



Test report No:  
NIE: 66136RRF.002

## Test Report

Reference Standard:  
USA FCC Part 27  
CANADA RSS-130, RSS-139

|                                           |                                                                                                                                                                                                                   |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (*) Identification of item tested         | LTE Wireless module                                                                                                                                                                                               |
| (*) Trademark                             | Telit                                                                                                                                                                                                             |
| (*) Model and /or type reference          | LE910C1-SAX                                                                                                                                                                                                       |
| Other identification of the product       | HW version: 1.10<br>SW version: M0F.313002<br>FCC ID: R17LE910CXSAX<br>IC: 5131A-LE910CXSAX                                                                                                                       |
| (*) Features                              | GNSS, Audio: VoLTE                                                                                                                                                                                                |
| Applicant                                 | Telit Wireless Solutions Co., LTD<br>13th Fl., Shinyoung Securities Bld, 6, Gukjegeumyung-ro<br>8-gil, Yeongdeungpo-gu, Seoul, 07330, South Korea                                                                 |
| Test method requested, standard           | USA FCC Part 27 (10-1-19 Edition).<br>CANADA RSS-130 Issue 2, Feb. 2019.<br>CANADA RSS-139 Issue 3, Jul. 2015.<br>ANSI C63.26: 2015.<br>KDB 971168 D01 Power Meas License Digital Systems<br>v03r01, April. 2018. |
| Summary                                   | IN COMPLIANCE                                                                                                                                                                                                     |
| Approved by (name / position & signature) | José Carlos Luque<br>RF Lab. Supervisor                                                                                                                                                                           |
| Date of issue                             | 2020-11-05                                                                                                                                                                                                        |
| Report template No                        | FDT08_22<br>(*) "Data provided by the client"                                                                                                                                                                     |

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## Competences and guarantees

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DEKRA Testing and Certification S.A.U. is a testing laboratory competent to carry out the tests described in this report.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

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## General conditions

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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## Uncertainty

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Uncertainty (factor  $k=2$ ) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

## Data provided by the client

---

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model LE910C1-SAX is a LTE Wireless module with LTE Cat.1; LTE bands: FDD B2, B4, B12, B66; Data Capability: LTE CAT1 10/5 Mb.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

## Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

| Control N° | Description         | Model       | Serial N° | Date of reception |
|------------|---------------------|-------------|-----------|-------------------|
| 66136/011  | LTE Wireless module | LE910C1-SAX | --        | 2020/09/23        |
| 66136/017  | Antenna             | --          | --        | 2020/09/23        |
| 66136/018  | Antenna             | --          | --        | 2020/09/23        |
| 66136/020  | Antenna             | --          | --        | 2020/09/23        |

Auxiliary elements used with the Sample S/01:

| Control N° | Description    | Model | Serial N° | Date of reception |
|------------|----------------|-------|-----------|-------------------|
| 66136/012  | Cradle         | --    | --        | 2020/09/23        |
| 66136/026  | Power Cable DC | --    | --        | 2020/09/23        |

Sample S/01 has undergone the following test(s): The Radiated tests indicated in Appendix A.

- Sample S/02 is composed of the following elements:

| Control N° | Description         | Model       | Serial N° | Date of reception |
|------------|---------------------|-------------|-----------|-------------------|
| 66136/011  | LTE Wireless module | LE910C1-SAX | --        | 2020/09/23        |

Auxiliary elements used with the Sample S/01:

| Control N° | Description    | Model | Serial N° | Date of reception |
|------------|----------------|-------|-----------|-------------------|
| 66136/012  | Cradle         | --    | --        | 2020/09/23        |
| 66136/026  | Power Cable DC | --    | --        | 2020/09/23        |

Sample S/02 has undergone the following test(s): The Conducted tests indicated in Appendix A.

## Test sample description

|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
|-----------------------------------------------|-------------------------------------|--------------------------------|--------------------------|-------------------------------|-----------------------------------|--------------------------|--------------------------|--|--|--|--|--|
| Ports.....:                                   | Port name and description           | Cable                          |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     | Specified max length [m]       | Attached during test     | Shielded                      | Coupled to patient <sup>(3)</sup> |                          |                          |  |  |  |  |  |
|                                               | Main(Primary) port                  | x                              | <input type="checkbox"/> | <input type="checkbox"/>      | <input type="checkbox"/>          |                          |                          |  |  |  |  |  |
|                                               | Diversity port                      | x                              | <input type="checkbox"/> | <input type="checkbox"/>      | <input type="checkbox"/>          |                          |                          |  |  |  |  |  |
|                                               | GNSS port                           | x                              | <input type="checkbox"/> | <input type="checkbox"/>      | <input type="checkbox"/>          |                          |                          |  |  |  |  |  |
|                                               |                                     |                                | <input type="checkbox"/> | <input type="checkbox"/>      | <input type="checkbox"/>          |                          |                          |  |  |  |  |  |
|                                               |                                     |                                | <input type="checkbox"/> | <input type="checkbox"/>      | <input type="checkbox"/>          |                          |                          |  |  |  |  |  |
| Supplementary information to the ports.....:  | SMA type connectors                 |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Rated power supply 3.4~4.2V, typ 3.8V         | Voltage and Frequency               |                                | Reference poles          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     |                                | L1                       | L2                            | L3                                | N                        | PE                       |  |  |  |  |  |
|                                               | <input type="checkbox"/>            | AC:                            | <input type="checkbox"/> | <input type="checkbox"/>      | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |  |  |  |  |  |
|                                               | <input type="checkbox"/>            | AC:                            | <input type="checkbox"/> | <input type="checkbox"/>      | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |  |  |  |  |  |
|                                               | <input checked="" type="checkbox"/> | DC: 3.4~4.2V, typ 3.8V         |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               | <input type="checkbox"/>            | DC:                            |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Rated Power .....                             | 0.2W                                |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Clock frequencies.....:                       | 19.2MHz                             |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Other parameters .....                        |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Software version .....                        | M0F.313002                          |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Hardware version .....                        | 1.10                                |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Dimensions in cm (W x H x D) .....            | 28.2 x 28.2 x 2.2mm                 |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Mounting position .....                       | <input type="checkbox"/>            | Table top equipment            |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               | <input type="checkbox"/>            | Wall/Ceiling mounted equipment |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               | <input type="checkbox"/>            | Floor standing equipment       |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               | <input type="checkbox"/>            | Hand-held equipment            |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               | <input checked="" type="checkbox"/> | Other: Variable equipment      |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Modules/parts.....:                           | Module/parts of test item           |                                |                          | Type                          | Manufacturer                      |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Accessories (not part of the test item) ..... | Description                         |                                |                          | Type                          | Manufacturer                      |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
|                                               |                                     |                                |                          |                               |                                   |                          |                          |  |  |  |  |  |
| Documents as provided by the applicant .....  | Description                         |                                |                          | File name                     | Issue date                        |                          |                          |  |  |  |  |  |
|                                               | Hardware_Design_Guide               |                                |                          | LE910Cx_Hardware_Design_Guide | 2020-07-31                        |                          |                          |  |  |  |  |  |

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

(3) Only for Medical Equipment

## Identification of the client

Telit Wireless Solutions Co., LTD  
13th Fl., Shinyoung Securities Bld, 6, Gukjegeumyung-ro 8-gil, Yeongdeungpo-gu, Seoul, 07330, South Korea

## Testing period and place

|               |                                        |
|---------------|----------------------------------------|
| Test Location | DEKRA Testing and Certification S.A.U. |
| Date (start)  | 2020-09-23                             |
| Date (finish) | 2020-10-21                             |

## Document history

| Report number | Date       | Description   |
|---------------|------------|---------------|
| 66136RRF.002  | 2020-11-05 | First release |

## Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

|                   |                              |
|-------------------|------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C |
| Relative humidity | Min. = 20 %<br>Max. = 75 %   |

In the semianechoic chamber, the following limits were not exceeded during the test.

|                   |                              |
|-------------------|------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C |
| Relative humidity | Min. = 20 %<br>Max. = 75 %   |

In the chamber for conducted measurements, the following limits were not exceeded during the test:

|                   |                              |
|-------------------|------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C |
| Relative humidity | Min. = 20 %<br>Max. = 75 %   |

## Remarks and comments

The tests have been performed by the technical personnel: Cristina Calle, Miguel Manuel López, Javier Miguel Nadales and Verónica García.

Used instrumentation:

### Conducted Measurements

|                                                                        | Last Calibration | Due Calibration |
|------------------------------------------------------------------------|------------------|-----------------|
| 1. Shielded Room ETS LINDGREN S101                                     | N.A.             | N.A.            |
| 2. Chamber HERAEUS VMT 04/35                                           | 2020/07          | 2022/07         |
| 3. DC Power Supply, 30V/5A KEYSIGHT TECHNOLOGIES U8002A                | N.A.             | N.A.            |
| 4. Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40 | 2019/09          | 2021/09         |
| 5. Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500        | 2020/04          | 2021/04         |
| 6. RF Attenuator 10 dB, 5W, DC-40 GHz Aeroflex Weinschel 75A-10-11     | 2020/05          | 2021/05         |
| 7. Digital Multimeter FLUKE 179                                        | 2020/10          | 2021/10         |
| 8. Signal Analyzer 20 Hz to 8 GHz ROHDE AND SCHWARZ FSQ8               | 2020/10          | 2022/10         |

### Radiated Measurements

|                                                                    | Last Calibration | Due Calibration |
|--------------------------------------------------------------------|------------------|-----------------|
| 1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP | N.A.             | N.A.            |
| 2. Shielded Room ETS LINDGREN S101                                 | N.A.             | N.A.            |
| 3. Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D   | 2019/11          | 2022/11         |
| 4. Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E         | 2020/04          | 2023/04         |
| 5. RF Preamplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M   | 2020/05          | 2021/05         |
| 6. Preamplifier G>40dB 10MHz-6GHz, BONN ELEKTRONIK, BLNA 0160-01N  | 2020/02          | 2021/02         |
| 7. Spectrum Analyzer ROHDE AND SCHWARZ FSW50                       | 2020/07          | 2022/07         |
| 8. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7                  | 2019/10          | 2021/10         |
| 9. Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500    | 2020/04          | 2021/04         |
| 10. DC Power Supply, 30V/5A KEYSIGHT TECHNOLOGIES U8002A           | N.A.             | N.A.            |
| 11. Digital multimeter FLUKE 179                                   | 2020/06          | 2021/06         |

## Testing verdicts

|                 |     |
|-----------------|-----|
| Not applicable: | N/A |
| Pass:           | P   |
| Fail:           | F   |
| Not measured:   | N/M |

## Summary

| FCC PART 27 / RSS-130, RSS-139 PARAGRAPH                                        |         |        |
|---------------------------------------------------------------------------------|---------|--------|
| Requirement – Test case                                                         | Verdict | Remark |
| FCC 27.50 / RSS-130 4.6., RSS-139 6.5.: RF Output Power                         | P       |        |
| FCC 2.1047 / RSS-130 4.1., RSS-139 6.2.: Modulation Characteristics             | P       |        |
| FCC 27.54 / RSS-130 4.5., RSS-139 6.4.: Frequency Stability                     | P       |        |
| FCC 2.1049: Occupied Bandwidth                                                  | P       |        |
| FCC 27.53 / RSS-130 4.7., RSS-139 6.6.: Spurious Emissions at Antenna Terminals | P       |        |
| FCC 27.53 / RSS-130 4.7., RSS-139 6.6.: Radiated Emissions                      | P       |        |
| <u>Supplementary information and remarks:</u>                                   |         |        |
| None.                                                                           |         |        |

## Appendix A: Test results for FCC PART 27 / RSS-130, RSS-139

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## TEST CONDITIONS

### POWER SUPPLY (V):

Vn: 3.80 Vdc  
Vmin: 3.23 Vdc (\*)  
Vmax: 4.37 Vdc (\*)

Type of Power Supply: Internal DC.

The subscripts 'n', 'min' and 'max' indicate voltage test conditions (nominal, minimum and maximum respectively), as declared by the applicant.

### ANTENNA:

| LOW Bands   |          | ANTENNA TYPE      |
|-------------|----------|-------------------|
| LTE Band 12 | +1.5 dBi | External (Dipole) |

| MIDDLE Bands |          | ANTENNA TYPE      |
|--------------|----------|-------------------|
| LTE Band 66  | +3.5 dBi | External (Dipole) |

### TEST FREQUENCIES:

#### LTE Band 12. QPSK AND 16QAM MODULATION:

|        | Channel (Frequency)  |                      |                      |                      |
|--------|----------------------|----------------------|----------------------|----------------------|
|        | BW = 1.4 MHz         | BW = 3 MHz           | BW = 5 MHz           | BW = 10 MHz          |
| Low    | 23017<br>(699.7 MHz) | 23025<br>(700.5 MHz) | 23035<br>(701.5 MHz) | 23060<br>(704.0 MHz) |
| Middle | 23095<br>(707.5 MHz) | 23095<br>(707.5 MHz) | 23095<br>(707.5 MHz) | 23095<br>(707.5 MHz) |
| High   | 23173<br>(715.3 MHz) | 23165<br>(714.5 MHz) | 23155<br>(713.5 MHz) | 23130<br>(711.0 MHz) |

Note: LTE Category 1 device, so for BW=10 MHz the 16QAM modulation does not support transmission in RB=All.

#### LTE Band 66. QPSK AND 16QAM MODULATION:

|        | Channel (Frequency)    |                        |                        |                        |                        |                        |
|--------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
|        | BW = 1.4 MHz           | BW = 3 MHz             | BW = 5 MHz             | BW = 10 MHz            | BW = 15 MHz            | BW = 20 MHz            |
| Low    | 131979<br>(1710.7 MHz) | 131987<br>(1711.5 MHz) | 131997<br>(1712.5 MHz) | 132022<br>(1715.0 MHz) | 132047<br>(1717.5 MHz) | 132072<br>(1720.0 MHz) |
| Middle | 132322<br>(1745.0 MHz) | 132322<br>(1745.0 MHz) | 132322<br>(1745.0 MHz) | 132322<br>(1745.0 MHz) | 132322<br>(1745.0 MHz) | 132322<br>(1745.0 MHz) |
| High   | 132665<br>(1779.3 MHz) | 132657<br>(1778.5 MHz) | 132647<br>(1777.5 MHz) | 132622<br>(1775.0 MHz) | 132597<br>(1772.5 MHz) | 132572<br>(1770.0 MHz) |

Note: LTE Category 1 device, so for BW=10 MHz, 15 MHz and 20 MHz the 16QAM modulation does not support transmission in RB=All.

## RF Output Power

### SPECIFICATION:

#### FCC §27.50 (c) (10):

(10) Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

#### FCC §27.50 (d) (4) & (5):

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

(5) Equipment employed must be authorized in accordance with the provisions of §24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. 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.

#### RSS-130 Clause 4.6:

##### 4.6.1 General

The transmitter output power shall be measured in terms of average power. In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the High PAPR during periods of continuous transmission.

##### 4.6.2 Frequency bands 617-652 MHz and 663-698 MHz

The e.r.p. shall not exceed 3 watts for mobile equipment, fixed subscriber equipment and portable equipment.

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the equivalent isotropically radiated power (e.i.r.p.) limits.

##### 4.6.3 Frequency bands 698-756 MHz and 777-787 MHz

The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the e.i.r.p. limits.

#### RSS-139 Clause 6.5:

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1710-1780 MHz shall not exceed one watt.

Consult SRSP-513 for e.i.r.p. limits on fixed and base stations operating in the band 2110-2180 MHz.

In addition, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the High PAPR during periods of continuous transmission.

## METHOD:

The conducted RF output power measurements were made at the RF output terminals of the EUT using the power meter of the Universal Radio Communication tester R&S CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

$$\text{E.R.P.} = \text{E.I.R.P.} - 2.15 \text{ dB}$$

The peak-to-average power ratio (PAPR) is measured using an attenuator, power splitter and spectrum analyser with a Complementary Cumulative Distribution Function implemented.

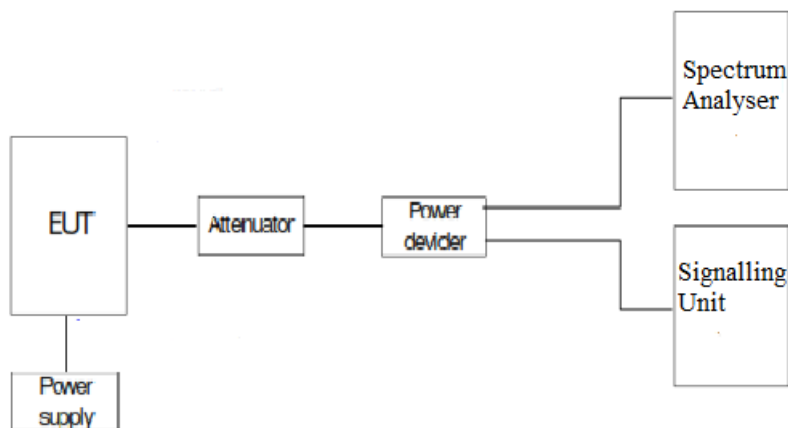
The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

## TEST SETUP:

### 1. CONDUCTED AVERAGE POWER:



### 2. PEAK-TO-AVERAGE POWER RATIO (PAPR) and Conducted Average power:



## RESULTS:

### 1. CONDUCTED AVERAGE POWER:

#### LTE Band 12:

LTE Band 12. QPSK MODULATION. Bandwidth = 1.4 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +1.5   | +1.5   | +1.5  |
| Measured maximum average power (dBm) at antenna port             | 23.27  | 22.94  | 23.13 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.77  | 24.44  | 24.63 |
| Maximum effective radiated power E.R.P. (dBm)                    | 22.62  | 22.29  | 22.48 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.

(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 6, RB Offset: 0 as the worst case. The results in the next tables shows the results for this configuration.

LTE Band 12. 16QAM MODULATION. Bandwidth = 1.4 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +1.5   | +1.5   | +1.5  |
| Measured maximum average power (dBm) at antenna port             | 21.79  | 22.11  | 22.51 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.29  | 23.61  | 24.01 |
| Maximum effective radiated power E.R.P. (dBm)                    | 21.14  | 21.46  | 21.86 |
| PAPR (dB)                                                        | 6.15   | 5.96   | 5.98  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.

Worst case PAPR: Modulation 16QAM. RB Size: 6. RB Offset: 0.

LTE Band 12. QPSK MODULATION. Bandwidth = 3 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +1.5   | +1.5   | +1.5  |
| Measured maximum average power (dBm) at antenna port             | 23.19  | 23.25  | 23.19 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.69  | 24.75  | 24.69 |
| Maximum effective radiated power E.R.P. (dBm)                    | 22.54  | 22.60  | 22.54 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 7.  
(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 15, RB Offset: 0 as the worst case.  
The results in the next tables shows the results for this configuration.

LTE Band 12. 16QAM MODULATION. Bandwidth = 3 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +1.5   | +1.5   | +1.5  |
| Measured maximum average power (dBm) at antenna port             | 22.31  | 22.45  | 21.84 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.81  | 23.95  | 23.34 |
| Maximum effective radiated power E.R.P. (dBm)                    | 21.66  | 21.80  | 21.19 |
| PAPR (dB)                                                        | 6.11   | 6.09   | 6.09  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.  
Worst case PAPR: Modulation 16QAM. RB Size: 15. RB Offset: 0.

LTE Band 12. QPSK MODULATION. Bandwidth = 5 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +1.5   | +1.5   | +1.5  |
| Measured maximum average power (dBm) at antenna port             | 22.75  | 23.03  | 22.28 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.25  | 24.53  | 23.78 |
| Maximum effective radiated power E.R.P. (dBm)                    | 22.10  | 22.38  | 21.63 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.  
(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 25, RB Offset: 0 as the worst case.  
The results in the next tables shows the results for this configuration.

LTE Band 12. 16QAM MODULATION. Bandwidth = 5 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +1.5   | +1.5   | +1.5  |
| Measured maximum average power (dBm) at antenna port             | 21.17  | 21.93  | 21.82 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 22.67  | 23.43  | 23.32 |
| Maximum effective radiated power E.R.P. (dBm)                    | 20.12  | 21.28  | 21.17 |
| PAPR (dB)                                                        | 6.12   | 5.93   | 6.09  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 12.  
Worst case PAPR: Modulation 16QAM. RB Size: 25. RB Offset: 0.

LTE Band 12. QPSK MODULATION. Bandwidth = 10 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +1.5   | +1.5   | +1.5  |
| Measured maximum average power (dBm) at antenna port             | 23.25  | 23.29  | 23.22 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.75  | 24.79  | 24.72 |
| Maximum effective radiated power E.R.P. (dBm)                    | 22.60  | 22.64  | 22.57 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 24.  
(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 25, RB Offset: 24 as the worst case. The results in the next tables shows the results for this configuration.

LTE Band 12. 16QAM MODULATION. Bandwidth = 10 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +1.5   | +1.5   | +1.5  |
| Measured maximum average power (dBm) at antenna port             | 22.08  | 22.78  | 22.82 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.58  | 24.28  | 24.32 |
| Maximum effective radiated power E.R.P. (dBm)                    | 21.43  | 22.13  | 22.17 |
| PAPR (dB)                                                        | 5.74   | 5.82   | 5.95  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 24.  
Worst case PAPR (\*): Modulation 16QAM. RB Size: 25. RB Offset: 24.

(\*): Not supported RB Size: 50, RB Offset: 0.

### LTE Band 66:

LTE Band 66. QPSK MODULATION. Bandwidth = 1.4 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 22.84  | 23.28  | 22.91 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 26.34  | 26.78  | 26.41 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.

(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 6, RB Offset: 0 as the worst case. The results in the next tables shows the results for this configuration.

LTE Band 66. 16QAM MODULATION. Bandwidth = 1.4 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 22.12  | 22.70  | 21.85 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 25.62  | 26.20  | 25.35 |
| PAPR (dB)                                                        | 5.59   | 5.34   | 5.34  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 2.

Worst case PAPR: Modulation 16QAM. RB Size: 6. RB Offset: 0.

LTE Band 66. QPSK MODULATION. Bandwidth = 3 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 22.97  | 23.16  | 22.91 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 26.47  | 26.66  | 26.41 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 7.

(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 15, RB Offset: 0 as the worst case. The results in the next tables shows the results for this configuration.

LTE Band 66. 16QAM MODULATION. Bandwidth = 3 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 22.45  | 22.63  | 22.11 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 25.95  | 26.13  | 25.61 |
| PAPR (dB)                                                        | 5.74   | 5.50   | 5.58  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.  
Worst case PAPR: Modulation 16QAM. RB Size: 15. RB Offset: 0.

LTE Band 66. QPSK MODULATION. Bandwidth = 5 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 22.96  | 23.16  | 23.05 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 26.46  | 26.66  | 26.55 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 12.  
(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 25, RB Offset: 0 as the worst case.  
The results in the next tables shows the results for this configuration.

LTE Band 66. 16QAM MODULATION. Bandwidth = 5 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 21.7   | 22.65  | 22.34 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 25.2   | 26.15  | 25.84 |
| PAPR (dB)                                                        | 5.51   | 5.53   | 5.69  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 12.  
Worst case PAPR: Modulation 16QAM. RB Size: 25. RB Offset: 0.

LTE Band 66. QPSK MODULATION. Bandwidth = 10 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 23.10  | 23.41  | 22.84 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 26.60  | 26.91  | 26.34 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.

(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 25, RB Offset: 24 as the worst case. The results in the next tables shows the results for this configuration.

LTE Band 66. 16QAM MODULATION. Bandwidth = 10 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 22.59  | 22.72  | 21.75 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 26.09  | 26.22  | 25.25 |
| PAPR (dB)                                                        | 5.48   | 5.18   | 5.24  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.

Worst case PAPR (\*): Modulation 16QAM. RB Size: 25. RB Offset: 24.

(\*): Not supported RB Size: 50, RB Offset: 0.

LTE Band 66. QPSK MODULATION. Bandwidth = 15 MHz.

| Channel                                                          | Low    | Middle | High |
|------------------------------------------------------------------|--------|--------|------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5 |
| Measured maximum average power (dBm) at antenna port             | 23.13  | 23.25  | 23   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 26.63  | 26.75  | 26.5 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |      |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 74.

(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 1, RB Offset: 0 as the worst case. The results in the next tables shows the results for this configuration.

LTE Band 66. 16QAM MODULATION. Bandwidth = 15 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 23.07  | 22.6   | 22.51 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 26.57  | 26.1   | 26.01 |
| PAPR (dB)                                                        | 4.74   | 4.76   | 3.96  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 37.  
Worst case PAPR: Modulation 16QAM. RB Size: 1. RB Offset: 0.

LTE Band 66. QPSK MODULATION. Bandwidth = 20 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 22.80  | 23.20  | 22.97 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 26.30  | 26.70  | 26.47 |
| PAPR (dB)                                                        | 4.86   | 4.71   | 4.55  |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 49.  
Worst case PAPR: Modulation QPSK. RB Size: 100. RB Offset: 0.  
The results in the next tables shows the results for this configuration.

LTE Band 66. 16QAM MODULATION. Bandwidth = 20 MHz.

| Channel                                                          | Low    | Middle | High  |
|------------------------------------------------------------------|--------|--------|-------|
| Maximum declared antenna gain (dBi)                              | +3.5   | +3.5   | +3.5  |
| Measured maximum average power (dBm) at antenna port             | 21.93  | 22.20  | 21.89 |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 25.43  | 25.70  | 25.39 |
| PAPR (dB)                                                        | (*)    | (*)    | (*)   |
| Measurement uncertainty (dB)                                     | <±1.58 |        |       |

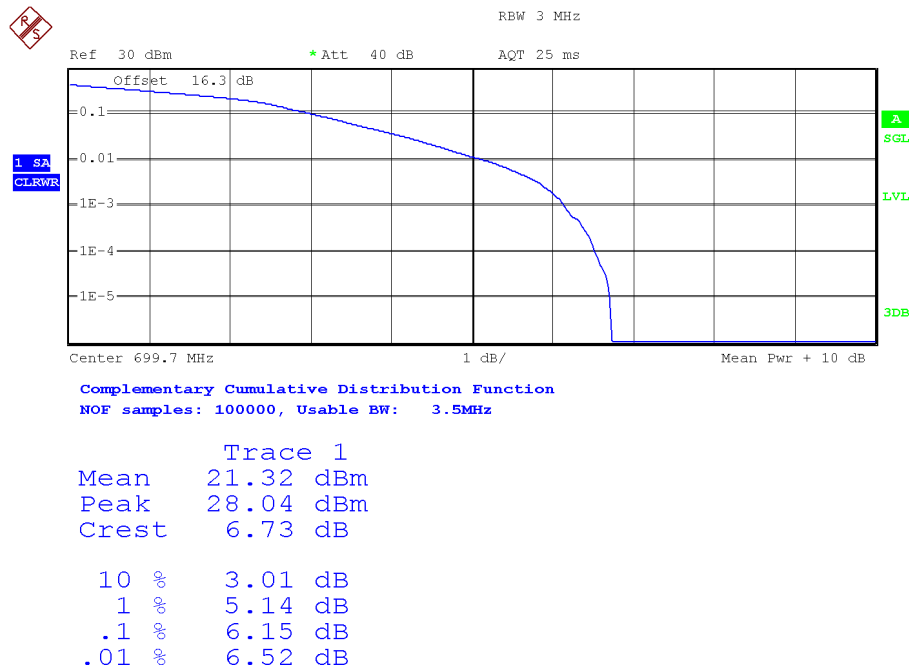
Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.  
(\*):- Preliminary measurements determined that the modulation QPSK, RB Size: 100, RB Offset: 0 as the worst case.  
- Not supported in the Middle Channel: RB Size: 50, RB Offset: 0; RB Size: 50, RB Offset: 24; RB Size: 50, RB Offset: 49; RB Size: 100, RB Offset: 0.  
The results in the next tables shows the results for this configuration.

Verdict: PASS

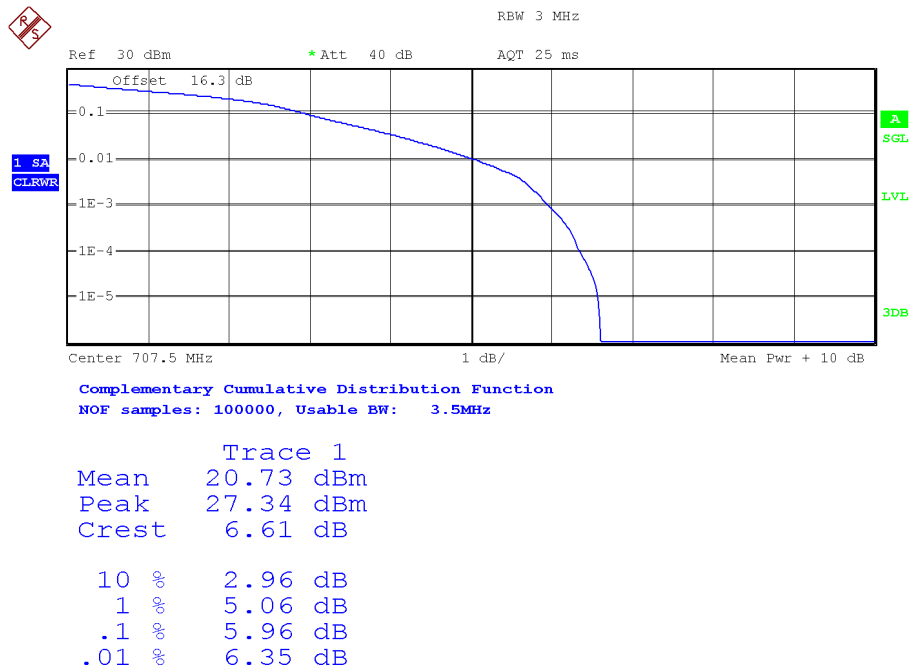
2. PEAK-TO-AVERAGE POWER RATIO (PAPR):

LTE Band 12. Bandwidth = 1.4 MHz. Modulation 16QAM. RB Size: 6. RB Offset: 0.

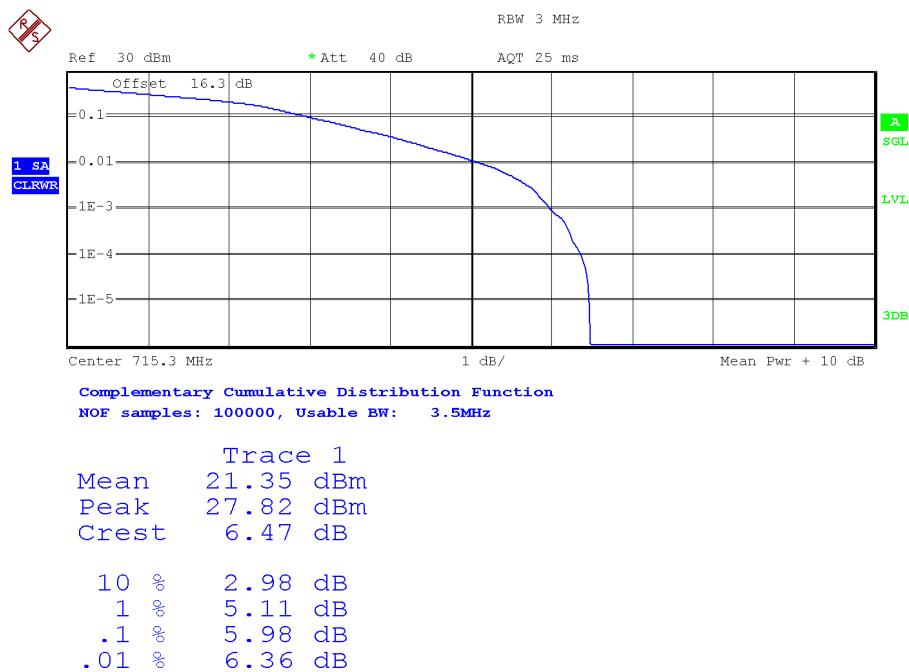
Low Channel:



Middle Channel:

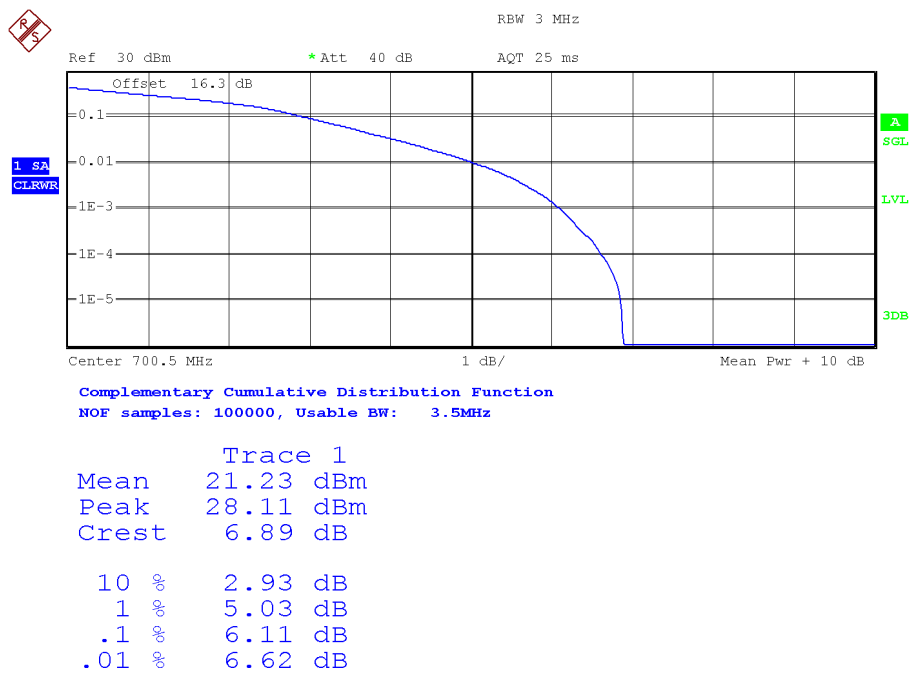


High Channel:

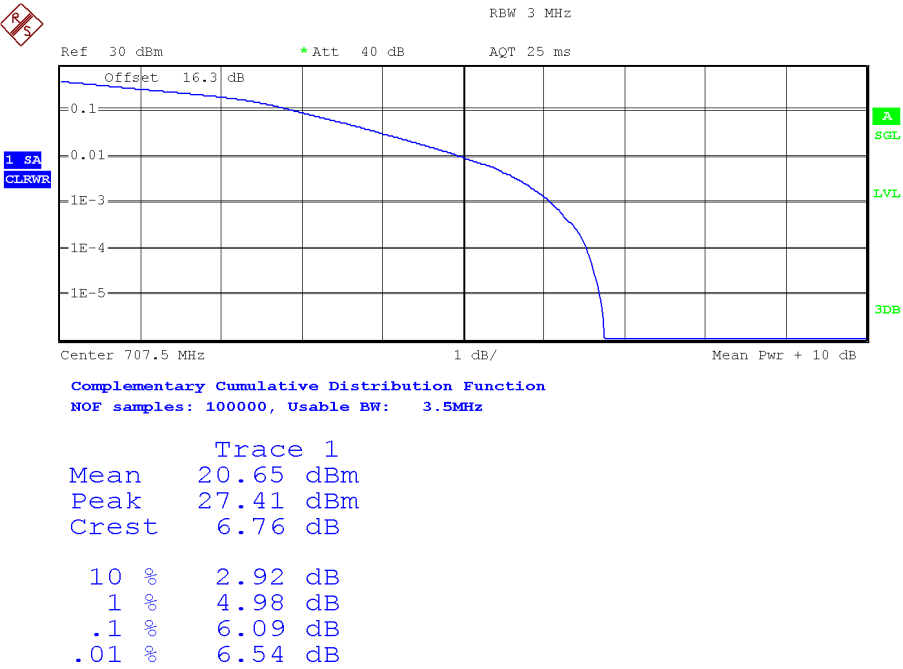


LTE Band 12. Bandwidth = 3 MHz. Modulation 16QAM. RB Size: 15. RB Offset: 0.

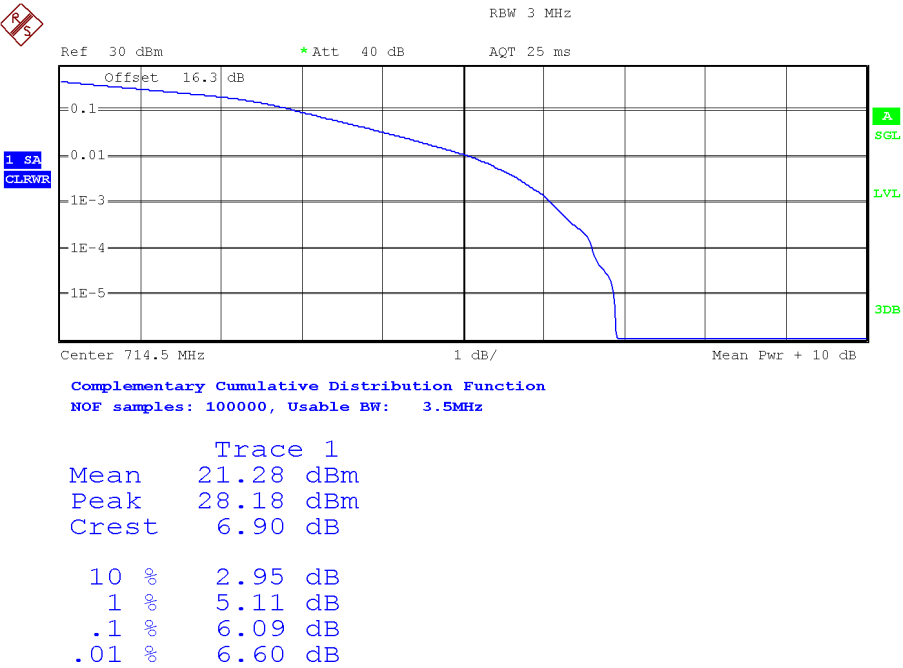
Low Channel:



Middle Channel:

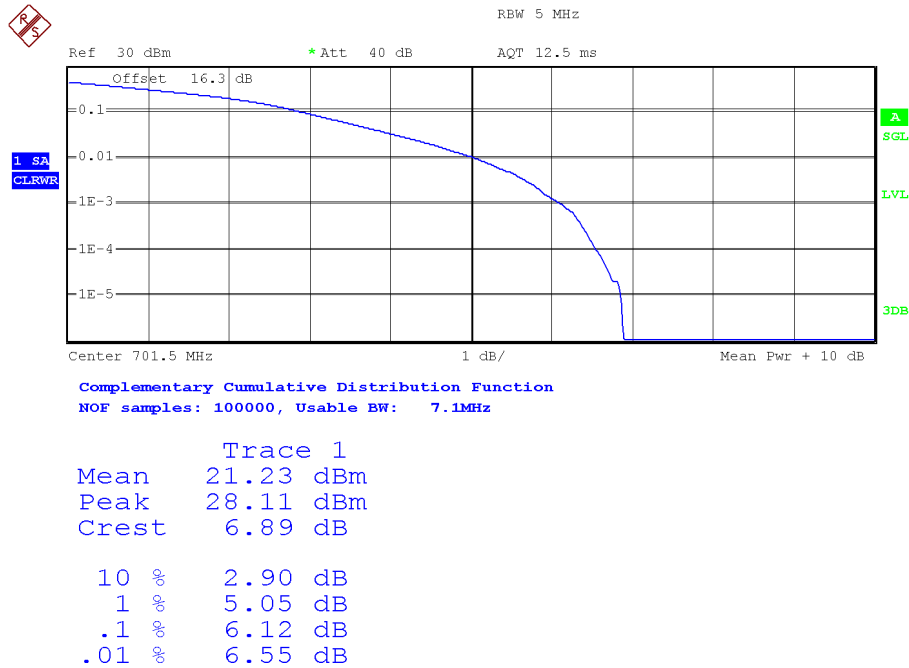


High Channel:

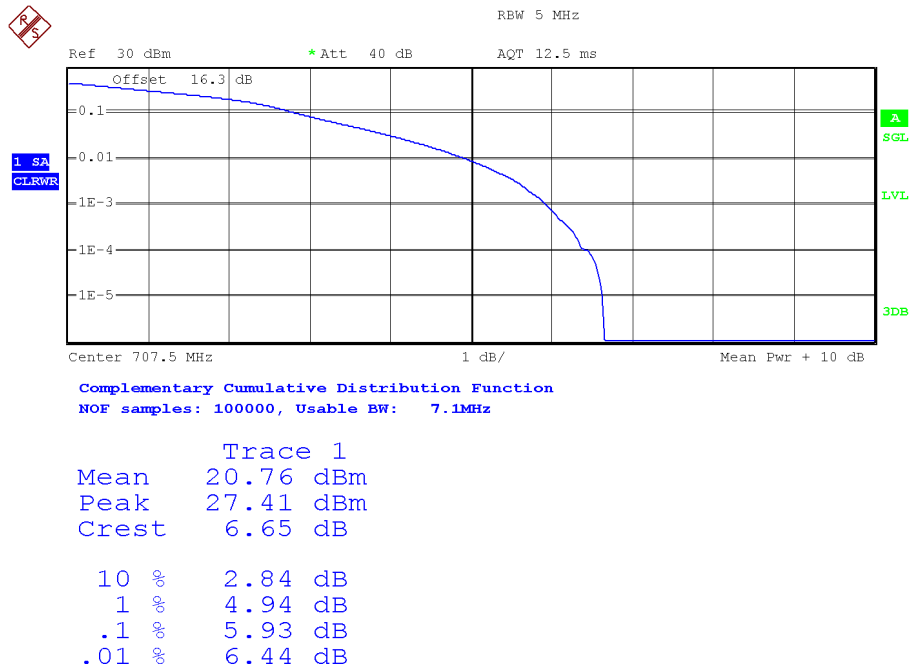


LTE Band 12. Bandwidth = 5 MHz. Modulation 16QAM. RB Size: 25. RB Offset: 0.

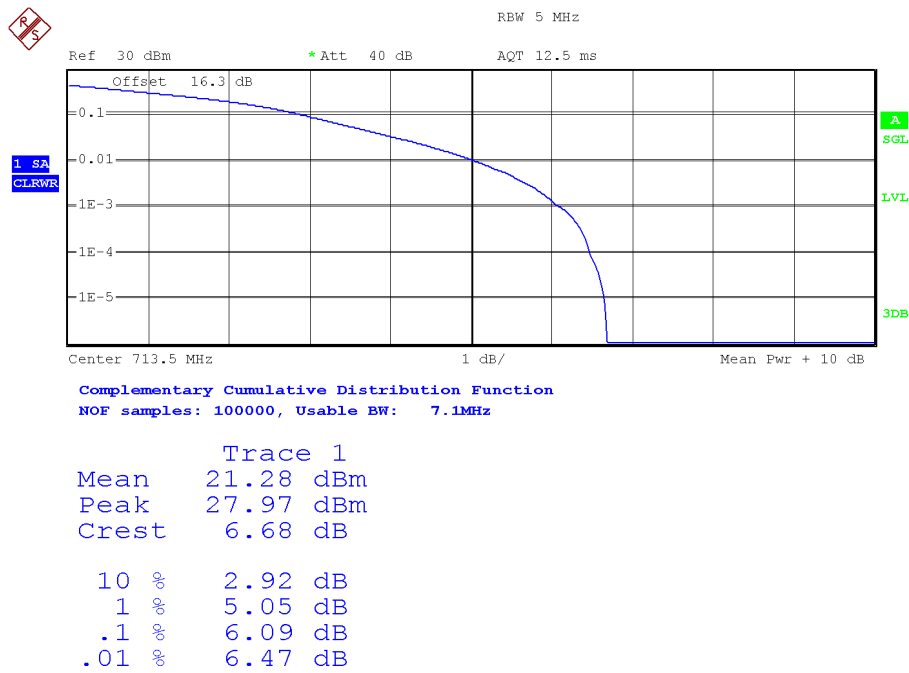
Low Channel:



Middle Channel:



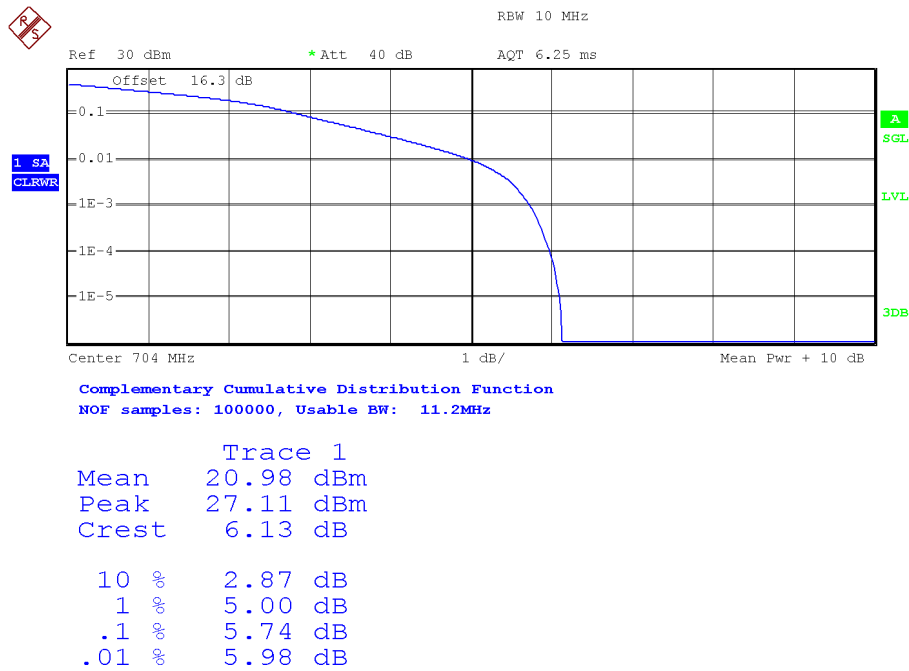
High Channel:



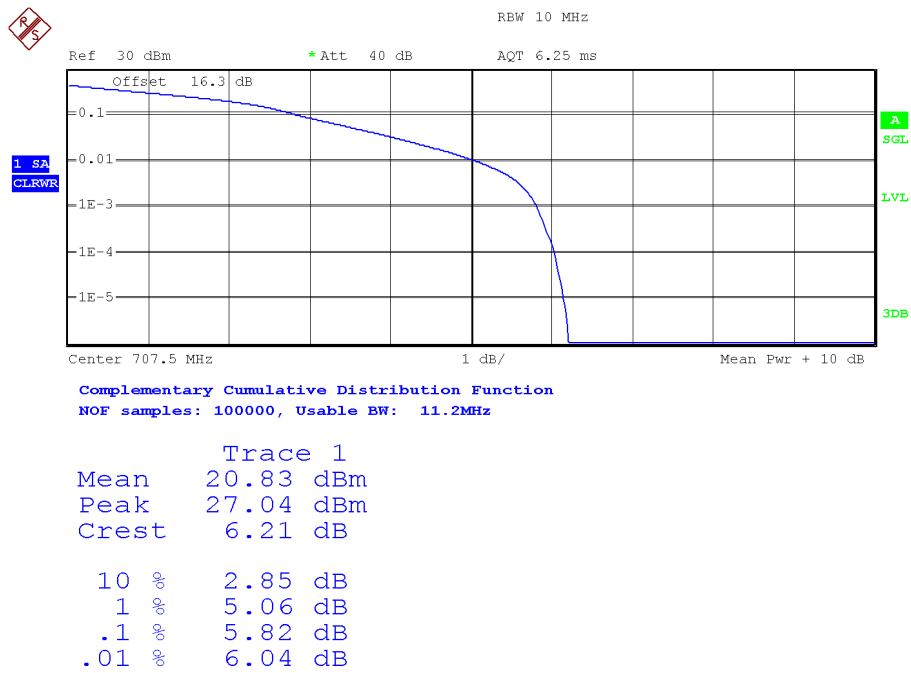
LTE Band 12.

Bandwidth = 10 MHz. Modulation 16QAM. RB Size: 25. RB Offset: 24.

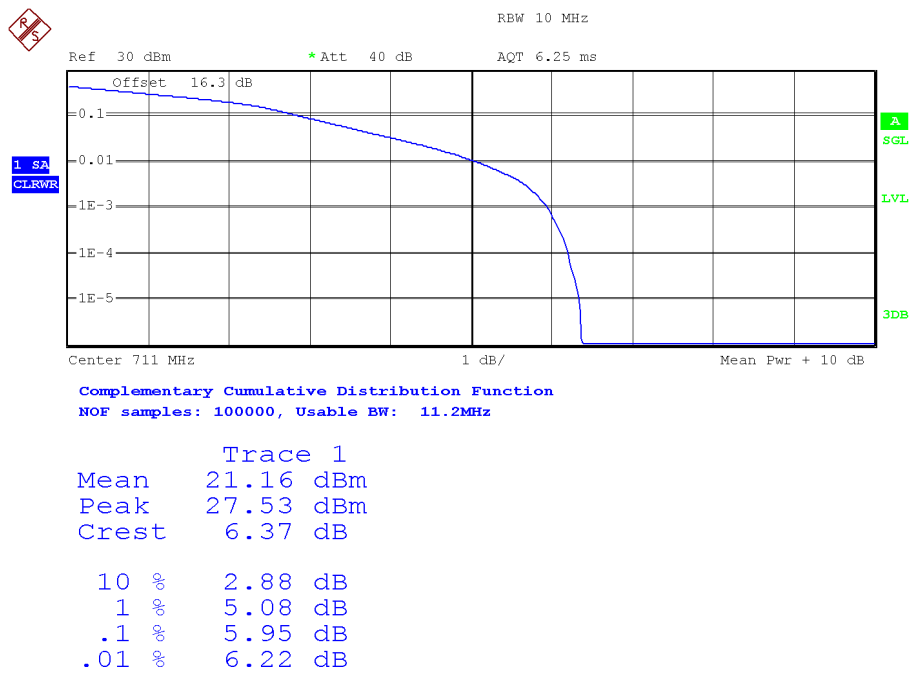
Low Channel:



Middle Channel:

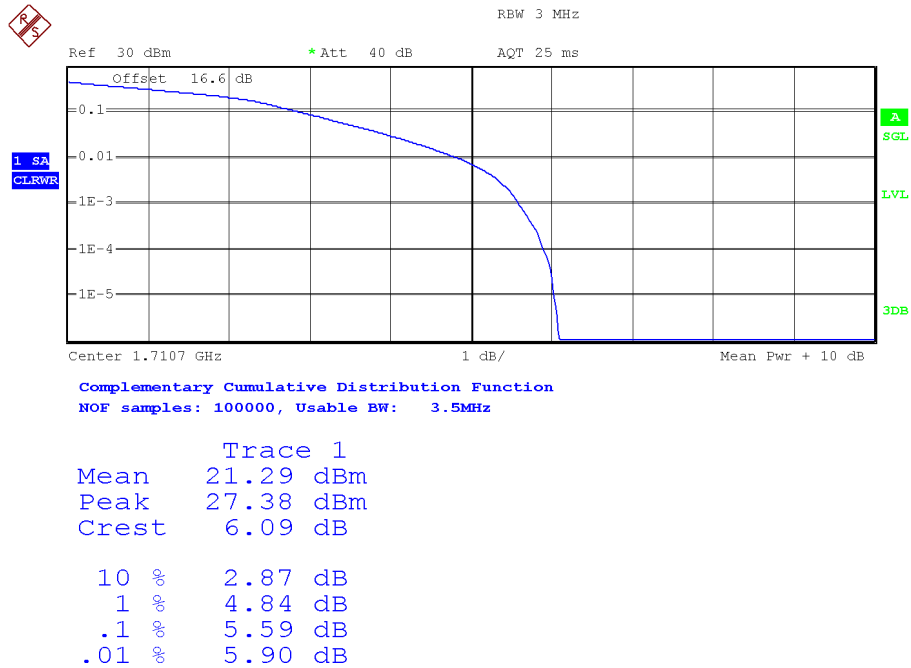


High Channel:

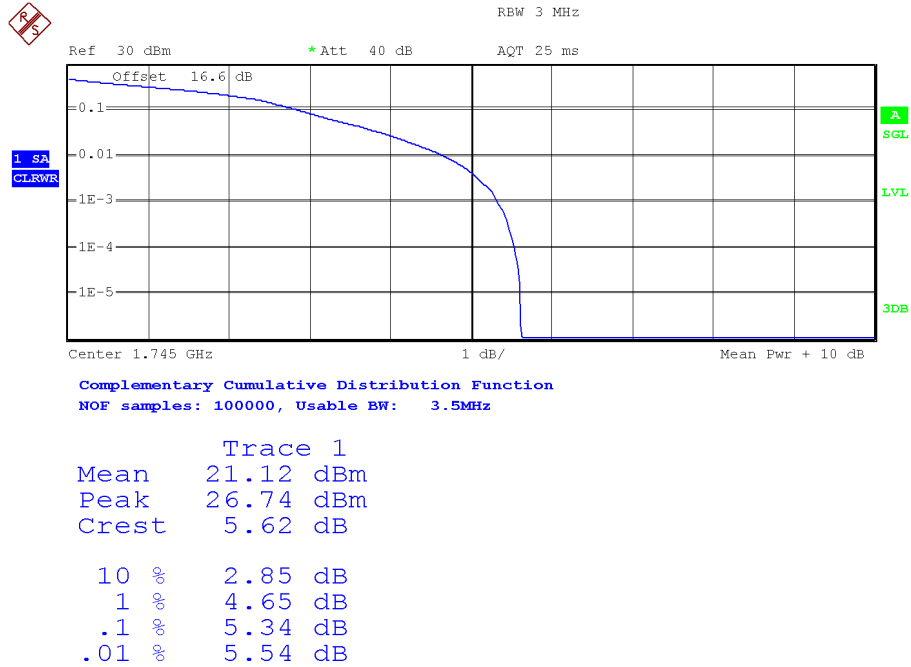


LTE Band 66. Bandwidth = 1.4 MHz. Modulation 16QAM. RB Size: 6. RB Offset: 0.

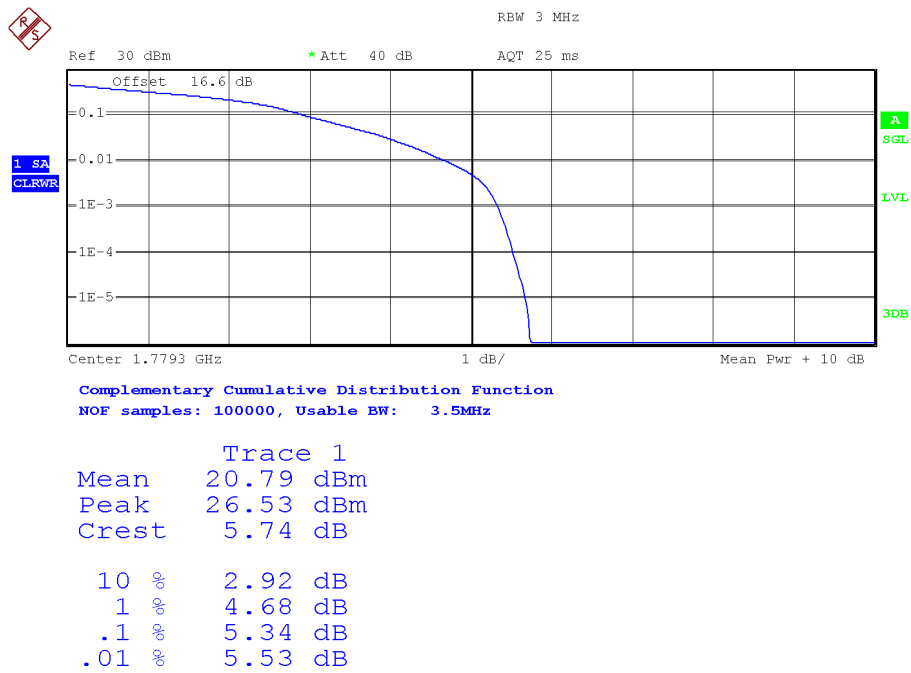
Low Channel:



Middle Channel:



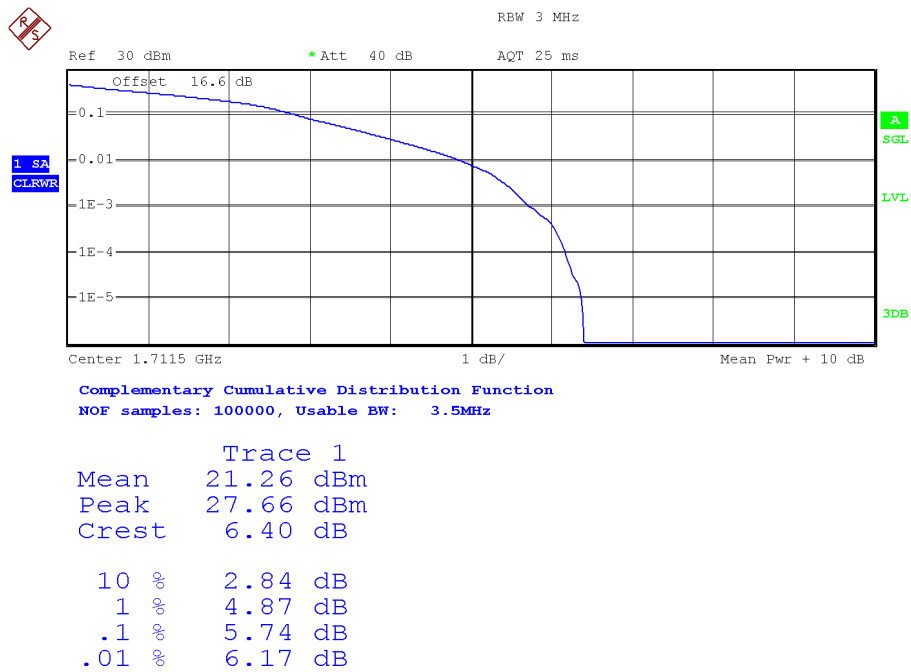
High Channel:



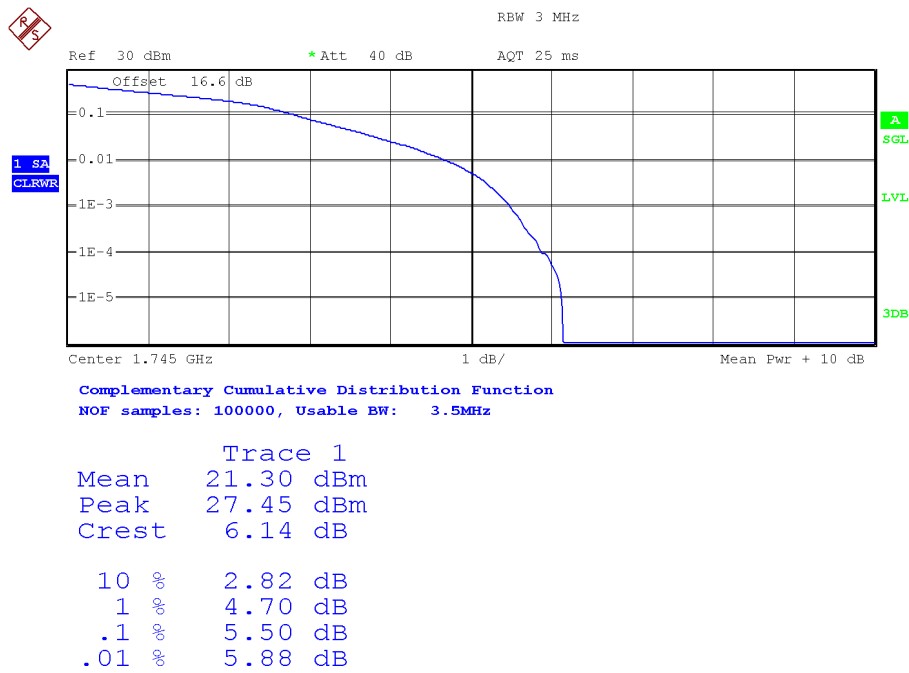
LTE Band 66.

Bandwidth = 3 MHz. Modulation 16QAM. RB Size: 15. RB Offset: 0.

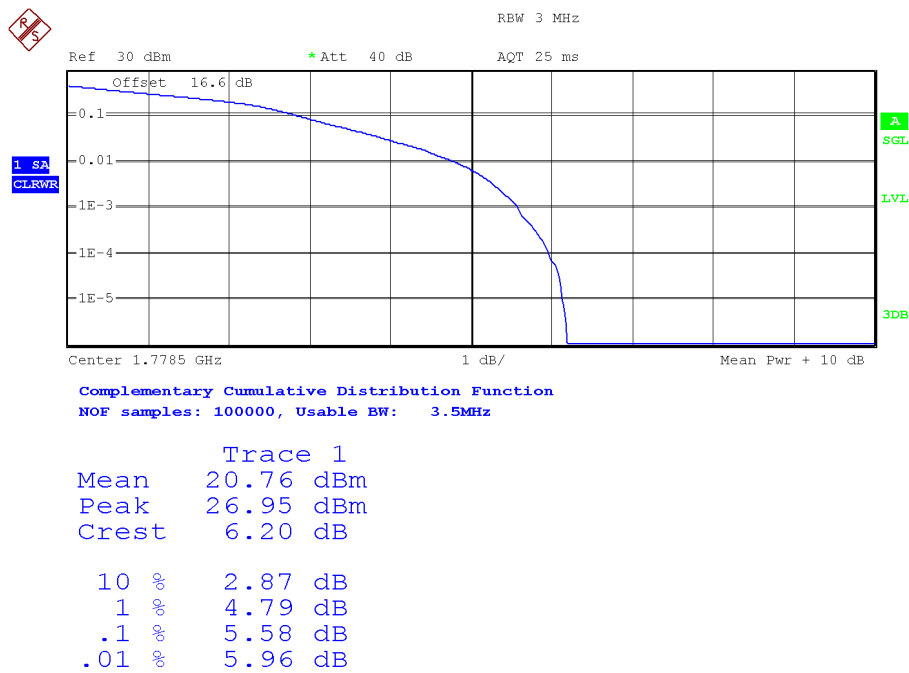
Low Channel:



Middle Channel:

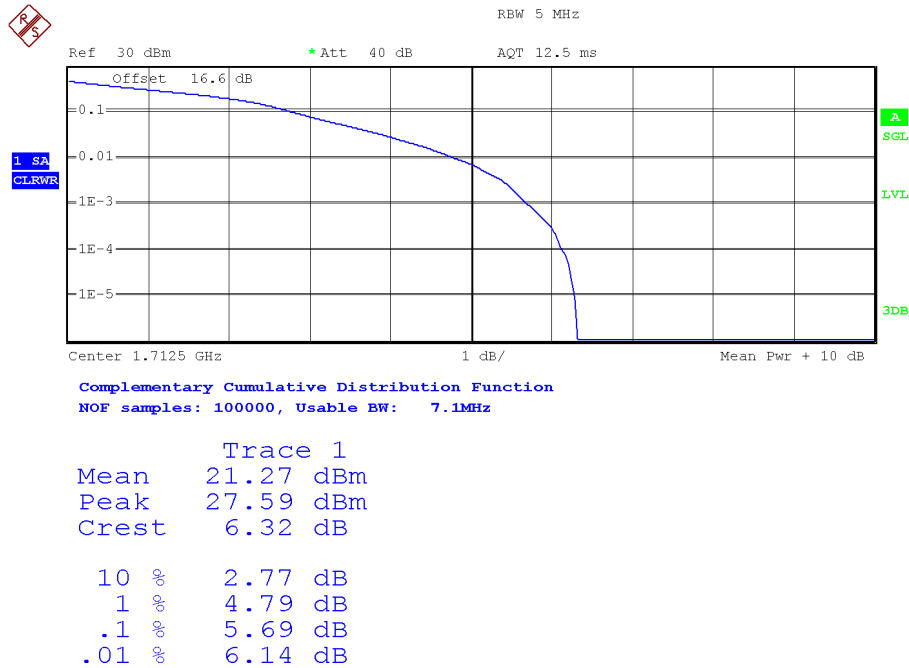


High Channel:

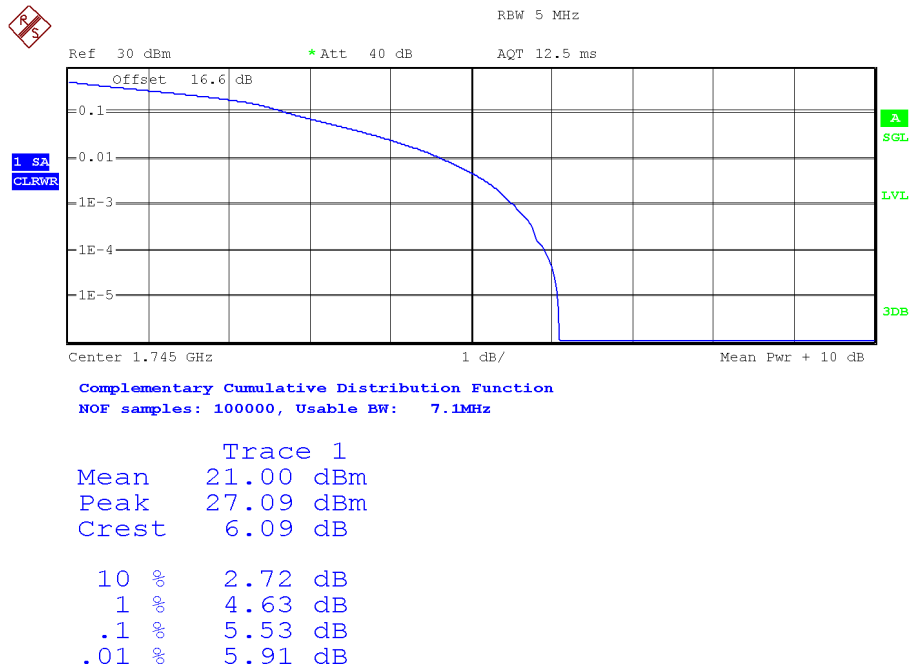


LTE Band 66. Bandwidth = 5 MHz. Modulation 16QAM. RB Size: 25. RB Offset: 0.

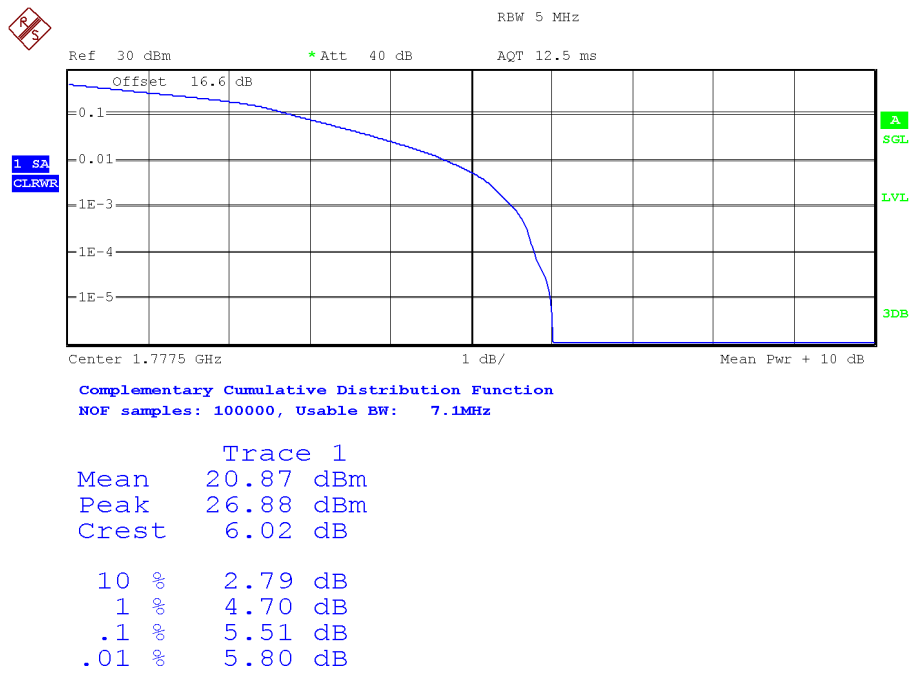
Low Channel:



Middle Channel:



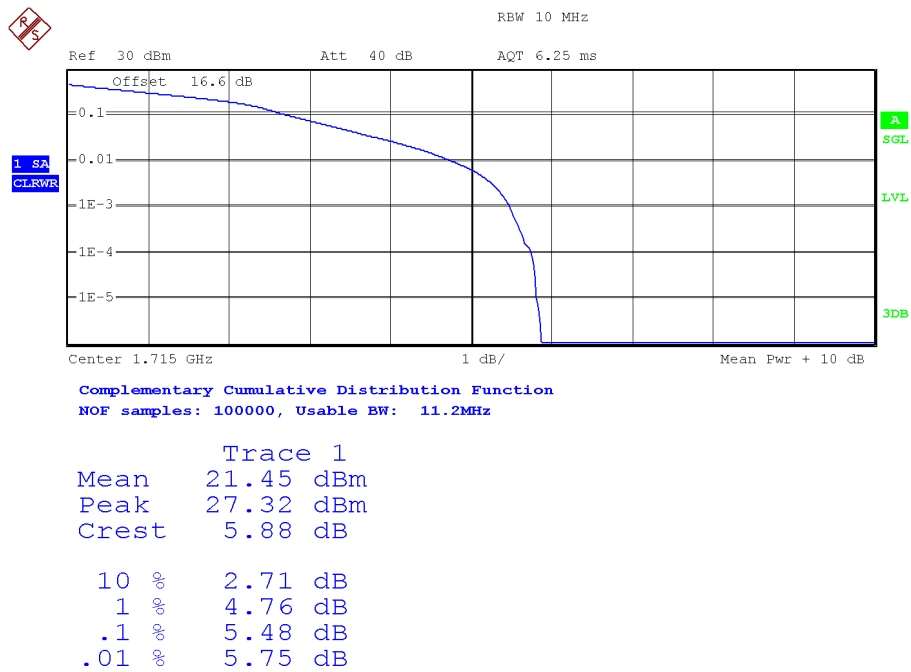
High Channel:



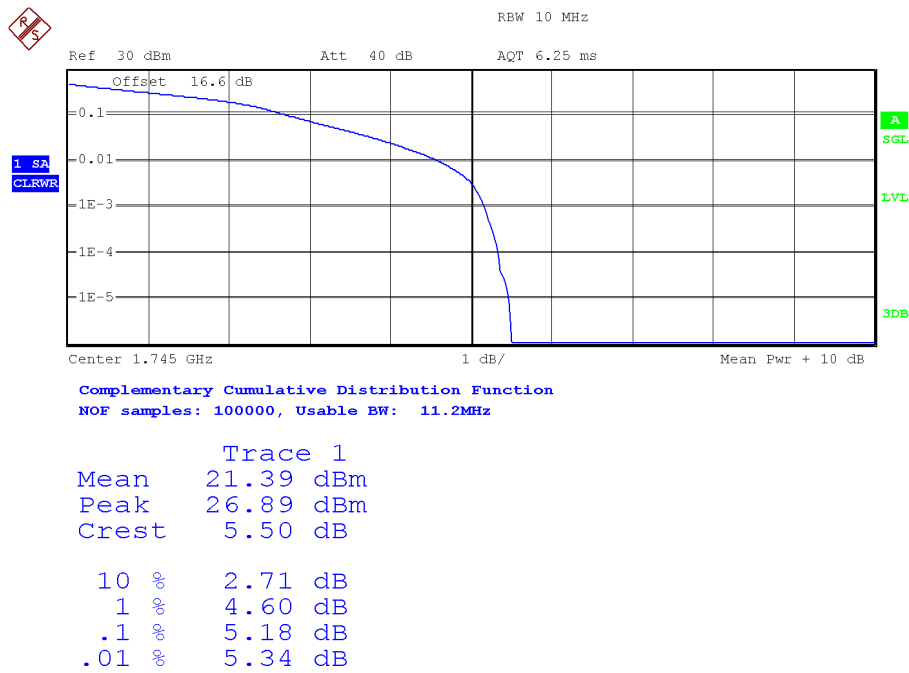
LTE Band 66.

Bandwidth = 10 MHz. Modulation 16QAM. RB Size: 25. RB Offset: 24.

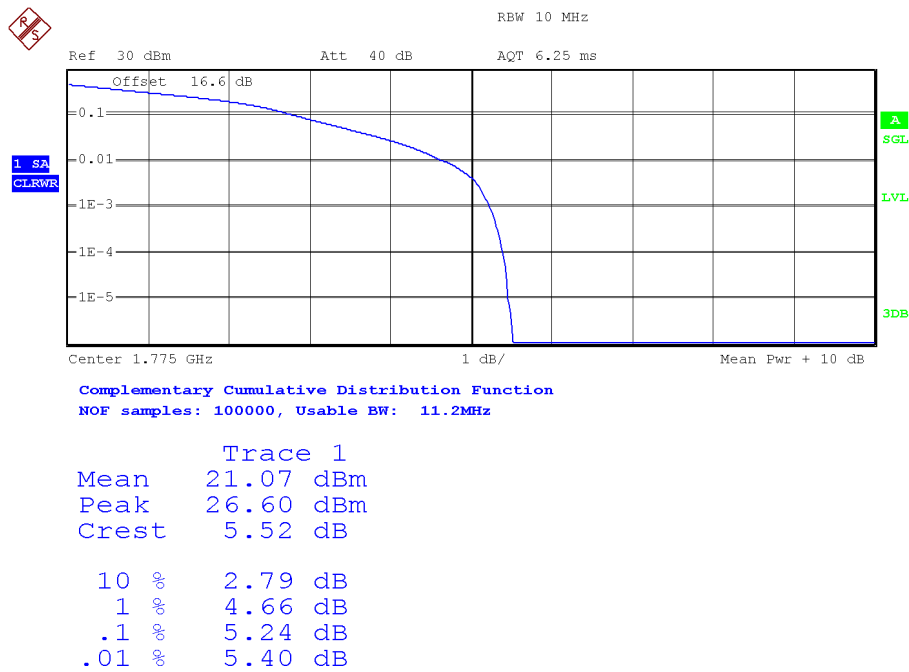
Low Channel:



Middle Channel:

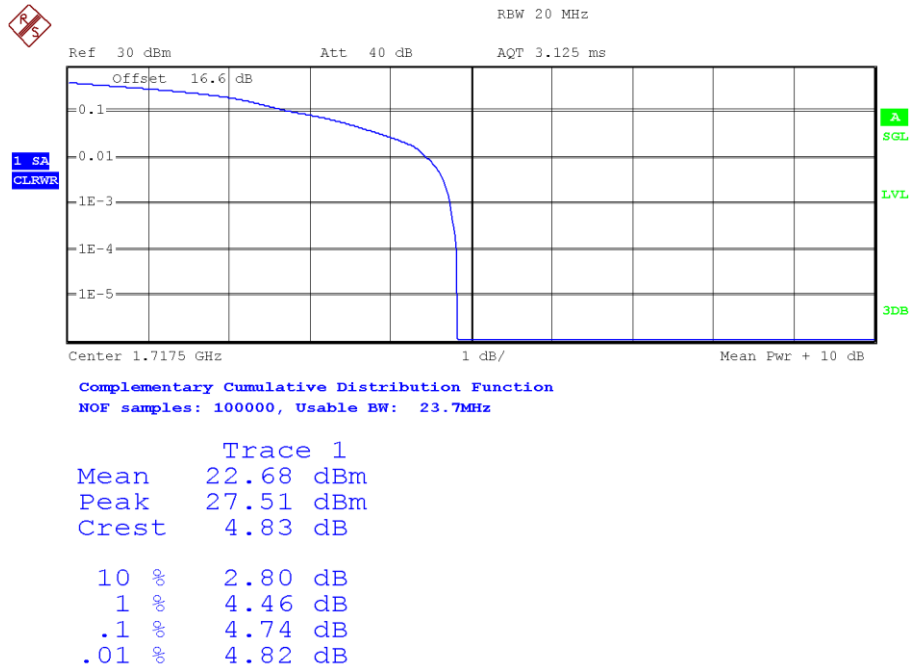


High Channel:

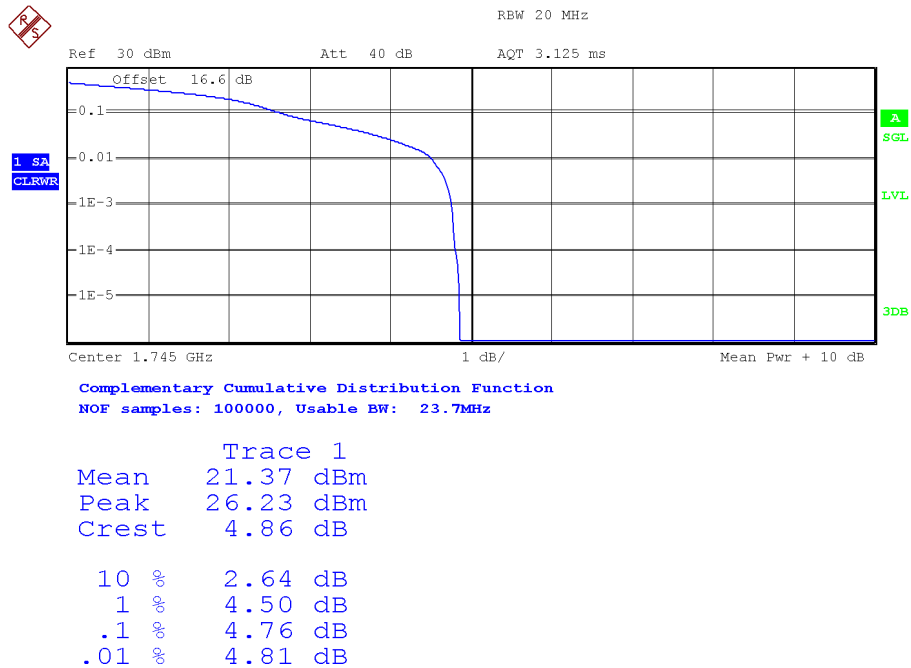


LTE Band 66. Bandwidth = 15 MHz. Modulation 16QAM. RB Size: 1. RB Offset: 0.

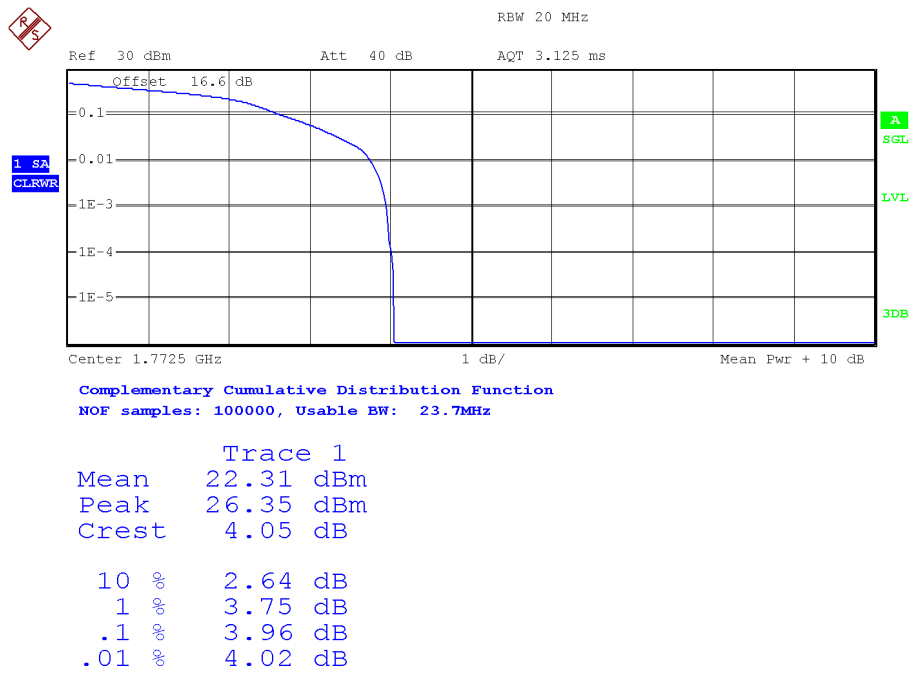
Low Channel:



Middle Channel:



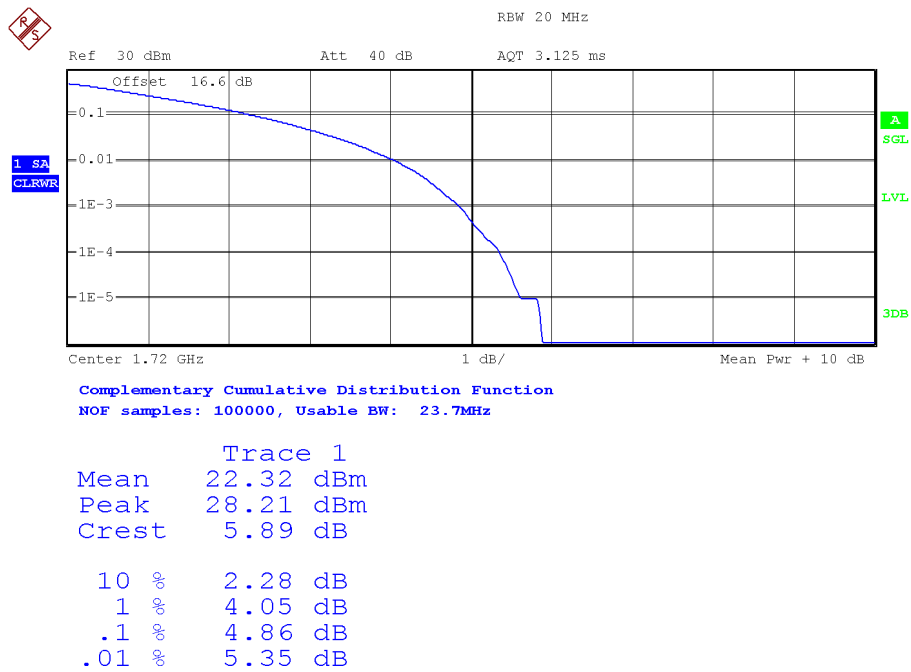
High Channel:



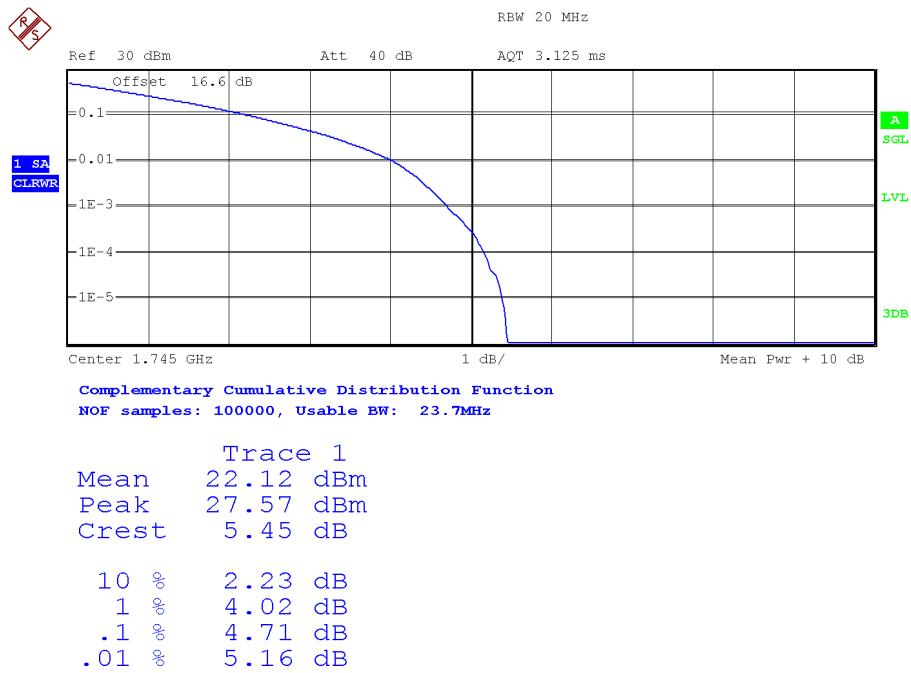
LTE Band 66.

Bandwidth = 20 MHz. Modulation QPSK. RB Size: 100. RB Offset: 0.

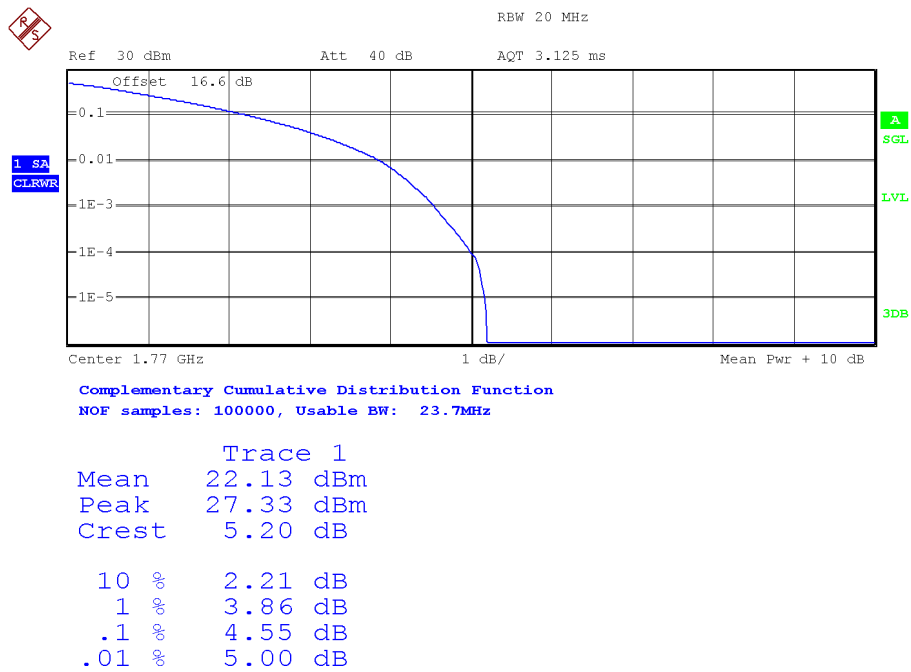
Low Channel:



Middle Channel:



High Channel:



Verdict: PASS

## Modulation Characteristics

### SPECIFICATION:

FCC §2.1047: Measurements required: Modulation characteristics.

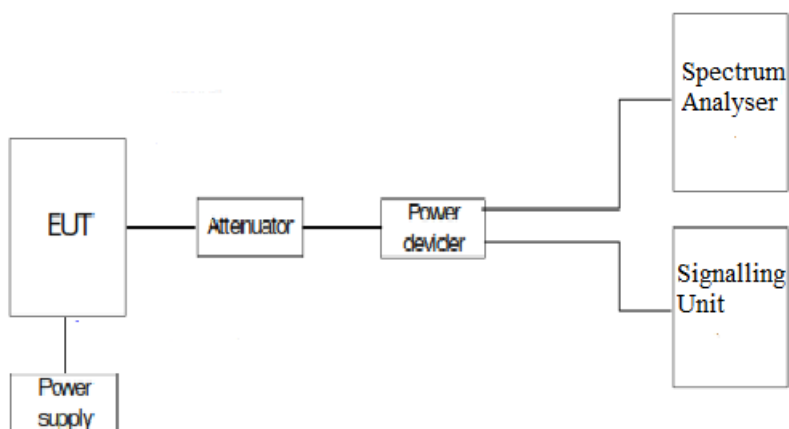
RSS-130 Clause 4.2: Equipment certified under this standard shall employ digital modulation.

RSS-139 Clause 6.2. : Modulation characteristics.

### METHOD:

For LTE the EUT operates with QPSK and 16QAM modulation modes in which the information is digitised and coded into a bit stream. The RF transmission is multiplexed using *Orthogonal Frequency Division Multiplexing (OFDM)* using different possible arrangement of subcarriers (Resource Blocks RB).

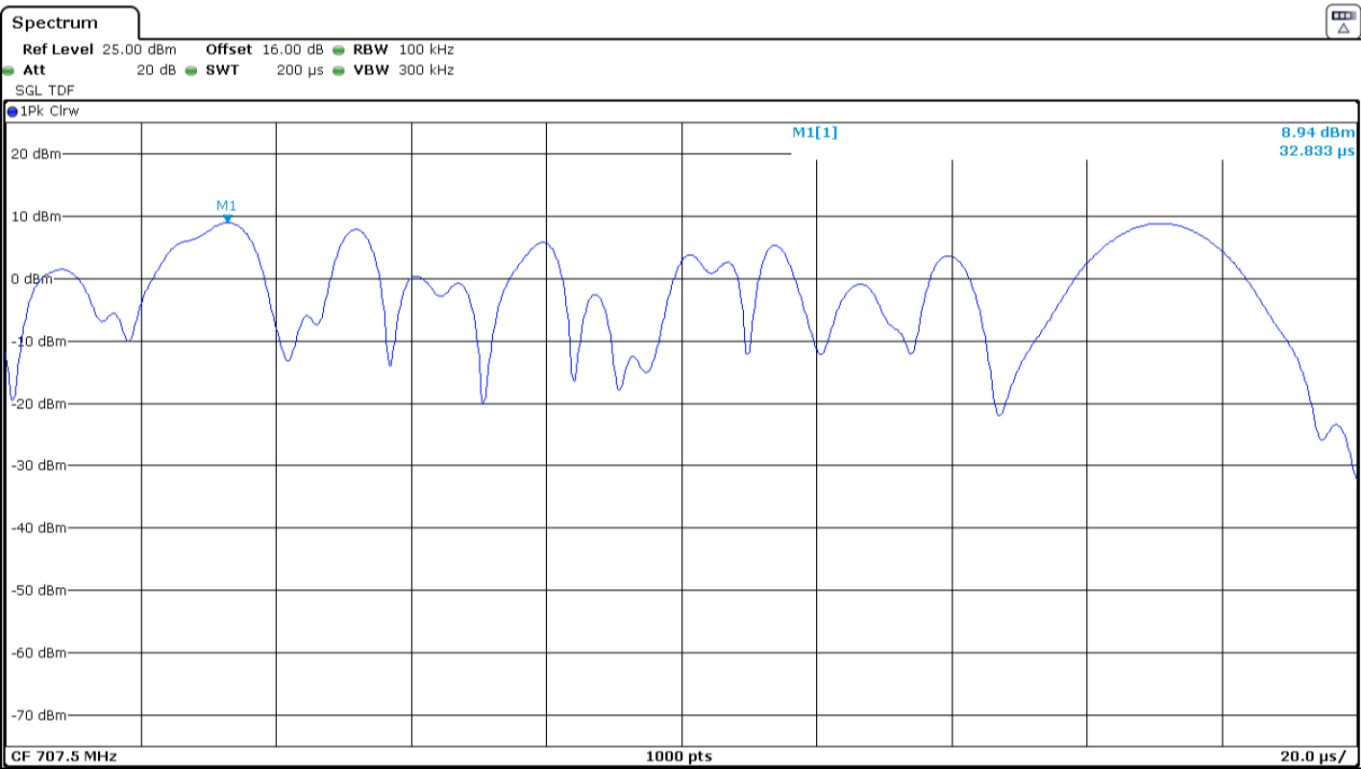
### TEST SETUP:



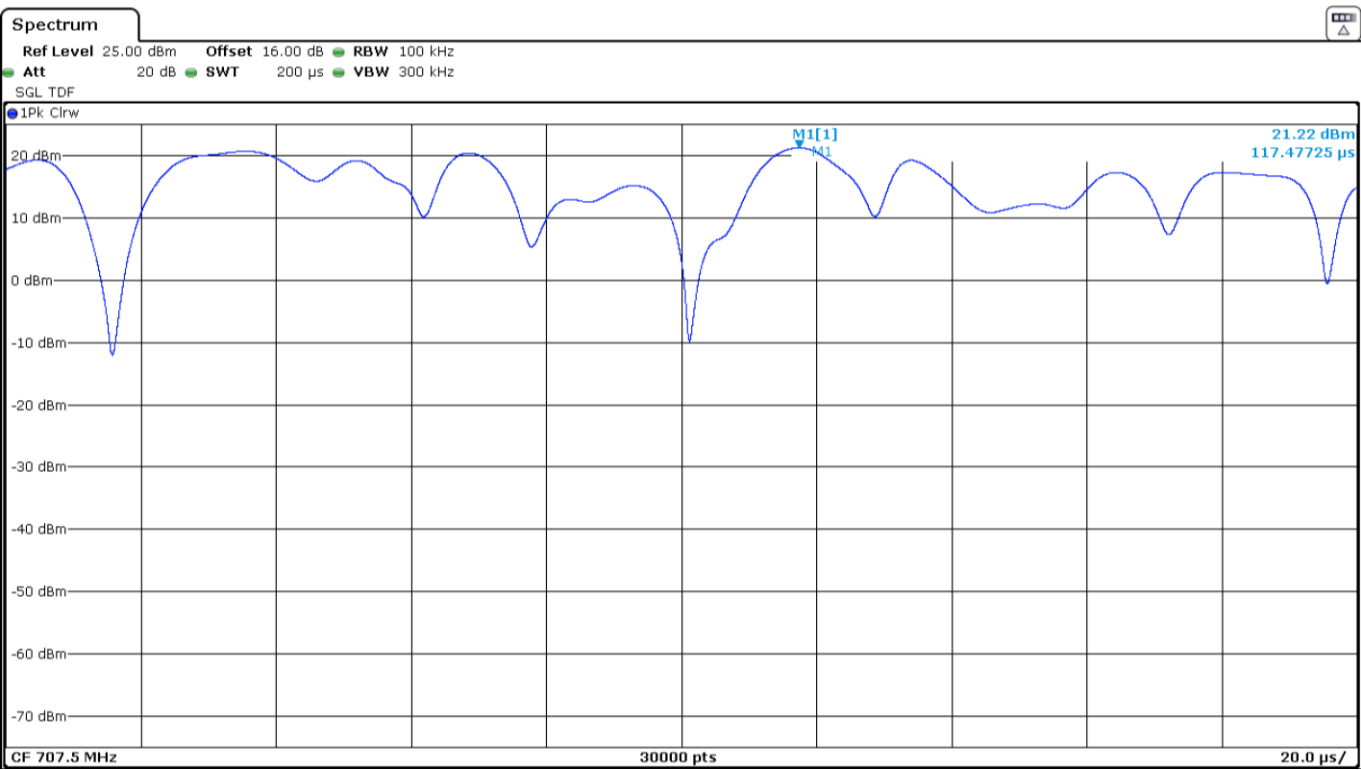
RESULTS:

The following plots show the modulation schemes in the EUT.

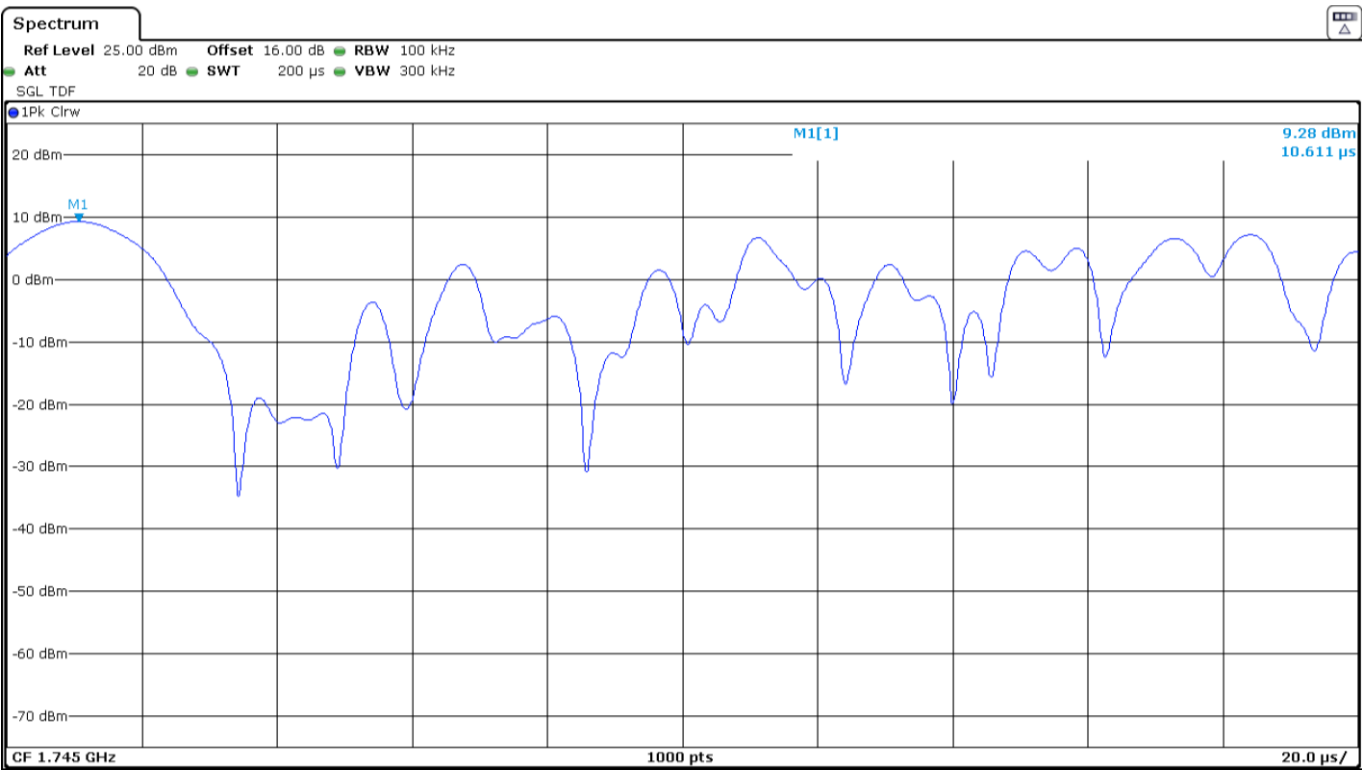
LTE Band 12. QPSK MODULATION. BW = 10 MHz.



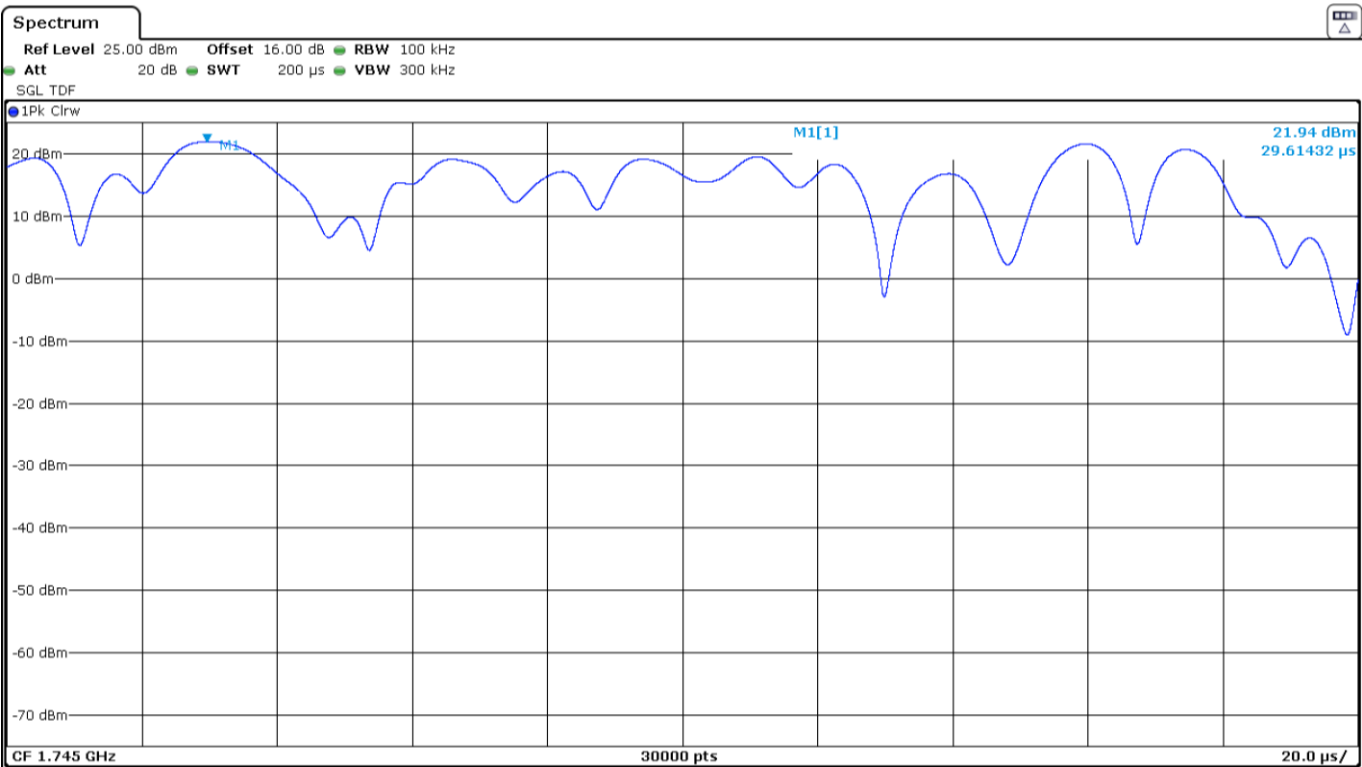
LTE Band 12. 16QAM MODULATION. BW = 10 MHz.



LTE Band 66. QPSK MODULATION. BW = 10 MHz.



LTE Band 66. 16QAM MODULATION. BW = 10 MHz.



## Frequency Stability

### SPECIFICATION:

#### FCC §27.54 & §2.1055:

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

#### RSS-130 Clause 4.5:

For equipment that is capable of transmitting numerous channels simultaneously for different applications (e.g. LTE and narrowband – Internet of Things (IoT)), the occupied bandwidth shall be the bandwidth representing the sum of the occupied bandwidths of these channels.

The frequency stability shall be sufficient to ensure that the occupied bandwidth remains within each operating frequency block range when tested at the temperature and supply voltage variations specified in RSS-Gen.

#### RSS-139 Clause 6.4:

The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

### METHOD:

The frequency tolerance measurements over temperature variations were made over the temperature range of –30°C to +50°C. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from –30°C up to +50°C.

The supply voltage was varied between 85% and 115% of nominal voltage.

The EUT was set in “Radio Resource Control (RRC) mode” in the middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.

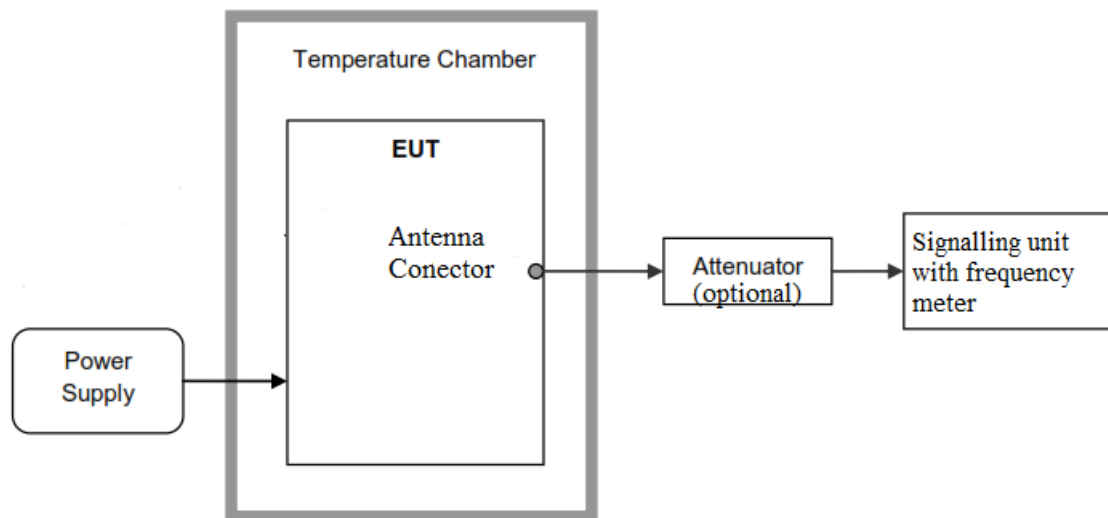
The worst case LTE mode for conducted power was used for the test.

In order to check that the frequency stability is sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point is established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the Low and High Channel of operation are identified as fL and fH respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of fL and fH to check that the resulting frequencies remain within the band.

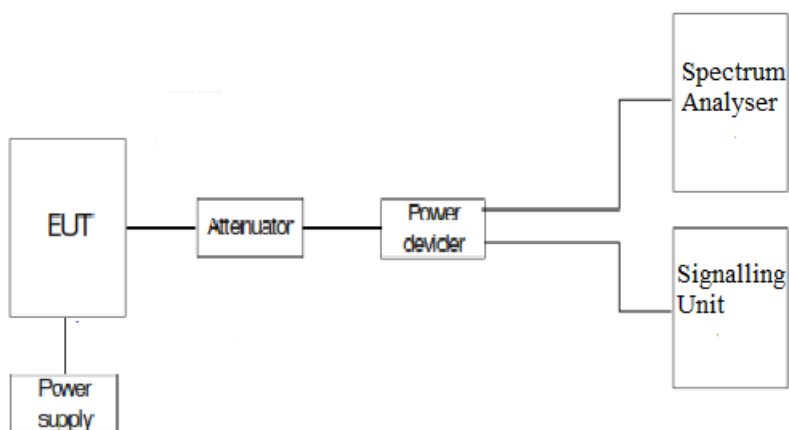
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

## TEST SETUP:

### 1. Frequency Tolerance:



### 2. Reference Frequency Points fL and fH:



## RESULTS:

### 1. FREQUENCY TOLERANCE:

- Frequency Stability over Temperature Variations:**

LTE Band 12. QPSK MODULATION. BW = 10 MHz.

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| +50              | -0.37                | -0.000522968          |
| +40              | 0.23                 | 0.000325088           |
| +30              | 0.01                 | 1.41343E-05           |
| +20              | -0.11                | -0.000155477          |
| +10              | 1.17                 | 0.00165371            |
| 0                | 1.14                 | 0.001611307           |
| -10              | 0.97                 | 0.001371025           |
| -20              | 1.10                 | 0.00155477            |
| -30              | 0.06                 | 8.48057E-05           |

LTE Band 66. QPSK MODULATION. BW = 10 MHz.

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| +50              | -2.63                | -0.001507163          |
| +40              | -2.86                | -0.001638968          |
| +30              | -3.42                | -0.001959885          |
| +20              | -3.19                | -0.00182808           |
| +10              | -1.19                | -0.000681948          |
| 0                | -0.60                | -0.00034384           |
| -10              | -3.05                | -0.001747851          |
| -20              | -3.18                | -0.00182235           |
| -30              | -1.95                | -0.001117479          |

- Frequency Stability over Voltage Variations.**

LTE Band 12. QPSK MODULATION. BW = 10 MHz.

| Battery Supply voltage | Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------------|-------------|----------------------|-----------------------|
| Vmax                   | 4.37        | -0.43                | -0.000607774          |
| Vmin(*)                | 3.23        | 0.74                 | 0.001045936           |

(\*): Operating end point specified by the manufacturer.

LTE Band 66. QPSK MODULATION. BW = 10 MHz.

| Battery Supply voltage | Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------------|-------------|----------------------|-----------------------|
| Vmax                   | 4.37        | -2.90                | -0.001661891          |
| Vmin(*)                | 3.23        | -3.45                | -0.001977077          |

(\*): Operating end point specified by the manufacturer.

## 2. REFERENCE FREQUENCY POINTS $f_L$ AND $f_H$ :

The worst-case frequency offsets added or subtracted per band and bandwidth:

### LTE Band 12:

|             |                                     |
|-------------|-------------------------------------|
|             | LTE QPSK MODULATION.<br>BW = 10 MHz |
| $f_L$ (MHz) | 699.2390                            |
| $f_H$ (MHz) | 715.7750                            |

### LTE Band 66:

|             |                                     |
|-------------|-------------------------------------|
|             | LTE QPSK MODULATION.<br>BW = 10 MHz |
| $f_L$ (MHz) | 1710.1454                           |
| $f_H$ (MHz) | 1779.8586                           |

The reference frequency points  $f_L$  and  $f_H$  stay within the authorized blocks for all the bands above.

Verdict: PASS

## Occupied Bandwidth

### SPECIFICATION:

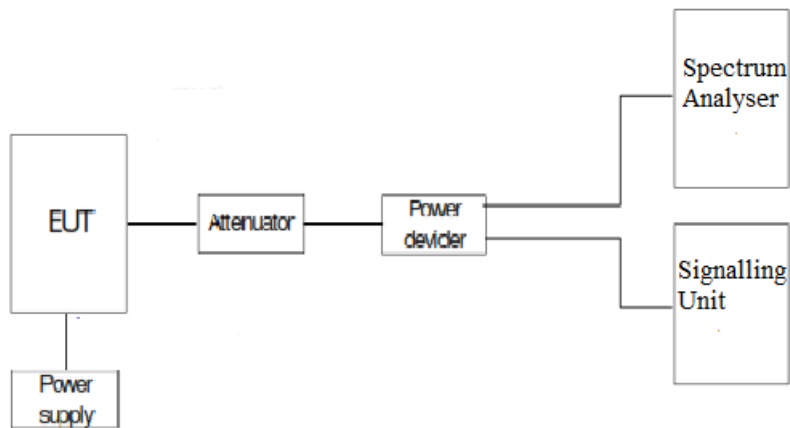
FCC §2.1049: Measurements required: Occupied bandwidth.

RSS-Gen Clause 6.7: Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth.

### METHOD:

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation. The 99% occupied bandwidth and the -26 dBc bandwidth were measured directly using the built-in bandwidth measuring option of spectrum analyser.

### TEST SETUP:



## RESULTS:

**LTE Band:** The worst case of Occupied Bandwidth corresponds to all Resource Blocks (RB) with Offset 0, regardless the nominal bandwidth selected.

### LTE Band 12:

LTE Band 12. QPSK MODULATION. BW = 1.4 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (kHz)  | 1.109       | 1.092          | 1.102        |
| -26 dBc bandwidth (kHz)       | 1.321       | 1.301          | 1.326        |
| Measurement uncertainty (kHz) | <±4.05      |                |              |

LTE Band 12. 16QAM MODULATION. BW = 1.4 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (kHz)  | 1.095       | 1.093          | 1.107        |
| -26 dBc bandwidth (kHz)       | 1.309       | 1.305          | 1.318        |
| Measurement uncertainty (kHz) | <±4.05      |                |              |

LTE Band 12. QPSK MODULATION. BW = 3 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (kHz)  | 2.744       | 2.742          | 2.728        |
| -26 dBc bandwidth (kHz)       | 3.085       | 3.071          | 3.056        |
| Measurement uncertainty (kHz) | <±12.71     |                |              |

LTE Band 12. 16QAM MODULATION. BW = 3 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (kHz)  | 2.734       | 2.740          | 2.738        |
| -26 dBc bandwidth (kHz)       | 3.059       | 3.063          | 3.062        |
| Measurement uncertainty (kHz) | <±12.71     |                |              |

LTE Band 12. QPSK MODULATION. BW = 5 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (kHz)  | 4.500       | 4.547          | 4.493        |
| -26 dBc bandwidth (kHz)       | 4.993       | 5.077          | 5.014        |
| Measurement uncertainty (kHz) | <±13.48     |                |              |

LTE Band 12. 16QAM MODULATION. BW = 5 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (kHz)  | 4.500       | 4.510          | 4.490        |
| -26 dBc bandwidth (kHz)       | 5.013       | 5.064          | 4.990        |
| Measurement uncertainty (kHz) | <±13.48     |                |              |

LTE Band 12. QPSK MODULATION. BW = 10 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (kHz)  | 8.960       | 9.040          | 9.053        |
| -26 dBc bandwidth (kHz)       | 10.075      | 10.041         | 10.154       |
| Measurement uncertainty (kHz) | <±15.40     |                |              |

LTE Band 12. 16QAM MODULATION. BW = 10 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (kHz)  | 4.513       | 4.527          | 4.527        |
| -26 dBc bandwidth (kHz)       | 5.246       | 5.293          | 5.223        |
| Measurement uncertainty (kHz) | <±15.40     |                |              |

LTE Band 66:

LTE Band 66. QPSK MODULATION. BW = 1.4 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 1.097       | 1.101          | 1.090        |
| -26 dBc bandwidth (MHz)       | 1.300       | 1.383          | 1.306        |
| Measurement uncertainty (kHz) | <±4.05      |                |              |

LTE Band 66. 16QAM MODULATION. BW = 1.4 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 1.106       | 1.096          | 1.094        |
| -26 dBc bandwidth (MHz)       | 1.323       | 1.315          | 1.309        |
| Measurement uncertainty (kHz) | <±4.05      |                |              |

LTE Band 66. QPSK MODULATION. BW = 3 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 2.740       | 2.744          | 2.746        |
| -26 dBc bandwidth (MHz)       | 3.073       | 3.088          | 3.093        |
| Measurement uncertainty (kHz) | <±12.71     |                |              |

LTE Band 66. 16QAM MODULATION. BW = 3 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 2.736       | 2.746          | 2.728        |
| -26 dBc bandwidth (MHz)       | 3.069       | 3.070          | 3.069        |
| Measurement uncertainty (kHz) | <±12.71     |                |              |

LTE Band 66. QPSK MODULATION. BW = 5 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 4.537       | 4.513          | 4.500        |
| -26 dBc bandwidth (MHz)       | 5.091       | 5.015          | 5.027        |
| Measurement uncertainty (kHz) | <±13.48     |                |              |

LTE Band 66. 16QAM MODULATION. BW = 5 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 4.513       | 4.510          | 4.500        |
| -26 dBc bandwidth (MHz)       | 5.061       | 5.038          | 5.004        |
| Measurement uncertainty (kHz) | <±13.48     |                |              |

LTE Band 66. QPSK MODULATION. BW = 10 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 9.027       | 9.027          | 9.040        |
| -26 dBc bandwidth (MHz)       | 10.219      | 10.199         | 10.069       |
| Measurement uncertainty (kHz) | <±15.40     |                |              |

LTE Band 66. 16QAM MODULATION. BW = 10 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 4,540       | 4,533          | 4,527        |
| -26 dBc bandwidth (MHz)       | 5,303       | 5,274          | 5,357        |
| Measurement uncertainty (kHz) | <±15.40     |                |              |

LTE Band 66. QPSK MODULATION. BW = 15 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 13.430      | 13.460         | 13.460       |
| -26 dBc bandwidth (MHz)       | 14.681      | 14.806         | 14.868       |
| Measurement uncertainty (kHz) | <±17.34     |                |              |

LTE Band 66. 16QAM MODULATION. BW = 15 MHz.

|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 4,520       | 4,530          | 4,530        |
| -26 dBc bandwidth (MHz)       | 5,236       | 5,277          | 5,461        |
| Measurement uncertainty (kHz) | <±17.34     |                |              |

LTE Band 66. QPSK MODULATION. BW = 20 MHz.

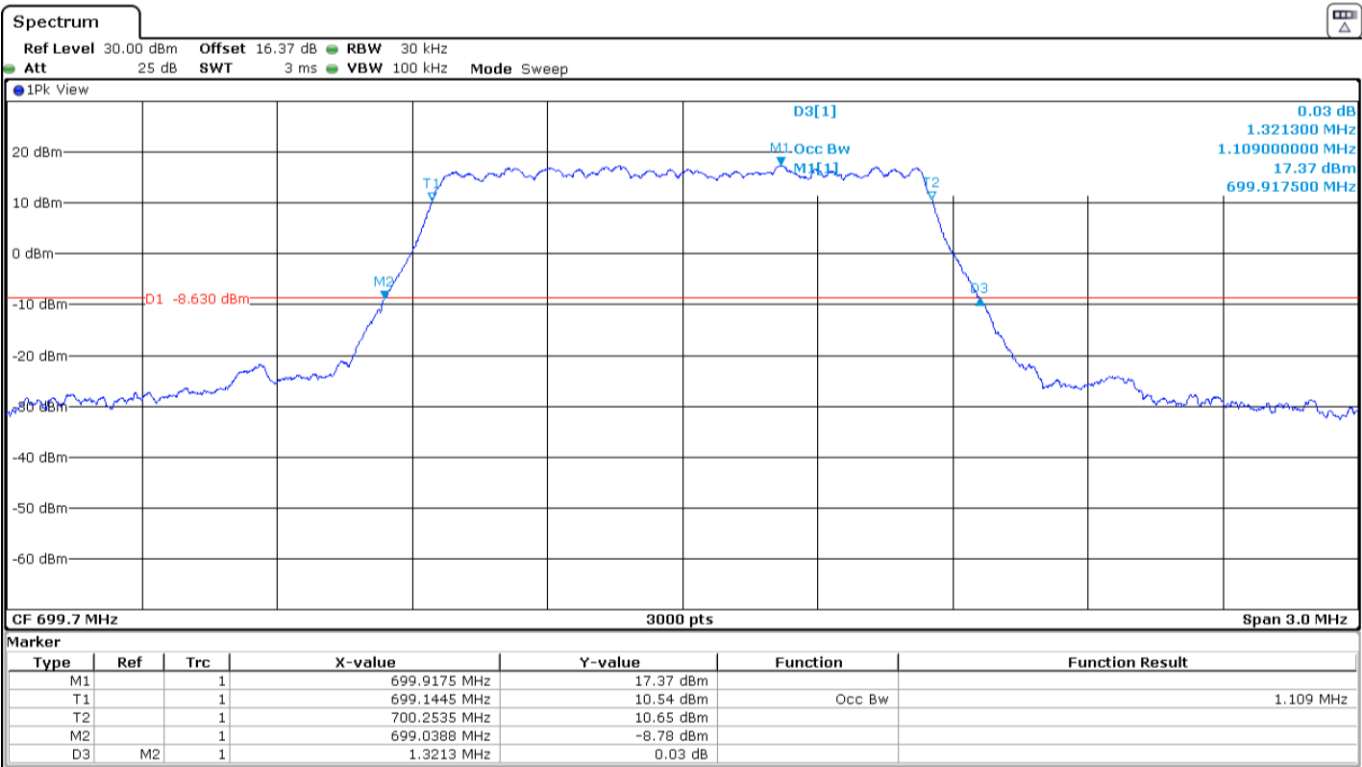
|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 17.867      | 17.880         | 17.867       |
| -26 dBc bandwidth (MHz)       | 19.448      | 19.351         | 19.475       |
| Measurement uncertainty (kHz) | <±19.26     |                |              |

LTE Band 66. 16QAM MODULATION. BW = 20 MHz.

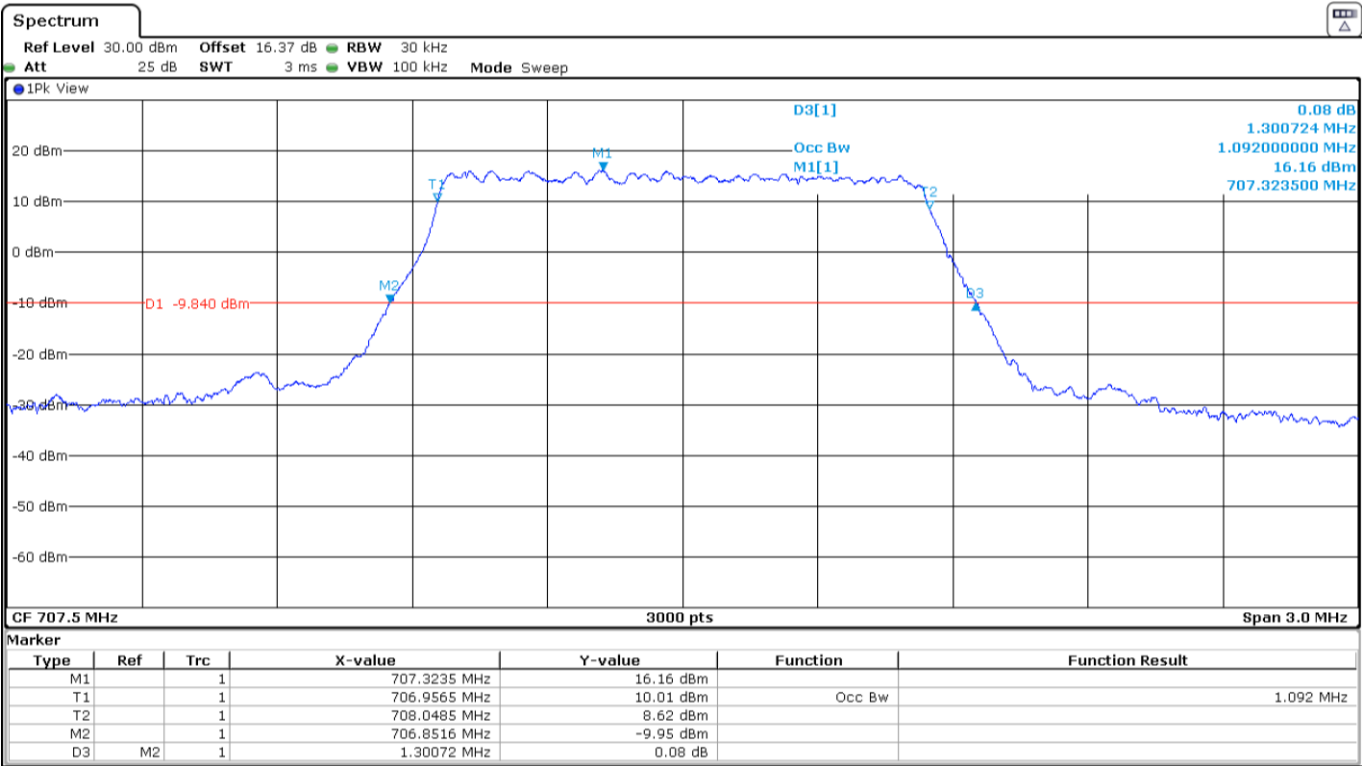
|                               | Low Channel | Middle Channel | High Channel |
|-------------------------------|-------------|----------------|--------------|
| 99% Occupied bandwidth (MHz)  | 4,573       | 4,573          | 4,573        |
| -26 dBc bandwidth (MHz)       | 5,505       | 5,532          | 5,657        |
| Measurement uncertainty (kHz) | <±19.26     |                |              |

LTE Band 12. QPSK MODULATION. BW = 1.4 MHz.

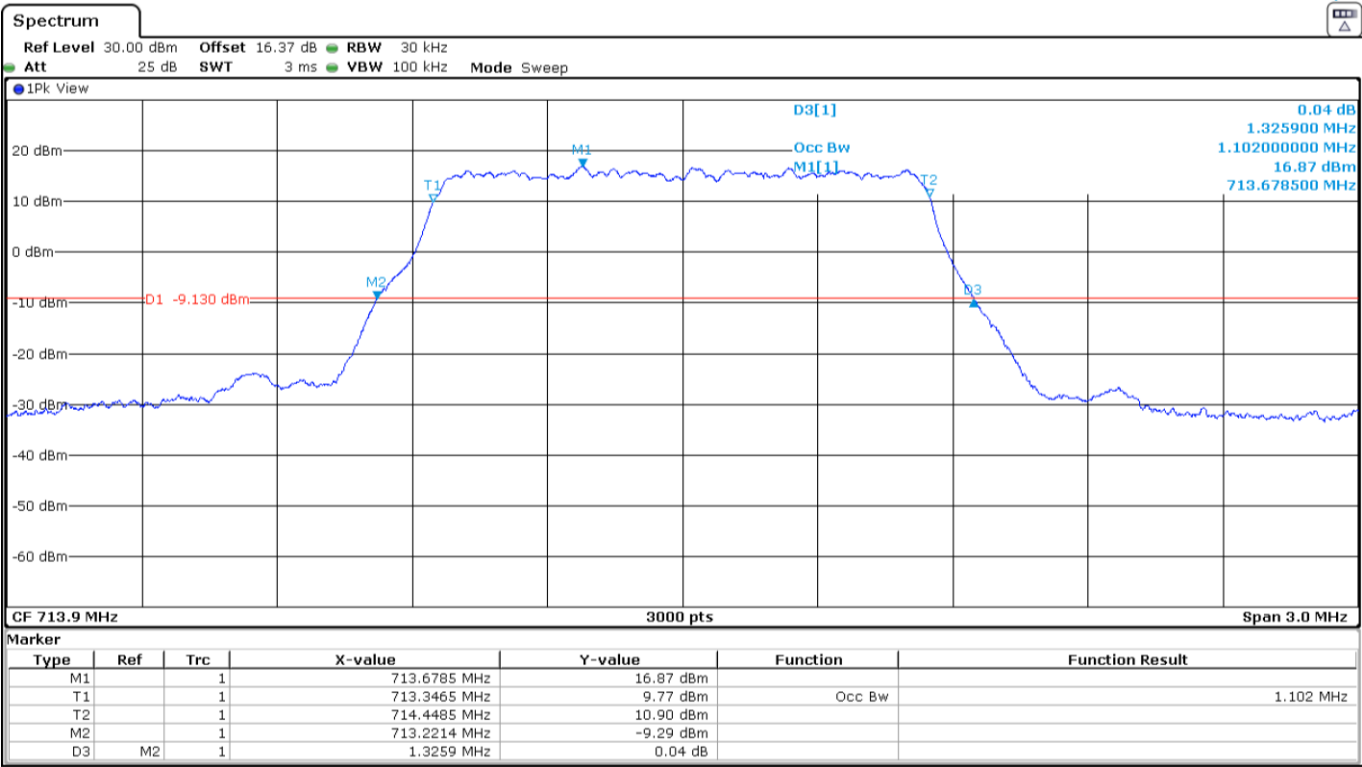
Low Channel:



Middle Channel:

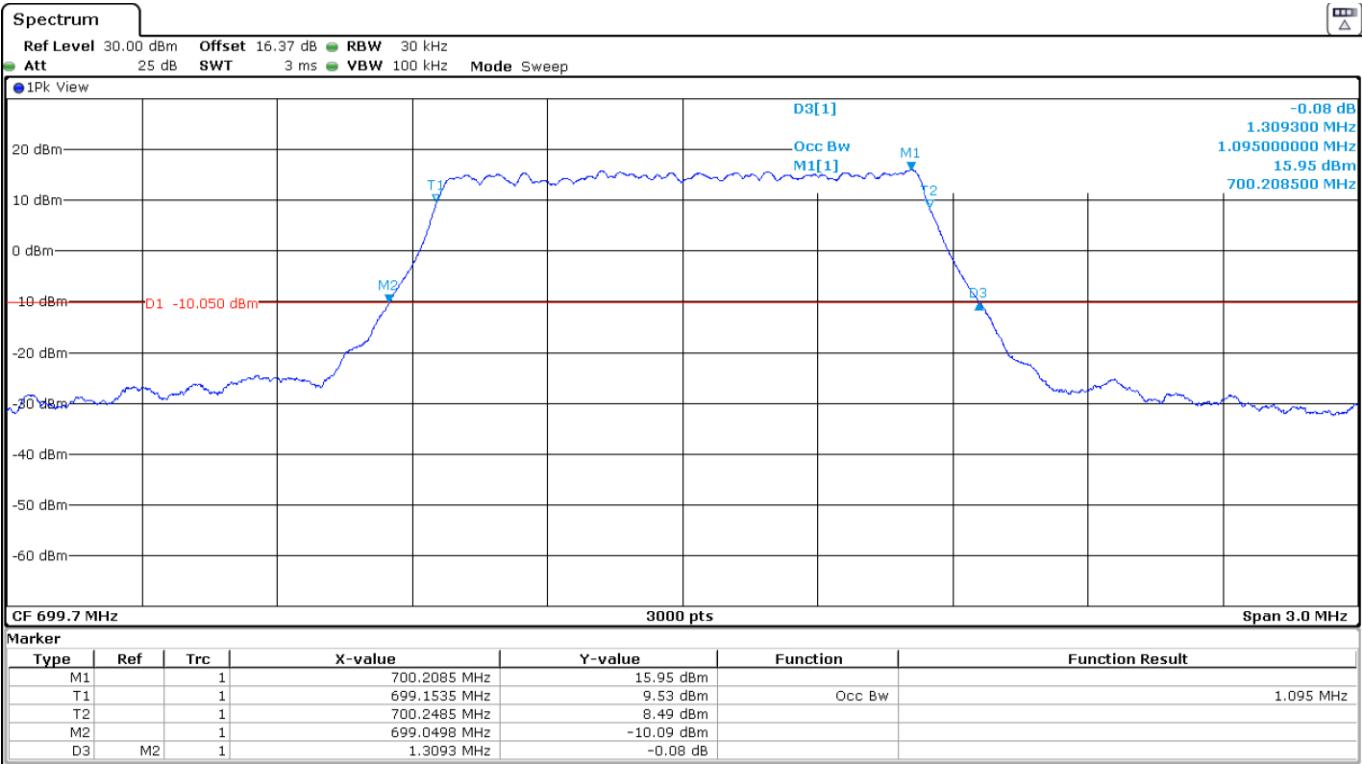


High Channel:

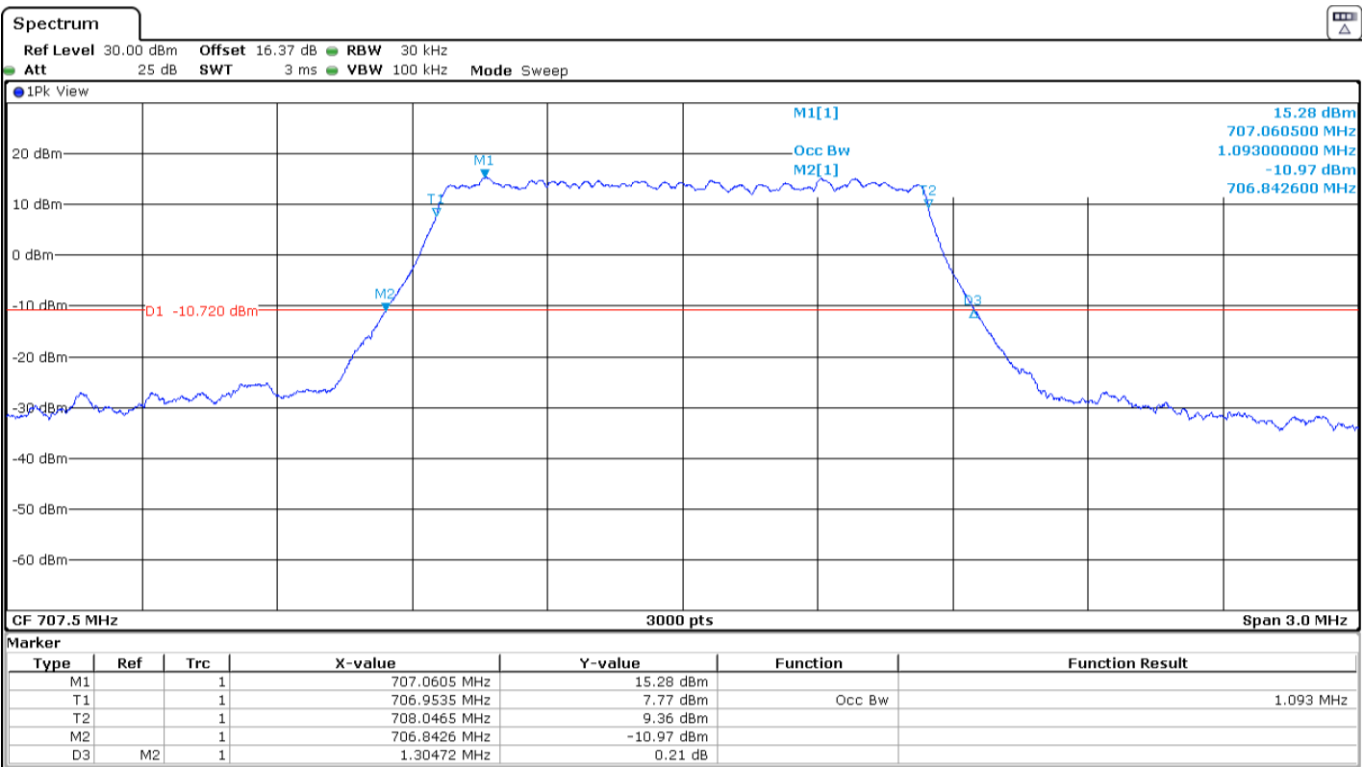


LTE Band 12. 16QAM MODULATION. BW = 1.4 MHz.

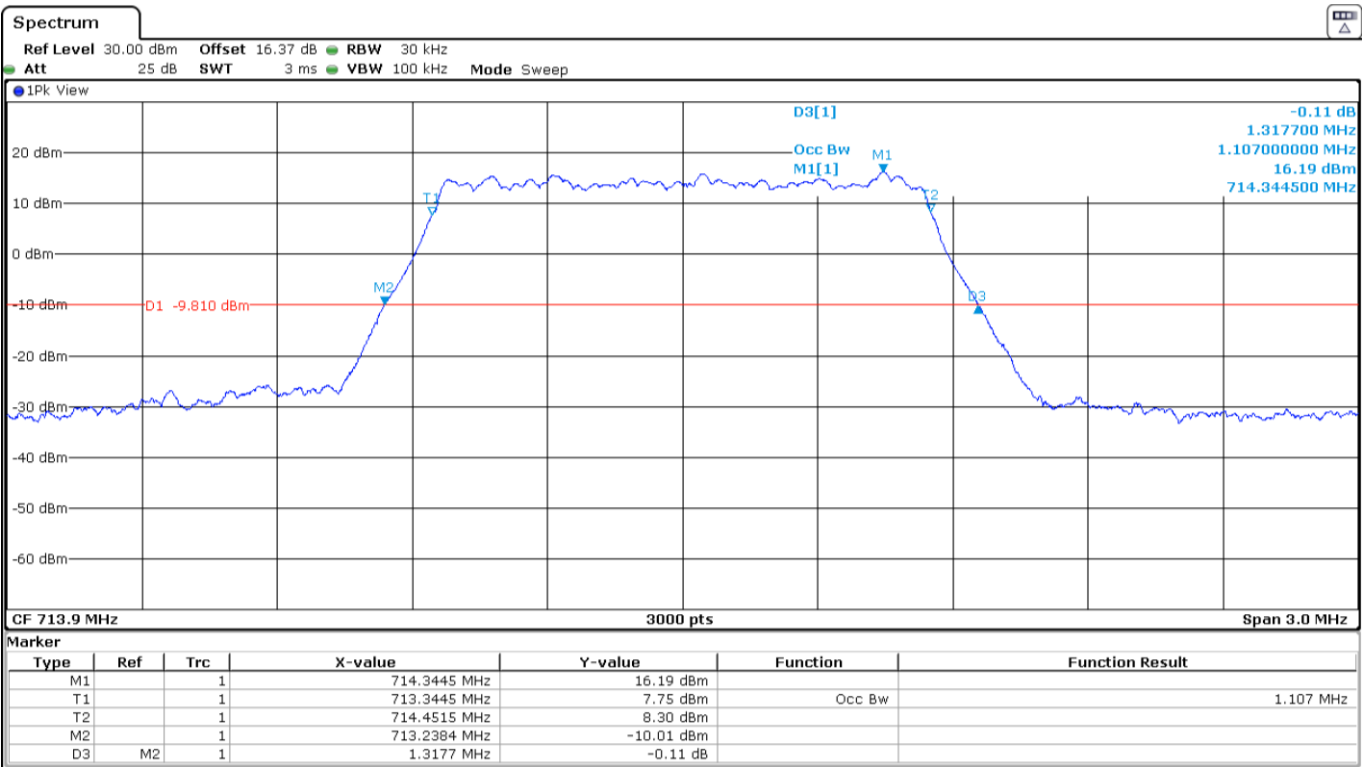
Low Channel:



Middle Channel:

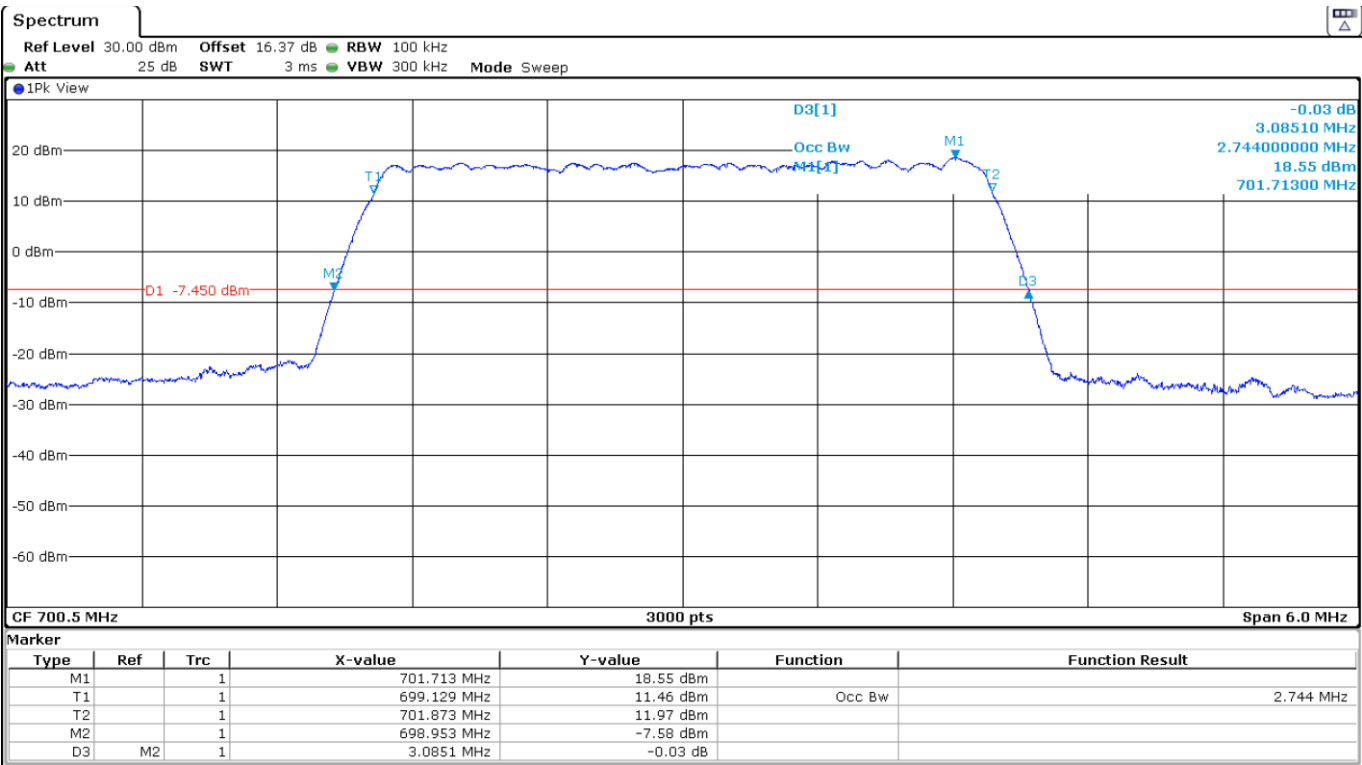


High Channel:

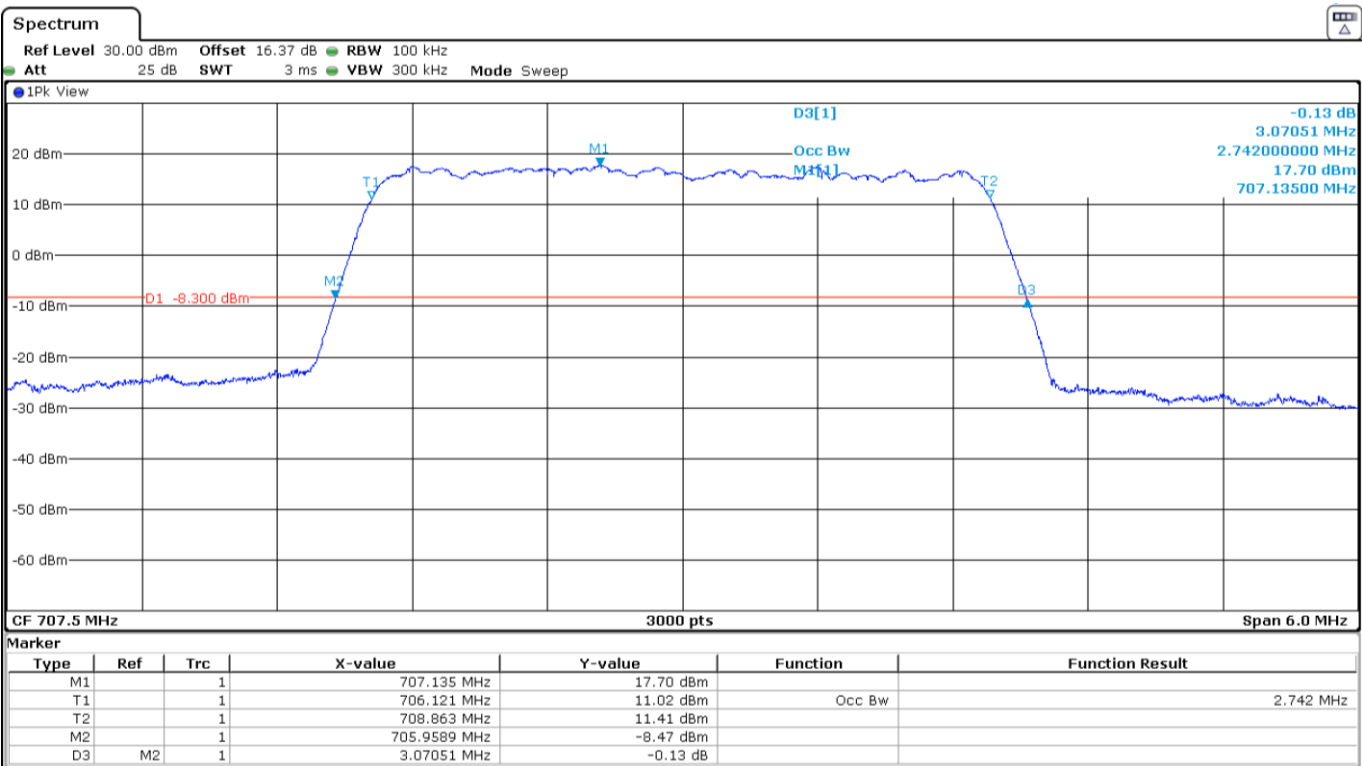


LTE Band 12. QPSK MODULATION. BW = 3 MHz.

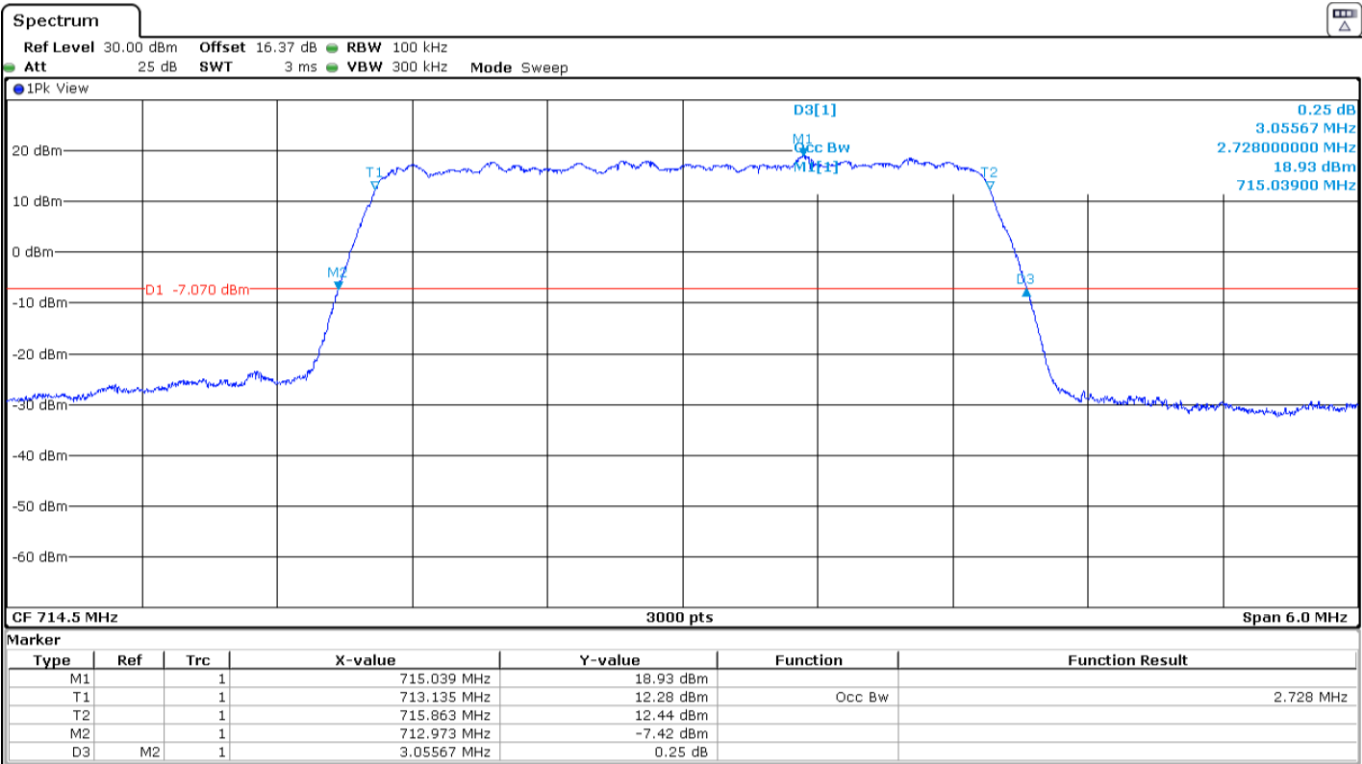
Low Channel:



Middle Channel:

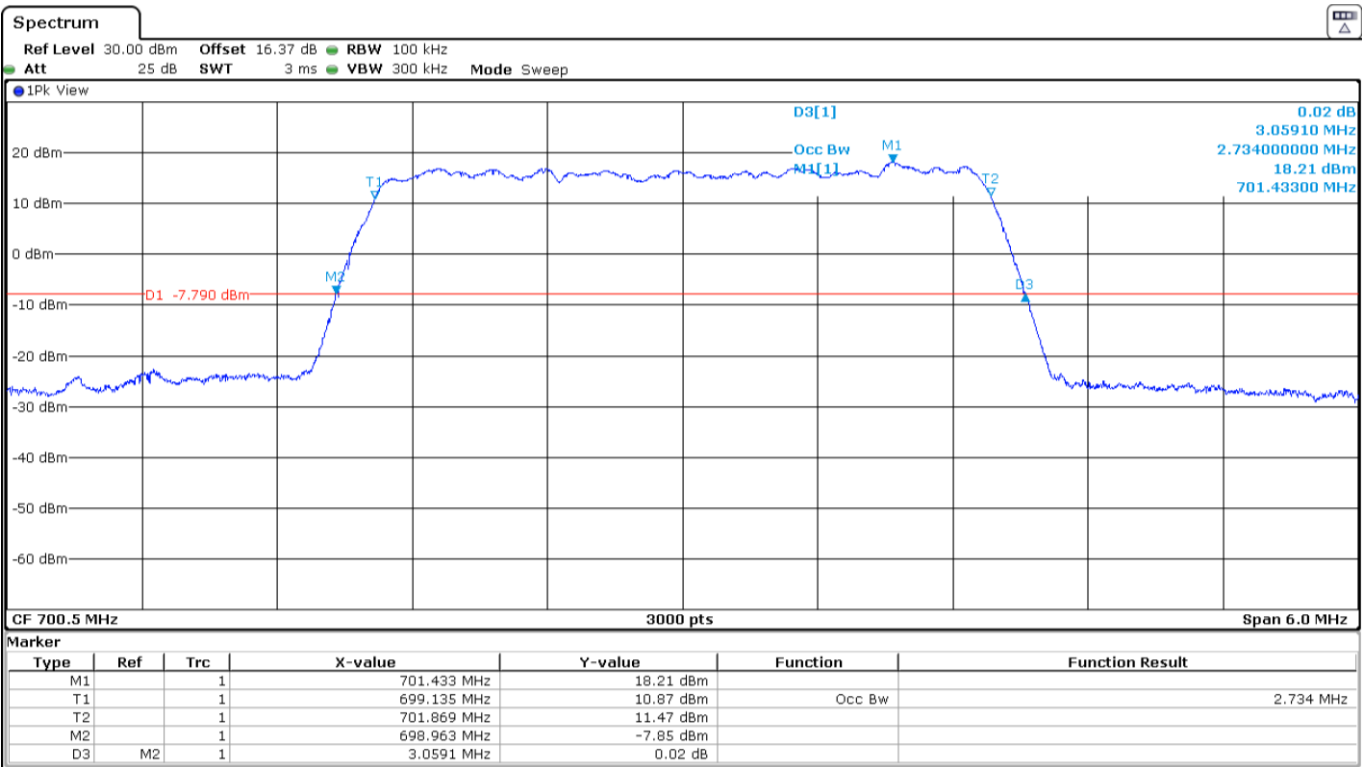


High Channel:

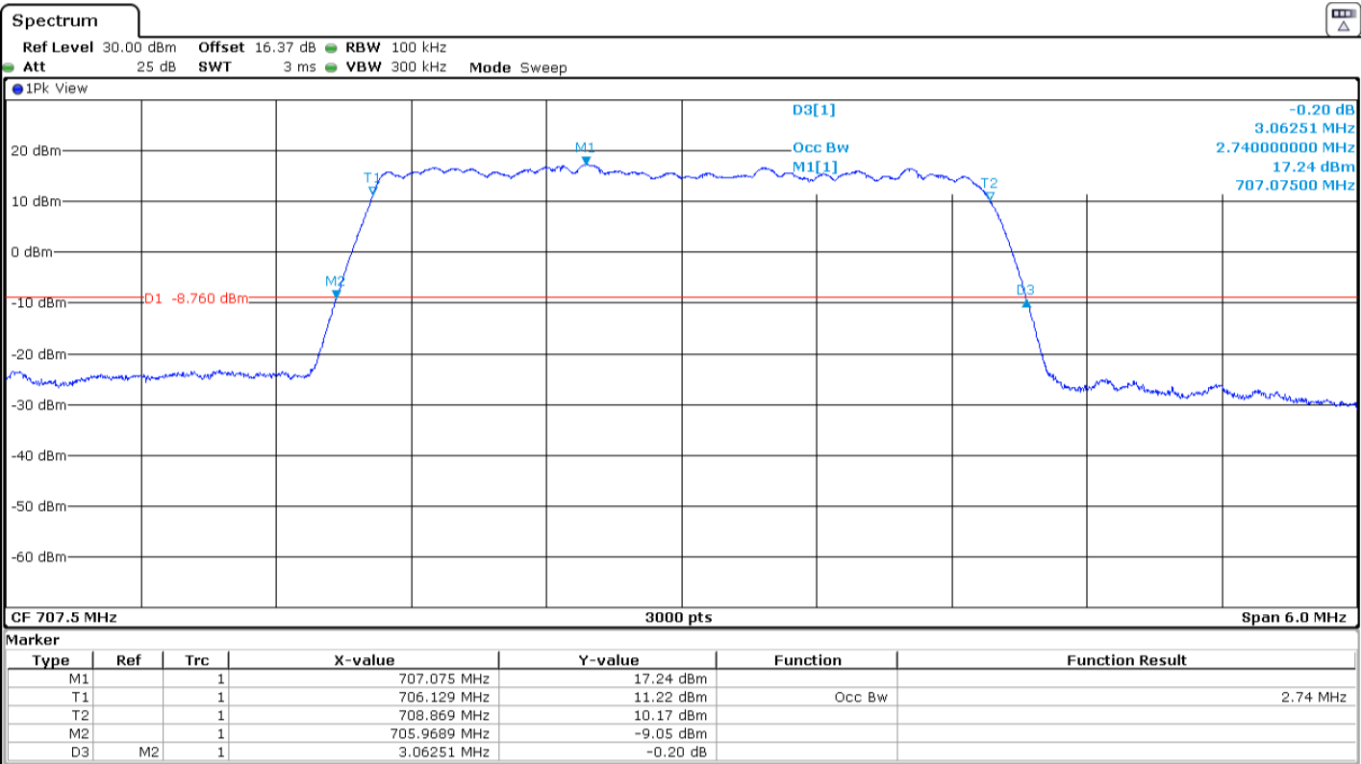


LTE Band 12. 16QAM MODULATION. BW = 3 MHz.

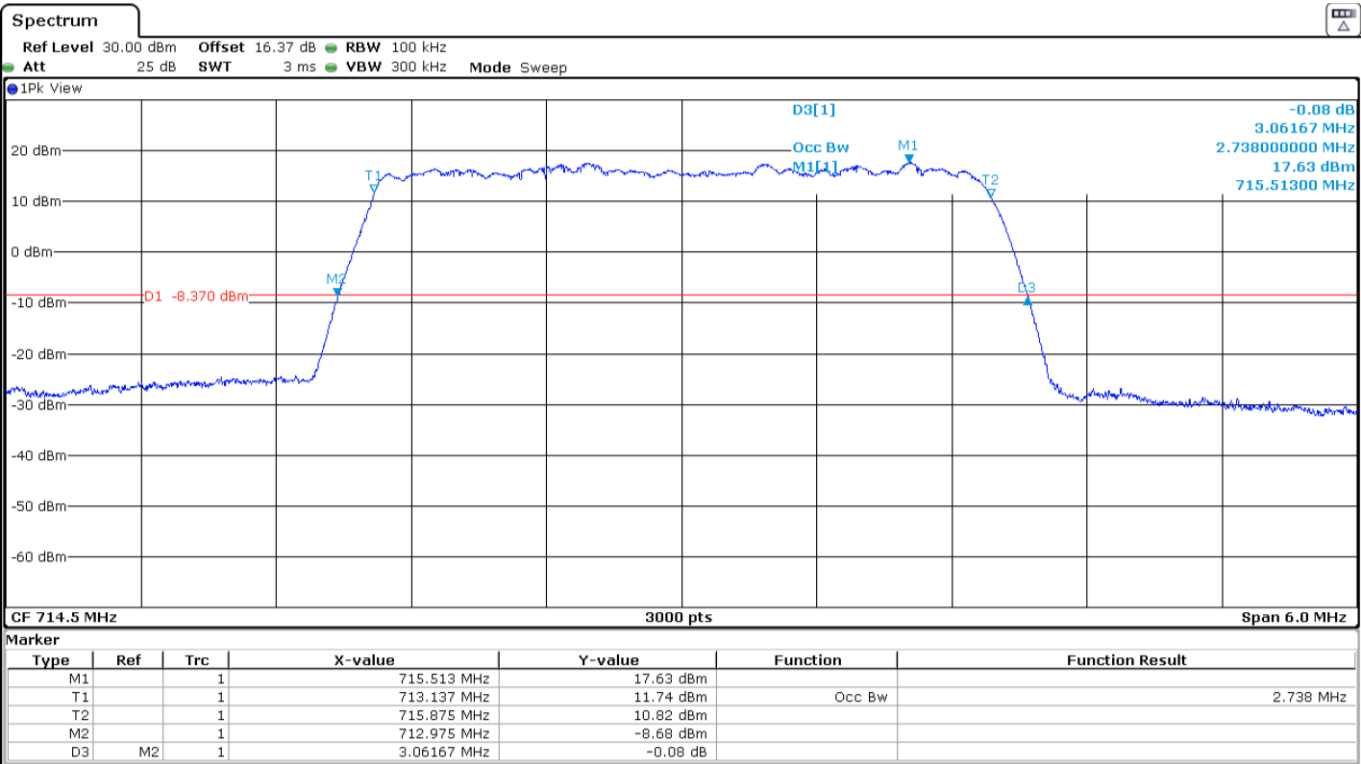
Low Channel:



Middle Channel:

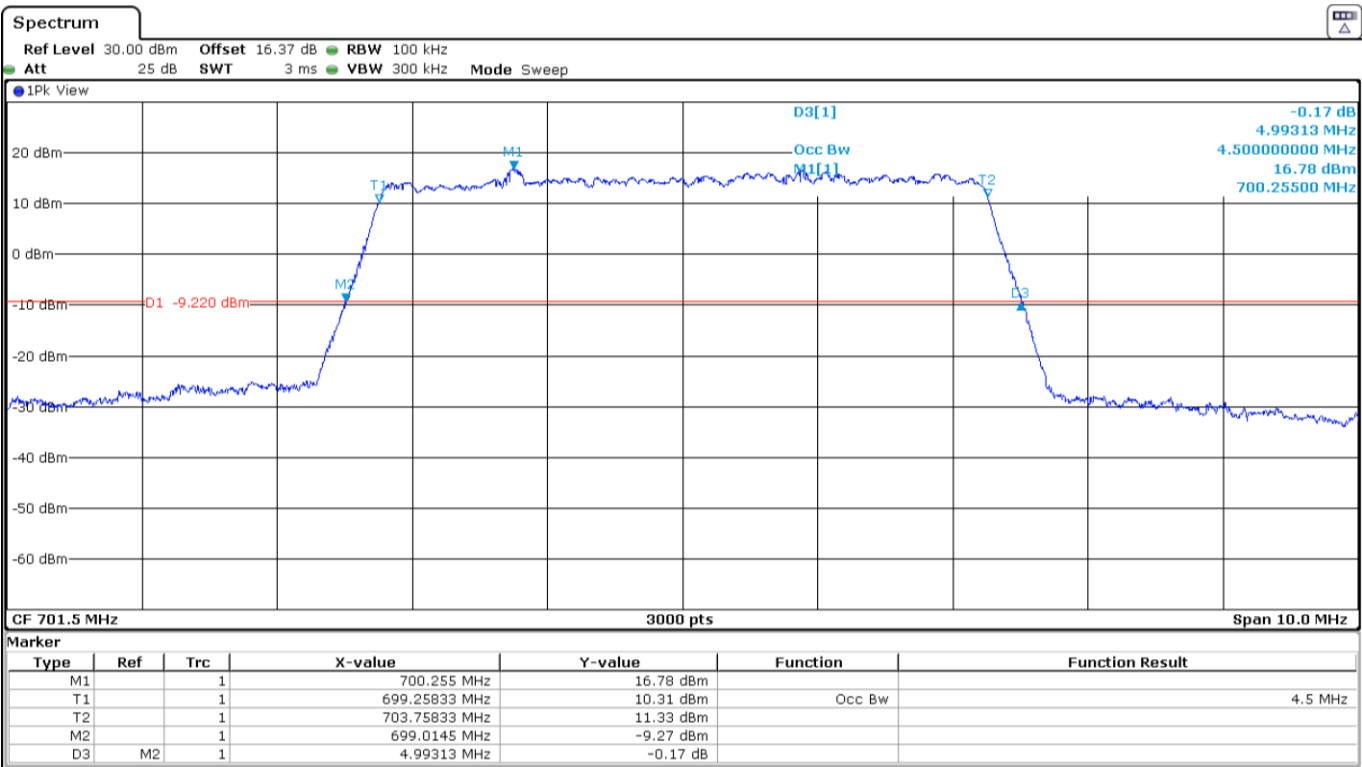


High Channel:

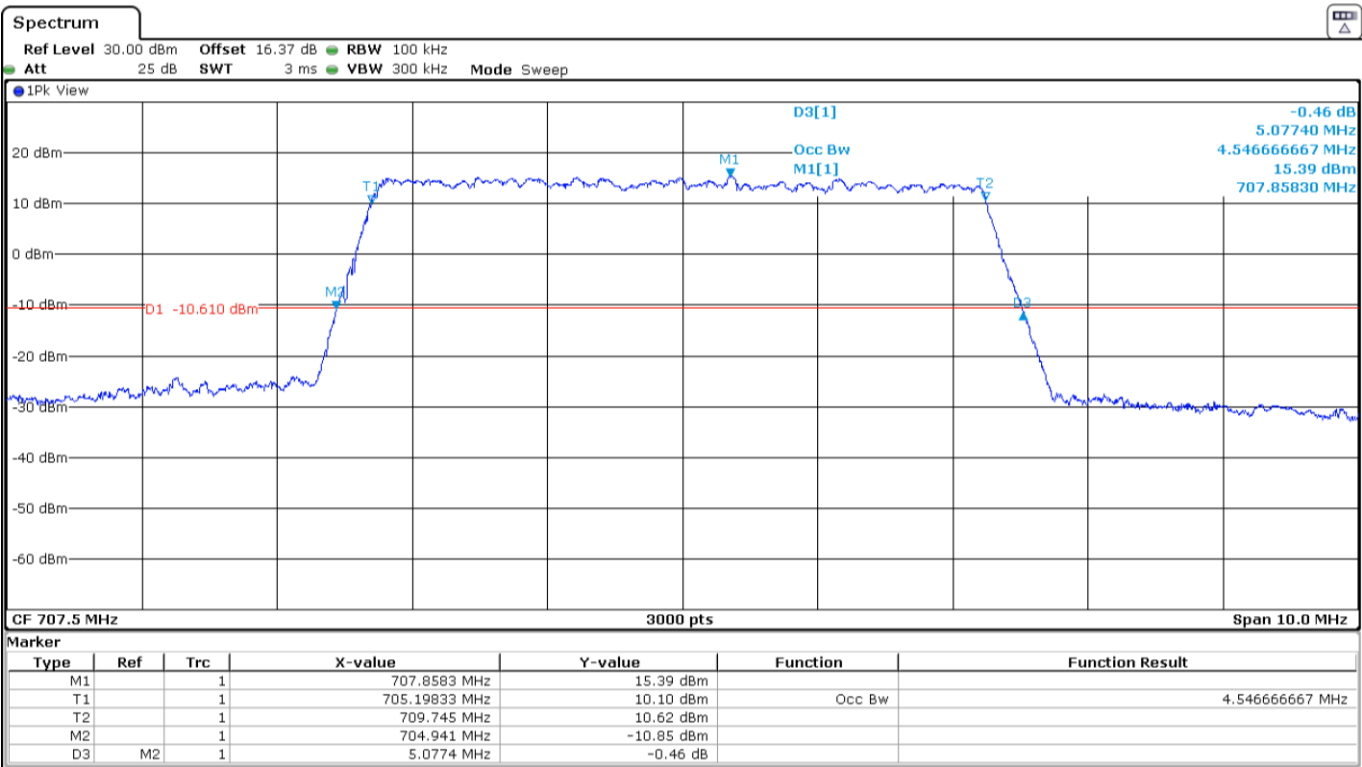


LTE Band 12. QPSK MODULATION. BW = 5 MHz.

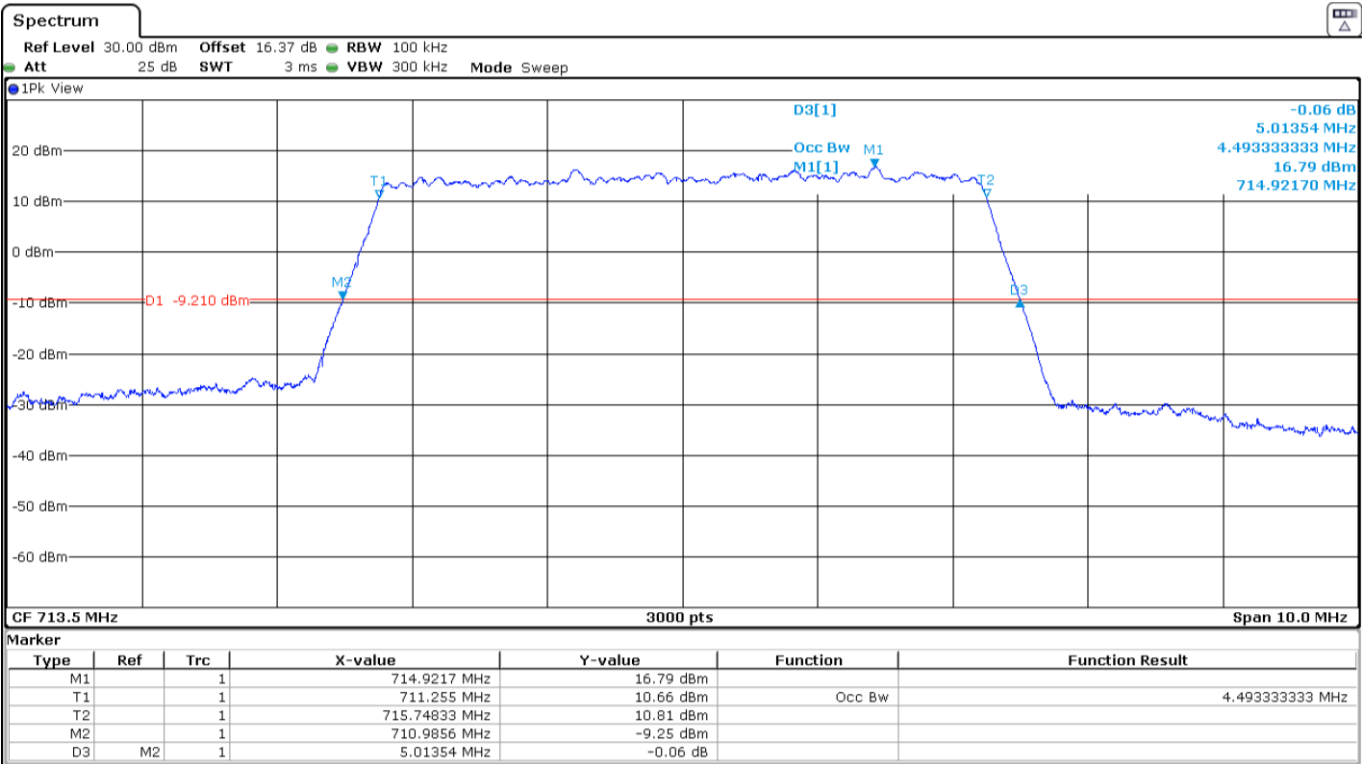
Low Channel:



Middle Channel:

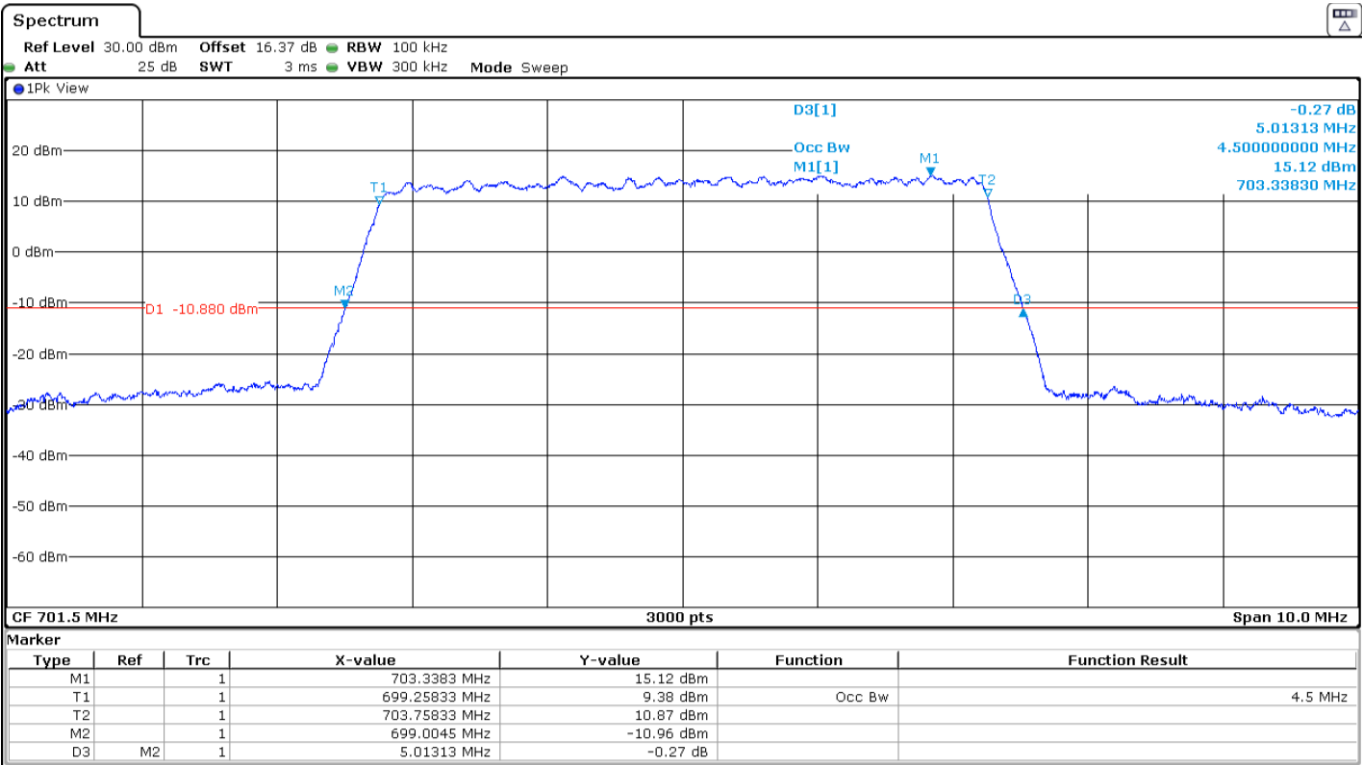


High Channel:

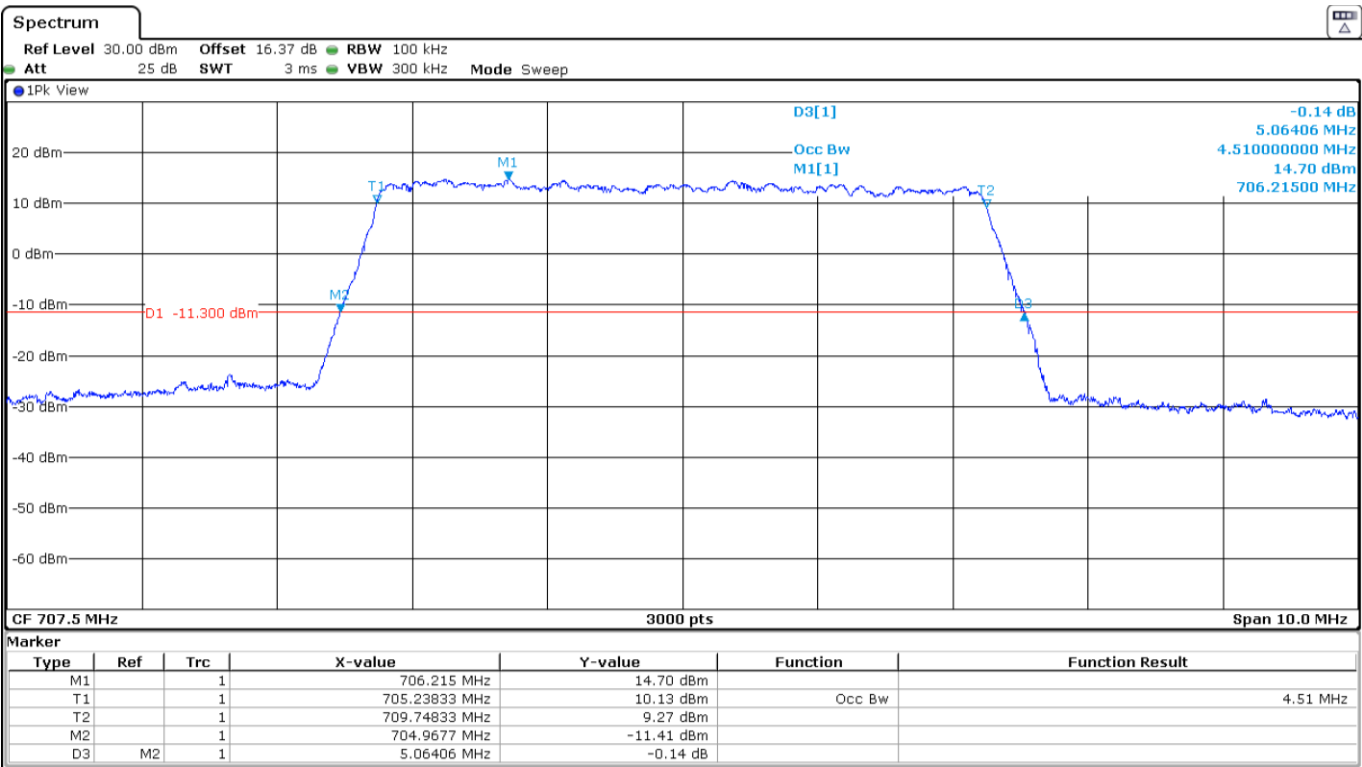


LTE Band 12. 16QAM MODULATION. BW = 5 MHz.

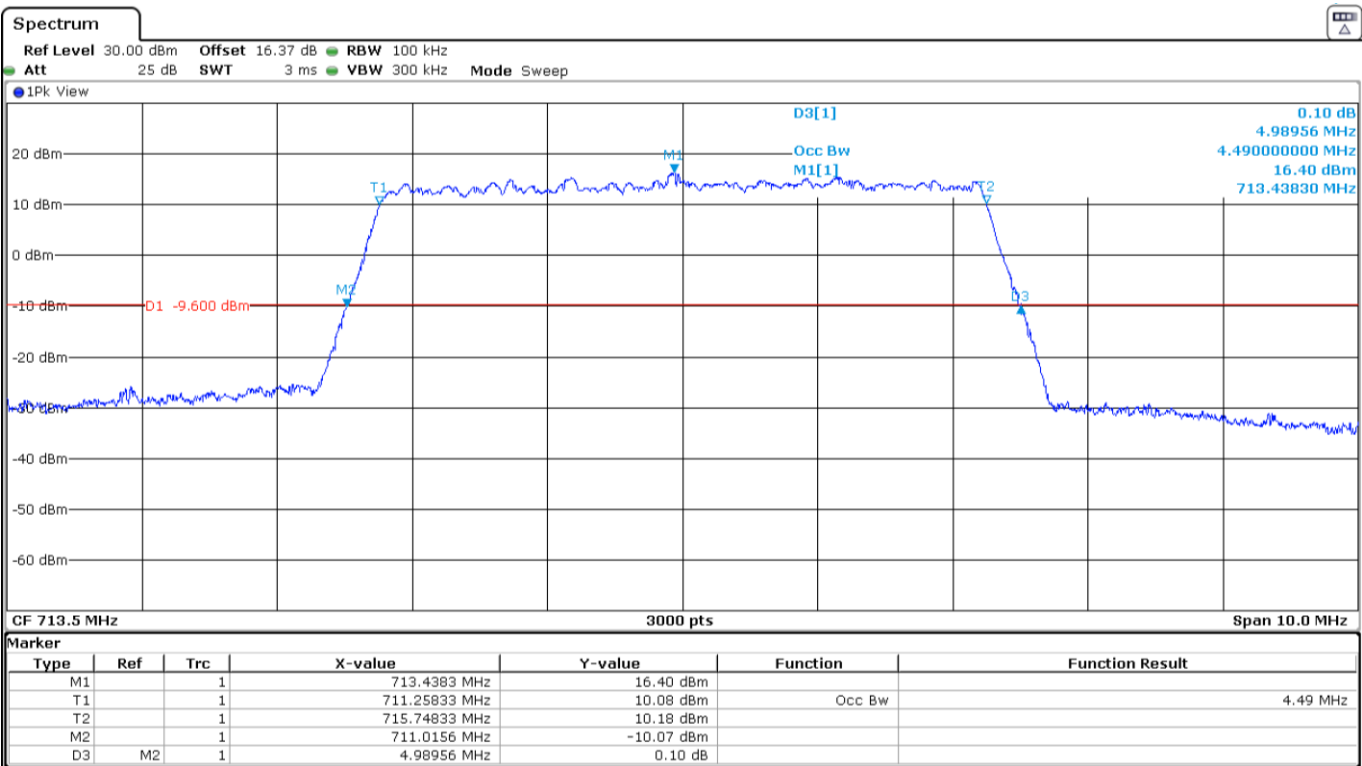
Low Channel:



Middle Channel:

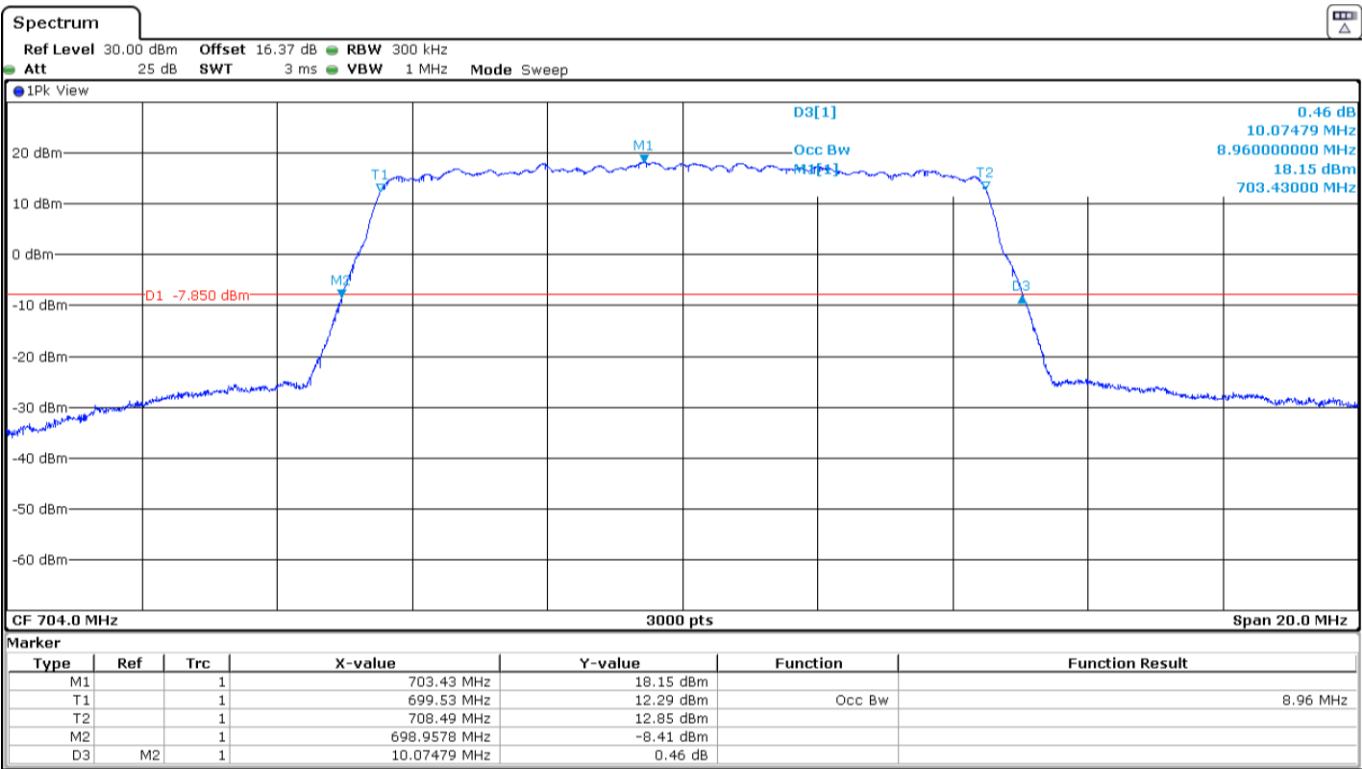


High Channel:

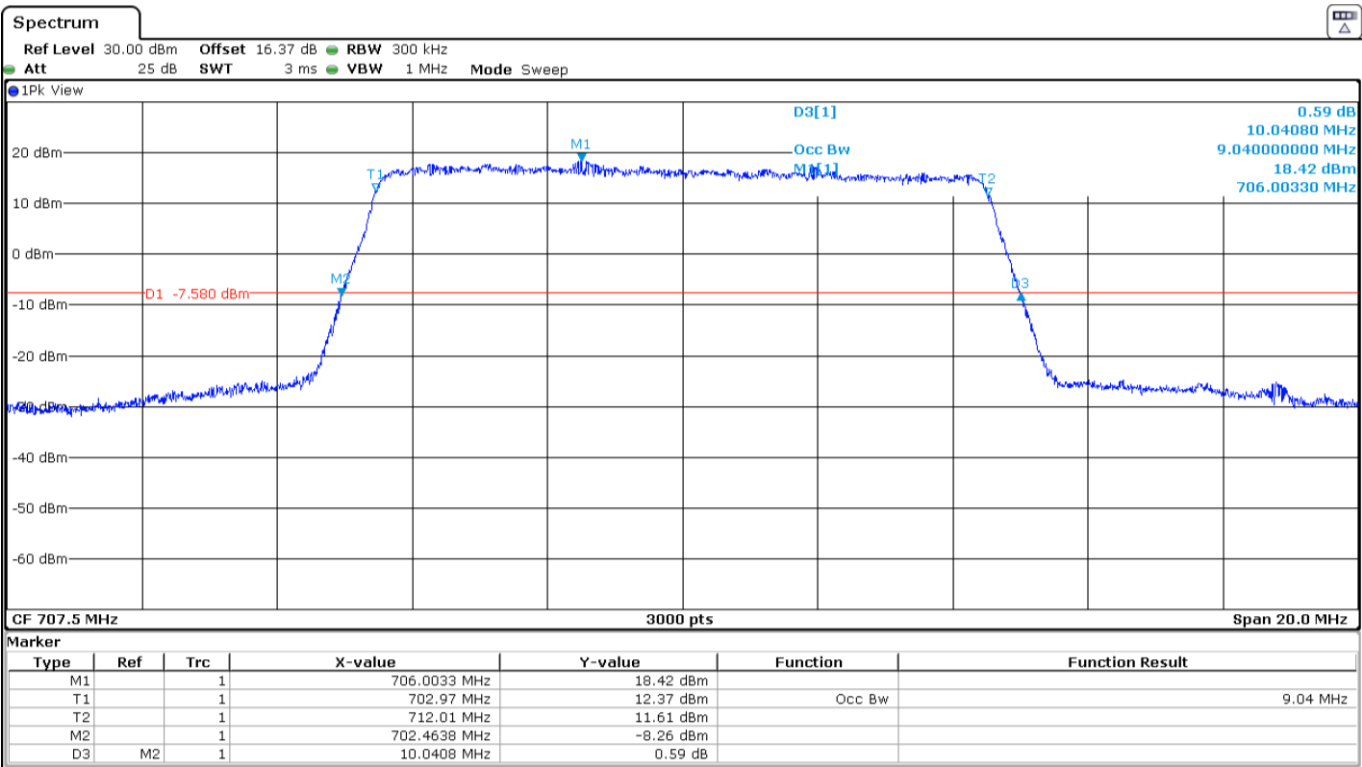


LTE Band 12. QPSK MODULATION. BW = 10 MHz.

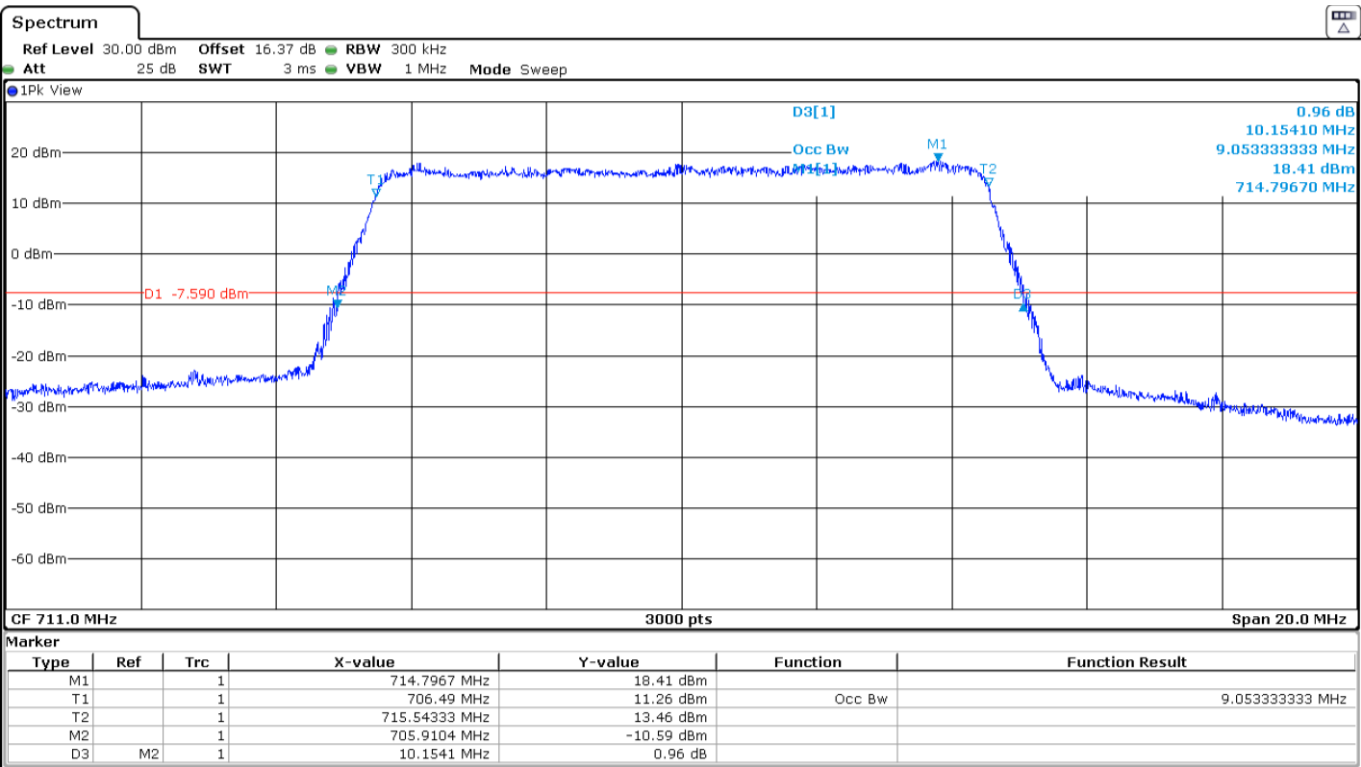
Low Channel:



Middle Channel:

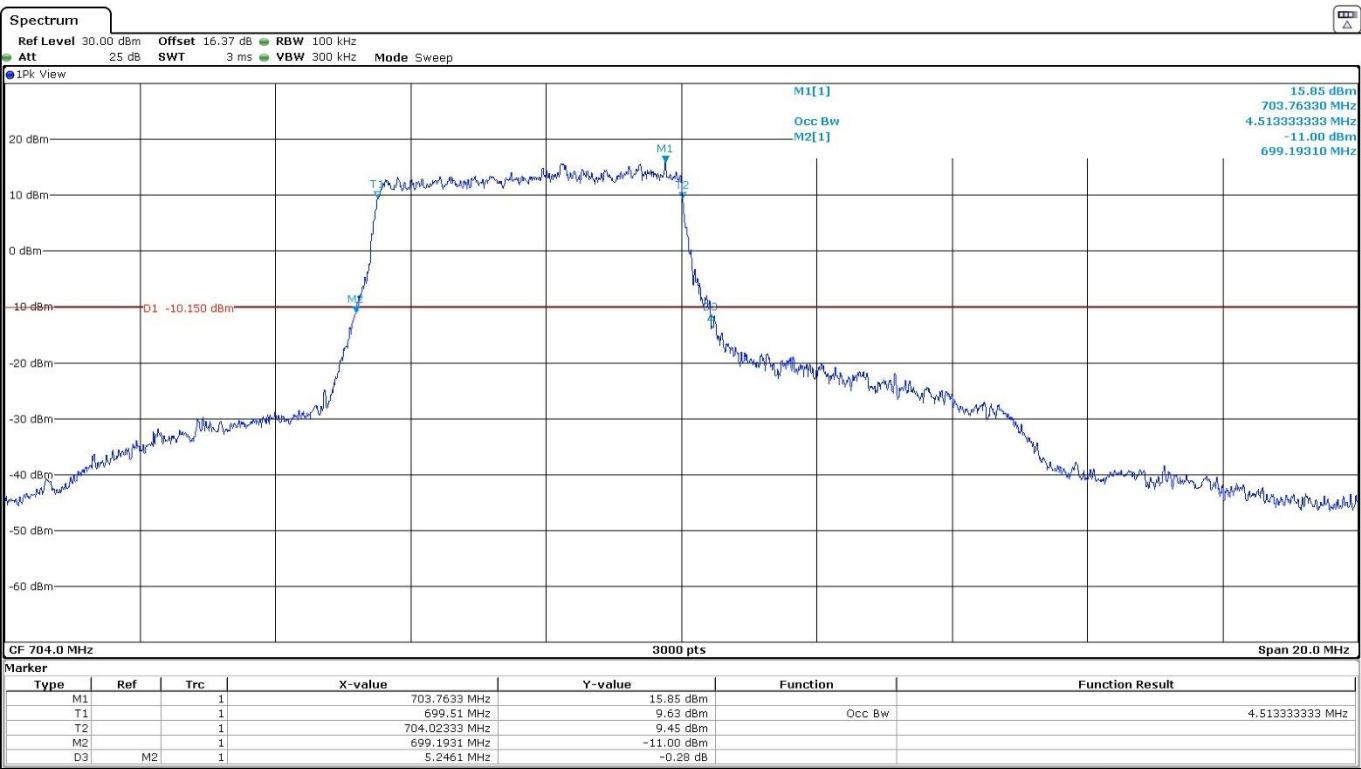


High Channel:

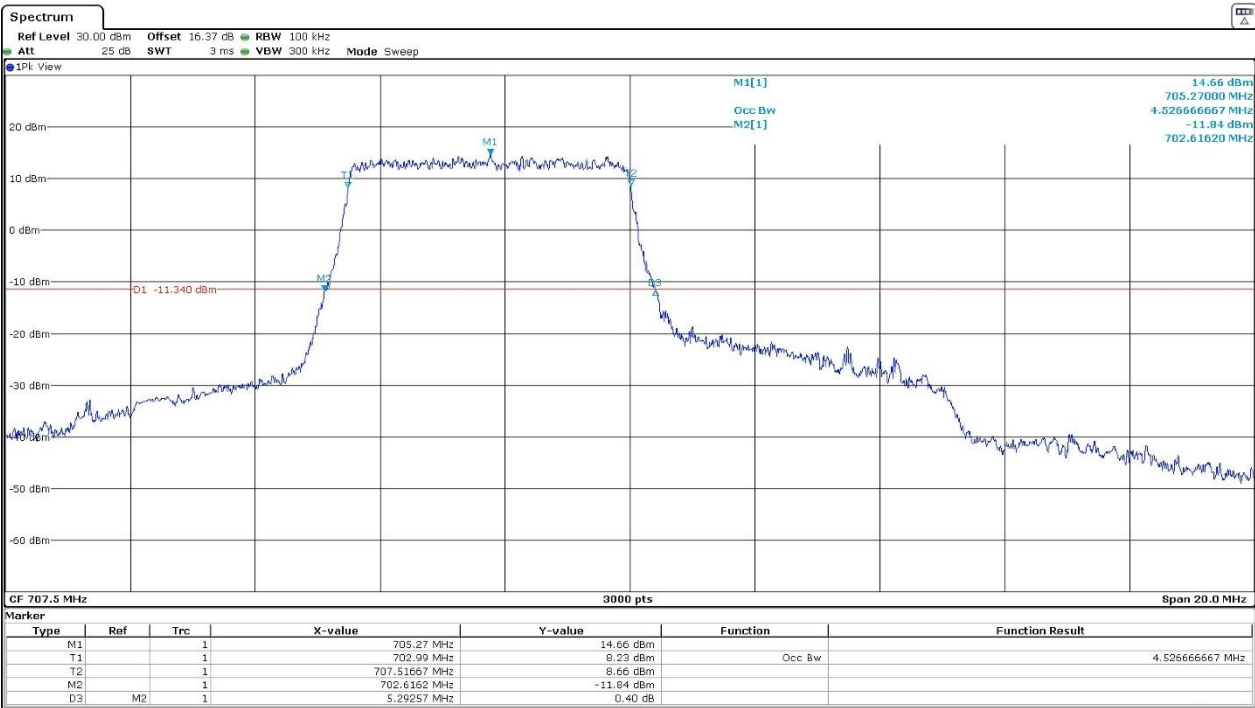


LTE Band 12. 16QAM MODULATION. BW = 10 MHz.

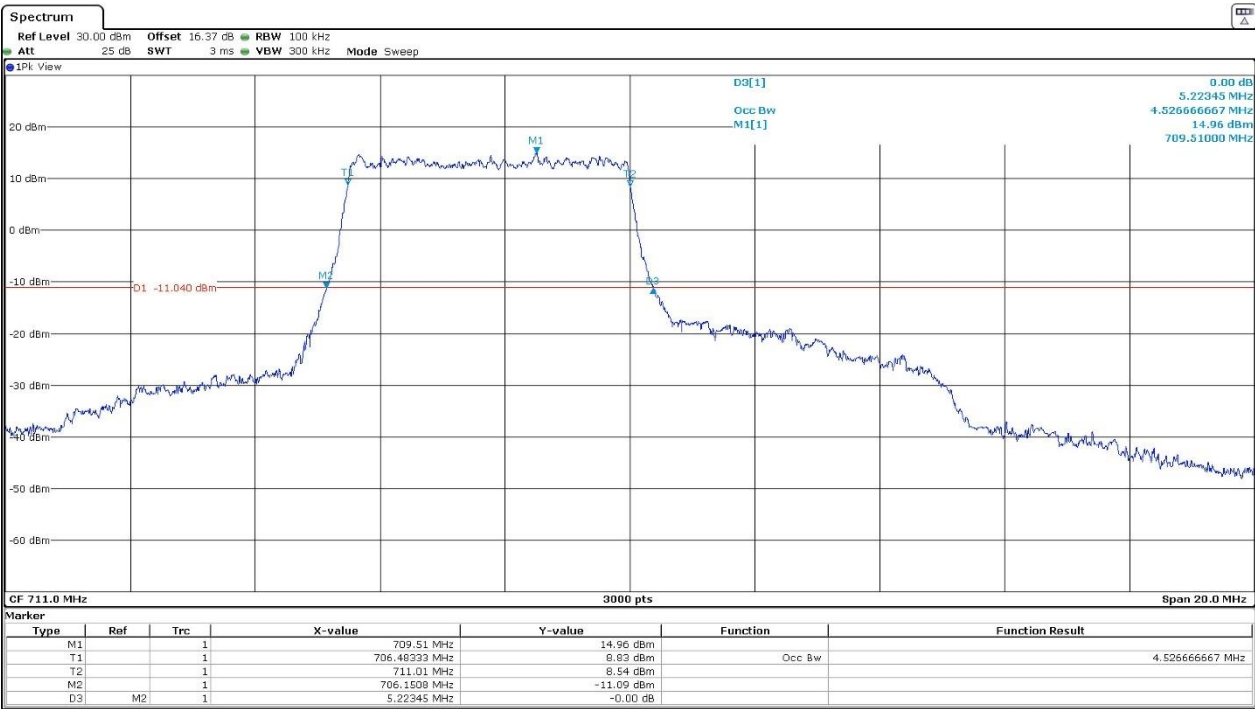
Low Channel:



Middle Channel:

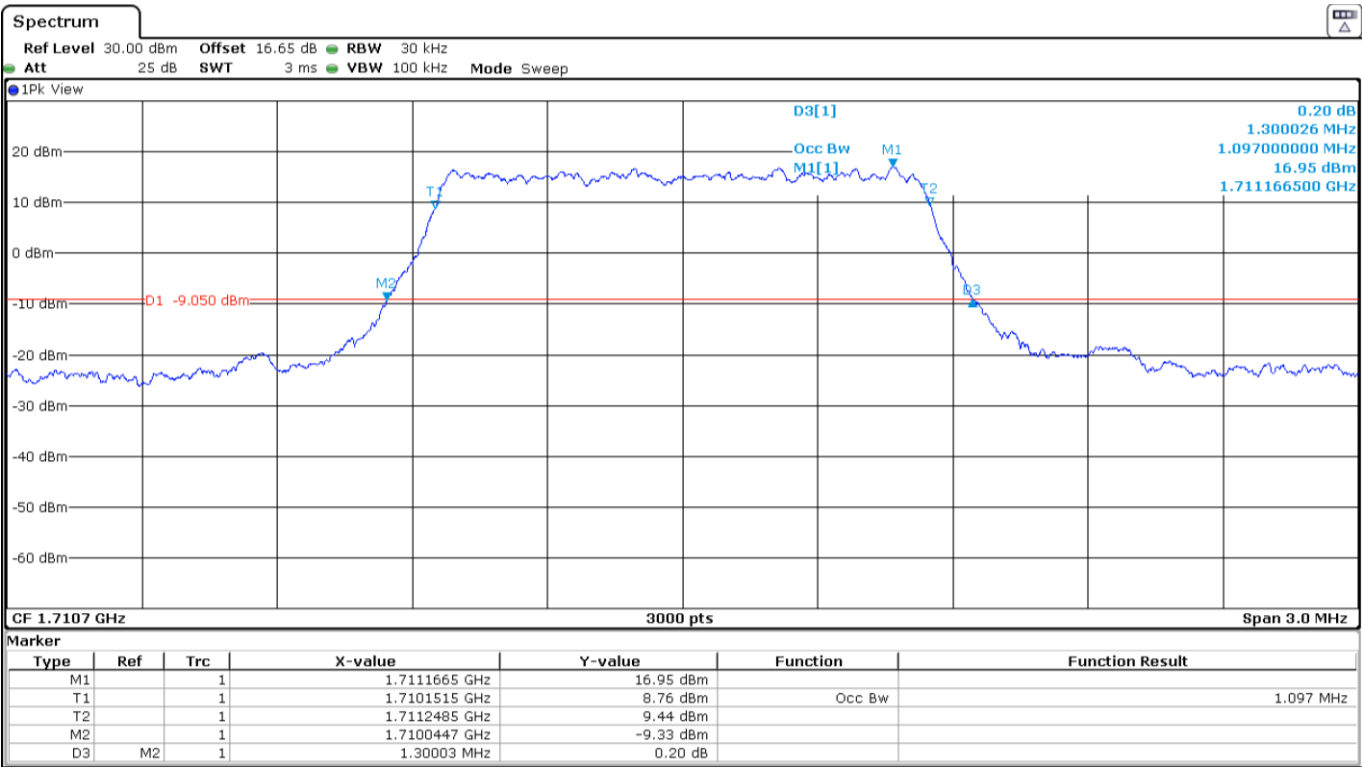


High Channel:

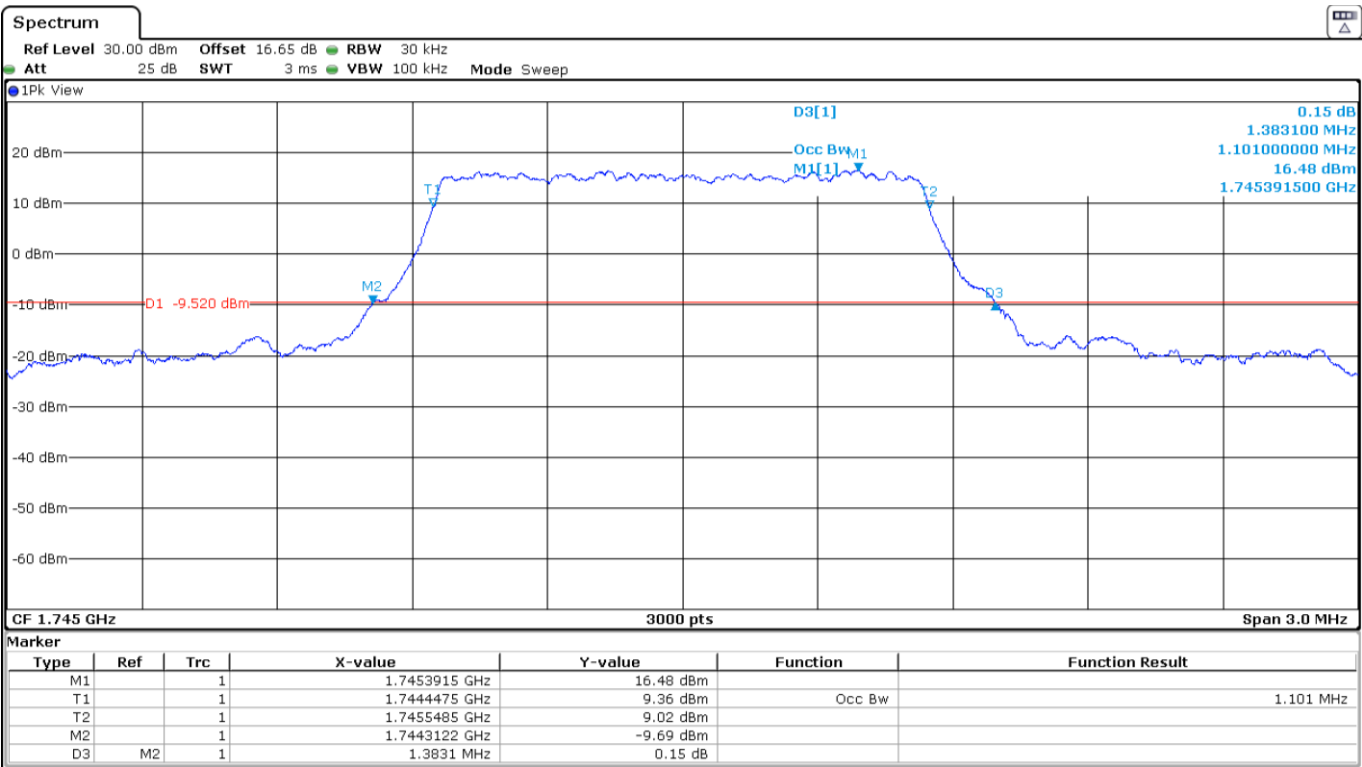


LTE Band 66. QPSK MODULATION. BW = 1.4 MHz.

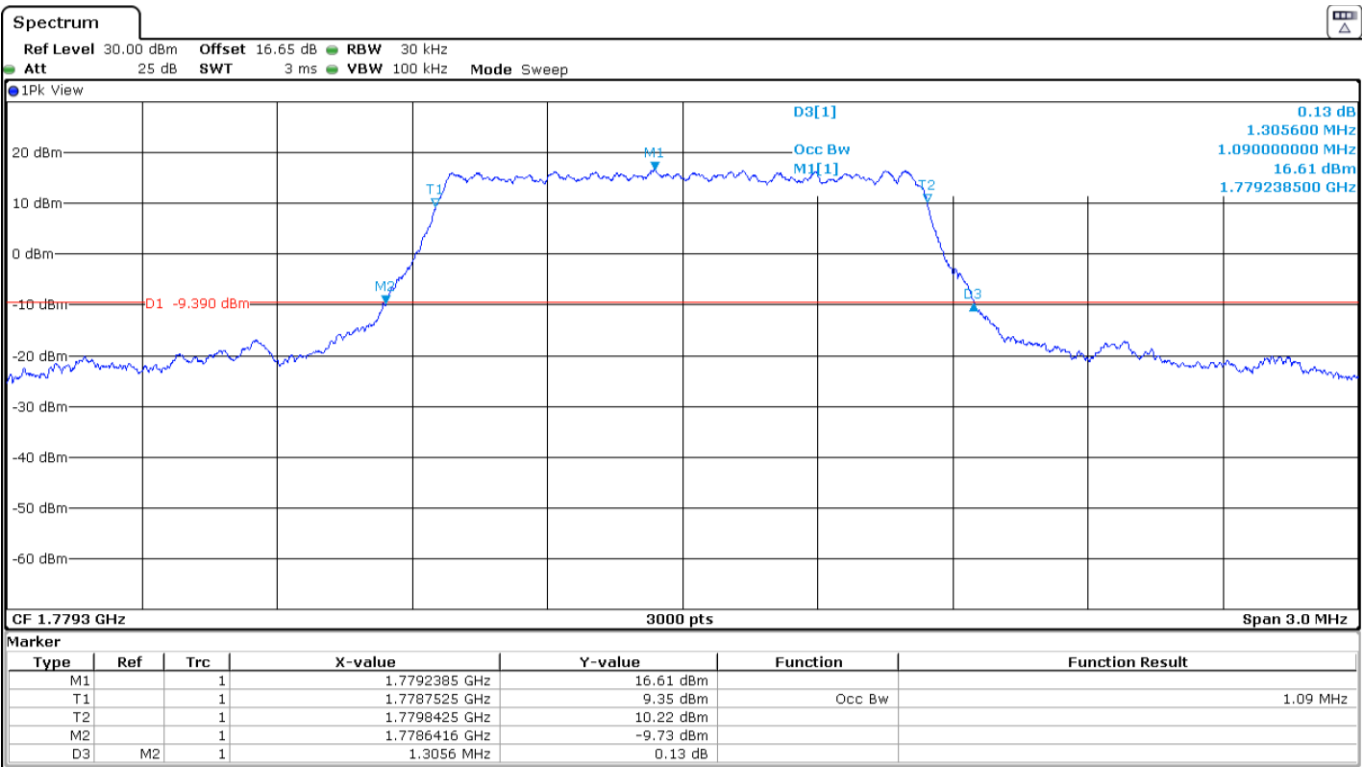
Low Channel:



Middle Channel:

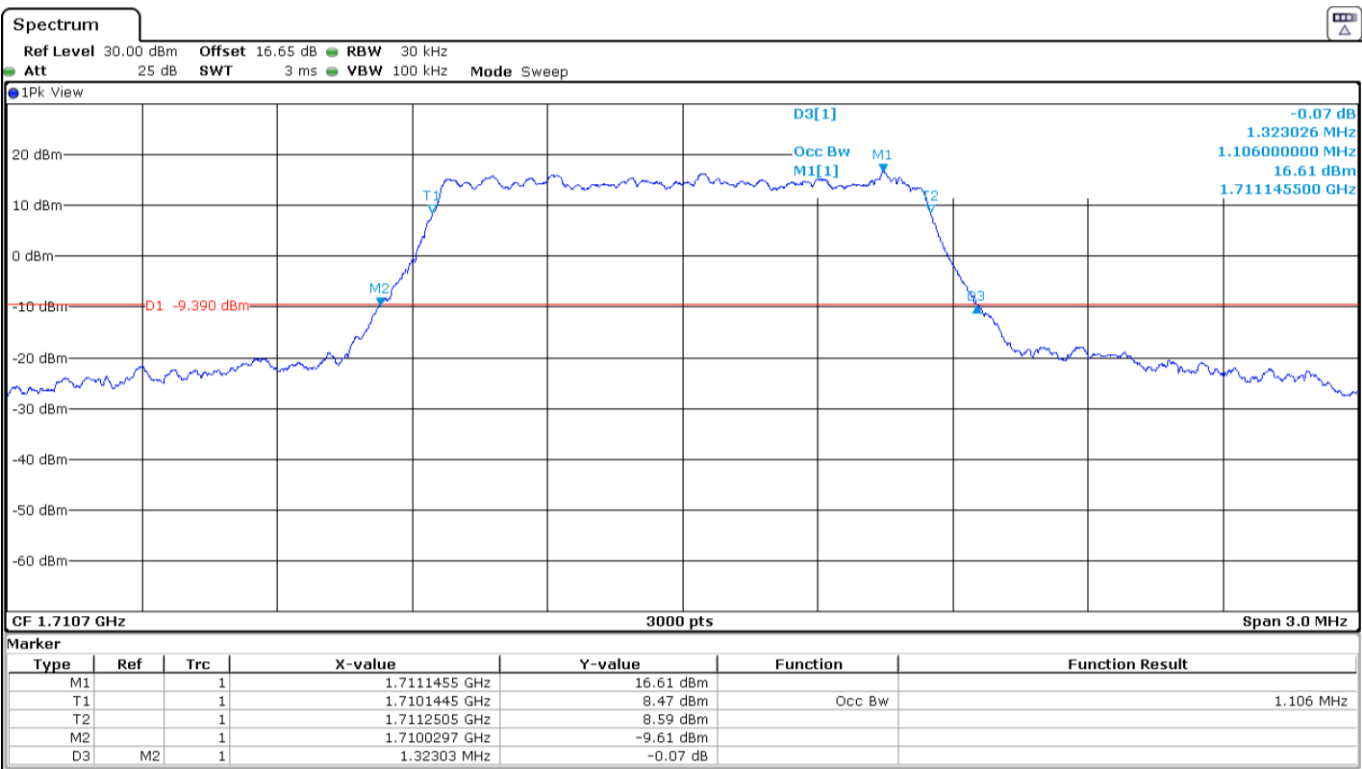


High Channel:

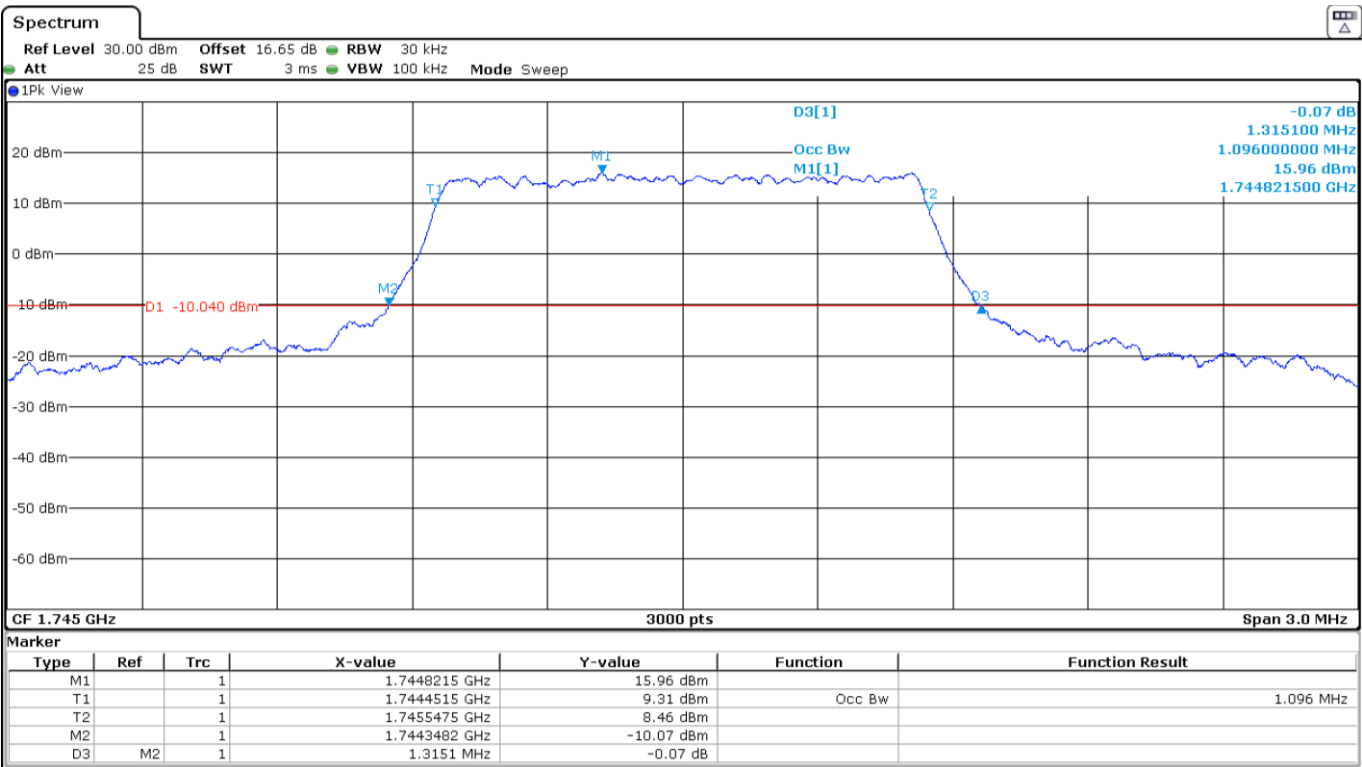


LTE Band 66. 16QAM MODULATION. BW = 1.4 MHz.

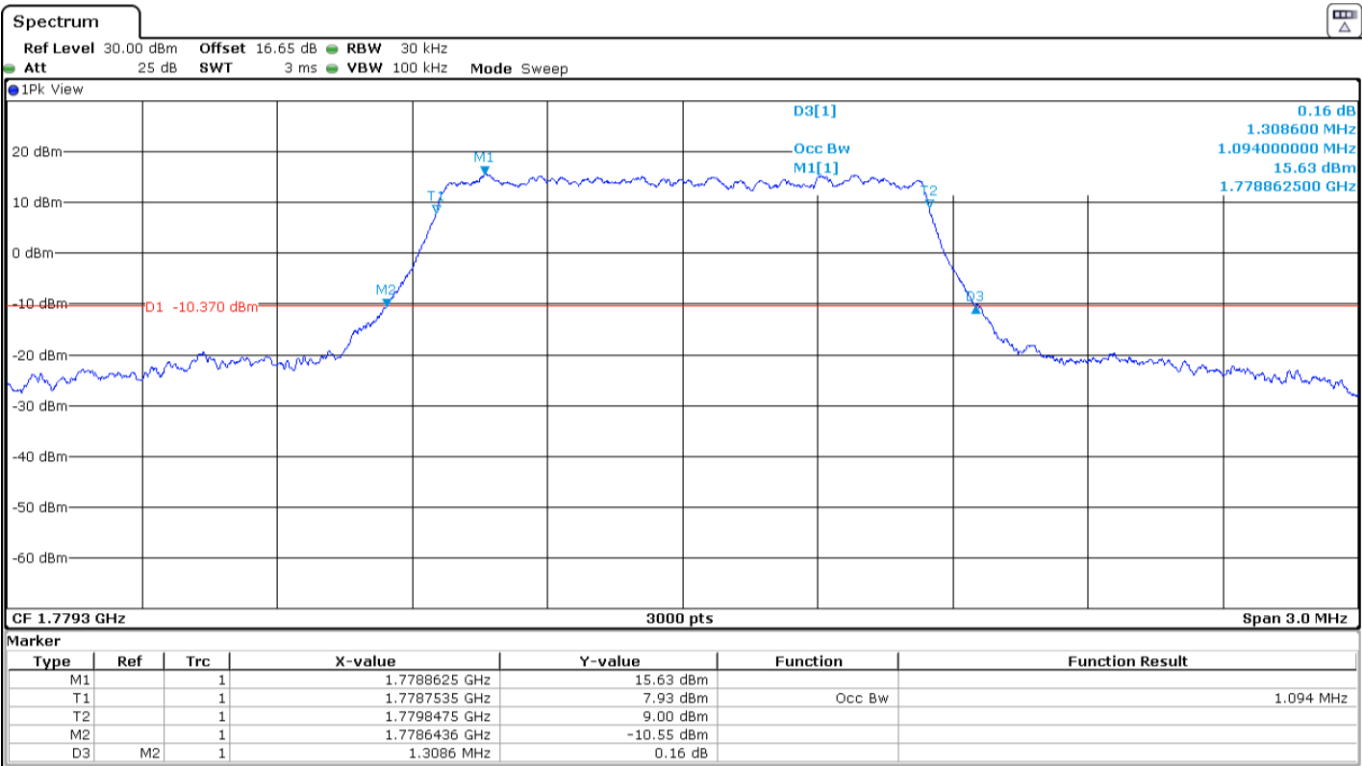
Low Channel:



Middle Channel:

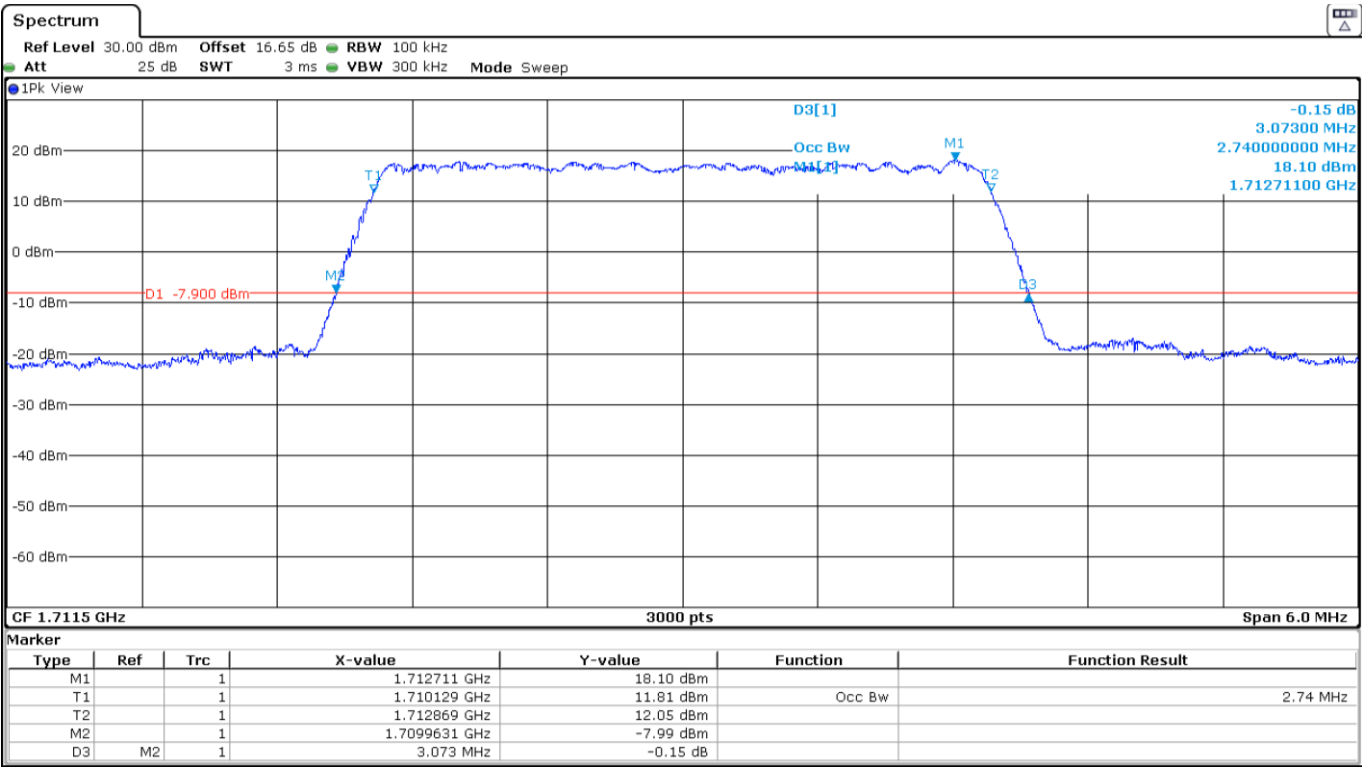


High Channel:

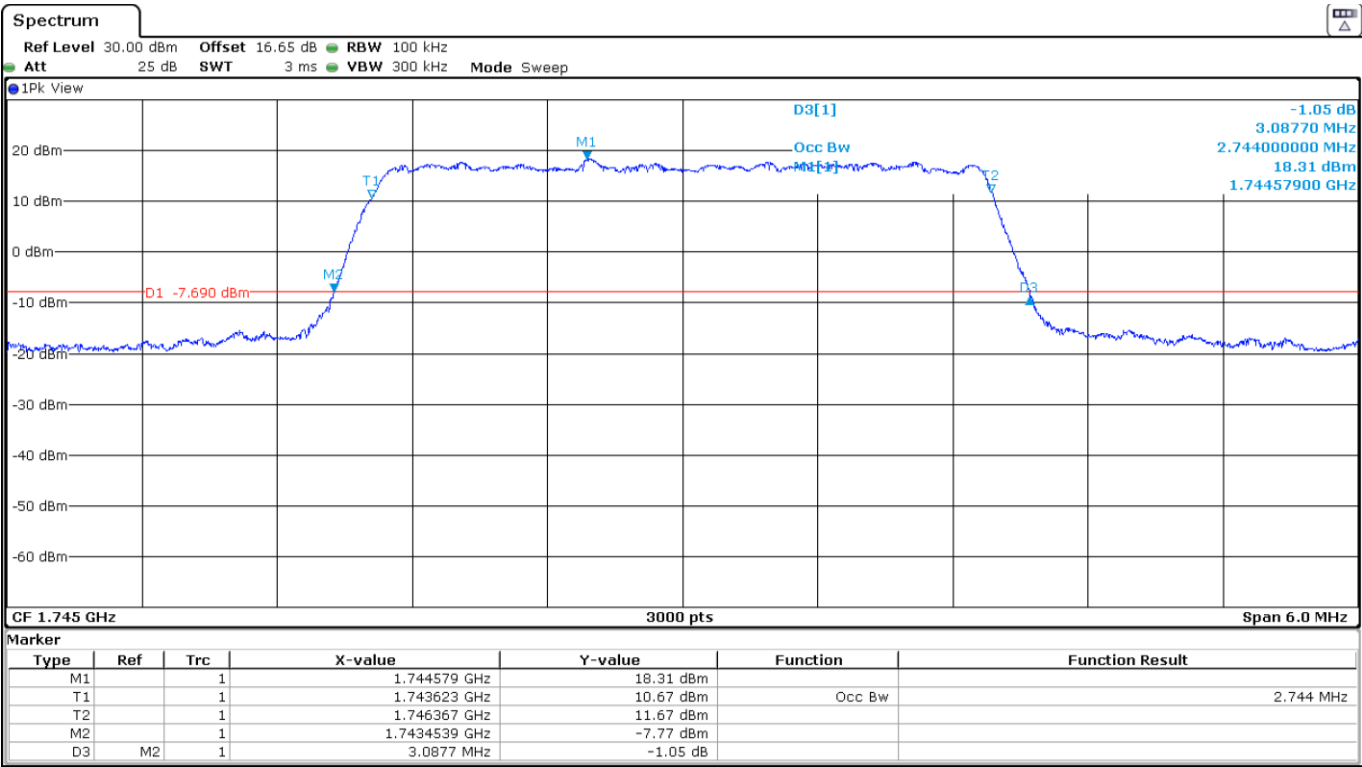


LTE Band 66. QPSK MODULATION. BW = 3 MHz.

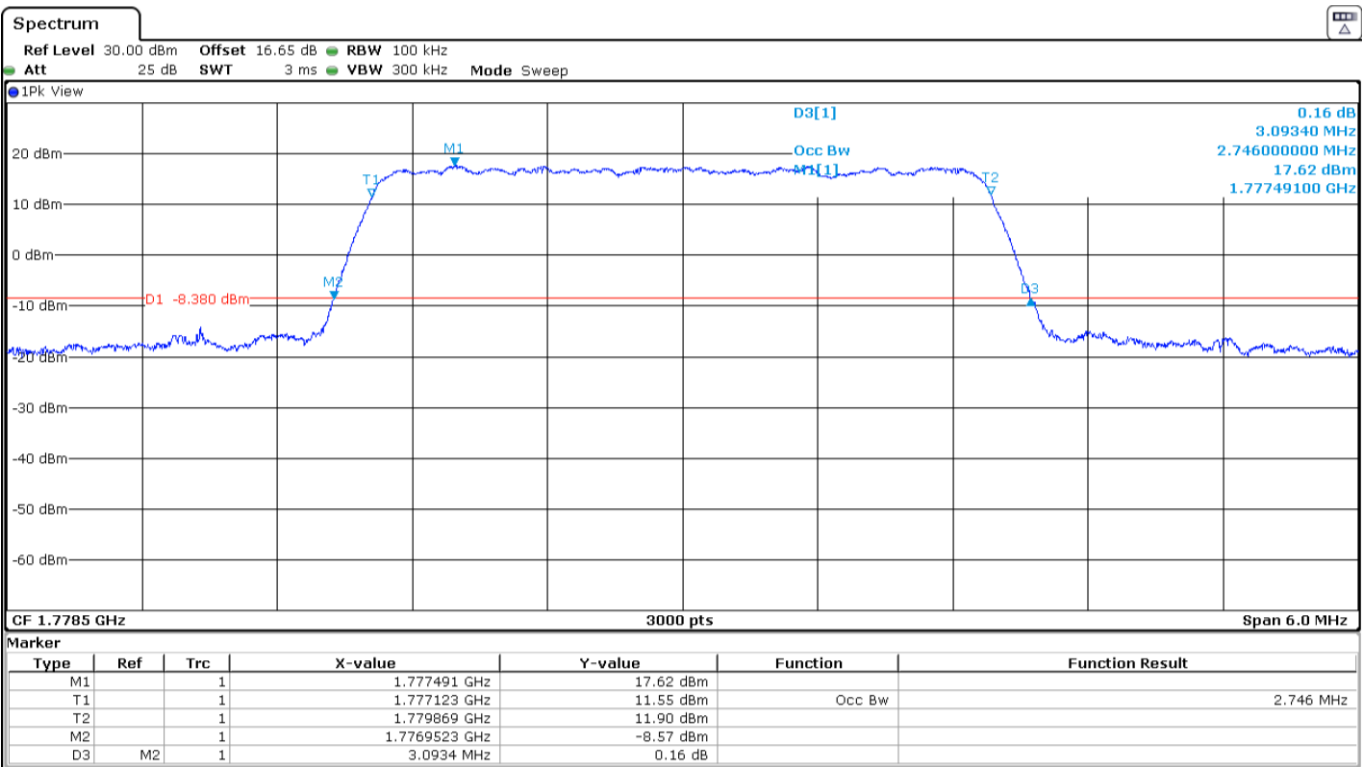
Low Channel:



Middle Channel:

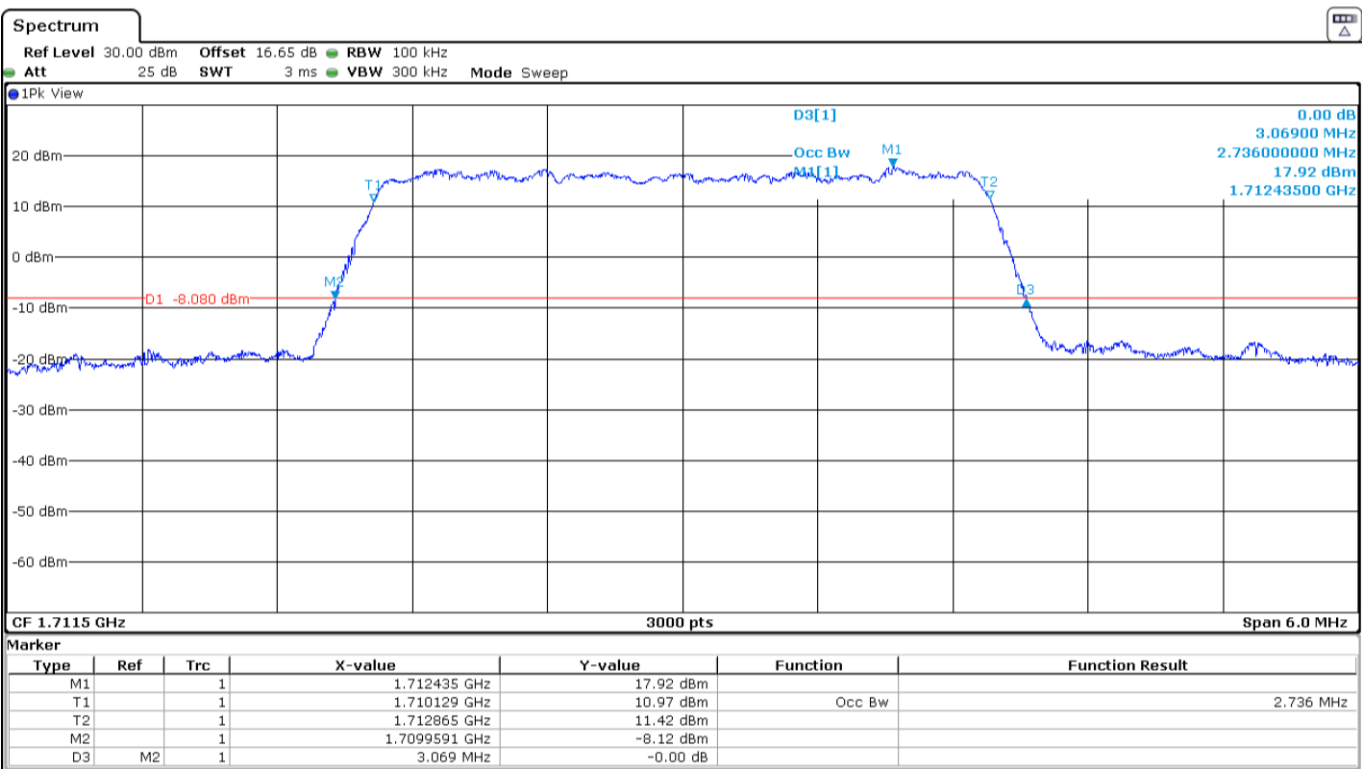


High Channel:

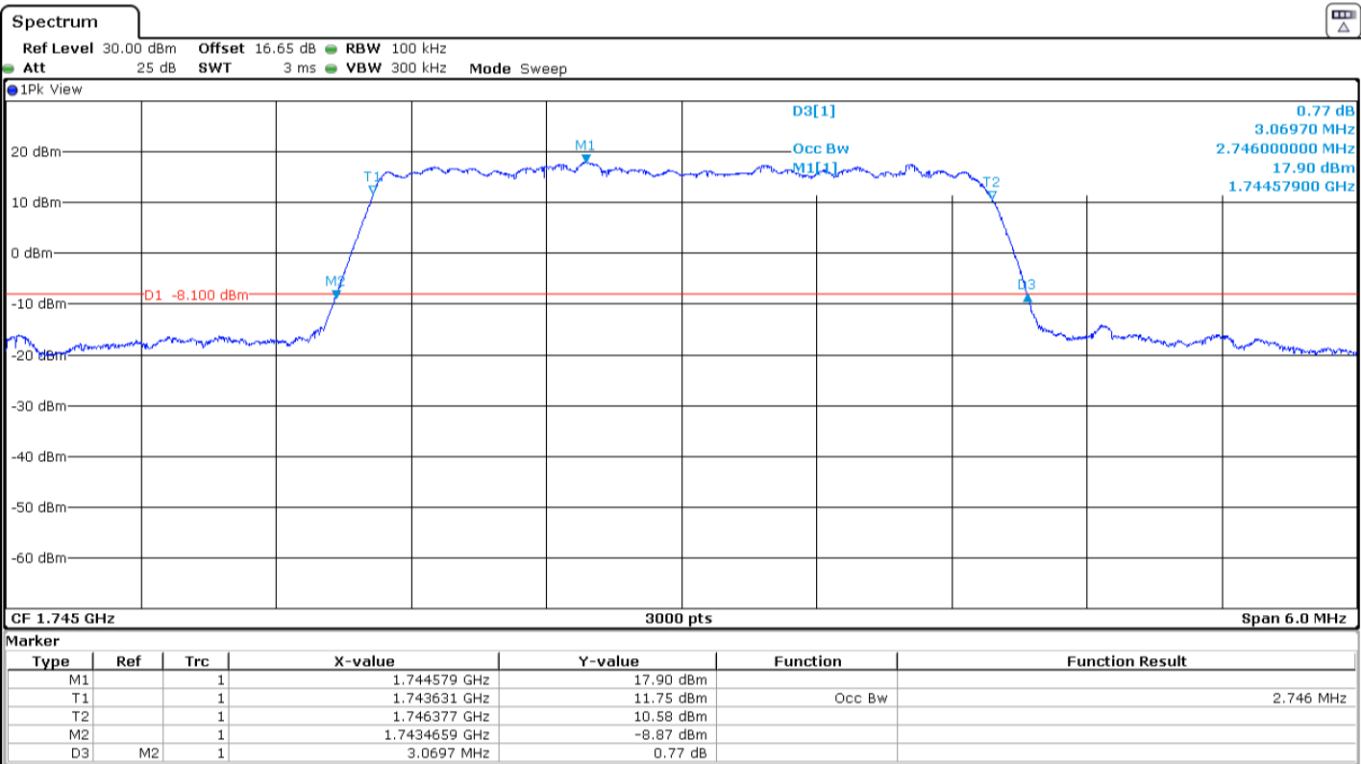


LTE Band 66. 16QAM MODULATION. BW = 3 MHz.

Low Channel:



Middle Channel:



High Channel:

