LTE Band 25, 20MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
50	3.89	1850.780	1914.230	0.00	0.0000
40				1.46	0.0008
30				0.51	0.0003
20				0.83	0.0004
10				-2.10	0.0011
0				0.51	0.0003
-10				-0.64	0.0003
-20				-0.70	0.0004
-30					

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.60	20	1850.780	1914.230	-0.56	0.0003
4.48				0.04	0.0000

Expanded measurement uncertainty is 10Hz, k = 2

LTE Band 26(814MHz-824MHz), 10MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.89	814.340	823.630	1.90	0.0023
50				-0.07	0.0001
40				1.77	0.0022
30				0.26	0.0003
10				1.64	0.0020
0				0.29	0.0004
-10				1.62	0.0020
-20				0.44	0.0005
-30					

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.60	20	814.340	823.630	1.67	0.0020
4.48				1.35	0.0017

Expanded measurement uncertainty is 10Hz, k = 2

LTE band 26(824MHz-849MHz), 15MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.89	824.490	848.480		
50				0.20	0.0002
40				-0.70	0.0008
30				-0.75	0.0009
10				-0.81	0.0010
0				0.47	0.0006
-10				-0.98	0.0012
-20				0.13	0.0002
-30				-0.22	0.0003

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.60	20	824.490	848.480	-1.40	0.0017
4.48				-0.58	0.0007

Expanded measurement uncertainty is 10Hz, k = 2

LTE Band 38, 20MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.89	2570.620	2619.380		
50				-0.49	0.0002
40				-0.29	0.0001
30				-0.99	0.0004
10				-1.02	0.0004
0				-1.09	0.0004
-10				0.22	0.0001
-20				0.10	0.0000
-30				-1.70	0.0007

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.60	20	2570.620	2619.380	0.30	0.0001
4.48				-0.06	0.0000

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

LTE band 41, 20MHz bandwidth QPSK(worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.89	2496.500	2689.440		
50				0.34	0.0001
40				1.26	0.0005
30				1.24	0.0005
10				-0.14	0.0001
0				1.42	0.0005
-10				0.09	0.0000
-20				1.33	0.0005
-30				1.07	0.0004

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.60	20	2496.500	2689.440	1.26	0.0005
4.48				0.73	0.0003

Expanded measurement uncertainty is 10 Hz, k = 2

LTE Band 66, 20MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.89	1710.760	1779.250		
50				1.32	0.0008
40				0.72	0.0004
30				-0.66	0.0004
10				-0.36	0.0002
0				-0.02	0.0000
-10				-0.40	0.0002
-20				1.32	0.0008
-30				-0.19	0.0001

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.60	20	1710.760	1779.250	0.14	0.0001
4.48				-0.17	0.0001

Expanded measurement uncertainty is 10Hz, k = 2

LTE band CA_7C, 20MHz+20MHz bandwidth QPSK(worst case of all bandwidths)

Frequency Error vs Voltage

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.87	2500.480	2569.480		
50				1.90	0.0008
40				-0.72	0.0003
30				-0.39	0.0002
10				2.25	0.0009
0				2.47	0.0010
-10				-1.63	0.0006
-20				0.99	0.0004
-30				0.83	0.0003

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.45	20	2500.480	2569.480	0.38	0.0001
4.45				1.45	0.0006

Expanded measurement uncertainty is 10Hz, k = 2

LTE band CA_38C, 20MHz+20MHz bandwidth QPSK(worst case of all bandwidths)

Frequency Error vs Voltage

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.87	2570.620	2619.360		
50				0.44	0.0002
40				1.65	0.0006
30				-0.54	0.0002
10				-0.48	0.0002
0				-1.49	0.0006
-10				1.50	0.0006
-20				-2.27	0.0009
-30				-2.18	0.0008

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.45	20	2570.620	2619.360	-0.16	0.0001
4.45				-1.06	0.0004

Expanded measurement uncertainty is 10Hz, k = 2

LTE band CA_41C, 20MHz+20MHz bandwidth QPSK(worst case of all bandwidths)

Frequency Error vs Voltage

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.87	2496.940	2689.060		
50				-0.42	0.0002
40				-1.83	0.0007
30				-0.09	0.0000
10				-1.15	0.0004
0				-0.38	0.0001
-10				-1.84	0.0007
-20				-0.32	0.0001
-30				0.47	0.0002

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.45	20	2496.940	2689.060	-1.17	0.0005
4.45				-1.88	0.0007

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.

a) 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).

b) 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.

c) 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 10log (OBW / RBW) below the reference level.

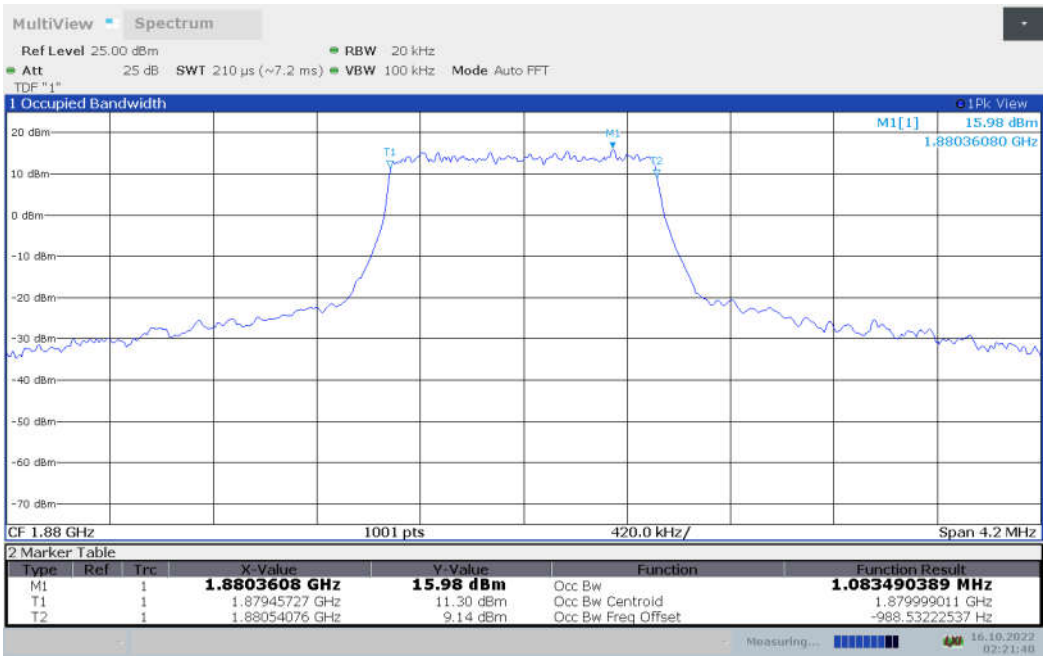
d) Set the detection mode to peak, and the trace mode to max hold.

e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

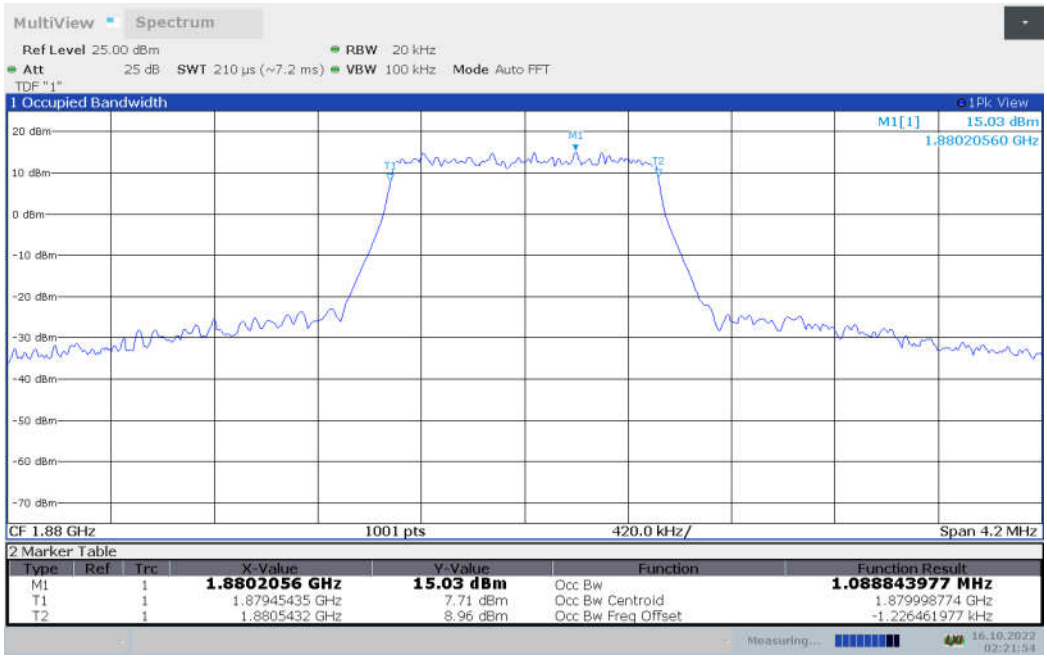
LTE band 2,1.4MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1880	1.083	1.089

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



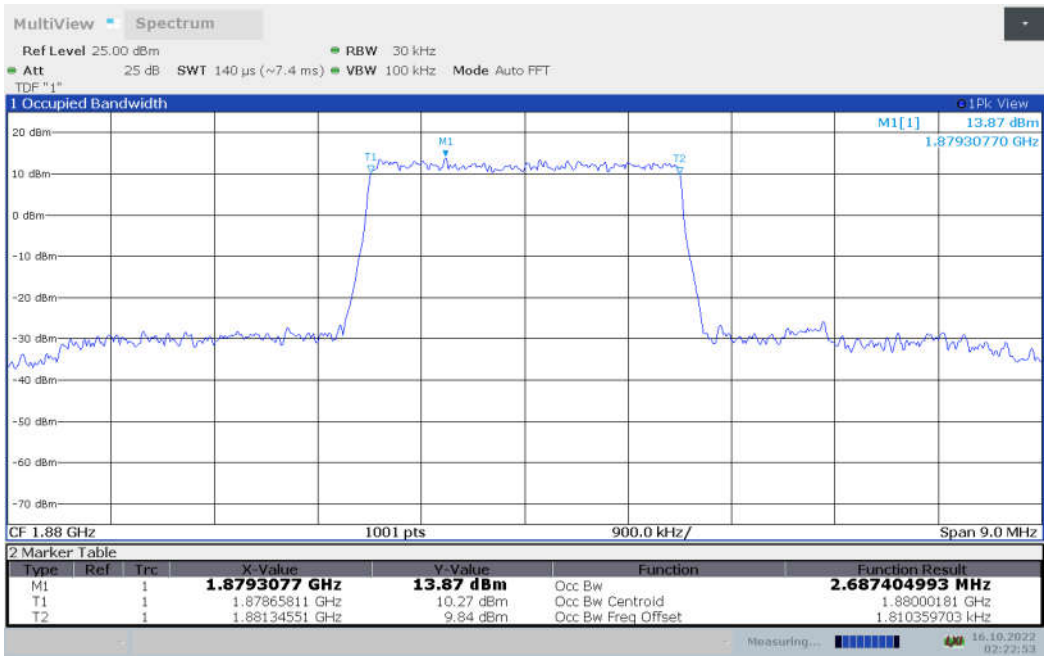
LTE band 2 , 1.4MHz Bandwidth,16QAM (99% BW)



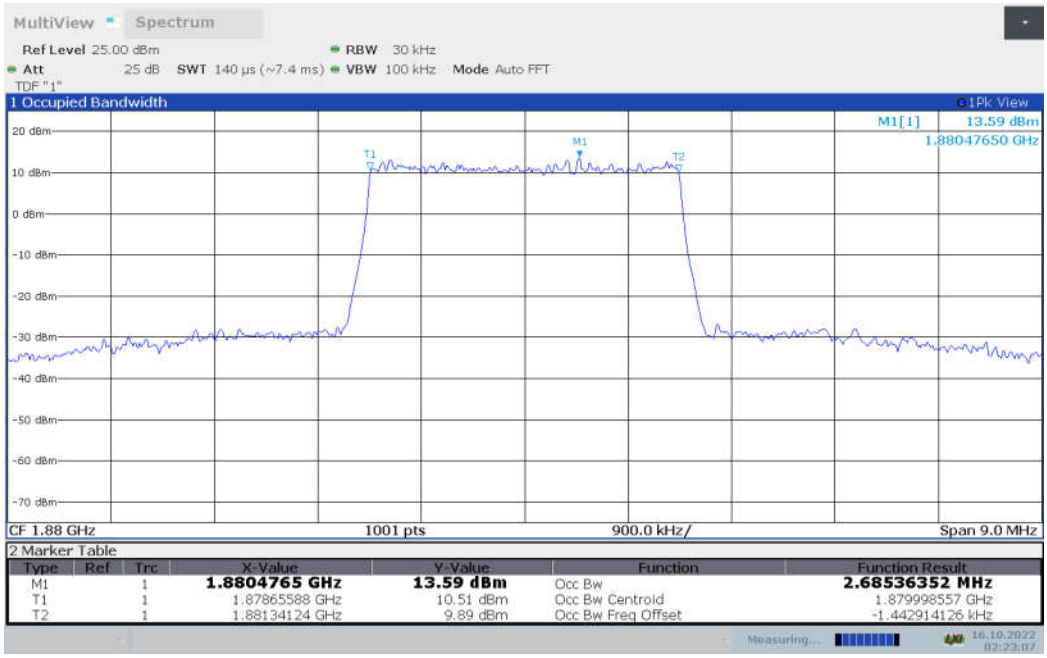
LTE band 2,3MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1880	2.687	2.685

LTE band 2 , 3MHz Bandwidth,QPSK (99% BW)



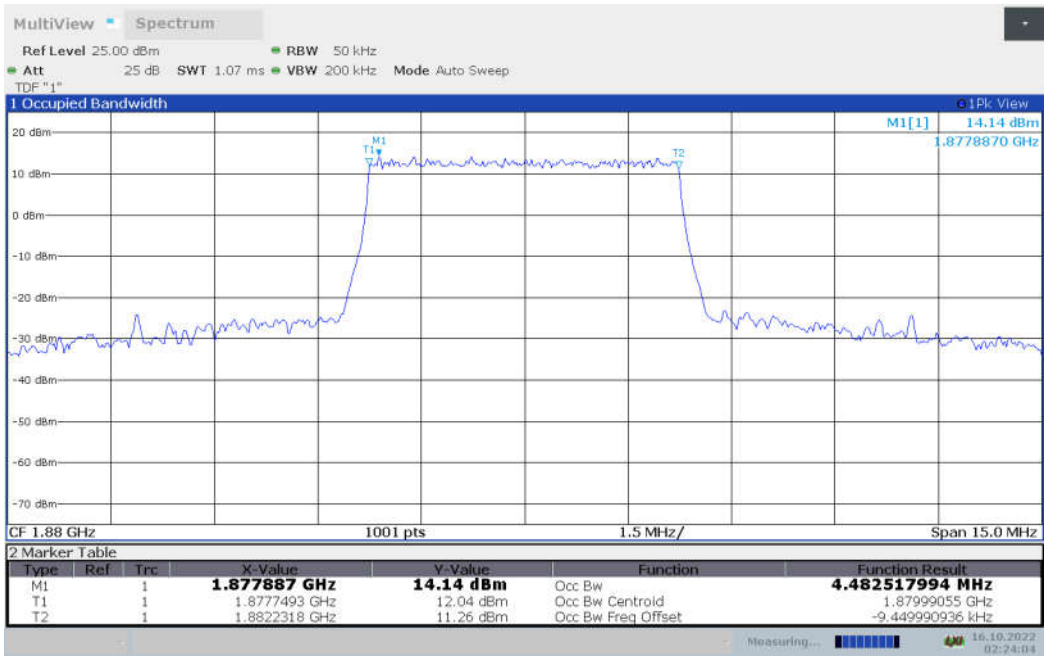
LTE band 2 , 3MHz Bandwidth,16QAM (99% BW)



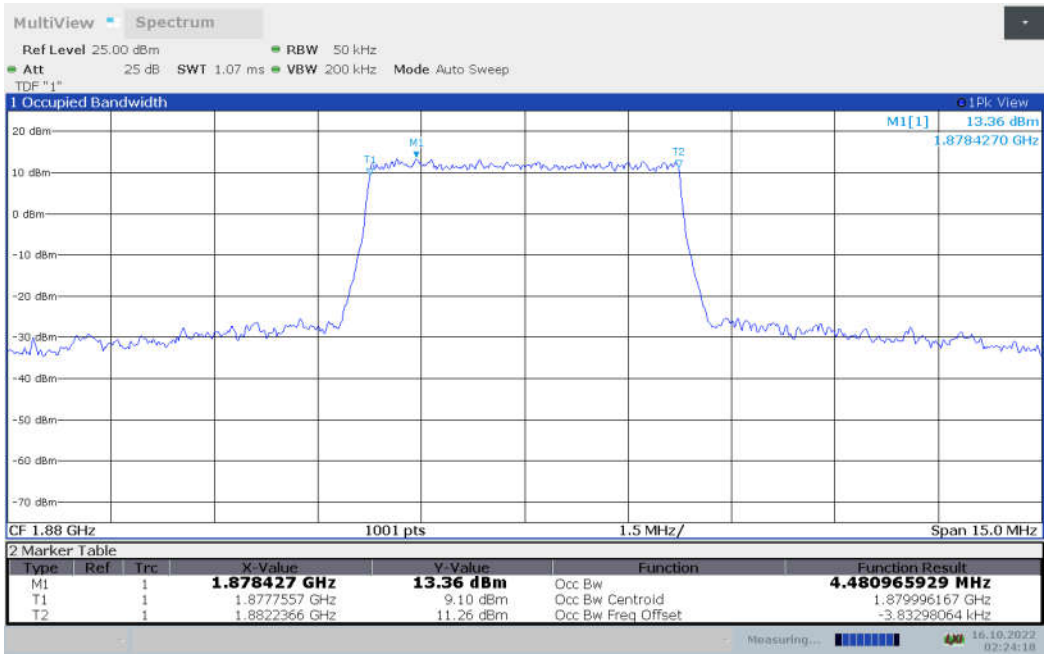
LTE band 2,5MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1880	4.483	4.481

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



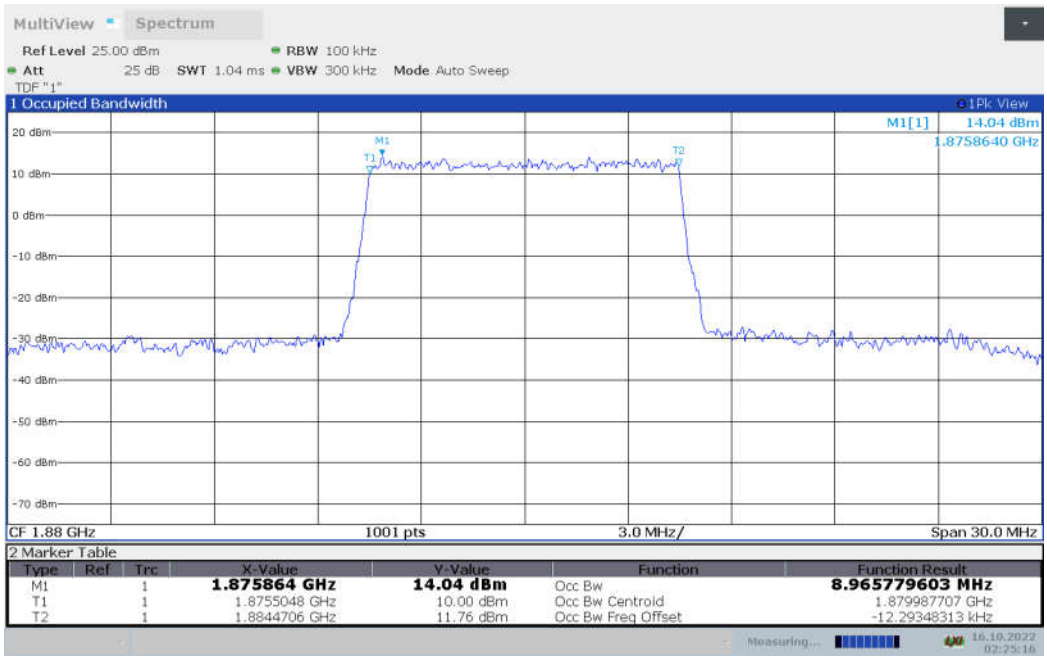
LTE band 2 , 5MHz Bandwidth,16QAM (99% BW)



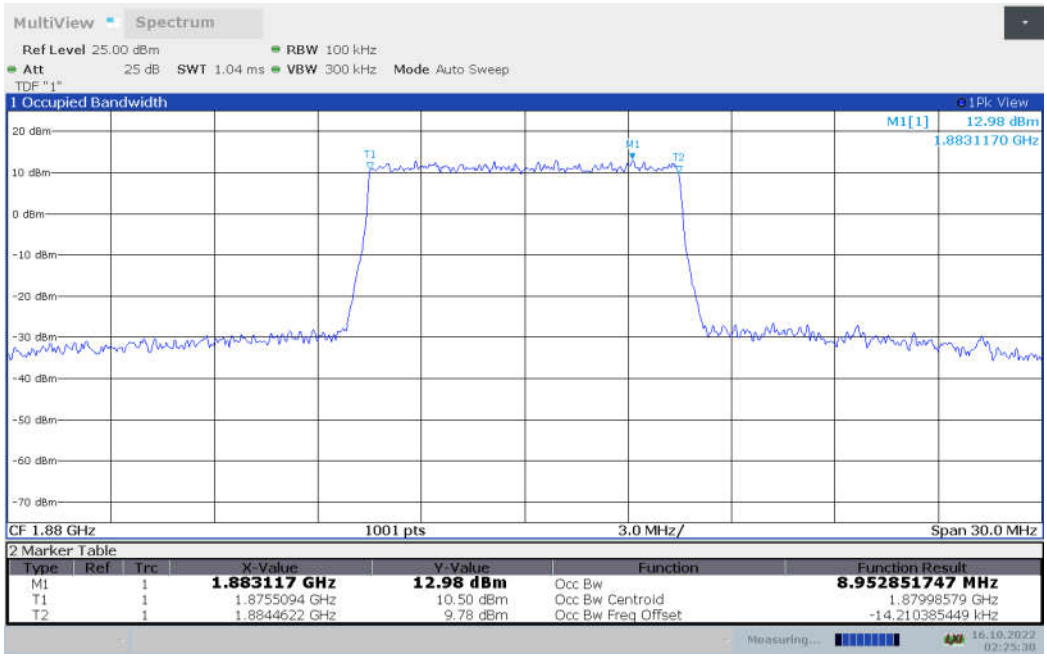
LTE band 2,10MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1880	8.966	8.953

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



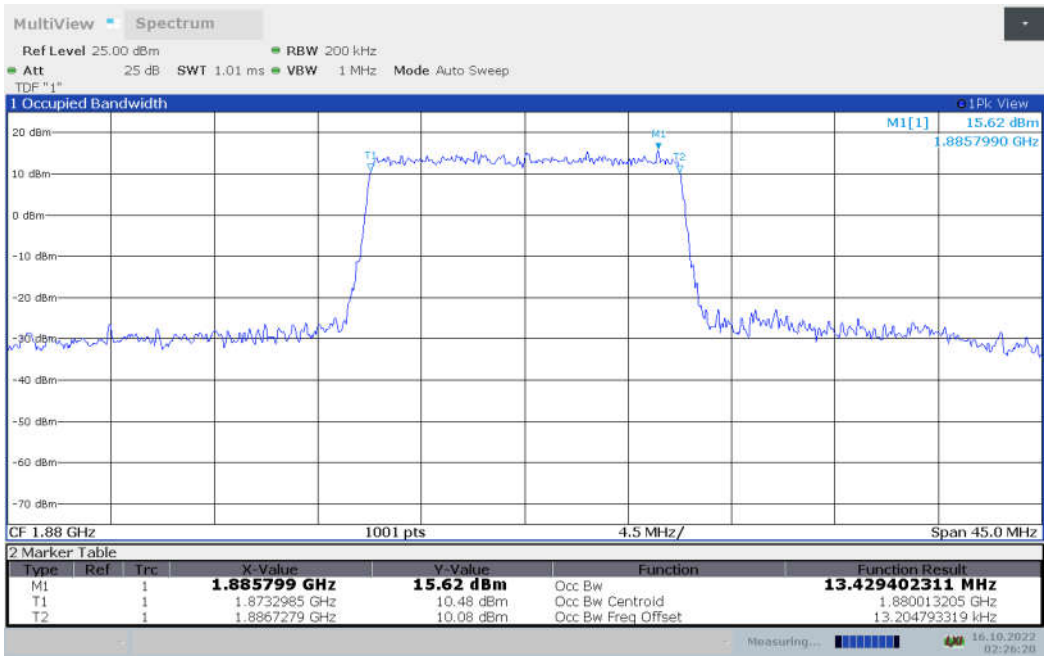
LTE band 2 , 10MHz Bandwidth,16QAM (99% BW)



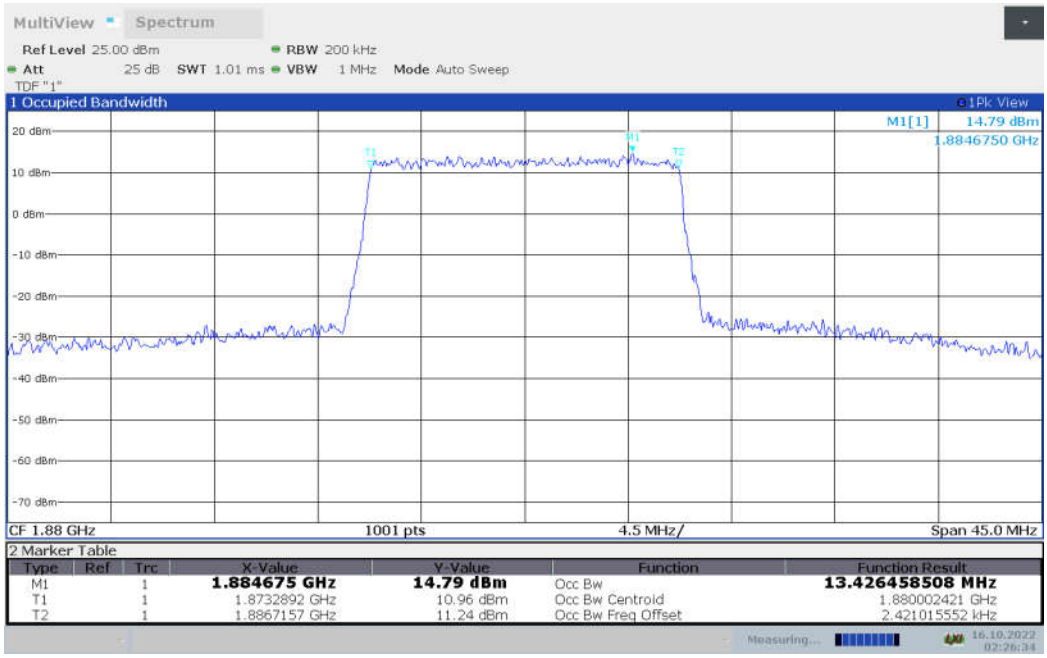
LTE band 2,15MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1880	13.429	13.426

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



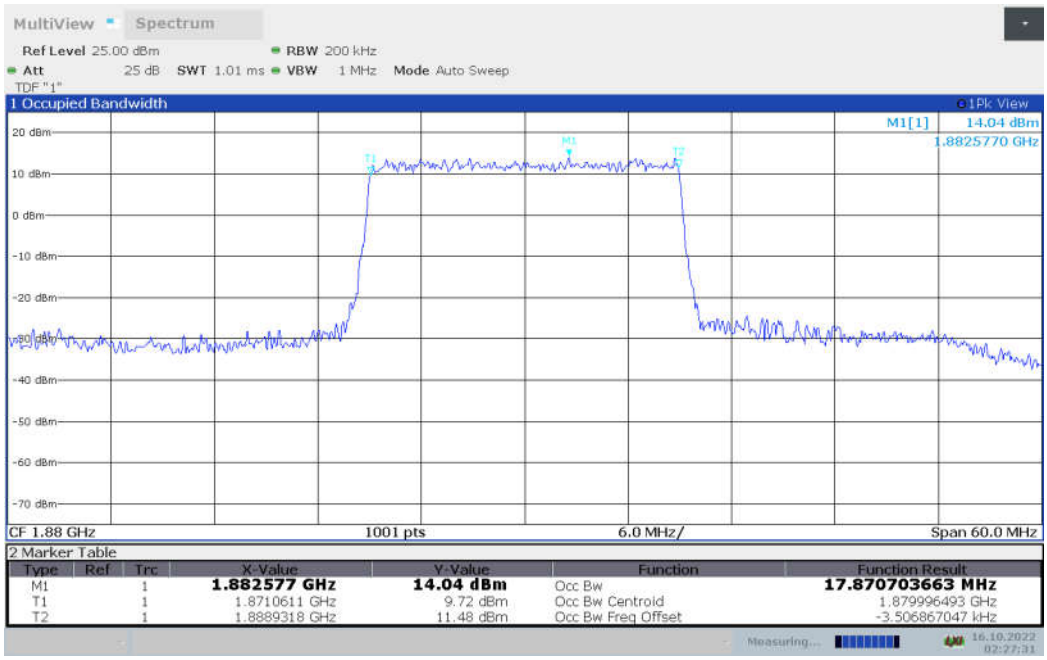
LTE band 2 , 15MHz Bandwidth,16QAM (99% BW)



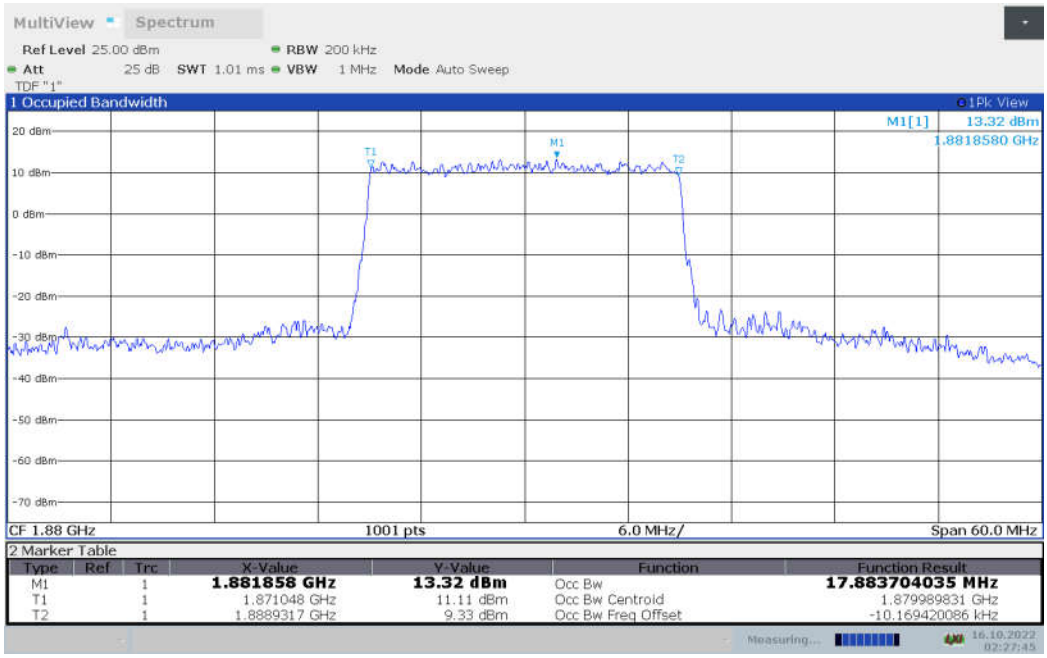
LTE band 2,20MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1880	17.871	17.884

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



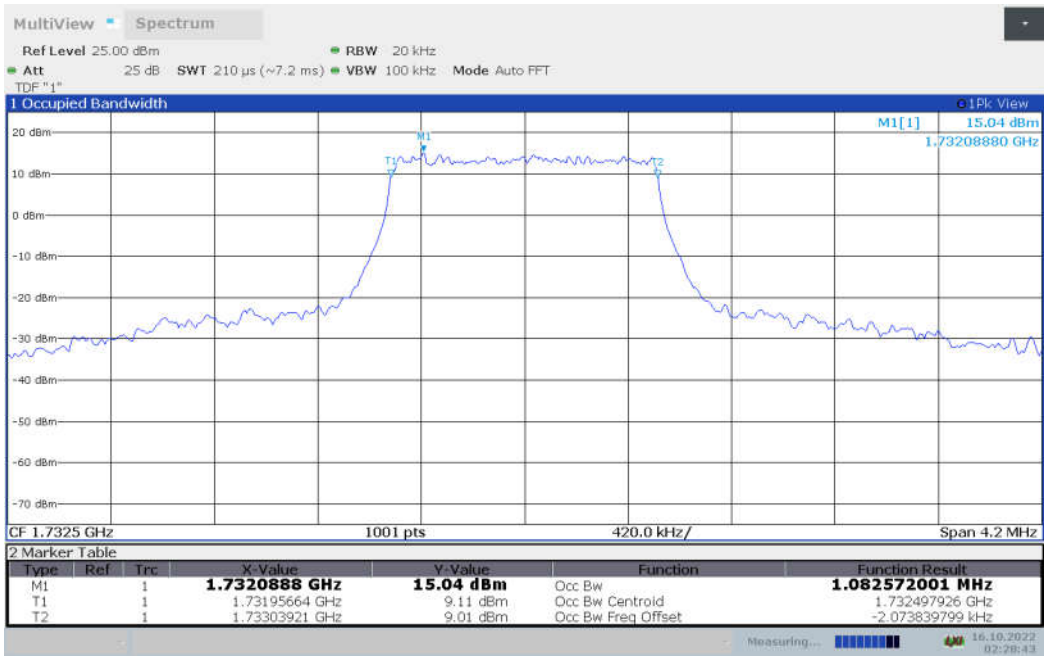
LTE band 2 , 20MHz Bandwidth,16QAM (99% BW)



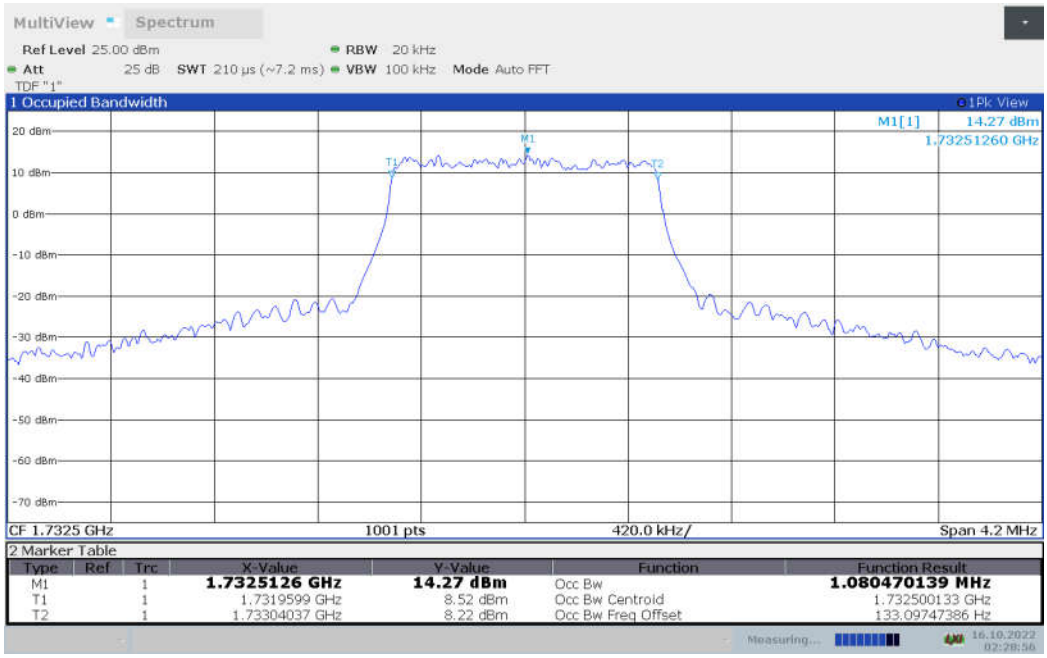
LTE band 4,1.4MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1732.5	1.083	1.080

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



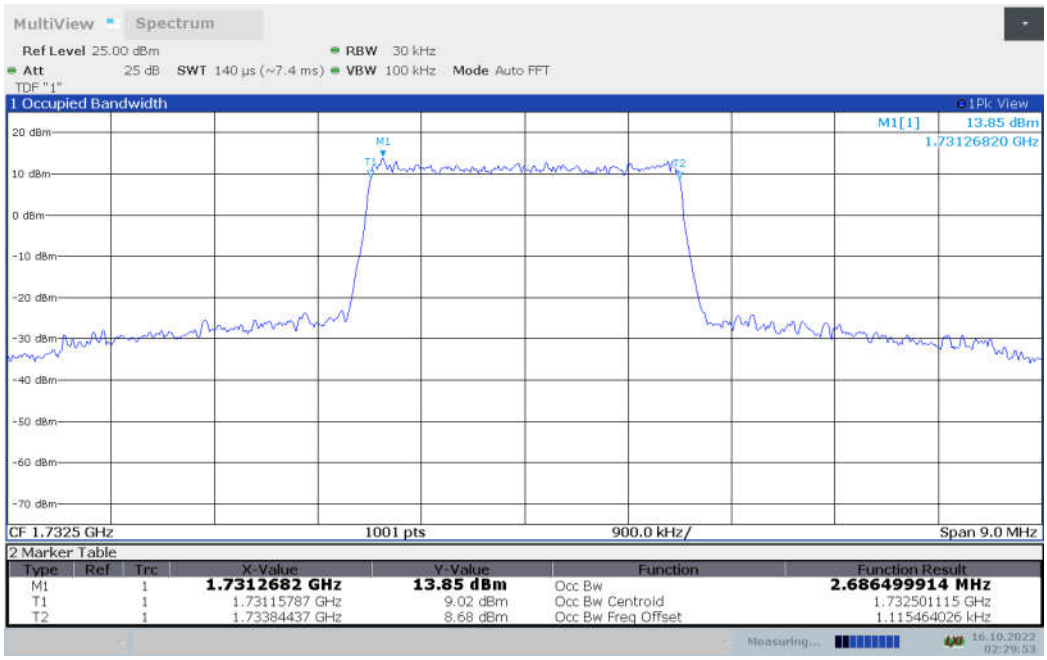
LTE band 4 , 1.4MHz Bandwidth,16QAM (99% BW)



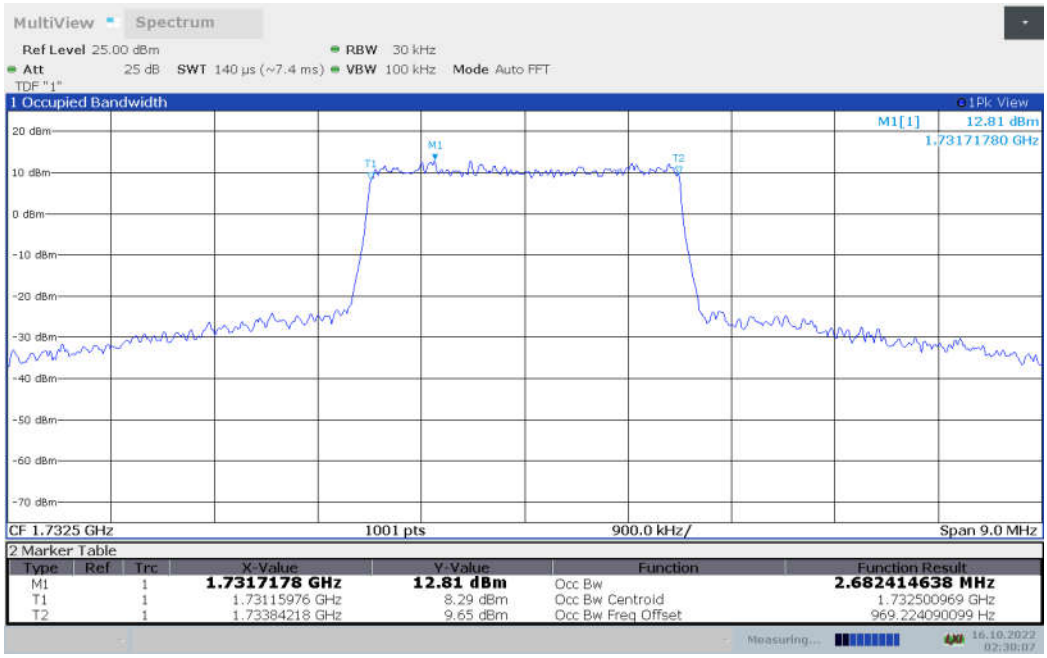
LTE band 4,3MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1732.5	2.686	2.682

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



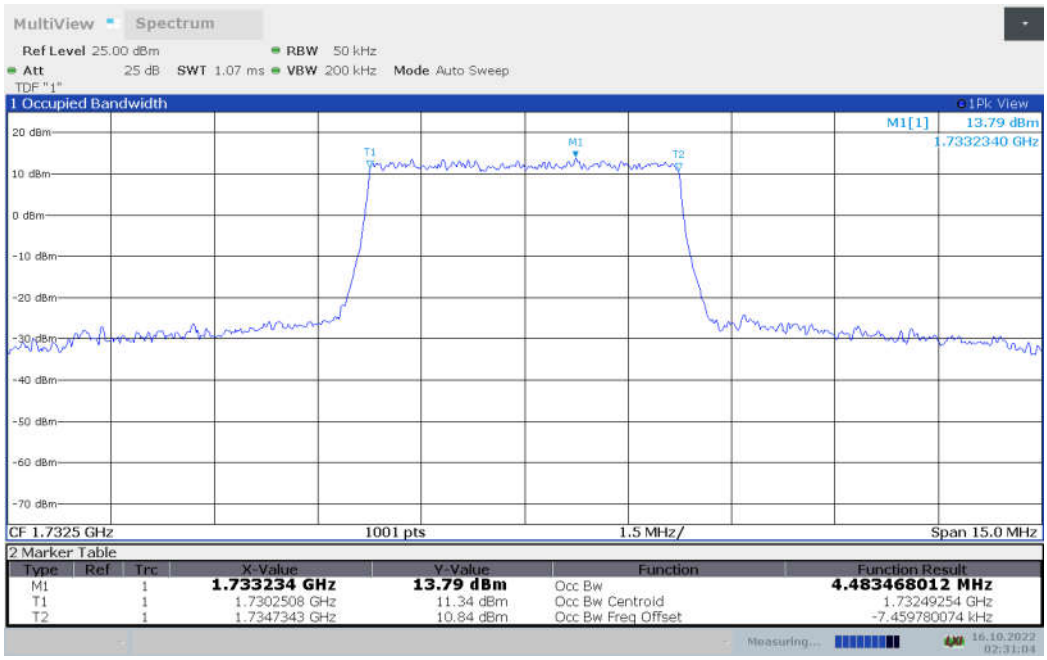
LTE band 4 , 3MHz Bandwidth,16QAM (99% BW)



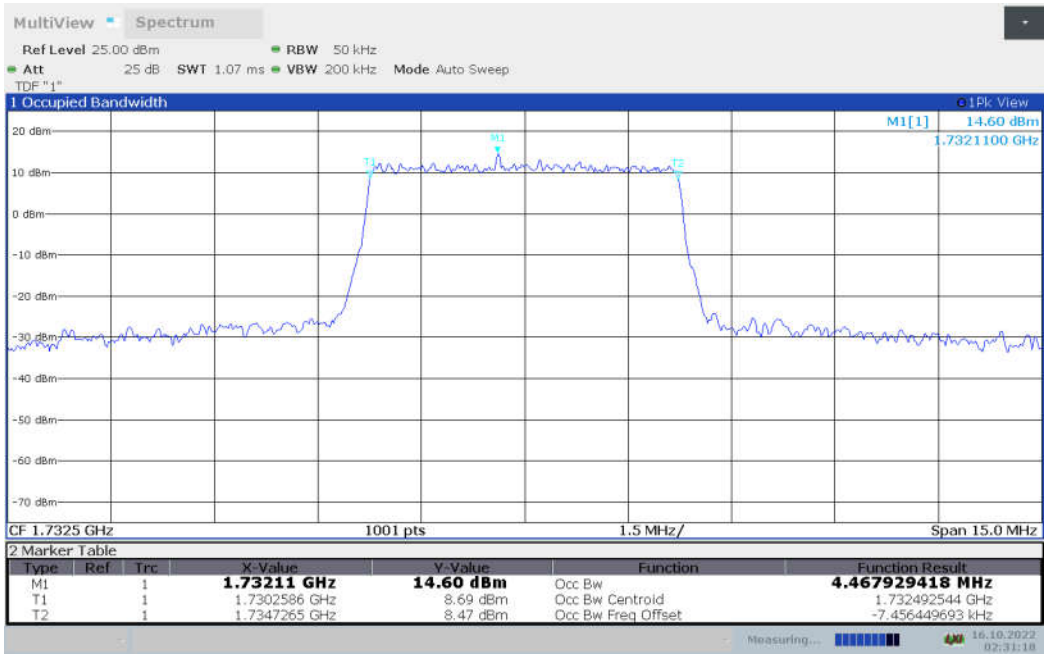
LTE band 4,5MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1732.5	4.483	4.468

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



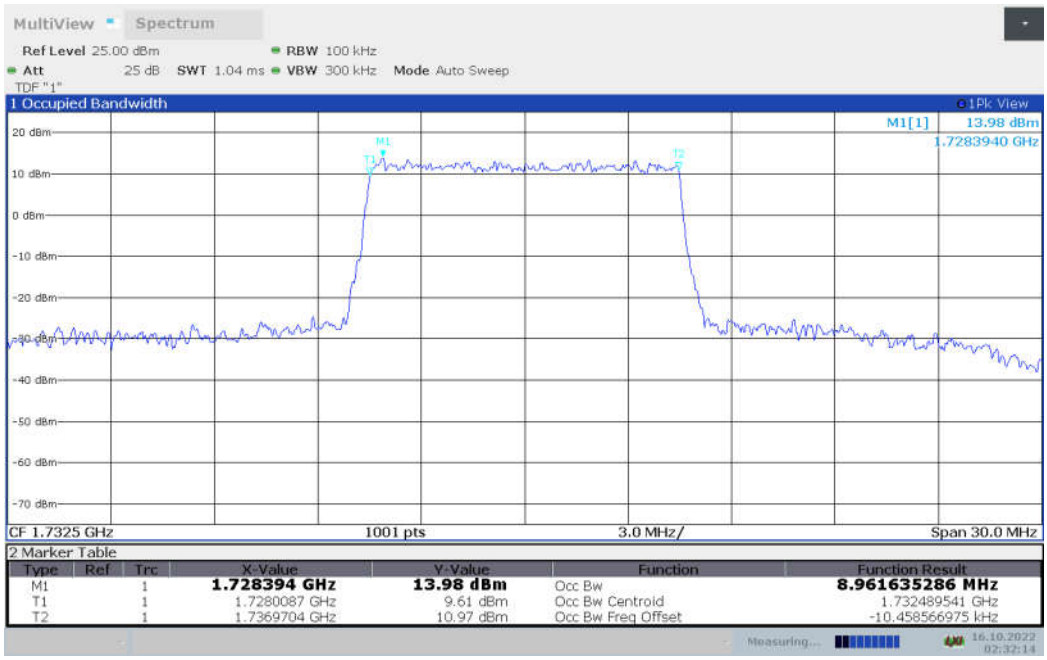
LTE band 4 , 5MHz Bandwidth,16QAM (99% BW)



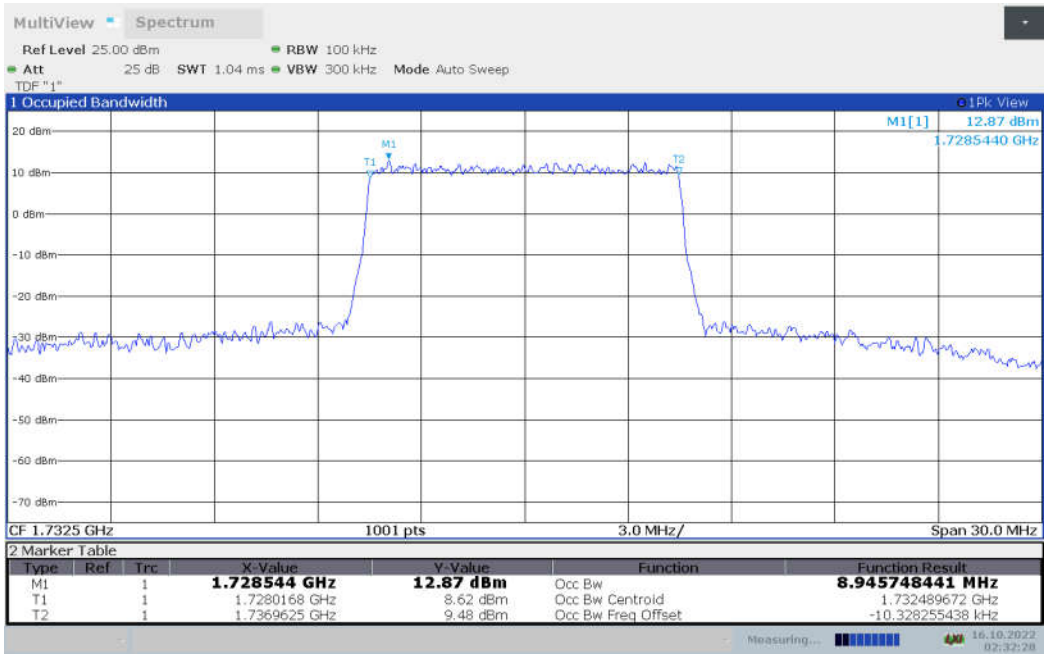
LTE band 4,10MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1732.5	8.962	8.946

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



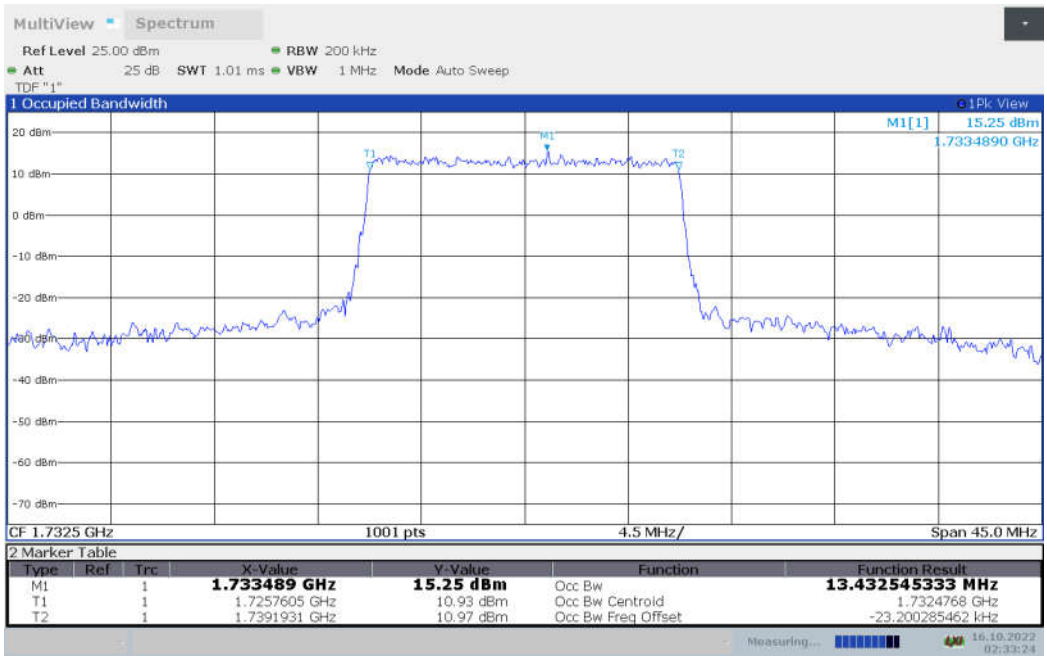
LTE band 4 , 10MHz Bandwidth,16QAM (99% BW)



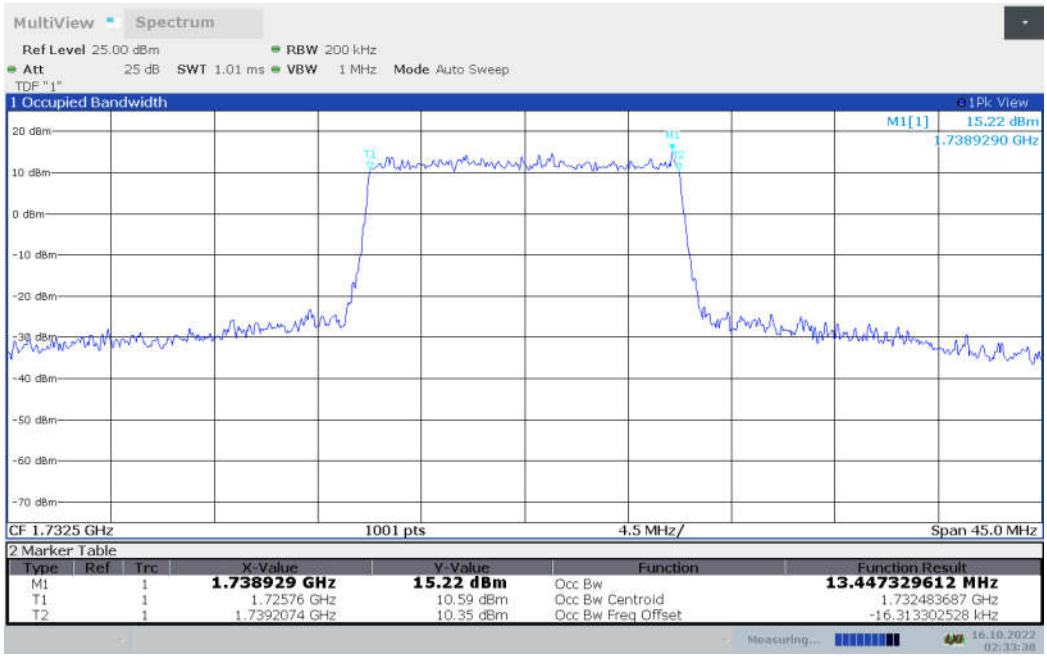
LTE band 4,15MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1732.5	13.433	13.447

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



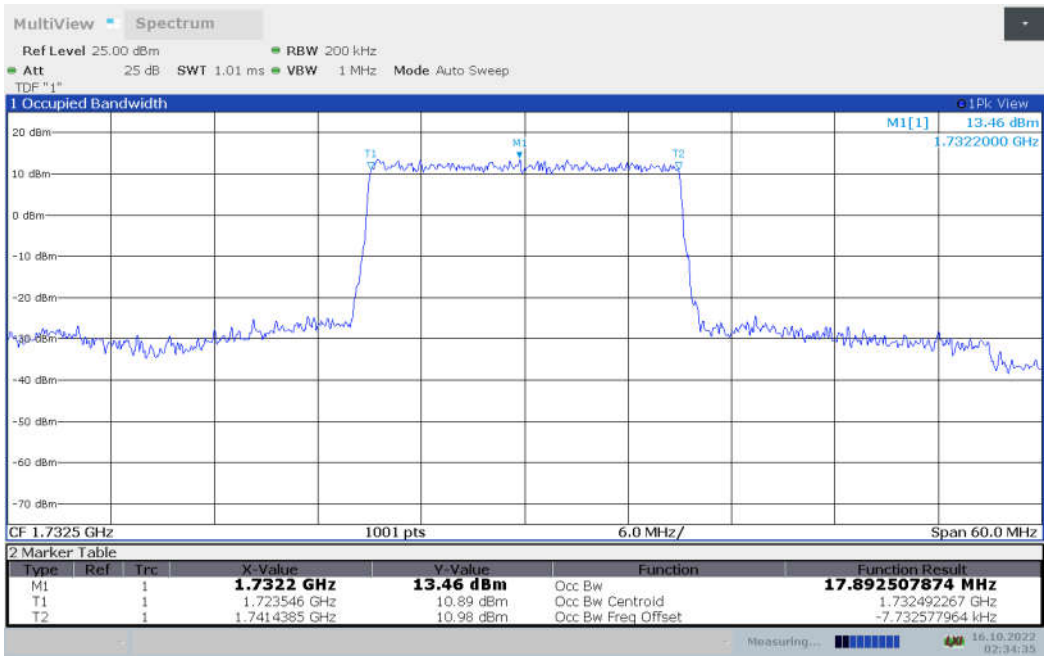
LTE band 4 , 15MHz Bandwidth,16QAM (99% BW)



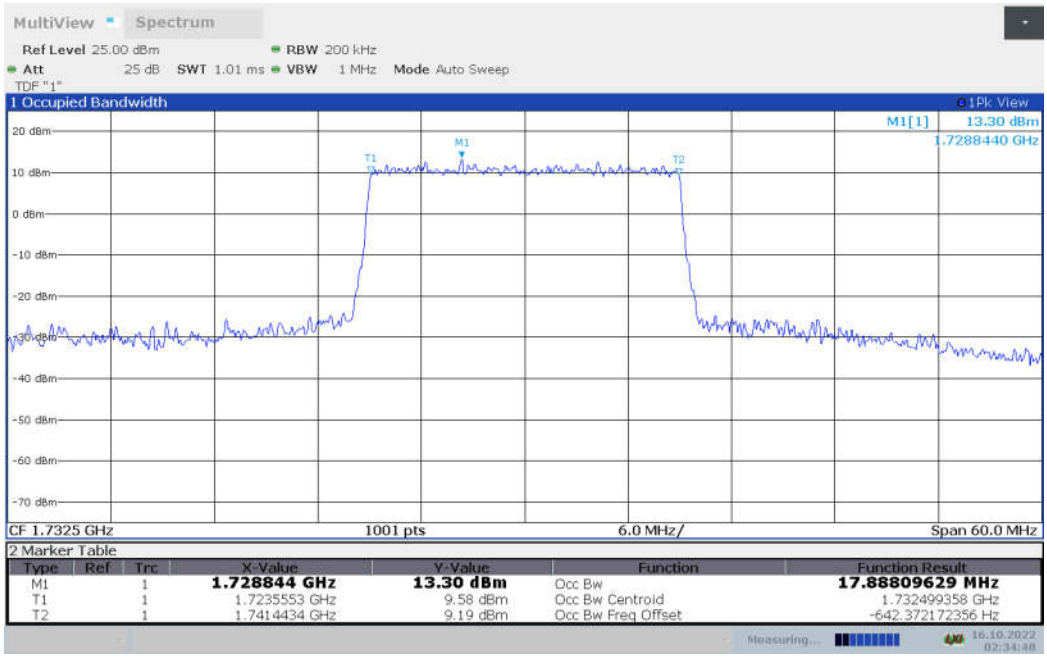
LTE band 4,20MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1732.5	17.893	17.888

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



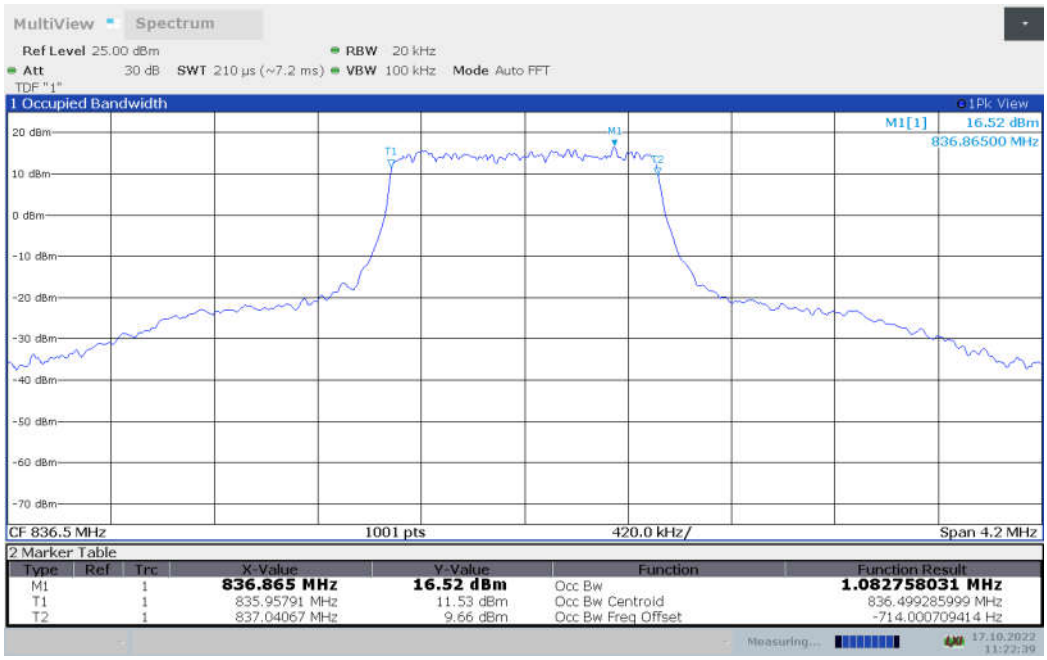
LTE band 4 , 20MHz Bandwidth,16QAM (99% BW)



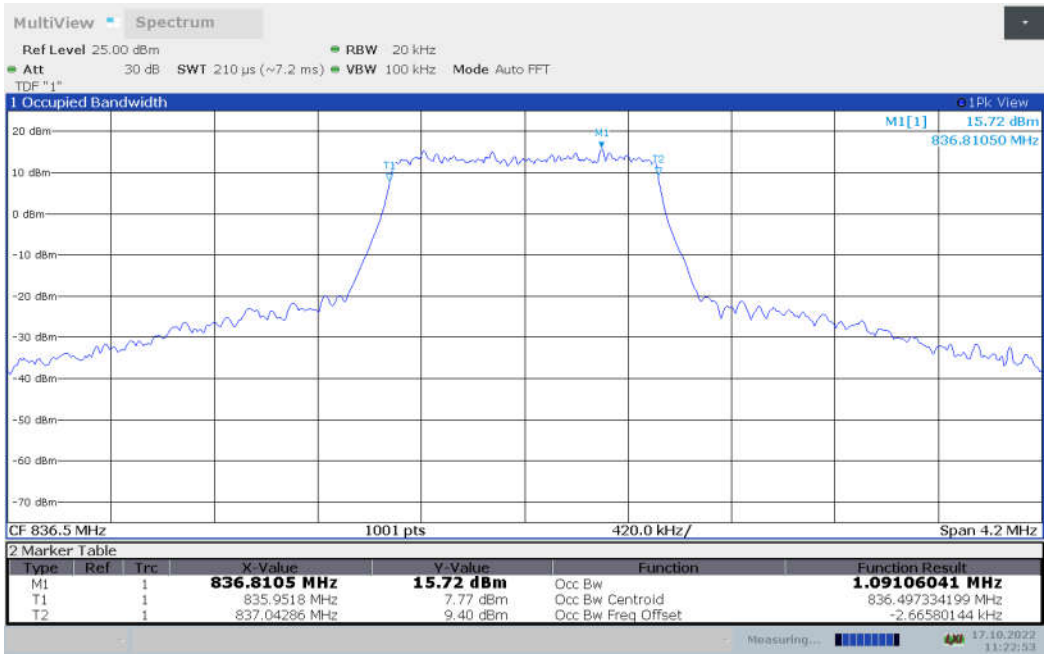
LTE band 5,1.4MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
836.5	1.083	1.091

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



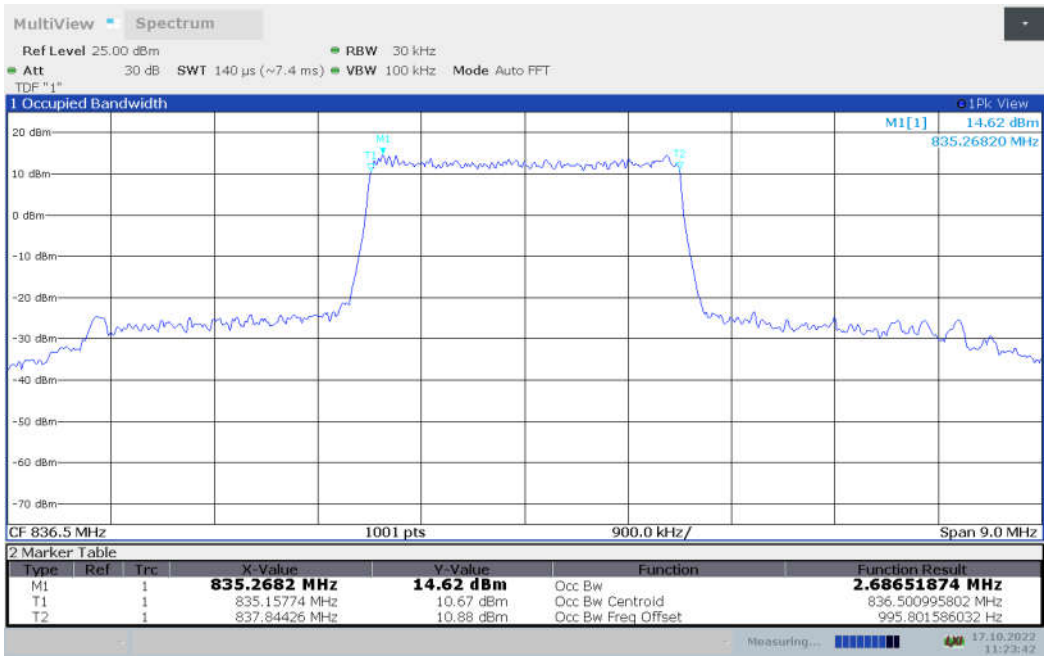
LTE band 5 , 1.4MHz Bandwidth,16QAM (99% BW)



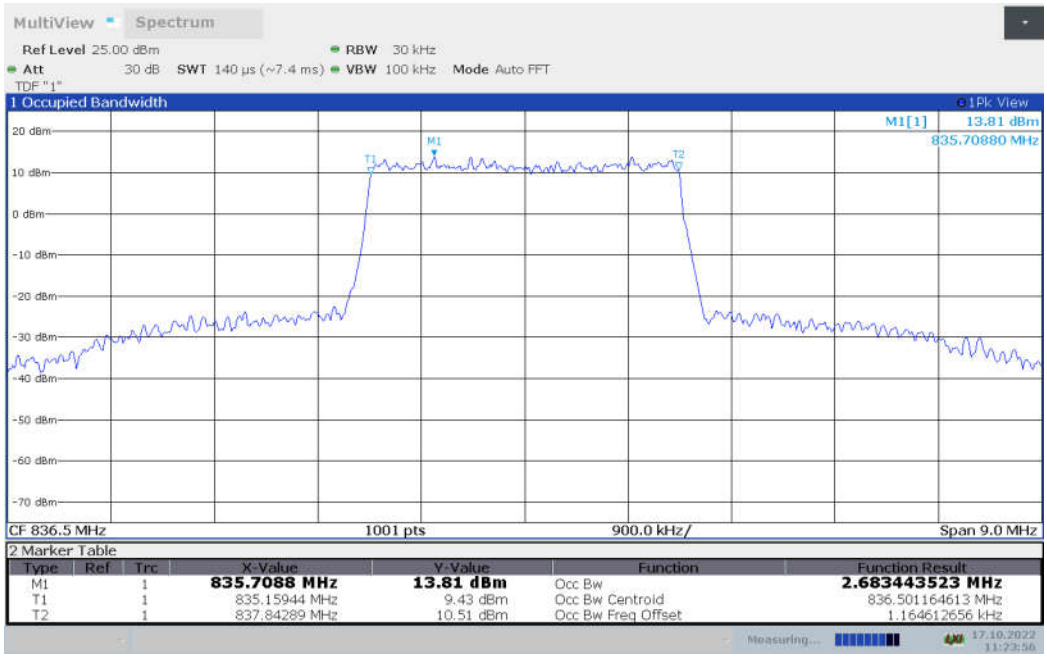
LTE band 5,3MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
836.5	2.687	2.683

LTE band 5 , 3MHz Bandwidth,QPSK (99% BW)



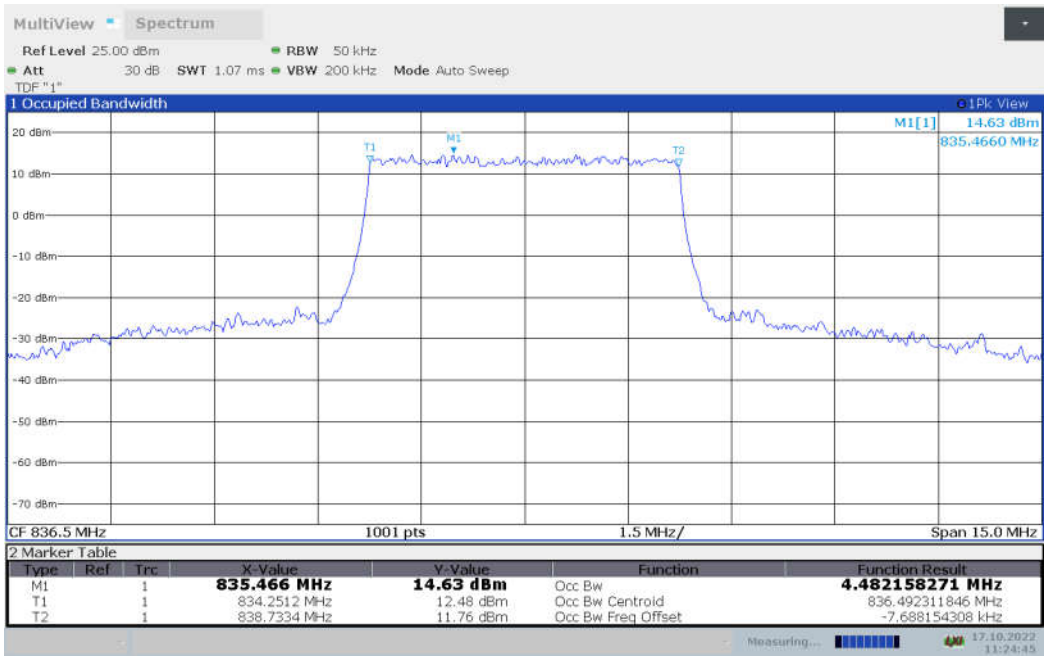
LTE band 5 , 3MHz Bandwidth,16QAM (99% BW)



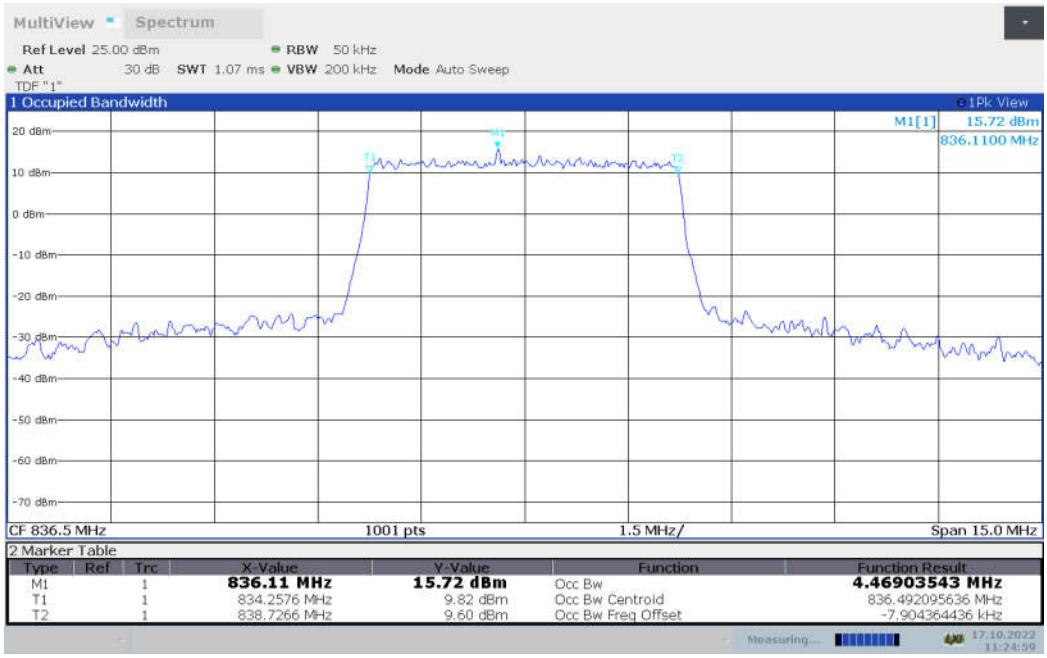
LTE band 5,5MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
836.5	4.482	4.469

LTE band 5 , 5MHz Bandwidth,QPSK (99% BW)



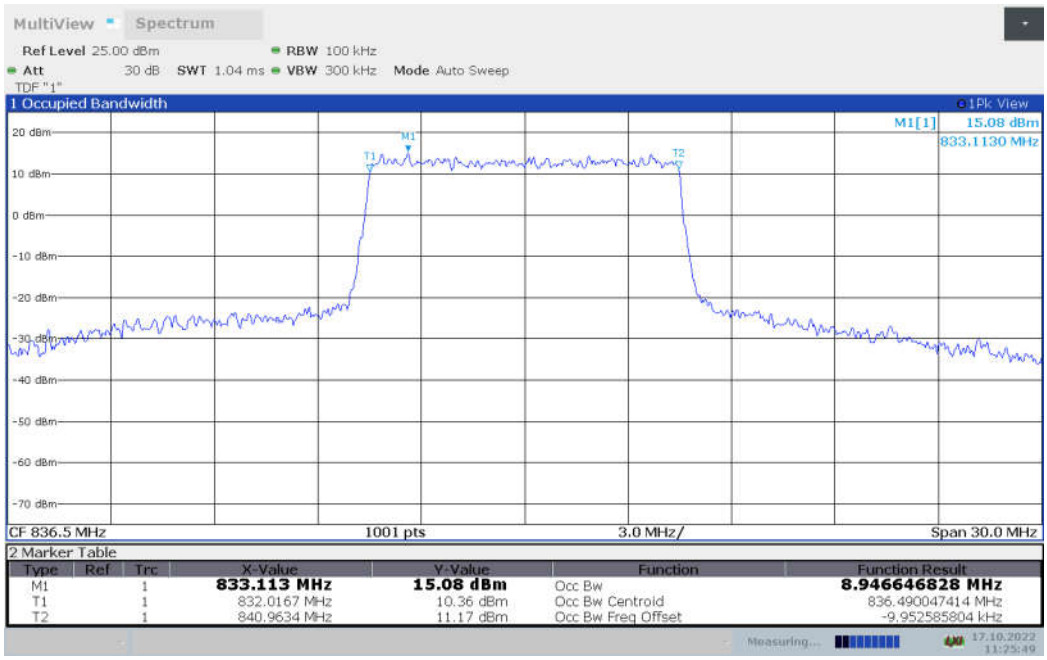
LTE band 5 , 5MHz Bandwidth,16QAM (99% BW)



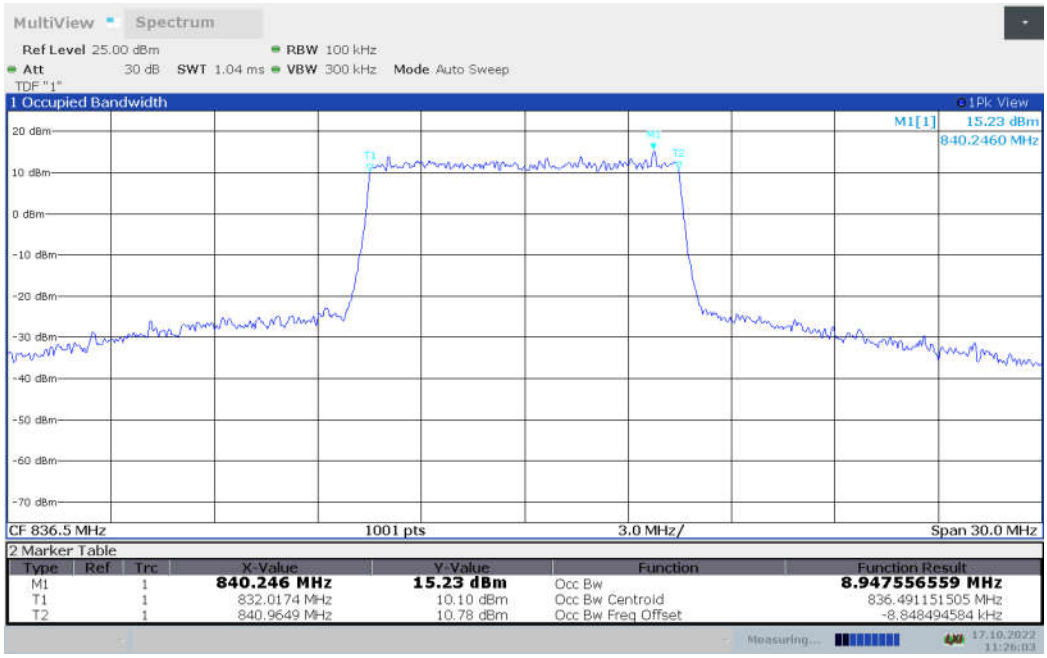
LTE band 5,10MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
836.5	8.947	8.948

LTE band 5 , 10MHz Bandwidth,QPSK (99% BW)



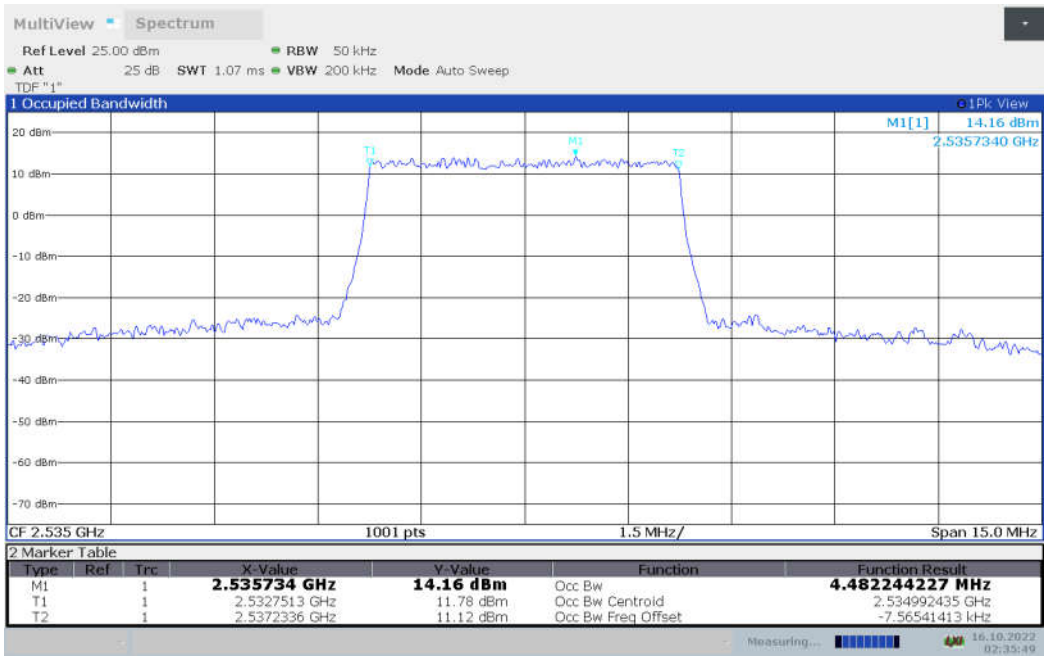
LTE band 5 , 10MHz Bandwidth,16QAM (99% BW)



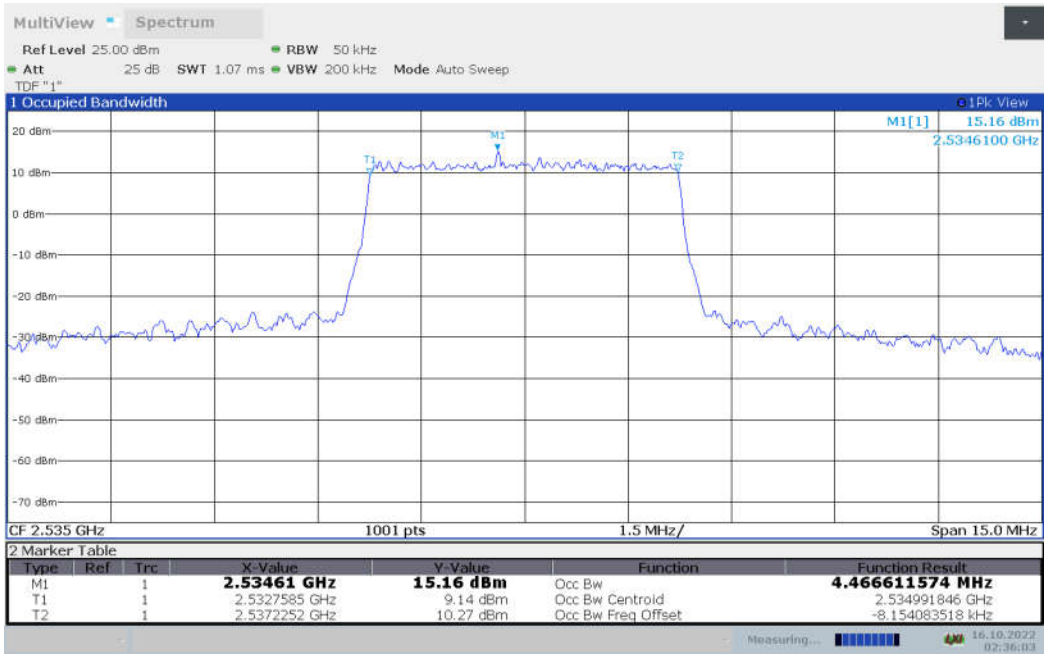
LTE band 7,5MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
2535	4.482	4.467

LTE band 7 , 5MHz Bandwidth,QPSK (99% BW)



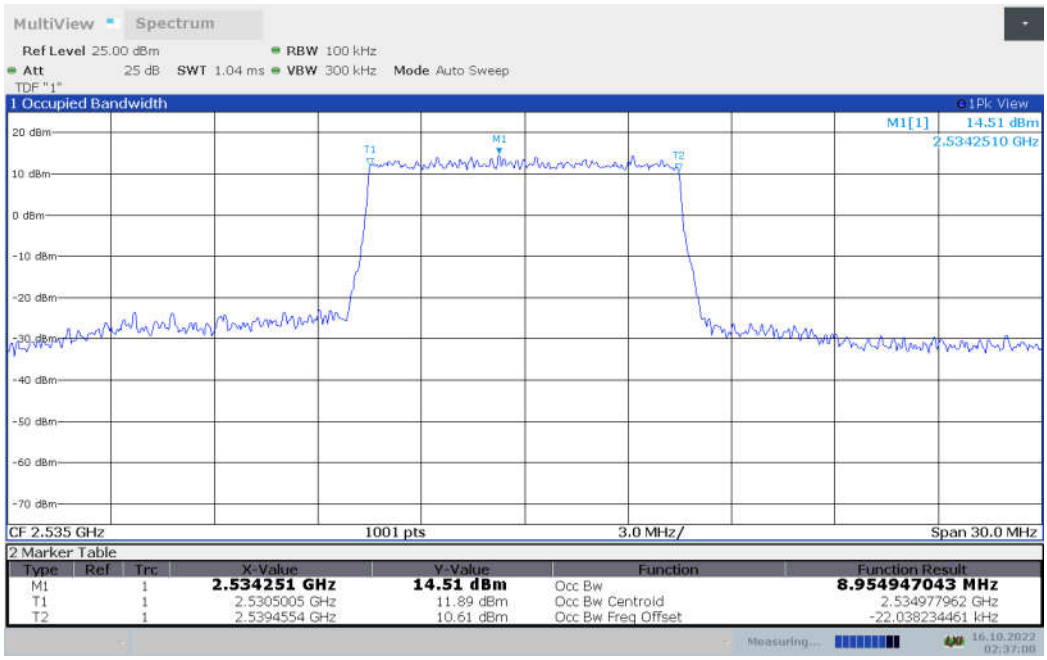
LTE band 7 , 5MHz Bandwidth,16QAM (99% BW)



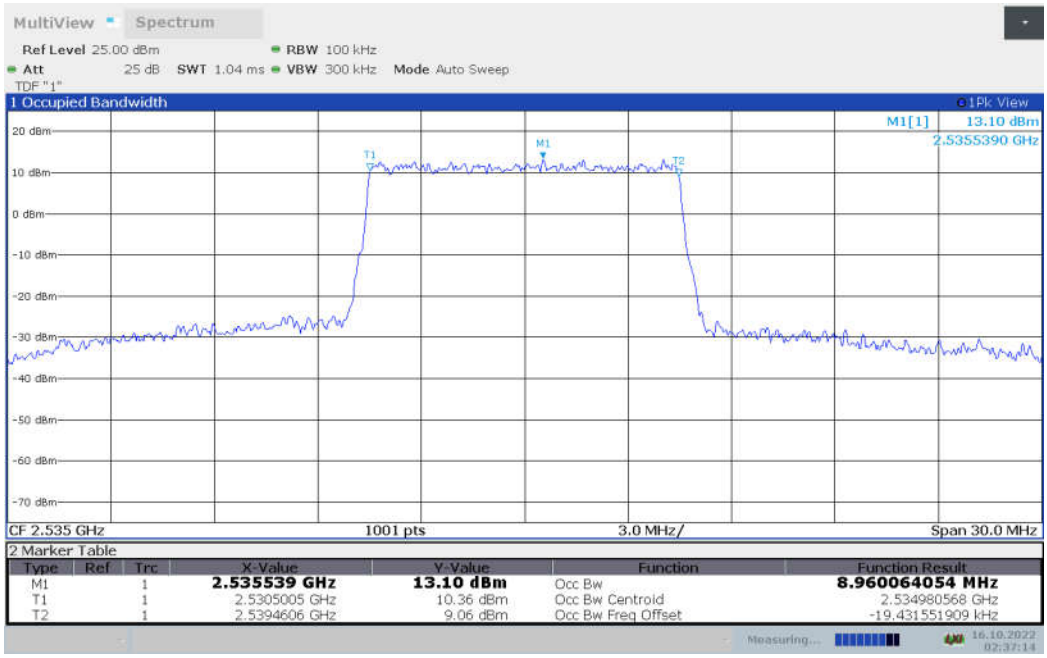
LTE band 7,10MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
2535	8.955	8.960

LTE band 7 , 10MHz Bandwidth,QPSK (99% BW)



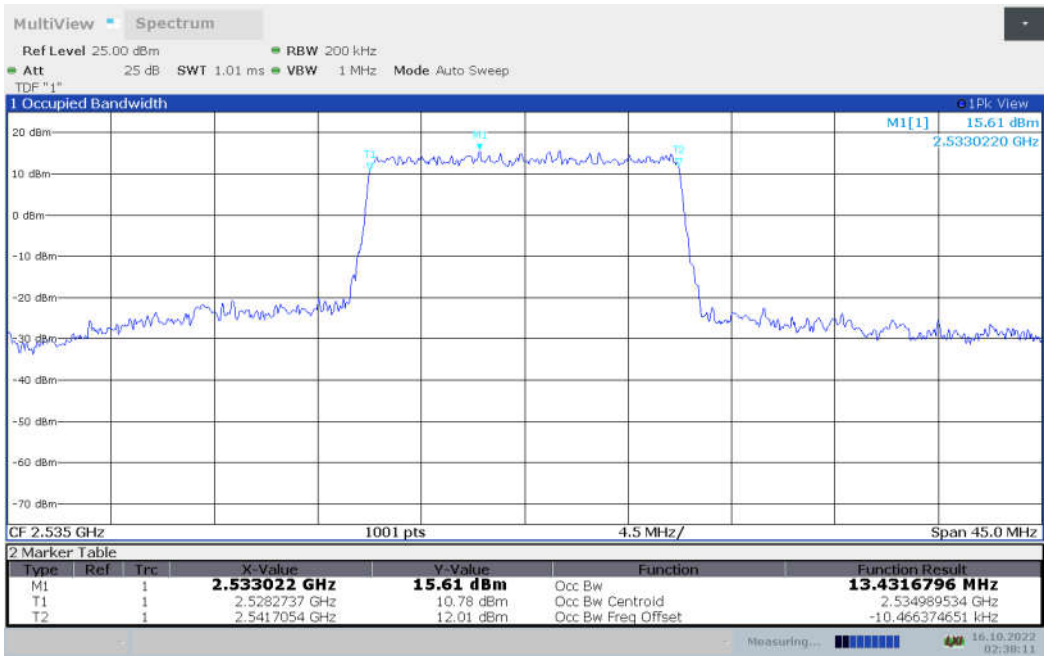
LTE band 7 , 10MHz Bandwidth,16QAM (99% BW)



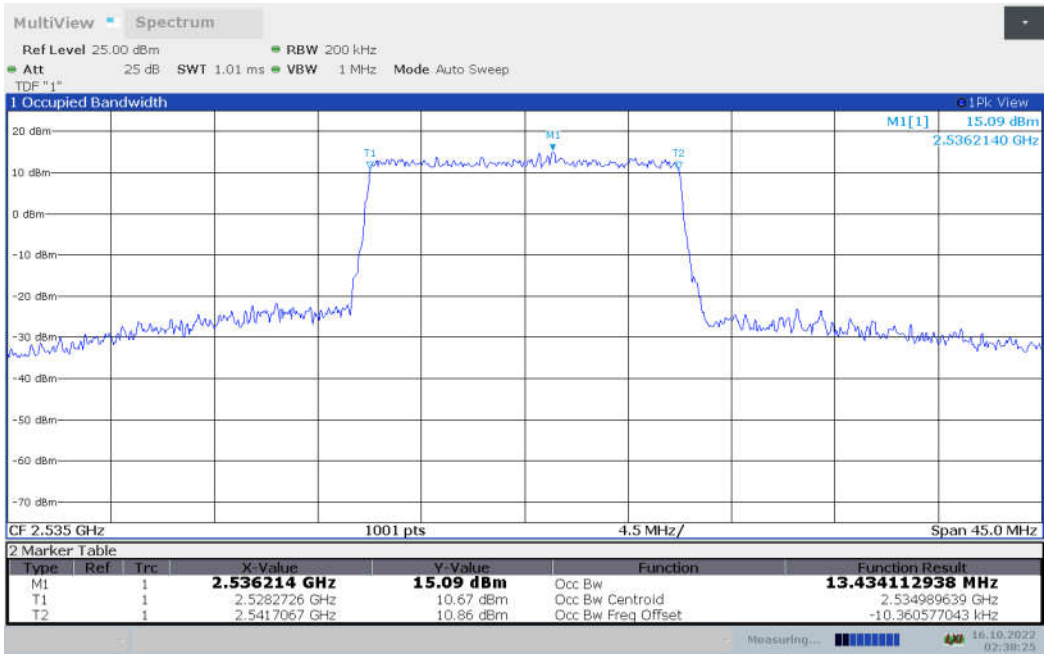
LTE band 7,15MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
2535	13.432	13.434

LTE band 7 , 15MHz Bandwidth,QPSK (99% BW)



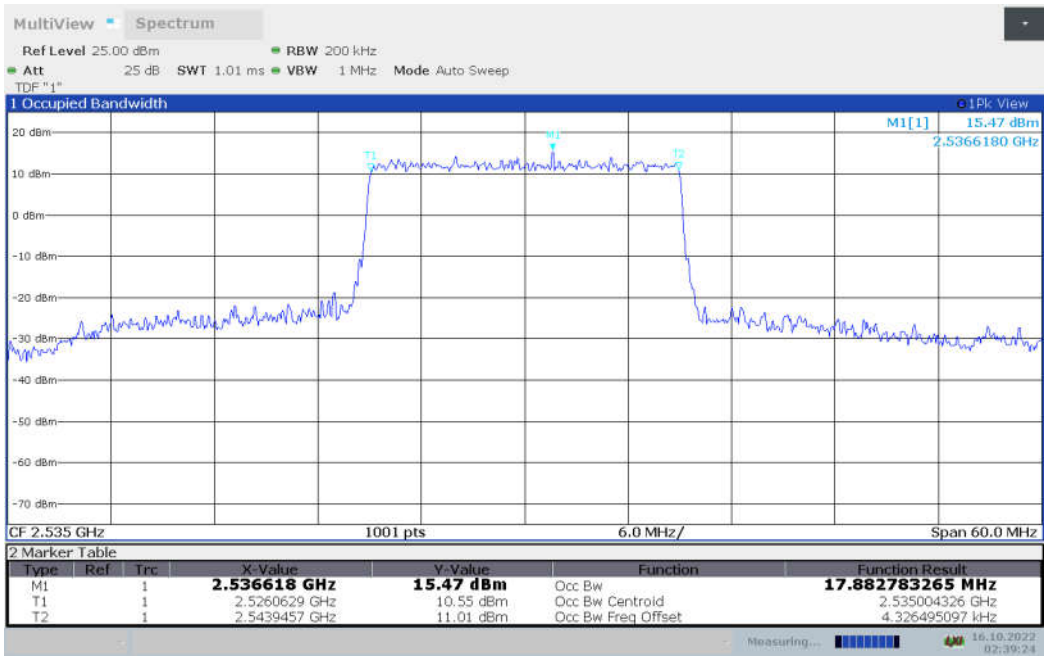
LTE band 7 , 15MHz Bandwidth,16QAM (99% BW)



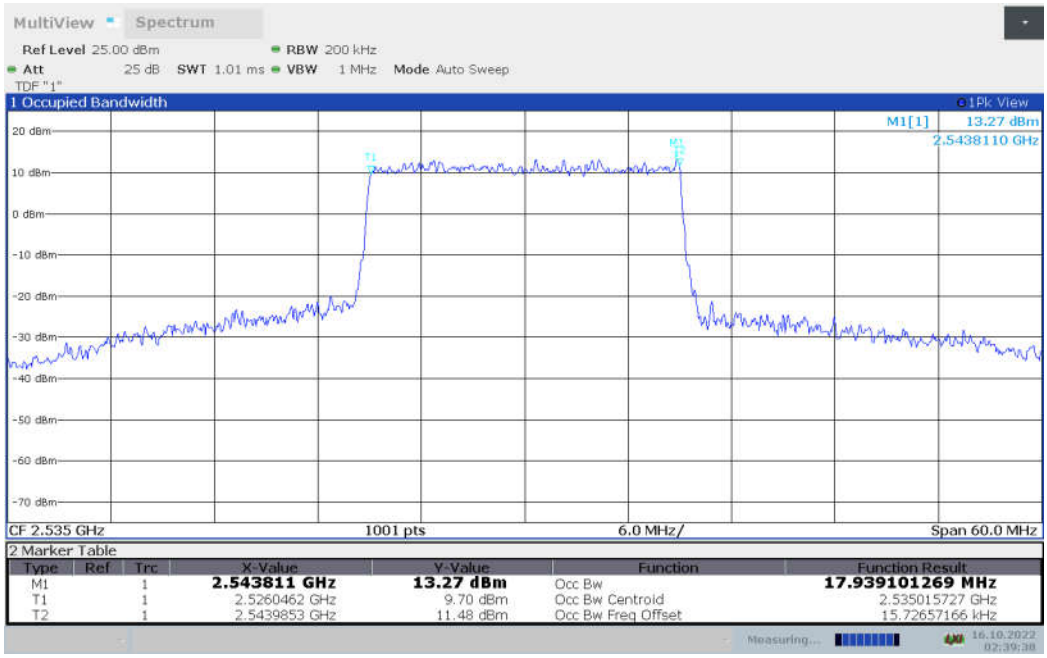
LTE band 7,20MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
2535	17.883	17.939

LTE band 7 , 20MHz Bandwidth,QPSK (99% BW)



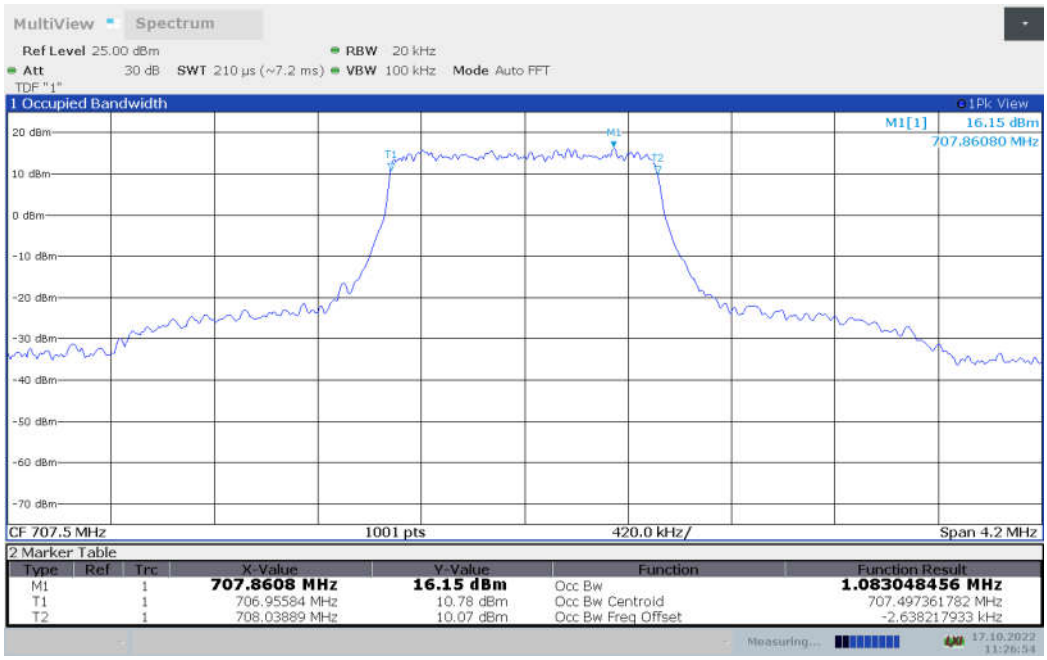
LTE band 7 , 20MHz Bandwidth,16QAM (99% BW)



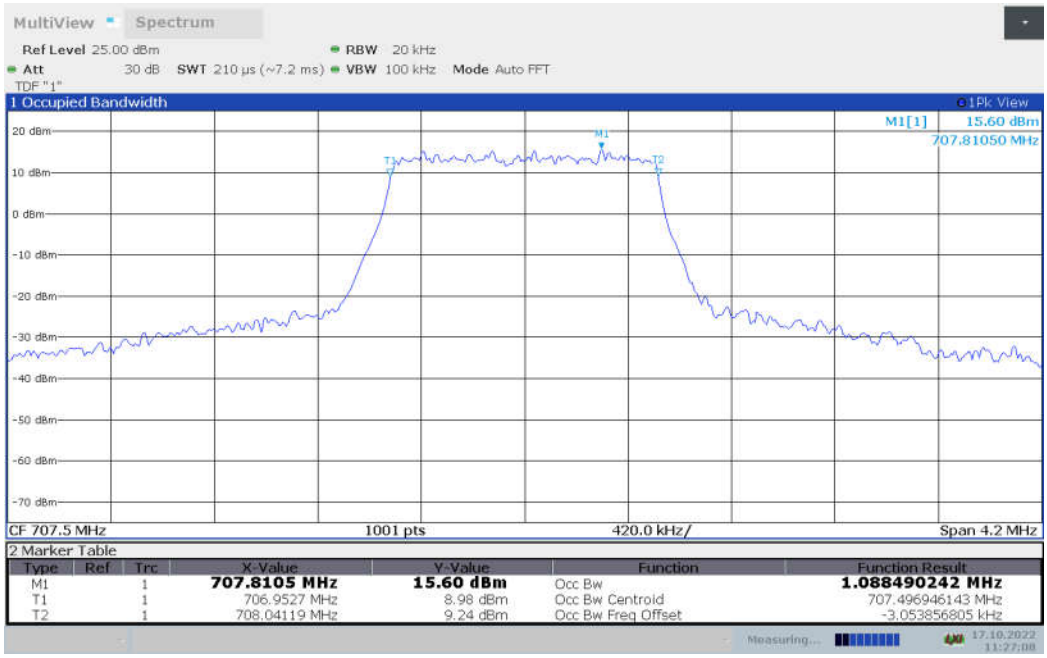
LTE band 12,1.4MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
707.5	1.083	1.088

LTE band 12 , 1.4MHz Bandwidth,QPSK (99% BW)



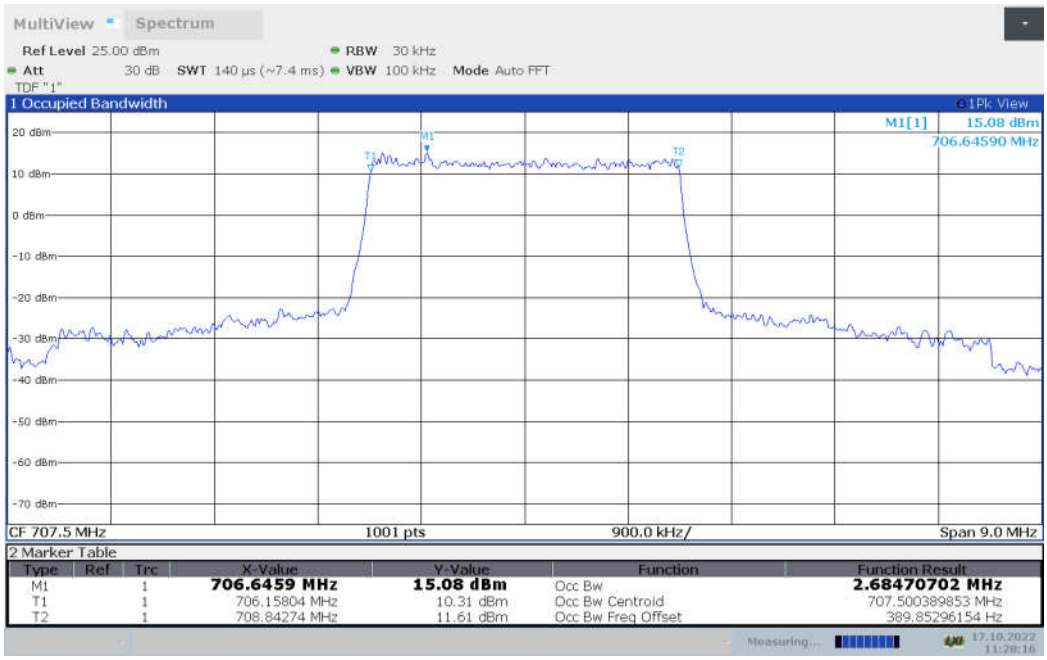
LTE band 12 , 1.4MHz Bandwidth,16QAM (99% BW)



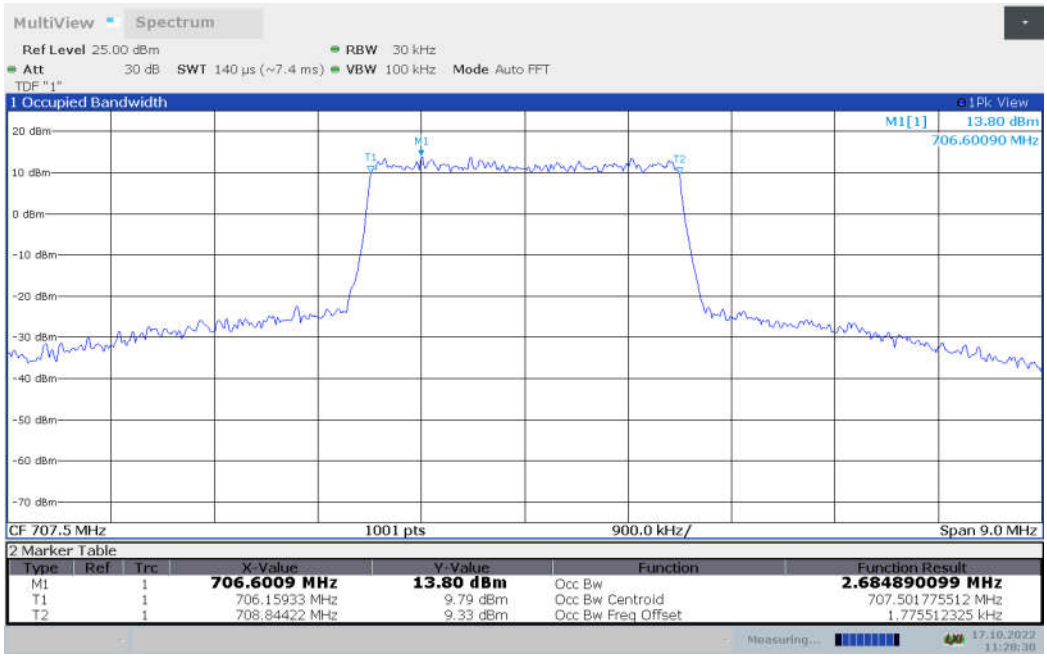
LTE band 12,3MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
707.5	2.685	2.685

LTE band 12 , 3MHz Bandwidth,QPSK (99% BW)



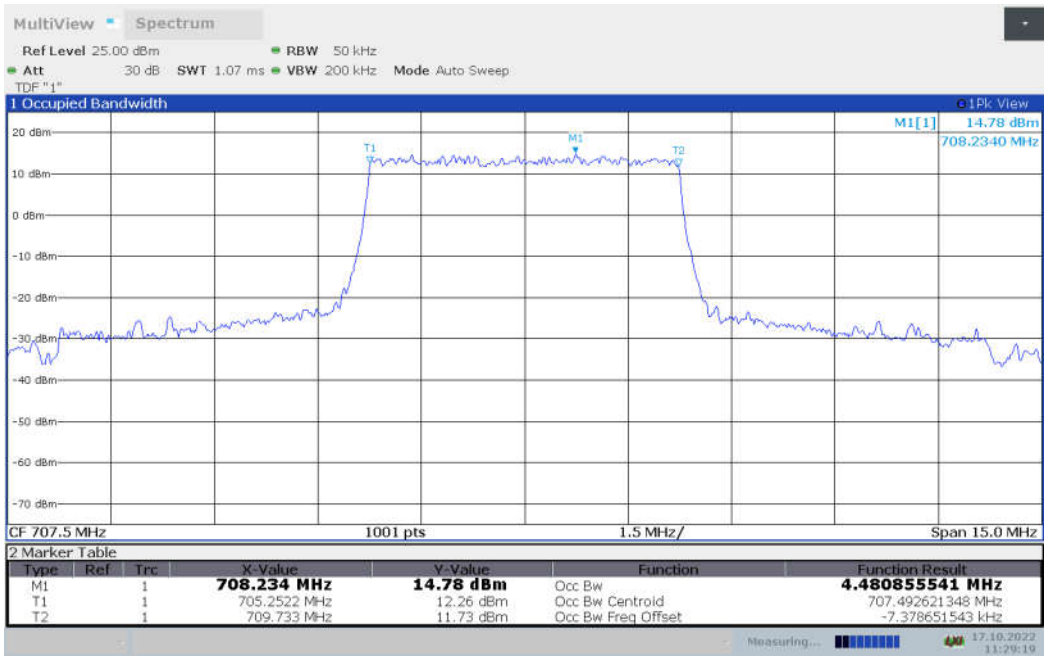
LTE band 12 , 3MHz Bandwidth,16QAM (99% BW)



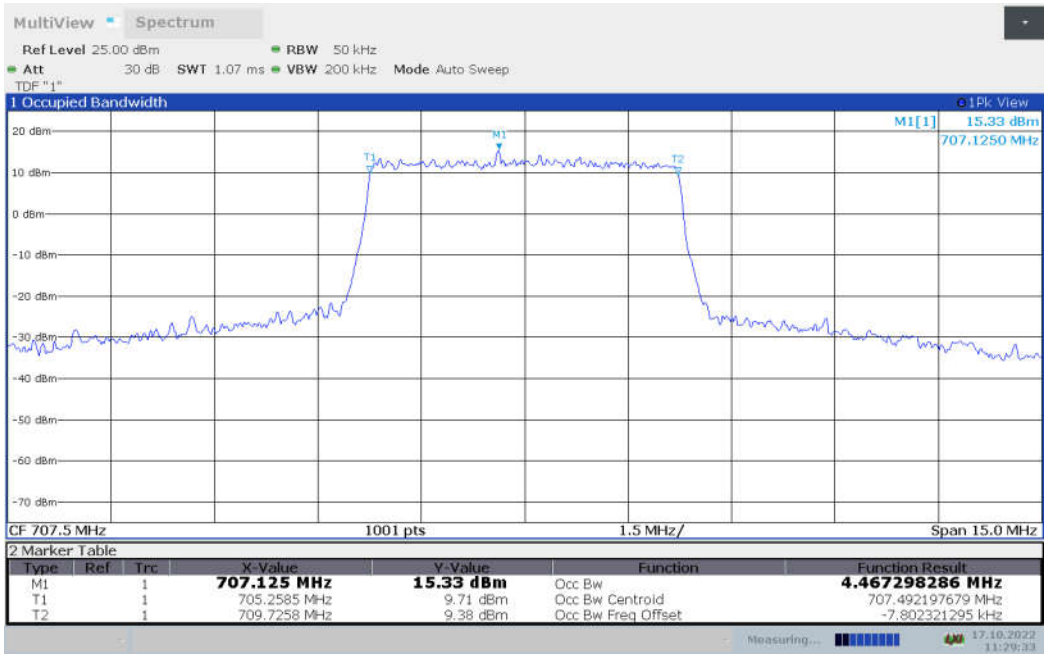
LTE band 12,5MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
707.5	4.481	4.467

LTE band 12 , 5MHz Bandwidth,QPSK (99% BW)



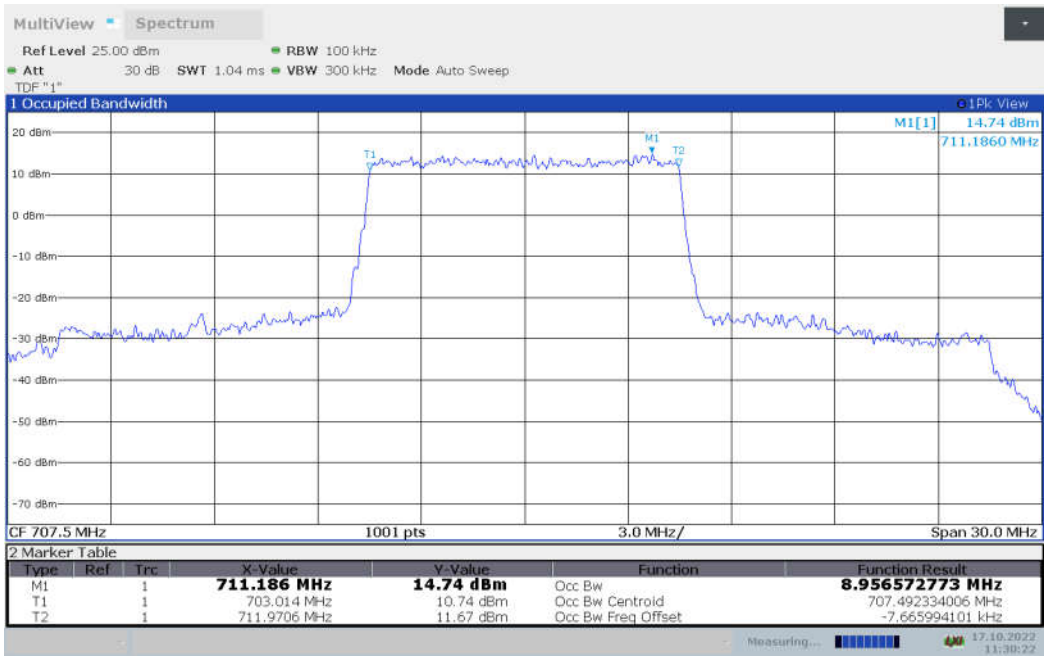
LTE band 12 , 5MHz Bandwidth,16QAM (99% BW)



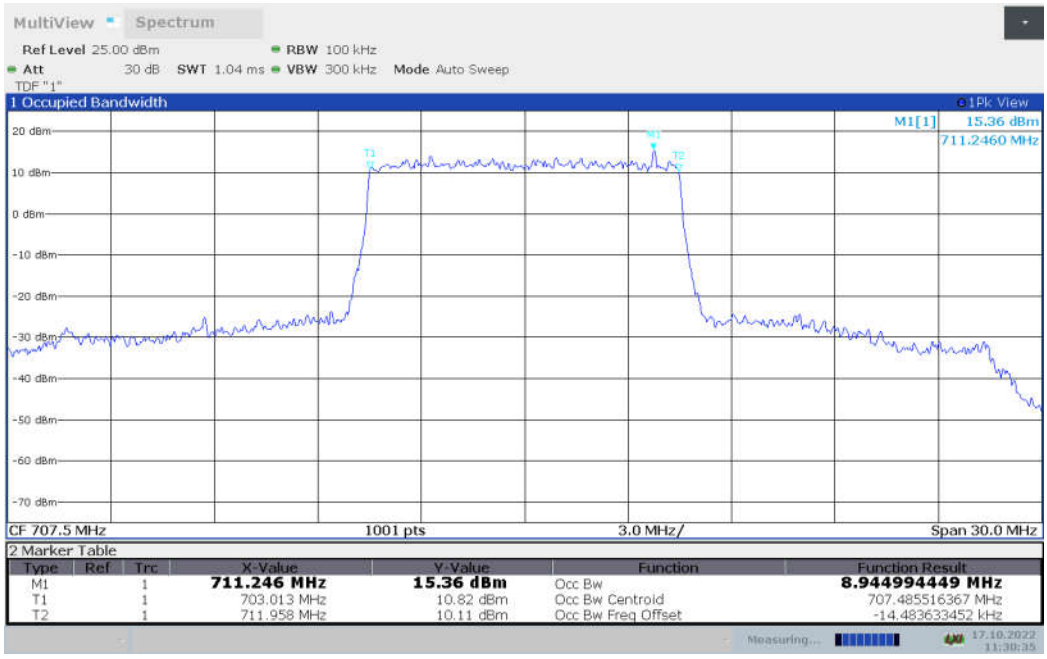
LTE band 12,10MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
707.5	8.957	8.945

LTE band 12 , 10MHz Bandwidth,QPSK (99% BW)



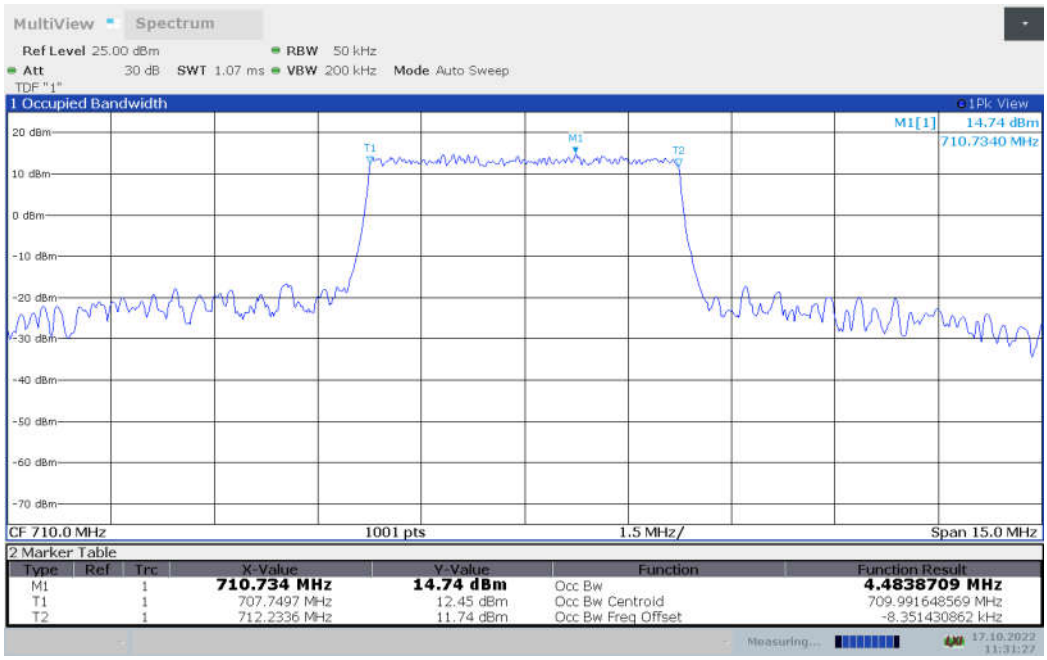
LTE band 12 , 10MHz Bandwidth,16QAM (99% BW)



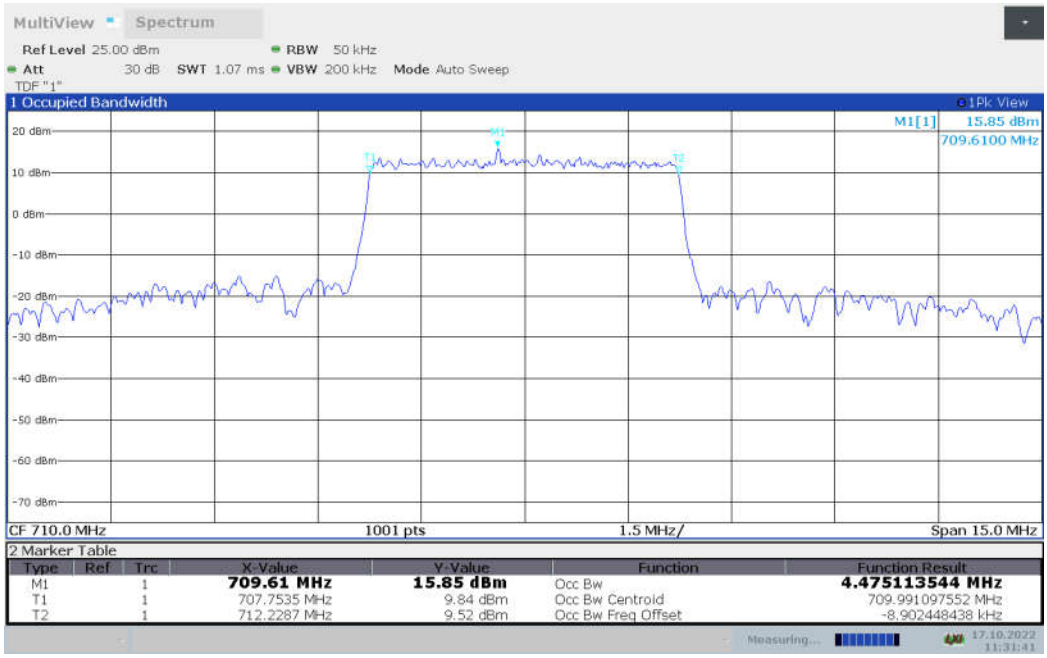
LTE band 17,5MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
710	4.484	4.475

LTE band 17 , 5MHz Bandwidth,QPSK (99% BW)



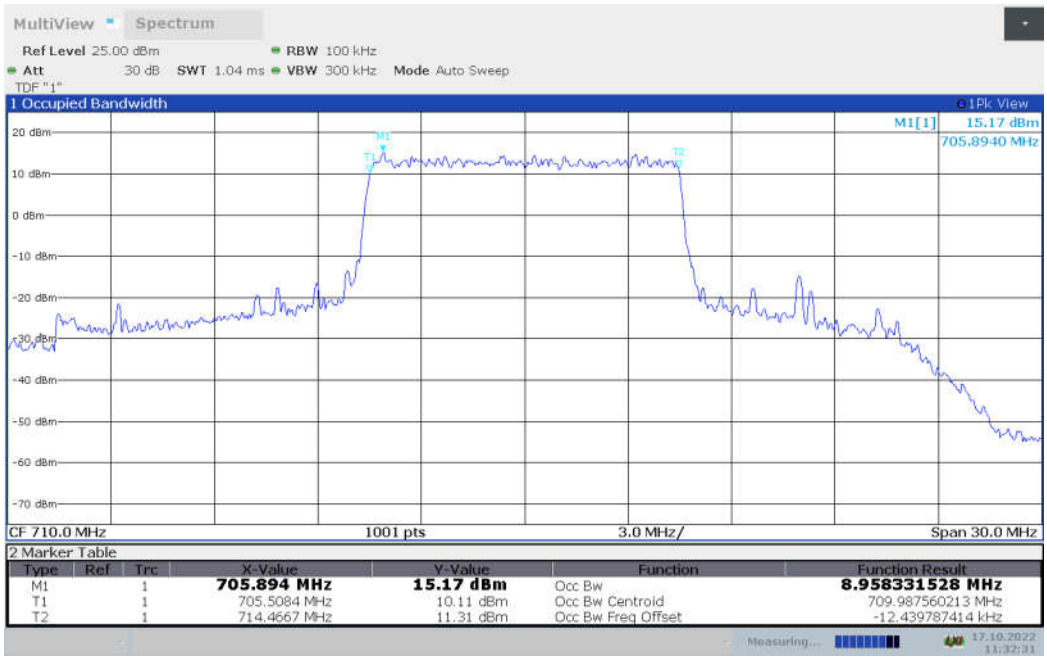
LTE band 17 , 5MHz Bandwidth,16QAM (99% BW)



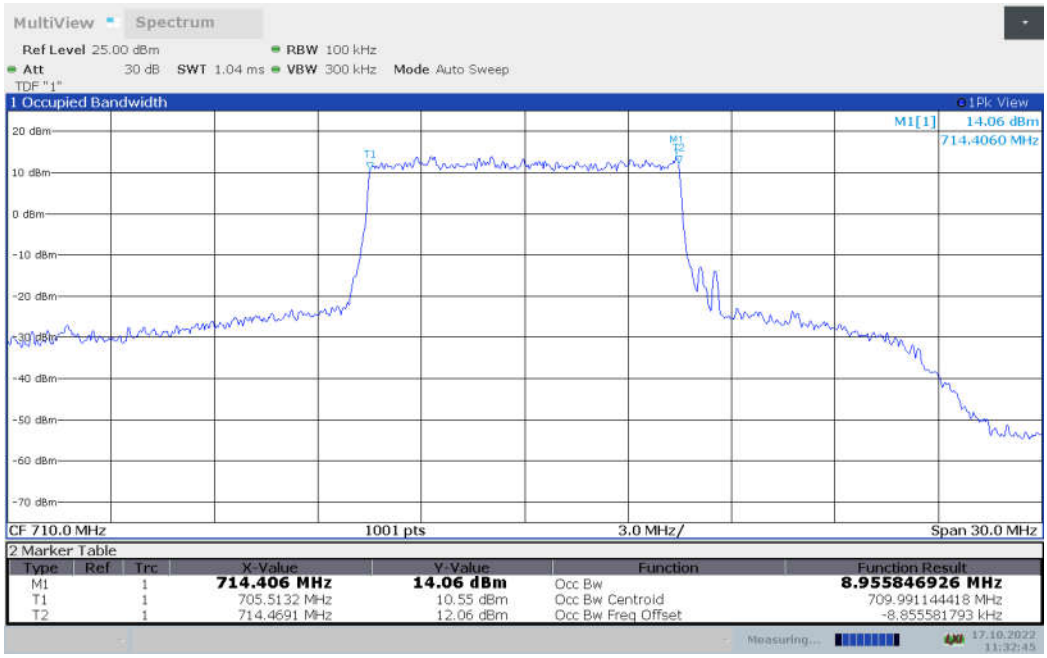
LTE band 17,10MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
710	8.958	8.956

LTE band 17 , 10MHz Bandwidth,QPSK (99% BW)



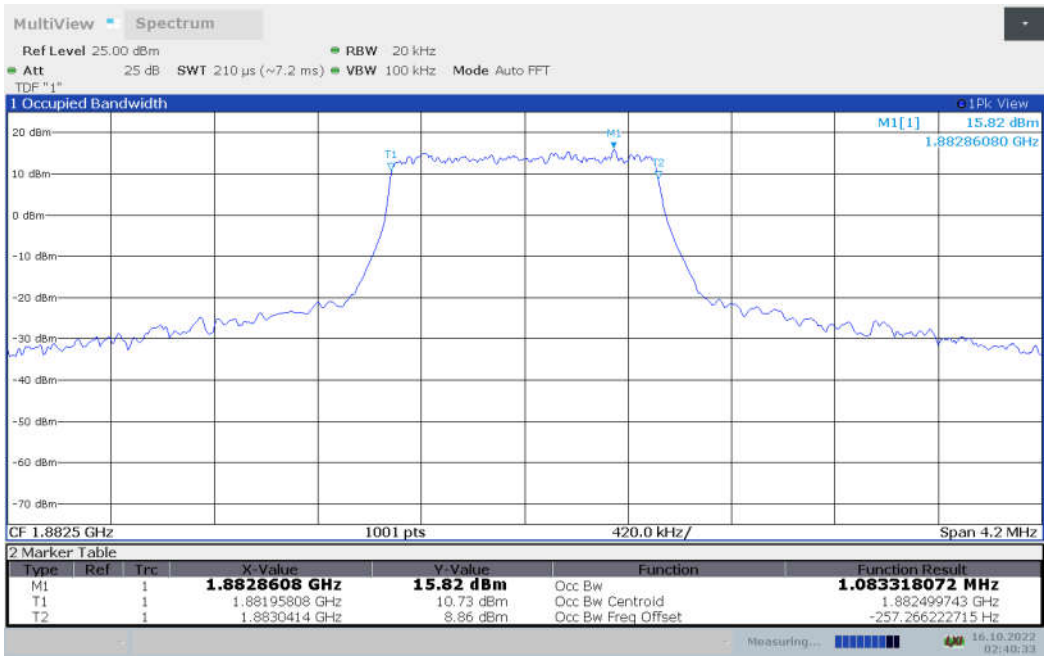
LTE band 17 , 10MHz Bandwidth,16QAM (99% BW)



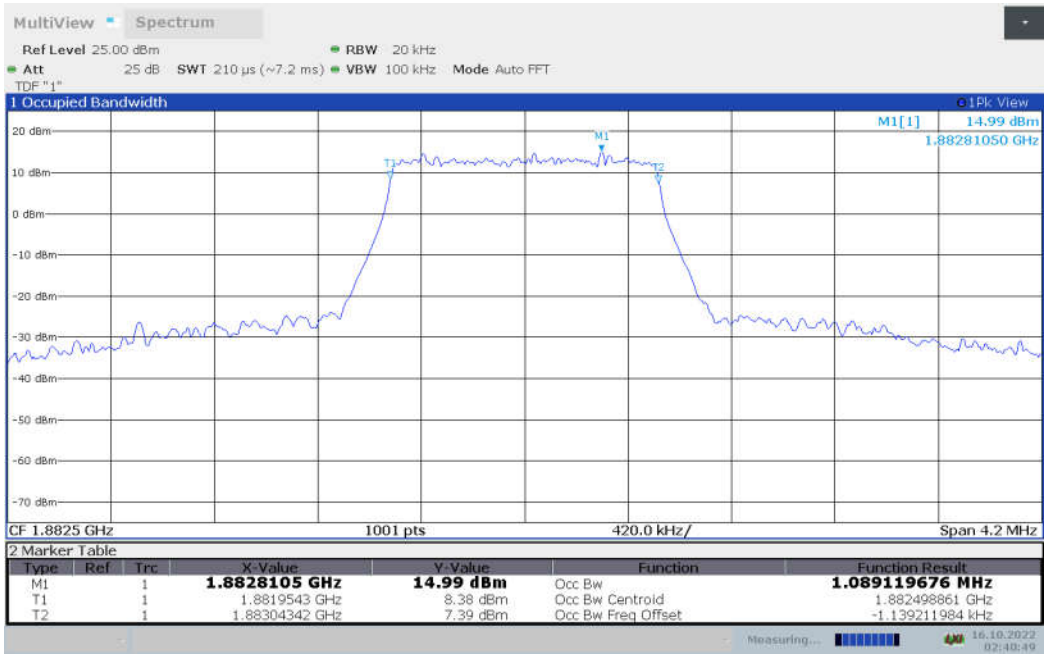
LTE band 25,1.4MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1882.5	1.083	1.089

LTE band 25 , 1.4MHz Bandwidth,QPSK (99% BW)



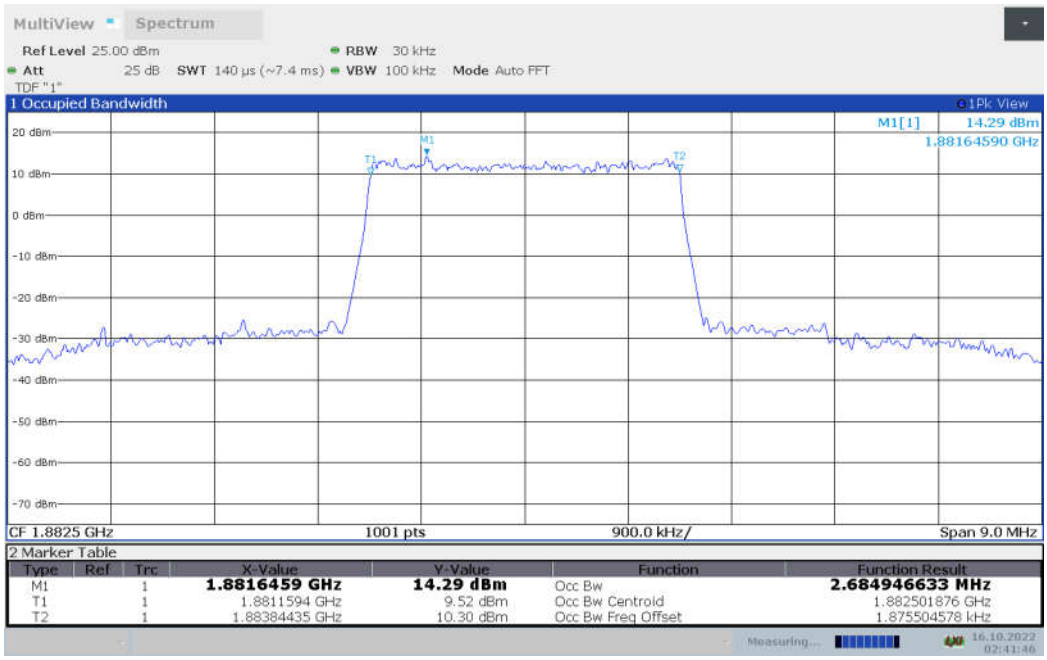
LTE band 25 , 1.4MHz Bandwidth,16QAM (99% BW)



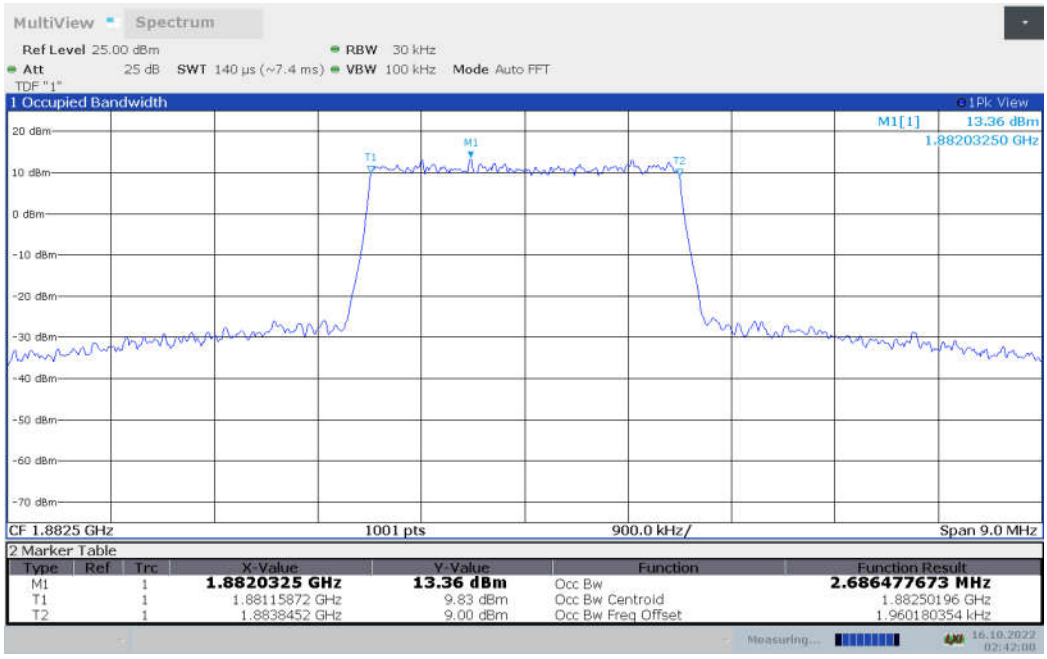
LTE band 25,3MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1882.5	2.685	2.686

LTE band 25 , 3MHz Bandwidth,QPSK (99% BW)



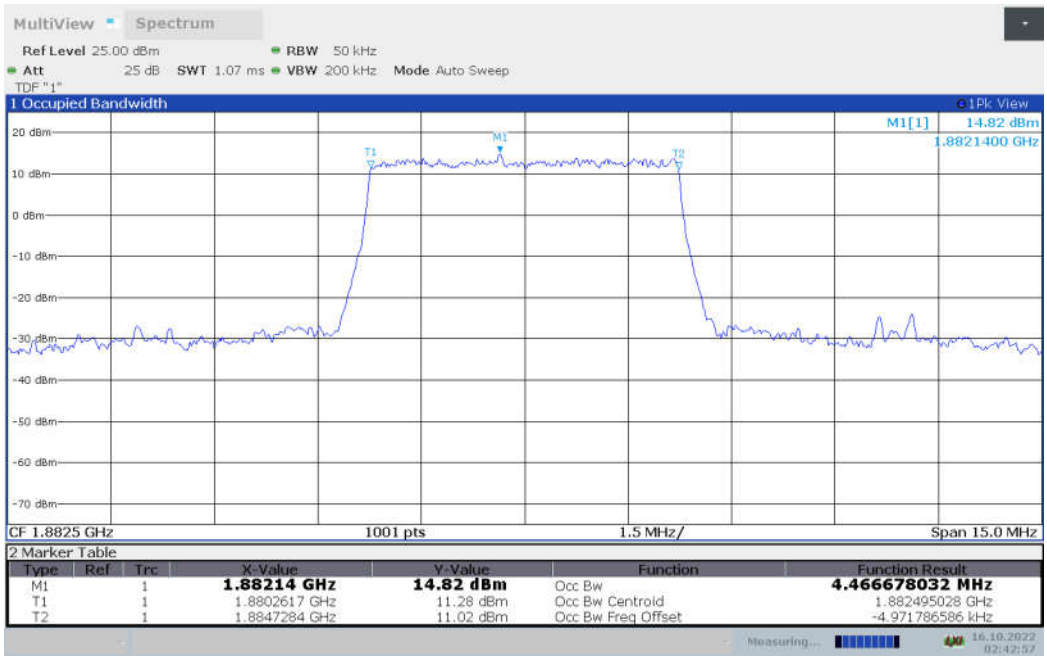
LTE band 25 , 3MHz Bandwidth,16QAM (99% BW)



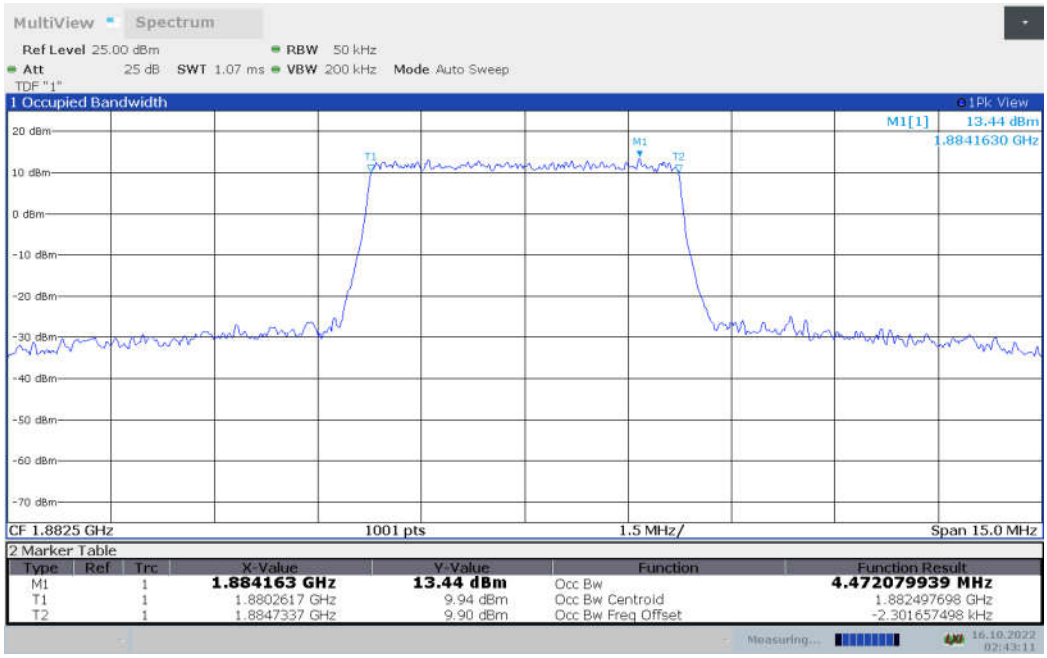
LTE band 25,5MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1882.5	4.467	4.472

LTE band 25 , 5MHz Bandwidth,QPSK (99% BW)



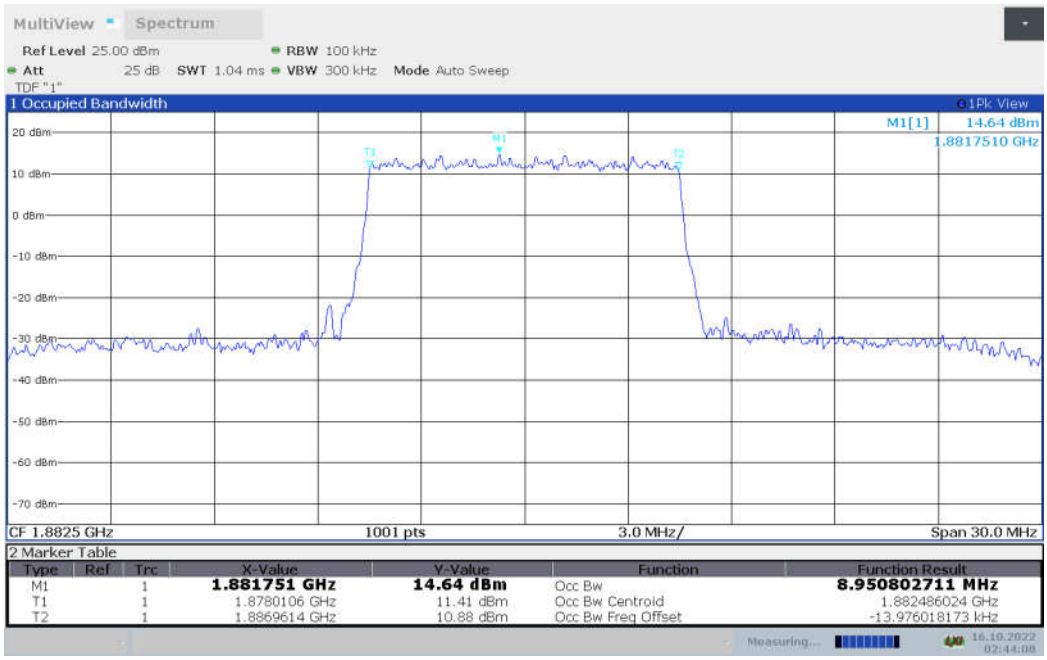
LTE band 25 , 5MHz Bandwidth,16QAM (99% BW)



LTE band 25,10MHz (99% BW)

Frequency (MHz)	Occupied Bandwidth (99% BW)(MHz)	
	QPSK	16QAM
1882.5	8.951	8.958

LTE band 25 , 10MHz Bandwidth,QPSK (99% BW)



LTE band 25 , 10MHz Bandwidth,16QAM (99% BW)