

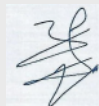
ISED CABid: ES1909  
Lab. Company Number: 4621A

Test report No:  
75461RRF.001

## Test Report

### USA FCC Part 22

### CANADA RSS-132

|                                                  |                                                                                                                                                                            |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (*) Identification of item tested                | LTE Cat 1bis module                                                                                                                                                        |
| (*) Trademark                                    | Sequans Communications                                                                                                                                                     |
| (*) Model and /or type reference                 | GC02S1-NA2                                                                                                                                                                 |
| Other identification of the product              | FCC ID: 2AAGMGC02SA<br>IC: 12732A-GC02SA                                                                                                                                   |
| (*) Features                                     | 4G LTE module<br>HW version: Rev1<br>SW version: LR9.0.1.1-59215                                                                                                           |
| Applicant                                        | SEQUANS COMMUNICATIONS<br>55 Boulevard Charles de Gaulle, 92700 Colombes,<br>France                                                                                        |
| Test method requested, standard                  | USA FCC Part 22 (10-1-21 Edition).<br>CANADA RSS-132 Issue 4, Jan. 2023.<br>ANSI C63.26-2015.<br>KDB 971168 D01 Power Meas License Digital Systems<br>v03r01, April. 2018. |
| Summary                                          | IN COMPLIANCE                                                                                                                                                              |
| Approved by (name / <b>position</b> & signature) | José Manuel Gómez Galván<br>EMC Consumer & RF<br>Lab. Manager<br>                     |
| Date of issue                                    | 2023-11-09                                                                                                                                                                 |
| Report template No                               | FDT08_24<br>(*) "Data provided by the client"                                                                                                                              |

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## Competences and guarantees

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DEKRA Testing and Certification is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

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## General conditions

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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

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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 model is GC02S1-NA2. The Calliope 2 GC02S1 modules are based on Sequans's second-generation Calliope 2 silicon and delivers optimized 4G LTE Cat 1 connectivity for IoT, M2M and consumer devices such as wearables and hearables that require voice support and speed higher than LTE-M.

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 |
|------------------|---------------------|------------|-----------------|-------------------|
| 75461B/005<br>*  | LTE Cat 1bis module | GC02S1-NA2 | C2E230509001024 | 21-07-2023        |
| 75461B/008       | Antenna Cable       | -          | -               | 21-07-2023        |
| 75461B/004<br>** | LTE Cat 1bis module | GC02S1-NA2 | C2E230509001008 | 21-07-2023        |

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

\* : Used in the conducted tests but the PAPR, Spurious Emissions at Antenna Terminals at Block Edge tests.

\*\* : Used in the PAPR, Spurious Emissions at Antenna Terminals at Block Edge tests.

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

| Control N° | Description         | Model            | Serial N°       | Date of reception |
|------------|---------------------|------------------|-----------------|-------------------|
| 75461B/004 | LTE Cat 1bis module | GC02S1-NA2       | C2E230509001008 | 21-07-2023        |
| 75461B/001 | Antenna             | OmniLOG<br>90200 | 20200100252     | 21-07-2023        |
| 75461B/012 | Antenna Cable       | -                | -               | 21-07-2023        |

Sample S/02 has undergone the following test(s): The radiated 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> |                          |
|                                              | USB                                 |                     |                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          |                          |
| Supplementary information to the ports.....: | -                                   |                     |                          |                                     |                          |                                   |                          |
| Rated power supply .....                     | Voltage and Frequency               |                     |                          | Reference poles                     |                          |                                   |                          |
|                                              | <input type="checkbox"/>            | AC:                 | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> |
|                                              | <input checked="" type="checkbox"/> | DC: 3.2 to 5.5 V    |                          |                                     |                          |                                   |                          |
| Rated Power.....:                            | -                                   |                     |                          |                                     |                          |                                   |                          |
| Clock frequencies.....:                      | -                                   |                     |                          |                                     |                          |                                   |                          |
| Other parameters .....                       | -                                   |                     |                          |                                     |                          |                                   |                          |
| Software version.....:                       | LR9.0.1.1-59215                     |                     |                          |                                     |                          |                                   |                          |
| Hardware version .....                       | Rev1                                |                     |                          |                                     |                          |                                   |                          |
| Dimensions in cm (W x H x D) ...:            | 21 x 1.8 x 19.5 mm                  |                     |                          |                                     |                          |                                   |                          |
| Mounting position .....                      | <input checked="" 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 type="checkbox"/>  | Other:                         |           |              |
| Modules/parts..... :                            | Module/parts of test item |                                | Type      | Manufacturer |
|                                                 | -                         |                                | -         | -            |
| Accessories (not part of the test item) ..... : | Description               |                                | Type      | Manufacturer |
|                                                 | USB Cables                |                                | USB       | -            |
|                                                 | Antennas                  |                                | Antenna   | -            |
| Documents as provided by the applicant..... :   | Description               |                                | File name | Issue date   |
|                                                 | -                         |                                | -         | -            |

## Identification of the client

SEQUANS COMMUNICATIONS  
55 Boulevard Charles de Gaulle, 92700, Colombes, France

## Testing period and place

|               |                                        |
|---------------|----------------------------------------|
| Test Location | DEKRA Testing and Certification S.A.U. |
| Date (start)  | 2023-08-14                             |
| Date (finish) | 2023-08-30                             |

## Document history

| Report number | Date       | Description    |
|---------------|------------|----------------|
| 75461RRF.001  | 2023-11-09 | 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 semi-anechoic 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: Pablo Redondo, Antonio Maireles, Rafael Fernández, Irene Bibang, Sergio Carrasco, Fernando Chito.

Used instrumentation:

| Control No. | Equipment                                                           | Next Calibration |
|-------------|---------------------------------------------------------------------|------------------|
| 8002        | Climatic Chamber BINDER MK 56                                       | 2024-03          |
| 6157        | Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40 | 2023-10          |
| 9229        | Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500        | 2024-06          |
| 6794        | Shielded Room ETS LINDGREN S101                                     | N/A              |
| 6254        | Attenuator 6 dB 2W DC-26.5 GHz, TECHNIWAVE TWSMAG2                  | 2024-03          |
| 2214        | Power Divider DC-25 GHz PICOSECOND PULSE LABS 5333-104              | 2023-12          |
| 7794        | Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40 | 2025-04          |
| 7798        | EMC/RF Testing SW ROHDE AND SCHWARZ WMS32                           | N/A              |
| 6791        | Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP     | N/A              |
| 6792        | Shielded Room ETS LINDGREN S101                                     | N/A              |
| 6143        | Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E             | 2023-10          |
| 4612        | Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D       | 2024-07          |
| 3783        | RF Preamplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A        | 2023-12          |
| 6142        | RF Preamplifier, G>38dB 30MHz-6GHz BONN ELEKTRONIK BLNA 0360-01N    | 2024-06          |
| 7817        | EMI Test Receiver 2 Hz - 44 GHz, ROHDE AND SCHWARZ ESW44            | 2023-12          |
| 6667        | Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500        | 2024-06          |
| 4848        | EMC/RF Testing SW ROHDE AND SCHWARZ EMC32                           | N/A              |

## Testing verdicts

|                 |     |
|-----------------|-----|
| Not Applicable: | N/A |
| Pass:           | P   |
| Fail:           | F   |
| Not Measured:   | N/M |

## Summary

### Appendix A: LTE Cat 1bis Band 5.

| FCC PART 22 / RSS-132 PARAGRAPH                                                  |         |        |
|----------------------------------------------------------------------------------|---------|--------|
| Requirement – Test case                                                          | Verdict | Remark |
| FCC 22.913 / RSS-132 5.4: RF Output Power                                        | P       |        |
| FCC 2.1047 / RSS-132 5.2: Modulation Characteristics                             | P       |        |
| FCC 22.355 / RSS-132 5.3: Frequency Stability                                    | P       |        |
| FCC 2.1049: Occupied Bandwidth                                                   | P       |        |
| FCC 22.917 / RSS-132 5.5: Spurious Emissions at Antenna Terminals                | P       |        |
| FCC 22.917 / RSS-132 5.5: Spurious Emissions at Antenna Terminals at Block Edges | P       |        |
| FCC 22.917 / RSS-132 5.5: Radiated Emissions                                     | P       |        |
| <u>Supplementary information and remarks:</u>                                    |         |        |
| None.                                                                            |         |        |

## Appendix A: Test results for FCC 22 / RSS-132

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## TEST CONDITIONS

(\*): Declared by the Applicant.

### POWER SUPPLY (\*):

Vnominal: 3.8 Vdc  
 Vminimum: 3.2 Vdc  
 Vmaximum: 5.5 Vdc

Type of Power Supply: DC External.

### ANTENNA (\*):

| MIDDLE BAND         |          | ANTENNA TYPE             |
|---------------------|----------|--------------------------|
| LTE Cat 1bis Band 5 | +2 dBi   | External (OmniLOG 90200) |
| LTE Cat 1bis Band 5 | +1.1 dBi | Internal (FR01-S4-210)   |

Note: Pre-scan determines that external antenna is the worst case in terms of radiated spurious emissions.

### TEST FREQUENCIES:

LTE Cat 1bis Band 5. QPSK and 16QAM:

|        | Channel (Frequency MHz) |                |
|--------|-------------------------|----------------|
|        | BW=5 MHz                | BW=10 MHz      |
| Low    | 20425 (826.50)          | 20450 (829.00) |
| Middle | 20525 (836.50)          | 20525 (836.50) |
| High   | 20625 (846.50)          | 20600 (844.00) |

Note: BW=1.4 MHz and 3 MHz not supported.

## RF Output Power

### Limits

\* FCC § 22.913:

Licensees in the Cellular Radiotelephone Service are subject to the effective radiated power (ERP) limits and other requirements in this Section. See also § 22.169.

(a) Maximum ERP. The ERP of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(5) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts (38.45 dBm E.R.P.).

\* FCC § 2.1046. Measurements required: RF power output.

\* RSS-132, 5.4:

The transmitter output power shall be measured in terms of average power. The equivalent radiated power (e.r.p.) shall not exceed 7 watts for mobile equipment and 3 watts for portable equipment.

The effective isotropic radiated power (e.i.r.p.) shall not exceed the limits specified in SRSP-503 for base station equipment.

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

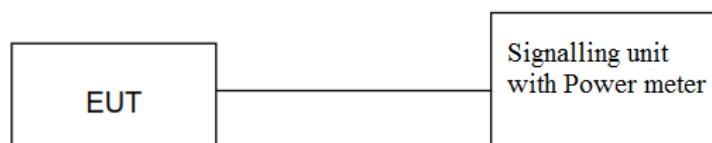
The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

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:

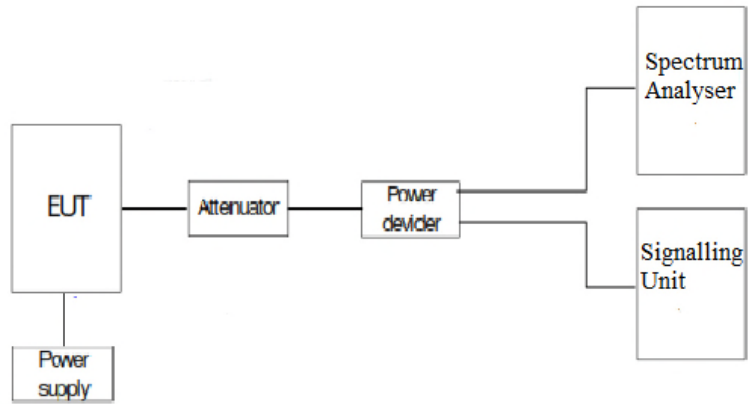
$$\text{E.R.P.} = \text{E.I.R.P.} - 2.15 \text{ dB}$$

### Test Setup

1. CONDUCTED AVERAGE POWER:



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



## Results

### 1. CONDUCTED AVERAGE POWER:

#### LTE Cat 1bis Band 5:

Preliminary measurements determined the worst case of RF Power is BW=10 MHz, Middle Channel, QPSK, RB Size=1, RB Offset=0.

| BANDWIDTH<br>(MHz) | CHANNEL         | FREQUENCY<br>(MHz) | MODULATION | RB<br>SIZE | RB<br>OFFSET | AVERAGE<br>POWER<br>(dBm) |
|--------------------|-----------------|--------------------|------------|------------|--------------|---------------------------|
| 10                 | Low<br>20450    | 829 MHz            | QPSK       | 1          | 0            | 22.32                     |
|                    |                 |                    |            | 1          | 24           | 22.4                      |
|                    |                 |                    |            | 1          | 49           | 22.37                     |
|                    |                 |                    |            | 25         | 0            | 21.29                     |
|                    |                 |                    |            | 25         | 12           | 21.34                     |
|                    |                 |                    |            | 25         | 24           | 21.29                     |
|                    |                 |                    |            | 50         | 0            | 21.17                     |
|                    |                 |                    | 16-QAM     | 1          | 0            | 21.43                     |
|                    |                 |                    |            | 1          | 24           | 21.51                     |
|                    |                 |                    |            | 1          | 49           | 21.47                     |
|                    |                 |                    |            | 25         | 0            | 20.29                     |
|                    |                 |                    |            | 25         | 12           | 20.34                     |
|                    |                 |                    |            | 25         | 24           | 20.32                     |
|                    |                 |                    |            | 50         | 0            | *                         |
|                    | Middle<br>20525 | 836.5 MHz          | QPSK       | 1          | 0            | 22.75                     |
|                    |                 |                    |            | 1          | 24           | 22.64                     |
|                    |                 |                    |            | 1          | 49           | 22.65                     |
|                    |                 |                    |            | 25         | 0            | 21.5                      |
|                    |                 |                    |            | 25         | 12           | 21.44                     |
|                    |                 |                    |            | 25         | 24           | 21.43                     |
|                    |                 |                    |            | 50         | 0            | 21.36                     |
|                    |                 |                    | 16-QAM     | 1          | 0            | 21.39                     |
|                    |                 |                    |            | 1          | 24           | 21.37                     |
|                    |                 |                    |            | 1          | 49           | 21.39                     |
|                    |                 |                    |            | 25         | 0            | 20.47                     |
|                    |                 |                    |            | 25         | 12           | 20.43                     |
|                    |                 |                    |            | 25         | 24           | 20.45                     |
|                    |                 |                    |            | 50         | 0            | *                         |
|                    | High<br>20600   | 844 MHz            | QPSK       | 1          | 0            | 22.61                     |
|                    |                 |                    |            | 1          | 24           | 22.57                     |
|                    |                 |                    |            | 1          | 49           | 22.31                     |
|                    |                 |                    |            | 25         | 0            | 21.33                     |
|                    |                 |                    |            | 25         | 12           | 21.42                     |
|                    |                 |                    |            | 25         | 24           | 21.26                     |
|                    |                 |                    |            | 50         | 0            | 21.23                     |
|                    |                 |                    | 16-QAM     | 1          | 0            | 21.43                     |
|                    |                 |                    |            | 1          | 24           | 21.49                     |

|  |  |  |  |    |    |       |
|--|--|--|--|----|----|-------|
|  |  |  |  | 1  | 49 | 21.2  |
|  |  |  |  | 25 | 0  | 20.32 |
|  |  |  |  | 25 | 12 | 20.36 |
|  |  |  |  | 25 | 24 | 20.25 |
|  |  |  |  | 50 | 0  | *     |

\* Not supported

BW=10 MHz. QPSK:

| MAX<br>POWER | QPSK<br>COND.<br>POWER<br>AVG (dBm) | ANTENNA<br>GAIN (dBi) | RAD.<br>POWER<br>AVG<br>EIRP(dBm) | RAD.<br>POWER<br>AVG<br>ERP(dBm) |
|--------------|-------------------------------------|-----------------------|-----------------------------------|----------------------------------|
| LOW          | 22.4                                | 2                     | 24.4                              | 22.25                            |
| MIDDLE       | 22.75                               | 2                     | 24.75                             | 22.6                             |
| HIGH         | 22.61                               | 2                     | 24.61                             | 22.46                            |
| MAX:         | 22.75                               |                       | 24.75                             | 22.6                             |

BW=10 MHz. 16QAM:

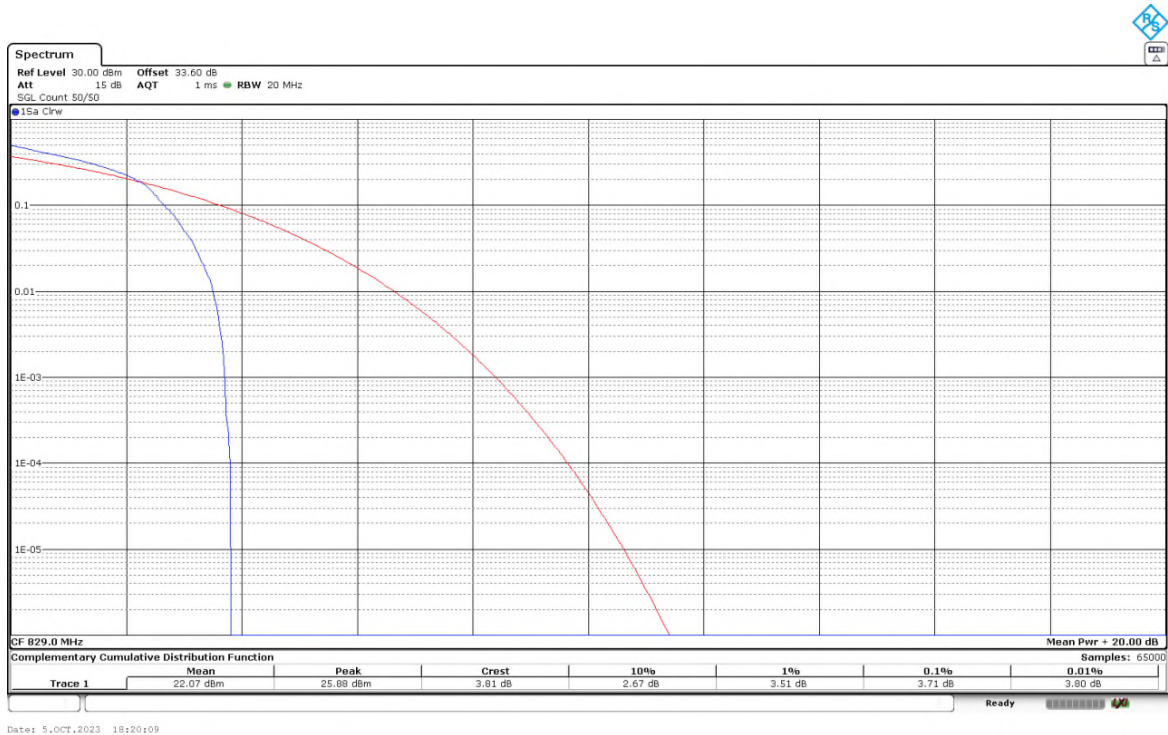
| MAX<br>POWER | 16QAM<br>COND.<br>POWER<br>AVG (dBm) | ANTENNA<br>GAIN (dBi) | RAD.<br>POWER<br>AVG<br>EIRP(dBm) | RAD.<br>POWER<br>AVG<br>ERP(dBm) |
|--------------|--------------------------------------|-----------------------|-----------------------------------|----------------------------------|
| LOW          | 21.51                                | 2                     | 23.51                             | 21.36                            |
| MIDDLE       | 21.39                                | 2                     | 23.39                             | 21.24                            |
| HIGH         | 21.49                                | 2                     | 23.49                             | 21.34                            |
| MAX:         | 21.51                                |                       | 23.51                             | 21.36                            |

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

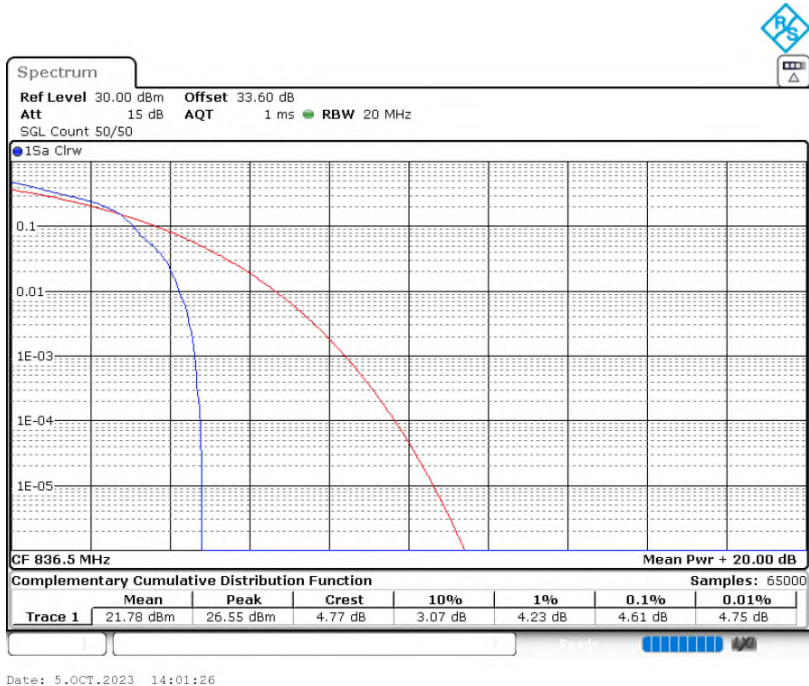
LTE Cat 1bis Band 5:

Preliminary measurements determined the worst-case of PAPR is BW=10 MHz, Middle Channel, 16QAM, RB Size=1, RB Offset=49.

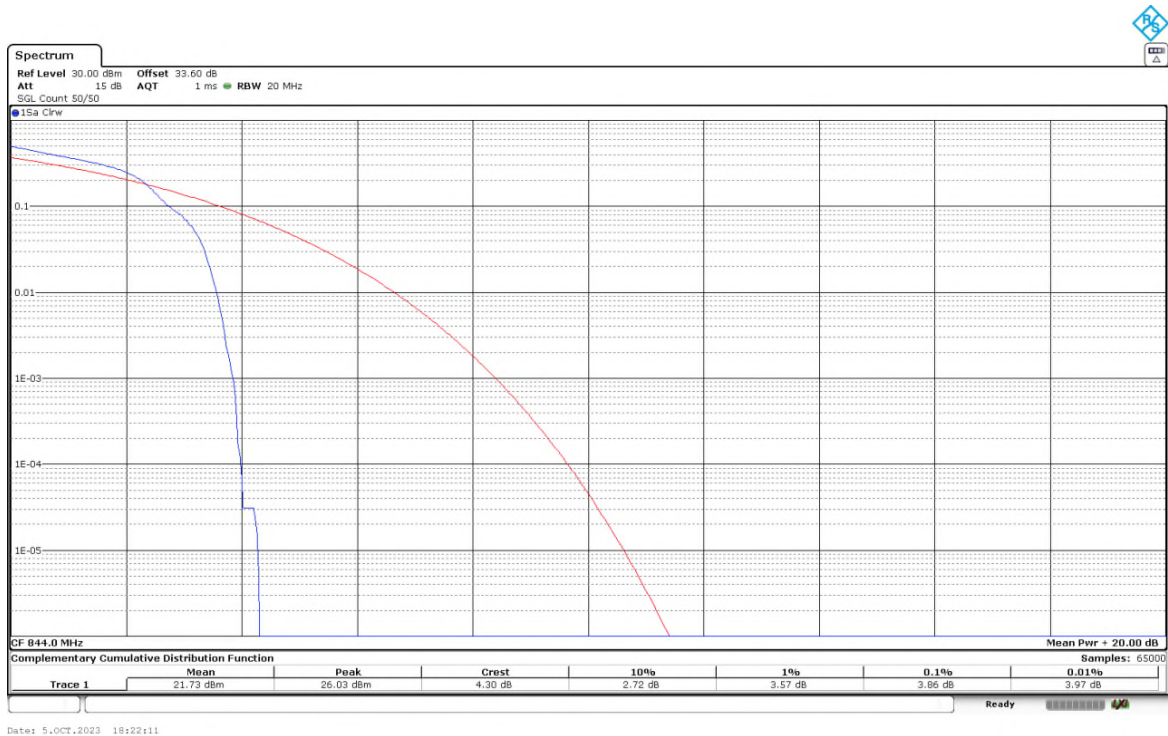
Low Channel:



Middle Channel:



High Channel:



|           |      |        |      |
|-----------|------|--------|------|
| 16QAM     | Low  | Middle | High |
| PAPR (dB) | 3.71 | 4.61   | 3.86 |

Measurement uncertainty (dB) <±1.11

Verdict

Pass

## Frequency Stability

### Limits

\* FCC § 22.355:

Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C–1 of this section.

Table C–1—Frequency Tolerance for Transmitters in the Public Mobile Services

| Frequency range (MHz) | Base, fixed (ppm) | Mobile >3 watts (ppm) | Mobile ≤3 watts (ppm) |
|-----------------------|-------------------|-----------------------|-----------------------|
| 821 to 896            | 1.5               | 2.5                   | 2.5                   |

\* FCC § 2.1055: Measurements required: Frequency stability.

\* RSS-132, 5.3. The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within each of the sub-bands when tested at 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.

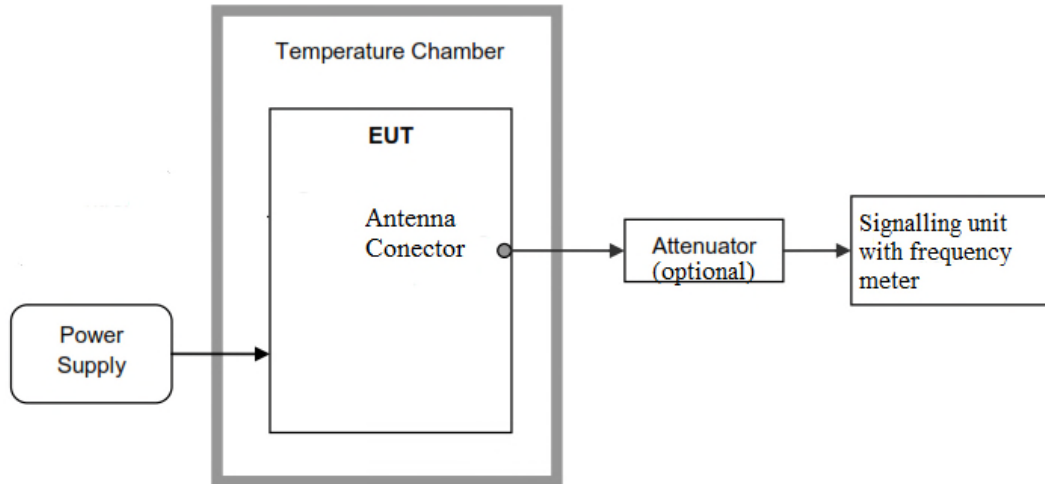
The supply voltage was varied between 85% and 115% of nominal voltage.

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 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:



## Results

### LTE Cat 1bis Band 5:

The worst case modulation in terms of Frequency Stability is BW=5 MHz, QPSK, RB Size=1, RB Offset=0.

#### 1. Frequency Tolerance:

- Frequency Stability over Temperature Variations:

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| +85              | 0,16                 | 0,000191273           |
| +80              | 2,11                 | 0,002522415           |
| +70              | -2,01                | -0,002402869          |
| +60              | -1,46                | -0,001745368          |
| +50              | 1,04                 | 0,001243276           |
| +40              | -0,9                 | -0,001075912          |
| +30              | -1,33                | -0,001589958          |
| +20              | -0,63                | -0,000753138          |
| +10              | -1,84                | -0,002199641          |
| 0                | -1,99                | -0,00237896           |
| -10              | -1,49                | -0,001781231          |
| -20              | -1,57                | -0,001876868          |
| -30              | -1,19                | -0,001422594          |

- Frequency Stability over Voltage Variations.

| Supply voltage | Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|----------------|-------------|----------------------|-----------------------|
| Vmax           | 5.5         | -1.9                 | -0.002271369          |
| Vmin           | 3.2         | -1.67                | -0.001996414          |

#### 2. Reference Frequency Points f<sub>L</sub> and f<sub>H</sub>:

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

|                      |          |
|----------------------|----------|
| f <sub>L</sub> (MHz) | 824.1356 |
| f <sub>H</sub> (MHz) | 848.8555 |

The reference frequency points f<sub>L</sub> and f<sub>H</sub> stay within the authorized blocks for the band above.

Measurement uncertainty (Hz) <± 249.55

## Verdict

Pass

## Modulation Characteristics

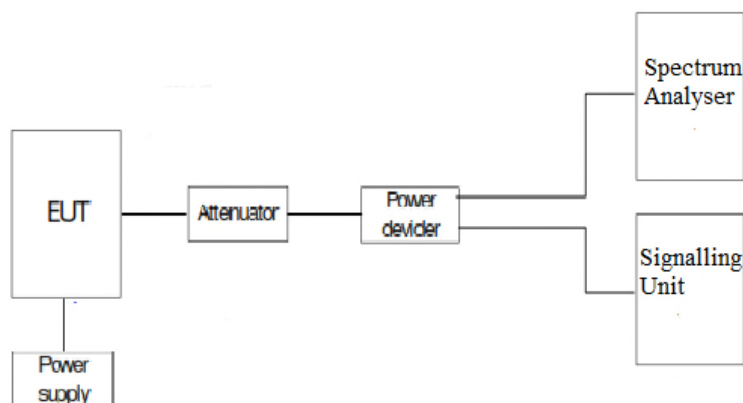
### Limits

- \* FCC § 2.1047: Measurements required: Modulation characteristics.
- \* RSS-132, 5.2: Digital modulation shall be used.

### Method

For LTE the EUT operates with QPSK and 16QAM modes in which the information is digitized 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).

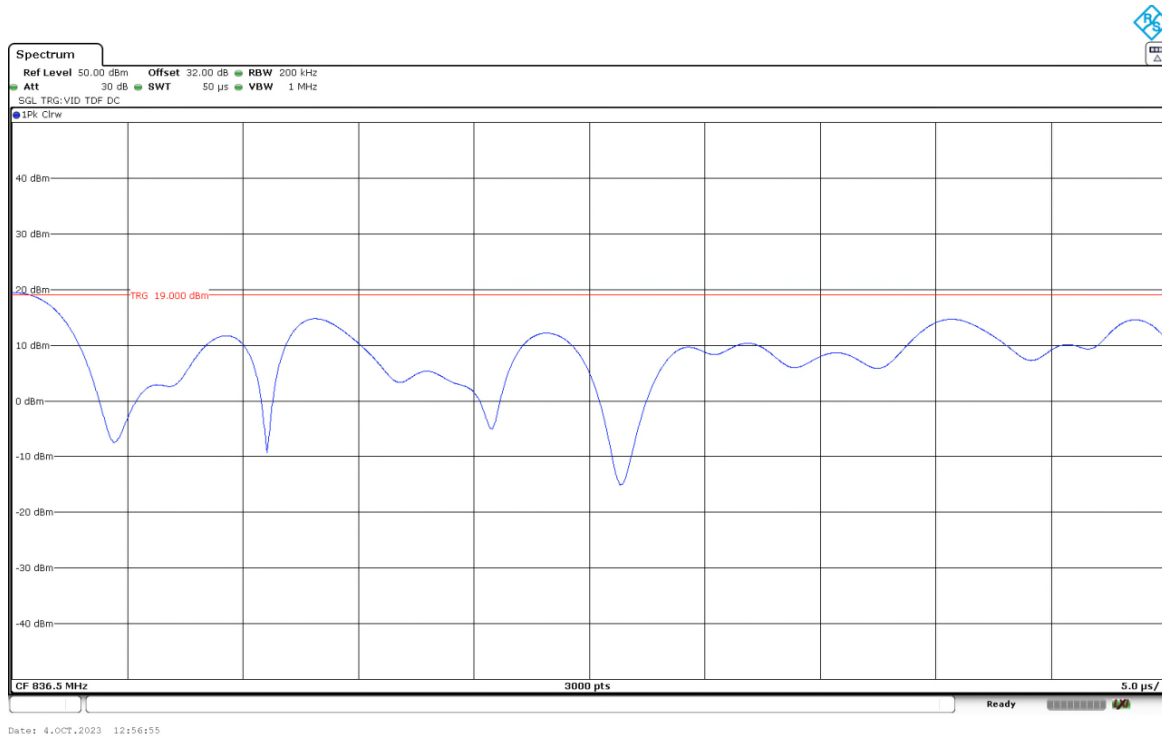
### Test Setup



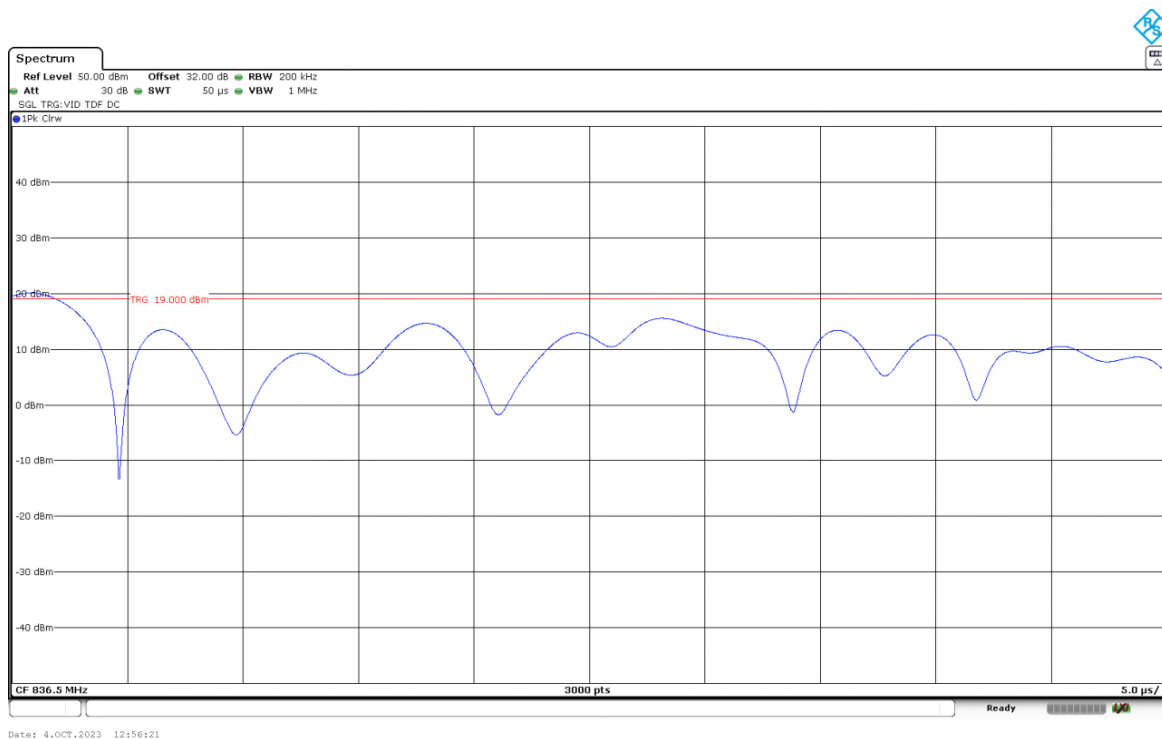
## Results

The following plots show the modulation schemes in the EUT.

**LTE Cat 1bis Band 5:** BW=5 MHz. QPSK. RB Size=25. RB Offset=0.



**LTE Cat 1bis Band 5:** BW=5 MHz. 16QAM. RB Size=25. RB Offset=0.



## Occupied Bandwidth

### Limits

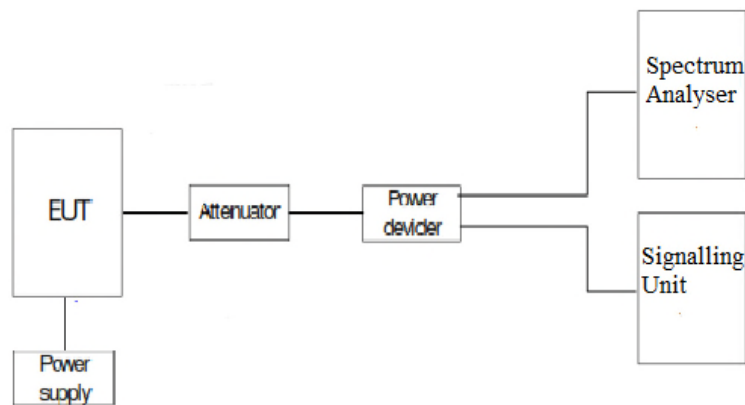
\* FCC § 2.1049. Measurements required: Occupied bandwidth.

\* RSS-Gen, 6.7: Occupied bandwidth (or 99% emission 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

The worst case of occupied bandwidth corresponds to Resource Block (RB) Size All and Offset 0 regardless the nominal bandwidth selected.

#### LTE Cat 1bis Band 5:

LTE Cat 1bis Band 5. BW=5 MHz. QPSK. RB Size=All. RB Offset=0.

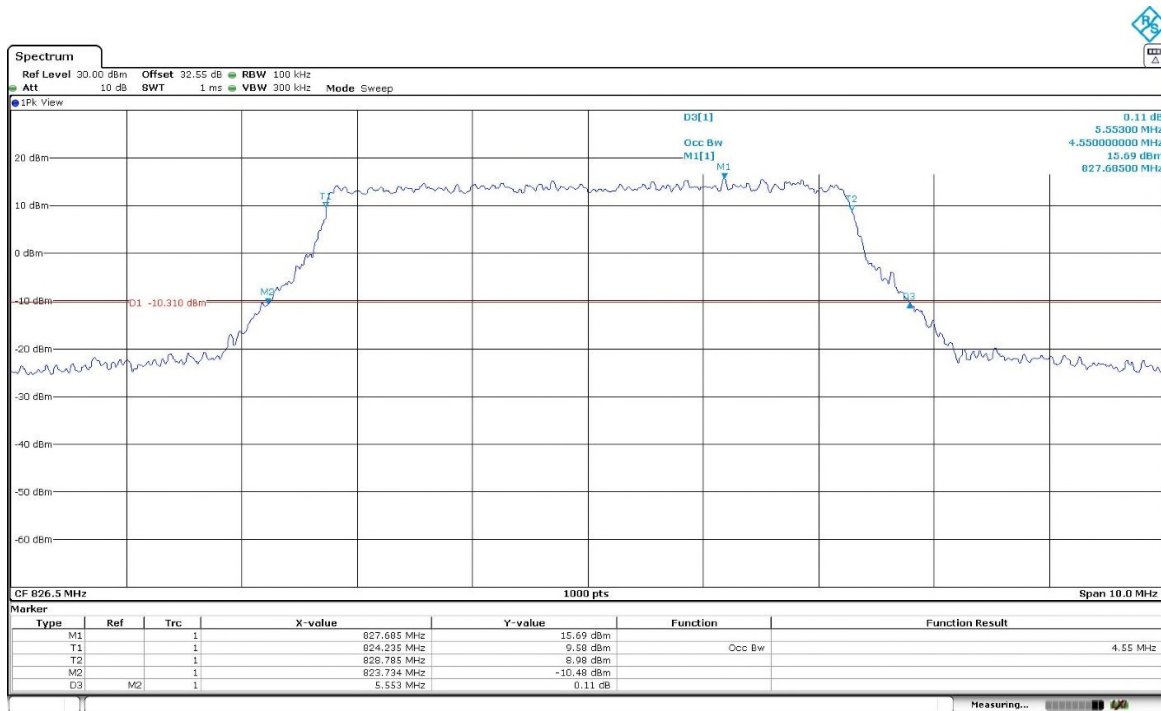
| Channel                       | Low     | Middle  | High    |
|-------------------------------|---------|---------|---------|
| 99% Occupied Bandwidth (kHz)  | 4550.00 | 4580.00 | 4540.00 |
| -26 dBc Bandwidth (kHz)       | 5553.00 | 5425.00 | 5526.00 |
| Measurement uncertainty (kHz) | <±3.75  |         |         |

LTE Cat 1bis Band 5. BW=5 MHz. 16QAM. RB Size=All. RB Offset=0.

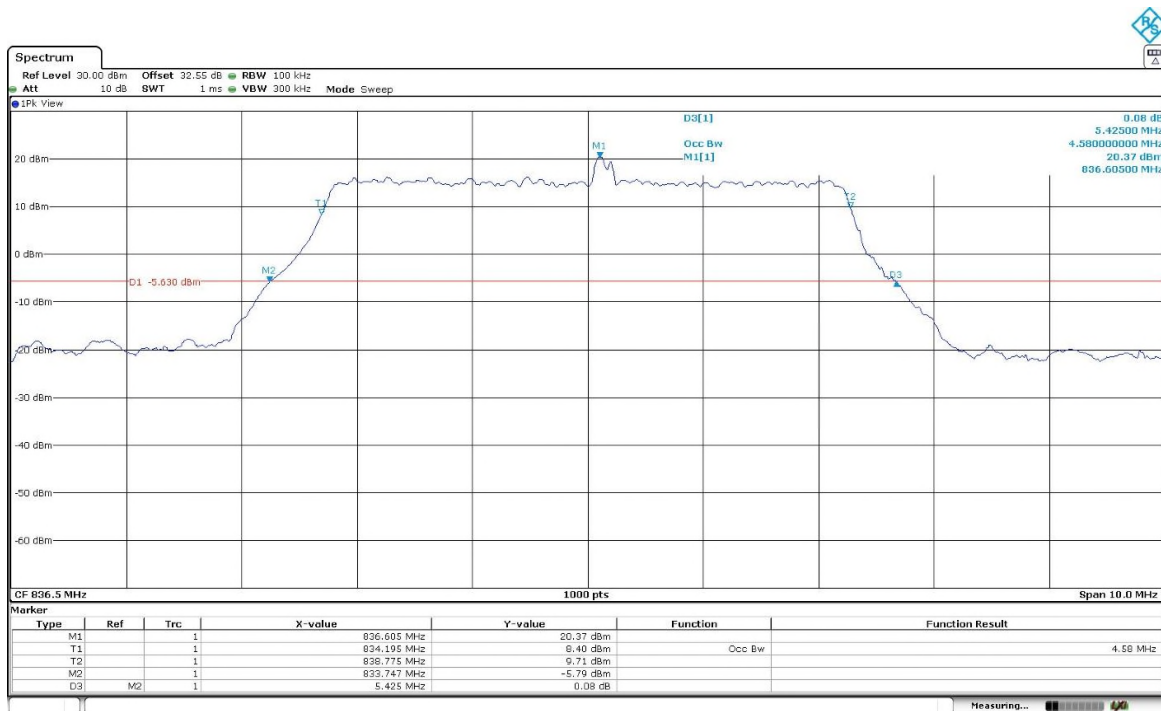
| Channel                       | Low     | Middle  | High    |
|-------------------------------|---------|---------|---------|
| 99% Occupied Bandwidth (kHz)  | 4540.00 | 4560.00 | 4560.00 |
| -26 dBc Bandwidth (kHz)       | 5624.00 | 5665.00 | 5626.00 |
| Measurement uncertainty (kHz) | <±3.75  |         |         |

LTE Cat 1bis Band 5. BW=5 MHz. QPSK. RB Size=All.

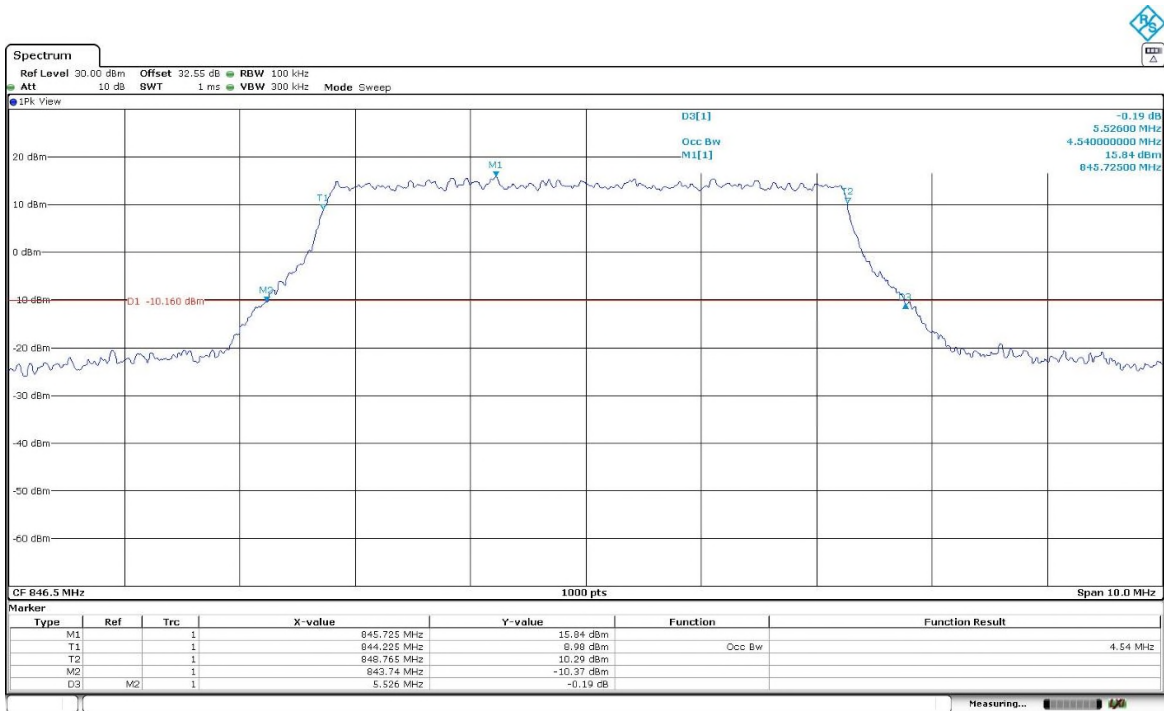
Low Channel:



Middle Channel:

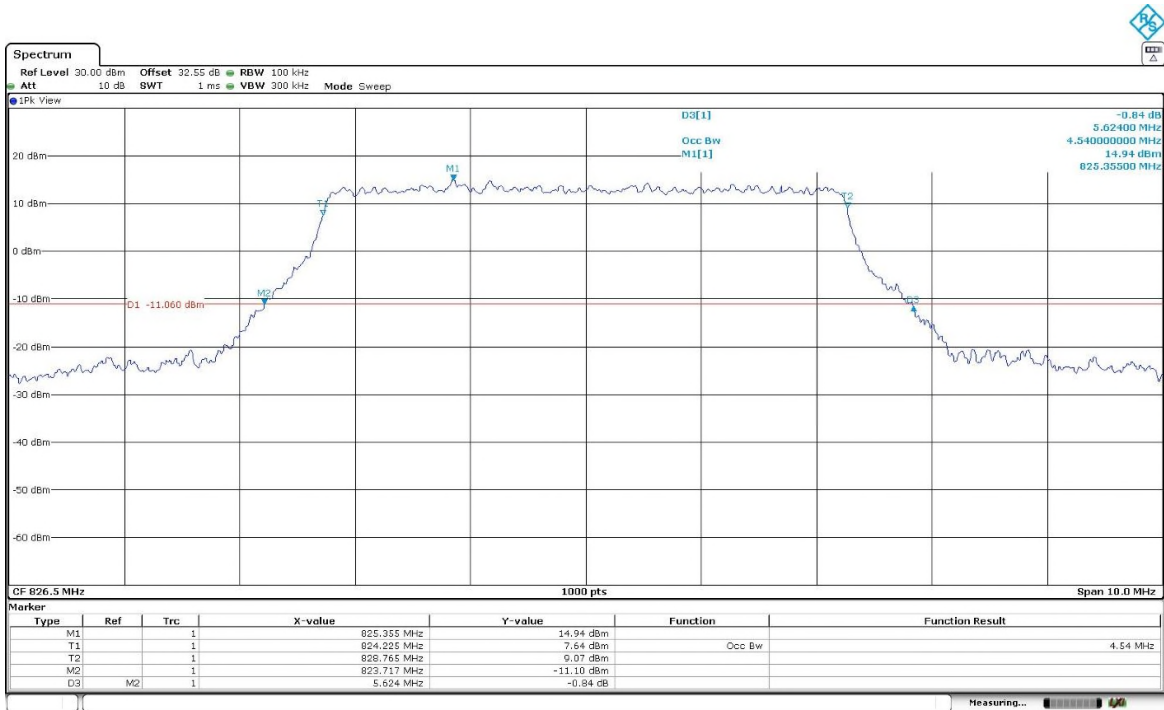


High Channel:

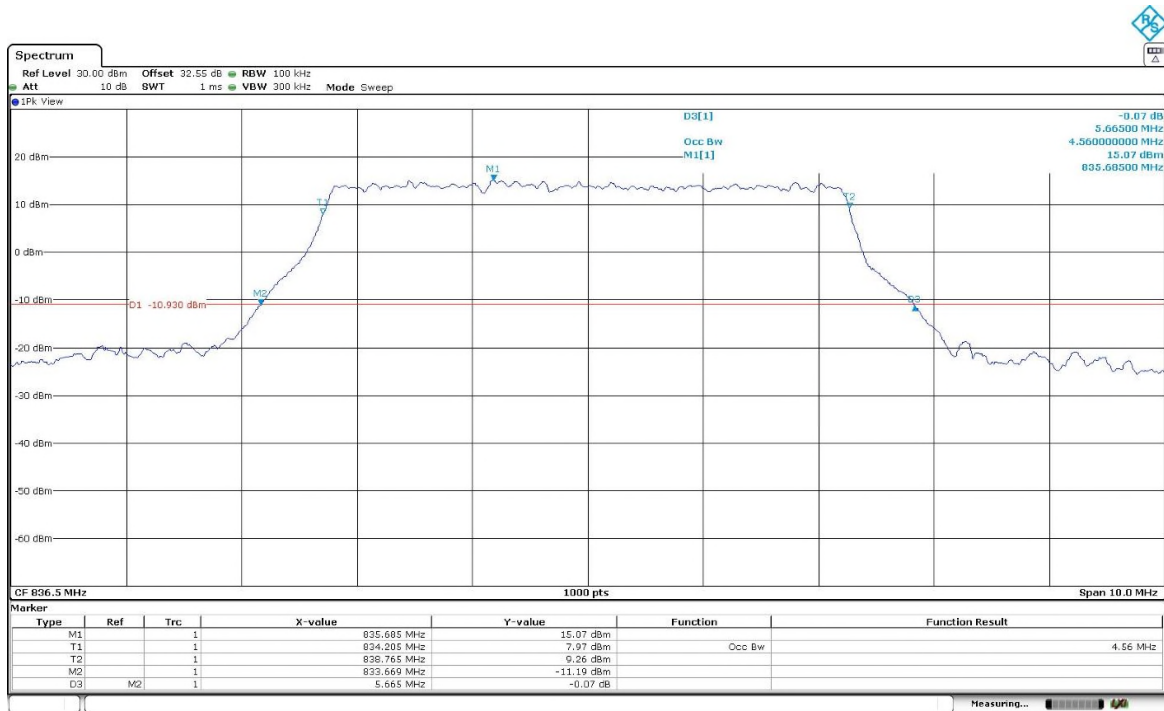


LTE Cat 1bis Band 5. BW=5 MHz. 16QAM. RB Size=All.

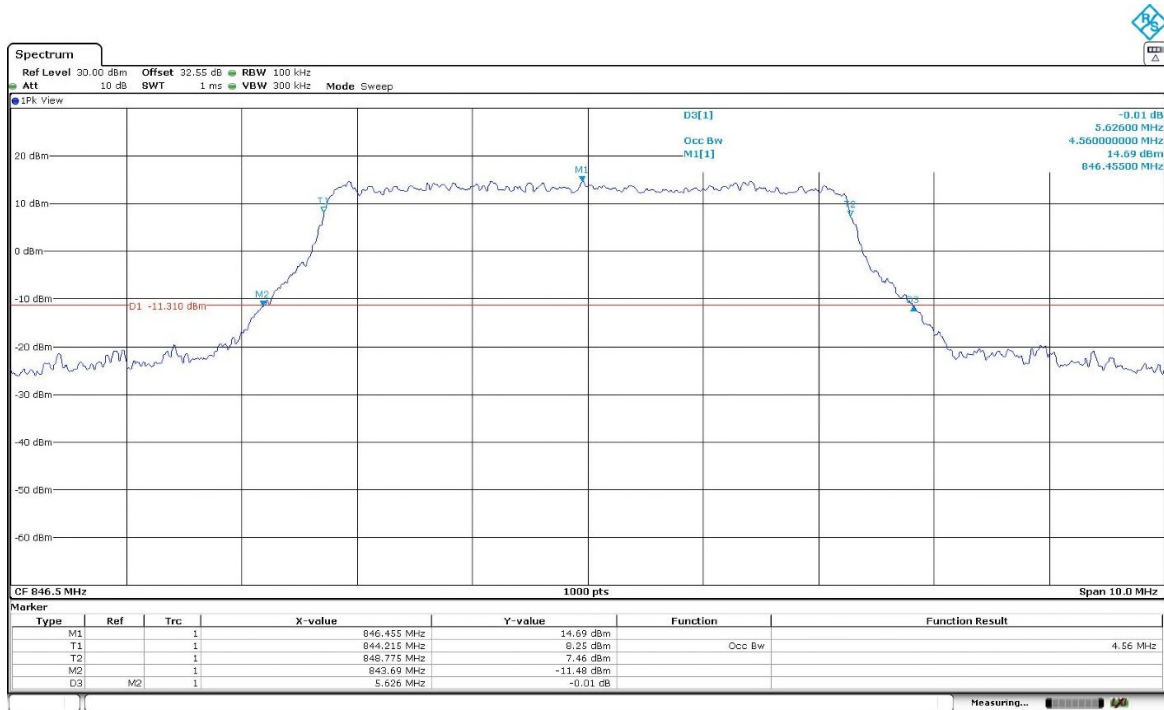
Low Channel:



Middle Channel:



High Channel:



LTE Cat 1bis Band 5. BW=10 MHz. QPSK. RB Size=All. RB Offset=0.

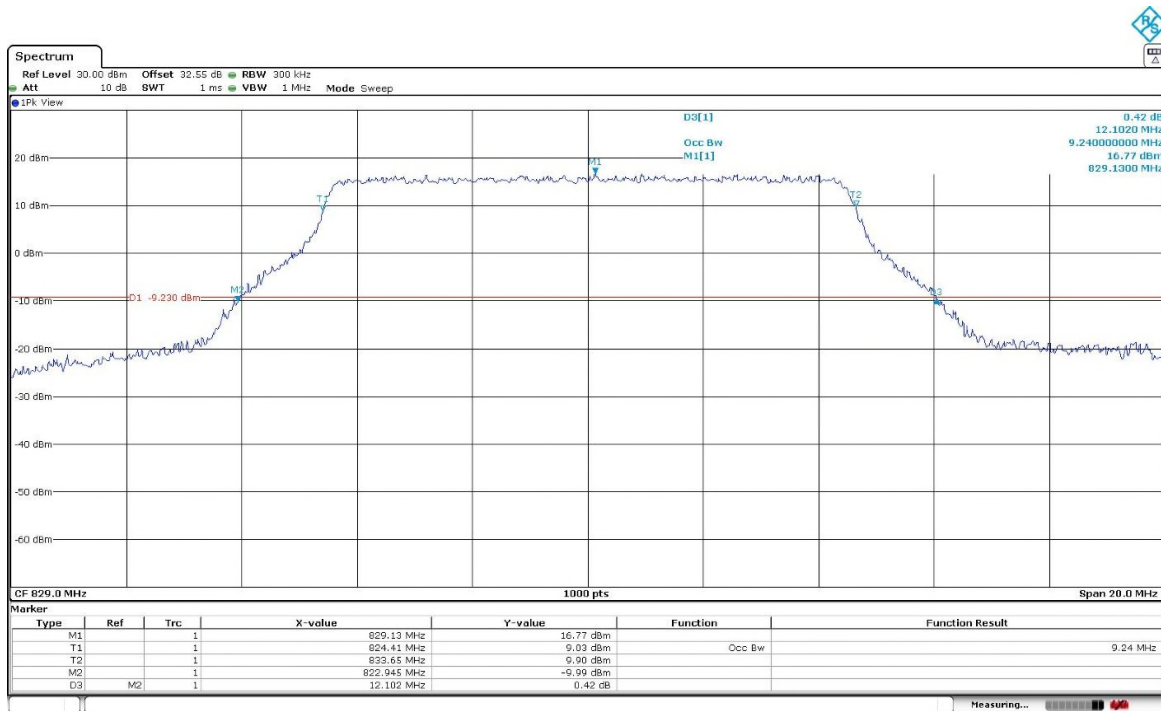
| Channel                       | Low      | Middle   | High     |
|-------------------------------|----------|----------|----------|
| 99% Occupied Bandwidth (kHz)  | 9240.00  | 9340.00  | 9260.00  |
| -26 dBc Bandwidth (kHz)       | 12102.00 | 12137.00 | 11996.00 |
| Measurement uncertainty (kHz) | <±3.75   |          |          |

LTE Cat 1bis Band 5. BW=10 MHz. 16QAM. RB Size=All. RB Offset=0.

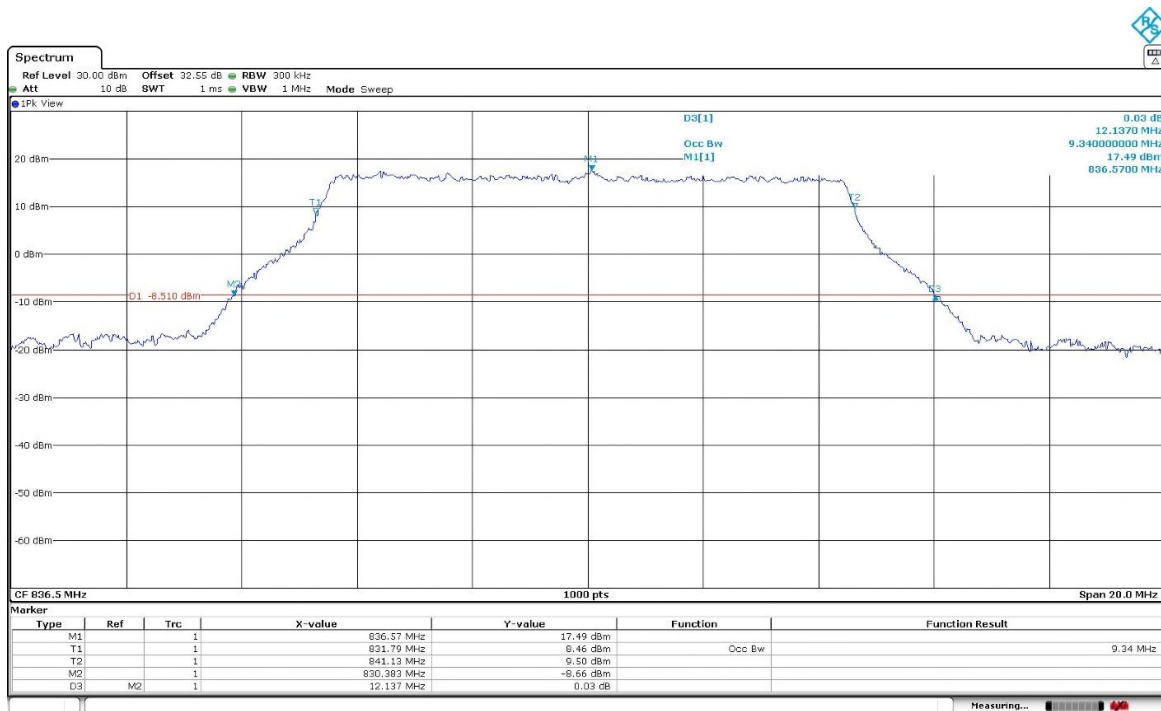
| Channel                       | Low     | Middle  | High    |
|-------------------------------|---------|---------|---------|
| 99% Occupied Bandwidth (kHz)  | 5220.00 | 5060.00 | 5320.00 |
| -26 dBc Bandwidth (kHz)       | 9011.00 | 8009.00 | 8420.00 |
| Measurement uncertainty (kHz) | <±3.75  |         |         |

LTE Cat 1bis Band 5. BW=10 MHz. QPSK. RB Size=All.

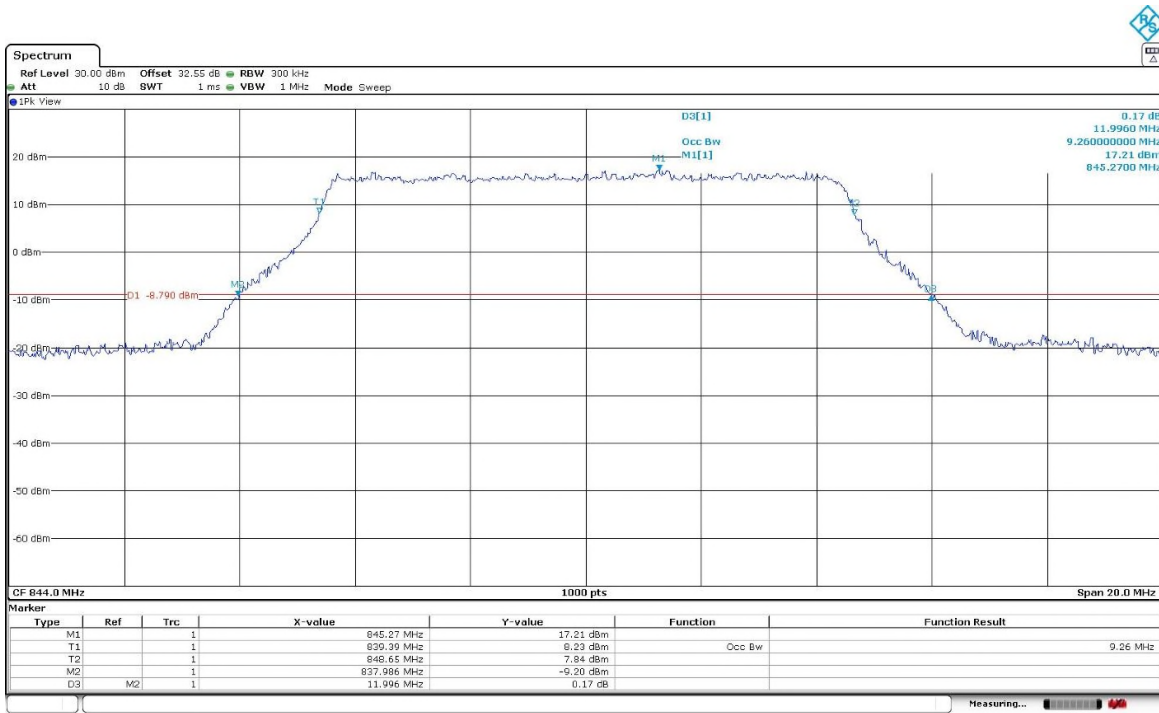
Low Channel:



Middle Channel:

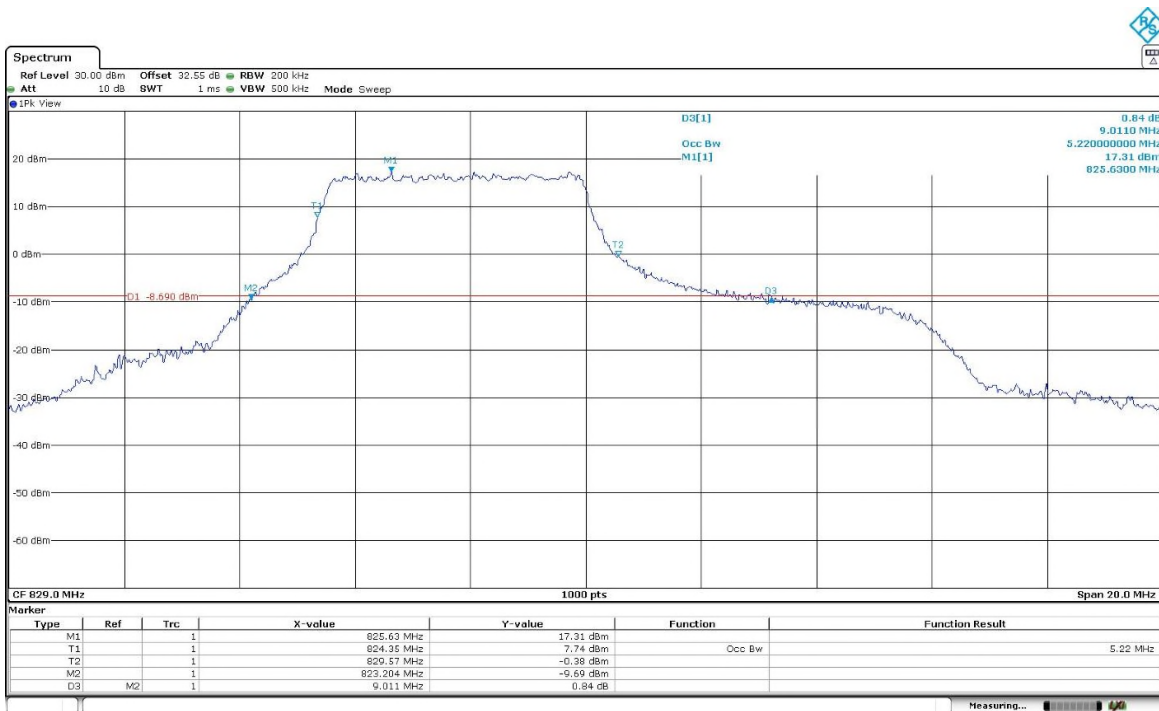


High Channel:

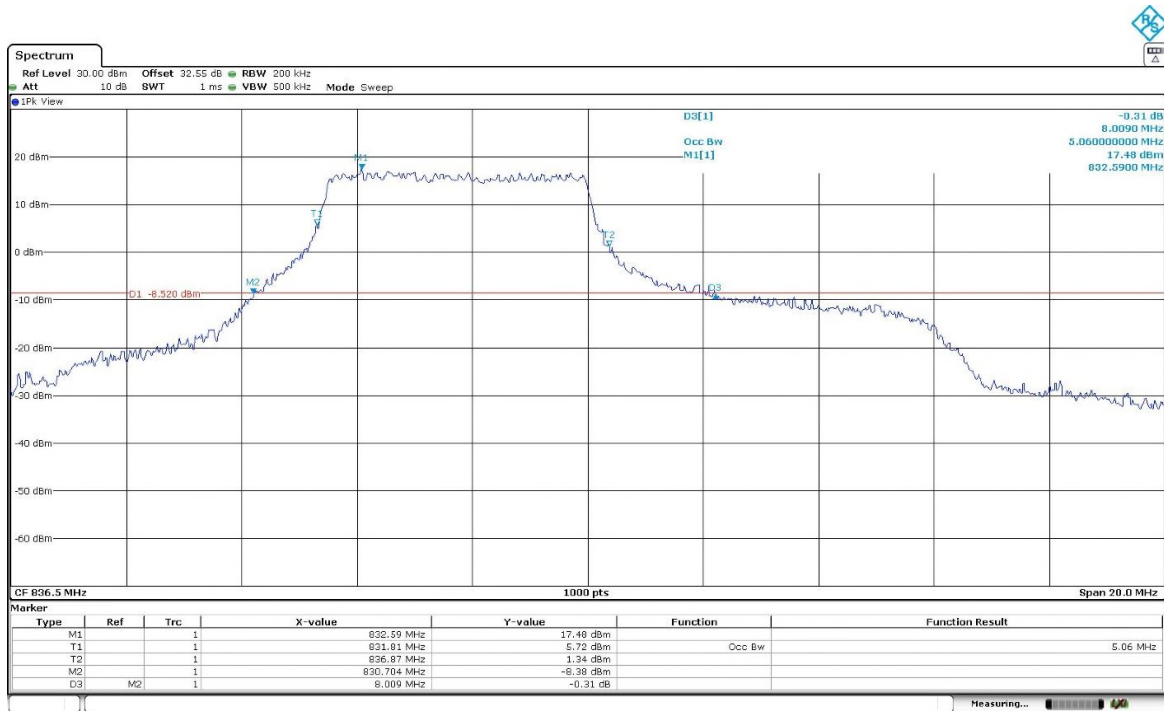


LTE Cat 1bis Band 5. BW=10 MHz. 16QAM. RB Size=All.

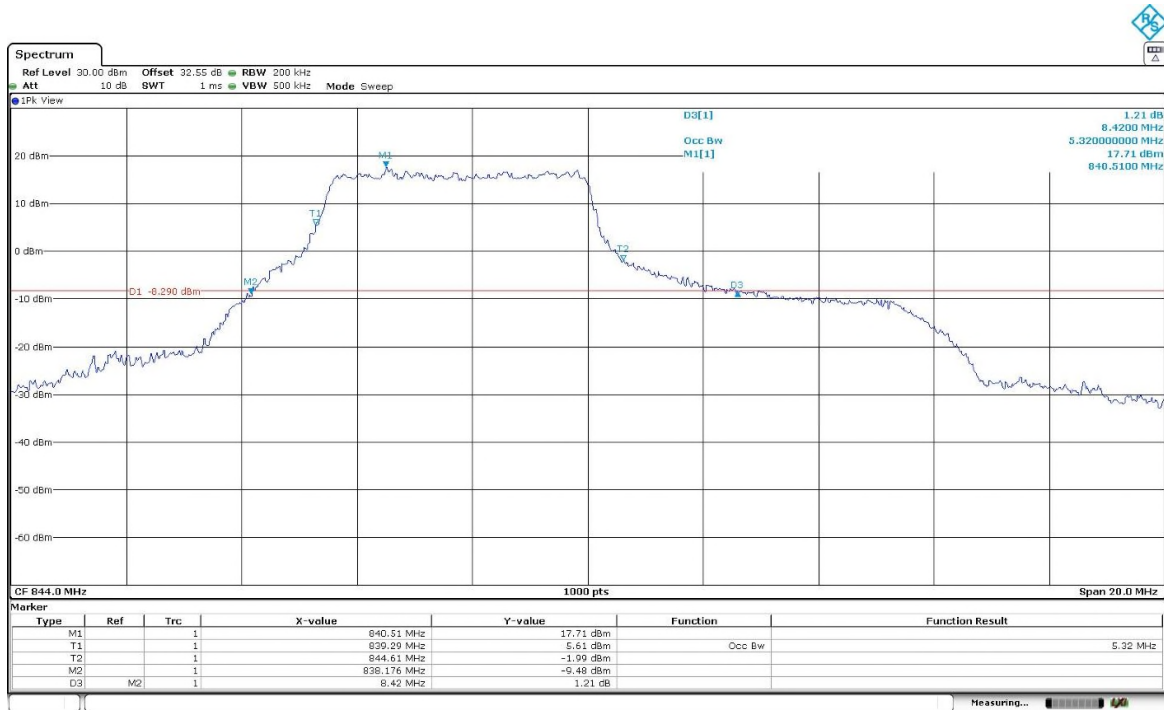
Low Channel:



Middle Channel:



High Channel:



## Spurious emissions at antenna terminals

### Limits

\* FCC § 2.1051 and § 22.917:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

Compliance with these rules is based on the use of measurement instrumentation employing a reference bandwidth as follows:

In the spectrum below 1 GHz, instrumentation should employ a reference bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

- \* RSS-132. 5.5: Mobile and base station equipment shall comply with the limits in (i) and (ii) below.
- In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P ( dBW) by at least  $43 + 10 \log_{10} P$  (watts).
  - After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least  $43 + 10 \log_{10} P$  (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

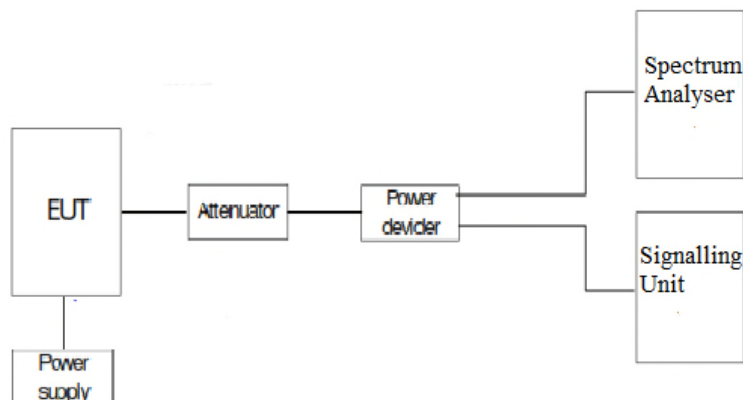
### Method

The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50-Ohm attenuator and a power divider.

The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

The configuration of Resource Blocks and modulation which is the worst case for conducted power was used.

### Test Setup



## Results

### LTE Cat 1bis Band 5:

A preliminary scan determined the worst-case:

BW=10 MHz. QPSK. RB Size=1. RB Offset=0.

The next results are for this worst-case configuration.

#### Frequency range 9 KHz - 10 GHz:

- Low Channel: No spurious frequencies at less than 20 dB below the limit.
- Middle Channel: No spurious frequencies at less than 20 dB below the limit.
- High Channel: No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB):  $<\pm 2.76$

Verdict: PASS