

**LTE Band CA\_41C, 20MHz+20MHz, QPSK, Channel 39750+39948**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 17012.50       | -46.20                 | 2.90      | 14.50        | -34.60        | -25.00      | H            |
| 17213.12       | -45.75                 | 2.90      | 14.50        | -34.15        | -25.00      | H            |
| 17233.12       | -46.37                 | 3.20      | 14.50        | -35.07        | -25.00      | H            |
| 17503.75       | -43.76                 | 2.90      | 12.80        | -33.86        | -25.00      | H            |
| 17591.25       | -43.96                 | 3.30      | 12.80        | -34.46        | -25.00      | H            |
| 17833.12       | -43.41                 | 3.60      | 12.80        | -34.21        | -25.00      | H            |

**LTE Band CA\_41C, 20MHz+20MHz, QPSK, Channel 40521+40719**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 16950.62       | -48.31                 | 2.90      | 16.50        | -34.71        | -25.00      | H            |
| 17173.75       | -45.48                 | 2.90      | 14.50        | -33.88        | -25.00      | H            |
| 17226.25       | -45.65                 | 3.20      | 14.50        | -34.35        | -25.00      | H            |
| 17512.50       | -43.91                 | 2.90      | 12.80        | -34.01        | -25.00      | H            |
| 17583.12       | -43.63                 | 3.30      | 12.80        | -34.13        | -25.00      | H            |
| 17776.88       | -43.25                 | 3.60      | 12.80        | -34.05        | -25.00      | H            |

**LTE Band CA\_41C, 20MHz+20MHz, QPSK, Channel 41292+41490**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 16950.62       | -48.75                 | 2.90      | 16.50        | -35.15        | -25.00      | H            |
| 17181.88       | -46.68                 | 2.90      | 14.50        | -35.08        | -25.00      | H            |
| 17348.75       | -45.41                 | 3.20      | 14.50        | -34.11        | -25.00      | H            |
| 17458.12       | -45.64                 | 2.90      | 14.50        | -34.04        | -25.00      | H            |
| 17539.38       | -43.83                 | 2.90      | 12.80        | -33.93        | -25.00      | H            |
| 17839.38       | -44.09                 | 3.60      | 12.80        | -34.89        | -25.00      | H            |

**LTE Band CA\_41C, 20MHz+20MHz, 16QAM, Channel 39750+39948**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 16981.88       | -48.55                 | 2.90      | 16.50        | -34.95        | -25.00      | H            |
| 17125.62       | -45.81                 | 2.90      | 14.50        | -34.21        | -25.00      | H            |
| 17235.00       | -45.88                 | 3.20      | 14.50        | -34.58        | -25.00      | H            |
| 17455.62       | -45.66                 | 2.90      | 14.50        | -34.06        | -25.00      | H            |
| 17595.62       | -43.51                 | 3.30      | 12.80        | -34.01        | -25.00      | H            |
| 17833.75       | -43.25                 | 3.60      | 12.80        | -34.05        | -25.00      | H            |

**LTE Band CA\_41C, 20MHz+20MHz, 16QAM, Channel 40521+40719**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 16968.12       | -48.83                 | 2.90      | 16.50        | -35.23        | -25.00      | H            |
| 17113.75       | -46.39                 | 2.90      | 14.50        | -34.79        | -25.00      | H            |
| 17352.50       | -45.23                 | 3.20      | 14.50        | -33.93        | -25.00      | H            |
| 17518.12       | -43.85                 | 2.90      | 12.80        | -33.95        | -25.00      | H            |
| 17526.25       | -44.67                 | 2.90      | 12.80        | -34.77        | -25.00      | H            |
| 17790.00       | -43.65                 | 3.60      | 12.80        | -34.45        | -25.00      | H            |

**LTE Band CA\_41C, 20MHz+20MHz, 16QAM, Channel 41292+41490**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 17005.62       | -46.58                 | 2.90      | 14.50        | -34.98        | -25.00      | H            |
| 17129.38       | -46.43                 | 2.90      | 14.50        | -34.83        | -25.00      | H            |
| 17276.88       | -45.97                 | 3.20      | 14.50        | -34.67        | -25.00      | H            |
| 17524.38       | -44.76                 | 2.90      | 12.80        | -34.86        | -25.00      | H            |
| 17600.62       | -44.29                 | 3.30      | 12.80        | -34.79        | -25.00      | H            |
| 17830.62       | -43.17                 | 3.60      | 12.80        | -33.97        | -25.00      | H            |

**LTE Band CA\_41C, 20MHz+20MHz, 64QAM, Channel 39750+39948**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 17003.75       | -47.28                 | 2.90      | 14.50        | -35.68        | -25.00      | H            |
| 17124.38       | -46.43                 | 2.90      | 14.50        | -34.83        | -25.00      | H            |
| 17272.50       | -45.95                 | 3.20      | 14.50        | -34.65        | -25.00      | H            |
| 17520.62       | -44.60                 | 2.90      | 12.80        | -34.70        | -25.00      | H            |
| 17626.25       | -44.09                 | 3.30      | 12.80        | -34.59        | -25.00      | H            |
| 17768.12       | -43.97                 | 3.60      | 12.80        | -34.77        | -25.00      | H            |

**LTE Band CA\_41C, 20MHz+20MHz, 64QAM, Channel 40521+40719**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 16961.25       | -48.28                 | 2.90      | 16.50        | -34.68        | -25.00      | H            |
| 17213.12       | -46.19                 | 2.90      | 14.50        | -34.59        | -25.00      | H            |
| 17275.62       | -46.13                 | 3.20      | 14.50        | -34.83        | -25.00      | H            |
| 17515.00       | -44.63                 | 2.90      | 12.80        | -34.73        | -25.00      | H            |
| 17560.62       | -44.26                 | 2.90      | 12.80        | -34.36        | -25.00      | H            |
| 17775.00       | -43.36                 | 3.60      | 12.80        | -34.16        | -25.00      | H            |

**LTE Band CA\_41C, 20MHz+20MHz, 64QAM, Channel 41292+41490**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak ERP(dBm) | Limit (dBm) | Polarization |
|----------------|------------------------|-----------|--------------|---------------|-------------|--------------|
| 16997.50       | -48.67                 | 2.90      | 16.50        | -35.07        | -25.00      | H            |
| 17190.62       | -46.13                 | 2.90      | 14.50        | -34.53        | -25.00      | H            |
| 17302.50       | -45.91                 | 3.20      | 14.50        | -34.61        | -25.00      | H            |
| 17416.25       | -45.80                 | 2.90      | 14.50        | -34.20        | -25.00      | H            |
| 17612.50       | -43.78                 | 3.30      | 12.80        | -34.28        | -25.00      | H            |
| 17784.38       | -43.67                 | 3.60      | 12.80        | -34.47        | -25.00      | H            |

Note: The maximum value of expanded measurement uncertainty for this test item is

U = 2.87dB(30MHz-3GHz)/3.35dB(3GHz-18GHz)/2.68dB(18GHz-40GHz), k = 2

### **A.3 FREQUENCY STABILITY**

#### **Reference**

FCC: CFR Part 2.1055, 22.355, 24.235, 27.54, 90.213.

#### **A.3.1 Method of Measurement**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of R&S CMW500.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on mid channel of all bands, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5 °C during the measurement procedure.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of the lower, higher and nominal voltage. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress.

### A.3.2 Measurement results

#### LTE Band 2, 20MHz bandwidth (worst case of all bandwidths)

##### Frequency Error vs Temperature

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 1850.280 | 1909.360 | 2.14       | 0.0012               |
| 40              |            |          |          | -1.66      | 0.0009               |
| 30              |            |          |          | -3.16      | 0.0017               |
| 20              |            |          |          | -0.54      | 0.0003               |
| 10              |            |          |          | -3.33      | 0.0018               |
| 0               |            |          |          | -2.09      | 0.0011               |
| -10             |            |          |          | 0.60       | 0.0003               |
| -20             |            |          |          | -1.79      | 0.0010               |
| -30             |            |          |          | 2.43       | 0.0013               |

##### Frequency Error vs Voltage

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 1850.280 | 1909.360 | 0.67       | 0.0004               |
| 4.45       |                 |          |          | 3.02       | 0.0016               |

Expanded measurement uncertainty is 10 Hz,  $k = 2$

#### LTE Band 4, 20MHz bandwidth (worst case of all bandwidths)

##### Frequency Error vs Temperature

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 1710.560 | 1754.480 | 3.12       | 0.0018               |
| 40              |            |          |          | 0.74       | 0.0004               |
| 30              |            |          |          | -1.45      | 0.0008               |
| 20              |            |          |          | 1.93       | 0.0011               |
| 10              |            |          |          | 0.23       | 0.0001               |
| 0               |            |          |          | -2.75      | 0.0016               |
| -10             |            |          |          | 2.22       | 0.0013               |
| -20             |            |          |          | 3.59       | 0.0021               |
| -30             |            |          |          | 2.85       | 0.0016               |

##### Frequency Error vs Voltage

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 1710.560 | 1754.480 | 1.17       | 0.0007               |
| 4.45       |                 |          |          | 4.88       | 0.0028               |

panded measurement uncertainty is 10Hz,  $k = 2$

**LTE Band 5, 10MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|---------|---------|------------|----------------------|
| 50              | 3.87       | 824.480 | 848.920 | 1.22       | 0.0015               |
| 40              |            |         |         | 1.37       | 0.0016               |
| 30              |            |         |         | 1.03       | 0.0012               |
| 20              |            |         |         | -1.70      | 0.0020               |
| 10              |            |         |         | 1.13       | 0.0014               |
| 0               |            |         |         | 0.84       | 0.0010               |
| -10             |            |         |         | 1.33       | 0.0016               |
| -20             |            |         |         | 2.80       | 0.0034               |
| -30             |            |         |         | 0.06       | 0.0001               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|---------|---------|------------|----------------------|
| 3.60       | 20              | 824.480 | 848.920 | 0.96       | 0.0011               |
| 4.45       |                 |         |         | -0.54      | 0.0007               |

Expanded measurement uncertainty is 10 Hz,  $k = 2$ 
**LTE Band 7, 20MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 2500.360 | 2569.540 | 2.51       | 0.0010               |
| 40              |            |          |          | -4.23      | 0.0017               |
| 30              |            |          |          | 1.25       | 0.0005               |
| 20              |            |          |          | 0.42       | 0.0002               |
| 10              |            |          |          | -4.74      | 0.0019               |
| 0               |            |          |          | -2.06      | 0.0008               |
| -10             |            |          |          | -2.90      | 0.0011               |
| -20             |            |          |          | -5.24      | 0.0021               |
| -30             |            |          |          | 5.98       | 0.0024               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 2500.360 | 2569.540 | 1.35       | 0.0005               |
| 4.45       |                 |          |          | 0.10       | 0.0000               |

Expanded measurement uncertainty is 10 Hz,  $k = 2$

**LTE Band 12, 10MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|---------|---------|------------|----------------------|
| 50              | 3.87       | 699.480 | 715.570 | 1.03       | 0.0015               |
| 40              |            |         |         | 0.67       | 0.0009               |
| 30              |            |         |         | 0.56       | 0.0008               |
| 20              |            |         |         | -0.70      | 0.0010               |
| 10              |            |         |         | -0.74      | 0.0011               |
| 0               |            |         |         | 0.14       | 0.0002               |
| -10             |            |         |         | -0.09      | 0.0001               |
| -20             |            |         |         | -0.33      | 0.0005               |
| -30             |            |         |         | -1.92      | 0.0027               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|---------|---------|------------|----------------------|
| 3.60       | 20              | 699.480 | 715.570 | -0.47      | 0.0007               |
| 4.45       |                 |         |         | -0.87      | 0.0012               |

Expanded measurement uncertainty is 10Hz, k = 2

**LTE Band 13, 10MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|---------|---------|------------|----------------------|
| 50              | 3.87       | 777.620 | 786.651 | 0.32       | 0.0004               |
| 40              |            |         |         | -2.99      | 0.0038               |
| 30              |            |         |         | -0.96      | 0.0012               |
| 20              |            |         |         | -0.64      | 0.0008               |
| 10              |            |         |         | -0.73      | 0.0009               |
| 0               |            |         |         | -1.25      | 0.0016               |
| -10             |            |         |         | -0.09      | 0.0001               |
| -20             |            |         |         | -2.43      | 0.0031               |
| -30             |            |         |         | 1.92       | 0.0025               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|---------|---------|------------|----------------------|
| 3.60       | 20              | 777.620 | 786.651 | -0.19      | 0.0002               |
| 4.45       |                 |         |         | -1.59      | 0.0020               |

Expanded measurement uncertainty is 10Hz, k = 2

**LTE Band 17, 10MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|---------|---------|------------|----------------------|
| 50              | 3.87       | 704.650 | 715.740 | 0.55       | 0.0008               |
| 40              |            |         |         | 0.44       | 0.0006               |
| 30              |            |         |         | -2.40      | 0.0034               |
| 20              |            |         |         | -0.17      | 0.0002               |
| 10              |            |         |         | 1.15       | 0.0016               |
| 0               |            |         |         | 0.50       | 0.0007               |
| -10             |            |         |         | -0.83      | 0.0012               |
| -20             |            |         |         | -0.99      | 0.0014               |
| -30             |            |         |         | -0.04      | 0.0001               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|---------|---------|------------|----------------------|
| 3.60       | 20              | 704.650 | 715.740 | 0.77       | 0.0011               |
| 4.45       |                 |         |         | -0.44      | 0.0006               |

Expanded measurement uncertainty is 10Hz, k = 2

**LTE Band 26(814MHz-824MHz), 10MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|---------|---------|------------|----------------------|
| 50              | 3.87       | 814.562 | 823.860 | 2.32       | 0.0028               |
| 40              |            |         |         | 1.37       | 0.0017               |
| 30              |            |         |         | -0.92      | 0.0011               |
| 20              |            |         |         | -0.57      | 0.0007               |
| 10              |            |         |         | -1.75      | 0.0021               |
| 0               |            |         |         | -0.79      | 0.0010               |
| -10             |            |         |         | -2.88      | 0.0035               |
| -20             |            |         |         | -2.37      | 0.0029               |
| -30             |            |         |         | -1.59      | 0.0019               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|---------|---------|------------|----------------------|
| 3.60       | 20              | 814.562 | 823.860 | 0.22       | 0.0003               |
| 4.45       |                 |         |         | -0.92      | 0.0011               |

Expanded measurement uncertainty is 10Hz, k = 2

**LTE band 26(824MHz-849MHz), 15MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|---------|---------|------------|----------------------|
| 50              | 3.87       | 824.640 | 848.700 | 1.38       | 0.0016               |
| 40              |            |         |         | 0.59       | 0.0007               |
| 30              |            |         |         | 0.21       | 0.0003               |
| 20              |            |         |         | -0.43      | 0.0005               |
| 10              |            |         |         | 1.43       | 0.0017               |
| 0               |            |         |         | 0.29       | 0.0003               |
| -10             |            |         |         | 2.47       | 0.0030               |
| -20             |            |         |         | 1.56       | 0.0019               |
| -30             |            |         |         | 0.77       | 0.0009               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz) | FH(MHz) | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|---------|---------|------------|----------------------|
| 3.60       | 20              | 824.640 | 848.700 | 0.52       | 0.0006               |
| 4.45       |                 |         |         | 1.12       | 0.0013               |

Expanded measurement uncertainty is 10Hz, k = 2

**LTE Band 38, 20MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 2570.880 | 2619.120 | 1.85       | 0.0007               |
| 40              |            |          |          | 1.70       | 0.0007               |
| 30              |            |          |          | 2.33       | 0.0009               |
| 20              |            |          |          | 2.52       | 0.0010               |
| 10              |            |          |          | 1.29       | 0.0005               |
| 0               |            |          |          | 0.26       | 0.0001               |
| -10             |            |          |          | 2.48       | 0.0010               |
| -20             |            |          |          | -1.23      | 0.0005               |
| -30             |            |          |          | -1.03      | 0.0004               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 2570.880 | 2619.120 | 3.38       | 0.0013               |
| 4.45       |                 |          |          | 1.07       | 0.0004               |

Expanded measurement uncertainty is 10Hz, k = 2

**LTE Band 41, 20MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 2496.800 | 2689.200 | 0.25       | 0.0001               |
| 40              |            |          |          | -5.24      | 0.0020               |
| 30              |            |          |          | 3.55       | 0.0014               |
| 20              |            |          |          | 3.83       | 0.0015               |
| 10              |            |          |          | -0.40      | 0.0002               |
| 0               |            |          |          | 0.53       | 0.0002               |
| -10             |            |          |          | 0.10       | 0.0000               |
| -20             |            |          |          | 3.43       | 0.0013               |
| -30             |            |          |          | 0.73       | 0.0003               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 2496.800 | 2689.200 | 4.89       | 0.0019               |
| 4.45       |                 |          |          | 0.36       | 0.0001               |

Expanded measurement uncertainty is 10 Hz,  $k = 2$ 
**LTE Band 66, 20MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Temperature**

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 1710.540 | 1779.560 | 1.02       | 0.0006               |
| 40              |            |          |          | 0.19       | 0.0001               |
| 30              |            |          |          | 0.93       | 0.0005               |
| 20              |            |          |          | -2.75      | 0.0016               |
| 10              |            |          |          | 0.67       | 0.0004               |
| 0               |            |          |          | 2.53       | 0.0015               |
| -10             |            |          |          | -0.33      | 0.0002               |
| -20             |            |          |          | -0.90      | 0.0005               |
| -30             |            |          |          | -0.22      | 0.0001               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 1710.540 | 1779.560 | 0.79       | 0.0005               |
| 4.45       |                 |          |          | -0.12      | 0.0001               |

Expanded measurement uncertainty is 10Hz,  $k = 2$

**LTE band 7\_CA, 20MHz+20MHz bandwidth QPSK(worst case of all bandwidths)**
**Frequency Error vs Voltage**

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 2500.540 | 2569.480 | 5.21       | 0.0021               |
| 40              |            |          |          | 8.00       | 0.0032               |
| 30              |            |          |          | 10.17      | 0.0040               |
| 20              |            |          |          | 6.79       | 0.0027               |
| 10              |            |          |          | 4.24       | 0.0017               |
| 0               |            |          |          | 6.26       | 0.0025               |
| -10             |            |          |          | 7.35       | 0.0029               |
| -20             |            |          |          | 10.46      | 0.0041               |
| -30             |            |          |          | 5.11       | 0.0020               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 2500.540 | 2569.480 | 3.31       | 0.0013               |
| 4.45       |                 |          |          | 1.16       | 0.0005               |

Expanded measurement uncertainty is 10Hz, k = 2

**LTE band 38\_CA, 20MHz+20MHz bandwidth QPSK(worst case of all bandwidths)**
**Frequency Error vs Voltage**

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 2570.620 | 2619.360 | 4.32       | 0.0017               |
| 40              |            |          |          | -4.04      | 0.0016               |
| 30              |            |          |          | -1.87      | 0.0007               |
| 20              |            |          |          | 0.43       | 0.0002               |
| 10              |            |          |          | -2.63      | 0.0010               |
| 0               |            |          |          | -1.13      | 0.0004               |
| -10             |            |          |          | -5.93      | 0.0023               |
| -20             |            |          |          | -6.44      | 0.0025               |
| -30             |            |          |          | 4.86       | 0.0019               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 2570.620 | 2619.360 | -1.46      | 0.0006               |
| 4.45       |                 |          |          | -4.08      | 0.0016               |

Expanded measurement uncertainty is 10Hz, k = 2



**LTE band 41\_CA, 20MHz+20MHz bandwidth QPSK(worst case of all bandwidths)**

**Frequency Error vs Voltage**

| Temperature(°C) | Voltage(V) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|-----------------|------------|----------|----------|------------|----------------------|
| 50              | 3.87       | 2496.940 | 2689.060 | 6.84       | 0.0026               |
| 40              |            |          |          | 3.61       | 0.0014               |
| 30              |            |          |          | -1.14      | 0.0004               |
| 20              |            |          |          | -3.02      | 0.0012               |
| 10              |            |          |          | -0.06      | 0.0000               |
| 0               |            |          |          | 5.78       | 0.0022               |
| -10             |            |          |          | -2.02      | 0.0008               |
| -20             |            |          |          | 7.01       | 0.0027               |
| -30             |            |          |          | 5.33       | 0.0021               |

**Frequency Error vs Voltage**

| Voltage(V) | Temperature(°C) | FL(MHz)  | FH(MHz)  | Offset(Hz) | Frequency error(ppm) |
|------------|-----------------|----------|----------|------------|----------------------|
| 3.60       | 20              | 2496.940 | 2689.060 | 5.67       | 0.0022               |
| 4.45       |                 |          |          | 0.77       | 0.0003               |

Expanded measurement uncertainty is 10Hz, k = 2



## A.4 OCCUPIED BANDWIDTH

### Reference

FCC: CFR Part 2.1049, 22.917, 24.238, 27.53, 90.1215.

#### A.4.1 Occupied Bandwidth Results

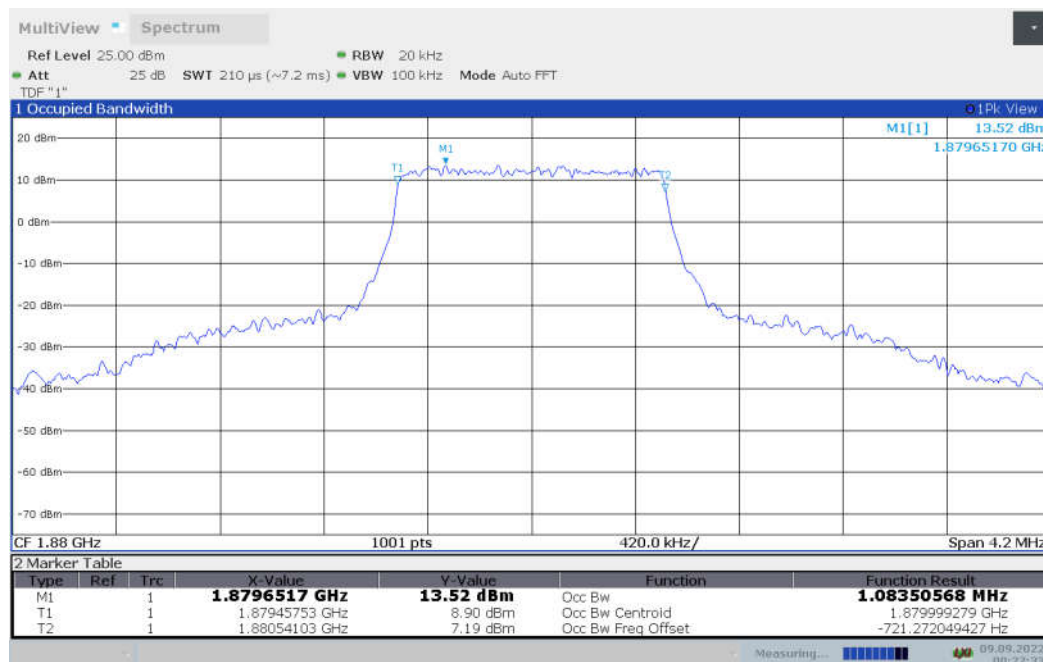
Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
- Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least  $10\log(\text{OBW} / \text{RBW})$  below the reference level.
- Set the detection mode to peak, and the trace mode to max hold.
- Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

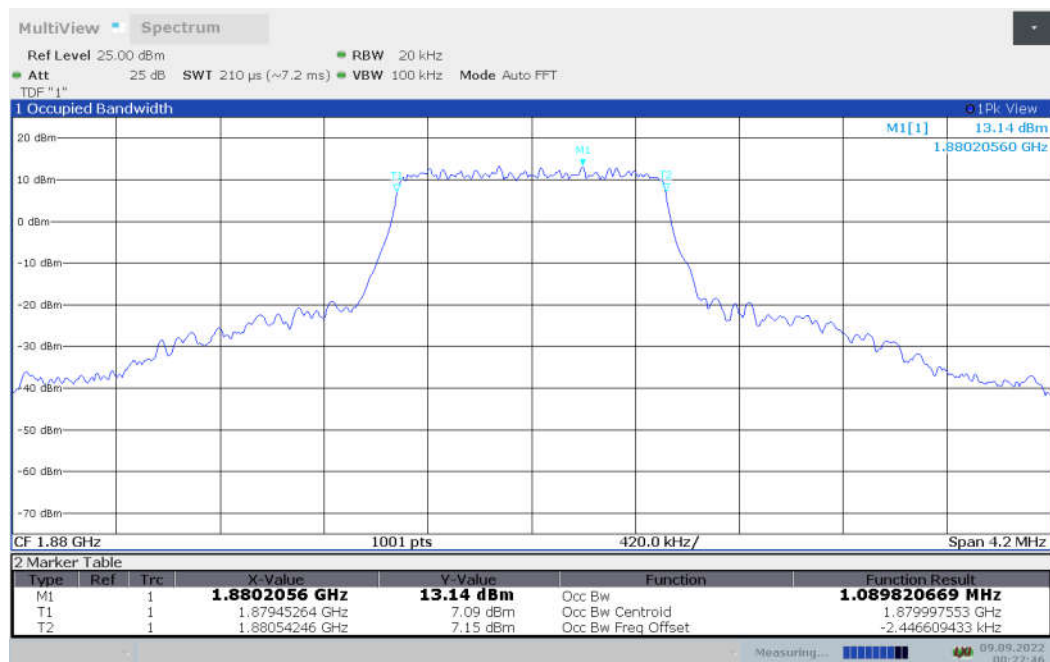
#### LTE band 2, 1.4MHz (99% BW)

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |       |       |
|----------------|-----------------------------------|-------|-------|
| 1880.0         | QPSK                              | 16QAM | 64QAM |
|                | 1.083                             | 1.090 | 1.086 |

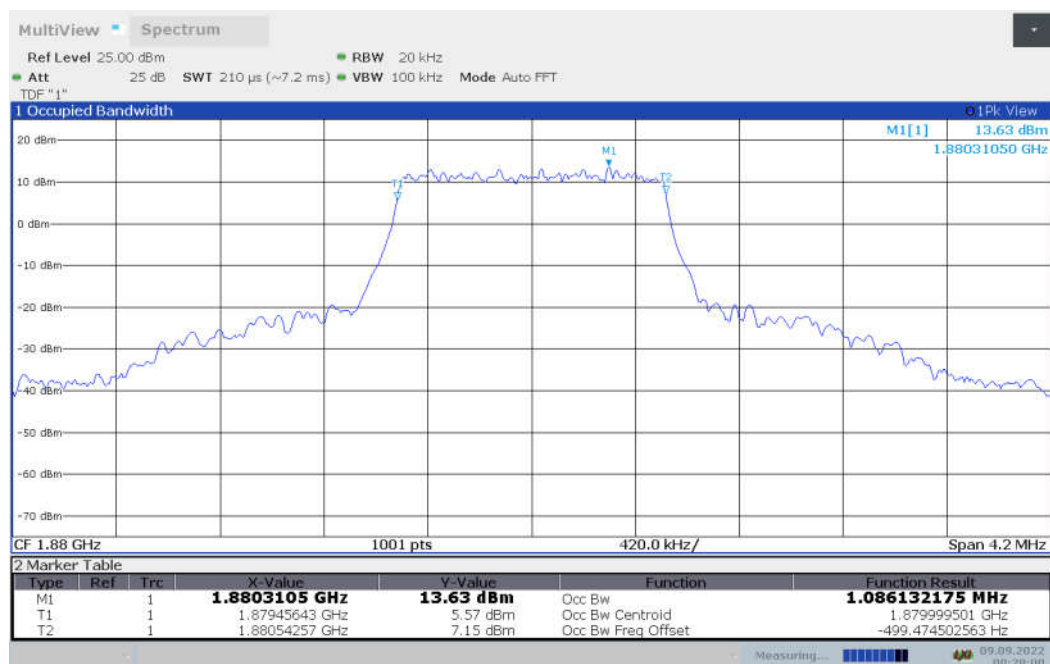
#### LTE band 2, 1.4MHz Bandwidth, QPSK (99% BW)



### LTE band 2, 1.4MHz Bandwidth, 16QAM (99% BW)

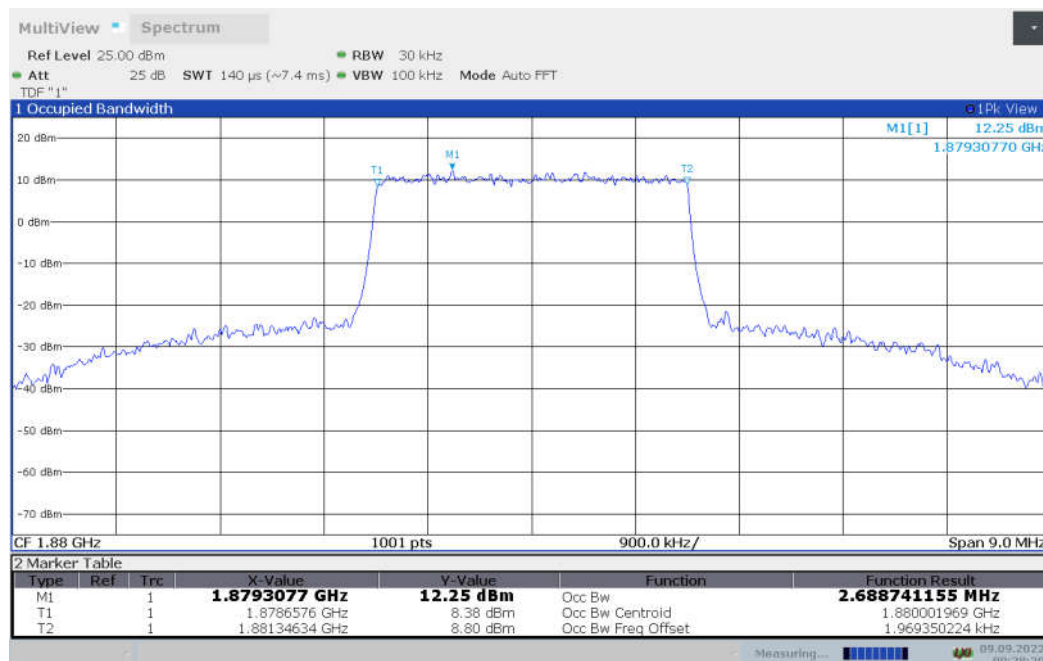
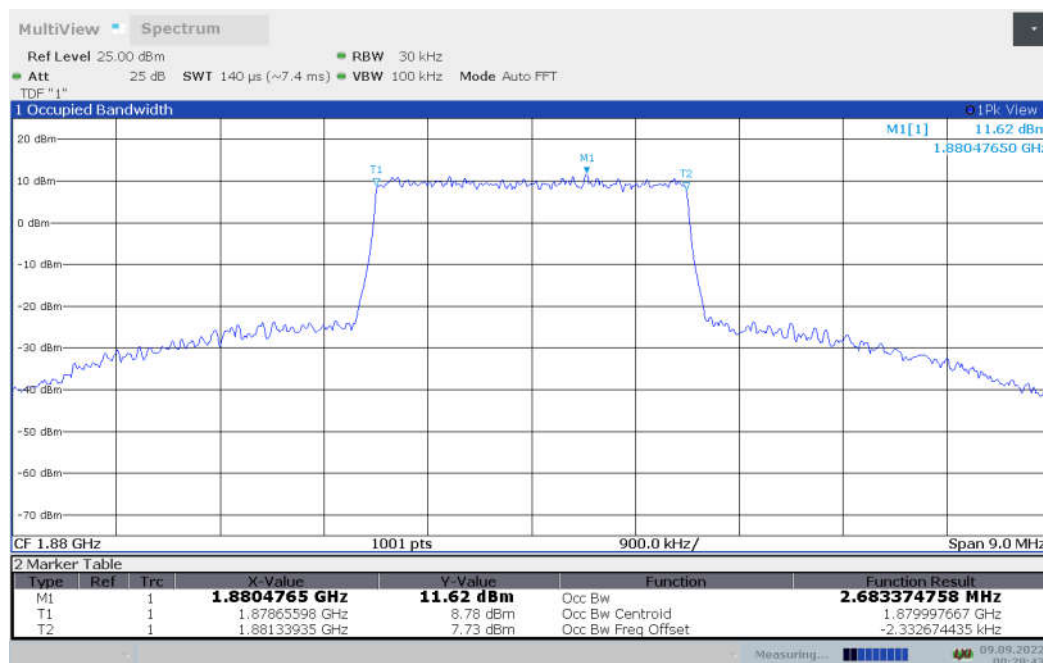


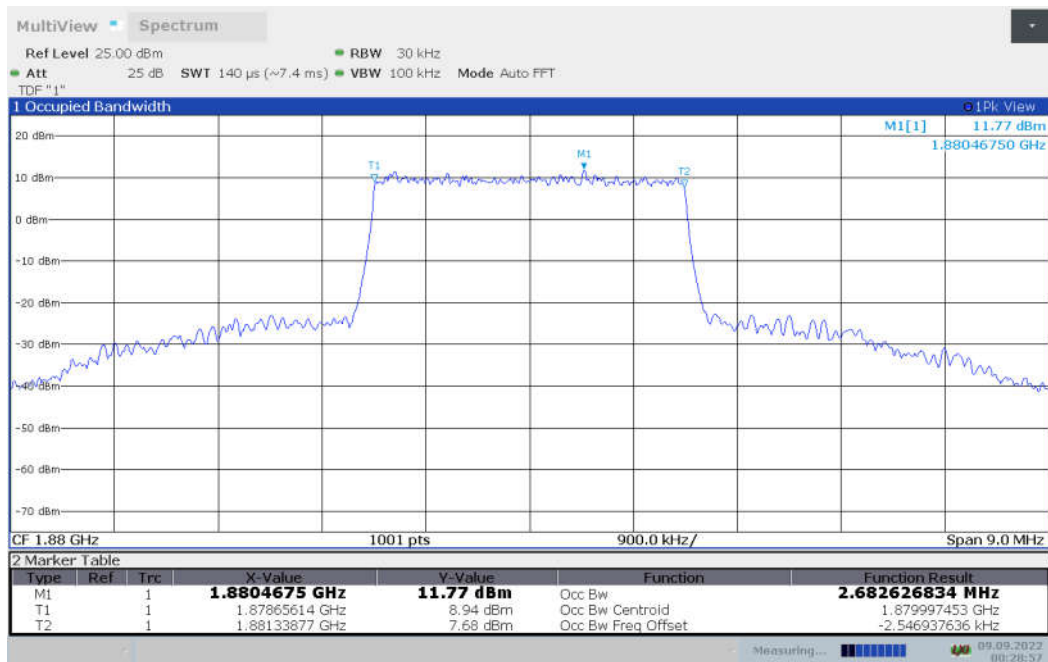
### LTE band 2, 1.4MHz Bandwidth, 64QAM (99% BW)



**LTE band 2, 3MHz (99% BW)**

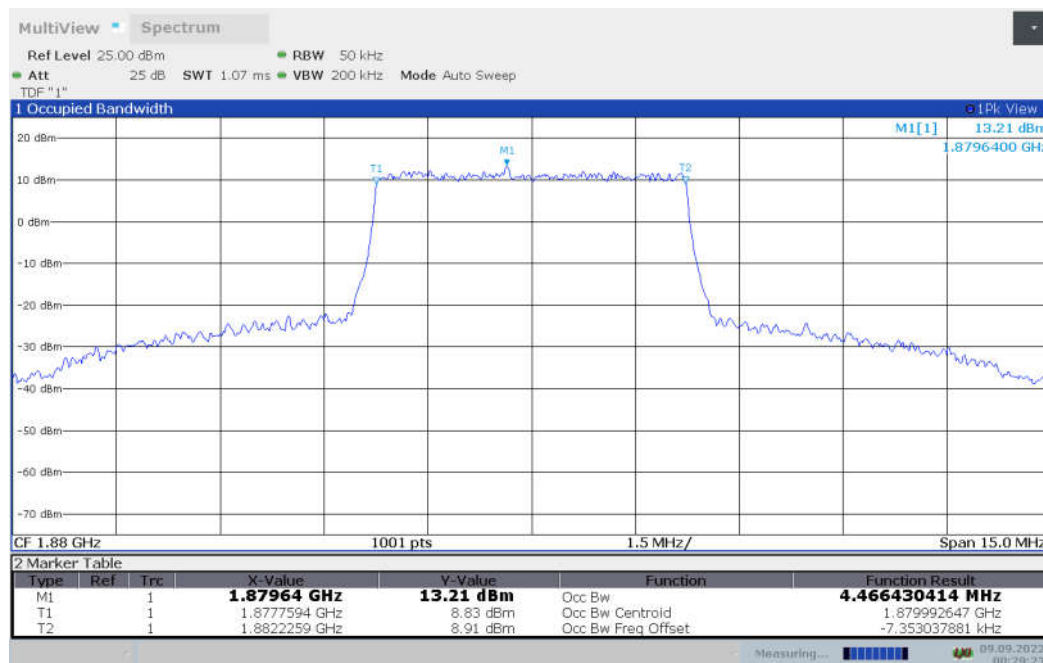
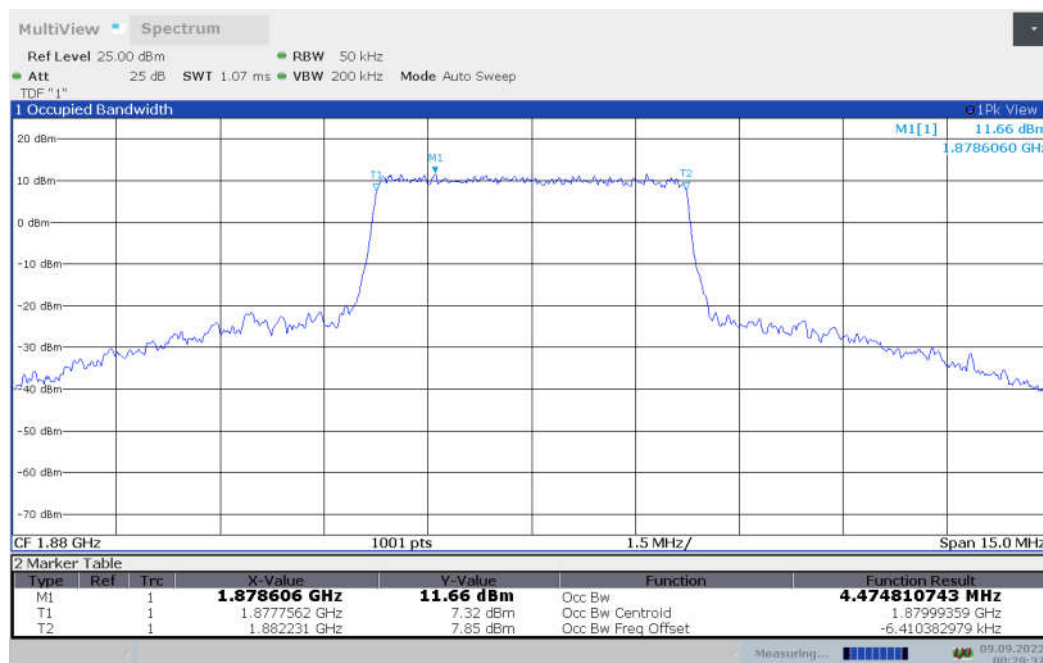
| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |       |       |
|----------------|-----------------------------------|-------|-------|
| 1880.0         | QPSK                              | 16QAM | 64QAM |
|                | 2.688                             | 2.683 | 2.682 |

**LTE band 2, 3MHz Bandwidth, QPSK (99% BW)****LTE band 2, 3MHz Bandwidth, 16QAM (99% BW)****LTE Band 2, 3MHz Bandwidth, 64QAM (99% BW)**



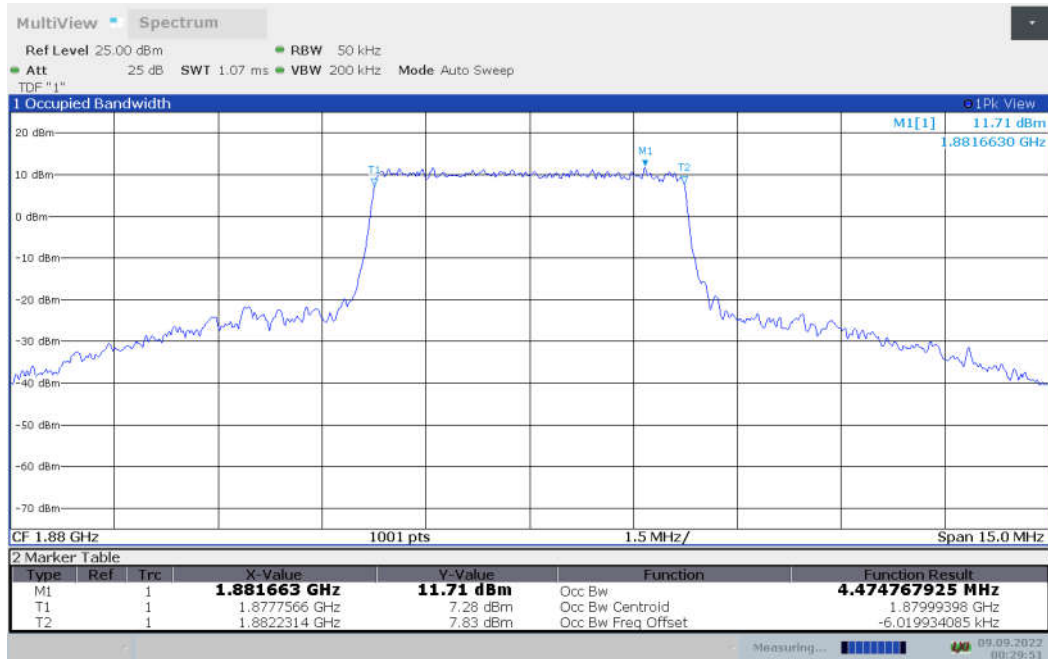
**LTE band 2, 5MHz (99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |       |       |
|----------------|-----------------------------------|-------|-------|
| 1880.0         | QPSK                              | 16QAM | 64QAM |
|                | 4.466                             | 4.475 | 4.475 |

**LTE band 2, 5MHz Bandwidth, QPSK (99% BW)****LTE band 2, 5MHz Bandwidth, 16QAM (99% BW)**

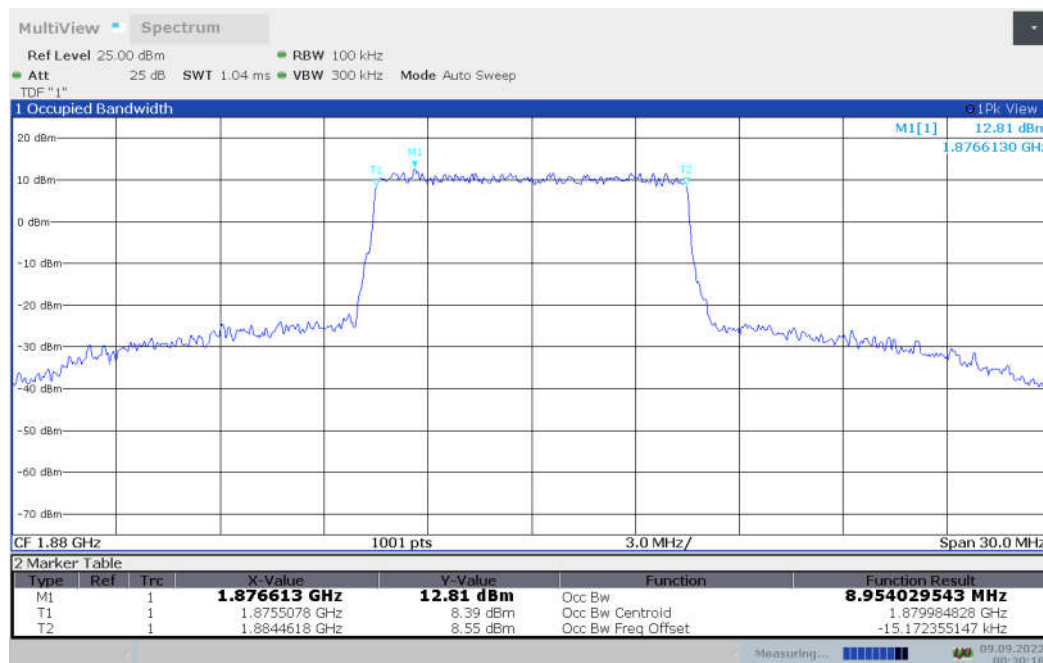
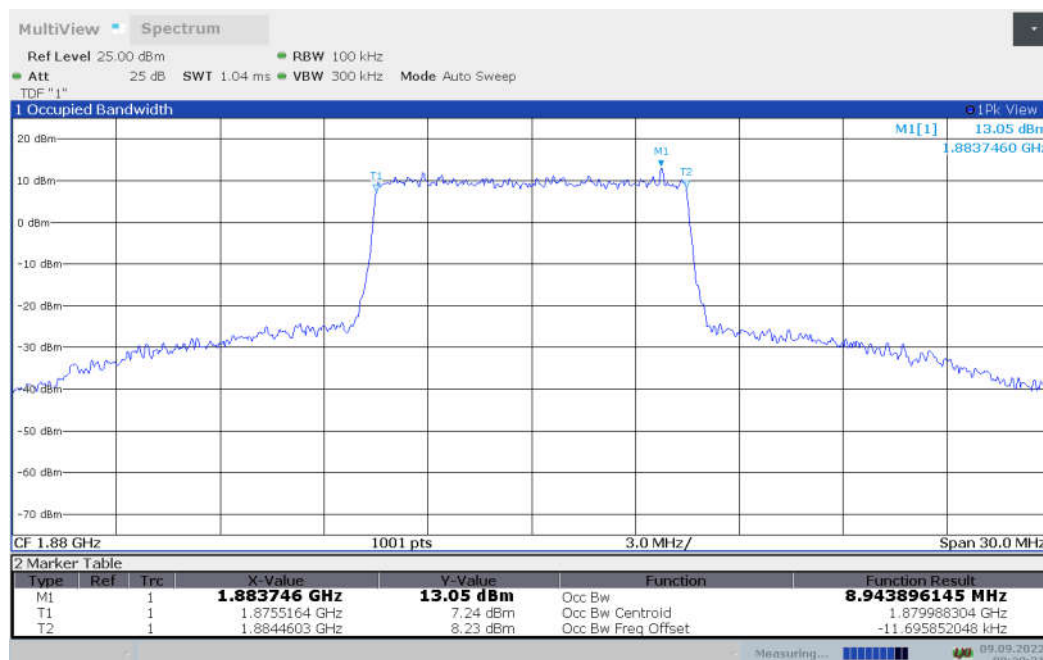


LTE Band 2, 5MHz Bandwidth,64QAM (99% BW)



**LTE band 2, 10MHz (99% BW)**

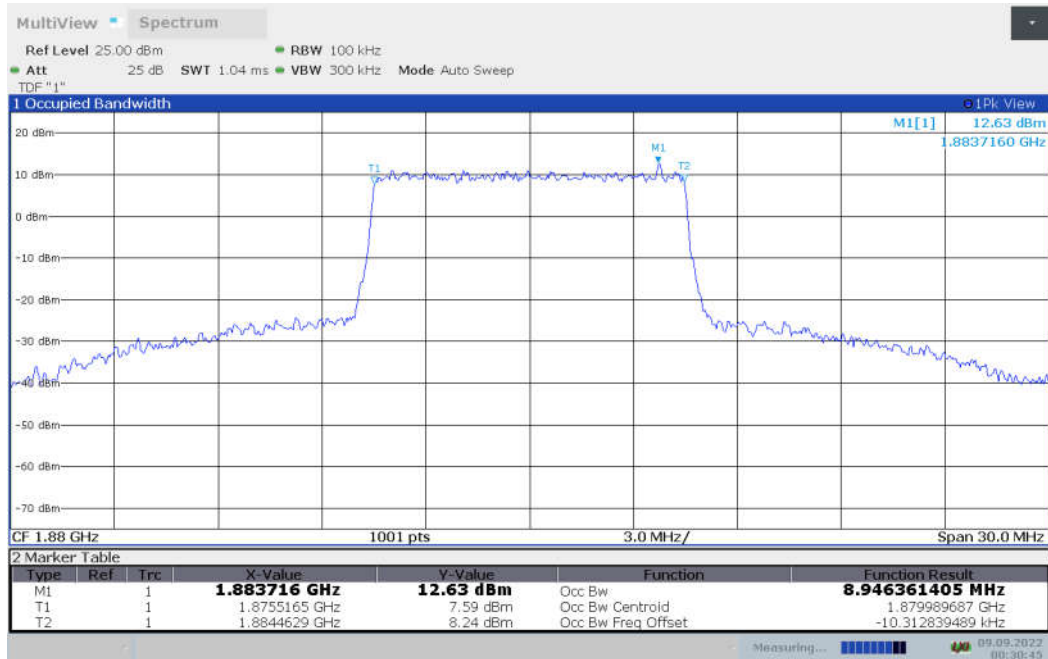
| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |       |       |
|----------------|-----------------------------------|-------|-------|
| 1880.0         | QPSK                              | 16QAM | 64QAM |
|                | 8.954                             | 8.944 | 8.946 |

**LTE band 2, 10MHz Bandwidth, QPSK (99% BW)****LTE band 2, 10MHz Bandwidth, 16QAM (99% BW)**



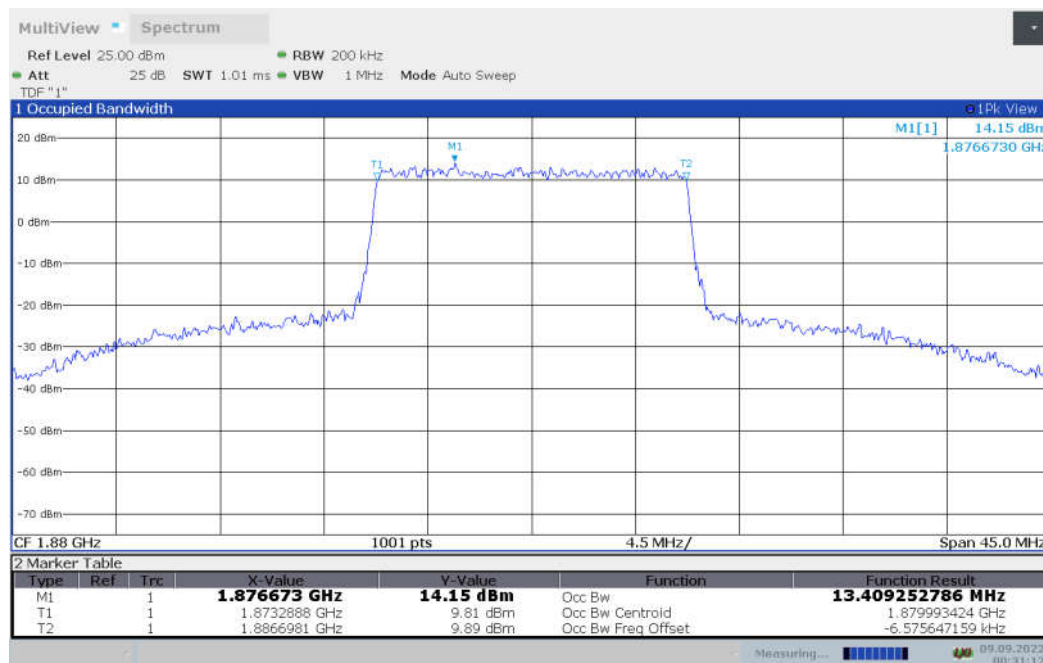
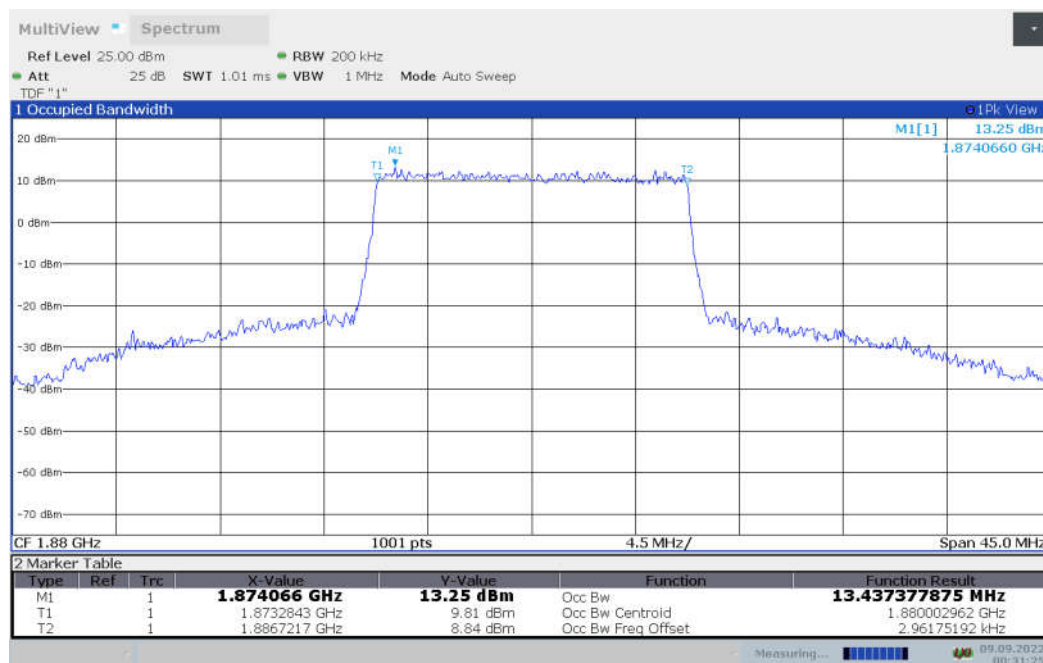
No.I22N01710-RF-LTE

LTE Band 2, 10MHz Bandwidth, 64QAM (99% BW)



**LTE band 2, 15MHz (99% BW)**

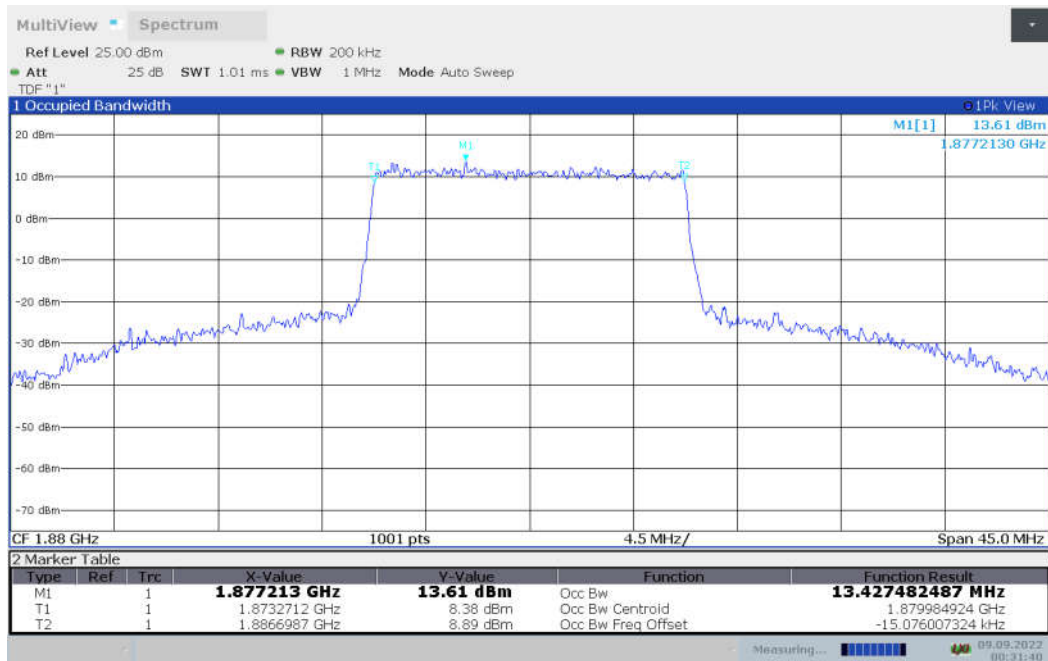
| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |        |        |
|----------------|-----------------------------------|--------|--------|
| 1880.0         | QPSK                              | 16QAM  | 64QAM  |
|                | 13.409                            | 13.437 | 13.427 |

**LTE band 2, 15MHz Bandwidth, QPSK (99% BW)****LTE band 2, 15MHz Bandwidth, 16QAM (99% BW)**



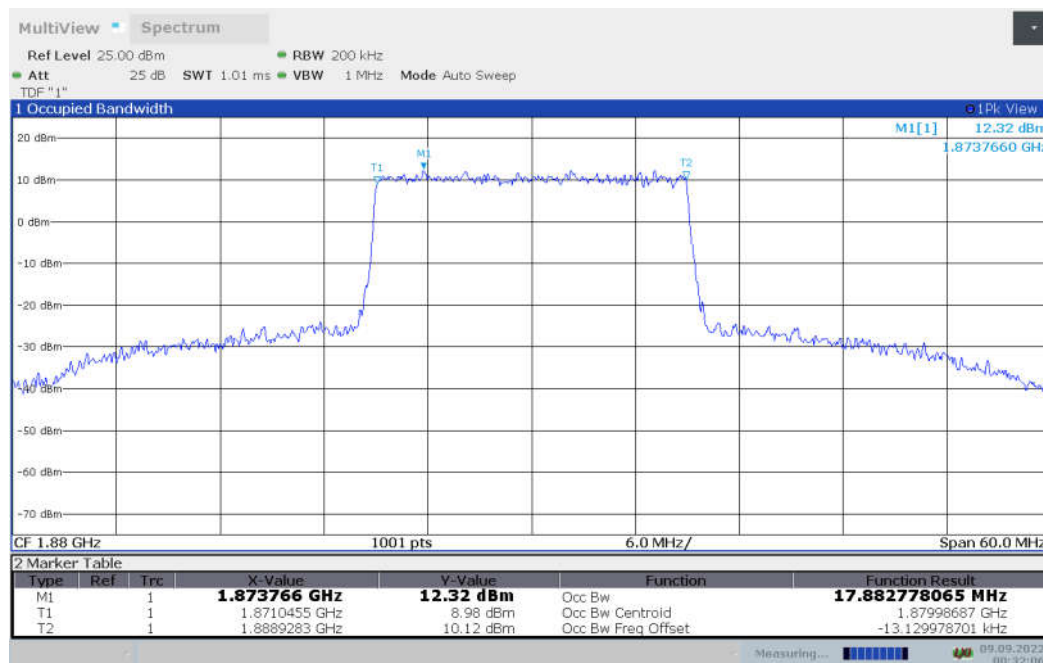
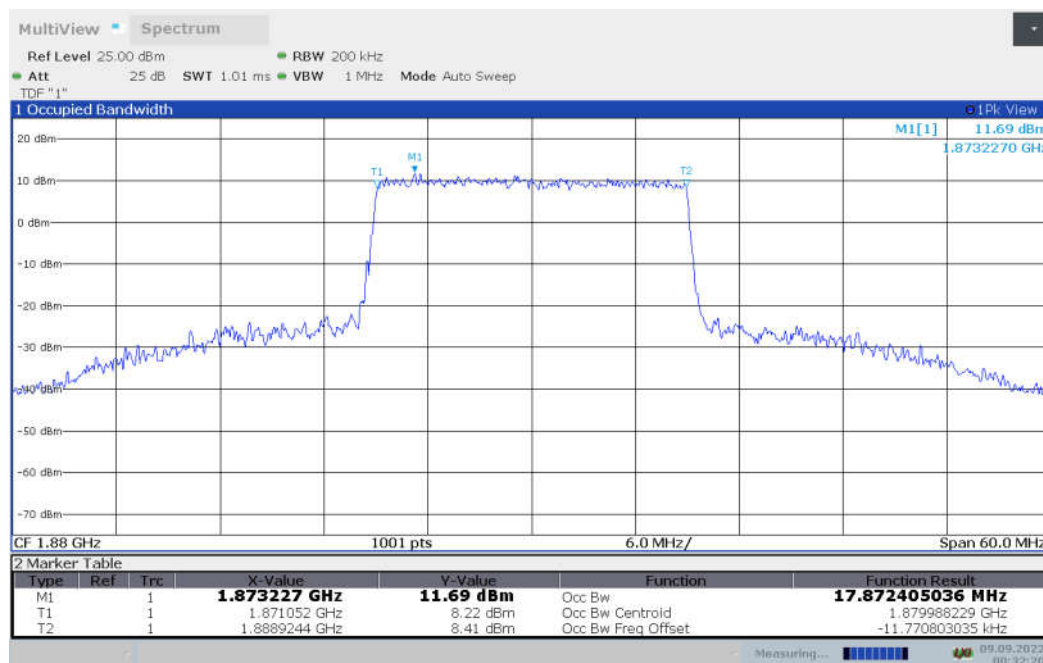
No.I22N01710-RF-LTE

LTE Band 2, 15MHz Bandwidth, 64QAM (99% BW)



**LTE band 2, 20MHz (99% BW)**

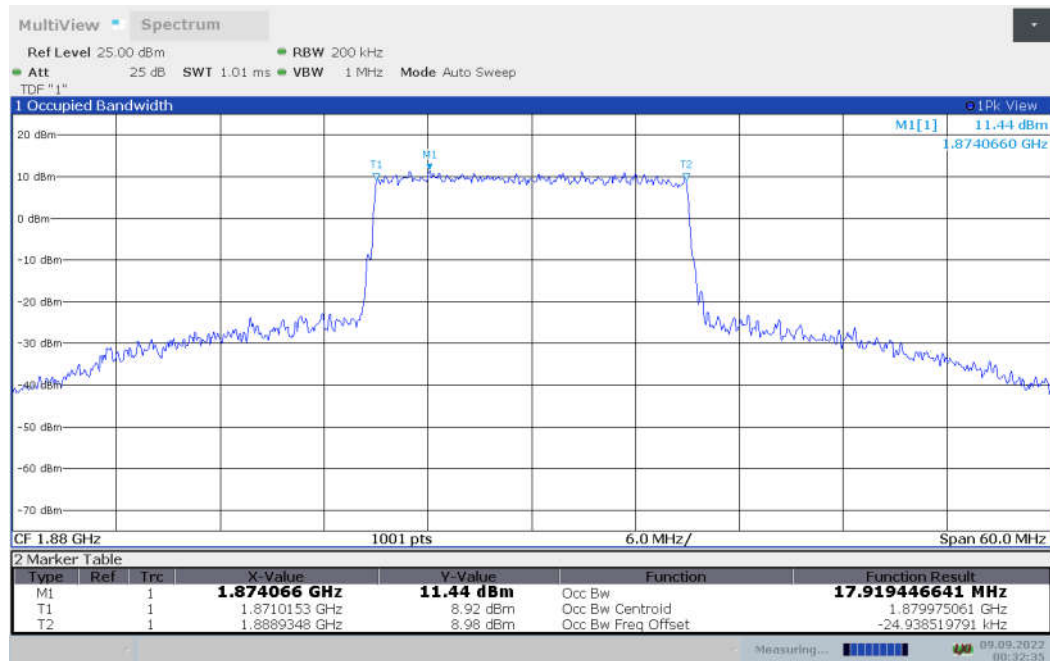
| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |        |        |
|----------------|-----------------------------------|--------|--------|
| 1880.0         | QPSK                              | 16QAM  | 64QAM  |
|                | 17.883                            | 17.872 | 17.919 |

**LTE band 2, 20MHz Bandwidth, QPSK (99% BW)****LTE band 2, 20MHz Bandwidth, 16QAM (99% BW)**



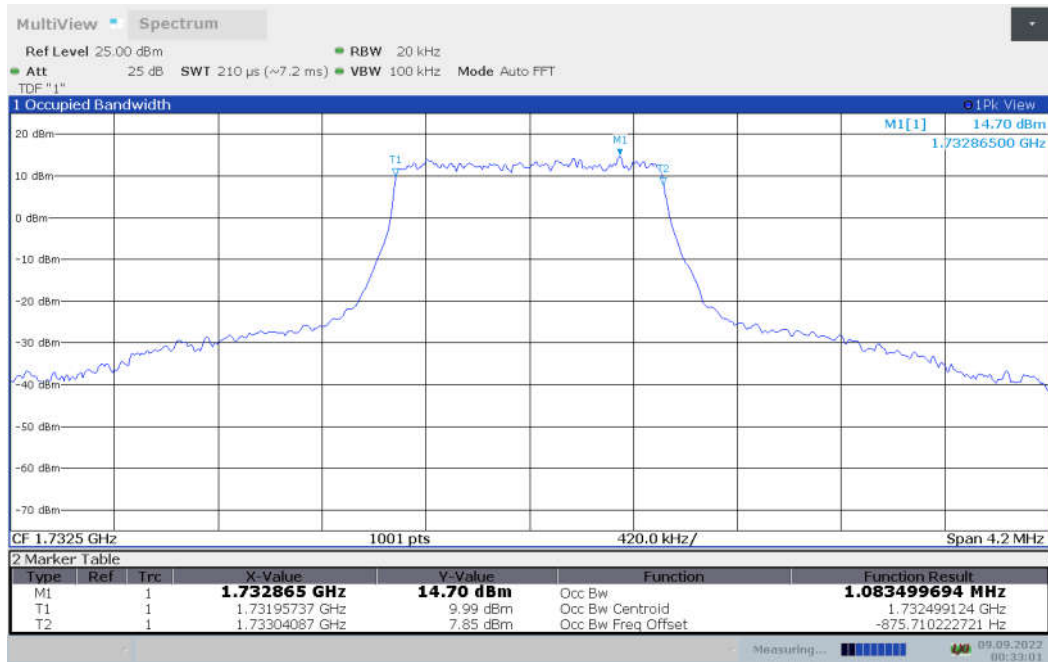
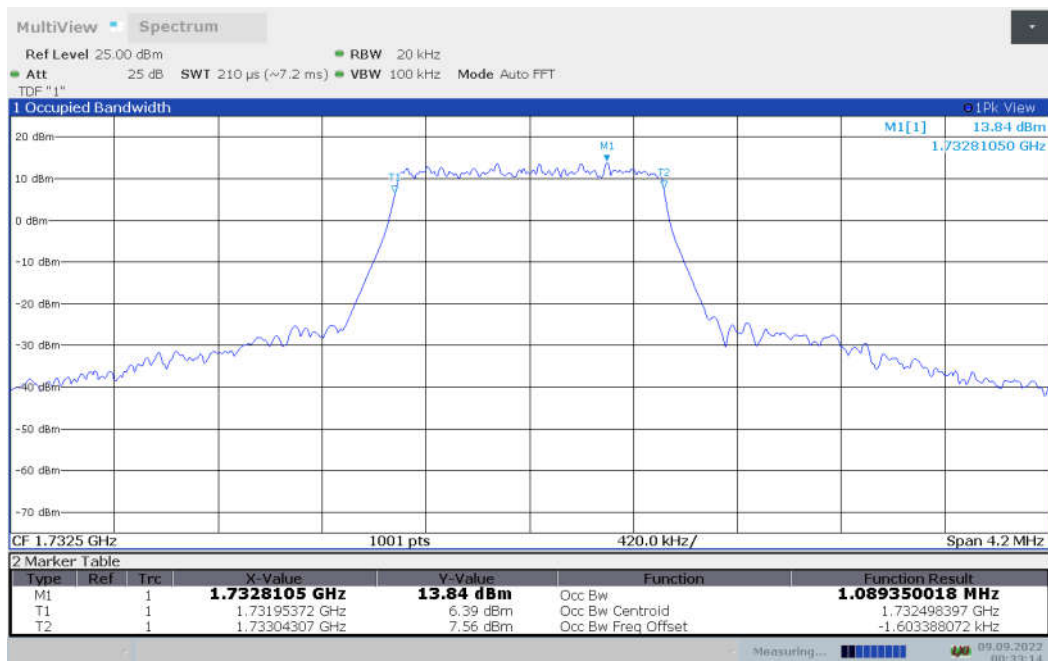
No.I22N01710-RF-LTE

LTE Band 2, 20MHz Bandwidth, 64QAM (99% BW)



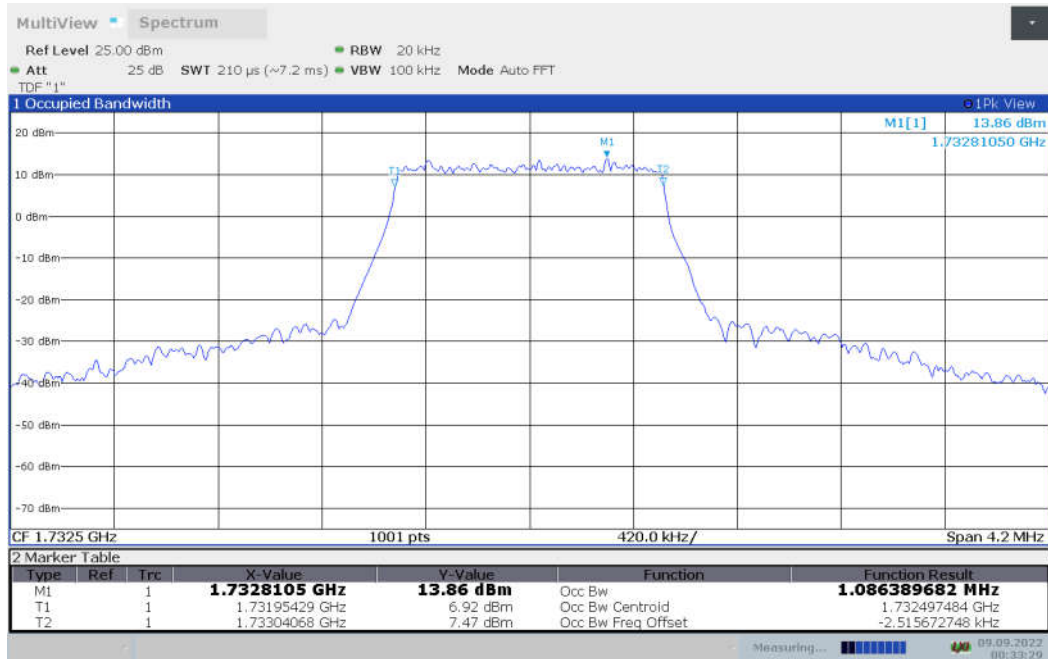
**LTE band 4, 1.4MHz (99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)(MHz) |       |       |
|----------------|----------------------------------|-------|-------|
| 1732.5         | QPSK                             | 16QAM | 64QAM |
|                | 1.083                            | 1.089 | 1.086 |

**LTE band 4, 1.4MHz Bandwidth, QPSK (99% BW)****LTE band 4, 1.4MHz Bandwidth, 16QAM (99% BW)**

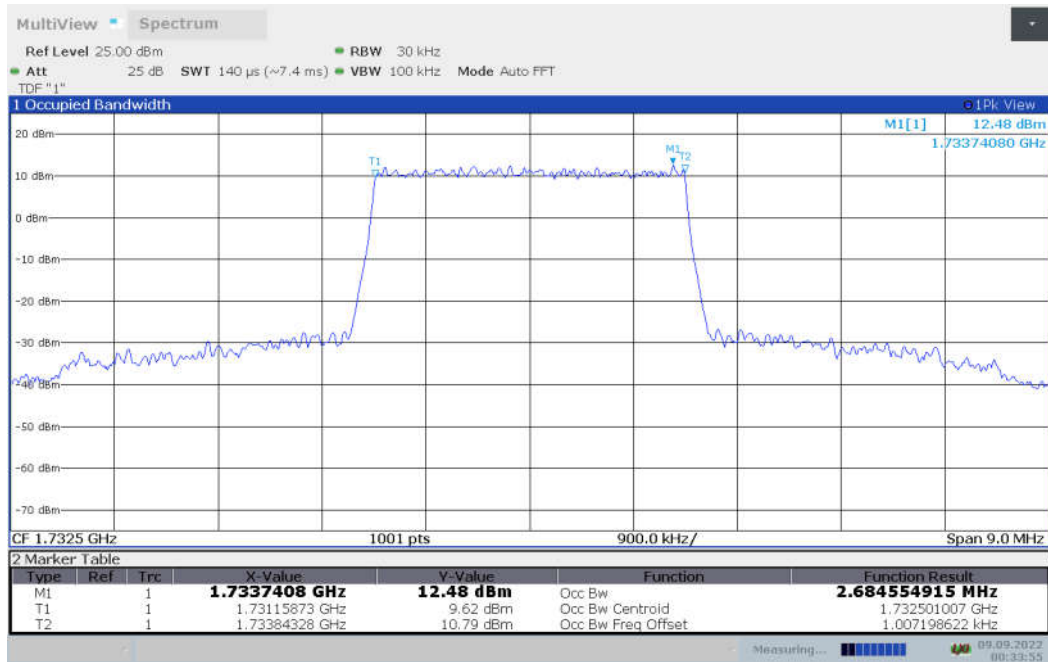
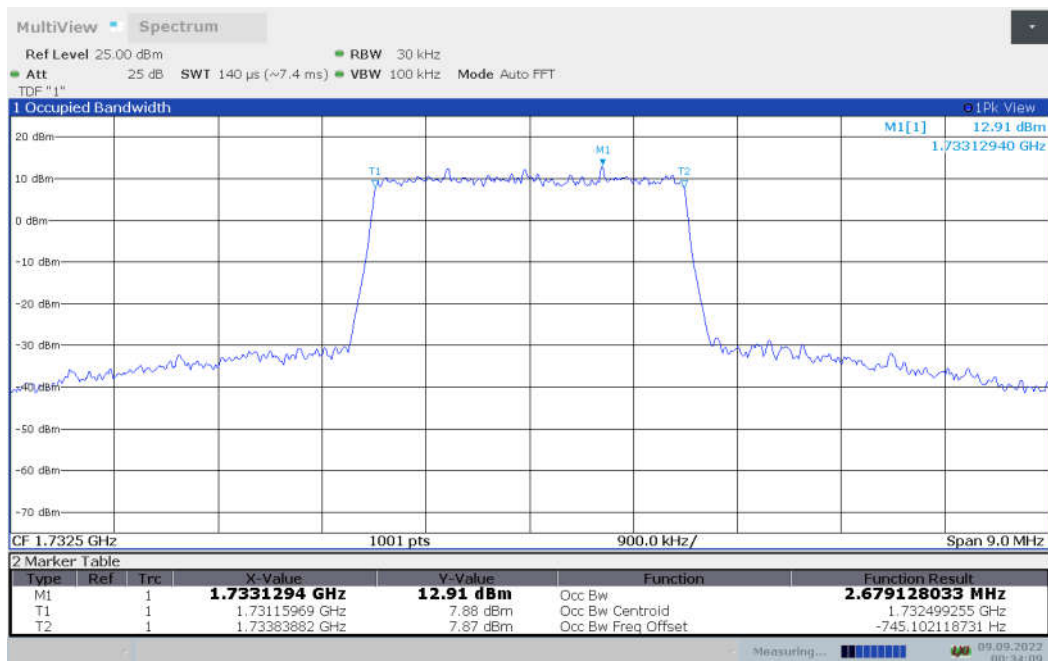


LTE band 4, 1.4MHz Bandwidth, 64QAM (99% BW)



**LTE band 4, 3MHz (99% BW)**

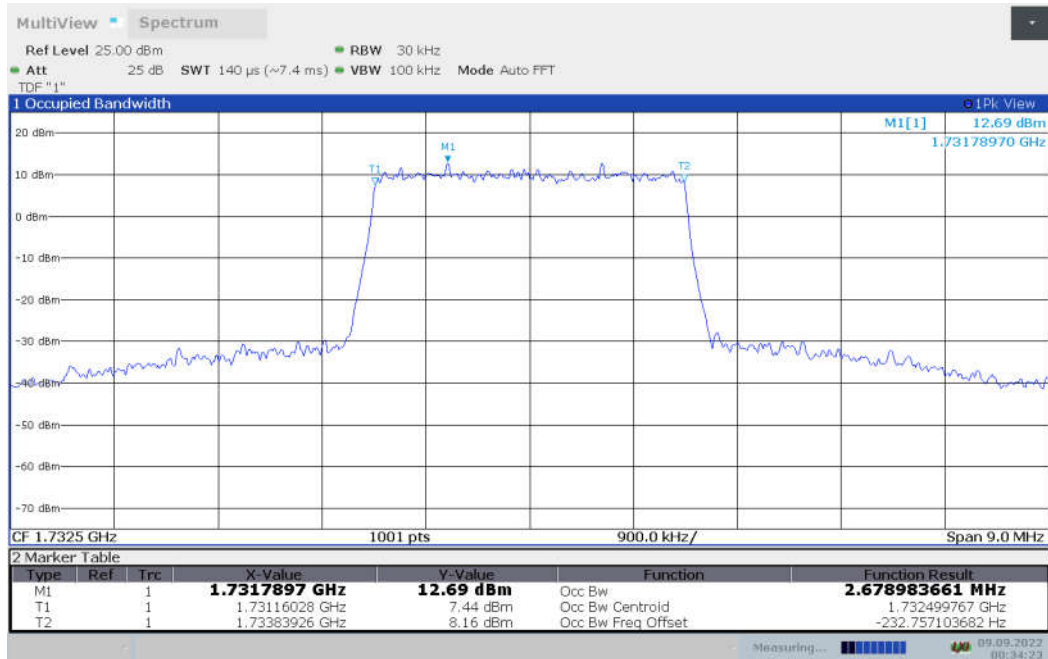
| Frequency(MHz) | Occupied Bandwidth (99% BW)(MHz) |       |       |
|----------------|----------------------------------|-------|-------|
| 1732.5         | QPSK                             | 16QAM | 64QAM |
|                | 2.685                            | 2.679 | 2.679 |

**LTE band 4, 3MHz Bandwidth, QPSK (99% BW)****LTE band 4, 3MHz Bandwidth, 16QAM (99% BW)**



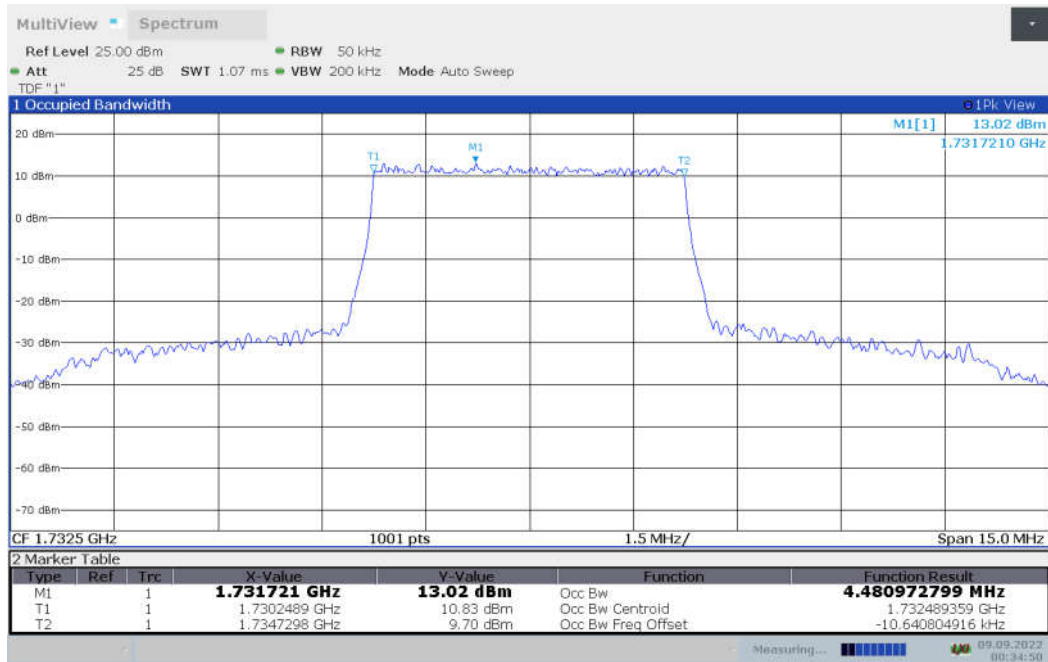
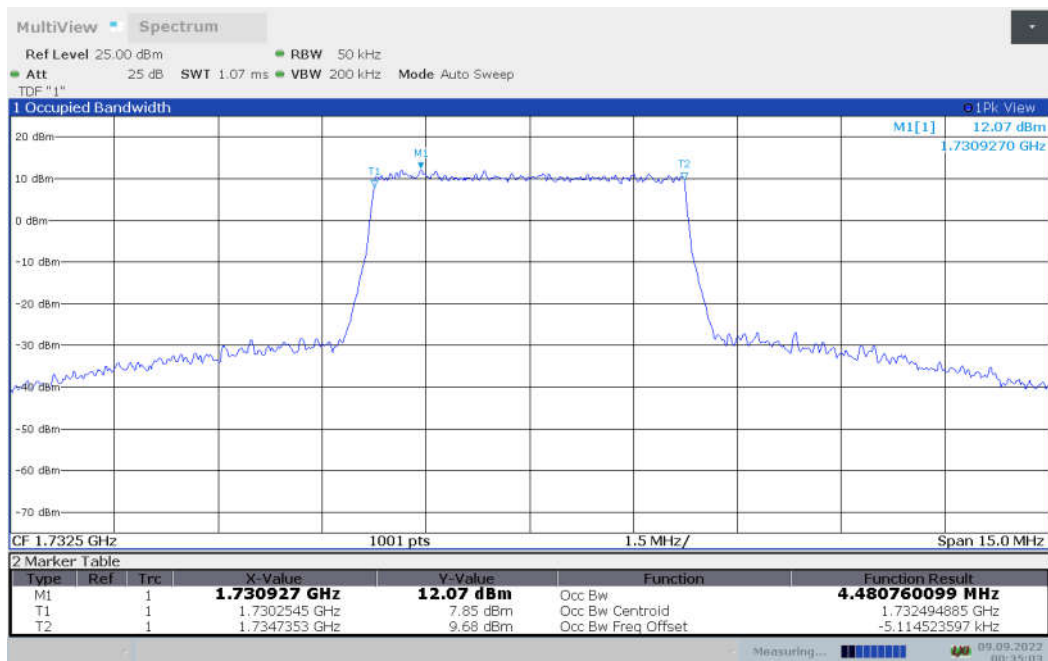
No.I22N01710-RF-LTE

**LTE band 4, 3MHz Bandwidth, 64QAM (99% BW)**



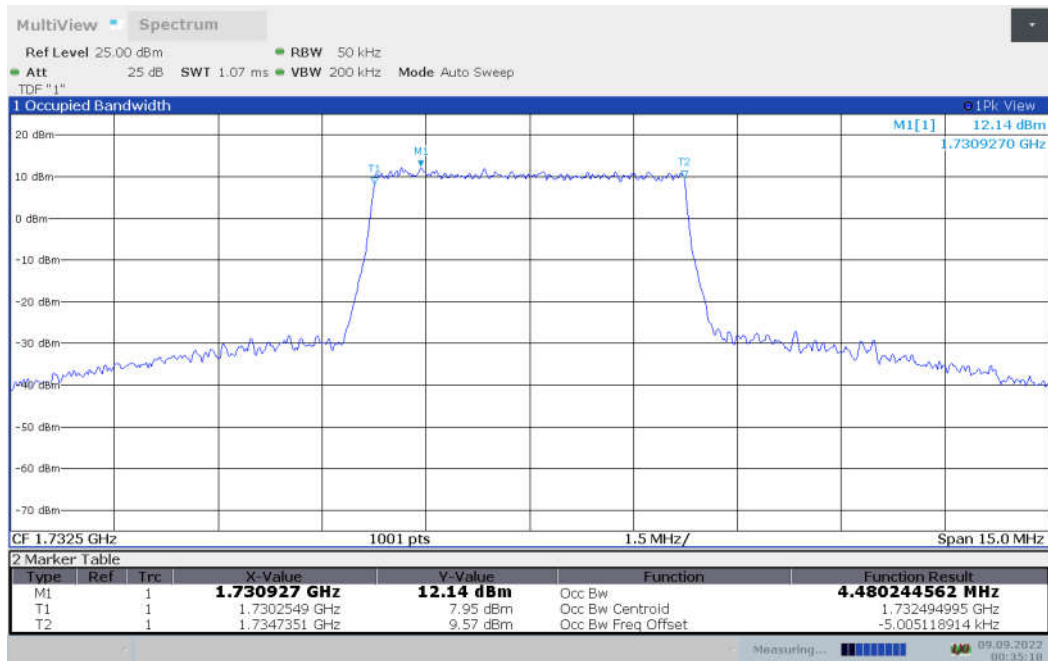
**LTE band 4, 5MHz (99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)(MHz) |       |       |
|----------------|----------------------------------|-------|-------|
| 1732.5         | QPSK                             | 16QAM | 64QAM |
|                | 4.481                            | 4.481 | 4.480 |

**LTE band 4, 5MHz Bandwidth, QPSK (99% BW)****LTE band 4, 5MHz Bandwidth, 16QAM (99% BW)**

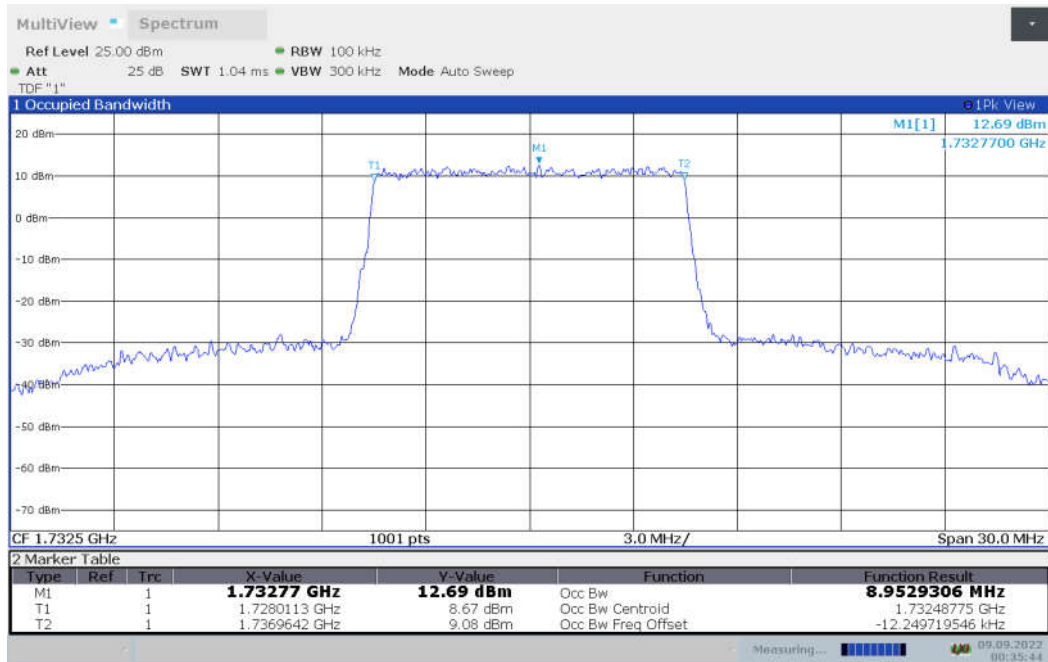
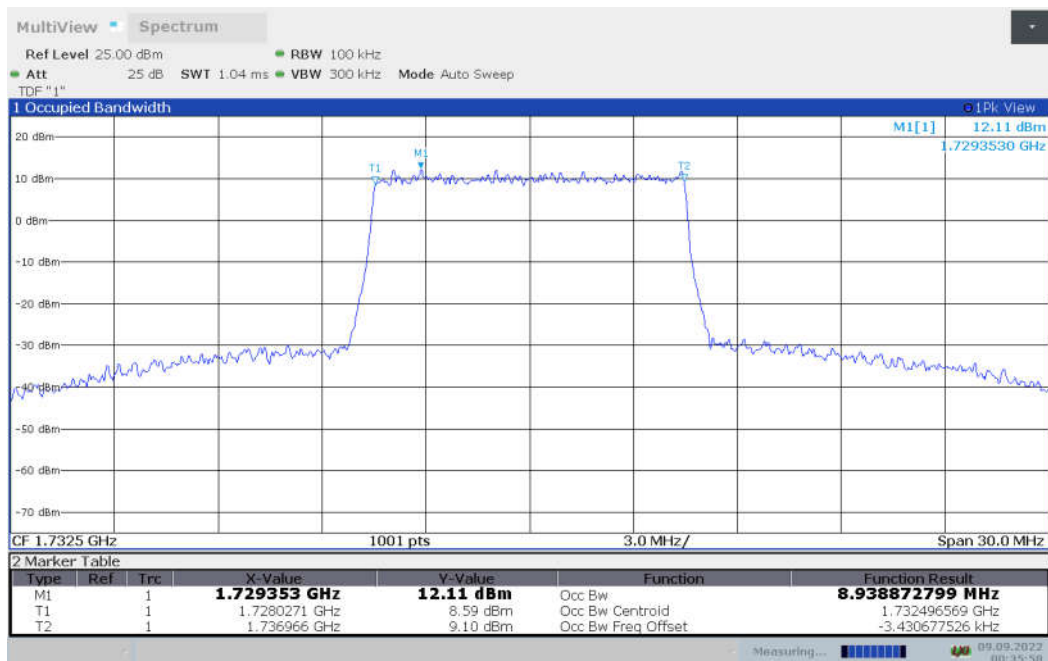


LTE band 4, 5MHz Bandwidth,64QAM (99% BW)



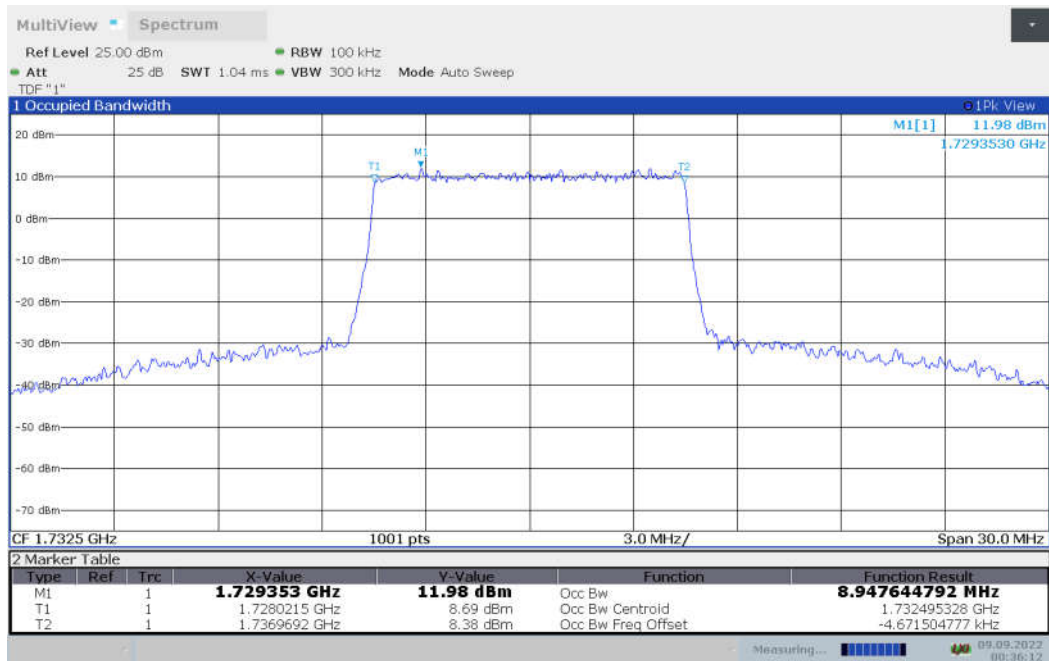
**LTE band 4, 10MHz (99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)(MHz) |       |       |
|----------------|----------------------------------|-------|-------|
| 1732.5         | QPSK                             | 16QAM | 64QAM |
|                | 8.953                            | 8.939 | 8.948 |

**LTE band 4, 10MHz Bandwidth, QPSK (99% BW)****LTE band 4, 10MHz Bandwidth, 16QAM (99% BW)**

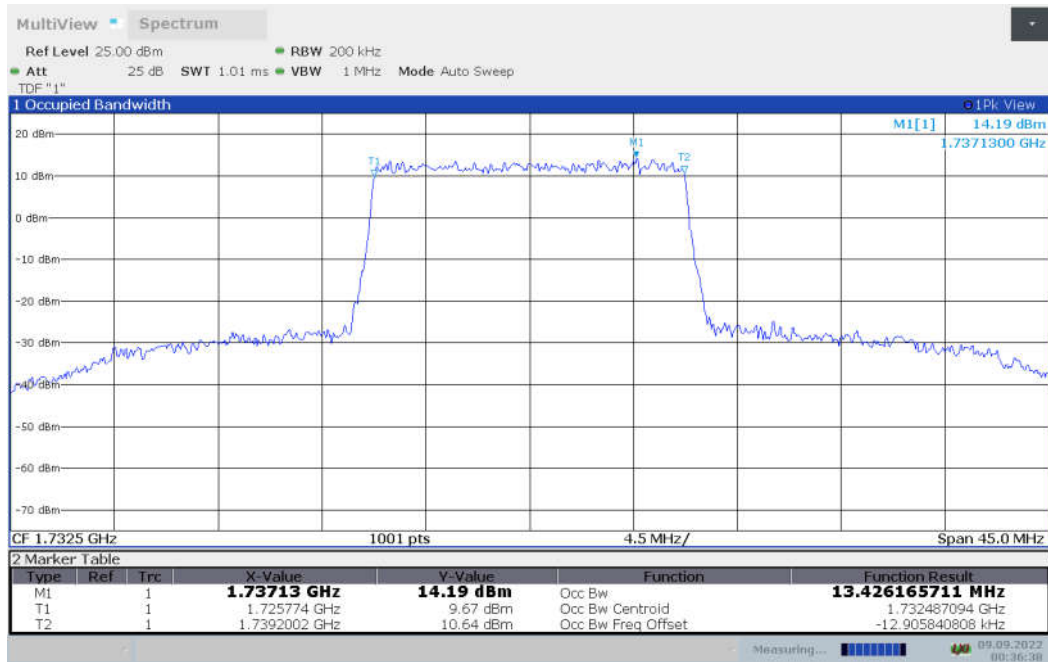
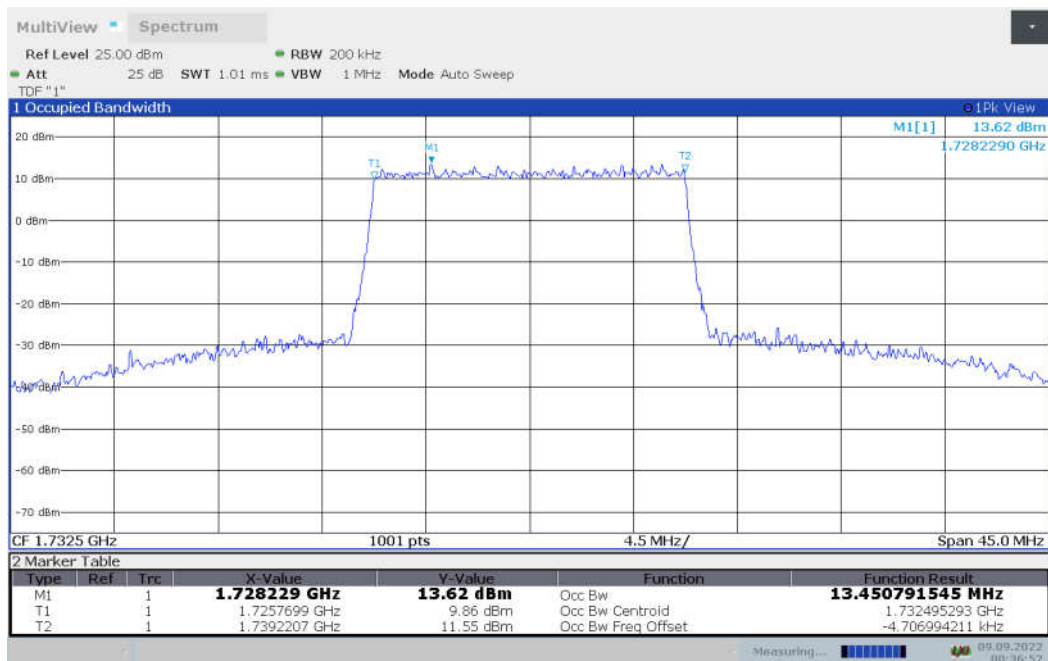


LTE band 4, 10MHz Bandwidth, 64QAM (99% BW)



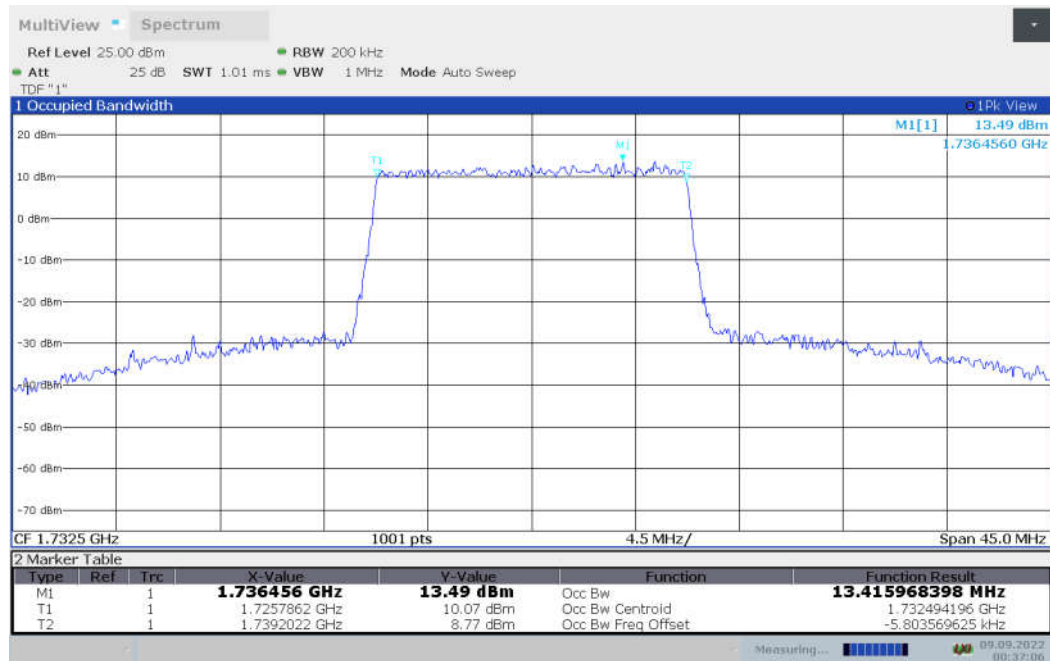
**LTE band 4, 15MHz (99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)(MHz) |        |        |
|----------------|----------------------------------|--------|--------|
| 1732.5         | QPSK                             | 16QAM  | 64QAM  |
|                | 13.426                           | 13.451 | 13.416 |

**LTE band 4, 15MHz Bandwidth, QPSK (99% BW)****LTE band 4, 15MHz Bandwidth, 16QAM (99% BW)**



LTE band 4, 15MHz Bandwidth, 64QAM (99% BW)



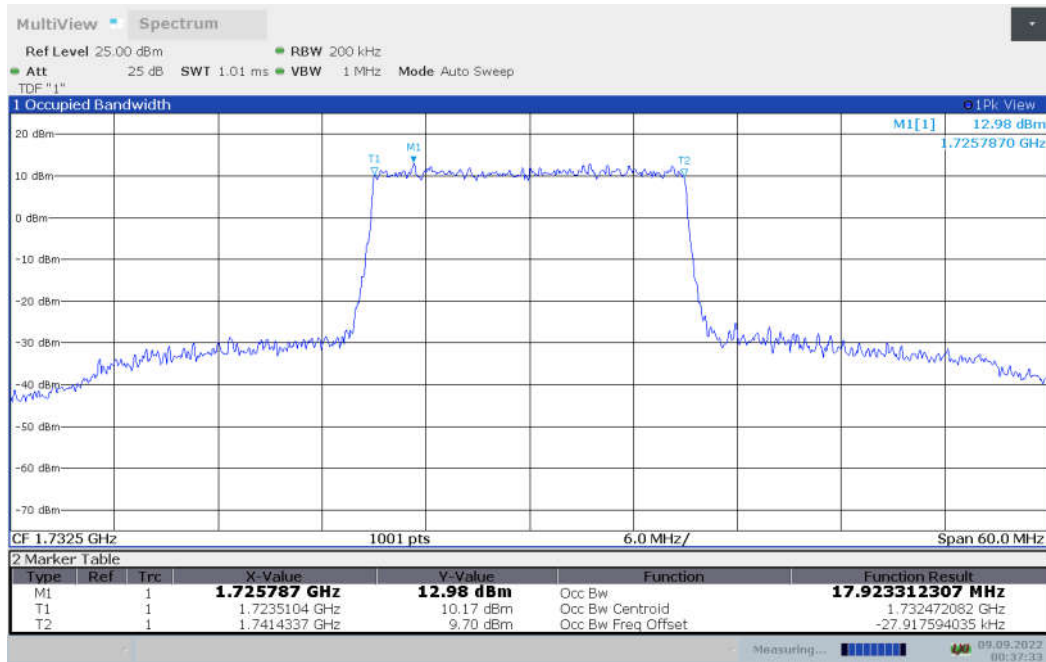


No.I22N01710-RF-LTE

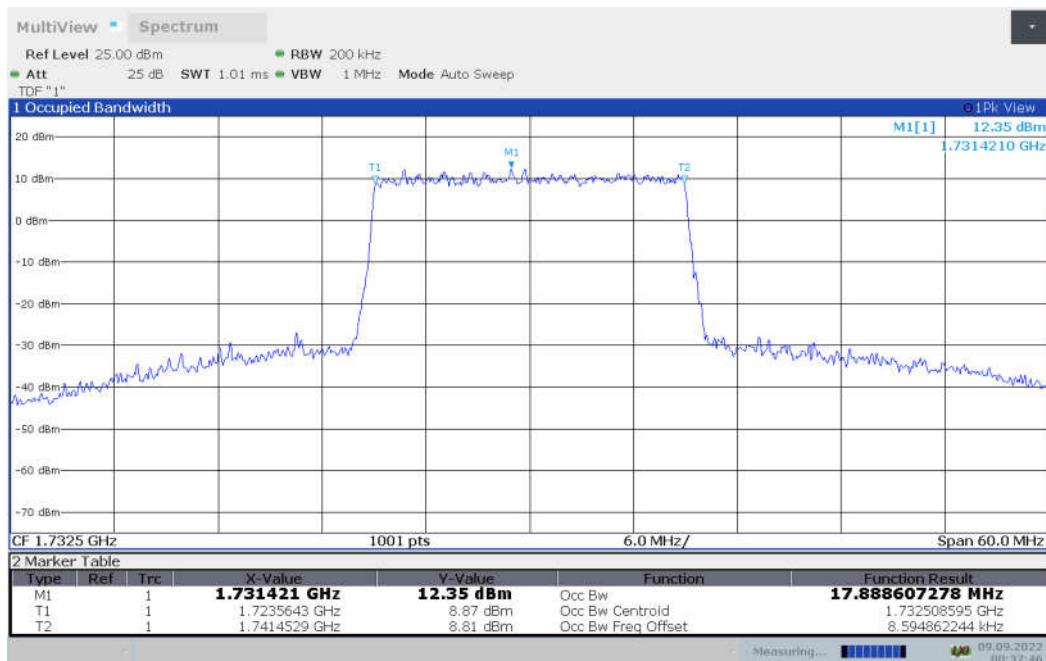
**LTE band 4, 20MHz (99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)(MHz) |        |        |
|----------------|----------------------------------|--------|--------|
| 1732.5         | QPSK                             | 16QAM  | 64QAM  |
|                | 17.922                           | 17.889 | 17.899 |

**LTE band 4, 20MHz Bandwidth, QPSK (99% BW)**

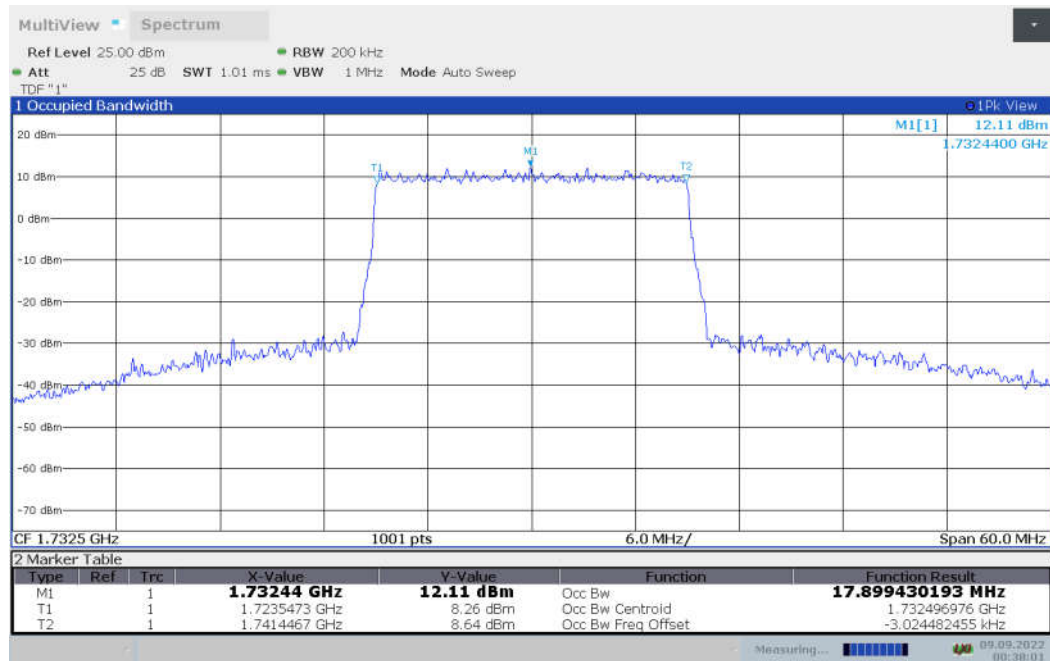


**LTE band 4, 20MHz Bandwidth, 16QAM (99% BW)**



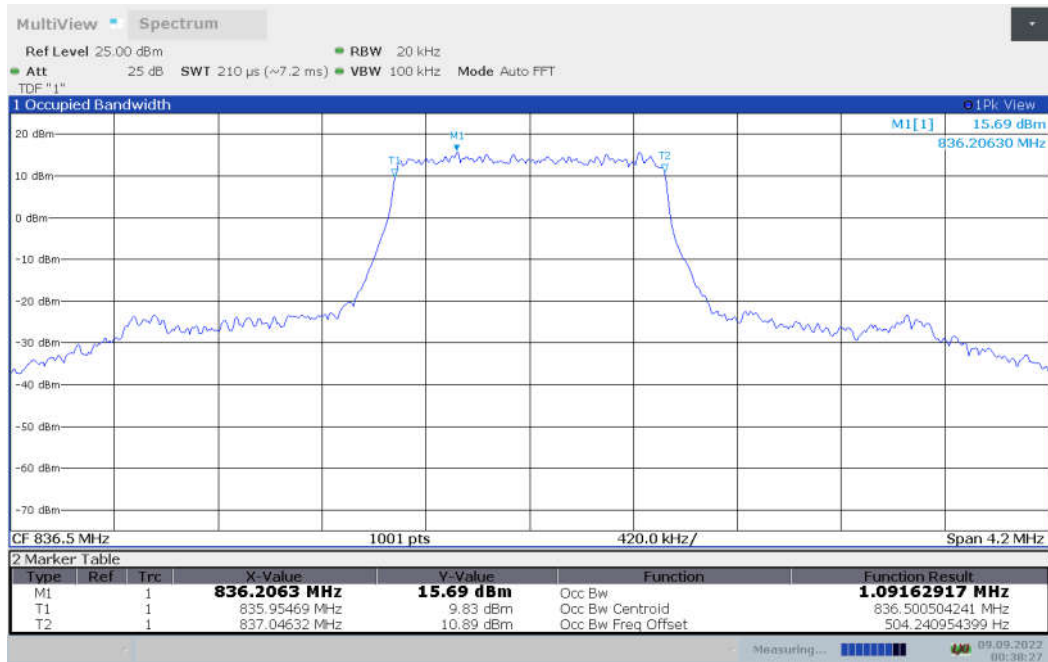
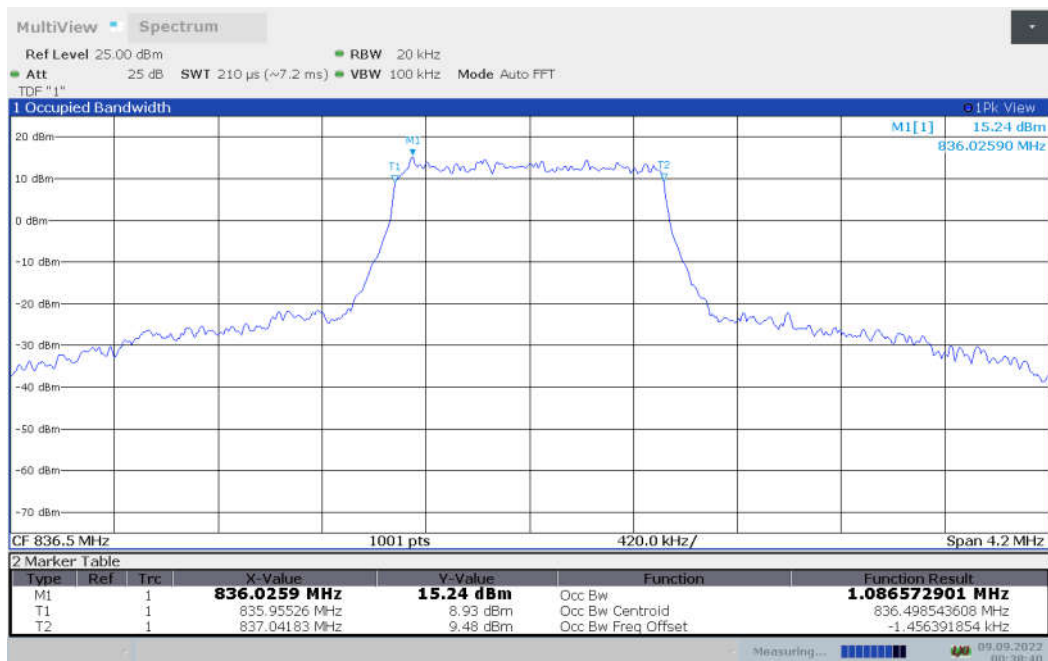


**LTE band 4, 20MHz Bandwidth, 64QAM (99% BW)**



**LTE band 5, 1.4MHz (99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)(MHz) |       |       |
|----------------|----------------------------------|-------|-------|
| 836.5          | QPSK                             | 16QAM | 64QAM |
|                | 1.091                            | 1.087 | 1.087 |

**LTE band 5, 1.4MHz Bandwidth, QPSK (99% BW)****LTE band 5, 1.4MHz Bandwidth, 16QAM (99% BW)**



LTE band 5, 1.4MHz Bandwidth,64QAM (99% BW)

