

**LTE Cat-M1 Band 13:**

LTE Cat-M1 Band 13. BW=5 MHz. QPSK. RB Size 6.

Channel	Low	High
99% Occupied Bandwidth (MHz)	1.10925	1.11300
-26 dBc Bandwidth (MHz)	1.37340	1.36568
Measurement uncertainty (kHz)	<±3.75	

LTE Cat-M1 Band 13. BW=5 MHz. 16QAM. RB Size 5.

Channel	Low	High
99% Occupied Bandwidth (MHz)	0.94950	0.94500
-26 dBc Bandwidth (MHz)	1.32915	1.30493
Measurement uncertainty (kHz)	<±3.75	

**LTE Cat-M1 Band 66:**

LTE Cat-M1 Band 66. BW=1.4 MHz. QPSK. RB Size 6.

Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	1.111	1.111	1.113
-26 dBc Bandwidth (MHz)	1.375	1.387	1.414
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-M1 Band 66. BW=1.4 MHz. 16QAM. RB Size 5.

Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	0.931	0.938	0.967
-26 dBc Bandwidth (MHz)	1.291	1.336	1.349
Measurement uncertainty (kHz)	<±3.75		

**LTE Cat-M1 Band 71:**

LTE Cat-M1 Band 71. BW=5 MHz. QPSK. RB Size 6.

Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	1.10775	1.11000	1.11075
-26 dBc Bandwidth (MHz)	1.38290	1.38537	1.37930
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-M1 Band 71. BW=5 MHz. 16QAM. RB Size 5.

Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	0.94275	0.93975	0.94275
-26 dBc Bandwidth (MHz)	1.31040	1.30118	1.28168
Measurement uncertainty (kHz)	<±3.75		

**LTE Cat-M1 Band 85:**

LTE Cat-M1 Band 85. BW=5 MHz. QPSK. RB Size 6.

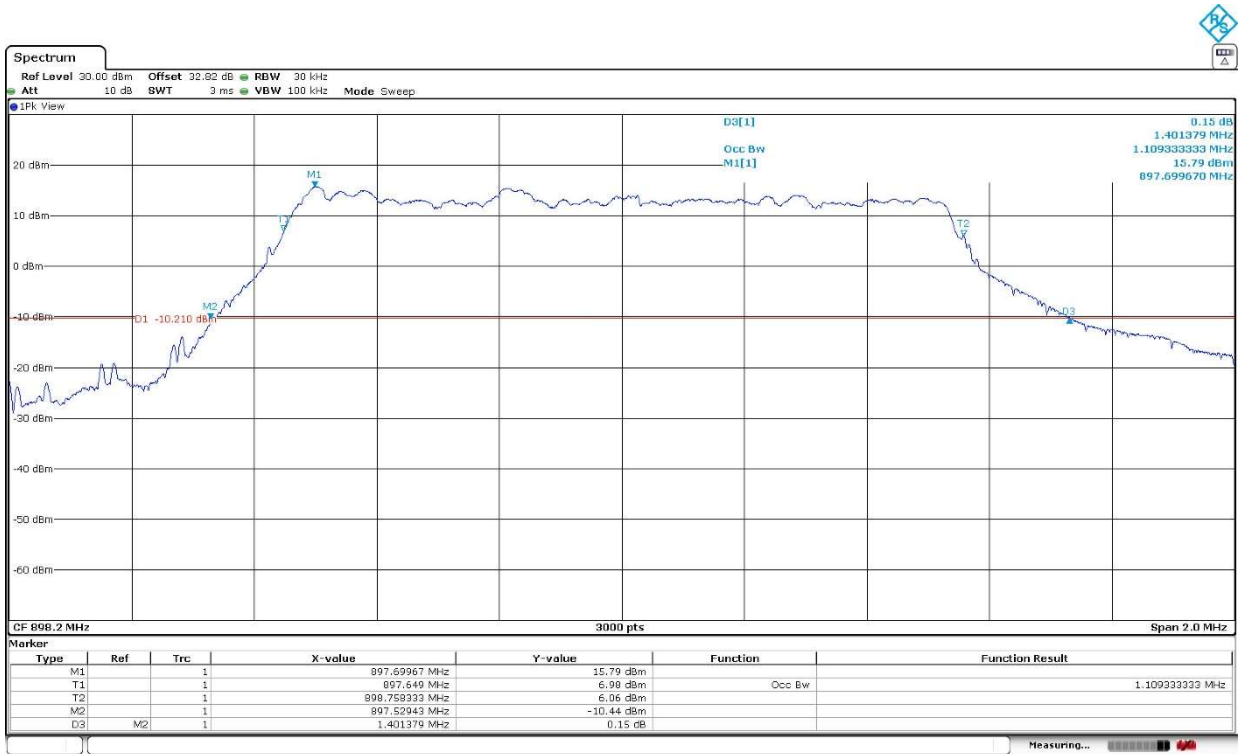
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	1.111	1.113	1.113
-26 dBc Bandwidth (MHz)	1.381	1.414	1.403
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-M1 Band 85. BW=5 MHz. 16QAM. RB Size 5.

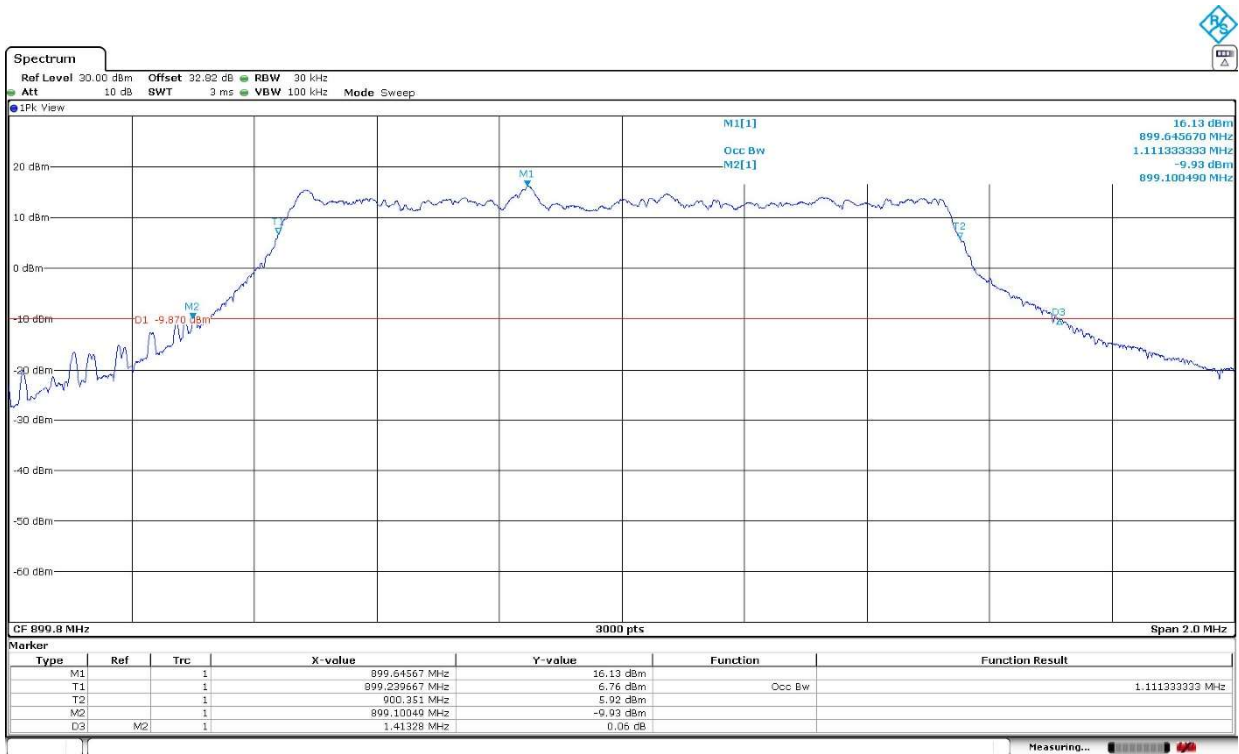
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	0.952	0.954	0.964
-26 dBc Bandwidth (MHz)	1.295	1.306	1.415
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-M1 Band 8. BW=1.4 MHz. QPSK. RB Size 6.

Low Channel:

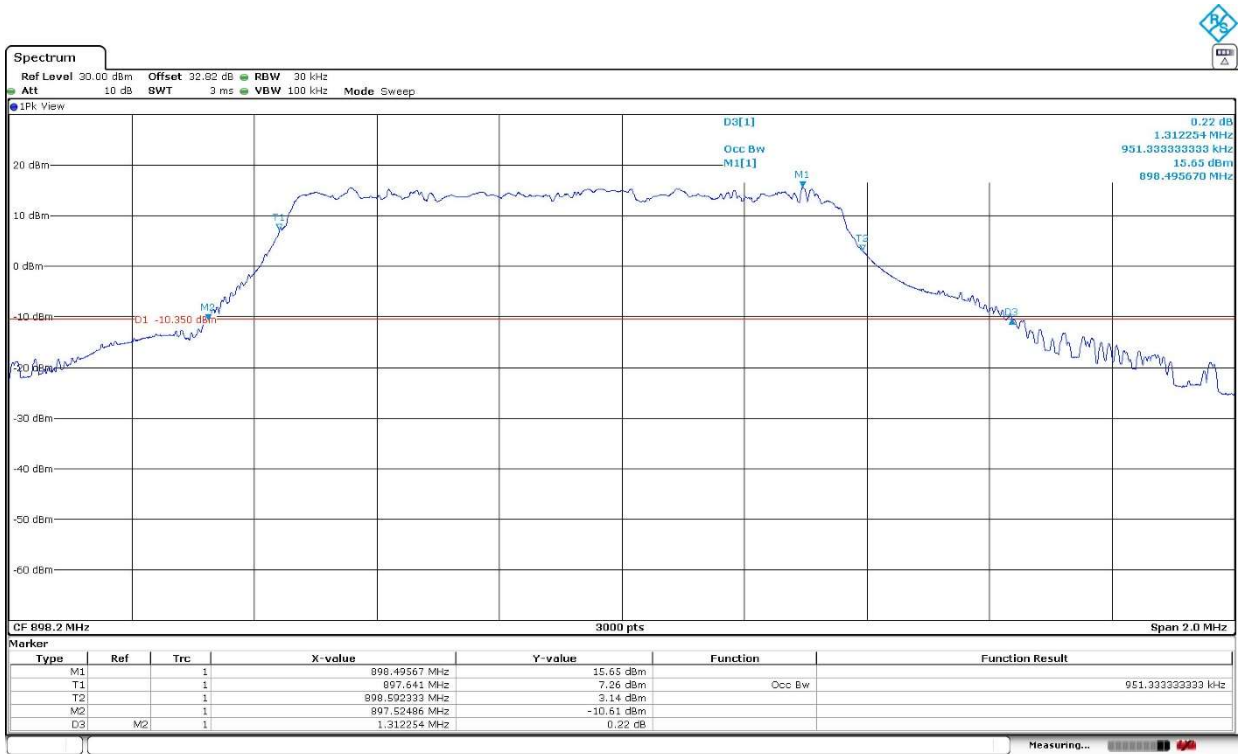


High Channel:

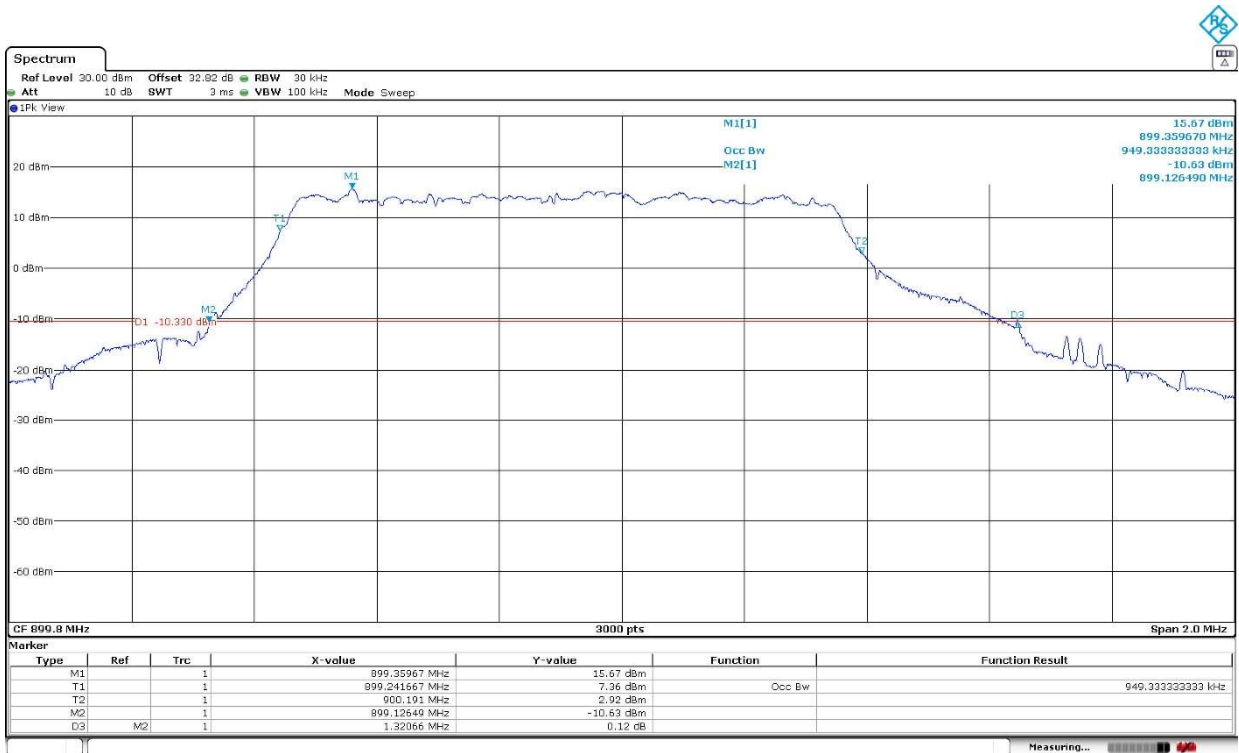


LTE Cat-M1 Band 8. BW=1.4 MHz. 16QAM. RB Size 5.

Low Channel:

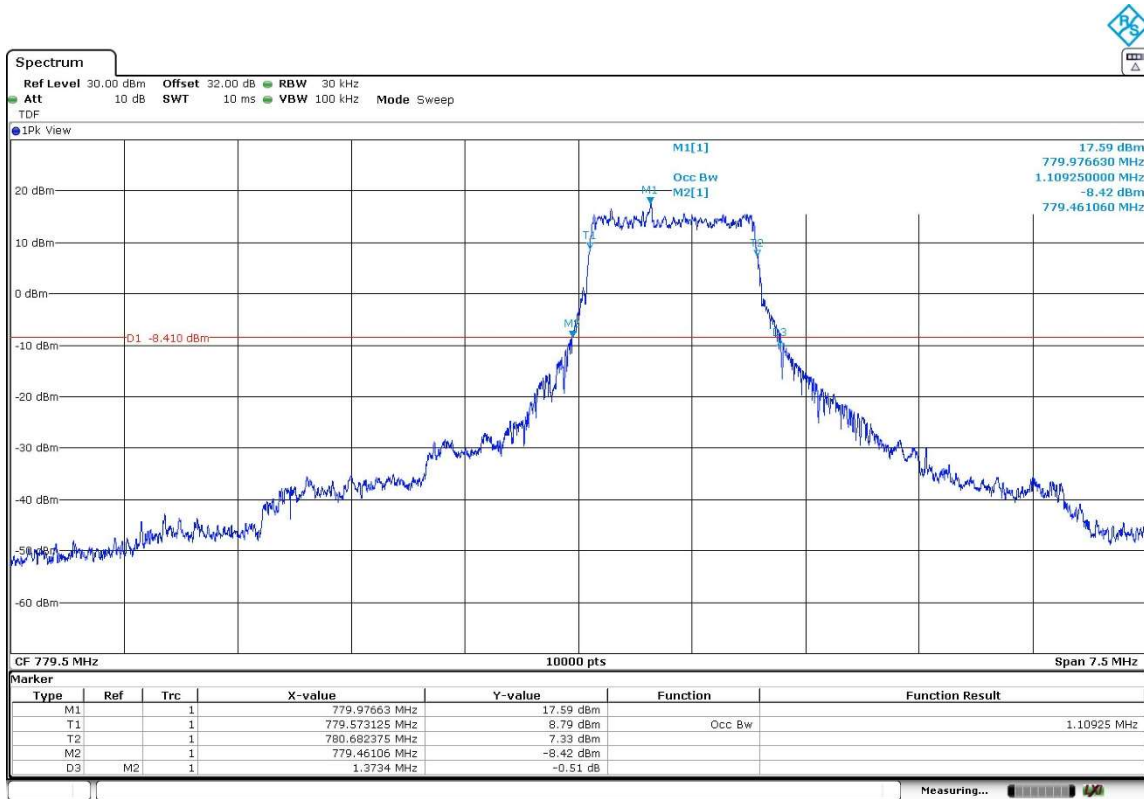


High Channel:

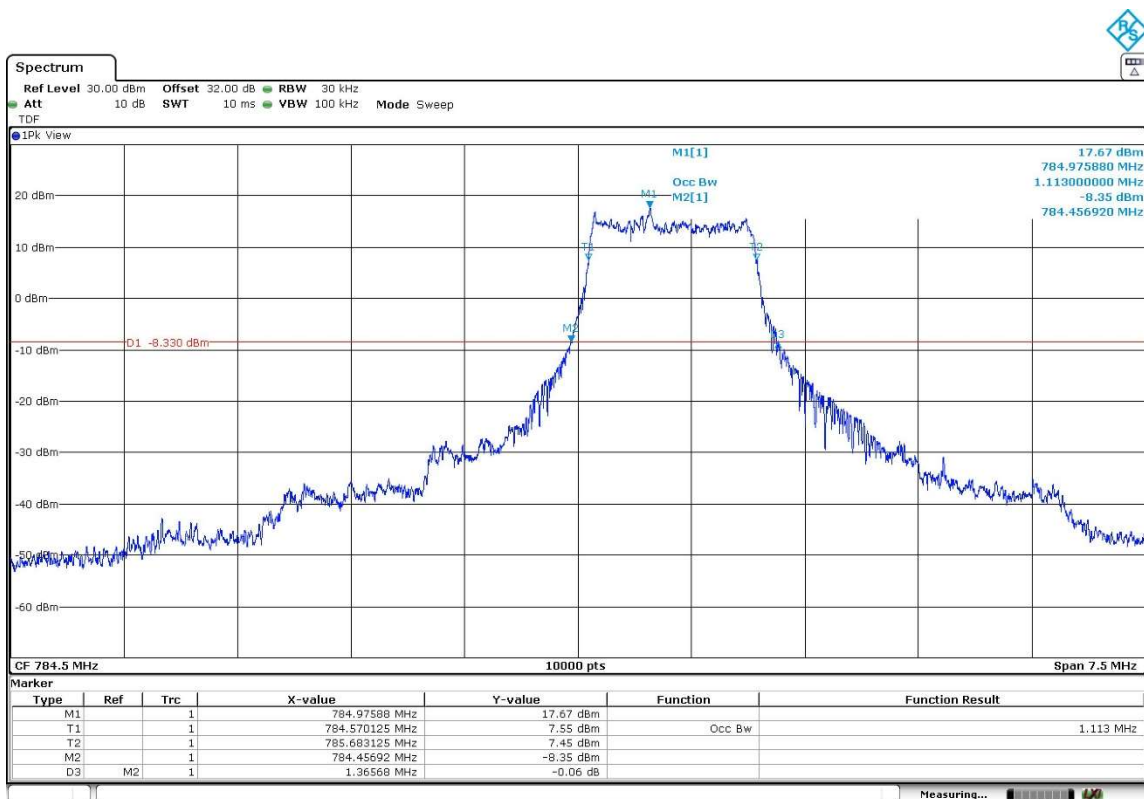


LTE Cat-M1 Band 13. BW=5 MHz. QPSK. RB Size 6.

Low Channel:

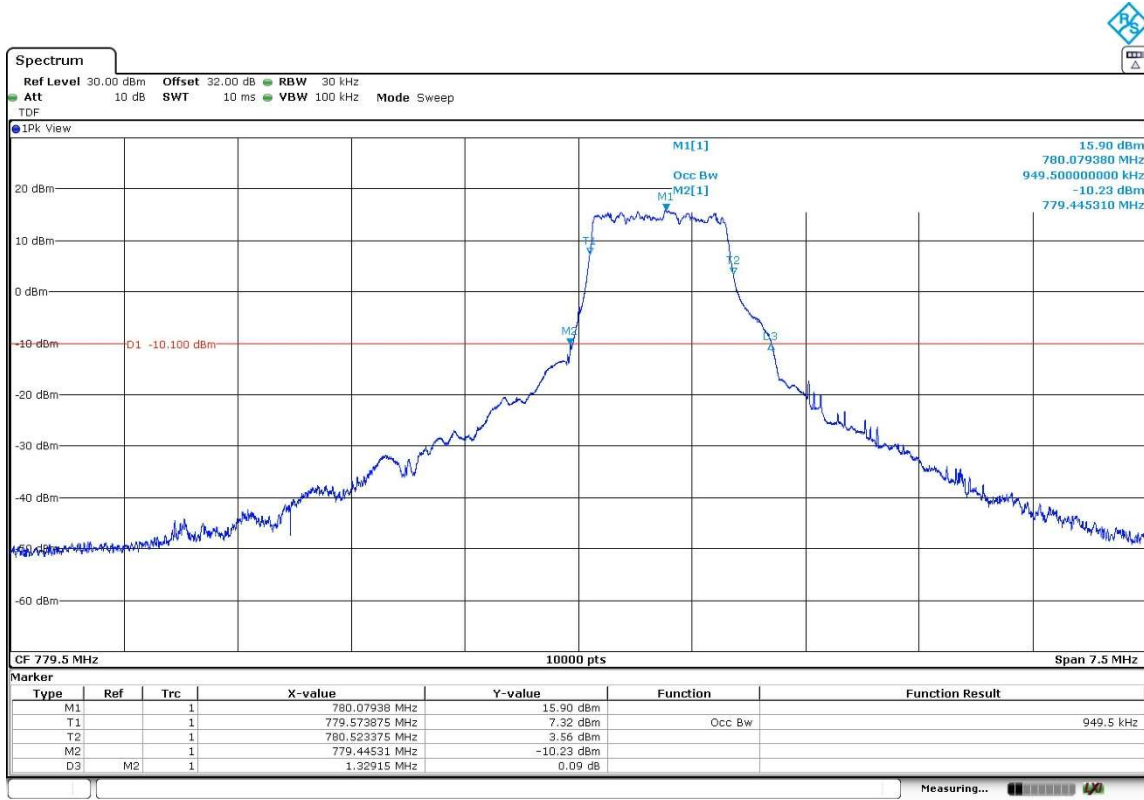


High Channel:

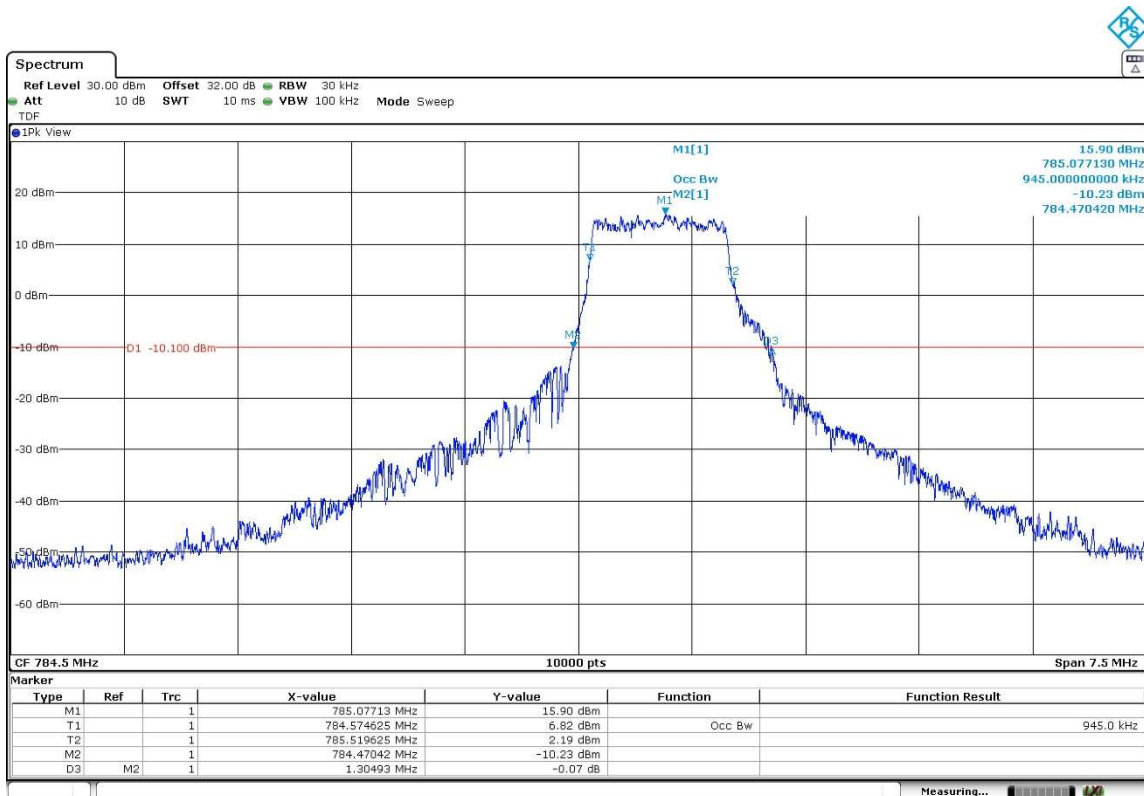


LTE Cat-M1 Band 13. BW=5 MHz. 16QAM. RB Size 5.

Low Channel:

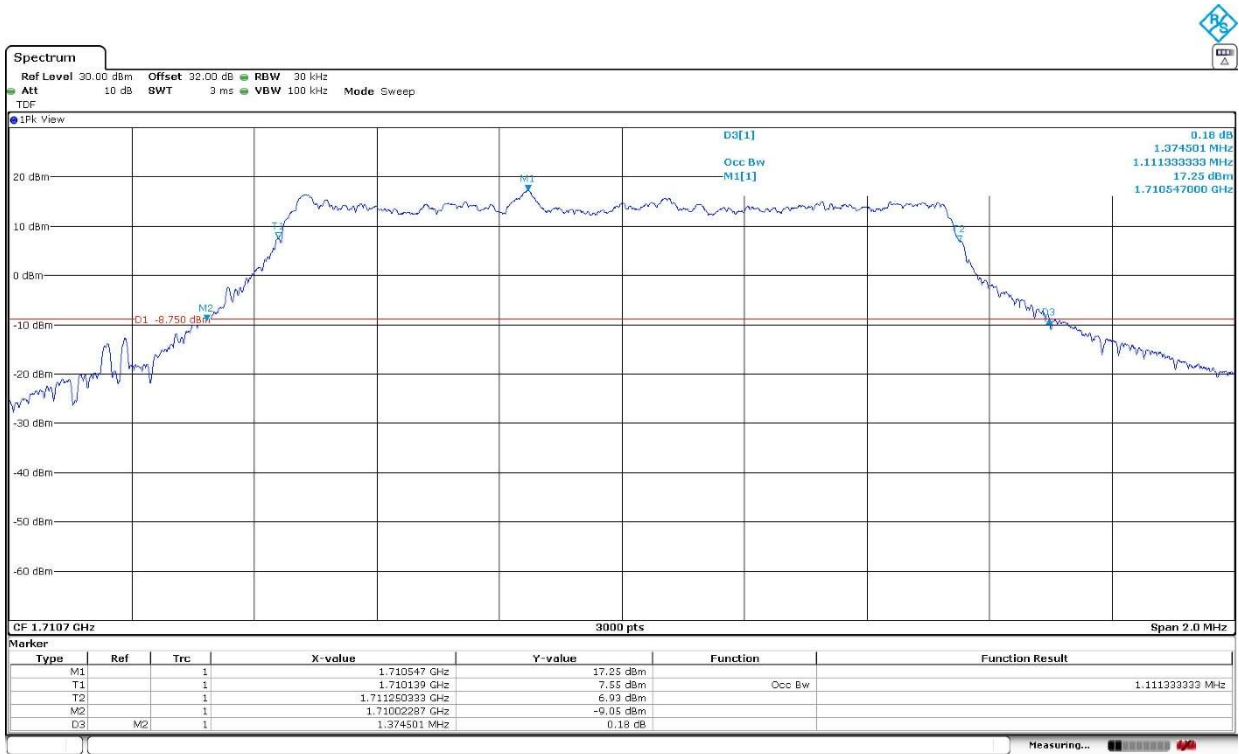


High Channel:

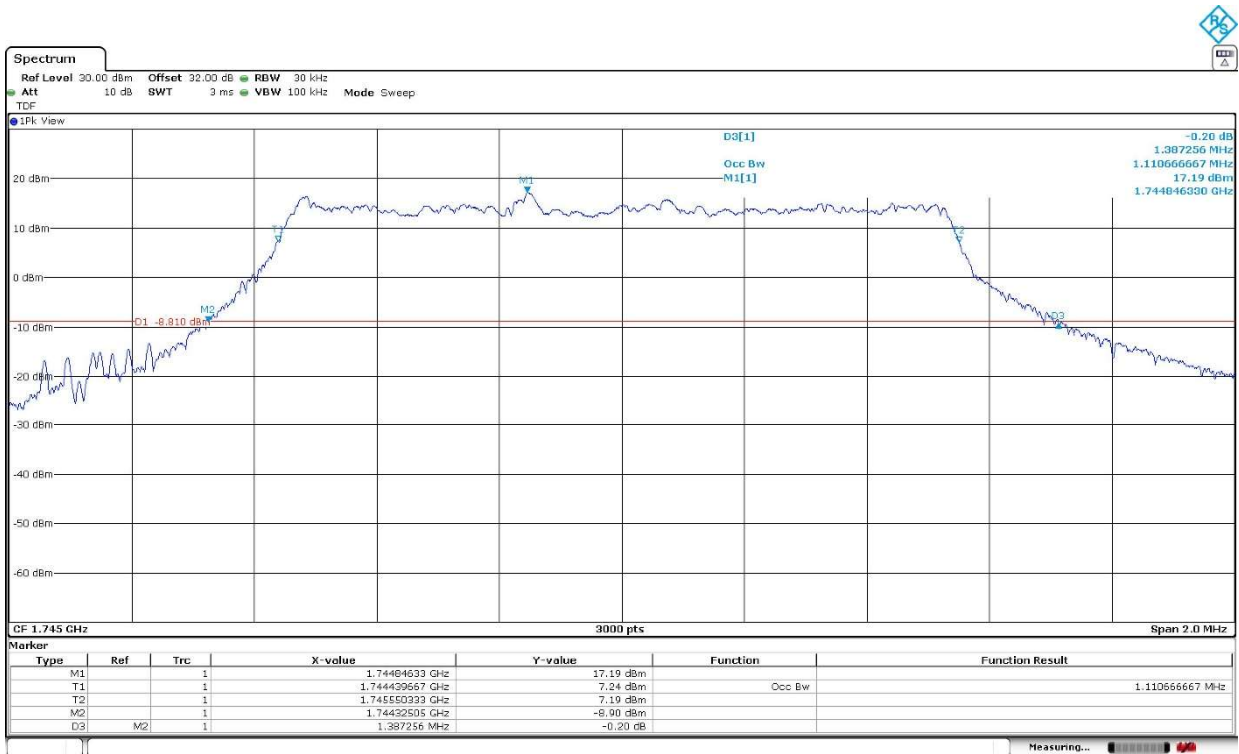


LTE Cat-M1 Band 66. BW=1.4 MHz. QPSK. RB Size 6.

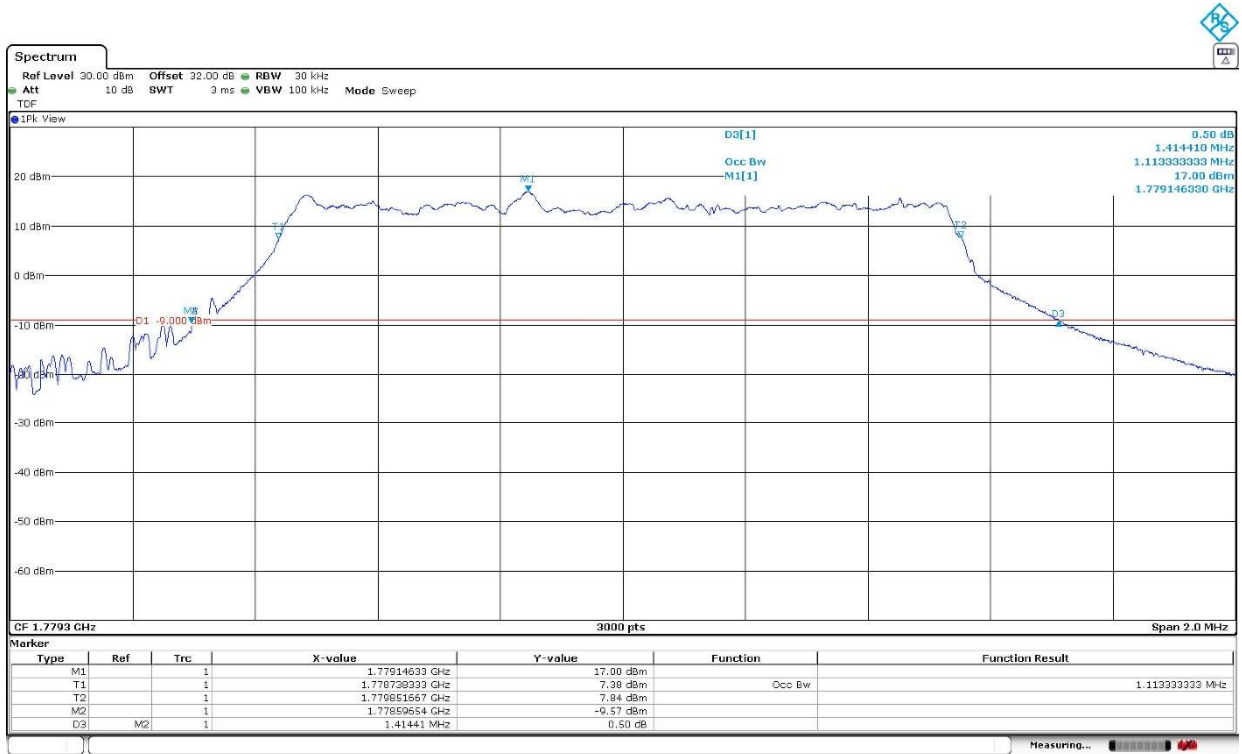
Low Channel:



Middle Channel:



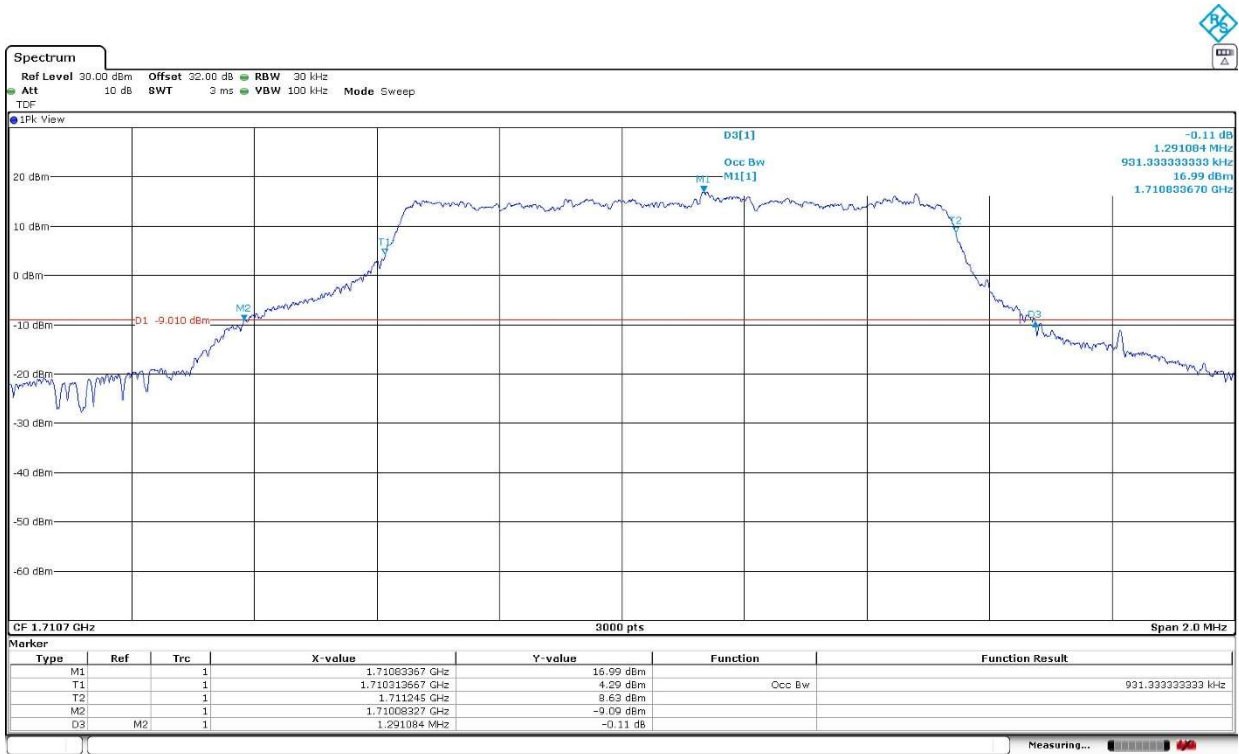
High Channel:



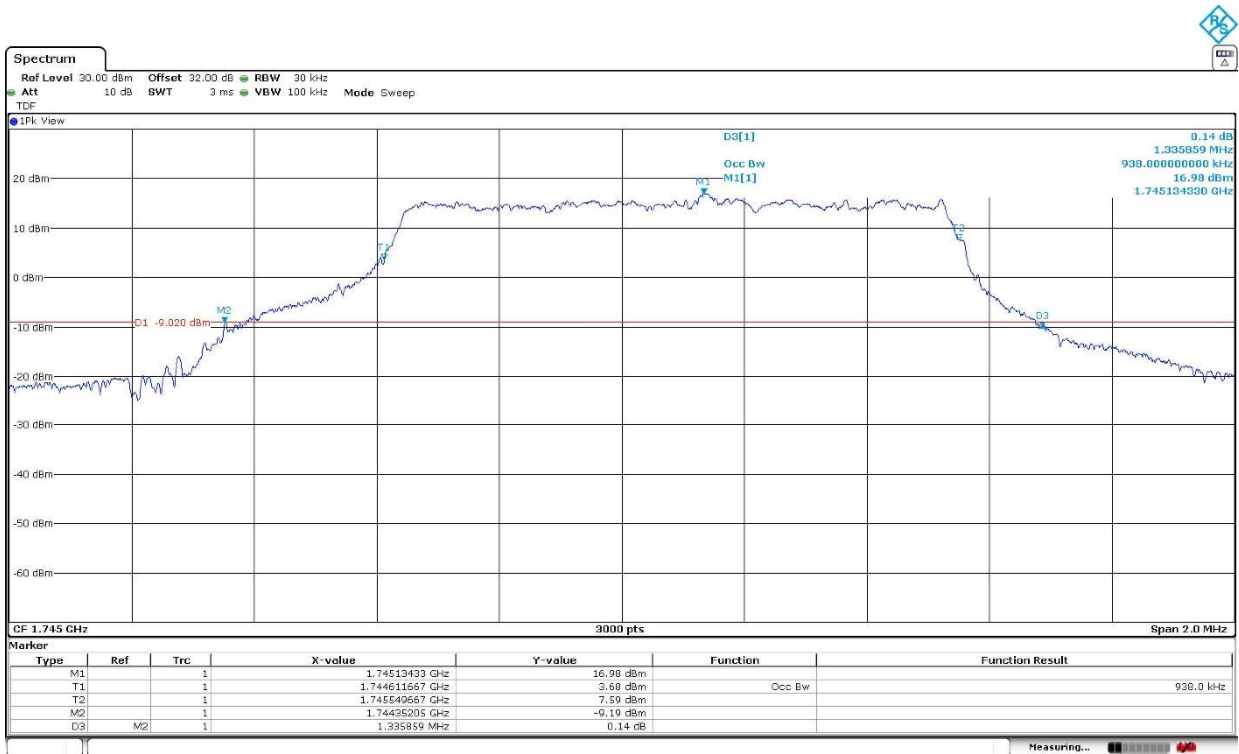


LTE Cat-M1 Band 66. BW=1.4 MHz. 16QAM. RB Size 5.

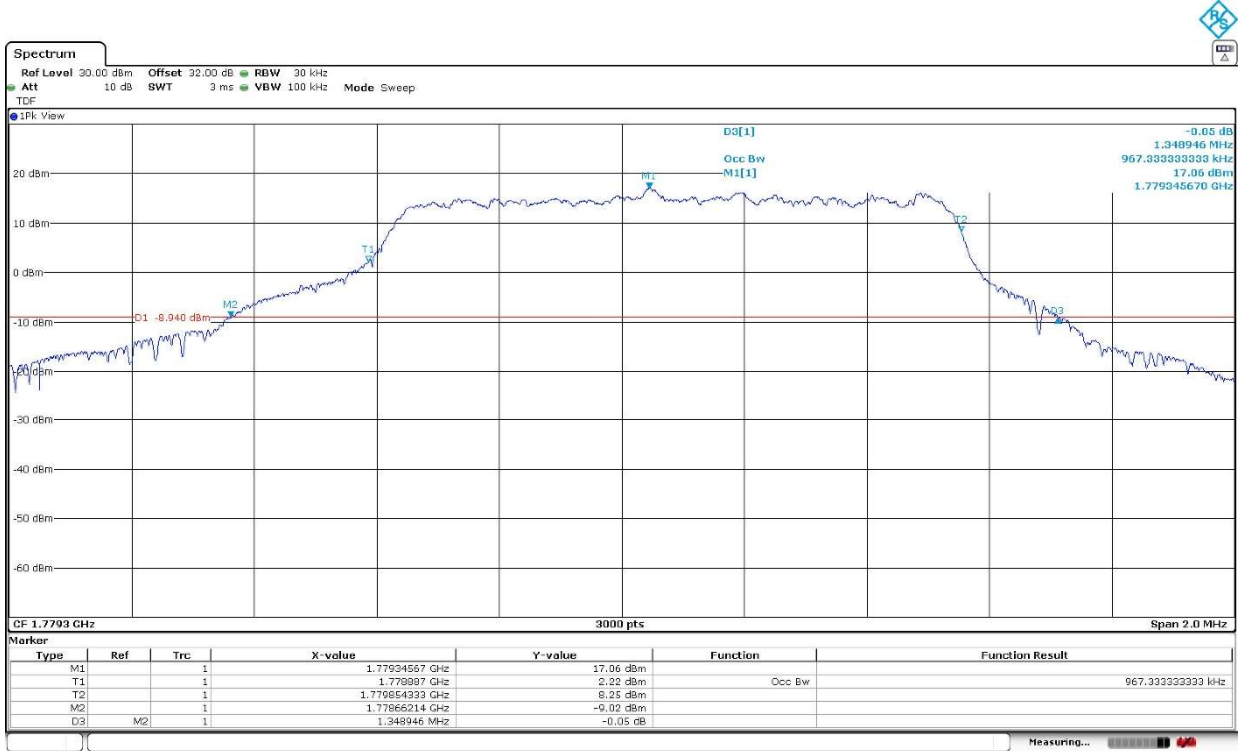
Low Channel:



Middle Channel:

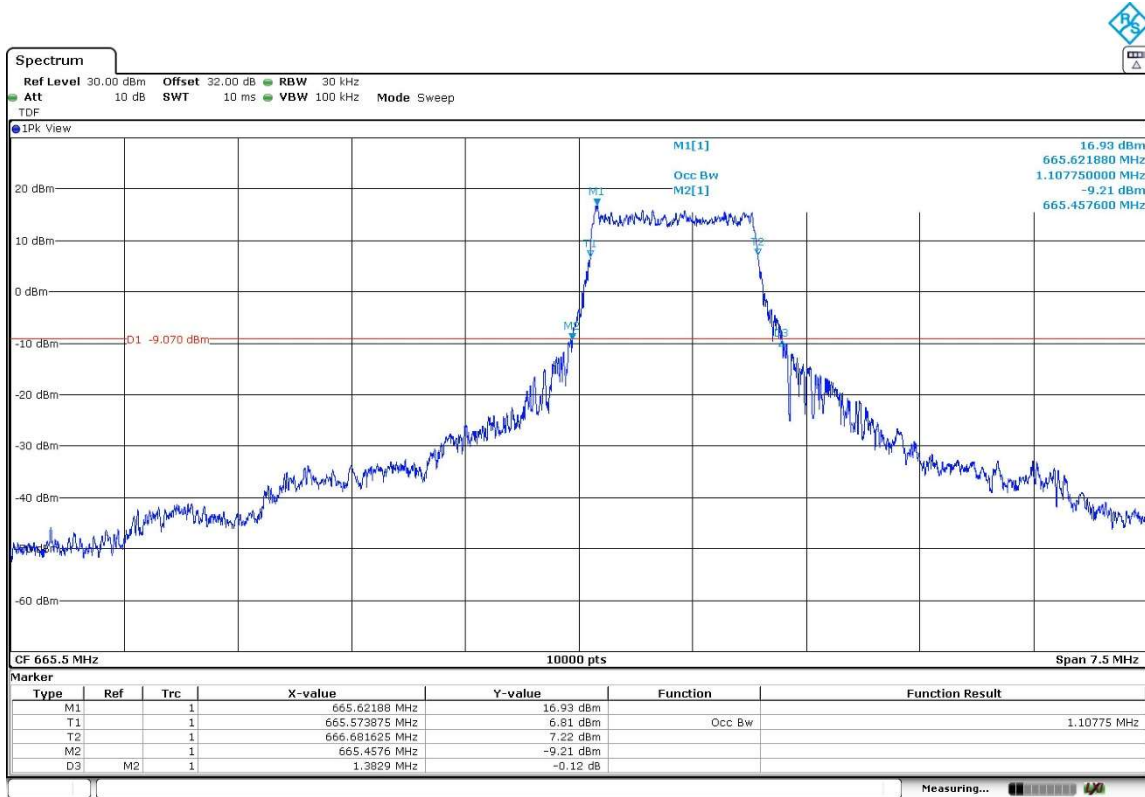


High Channel:

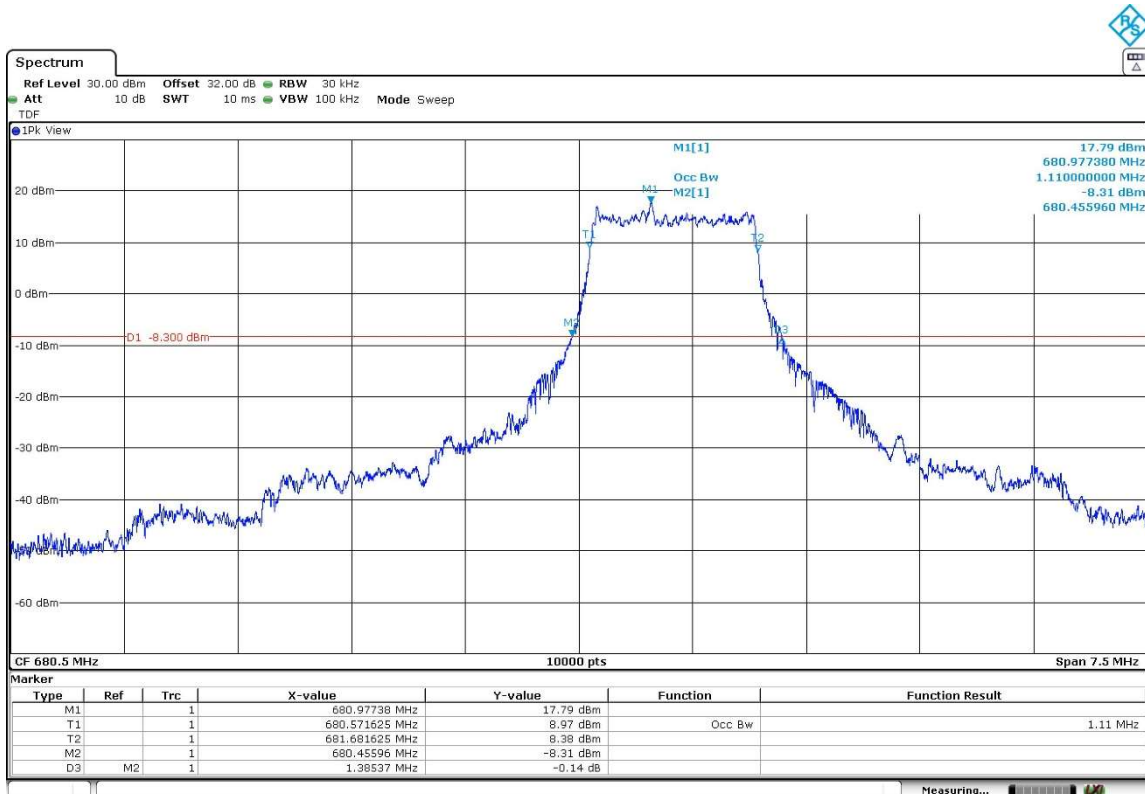


LTE Cat-M1 Band 71. BW=5 MHz. QPSK. RB Size 6.

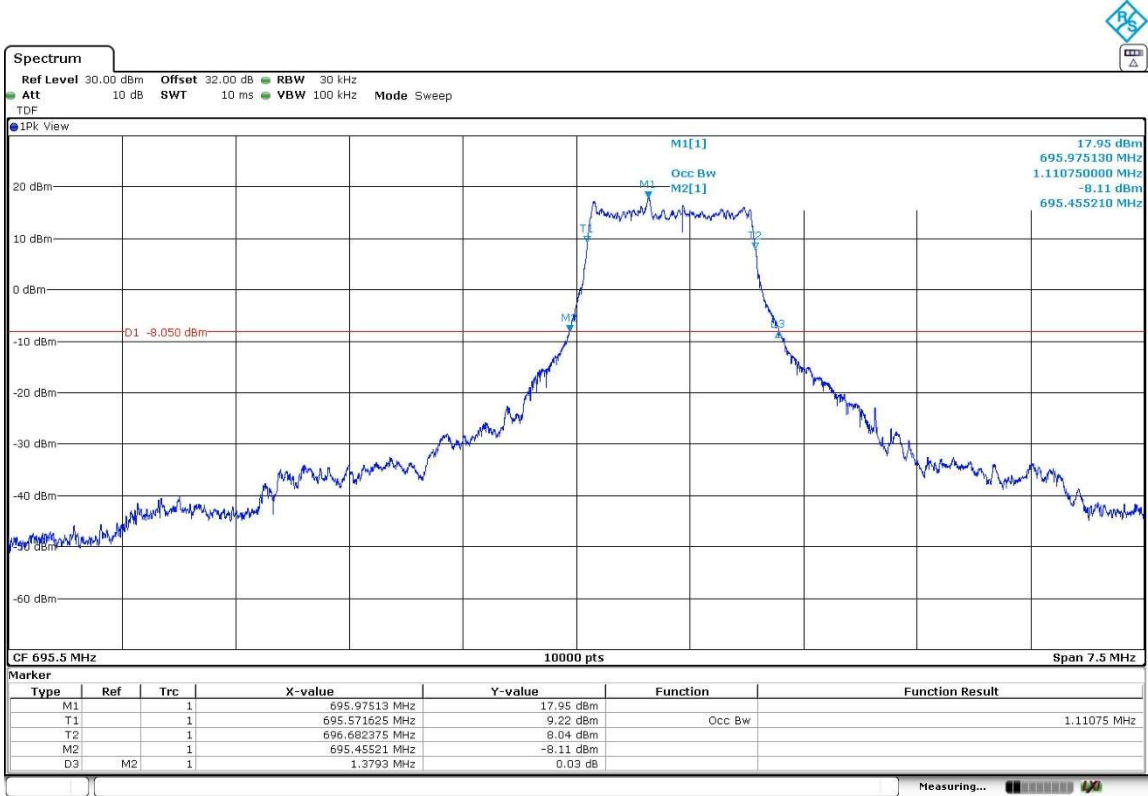
Low Channel:



Middle Channel:

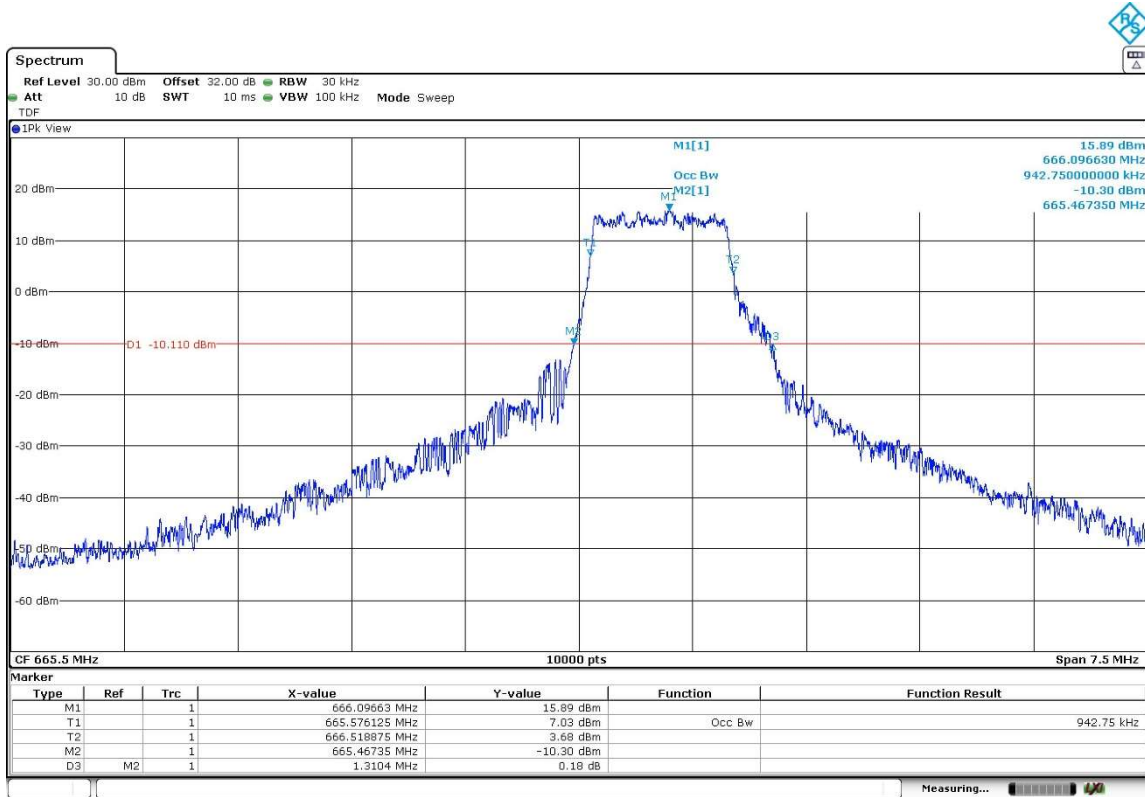


High Channel:

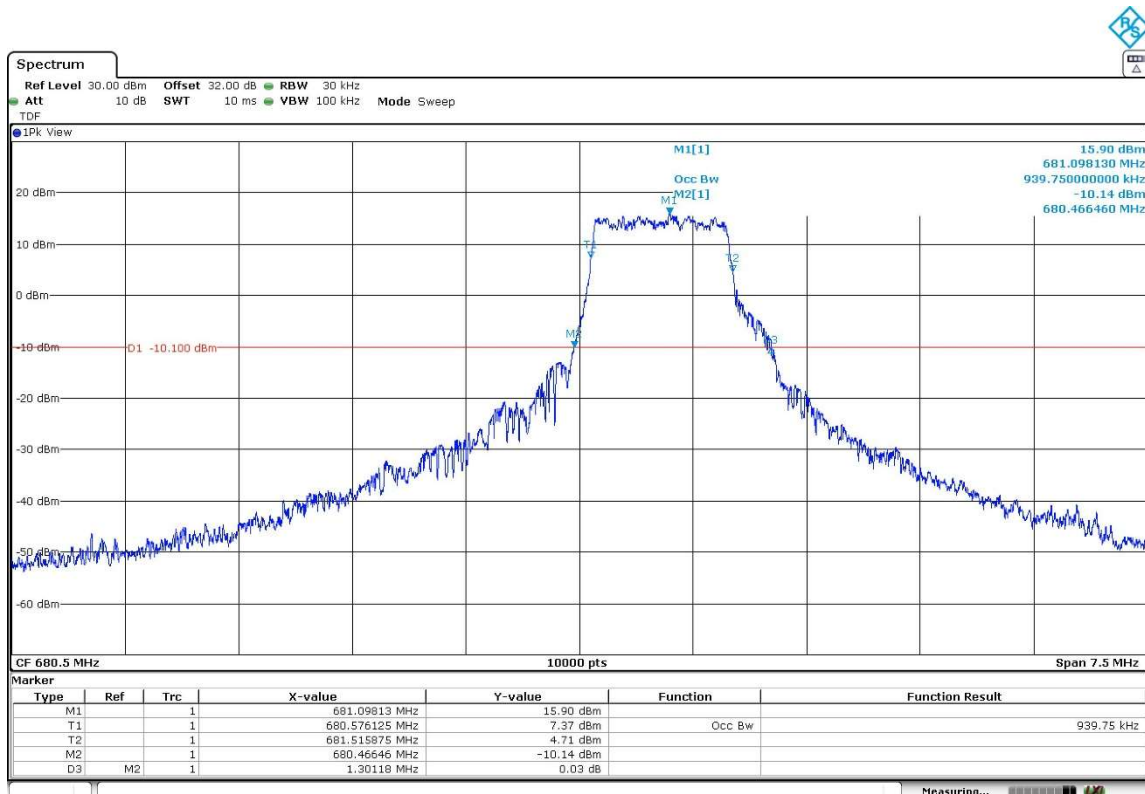


LTE Cat-M1 Band 71. BW=5 MHz. 16QAM. RB Size 5.

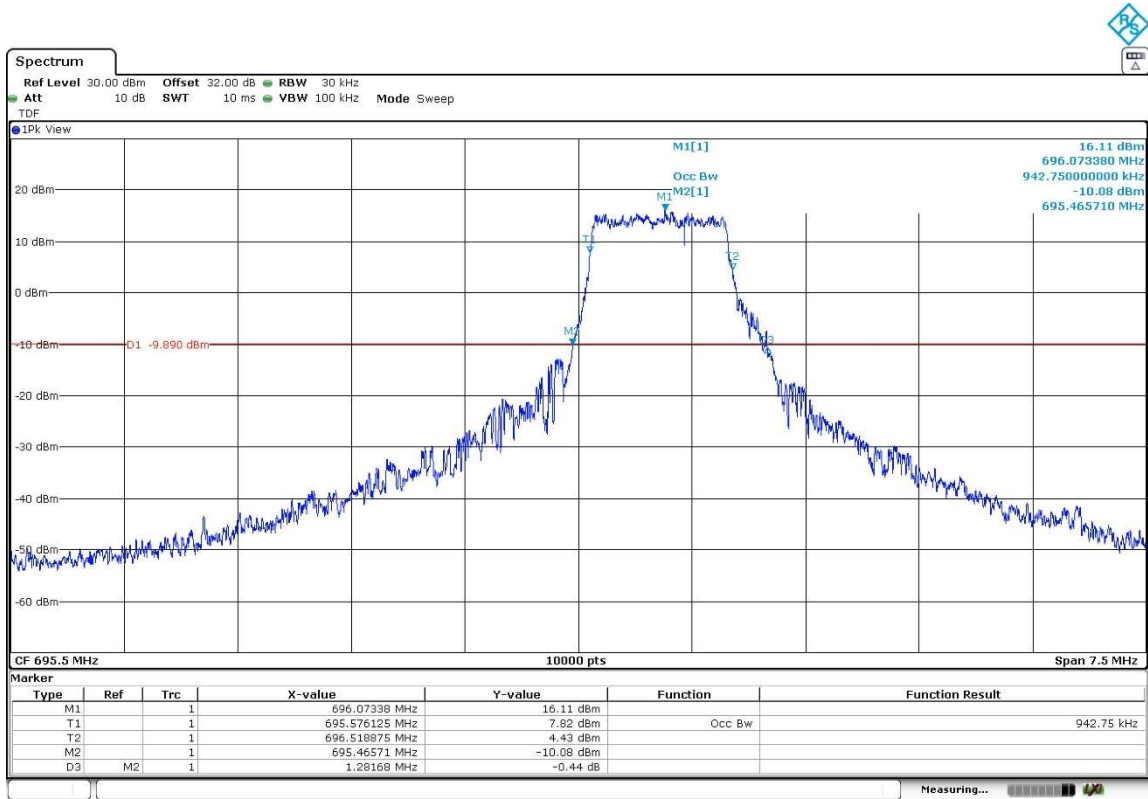
Low Channel:



Middle Channel:

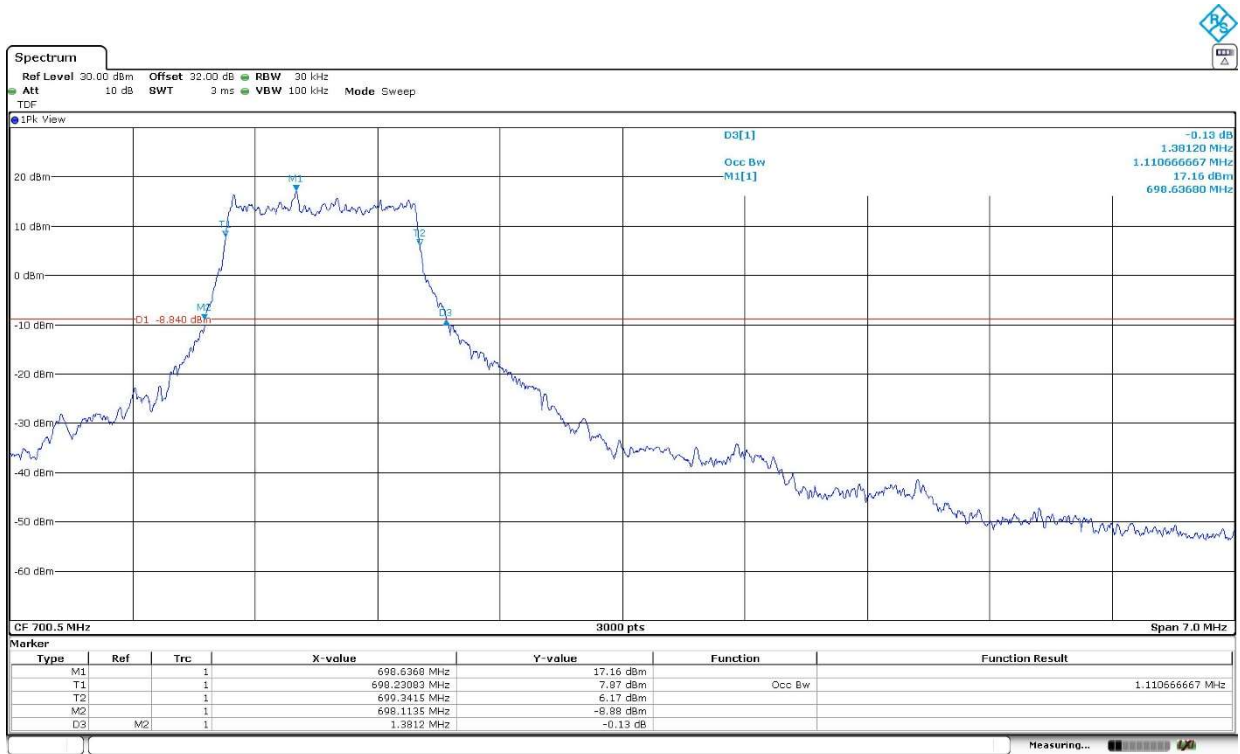


High Channel:

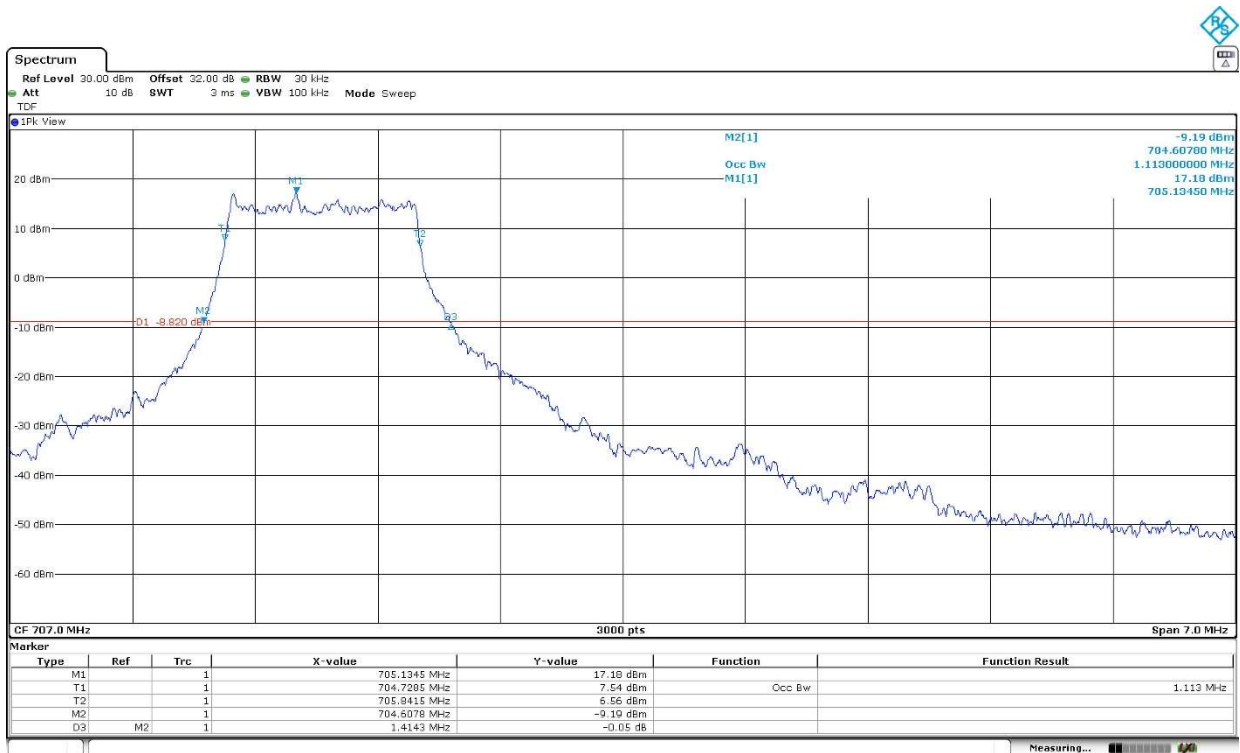


LTE Cat-M1 Band 85. BW=5 MHz. QPSK. RB Size 6.

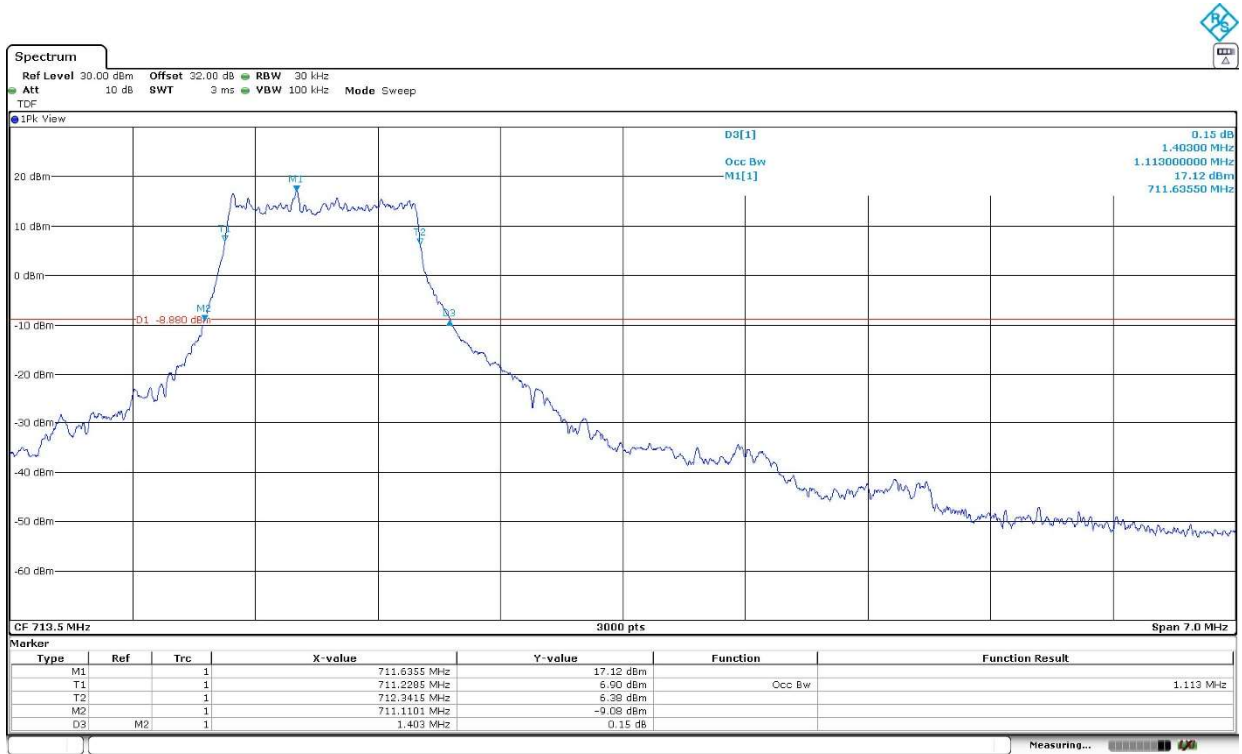
Low Channel:



Middle Channel:



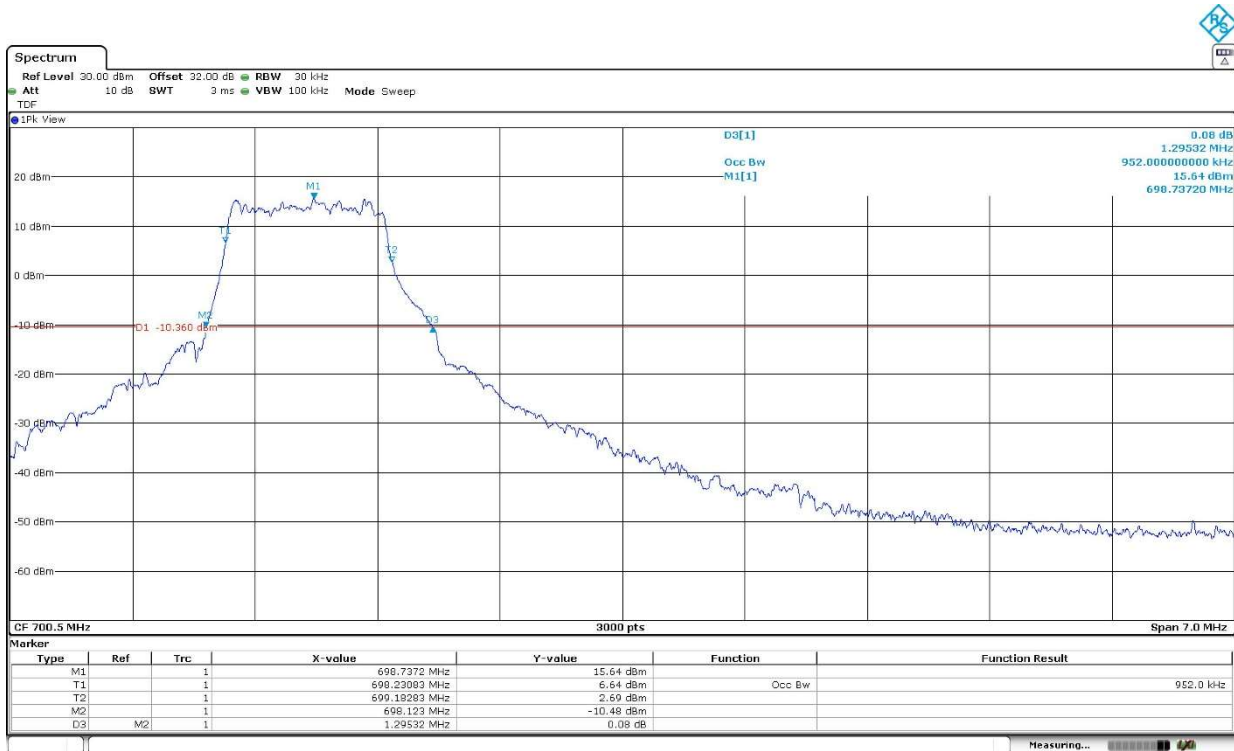
High Channel:



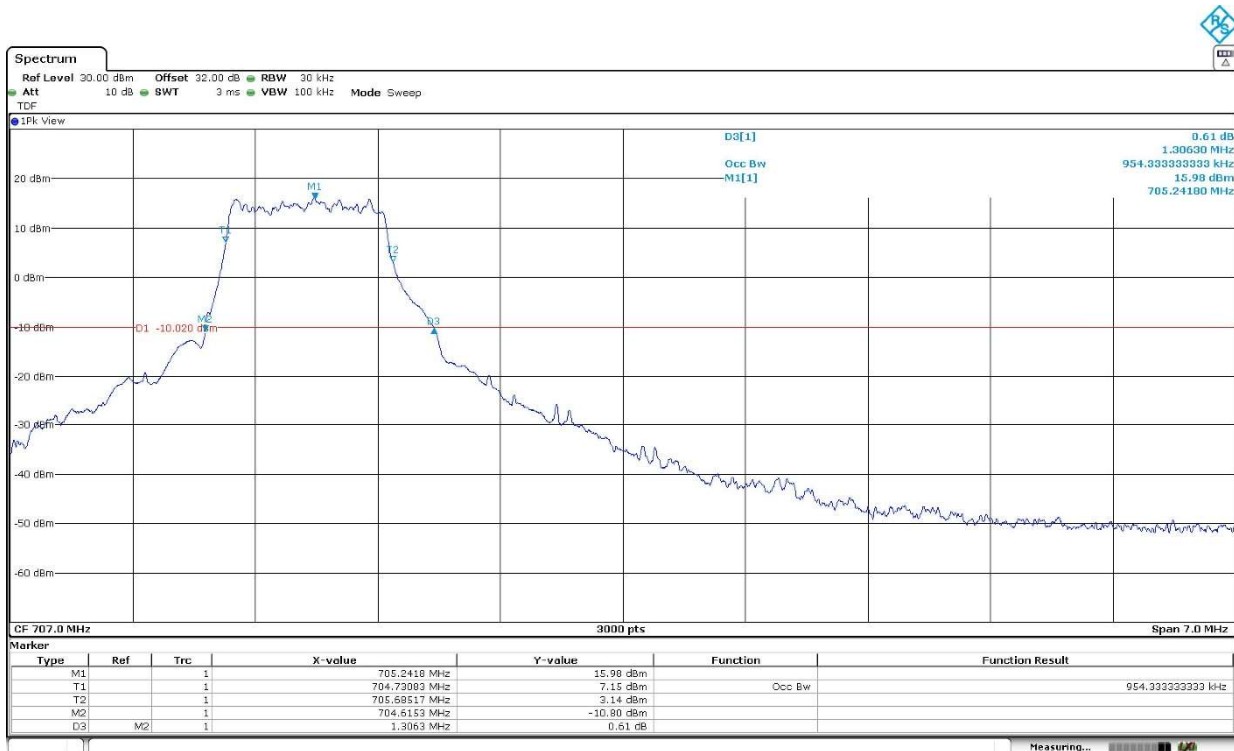


LTE Cat-M1 Band 85. BW=5 MHz. 16QAM. RB Size 5.

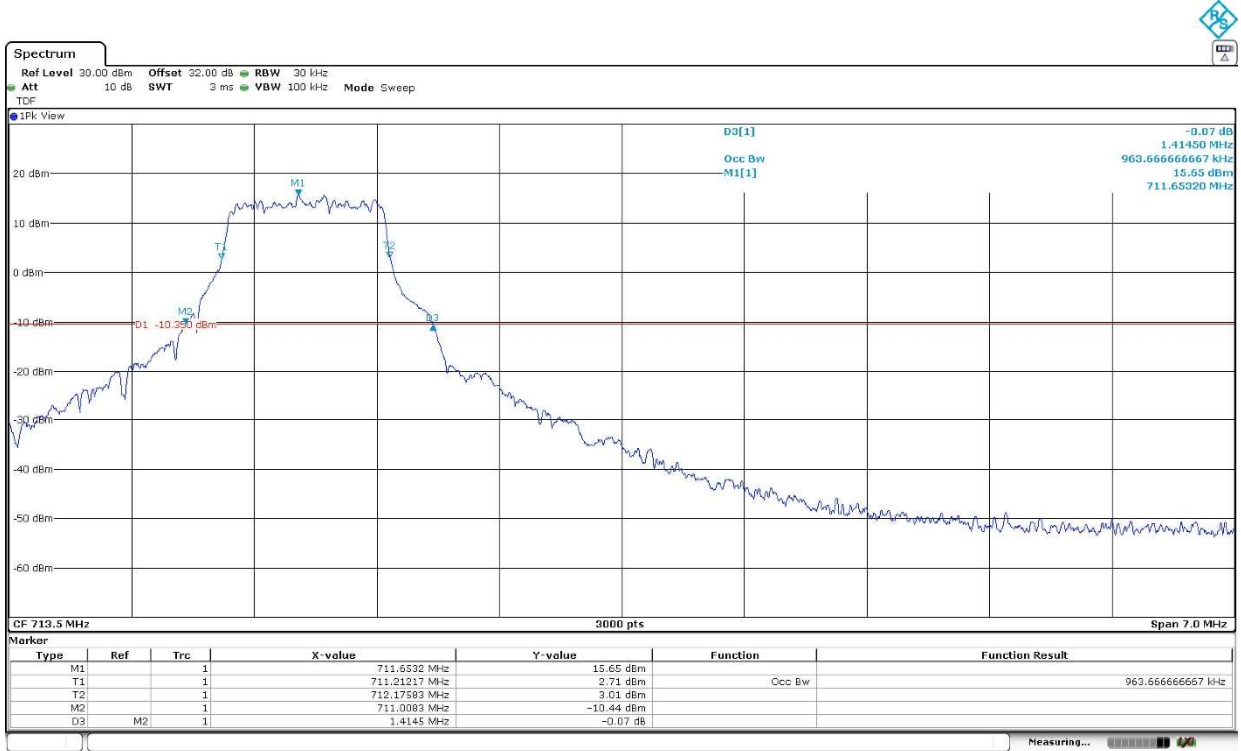
Low Channel:



Middle Channel:



High Channel:



## Spurious Emissions at Antenna Terminals

### Limits

#### 1. LTE Cat-M1 Band 8. FCC §27.1509 (a).

FCC §27.1509 (a):

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:

- (a) For 900 MHz broadband operations in 897.5–900.5 MHz band by at least  $43 + 10 \log (P)$  dB.

#### 2. LTE Cat-M1 Band 13.

FCC §27.53 (c):

On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB. Compliance is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater.

On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations. Compliance is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

RSS-130, Clause 4.7.2:

The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least  $65 + 10 \log_{10} p(\text{watts})$ , dB, for mobile and portable equipment.

#### 3. LTE Cat-M1 Band 66.

FCC §27.53 (h), RSS-139, Clause 6.6:

According to specification, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10} (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

#### 4. LTE Cat-M1 Band 71 & LTE Cat-M1 Band 85.

FCC §27.53 (g):

For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater.

RSS-130, Clause 4.7.1:

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least  $43 + 10 \log_{10} p(\text{watts})$ , dB.

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

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

At  $P_o$  transmitting power, the specified minimum attenuation becomes  $65 + 10 \log (P_o)$ , and the level in dBm relative to  $P_o$  becomes:

$$P_o \text{ (dBm)} - [65 + 10 \log (P_o \text{ in mW}) - 30] = -35 \text{ dBm}$$

### Method

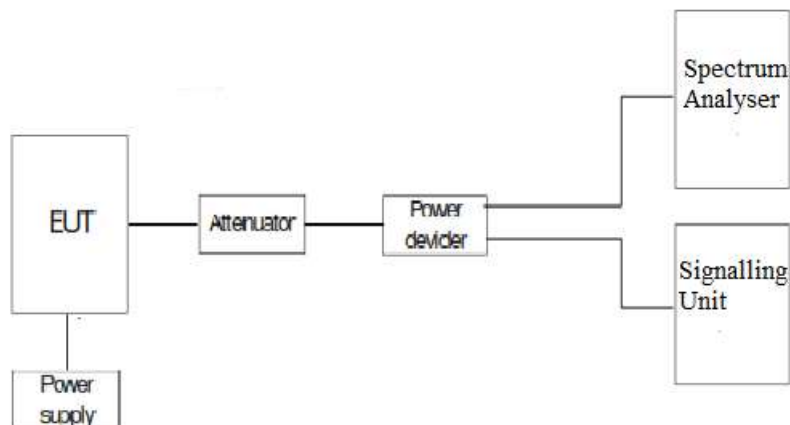
The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50-Ohm attenuator and a power divider.

The spectrum was investigated from 9 kHz to 10 GHz for LTE Cat M1 Bands 8, 13, 71 & 85 and from 9 kHz to 20 GHz for LTE Cat M1 Band 66.

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

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

### Test Setup



## Results

### **LTE Cat-M1 Band 8:** BW=1.4 MHz. QPSK. RB Size 1. RB Offset 2.

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

### **LTE Cat-M1 Band 13:** BW=5 MHz. QPSK. RB Size 1. RB Offset 0.

- Low Channel: Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Limitations Conducted (dBm)	Limit (dBm)
774.3418	-50.86	-35

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

### **LTE Cat-M1 Band 66:** BW=10 MHz. 16QAM. RB Size 1. RB Offset 2.

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

### **LTE Cat-M1 Band 71:** BW=10 MHz. 16QAM. RB Size 1, RB Offset 2.

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

### **LTE Cat-M1 Band 85:** BW=10 MHz. 16QAM. RB Size 1, RB Offset 2.

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

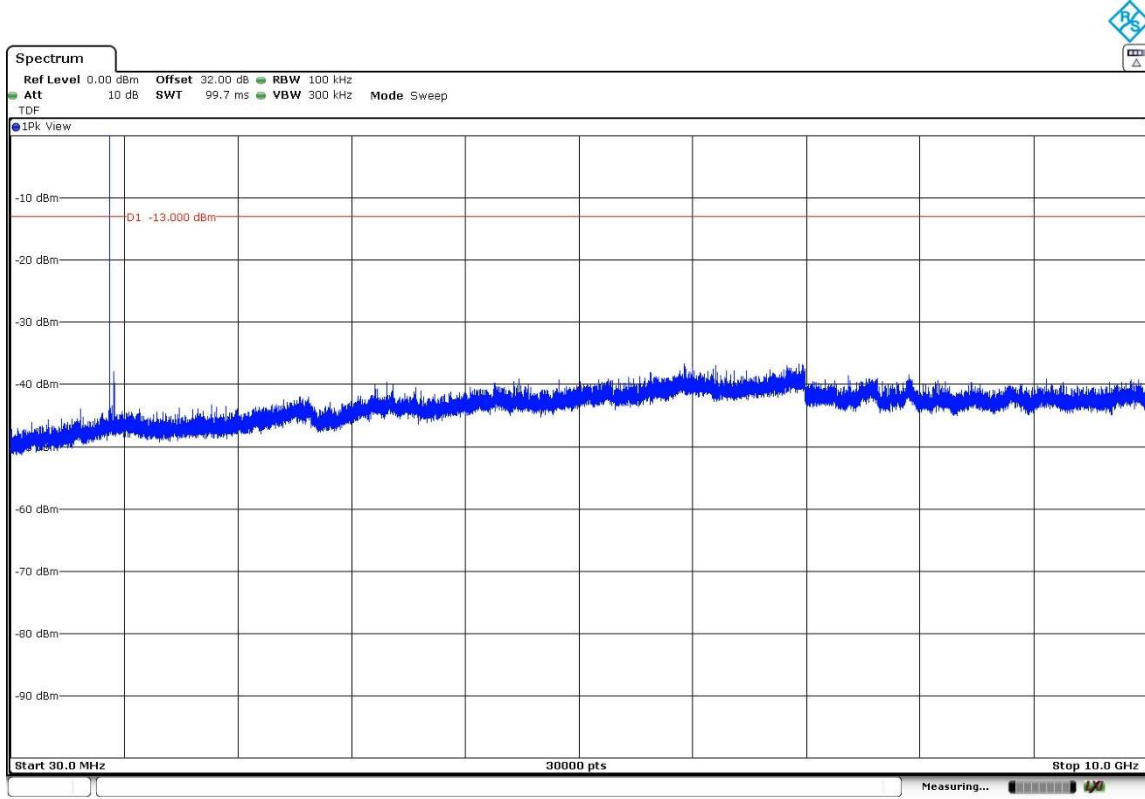
Measurement uncertainty (dB):  $<\pm 2.76$

## Verdict

PASS

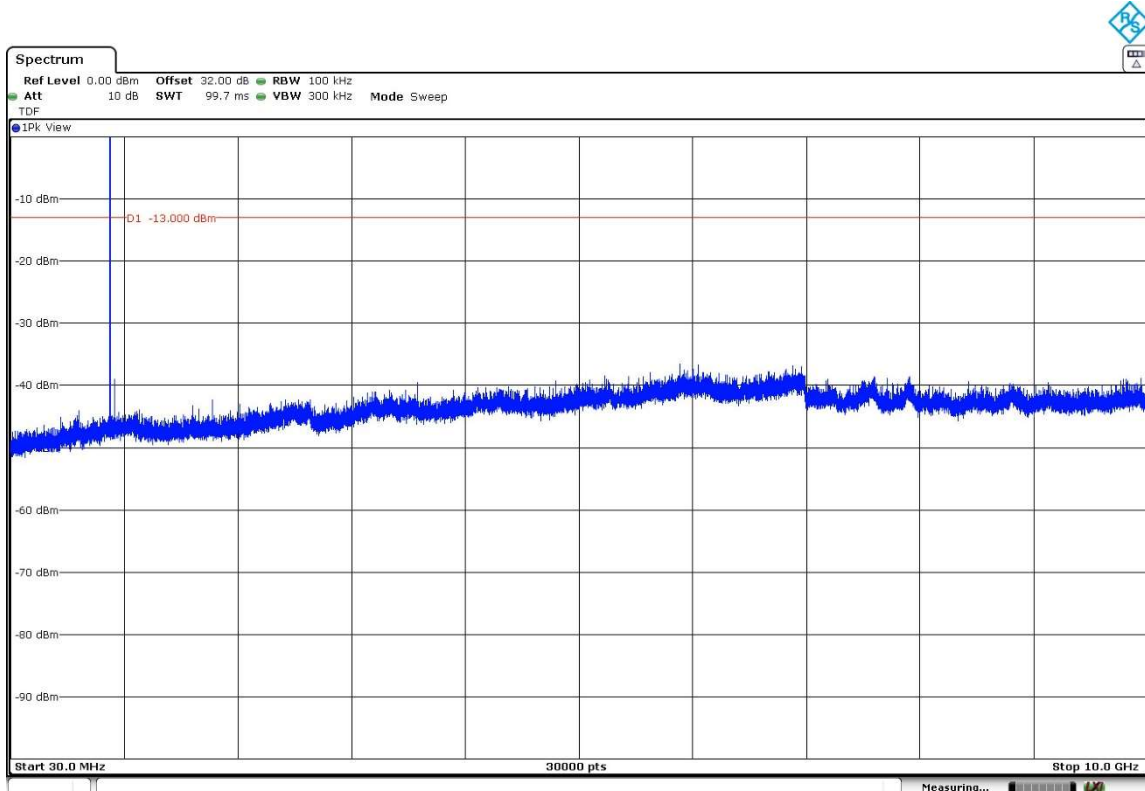
LTE Cat-M1 Band 8. BW=1.4 MHz. QPSK. RB Size 1. RB Offset 2.

Low Channel:



The peak above the limit is the carrier frequency.

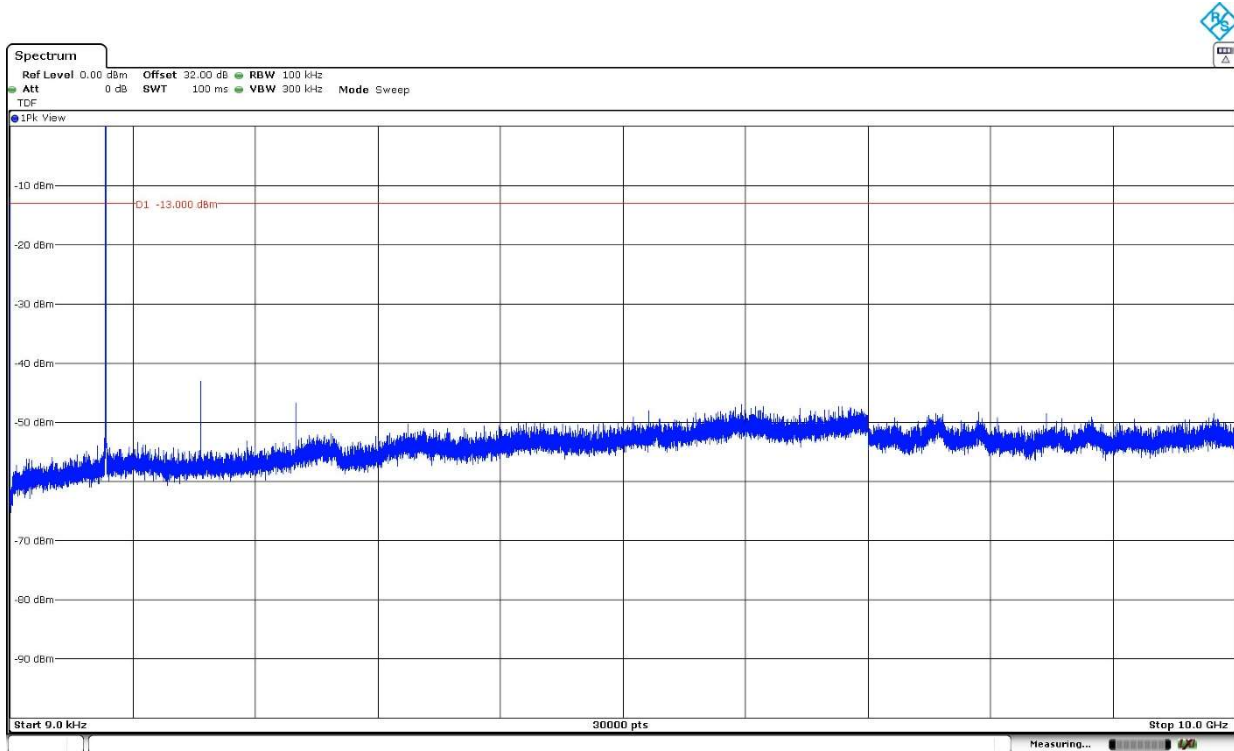
High Channel:



The peak above the limit is the carrier frequency.

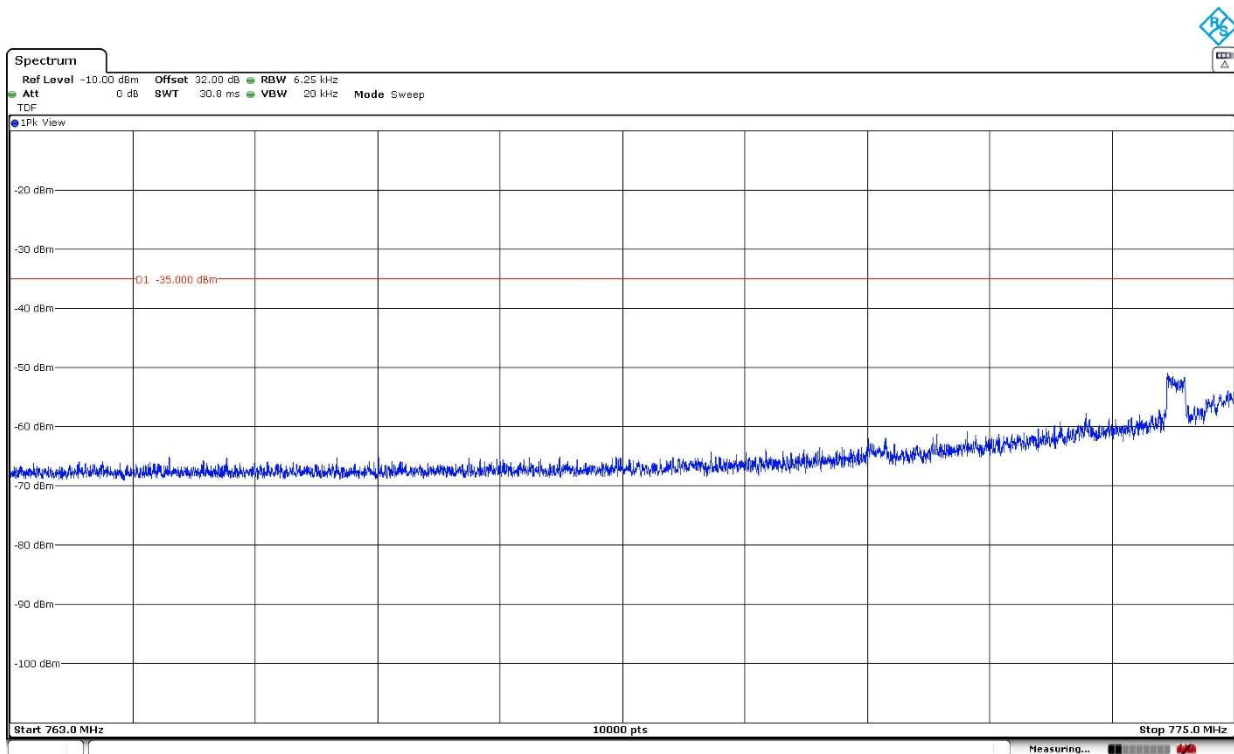
LTE Cat-M1 Band 13. BW=5 MHz. QPSK. RB Size 1. RB Offset 0.

Low Channel:

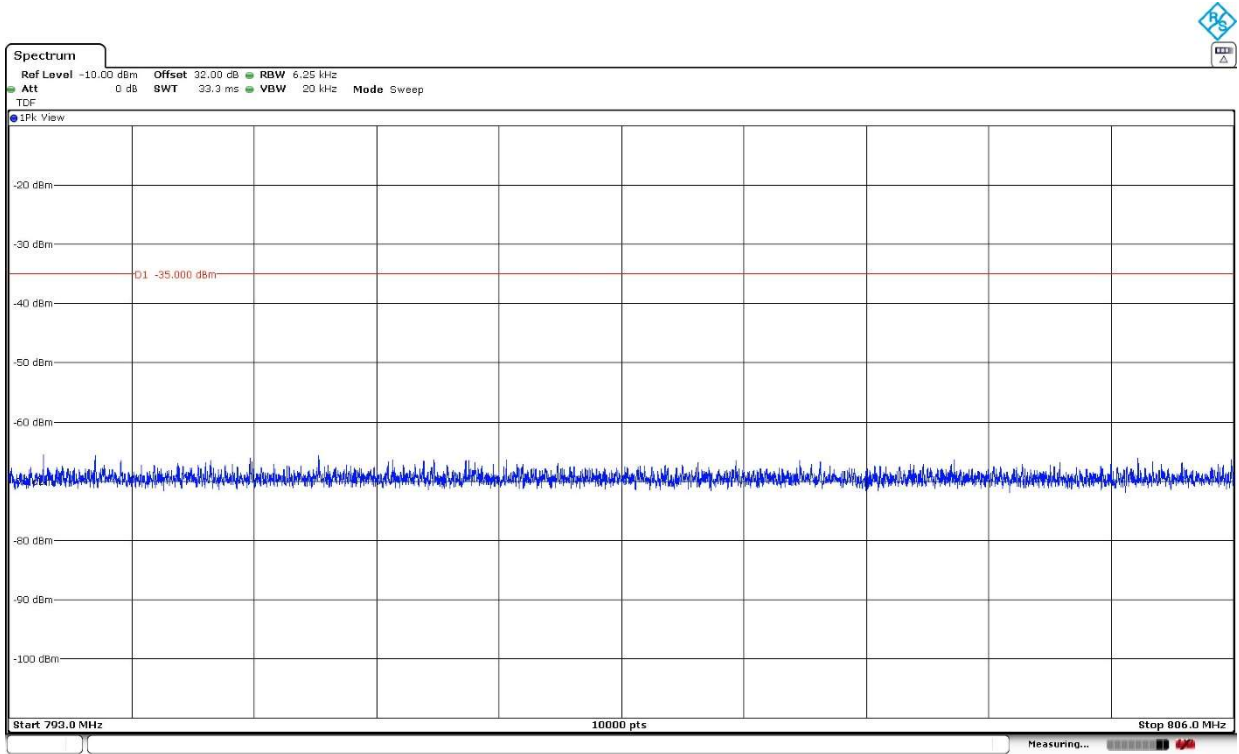


The peak above the limit is the carrier frequency.

- Frequency range 763 MHz – 775 MHz:



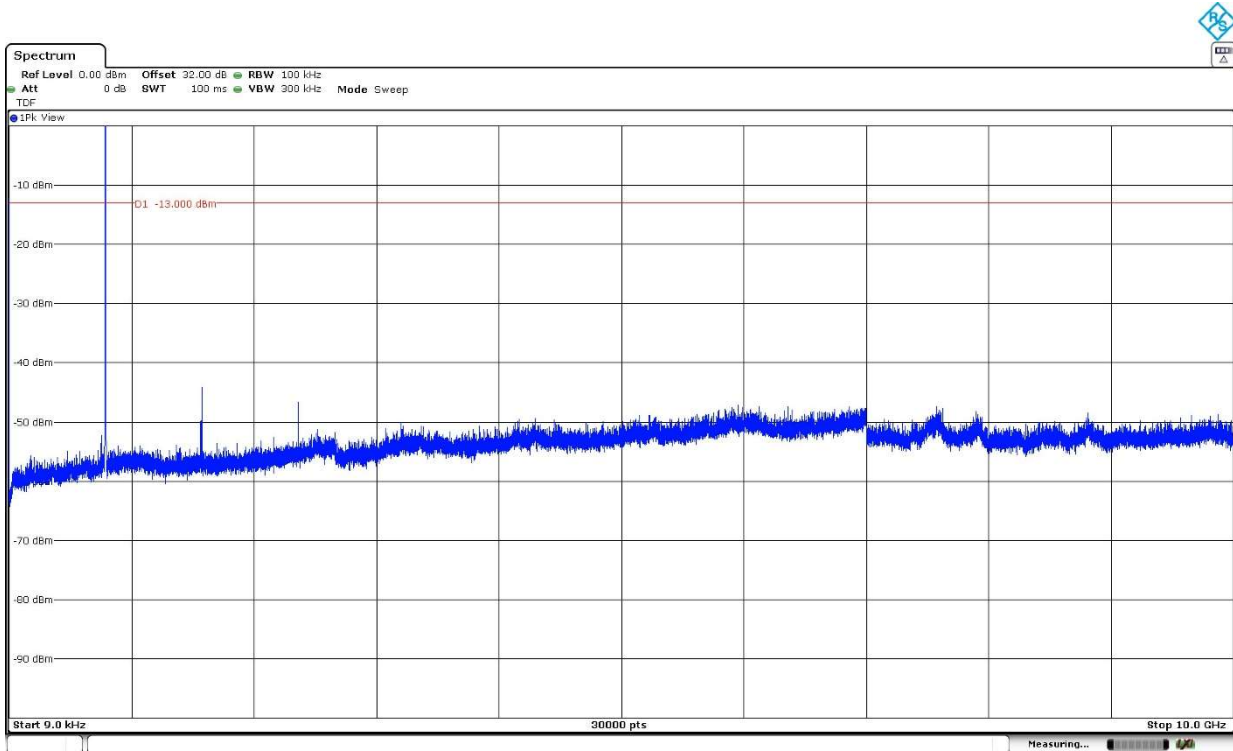
- Frequency range 793 MHz – 806 MHz:





High Channel:

- Frequency range 9 kHz – 8 GHz:



The peak above the limit is the carrier frequency.

- Frequency range 763 MHz – 775 MHz:

