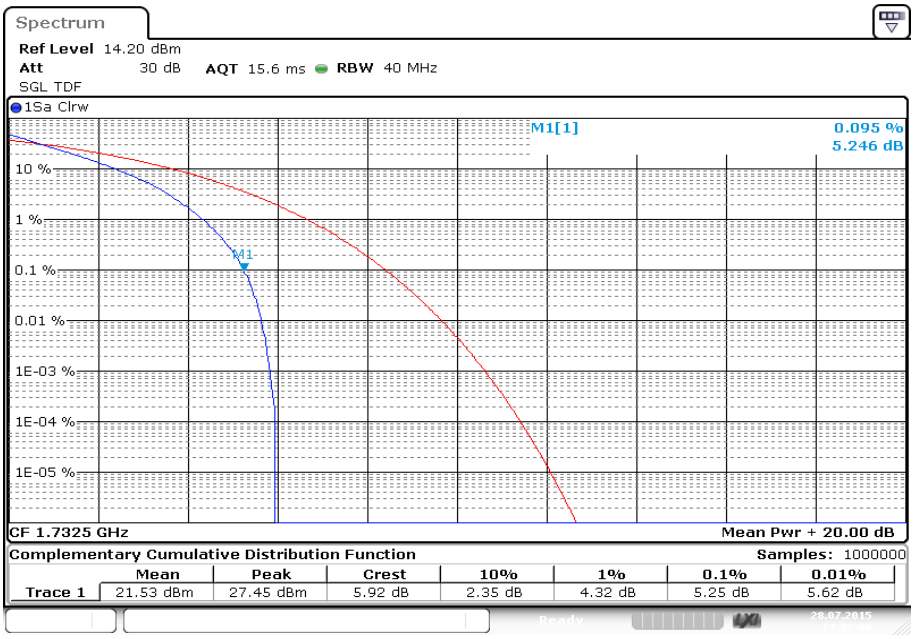

Date: 28.JUL.2015 14:00:01

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



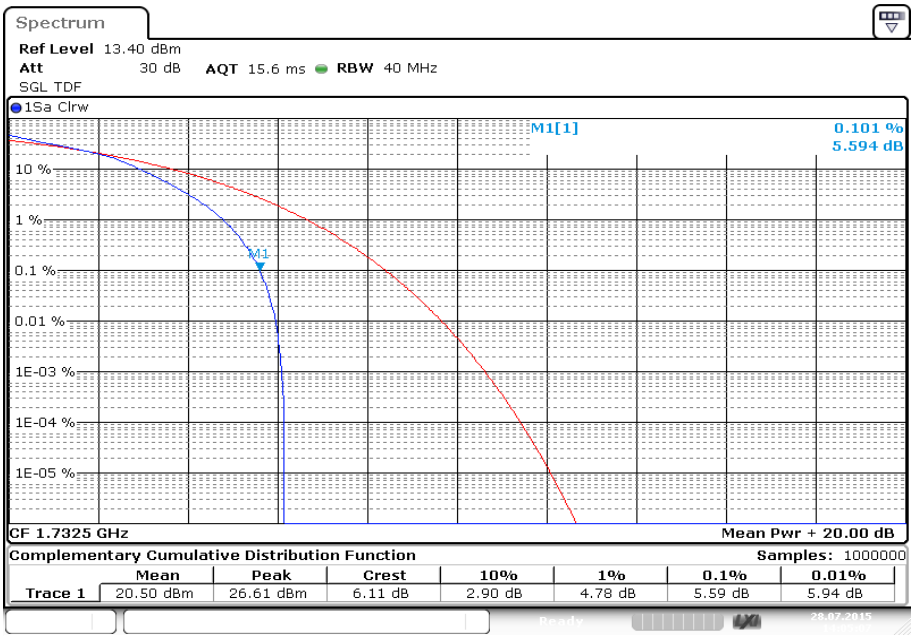

Date: 28.JUL.2015 14:00:08

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



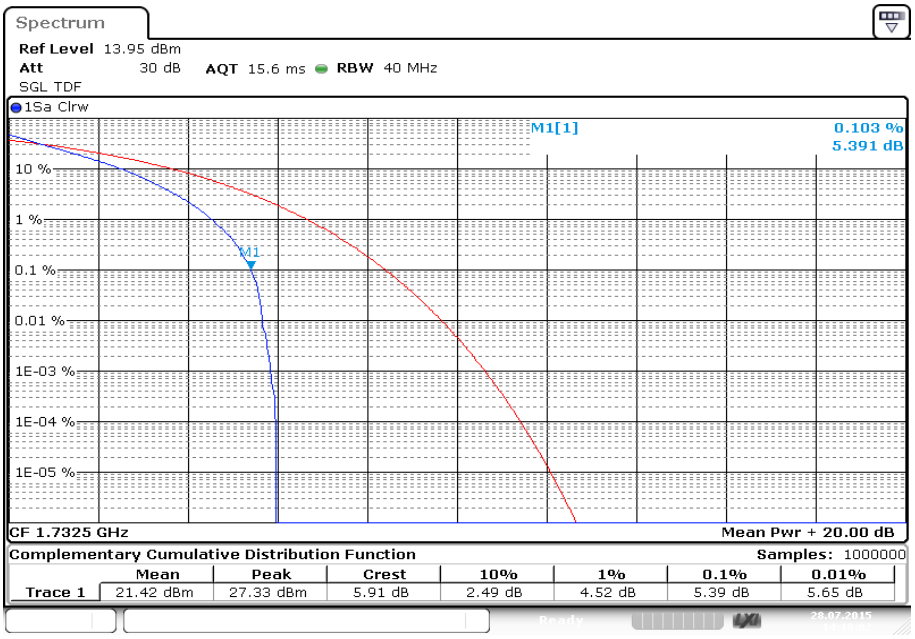

Date: 28.JUL.2015 14:05:00

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



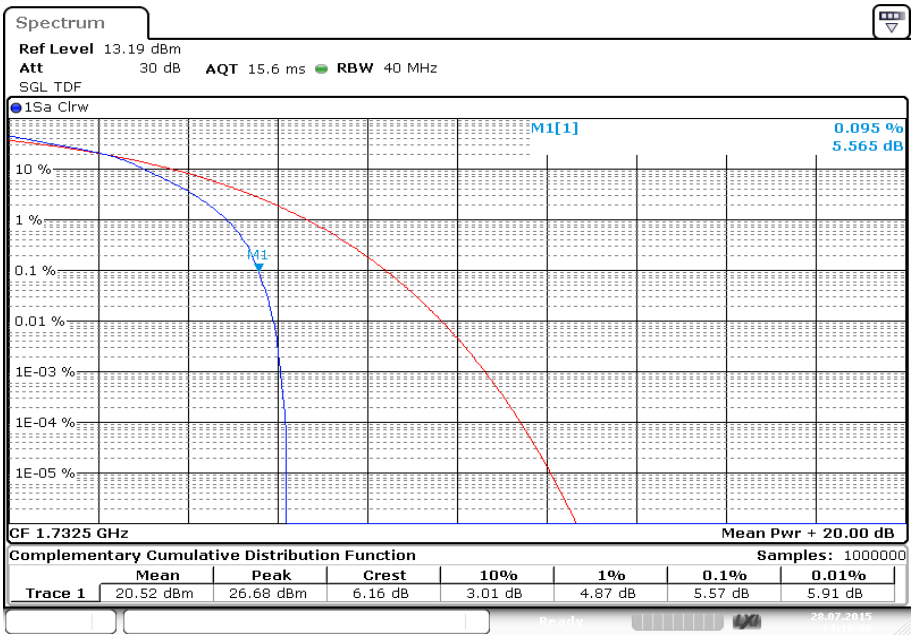

Date: 28.JUL.2015 14:05:07

**Plot 9:** 15 MHz cell bandwidth, mid channel, 100% #RB, QPSK



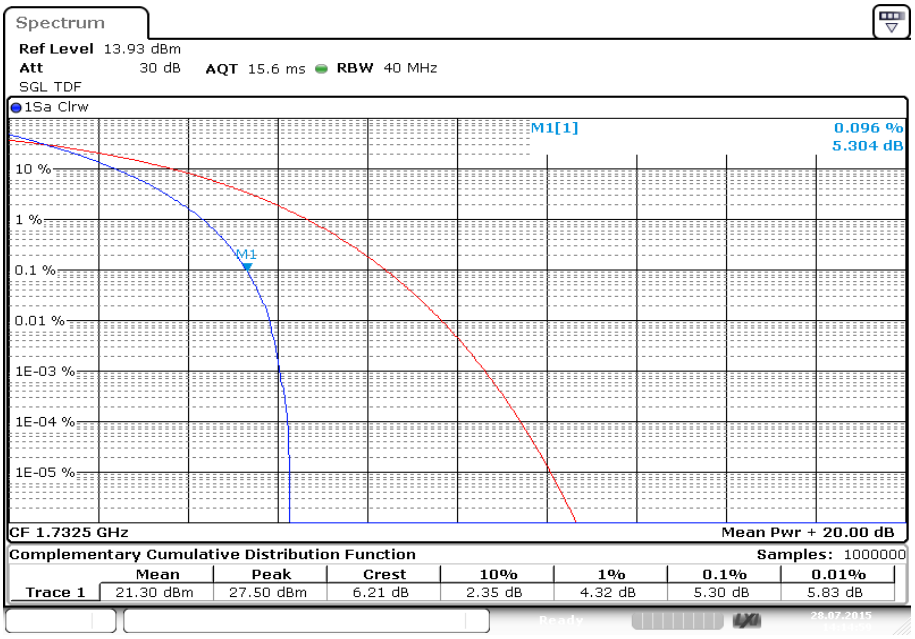

Date: 28.JUL.2015 14:10:01

**Plot 10:** 15 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



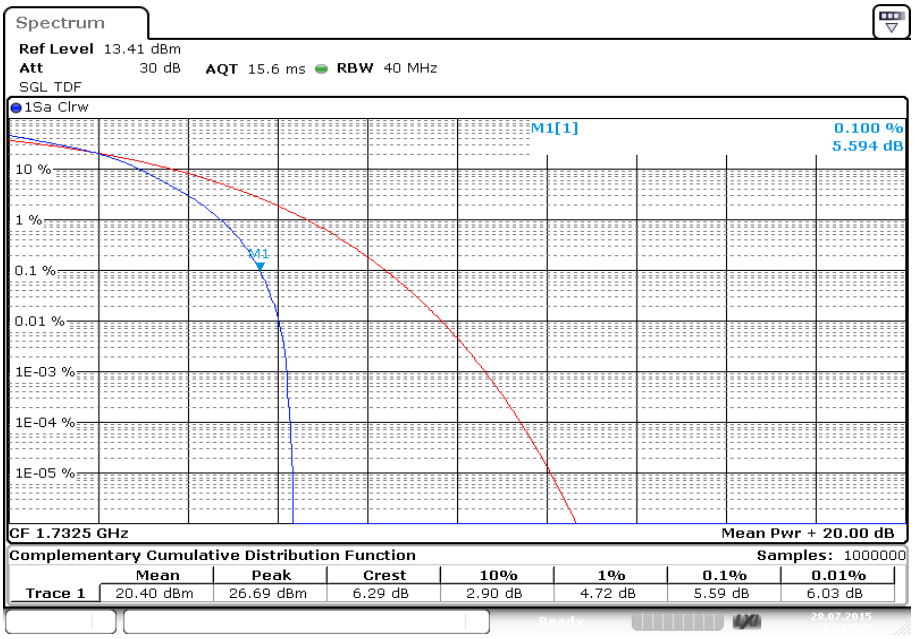

Date: 28.JUL.2015 14:10:08

**Plot 11:** 20 MHz cell bandwidth, mid channel, 100% #RB, QPSK




Date: 28.JUL.2015 14:14:58

**Plot 12:** 20 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM




Date: 28.JUL.2015 14:15:05

## 11.2.2 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: | |
| Resolution bandwidth: | |
| Video bandwidth: | |
| Span: | |
| Trace-Mode: | |
| Used equipment: | see chapter chapter 7.2 – B |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| Frequency Stability | |
| < 2.5 ppm | |

**Results:**

**FREQ ERROR versus VOLTAGE**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 13.8 | 8 | 0.00000046 | 0.0046 |
| 12.0 | 7 | 0.00000040 | 0.0040 |
| 10.2 | 8 | 0.00000046 | 0.0046 |

**FREQ ERROR versus TEMPERATURE**

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | 7 | 0.00000040 | 0.0040 |
| -20 | 10 | 0.00000058 | 0.0058 |
| -10 | 9 | 0.00000052 | 0.0052 |
| ± 0 | 7 | 0.00000040 | 0.0040 |
| 10 | 8 | 0.00000046 | 0.0046 |
| 20 | 7 | 0.00000040 | 0.0040 |
| 30 | 7 | 0.00000040 | 0.0040 |
| 40 | 8 | 0.00000046 | 0.0046 |
| 50 | 6 | 0.00000035 | 0.0035 |
| 60 | 5 | 0.00000029 | 0.0029 |

**Verdict:** compliant

## 11.2.3 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 1754.3 MHz. Measurement made up to 26 GHz. The resolution bandwidth is set as outlined in Part 27.238. The spectrum was scanned with the mobile station transmitting at the middle carrier frequency of the LTE band IV.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak / RMS |
| Sweep time: | 5 ms/MHz |
| Resolution bandwidth: | 1 MHz |
| Video bandwidth: | 3 MHz |
| Span: | different steps |
| Trace-Mode: | Max Hold |
| Used equipment: | see chapter 7.1 - A<br>& 7.2 - A |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| 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 frequencies of the LTE band 4 (1732.5 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 4 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 with 10 MHz bandwidth and full resource blocks. If spurious were detected, the lowest and highest channel and all supported channel bandwidths were checked, too.

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

**QPSK**

| Spurious Emission Level (dBm) | |
|---|---|
| **Middle channel** | |
| Spurious emissions | Level [dBm] |
| 3465.0 | - |
| 5197.5 | - |
| 6930.0 | - |
| 8662.5 | - |
| 10395.0 | - |
| 12127.5 | - |
| 13860.0 | - |
| 15592.5 | - |
| 17325.0 | - |
| | |

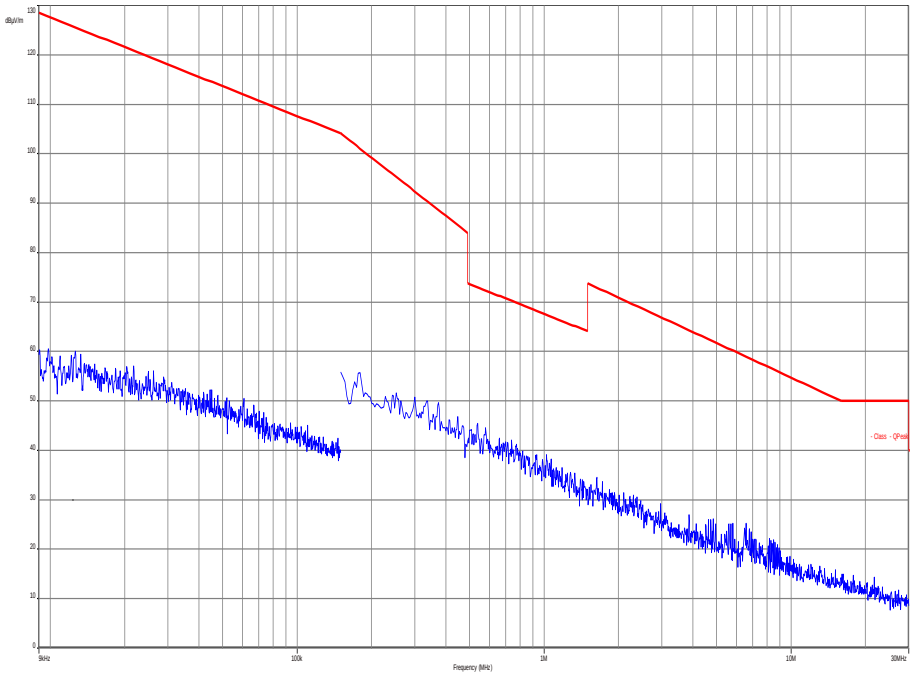
**16-QAM**

| Spurious Emission Level (dBm) | |
|---|---|
| **Middle channel** | |
| Spurious emissions | Level [dBm] |
| 3465.0 | - |
| 5197.5 | - |
| 6930.0 | - |
| 8662.5 | - |
| 10395.0 | - |
| 12127.5 | - |
| 13860.0 | - |
| 15592.5 | - |
| 17325.0 | - |
| | |

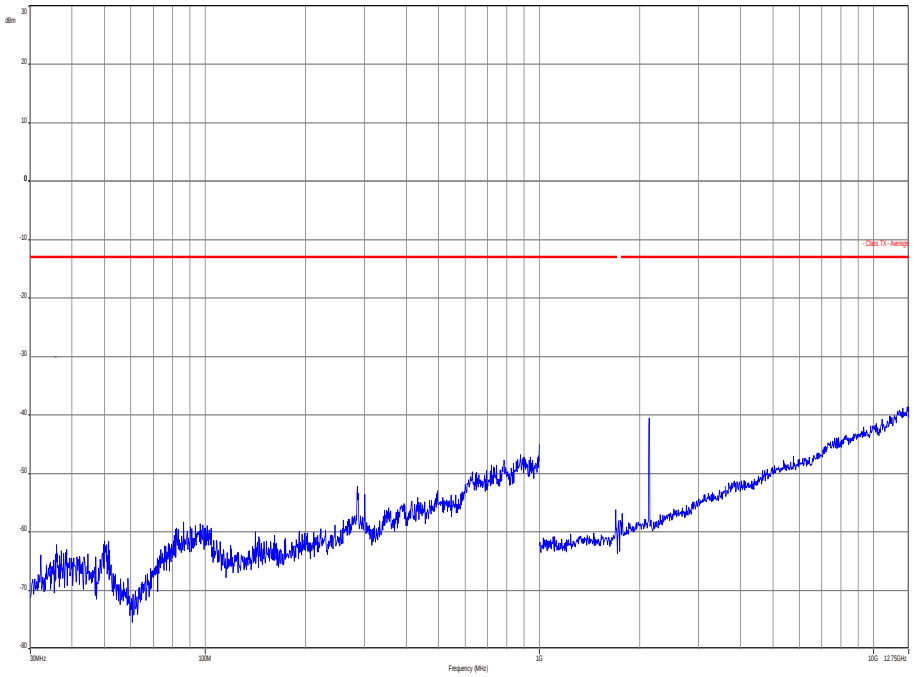
**Verdict:** compliant

**QPSK with 10 MHz channel bandwidth**

**Plot 1:** Middle channel, up to 30 MHz

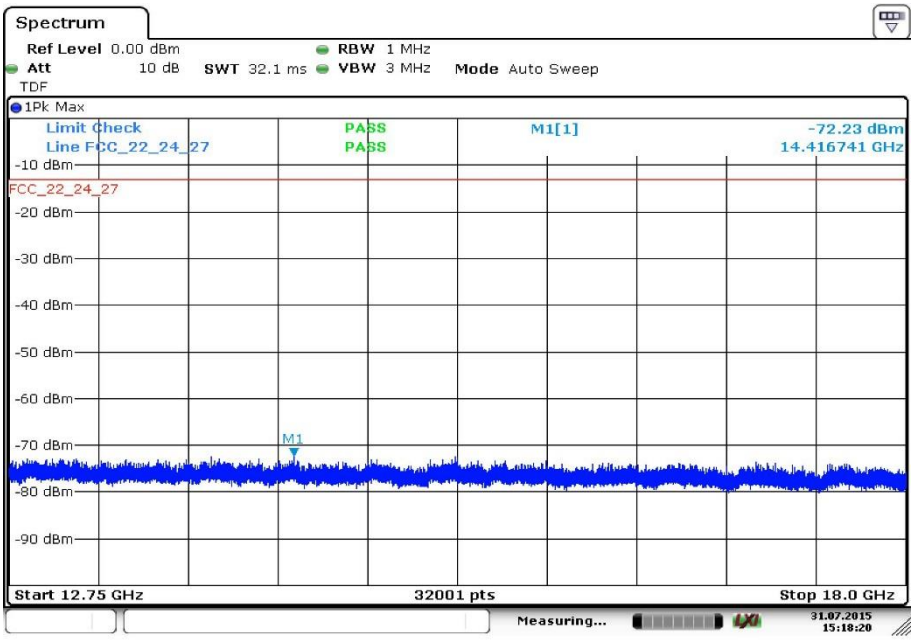


**Plot 2:** Middle channel, 30 MHz to 12.75 GHz



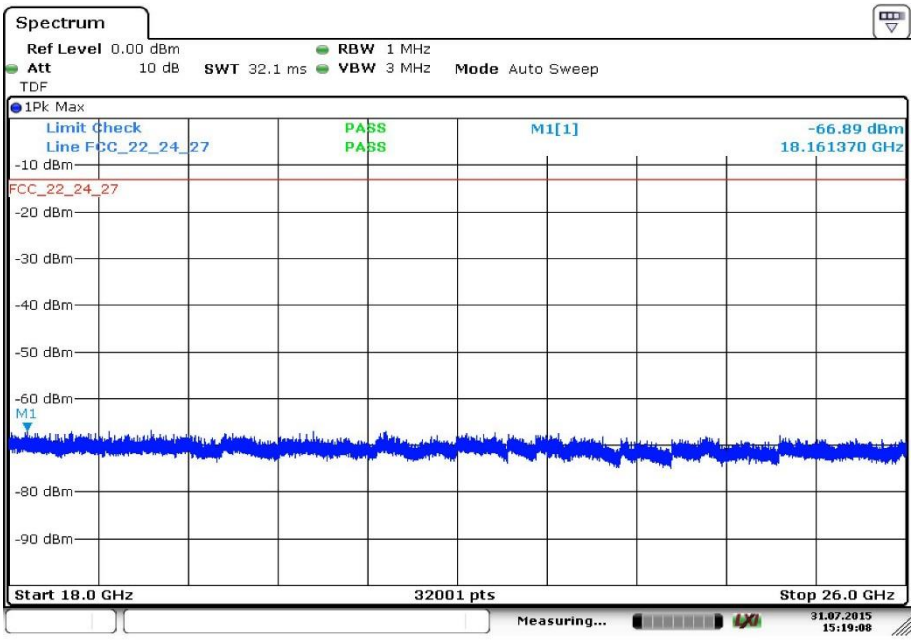
*Carrier notched with 1.7 GHz rejection filter*

**Plot 3: Middle channel, 12.75 GHz to 18 GHz**




Date: 31.JUL.2015 15:18:21

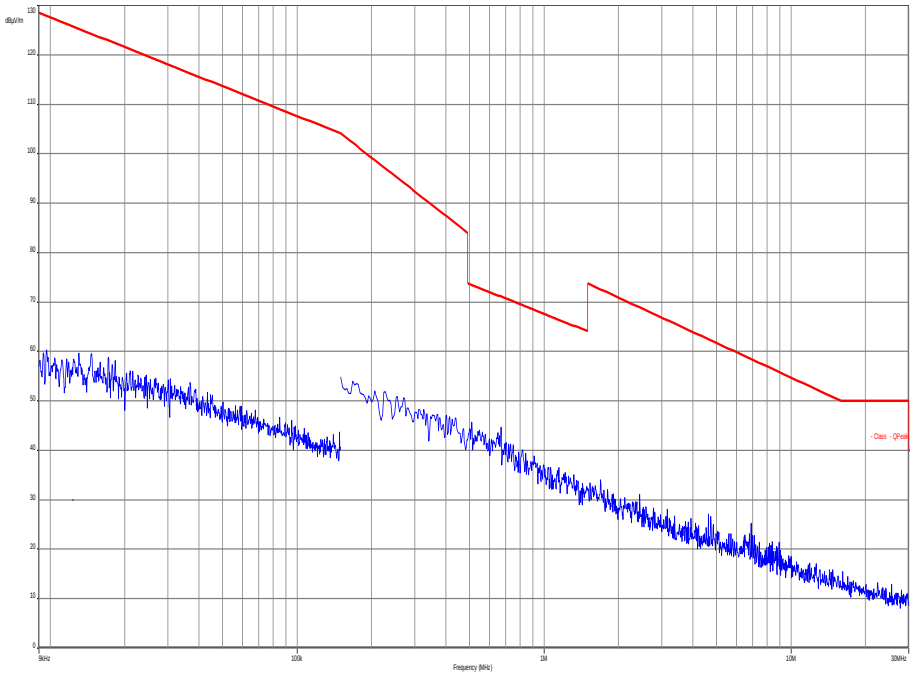
**Plot 4: Middle channel, 18 GHz to 26 GHz**



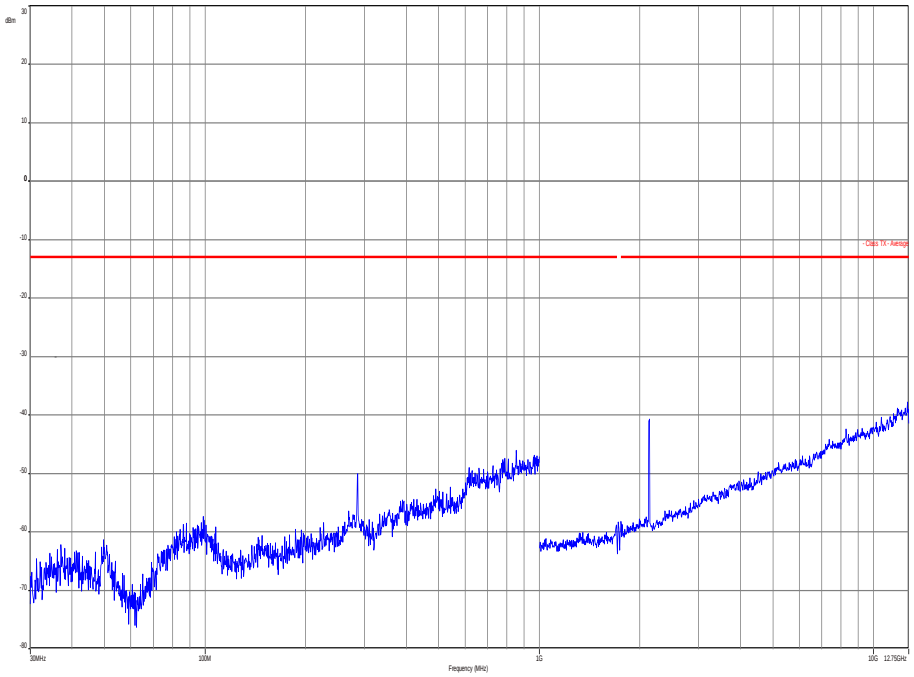

Date: 31.JUL.2015 15:19:09

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

**Plot 5:** Middle channel, up to 30 MHz

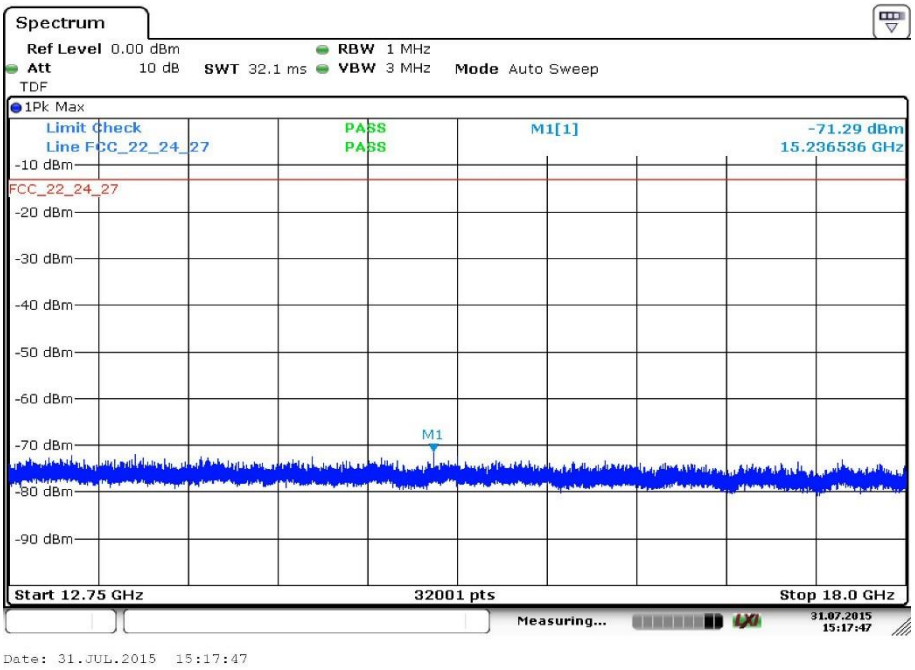


**Plot 6:** Middle channel, 30 MHz to 12.75 GHz

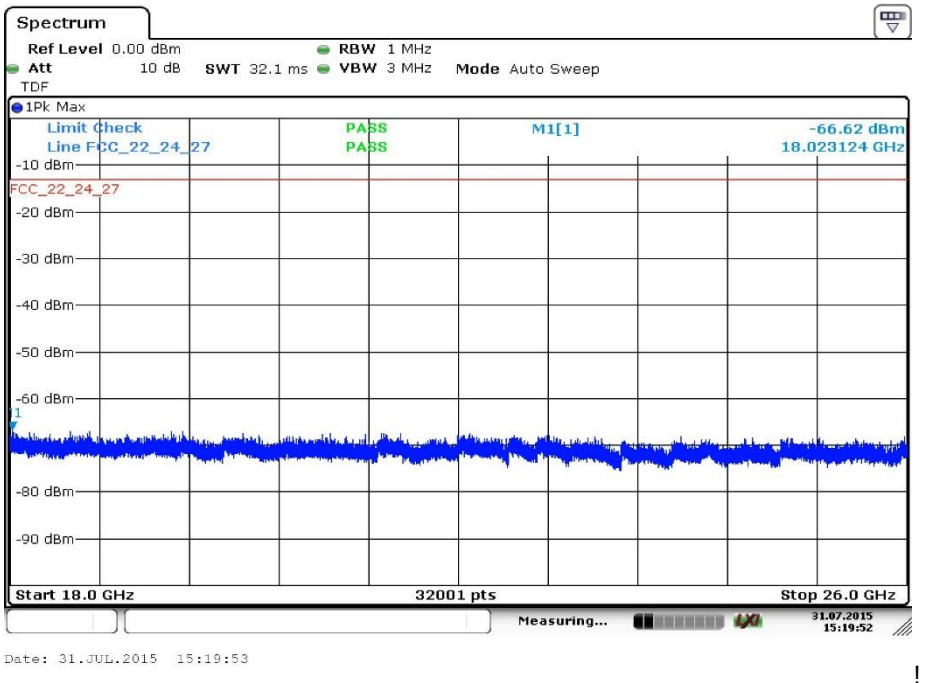


*Carrier notched with 1.7 GHz rejection filter*

**Plot 7:** Middle channel, 12 GHz to 25 GHz




**Plot 8:** Middle channel, 12 GHz to 25 GHz




!

## 11.2.4 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 17.6 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.

For the measurement the lowest, middle and highest channel bandwidth was used. If spurious were found the other bandwidths were measured, too.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak / RMS |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 MHz |
| Video bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement 3 MHz |
| Span: | 10 MHz – 26 GHz |
| Trace-Mode: | Max Hold |
| Used equipment: | see chapter 7.3 |
| Measurement uncertainty: | see chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| 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) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3421.4 | - | 3465.0 | - | 3508.6 | - |
| 5132.1 | - | 5197.5 | - | 5262.9 | - |
| 6842.8 | - | 6930.0 | - | 7017.2 | - |
| 8553.5 | - | 8662.5 | - | 8771.5 | - |
| 10264.2 | - | 10395.0 | - | 10525.8 | - |
| 11974.9 | - | 12127.5 | - | 12280.1 | - |
| 13685.6 | - | 13860.0 | - | 14034.4 | - |
| 15396.3 | - | 15592.5 | - | 15788.7 | - |
| 17107.0 | - | 17325.0 | - | 17543.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**16-QAM**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3421.4 | - | 3465.0 | - | 3508.6 | - |
| 5132.1 | - | 5197.5 | - | 5262.9 | - |
| 6842.8 | - | 6930.0 | - | 7017.2 | - |
| 8553.5 | - | 8662.5 | - | 8771.5 | - |
| 10264.2 | - | 10395.0 | - | 10525.8 | - |
| 11974.9 | - | 12127.5 | - | 12280.1 | - |
| 13685.6 | - | 13860.0 | - | 14034.4 | - |
| 15396.3 | - | 15592.5 | - | 15788.7 | - |
| 17107.0 | - | 17325.0 | - | 17543.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**Verdict:** compliant

**Results:** for 3 MHz channel bandwidth

**QPSK**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3423.0 | - | 3465.0 | - | 3507.0 | - |
| 5134.5 | - | 5197.5 | - | 5260.5 | - |
| 6846.0 | - | 6930.0 | - | 7014.0 | - |
| 8557.5 | - | 8662.5 | - | 8767.5 | - |
| 10269.0 | - | 10395.0 | - | 10521.0 | - |
| 11980.5 | - | 12127.5 | - | 12274.5 | - |
| 13692.0 | - | 13860.0 | - | 14028.0 | - |
| 15403.5 | - | 15592.5 | - | 15781.5 | - |
| 17115.0 | - | 17325.0 | - | 17535.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**16-QAM**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3423.0 | - | 3465.0 | - | 3507.0 | - |
| 5134.5 | - | 5197.5 | - | 5260.5 | - |
| 6846.0 | - | 6930.0 | - | 7014.0 | - |
| 8557.5 | - | 8662.5 | - | 8767.5 | - |
| 10269.0 | - | 10395.0 | - | 10521.0 | - |
| 11980.5 | - | 12127.5 | - | 12274.5 | - |
| 13692.0 | - | 13860.0 | - | 14028.0 | - |
| 15403.5 | - | 15592.5 | - | 15781.5 | - |
| 17115.0 | - | 17325.0 | - | 17535.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**Verdict:** compliant

**Results:** for 5 MHz channel bandwidth

**QPSK**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3425.0 | - | 3465.0 | - | 3505.0 | - |
| 5137.5 | - | 5197.5 | - | 5257.5 | - |
| 6850.0 | - | 6930.0 | - | 7010.0 | - |
| 8562.5 | - | 8662.5 | - | 8762.5 | - |
| 10275.0 | - | 10395.0 | - | 10515.0 | - |
| 11987.5 | - | 12127.5 | - | 12267.5 | - |
| 13700.0 | - | 13860.0 | - | 14020.0 | - |
| 15412.5 | - | 15592.5 | - | 15772.5 | - |
| 17125.0 | - | 17325.0 | - | 17525.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**16-QAM**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3425.0 | - | 3465.0 | - | 3505.0 | - |
| 5137.5 | - | 5197.5 | - | 5257.5 | - |
| 6850.0 | - | 6930.0 | - | 7010.0 | - |
| 8562.5 | - | 8662.5 | - | 8762.5 | - |
| 10275.0 | - | 10395.0 | - | 10515.0 | - |
| 11987.5 | - | 12127.5 | - | 12267.5 | - |
| 13700.0 | - | 13860.0 | - | 14020.0 | - |
| 15412.5 | - | 15592.5 | - | 15772.5 | - |
| 17125.0 | - | 17325.0 | - | 17525.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**Verdict:** compliant

**Results:** for 10 MHz channel bandwidth

**QPSK**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3430.0 | - | 3465.0 | - | 3500.0 | - |
| 5145.0 | - | 5197.5 | - | 5250.0 | - |
| 6860.0 | - | 6930.0 | - | 7000.0 | - |
| 8575.0 | - | 8662.5 | - | 8750.0 | - |
| 10290.0 | - | 10395.0 | - | 10500.0 | - |
| 12005.0 | - | 12127.5 | - | 12250.0 | - |
| 13720.0 | - | 13860.0 | - | 14000.0 | - |
| 15435.0 | - | 15592.5 | - | 15750.0 | - |
| 17150.0 | - | 17325.0 | - | 17500.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**16-QAM**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3430.0 | - | 3465.0 | - | 3500.0 | - |
| 5145.0 | - | 5197.5 | - | 5250.0 | - |
| 6860.0 | - | 6930.0 | - | 7000.0 | - |
| 8575.0 | - | 8662.5 | - | 8750.0 | - |
| 10290.0 | - | 10395.0 | - | 10500.0 | - |
| 12005.0 | - | 12127.5 | - | 12250.0 | - |
| 13720.0 | - | 13860.0 | - | 14000.0 | - |
| 15435.0 | - | 15592.5 | - | 15750.0 | - |
| 17150.0 | - | 17325.0 | - | 17500.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**Verdict:** compliant

**Results:** for 15 MHz channel bandwidth

**QPSK**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3435.0 | - | 3465.0 | - | 3495.0 | - |
| 5152.5 | - | 5197.5 | - | 5242.5 | - |
| 6870.0 | - | 6930.0 | - | 6990.0 | - |
| 8587.5 | - | 8662.5 | - | 8737.5 | - |
| 10305.0 | - | 10395.0 | - | 10485.0 | - |
| 12022.5 | - | 12127.5 | - | 12232.5 | - |
| 13740.0 | - | 13860.0 | - | 13980.0 | - |
| 15457.5 | - | 15592.5 | - | 15727.5 | - |
| 17175.0 | - | 17325.0 | - | 17475.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**16-QAM**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3435.0 | - | 3465.0 | - | 3495.0 | - |
| 5152.5 | - | 5197.5 | - | 5242.5 | - |
| 6870.0 | - | 6930.0 | - | 6990.0 | - |
| 8587.5 | - | 8662.5 | - | 8737.5 | - |
| 10305.0 | - | 10395.0 | - | 10485.0 | - |
| 12022.5 | - | 12127.5 | - | 12232.5 | - |
| 13740.0 | - | 13860.0 | - | 13980.0 | - |
| 15457.5 | - | 15592.5 | - | 15727.5 | - |
| 17175.0 | - | 17325.0 | - | 17475.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

**Verdict:** compliant

**Results:** for 20 MHz channel bandwidth

**QPSK**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3440.0 | - | 3465.0 | - | 3490.0 | - |
| 5160.0 | - | 5197.5 | - | 5235.0 | - |
| 6880.0 | - | 6930.0 | - | 6980.0 | - |
| 8600.0 | - | 8662.5 | - | 8725.0 | - |
| 10320.0 | - | 10395.0 | - | 10470.0 | - |
| 12040.0 | - | 12127.5 | - | 12215.0 | - |
| 13760.0 | - | 13860.0 | - | 13960.0 | - |
| 15480.0 | - | 15592.5 | - | 15705.0 | - |
| 17200.0 | - | 17325.0 | - | 17450.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

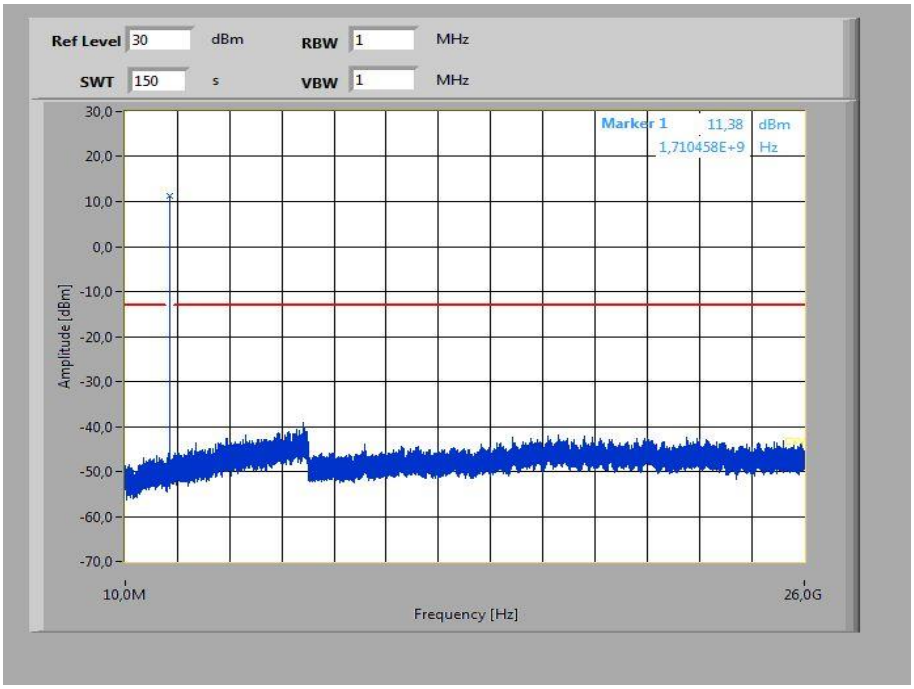
**16-QAM**

| Spurious Emission Level (dBm) | | | | | |
|---|---|---|---|---|---|
| **Lowest channel** | | **Middle channel** | | **Highest channel** | |
| Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] | Spurious emissions | Level [dBm] |
| 3440.0 | - | 3465.0 | - | 3490.0 | - |
| 5160.0 | - | 5197.5 | - | 5235.0 | - |
| 6880.0 | - | 6930.0 | - | 6980.0 | - |
| 8600.0 | - | 8662.5 | - | 8725.0 | - |
| 10320.0 | - | 10395.0 | - | 10470.0 | - |
| 12040.0 | - | 12127.5 | - | 12215.0 | - |
| 13760.0 | - | 13860.0 | - | 13960.0 | - |
| 15480.0 | - | 15592.5 | - | 15705.0 | - |
| 17200.0 | - | 17325.0 | - | 17450.0 | - |
| Measurement uncertainty | | | ± 3dB | | |

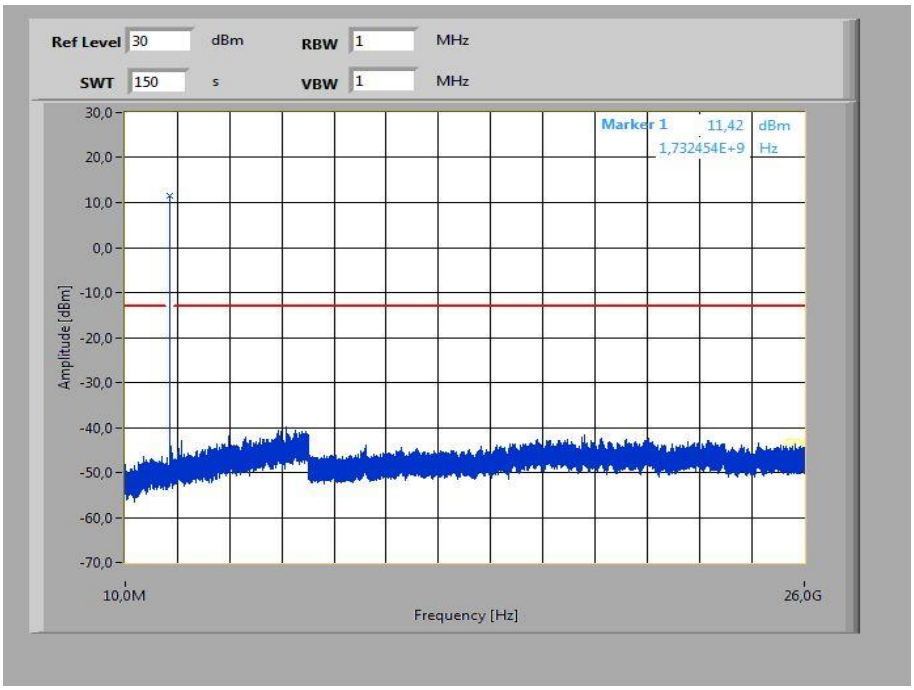
**Verdict:** compliant

**Plots for 1.4 MHz channel bandwidth, QPSK**

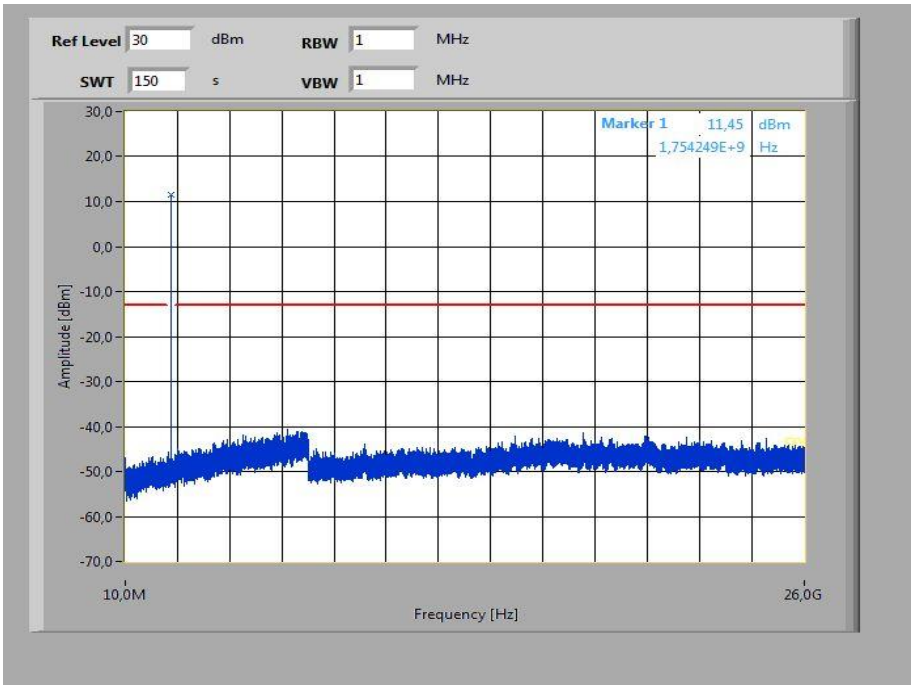
**Plot 1:** Lowest channel, 10 MHz to 26 GHz




**Plot 2:** Middle channel, 10 MHz to 26 GHz

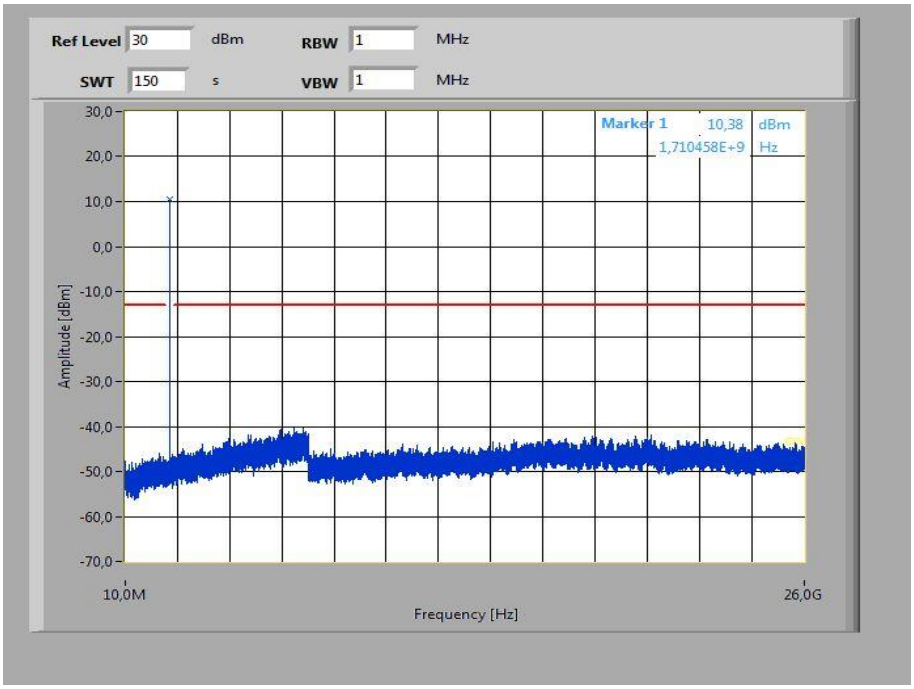


**Plot 3:** Highest channel, 10 MHz to 26 GHz

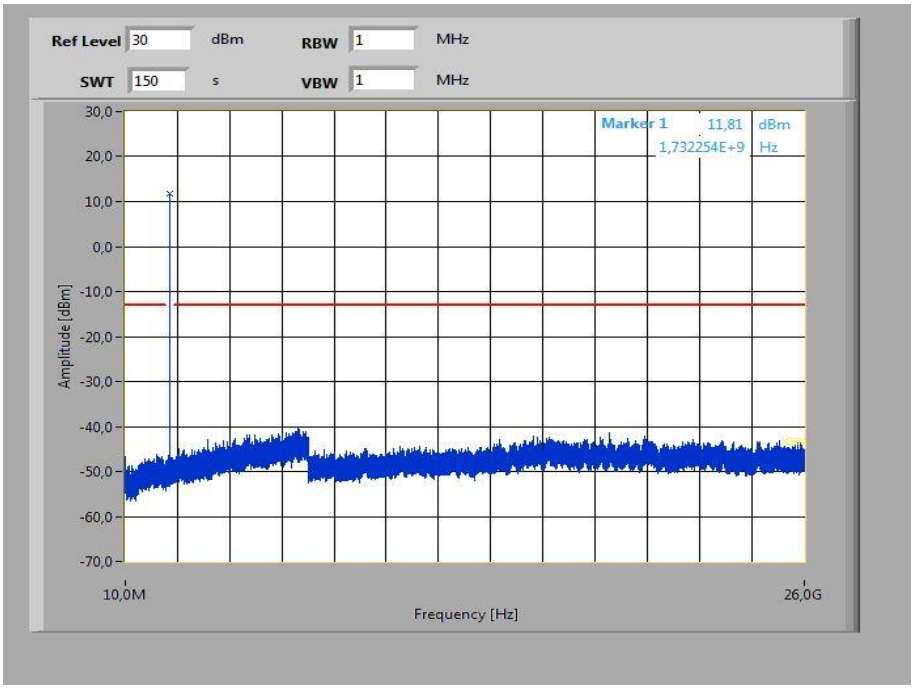


**Plots for 1.4 MHz channel bandwidth, 16-QAM**

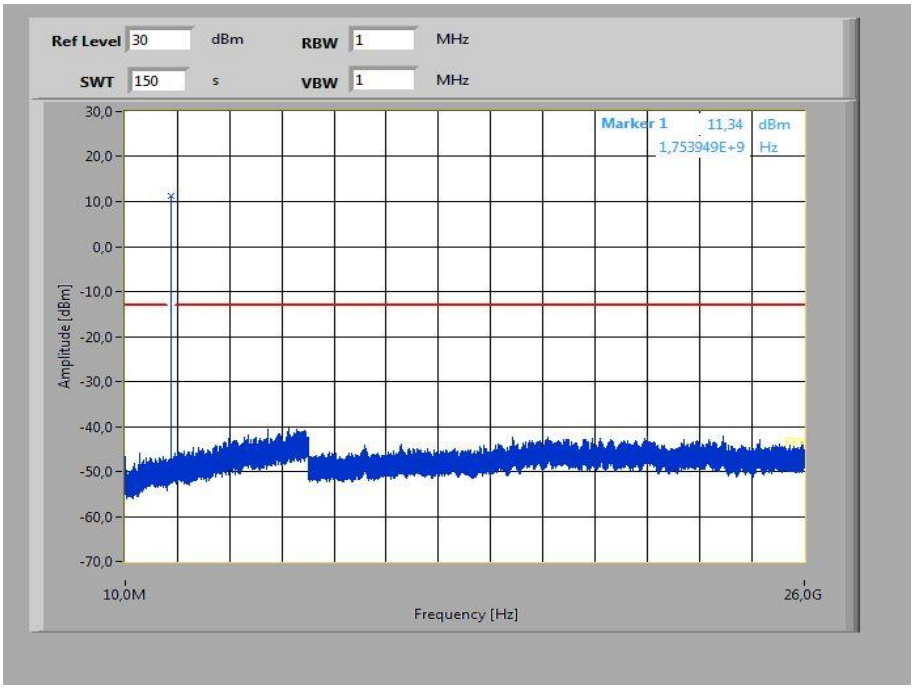
**Plot 4:** Lowest channel, 10 MHz to 26 GHz




**Plot 5:** Middle channel, 10 MHz to 26 GHz

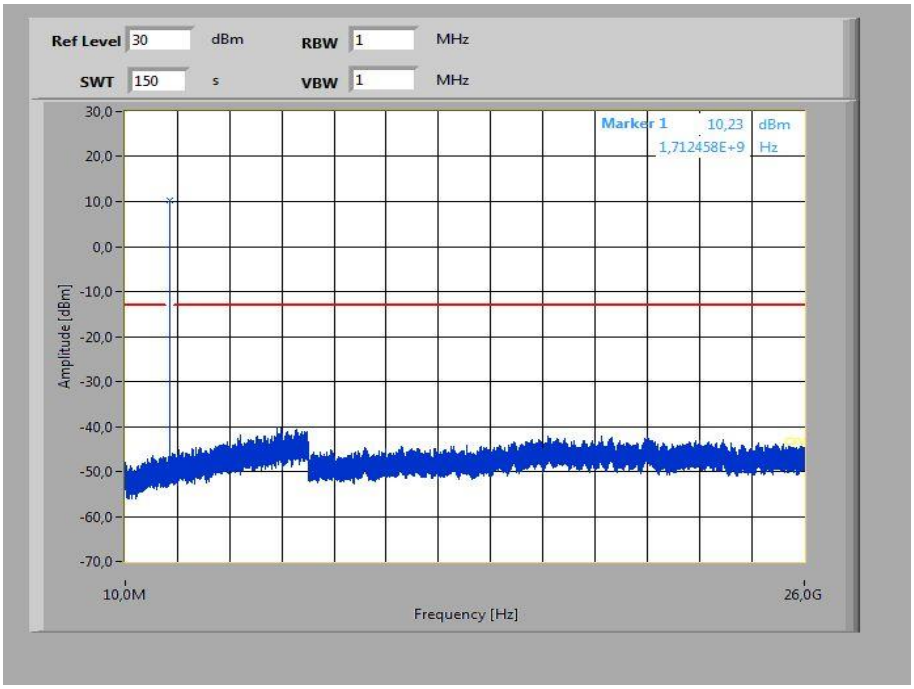


**Plot 6:** Highest channel, 10 MHz to 26 GHz

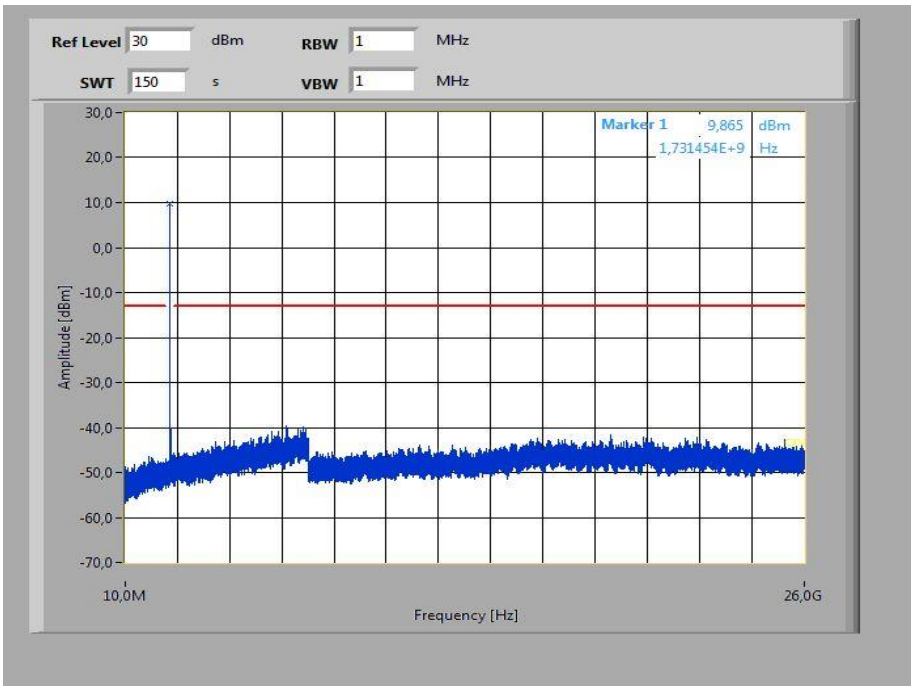


**Plots for 3 MHz channel bandwidth, QPSK**

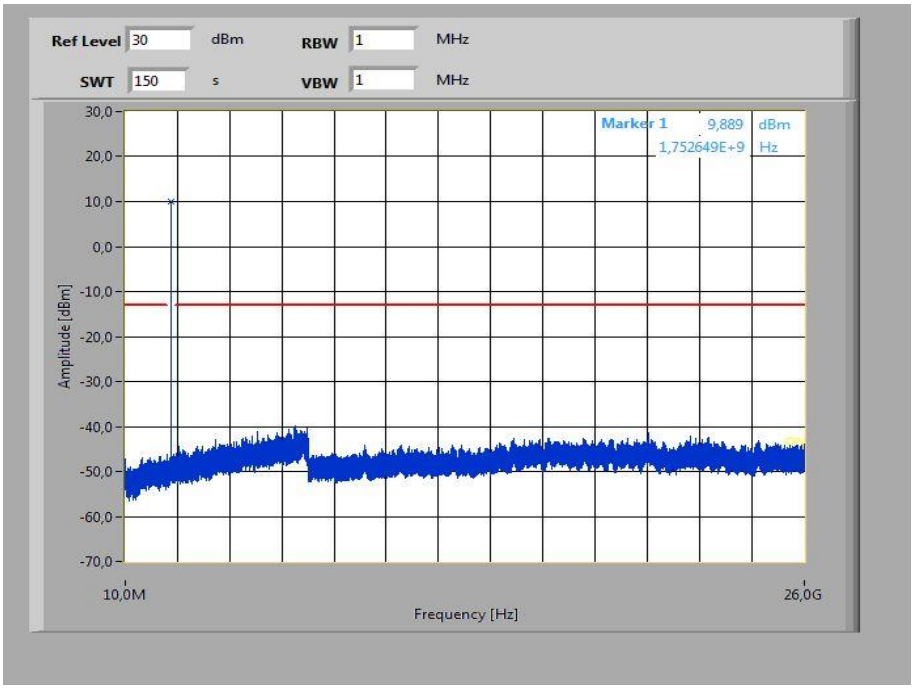
**Plot 1:** Lowest channel, 10 MHz to 26 GHz




**Plot 2:** Middle channel, 10 MHz to 26 GHz

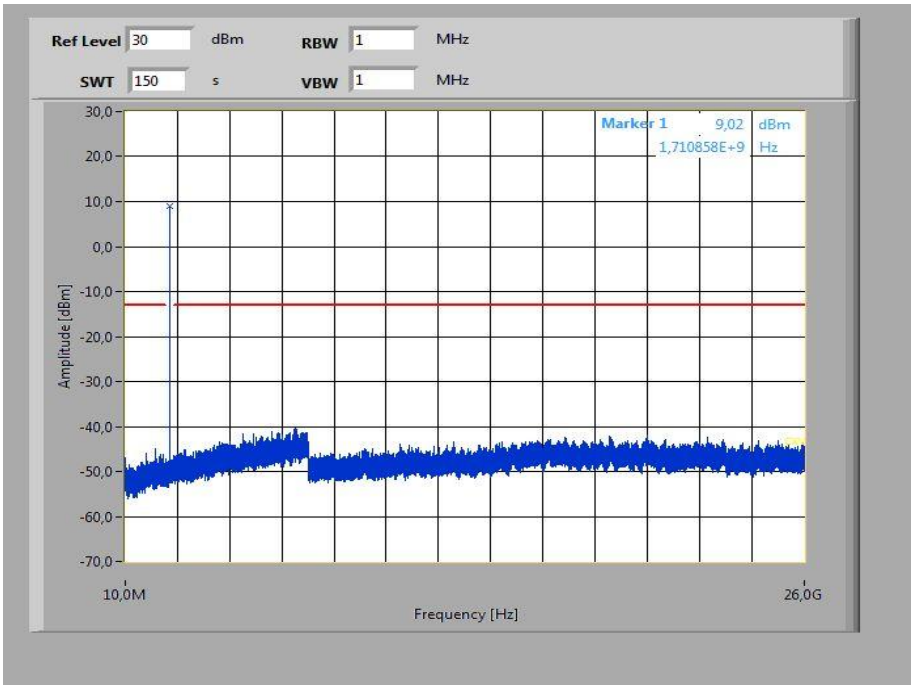


**Plot 3:** Highest channel, 10 MHz to 26 GHz

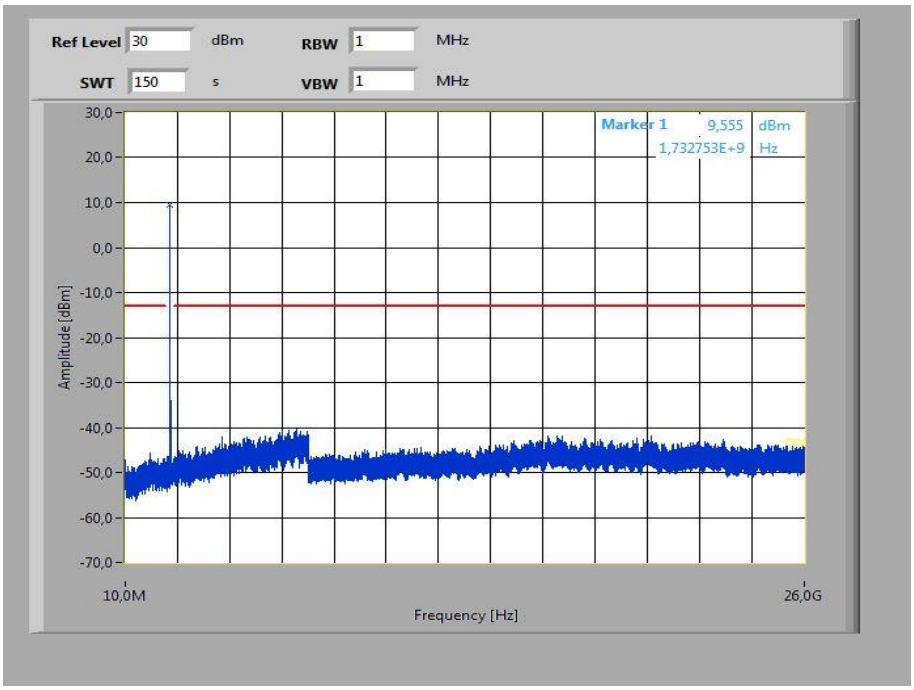


**Plots for 3 MHz channel bandwidth, 16-QAM**

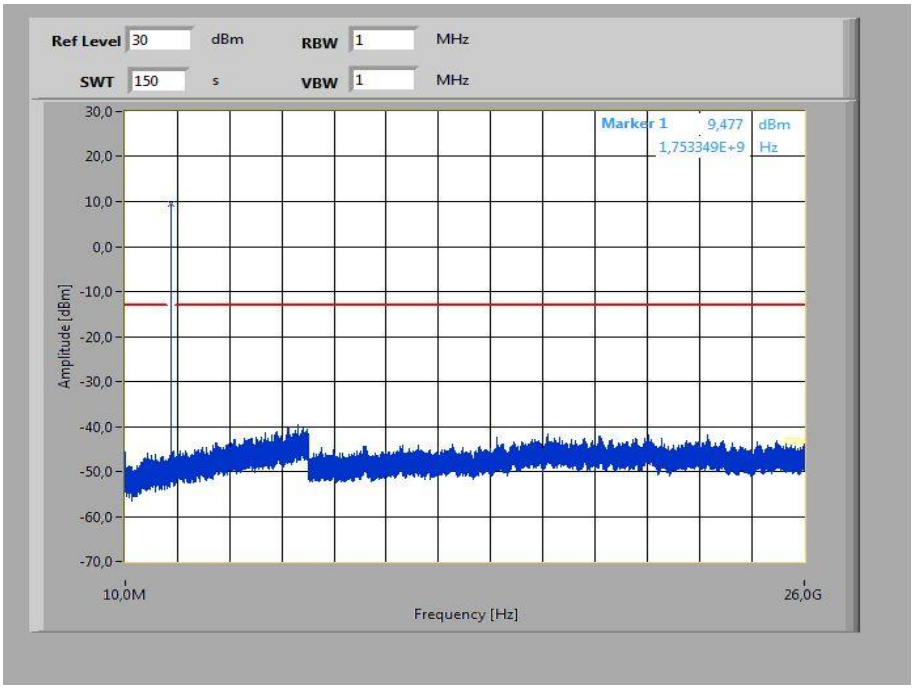
**Plot 4:** Lowest channel, 10 MHz to 26 GHz




**Plot 5:** Middle channel, 10 MHz to 26 GHz

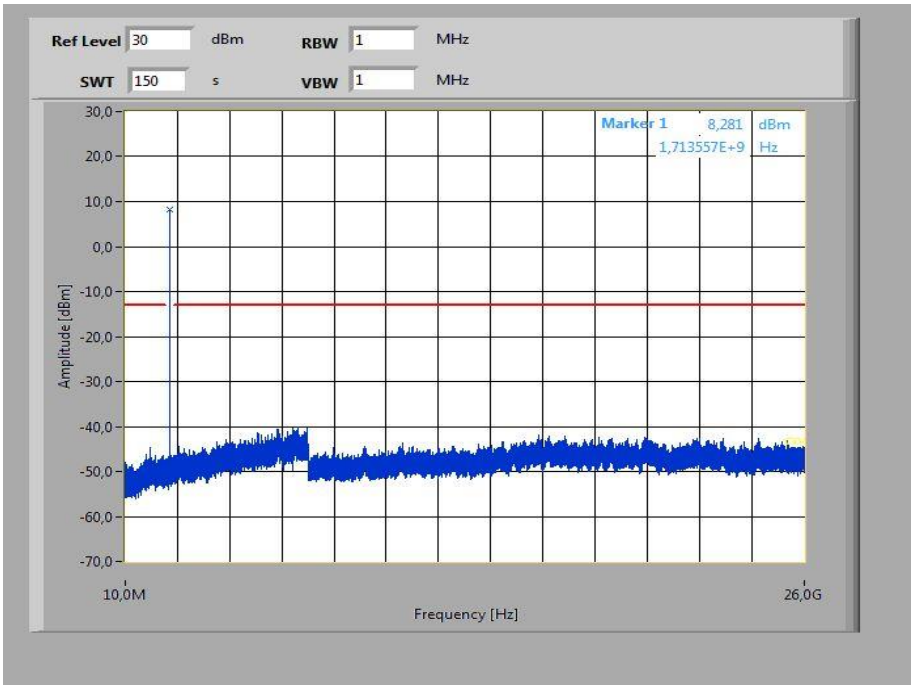


**Plot 6:** Highest channel, 10 MHz to 26 GHz

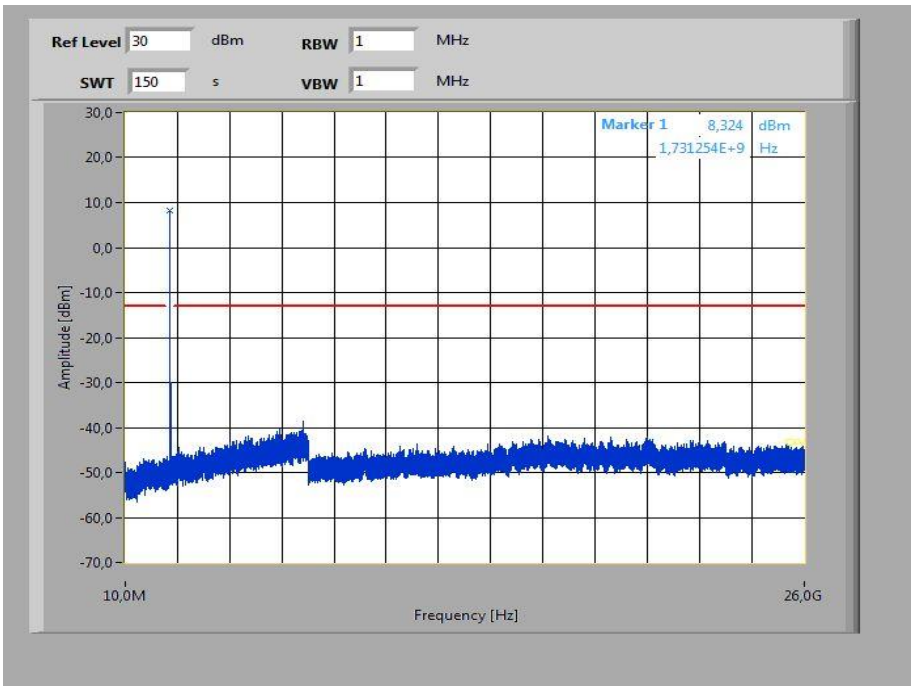


**Plots for 5 MHz channel bandwidth, QPSK**

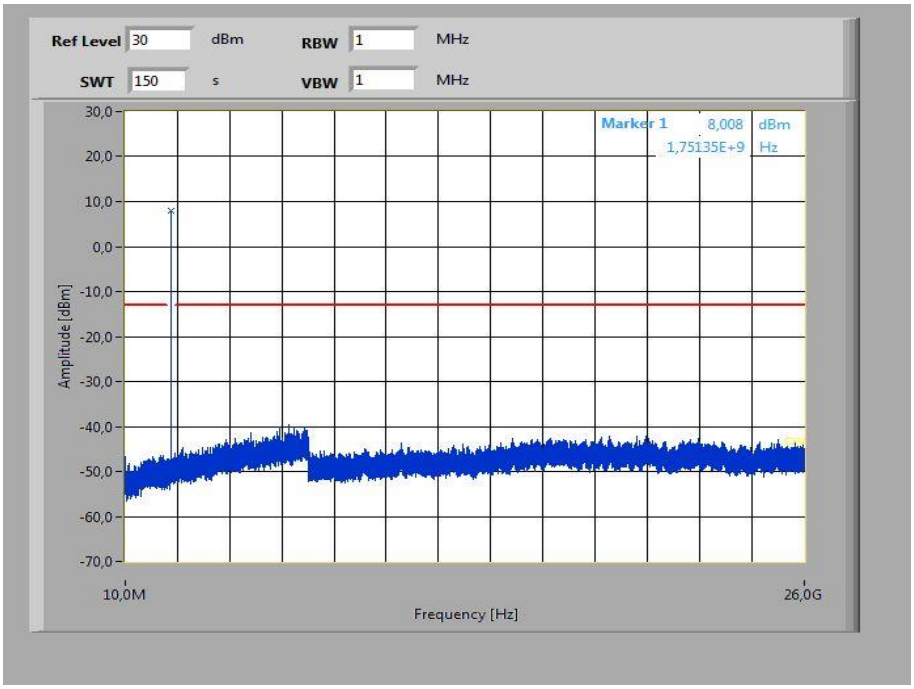
**Plot 1:** Lowest channel, 10 MHz to 26 GHz




**Plot 2:** Middle channel, 10 MHz to 26 GHz

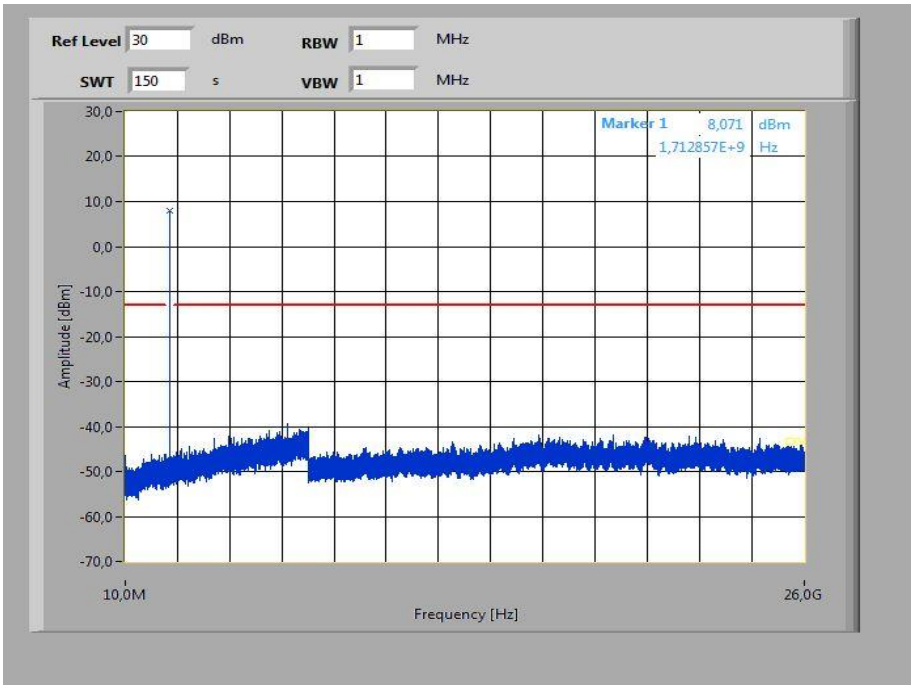


**Plot 3:** Highest channel, 10 MHz to 26 GHz

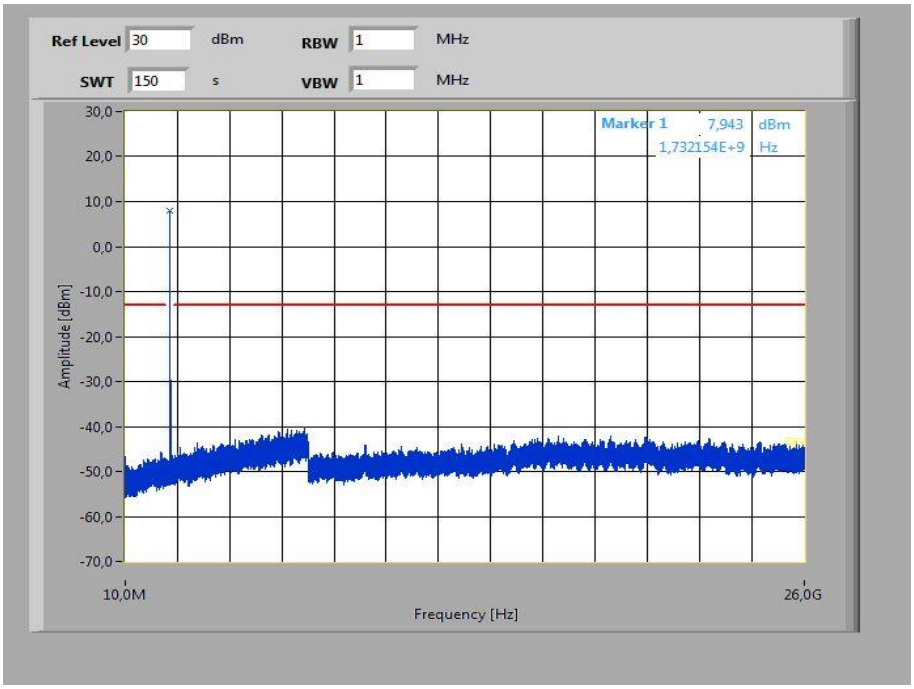


**Plots for 5 MHz channel bandwidth, 16-QAM**

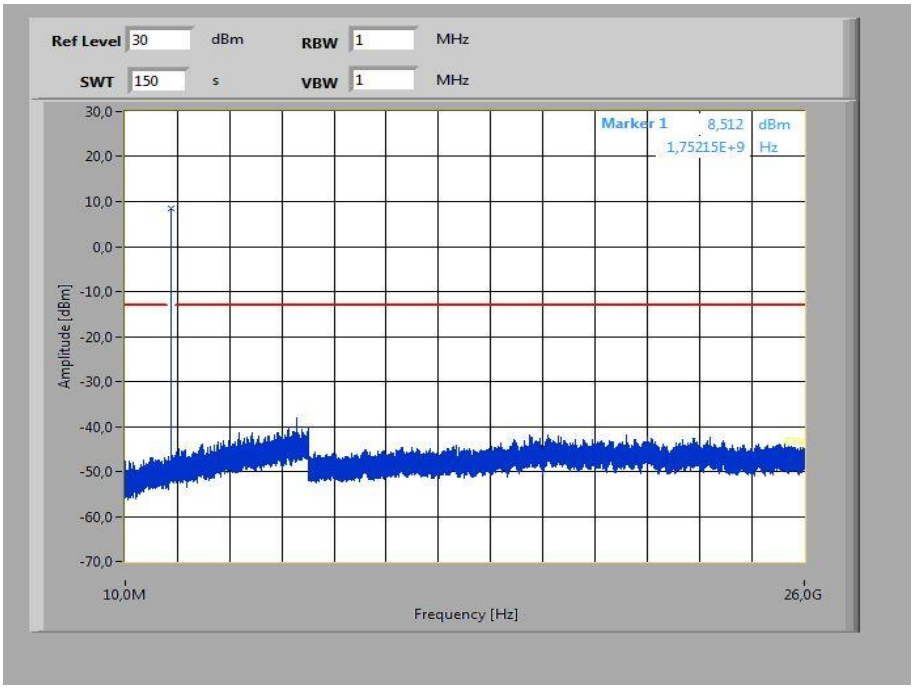
**Plot 4:** Lowest channel, 10 MHz to 26 GHz




**Plot 5:** Middle channel, 10 MHz to 26 GHz

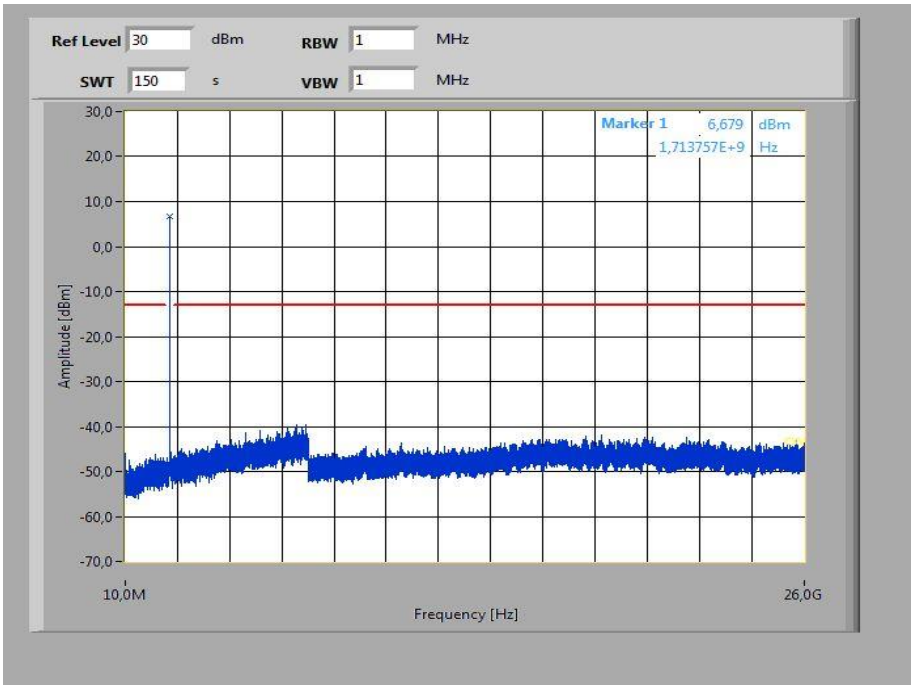


**Plot 6:** Highest channel, 10 MHz to 26 GHz

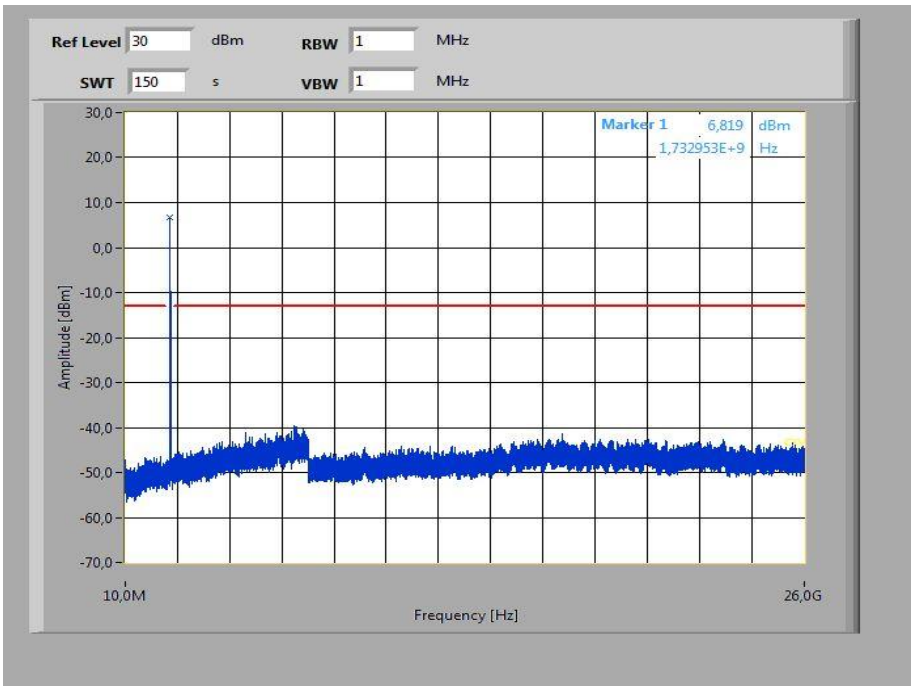


**Plots for 10 MHz channel bandwidth, QPSK**

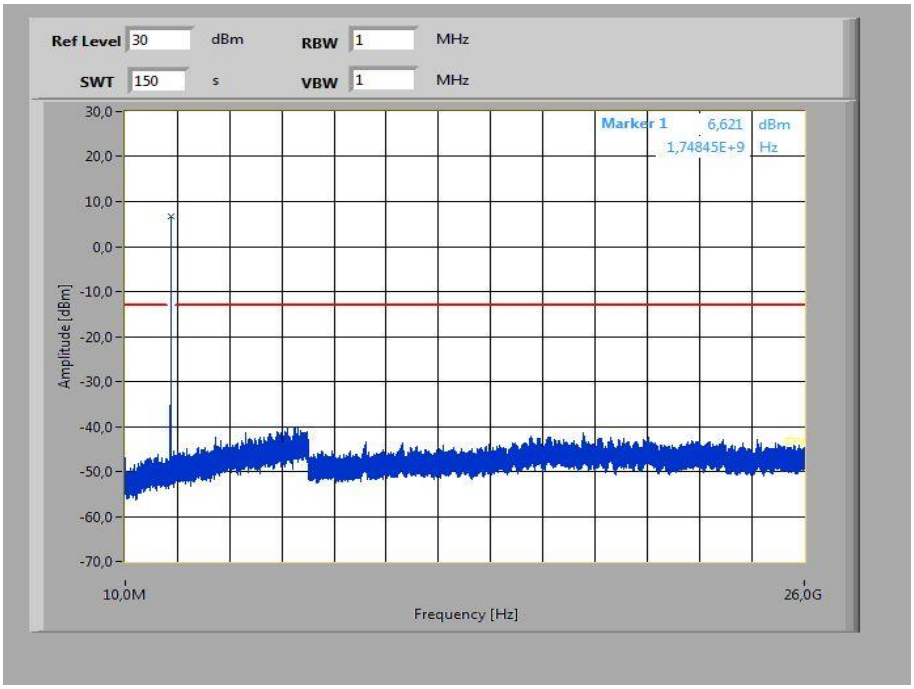
**Plot 1:** Lowest channel, 10 MHz to 26 GHz




**Plot 2:** Middle channel, 10 MHz to 26 GHz

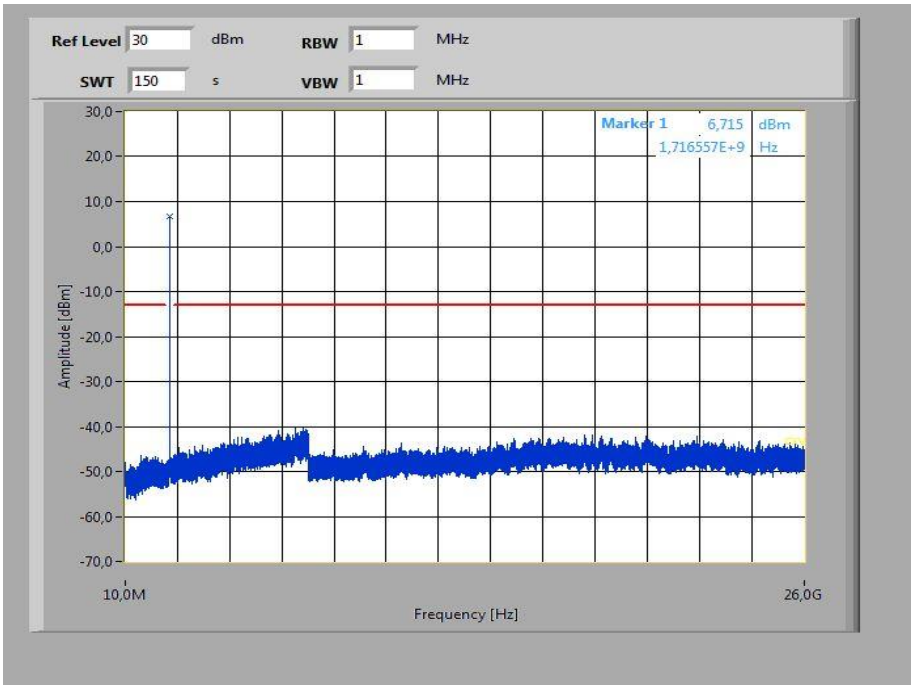


**Plot 3:** Highest channel, 10 MHz to 26 GHz

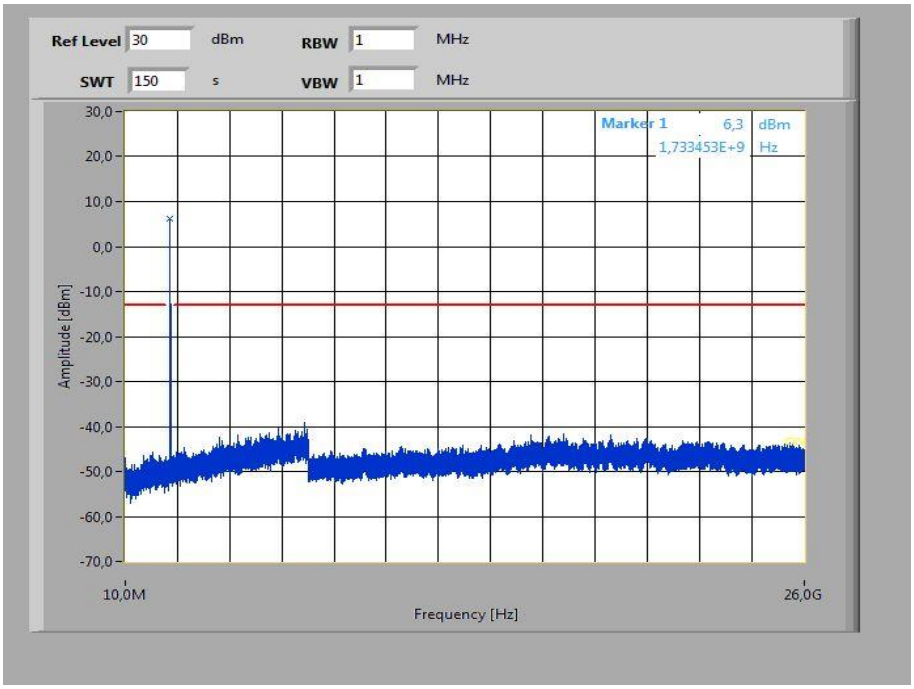


**Plots for 10 MHz channel bandwidth, 16-QAM**

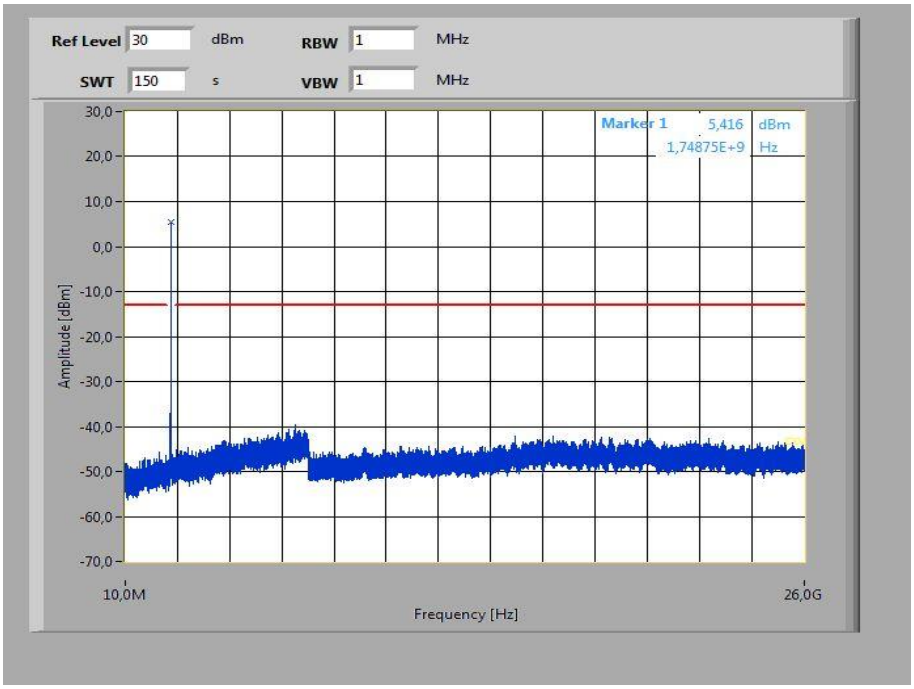
**Plot 4:** Lowest channel, 10 MHz to 26 GHz




**Plot 5:** Middle channel, 10 MHz to 26 GHz

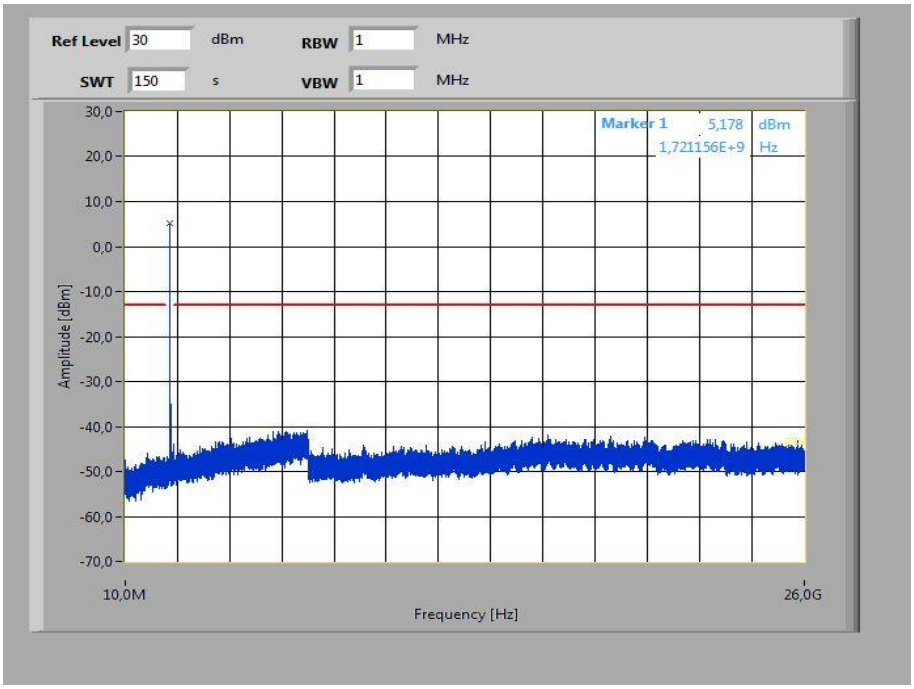


**Plot 6:** Highest channel, 10 MHz to 26 GHz

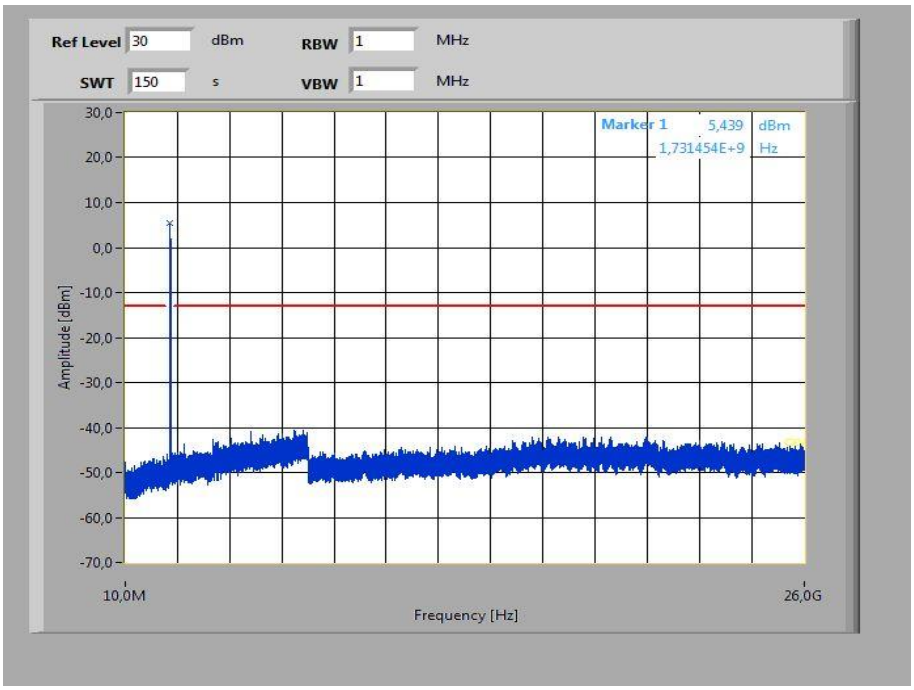


**Plots for 15 MHz channel bandwidth, QPSK**

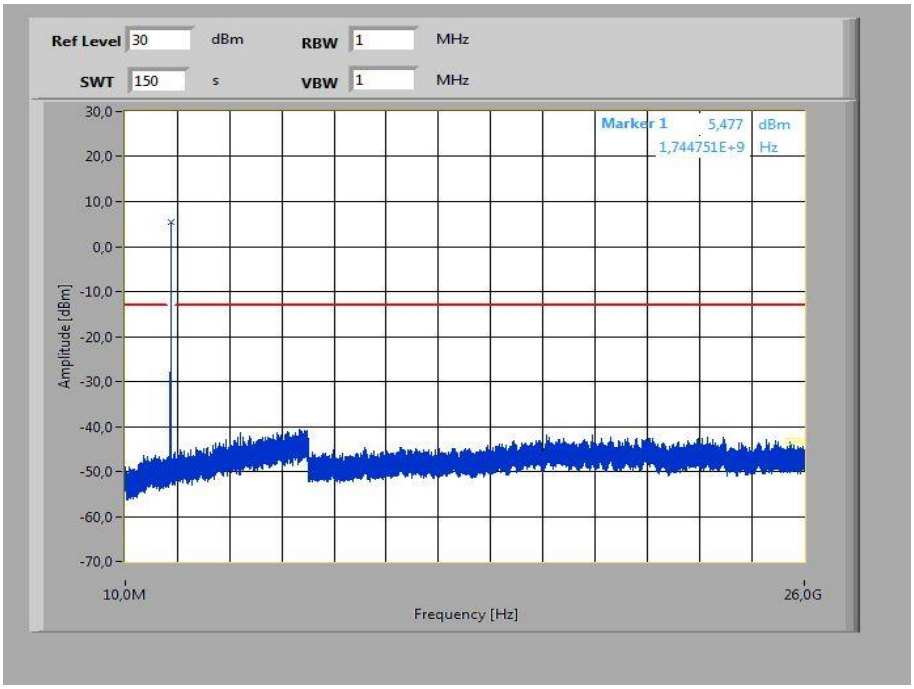
**Plot 1:** Lowest channel, 10 MHz to 26 GHz




**Plot 2:** Middle channel, 10 MHz to 26 GHz

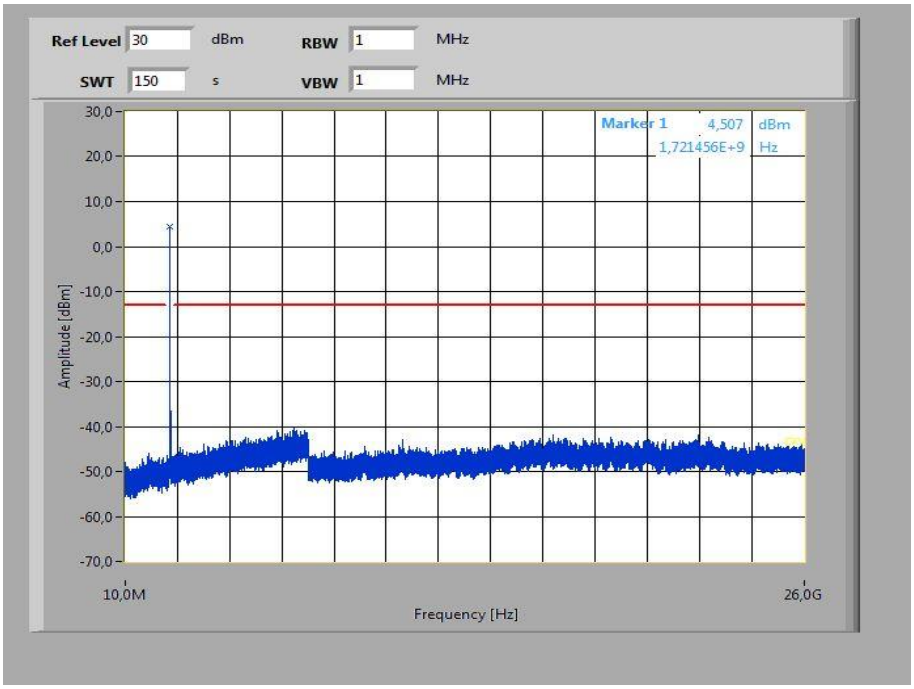


**Plot 3:** Highest channel, 10 MHz to 26 GHz

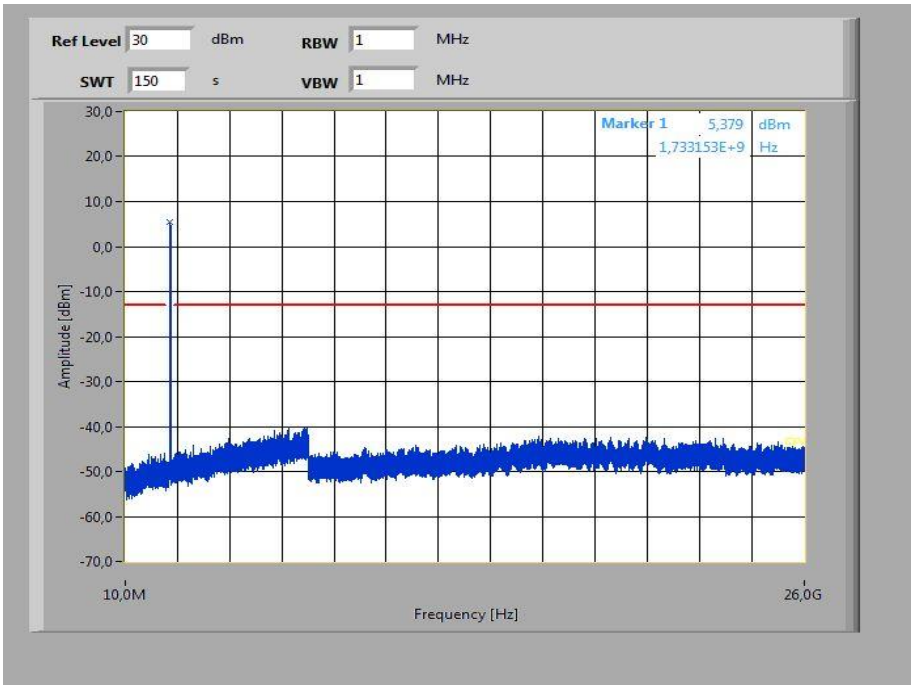


**Plots for 15 MHz channel bandwidth, 16-QAM**

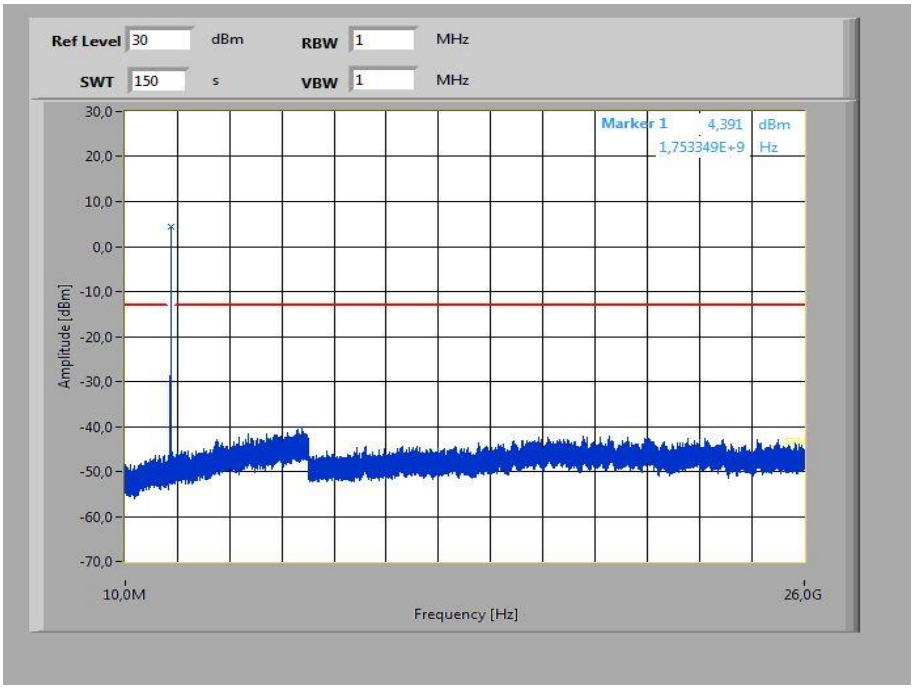
**Plot 4:** Lowest channel, 10 MHz to 26 GHz




**Plot 5:** Middle channel, 10 MHz to 26 GHz

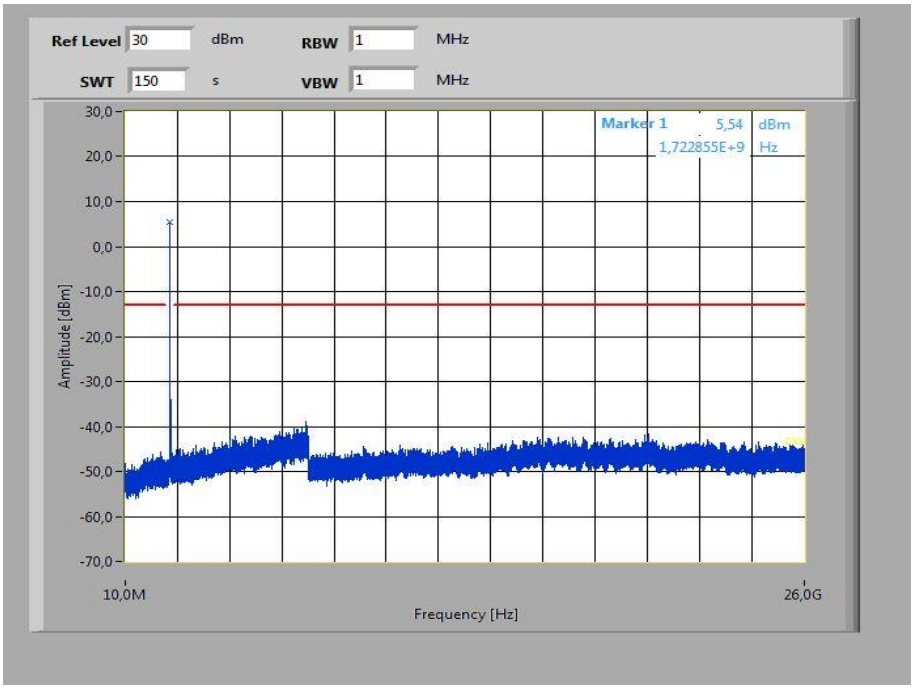


**Plot 6:** Highest channel, 10 MHz to 26 GHz

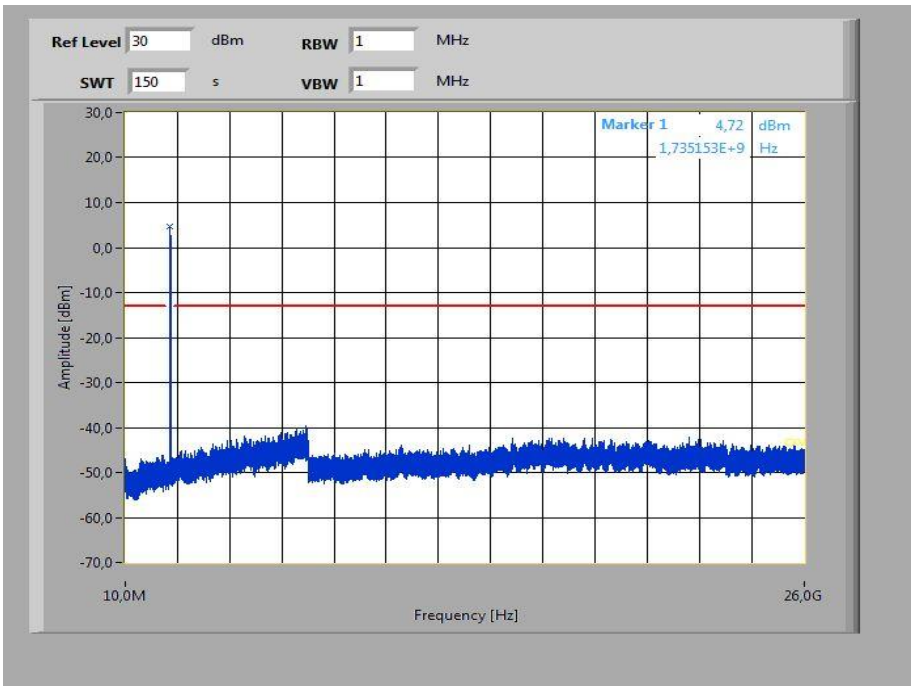


**Plots for 20 MHz channel bandwidth, QPSK**

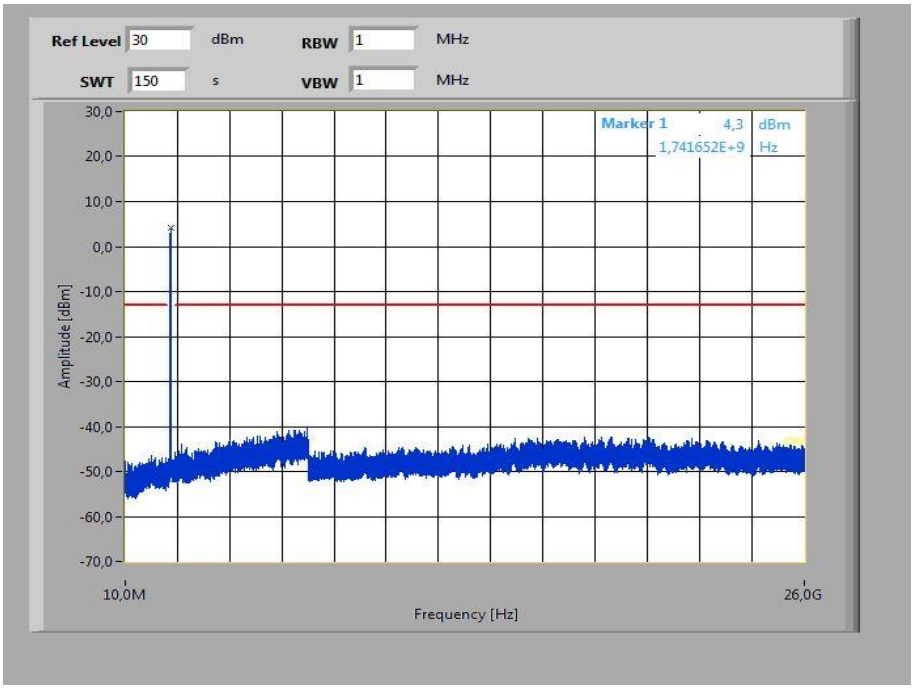
**Plot 1:** Lowest channel, 10 MHz to 26 GHz




**Plot 2:** Middle channel, 10 MHz to 26 GHz

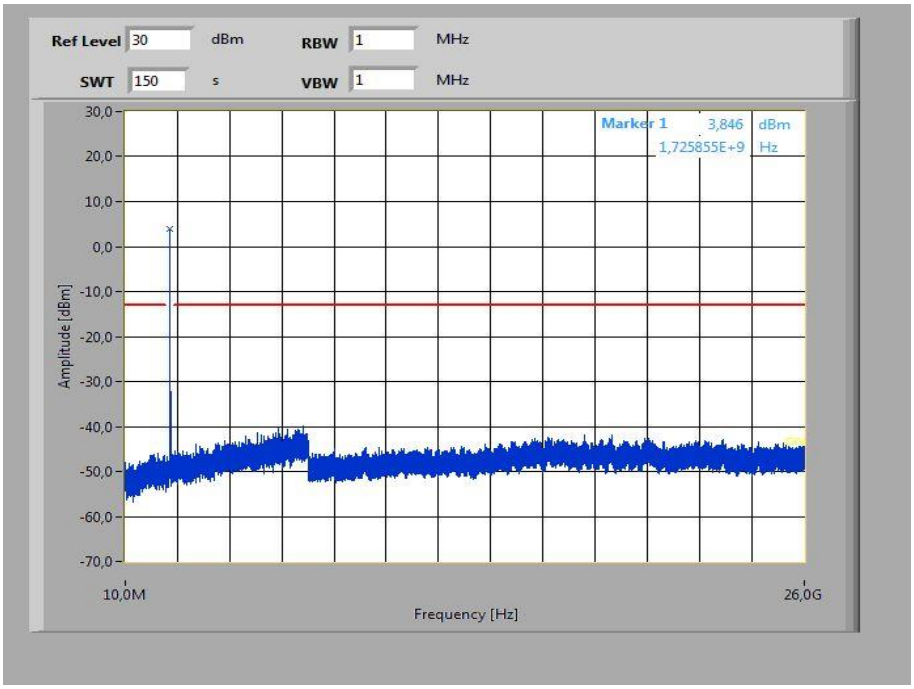


**Plot 3:** Highest channel, 10 MHz to 26 GHz

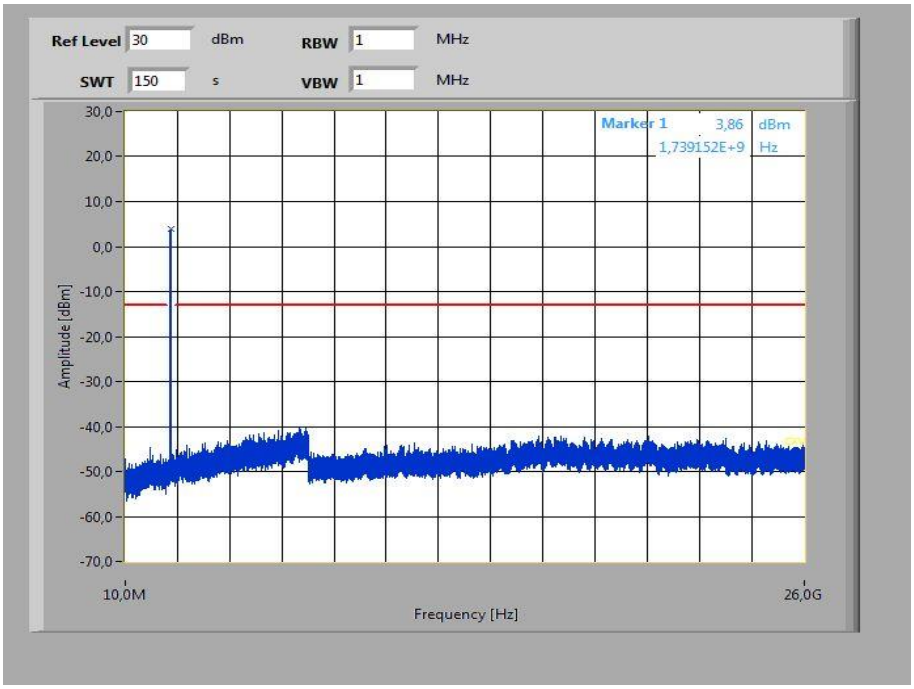


**Plots for 20 MHz channel bandwidth, 16-QAM**

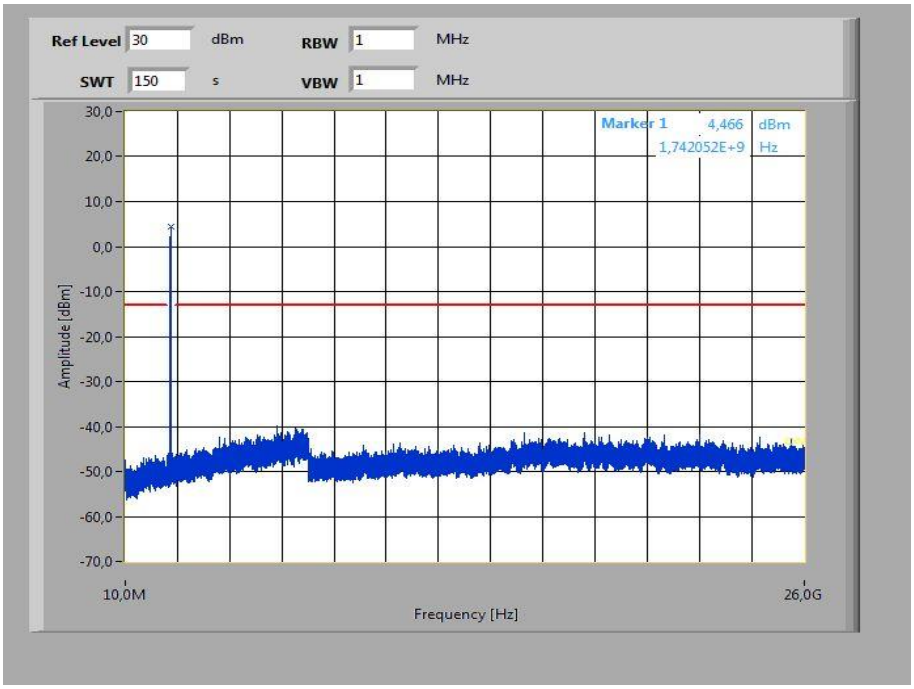
**Plot 4:** Lowest channel, 10 MHz to 26 GHz




**Plot 5:** Middle channel, 10 MHz to 26 GHz



**Plot 6:** Highest channel, 10 MHz to 26 GHz



### 11.2.5 Block edge compliance

**Description:**

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

For the measurement all available channel bandwidths were used.

**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 7.3 - A |
| Measurement uncertainty: | see chapter 8 |

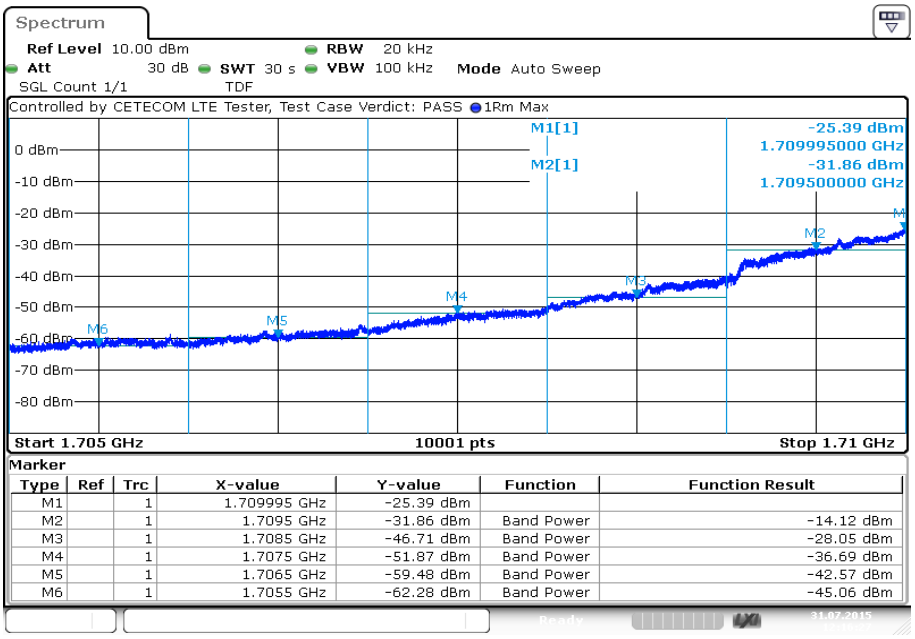
Plot shows the band edge. M1 shows the value with the 1% OBW filter. The table below the plot shows the channel power values over 1 MHz.

**Limits:**

| FCC | IC |
|---|---|
| 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 modulation

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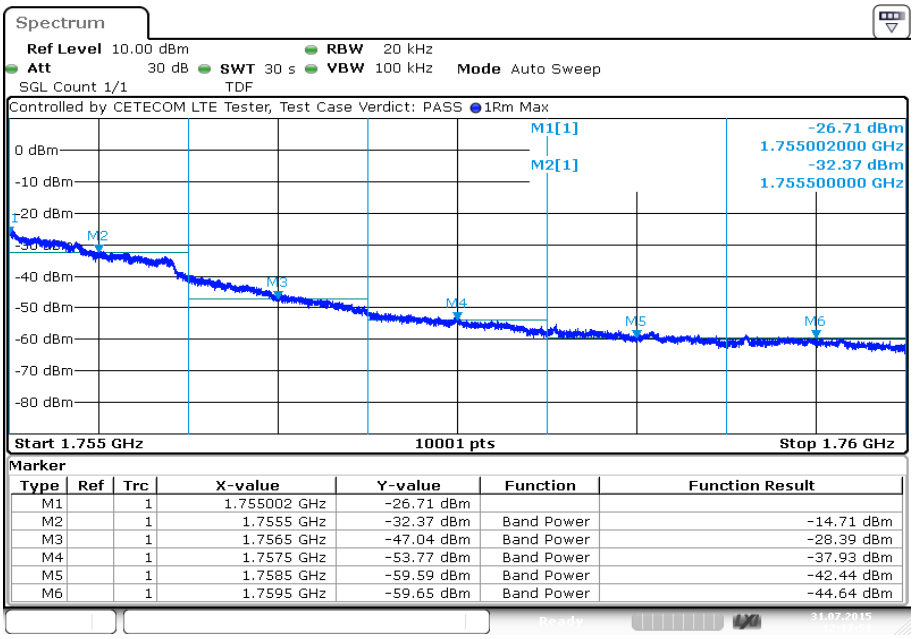
**Plot 2:** Highest channel, QPSK modulation

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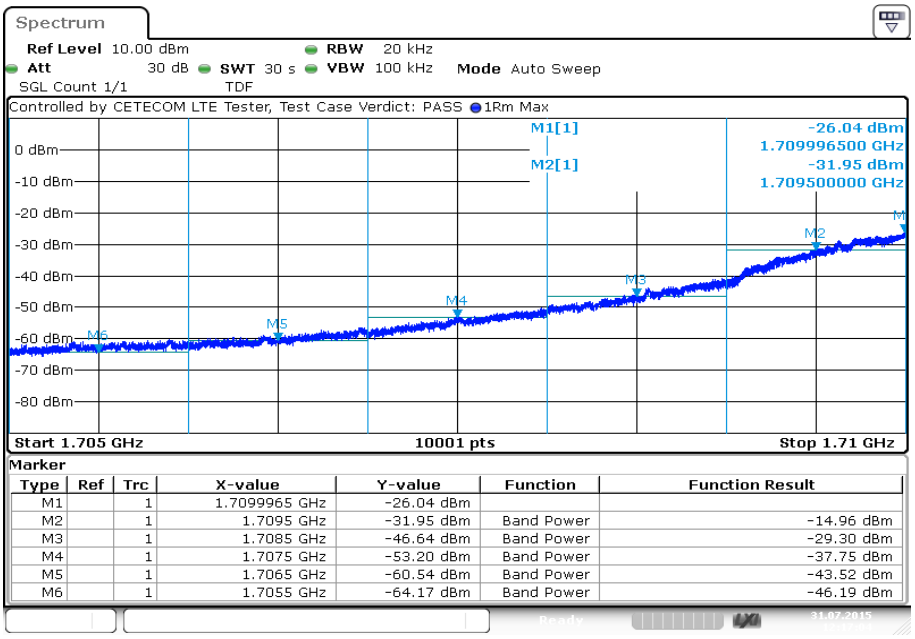
**Plot 3:** Lowest channel, 16 – QAM modulation




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.7099965 GHz | -26.04 dBm | | |
| M2 | | 1 | 1.7095 GHz | -31.95 dBm | Band Power | -14.96 dBm |
| M3 | | 1 | 1.7085 GHz | -46.64 dBm | Band Power | -29.30 dBm |
| M4 | | 1 | 1.7075 GHz | -53.20 dBm | Band Power | -37.75 dBm |
| M5 | | 1 | 1.7065 GHz | -60.54 dBm | Band Power | -43.52 dBm |
| M6 | | 1 | 1.7055 GHz | -64.17 dBm | Band Power | -46.19 dBm |

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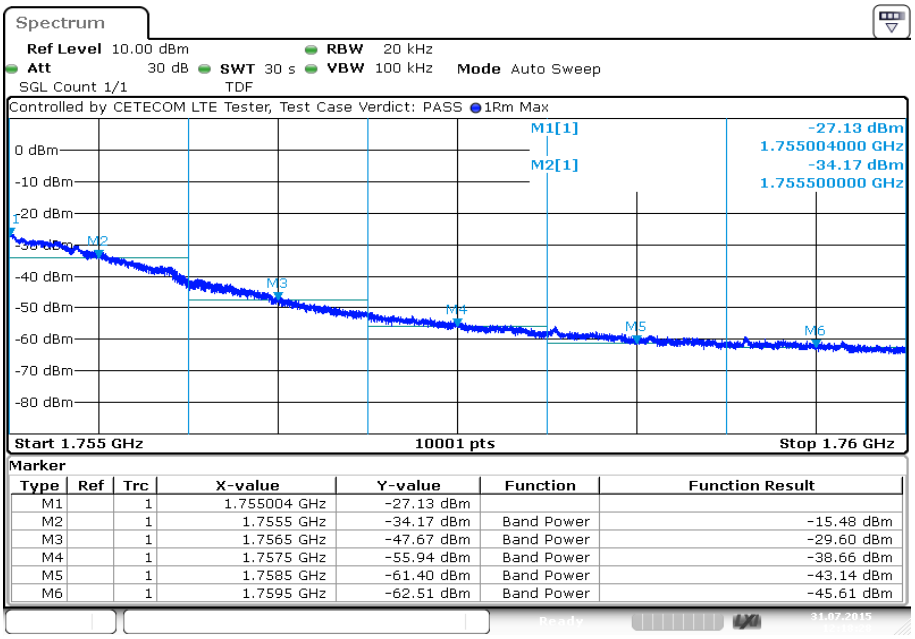
**Plot 4:** Highest channel, 16 – QAM modulation




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.755004 GHz | -27.13 dBm | | |
| M2 | | 1 | 1.7555 GHz | -34.17 dBm | Band Power | -15.48 dBm |
| M3 | | 1 | 1.7565 GHz | -47.67 dBm | Band Power | -29.60 dBm |
| M4 | | 1 | 1.7575 GHz | -55.94 dBm | Band Power | -38.66 dBm |
| M5 | | 1 | 1.7585 GHz | -61.40 dBm | Band Power | -43.14 dBm |
| M6 | | 1 | 1.7595 GHz | -62.51 dBm | Band Power | -45.61 dBm |

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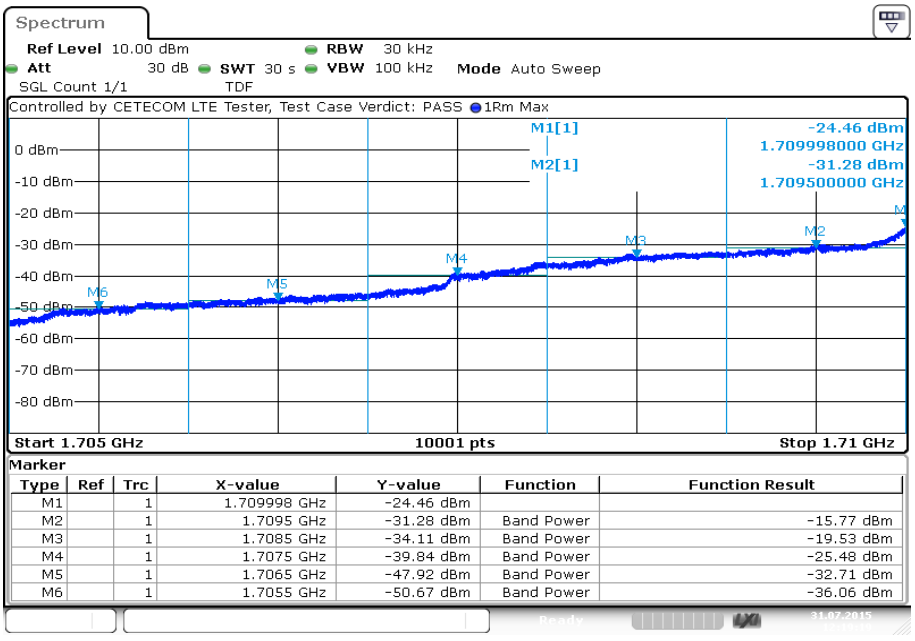
**Results:** **3 MHz channel bandwidth**

**Plot 1:** Lowest channel, QPSK modulation




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.709998 GHz | -24.46 dBm | | |
| M2 | | 1 | 1.7095 GHz | -31.28 dBm | Band Power | -15.77 dBm |
| M3 | | 1 | 1.7085 GHz | -34.11 dBm | Band Power | -19.53 dBm |
| M4 | | 1 | 1.7075 GHz | -39.84 dBm | Band Power | -25.48 dBm |
| M5 | | 1 | 1.7065 GHz | -47.92 dBm | Band Power | -32.71 dBm |
| M6 | | 1 | 1.7055 GHz | -50.67 dBm | Band Power | -36.06 dBm |

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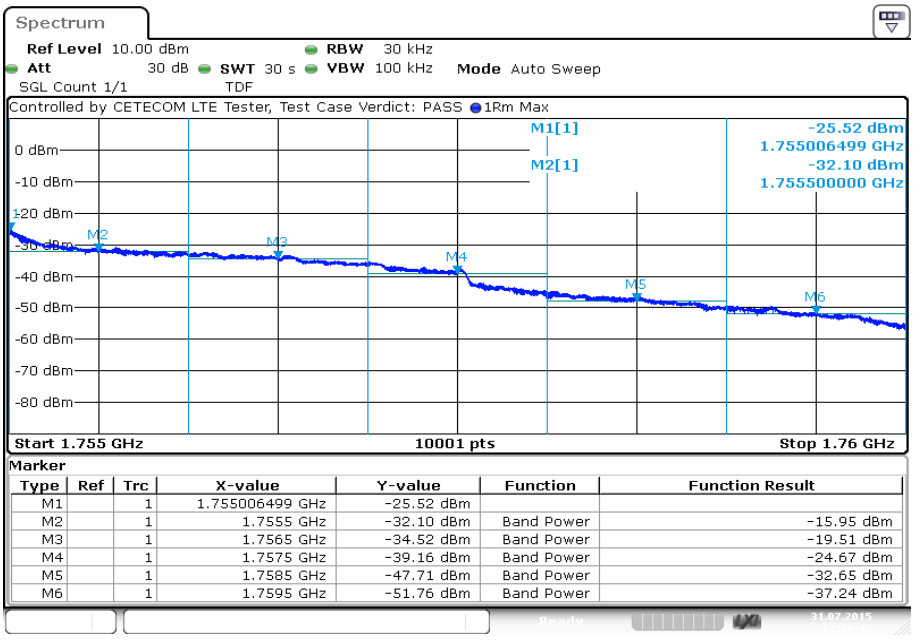
**Plot 2:** Highest channel, QPSK modulation




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.755006499 GHz | -25.52 dBm | | |
| M2 | | 1 | 1.7555 GHz | -32.10 dBm | Band Power | -15.95 dBm |
| M3 | | 1 | 1.7565 GHz | -34.52 dBm | Band Power | -19.51 dBm |
| M4 | | 1 | 1.7575 GHz | -39.16 dBm | Band Power | -24.67 dBm |
| M5 | | 1 | 1.7585 GHz | -47.71 dBm | Band Power | -32.65 dBm |
| M6 | | 1 | 1.7595 GHz | -51.76 dBm | Band Power | -37.24 dBm |

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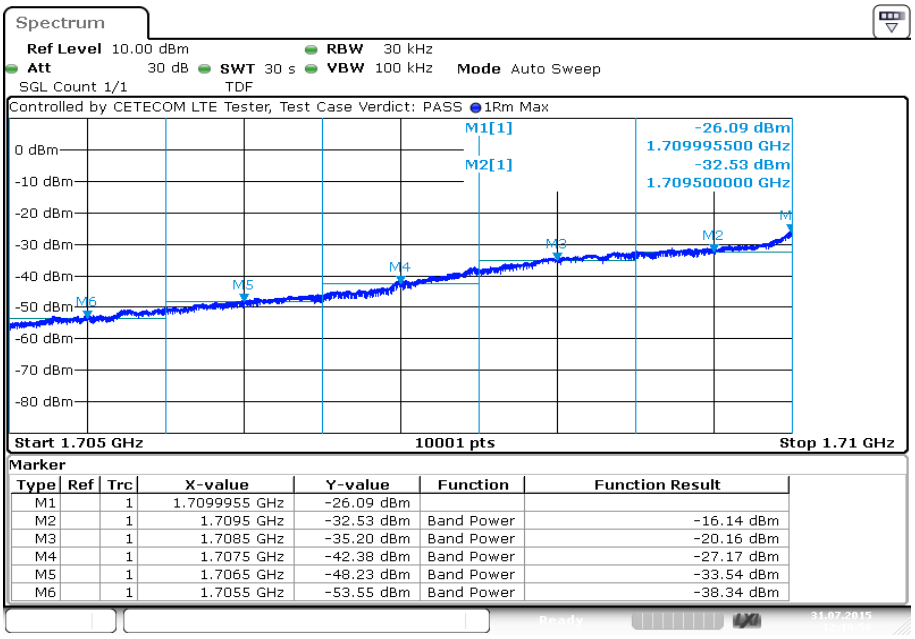
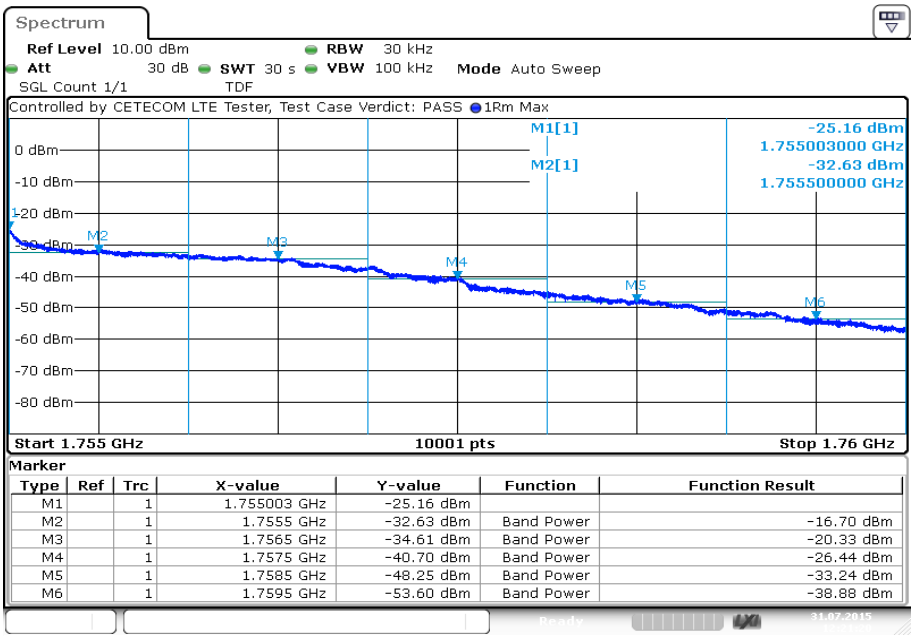
**Plot 3:** Lowest channel, 16 – QAM modulation




Date: 31.JUL.2015 12:19:56

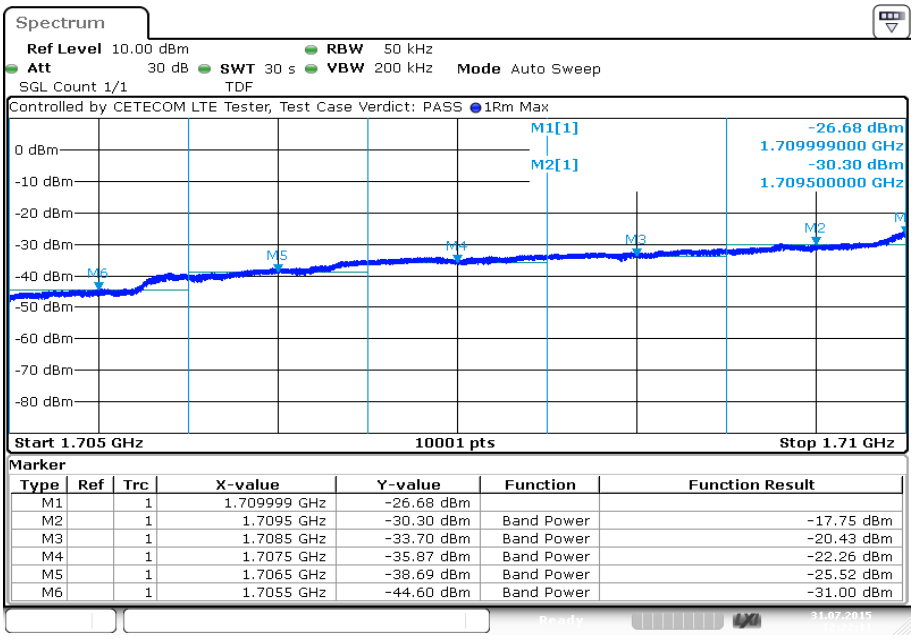
**Plot 4:** Highest channel, 16 – QAM modulation




Date: 31.JUL.2015 12:21:20

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

**Plot 1:** Lowest channel, QPSK modulation




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.709999 GHz | -26.68 dBm | | |
| M2 | | 1 | 1.7095 GHz | -30.30 dBm | Band Power | -17.75 dBm |
| M3 | | 1 | 1.7085 GHz | -33.70 dBm | Band Power | -20.43 dBm |
| M4 | | 1 | 1.7075 GHz | -35.87 dBm | Band Power | -22.26 dBm |
| M5 | | 1 | 1.7065 GHz | -38.69 dBm | Band Power | -25.52 dBm |
| M6 | | 1 | 1.7055 GHz | -44.60 dBm | Band Power | -31.00 dBm |

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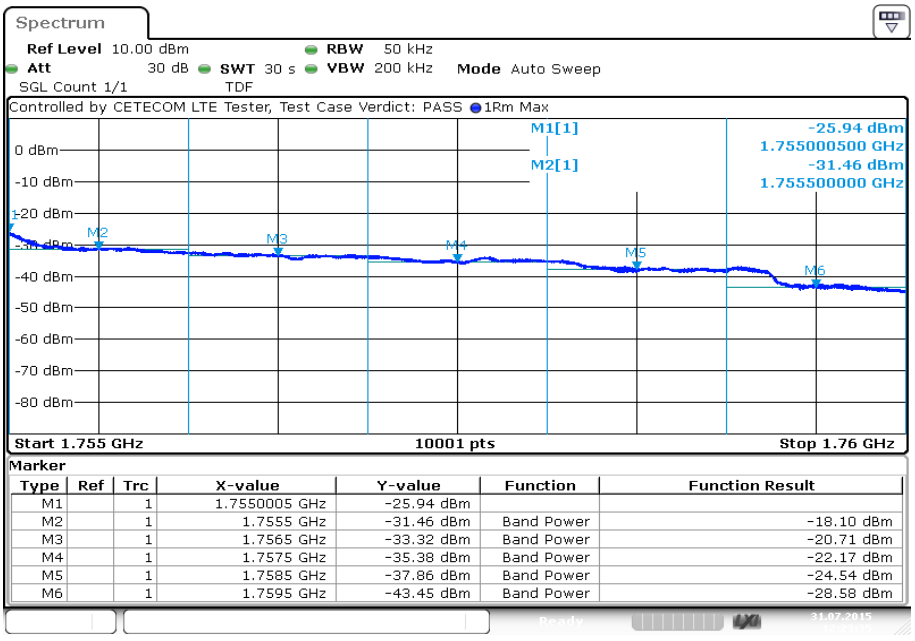
**Plot 2:** Highest channel, QPSK modulation




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.7550005 GHz | -25.94 dBm | | |
| M2 | | 1 | 1.7555 GHz | -31.46 dBm | Band Power | -18.10 dBm |
| M3 | | 1 | 1.7565 GHz | -33.32 dBm | Band Power | -20.71 dBm |
| M4 | | 1 | 1.7575 GHz | -35.38 dBm | Band Power | -22.17 dBm |
| M5 | | 1 | 1.7585 GHz | -37.86 dBm | Band Power | -24.54 dBm |
| M6 | | 1 | 1.7595 GHz | -43.45 dBm | Band Power | -28.58 dBm |

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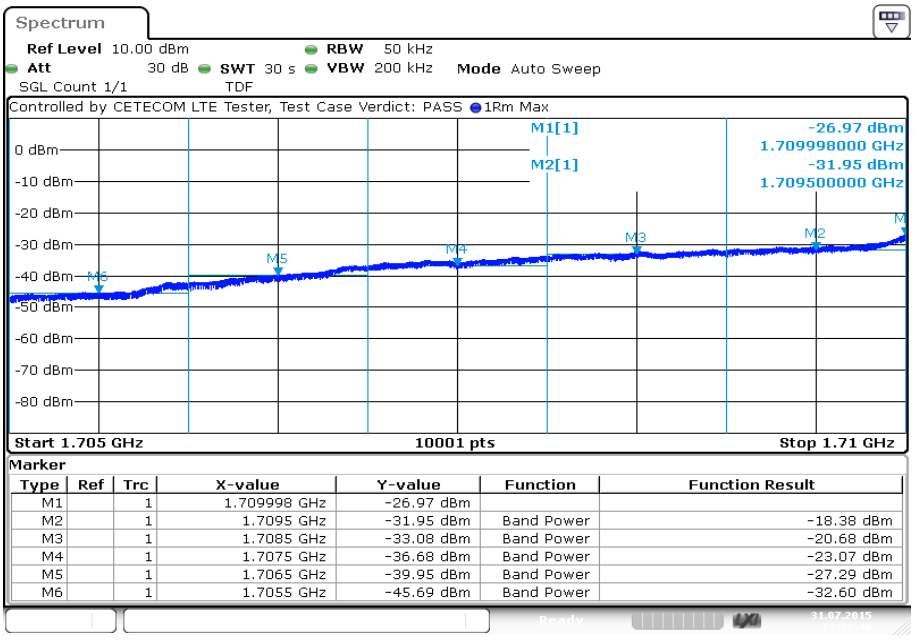
**Plot 3:** Lowest channel, 16 – QAM modulation

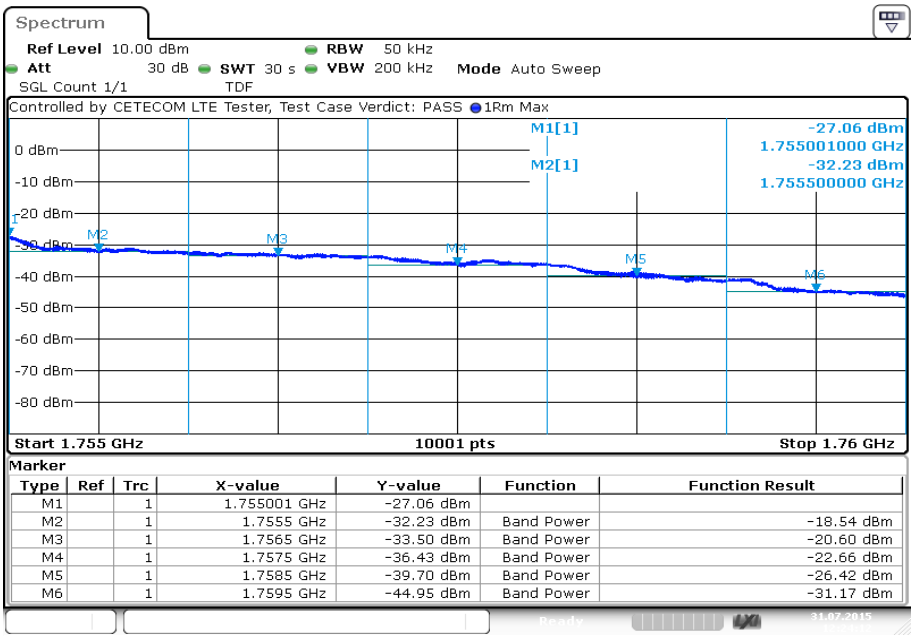



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.709998 GHz | -26.97 dBm | | |
| M2 | | 1 | 1.7095 GHz | -31.95 dBm | Band Power | -18.38 dBm |
| M3 | | 1 | 1.7085 GHz | -33.08 dBm | Band Power | -20.68 dBm |
| M4 | | 1 | 1.7075 GHz | -36.68 dBm | Band Power | -23.07 dBm |
| M5 | | 1 | 1.7065 GHz | -39.95 dBm | Band Power | -27.29 dBm |
| M6 | | 1 | 1.7055 GHz | -45.69 dBm | Band Power | -32.60 dBm |

Date: 31.JUL.2015 12:22:48

**Plot 4:** Highest channel, 16 – QAM modulation



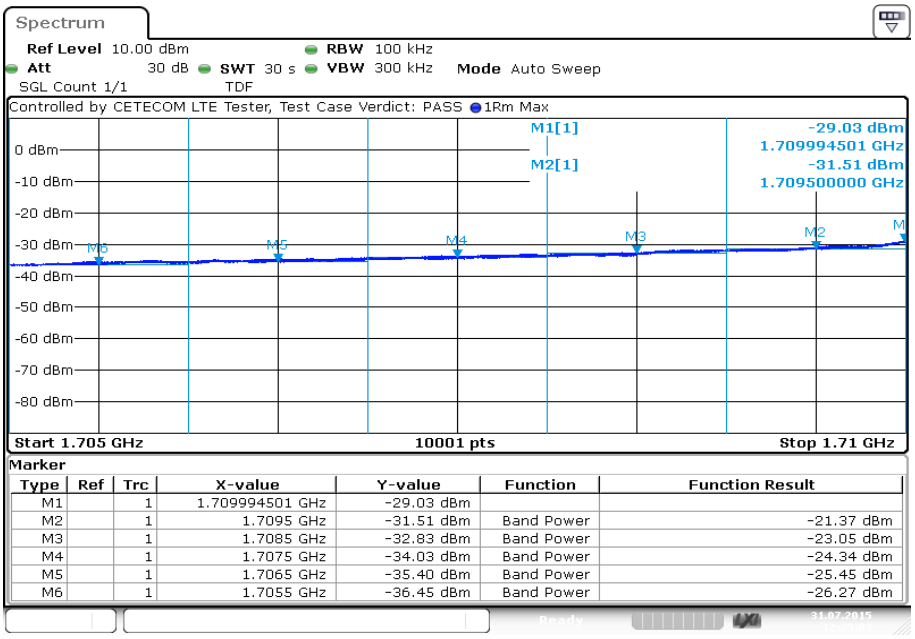

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.755001 GHz | -27.06 dBm | | |
| M2 | | 1 | 1.7555 GHz | -32.23 dBm | Band Power | -18.54 dBm |
| M3 | | 1 | 1.7565 GHz | -33.50 dBm | Band Power | -20.60 dBm |
| M4 | | 1 | 1.7575 GHz | -36.43 dBm | Band Power | -22.66 dBm |
| M5 | | 1 | 1.7585 GHz | -39.70 dBm | Band Power | -26.42 dBm |
| M6 | | 1 | 1.7595 GHz | -44.95 dBm | Band Power | -31.17 dBm |

Date: 31.JUL.2015 12:24:12

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

**Plot 1:** Lowest channel, QPSK modulation

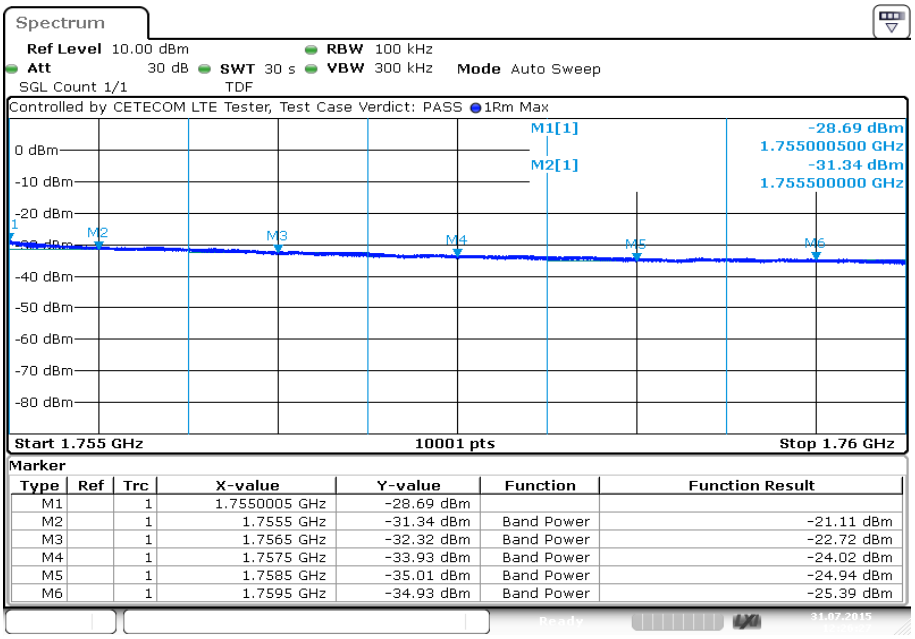



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.709994501 GHz | -29.03 dBm | | |
| M2 | | 1 | 1.7095 GHz | -31.51 dBm | Band Power | -21.37 dBm |
| M3 | | 1 | 1.7085 GHz | -32.83 dBm | Band Power | -23.05 dBm |
| M4 | | 1 | 1.7075 GHz | -34.03 dBm | Band Power | -24.34 dBm |
| M5 | | 1 | 1.7065 GHz | -35.40 dBm | Band Power | -25.45 dBm |
| M6 | | 1 | 1.7055 GHz | -36.45 dBm | Band Power | -26.27 dBm |

Date: 31.JUL.2015 12:25:03

**Plot 2:** Highest channel, QPSK modulation

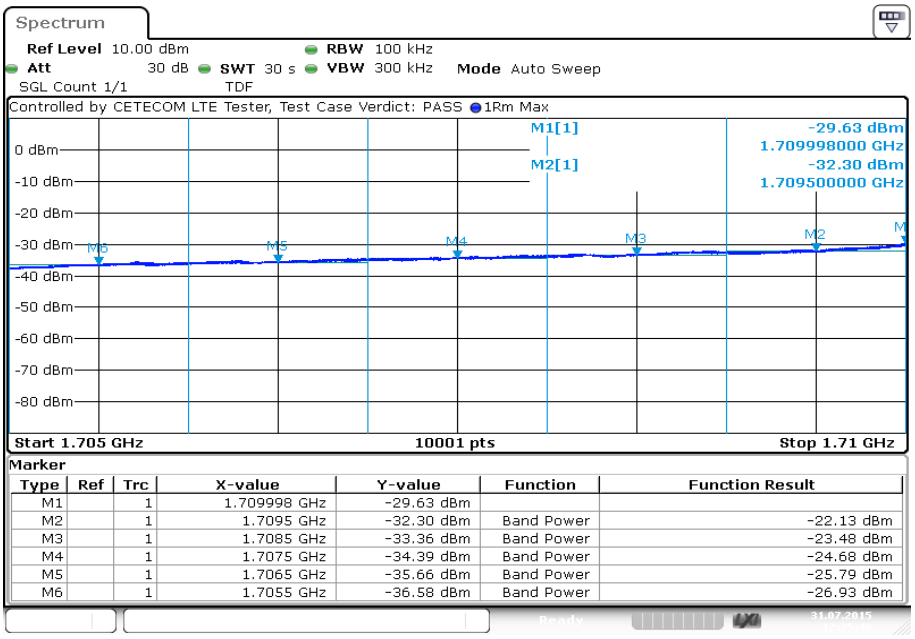



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.7550005 GHz | -28.69 dBm | | |
| M2 | | 1 | 1.7555 GHz | -31.34 dBm | Band Power | -21.11 dBm |
| M3 | | 1 | 1.7565 GHz | -32.32 dBm | Band Power | -22.72 dBm |
| M4 | | 1 | 1.7575 GHz | -33.93 dBm | Band Power | -24.02 dBm |
| M5 | | 1 | 1.7585 GHz | -35.01 dBm | Band Power | -24.94 dBm |
| M6 | | 1 | 1.7595 GHz | -34.93 dBm | Band Power | -25.39 dBm |

Date: 31.JUL.2015 12:26:27

**Plot 3:** Lowest channel, 16 – QAM modulation

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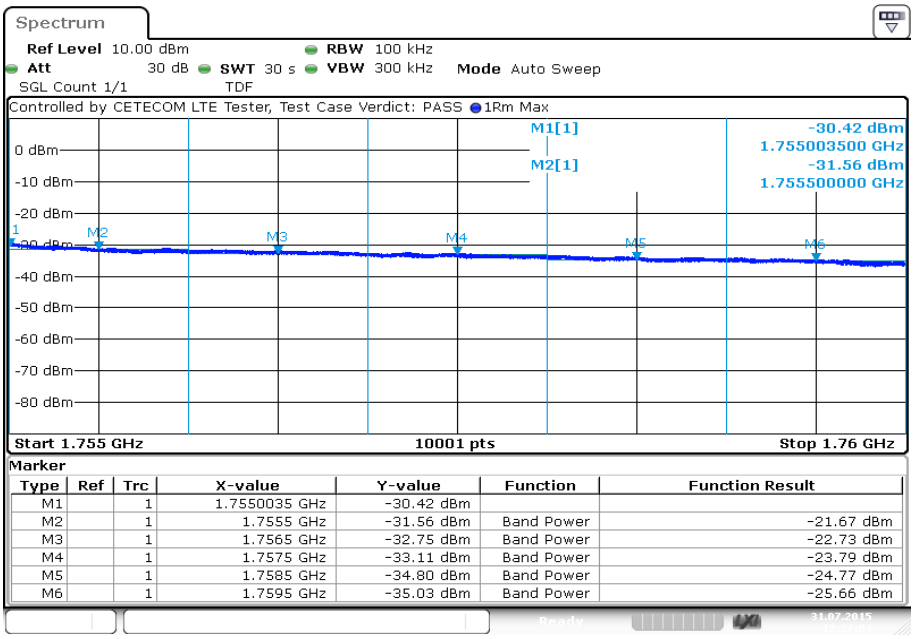
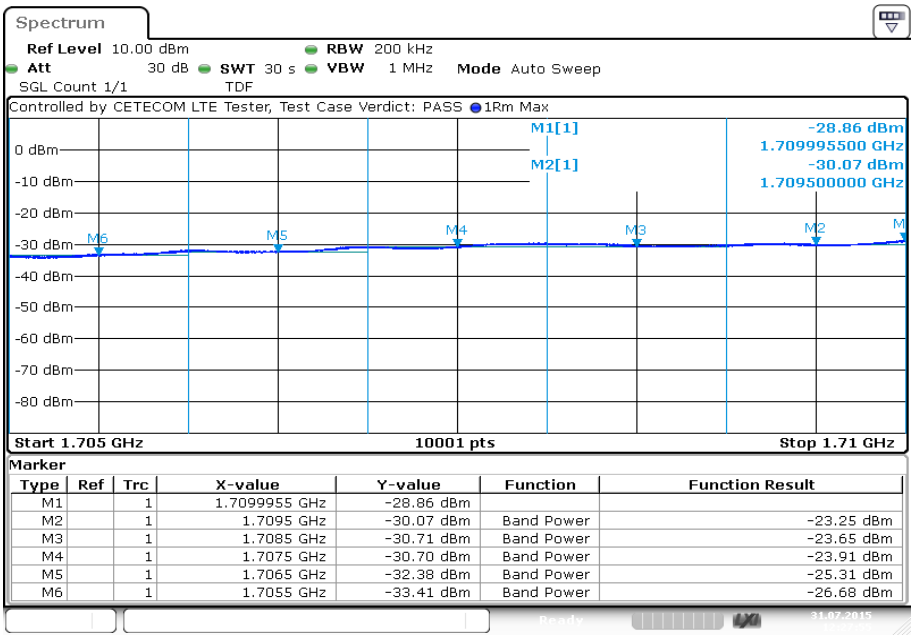
**Plot 4:** Highest channel, 16 – QAM modulation




Date: 31.JUL.2015 12:27:04

**Results:** **15 MHz channel bandwidth**

**Plot 1:** Lowest channel, QPSK modulation

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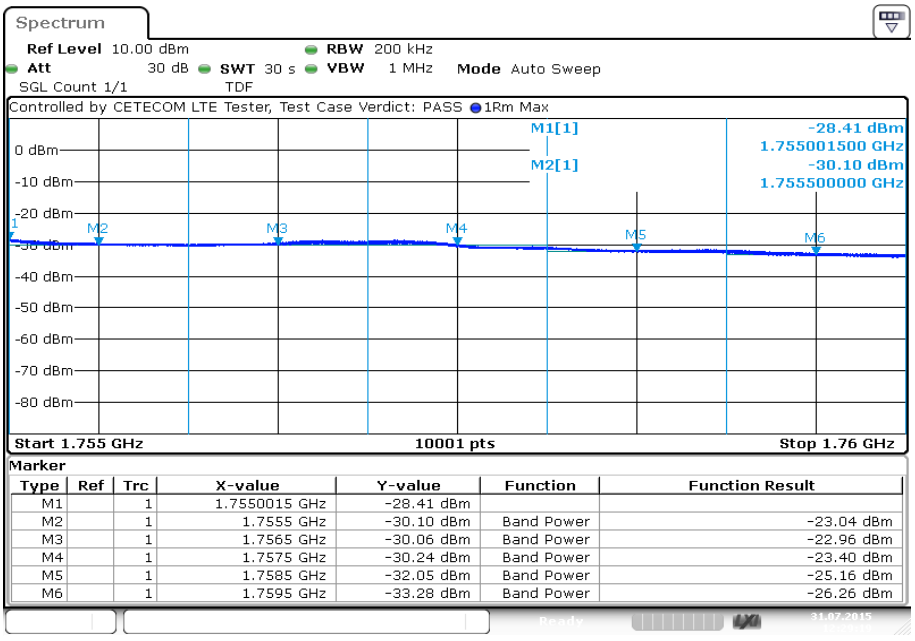
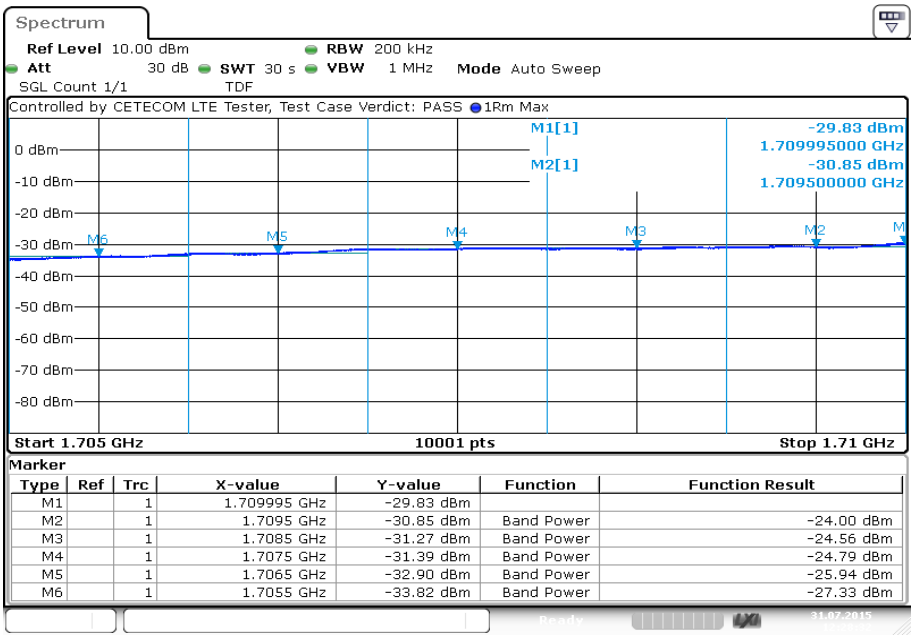
**Plot 2:** Highest channel, QPSK modulation




Date: 31.JUL.2015 12:29:19

**Plot 3:** Lowest channel, 16 – QAM modulation

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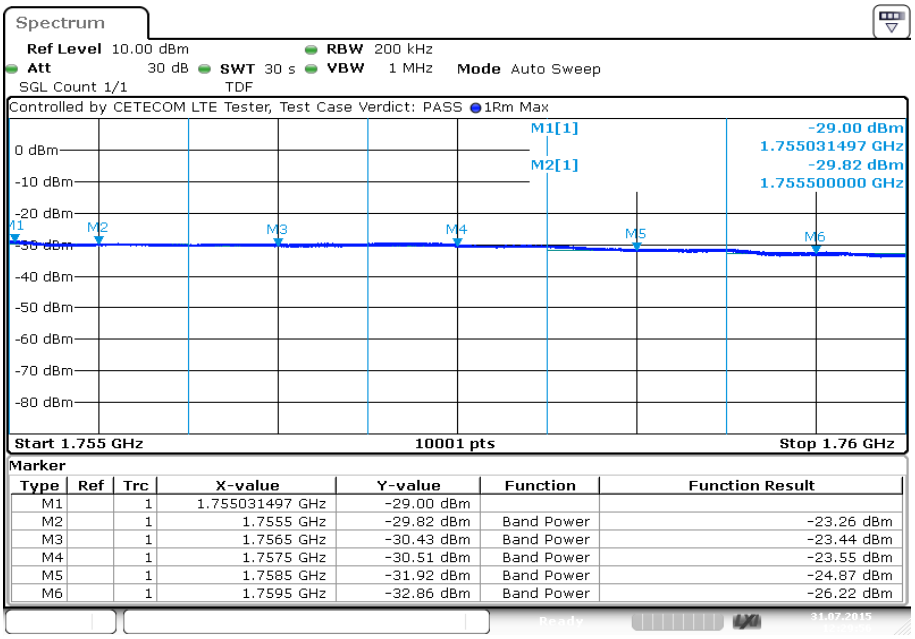
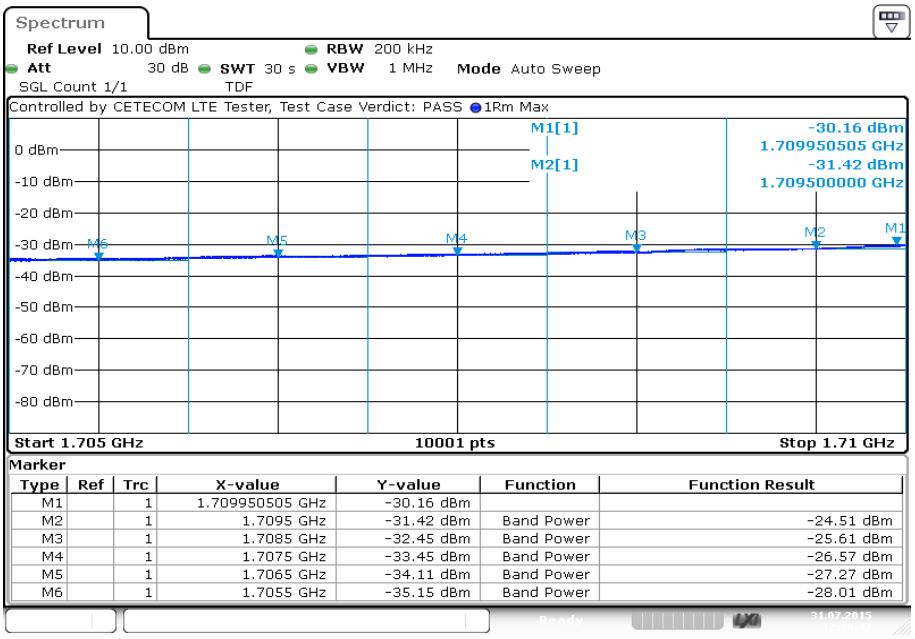
**Plot 4:** Highest channel, 16 – QAM modulation




Date: 31.JUL.2015 12:29:56

**Results:** **20 MHz channel bandwidth**

**Plot 1:** Lowest channel, QPSK modulation

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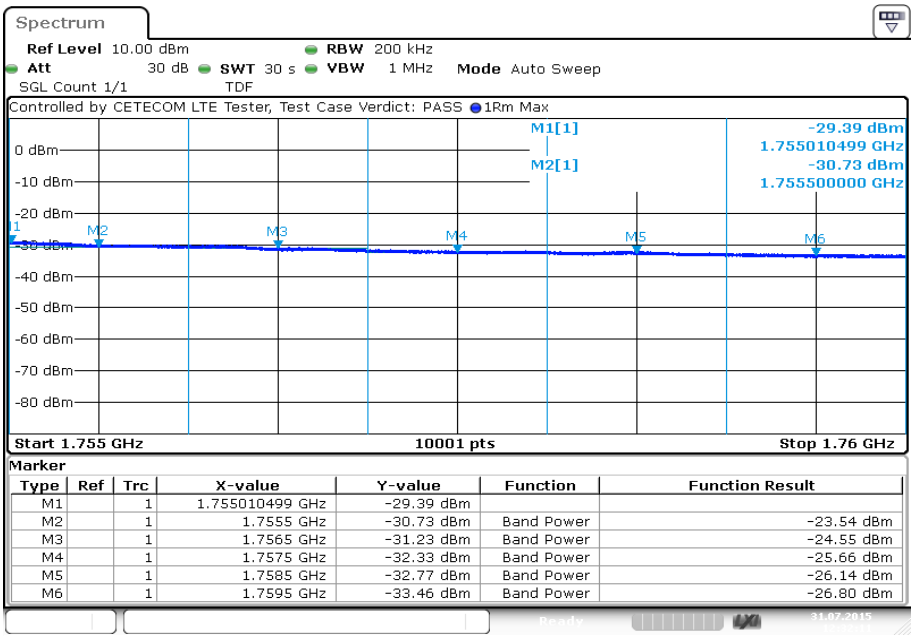
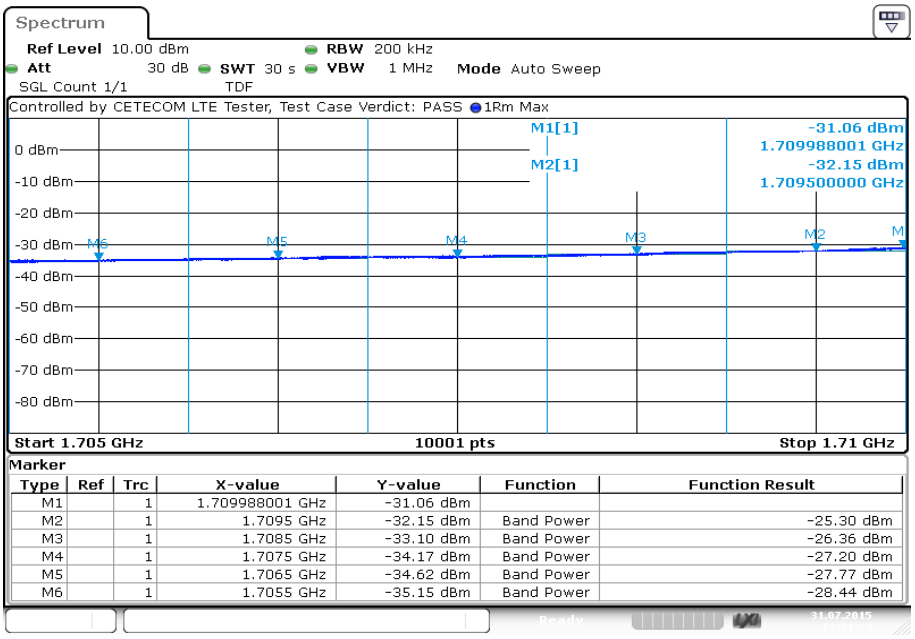
**Plot 2:** Highest channel, QPSK modulation




Date: 31.JUL.2015 12:32:11

**Plot 3:** Lowest channel, 16 – QAM modulation

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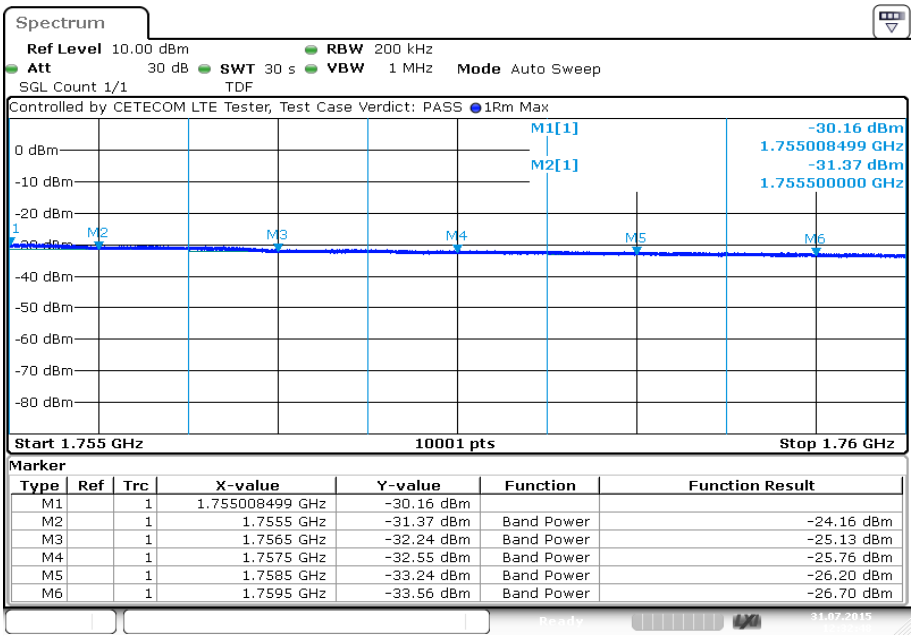
**Plot 4:** Highest channel, 16 – QAM modulation




Date: 31.JUL.2015 12:32:48

**Verdict:** compliant

## 11.2.6 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 mid frequencies of the LTE band 4 frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 27.53 requires a measurement bandwidth of at least 1% of the occupied bandwidth.

| 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 |
|---|---|
| Occupied Bandwidth | |
| Spectrum must fall completely in the specified band | |

**Results:**

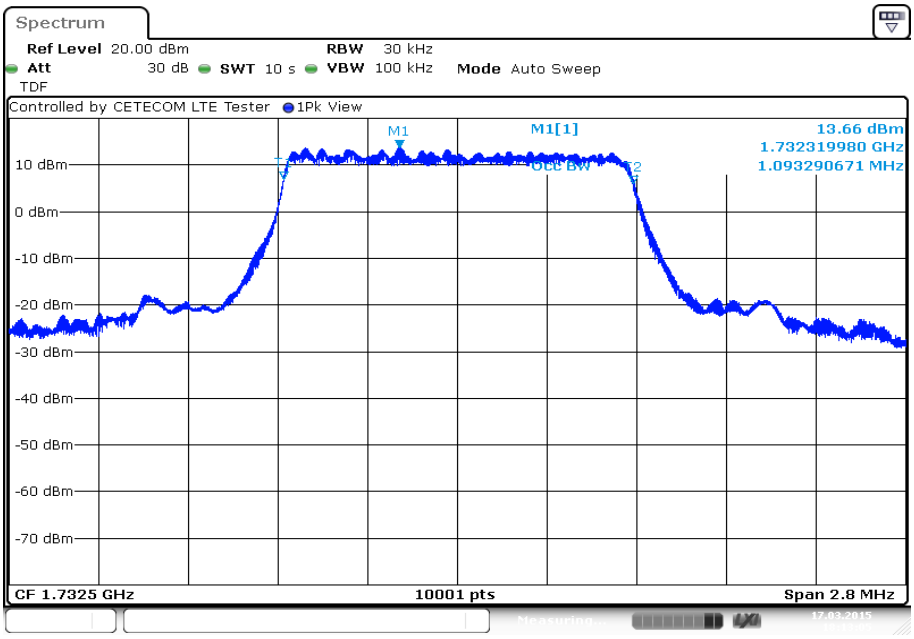
| Occupied Bandwidth - QPSK | | |
|---|---|---|
| **Bandwidth [MHz]** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| **1.4** | 1093 | 1304 |
| **3** | 2741 | 3129 |
| **5** | 4512 | 5106 |
| **10** | 9057 | 10195 |
| **15** | 13424 | 14897 |
| **20** | 17938 | 19870 |
| Measurement uncertainty | ± 100 kHz | |

| Occupied Bandwidth – 16-QAM | | |
|---|---|---|
| **Bandwidth [MHz]** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| **1.4** | 1100 | 1318 |
| **3** | 2739 | 3150 |
| **5** | 4500 | 5034 |
| **10** | 9057 | 10087 |
| **15** | 13427 | 14909 |
| **20** | 17946 | 19966 |
| Measurement uncertainty | ± 100 kHz | |

**Verdict:** **compliant**

## Plots: QPSK

**Plot 1:** 1.4 MHz, 99% OBW

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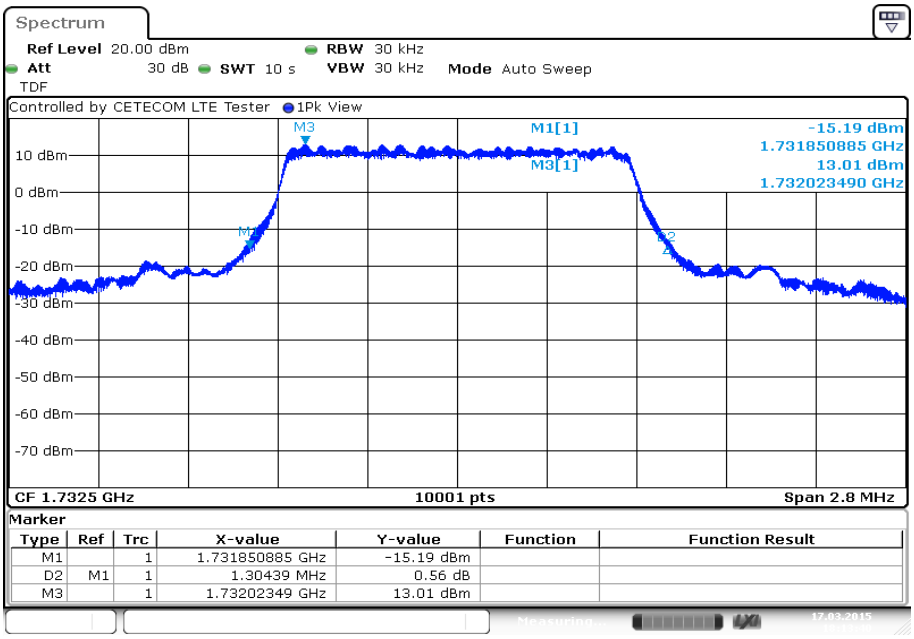
**Plot 2:** 1.4 MHz, -26 dBc OBW

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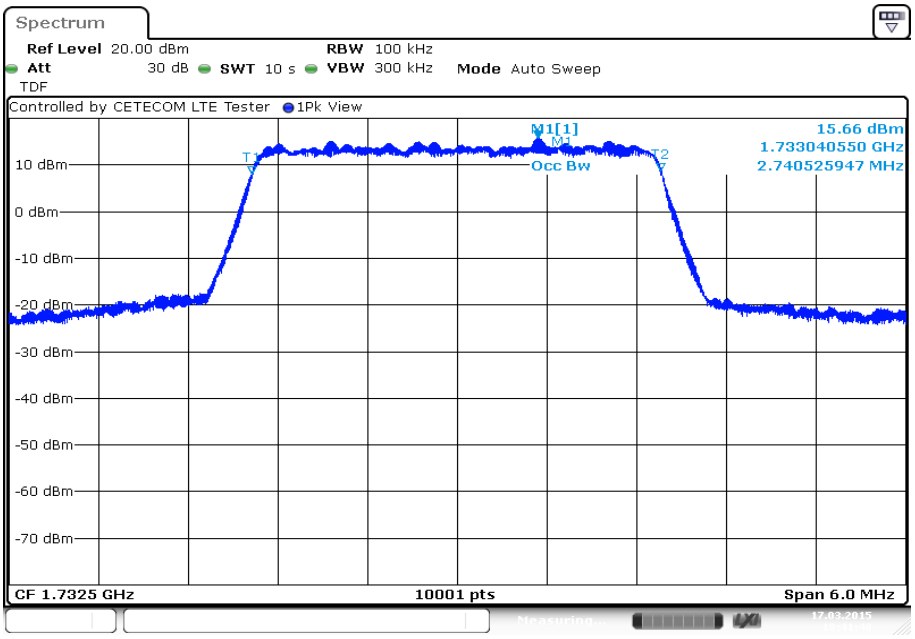
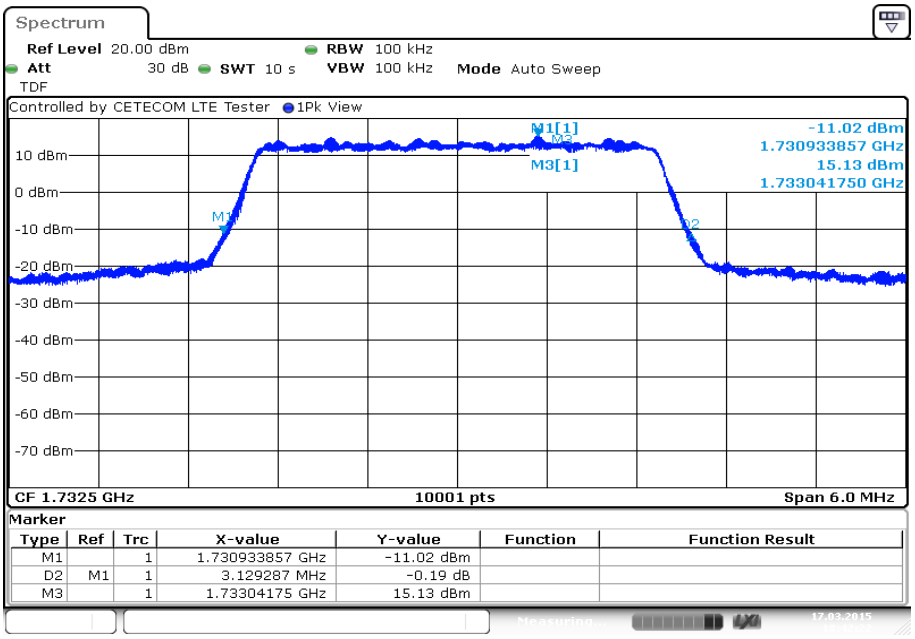
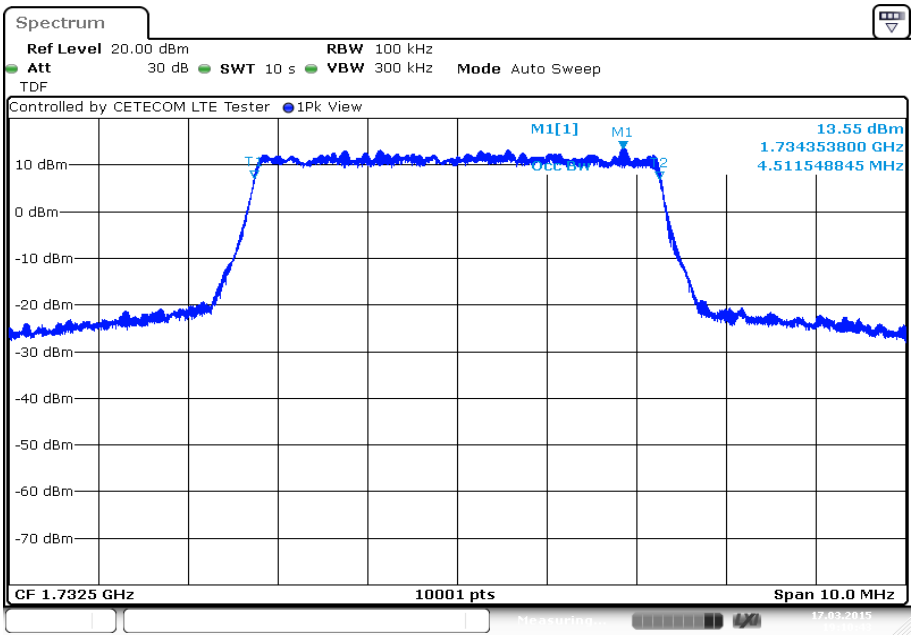
**Plot 3:** 3 MHz, 99% OBW



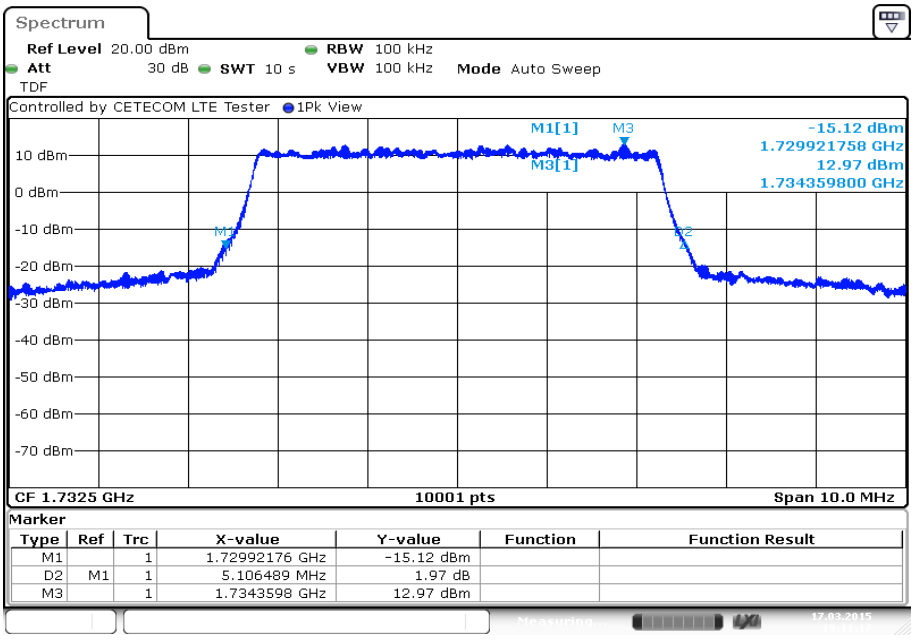

**Plot 4:** 3 MHz, -26 dBc OBW



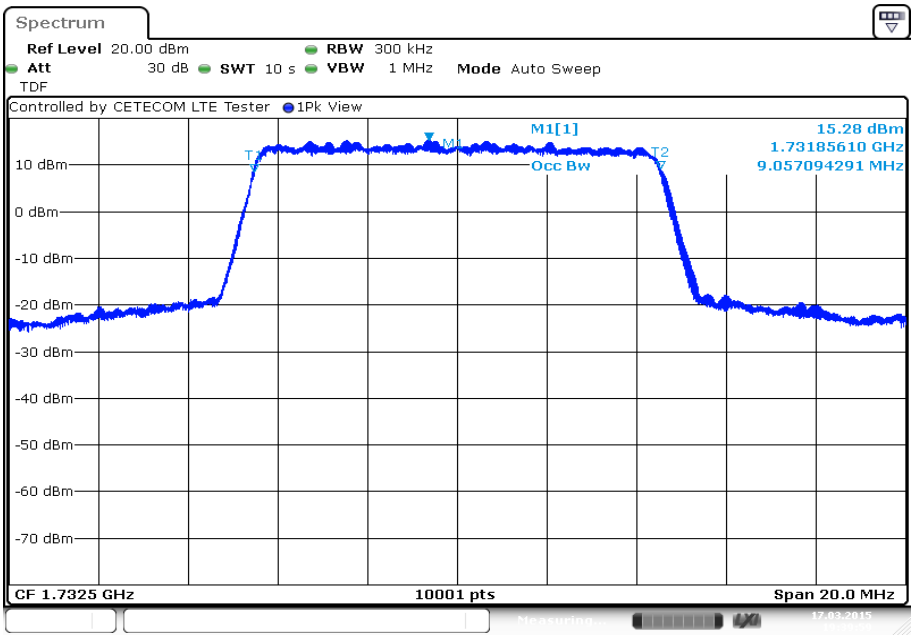
**Plot 5:** 5 MHz, 99% OBW



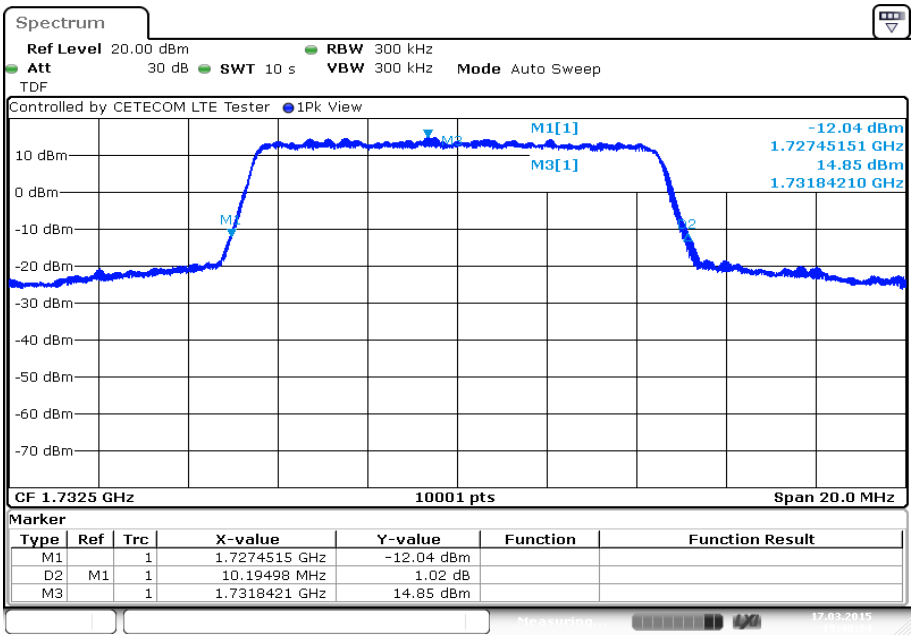

**Plot 6:** 5 MHz, -26 dBc OBW



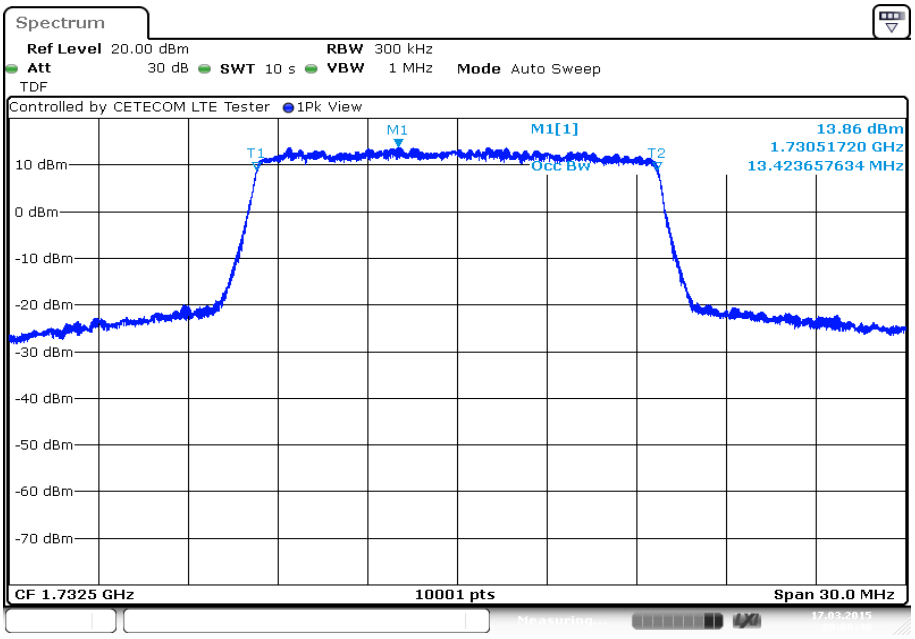
**Plot 7:** 10 MHz, 99% OBW



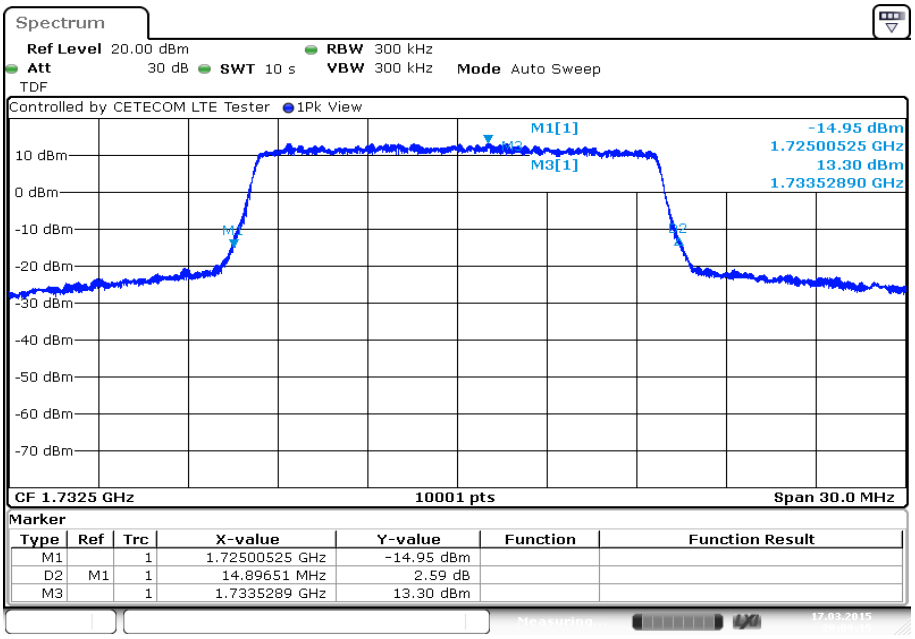

**Plot 8:** 10 MHz, -26 dBc OBW



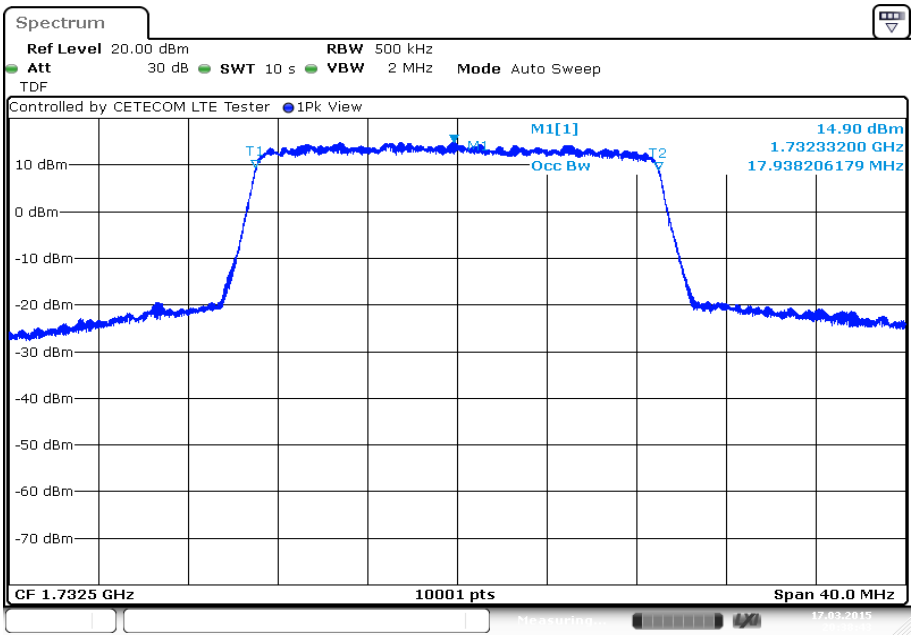
**Plot 9:** 15 MHz, 99% OBW




**Plot 10:** 15 MHz, -26 dBc OBW



**Plot 11:** 20 MHz, 99% OBW

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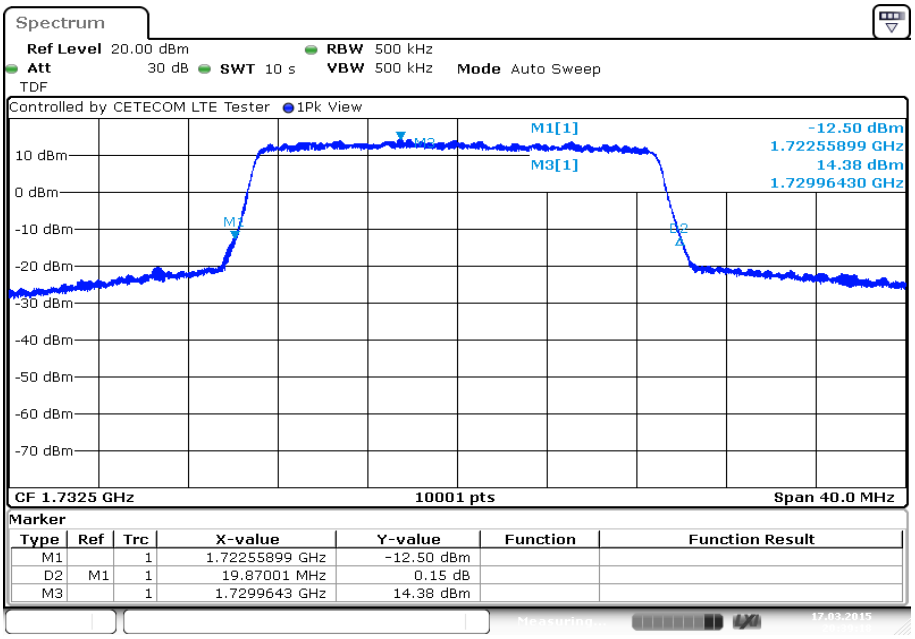
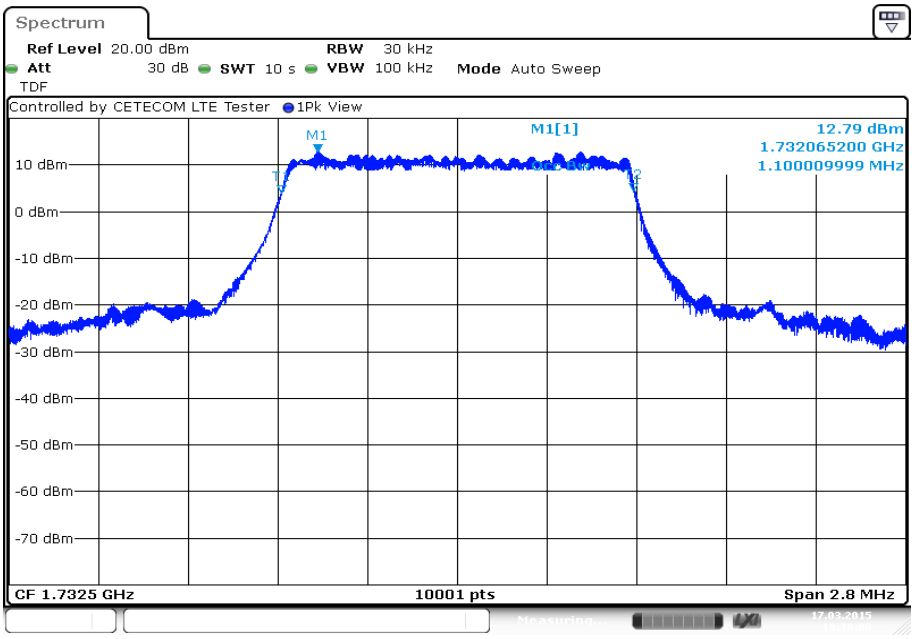
**Plot 12:** 20 MHz, -26 dBc OBW




Date: 17.MAR.2015 20:39:18

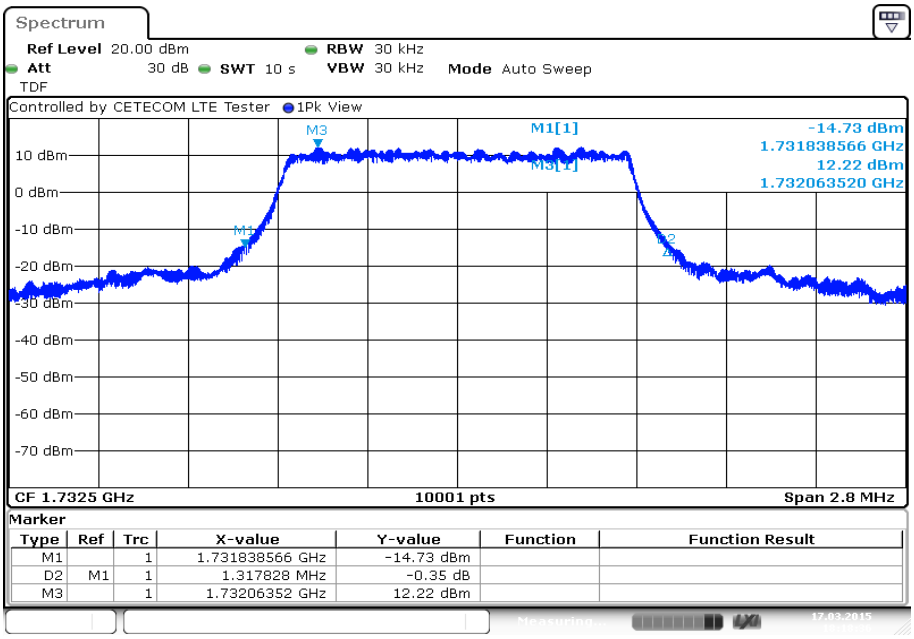
## Plots: 16-QAM

**Plot 1:** 1.4 MHz, 99% OBW



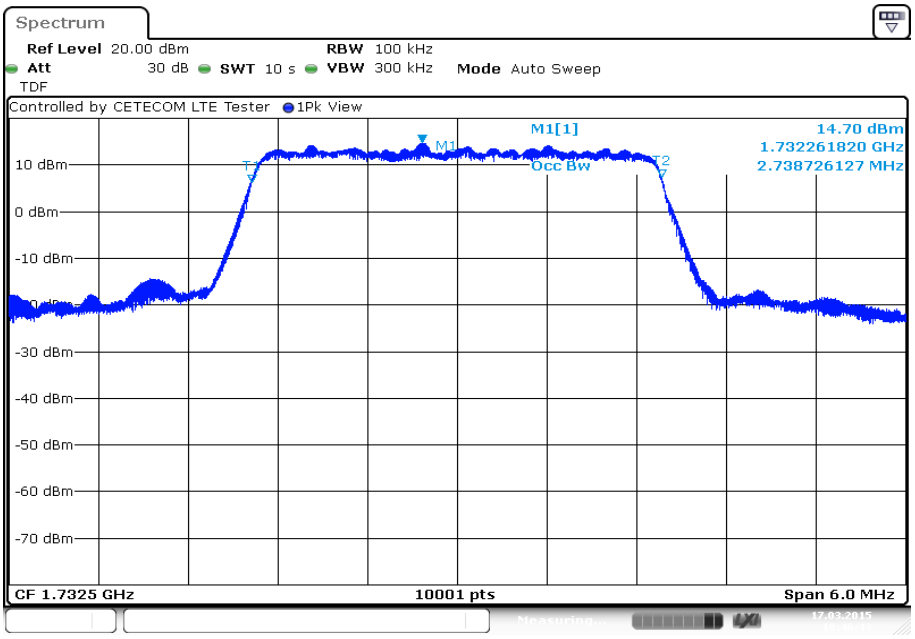

Date: 17.MAR.2015 18:18:01

**Plot 2:** 1.4 MHz, -26 dBc OBW




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

**Plot 3:** 3 MHz, 99% OBW

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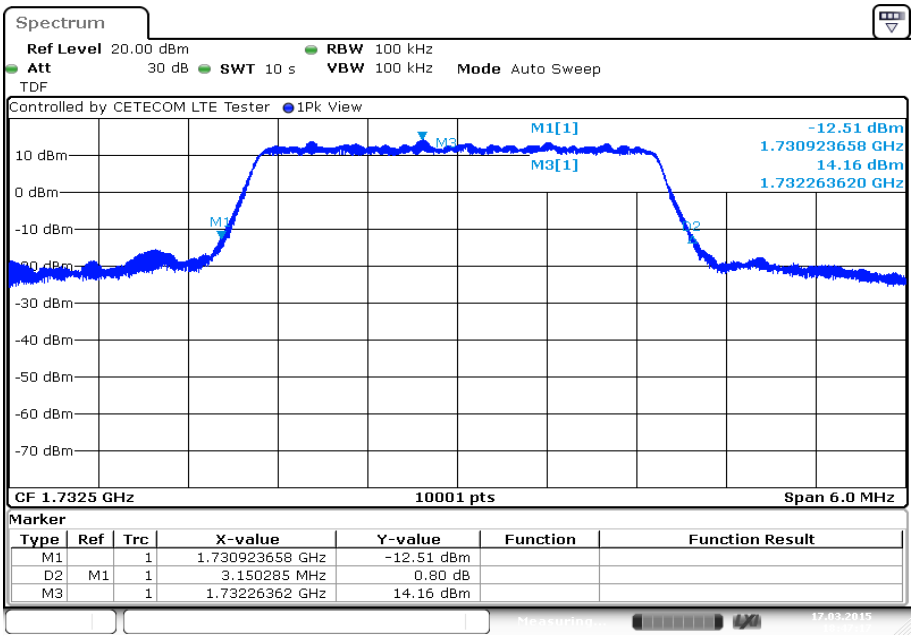
**Plot 4:** 3 MHz, -26 dBc OBW

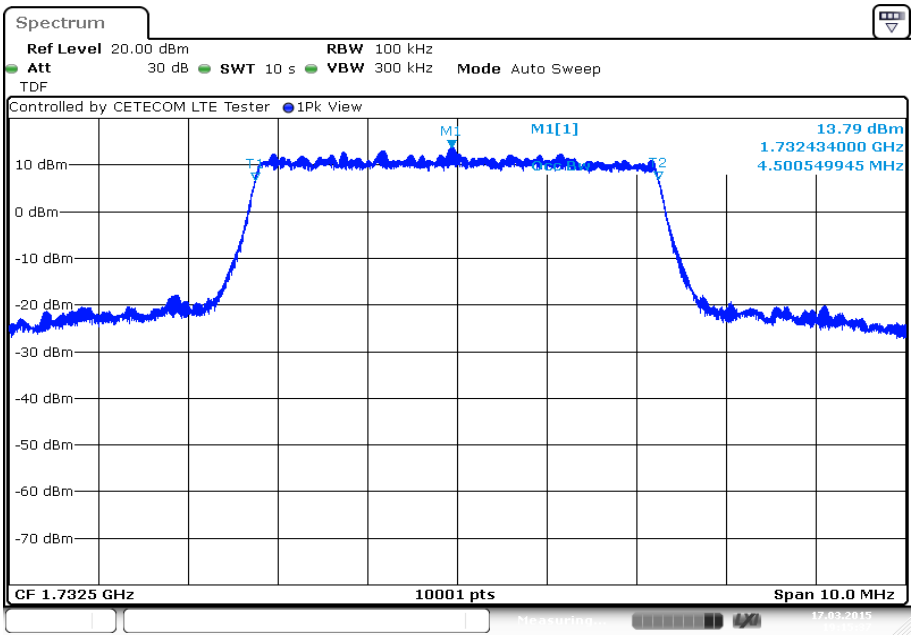



Marker

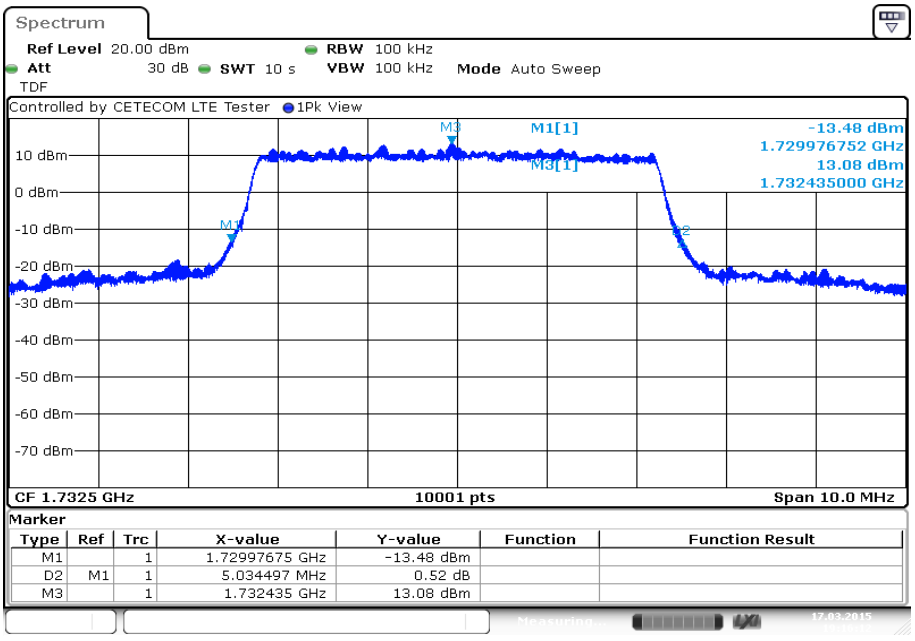
| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.730923658 GHz | -12.51 dBm | | |
| D2 | M1 | 1 | 3.150285 MHz | 0.80 dB | | |
| M3 | | 1 | 1.73226362 GHz | 14.16 dBm | | |

Date: 17.MAR.2015 18:47:18

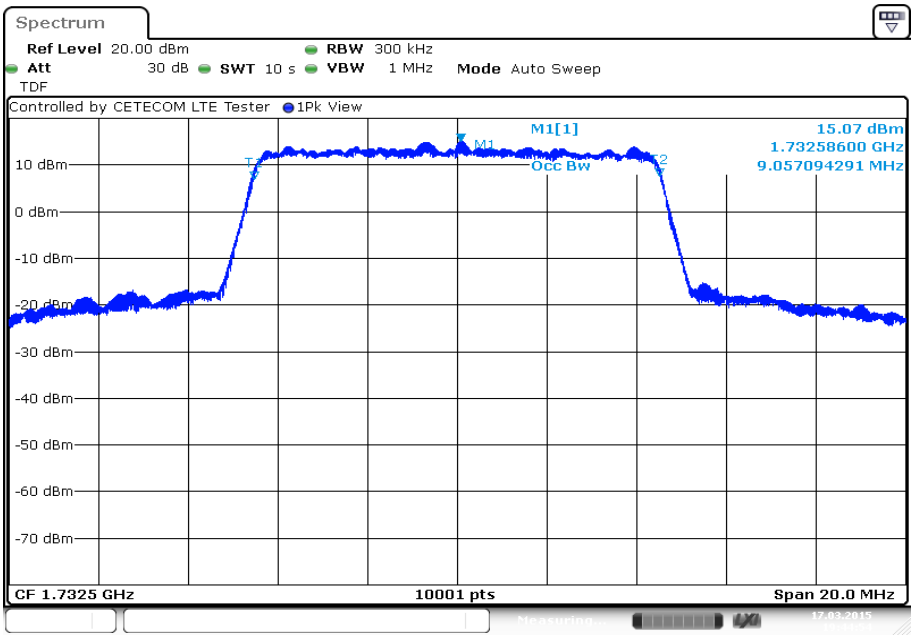
**Plot 5:** 5 MHz, 99% OBW




**Plot 6:** 5 MHz, -26 dBc OBW



**Plot 7:** 10 MHz, 99% OBW

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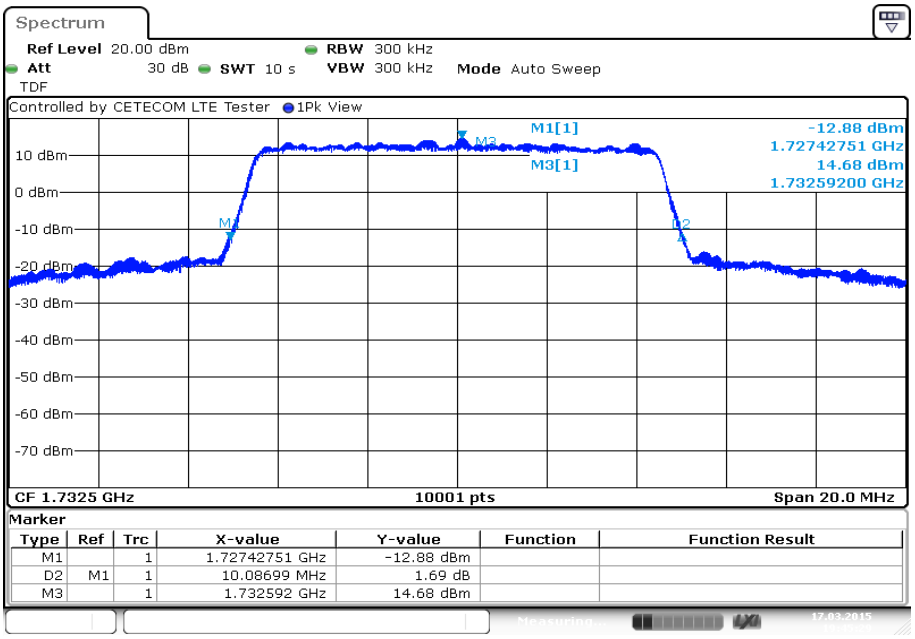
**Plot 8:** 10 MHz, -26 dBc OBW

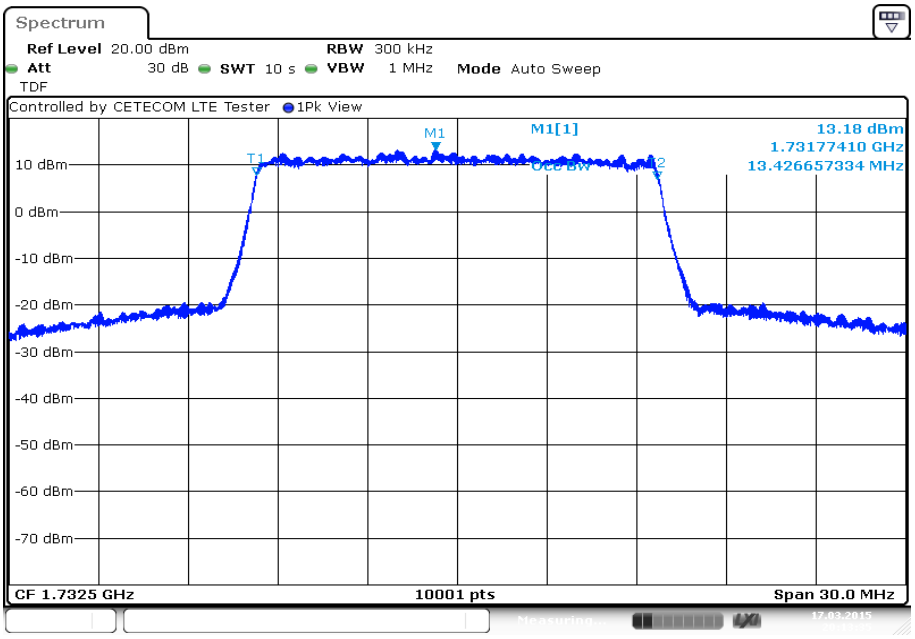



Marker

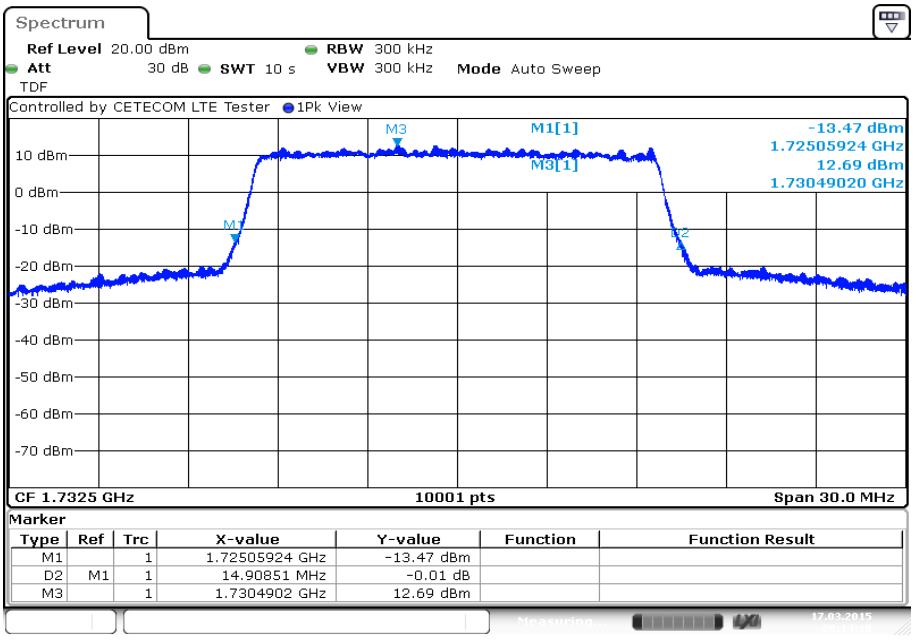
| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 1.72742751 GHz | -12.88 dBm | | |
| D2 | M1 | 1 | 10.08699 MHz | 1.69 dB | | |
| M3 | | 1 | 1.732592 GHz | 14.68 dBm | | |

Date: 17.MAR.2015 19:45:29

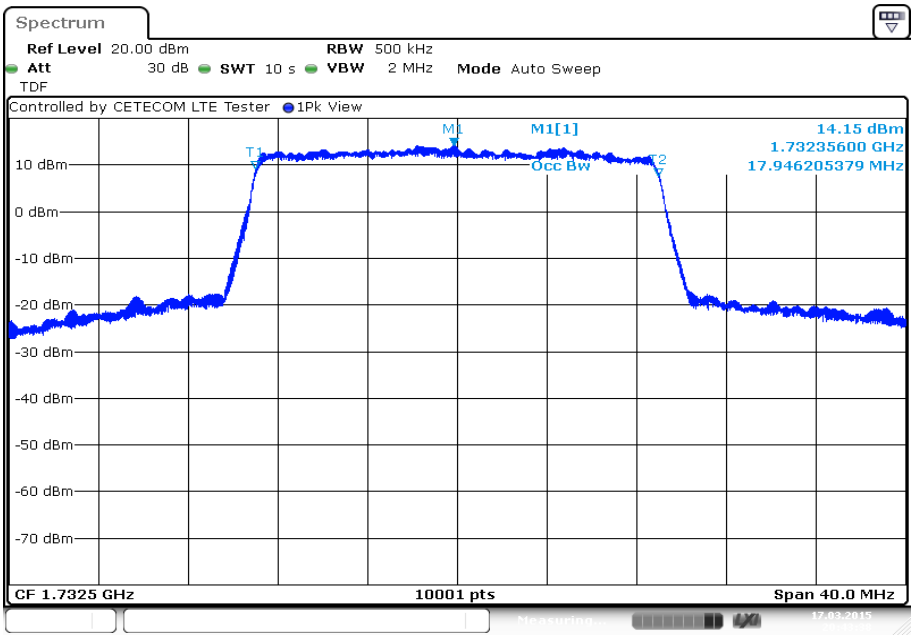
**Plot 9:** 15 MHz, 99% OBW




**Plot 10:** 15 MHz, -26 dBc OBW



**Plot 11:** 20 MHz, 99% OBW




**Plot 12:** 20 MHz, -26 dBc OBW