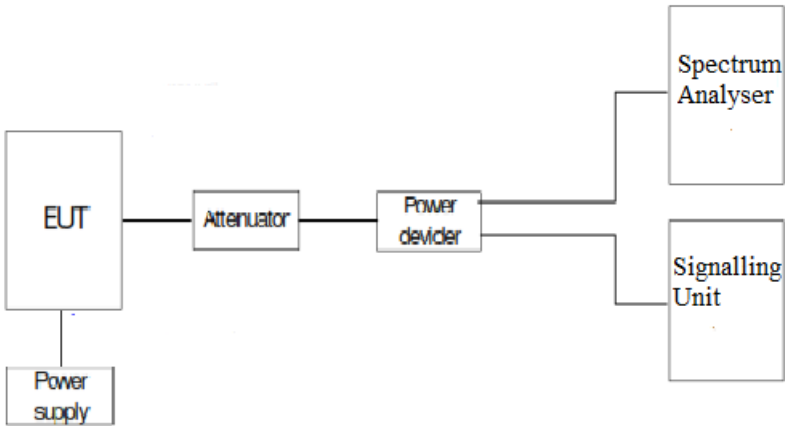


Test Setup



Results

The worst case of occupied bandwidth corresponds to the following ones.

LTE Cat NB2 Band 13:

LTE Cat NB2 Band 13. Pi/2-BPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=0.

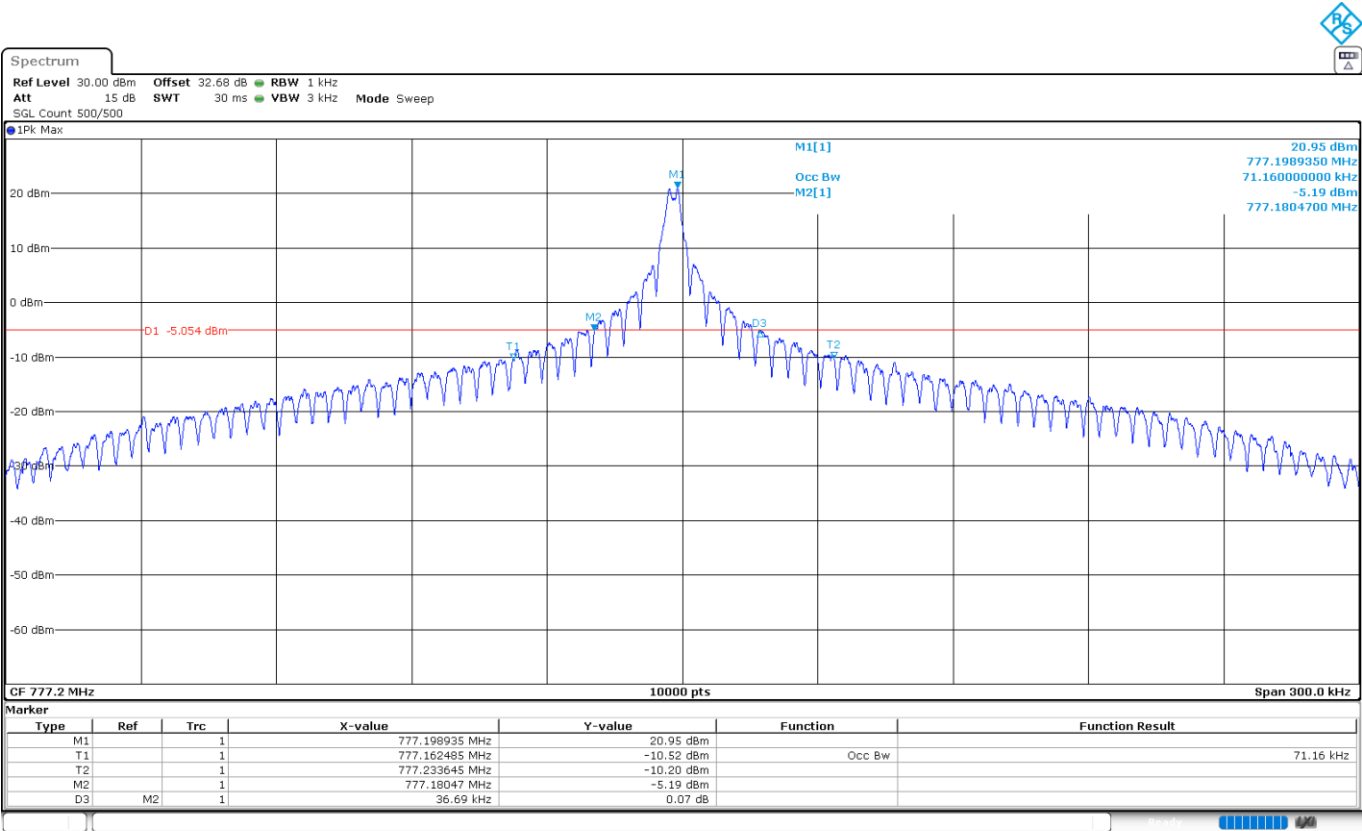
	Low Channel	High Channel
99% Occupied Bandwidth (kHz)	71.16000	70.65000
-26 dBc Bandwidth (kHz)	36.69000	70.65000
Measurement uncertainty (kHz)	<±0.35	

LTE Cat NB2 Band 13. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=3.

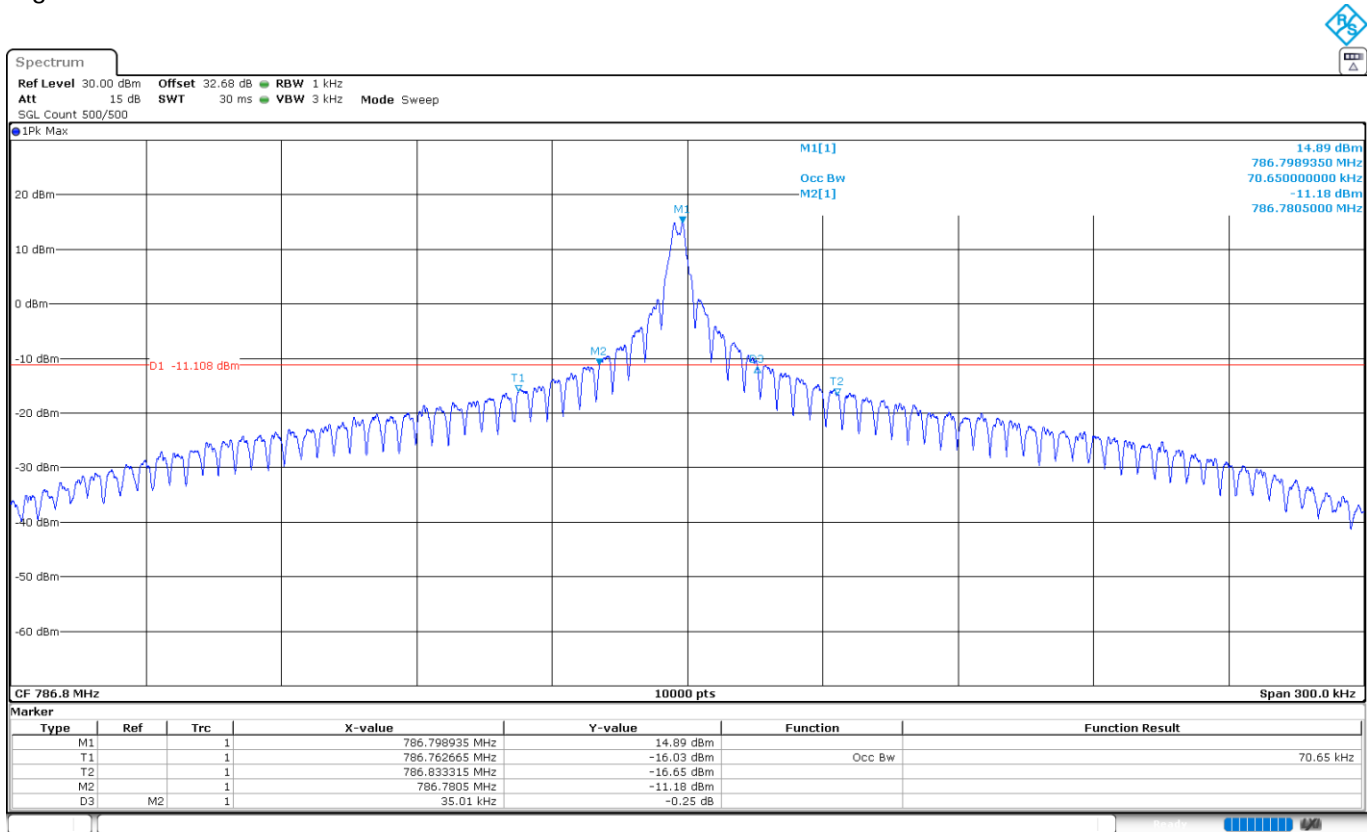
	Low Channel	High Channel
99% Occupied Bandwidth (kHz)	63.45000	65.01000
-26 dBc Bandwidth (kHz)	41.10000	41.49000
Measurement uncertainty (kHz)	<±0.35	

LTE Cat NB2 Band 13. Pi/2-BPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=0.

Low Channel:

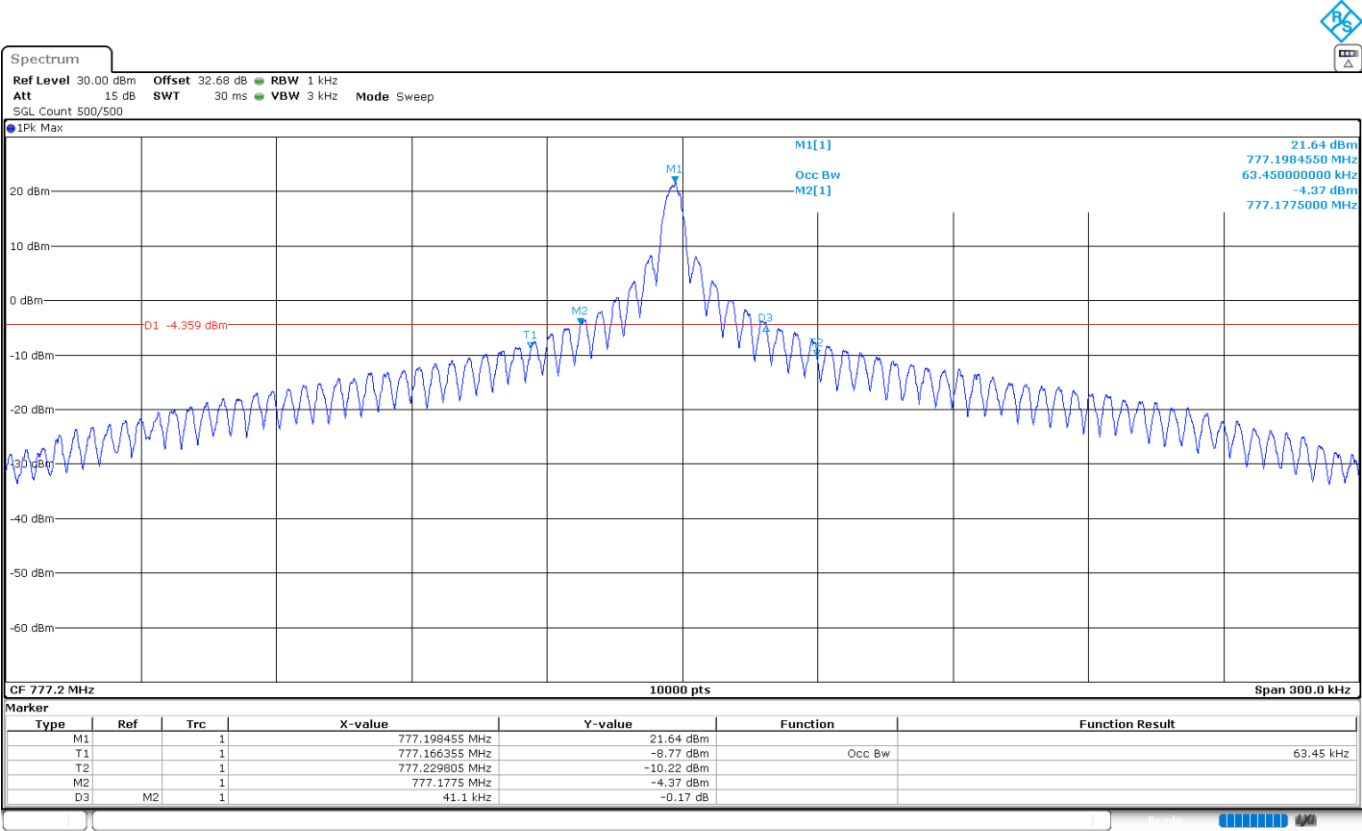


High Channel:

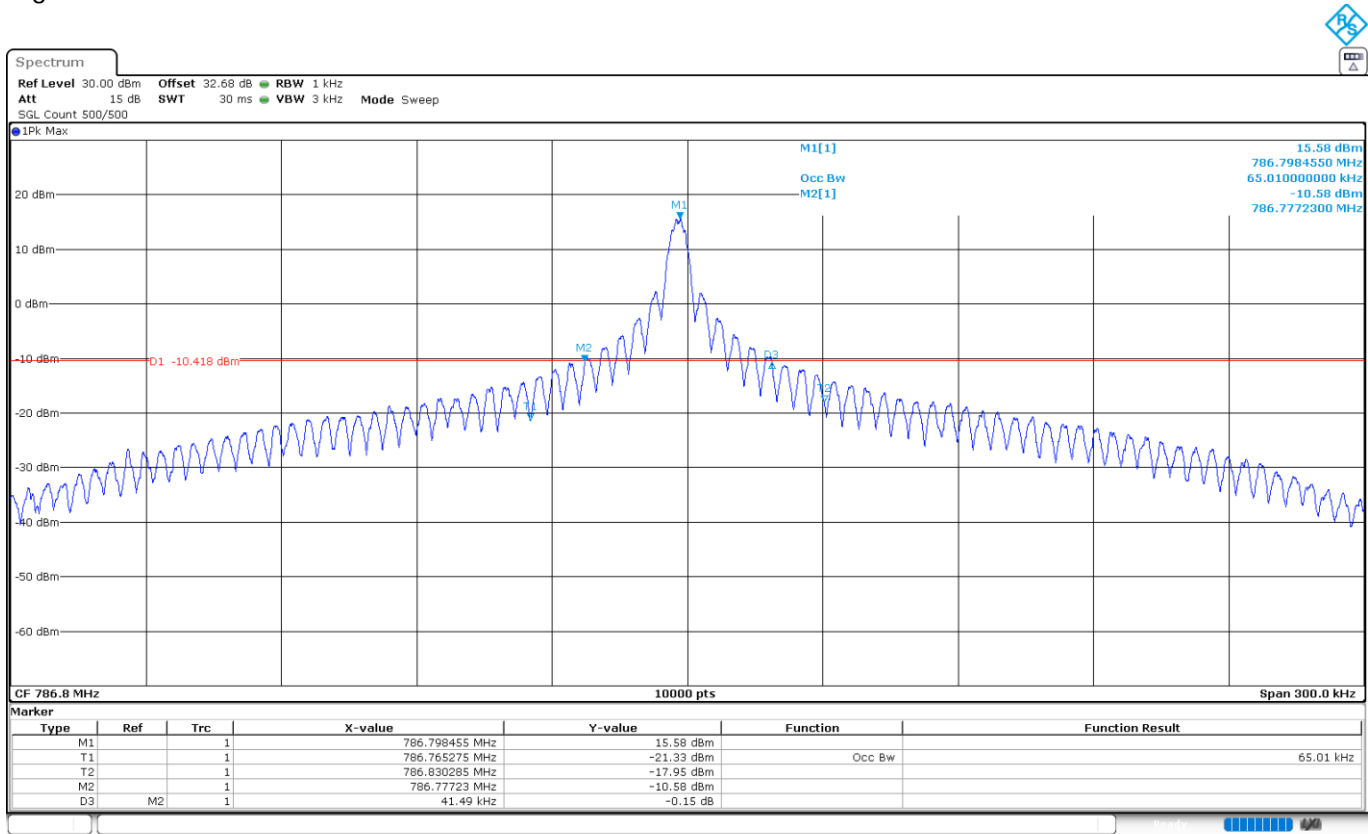


LTE Cat NB2 Band 13. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=3.

Low Channel:



High Channel:



LTE Cat NB2 Band 13. Pi/2-BPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=0.

	Low Channel	High Channel
99% Occupied Bandwidth (kHz)	130.83000	131.22000
-26 dBc Bandwidth (kHz)	127.35000	141.00000
Measurement uncertainty (kHz)	<±0.58	

LTE Cat NB2 Band 13. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=3.

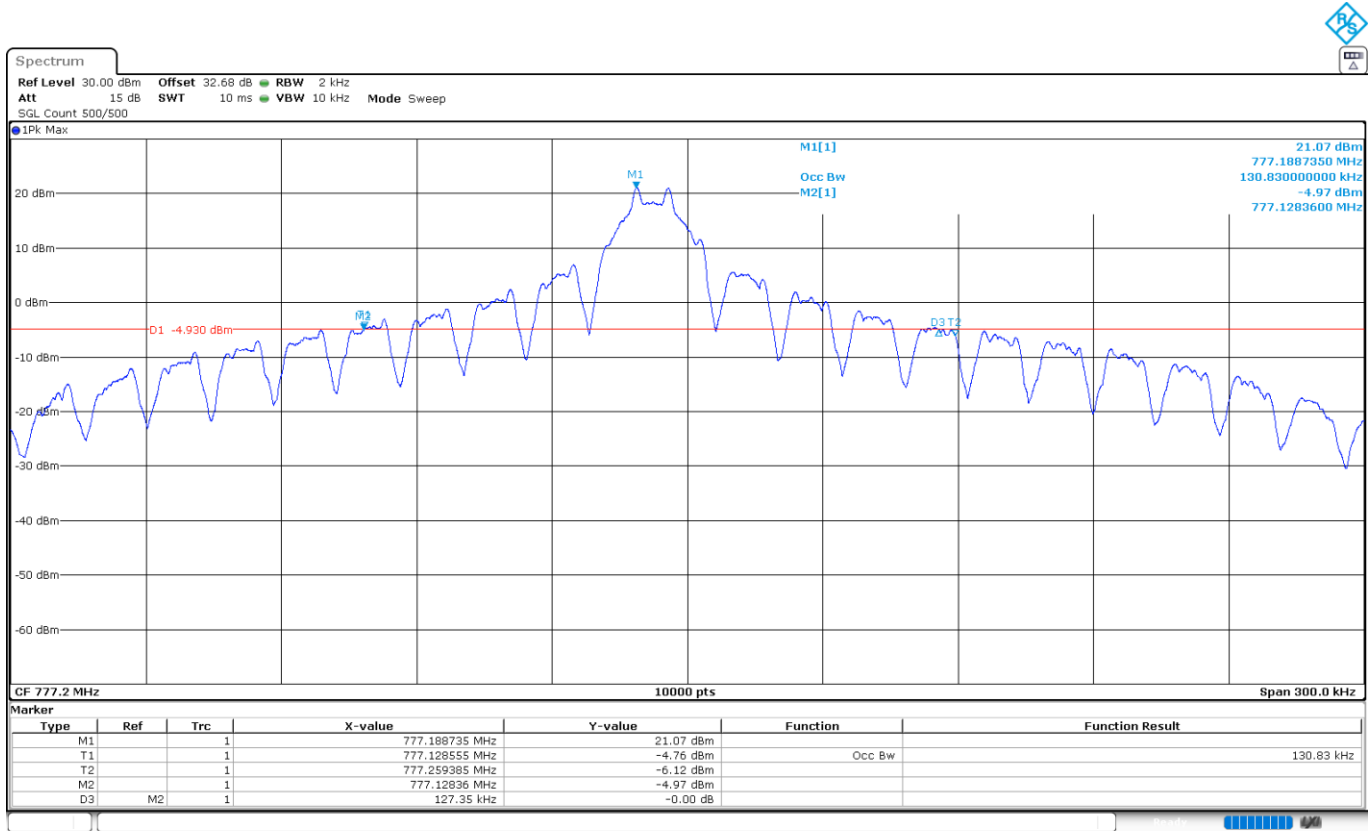
	Low Channel	High Channel
99% Occupied Bandwidth (kHz)	141.05000	140.15000
-26 dBc Bandwidth (kHz)	158.05000	158.70000
Measurement uncertainty (kHz)	<±0.58	

LTE Cat NB2 Band 13. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5.

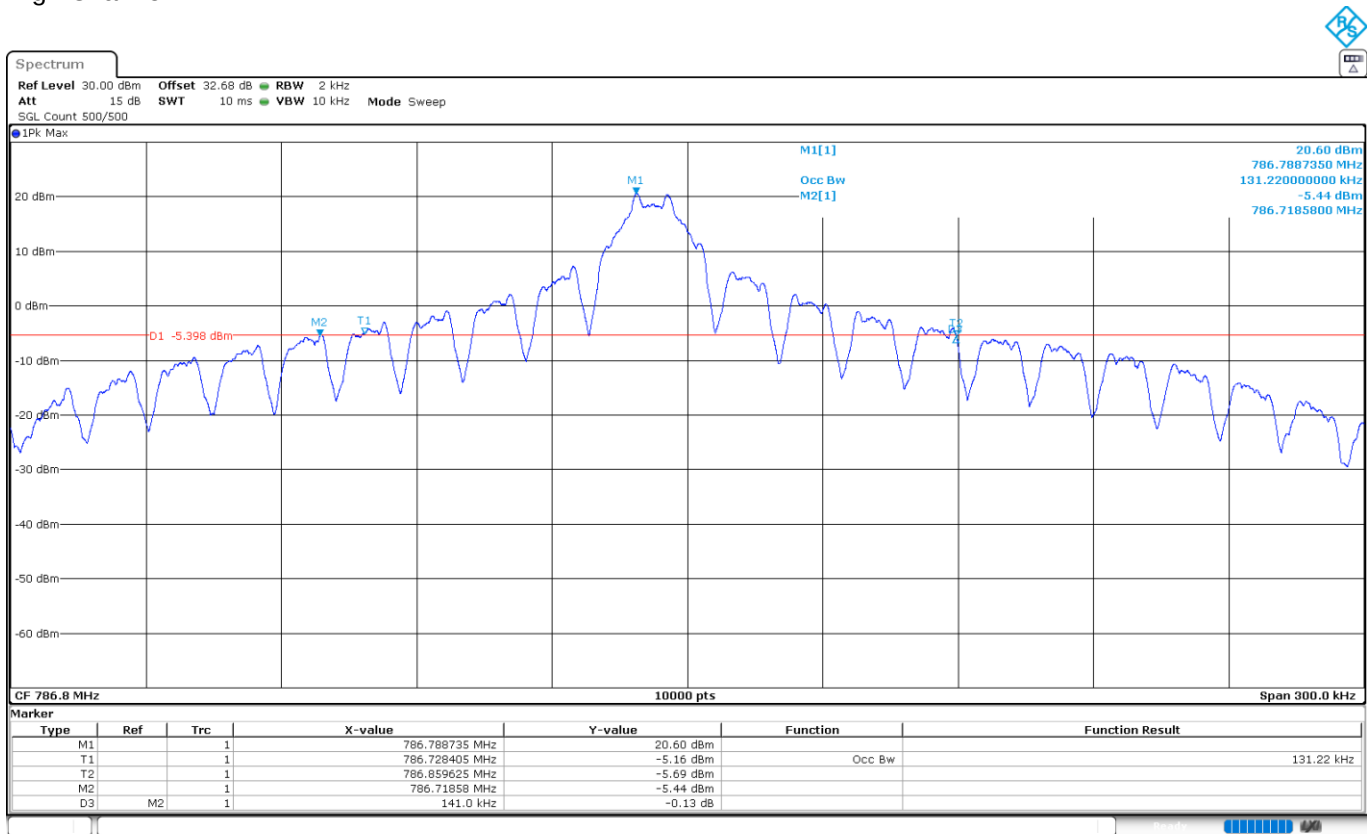
	Low Channel	High Channel
99% Occupied Bandwidth (kHz)	181.20000	180.10000
-26 dBc Bandwidth (kHz)	247.30000	257.05000
Measurement uncertainty (kHz)	<±0.58	

LTE Cat NB2 Band 13. Pi/2-BPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=0.

Low Channel:

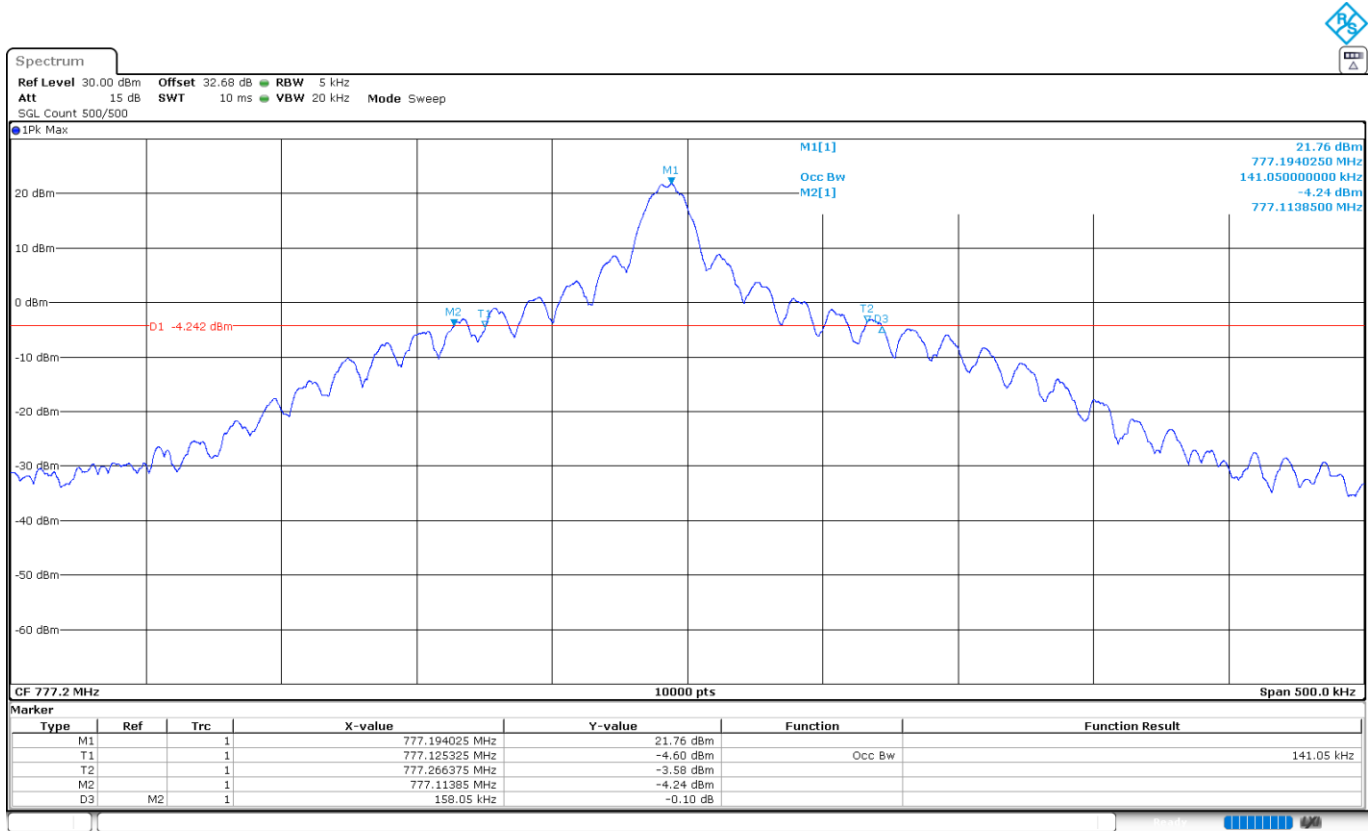


High Channel:

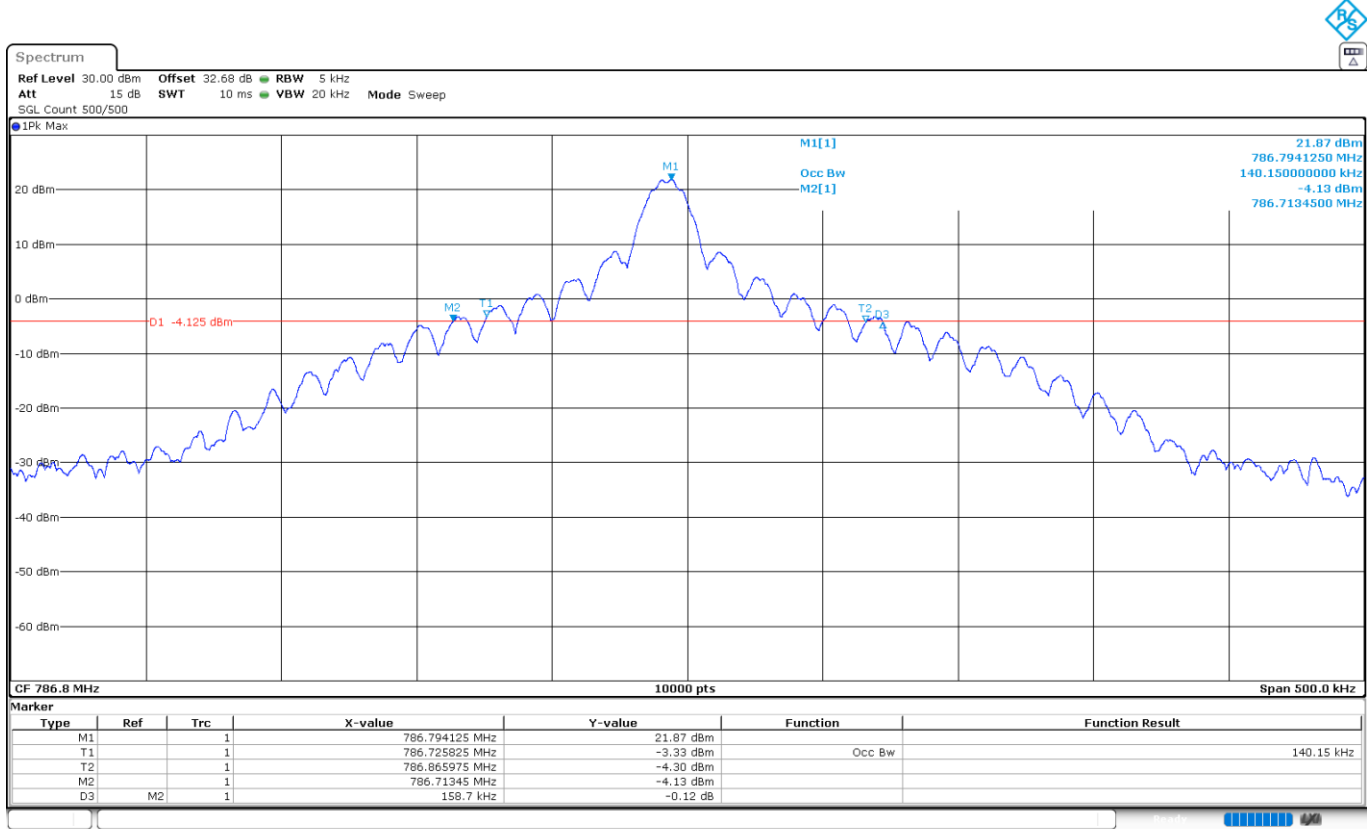


LTE Cat NB2 Band 13. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=3.

Low Channel:

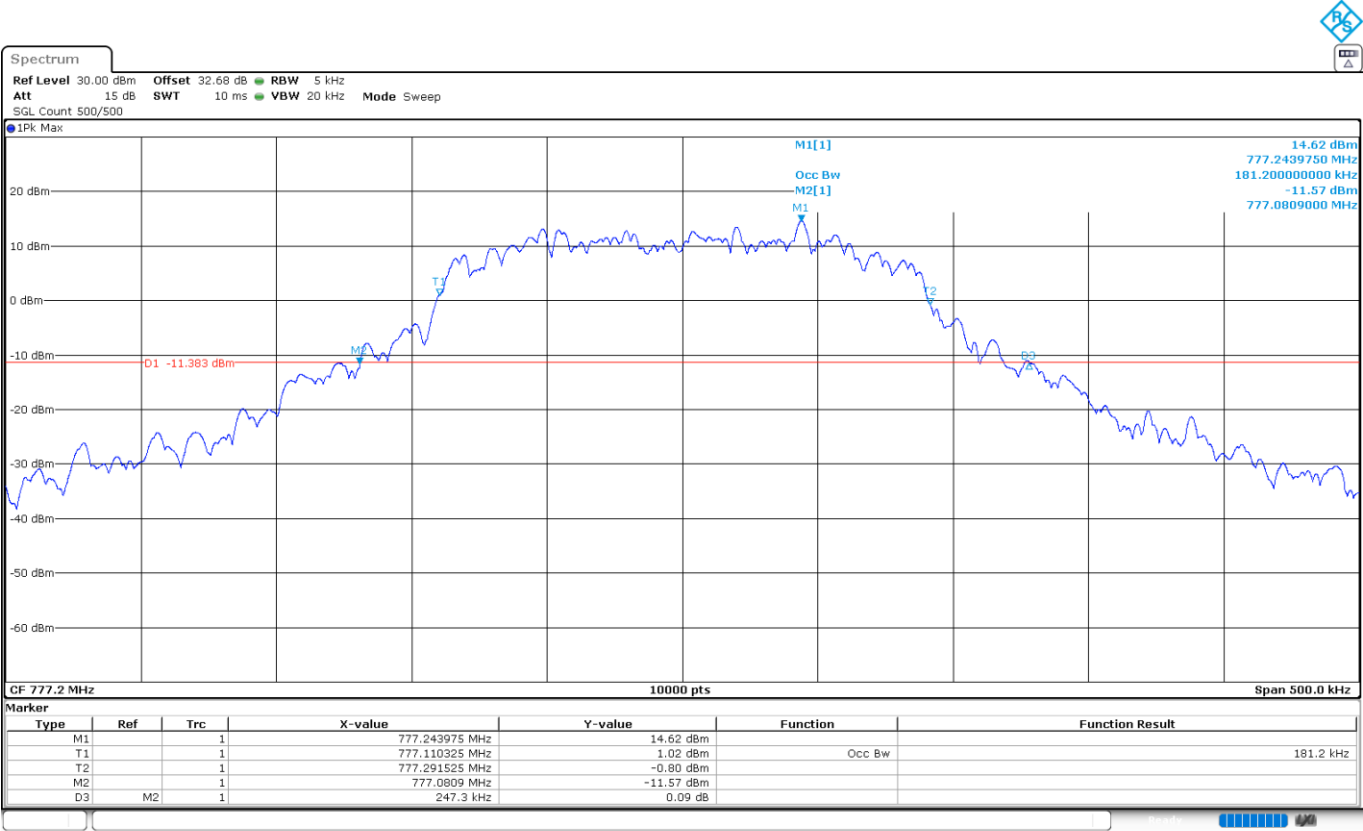


High Channel:

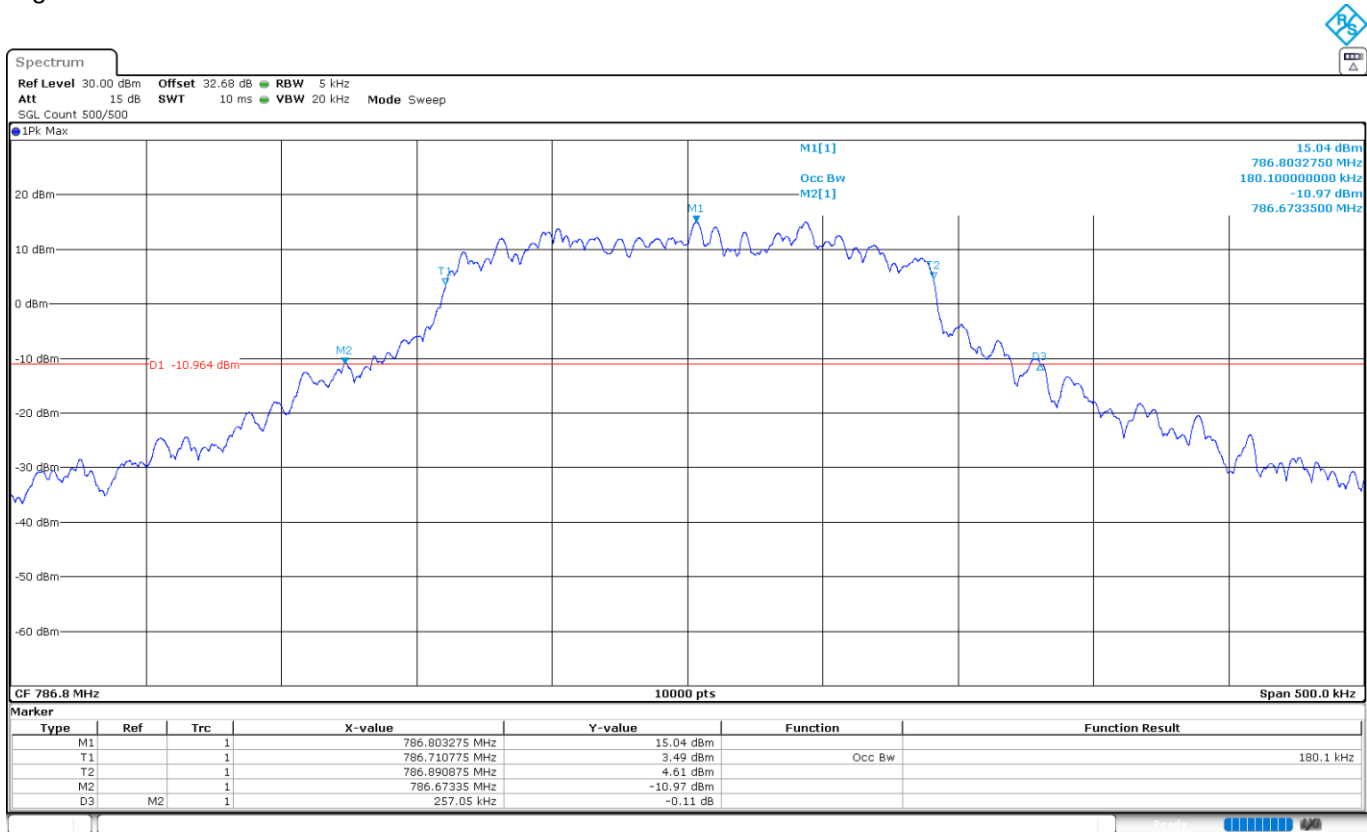


LTE Cat NB2 Band 13. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5.

Low Channel:



High Channel:



LTE Cat NB2 Band 66:

LTE Cat NB2 Band 66. Pi/2-BPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=0.

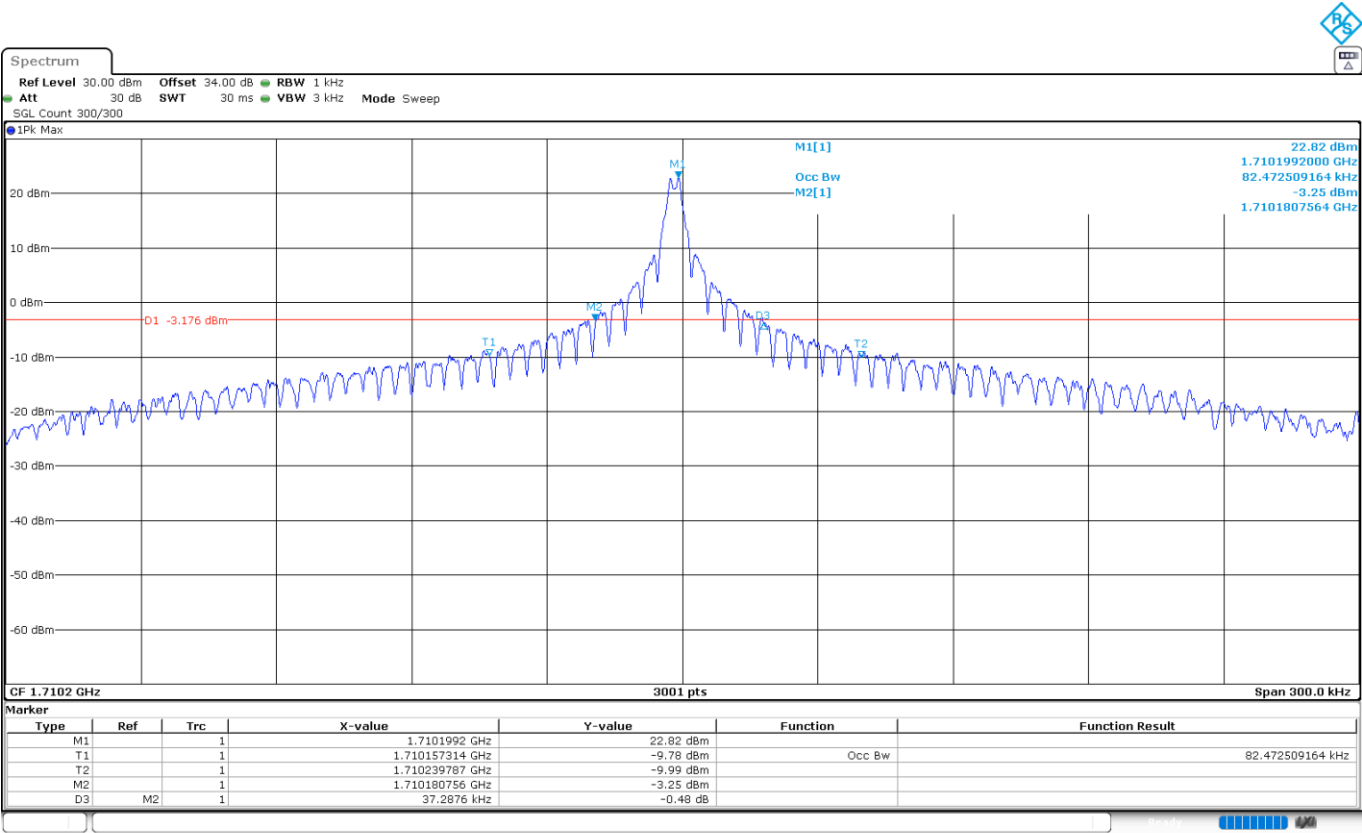
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	82.47251	75.07498	95.06831
-26 dBc Bandwidth (kHz)	37.28760	35.08830	38.78710
Measurement uncertainty (kHz)	<±0.35		

LTE Cat NB2 Band 66. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=3.

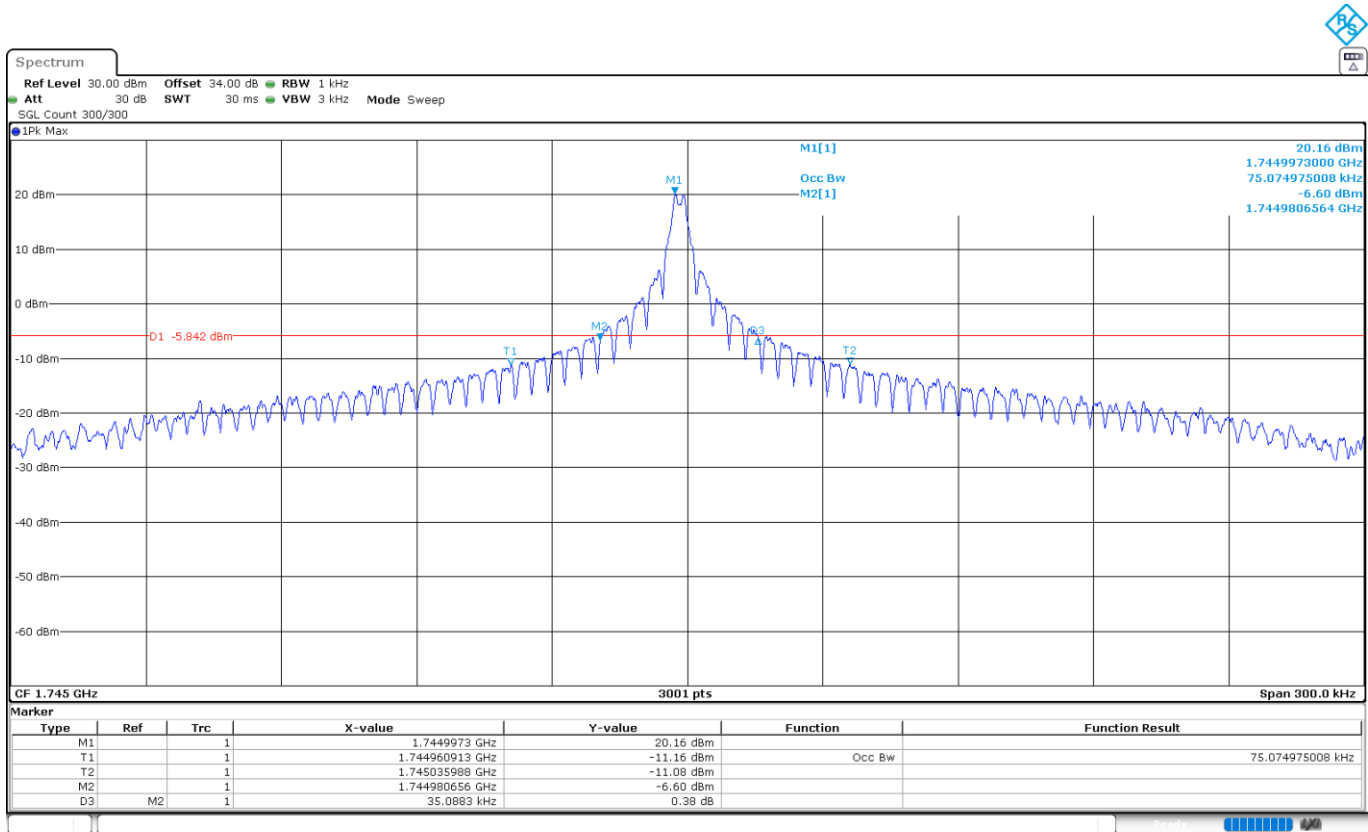
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	75.77474	68.47717	85.87138
-26 dBc Bandwidth (kHz)	41.58610	41.08630	41.18630
Measurement uncertainty (kHz)	<±0.35		

LTE Cat NB2 Band 66. Pi/2-BPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=0.

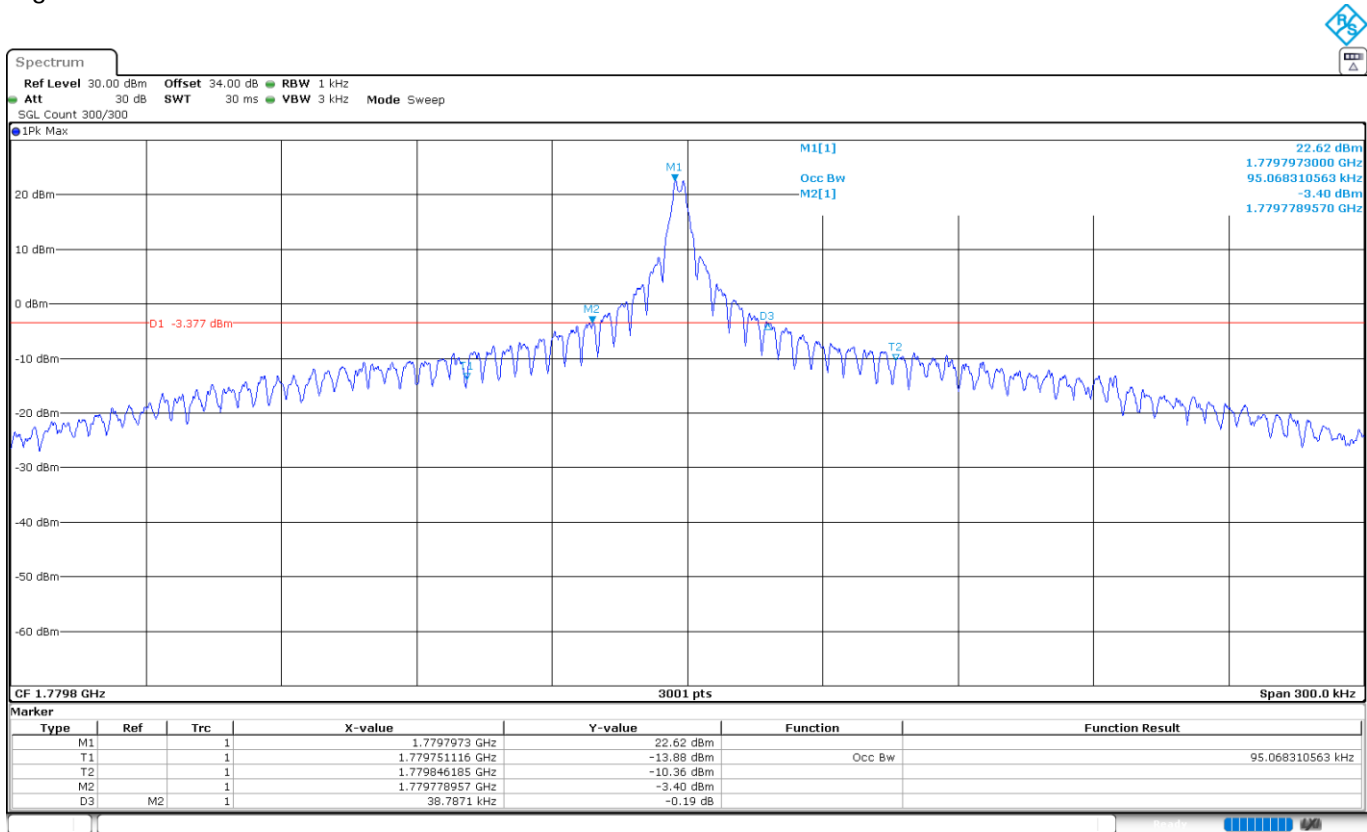
Low Channel:



Middle Channel:

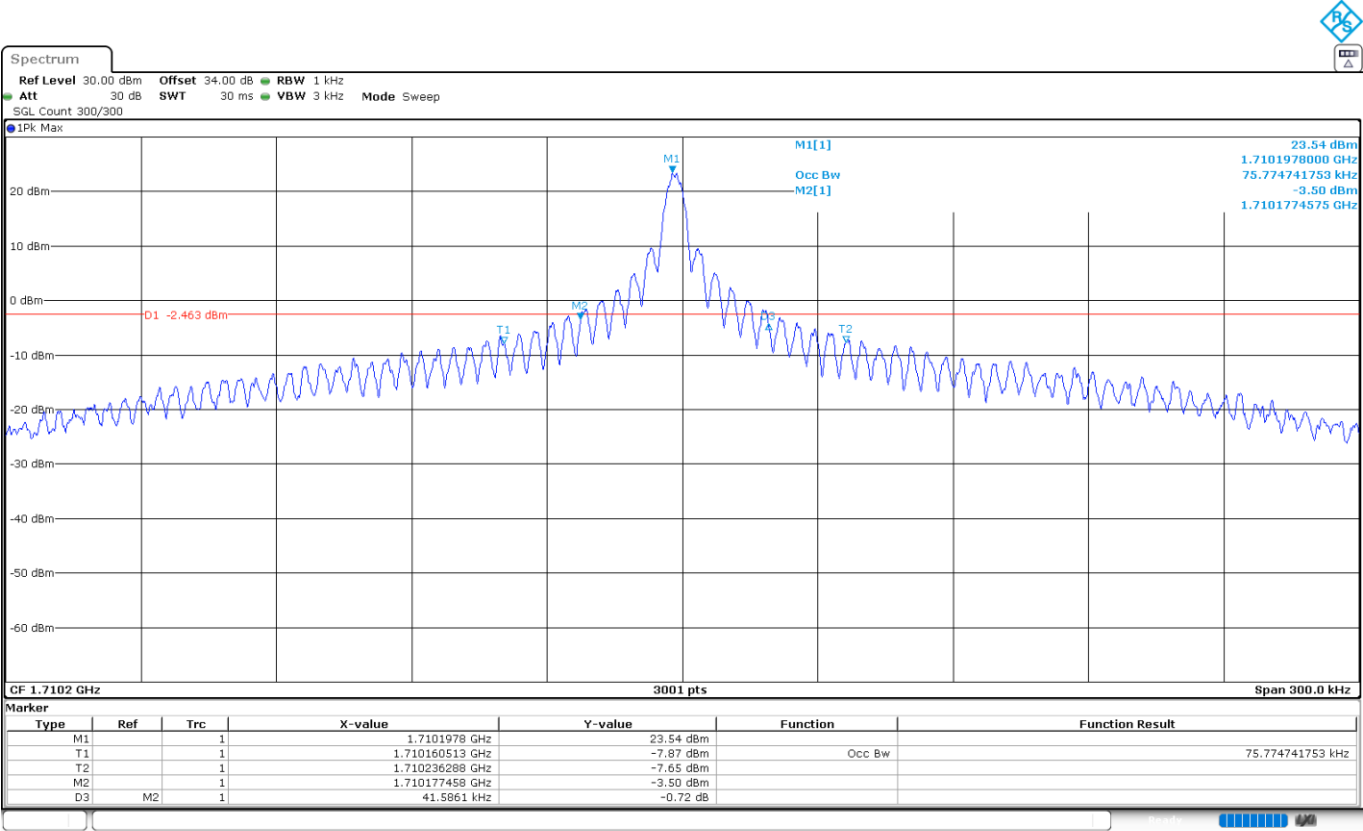


High Channel:

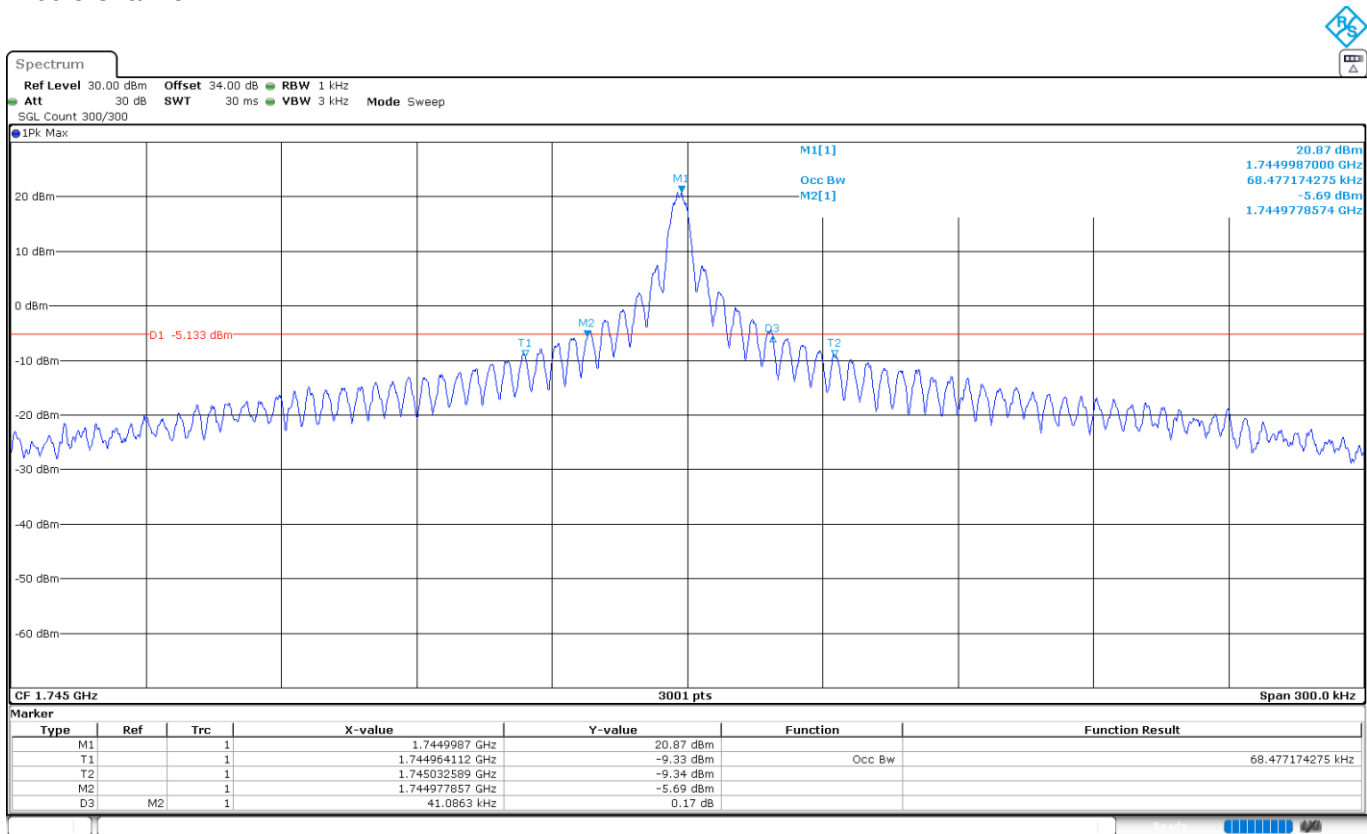


LTE Cat NB2 Band 66. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=3.

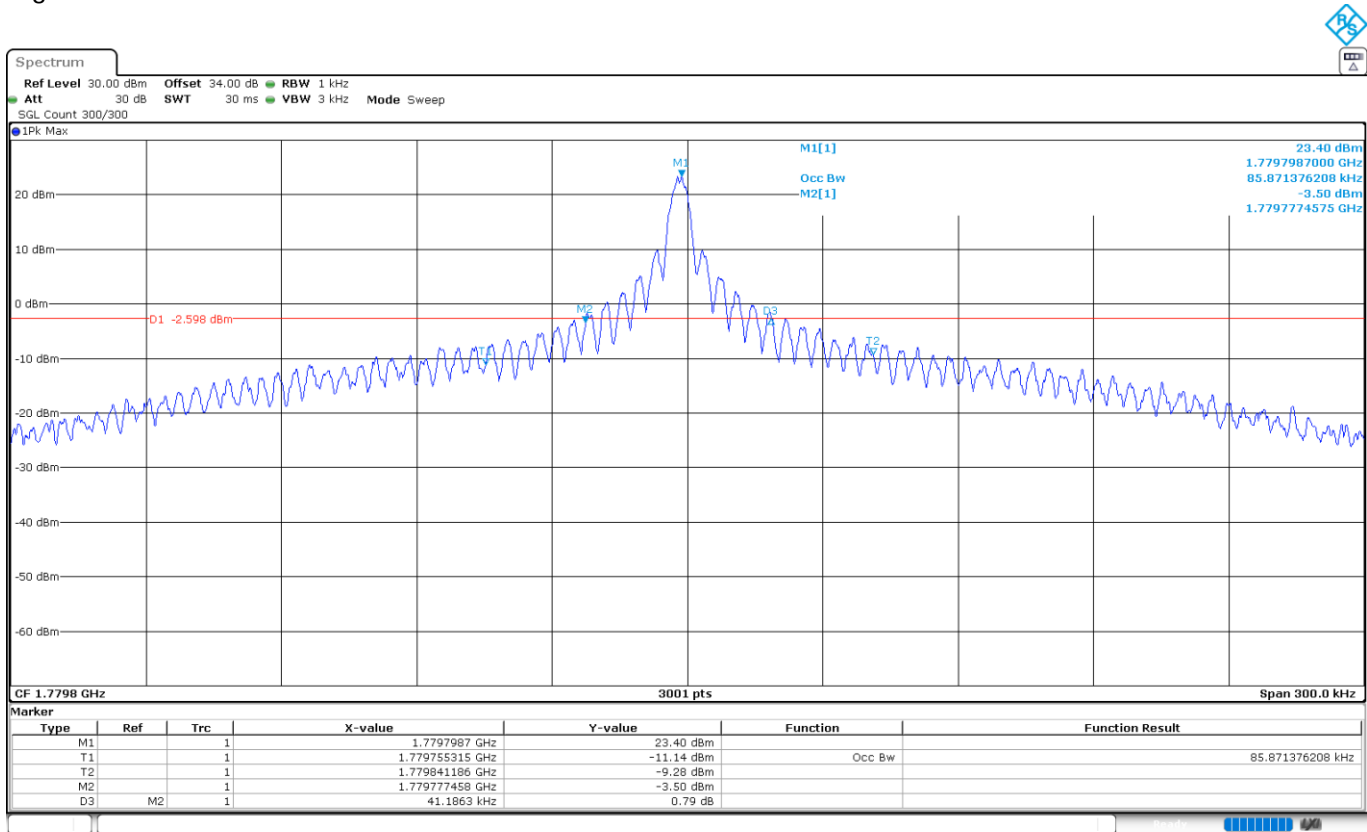
Low Channel:



Middle Channel:



High Channel:



LTE Cat NB2 Band 66. Pi/2-BPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=0.

	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	139.45352	136.75442	143.15228
-26 dBc Bandwidth (kHz)	130.85640	130.55650	143.15230
Measurement uncertainty (kHz)	<±0.58		

LTE Cat NB2 Band 66. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=3.

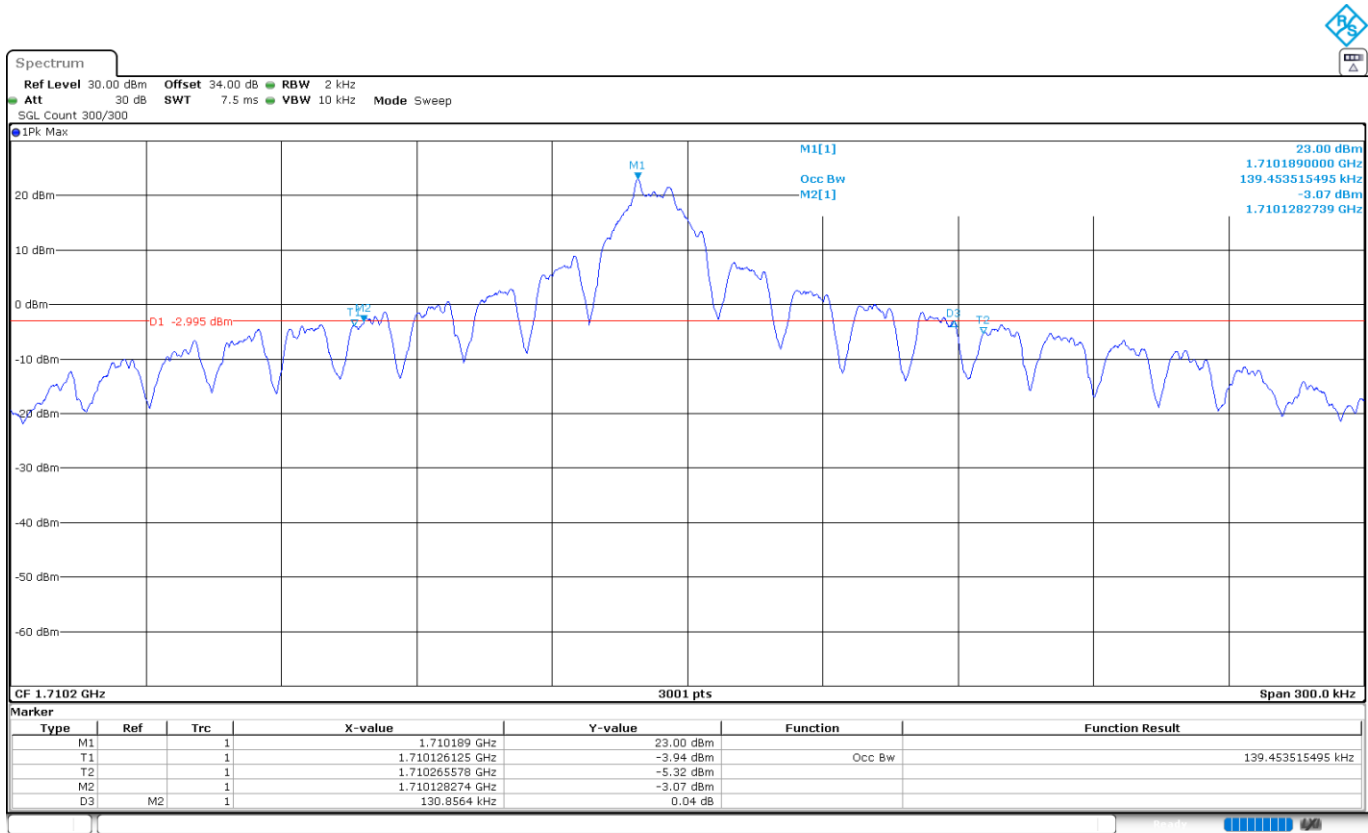
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	153.11563	145.61813	151.61613
-26 dBc Bandwidth (kHz)	159.28000	157.28100	159.11400
Measurement uncertainty (kHz)	<±0.58		

LTE Cat NB2 Band 66. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5.

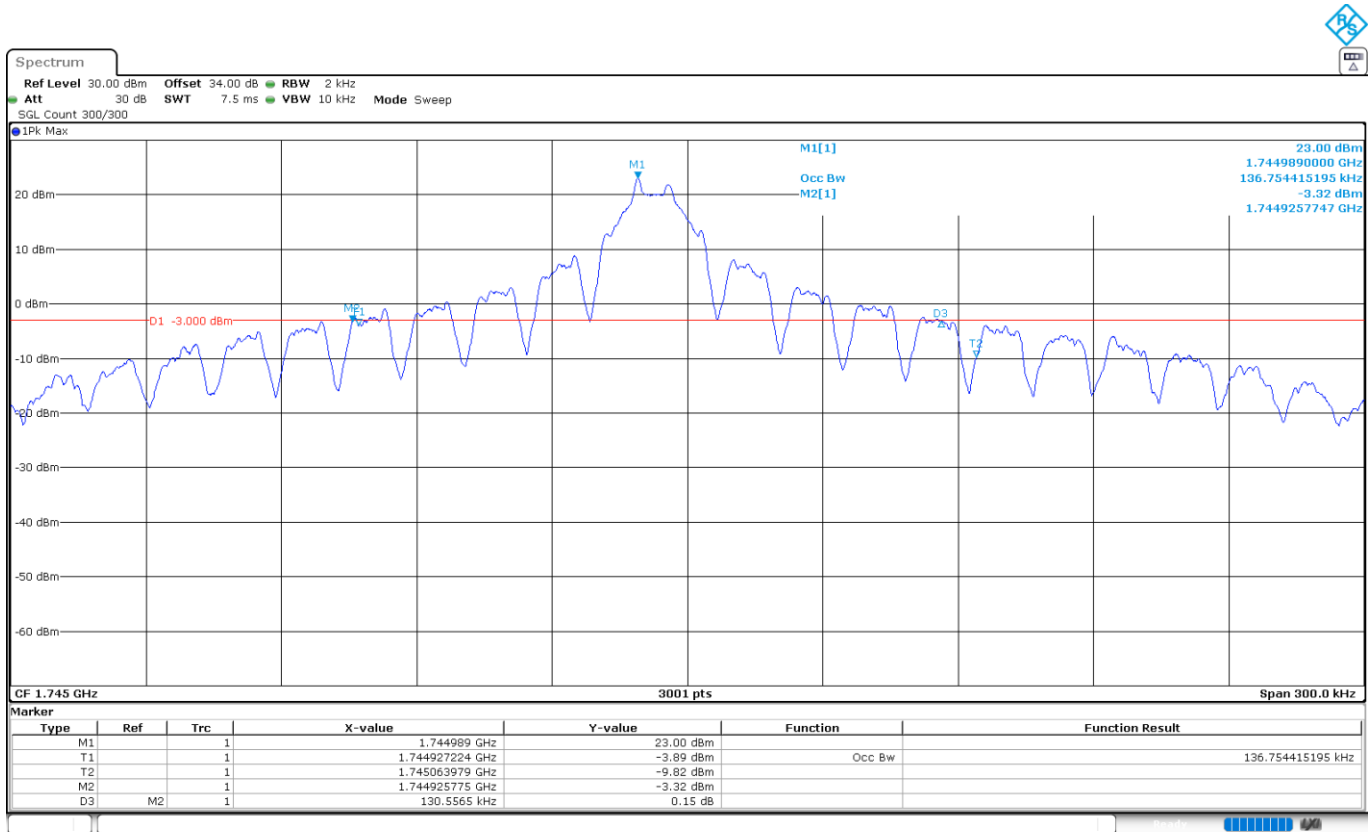
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	182.10596	179.60680	183.43885
-26 dBc Bandwidth (kHz)	257.41400	240.58600	265.07800
Measurement uncertainty (kHz)	<±0.58		

LTE Cat NB2 Band 66. Pi/2-BPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=0.

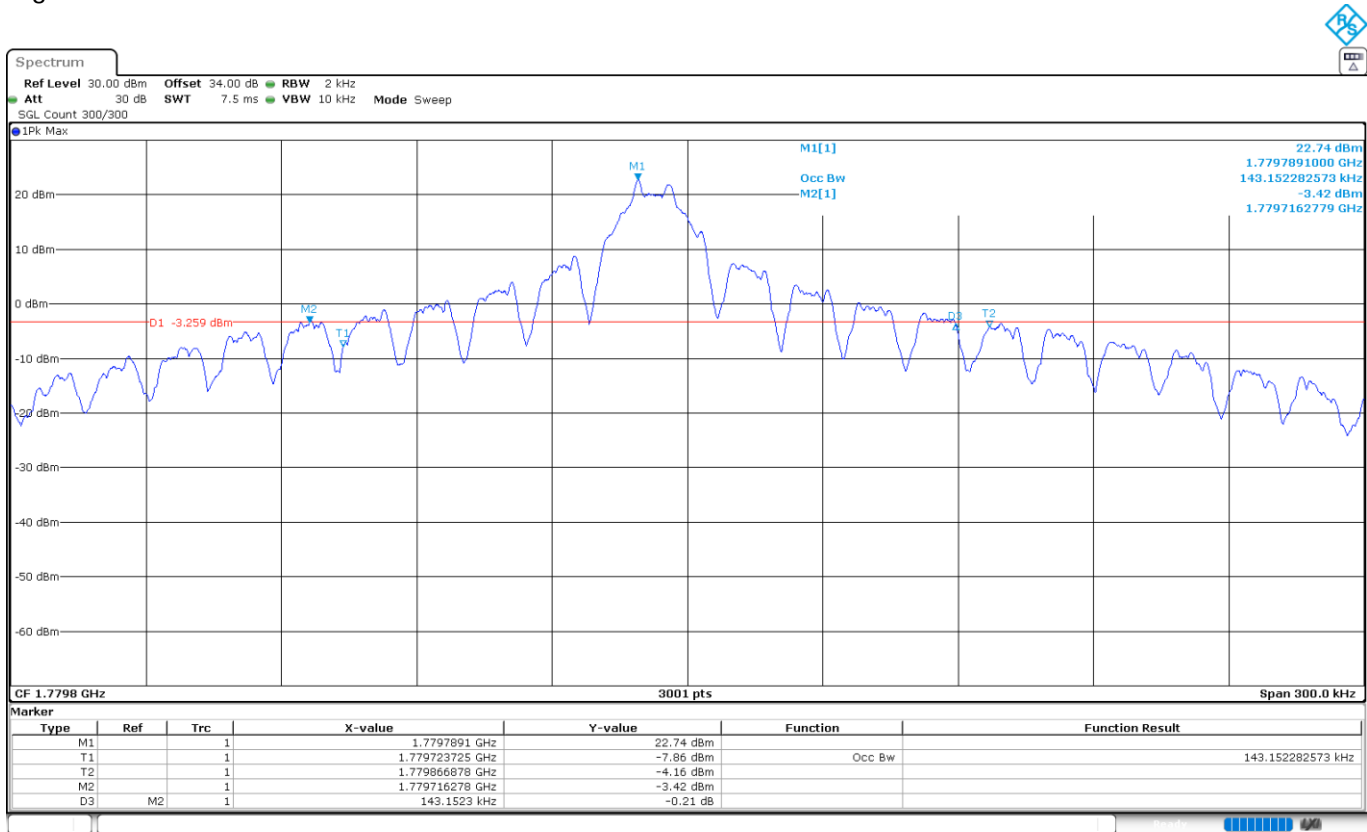
Low Channel:



Middle Channel:

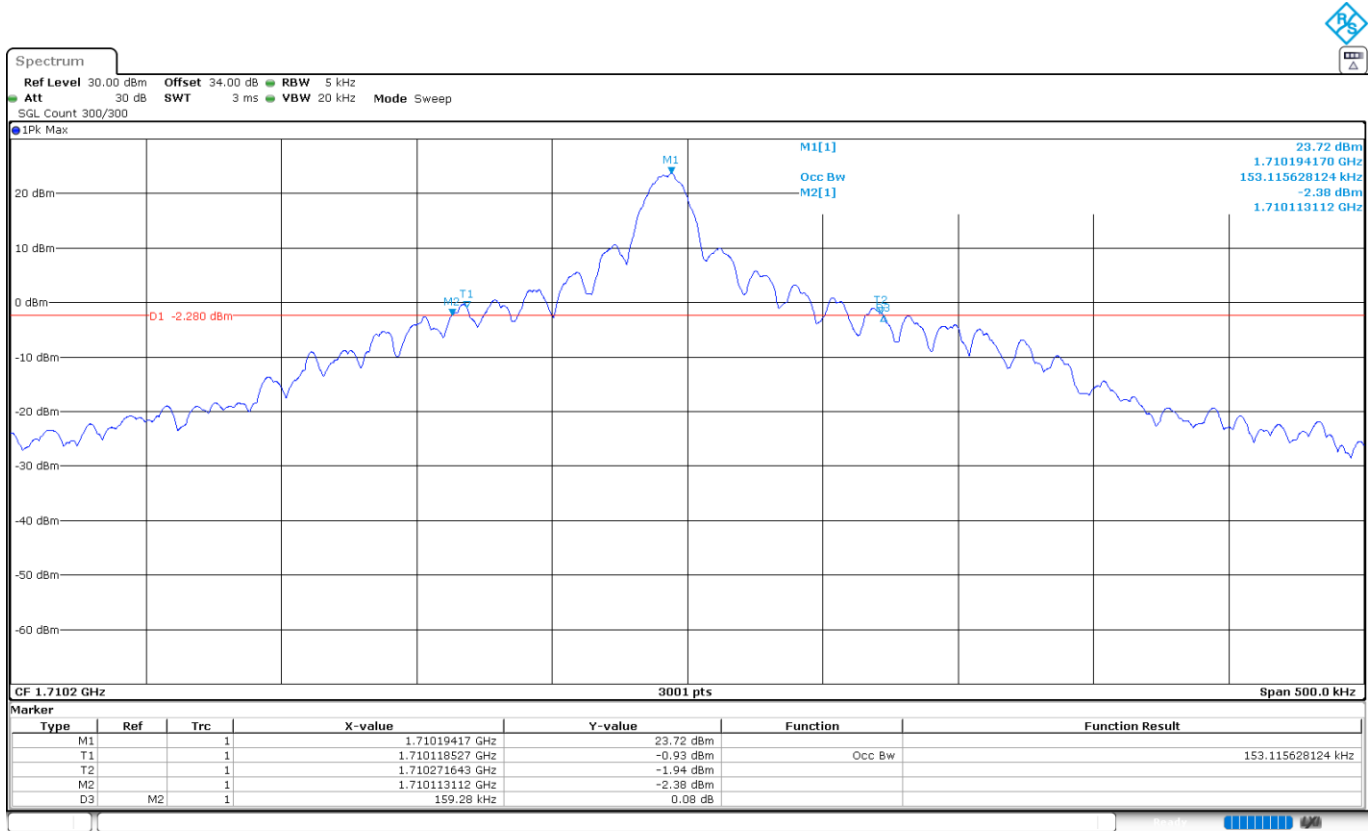


High Channel:

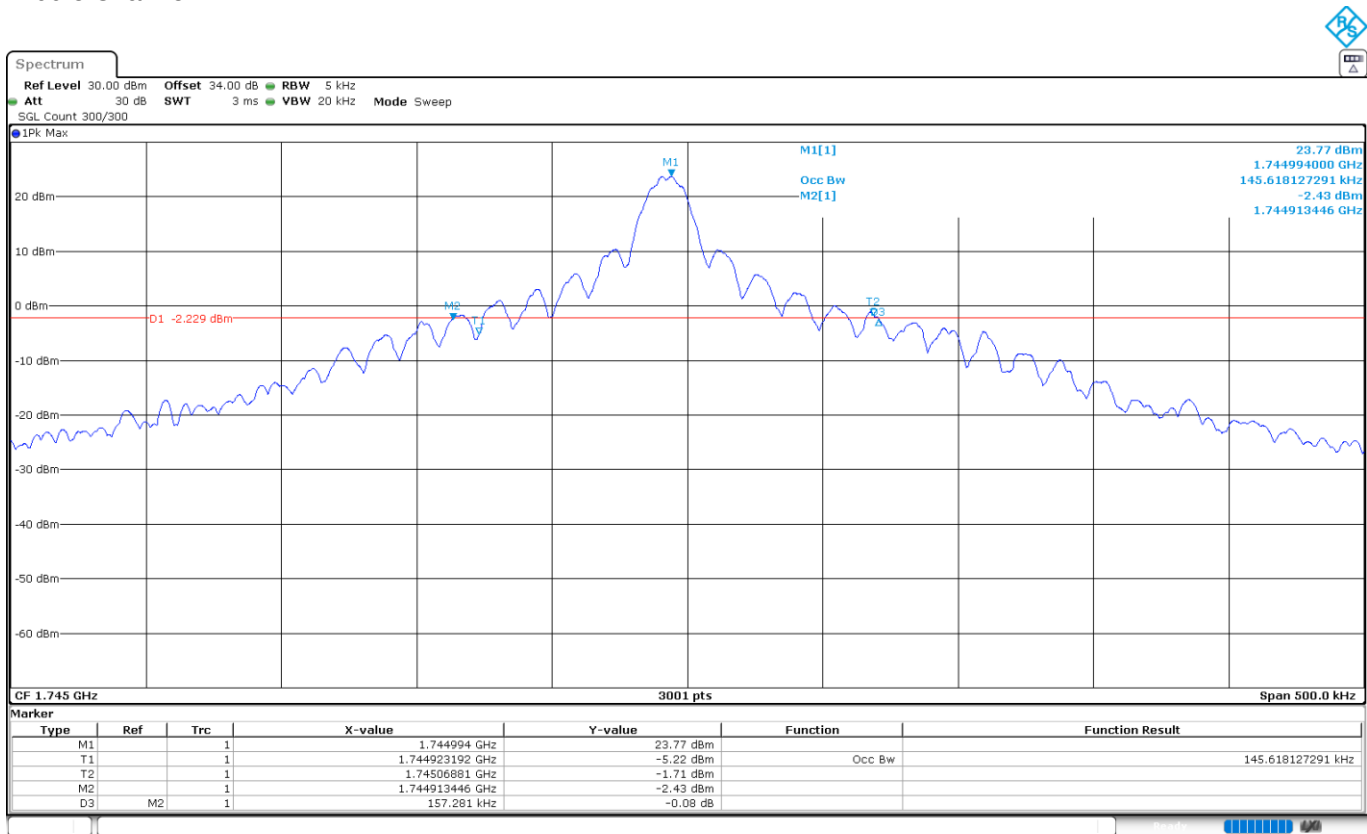


LTE Cat NB2 Band 66. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=3.

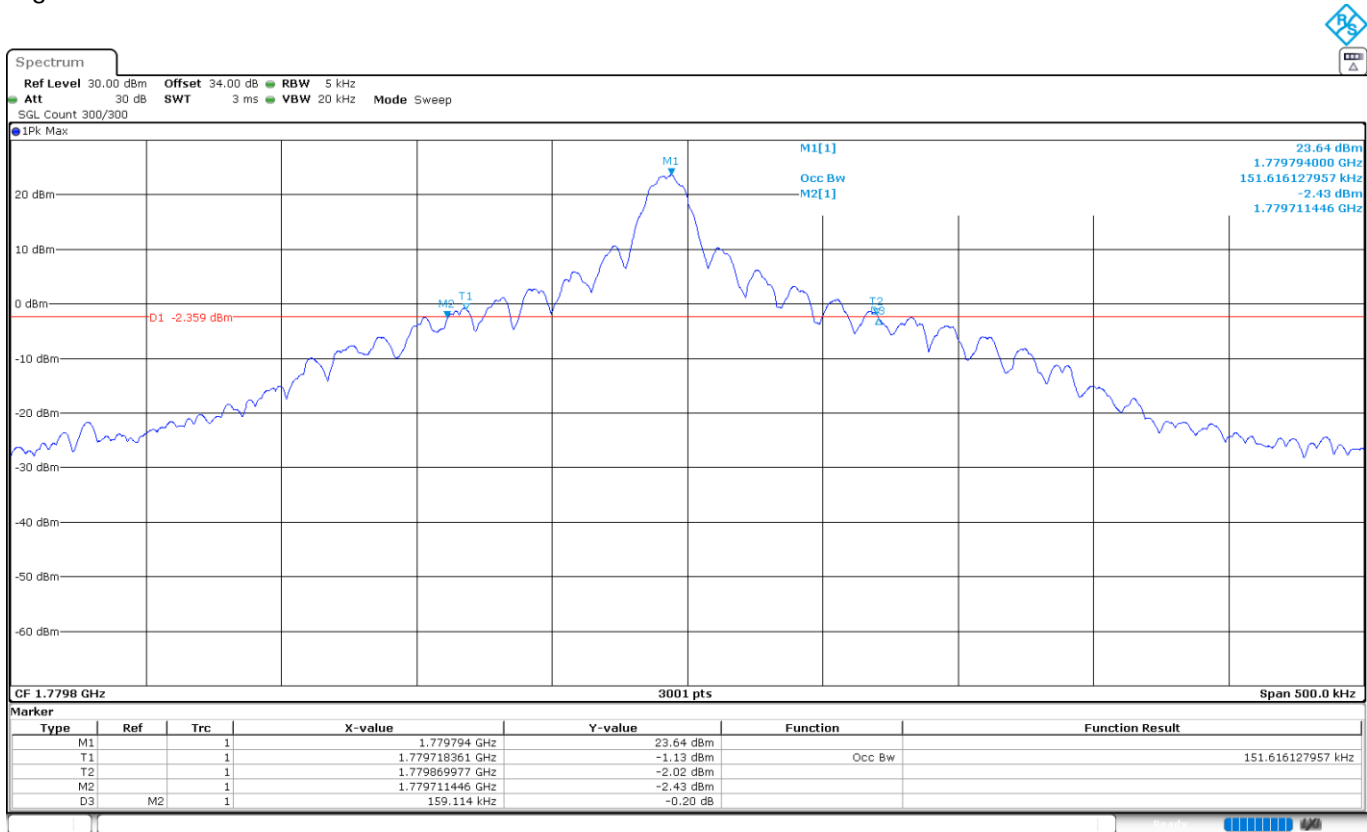
Low Channel:



Middle Channel:

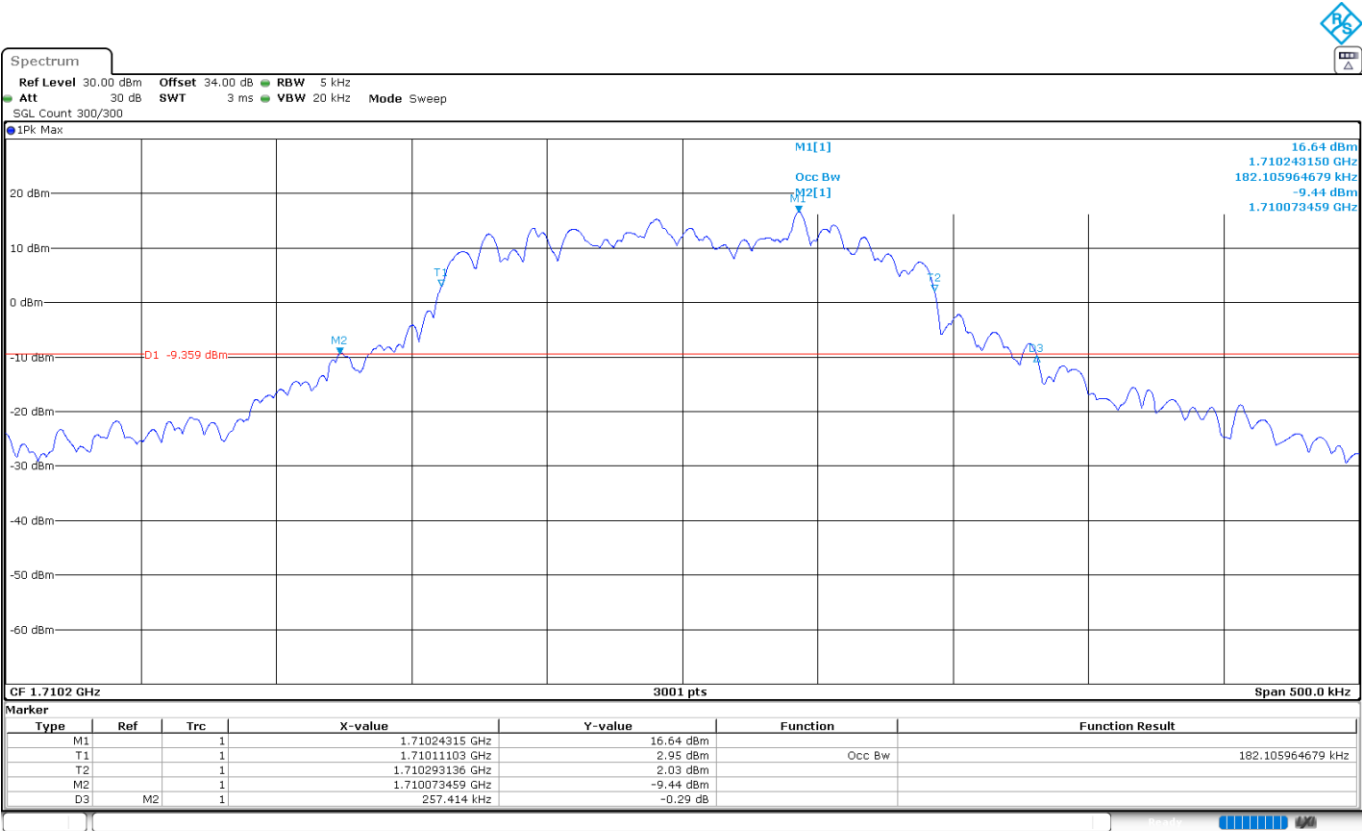


High Channel:

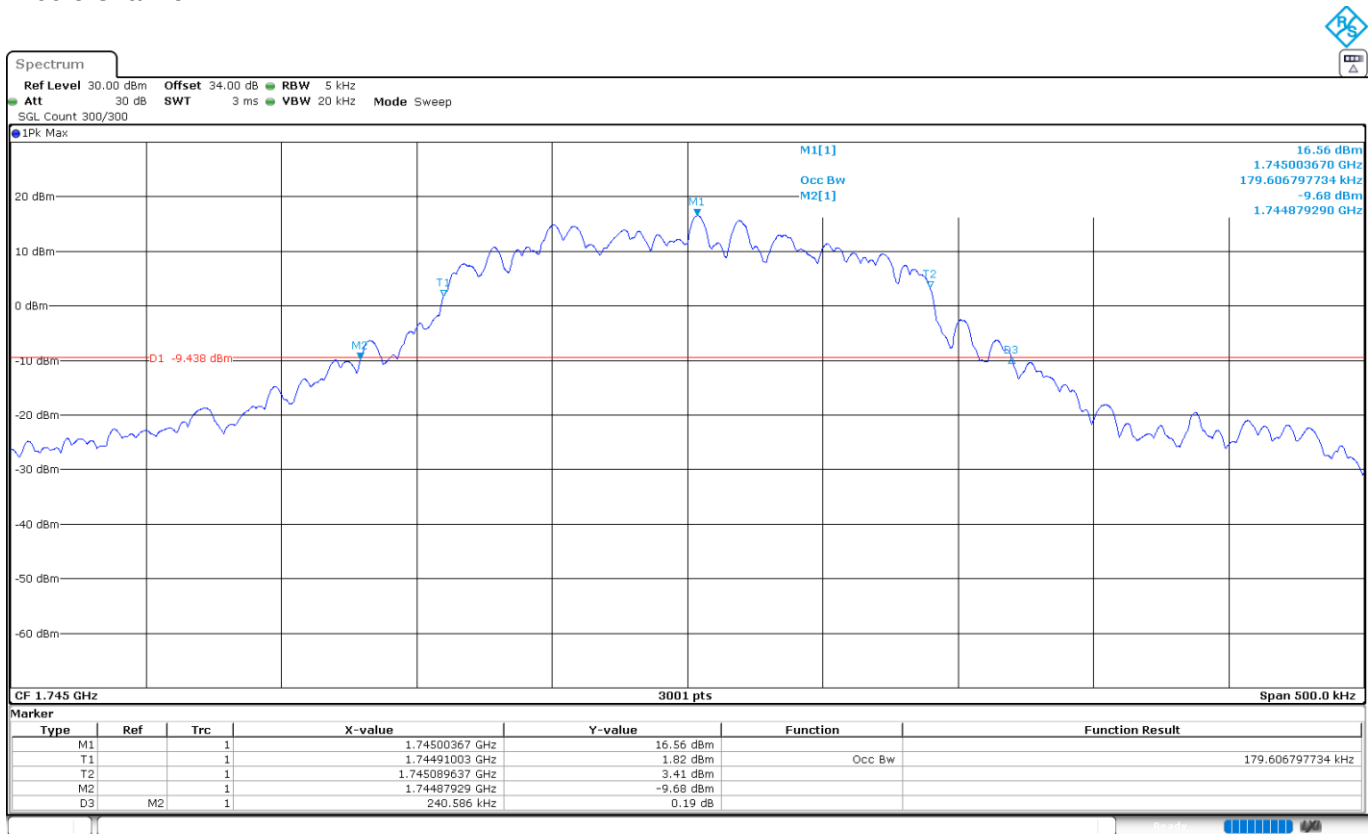


LTE Cat NB2 Band 66. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5.

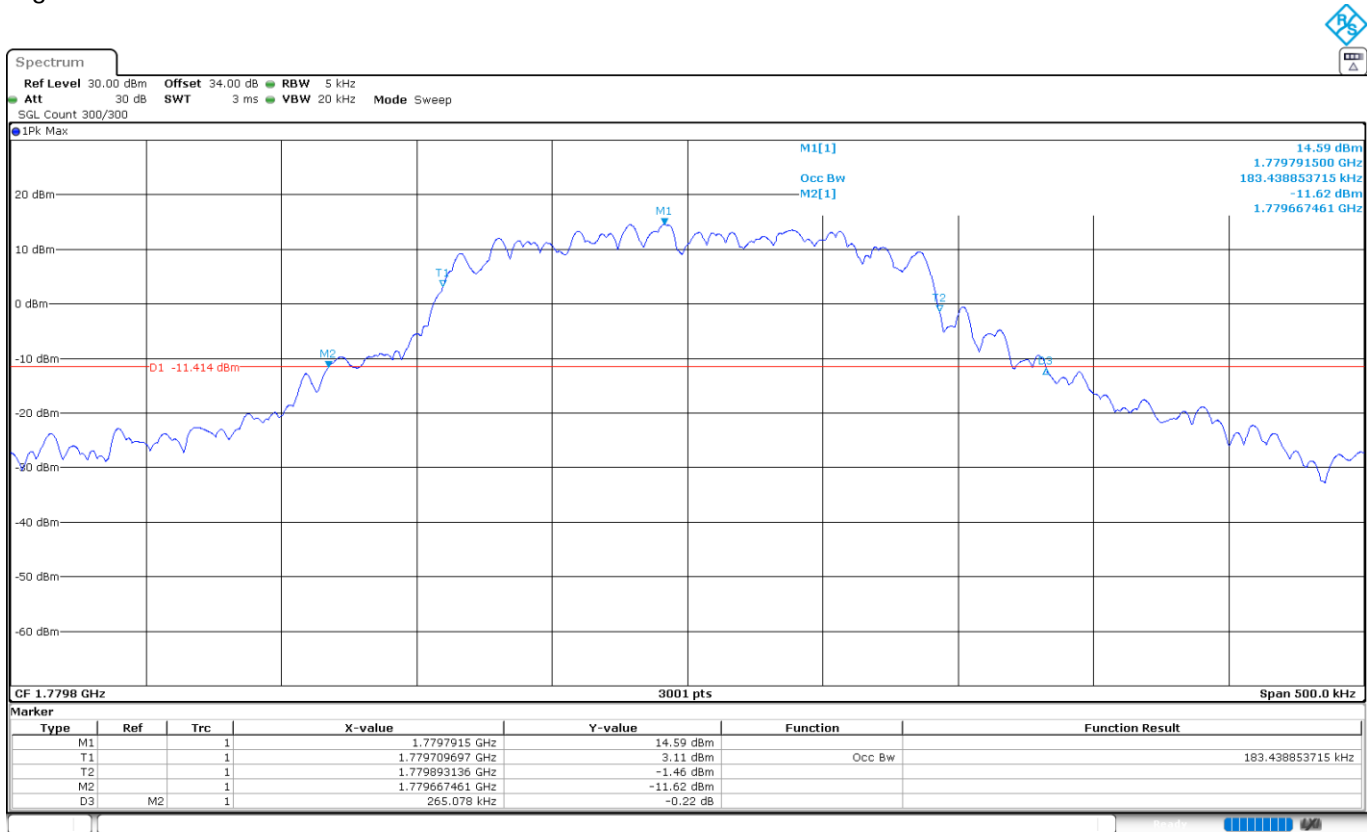
Low Channel:



Middle Channel:



High Channel:



LTE Cat NB2 Band 85:

LTE Cat NB2 Band 85. Pi/2-BPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=0.

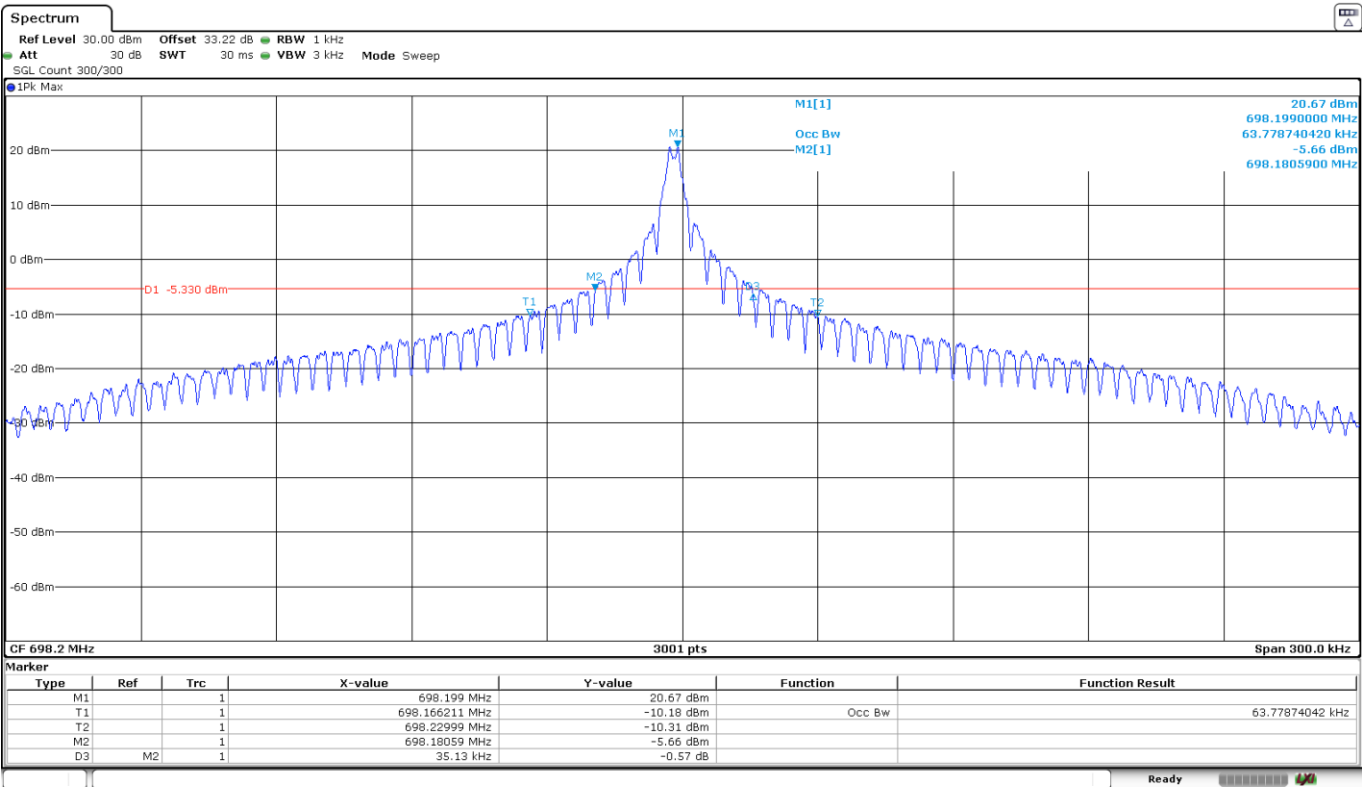
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	63.77874	61.67944	61.97934
-26 dBc Bandwidth (kHz)	35.13000	35.08830	34.98830
Measurement uncertainty (kHz)	<±0.35		

LTE Cat NB2 Band 85. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=3.

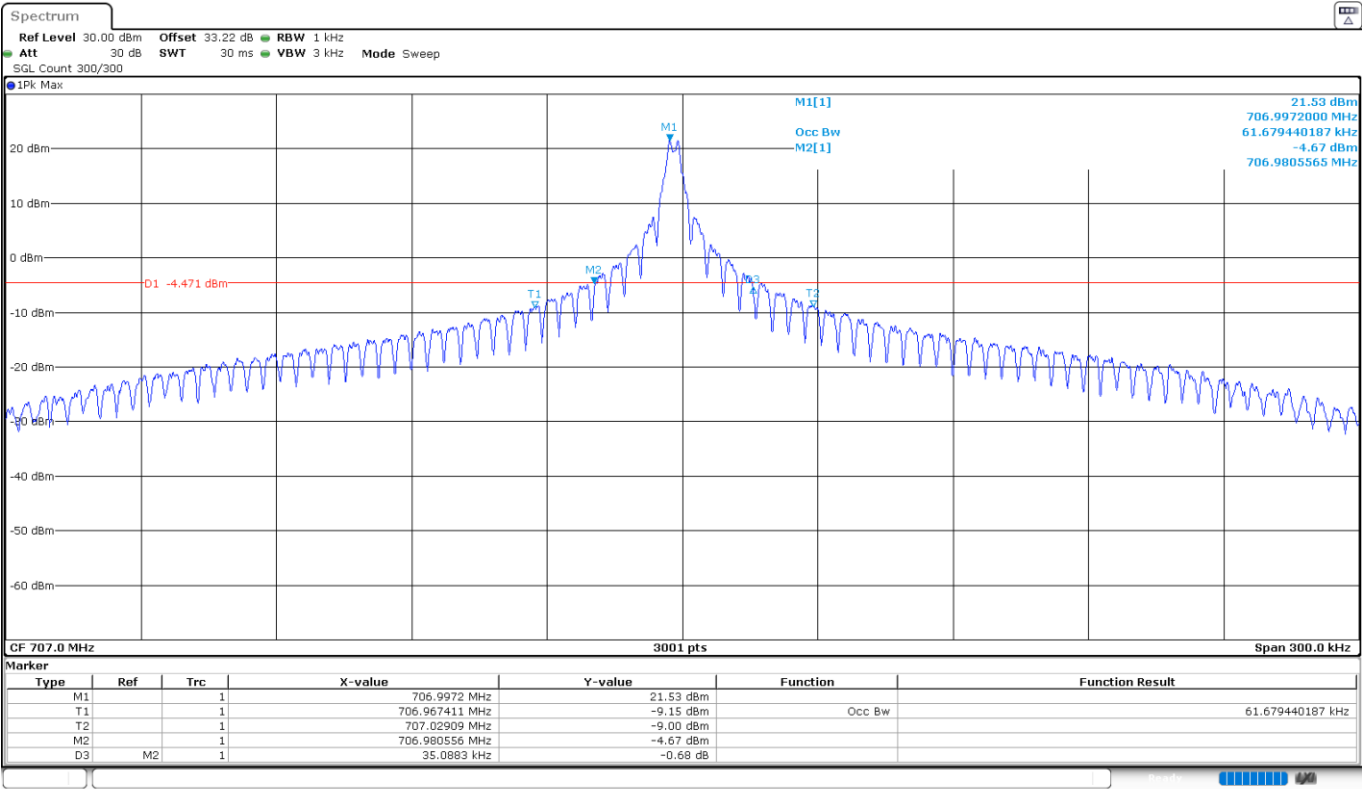
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	61.37954	61.07964	61.17961
-26 dBc Bandwidth (kHz)	41.31000	41.38620	40.78640
Measurement uncertainty (kHz)	<±0.35		

LTE Cat NB2 Band 85. Pi/2-BPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=0.

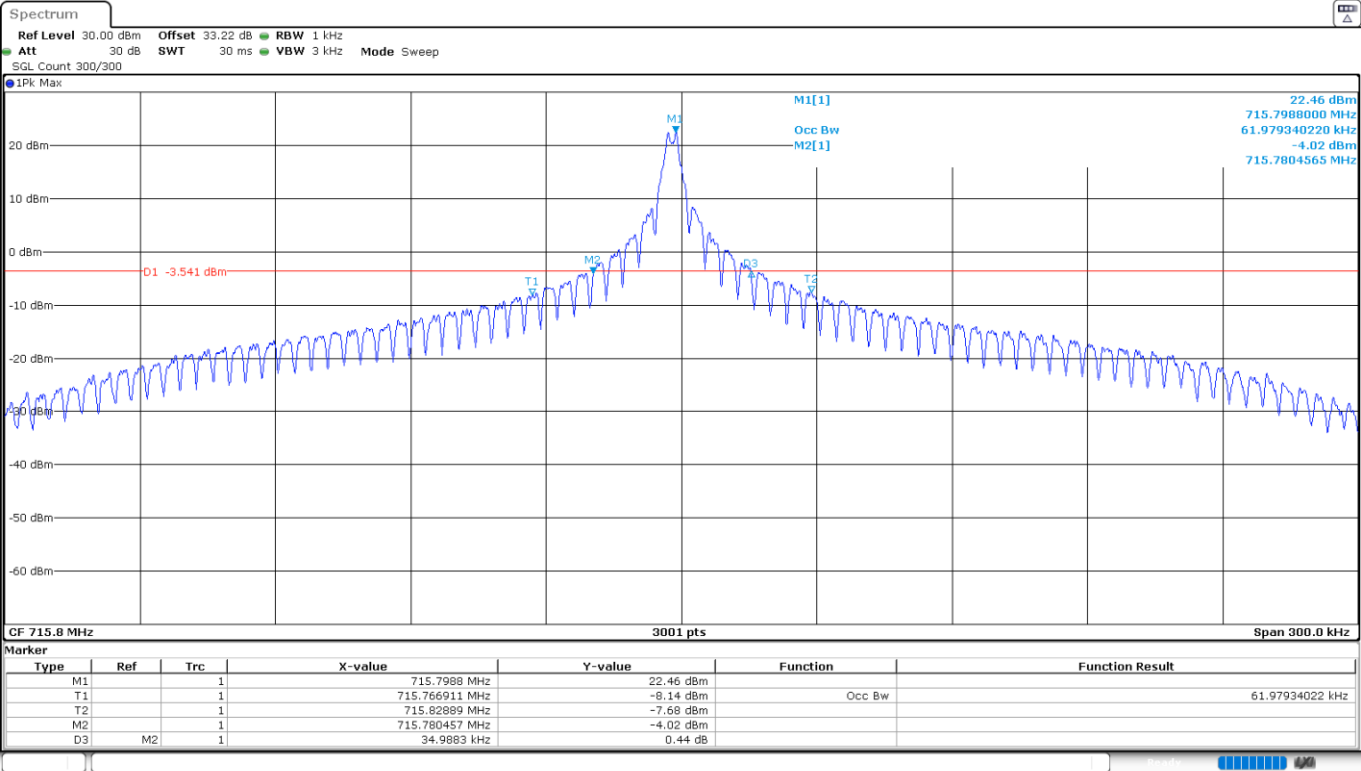
Low Channel:



Middle Channel:



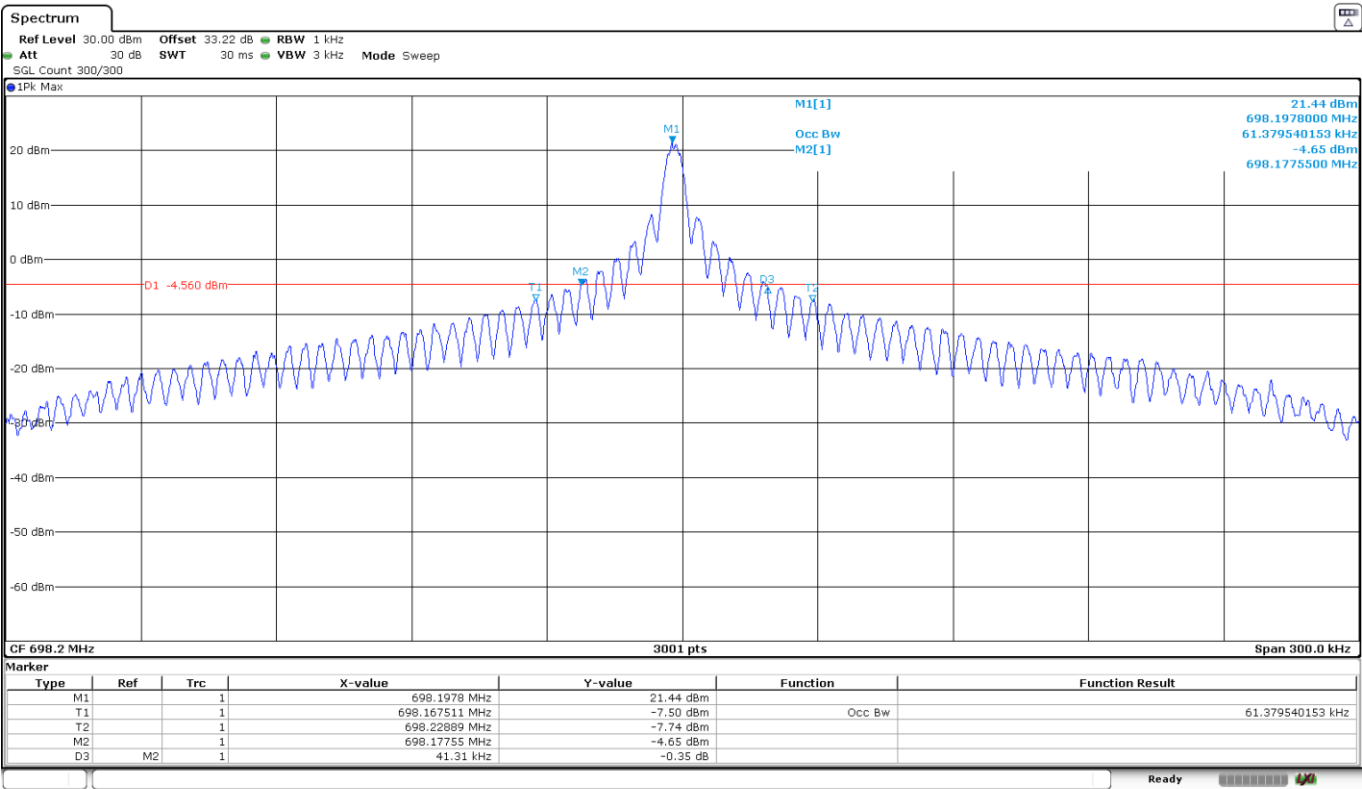
High Channel:



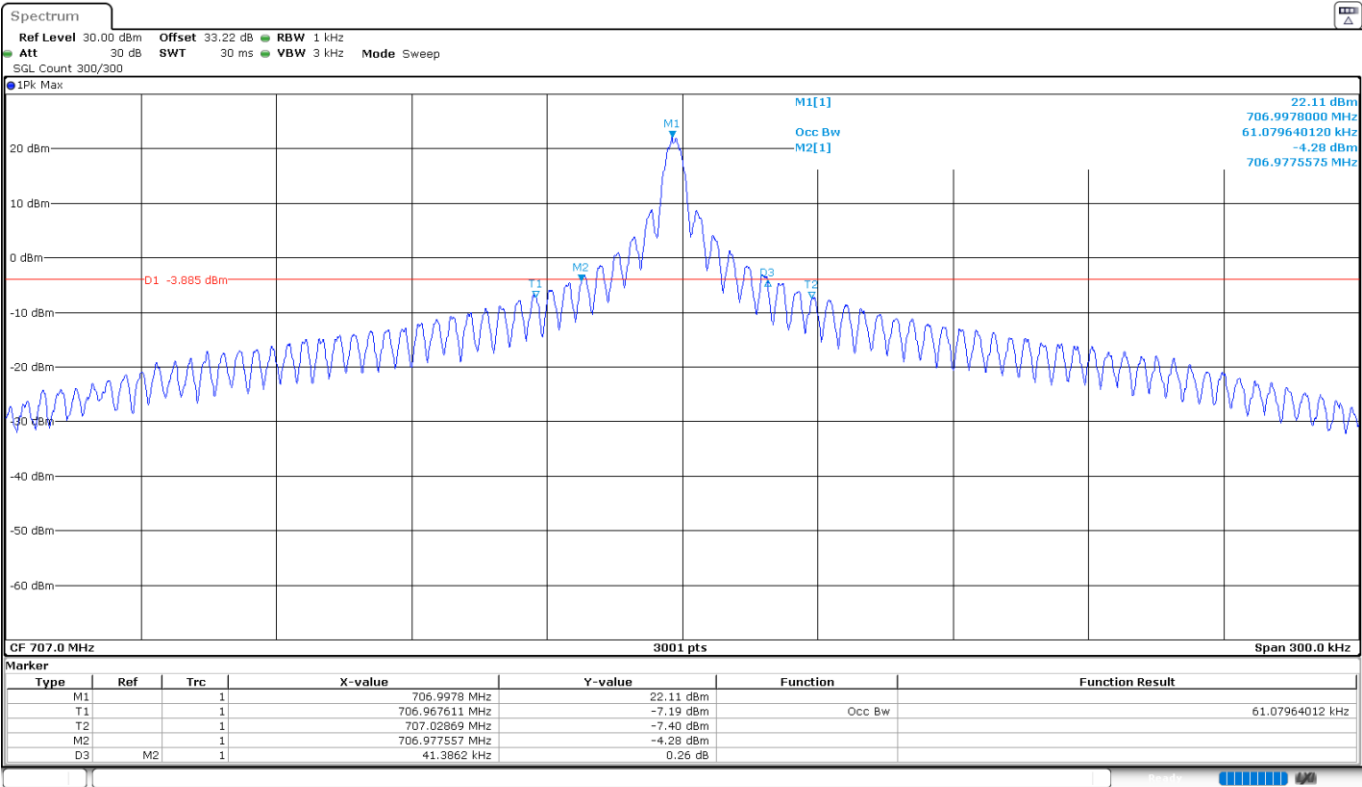
Date: 11.DEC.2024 21:28:40

LTE Cat NB2 Band 85. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=3.

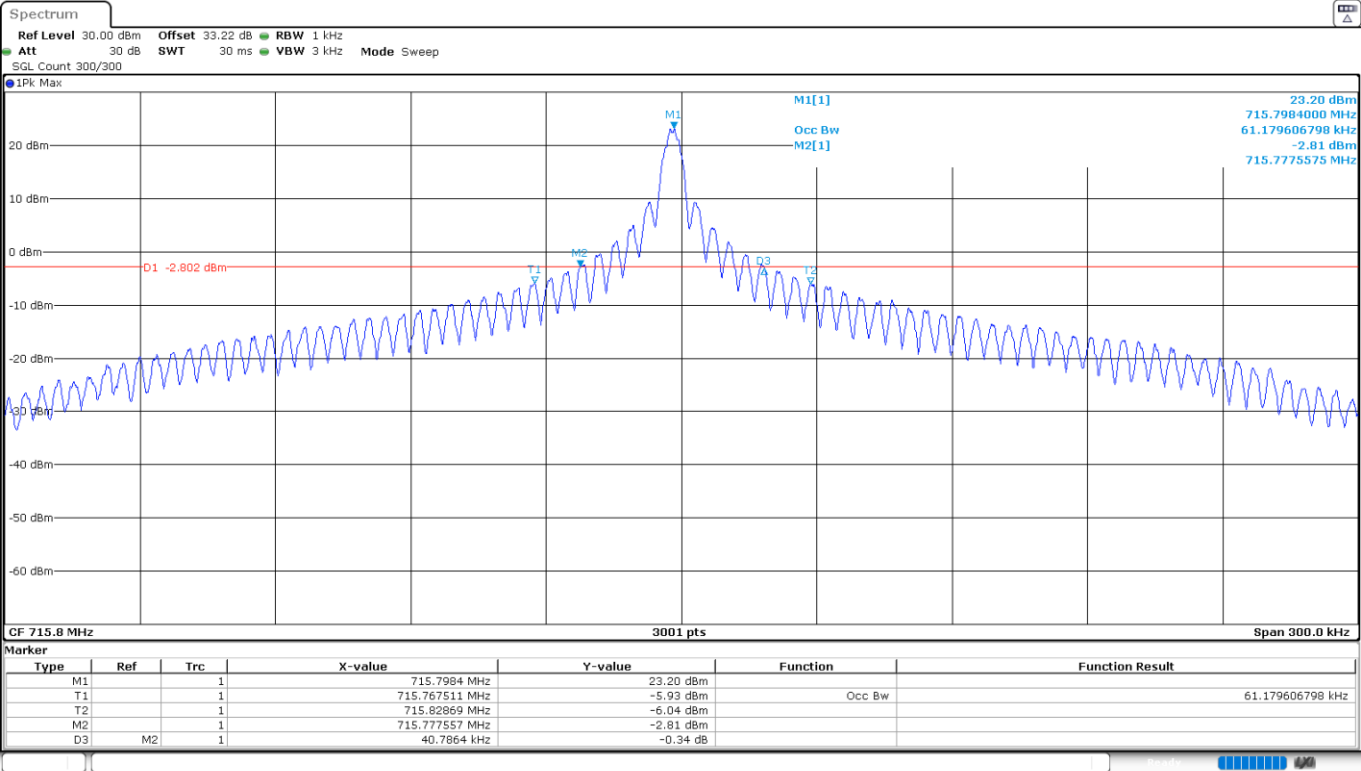
Low Channel:



Middle Channel:



High Channel:



Date: 11.DEC.2024 21:29:06

LTE Cat NB2 Band 85. Pi/2-BPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=0.

	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	130.45651	128.95701	128.35721
-26 dBc Bandwidth (kHz)	140.80000	130.65640	138.25390
Measurement uncertainty (kHz)	<±0.58		

LTE Cat NB2 Band 85. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=3.

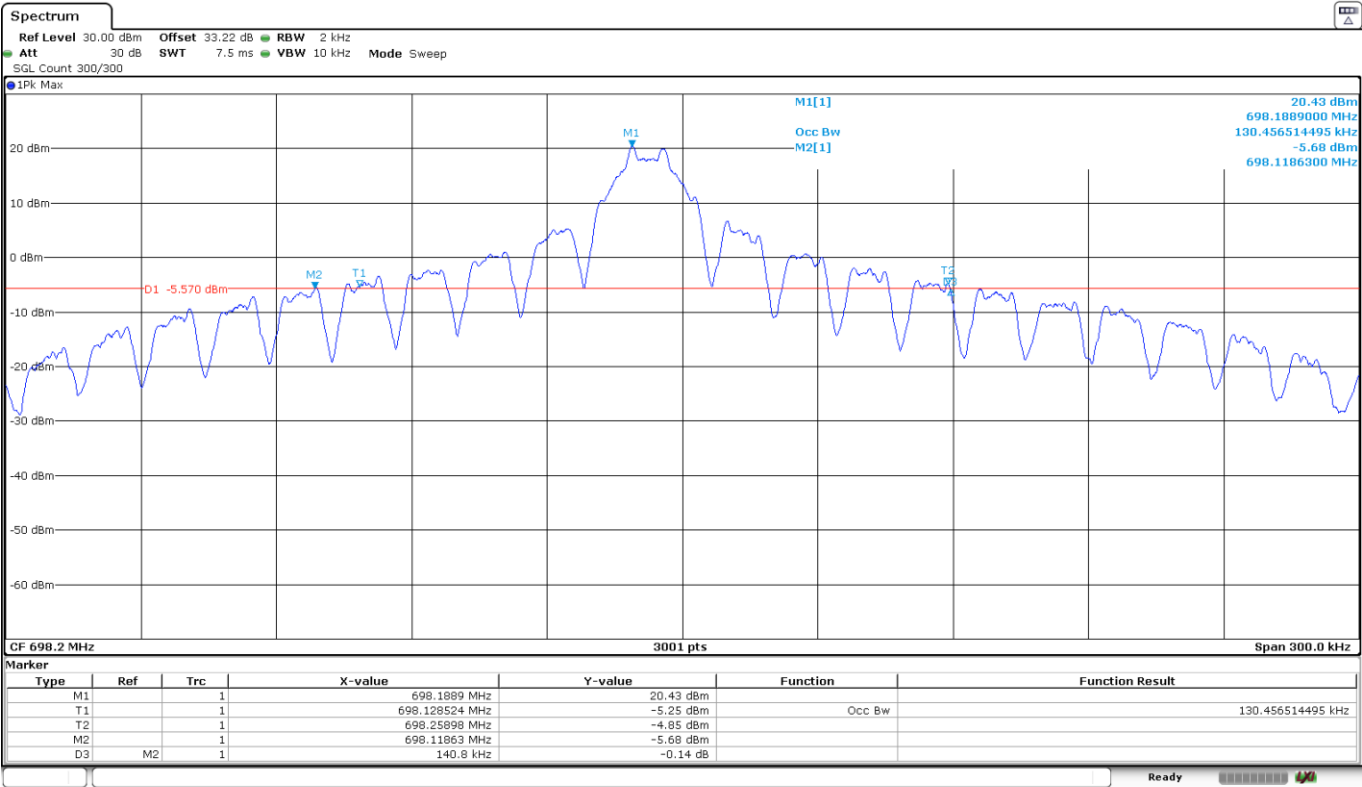
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	136.95435	137.78740	133.95535
-26 dBc Bandwidth (kHz)	145.47000	157.11400	158.44700
Measurement uncertainty (kHz)	<±0.58		

LTE Cat NB2 Band 85. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5.

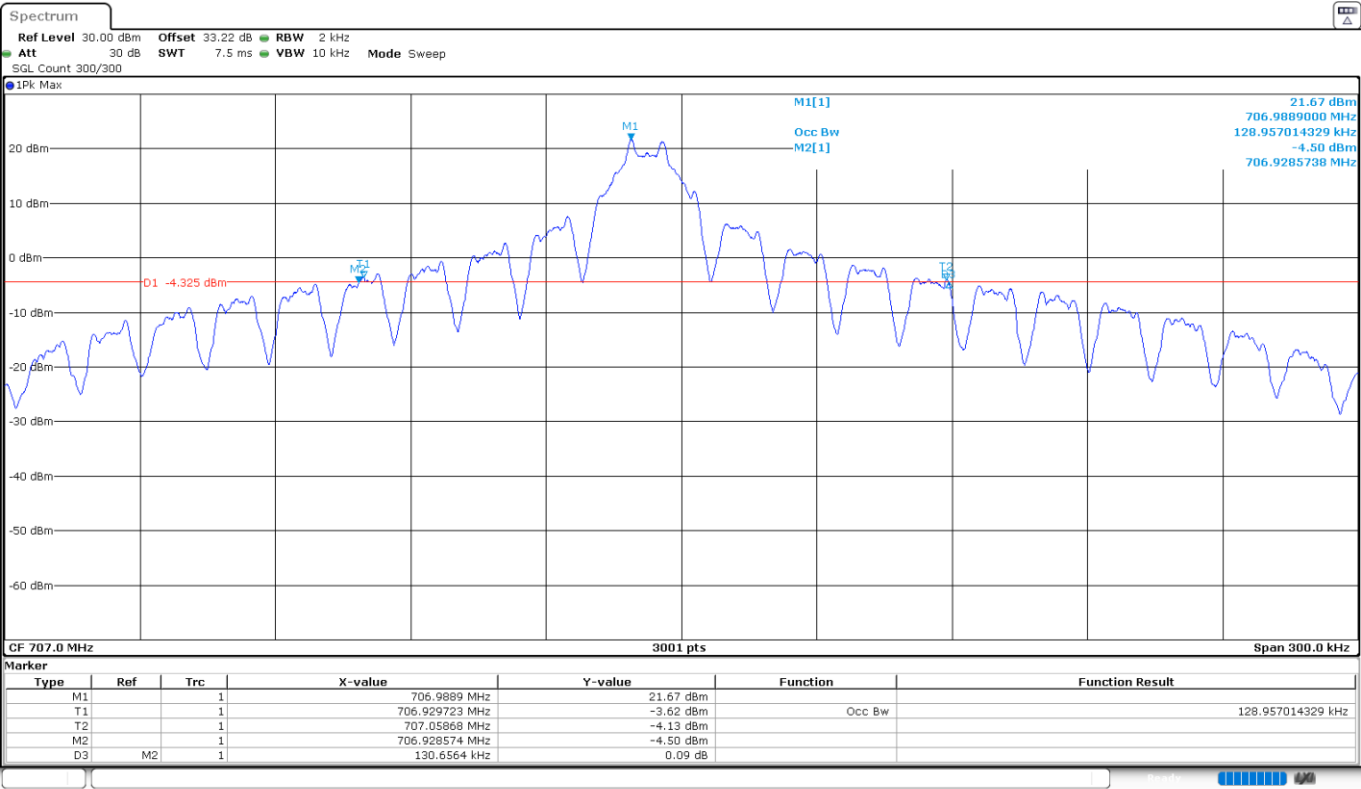
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	178.94035	178.94035	180.60665
-26 dBc Bandwidth (kHz)	260.59000	258.24700	238.75400
Measurement uncertainty (kHz)	<±0.58		

LTE Cat NB2 Band 85. Pi/2-BPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=0.

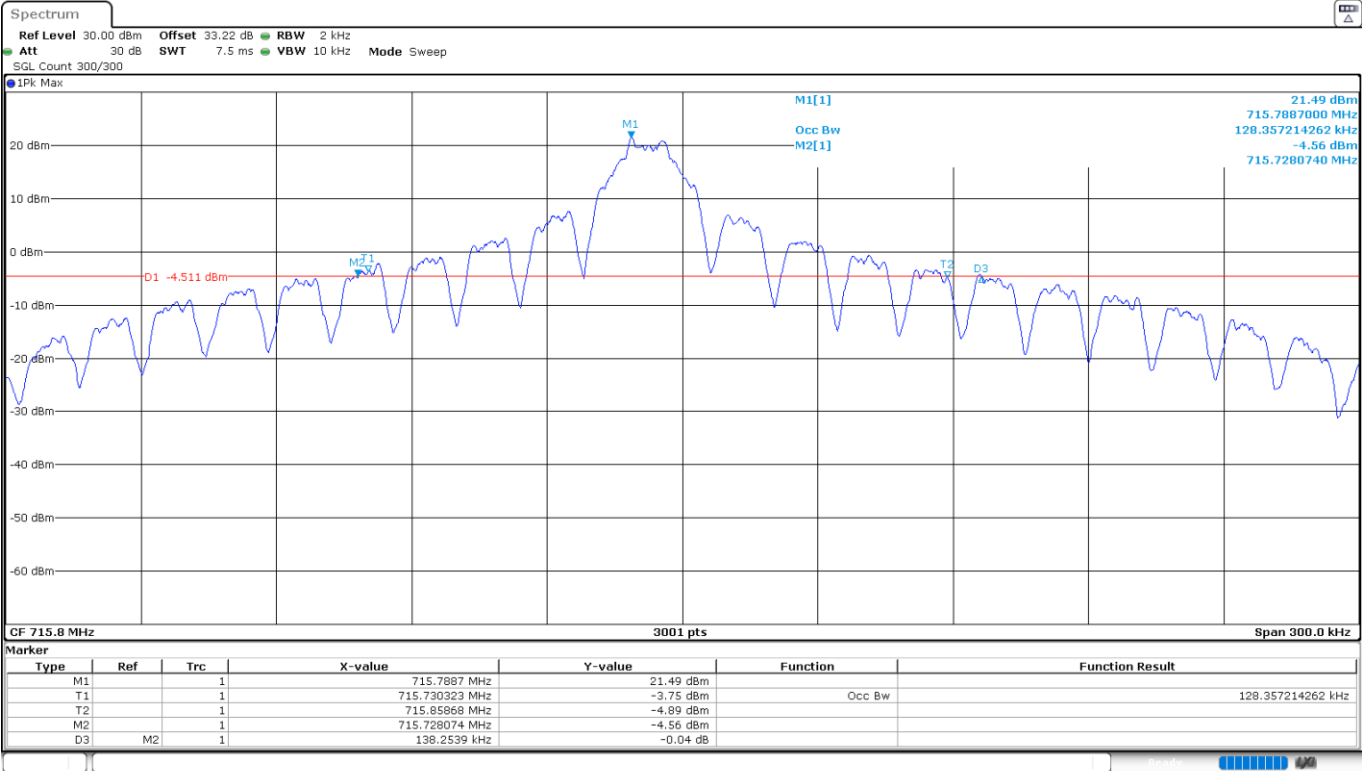
Low Channel:



Middle Channel:



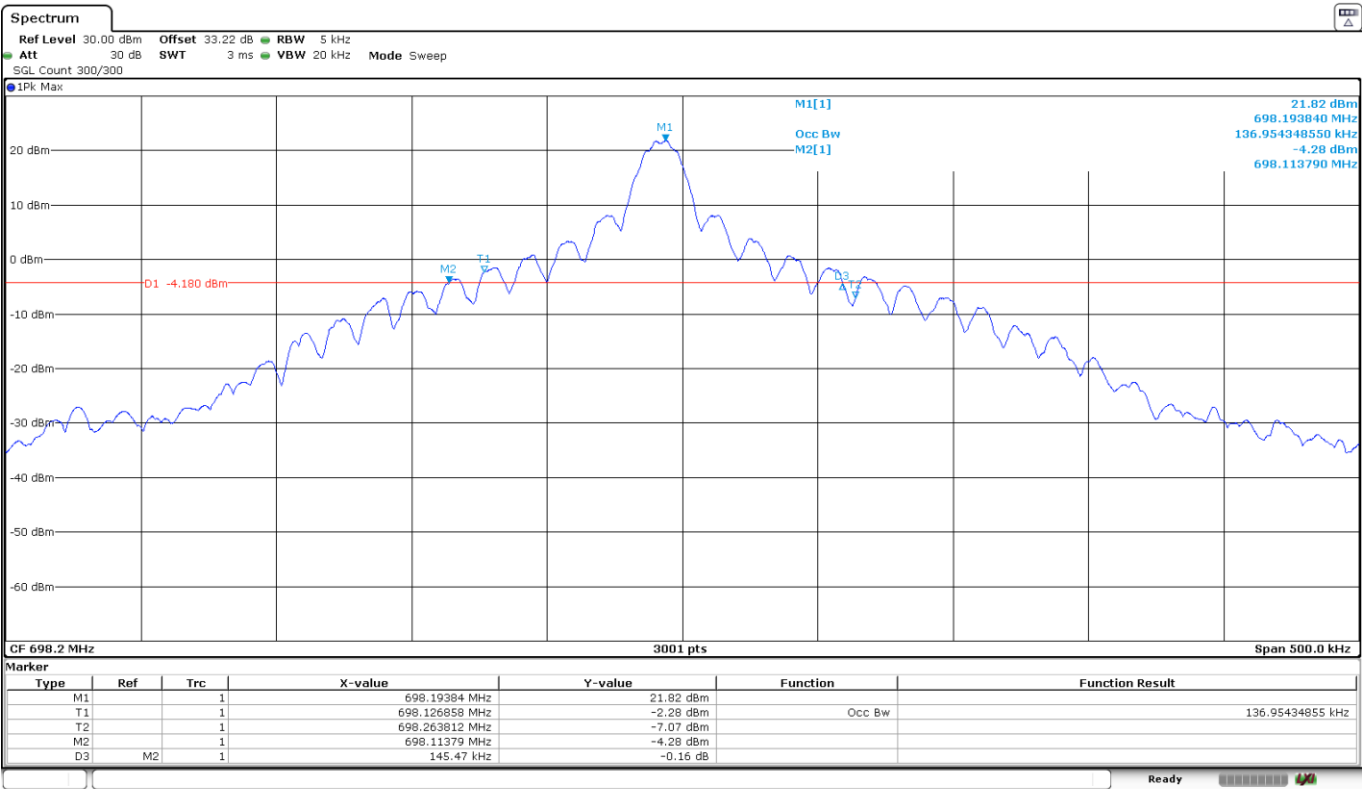
High Channel:



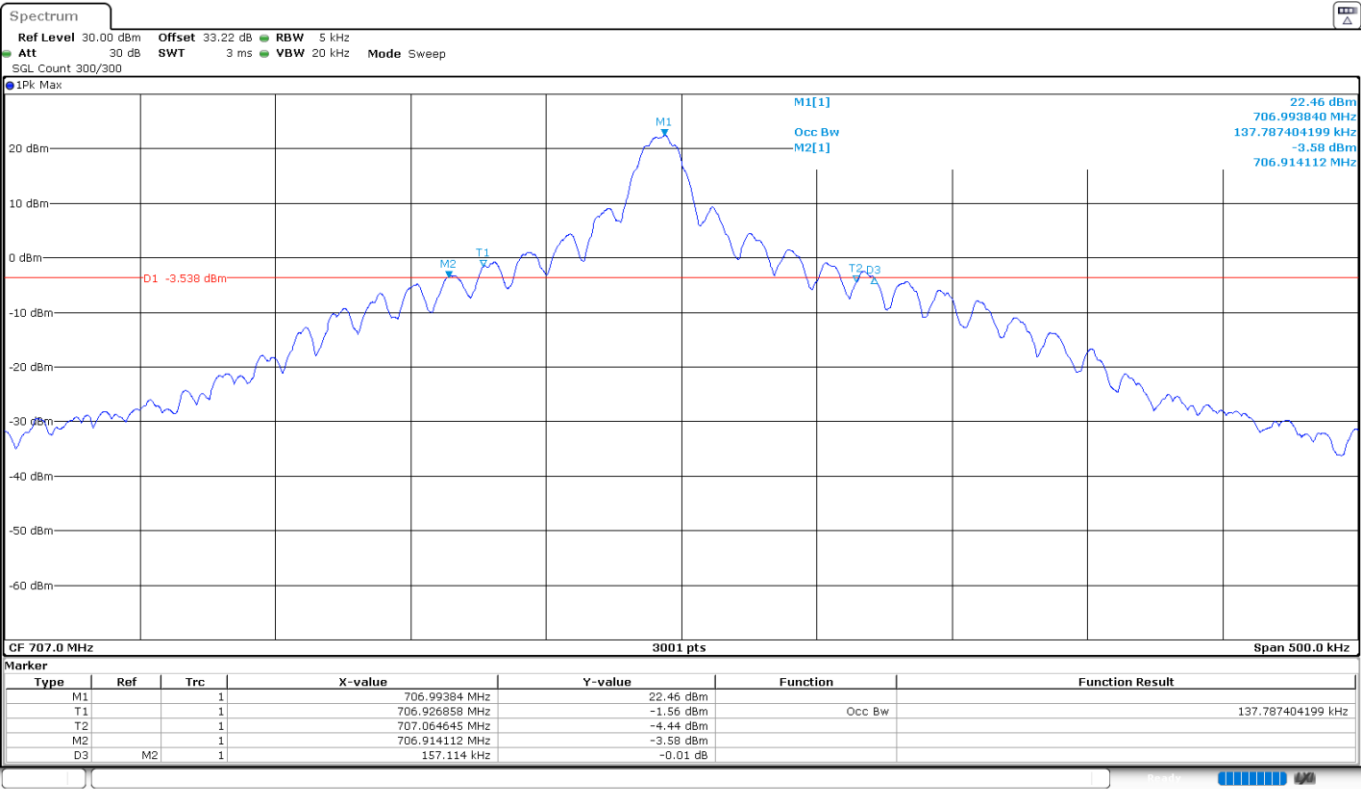
Date: 11.DEC.2024 21:29:33

LTE Cat NB2 Band 85. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=5. MSC/TBS=3.

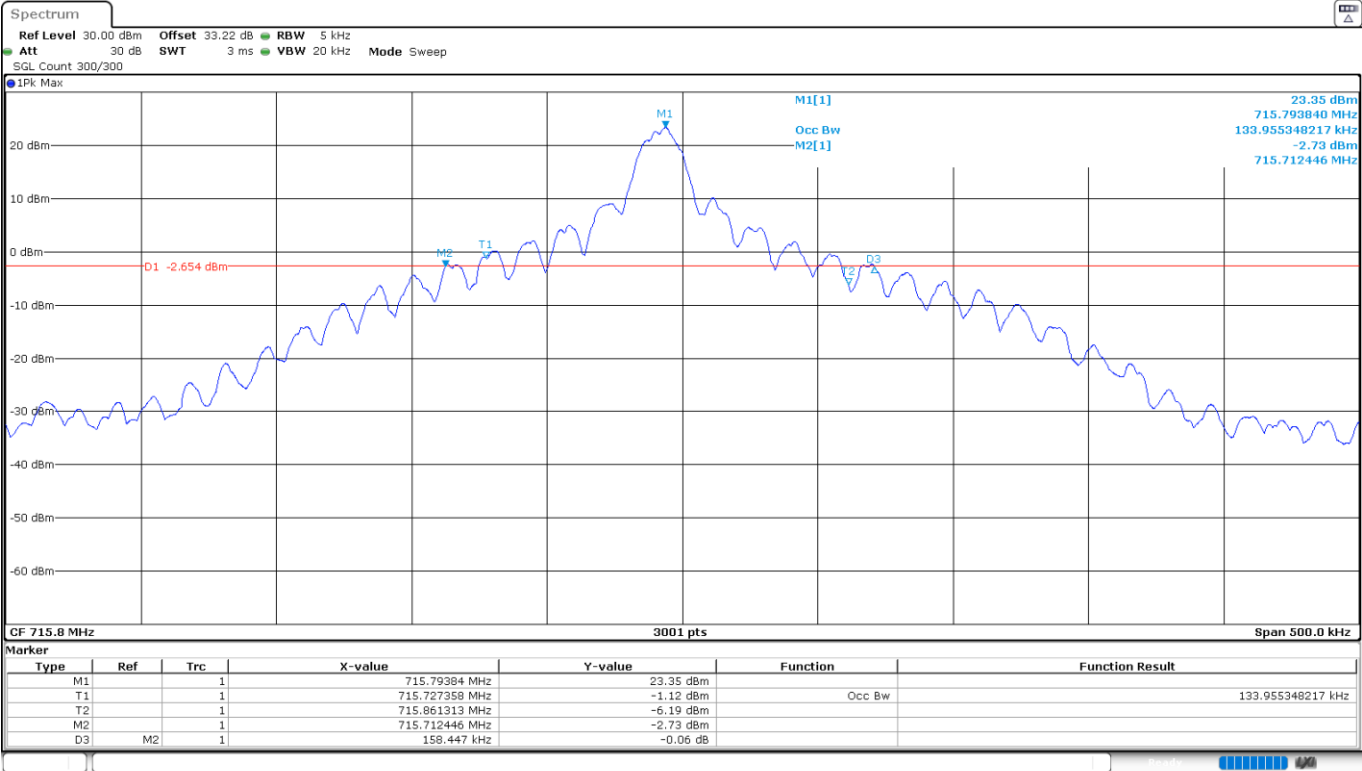
Low Channel:



Middle Channel:



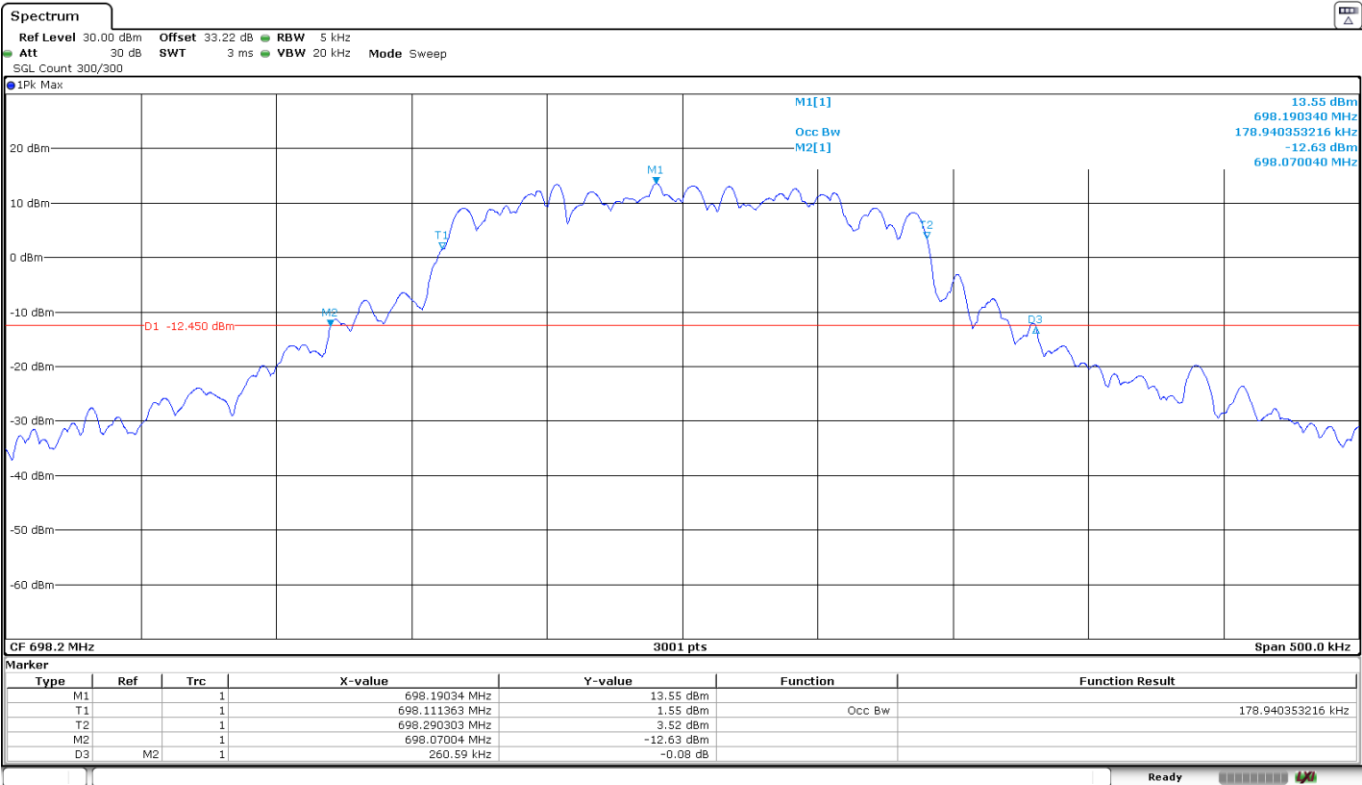
High Channel:



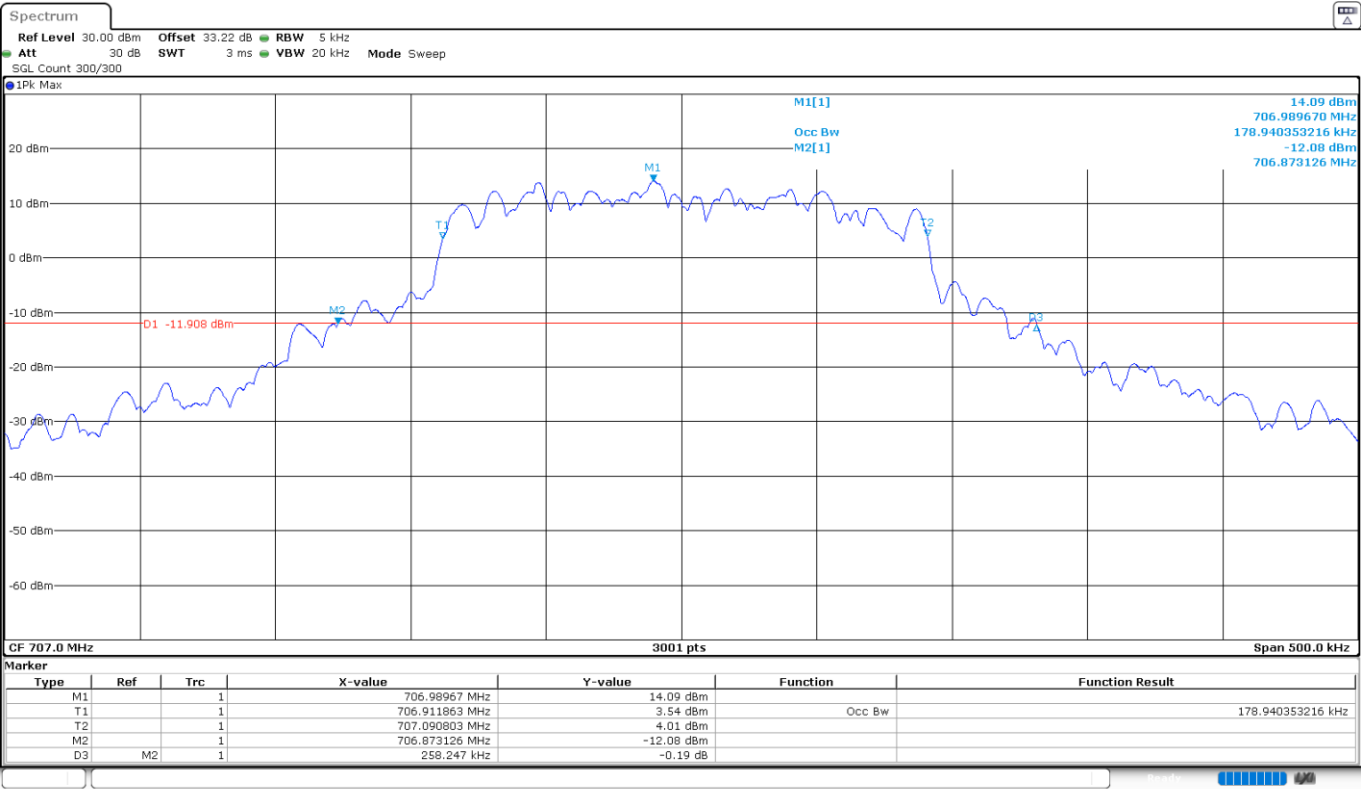
Date: 11.DEC.2024 21:29:50

LTE Cat NB2 Band 85. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5.

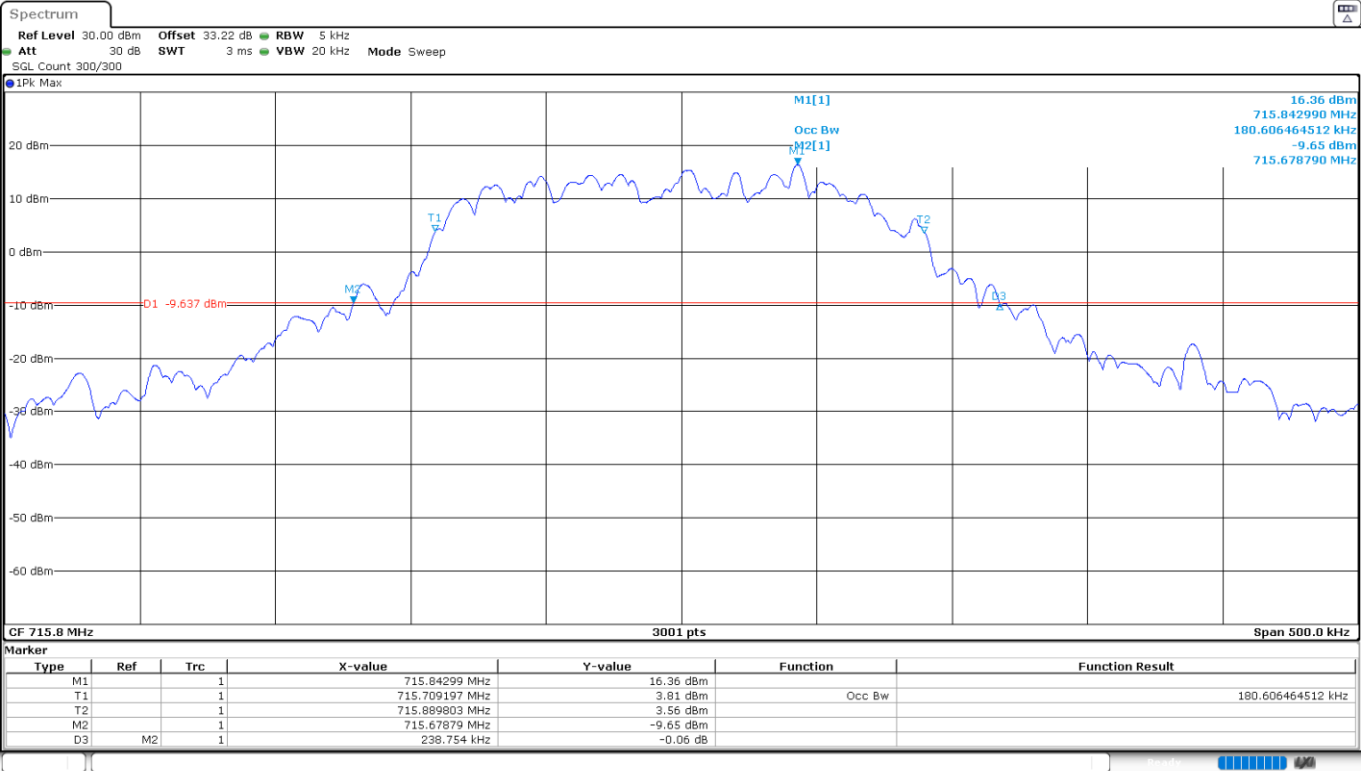
Low Channel:



Middle Channel:



High Channel:



Date: 11.DEC.2024 21:30:06

Spurious emissions at antenna terminals

Limits

1. LTE Cat NB2 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 4.7.1 and 4.7.2:

4.7.1 General unwanted emissions limits:

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 $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

4.7.2 Additional unwanted emissions limits:

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

a. 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:

- i. $76 + 10 \log_{10} p$ (watts), dB, for base and fixed equipment and
- ii. $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment

b. the e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

2. LTE Cat NB2 Band 66.

FCC §27.53 (h). RSS-139 5.6:

Unwanted emissions shall be measured in terms of average values.

For all equipment, the TRP or total conducted power (sum of conducted power across all antenna connectors) of the unwanted emissions outside the frequency block or frequency block group shall not exceed the limits shown in table 6.

Table 6: Unwanted emission limits	
Offset from the edge of the frequency block or frequency block group	Unwanted emission limits
1 MHz	-13 dBm/(1% of OB*)
>1 MHz	-13 dBm/MHz

*OB is the occupied bandwidth.

In addition to complying with the above limits, equipment operating in the band 2180-2200 MHz may require additional filtering (see SRSP-519).

3. LTE Cat NB2 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 $43 + 10 \log_{10} p$ (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:

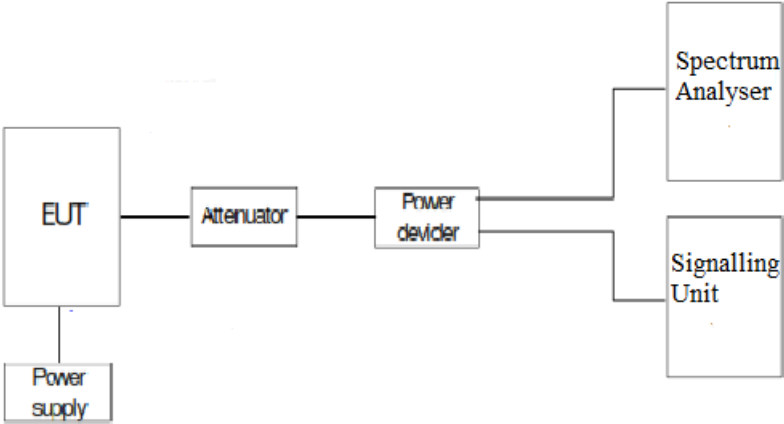
$$P_o \text{ (dBm)} - [65 + 10 \log (P_o \text{ in mW}) - 30] = -35 \text{ dBm}$$

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

Test Setup



Results

The next results are for the worst-case configuration for each LTE Cat NB2 Band.

LTE Cat NB2 Band 13:

A preliminary scan determined the worst-case:

Pi/4-QPSK. BW=15 kHz. Tone Number=3. Tone Offset=6. MSC/TBS=5.

Frequency range 9 KHz - 8 GHz:

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

Frequency (MHz)	Emission limitations conducted (dBm)
259.010938	-43.34
1036.25	-43.92

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

Frequency (MHz)	Emission limitations conducted (dBm)
1049.0625	-41.39
4720.90625	-39.39