



Test report No:  
NIE: 57478RRF.013A1

## Test report

REFERENCE STANDARD:  
USA FCC Part 24  
CANADA RSS-133

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (*) Identification of item tested   | Secure Smartphone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| (*) Trademark                       | Bittium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| (*) Model and /or type reference    | Tough Mobile 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Other identification of the product | HW Version: 0302<br>SW Version: 40.1<br>FCC ID: V27SD-61<br>IC: 3282B-SD61                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| (*) Features                        | LTE <ul style="list-style-type: none"> <li>• 3GPP Rel12</li> <li>• FDD/TDD Cat13/5,</li> <li>• DL 400Mbit/s,</li> <li>• UL 75 Mbit/s</li> </ul> UMTS/HSPA <ul style="list-style-type: none"> <li>• 3GPP rel8, HSPA+,</li> <li>• DL 42 Mbit/s,</li> <li>• UL 5.76 Mbit/s</li> </ul> GSM/GPRS/EDGE<br>Complementary Radios <ul style="list-style-type: none"> <li>• Wi-Fi 802.11 a/b/g/n/ac (2.4 and 5 GHz), 2 x 2</li> </ul> MIMO <ul style="list-style-type: none"> <li>• BT 5.0</li> <li>• NFC</li> </ul> |
| Applicant                           | BITTIUM WIRELESS OY<br>Ritaharjuntie 1, 90590 Oulu, Finland                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Test method requested, standard     | USA FCC Part 24 (10-1-18 Edition).<br>CANADA RSS-133 Issue 6, Jan. 2013.<br>ANSI C63.26-2015.<br>ANSI/TIA-603-E: 2016.<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                             | 2019-10-22                                    |
| Report template No                        | FDT08_22<br>(*) "Data provided by the client" |

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## Competences and guarantees

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## General conditions

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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 of Tough Mobile 2 consists of a Secure Smartphone targeted for professional use where High Security is required.

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 |
|------------|---------------------|----------------|-----------|-------------------|
| 57478C/032 | Secure Smartphone   | Tough Mobile 2 | ---       | 2018-11-26        |
| 57478C/033 | USB cable           | ---            | ---       | 2018-11-26        |
| 57478C/034 | AC/DC power adapter | ---            | ---       | 2018-11-26        |
| 57478C/039 | Headphones          | ---            | ---       | 2018-11-26        |

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

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

| Control N° | Description       | Model          | Serial N° | Date of reception |
|------------|-------------------|----------------|-----------|-------------------|
| 57478C/016 | Secure Smartphone | Tough Mobile 2 | ---       | 2018-10-25        |

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

## Test sample description

|                                               |                                     |                                |                          |                          |                          |                          |                          |
|-----------------------------------------------|-------------------------------------|--------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Ports..... :                                  | Port name and description           |                                | Cable                    |                          |                          |                          |                          |
|                                               |                                     |                                | Specified length [m]     | Attached during test     | Shielded                 |                          |                          |
|                                               | Not provided.                       |                                |                          | <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..... : | N/A                                 |                                |                          |                          |                          |                          |                          |
| Rated power supply .....                      | 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 checked="" type="checkbox"/> | DC: 3.6 – 4.35 Vdc.            |                          |                          |                          |                          |                          |
|                                               | <input type="checkbox"/>            | DC:                            |                          |                          |                          |                          |                          |
| Rated Power .....                             | Not provided                        |                                |                          |                          |                          |                          |                          |
| Clock frequencies.....                        | Not provided                        |                                |                          |                          |                          |                          |                          |
| Other parameters .....                        | FCC ID: V27SD-61<br>IC: 3282B-SD61  |                                |                          |                          |                          |                          |                          |
| Software version .....                        | 40.1                                |                                |                          |                          |                          |                          |                          |
| Hardware version .....                        | 0302                                |                                |                          |                          |                          |                          |                          |
| Dimensions in cm (L x W x D).....             | Not provided                        |                                |                          |                          |                          |                          |                          |
| Mounting position .....                       | <input type="checkbox"/>            | Table top equipment            |                          |                          |                          |                          |                          |
|                                               | <input type="checkbox"/>            | Wall/Ceiling mounted equipment |                          |                          |                          |                          |                          |
|                                               | <input type="checkbox"/>            | Floor standing equipment       |                          |                          |                          |                          |                          |
|                                               | <input checked="" 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             |                          |
|                                               | -                                   |                                |                          |                          |                          |                          |                          |
|                                               | -                                   |                                |                          |                          |                          |                          |                          |
|                                               | -                                   |                                |                          |                          |                          |                          |                          |
| Documents as provided by the applicant .....  | Description                         |                                | File name                |                          |                          | Issue date               |                          |
|                                               | -                                   |                                |                          |                          |                          |                          |                          |

## Identification of the client

BITTIUM WIRELESS OY  
Ritaharjuntie 1, 90590 Oulu, Finland

## Testing period and place

|               |                                        |
|---------------|----------------------------------------|
| Test Location | DEKRA Testing and Certification S.A.U. |
| Date (start)  | 2018-10-26                             |
| Date (finish) | 2019-04-30                             |

## Document history

| Report number  | Date       | Description                                                                      |
|----------------|------------|----------------------------------------------------------------------------------|
| 57478RRF.013   | 2019-08-27 | First release                                                                    |
| 57478RRF.013A1 | 2019-10-22 | Second release. RF Output Power measurements were added on the modulation 16 QAM |

## 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 %          |
| Air pressure      | Min. = 860 mbar<br>Max. = 1060 mbar |

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. = 35            |
| Air pressure      | Min. = 860 mbar<br>Max. = 1060 mbar |

## Remarks and comments

The tests have been performed by the technical personnel: Jaime Barranquero, Ignacio Cabra, Nicolás Salguero, Miguel Ángel Torres and José Alberto Aranda.

Used instrumentation:

### Conducted Measurements

|    |                                                                   |  | Last Calibration | Due Calibration |
|----|-------------------------------------------------------------------|--|------------------|-----------------|
| 1. | Chamber HERAEUS VMT 04/35                                         |  | 2018/06          | 2020/06         |
| 2. | Wideband Radio Communication Tester<br>ROHDE AND SCHWARZ CMW500   |  | 2018/05          | 2019/05         |
| 3. | Wideband Radio Communication Tester<br>ROHDE AND SCHWARZ CMW500   |  | 2019/02          | 2020/02         |
| 4. | Wideband Radio Communication Tester<br>ROHDE AND SCHWARZ CMW500   |  | 2018/04          | 2019/04         |
| 5. | Spectrum Analyzer PSA 3Hz-26.5 GHz<br>AGILENT TECHNOLOGIES E4440A |  | 2017/10          | 2019/10         |
| 6. | Spectrum Analyzer ROHDE AND SCHWARZ<br>FSW50                      |  | 2018/02          | 2020/02         |
| 7. | Signal Analyzer 20 Hz to 8 GHz ROHDE AND<br>SCHWARZ FSQ8          |  | 2018/08          | 2020/08         |
| 8. | Signal and Spectrum Analyzer ROHDE AND<br>SCHWARZ FSV40           |  | 2017/07          | 2019/07         |
| 9. | DC Power Supply 40V/40A Rohde & Schwarz<br>NGPE40                 |  | 2018/02          | 2021/02         |

### Radiated Measurements

|    |                                                                               |  | Last Calibration | Due Calibration |
|----|-------------------------------------------------------------------------------|--|------------------|-----------------|
| 1. | Semianechoic Absorber Lined Chamber ETS<br>LINDGREN FACT 3 200 STP            |  | N.A.             | N.A.            |
| 2. | Biconical/Log Antenna 30MHz - 6GHz ETS<br>LINDGREN 3142E                      |  | 2018/10          | 2021/10         |
| 3. | EMI Test Receiver R&S ESR7                                                    |  | 2018/08          | 2020/08         |
| 4. | Signal and Spectrum Analyzer ROHDE AND<br>SCHWARZ FSV40                       |  | 2018/02          | 2020/02         |
| 5. | Broadband Horn antenna 1-18 GHz<br>SCHWARZBECK MESS-ELEKTRONIK BBHA<br>9120 D |  | 2018/01          | 2021/01         |
| 6. | Wideband Radio Communication Tester<br>ROHDE AND SCHWARZ CMW500               |  | 2019/05          | 2020/05         |
| 7. | RF pre-amplifier 1-18 GHz Bonn Elektronik<br>BLMA 0118-1M                     |  | 2019/04          | 2020/04         |
| 8. | RF Pre-amplifier 30 dB, 18 GHz-40 GHz BONN<br>ELEKTRONIK BLMA 1840-1M         |  | 2019/02          | 2021/02         |
| 9. | Broadband Horn antenna 18-40 GHz<br>SCHWARZBECK BBHA 9170                     |  | 2018/07          | 2021/07         |

## Testing verdicts

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

## Summary

| FCC PART 24 / RSS-133 PARAGRAPH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|
| Requirement – Test case                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Verdict | Remark  |
| Clause 24.232/RSS-133 Clause 6.4: RF output power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | P       | (1) (2) |
| Clause 2.1047/RSS-133 Clause 6.2: Modulation characteristics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | P       | (1) (2) |
| Clause 24.235/RSS-133 Clause 6.3: Frequency stability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | P       | (1) (2) |
| Clause 2.1049: Occupied Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | P       | (1) (2) |
| Clause 24.238/RSS-133 Clause 6.5: Spurious emissions at antenna terminals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | P       | (1) (2) |
| Clause 24.238/RSS-133 Clause 6.5: Radiated emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | P       | (1) (2) |
| <b>Supplementary information and remarks:</b><br><p>(1) GSM mode has not been tested to prove USA FCC Part 24 compliance because the modulation scheme and the power maximum levels are the same as for GPRS mode.</p> <p>Taking into account the above comments, testing in GSM mode is redundant for FCC Part 24 as it is the same as GPRS mode. GPRS mode has been tested as indicated on the present test report.</p> <p>(2) HSDPA modulation mode has not been tested to prove USA FCC Part 24 compliance because it is an improved mode of operation only for Downlink (UE reception), but using the normal WCDMA mode for UL (Up Link, UE transmission). Therefore HSDPA has no associated a Power class or modulation scheme different than WCDMA mode for the UL transmission.</p> <p>Taking into account the above comments, testing in HSDPA modulation mode is redundant for FCC Part 24 as it is the same as WCDMA mode as long as UE transmission is concerned. WCDMA modulation mode has been tested as indicated on the present test report.</p> |         |         |

## Appendix A: Test results for FCC PART 24 / RSS-133

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## TEST CONDITIONS

### POWER SUPPLY (V):

Vn: 3.8 Vdc  
Vmin: 3.6 Vdc (\*)  
Vmax: 4.2 Vdc (\*)

Type of Power Supply: Rechargeable battery.

The subscripts 'n', 'min' and 'max' indicate temperature test conditions (normal, minimum and maximum respectively).

(\*): Declared by applicant.

### ANTENNA GAIN:

| MIDDLE Bands     |          | ANTENNA TYPE                      |
|------------------|----------|-----------------------------------|
| 2G 1900          | +0.1 dBi | Monopole with parasitic resonator |
| 3G WCDMA Band II | +0.1 dBi | Monopole with parasitic resonator |
| LTE Band 25      | +0.2 dBi | Monopole with parasitic resonator |

### TEST FREQUENCIES:

#### GPRS MODULATION:

Lowest channel (512): 1850.2 MHz  
Middle channel (662): 1880.2 MHz  
Highest channel (810): 1909.8 MHz

#### WCDMA AND HSUPA MODULATIONS:

Lowest channel (9262): 1852.4 MHz  
Middle channel (9400): 1880.0 MHz  
Highest channel (9538): 1907.6 MHz

#### LTE Band 2. QPSK AND 16QAM MODULATIONS:

|         | Channel (Frequency. MHz) |                |                |              |                |              |
|---------|--------------------------|----------------|----------------|--------------|----------------|--------------|
|         | BW = 1.4 MHz             | BW = 3 MHz     | BW = 5 MHz     | BW = 10 MHz  | BW = 15 MHz    | BW = 20 MHz  |
| Lowest  | 18607 (1850.7)           | 18615 (1851.5) | 18650 (1852.5) | 18675 (1855) | 18675 (1857.5) | 18700 (1860) |
| Middle  | 18900 (1880)             | 18900 (1880)   | 18900 (1880)   | 18900 (1880) | 18900 (1880)   | 18900 (1880) |
| Highest | 19193 (1909.3)           | 19185 (1908.5) | 19150 (1907.5) | 19150 (1905) | 19125 (1902.5) | 19100 (1900) |

NOTE: LTE Band 2 is completely included in LTE Band 25, so the channels of Band 25 were tested to give conformity to the assigned block.

LTE Band 25. QPSK AND 16QAM MODULATIONS:

|         | Channel (Frequency. MHz) |                |                |                |                |                |
|---------|--------------------------|----------------|----------------|----------------|----------------|----------------|
|         | BW = 1.4 MHz             | BW = 3 MHz     | BW = 5 MHz     | BW = 10 MHz    | BW = 15 MHz    | BW = 20 MHz    |
| Lowest  | 26047 (1850.7)           | 26055 (1851.5) | 26065 (1852.5) | 26090 (1855)   | 26115 (1857.5) | 26140 (1860)   |
| Middle  | 26365 (1882.5)           | 26365 (1882.5) | 26365 (1882.5) | 26365 (1882.5) | 26365 (1882.5) | 26365 (1882.5) |
| Highest | 26683 (1914.3)           | 26675 (1913.5) | 26665 (1912.5) | 26640 (1910)   | 26615 (1907.5) | 26590 (1905)   |

## RF Output Power

### SPECIFICATION:

FCC §2.1046 and §24.232

Mobile/portable stations are limited to 2 Watts (33 dBm) Effective Isotropic Radiated Power (E.I.R.P.).  
The peak-to-average ratio (PAR) of the transmission shall not exceed 13 dB.

RSS-133. Clause 6.4.

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

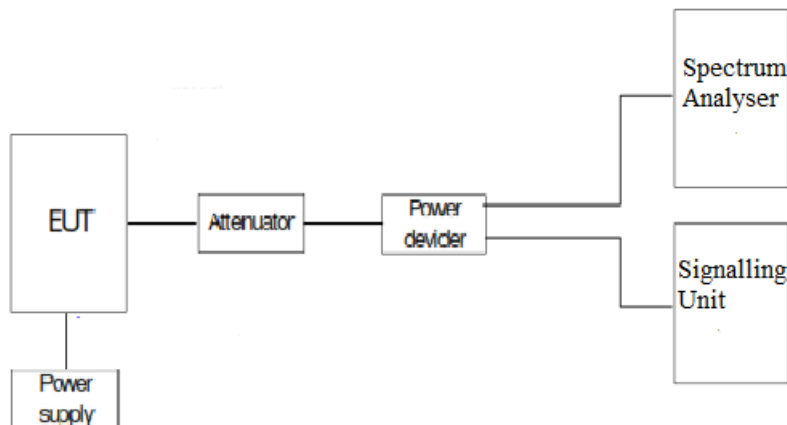
The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

### TEST SETUP:

#### 1. CONDUCTED AVERAGE POWER:



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



## RESULTS:

### 1. AVERAGE POWER:

#### 2G Band 1900 MHz :

##### GPRS MODULATION:

| Channel                                                               | Lowest | Middle | Highest |
|-----------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                                   | 0.1    | 0.1    | 0.1     |
| Measured maximum average power (dBm) at antenna port                  | 30.14  | 29.92  | 29.84   |
| Maximum effective isotropically radiated average power E.I.R.P. (dBm) | 30.24  | 30.02  | 29.94   |
| Peak-to-average ratio (PAR) (dB)                                      | 0.31   | 0.30   | 0.31    |
| Measurement uncertainty (dB)                                          | <±0.66 |        |         |

##### EDGE MODULATION:

| Channel                                                               | Lowest | Middle | Highest |
|-----------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                                   | 0.1    | 0.1    | 0.1     |
| Measured maximum average power (dBm) at antenna port                  | 25.98  | 25.63  | 25.69   |
| Maximum effective isotropically radiated average power E.I.R.P. (dBm) | 26.08  | 25.73  | 25.79   |
| Peak-to-average ratio (PAR) (dB)                                      | 0.31   | 0.31   | 0.31    |
| Measurement uncertainty (dB)                                          | <±0.66 |        |         |

#### 3G Band II:

##### WCDMA MODULATION:

| Channel                                                               | Lowest | Middle | Highest |
|-----------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                                   | 0.1    | 0.1    | 0.1     |
| Measured maximum average power (dBm) at antenna port                  | 23.73  | 24.35  | 24.06   |
| Maximum effective isotropically radiated average power E.I.R.P. (dBm) | 23.83  | 24.45  | 24.16   |
| Peak-to-average ratio (PAR) (dB)                                      | 3.16   | 3.16   | 3.09    |
| Measurement uncertainty (dB)                                          | <±0.66 |        |         |

#### HSUPA MODULATION:

| Channel                                                               | Lowest | Middle | Highest |
|-----------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                                   | 0.1    | 0.1    | 0.1     |
| Measured maximum average power (dBm) at antenna port                  | 21.98  | 21.95  | 21.92   |
| Maximum effective isotropically radiated average power E.I.R.P. (dBm) | 22.08  | 22.05  | 22.02   |
| Peak-to-average ratio (PAR) (dB)                                      | 4.04   | 3.30   | 3.35    |
| Measurement uncertainty (dB)                                          | <±0.66 |        |         |

#### LTE BAND 25:

LTE Band 25. QPSK MODULATION. Bandwidth = 1.4 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 24.04  | 23.72  | 23.91   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.24  | 23.92  | 24.11   |
| PAPR (dB)                                                        | (*)    | (*)    | (*)     |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 2.  
(\*): 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 25. 16QAM MODULATION. Bandwidth = 1.4 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.73  | 23.36  | 21.51   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.93  | 23.56  | 21.71   |
| PAPR (dB)                                                        | 5.45   | 6.03   | 5.48    |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 3. RB Offset: 1.  
Worst case PAPR: Modulation 16QAM. RB Size: 6. RB Offset: 0.

LTE Band 25. QPSK MODULATION. Bandwidth = 3 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.77  | 23.46  | 22.90   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.97  | 23.66  | 23.10   |
| PAPR (dB)                                                        | (*)    | (*)    | (*)     |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

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 25. 16QAM MODULATION. Bandwidth = 3 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.82  | 22.94  | 22.03   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.02  | 23.14  | 22.23   |
| PAPR (dB)                                                        | 5.74   | 6.09   | 5.71    |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 7.  
Worst case PAPR: Modulation 16QAM. RB Size: 15. RB Offset: 0.

LTE Band 25. QPSK MODULATION. Bandwidth = 5 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.73  | 23.42  | 23.09   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.93  | 23.62  | 23.29   |
| PAPR (dB)                                                        | (*)    | (*)    | (*)     |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

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 25. 16QAM MODULATION. Bandwidth = 5 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.67  | 23.20  | 23.38   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.87  | 23.40  | 23.58   |
| PAPR (dB)                                                        | 5.69   | 5.93   | 5.67    |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

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

LTE Band 25. QPSK MODULATION. Bandwidth = 10 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 24.02  | 23.71  | 22.37   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.22  | 23.91  | 22.57   |
| PAPR (dB)                                                        | (*)    | (*)    | (*)     |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.  
(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 50, RB Offset: 0 as the worst case.  
The results in the next tables shows the results for this configuration.

LTE Band 25. 16QAM MODULATION. Bandwidth = 10 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.86  | 23.13  | 22.68   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.06  | 23.33  | 22.88   |
| PAPR (dB)                                                        | 5.87   | 5.96   | 5.72    |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.  
Worst case PAPR: Modulation 16QAM. RB Size: 50. RB Offset: 0.

LTE Band 25. QPSK MODULATION. Bandwidth = 15 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 24.01  | 23.88  | 22.69   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 24.21  | 24.08  | 22.89   |
| PAPR (dB)                                                        | (*)    | (*)    | (*)     |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.  
(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 50, RB Offset: 0 as the worst case.  
The results in the next tables shows the results for this configuration.

LTE Band 25. 16QAM MODULATION. Bandwidth = 15 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.75  | 23.67  | 22.36   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.95  | 23.87  | 22.56   |
| PAPR (dB)                                                        | 6.04   | 6.12   | 5.82    |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.  
Worst case PAPR: Modulation 16QAM. RB Size: 75. RB Offset: 0.

LTE Band 25. QPSK MODULATION. Bandwidth = 20 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.65  | 23.90  | 22.82   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.85  | 24.10  | 23.02   |
| PAPR (dB)                                                        | (*)    | (*)    | (*)     |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.  
(\*): Preliminary measurements determined that the modulation 16QAM, RB Size: 50, RB Offset: 0 as the worst case.  
The results in the next tables shows the results for this configuration.

LTE Band 25. 16QAM MODULATION. Bandwidth = 20 MHz.

| Channel                                                          | Lowest | Middle | Highest |
|------------------------------------------------------------------|--------|--------|---------|
| Maximum declared antenna gain (dBi)                              | 0.2    | 0.2    | 0.2     |
| Measured maximum average power (dBm) at antenna port             | 23.71  | 24     | 22.79   |
| Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | 23.91  | 24.20  | 22.99   |
| PAPR (dB)                                                        | 6.03   | 6.01   | 6.06    |
| Measurement uncertainty (dB)                                     | <±0.66 |        |         |

Worst case AVERAGE POWER:

Modulation 16QAM. RB Size: 1. RB Offset: 0.

Worst case PAPR:

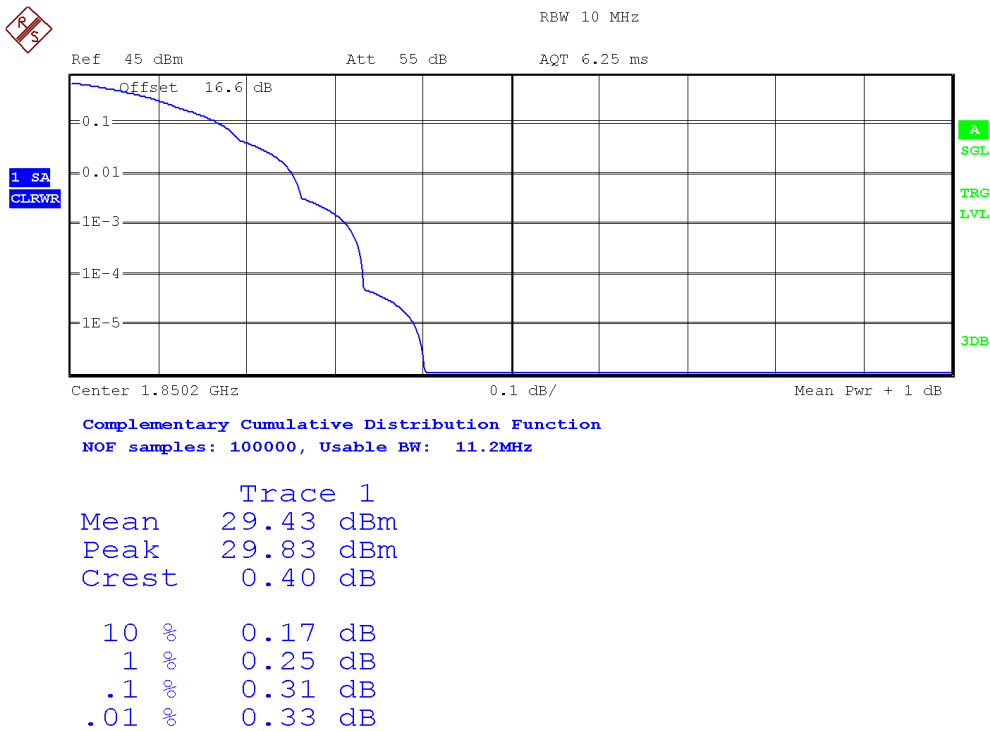
Modulation 16QAM. RB Size: 100. RB Offset: 0.

Verdict: PASS

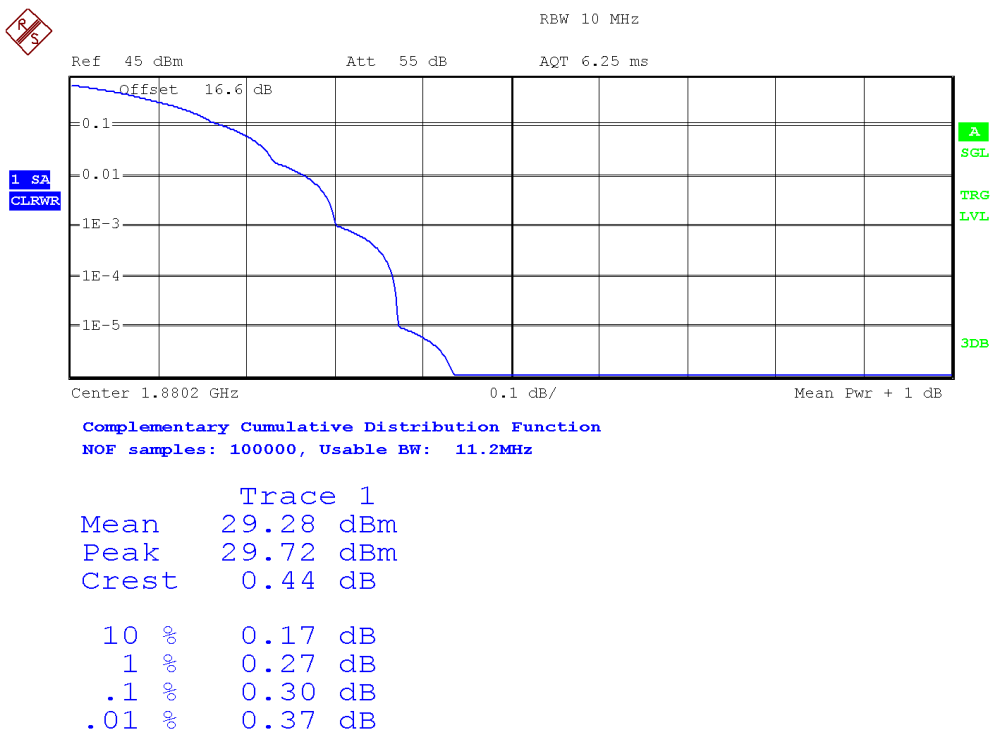
2. PEAK-TO-AVERAGE POWER RATIO (PAPR):

2G Band 1900 MHz. GPRS MODULATION.

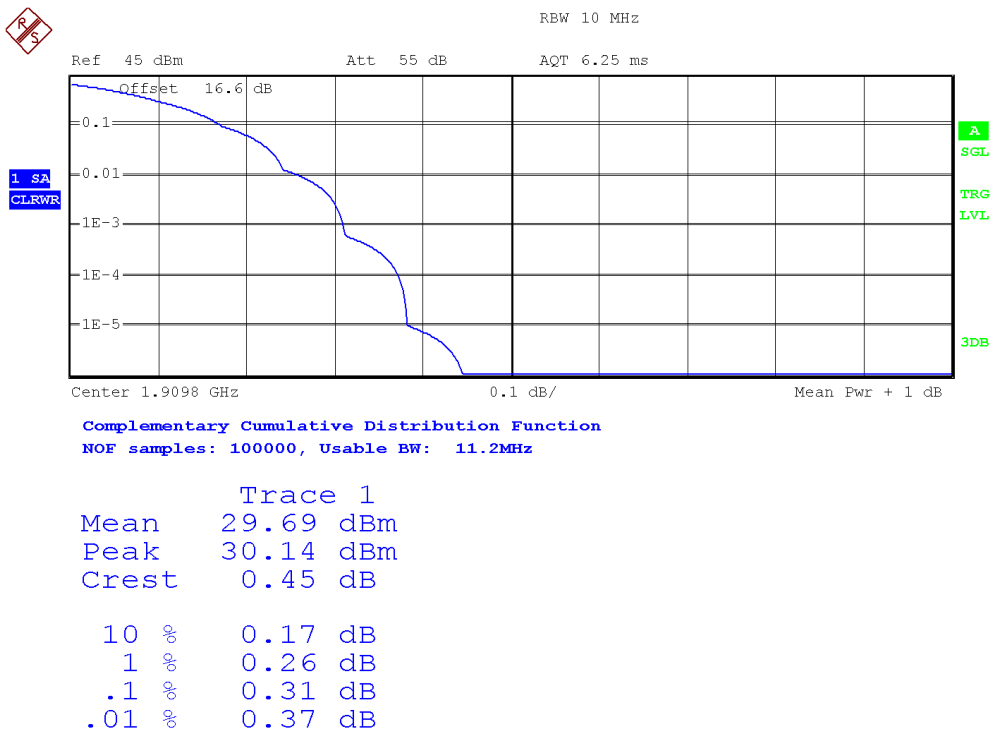
Lowest Channel :



Middle Channel:

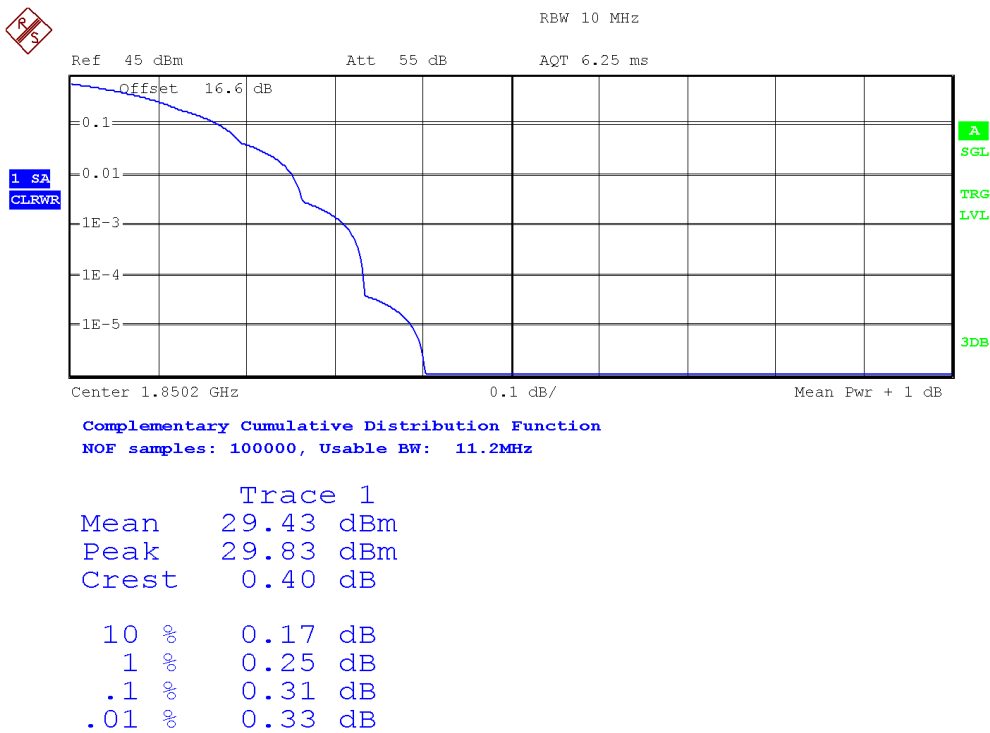


Highest Channel:

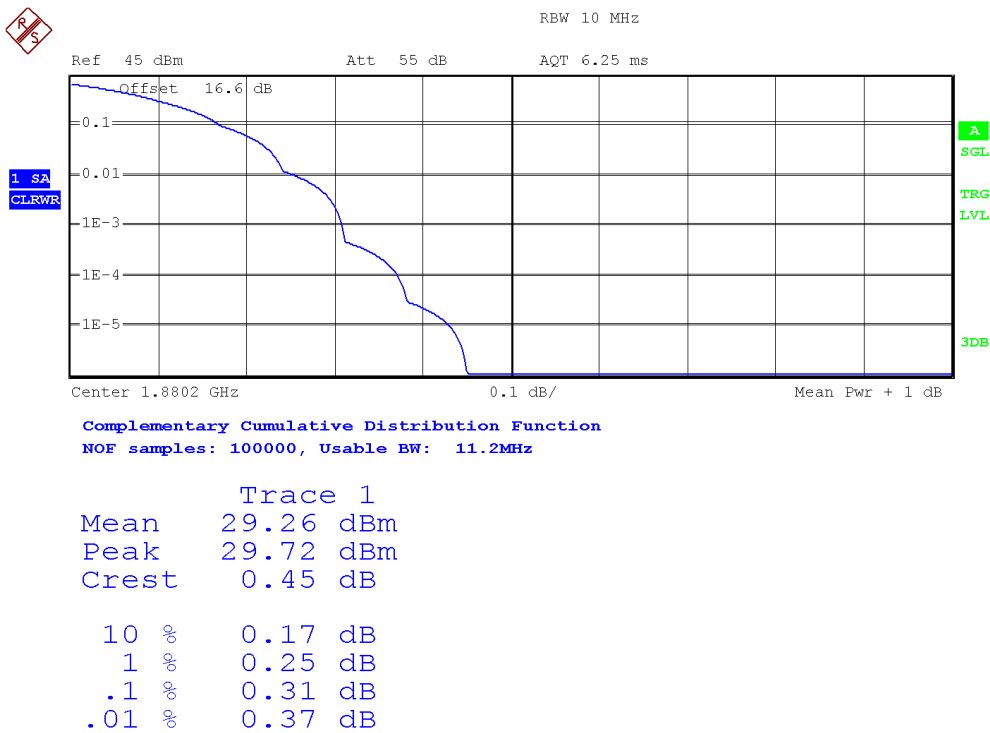


2G Band 1900 MHz. EDGE MODULATION.

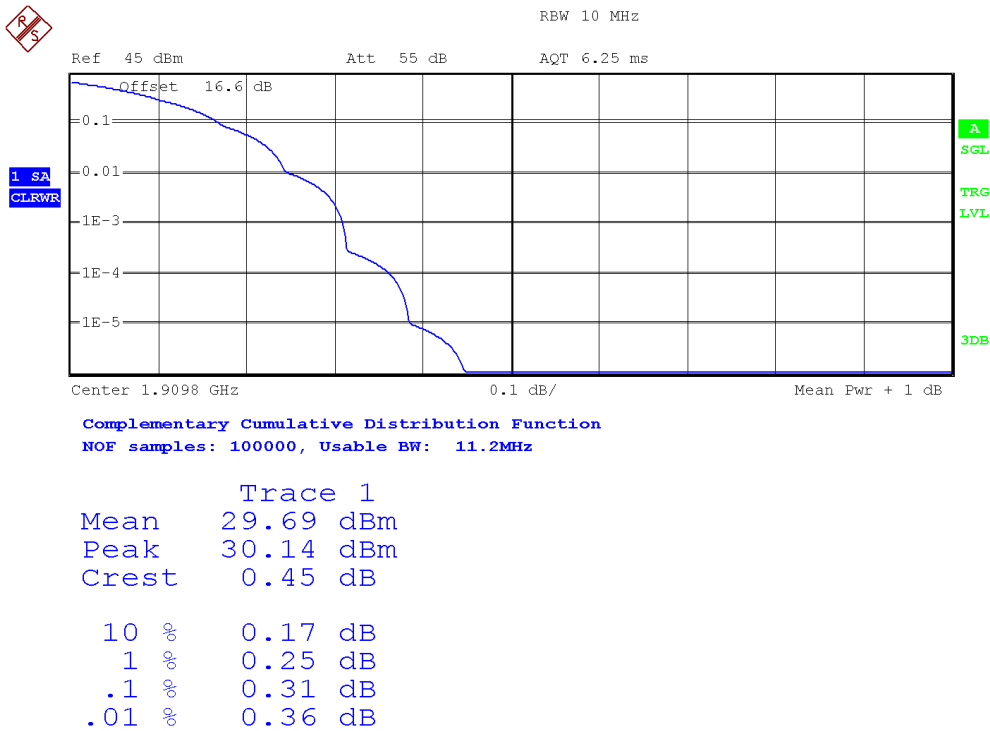
Lowest Channel:



Middle Channel:

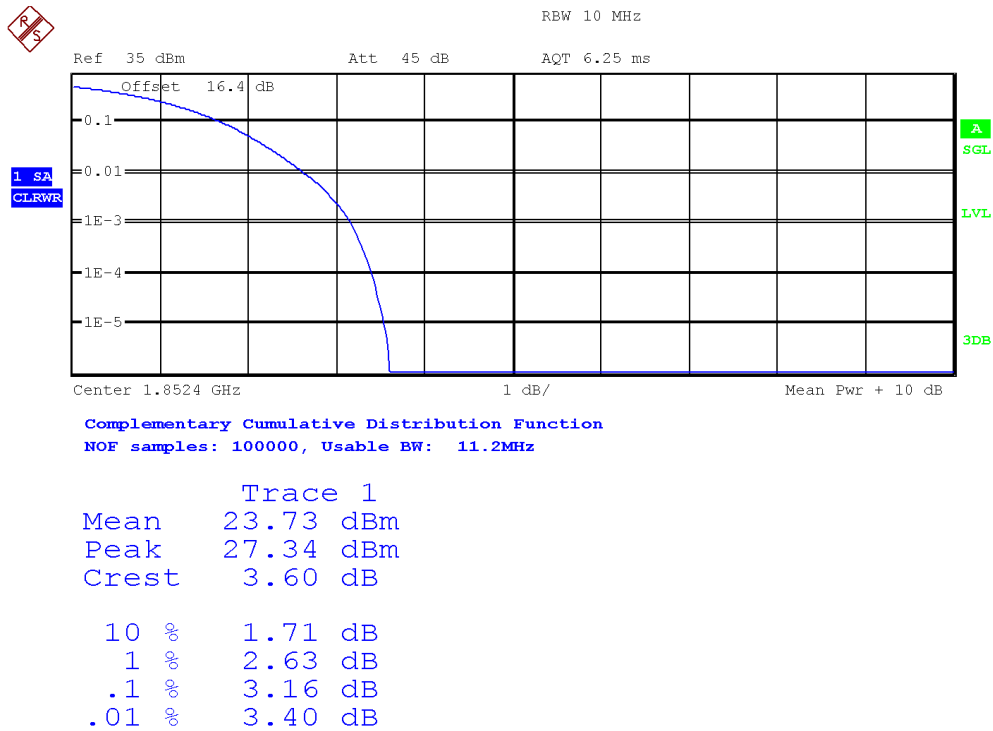


Highest Channel:

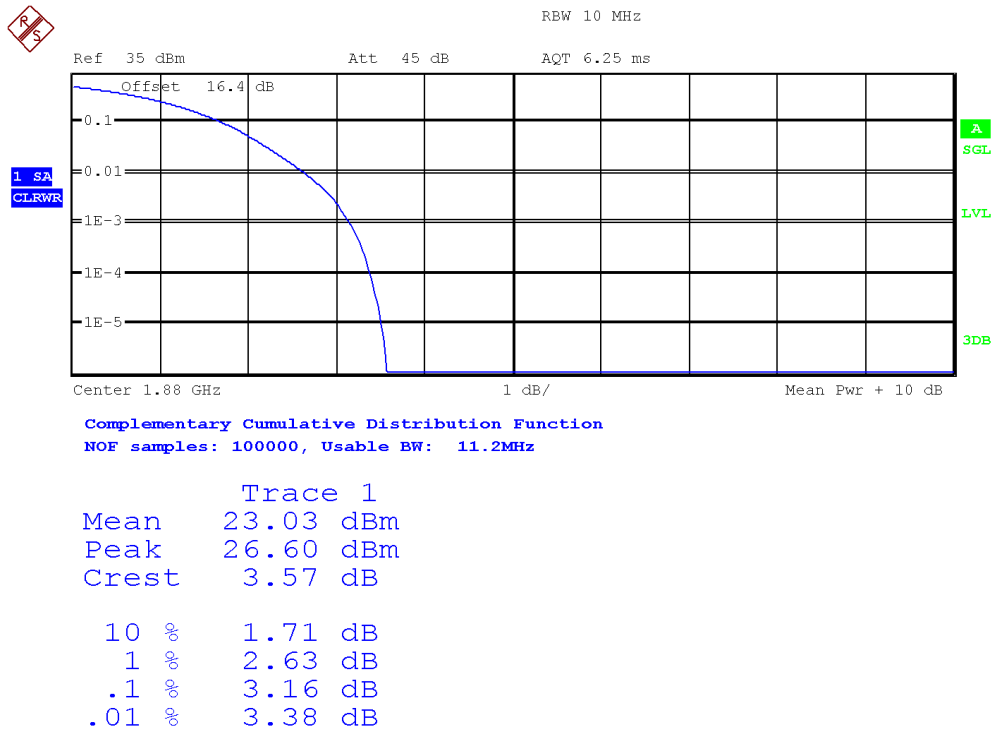


### 3G Band II. WCDMA MODULATION.

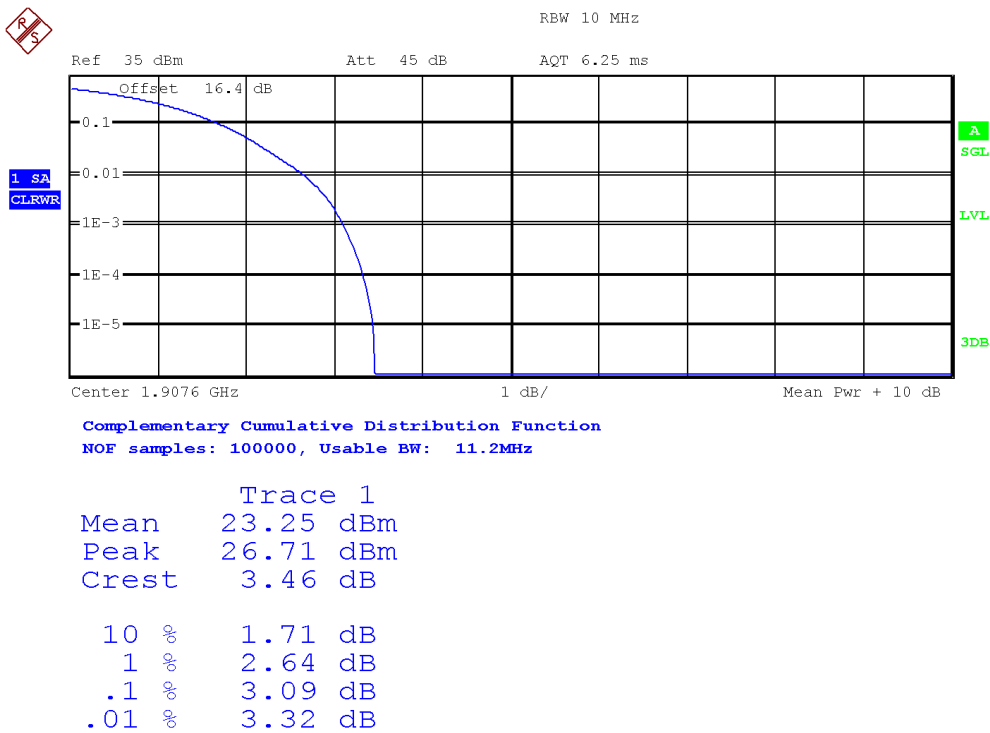
Lowest Channel:



Middle Channel:

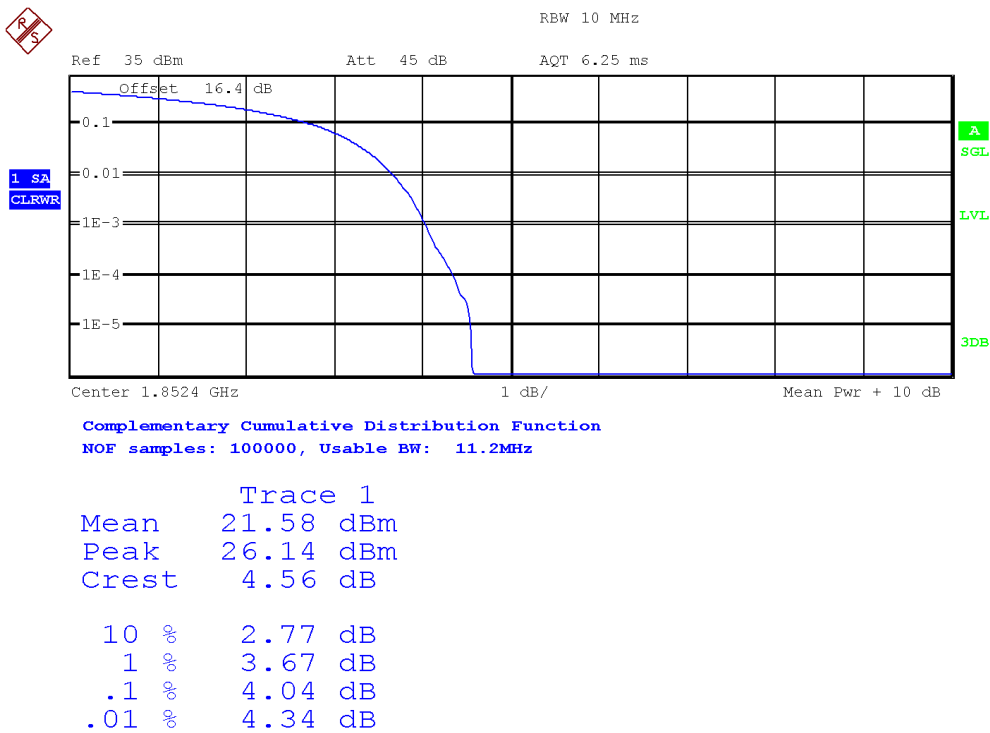


Highest Channel:

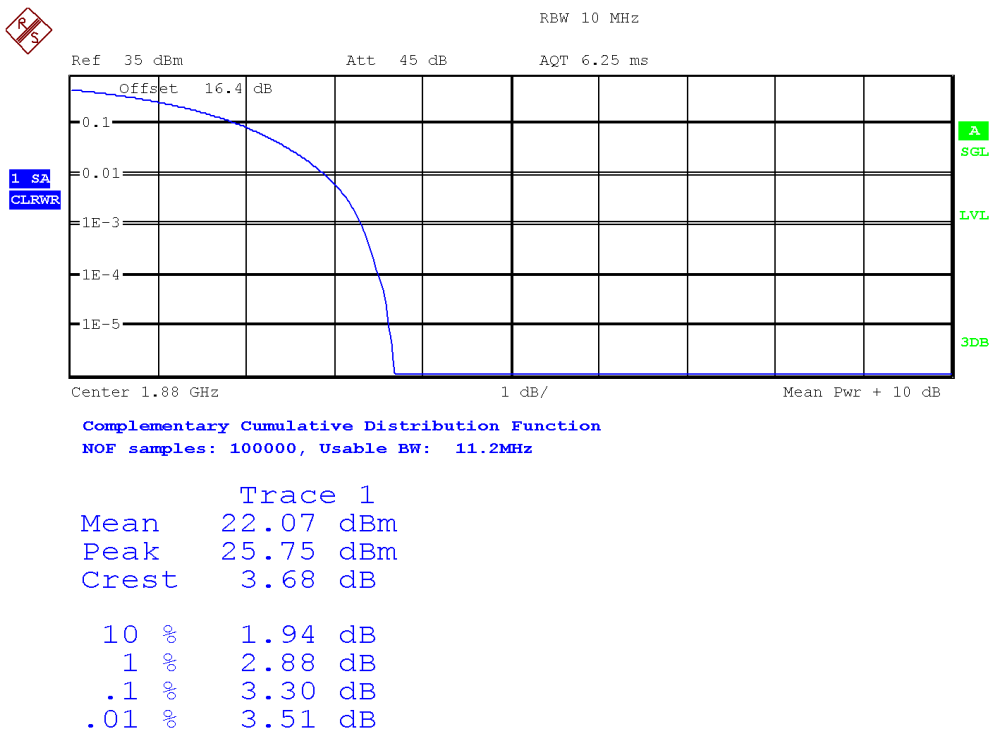


3G Band II. HSUPA MODULATION.

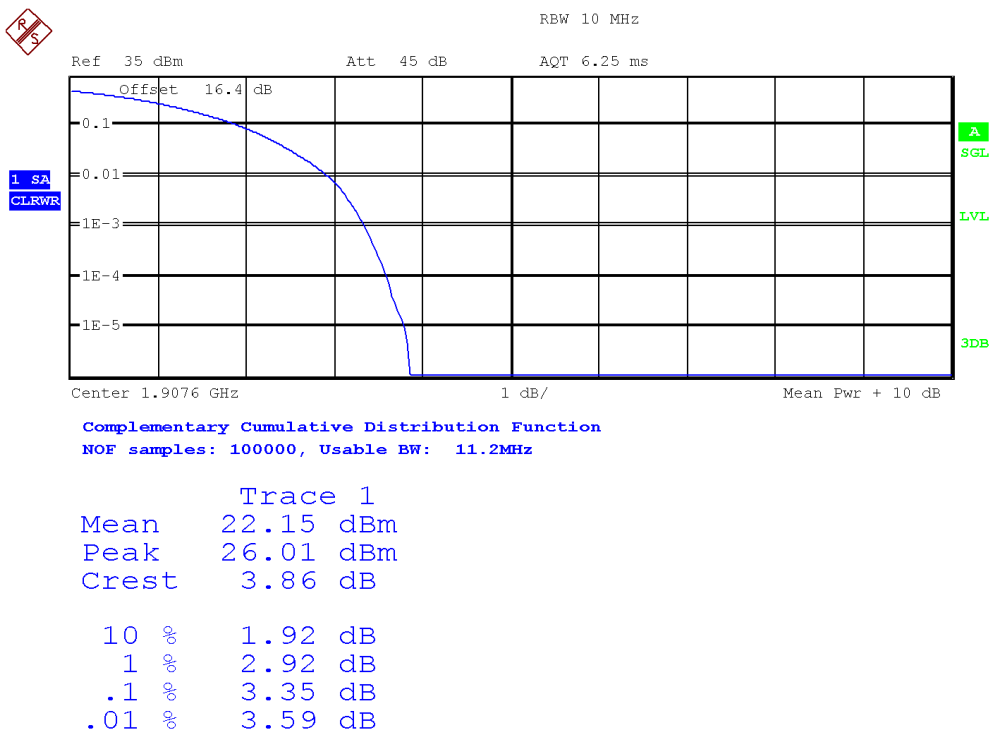
Lowest Channel:



Middle Channel:

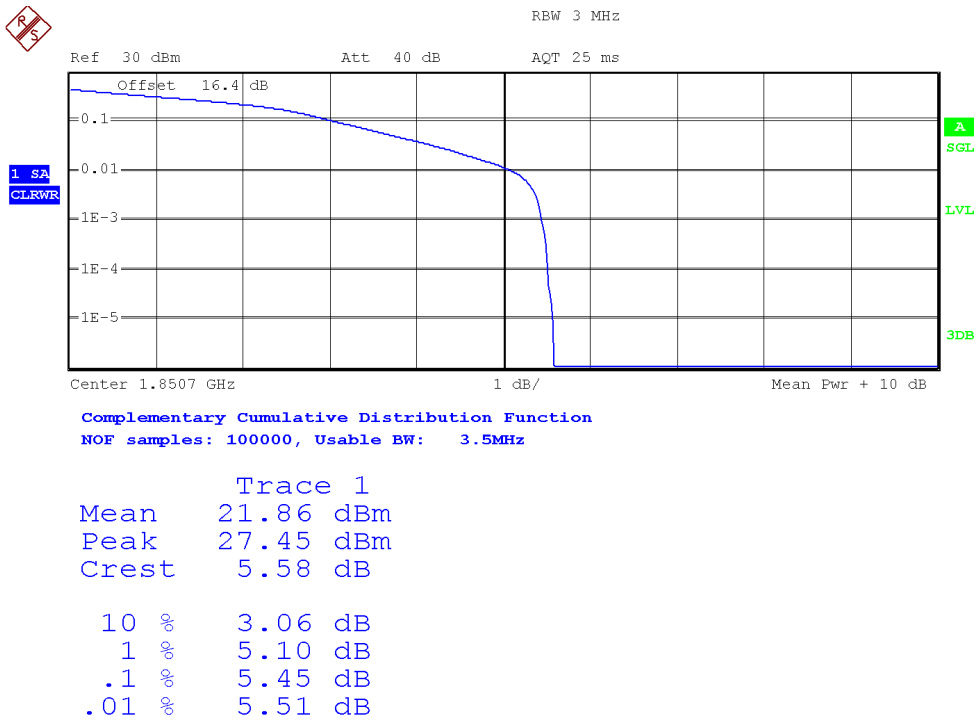


Highest Channel:

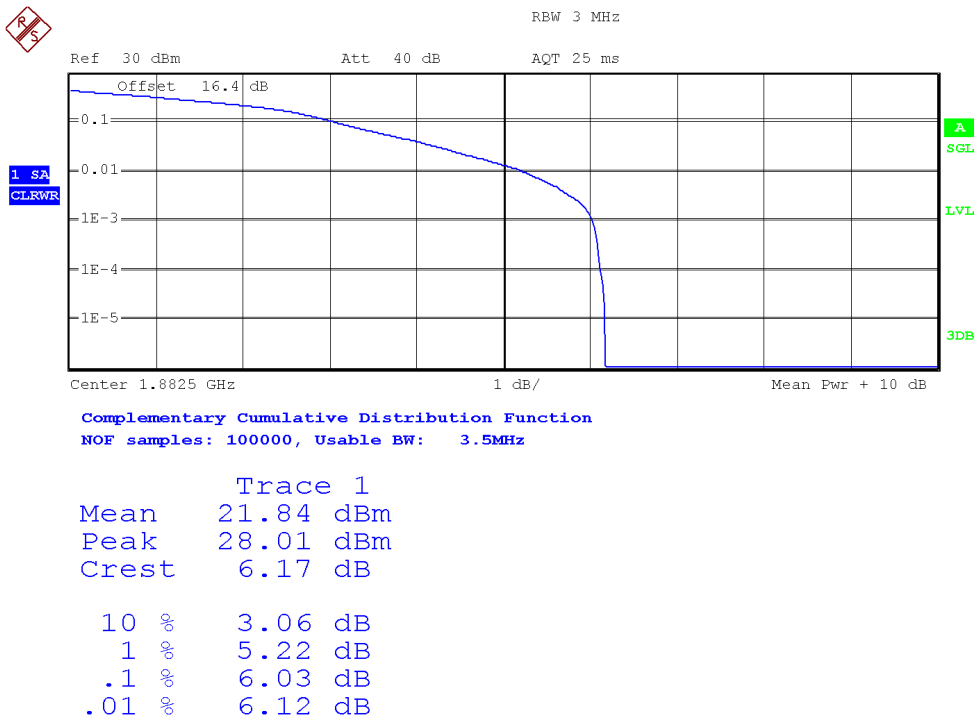


LTE Band 25. Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.

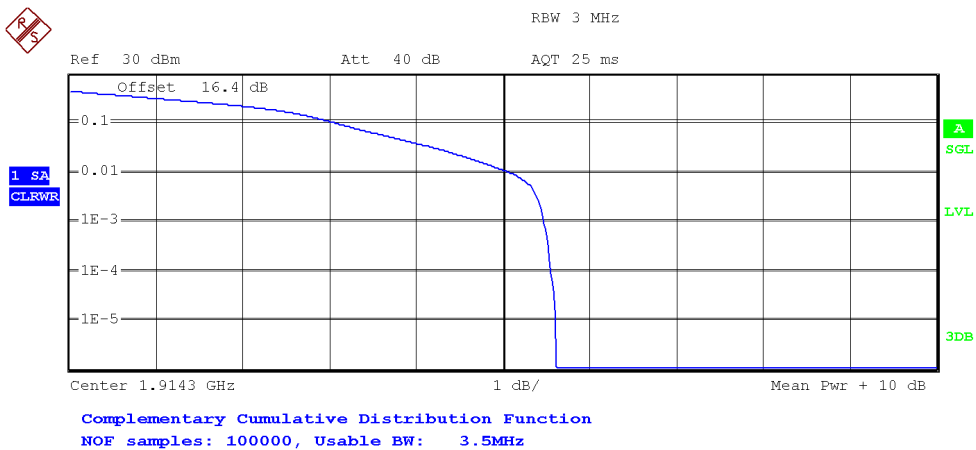
Lowest Channel:



Middle Channel:



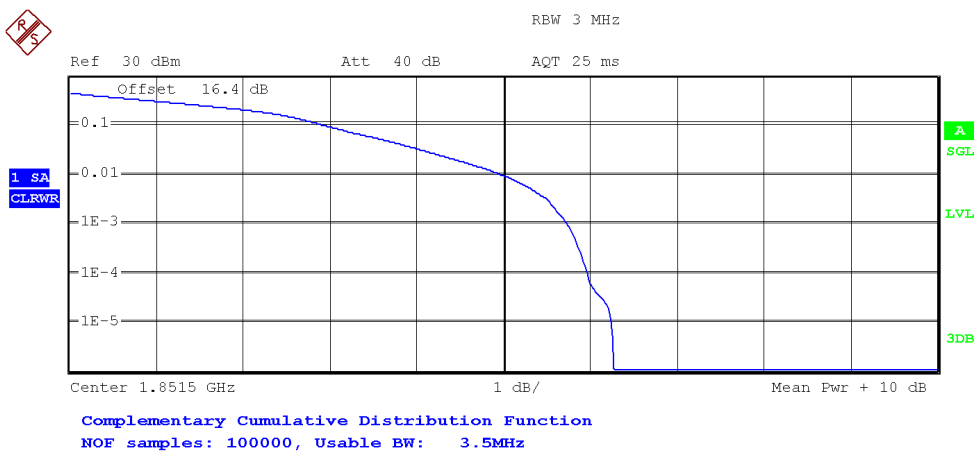
Highest Channel:



| Trace 1 |           |
|---------|-----------|
| Mean    | 20.14 dBm |
| Peak    | 25.75 dBm |
| Crest   | 5.61 dB   |
| 10 %    | 3.08 dB   |
| 1 %     | 5.08 dB   |
| .1 %    | 5.48 dB   |
| .01 %   | 5.56 dB   |

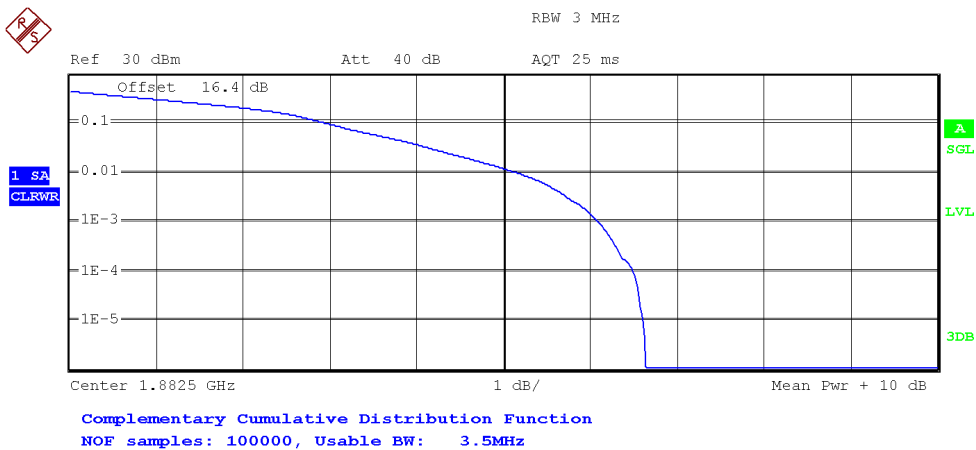
LTE Band 25. Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.

Lowest Channel:



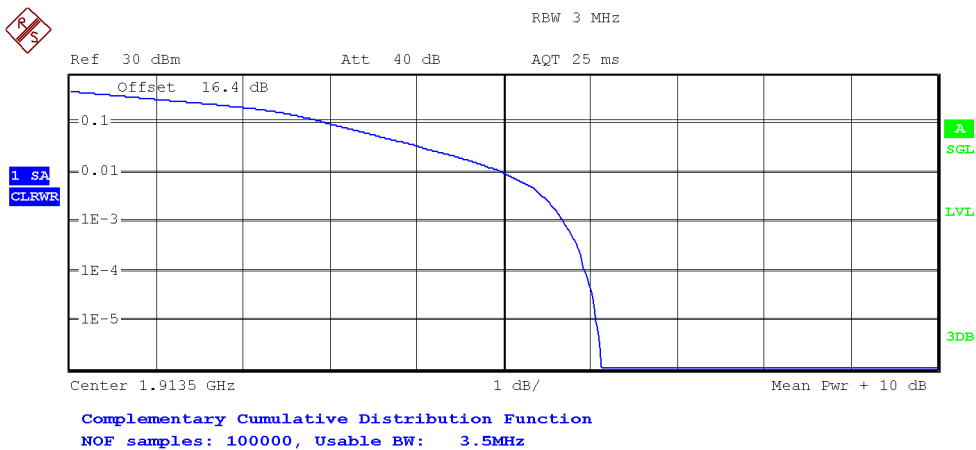
| Trace 1 |           |
|---------|-----------|
| Mean    | 22.16 dBm |
| Peak    | 28.43 dBm |
| Crest   | 6.27 dB   |
| 10 %    | 2.93 dB   |
| 1 %     | 4.97 dB   |
| .1 %    | 5.74 dB   |
| .01 %   | 5.98 dB   |

Middle Channel:



|         |           |
|---------|-----------|
| Trace 1 |           |
| Mean    | 21.86 dBm |
| Peak    | 28.50 dBm |
| Crest   | 6.64 dB   |
| 10 %    | 2.95 dB   |
| 1 %     | 5.14 dB   |
| .1 %    | 6.09 dB   |
| .01 %   | 6.51 dB   |

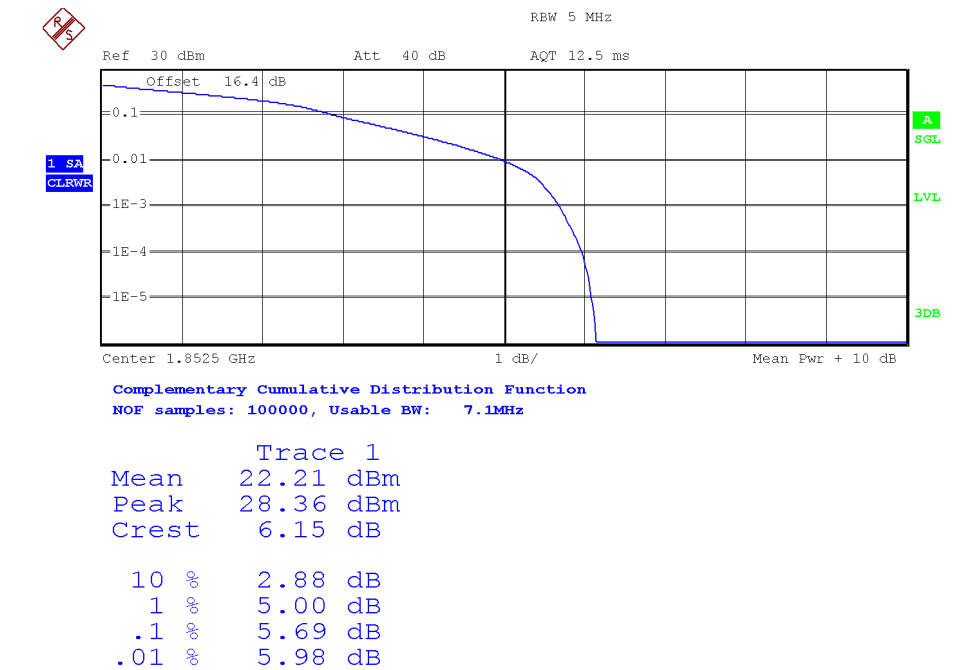
Highest Channel:



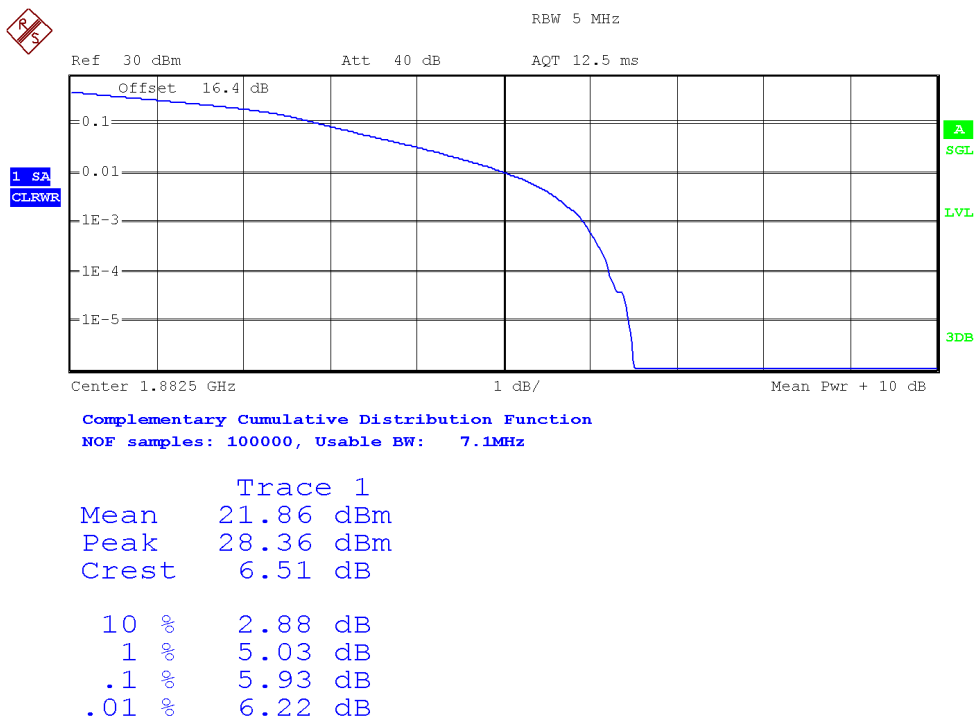
|         |           |
|---------|-----------|
| Trace 1 |           |
| Mean    | 20.82 dBm |
| Peak    | 26.95 dBm |
| Crest   | 6.13 dB   |
| 10 %    | 2.98 dB   |
| 1 %     | 4.98 dB   |
| .1 %    | 5.71 dB   |
| .01 %   | 5.95 dB   |

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

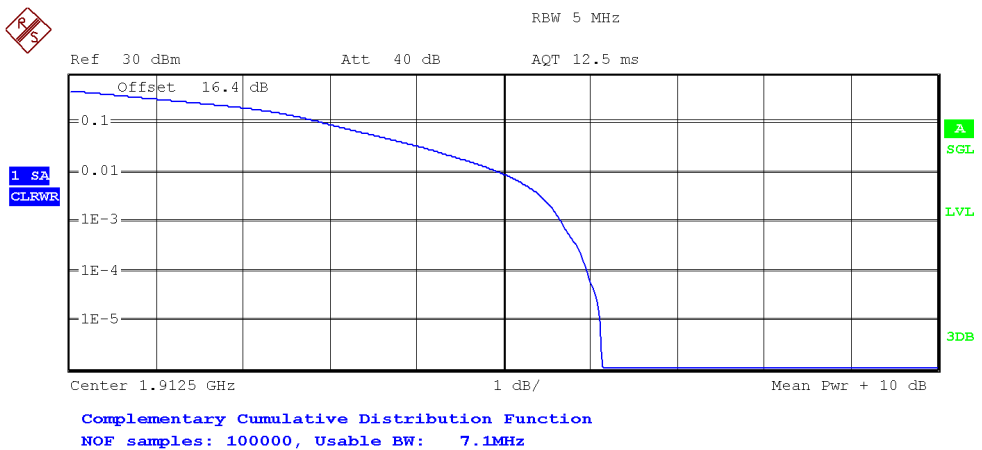
Lowest Channel:



Middle Channel:



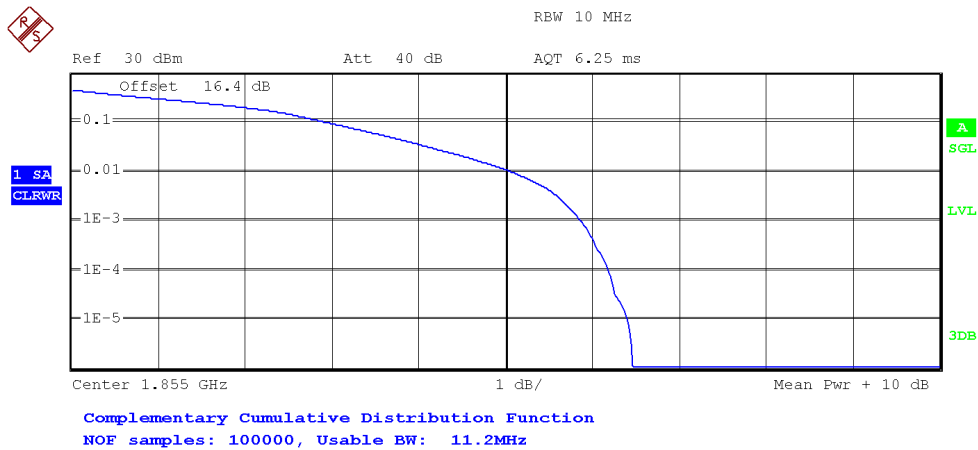
Highest Channel:



| Trace 1 |           |
|---------|-----------|
| Mean    | 21.17 dBm |
| Peak    | 27.30 dBm |
| Crest   | 6.13 dB   |
| 10 %    | 2.95 dB   |
| 1 %     | 4.95 dB   |
| .1 %    | 5.67 dB   |
| .01 %   | 5.98 dB   |

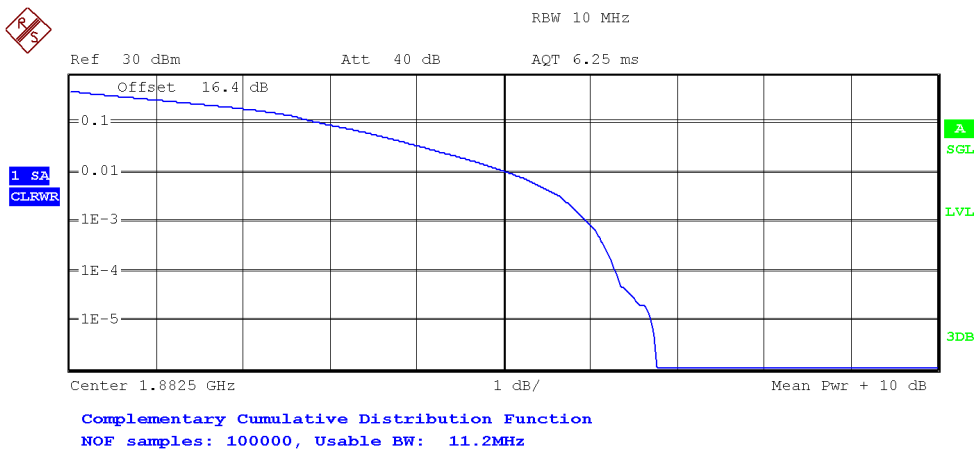
LTE Band 25. Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.

Lowest Channel:



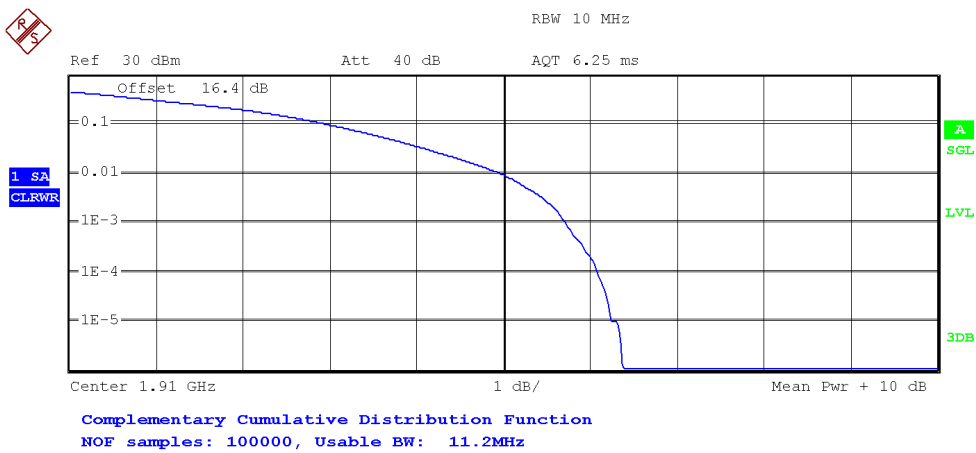
| Trace 1 |           |
|---------|-----------|
| Mean    | 22.50 dBm |
| Peak    | 28.97 dBm |
| Crest   | 6.47 dB   |
| 10 %    | 2.93 dB   |
| 1 %     | 5.06 dB   |
| .1 %    | 5.87 dB   |
| .01 %   | 6.19 dB   |

Middle Channel:



| Trace 1 |           |
|---------|-----------|
| Mean    | 22.18 dBm |
| Peak    | 28.95 dBm |
| Crest   | 6.77 dB   |
| 10 %    | 2.92 dB   |
| 1 %     | 5.06 dB   |
| .1 %    | 5.96 dB   |
| .01 %   | 6.30 dB   |

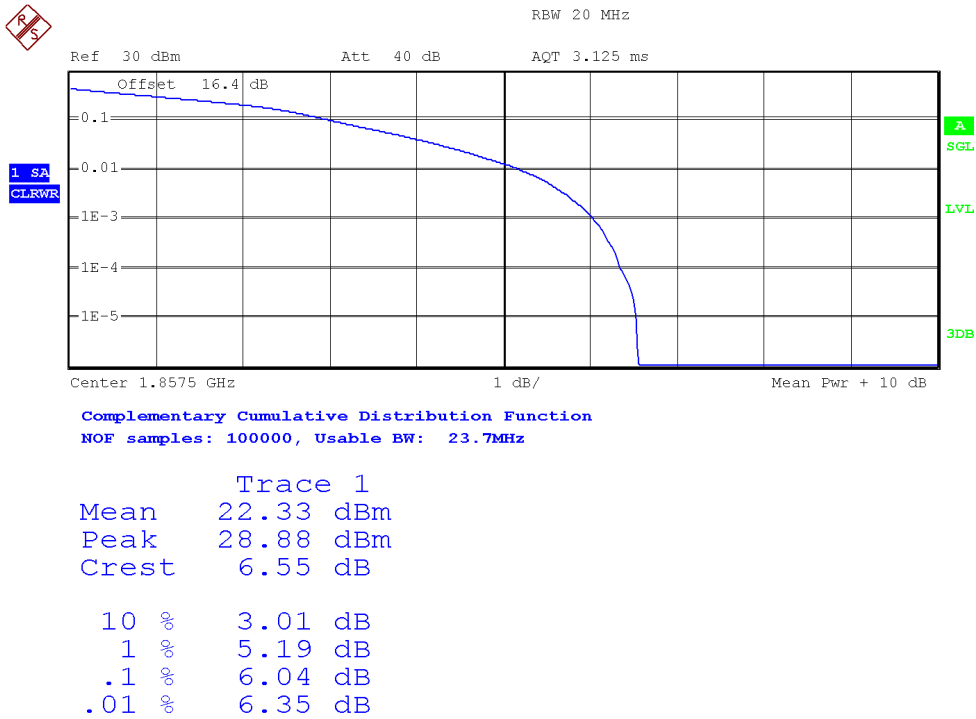
Highest Channel:



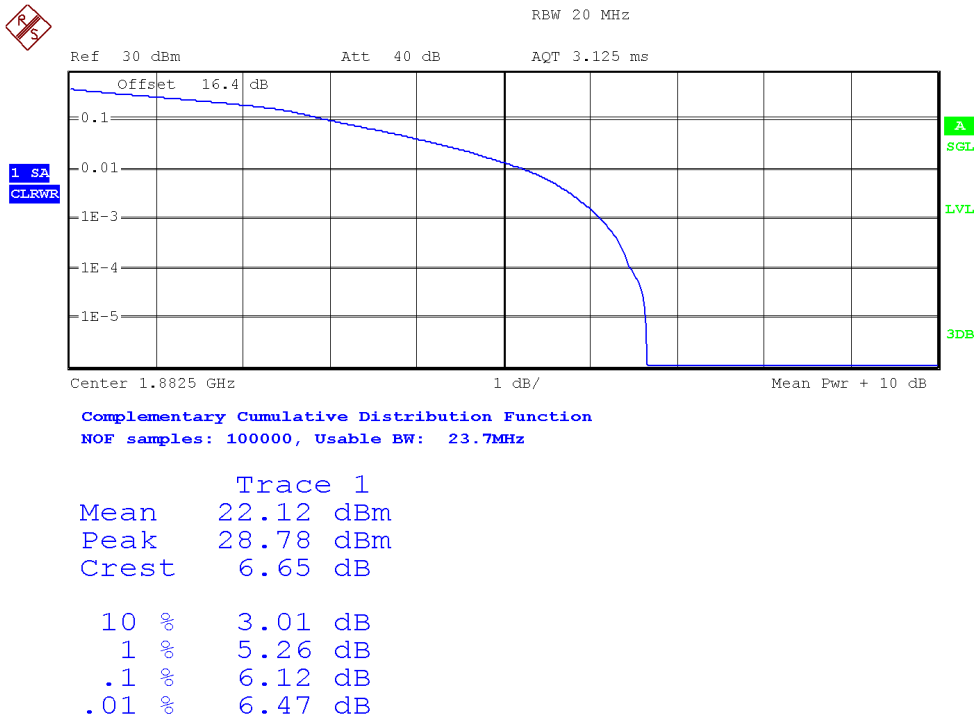
| Trace 1 |           |
|---------|-----------|
| Mean    | 21.47 dBm |
| Peak    | 27.84 dBm |
| Crest   | 6.38 dB   |
| 10 %    | 2.96 dB   |
| 1 %     | 4.97 dB   |
| .1 %    | 5.72 dB   |
| .01 %   | 6.09 dB   |

LTE Band 25. Bandwidth = 15 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.

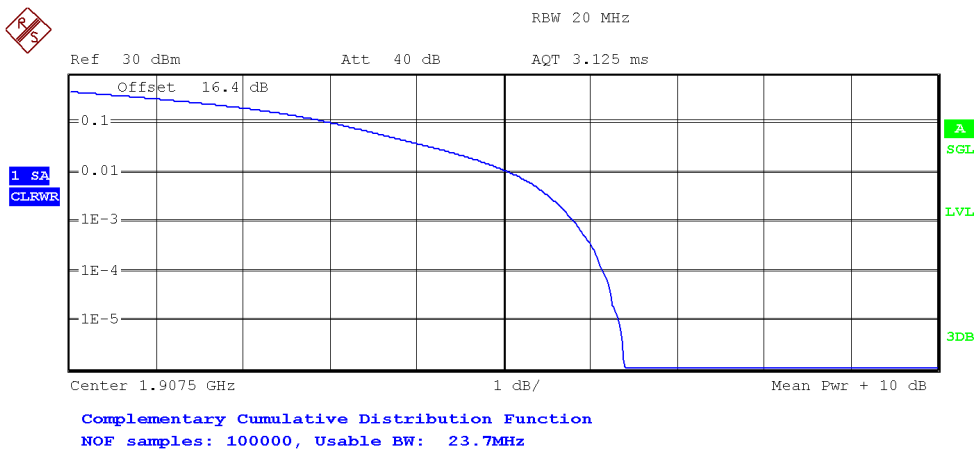
Lowest Channel:



Middle Channel:



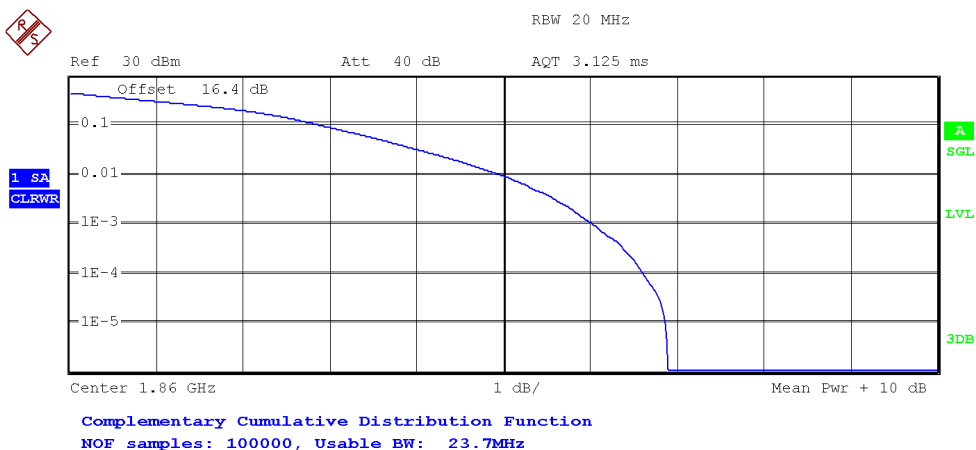
Highest Channel:



| Trace 1 |           |
|---------|-----------|
| Mean    | 21.48 dBm |
| Peak    | 27.88 dBm |
| Crest   | 6.40 dB   |
| 10 %    | 3.04 dB   |
| 1 %     | 5.08 dB   |
| .1 %    | 5.82 dB   |
| .01 %   | 6.15 dB   |

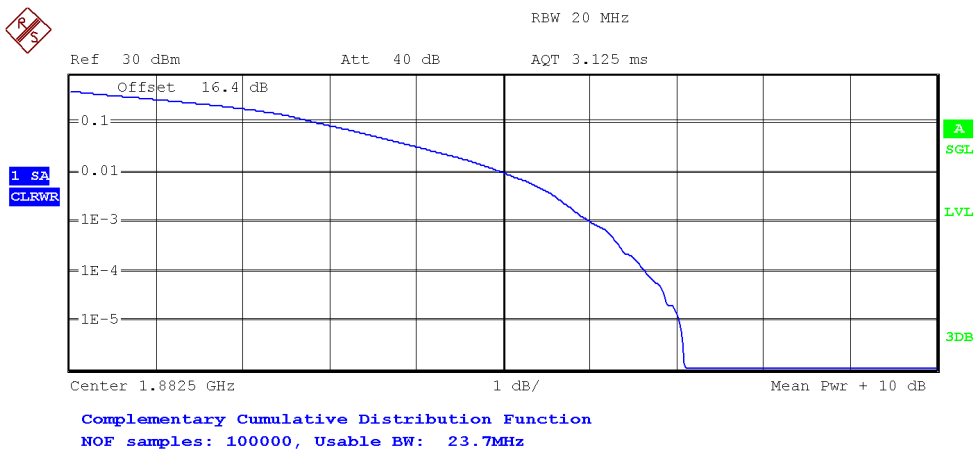
LTE Band 25. Bandwidth = 20 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.

Lowest Channel:



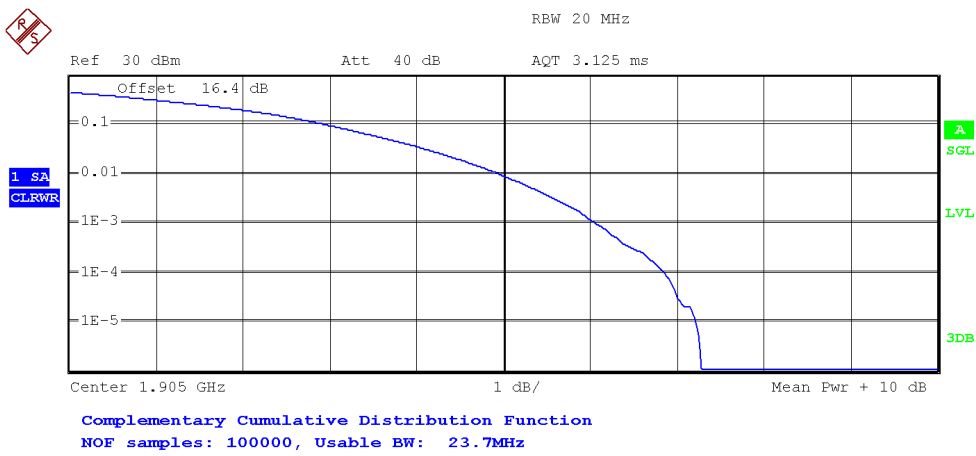
| Trace 1 |           |
|---------|-----------|
| Mean    | 20.87 dBm |
| Peak    | 27.76 dBm |
| Crest   | 6.90 dB   |
| 10 %    | 2.88 dB   |
| 1 %     | 4.97 dB   |
| .1 %    | 6.03 dB   |
| .01 %   | 6.62 dB   |

Middle Channel:



| Trace 1 |           |
|---------|-----------|
| Mean    | 20.62 dBm |
| Peak    | 27.72 dBm |
| Crest   | 7.10 dB   |
| 10 %    | 2.88 dB   |
| 1 %     | 5.00 dB   |
| .1 %    | 6.01 dB   |
| .01 %   | 6.63 dB   |

Highest Channel:



| Trace 1 |           |
|---------|-----------|
| Mean    | 20.37 dBm |
| Peak    | 27.66 dBm |
| Crest   | 7.28 dB   |
| 10 %    | 2.93 dB   |
| 1 %     | 4.95 dB   |
| .1 %    | 6.06 dB   |
| .01 %   | 6.84 dB   |

## Frequency Stability

### SPECIFICATION:

FCC §2.1055 and §24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-133. Clause 6.3. The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

### METHOD:

The frequency tolerance measurements over temperature variations were made over the temperature range of  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . The EUT was placed inside a climatic chamber and the temperature was raised hourly in  $10^{\circ}\text{C}$  steps from  $-30^{\circ}\text{C}$  up to  $+50^{\circ}\text{C}$ .

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.

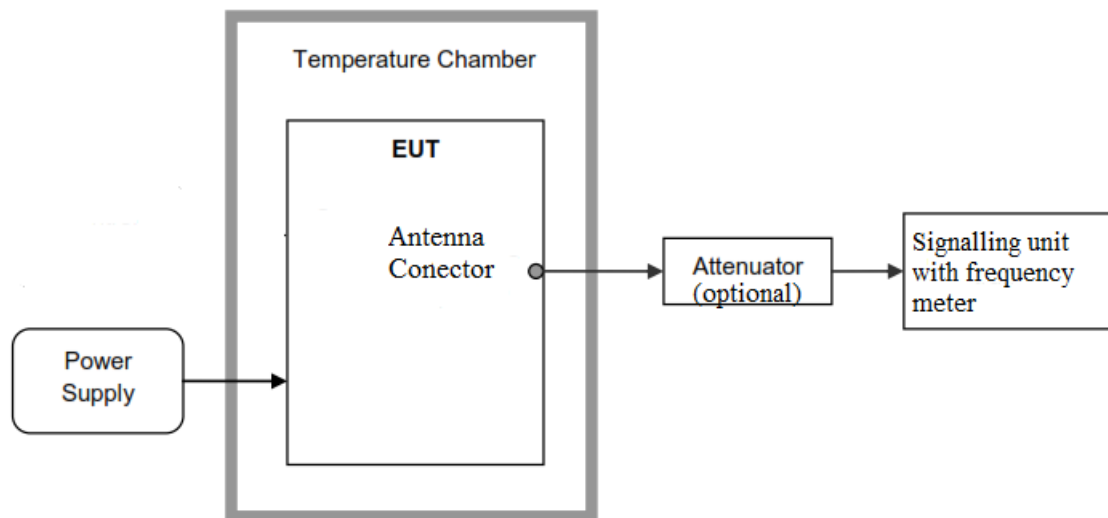
The worst case LTE mode for conducted power was used for the test.

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 lowest and highest 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.

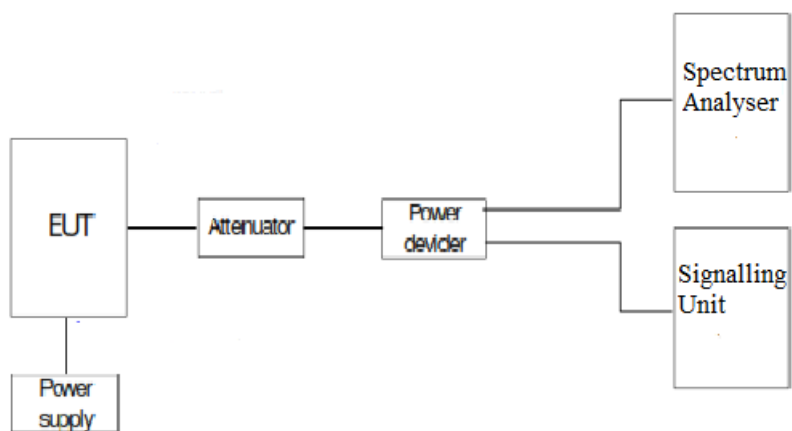
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

## TEST SETUP:

### 1. Frequency Tolerance:



### 2. Reference Frequency Points $f_L$ and $f_H$ :



## RESULTS:

### 1. Frequency Tolerance:

- Frequency Stability over Temperature Variations:

2G Band 1900 MHz. GPRS AND EDGE MODULATIONS.

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| +50              | 3.46                 | 0.002                 |
| +40              | 4.26                 | 0.002                 |
| +30              | 5.39                 | 0.003                 |
| +20              | 3.16                 | 0.002                 |
| +10              | 2.76                 | 0.001                 |
| 0                | 6.91                 | 0.004                 |
| -10              | 0.36                 | 0.0001                |
| -20              | -4.00                | -0.002                |
| -30              | -6.1                 | -0.003                |

3G Band II. WCDMA AND HSUPA MODULATION.

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| +50              | 12.81                | 0.007                 |
| +40              | 11.7                 | 0.006                 |
| +30              | 12.2                 | 0.006                 |
| +20              | 11.79                | 0.006                 |
| +10              | 12.07                | 0.006                 |
| 0                | 11.66                | 0.006                 |
| -10              | 10.96                | 0.006                 |
| -20              | 11.24                | 0.006                 |
| -30              | 11.44                | 0.006                 |

LTE Band 25. QPSK MODULATION. BW = 3 MHz.

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| +50              | -4.59                | -0.002                |
| +40              | -6.74                | -0.004                |
| +30              | -4.33                | -0.002                |
| +20              | -5.05                | -0.003                |
| +10              | -7.72                | -0.004                |
| 0                | -5.22                | -0.003                |
| -10              | -4.48                | -0.002                |
| -20              | -6.24                | -0.003                |
| -30              | -5.88                | -0.003                |

- Frequency Stability over Voltage Variations.**

2G Band 1900 MHz. GPRS AND EDGE MODULATIONS.

| Battery Supply voltage | Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------------|-------------|----------------------|-----------------------|
| V <sub>max</sub>       | 4.2         | 2.13                 | 0.0011                |
| V <sub>min</sub> (*)   | 3.6         | -0.9                 | -0.0004               |

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

3G Band II. WCDMA AND HSUPA MODULATIONS.

| Battery Supply voltage | Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------------|-------------|----------------------|-----------------------|
| V <sub>max</sub>       | 4.2         | 11.69                | 0.0062                |
| V <sub>min</sub> (*)   | 3.6         | 11.66                | 0.0062                |

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

LTE Band 25. QPSK MODULATION. BW = 3 MHz.

| Battery Supply voltage | Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------------|-------------|----------------------|-----------------------|
| V <sub>max</sub>       | 4.20        | -4.26                | -0.0023               |
| V <sub>min</sub> (*)   | 3.60        | -6.34                | -0.0034               |

(\*): 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:

2G Band 1900 MHz:

|             | GPRS MODULATION |
|-------------|-----------------|
| $f_L$ (MHz) | 1850.036994     |
| $f_H$ (MHz) | 1909.955007     |

3G Band II:

|             | WCDMA MODULATION |
|-------------|------------------|
| $f_L$ (MHz) | 1850.205189      |
| $f_H$ (MHz) | 1909.907613      |

LTE Band 25:

|          |                                       |
|----------|---------------------------------------|
|          | LTE QPSK<br>MODULATION.<br>BW = 3 MHz |
| fL (MHz) | 1850.030892                           |
| fH (MHz) | 1914.940804                           |

|                         |                         |
|-------------------------|-------------------------|
| Measurement uncertainty | $<\pm 1 \times 10^{-6}$ |
|-------------------------|-------------------------|

The reference frequency points fL and fH stay within the authorized blocks for all the bands above.

Verdict: PASS

## Modulation Characteristics

### SPECIFICATION:

FCC §2.1047

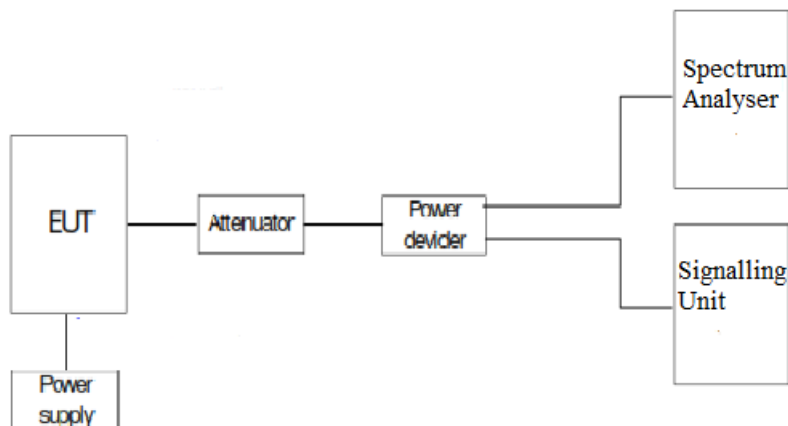
RSS-133. Clause 6.2. Equipment certified under this standard shall use digital modulation.

### METHOD:

For 2G/3G, the EUT operates with GPRS (GMSK), EDGE (8PSK), WCDMA (QPSK) and HSUPA (QPSK) modulation modes, in which the information is digitized and coded into a bit stream.

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).

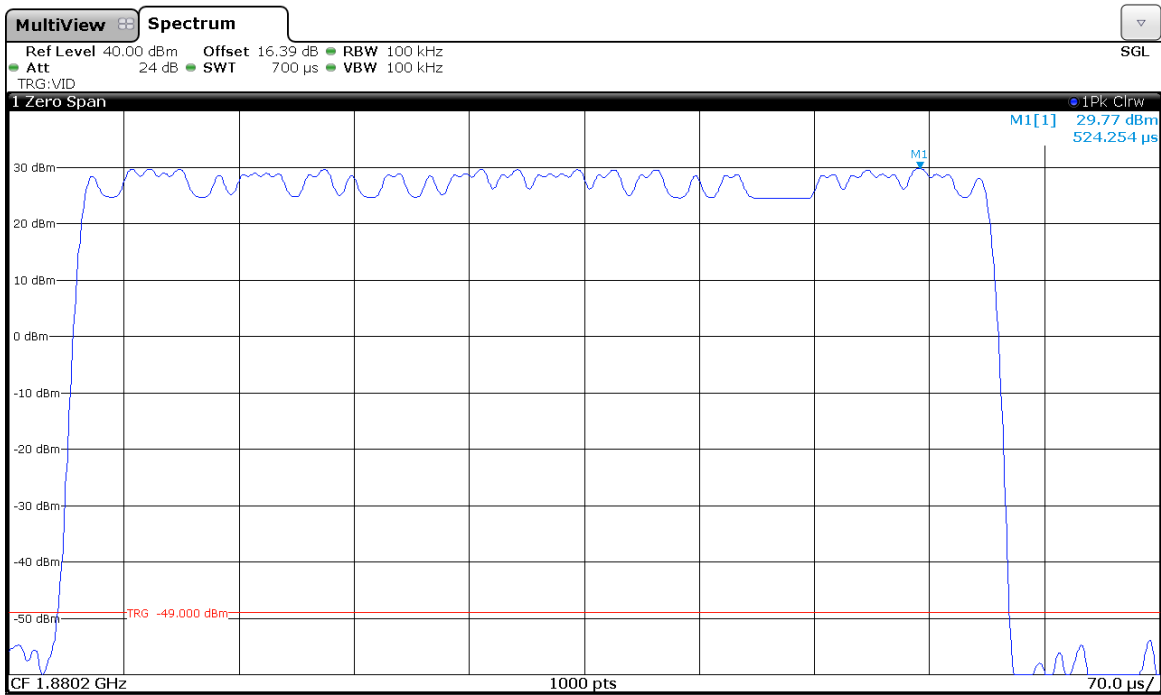
### TEST SETUP:



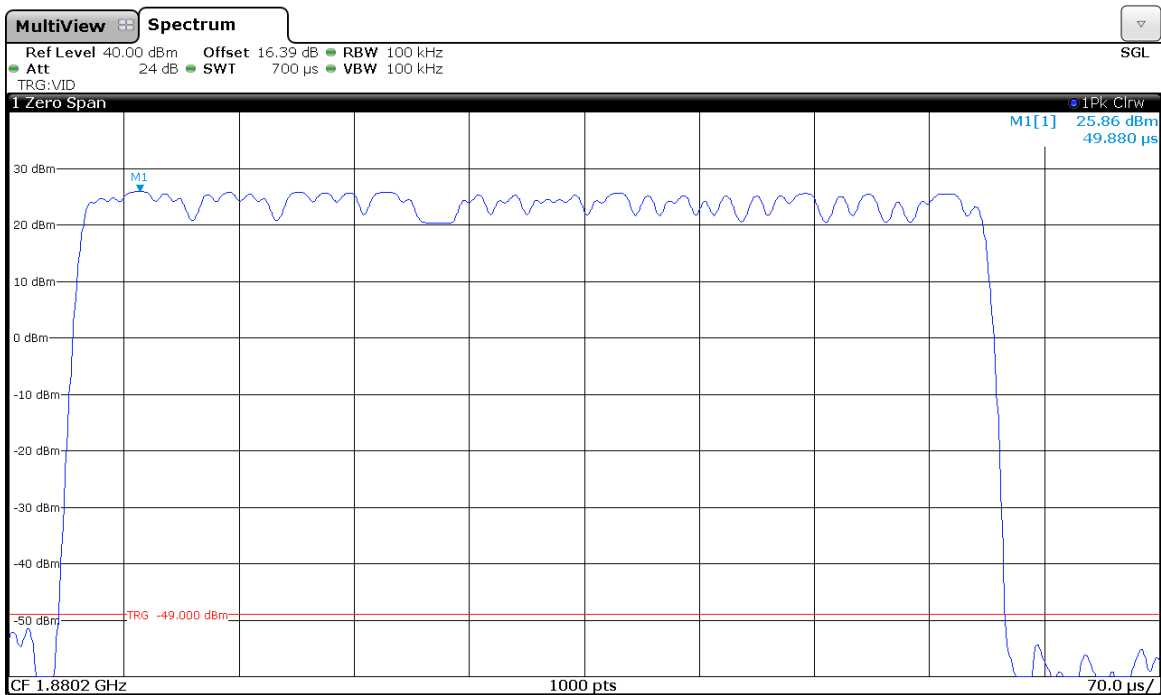
RESULTS:

The following plots show the modulation schemes in the EUT.

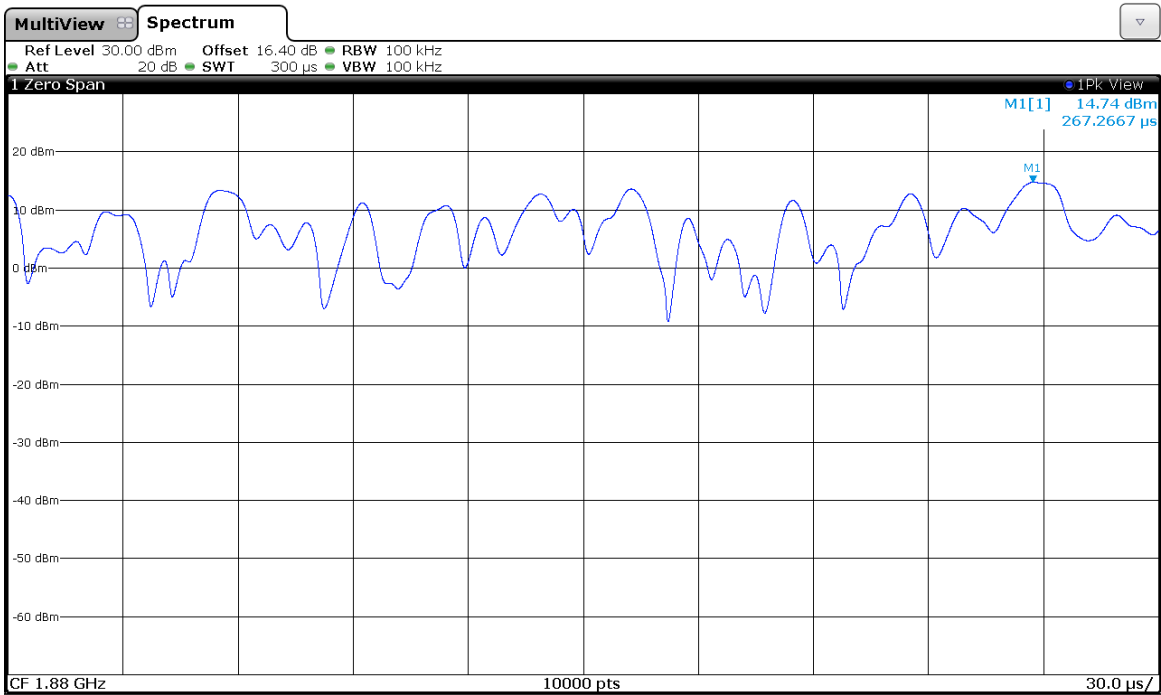
2G Band 1900 MHz. GPRS MODULATION.



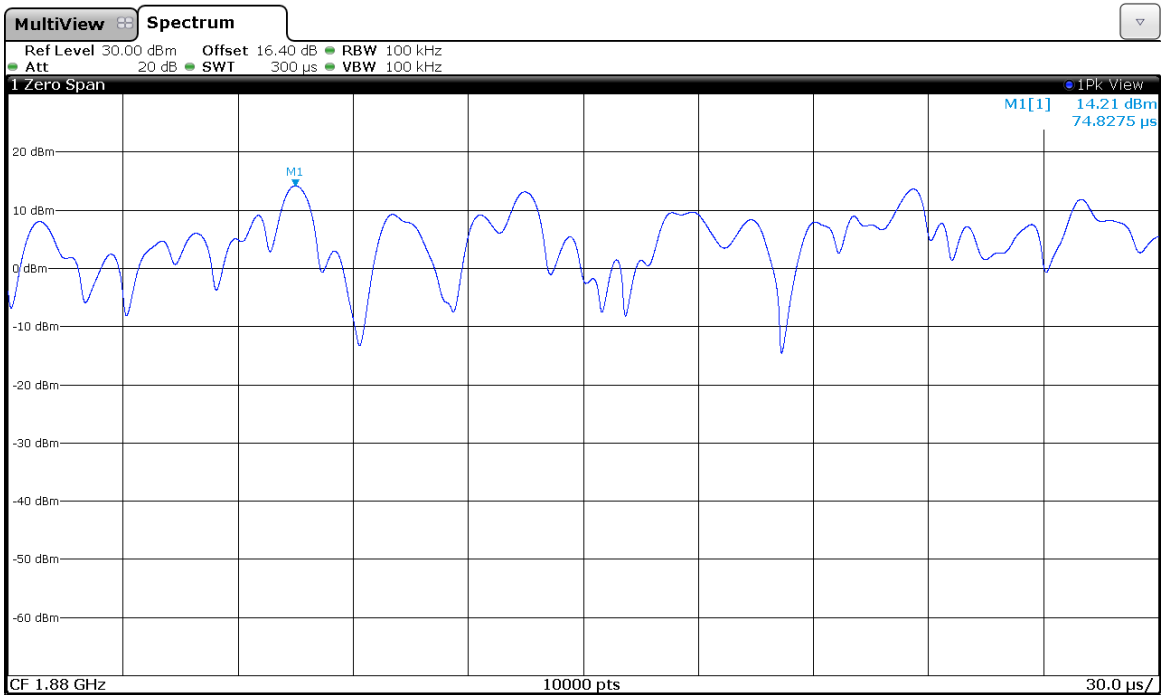
2G Band 1900 MHz. EDGE MODULATION.



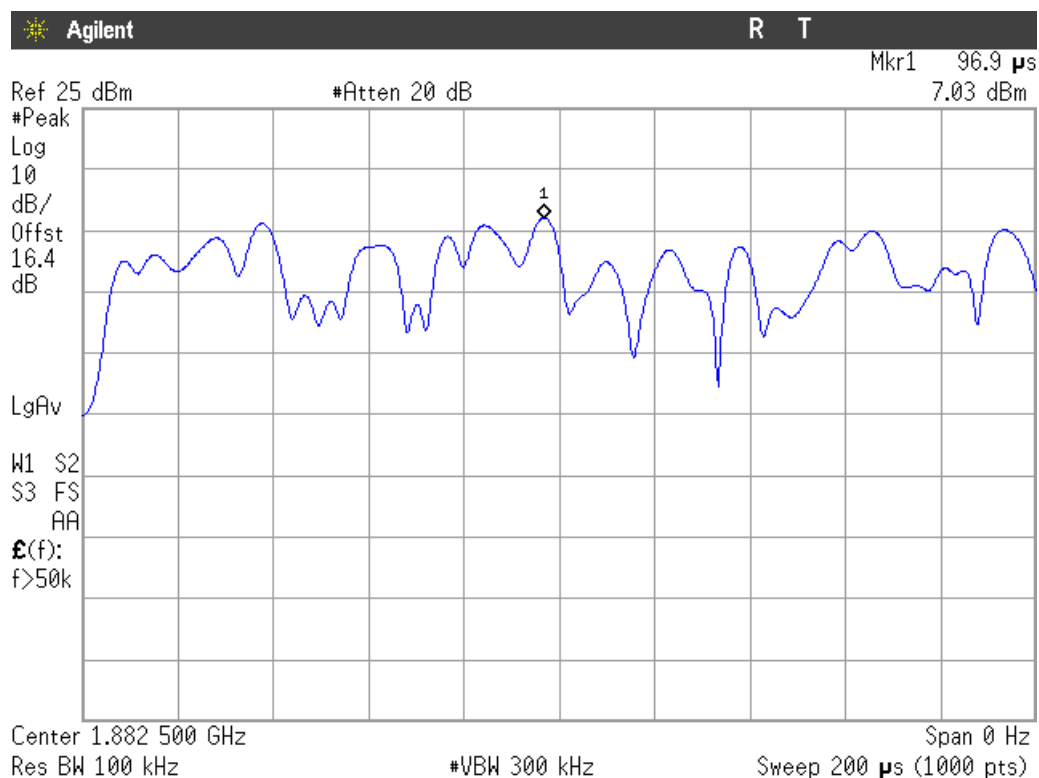
3G Band II. WCDMA MODULATION.



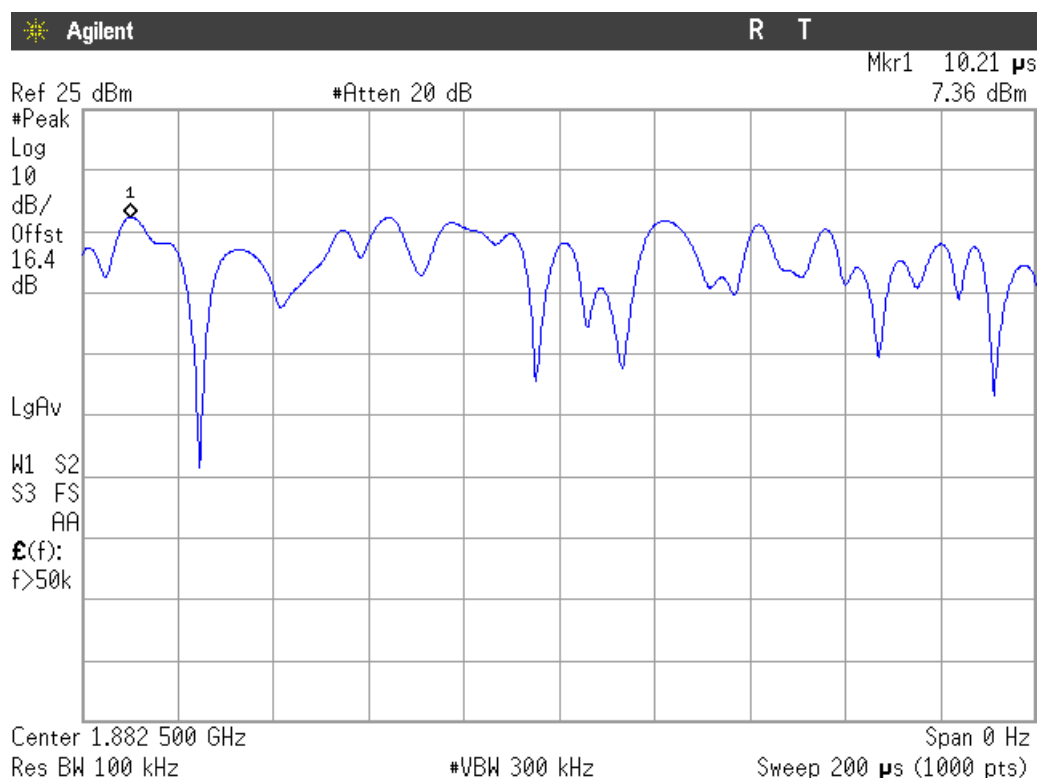
3G Band II. HSUPA MODULATION.



LTE Band 25. QPSK MODULATION. BW = 10 MHz.



LTE Band 25. 16QAM MODULATION. BW = 10 MHz.



## Occupied Bandwidth

### SPECIFICATION:

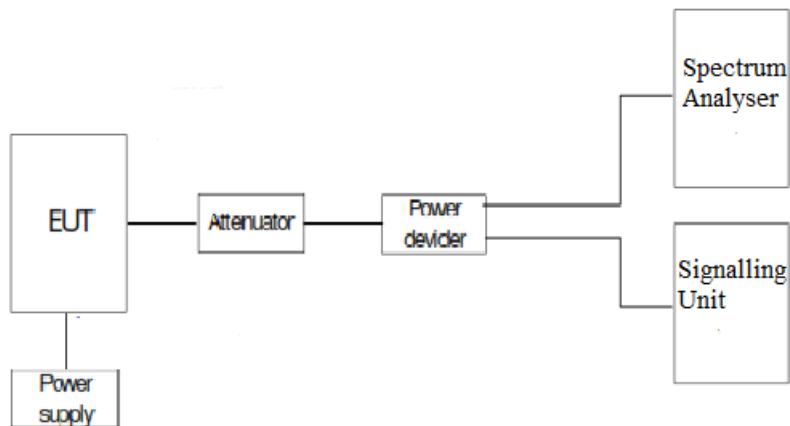
FCC §2.1049. Measurements required: Occupied bandwidth.

RSS-Gen Clause 6.7.

### 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:

### 2G Band 1900 MHz:

2G Band 1900 MHz. GPRS MODULATION.

| Channel                       | Lowest  | Middle  | Highest |
|-------------------------------|---------|---------|---------|
| 99% Occupied bandwidth (kHz)  | 244.091 | 242.346 | 242.569 |
| -26 dBc bandwidth (kHz)       | 303.164 | 300.174 | 300.666 |
| Measurement uncertainty (kHz) | <±1.67  |         |         |

2G Band 1900 MHz. EDGE MODULATION.

| Channel                       | Lowest  | Middle  | Highest |
|-------------------------------|---------|---------|---------|
| 99% Occupied bandwidth (kHz)  | 242.671 | 243.493 | 242.522 |
| -26 dBc bandwidth (kHz)       | 300.459 | 300.408 | 299.926 |
| Measurement uncertainty (kHz) | <±1.67  |         |         |

### 3G Band II:

3G Band II. WCDMA MODULATION.

| Channel                       | Lowest  | Middle | Highest |
|-------------------------------|---------|--------|---------|
| 99% Occupied bandwidth (kHz)  | 4137.9  | 4134.4 | 4123.3  |
| -26 dBc bandwidth (kHz)       | 4728.0  | 4698.0 | 4702.0  |
| Measurement uncertainty (kHz) | <±16.67 |        |         |

3G Band II. HSUPA MODULATION.

| Channel                       | Lowest  | Middle | Highest |
|-------------------------------|---------|--------|---------|
| 99% Occupied bandwidth (kHz)  | 4148.8  | 4127.5 | 4133.6  |
| -26 dBc bandwidth (kHz)       | 4693.0  | 4697.0 | 4686.0  |
| Measurement uncertainty (kHz) | <±16.67 |        |         |

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

### LTE Band 25:

LTE Band 25. QPSK MODULATION. BW = 1.4 MHz.

| Channel                       | Lowest | Middle | Highest |
|-------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 1.105  | 1.089  | 1.096   |
| -26 dBc bandwidth (MHz)       | 1.252  | 1.243  | 1.262   |
| Measurement uncertainty (kHz) | <±4.67 |        |         |

LTE Band 25. 16QAM MODULATION. BW = 1.4 MHz.

| Channel                       | Lowest | Middle | Highest |
|-------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 1.086  | 1.096  | 1.095   |
| -26 dBc bandwidth (MHz)       | 1.241  | 1.249  | 1.244   |
| Measurement uncertainty (kHz) | <±4.67 |        |         |

LTE Band 25. QPSK MODULATION. BW = 3 MHz.

| Channel                       | Lowest | Middle | Highest |
|-------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 2.779  | 2.753  | 2.750   |
| -26 dBc bandwidth (MHz)       | 3.097  | 3.092  | 3.100   |
| Measurement uncertainty (kHz) | <±10   |        |         |

LTE Band 25. 16QAM MODULATION. BW = 3 MHz.

| Channel                       | Lowest | Middle | Highest |
|-------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 2.745  | 2.749  | 2.742   |
| -26 dBc bandwidth (MHz)       | 3.086  | 3.062  | 3.076   |
| Measurement uncertainty (kHz) | <±10   |        |         |

LTE Band 25. QPSK MODULATION. BW = 5 MHz.

| Channel                       | Lowest  | Middle | Highest |
|-------------------------------|---------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 4.521   | 4.503  | 4.505   |
| -26 dBc bandwidth (MHz)       | 4.975   | 4.964  | 4.958   |
| Measurement uncertainty (kHz) | <±16.67 |        |         |

LTE Band 25. 16QAM MODULATION. BW = 5 MHz.

| Channel                       | Lowest  | Middle | Highest |
|-------------------------------|---------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 4.506   | 4.520  | 4.503   |
| -26 dBc bandwidth (MHz)       | 4.958   | 4.961  | 4.960   |
| Measurement uncertainty (kHz) | <±16.67 |        |         |

LTE Band 25. QPSK MODULATION. BW = 10 MHz.

| Channel                       | Lowest  | Middle | Highest |
|-------------------------------|---------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 9.037   | 9.067  | 9.086   |
| -26 dBc bandwidth (MHz)       | 10.039  | 10.126 | 10.047  |
| Measurement uncertainty (kHz) | <±33.33 |        |         |

LTE Band 25. 16QAM MODULATION. BW = 10 MHz.

| Channel                       | Lowest  | Middle | Highest |
|-------------------------------|---------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 9.060   | 9.066  | 9.073   |
| -26 dBc bandwidth (MHz)       | 9.948   | 9.981  | 9.993   |
| Measurement uncertainty (kHz) | <±33.33 |        |         |

LTE Band 25. QPSK MODULATION. BW = 15 MHz.

| Channel                       | Lowest | Middle | Highest |
|-------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 13.488 | 13.434 | 13.450  |
| -26 dBc bandwidth (MHz)       | 14.716 | 14.733 | 14.742  |
| Measurement uncertainty (kHz) | <±50   |        |         |

LTE Band 25. 16QAM MODULATION. BW = 15 MHz.

| Channel                       | Lowest | Middle | Highest |
|-------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 13.471 | 13.449 | 13.476  |
| -26 dBc bandwidth (MHz)       | 14.625 | 14.702 | 14.814  |
| Measurement uncertainty (kHz) | <±50   |        |         |

LTE Band 25. QPSK MODULATION. BW = 20 MHz.

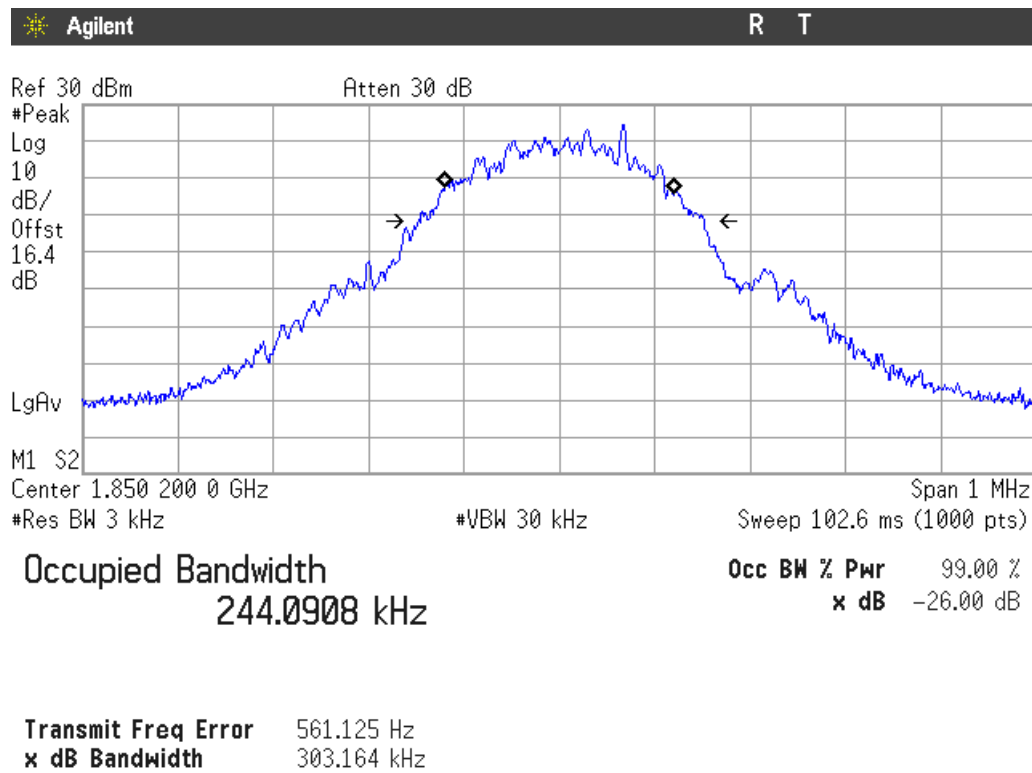
| Channel                       | Lowest  | Middle | Highest |
|-------------------------------|---------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 17.933  | 17.855 | 17.866  |
| -26 dBc bandwidth (MHz)       | 19.523  | 19.305 | 19.453  |
| Measurement uncertainty (kHz) | <±66.67 |        |         |

LTE Band 25. 16QAM MODULATION. BW = 20 MHz.

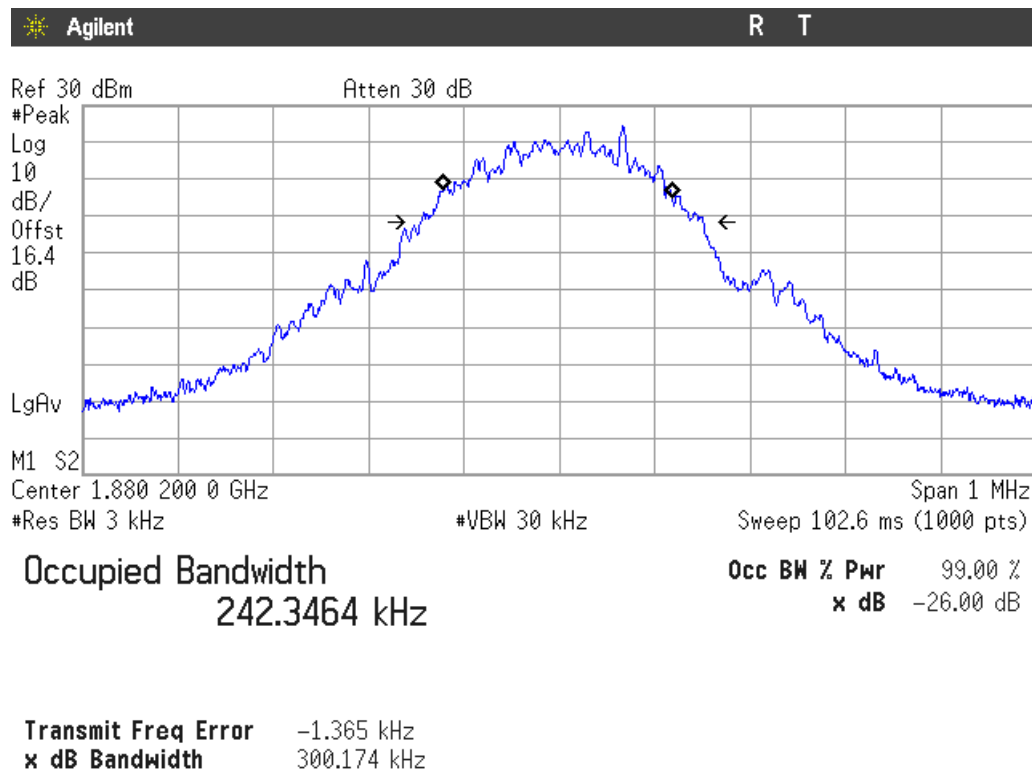
| Channel                       | Lowest  | Middle | Highest |
|-------------------------------|---------|--------|---------|
| 99% Occupied bandwidth (MHz)  | 17.912  | 17.870 | 17.879  |
| -26 dBc bandwidth (MHz)       | 19.301  | 19.294 | 19.267  |
| Measurement uncertainty (kHz) | <±66.67 |        |         |

## 2G Band 1900 MHz. GPRS MODULATION.

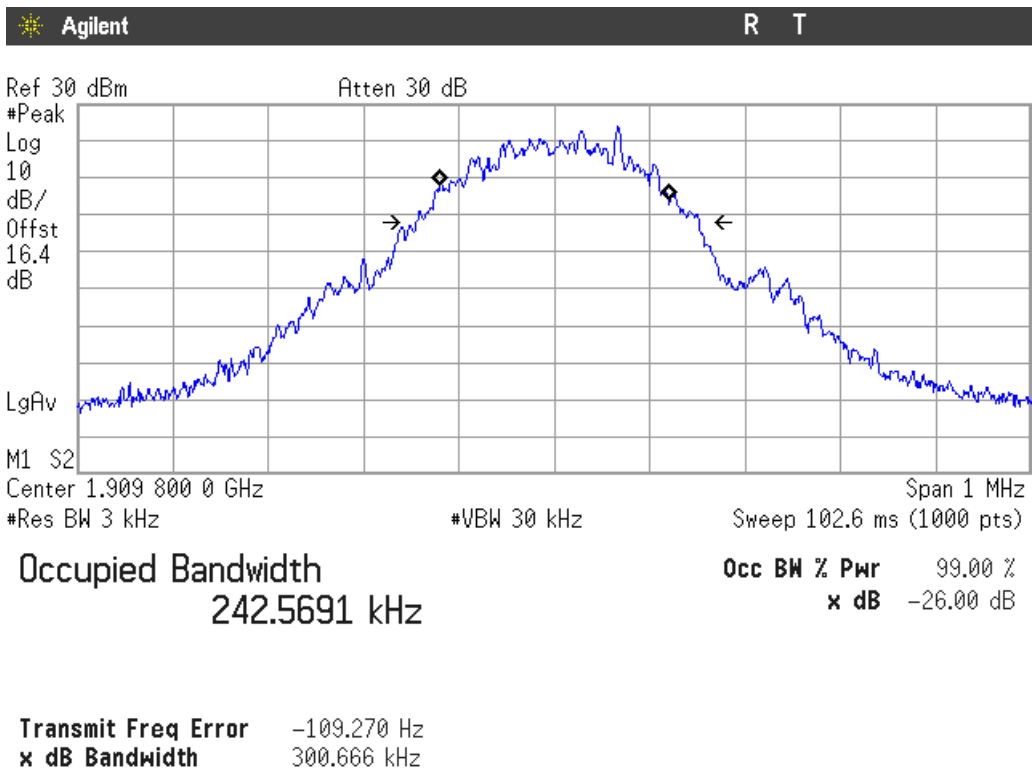
Lowest Channel:



Middle Channel:

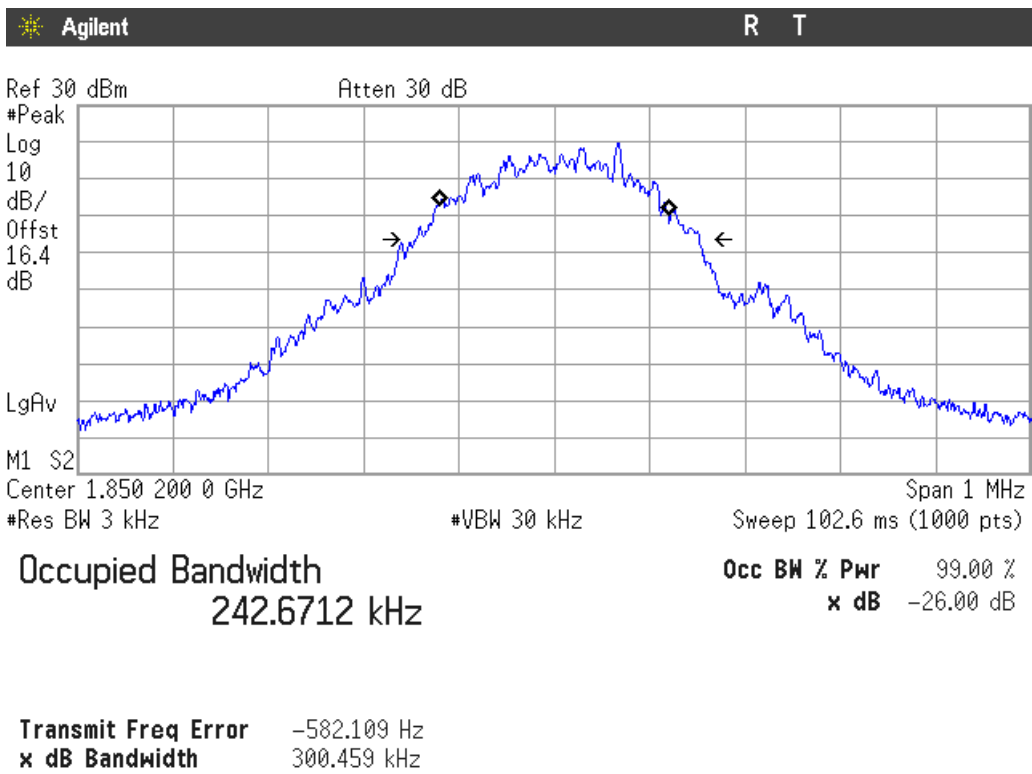


Highest Channel:

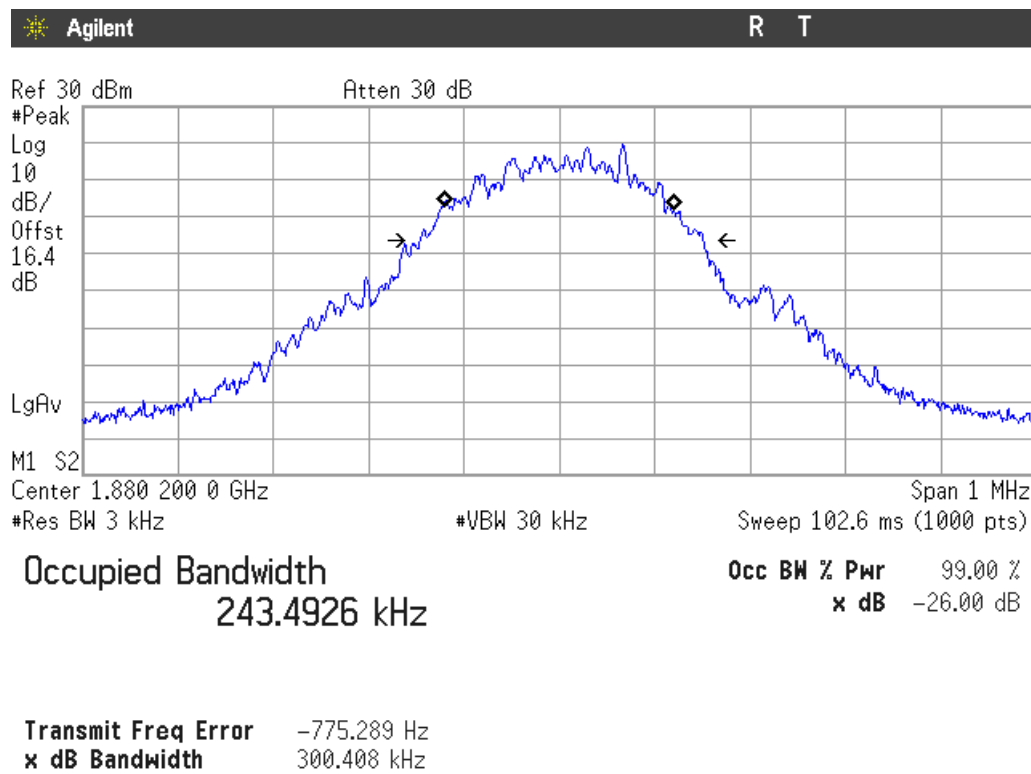


2G Band 1900 MHz. EDGE MODULATION.

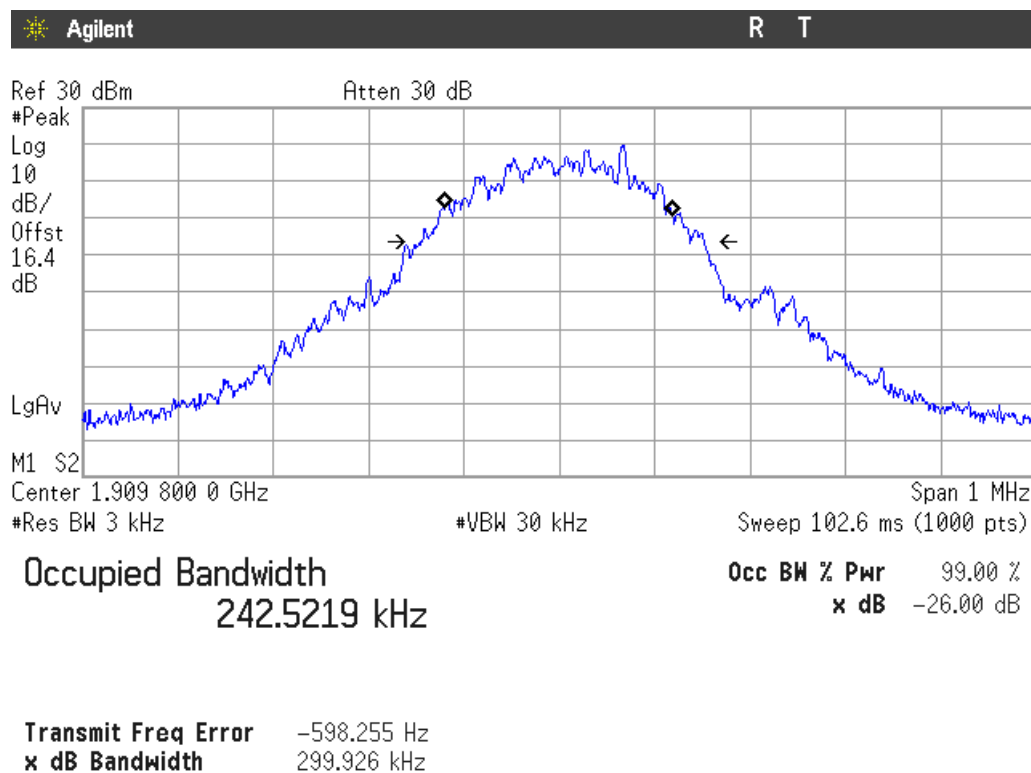
Lowest Channel:



Middle Channel:

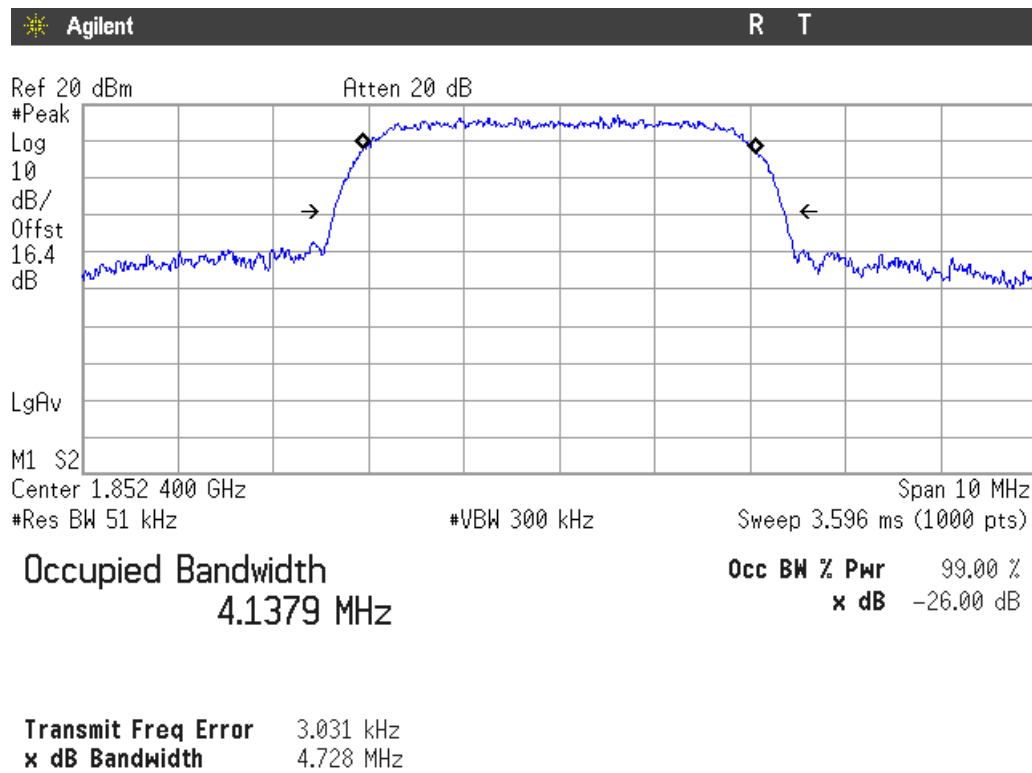


Highest Channel:

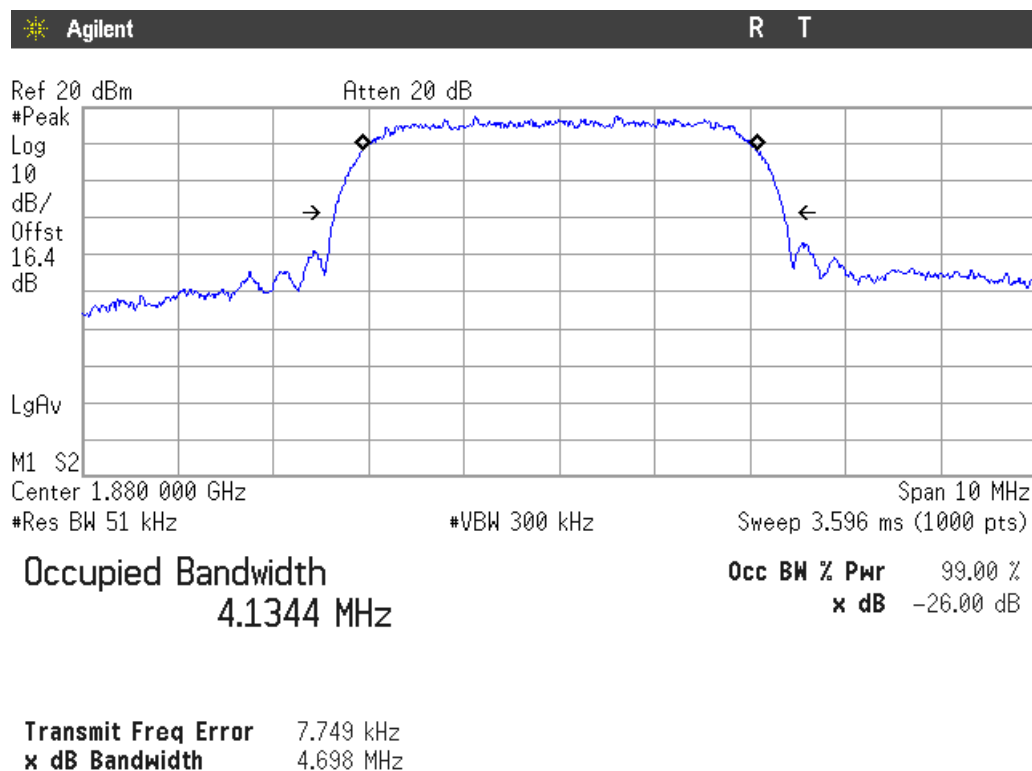


### 3G Band II. WCDMA MODULATION.

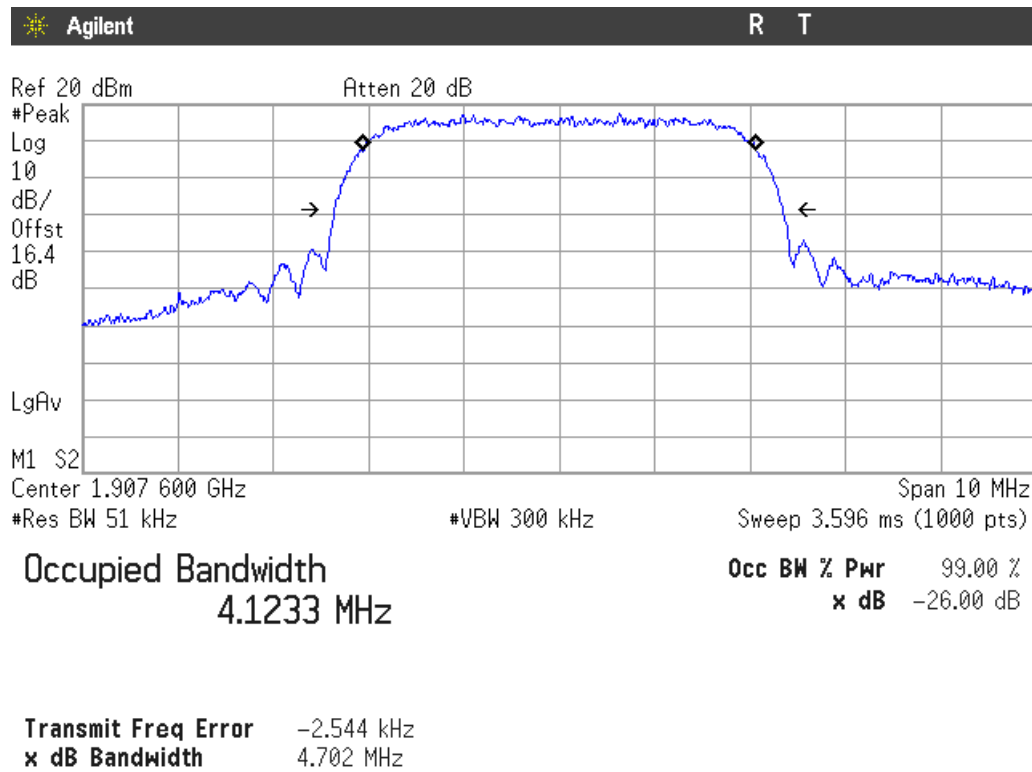
Lowest Channel:



Middle Channel:

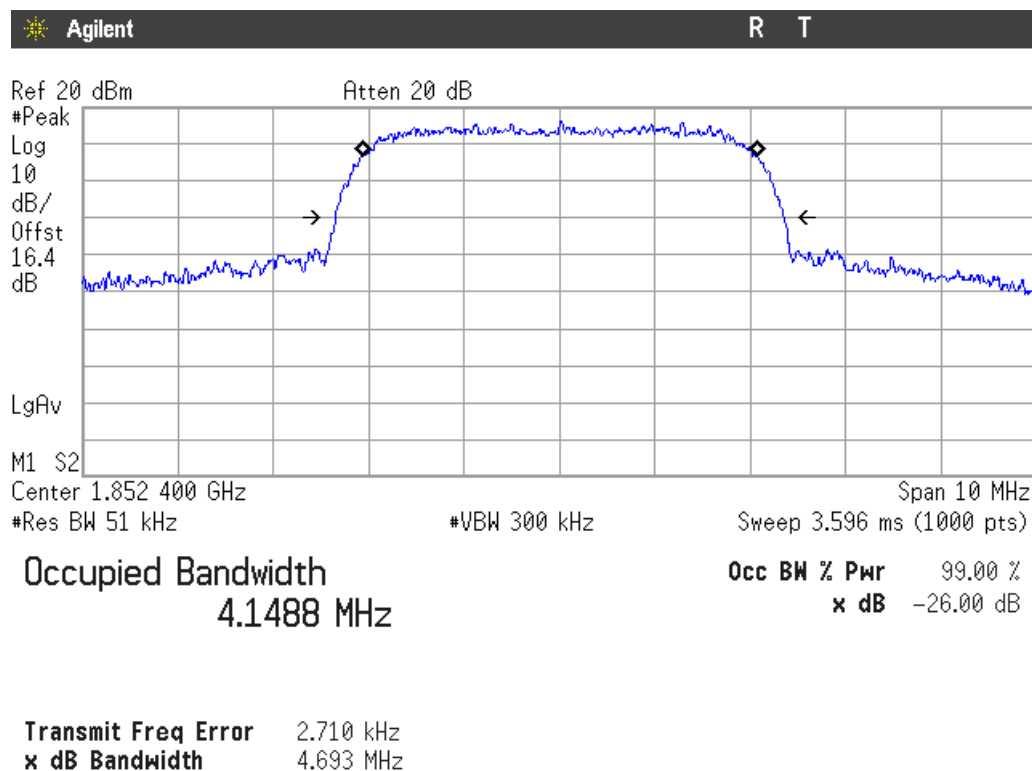


Highest Channel:

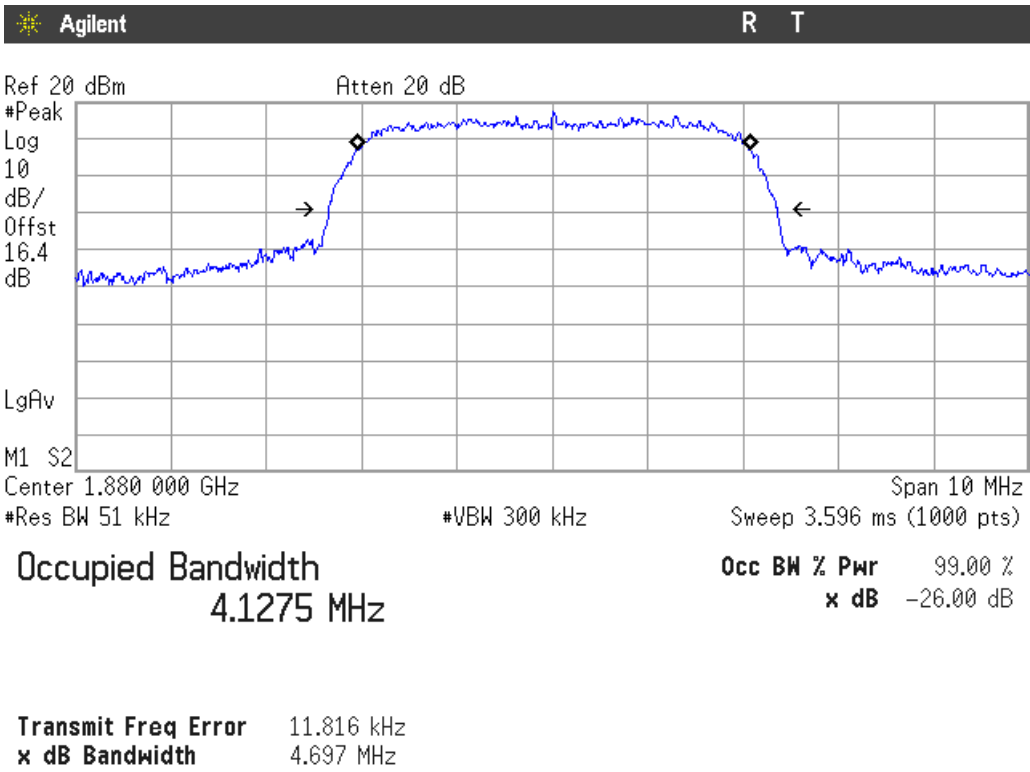


3G Band II. HSUPA MODULATION.

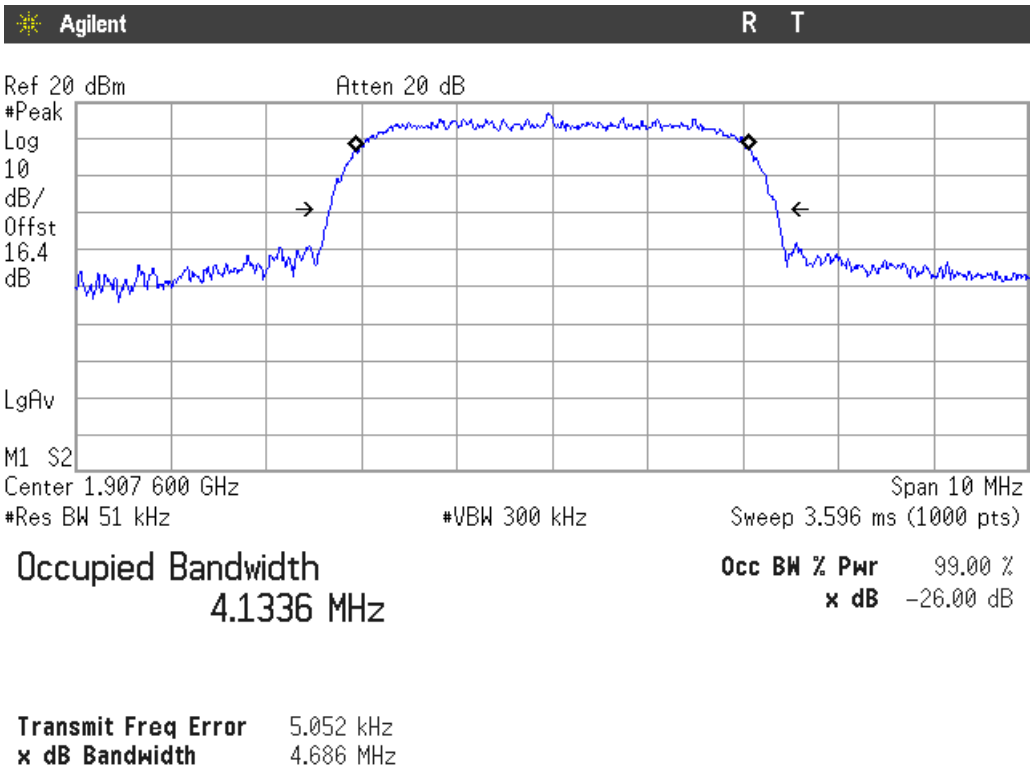
Lowest Channel:



Middle Channel:

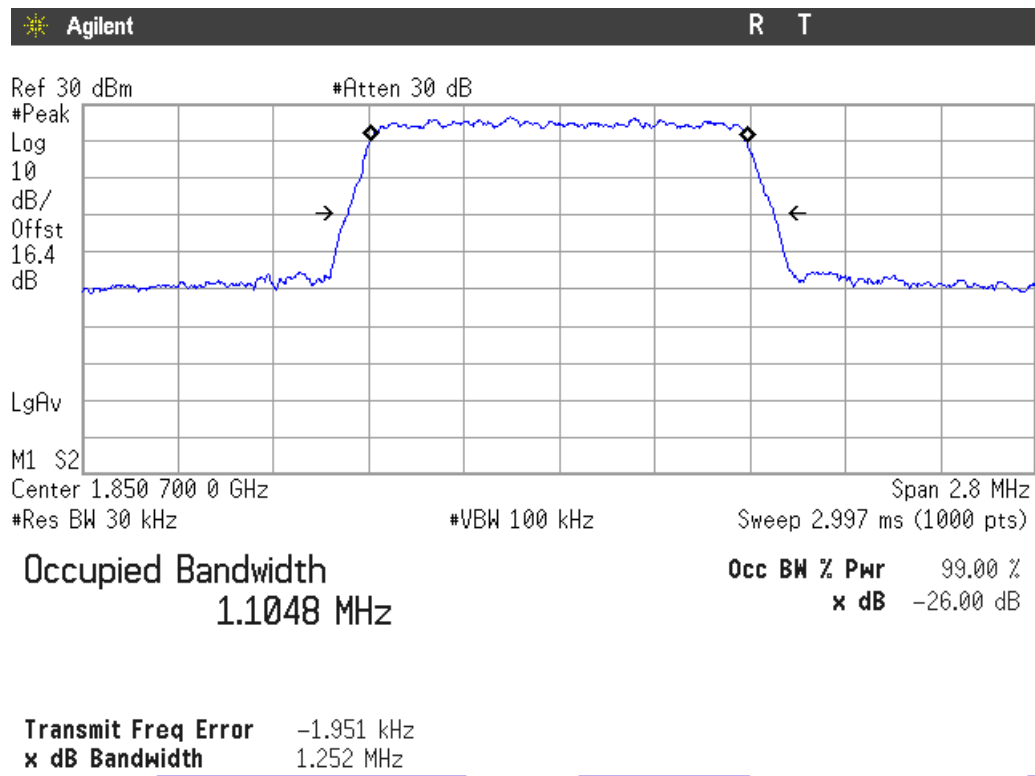


Highest Channel:

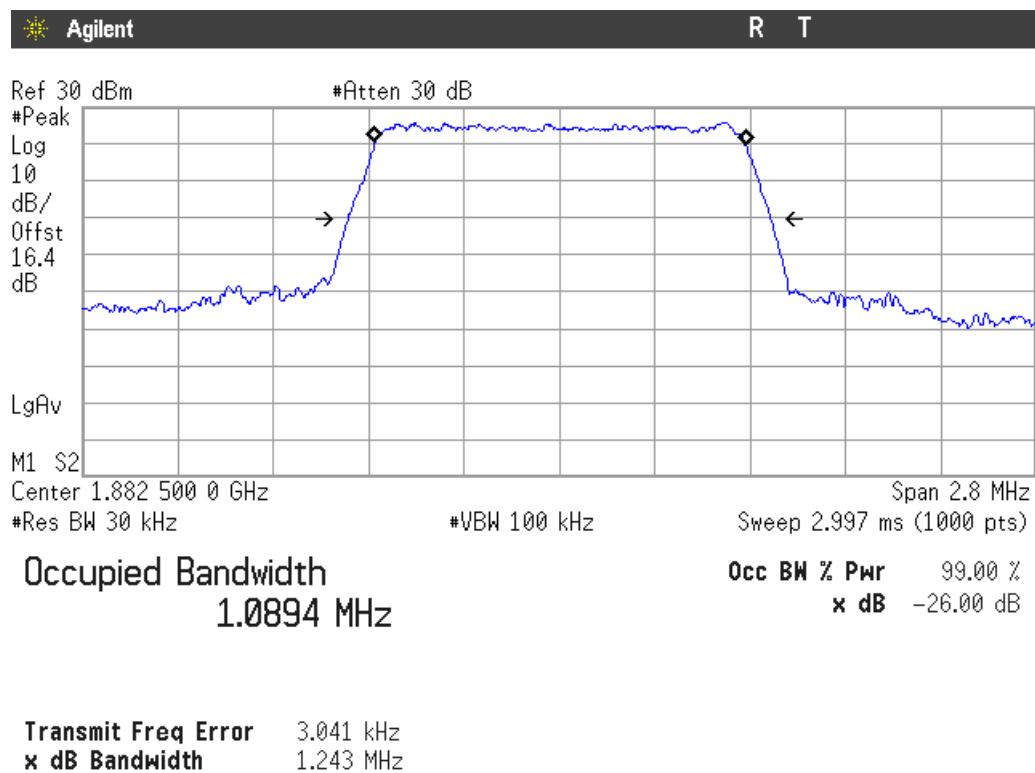


**LTE Band 25. QPSK MODULATION. BW = 1.4 MHz.**

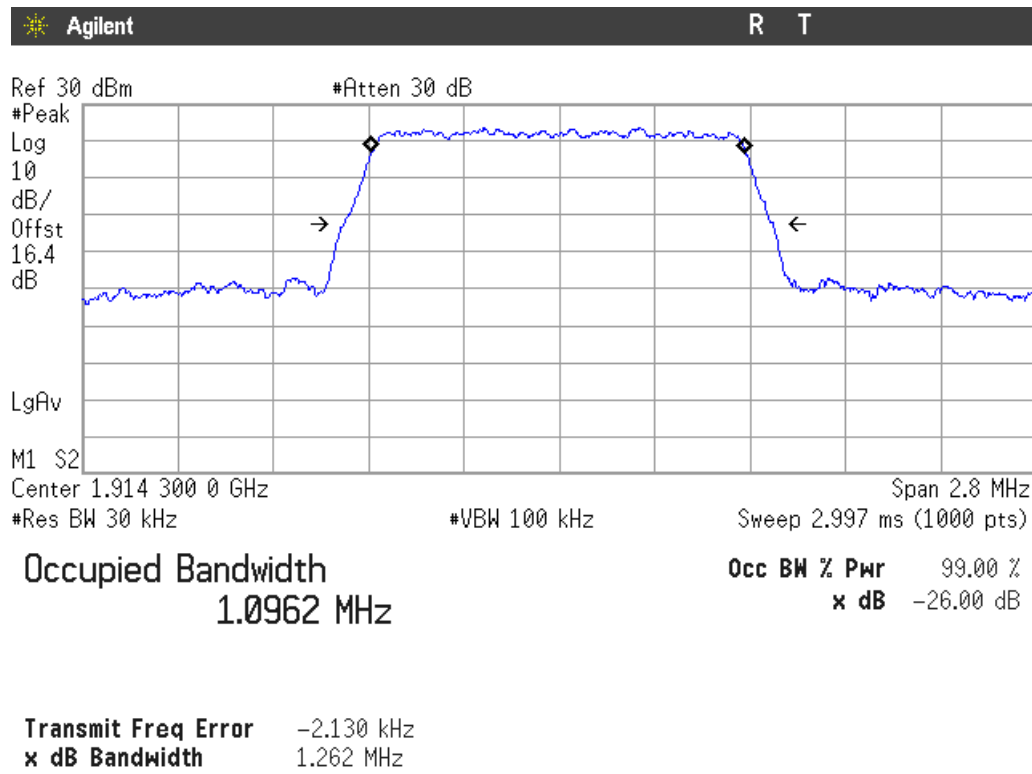
Lowest Channel:



Middle Channel:

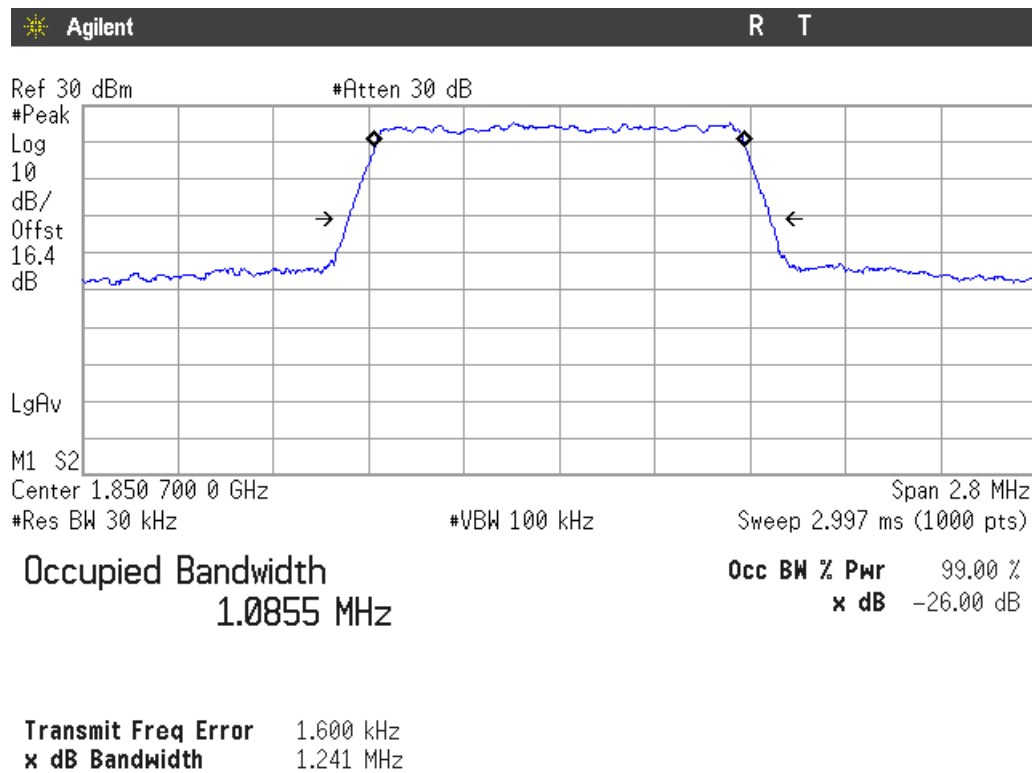


Highest Channel:

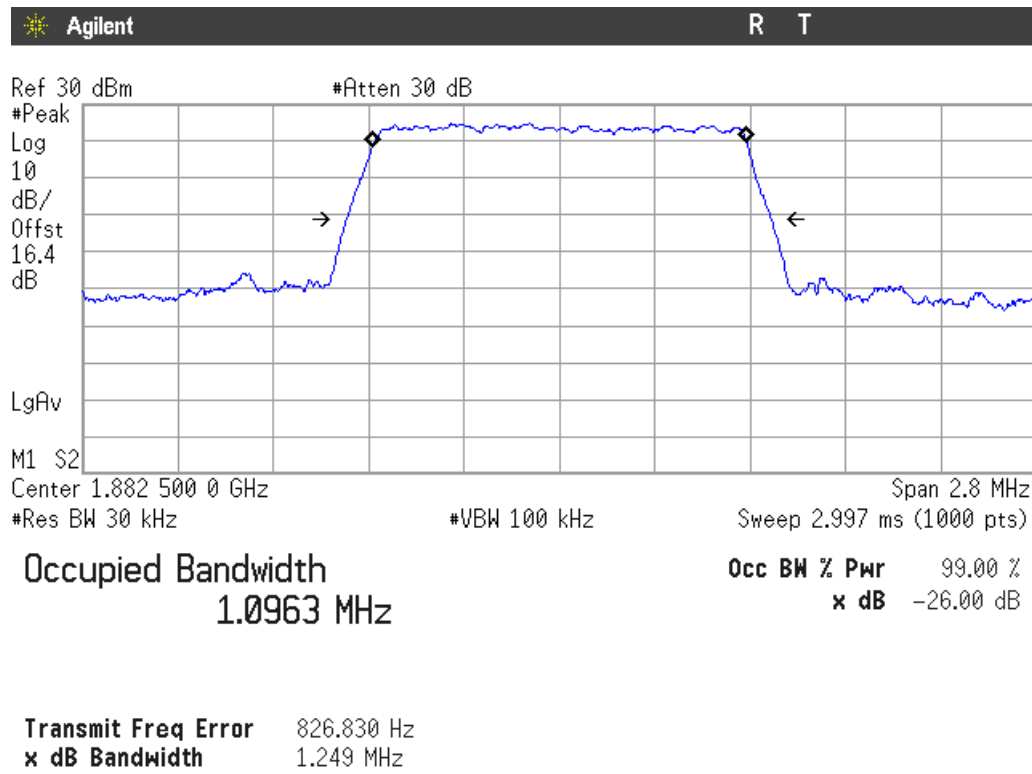


LTE Band 25. 16QAM MODULATION. BW = 1.4 MHz.

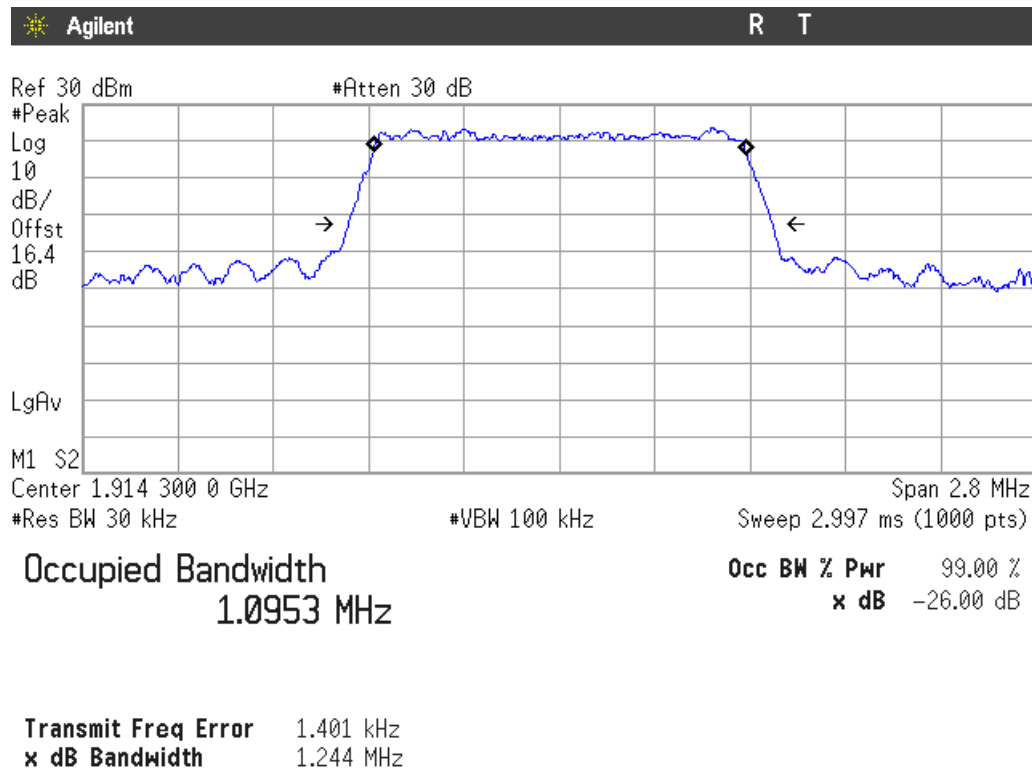
Lowest Channel:



Middle Channel:

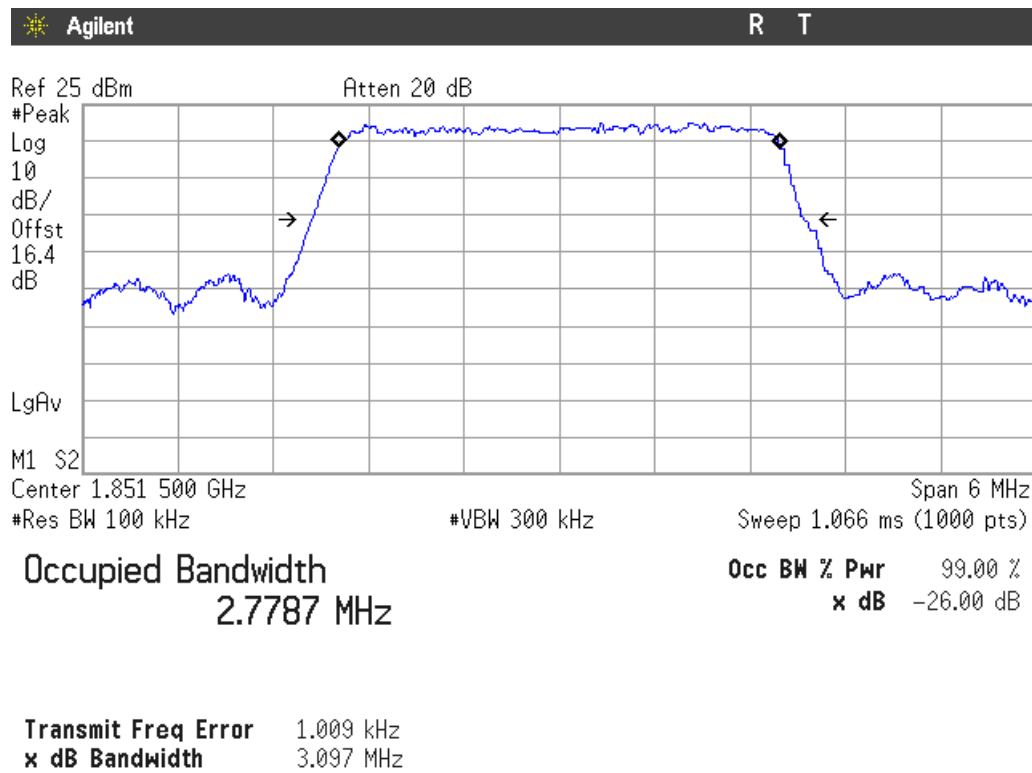


Highest Channel:

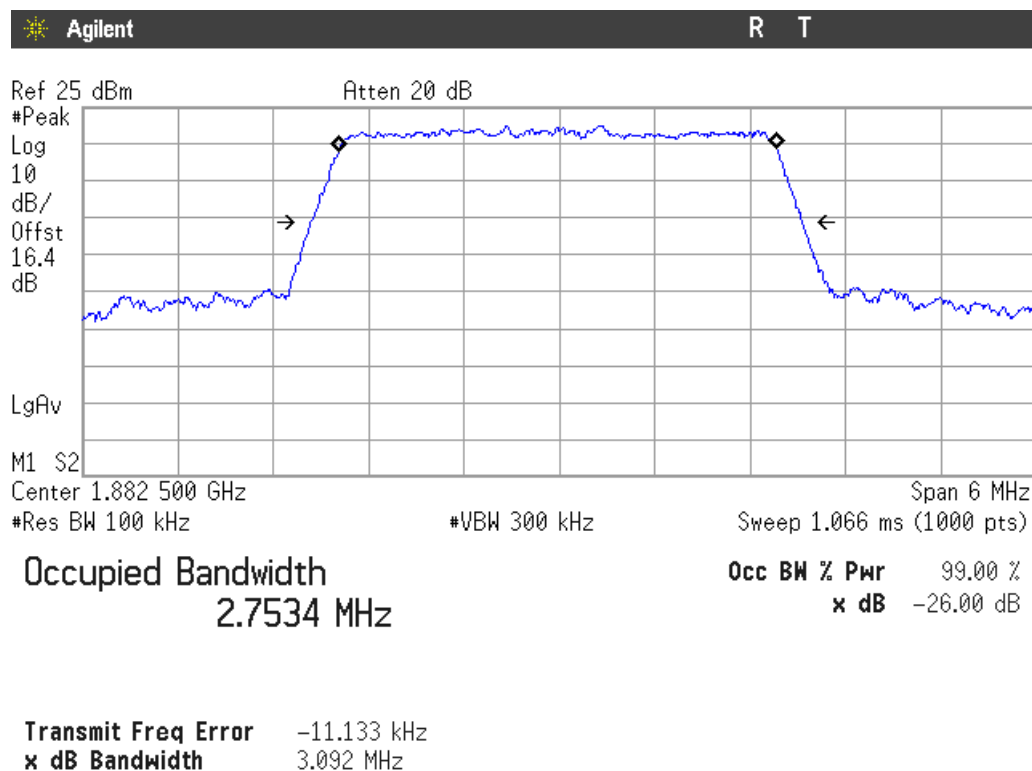


## LTE Band 25. QPSK MODULATION. BW = 3 MHz.

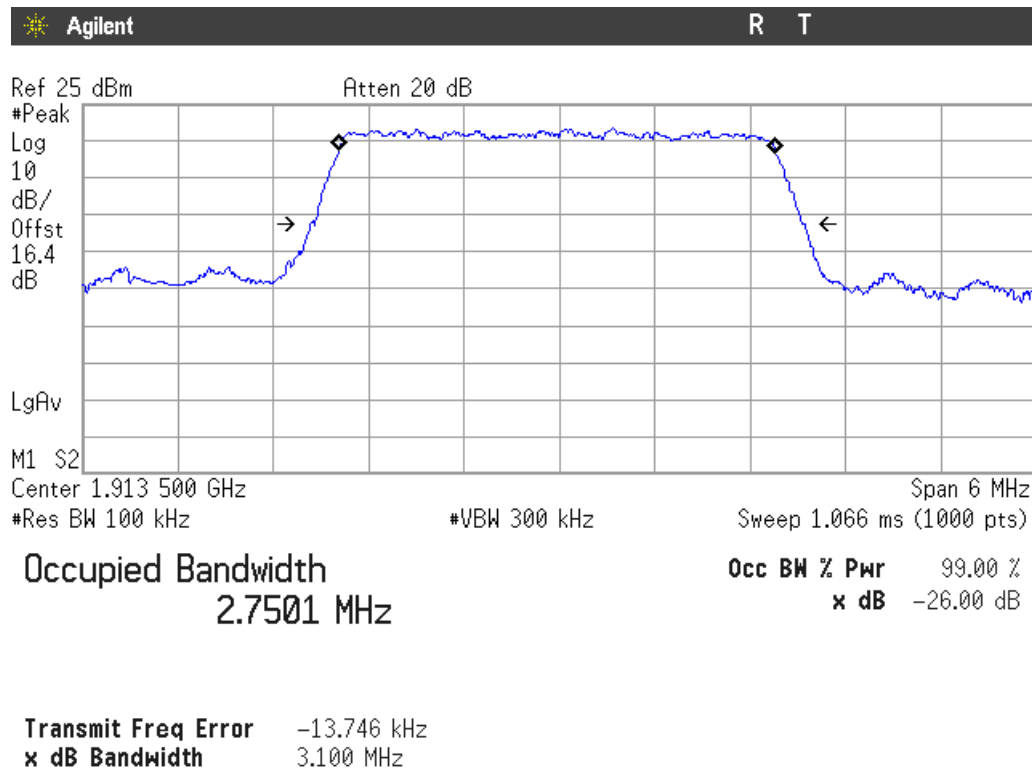
Lowest Channel:



Middle Channel:

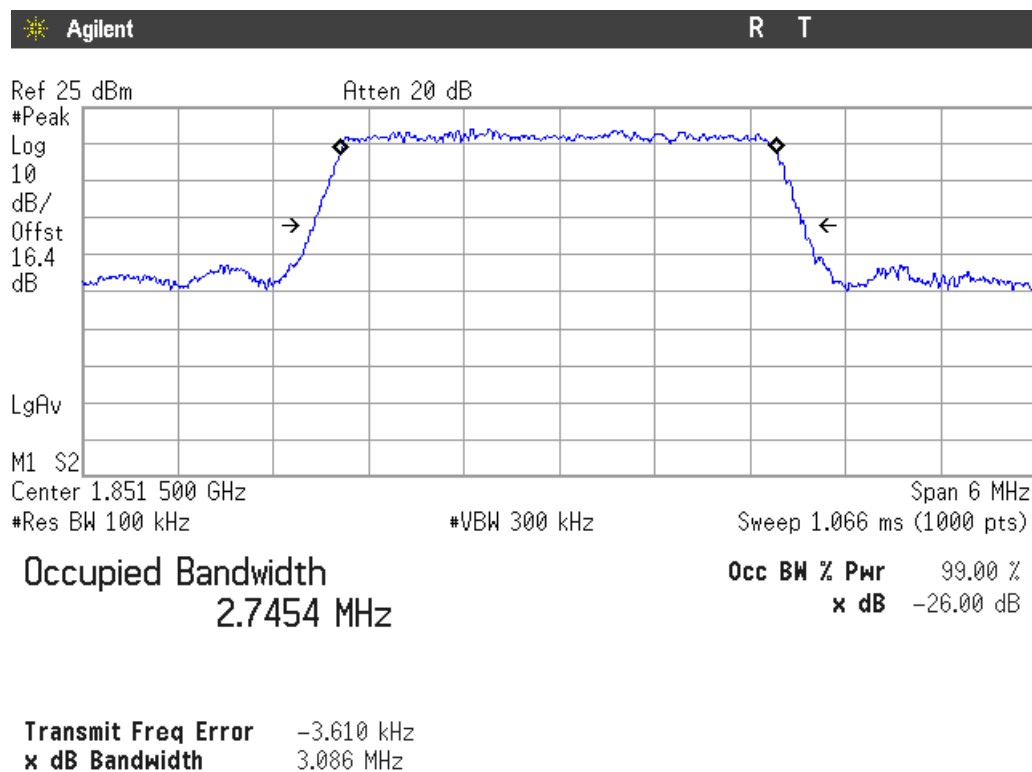


Highest Channel:

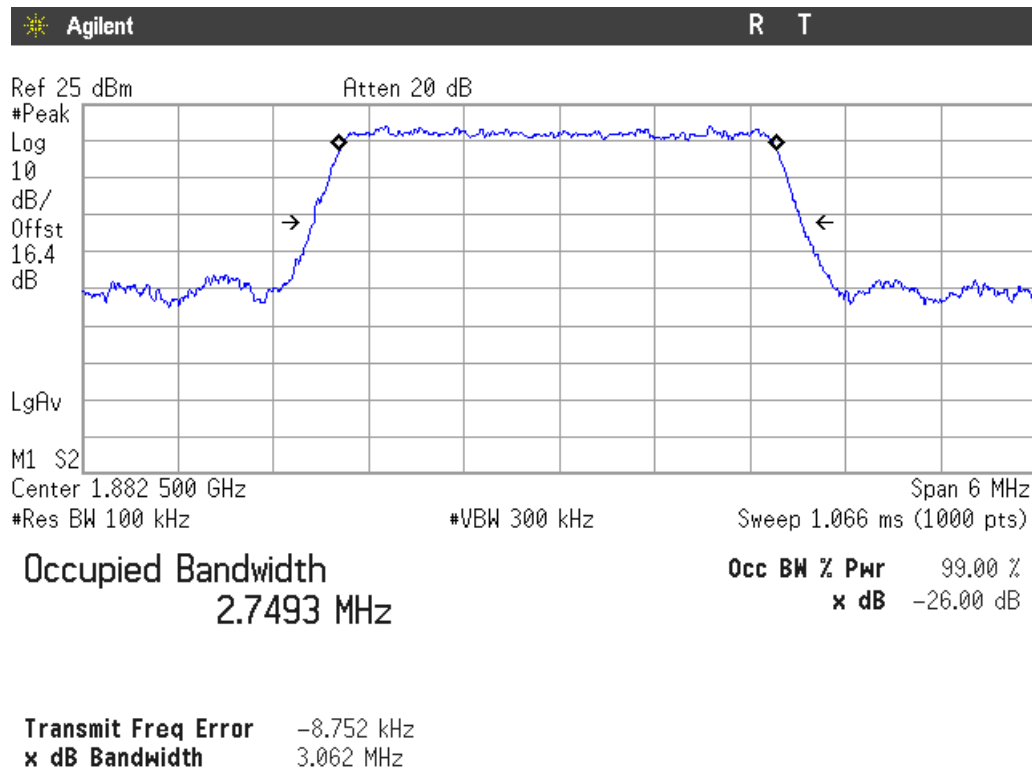


LTE Band 25. 16QAM MODULATION. BW = 3 MHz.

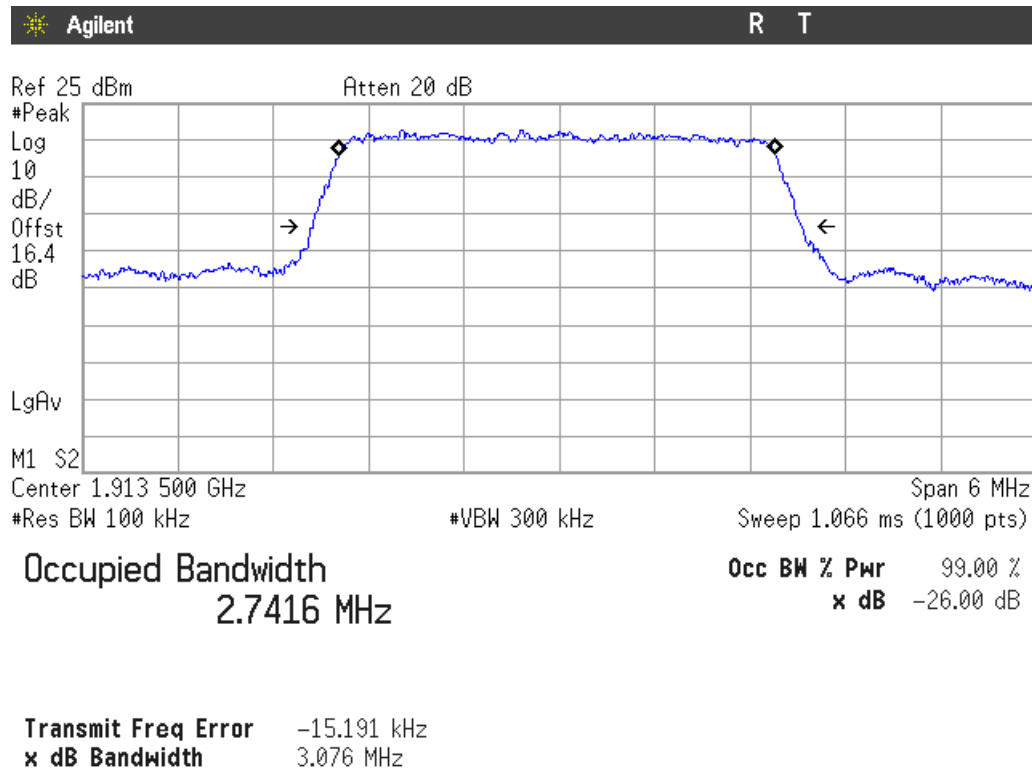
Lowest Channel:



Middle Channel:

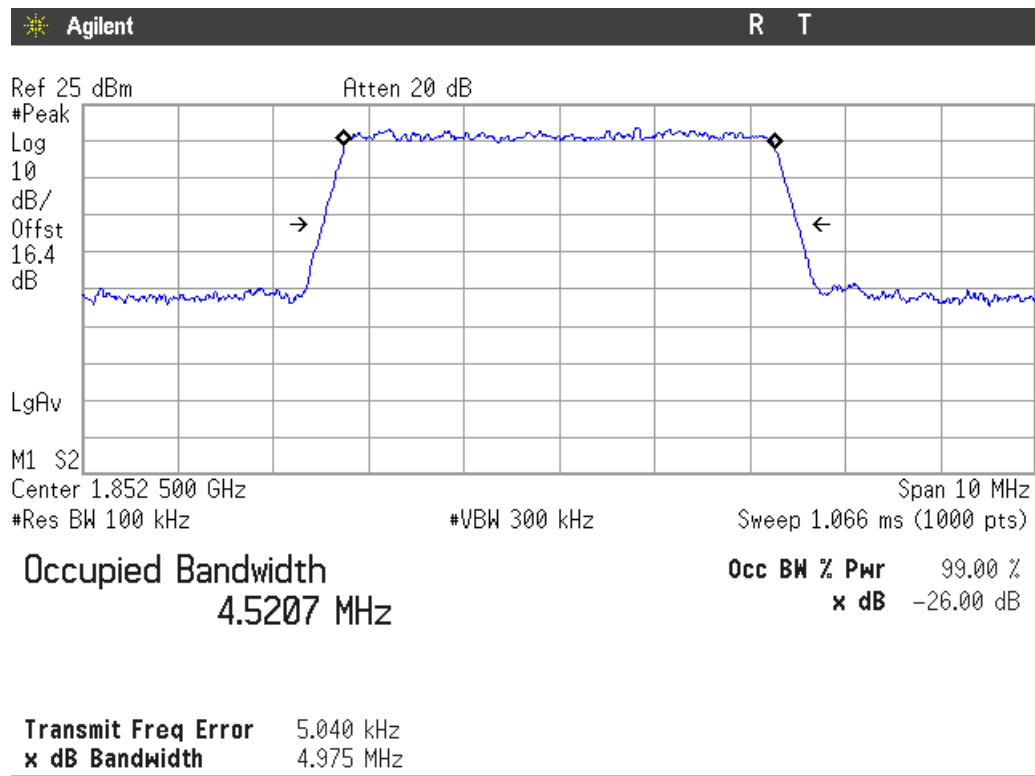


Highest Channel:

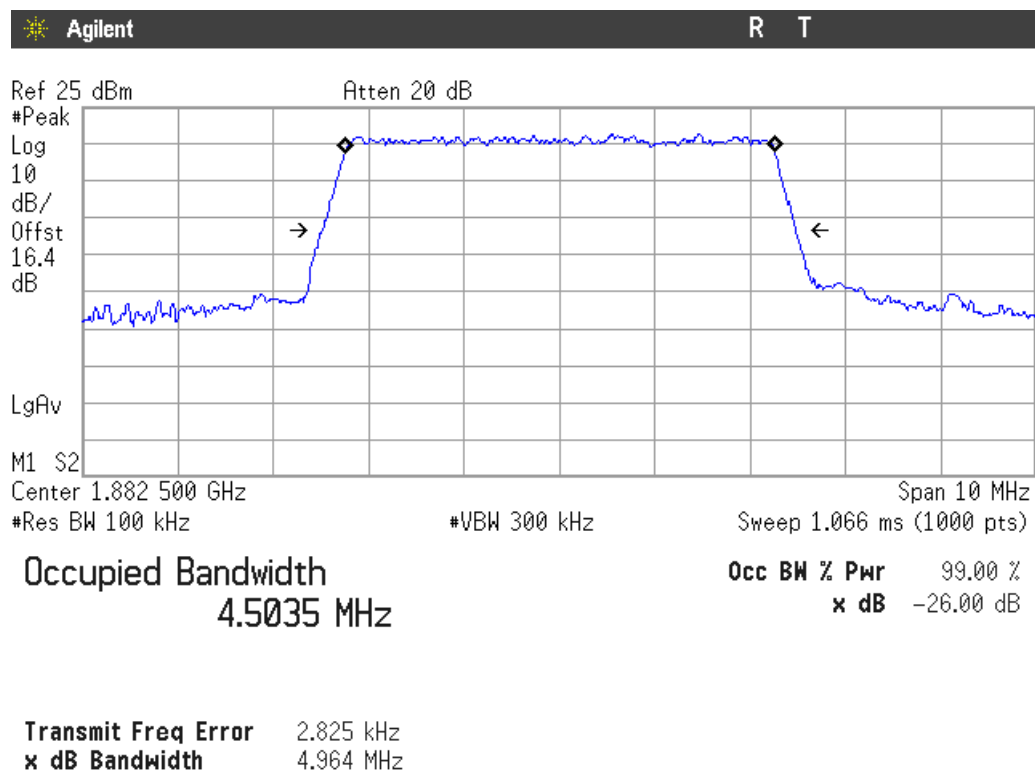


## LTE Band 25. QPSK MODULATION. BW = 5 MHz.

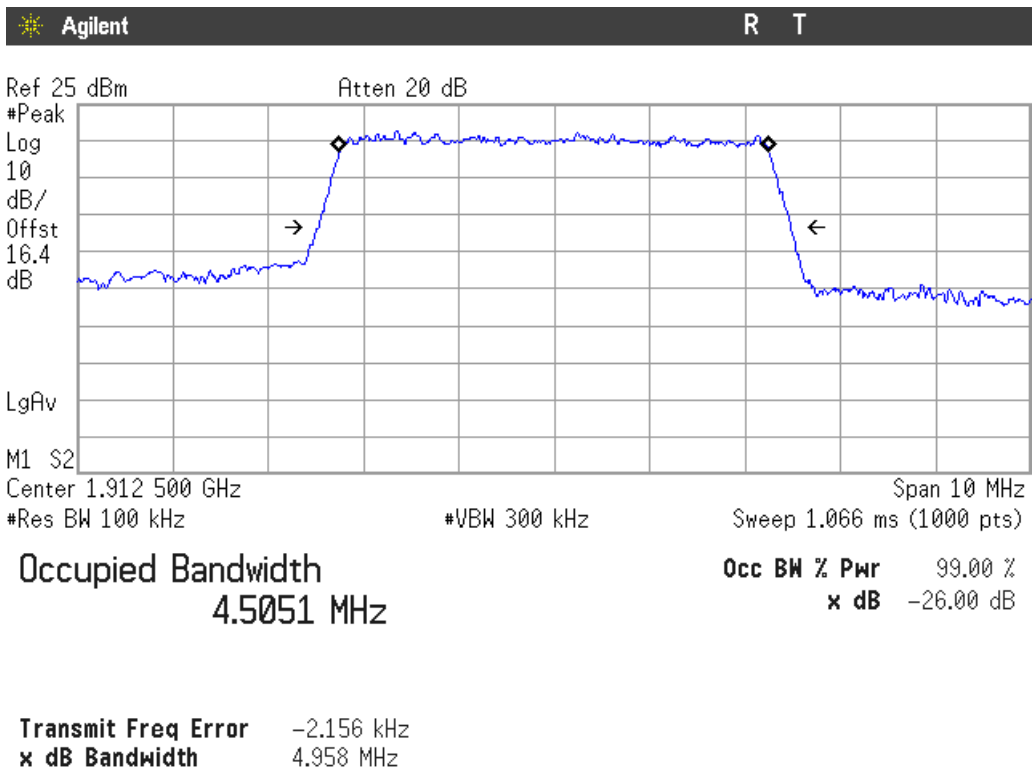
Lowest Channel:



Middle Channel:

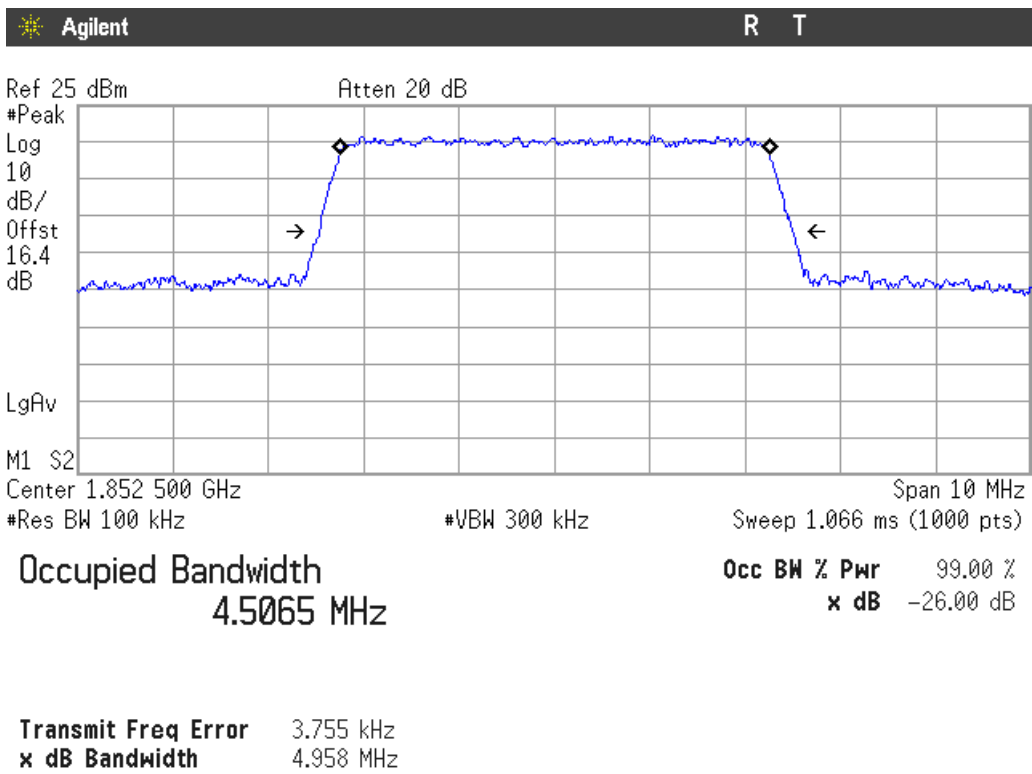


Highest Channel:

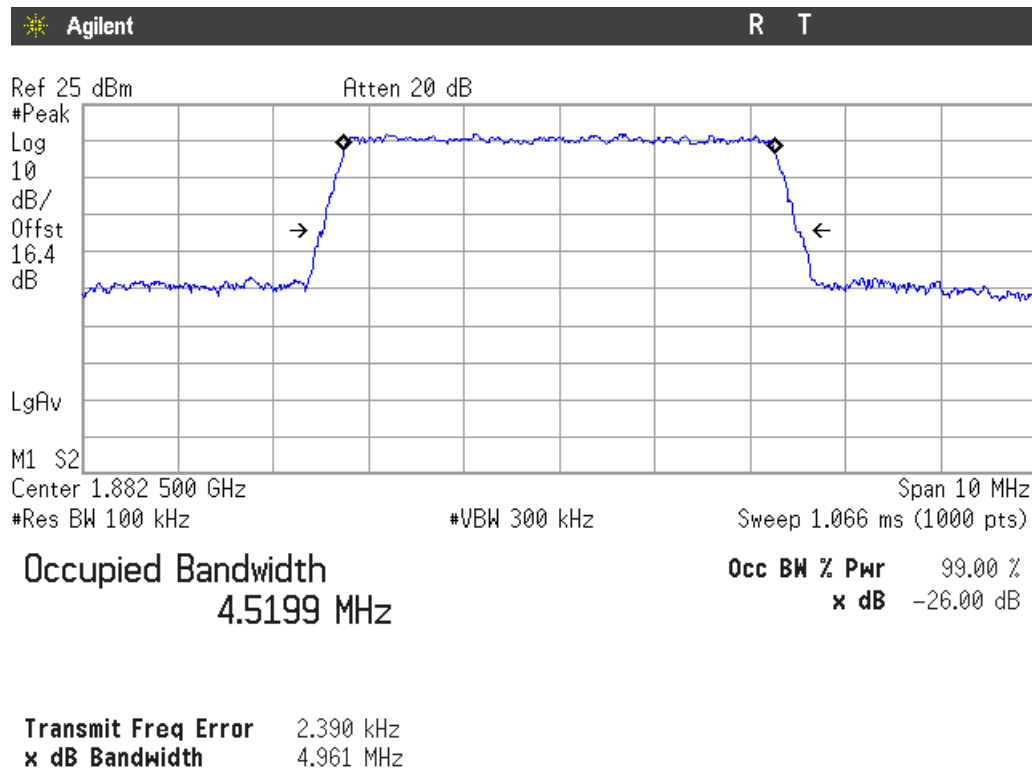


LTE Band 25. 16QAM MODULATION. BW = 5 MHz.

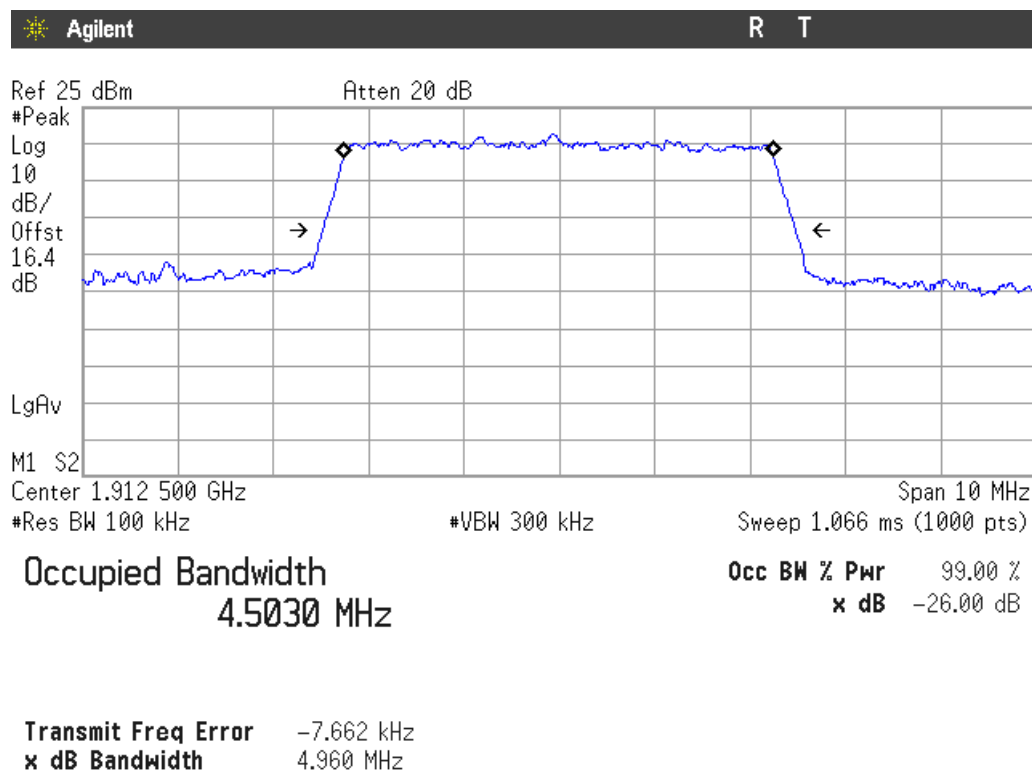
Lowest Channel:



Middle Channel:

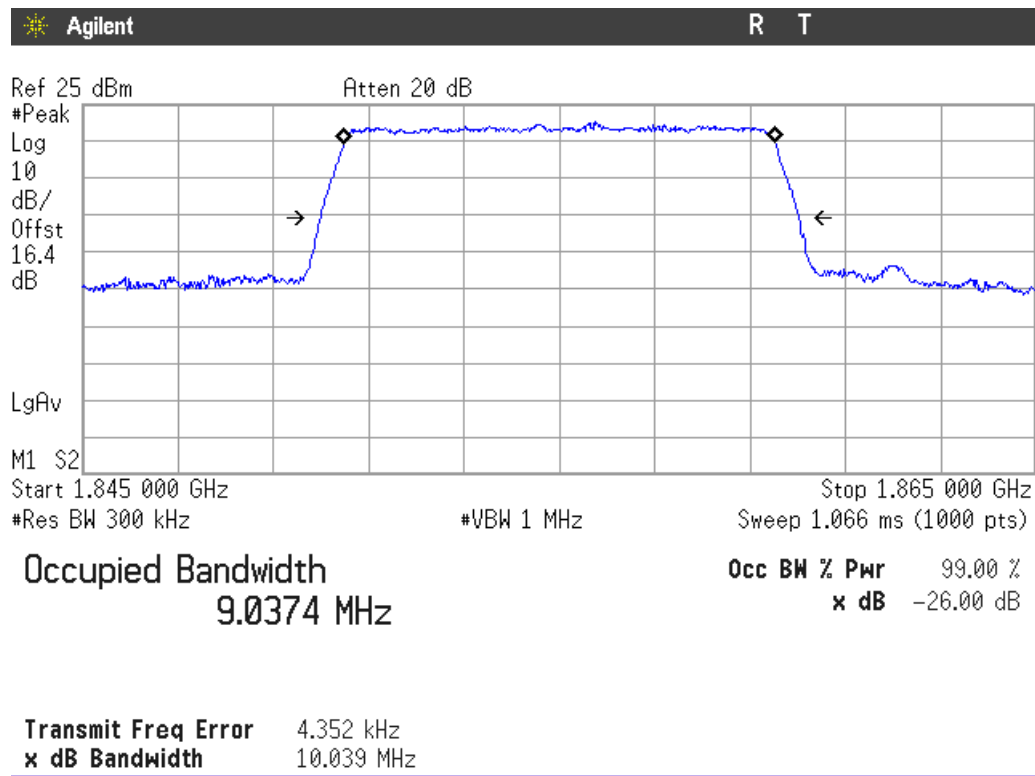


Highest Channel:

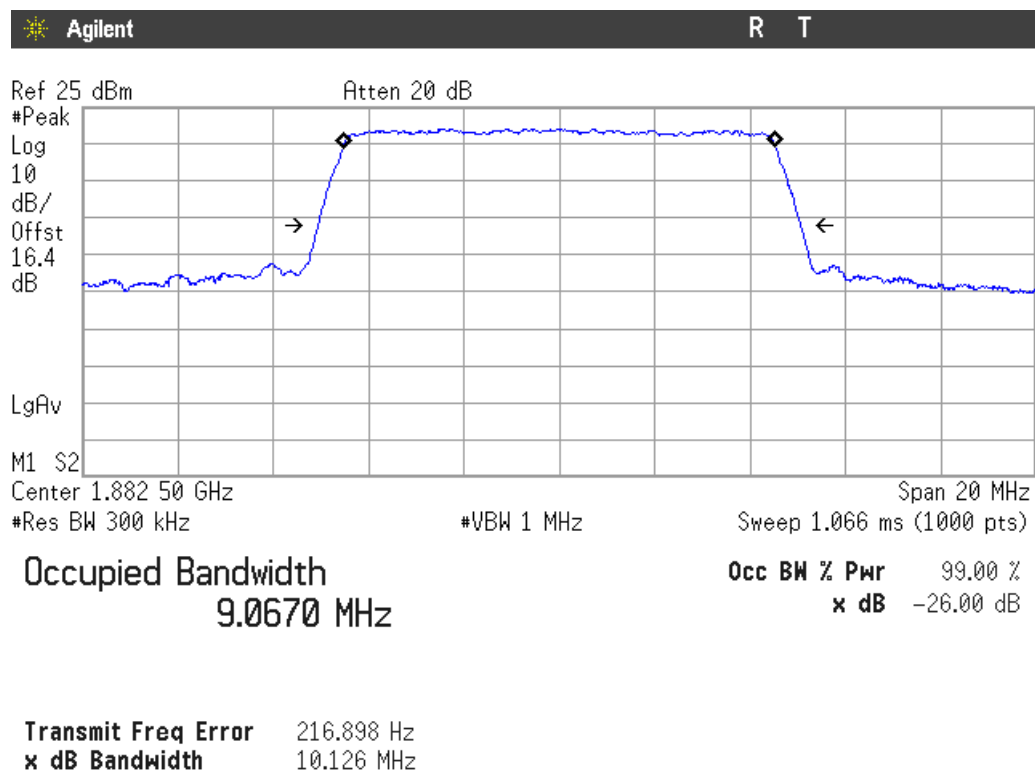


**LTE Band 25. QPSK MODULATION. BW = 10 MHz.**

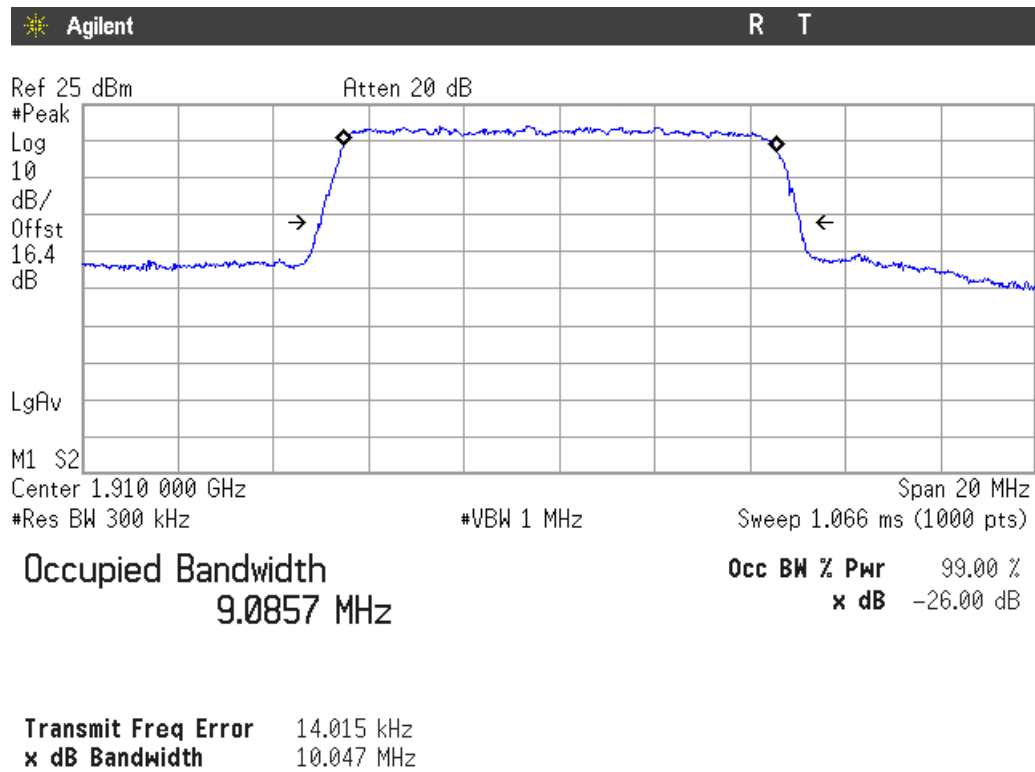
Lowest Channel:



Middle Channel:

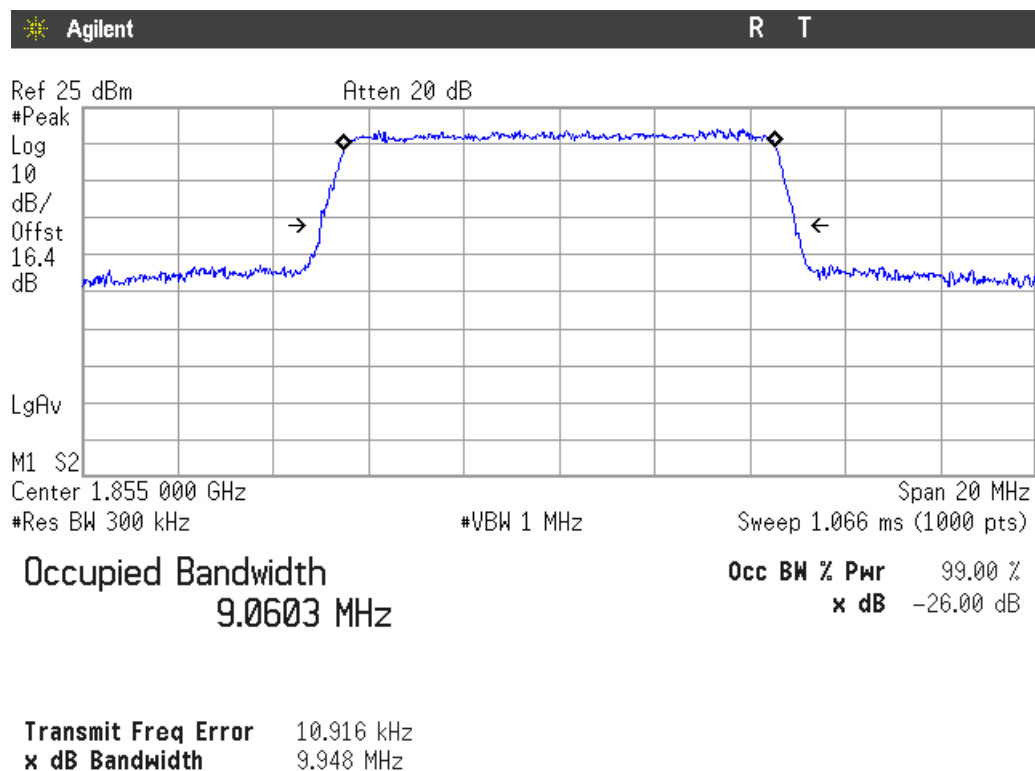


Highest Channel:

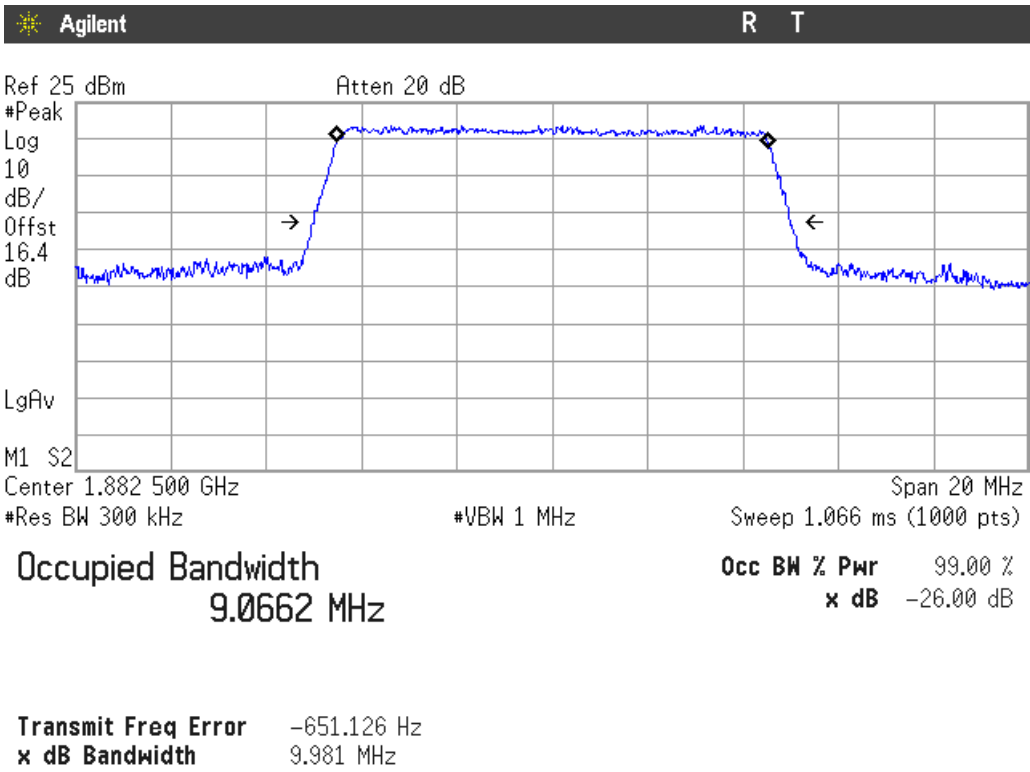


LTE Band 25. 16QAM MODULATION. BW = 10 MHz.

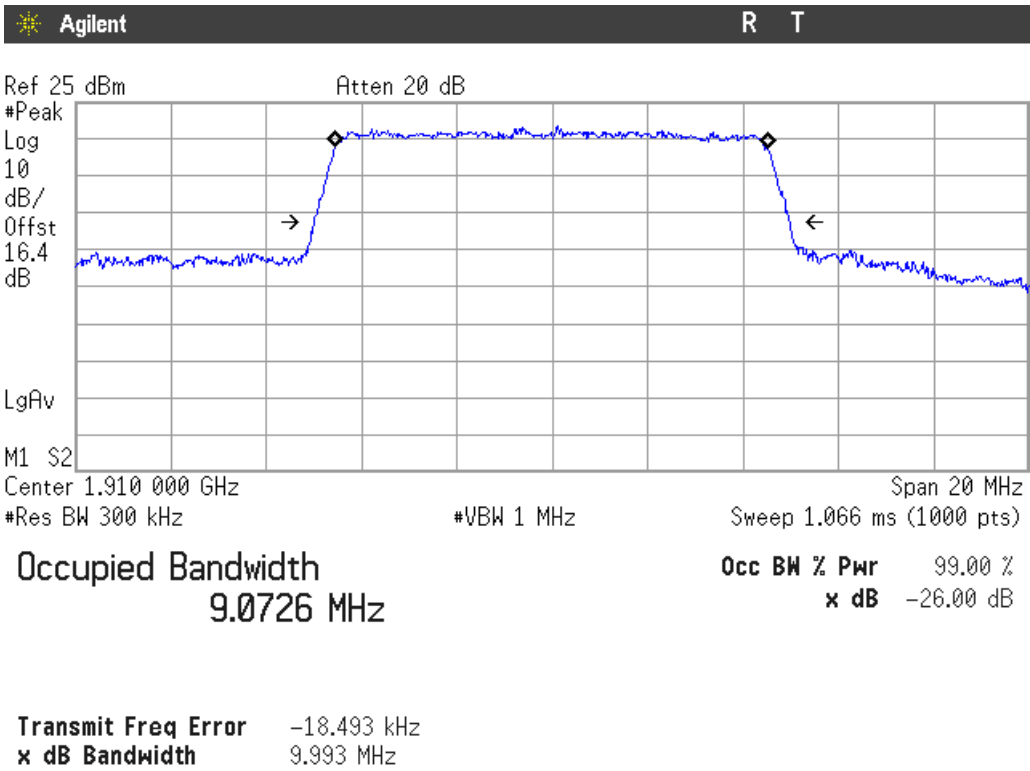
Lowest Channel:



Middle Channel:

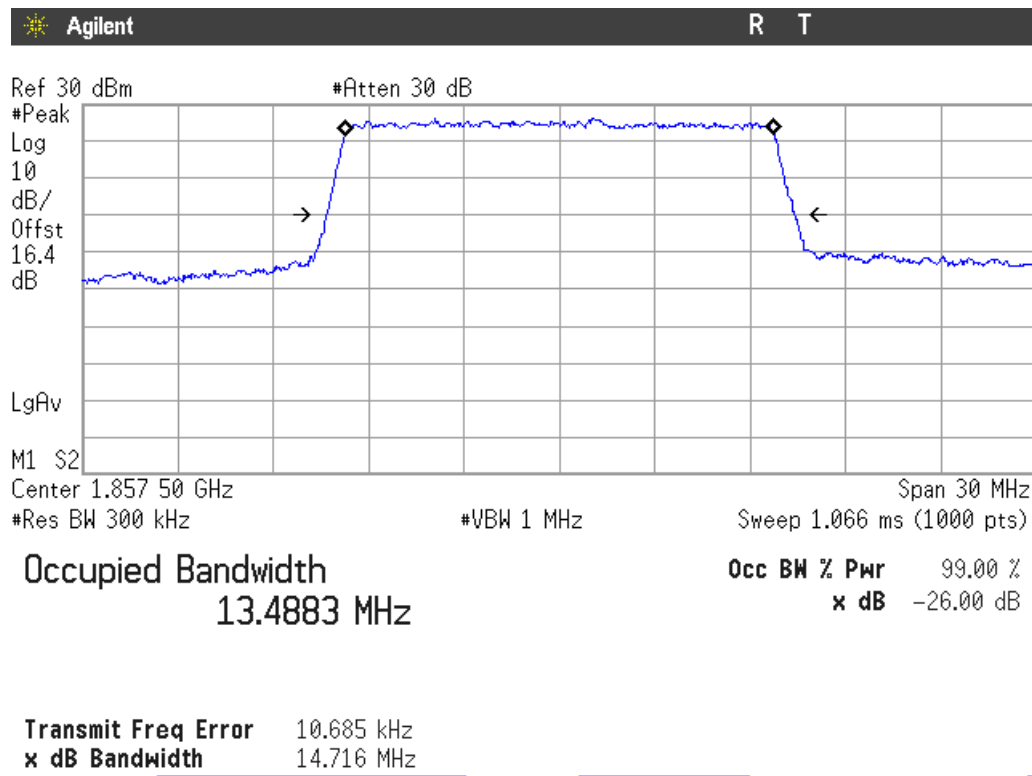


Highest Channel:

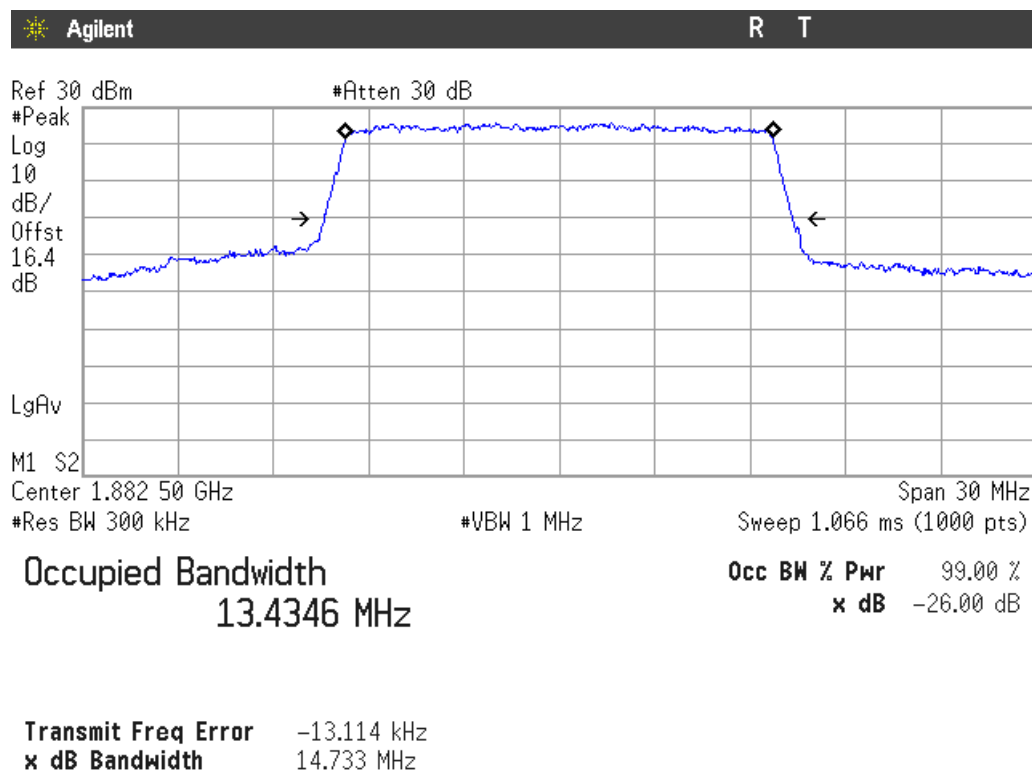


# LTE Band 25. QPSK MODULATION. BW = 15 MHz.

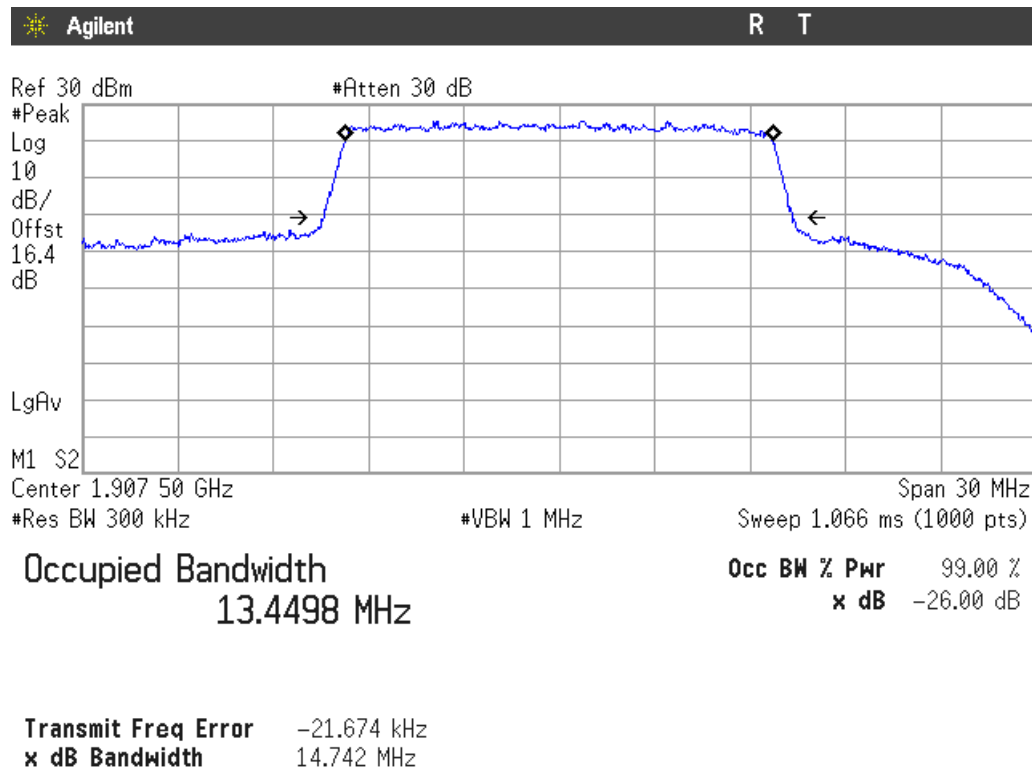
Lowest Channel:



Middle Channel:

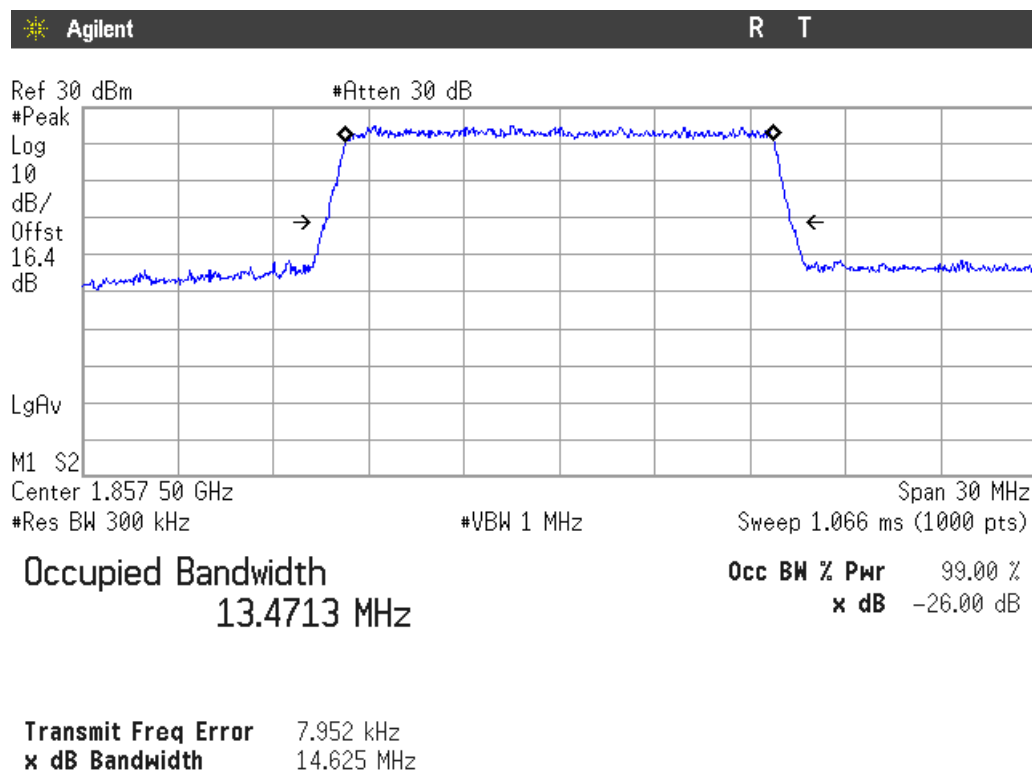


Highest Channel:

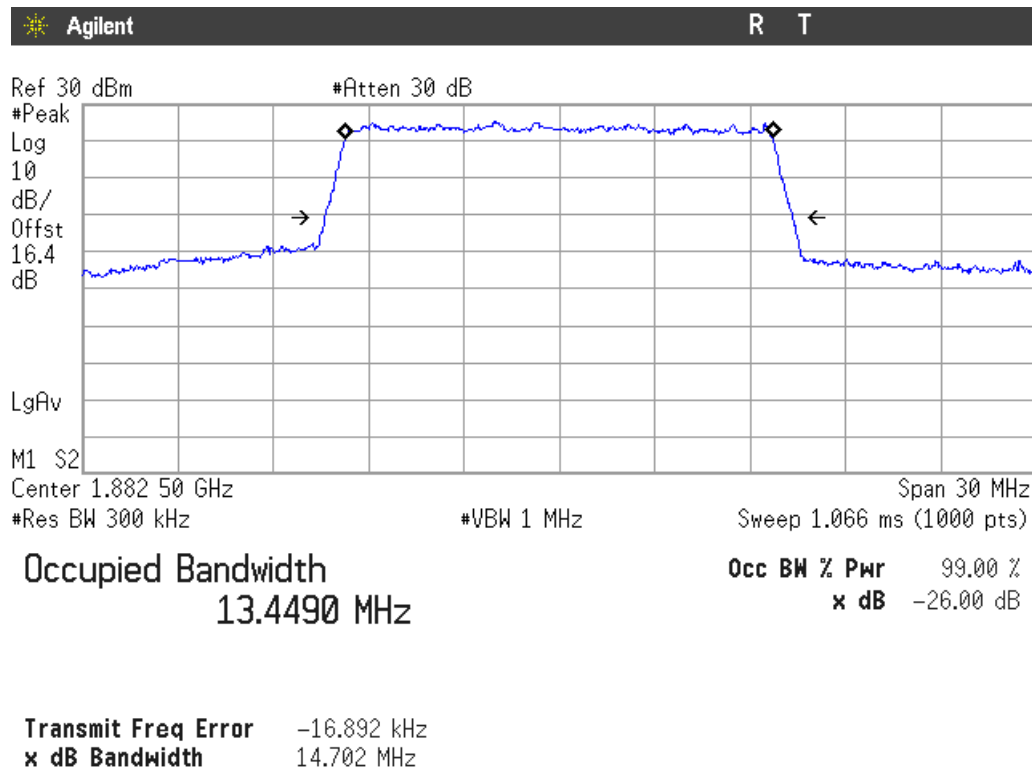


LTE Band 25. 16QAM MODULATION. BW = 15 MHz.

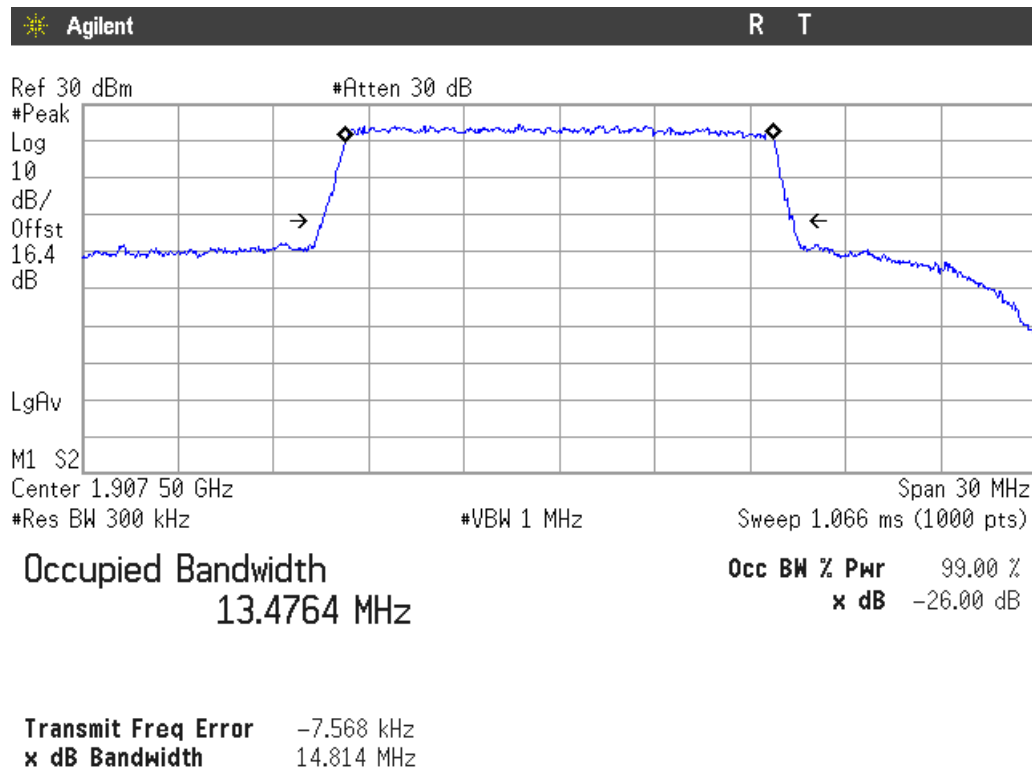
Lowest Channel:



Middle Channel:

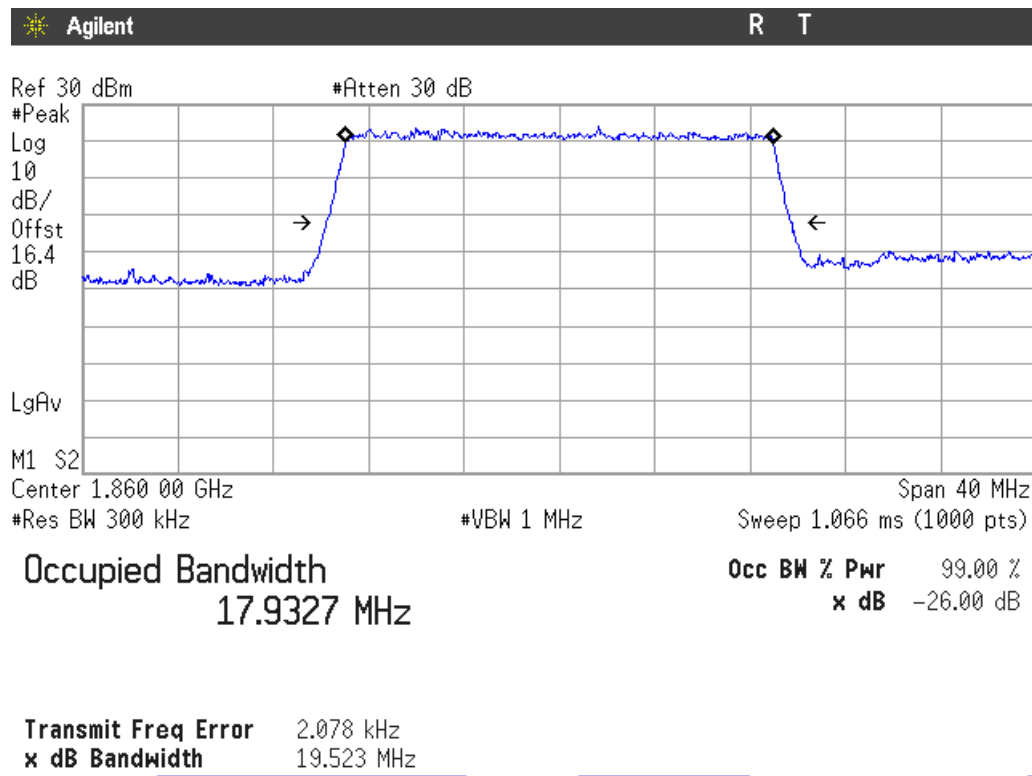


Highest Channel:

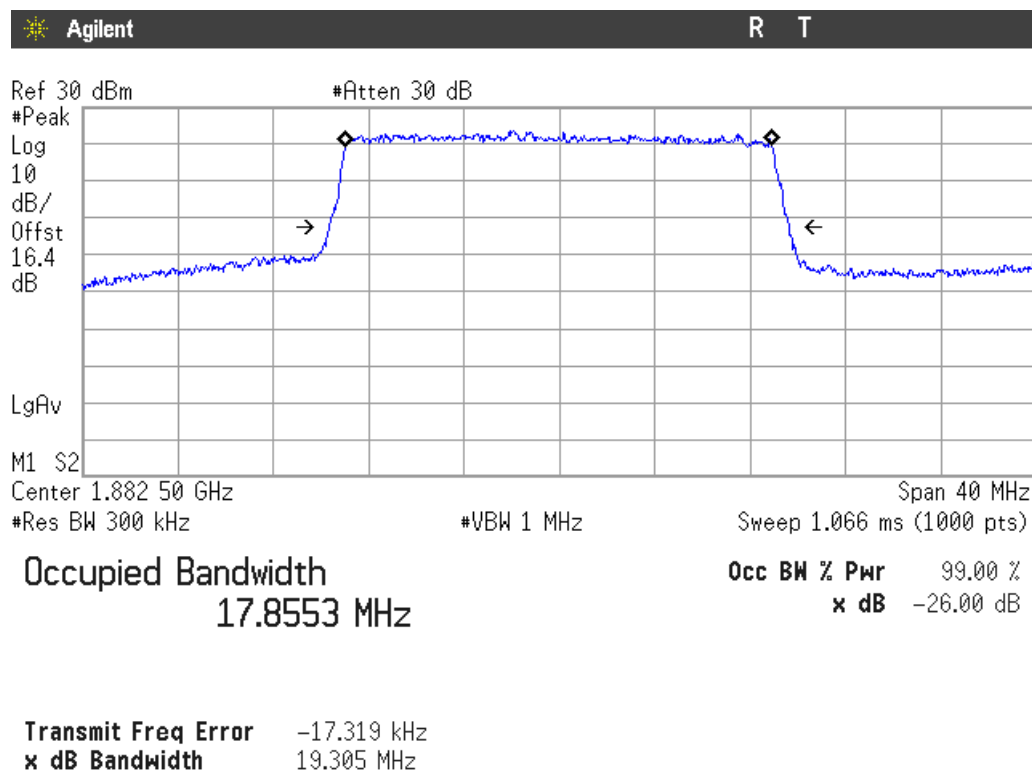


## LTE Band 25. QPSK MODULATION. BW = 20 MHz.

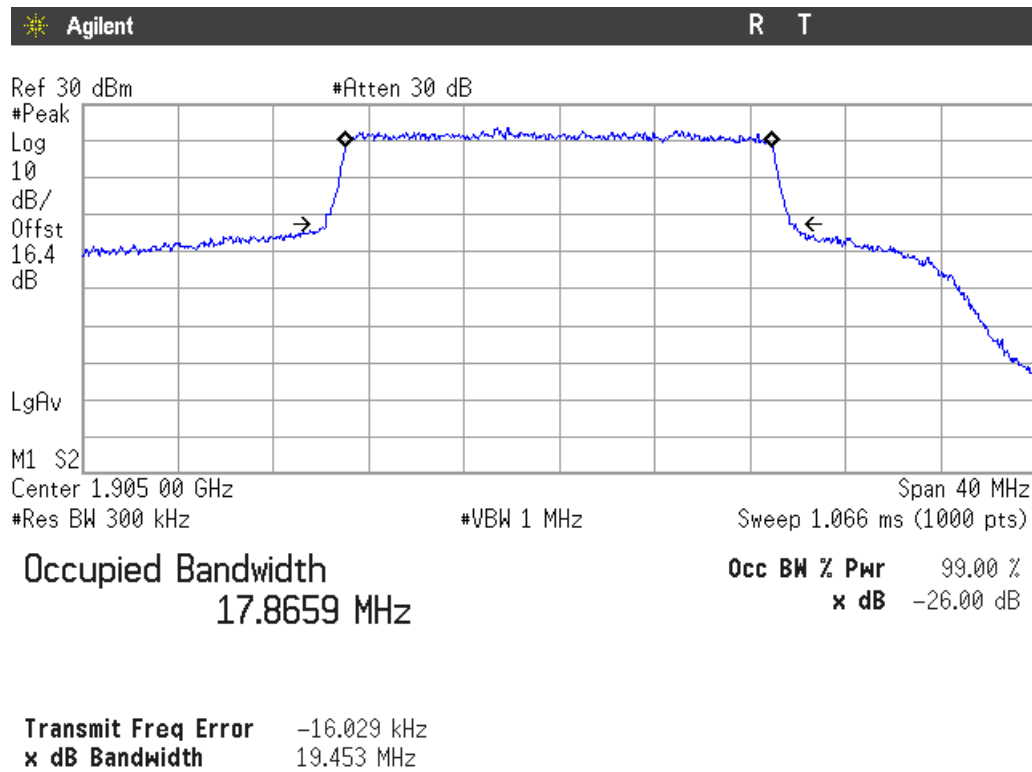
Lowest Channel:



Middle Channel:

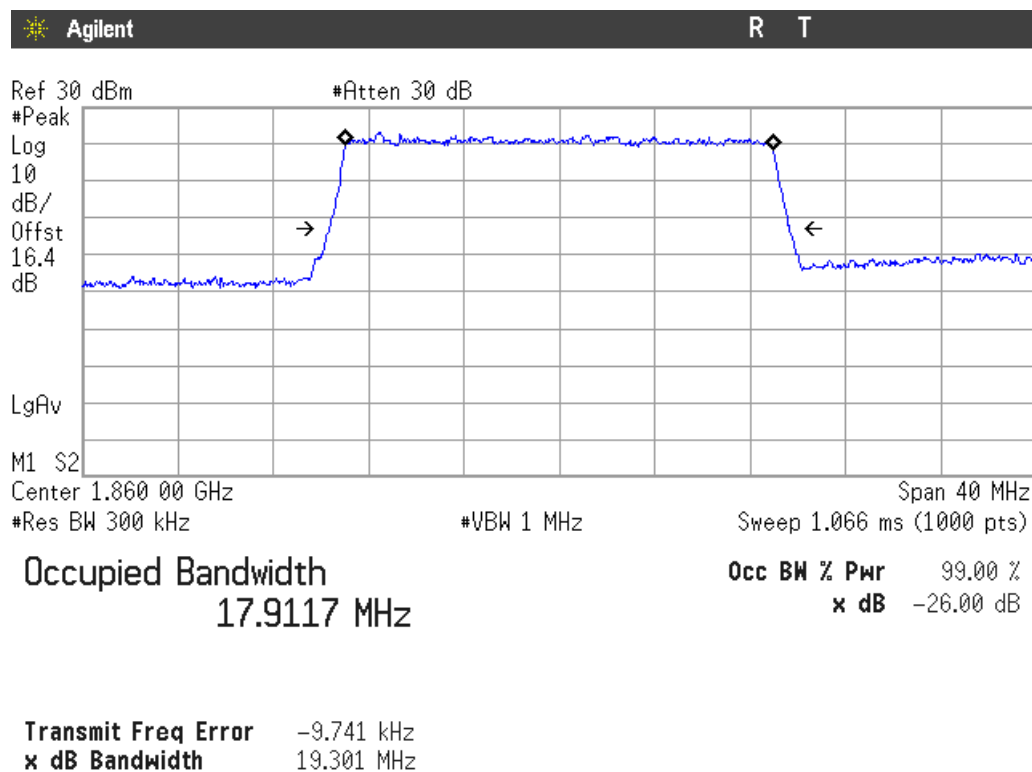


Highest Channel:

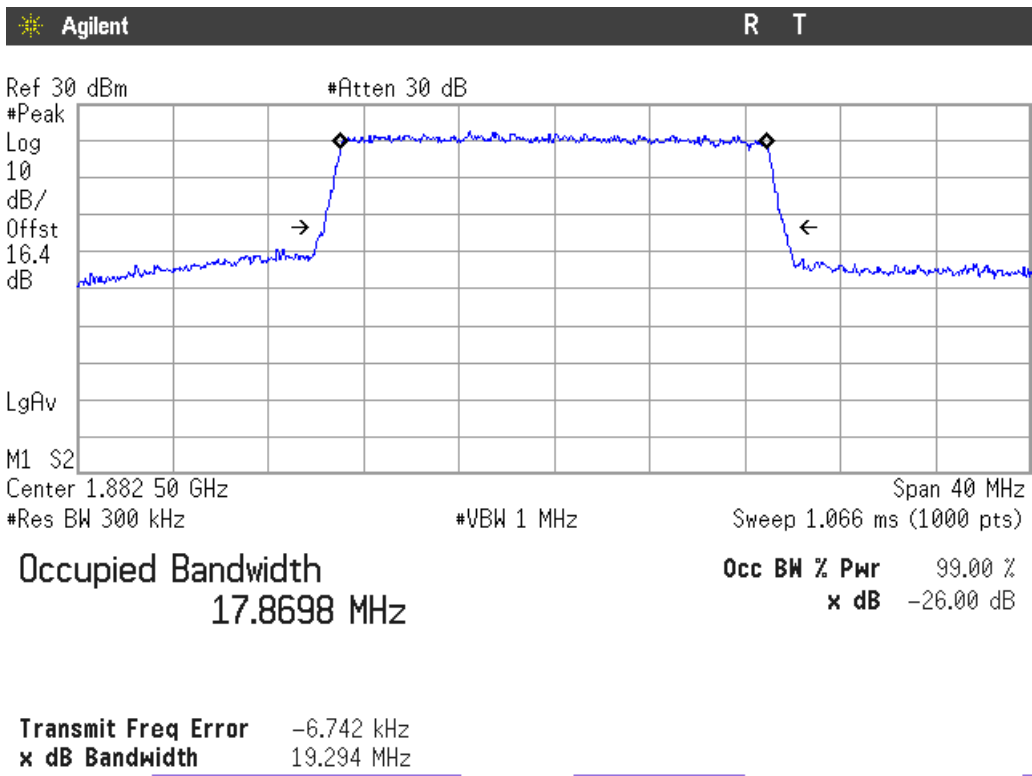


LTE Band 25. 16QAM MODULATION. BW = 20 MHz.

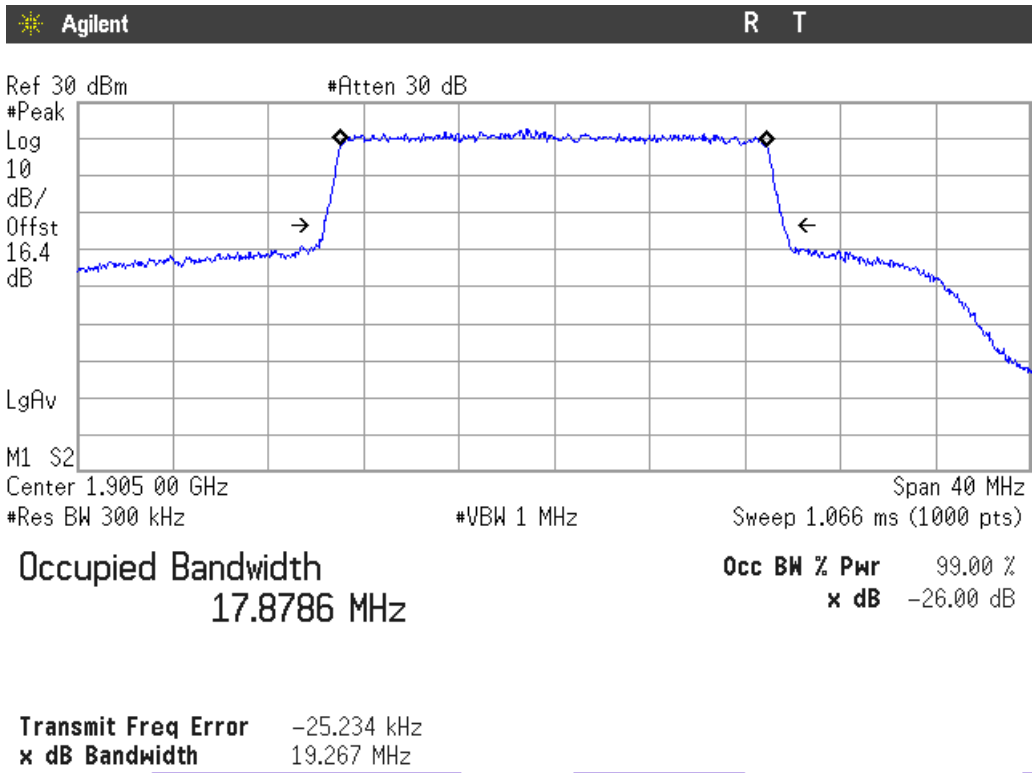
Lowest Channel:



Middle Channel:



Highest Channel:



## Spurious emissions at antenna terminals

### SPECIFICATION:

FCC §2.1051 and §24.238. RSS-133. Clause 6.5.

The power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

At  $P_o$  transmitting power, the specified minimum attenuation becomes  $43+10 \log (P_o)$ , and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = -13 \text{ dBm.}$$

### METHOD:

The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMU200 and CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 ohm attenuator and a power splitter.

The spectrum was investigated from 9 kHz to 20 GHz.

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

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.

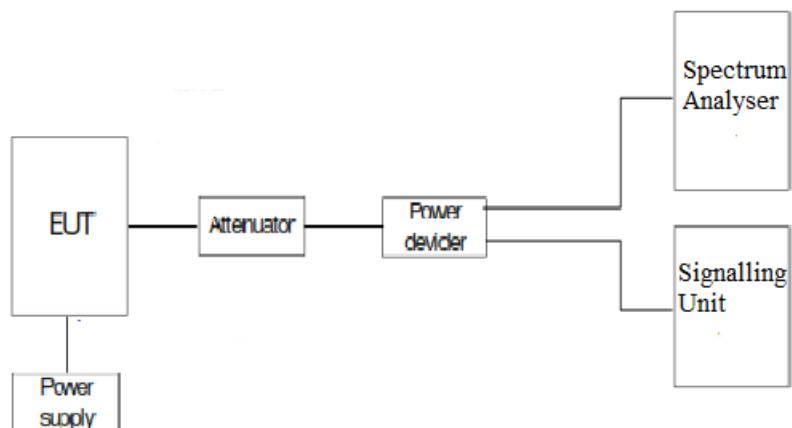
#### Measurement Limit:

According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

At  $P_o$  transmitting power. the specified minimum attenuation becomes  $43+10\log (P_o)$ . and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

TEST SETUP:



## RESULTS:

### 2G Band 1900 MHz. GPRS MODULATION.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range
- Highest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.

### 2G Band 1900 MHz. EDGE MODULATION.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Highest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.

### 3G Band II. WCDMA MODULATION.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Highest Channel:  
Spurious frequencies detected at less than 20 dB below the limit:

| Spurious frequency (GHz) | Level (dBm) | Measurement uncertainty (dB) |
|--------------------------|-------------|------------------------------|
| 7.6254                   | -30.84      | < ± 2.03                     |

### 3G Band II. HSUPA MODULATION.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Highest Channel:  
Spurious frequencies detected at less than 20 dB below the limit:

| Spurious frequency (GHz) | Level (dBm) | Measurement uncertainty (dB) |
|--------------------------|-------------|------------------------------|
| 7.6254                   | -32.43      | < ± 2.03                     |

LTE Band 25. QPSK MODULATION. BW = 1.4 MHz.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Highest Channel:  
Spurious frequencies detected at less than 20 dB below the limit:

| Spurious frequency (GHz) | Level (dBm) | Measurement uncertainty (dB) |
|--------------------------|-------------|------------------------------|
| 3.829009                 | -32.91      | < ± 1.20                     |

LTE Band 25. QPSK MODULATION. BW = 3 MHz.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Highest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.

LTE Band 25. QPSK MODULATION. BW = 5 MHz.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Highest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.

LTE Band 25. QPSK MODULATION. BW = 10 MHz.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Highest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.

LTE Band 25. QPSK MODULATION. BW = 15 MHz.

- Lowest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Middle Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.
- Highest Channel:  
No spurious frequencies detected at less than 20 dB below the limit in all the range.

LTE Band 25. QPSK MODULATION. BW = 20 MHz.

- Lowest Channel:

No spurious frequencies detected at less than 20 dB below the limit in all the range.

- Middle Channel:

No spurious frequencies detected at less than 20 dB below the limit in all the range.

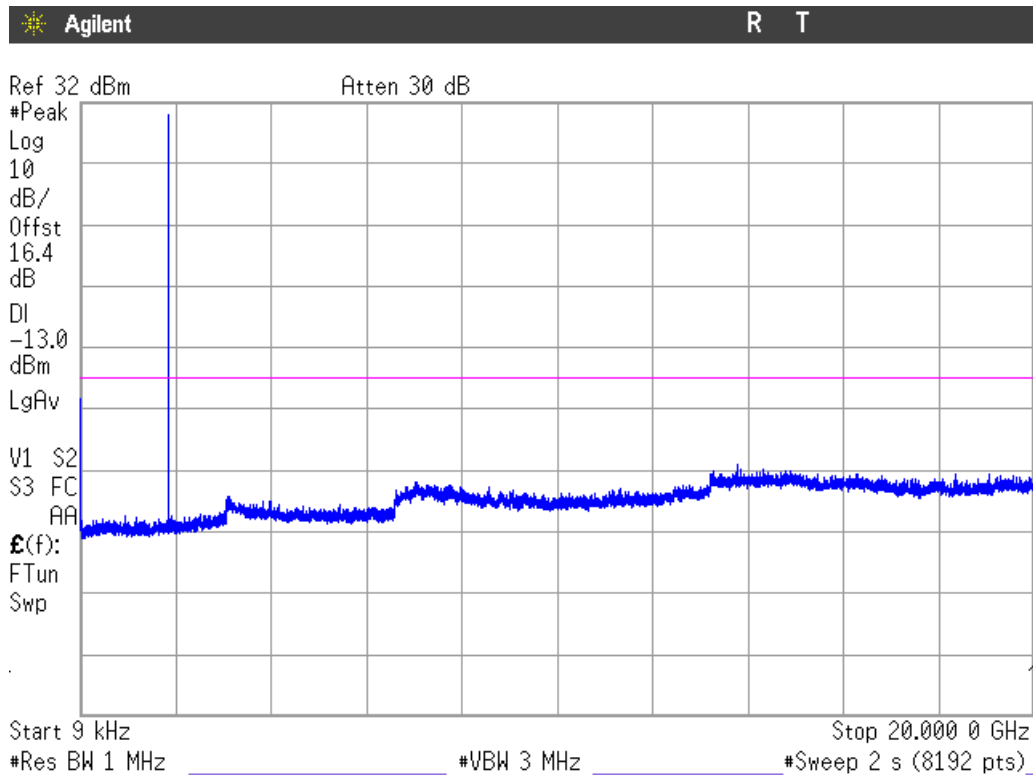
- Highest Channel:

No spurious frequencies detected at less than 20 dB below the limit in all the range.

Verdict: PASS

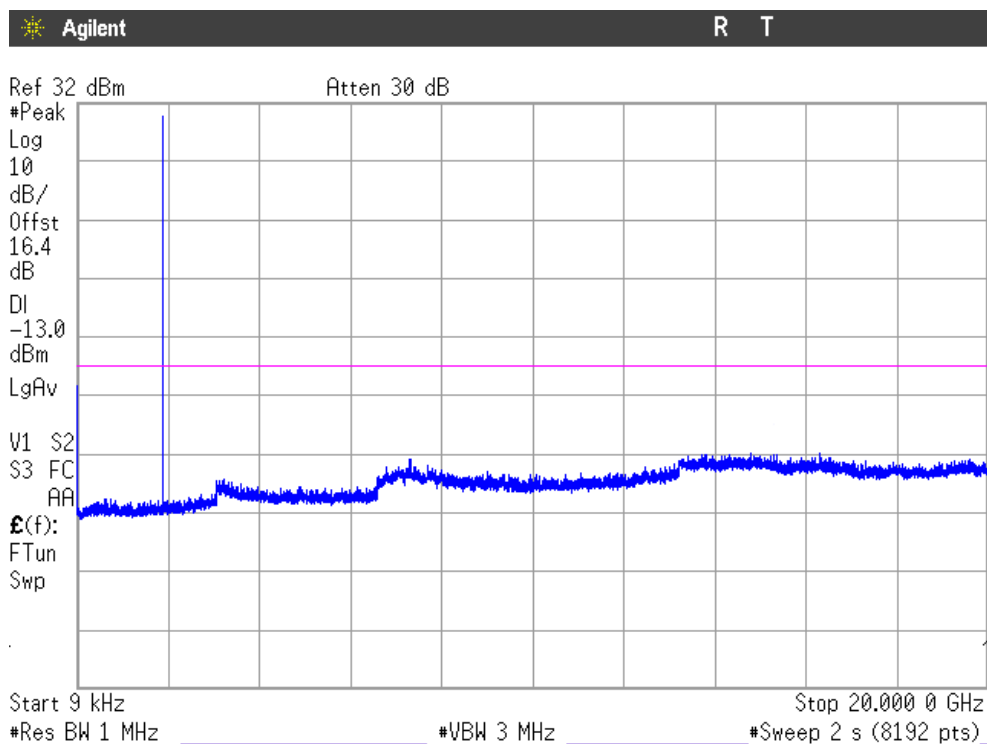
## 2G Band 1900 MHz. GPRS MODULATION.

Lowest Channel:



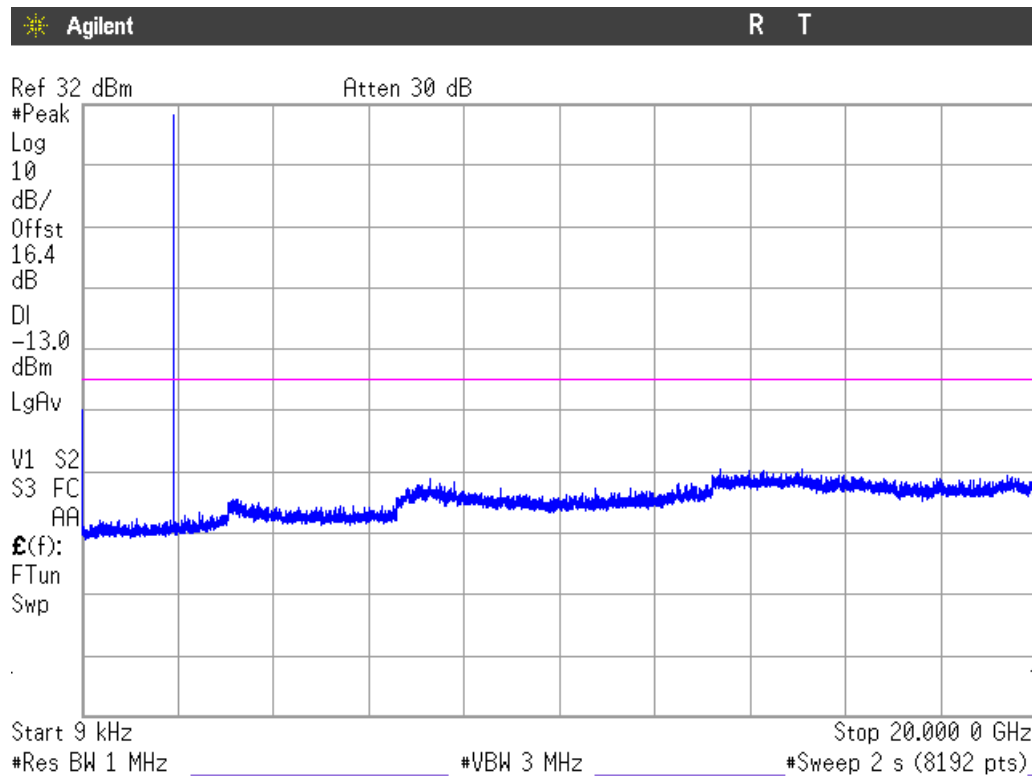
The peak above the limit is the carrier frequency.

Middle Channel:



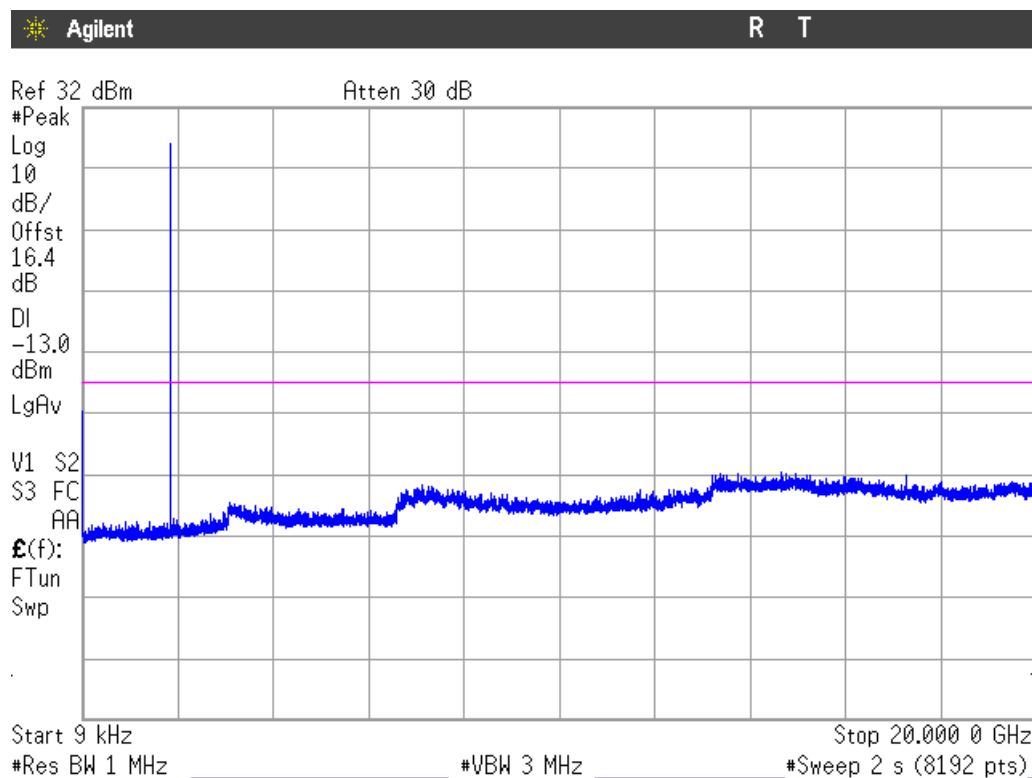
The peak above the limit is the carrier frequency.

Highest Channel:

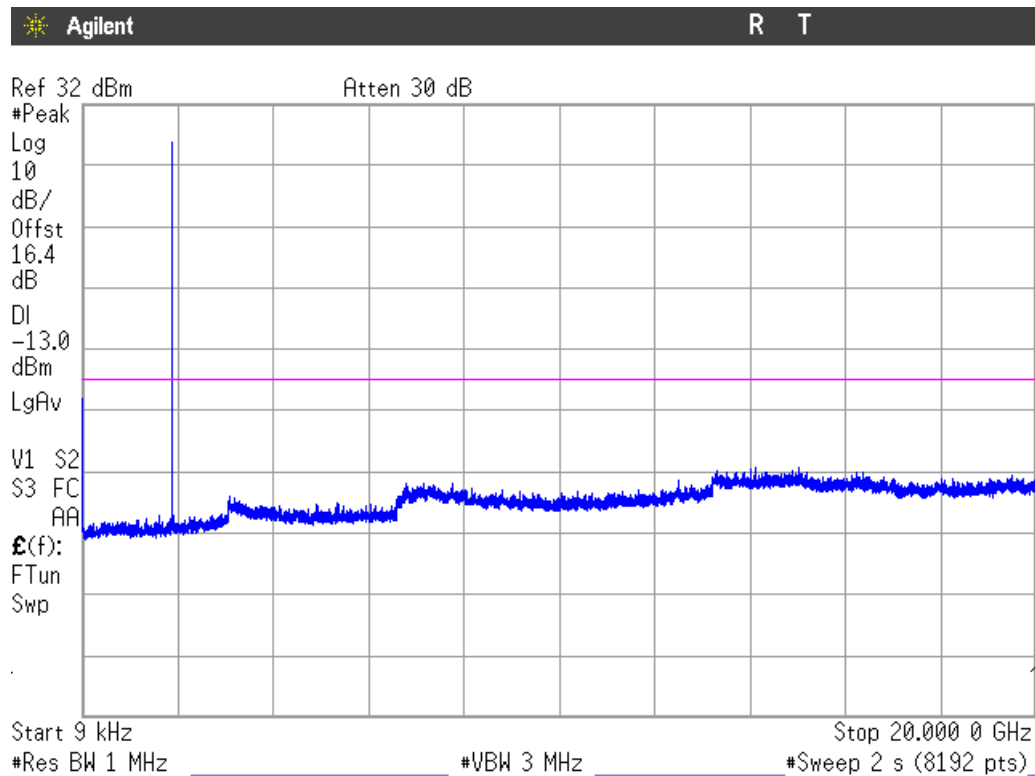


2G Band 1900 MHz. EDGE MODULATION.

Lowest Channel:

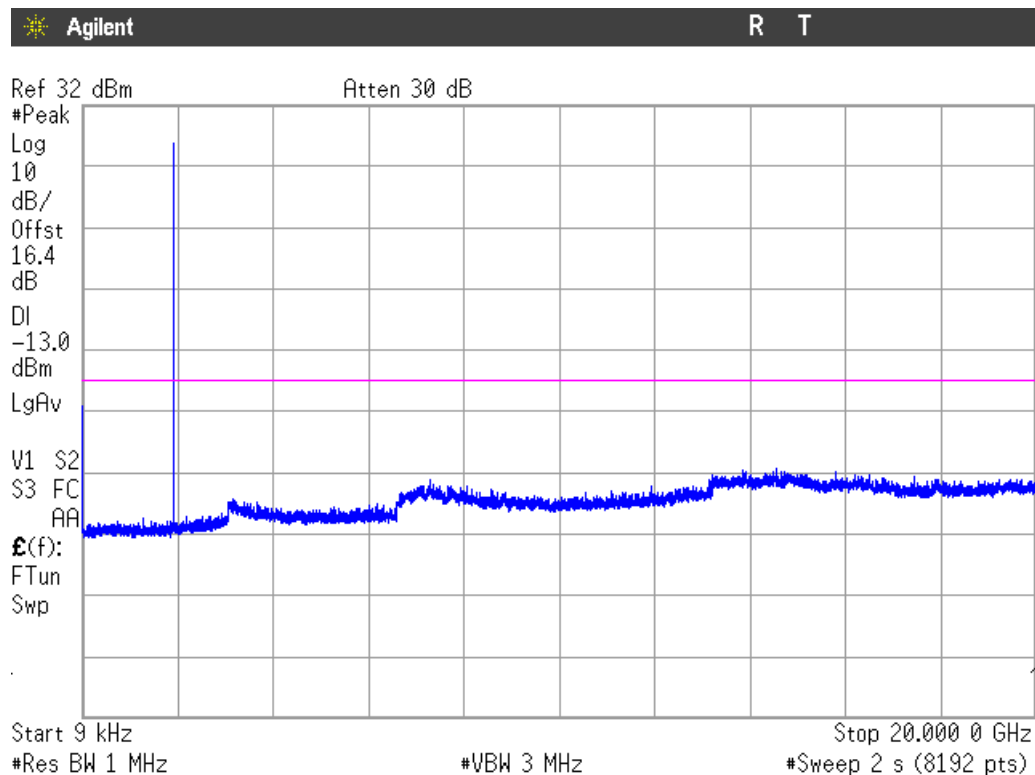


Middle Channel:



The peak above the limit is the carrier frequency.

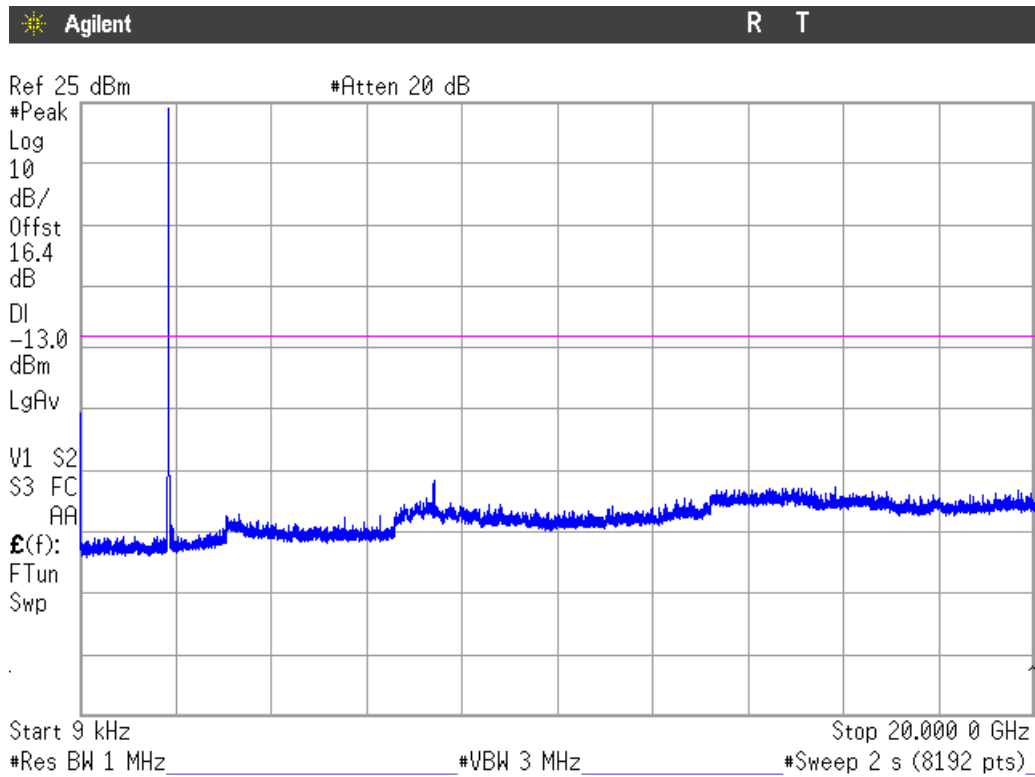
Highest Channel:



The peak above the limit is the carrier frequency.

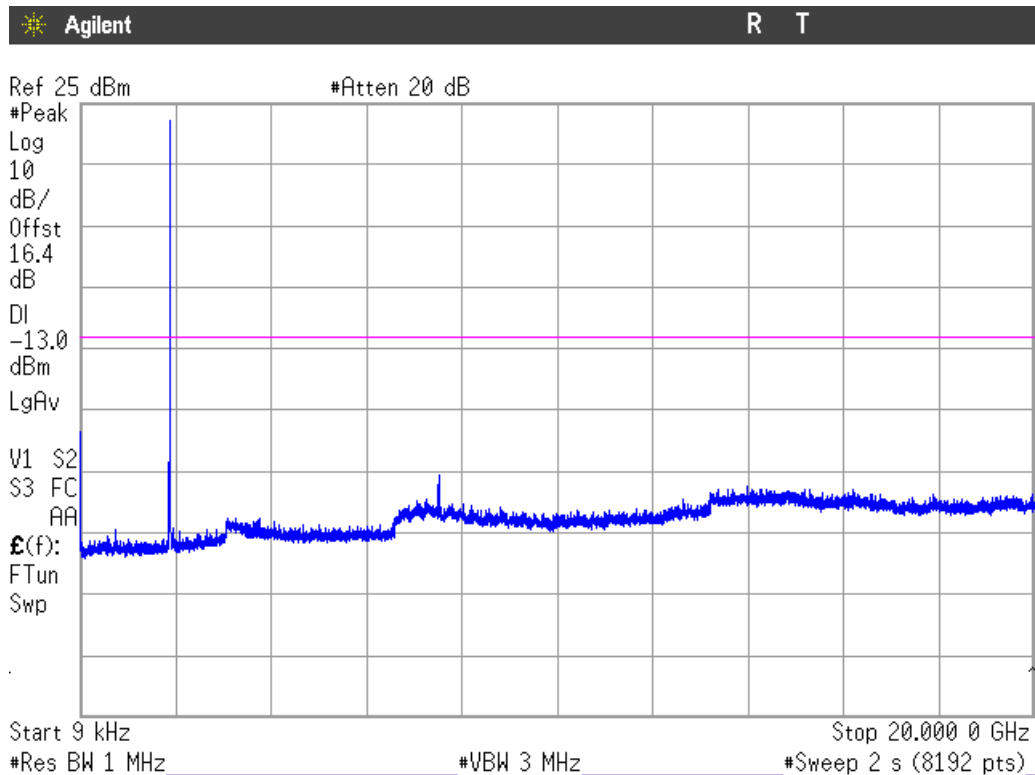
### 3G Band II. WCDMA MODULATION.

Lowest Channel:



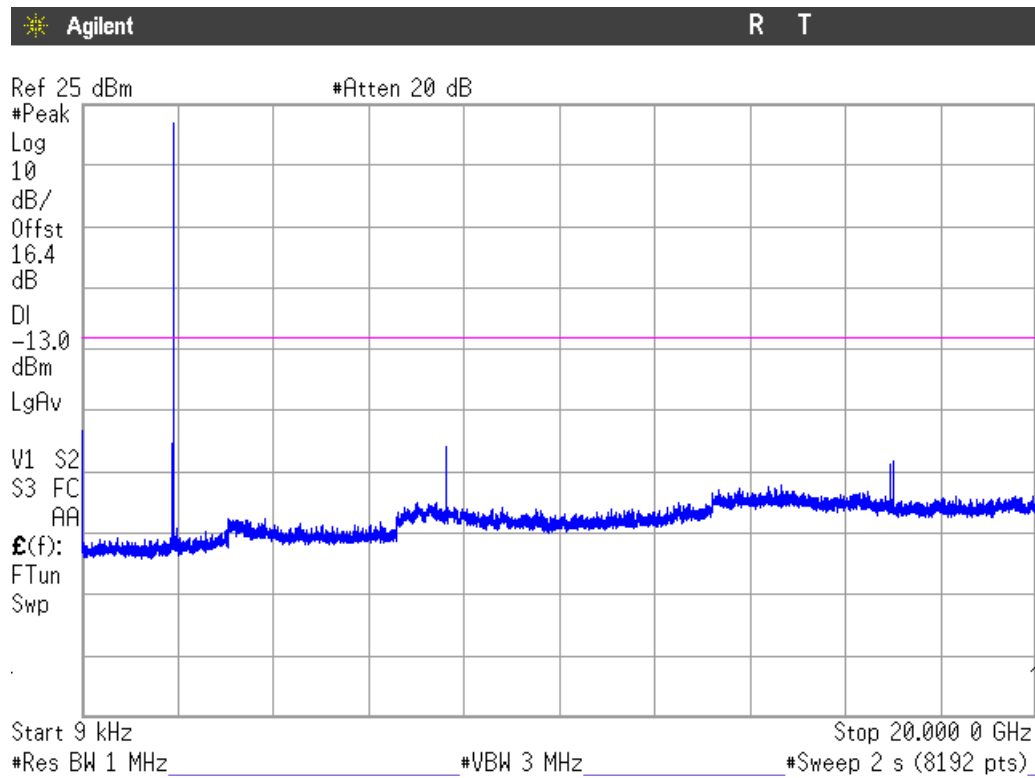
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

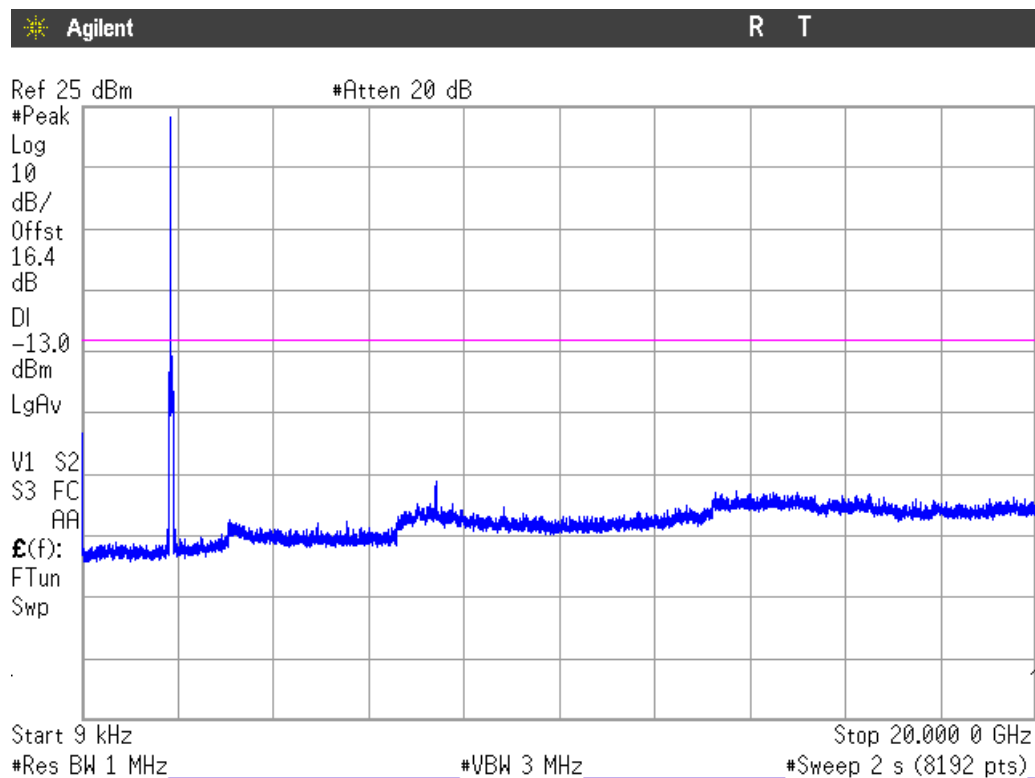
Highest Channel:



The peak above the limit is the carrier frequency.

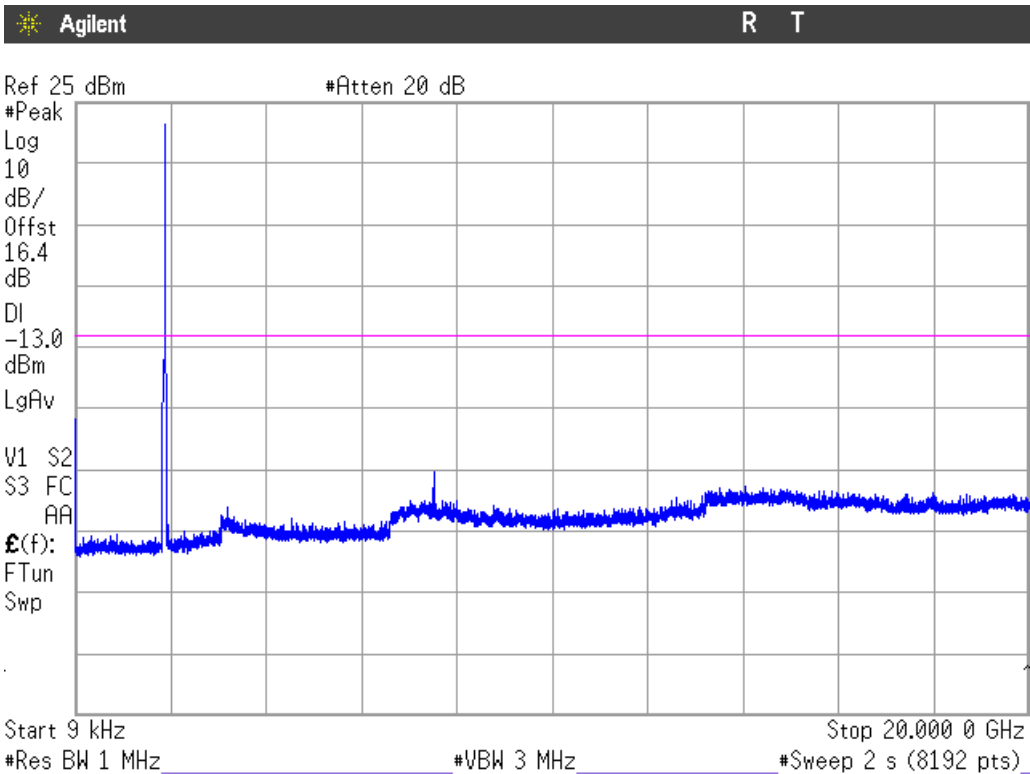
3G Band II. HSUPA MODULATION.

Lowest Channel:



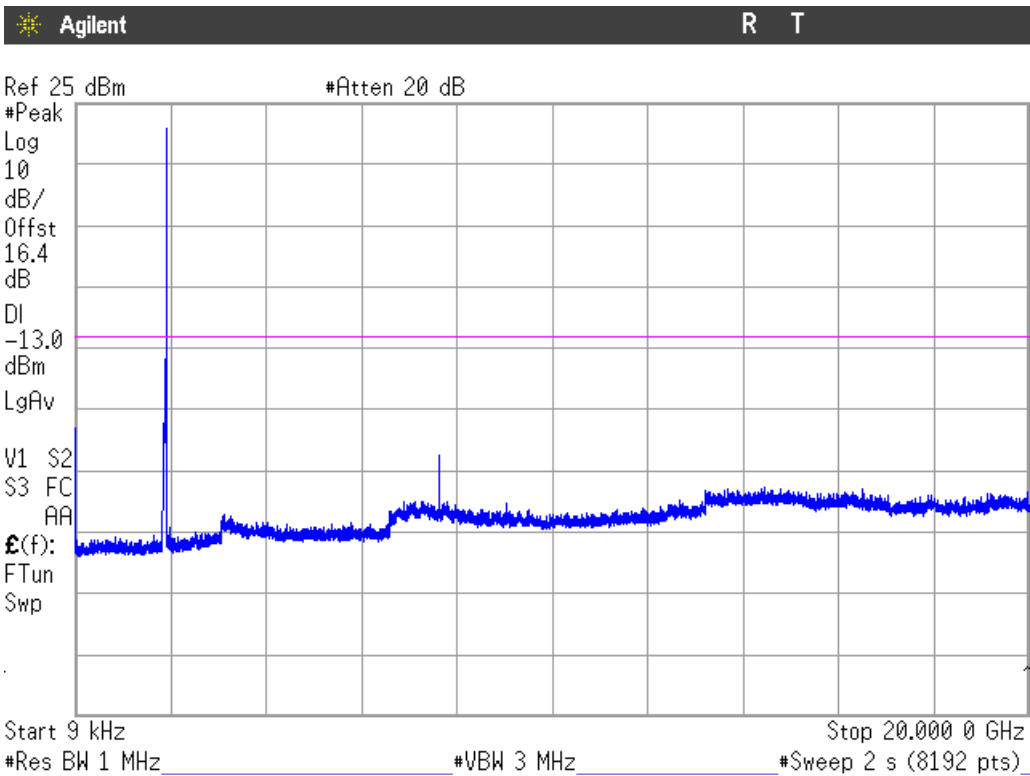
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

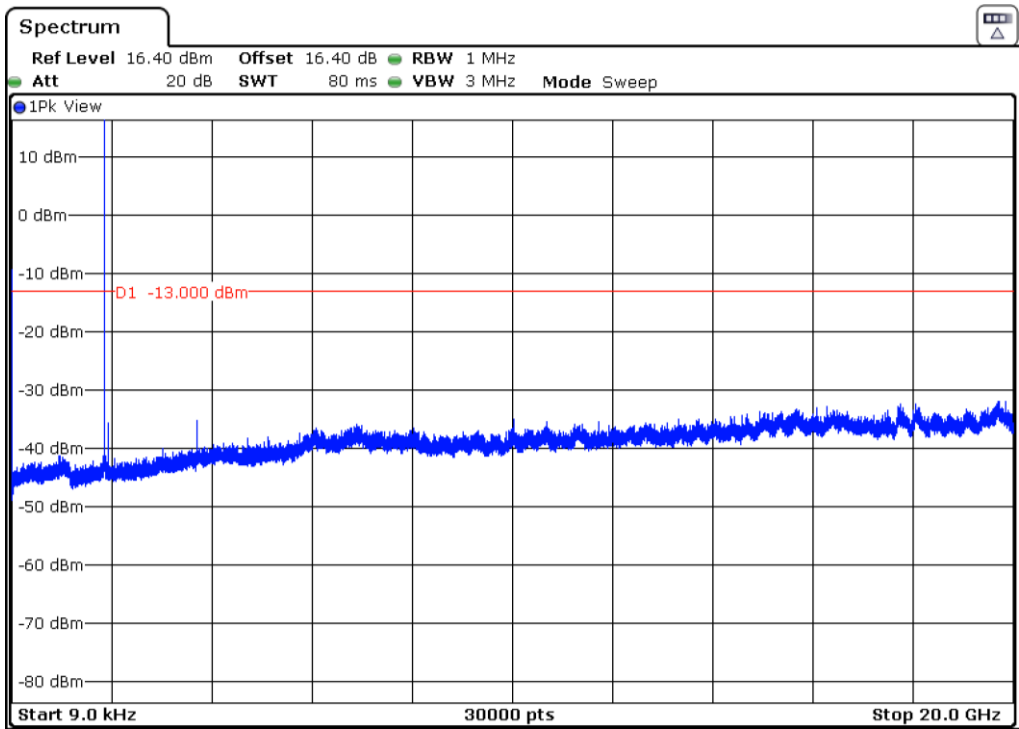
Highest Channel:



The peak above the limit is the carrier frequency.

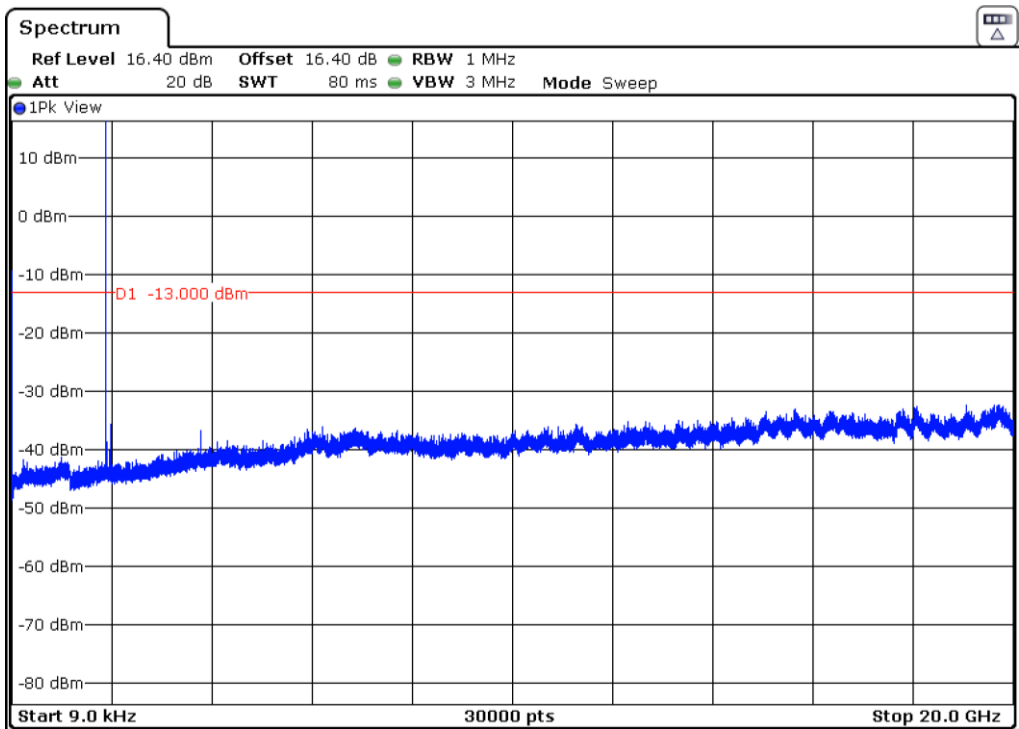
LTE Band 25. QPSK MODULATION. BW = 1.4 MHz.

Lowest Channel:



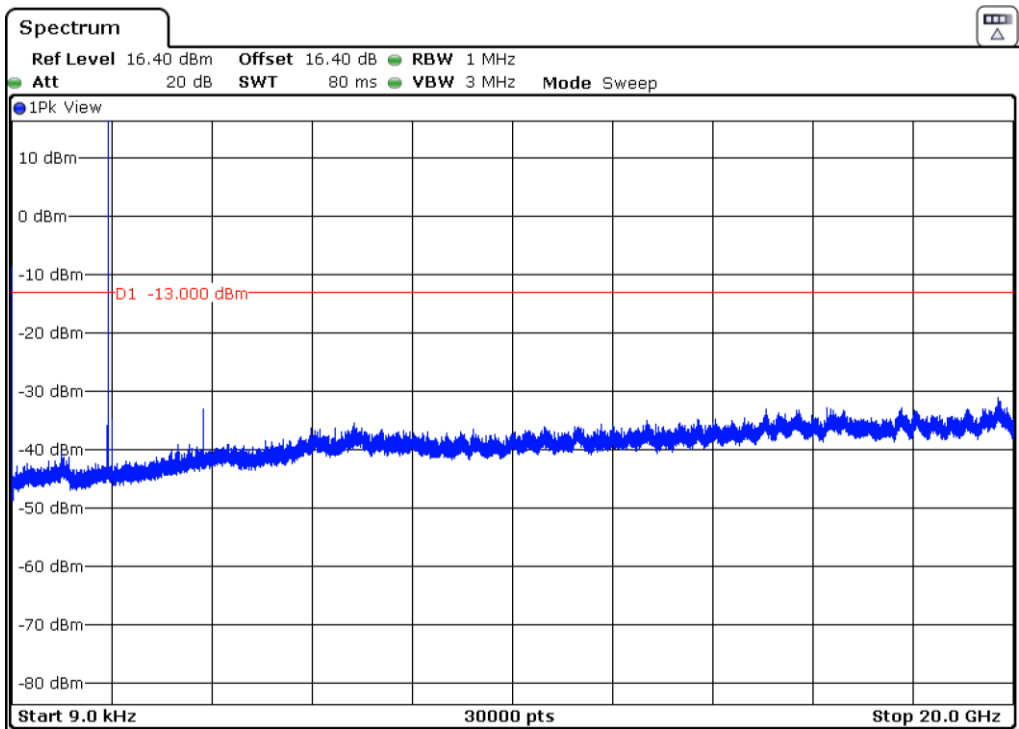
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

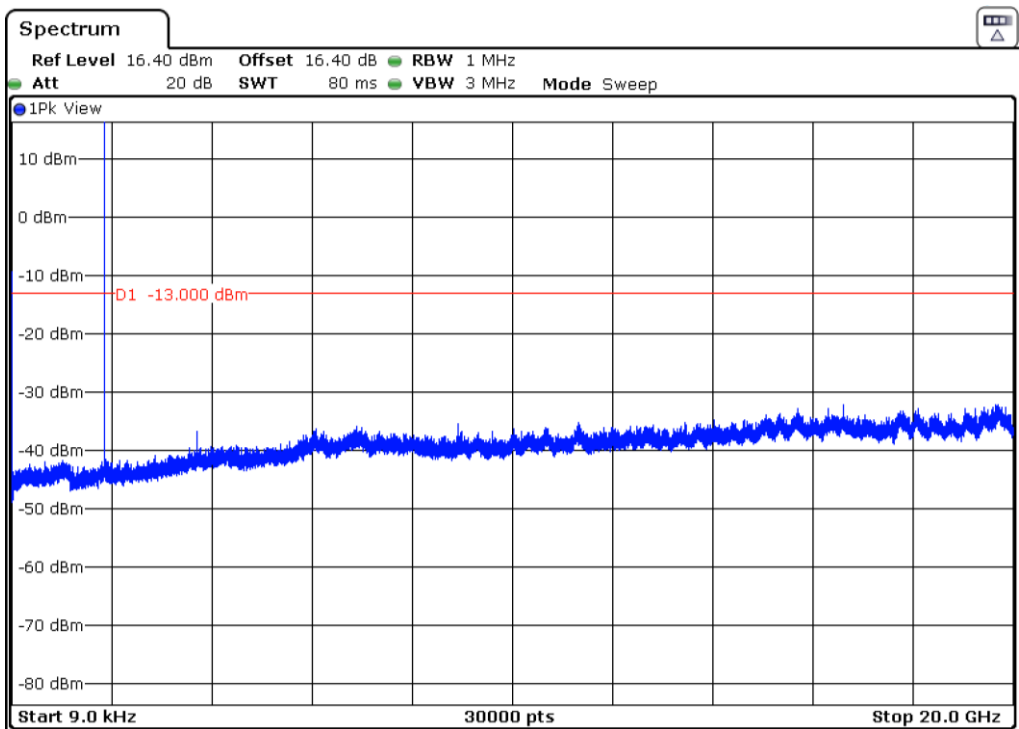
Highest Channel:



The peak above the limit is the carrier frequency.

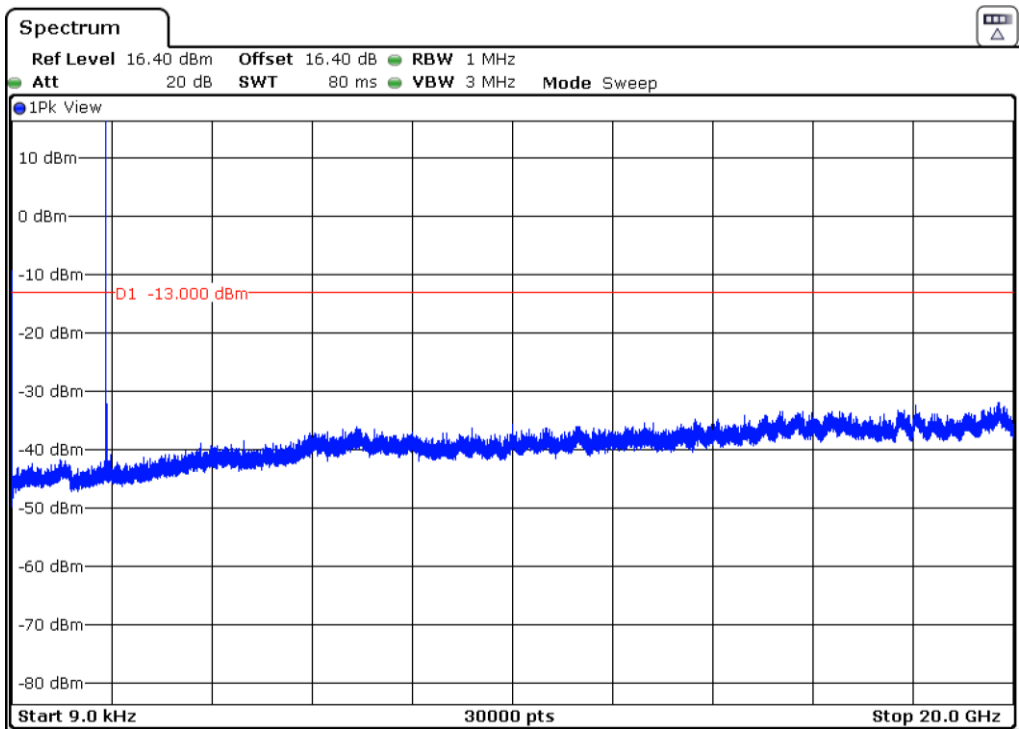
LTE Band 25. QPSK MODULATION. BW = 3 MHz.

Lowest Channel:



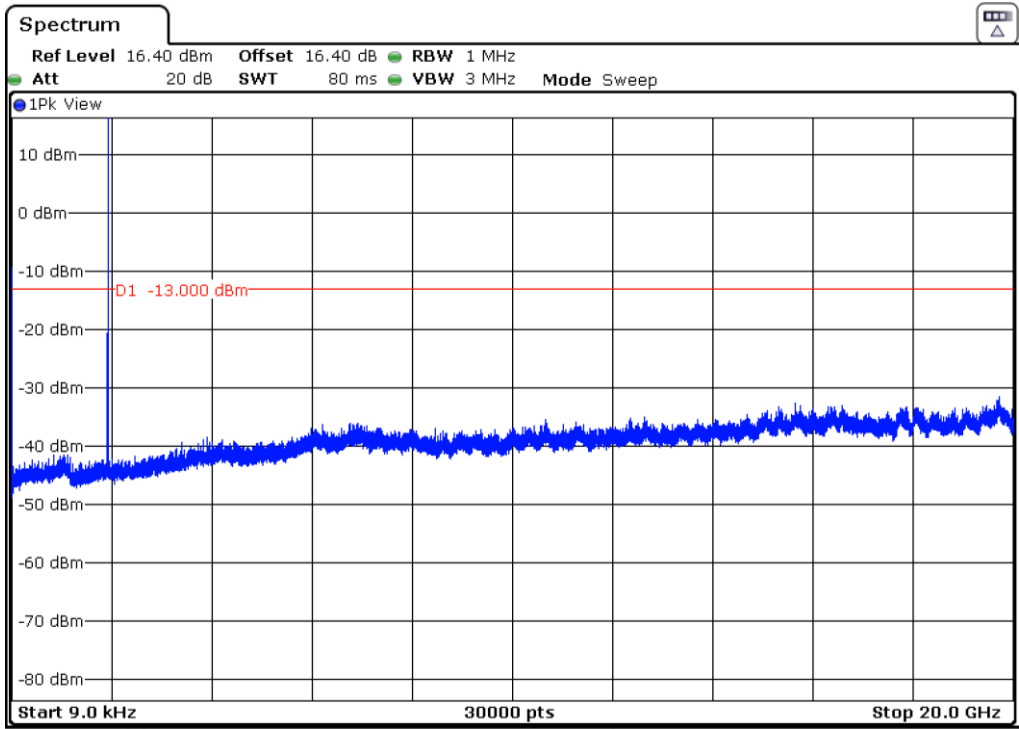
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

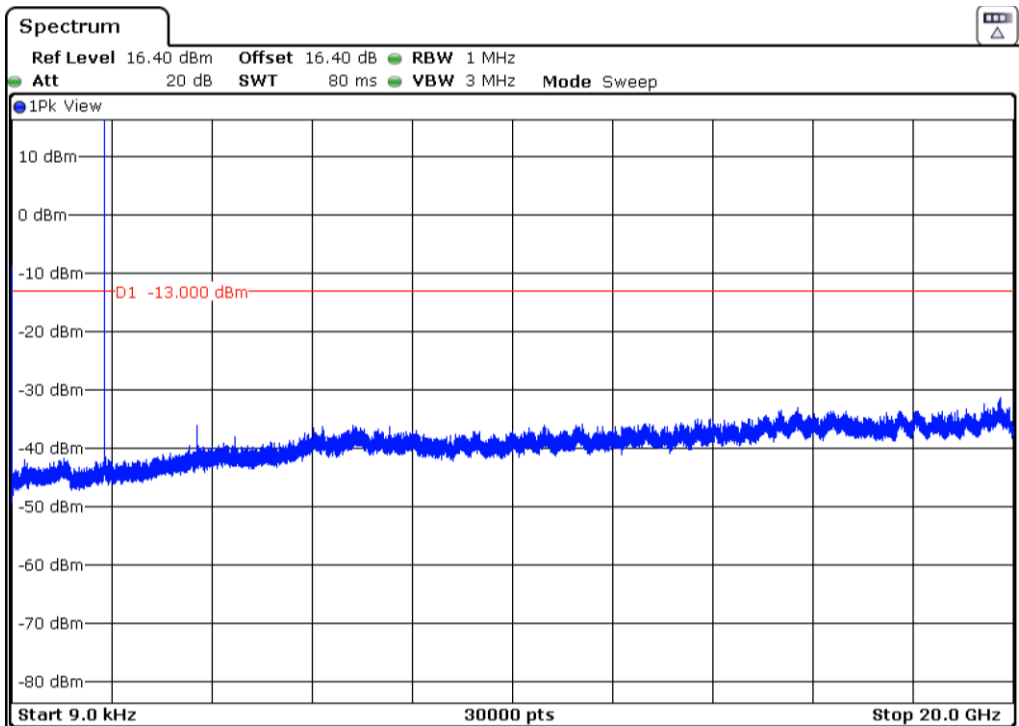
Highest Channel:



The peak above the limit is the carrier frequency.

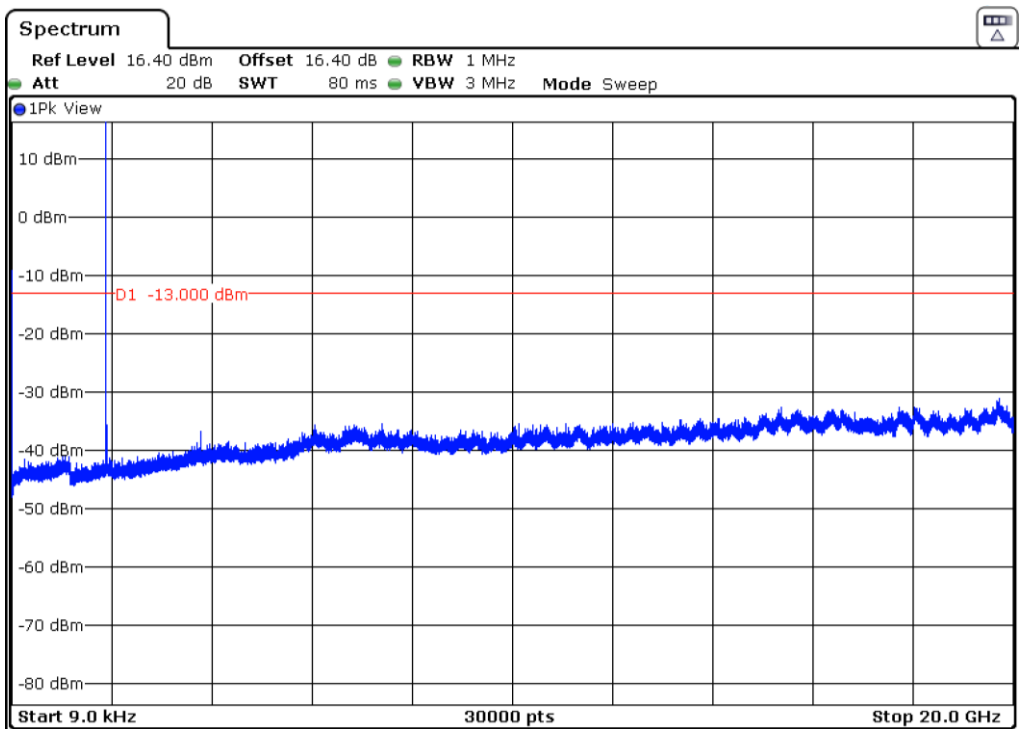
LTE Band 25. QPSK MODULATION. BW = 5 MHz.

Lowest Channel:



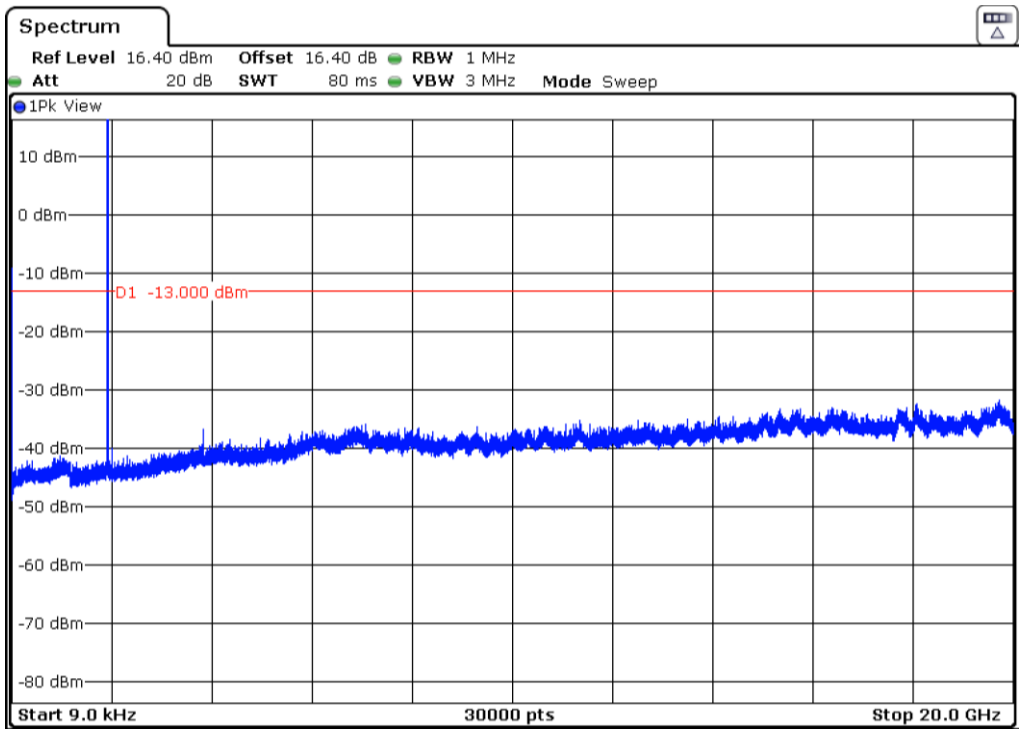
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

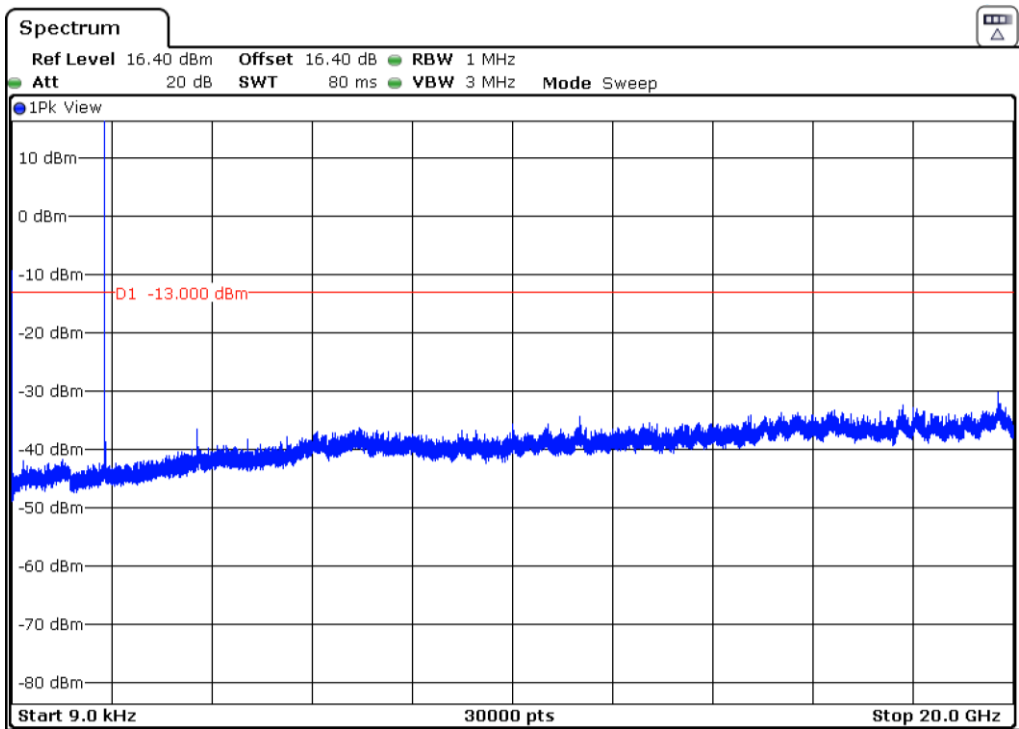
Highest Channel:



The peak above the limit is the carrier frequency.

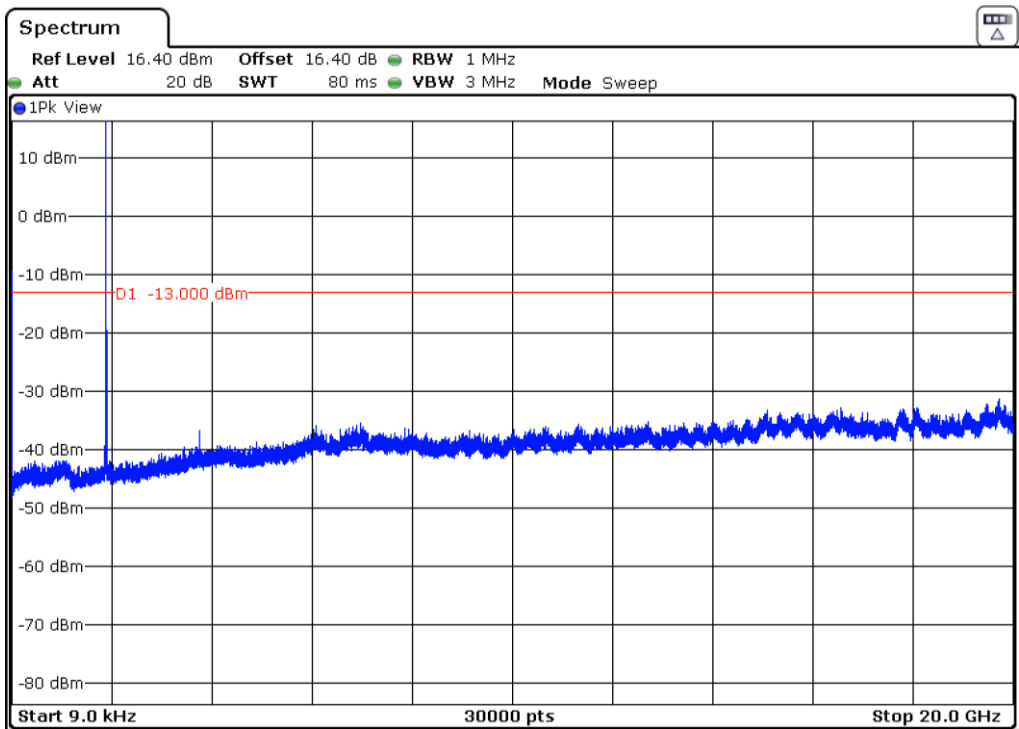
LTE Band 25. QPSK MODULATION. BW = 10 MHz.

Lowest Channel:



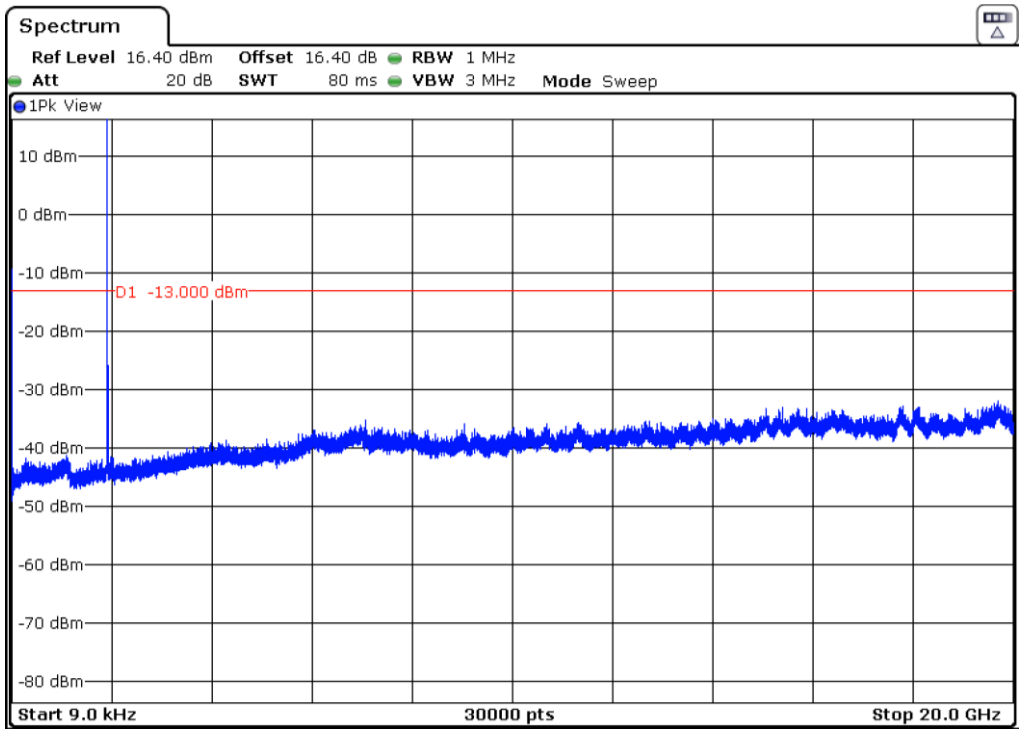
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

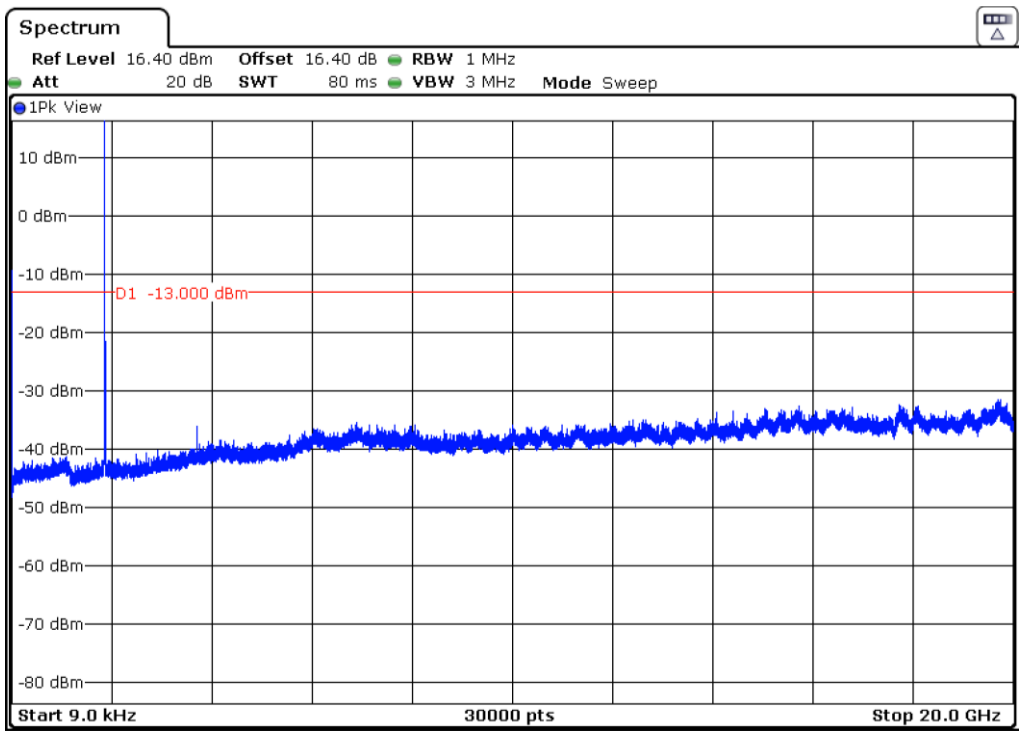
Highest Channel:



The peak above the limit is the carrier frequency.

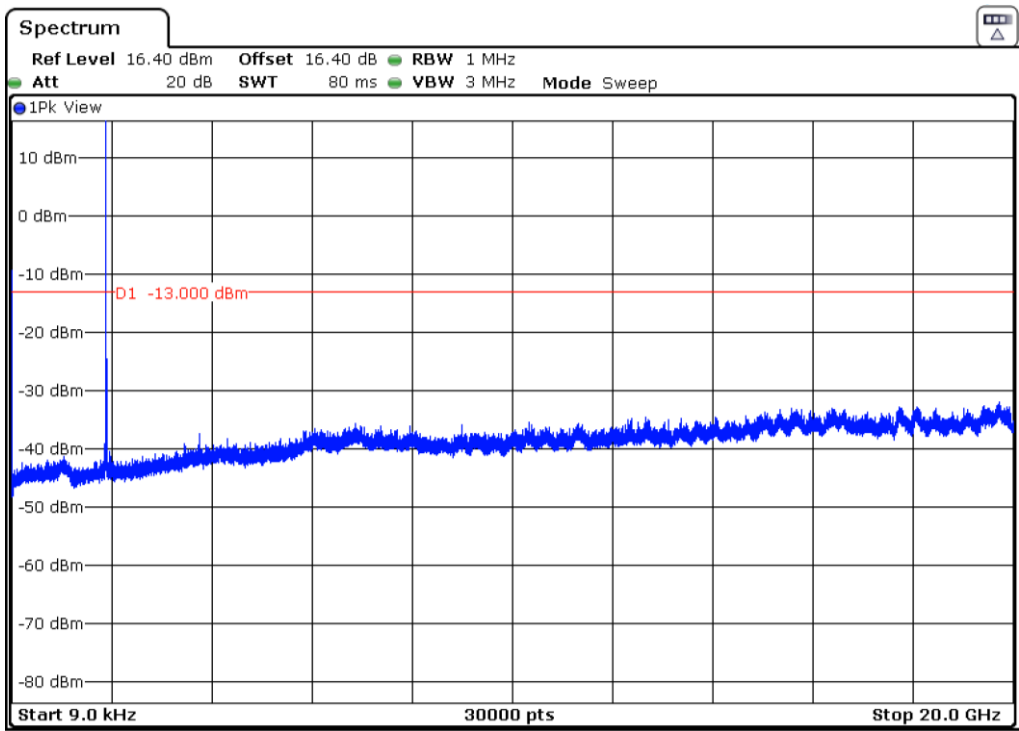
LTE Band 25. QPSK MODULATION. BW = 15 MHz.

Lowest Channel:



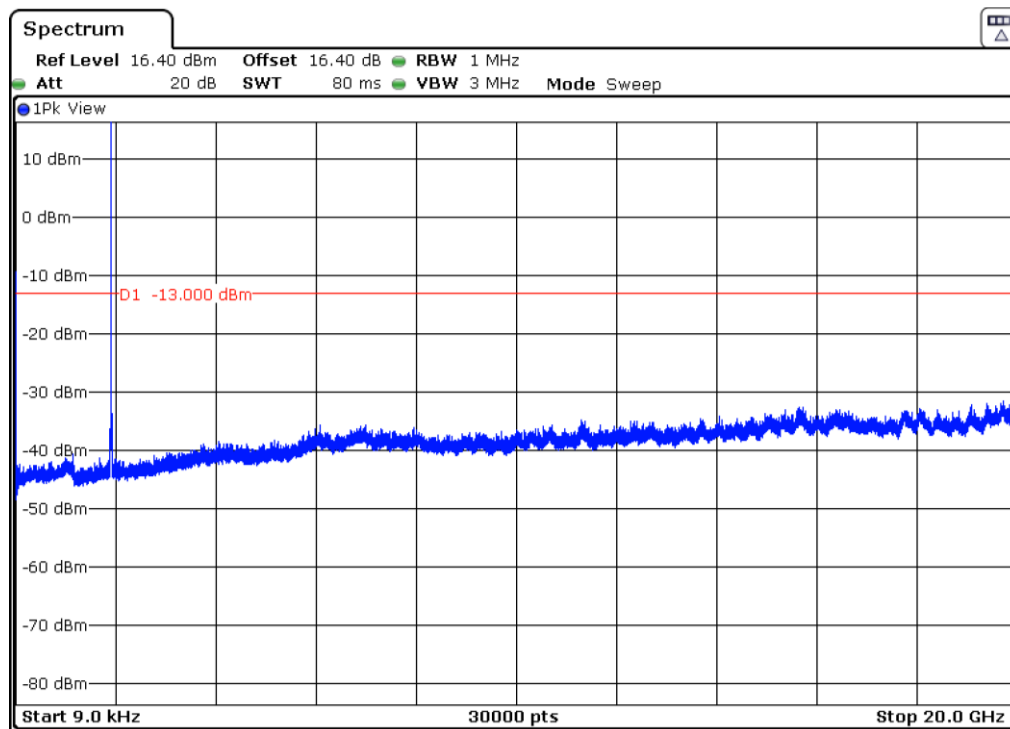
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

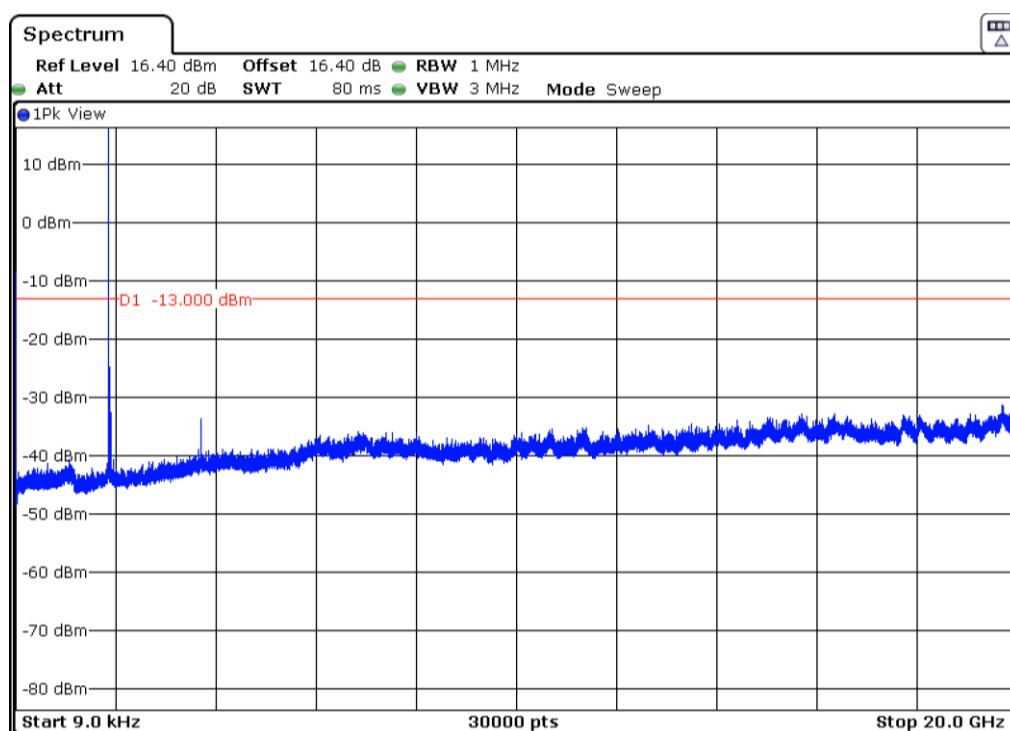
Highest Channel:



The peak above the limit is the carrier frequency.

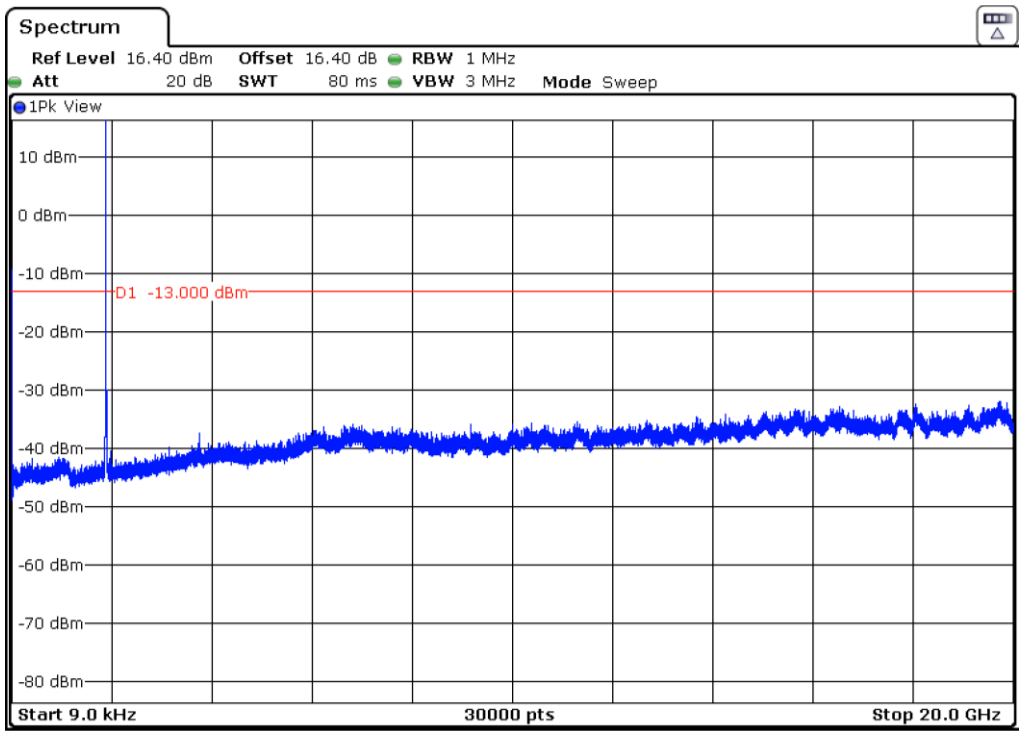
LTE Band 25. QPSK MODULATION. BW = 20 MHz.

Lowest Channel:



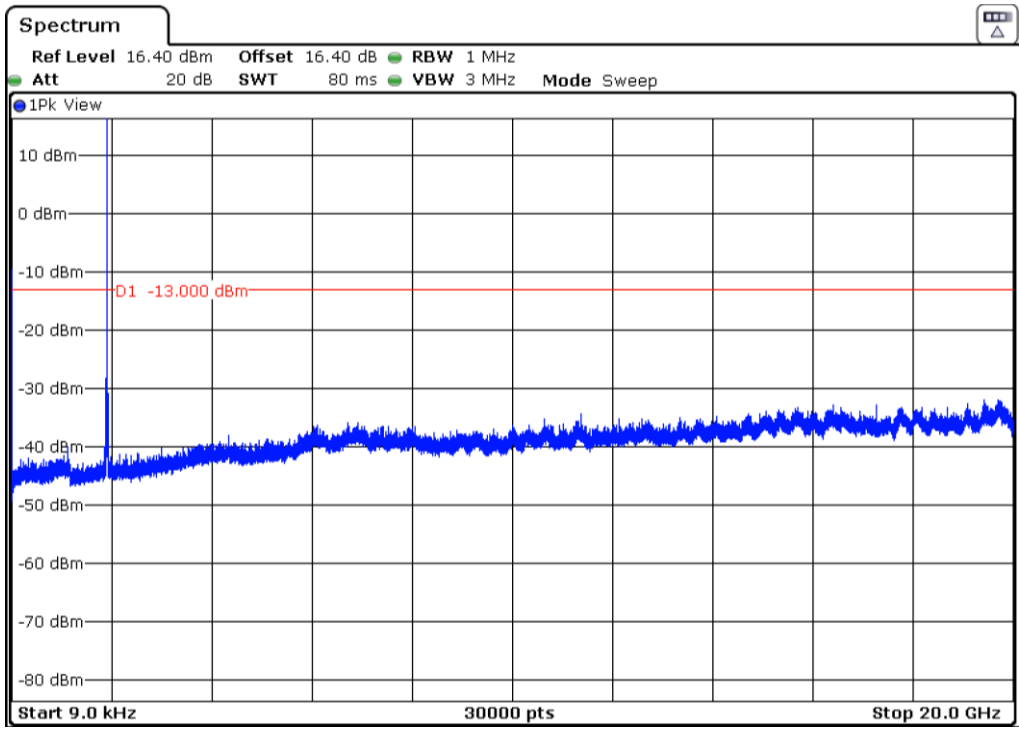
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

Highest Channel:



The peak above the limit is the carrier frequency.

## Spurious emissions at antenna terminals at Block Edges

### SPECIFICATION:

FCC §2.1051 and §24.238. RSS-133 Clause 6.5.

### 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 splitter.

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.

As indicated in FCC part 24/RSS-133. in the 1 MHz bands immediately outside and adjacent to the frequency block or band a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

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

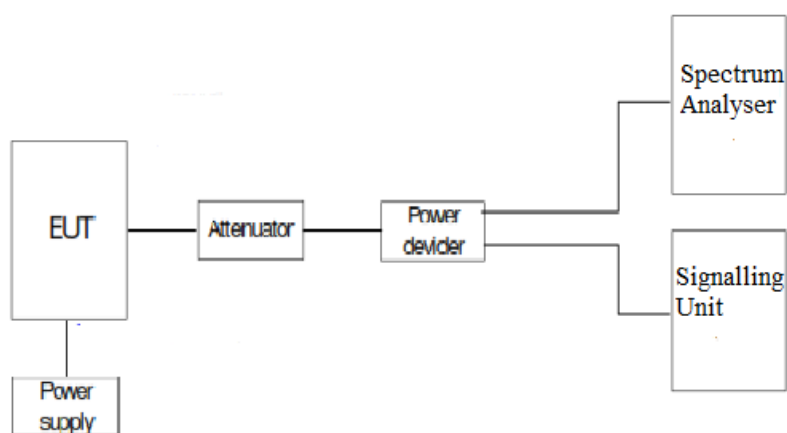
#### Measurement Limit:

According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

At  $P_o$  transmitting power. the specified minimum attenuation becomes  $43+10\log (P_o)$ . and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = -13 \text{ dBm}$$

### TEST SETUP:



## RESULTS:

### 2G Band 1900 MHz.

|                                                                          |        |        |
|--------------------------------------------------------------------------|--------|--------|
| MODULATION:                                                              | GPRS   | EDGE   |
| Maximum measured level at <u>Lowest Block Edge</u> at antenna port (dBm) | -19.70 | -27.55 |

|                                                                           |        |        |
|---------------------------------------------------------------------------|--------|--------|
| MODULATION:                                                               | GPRS   | EDGE   |
| Maximum measured level at <u>Highest Block Edge</u> at antenna port (dBm) | -22.99 | -26.77 |

### 3G Band II.

|                                                                          |        |        |
|--------------------------------------------------------------------------|--------|--------|
| MODULATION:                                                              | WCDMA  | HSUPA  |
| Maximum measured level at <u>Lowest Block Edge</u> at antenna port (dBm) | -25.17 | -24.79 |

|                                                                           |        |        |
|---------------------------------------------------------------------------|--------|--------|
| MODULATION:                                                               | WCDMA  | HSUPA  |
| Maximum measured level at <u>Highest Block Edge</u> at antenna port (dBm) | -23.35 | -29.42 |

### LTE Band 25.

|                                                                          |                                     |                                       |                                       |                                        |                                        |                                        |
|--------------------------------------------------------------------------|-------------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| LTE QPSK MODULATION:                                                     | RB=1.<br>Offset=0.<br>BW=1.4<br>MHz | RB=1 .<br>Offset =0.<br>BW = 3<br>MHz | RB=1 .<br>Offset =0.<br>BW = 5<br>MHz | RB=1 .<br>Offset =0.<br>BW = 10<br>MHz | RB=1 .<br>Offset =0.<br>BW = 15<br>MHz | RB=1 .<br>Offset =0.<br>BW = 20<br>MHz |
| Maximum measured level at <u>Lowest Block Edge</u> at antenna port (dBm) | -32.85                              | -18.94                                | -24.28                                | -33.15                                 | -33.9                                  | -33.34                                 |

|                                                                          |                                        |                                         |                                         |                                          |                                          |                                          |
|--------------------------------------------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| LTE QPSK MODULATION:                                                     | RB= All.<br>Offset=0.<br>BW=1.4<br>MHz | RB= All.<br>Offset =0.<br>BW = 3<br>MHz | RB= All.<br>Offset =0.<br>BW = 5<br>MHz | RB= All.<br>Offset =0.<br>BW = 10<br>MHz | RB= All.<br>Offset =0.<br>BW = 15<br>MHz | RB= All.<br>Offset =0.<br>BW = 20<br>MHz |
| Maximum measured level at <u>Lowest Block Edge</u> at antenna port (dBm) | -38.23                                 | -24.85                                  | -27.90                                  | -30.28                                   | -28.81                                   | -30.98                                   |

| LTE QPSK<br>MODULATION:                                                         | RB=1.<br>Offset=Max.<br>BW =1.4<br>MHz | RB=1.<br>Offset=Max.<br>BW = 3<br>MHz | RB=1 .<br>Offset=Max.<br>BW = 5<br>MHz | RB=1 .<br>Offset=Max.<br>BW = 10<br>MHz | RB=1 .<br>Offset=Max.<br>BW = 15<br>MHz | RB=1 .<br>Offset=Max.<br>BW = 20<br>MHz |
|---------------------------------------------------------------------------------|----------------------------------------|---------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|
| Maximum measured level<br>at <u>Highest Block Edge</u> at<br>antenna port (dBm) | -36.56                                 | -22.91                                | -28.39                                 | -36.57                                  | -34.11                                  | -37.31                                  |

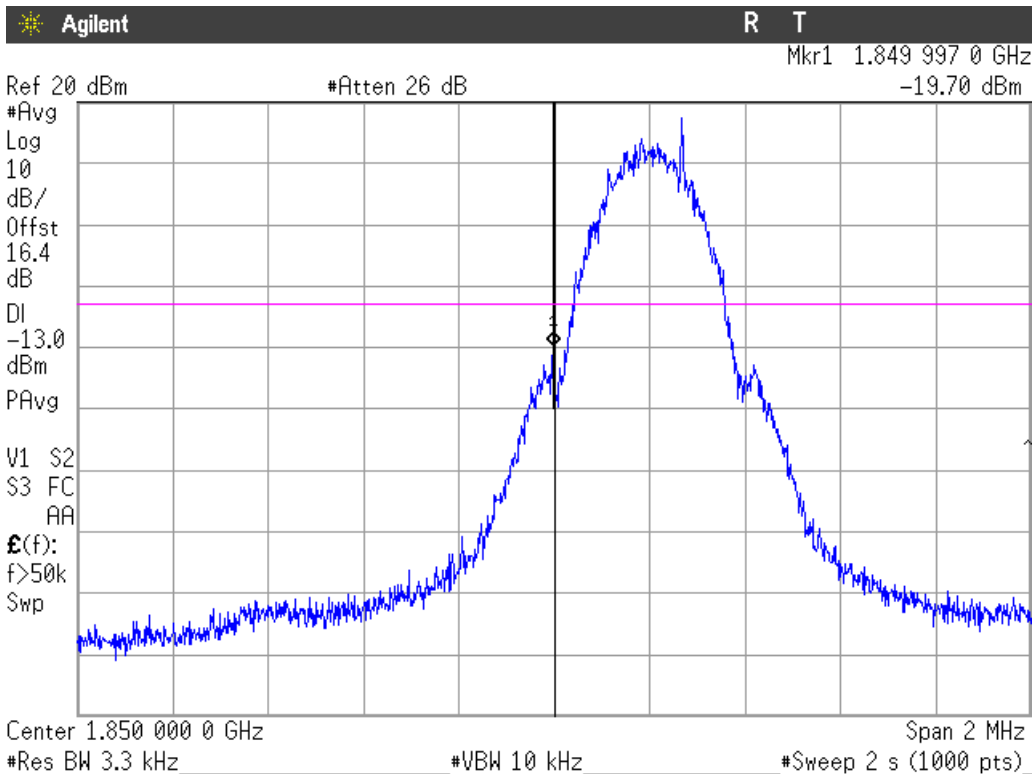
| LTE QPSK<br>MODULATION:                                                         | RB= All.<br>Offset=0.<br>BW=1.4<br>MHz | RB= All.<br>Offset =0.<br>BW = 3<br>MHz | RB= All.<br>Offset =0.<br>BW = 5<br>MHz | RB= All.<br>Offset =0.<br>BW = 10<br>MHz | RB= All.<br>Offset =0.<br>BW = 15<br>MHz | RB= All.<br>Offset =0.<br>BW = 20<br>MHz |
|---------------------------------------------------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| Maximum measured level<br>at <u>Highest Block Edge</u> at<br>antenna port (dBm) | -40.93                                 | -28.03                                  | -32.12                                  | -30.08                                   | -25.76                                   | -23.62                                   |

Measurement uncertainty:  $\leq \pm 2.03$  dB

Verdict: PASS

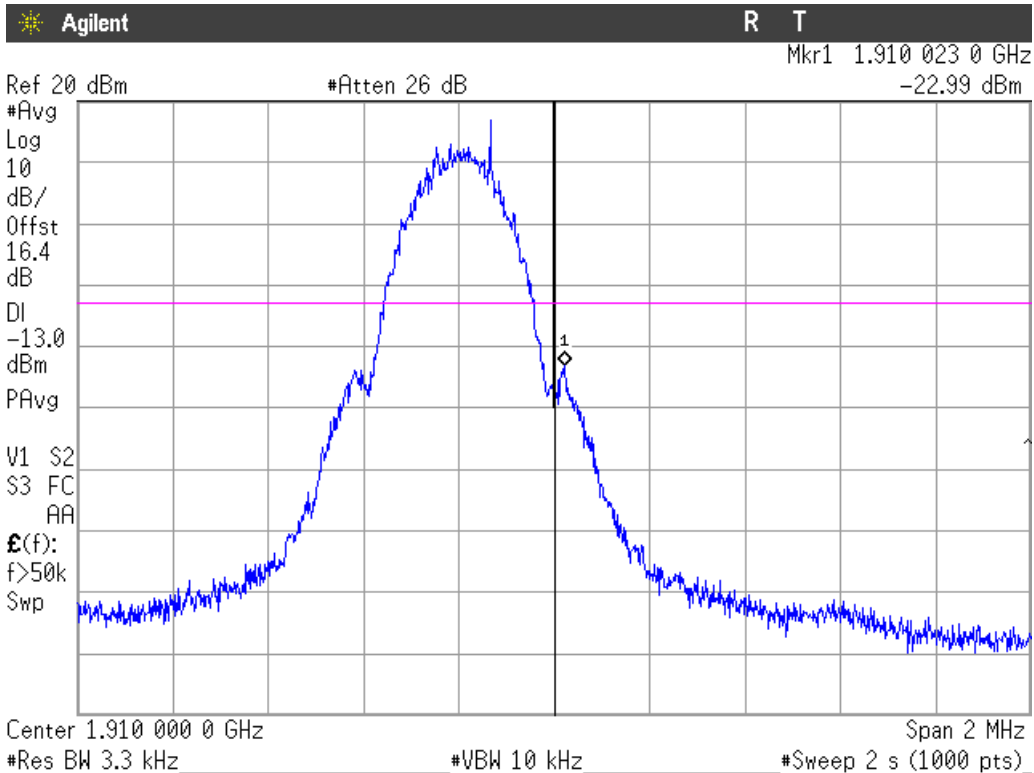
2G Band 1900 MHz. GPRS MODULATION.

Lowest Channel:



The equipment transmits at the maximum output power

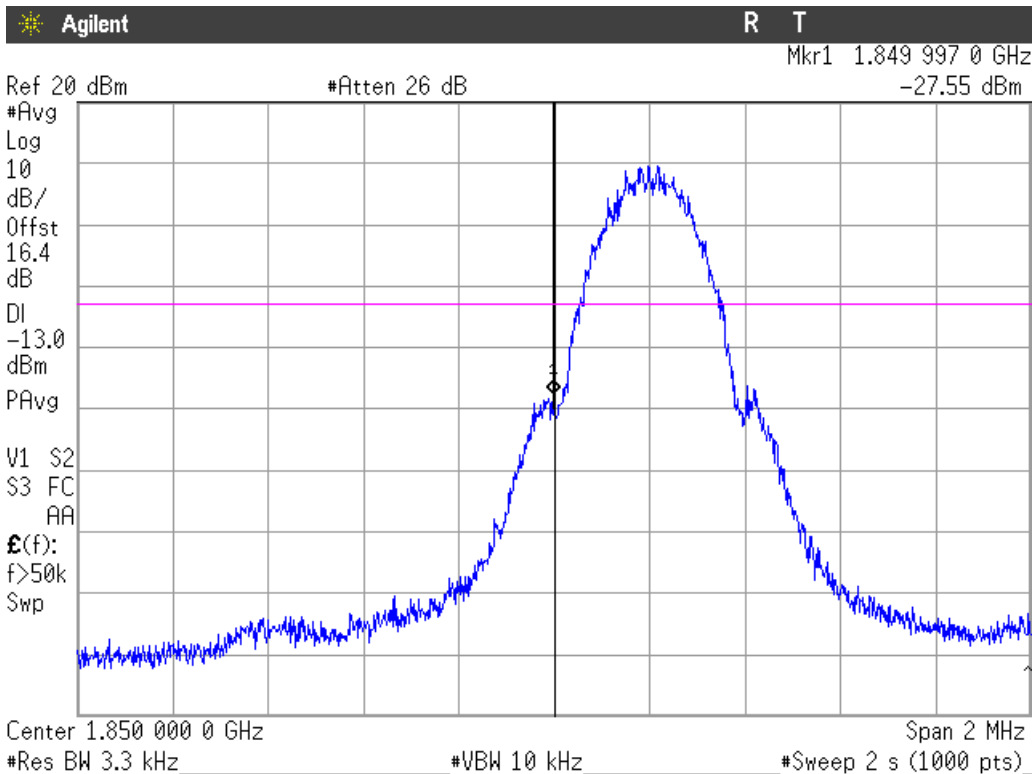
Highest Channel:



The equipment transmits at the maximum output power

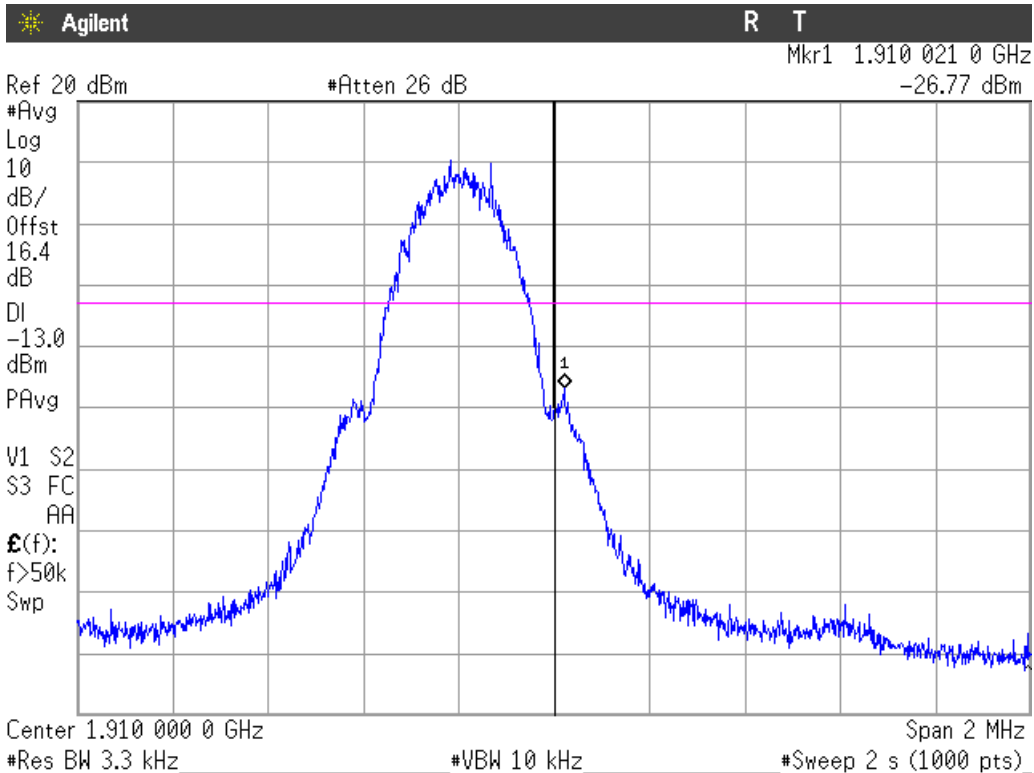
2G Band 1900 MHz. EDGE MODULATION.

Lowest Channel:



The equipment transmits at the maximum output power

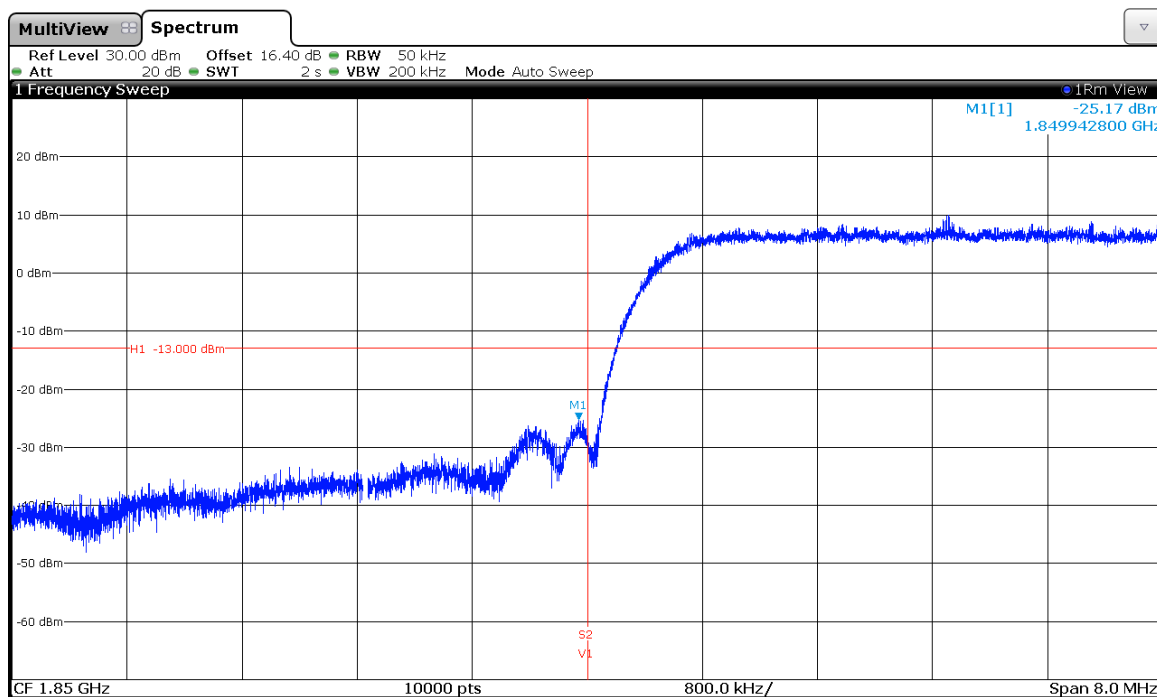
Highest Channel:



The equipment transmits at the maximum output power

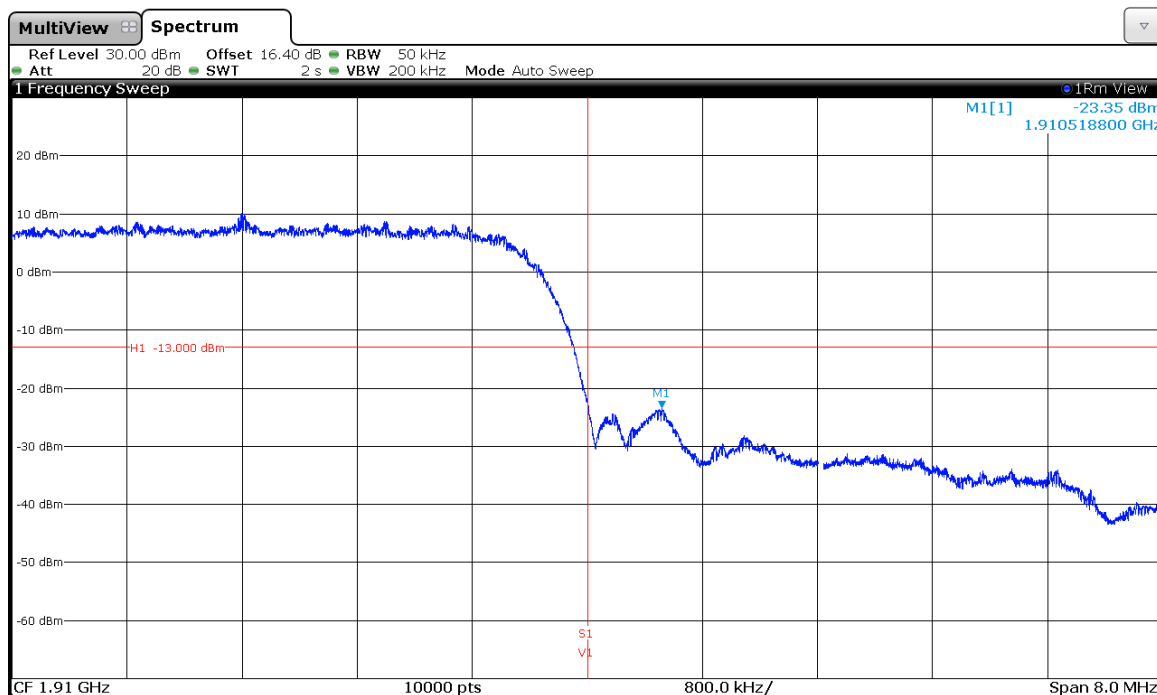
### 3G Band II. WCDMA MODULATION.

Lowest Channel:



The equipment transmits at the maximum output power

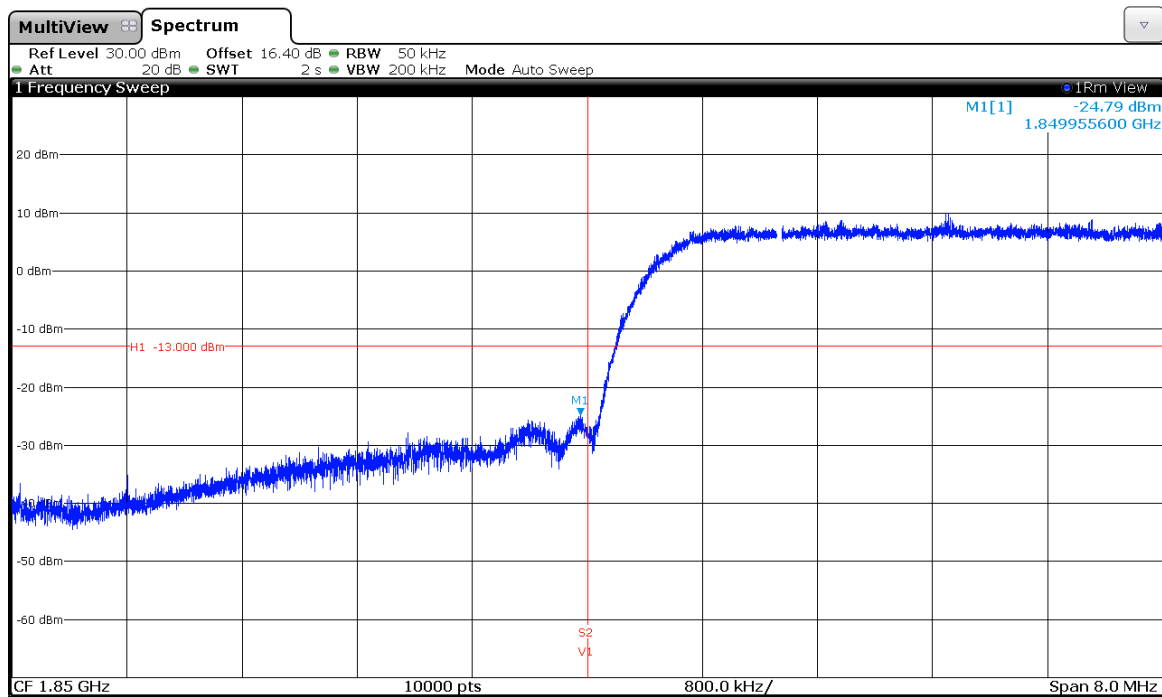
Highest Channel:



The equipment transmits at the maximum output power

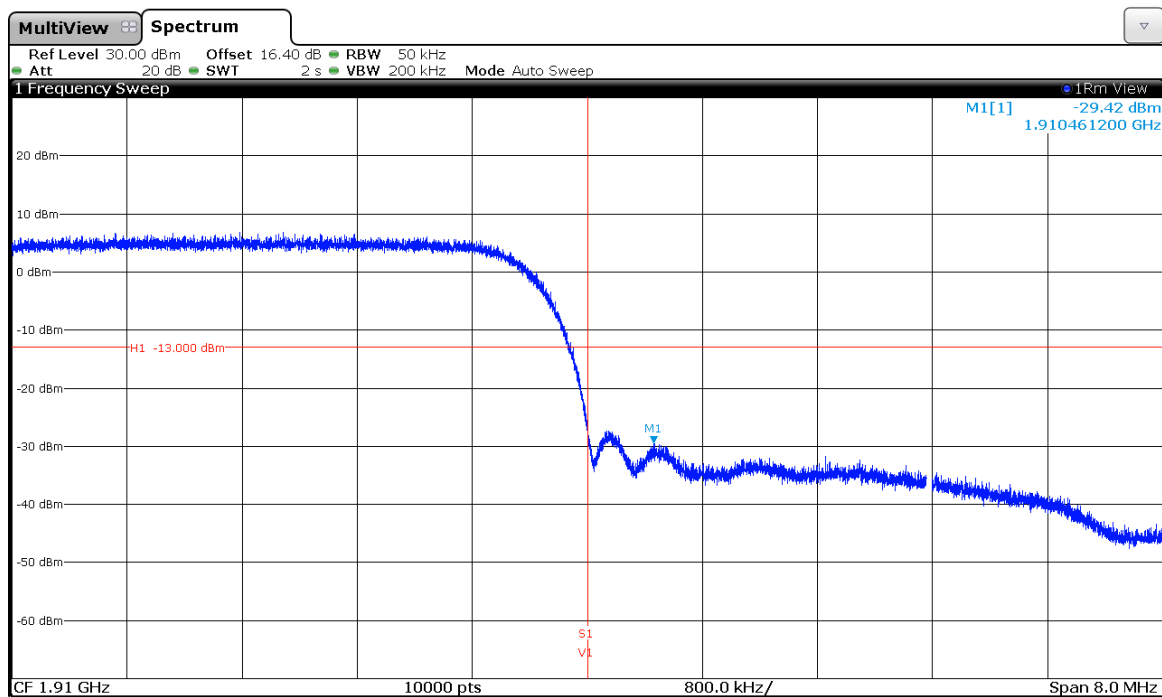
### 3G Band II. HSUPA MODULATION.

Lowest Channel:



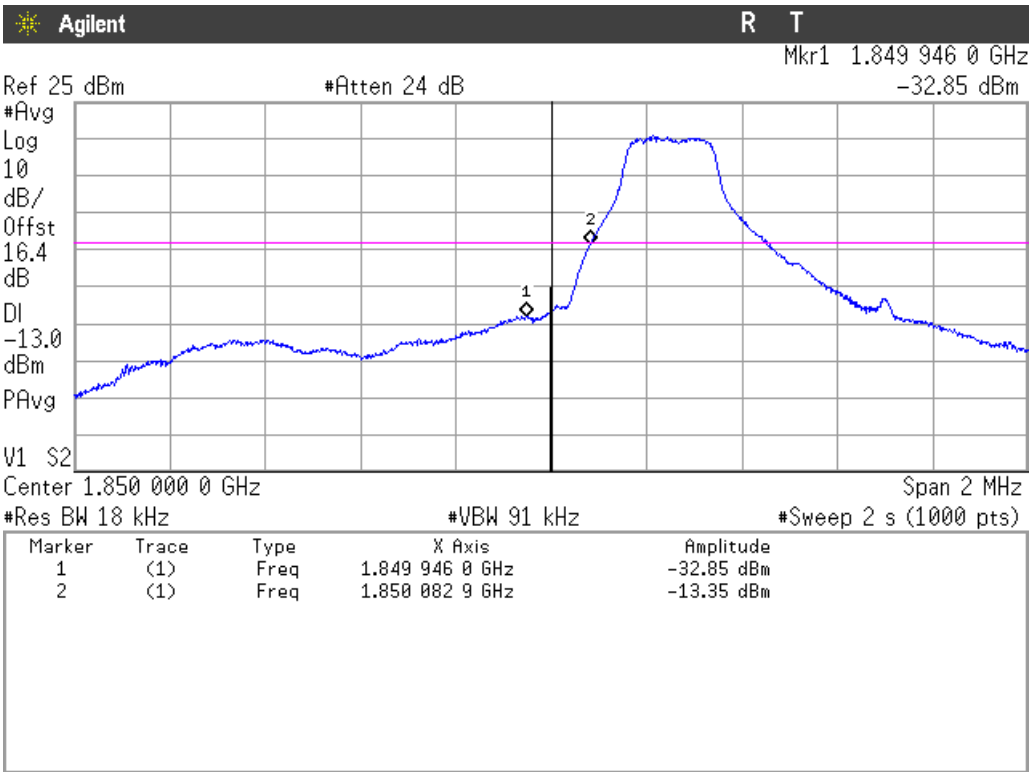
The equipment transmits at the maximum output power

Highest Channel:



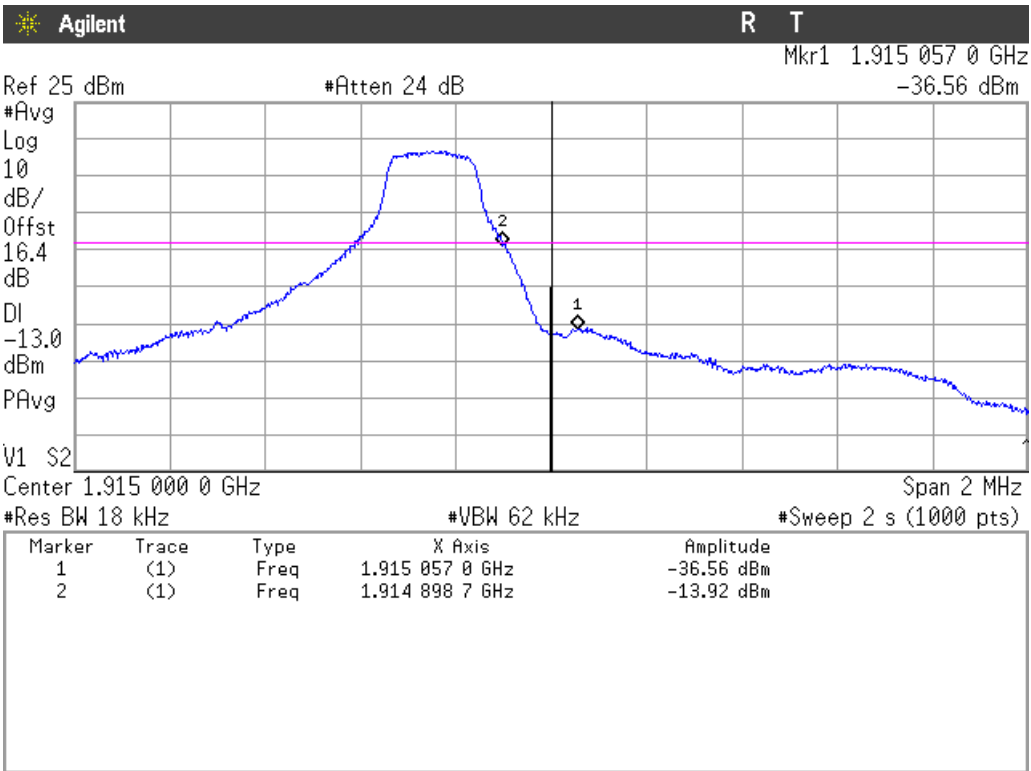
The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=1.4 MHz. RB=1. Offset=0. Lowest Block Edge:



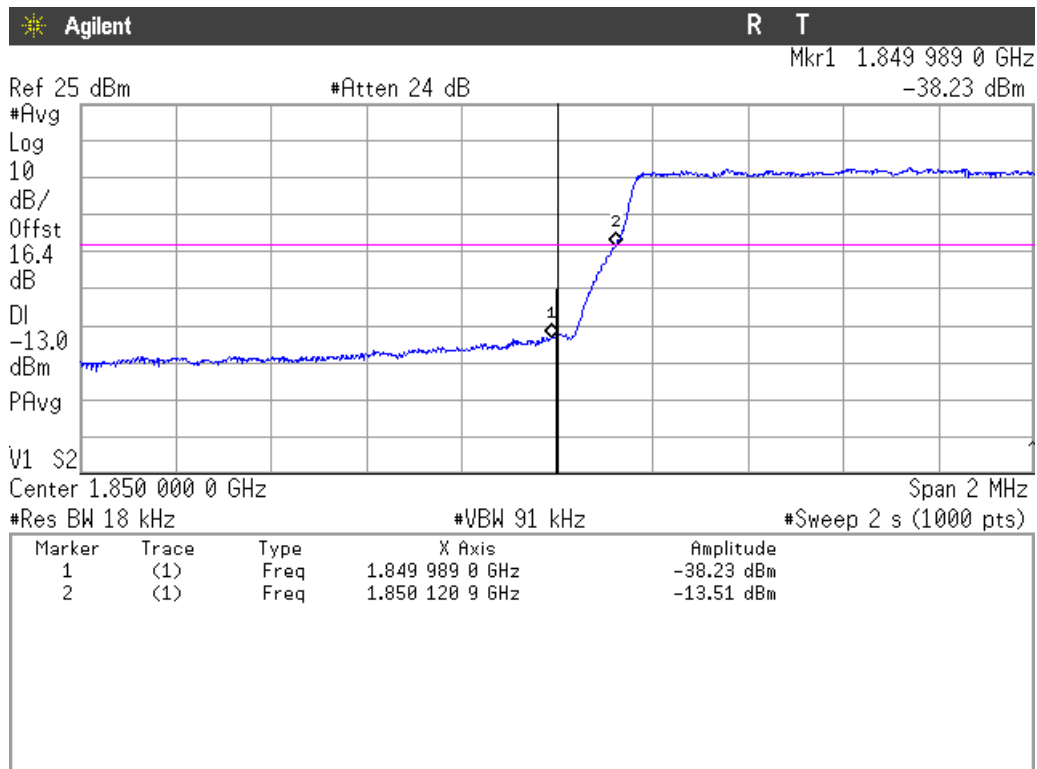
The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=1.4 MHz. RB=1. Offset=Max. Highest Block Edge:

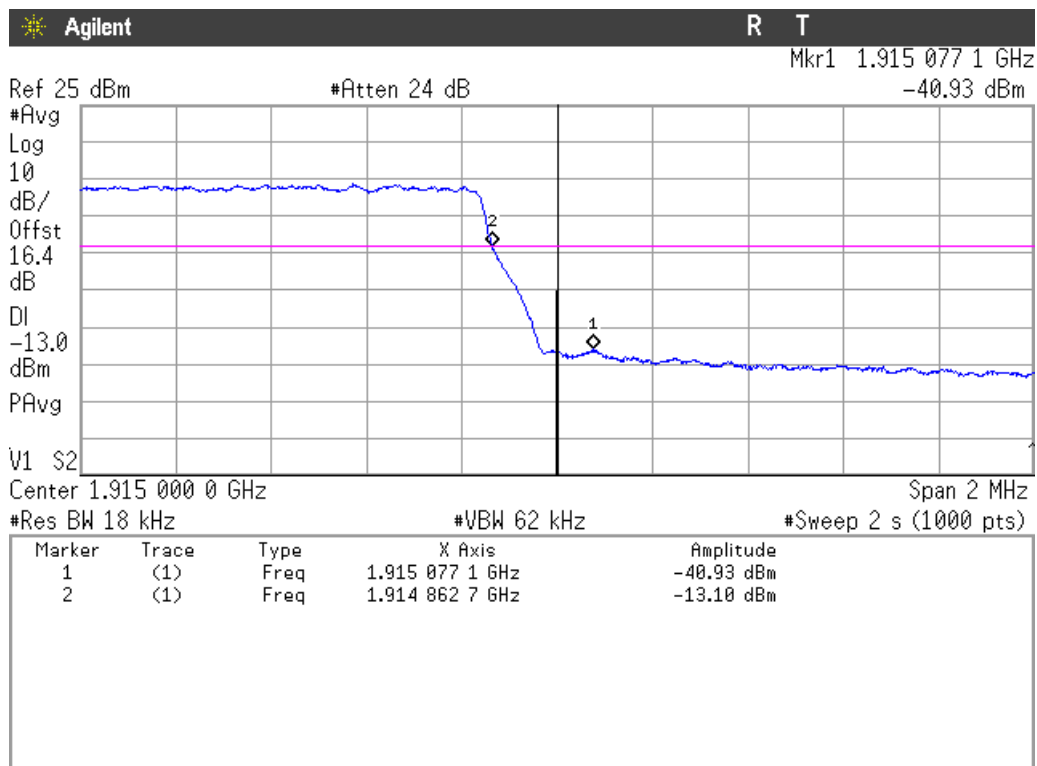


The equipment transmits at the maximum output power

**LTE Band 25. QPSK MODULATION. BW=1.4 MHz. RB=All. Offset=0. Lowest and Highest Block Edges:**



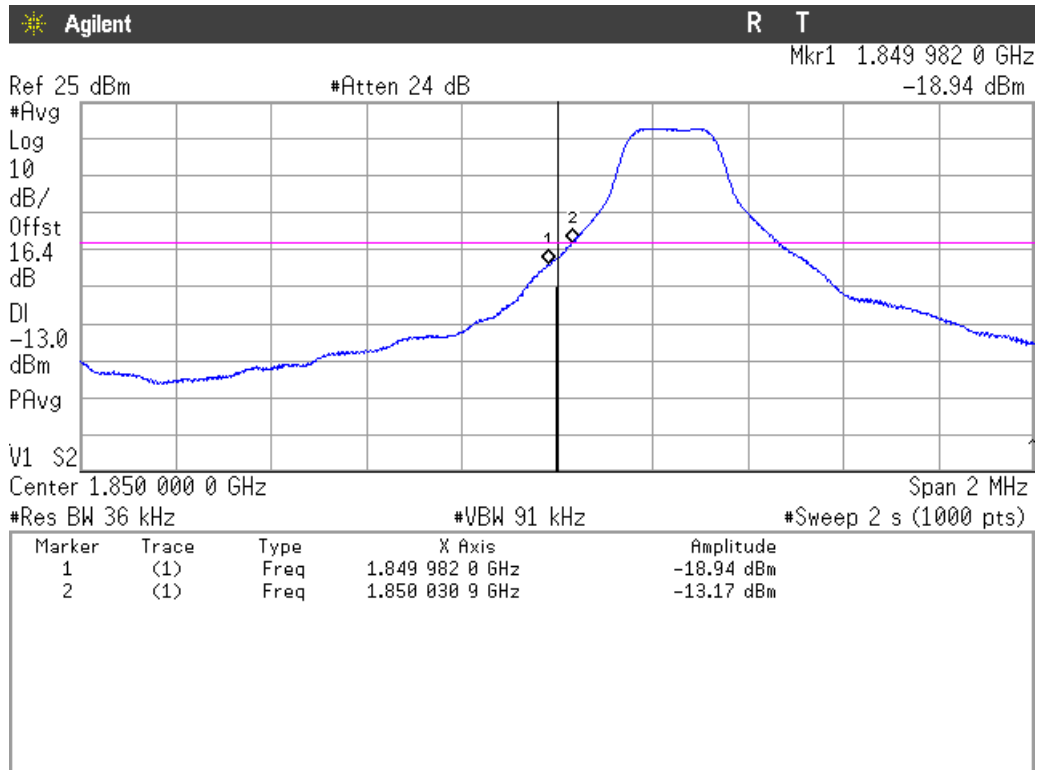
The equipment transmits at the maximum output power



The equipment transmits at the maximum output power

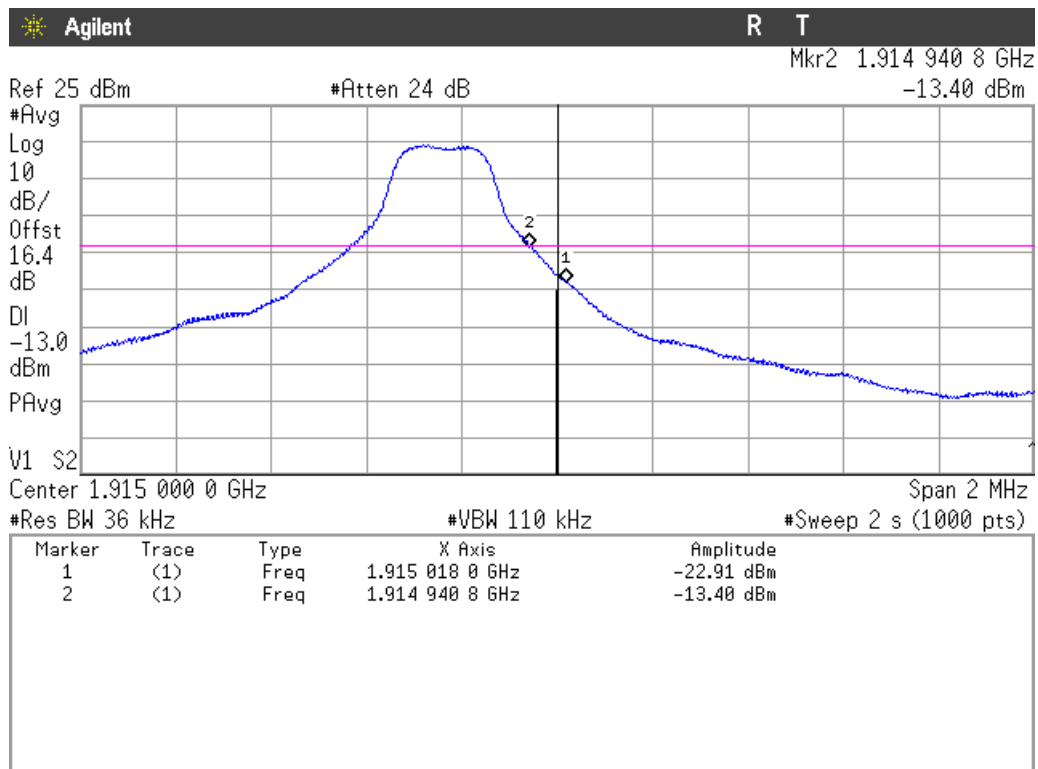
Verdict: PASS

LTE Band 25. QPSK MODULATION. BW=3 MHz. RB=1. Offset=0. Lowest Block Edge:



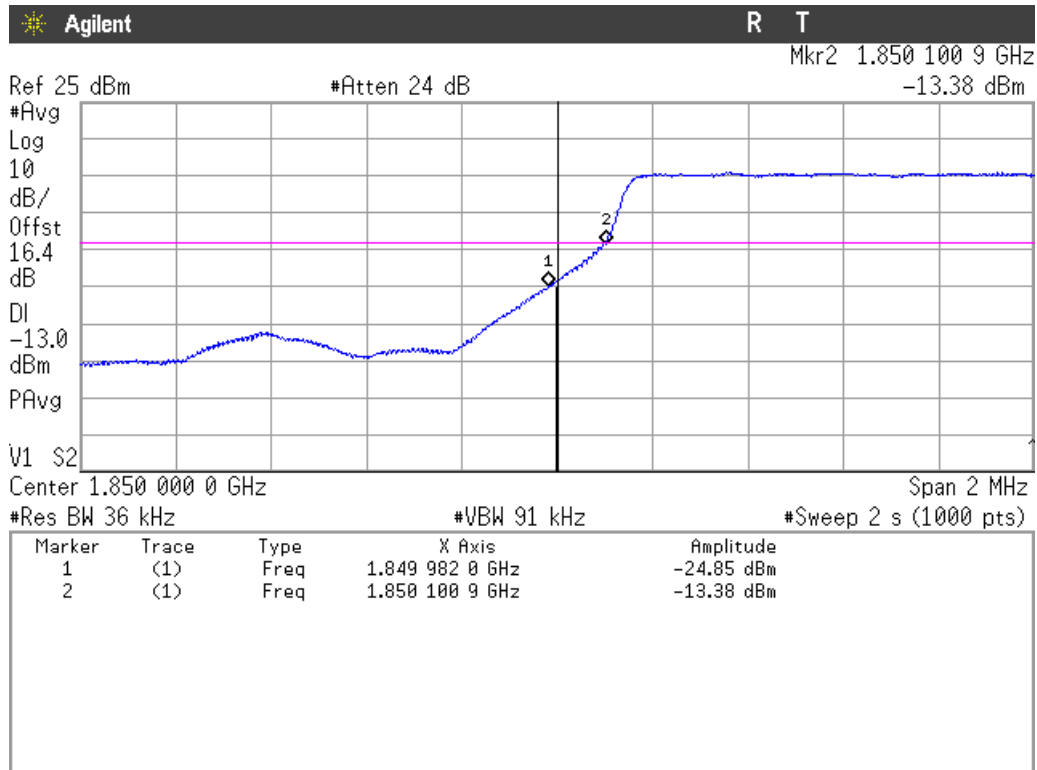
The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=3 MHz. RB=1. Offset=Max. Highest Block Edge:

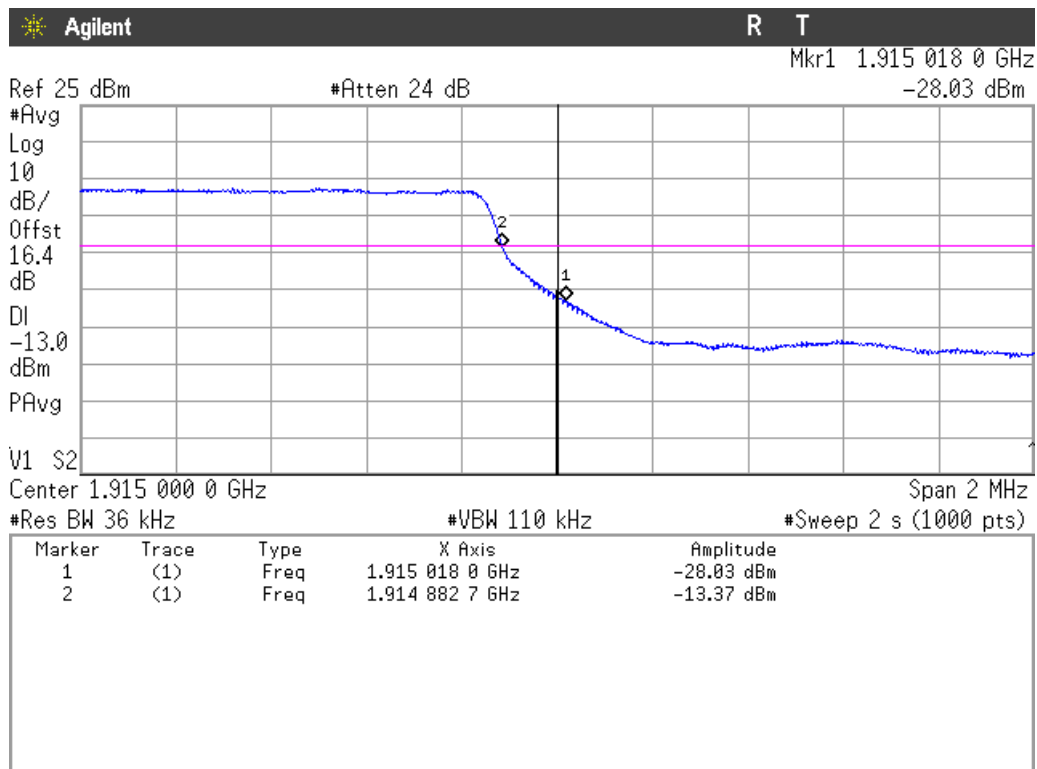


The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=3 MHz. RB=All. Offset=0. Lowest and Highest Block Edges:



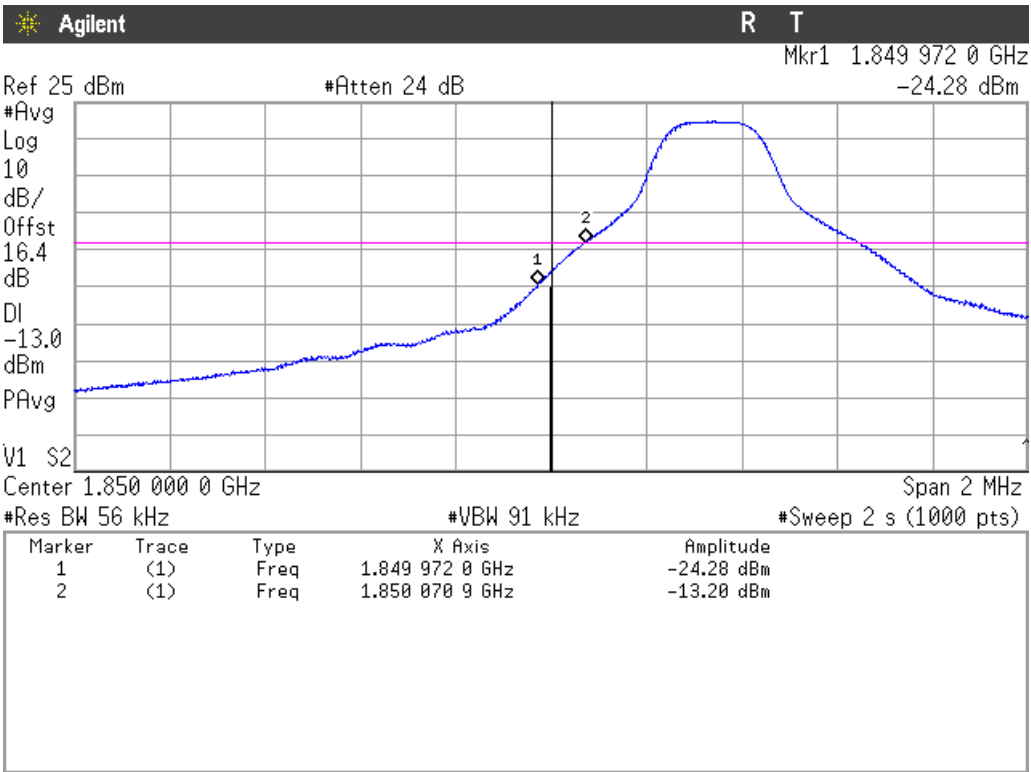
The equipment transmits at the maximum output power



The equipment transmits at the maximum output power

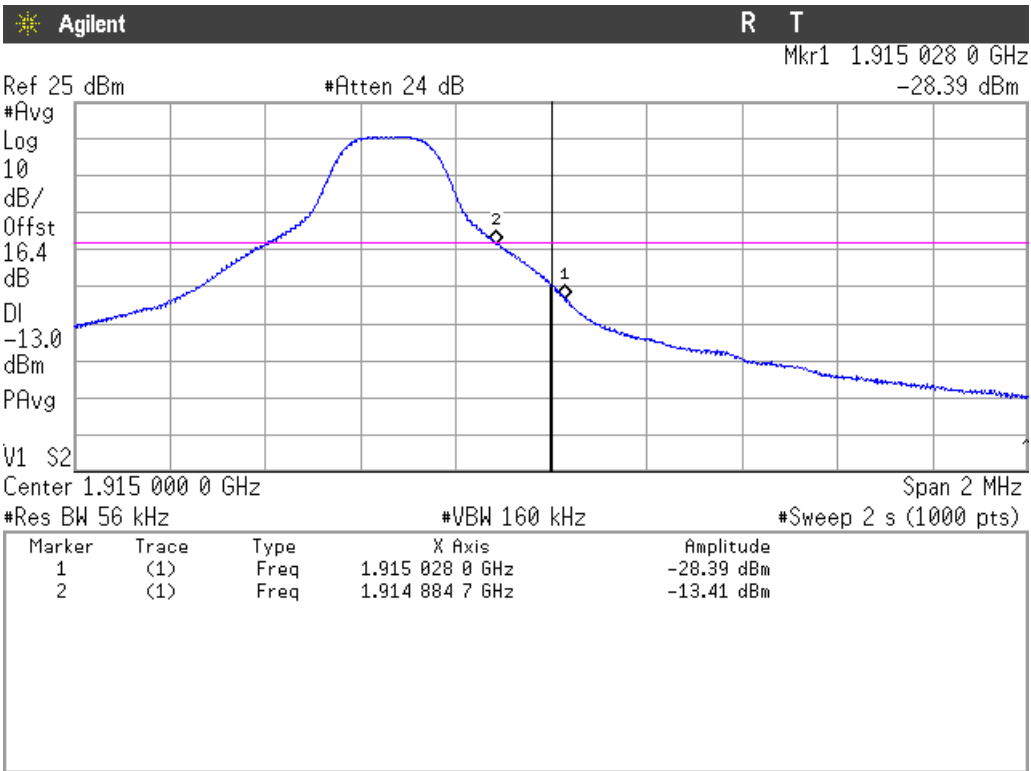
Verdict: PASS

LTE Band 25. QPSK MODULATION. BW=5 MHz. RB=1. Offset=0. Lowest Block Edge:



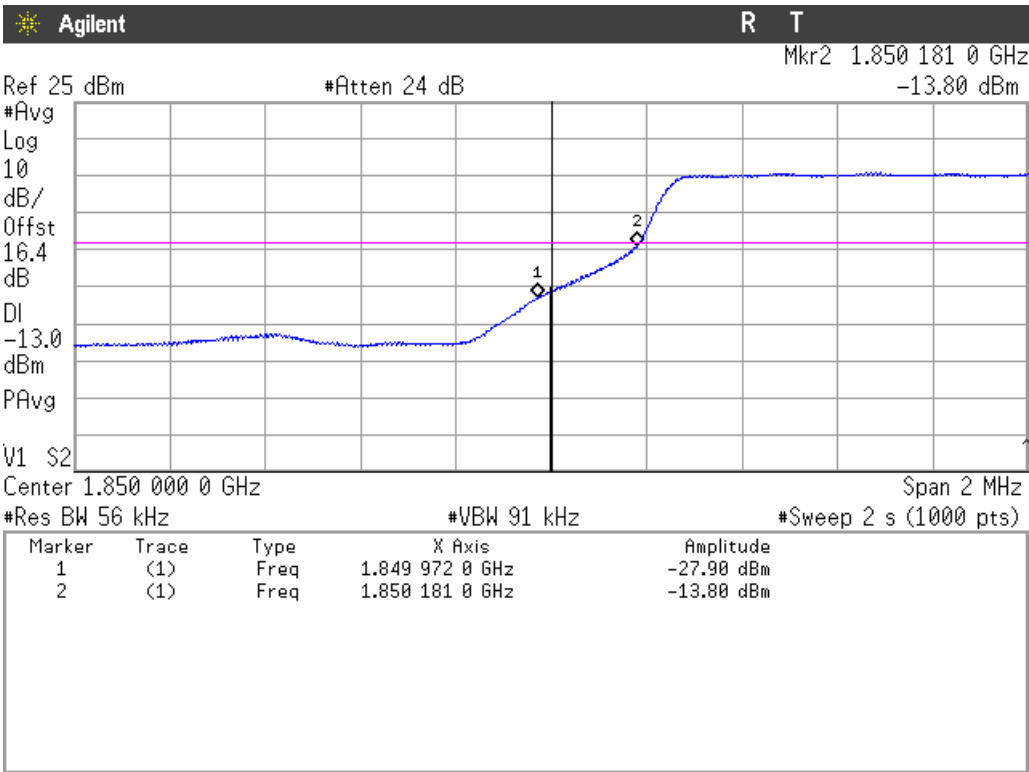
The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=5 MHz. RB=1. Offset=Max. Highest Block Edge:

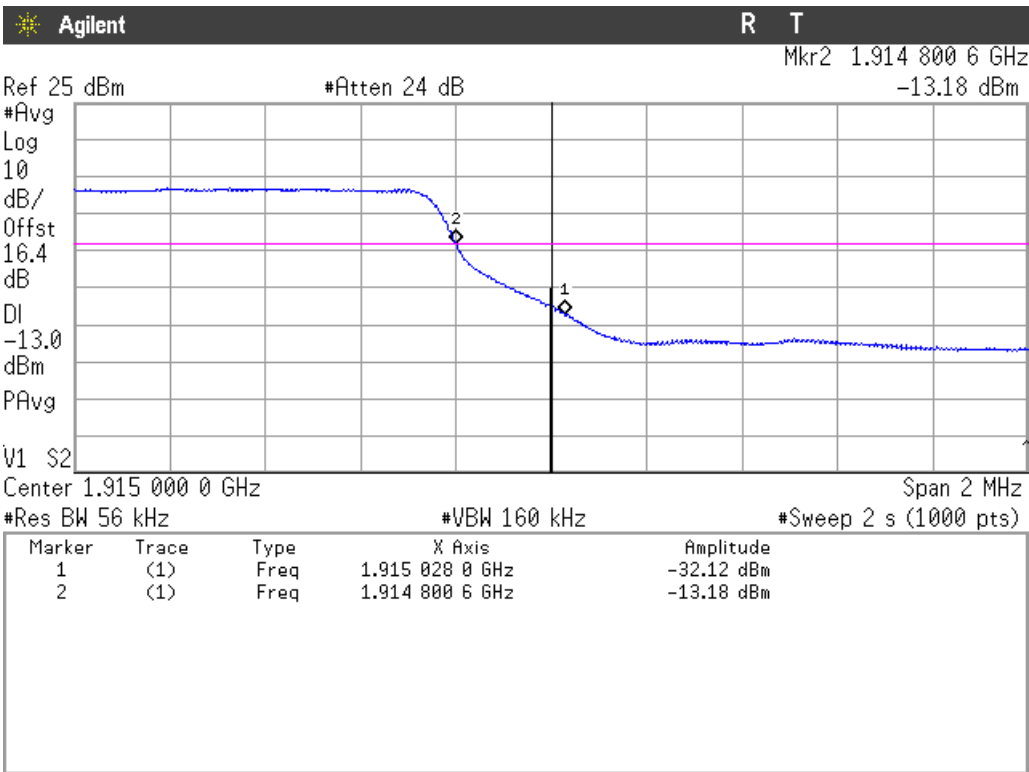


The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=5 MHz. RB=All. Offset=0. Lowest and Highest Block Edges:



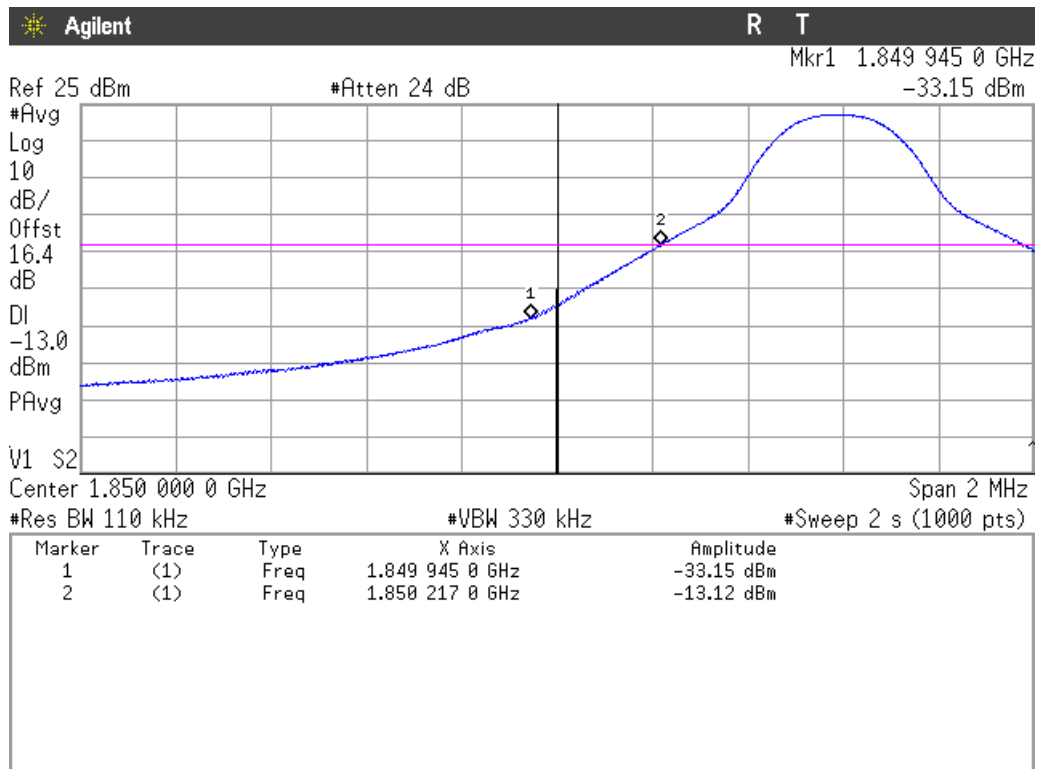
The equipment transmits at the maximum output power



The equipment transmits at the maximum output power

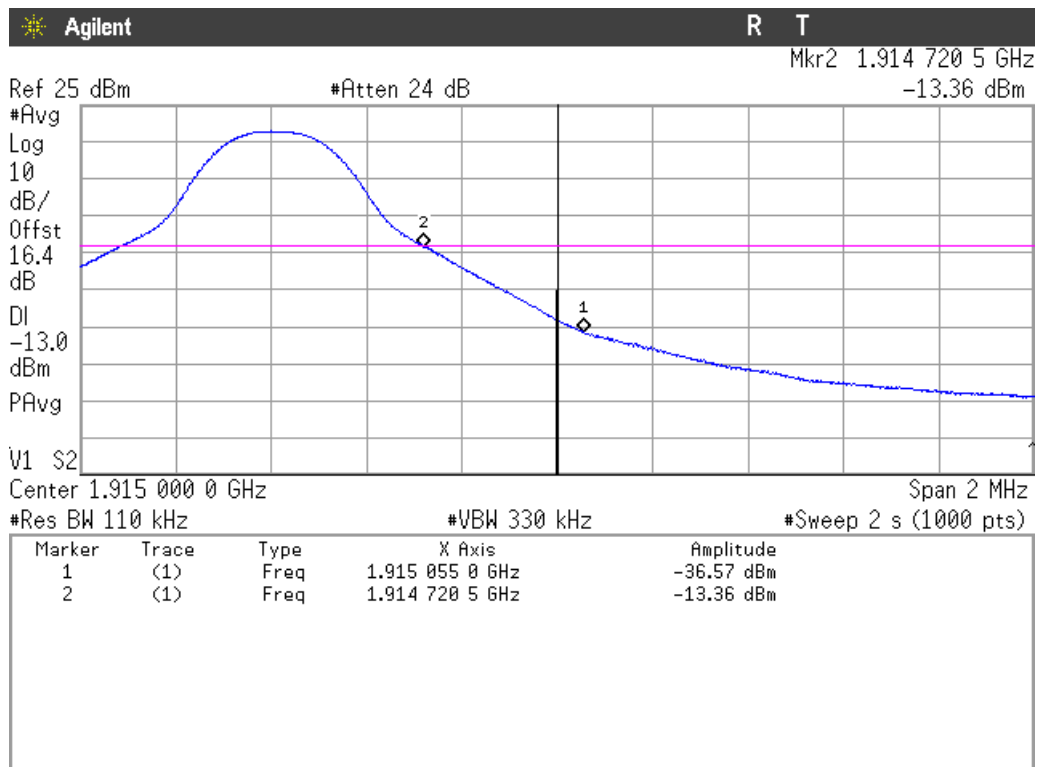
Verdict: PASS

LTE Band 25. QPSK MODULATION. BW=10 MHz. RB=1. Offset=0. Lowest Block Edge:



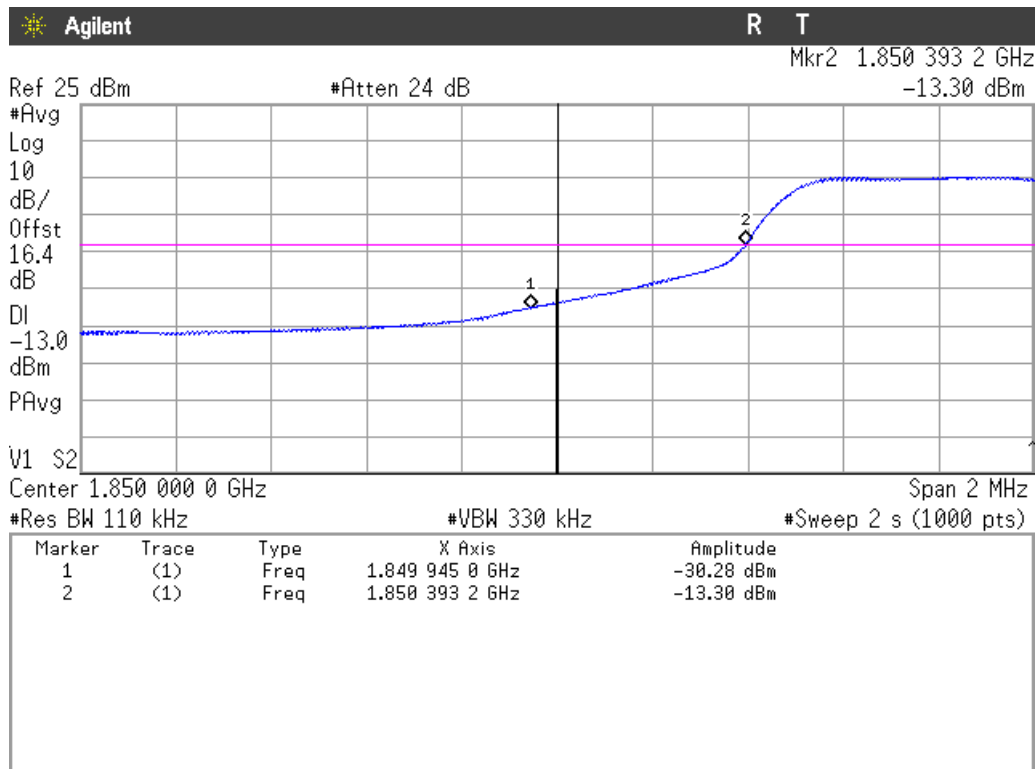
The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=10 MHz. RB=1. Offset=Max. Highest Block Edge:

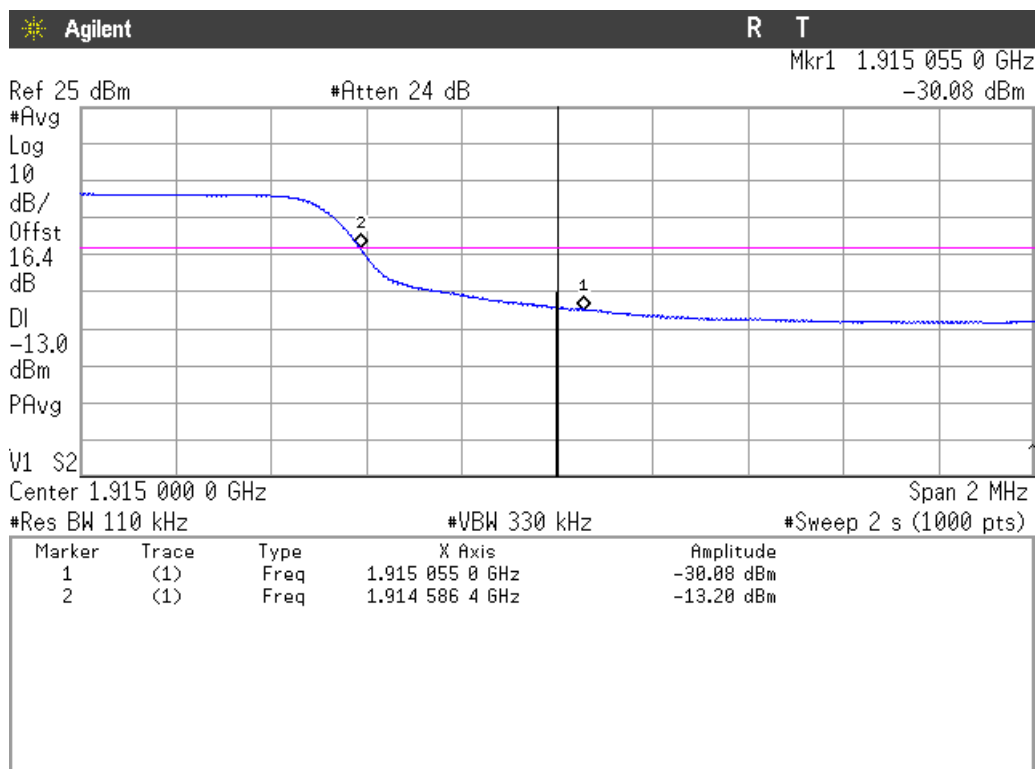


The equipment transmits at the maximum output power

**LTE Band 25. QPSK MODULATION. BW=10 MHz. RB=All. Offset=0. Lowest and Highest Block Edges:**



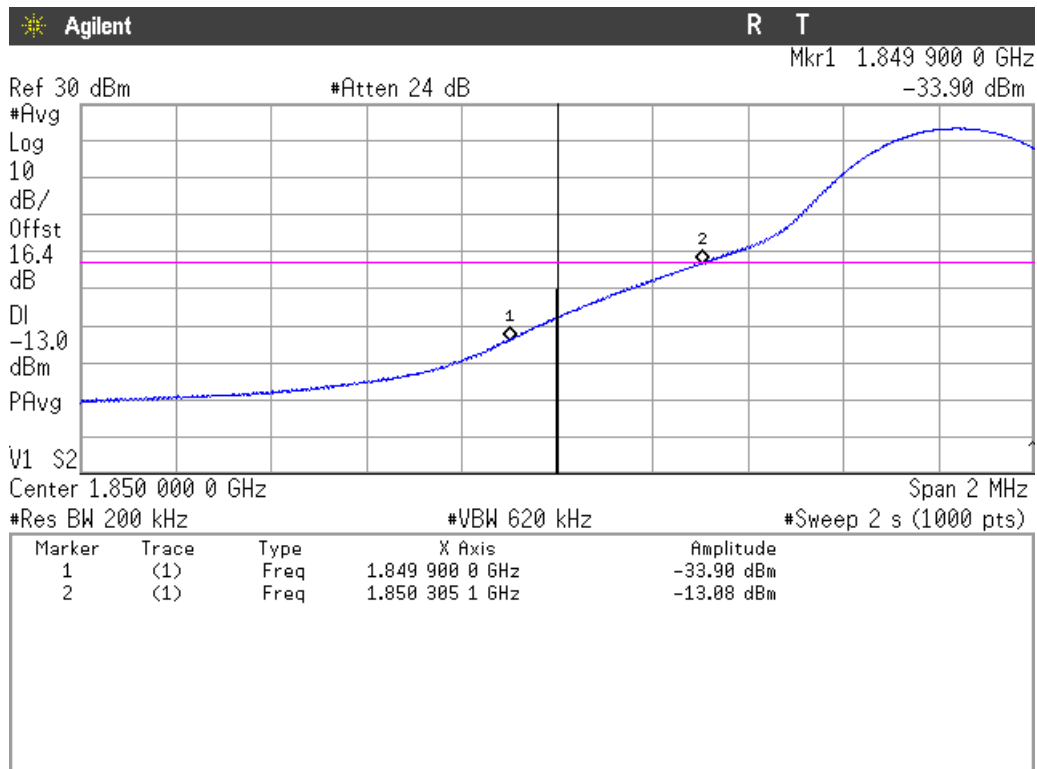
The equipment transmits at the maximum output power



The equipment transmits at the maximum output power

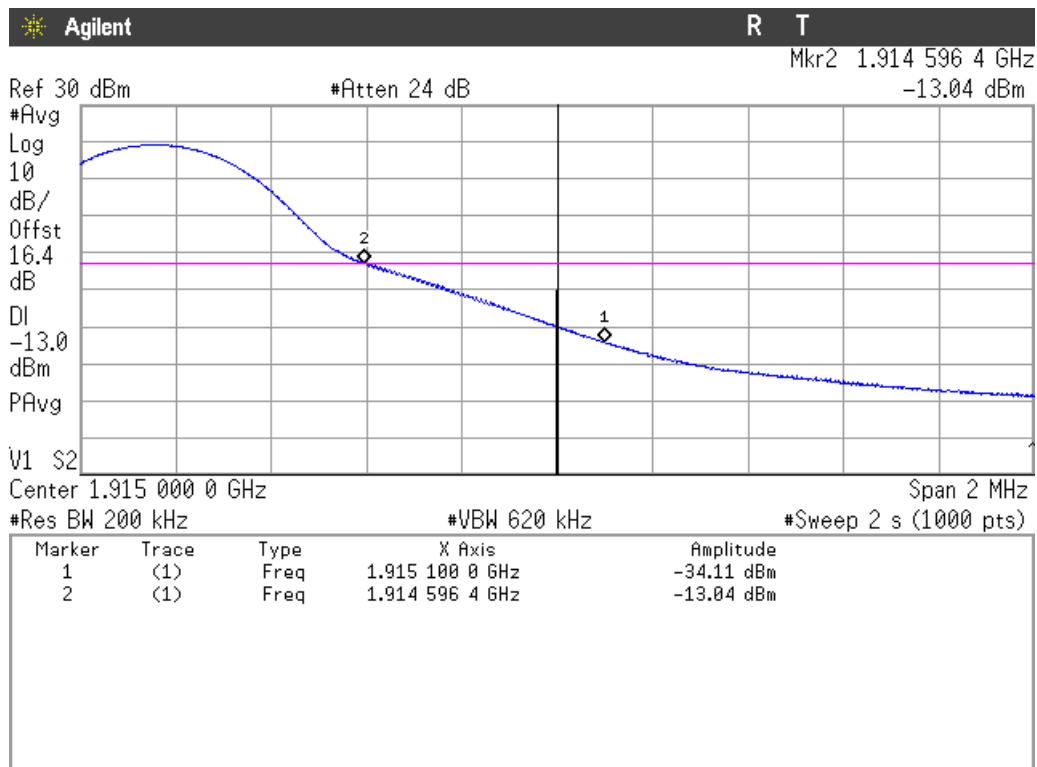
Verdict: PASS

LTE Band 25. QPSK MODULATION. BW=15 MHz. RB=1. Offset=0. Lowest Block Edge:



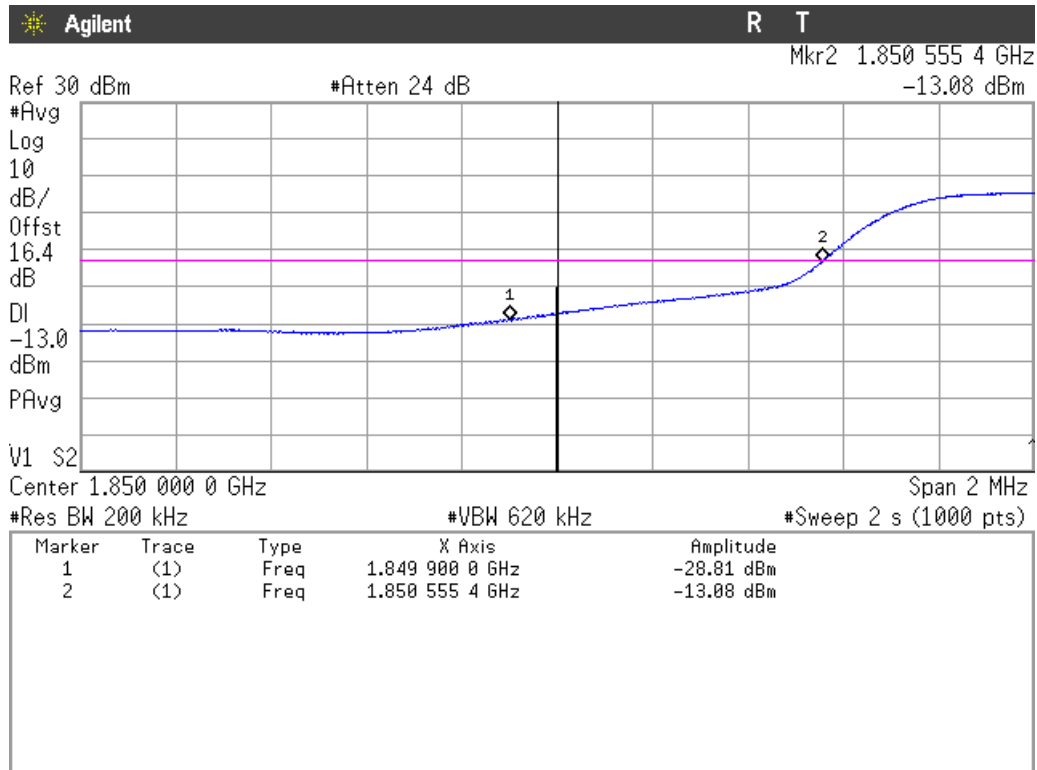
The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=15 MHz. RB=1. Offset=Max. Highest Block Edge:

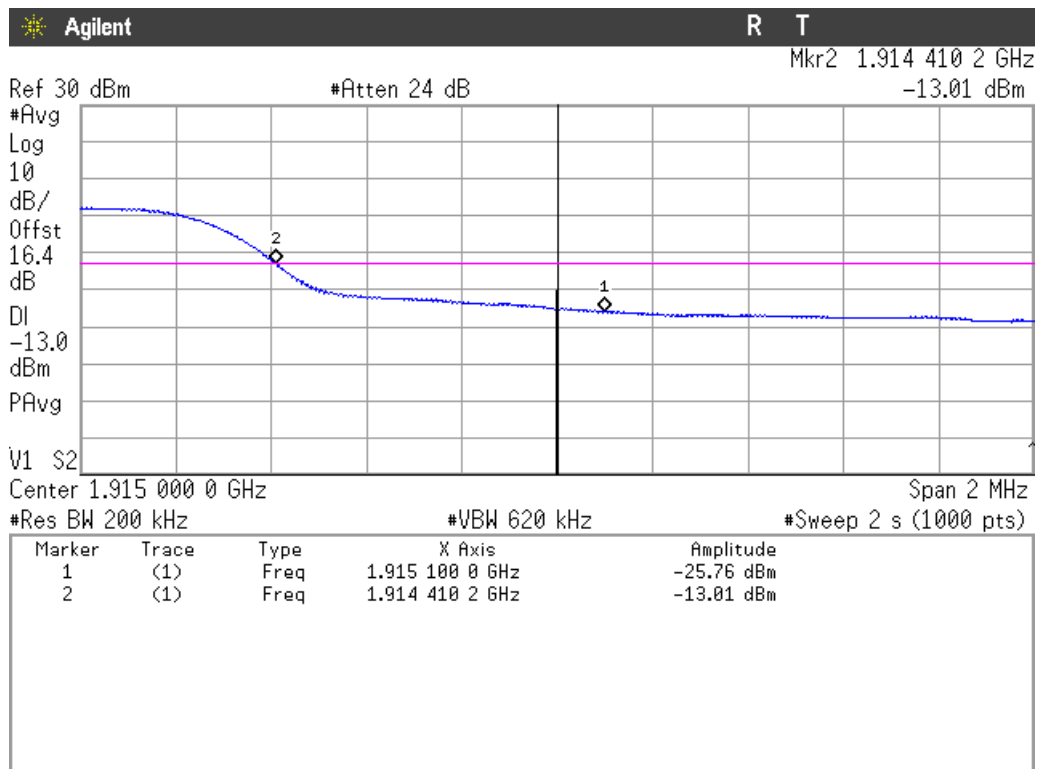


The equipment transmits at the maximum output power

**LTE Band 25. QPSK MODULATION. BW=15 MHz. RB=All. Offset=0. Lowest and Highest Block Edges:**



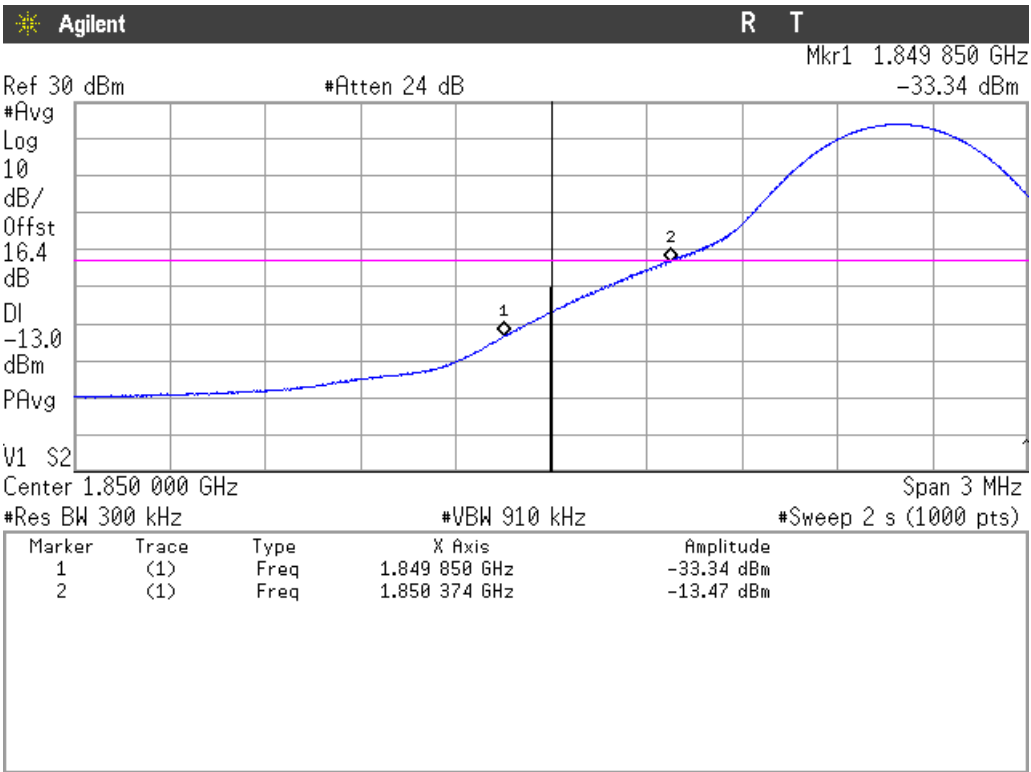
The equipment transmits at the maximum output power



The equipment transmits at the maximum output power

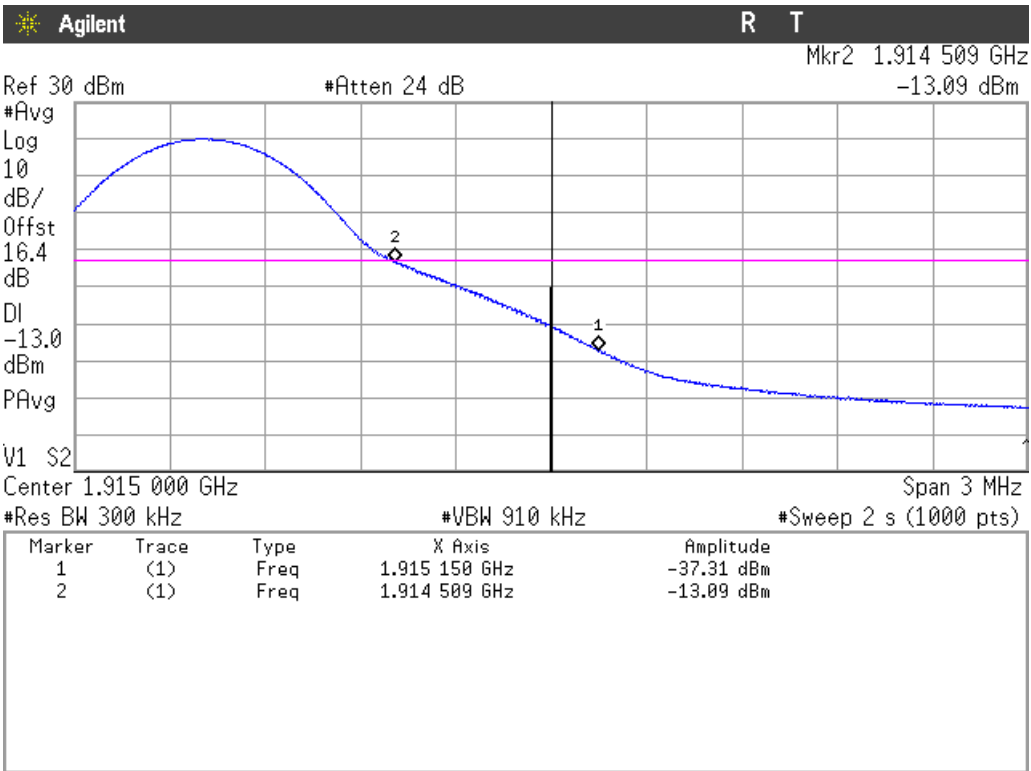
Verdict: PASS

LTE Band 25. QPSK MODULATION. BW=20 MHz. RB=1. Offset=0. Lowest Block Edge:



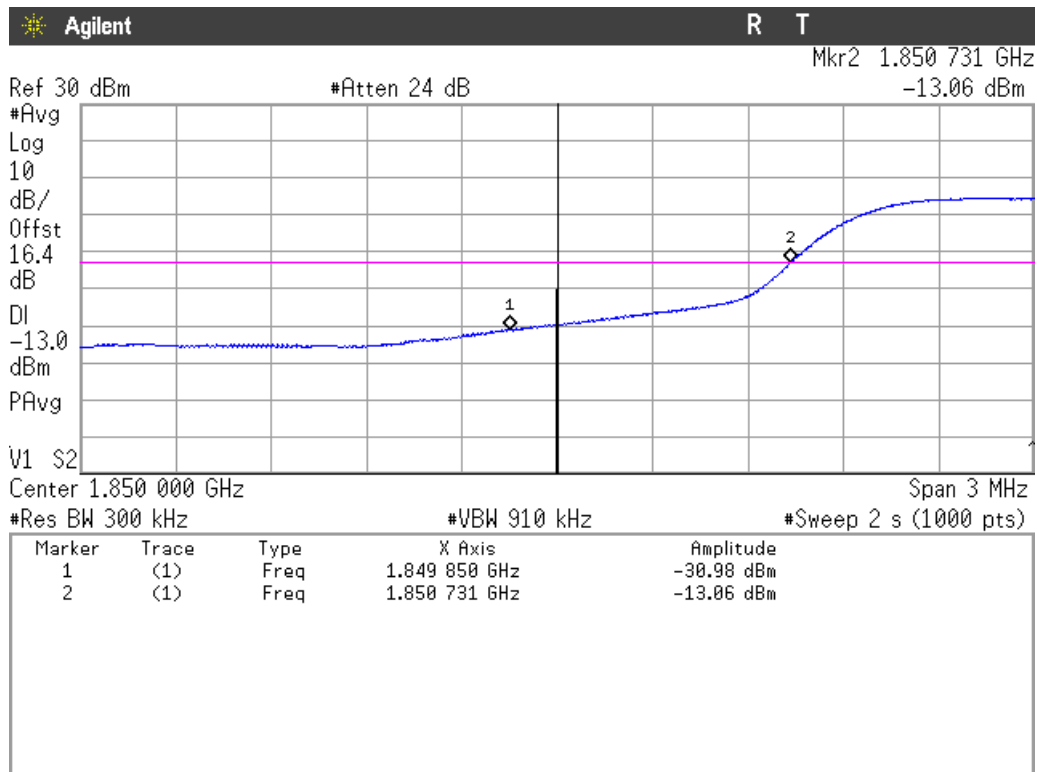
The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=20 MHz. RB=1. Offset=Max. Highest Block Edge:

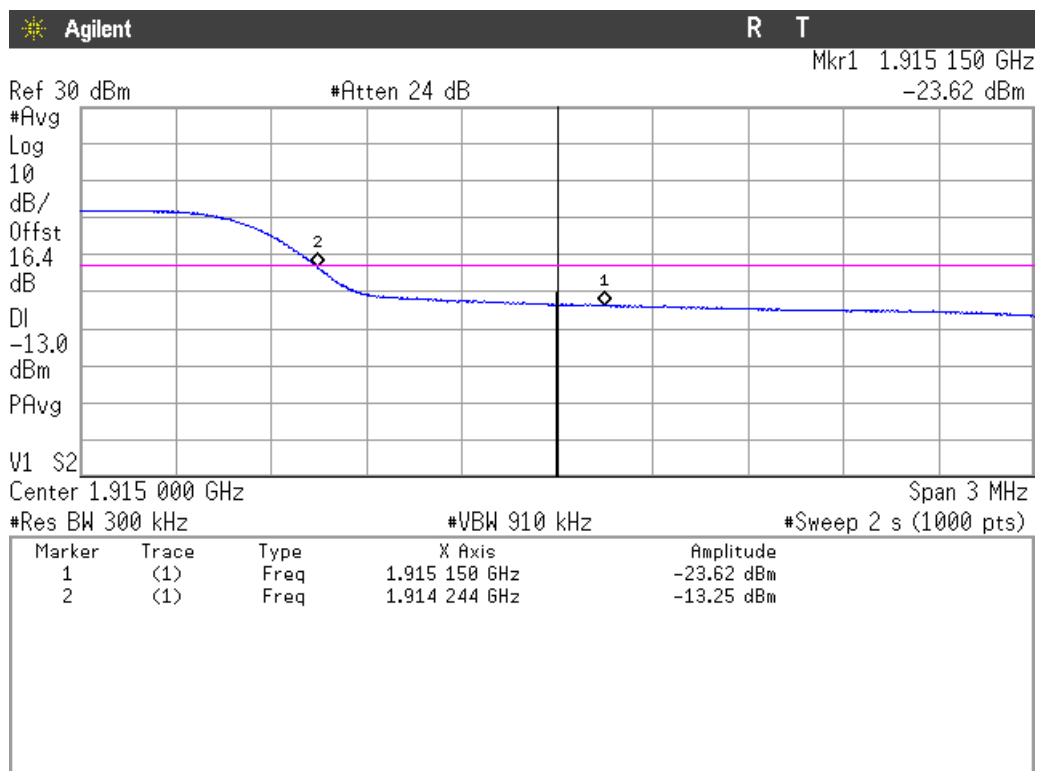


The equipment transmits at the maximum output power

LTE Band 25. QPSK MODULATION. BW=20 MHz. RB=All. Offset=0. Lowest and Highest Block Edges:



The equipment transmits at the maximum output power



The equipment transmits at the maximum output power

Verdict: PASS

## Radiated emissions

### SPECIFICATION:

FCC § 24.238. RSS-133 Clause 6.5.

The power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

### METHOD:

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.

The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.

Each detected emission at less than 20 dB respect to the limit is substituted by the Substitution method, in accordance with the ANSI/TIA-603-E.

### Measurement Limit:

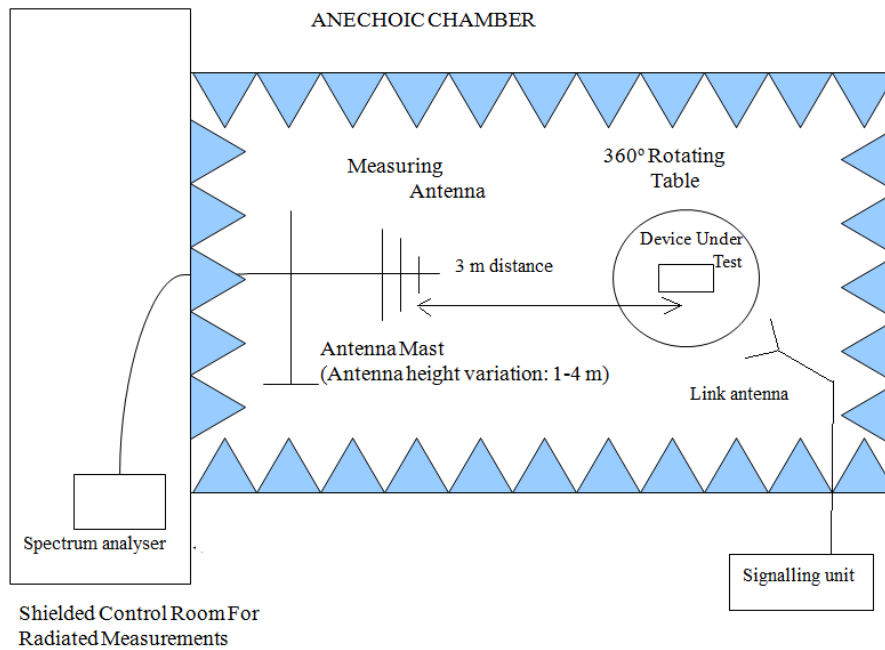
According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

At  $P_o$  transmitting power. the specified minimum attenuation becomes  $43+10\log (P_o)$  and the level in dBm relative  $P_o$  becomes:

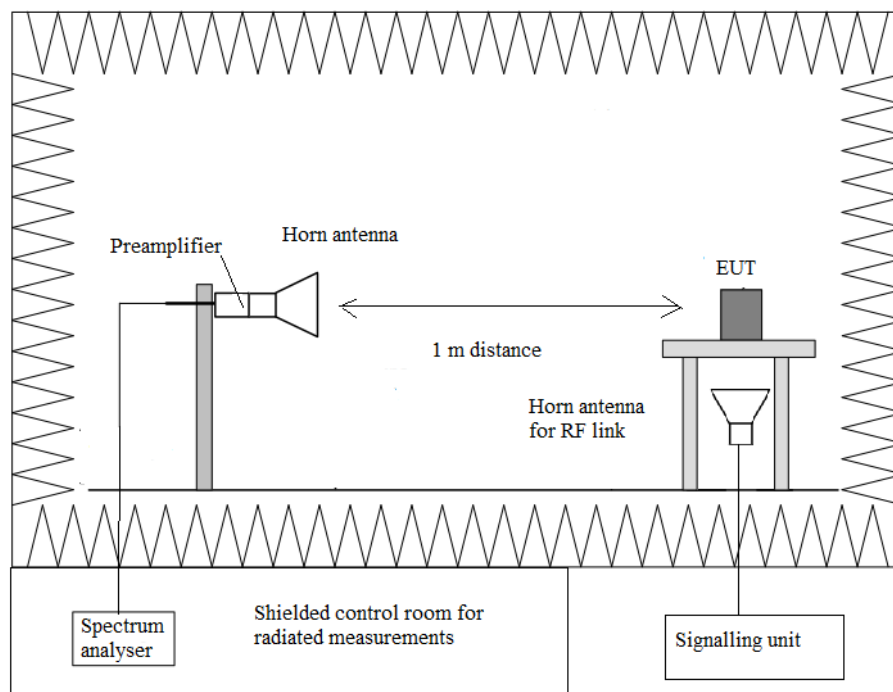
$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

## TEST SETUP:

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



## RESULTS:

### **2G Band 1900 MHz:**

#### **GPRS AND EDGE MODULATION:**

A preliminary scan determined the GPRS modulation as the worst case. The following tables and plots show the results for GPRS modulation.

#### **- Lowest Channel:**

##### **Frequency range 30 MHz - 1 GHz**

No spurious signals were found at less than 20 dB below the limit.

##### **Frequency range 1 - 18 GHz.**

No spurious signals were found at less than 20 dB below the limit.

##### **Frequency range 18 - 20 GHz**

No spurious signals were found at less than 20 dB below the limit.

#### **- Middle Channel:**

##### **Frequency range 30 MHz-1000 MHz**

No spurious signals were found at less than 20 dB below the limit.

##### **Frequency range 1 - 18 GHz**

Substitution method data:

| Frequency (MHz) | Instrument reading (dBm) | Polarization | (1) Generator output (dBm) | (2) Cable loss (dB) | (3) Substitution antenna gain Gi (respect to isotropic radiator) (dB) | E.I.R.P. (dBm) = (1) – (2) + (3) |
|-----------------|--------------------------|--------------|----------------------------|---------------------|-----------------------------------------------------------------------|----------------------------------|
| 5550.25         | -39.17                   | Vertical     | -42.07                     | 3.51                | 12.76                                                                 | -32.82                           |

##### **Frequency range 18 - 20 GHz**

No spurious signals were found at less than 20 dB below the limit.

#### **- Highest Channel:**

##### **Frequency range 30 MHz - 1 GHz**

No spurious signals were found at less than 20 dB below the limit.

### Frequency range 1 - 18 GHz

#### Substitution method data

| Frequency (MHz) | Instrument reading (dBm) | Polarization | (1) Generator output (dBm) | (2) Cable loss (dB) | (3) Substitution antenna gain Gi (respect to isotropic radiator) (dB) | E.I.R.P. (dBm) = (1) – (2) + (3) |
|-----------------|--------------------------|--------------|----------------------------|---------------------|-----------------------------------------------------------------------|----------------------------------|
| 5729.75         | -39.01                   | Vertical     | -41.73                     | 3.66                | 12.98                                                                 | -32.42                           |

### Frequency range 18 - 20 GHz

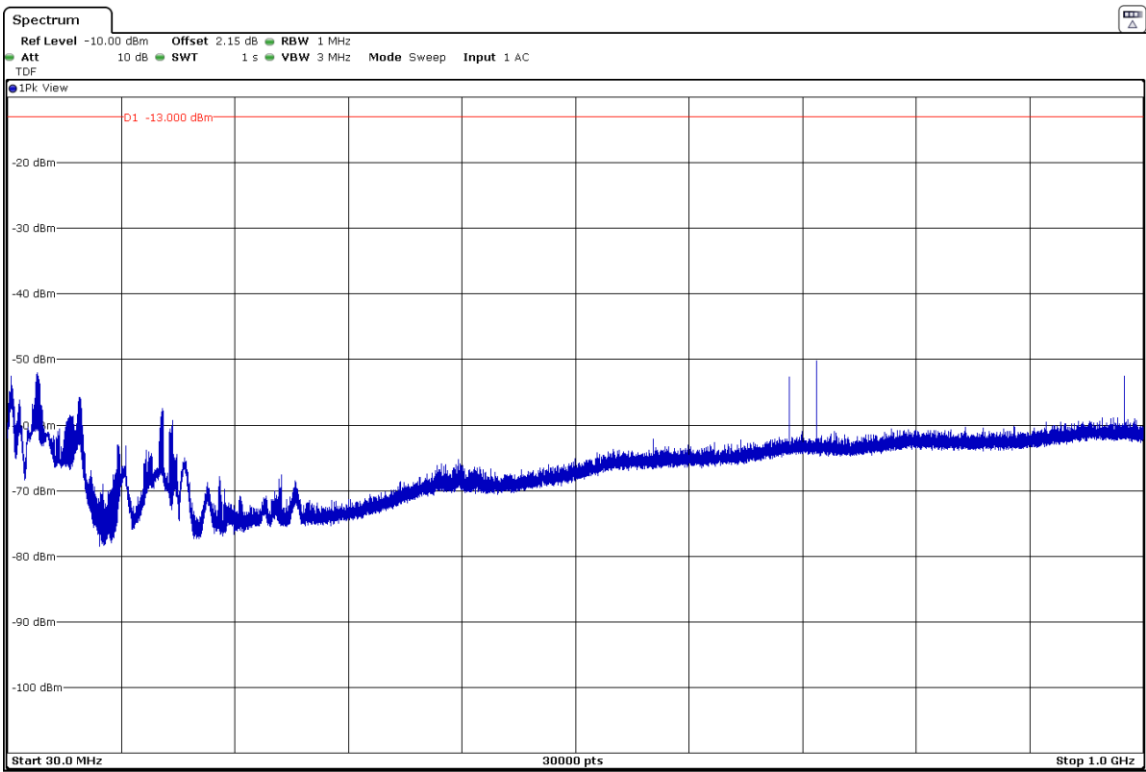
No spurious signals were found at less than 20 dB below the limit.

Verdict: PASS

|                              |                                                                                                                                                          |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement uncertainty (dB) | $\leq \pm 2.07$ for $f < 1\text{GHz}$<br>$\leq \pm 4.88$ for $f \geq 1\text{GHz}$ up to 18 GHz<br>$\leq \pm 3.31$ for $f \geq 18\text{GHz}$ up to 26 GHz |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

FREQUENCY RANGE 30 MHz - 1 GHz

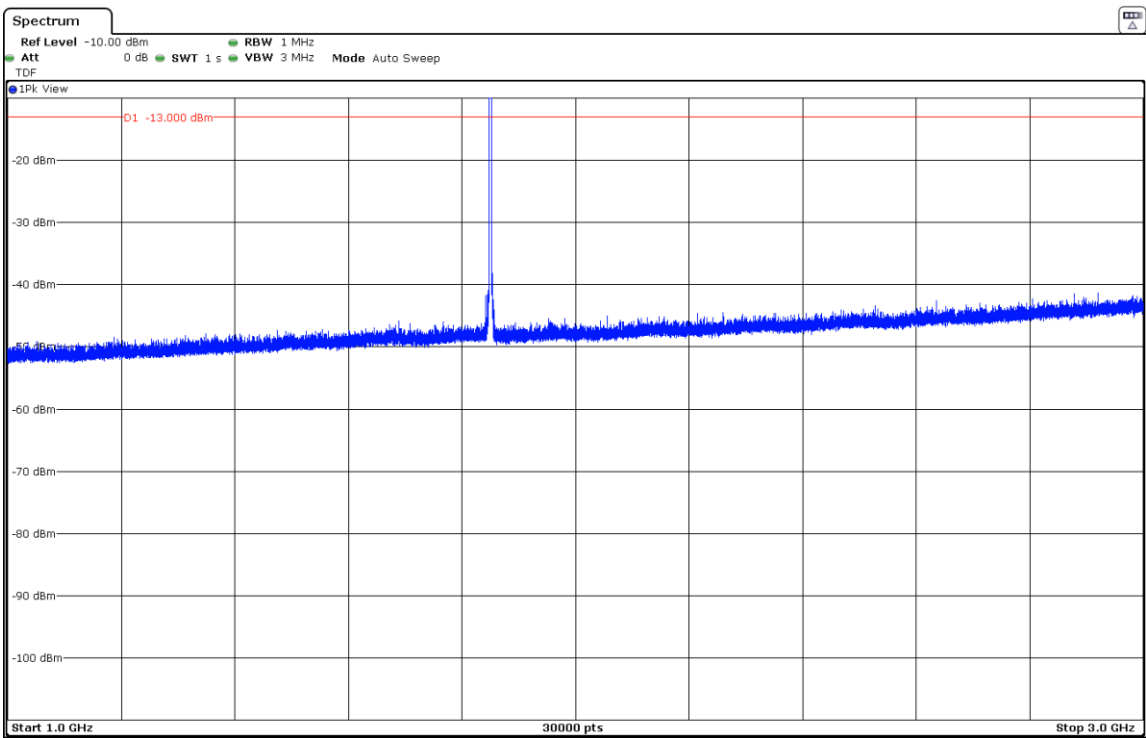
This plot is valid for the Lowest, Middle and Highest Channels:



FREQUENCY RANGE 1 - 3 GHz

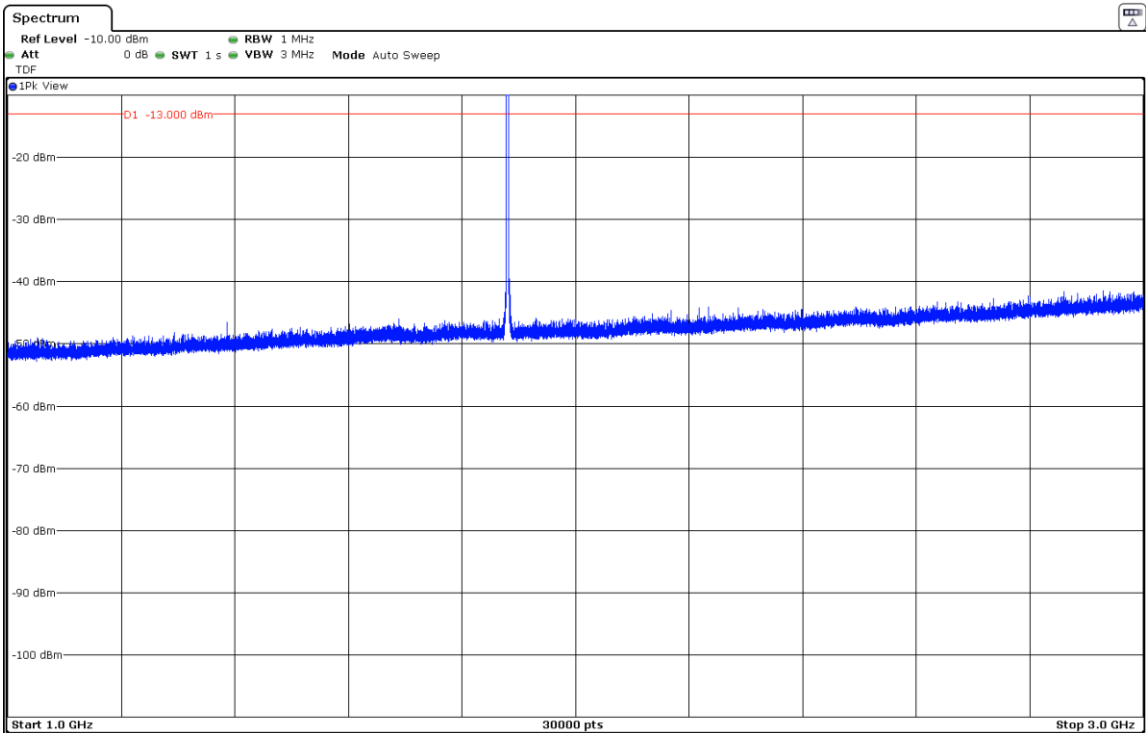
GPRS MODULATION

- Lowest Channel:



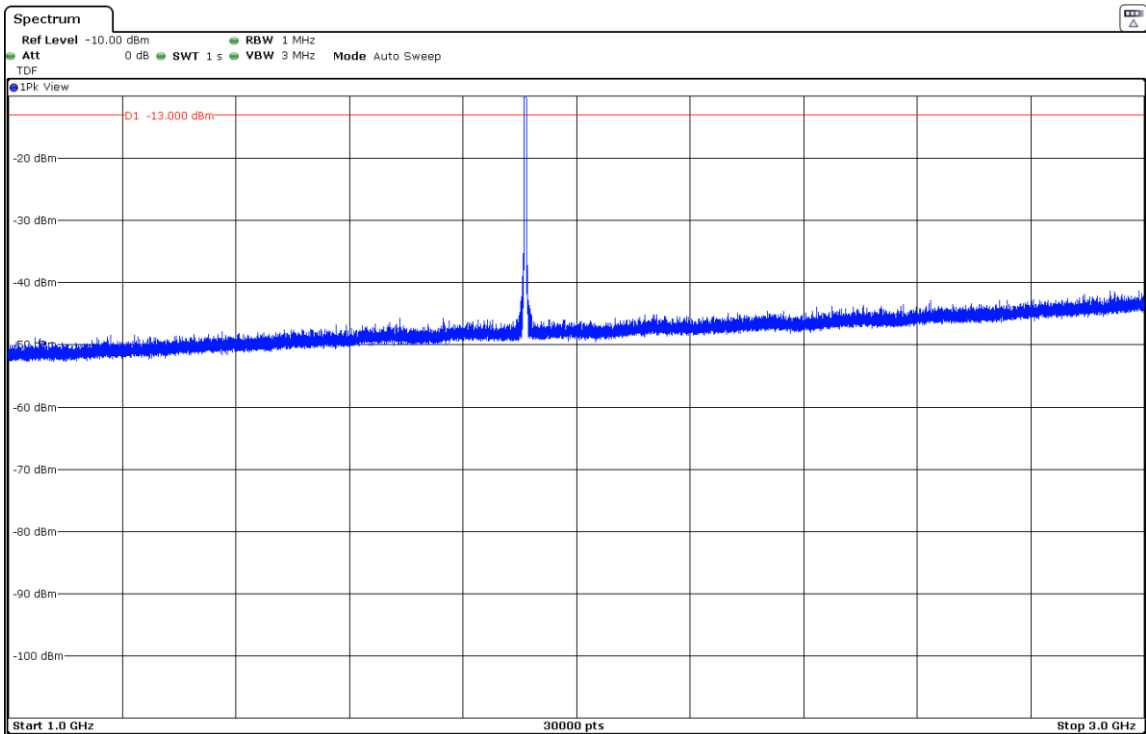
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

- Highest Channel:

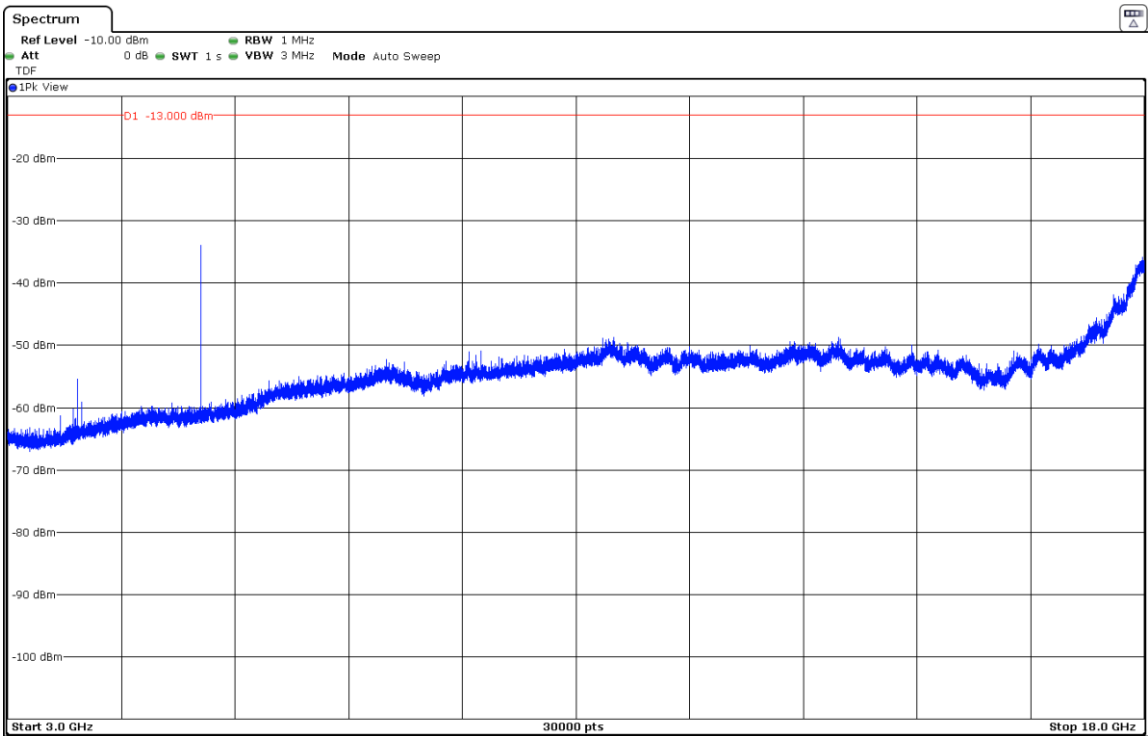


The peak above the limit is the carrier frequency.

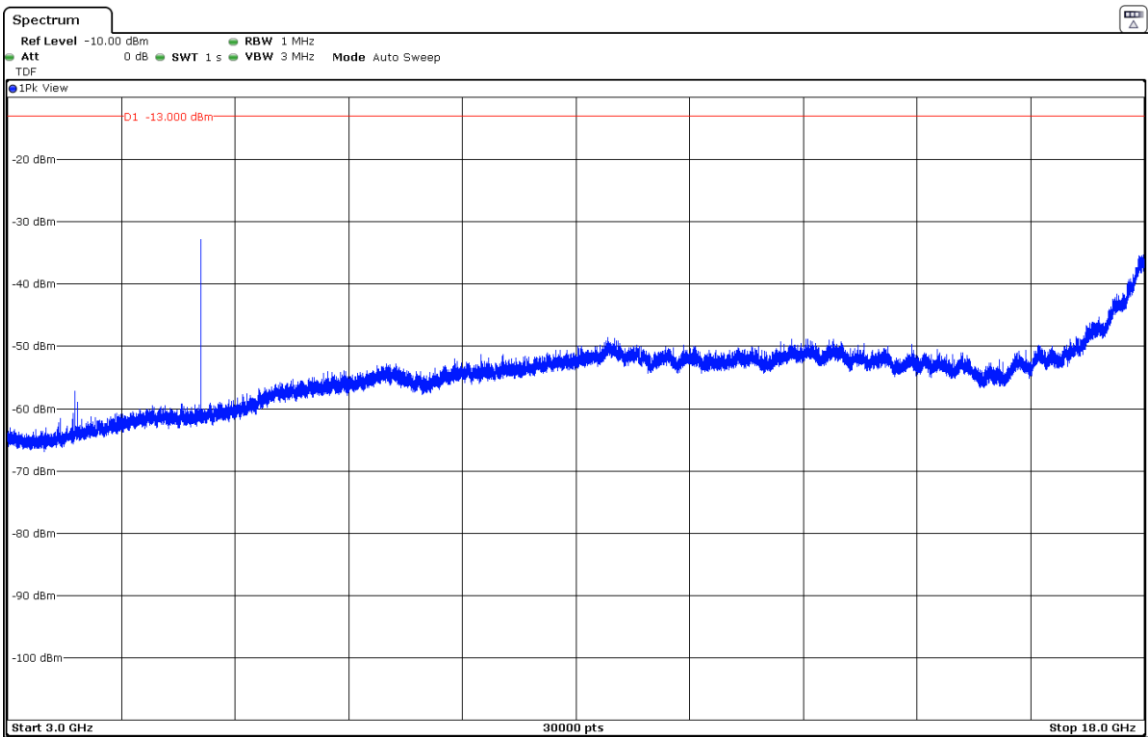
FREQUENCY RANGE 3 - 18 GHz

GPRS MODULATION

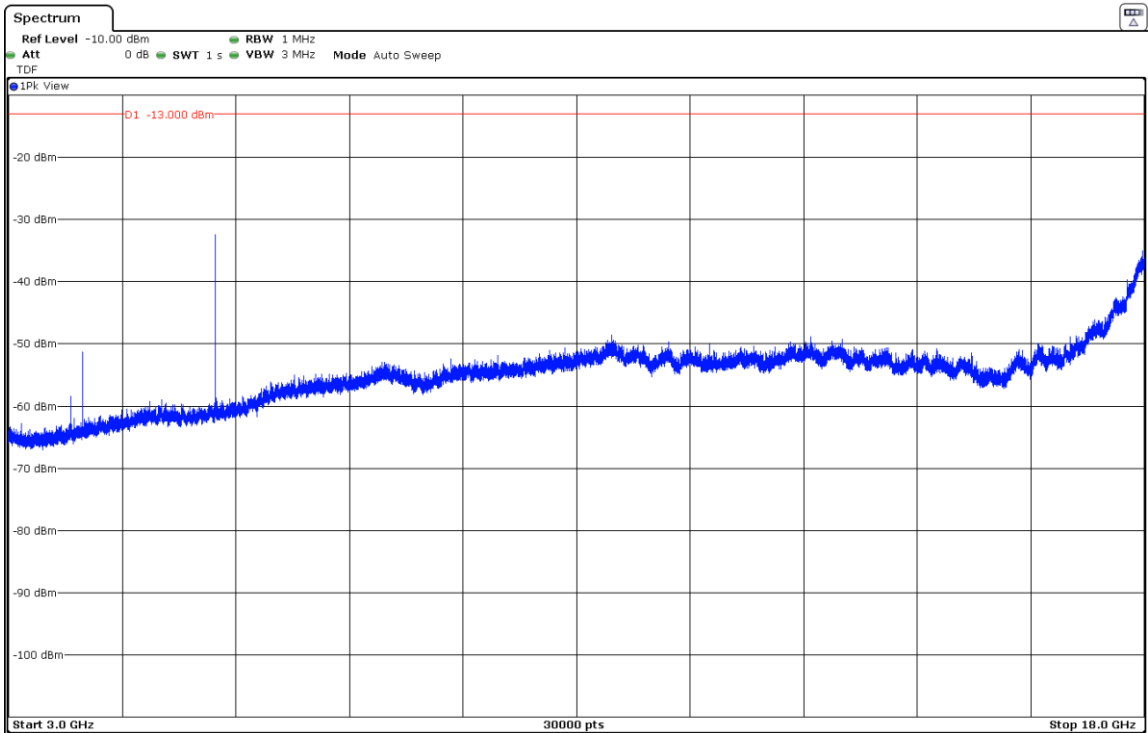
- Lowest Channel:



- Middle Channel:



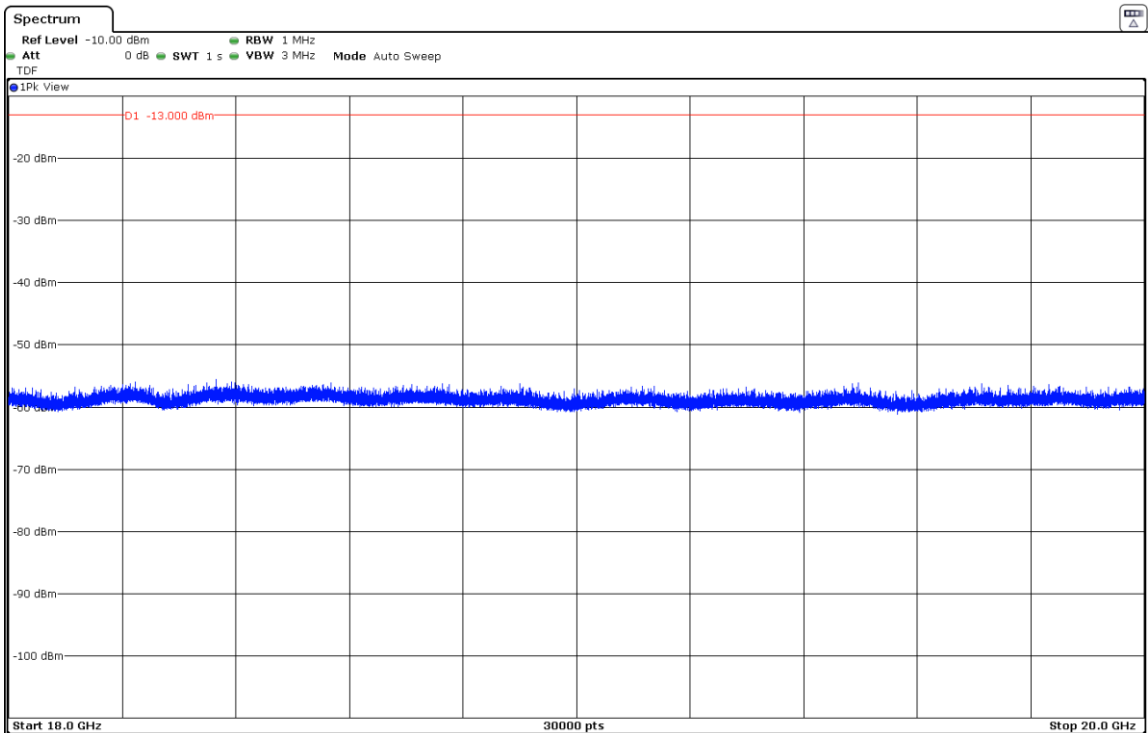
- Highest Channel:



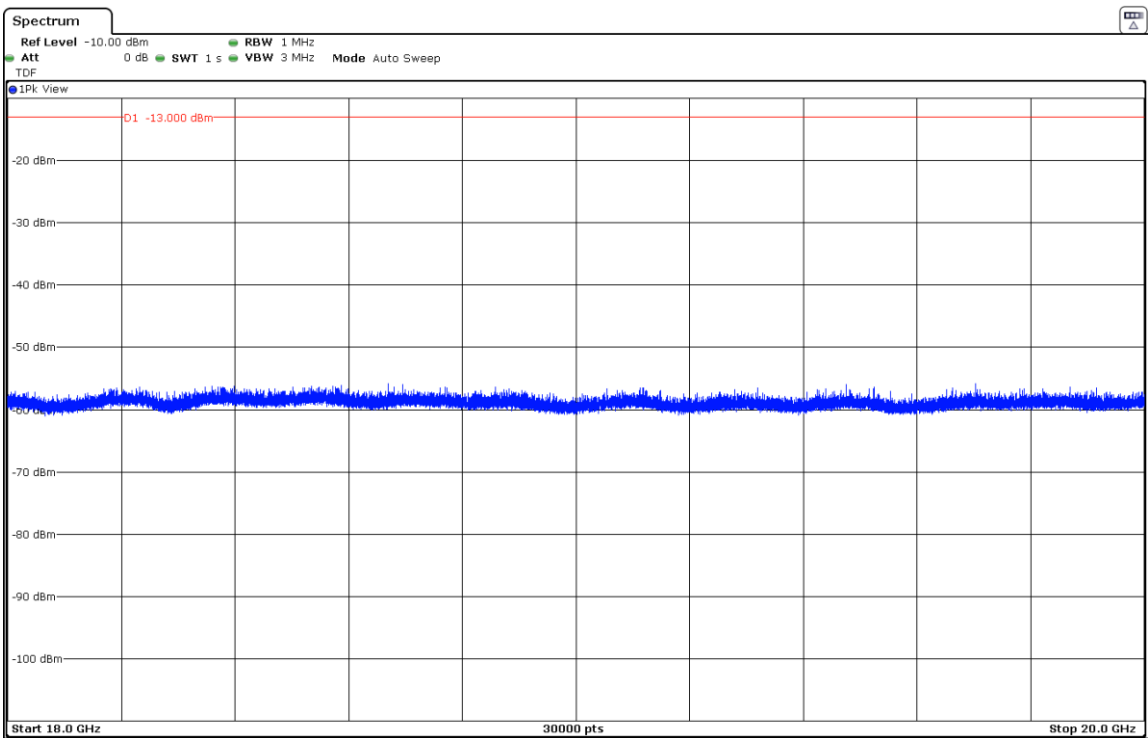
FREQUENCY RANGE 18 - 20 GHz

GPRS MODULATION

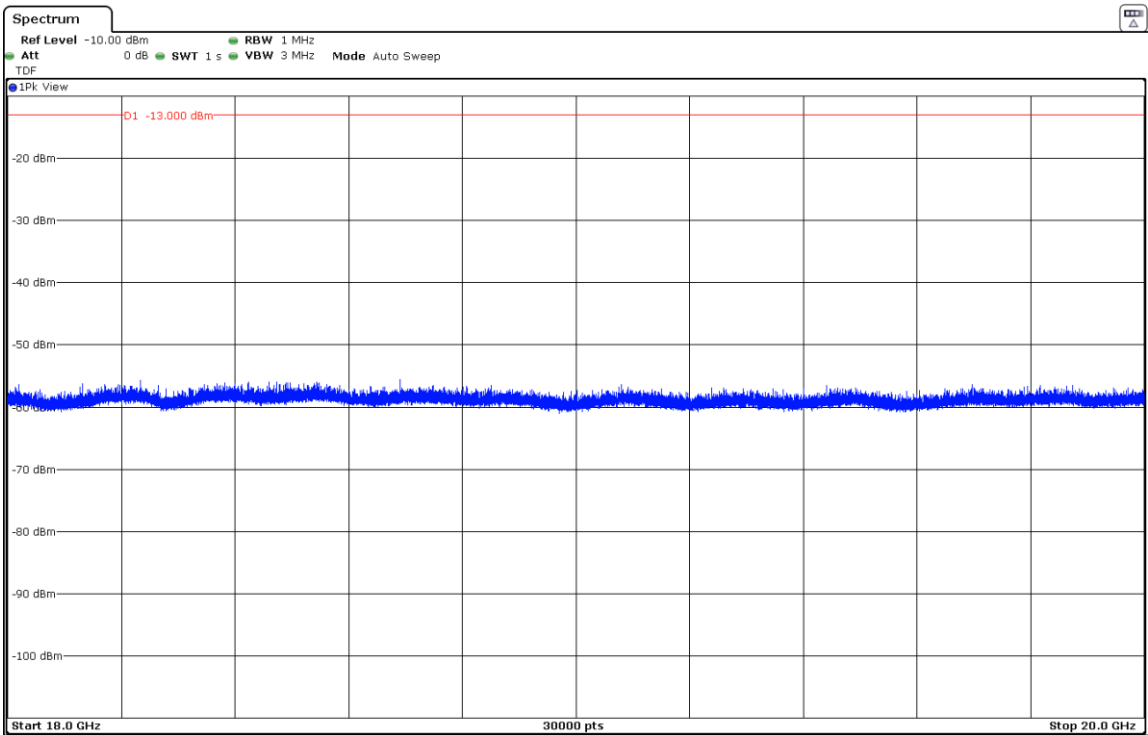
- Lowest Channel:



- Middle Channel:



- Highest Channel:



### **3G Band II:**

#### **WCDMA AND HSUPA MODULATION:**

A preliminary scan determined the HSUPA modulation as the worst case. The following tables and plots show the results for HSUPA modulation.

#### **- Lowest Channel:**

##### **Frequency range 30 MHz - 1 GHz**

No spurious signals were found at less than 20 dB below the limit.

##### **Frequency range 1 - 18 GHz**

No spurious signals were found at less than 20 dB below the limit.

##### **Frequency range 18 - 20 GHz**

No spurious signals were found at less than 20 dB below the limit.

#### **- Middle Channel:**

##### **Frequency range 30 MHz - 1 GHz**

No spurious signals were found at less than 20 dB below the limit.

##### **Frequency range 1 - 18 GHz**

No spurious signals were found at less than 20 dB below the limit.

##### **Frequency range 18 - 20 GHz**

No spurious signals were found at less than 20 dB below the limit.

#### **- Highest Channel:**

##### **Frequency range 30 MHz - 1 GHz**

No spurious signals were found at less than 20 dB below the limit.

##### **Frequency range 1 - 18 GHz**

No spurious signals were found at less than 20 dB respect to the limit.

##### **Frequency range 18 - 20 GHz**

No spurious signals were found at less than 20 dB below the limit.

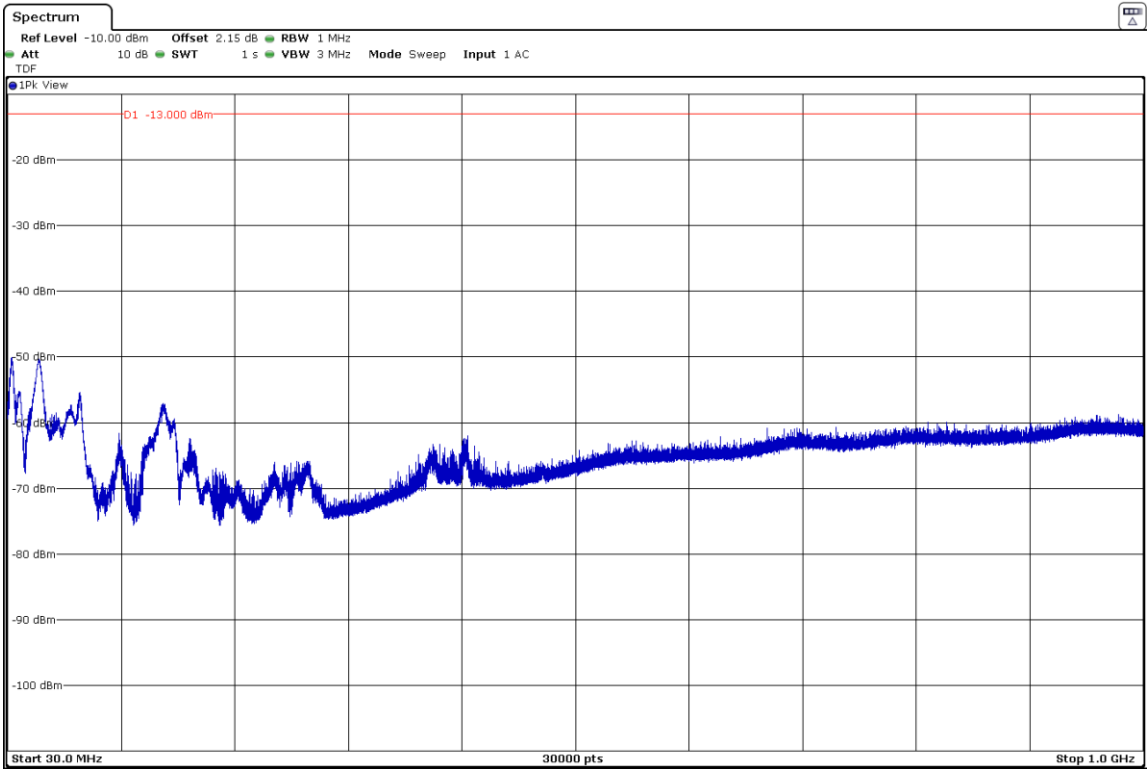
Verdict: PASS

|                              |                                                                                                |
|------------------------------|------------------------------------------------------------------------------------------------|
| Measurement uncertainty (dB) | <±2.07 for f < 1GHz<br><±4.88 for f ≥ 1 GHz up to 18 GHz<br><±3.31 for f ≥ 18 GHz up to 26 GHz |
|------------------------------|------------------------------------------------------------------------------------------------|

FREQUENCY RANGE 30 MHz - 1 GHz

HSUPA MODULATION

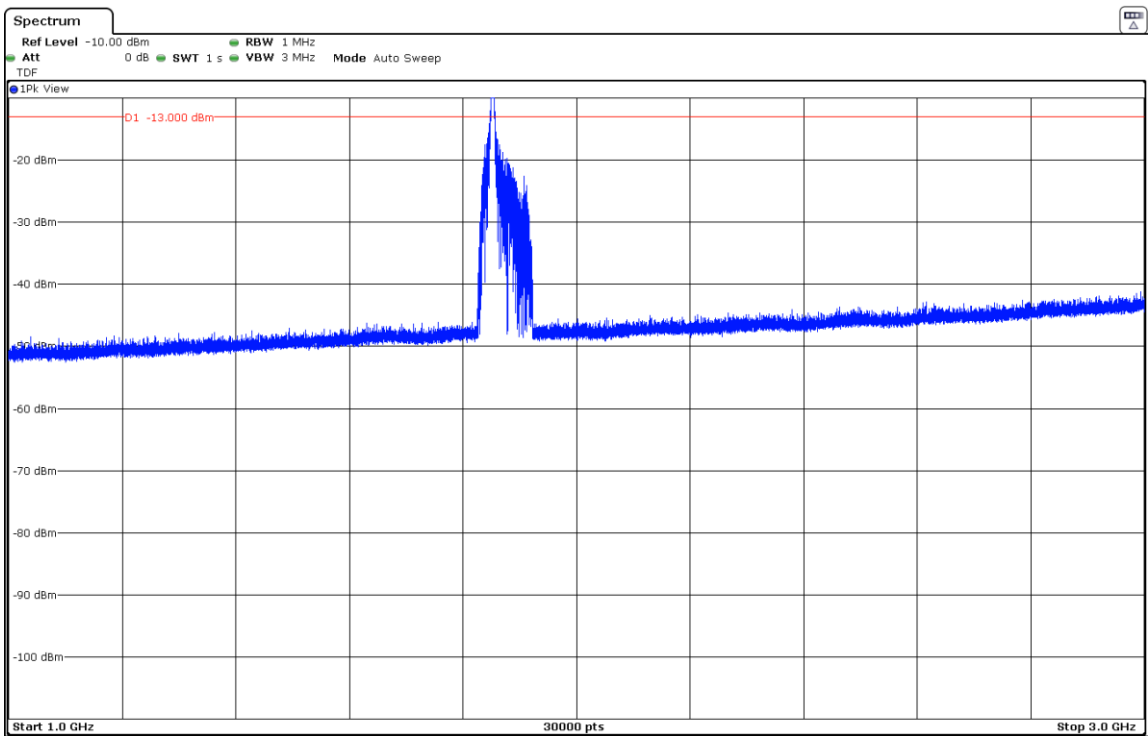
This plot is valid for the Lowest, Middle and Highest Channels:



FREQUENCY RANGE 1 - 3 GHz

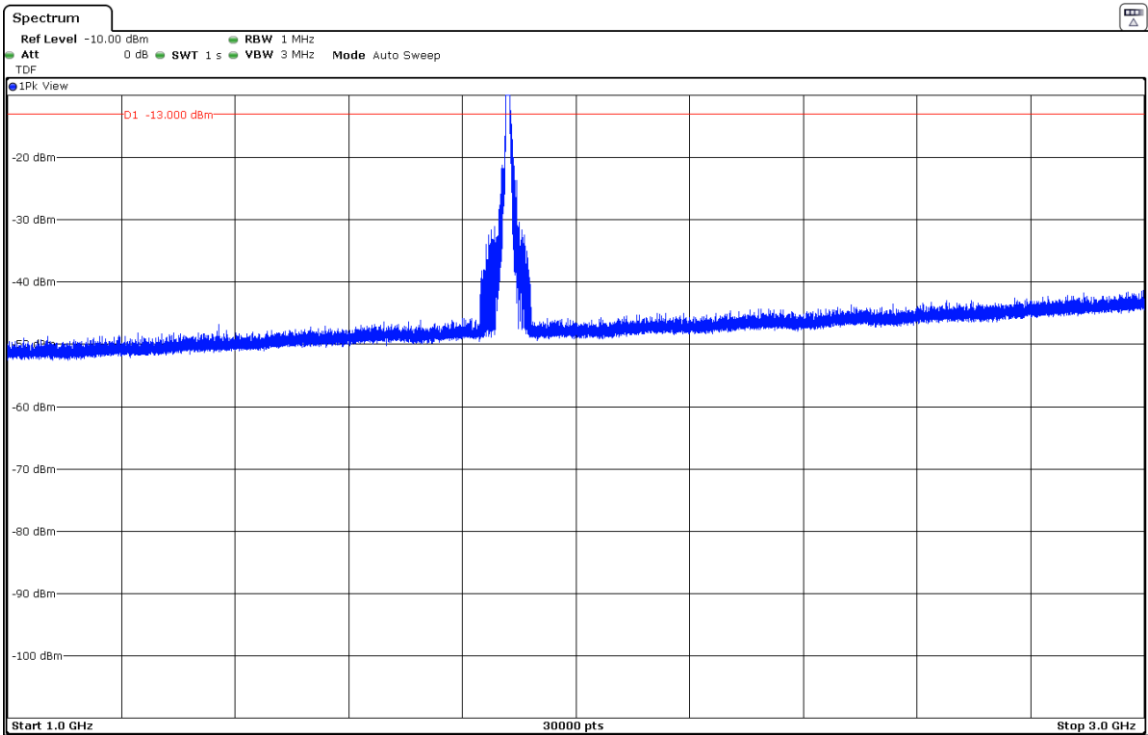
HSUPA MODULATION

- Lowest Channel:



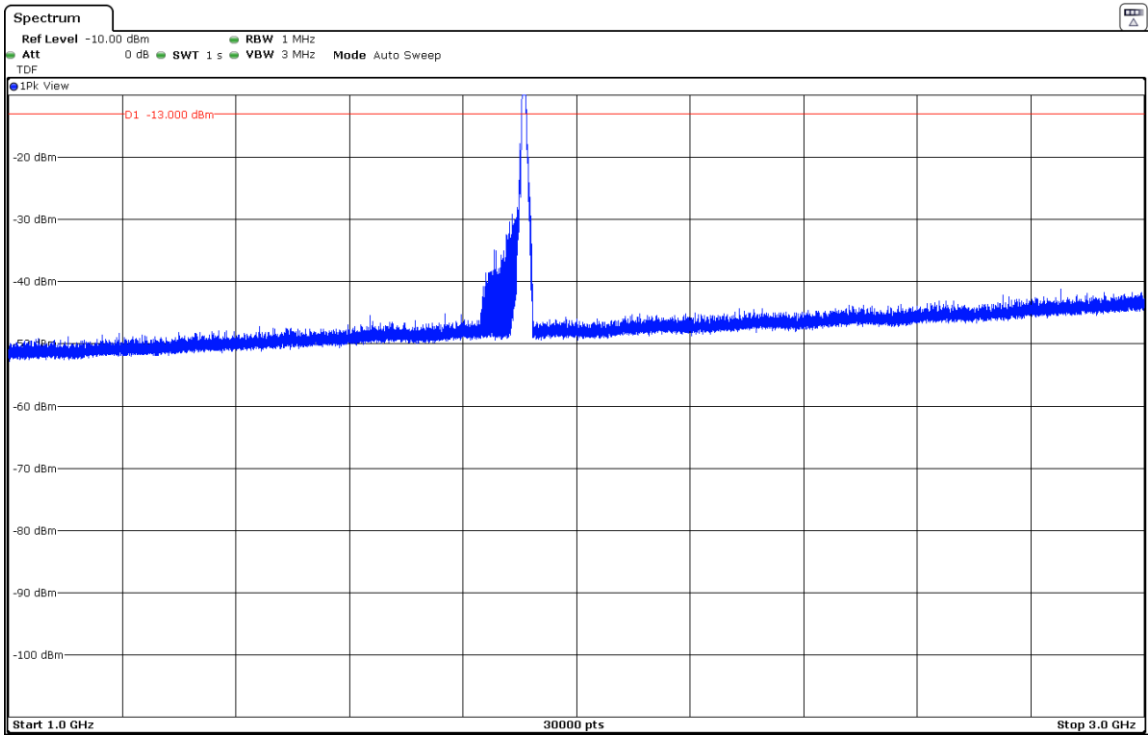
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

- Highest Channel:

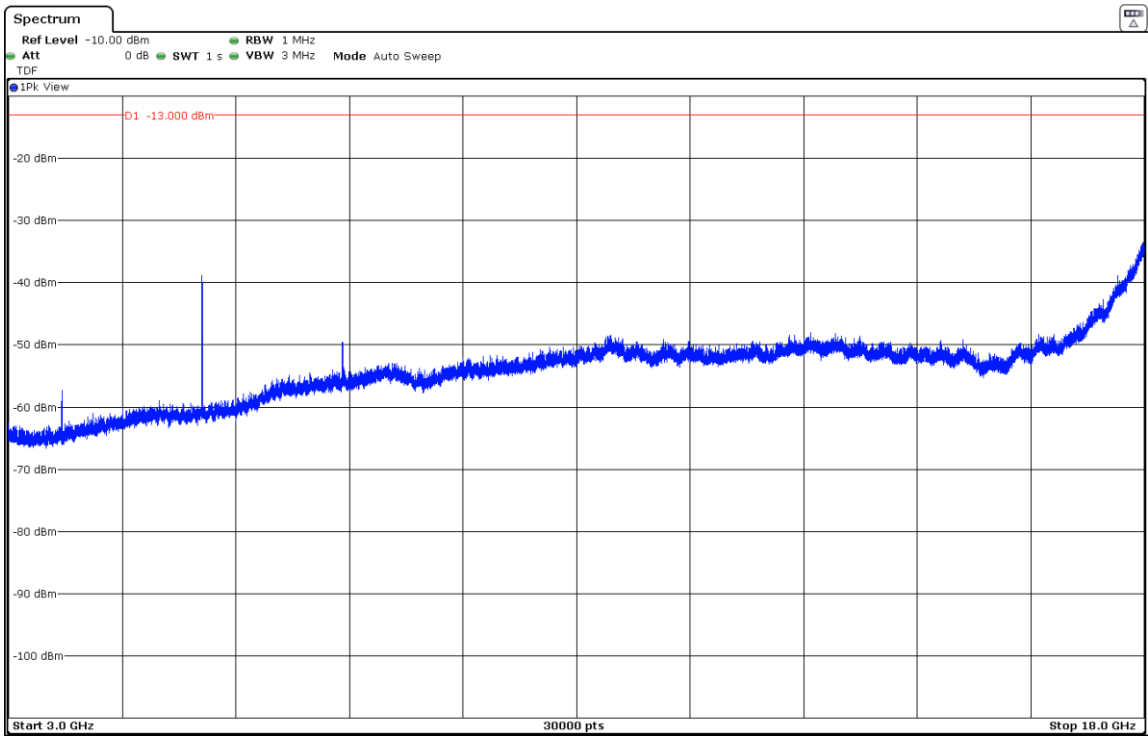


The peak above the limit is the carrier frequency.

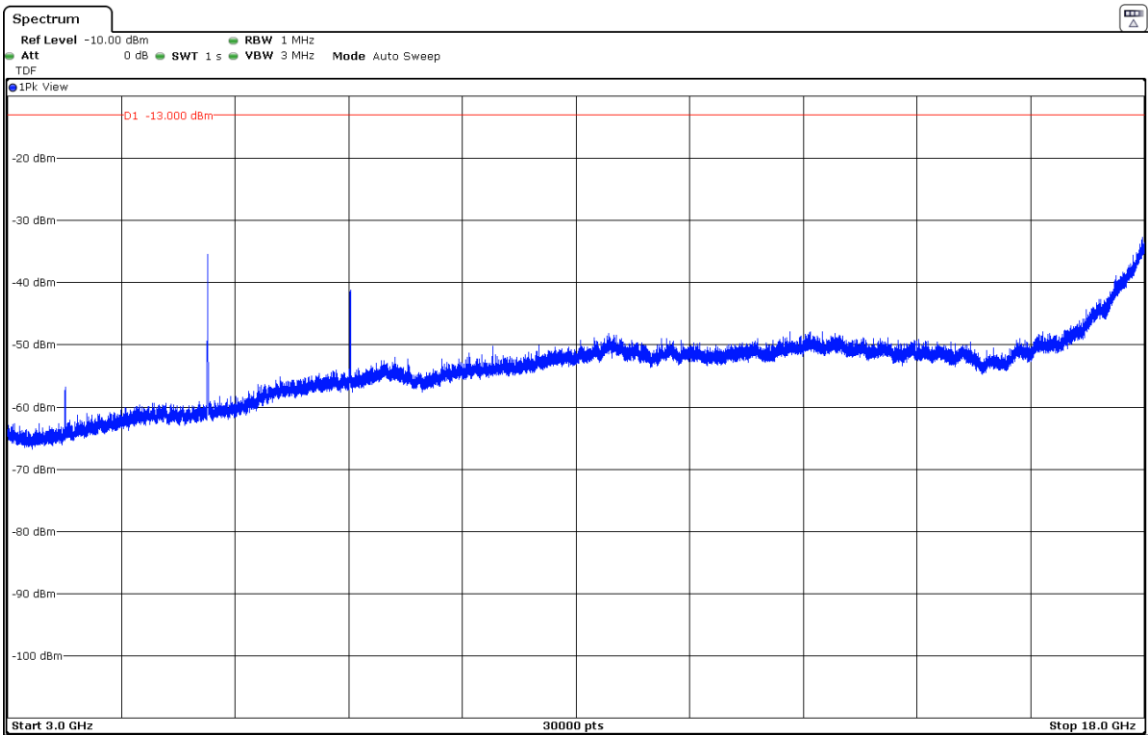
FREQUENCY RANGE 3 - 18 GHz

HSUPA MODULATION

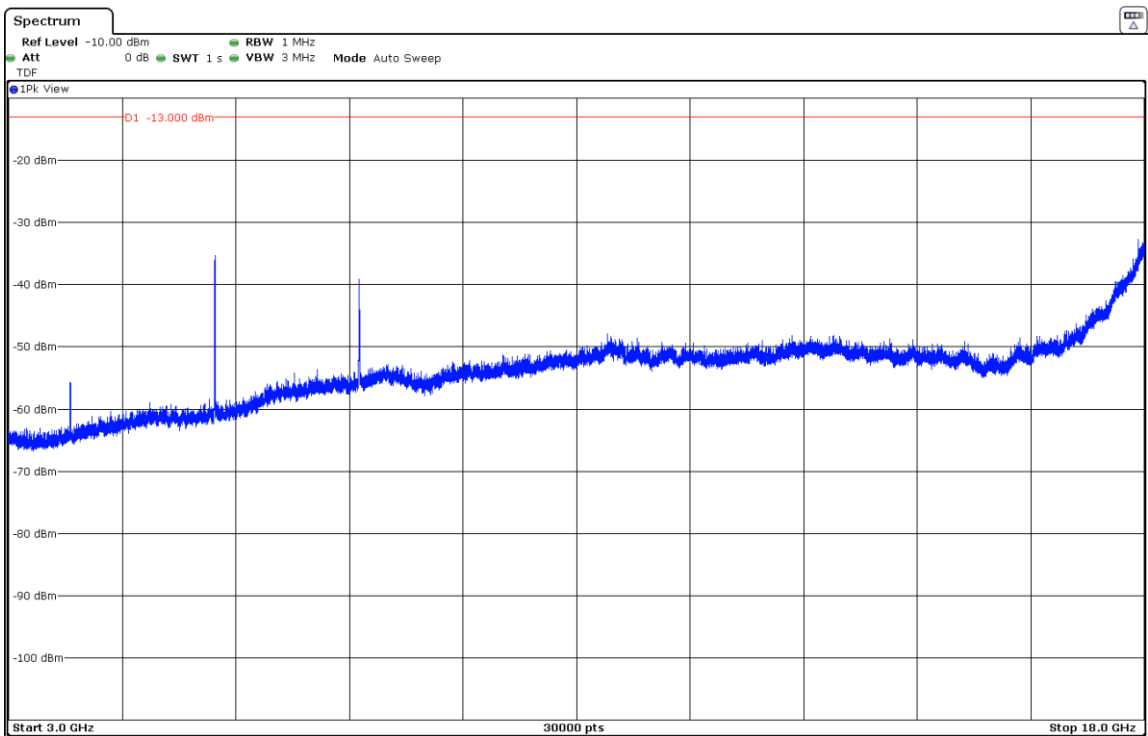
- Lowest Channel:



- Middle Channel:



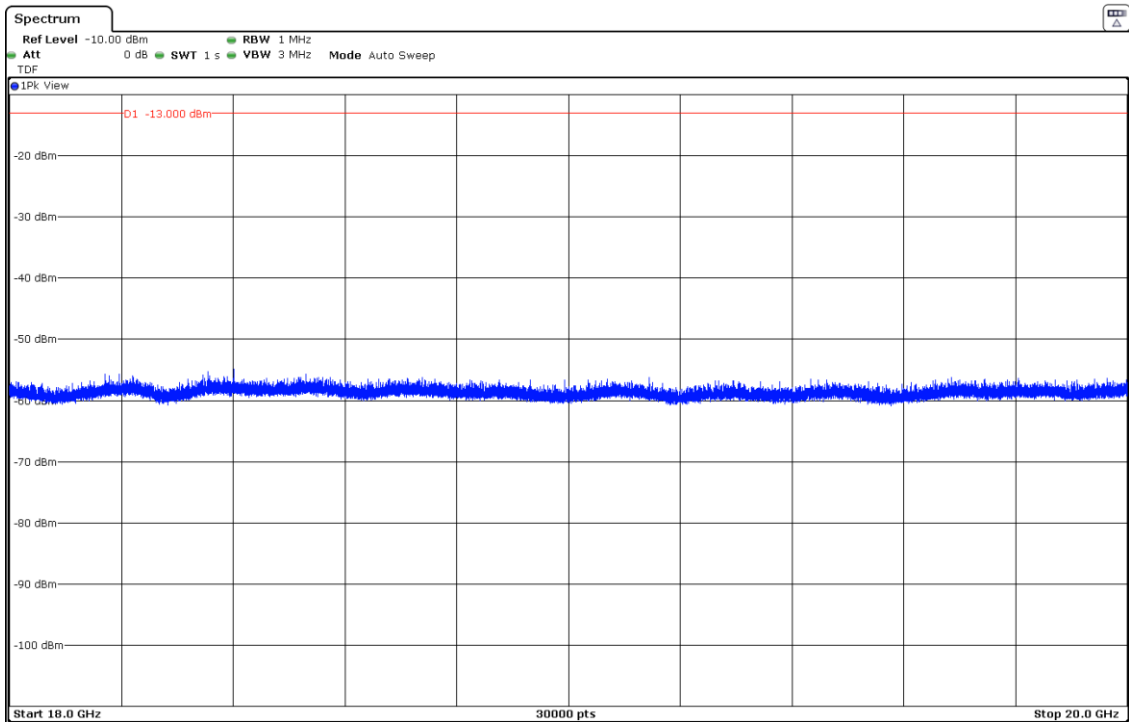
- Highest Channel:



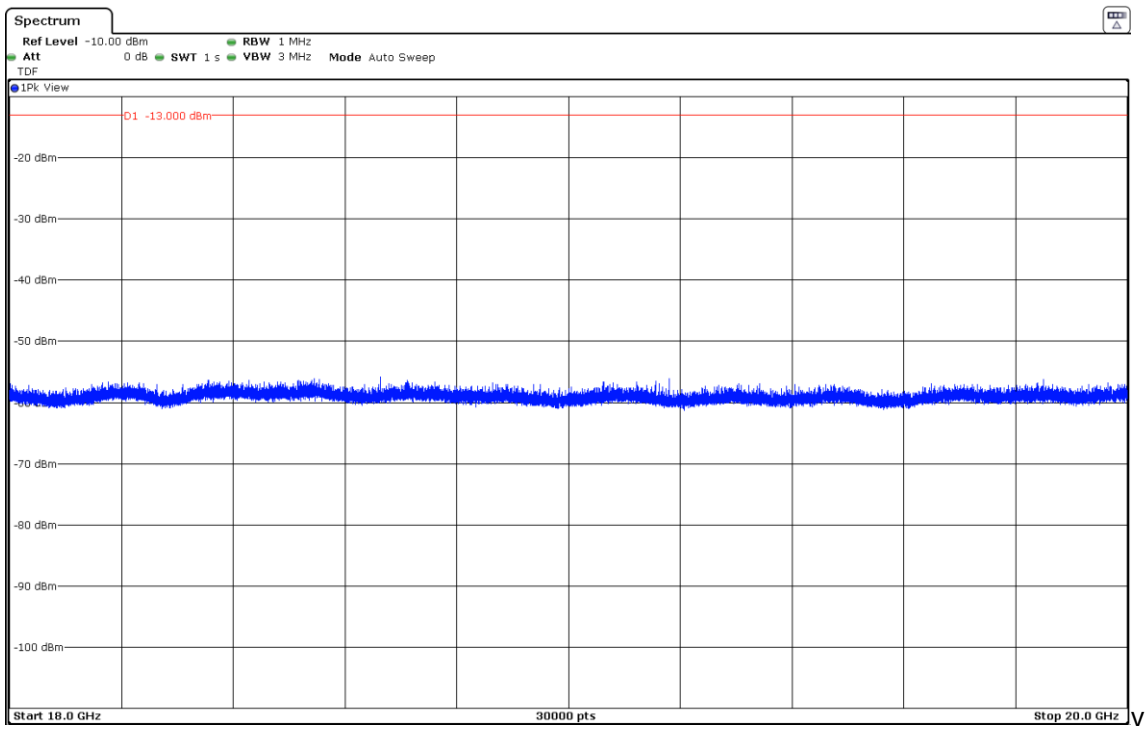
FREQUENCY RANGE 18 - 20 GHz

HSUPA MODULATION

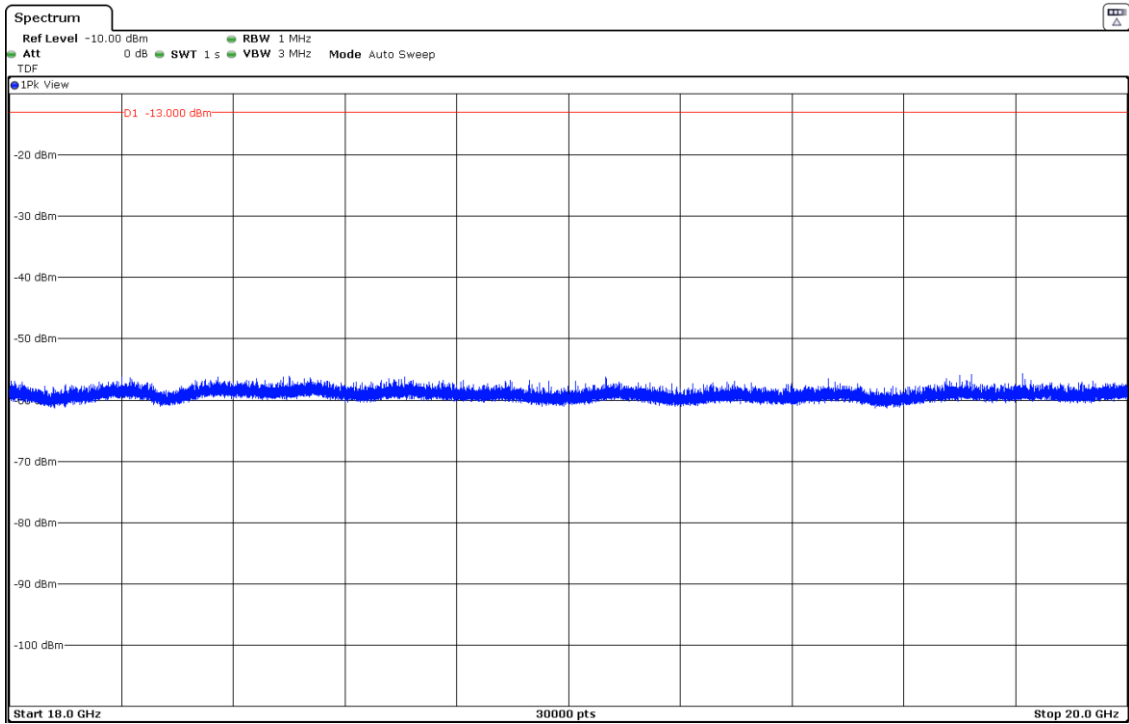
- Lowest Channel:



- Middle Channel:



- Highest Channel:



## **LTE Band 25:**

QPSK and 16QAM Modulations:

A preliminary scan determined the QPSK modulation, BW=20 MHz, RB=1, Offset=0 as the worst case.

### **- Lowest Channel:**

#### **Frequency range 30 MHz - 1 GHz**

No spurious signals were found at less than 20 dB below the limit.

#### **Frequency range 1 - 18 GHz**

Substitution method data:

| Frequency (MHz) | Instrument reading (dBm) | Polarization | (1) Generator output (dBm) | (2) Cable loss (dB) | (3) Substitution antenna gain Gi (respect to isotropic radiator) (dB) | E.I.R.P. (dBm) = (1) – (2) + (3) |
|-----------------|--------------------------|--------------|----------------------------|---------------------|-----------------------------------------------------------------------|----------------------------------|
| 7440.25         | -42.71                   | Vertical     | -38.18                     | 4.06                | 10.59                                                                 | -31.65                           |

#### **Frequency range 18 - 20 GHz**

No spurious signals were found at less than 20 dB below the limit.

### **- Middle Channel:**

#### **Frequency range 30 MHz - 1 GHz**

No spurious signals were found at less than 20 dB below the limit.

#### **Frequency range 1 GHz-18 GHz**

Substitution method data:

| Frequency (MHz) | Instrument reading (dBm) | Polarization | (1) Generator output (dBm) | (2) Cable loss (dB) | (3) Substitution antenna gain Gi (respect to isotropic radiator) (dB) | E.I.R.P. (dBm) = (1) – (2) + (3) |
|-----------------|--------------------------|--------------|----------------------------|---------------------|-----------------------------------------------------------------------|----------------------------------|
| 5620.75         | -39.89                   | Vertical     | -40.73                     | 3.40                | 12.84                                                                 | -31.29                           |
| 7494.25         | -45.87                   | Vertical     | -38.53                     | 4.09                | 10.70                                                                 | -31.92                           |

#### **Frequency range 18 - 20 GHz**

No spurious signals were found at less than 20 dB below the limit.

## - Highest Channel:

### Frequency range 30 MHz - 1 GHz

No spurious signals were found at less than 20 dB below the limit.

### Frequency range 1 GHz-18 GHz.

Substitution method data:

| Frequency (MHz) | Instrument reading (dBm) | Polarization | (1) Generator output (dBm) | (2) Cable loss (dB) | (3) Substitution antenna gain $G_i$ (respect to isotropic radiator) (dB) | E.I.R.P. (dBm) = (1) – (2) + (3) |
|-----------------|--------------------------|--------------|----------------------------|---------------------|--------------------------------------------------------------------------|----------------------------------|
| 7584.25         | -45.61                   | Vertical     | -38.08                     | 4.23                | 10.65                                                                    | -31.66                           |

### Frequency range 18 - 20 GHz

No spurious signals were found at less than 20 dB below the limit.

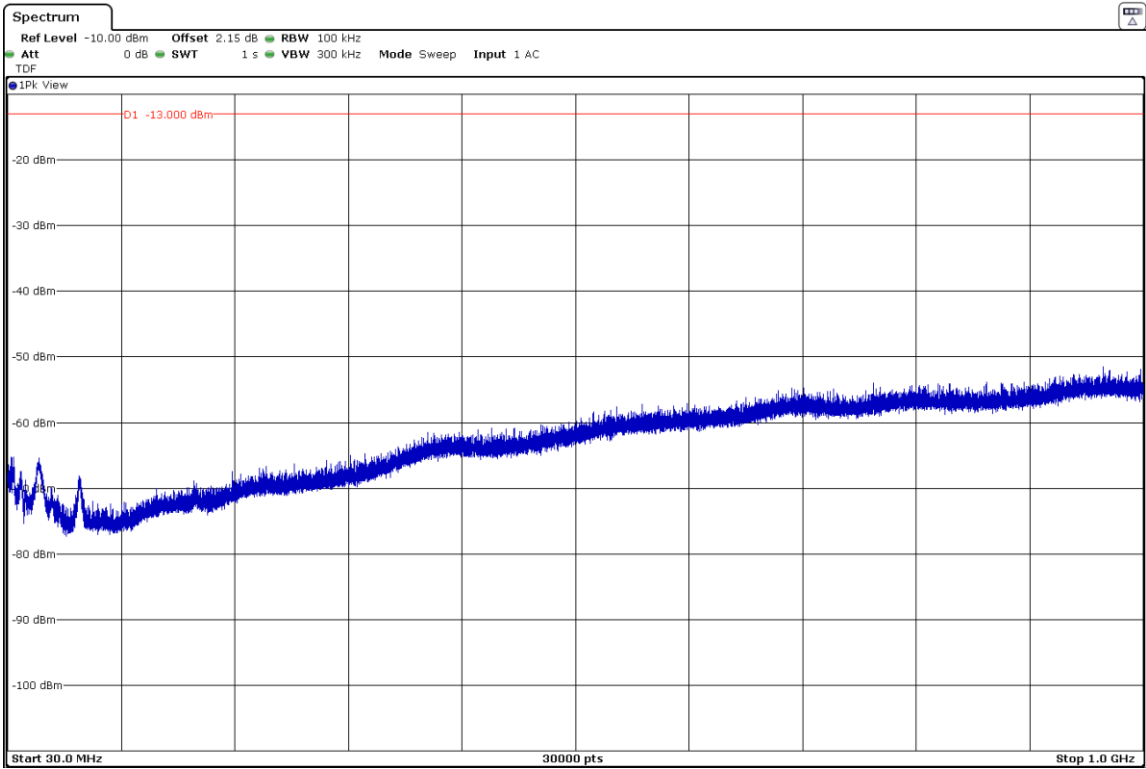
|                              |                                                                                                                                              |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement uncertainty (dB) | $<\pm 2.07$ for $f < 1\text{GHz}$<br>$<\pm 4.88$ for $f \geq 1\text{GHz}$ up to 18 GHz<br>$<\pm 3.31$ for $f \geq 18\text{GHz}$ up to 26 GHz |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

QPSK MODULATION

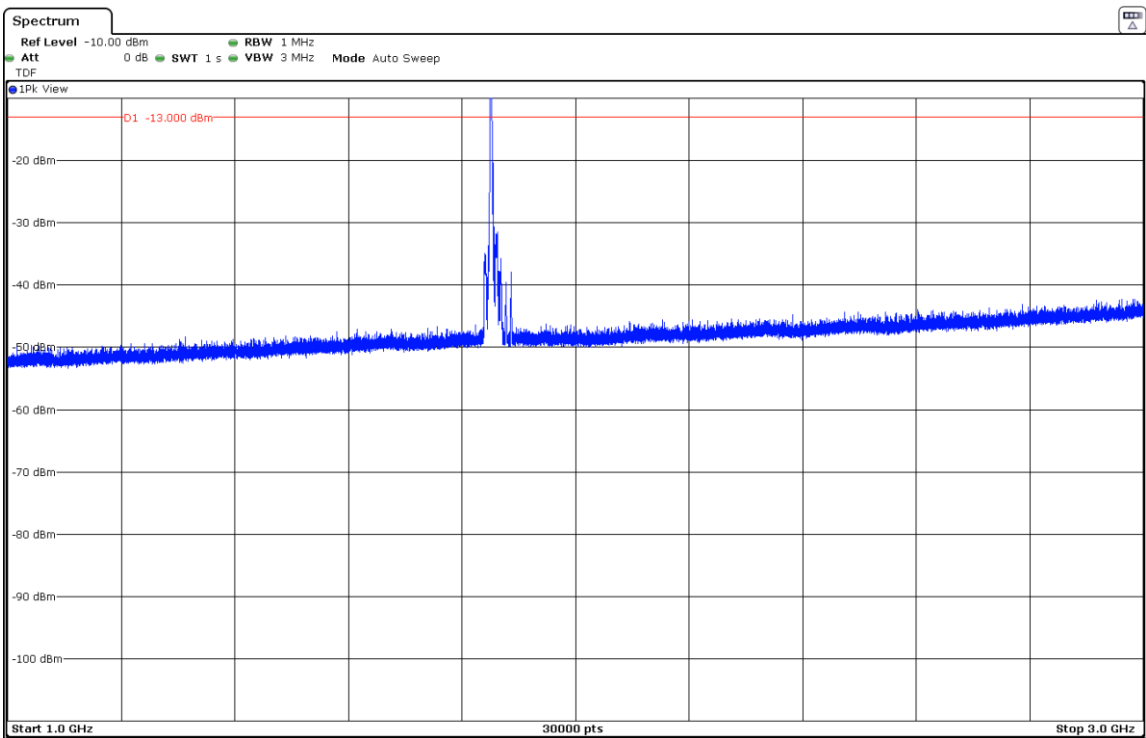
This plot is valid for the Lowest, Middle and Highest Channels:



FREQUENCY RANGE 1 - 3 GHz

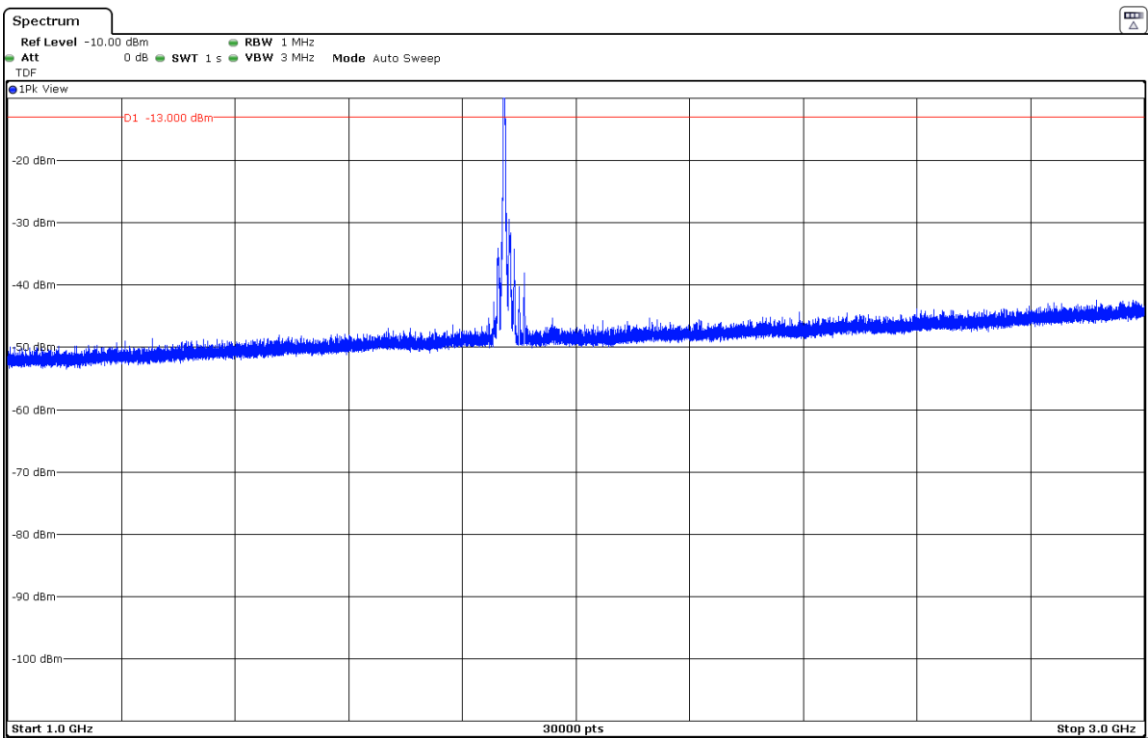
QPSK MODULATION

- Lowest Channel:



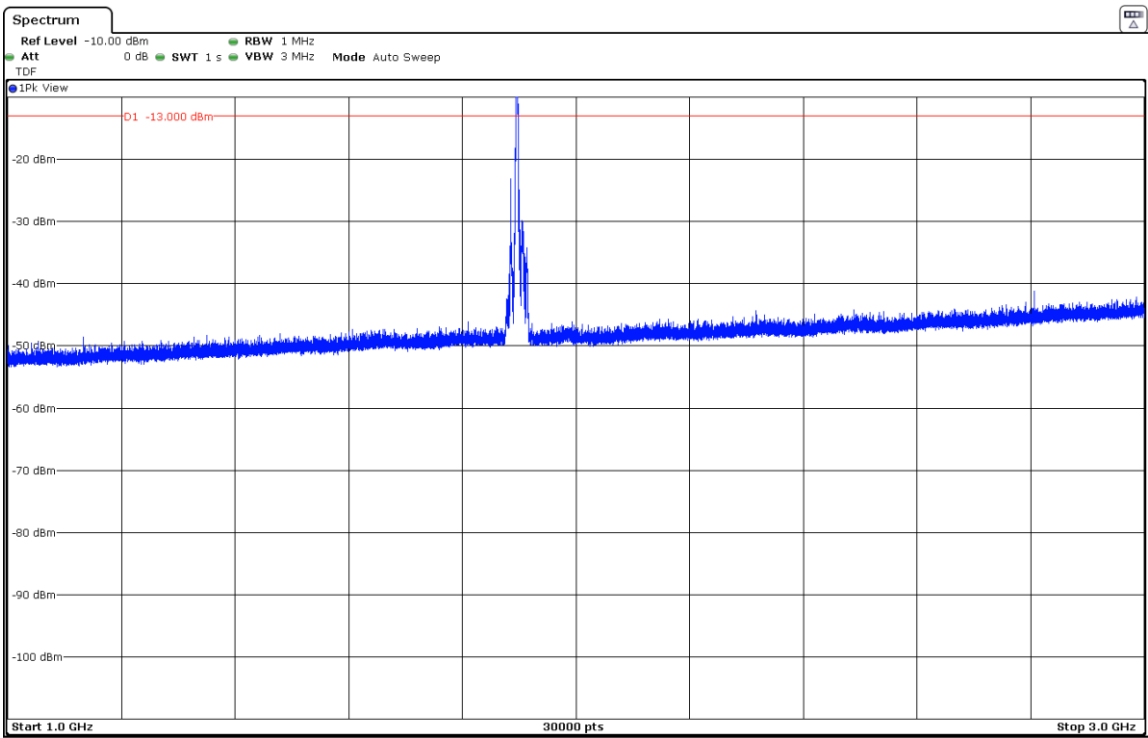
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

- Highest Channel:

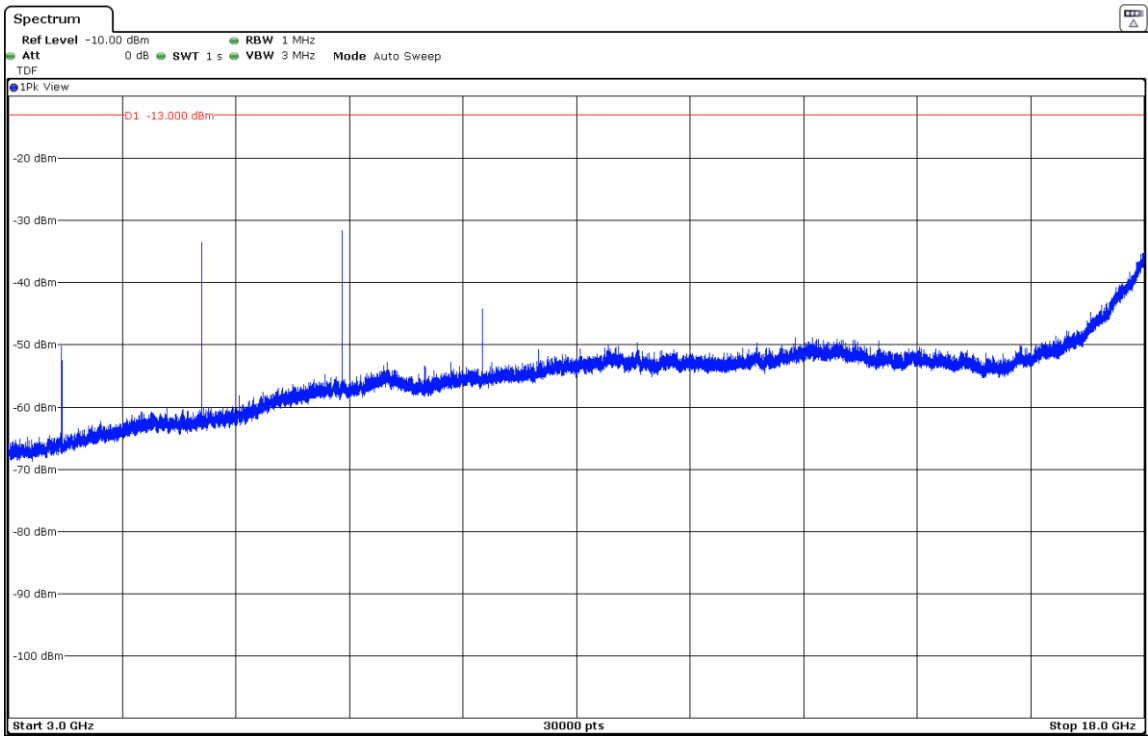


The peak above the limit is the carrier frequency.

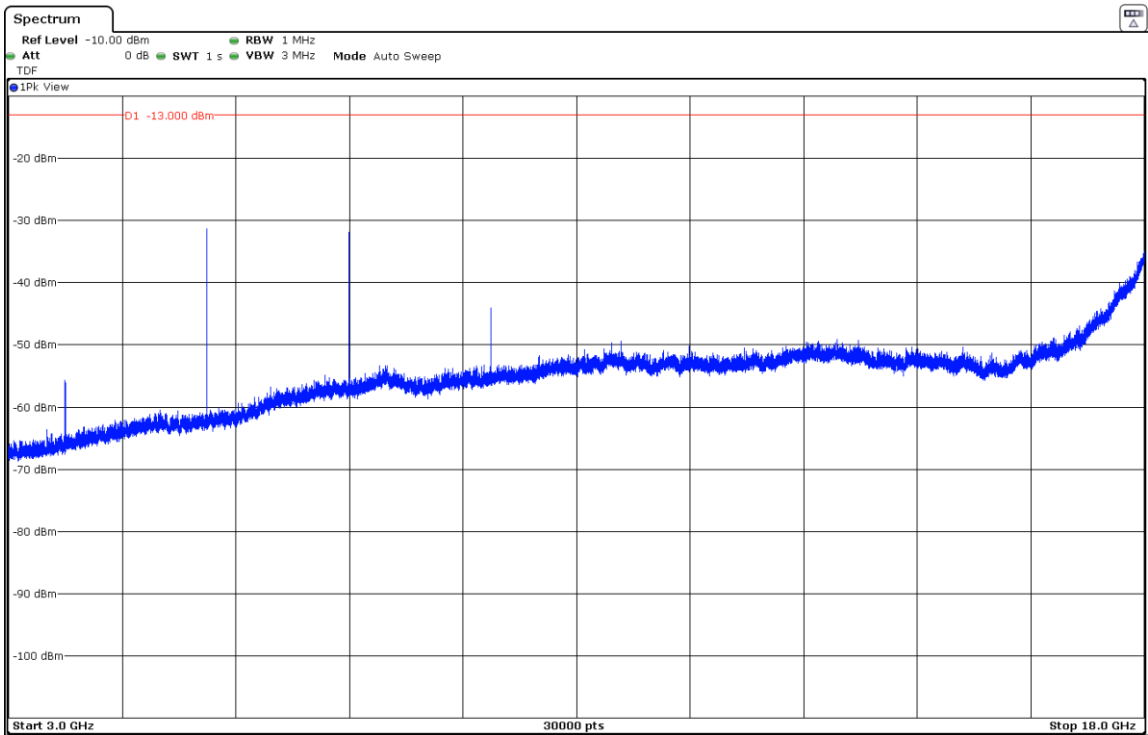
FREQUENCY RANGE 3 - 18 GHz

QPSK MODULATION

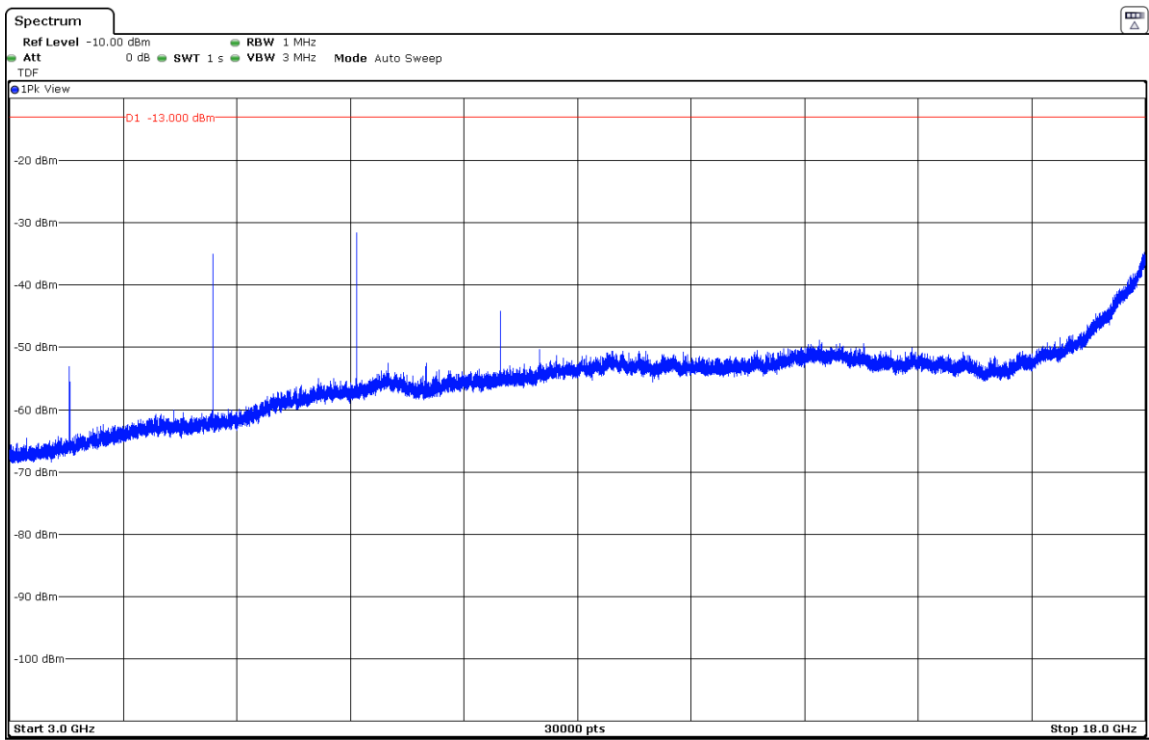
- Lowest Channel:



- Middle Channel:



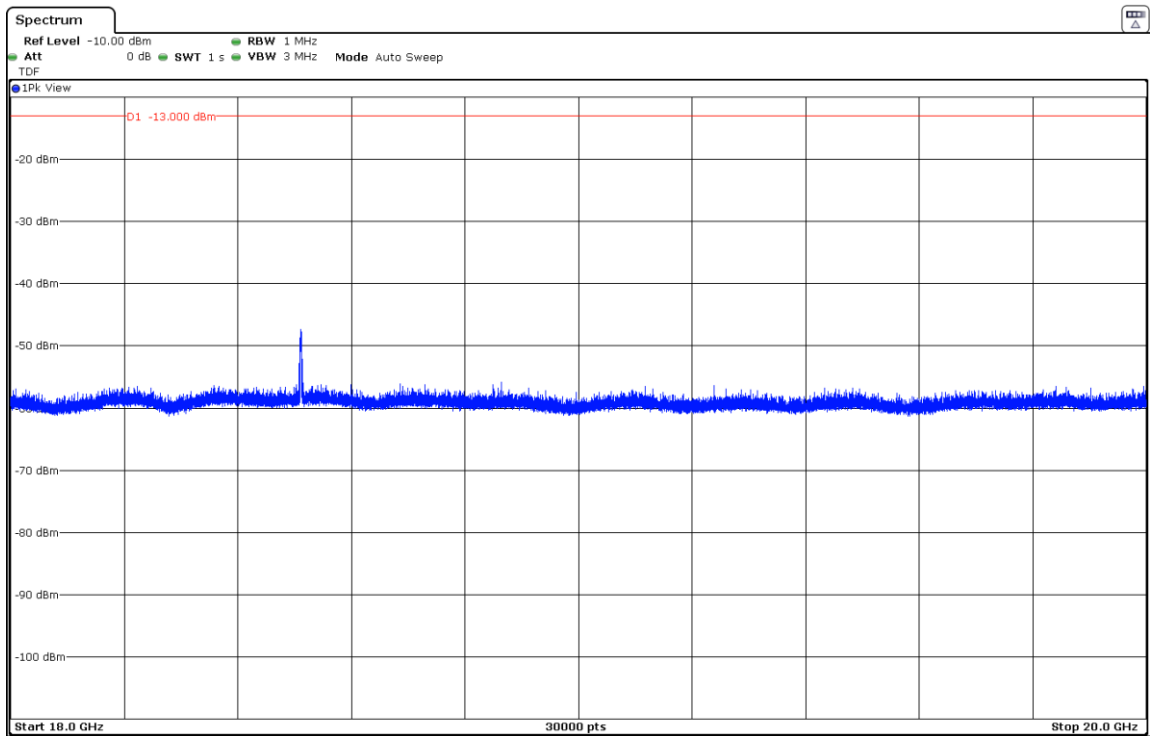
- Highest Channel:



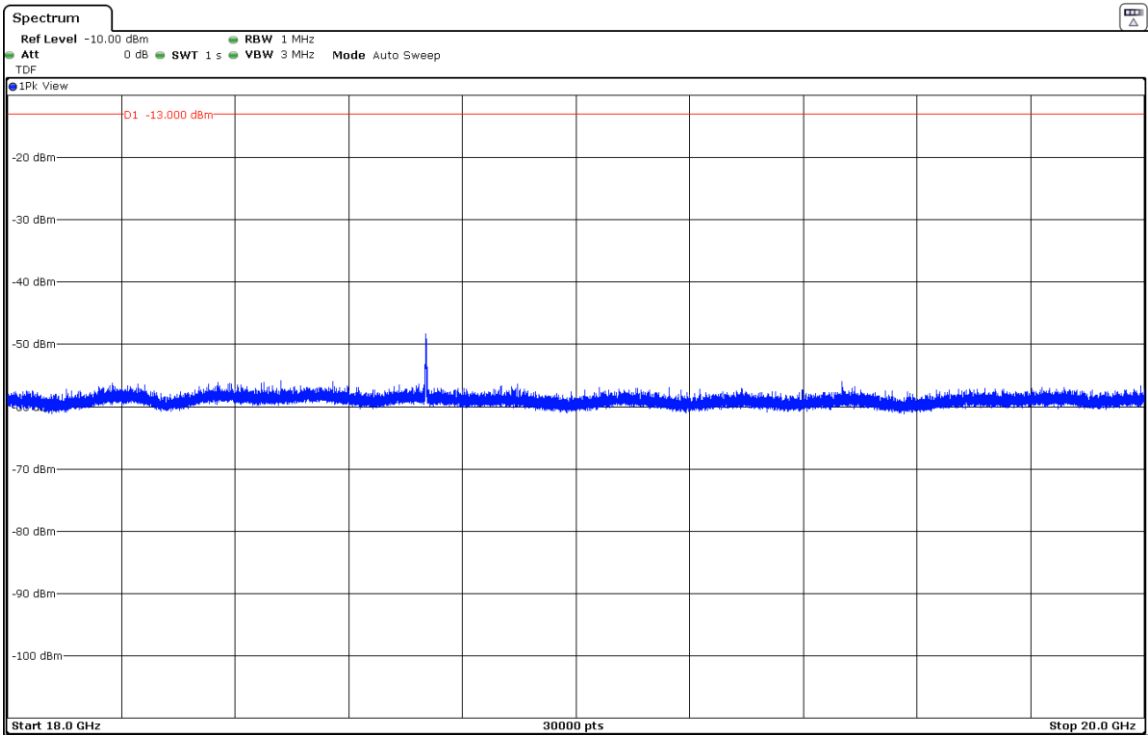
FREQUENCY RANGE 18 - 20 GHz

QPSK MODULATION

- Lowest Channel:



- Middle Channel:



- Highest Channel:

