

## ANALYZER SETTINGS:

RBW = VBW = 8MHz for occupied bandwidths equal to or less than 5MHz.

RBW = VBW = 20MHz for occupied bandwidths equal to or greater than 10MHz.

## ANNEX A.2. EMISSION LIMIT

### Reference

FCC: CFR 2.1051, 22.917,24.238(a), 27.53(g), 27.53(h) , 27.53(m).

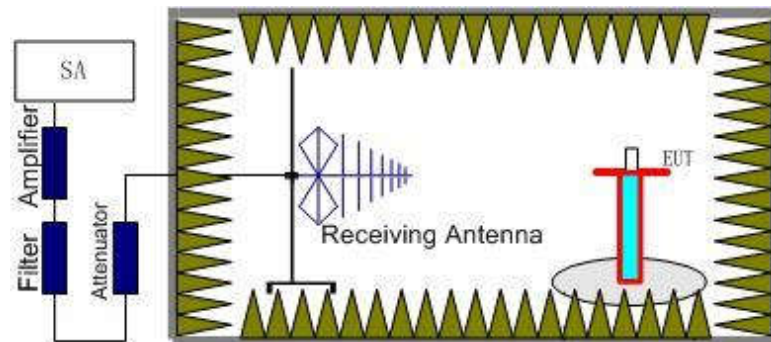
### A.2.1 Measurement Method

The measurements procedures in TIA-603E-2016 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

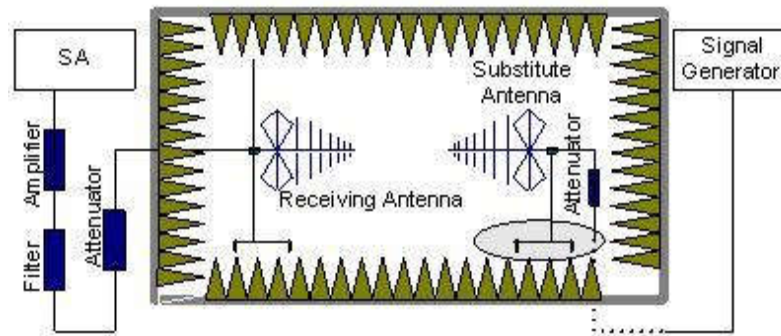
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 22.917,Part 24.238(a), Part 27.53(g), Part 27.53(h), Part 27.53(m). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 2,4,5,7,12,13,17,25,26,41,66.

### The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss ( $P_{pl}$ ) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain ( $G_a$ ) should be recorded after test.

An amplifier should be connected in for the test.

The Path loss ( $P_{pl}$ ) is the summation of the cable loss and the gain of the amplifier.

The measurement results are obtained as described below:

$$\text{Power (EIRP)} = P_{Mea} + P_{pl} + G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit: dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dB.

## A.2.2 Measurement Limit

Part 22.917, Part 24.238(a), Part 27.53(g), Part 27.53(h), Part 27.53(m) all specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power ( $P$ ) by a factor of at least  $43 + 10 \log(P)$  dB. The specification that emissions shall be attenuated below the transmitter power ( $P$ ) by at least  $43 + 10 \log(P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

## A.2.3 Measurement Results

7. Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Bands 2,4,5,7,12,13,17,25,26,41,66. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE Bands

2,4,5,7,12,13,17,25,26,41,66. into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this. The evaluated frequency range is from 30MHz to 26GHz.

**LTE Band 2, 1.4MHz, QPSK, Channel 18607**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3700.4	-31.86	6.6	7.7	-30.76	-13	V
5550.8	-27.66	8.2	9.5	-26.36	-13	V
7401.2	-50.72	9.7	14.6	-45.82	-13	V
9251.2	-52.04	10.6	18.5	-44.14	-13	V
11186.2	-50.46	12.1	18.5	-44.06	-13	V
12944.6	-47.36	13.0	20.2	-40.16	-13	H

**LTE Band 2, 1.4MHz, QPSK, Channel 18900**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3758.8	-31.54	6.6	7.7	-30.44	-13	V
5638.8	-28.64	8.3	10.5	-26.44	-13	V
7518.0	-49.43	9.7	14.6	-44.53	-13	V
9397.6	-50.57	10.7	18.6	-42.67	-13	V
11284.2	-50	12.1	18.5	-43.6	-13	H
12989.4	-46.99	13.2	20.2	-39.99	-13	H

**LTE Band 2, 1.4MHz, QPSK, Channel 19193**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3817.6	-33.57	6.7	7.7	-32.57	-13	V
5726.8	-30.97	8.5	10.5	-28.97	-13	V
7635.2	-53.05	9.7	15.3	-47.45	-13	V
9544.0	-49.22	10.7	18.6	-41.32	-13	V
11281.4	-49.67	12.1	18.5	-43.27	-13	H
13248.4	-48.61	13.0	21.8	-39.81	-13	V

**LTE Band 4, 1.4MHz QPSK, Channel 19957**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3420.4	-28.34	6.3	4.7	-29.94	-13	V
5130.8	-23.32	7.9	8.7	-22.52	-13	V
6841.2	-49	9.2	12.3	-45.9	-13	V
8550.8	-50.24	10.3	18.1	-42.44	-13	V
10216.0	-51.09	11.3	17.4	-44.99	-13	V
11963.2	-46.93	12.6	17.1	-42.43	-13	H

**LTE Band 4, 1.4MHz, QPSK, Channel 20175**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3464.0	-29.12	6.4	4.7	-30.82	-13	V
5196.0	-25.35	8.0	8.7	-24.65	-13	H
6928.4	-41.16	9.3	12.9	-37.56	-13	V
8660.0	-47.17	10.3	18.5	-38.97	-13	H
10448.8	-51.34	11.6	17.1	-45.84	-13	V
12124.2	-44.92	12.6	17.1	-40.42	-13	H

**LTE Band 4, 1.4MHz, QPSK, Channel 20393**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3507.6	-24.32	6.4	4.7	-26.02	-13	V
4509.2	-50.94	7.3	7.3	-50.94	-13	H
5261.6	-20.65	8.0	8.7	-19.95	-13	H
7015.6	-46.49	9.3	12.9	-42.89	-13	H
8769.2	-50.85	10.4	18.5	-42.75	-13	V
11621.6	-48.71	12.2	18.1	-42.81	-13	V

**LTE Band 5, 1.4MHz, QPSK, Channel 20407**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1271.0	-48.57	3.8	2.0	-50.37	-13	V
1823.1	-39.4	4.6	2.9	-41.1	-13	V
2472.7	-36.86	5.3	3.7	-38.46	-13	V
3568.4	-50.28	6.4	4.7	-51.98	-13	H
4532.0	-50.54	7.4	7.3	-50.64	-13	H
5938.4	-53.03	8.5	10.4	-51.13	-13	H

**LTE Band 5, 1.4MHz, QPSK, Channel 20525**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1672.2	-42.21	4.3	2.9	-43.61	-13	H
2508.5	-36.54	5.4	3.7	-38.24	-13	H
3574.0	-49.51	6.4	4.7	-51.21	-13	V
4812.8	-50.63	7.6	7.9	-50.33	-13	H
6294.4	-52.69	8.8	10.8	-50.69	-13	V
7892.2	-54.17	9.9	16.6	-47.47	-13	V

**LTE Band 5, 1.4MHz, QPSK, Channel 20643**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1695.7	-41.55	4.4	2.9	-43.05	-13	H
2543.5	-37.52	5.4	3.7	-39.22	-13	V
3588.8	-49.93	6.5	4.7	-51.73	-13	H
4933.6	-52.33	7.7	9.0	-51.03	-13	V
6655.2	-52.79	9.1	12.3	-49.59	-13	H
8558.5	-56.35	10.3	18.1	-48.55	-13	V

**LTE Band 7, 5 MHz, QPSK, Channel 20775**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3966.0	-49.99	6.8	7.7	-49.09	-13	H
5000.8	-46.5	7.8	9.0	-45.3	-13	H
5935.6	-48.26	8.5	10.4	-46.36	-13	V
7500.8	-34.26	9.7	14.6	-29.36	-13	V
9180.4	-48.86	10.5	18.5	-40.86	-13	H
12818.2	-39.23	12.5	19.2	-32.53	-13	H

**LTE Band 7, 5 MHz, QPSK, Channel 21100**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
4388.0	-47.48	7.3	7.3	-47.48	-13	H
5065.6	-46.38	7.8	9.0	-45.18	-13	H
6368.0	-47.06	8.8	10.8	-45.06	-13	V
7598.4	-35.22	9.7	14.6	-30.32	-13	V
9206.0	-48.05	10.5	18.5	-40.05	-13	V
12160.2	-40.14	12.6	17.5	-35.24	-13	H

**LTE Band 7, 5 MHz, QPSK, Channel 21425**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3574.8	-47.45	6.4	4.7	-49.15	-13	H
5130.4	-44.17	7.9	8.7	-43.37	-13	H
6283.2	-47.55	8.8	10.8	-45.55	-13	V
7696.0	-37.03	9.8	15.3	-31.53	-13	V
9566.4	-48.5	10.8	18.6	-40.7	-13	H
12916.2	-40.39	13.0	20.2	-33.19	-13	V

**LTE Band 12, 1.4MHz, QPSK, Channel 23017**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1398.4	-41.46	4.0	3.4	-42.06	-13	V
2097.7	-41.19	4.9	2.8	-43.29	-13	V
3496.0	-42.88	6.4	4.7	-44.58	-13	H
4195.2	-50.33	7.0	7.7	-49.63	-13	H
4964.4	-52.2	7.7	9.0	-50.9	-13	V
5628.8	-54.5	8.3	10.5	-52.3	-13	V

**LTE Band 12, 1.4MHz, QPSK, Channel 23095**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1414.0	-42.04	4.0	3.4	-42.64	-13	H
2190.8	-41.76	5.0	3.3	-43.46	-13	V
3535.2	-40.88	6.4	4.7	-42.58	-13	V
4242.0	-49.08	7.1	7.7	-48.48	-13	V
5379.2	-52.66	8.1	9.5	-51.26	-13	H
7202.2	-52.4	9.5	13.7	-48.2	-13	V

**LTE Band 12, 1.4MHz, QPSK, Channel 23173**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1429.9	-47.52	4.1	3.4	-48.22	-13	H
2144.2	-36.84	5.0	3.3	-38.54	-13	V
3574.4	-40.01	6.4	4.7	-41.71	-13	H
4236.0	-54	7.1	7.7	-53.4	-13	H
4959.2	-52.75	7.7	9.0	-51.45	-13	V
5599.6	-53.03	8.3	9.5	-51.83	-13	H

**LTE Band 13, 5MHz, QPSK, Channel 23205**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1452.4	-50.71	4.1	3.4	-51.41	-13	H
2201.5	-41.61	5.0	3.3	-43.31	-13	V
2814.2	-36.82	5.7	4.1	-38.42	-13	V
3546.0	-51.3	6.4	4.7	-53	-13	V
4907.2	-52.14	7.7	9.0	-50.84	-13	H
5626.8	-54.38	8.3	10.5	-52.18	-13	H

**LTE Band 13, 5MHz, QPSK, Channel 23230**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1273.1	-48.43	3.8	2.0	-50.23	-13	V
1534.4	-49.17	4.2	3.4	-49.97	-13	V
1825.2	-40.13	4.6	2.9	-41.83	-13	H
2451.2	-38.95	5.3	3.7	-40.55	-13	V
3564.8	-50.96	6.4	4.7	-52.66	-13	V
4549.2	-50.72	7.4	7.3	-50.82	-13	V

**LTE Band 13, 5MHz, QPSK, Channel 23255**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1509.2	-48.81	4.1	3.4	-49.51	-13	V
2197.3	-41.68	5.0	3.3	-43.38	-13	V
2617.3	-36.43	5.5	3.7	-38.23	-13	V
3571.6	-50.22	6.4	4.7	-51.92	-13	H
4550.8	-49.83	7.4	7.3	-49.93	-13	H
6390.4	-51.75	8.9	11.5	-49.15	-13	V



**LTE Band 17, 5MHz, QPSK, Channel 23755**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1408.8	-44.97	4.0	3.4	-45.57	-13	H
2112.7	-39.11	4.9	2.8	-41.21	-13	V
3521.2	-41.06	6.4	4.7	-42.76	-13	H
4226.4	-52.03	7.1	7.7	-51.43	-13	H
4952.4	-52.6	7.7	9.0	-51.3	-13	H
5638.8	-54.19	8.3	10.5	-51.99	-13	V

**LTE Band 17, 5MHz, QPSK, Channel 23790**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1415.7	-42.91	4.0	3.4	-43.51	-13	H
2123.5	-41.43	4.9	2.8	-43.53	-13	H
2968.8	-36.16	5.8	4.7	-37.26	-13	H
3539.2	-42.56	6.4	4.7	-44.26	-13	V
4246.8	-51.61	7.1	7.7	-51.01	-13	V
5096.8	-52.54	7.9	9.0	-51.44	-13	H

**LTE Band 17, 5MHz, QPSK, Channel 23800**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1422.3	-48	4.0	3.4	-48.6	-13	V
2133.5	-42.23	5.0	3.3	-43.93	-13	V
3556.4	-44.23	6.4	4.7	-45.93	-13	H
4268.4	-52.52	7.1	7.7	-51.92	-13	V
4918.0	-53.3	7.7	9.0	-52	-13	V
6446.8	-51.15	8.9	11.5	-48.55	-13	V

**LTE Band 25, 1.4MHz, QPSK, Channel 26047**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3772.4	-29.99	6.6	7.7	-28.89	-13	V
5658.8	-26.35	8.3	10.5	-24.15	-13	V

7544.8	-52.03	9.7	14.6	-47.13	-13	V
9431.2	-51.45	10.7	18.6	-43.55	-13	V
11379.4	-50.54	12.1	18.1	-44.54	-13	H
13203.6	-49.7	13.0	21.8	-40.9	-13	H

### LTE Band 25, 1.4MHz, QPSK, Channel 26365

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3764.0	-30.19	6.6	7.7	-29.09	-13	V
5646.0	-27.97	8.3	10.5	-25.77	-13	V
7528.0	-50.46	9.7	14.6	-45.56	-13	V
9410.4	-50.21	10.7	18.6	-42.31	-13	H
11330.4	-50.34	12.1	18.5	-43.94	-13	H
13130.8	-50.13	13.0	21.8	-41.33	-13	H

### LTE Band 25, 1.4MHz, QPSK, Channel 26683

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3827.6	-32.11	6.7	7.7	-31.11	-13	V
5741.6	-30.1	8.5	10.5	-28.1	-13	V
7655.2	-51.98	9.7	15.3	-46.38	-13	V
9569.2	-49.21	10.8	18.6	-41.41	-13	H
11362.6	-50.54	12.1	18.5	-44.14	-13	H
13139.2	-50.3	13.0	21.8	-41.5	-13	V

### LTE Band 26, 1.4MHz, QPSK, Channel 26697

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1636.9	-48.37	4.3	2.9	-49.77	-13	H
2450.0	-39.91	5.3	3.7	-41.51	-13	H
3207.2	-50.76	6.1	4.7	-52.16	-13	H
4030.0	-54.6	6.9	7.7	-53.8	-13	H
4851.2	-51.43	7.6	7.9	-51.13	-13	V

5687.2	-53.93	8.5	10.5	-51.93	-13	V
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**LTE Band 26, 1.4MHz, QPSK, Channel 26865**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1662.2	-45.05	4.3	2.9	-46.45	-13	H
2493.1	-29.31	5.4	3.7	-31.01	-13	H
3208.8	-51.12	6.1	4.7	-52.52	-13	H
4155.2	-49.69	7.0	7.7	-48.99	-13	H
4988.8	-53.24	7.8	9.0	-52.04	-13	V
5818.0	-53.6	8.4	10.5	-51.5	-13	H

**LTE Band 26, 1.4MHz, QPSK, Channel 27033**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1423.7	-50.86	4.0	3.4	-51.46	-13	H
2071.2	-42.76	4.9	2.8	-44.86	-13	H
2786.5	-37.34	5.7	4.1	-38.94	-13	V
3569.2	-50.68	6.4	4.7	-52.38	-13	H
4225.6	-53.64	7.1	7.7	-53.04	-13	V
5040.0	-52.9	7.8	9.0	-51.7	-13	V

**LTE Band 41, 5MHz, QPSK, Channel 40065**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
5070.4	-42.5	7.8	9.0	-41.3	-13	V
7605.6	-50.4	9.7	14.6	-45.5	-13	V
10255.2	-51.83	11.4	17.4	-45.83	-13	V
12813.0	-47.77	12.5	19.2	-41.07	-13	H
15460.4	-47.52	14.5	24.2	-37.82	-13	V
17363.0	-40.58	15.7	19.6	-36.68	-13	V

**LTE Band 41, 5MHz, QPSK, Channel 40620**

Frequency	PMea	Pcl (dBm)	Ga (dBd)	Peak ERP	Limit	Polarization
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y (MHz)	(dBm)			(dBm)	(dBm)	on
3606.4	-47.59	6.5	4.7	-49.39	-13	H
5181.6	-39.62	8.0	8.7	-38.92	-13	V
7586.0	-48.72	9.7	14.6	-43.82	-13	V
10011.2	-46.73	11.2	17.6	-40.33	-13	V
12540.0	-41.27	12.7	18.7	-35.27	-13	V
15340.0	-40.78	14.4	25.1	-30.08	-13	H

**LTE Band 41, 5MHz, QPSK, Channel 41215**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
5121.2	-41.01	7.9	9.0	-39.91	-13	V
7682.0	-52.84	9.8	15.3	-47.34	-13	H
10166.4	-51.69	11.3	17.4	-45.59	-13	H
12670.2	-48.24	12.7	19.2	-41.74	-13	V
15188.8	-49.95	14.5	25.1	-39.35	-13	H
17825.0	-39.15	16.0	20.6	-34.55	-13	H

**LTE Band 66, 5MHz, QPSK, Channel 40620**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3485.6	-24.61	6.4	4.7	-26.31	-13	V
5228.4	-21.64	8.0	8.7	-20.94	-13	V
6971.6	-40.6	9.3	12.9	-37	-13	V
8714.0	-48.38	10.4	18.5	-40.28	-13	V
10441.6	-51.31	11.6	17.1	-45.81	-13	V
12139.6	-47.74	12.6	17.5	-42.84	-13	H

**LTE Band 66, 5MHz, QPSK, Channel 40620**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3420.4	-27.07	6.3	4.7	-28.67	-13	V
5131.2	-23.99	7.9	8.7	-23.19	-13	V

6841.6	-47.62	9.2	12.3	-44.52	-13	V
8551.6	-48.2	10.3	18.1	-40.4	-13	V
10530.0	-50.98	11.6	17.1	-45.48	-13	V
12260.0	-47.13	12.6	17.5	-42.23	-13	H

**LTE Band 66, 5MHz, QPSK, Channel 40620**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
3554.0	-25.11	6.4	4.7	-26.81	-13	V
5331.2	-19.95	8.1	8.7	-19.35	-13	V
7108.4	-42.32	9.4	12.9	-38.82	-13	V
8885.6	-47.89	10.4	18.3	-39.99	-13	V
10551.6	-50.76	11.6	17.1	-45.26	-13	V
12279.6	-47.24	12.7	17.5	-42.44	-13	V

Note: The maximum value of expanded measurement uncertainty for this test item is  $U = 4.2$  dB,  $k = 2$ .

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

#### **Reference**

FCC: CFR Part 2.1055, 22.235, 24.235, 27.54.

#### **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 DIGITAL RADIO COMMUNICATION TESTER.

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 middle channel for LTE band 2/4/5/7/12/13/17/25/26/41/66, 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. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring 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 decrements from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

#### **A.3.2 Measurement Limit**

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. 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 between 3.5VDC and 4.4VDC, with a nominal voltage of 3.85VDC. 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. For the purposes of measuring frequency stability these voltage limits are to be used.

### A.3.3 Measurement results

#### LTE Band 2, 1.4MHz bandwidth (worst case of all bandwidths)

##### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	-5.72	-7.74	0.003	0.004
3.85	-6.19	-9.04	0.003	0.005
4.4	-6.44	-8.6	0.003	0.005

##### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-7.08	-10.46	0.004	0.006
40°	-7.54	-8.4	0.004	0.004
30°	-6.07	-8.88	0.003	0.005
20°	-5.28	-7.85	0.003	0.004
10°	-5.06	-9.04	0.003	0.005
0°	-5.18	-9.04	0.003	0.005
- 10°	-6.55	-9.44	0.003	0.005
- 20°	-6.65	-9.47	0.004	0.005
- 30°	-6.95	-7.98	0.004	0.004

#### LTE Band 4, 1.4MHz bandwidth (worst case of all bandwidths)

##### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	3.42	-6.41	0.002	0.004
3.85	-3.26	-7.15	0.002	0.004
4.4	1.76	-5.82	0.001	0.003

##### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2.95	-5.62	0.002	0.003
40°	-3.19	-4.94	0.002	0.003
30°	-3.08	-6.12	0.002	0.004
20°	-3.82	-5.29	0.002	0.003
10°	-2.32	-6.67	0.001	0.004
0°	-3.26	-6.38	0.002	0.004
- 10°	-3.13	-6.12	0.002	0.004
- 20°	2.39	-4.88	0.001	0.003
- 30°	3.59	-6.27	0.002	0.004

**LTE Band 5, 1.4MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	-1.46	6.69	0.002	0.008
3.85	-3.29	7.85	0.004	0.009
4.4	-3.09	5.95	0.004	0.007

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-1.85	7.02	0.002	0.008
40°	-2.88	6.04	0.003	0.007
30°	-2.53	7.72	0.003	0.009
20°	-2.68	6.47	0.003	0.008
10°	-3.71	6.57	0.004	0.008
0°	-3.09	6.49	0.004	0.008
- 10°	-1.89	6.47	0.002	0.008
- 20°	-2.49	7.85	0.003	0.009
- 30°	-2.6	6.24	0.003	0.007

**LTE Band 7, 5MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	-6.92	-12.2	0.003	0.005
3.85	-8.1	-13.78	0.003	0.005
4.4	-9.13	-12.33	0.004	0.005

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-8.4	-13.12	0.003	0.005
40°	-7.31	-11.54	0.003	0.005
30°	-7.64	-12.47	0.003	0.005
20°	-6.47	-14.06	0.003	0.006
10°	-7.91	-12.46	0.003	0.005
0°	-7.42	-13.29	0.003	0.005
- 10°	-8.58	-11.5	0.003	0.005
- 20°	-7.55	-11.04	0.003	0.004
- 30°	-7.31	-12.29	0.003	0.005



**LTE Band 12, 1.4MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	-2.1	7.72	0.003	0.011
3.85	-2.16	8.24	0.003	0.012
4.4	-3.08	6.84	0.004	0.01

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-1.56	6.57	0.002	0.009
40°	-2.55	7.34	0.004	0.01
30°	1.67	7.47	0.002	0.011
20°	1.53	7.11	0.002	0.01
10°	2.68	7.81	0.004	0.011
0°	2.13	7.95	0.003	0.011
- 10°	-1.7	7.44	0.002	0.011
- 20°	-2.3	7.07	0.003	0.01
- 30°	1.4	8.38	0.002	0.012

**LTE Band 13, 5MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	-2.76	-6.65	0.004	0.009
3.85	1.97	-5.71	0.003	0.007
4.4	-2.52	-8.25	0.003	0.011

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2.95	-8.17	0.004	0.01
40°	-2.66	-7.45	0.003	0.01
30°	-2.52	-8.21	0.003	0.01
20°	-2.15	-7.84	0.003	0.01
10°	-2.69	-6.45	0.003	0.008
0°	-2.78	-9.26	0.004	0.012
- 10°	-3.76	-7.2	0.005	0.009
- 20°	-1.96	-7.8	0.003	0.01
- 30°	-4.08	-8.1	0.005	0.01

**LTE Band 17, 5MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	-1.65	-5.46	0.002	0.008
3.85	2.2	-4.78	0.003	0.007
4.4	1.65	-5.21	0.002	0.007

### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2.98	-6.68	0.004	0.009
40°	-1.85	-5.65	0.003	0.008
30°	-2.17	-6.04	0.003	0.009
20°	-2.96	-4.43	0.004	0.006
10°	-1.5	-5.19	0.002	0.007
0°	-3.72	-6.09	0.005	0.009
- 10°	-2.57	-6.07	0.004	0.009
- 20°	2.29	-5.79	0.003	0.008
- 30°	-3.29	-5.68	0.005	0.008

### LTE Band 25, 10MHz bandwidth (worst case of all bandwidths)

#### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	3.36	10.94	0.002	0.006
3.85	4.91	12.62	0.003	0.007
4.4	-3.06	10.16	0.002	0.005

#### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-3.45	11.33	0.002	0.006
40°	-2.76	10.67	0.001	0.006
30°	4.63	9.17	0.002	0.005
20°	-4.36	9.31	0.002	0.005
10°	-3.12	11.44	0.002	0.006
0°	3.25	10.86	0.002	0.006
- 10°	3.15	10.13	0.002	0.005
- 20°	3.69	10.23	0.002	0.005
- 30°	3.71	12.53	0.002	0.007

### LTE Band 26, 5MHz bandwidth (worst case of all bandwidths)

#### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM

3.5	-2.68	10.23	0.003	0.012
3.85	-2.2	10.21	0.003	0.012
4.4	-1.6	11.6	0.002	0.014

### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-1.73	11.42	0.002	0.014
40°	-3.03	9.96	0.004	0.012
30°	-2.69	10.99	0.003	0.013
20°	-2.79	9.9	0.003	0.012
10°	-2.03	11.8	0.002	0.014
0°	-2.69	9.31	0.003	0.011
- 10°	2.76	9.64	0.003	0.012
- 20°	-4.13	9.21	0.005	0.011
- 30°	-1.79	10.04	0.002	0.012

### LTE Band 41, 15MHz bandwidth (worst case of all bandwidths)

#### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	67.25	8.48	0.026	0.003
3.85	12.93	12.62	0.005	0.005
4.4	12.03	11.8	0.005	0.005

#### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	15.03	-8.08	0.006	0.003
40°	16.82	11.34	0.006	0.004
30°	13.92	9.11	0.005	0.004
20°	13.09	-8.13	0.005	0.003
10°	14.08	11.4	0.005	0.004
0°	13.76	-5.87	0.005	0.002
- 10°	13.12	10.29	0.005	0.004
- 20°	13.39	8.78	0.005	0.003
- 30°	12.89	11.36	0.005	0.004

### LTE Band 66, 5MHz bandwidth (worst case of all bandwidths)

#### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.5	-8.15	15.68	0.003	0.007
3.85	-9.64	16.08	0.004	0.007

4.4	-10.57	13.85	0.004	0.006
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**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	7.14	16.57	0.003	0.007
40°	12.36	17.05	0.005	0.007
30°	-6.82	11.86	0.003	0.005
20°	9.07	12.89	0.004	0.005
10°	8.6	18.41	0.004	0.008
0°	9.71	15.99	0.004	0.007
- 10°	-10.49	17.74	0.004	0.008
- 20°	9.18	12.82	0.004	0.005
- 30°	-9.2	16.71	0.004	0.007

**ANNEX A.4. OCCUPIED BANDWIDTH****Reference**

FCC: CFR Part 2.1049(h)(i)

**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.

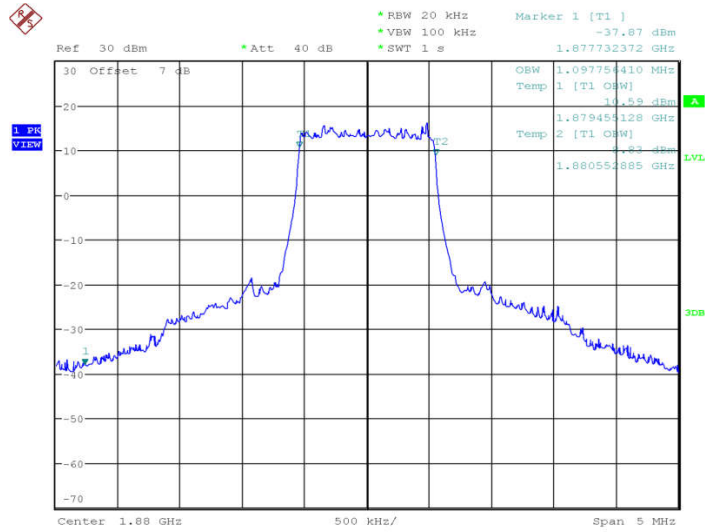
The measurement method is from KDB 971168 4:

- 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  $10\log(\text{OBW} / \text{RBW})$  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%)**

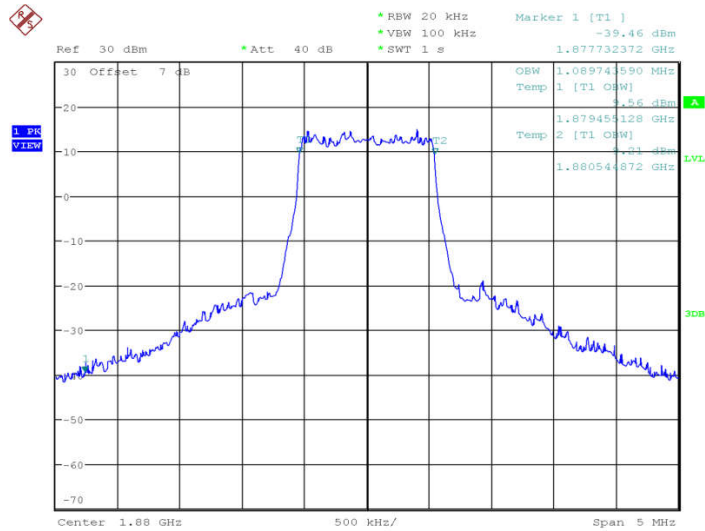
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1880.0	QPSK	16QAM
	1.098	1.090

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



IF Overload  
Date: 6.JAN.2003 06:27:07

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

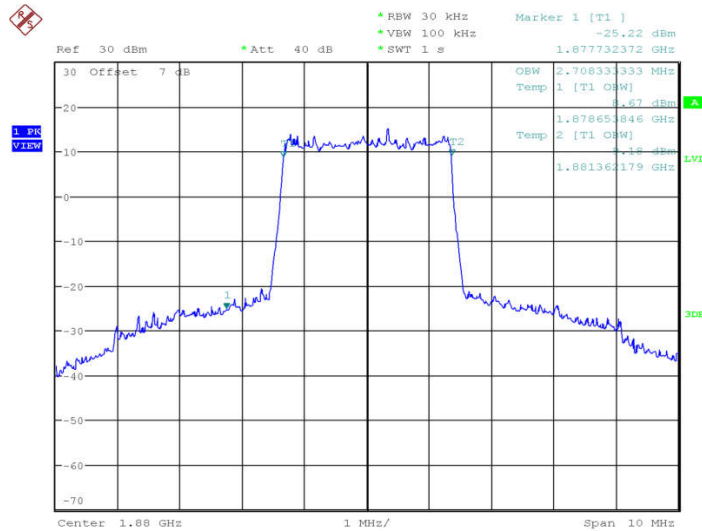


IF Overload  
Date: 6.JAN.2003 06:27:34

## LTE band 2, 3MHz (99%)

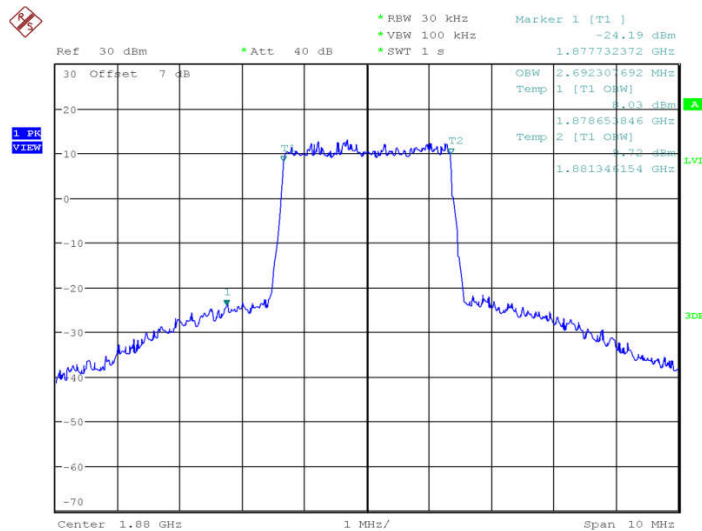
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1880.0	QPSK	16QAM
	2.708	2.692

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



IF Overload  
 Date: 6.JAN.2003 06:28:09

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

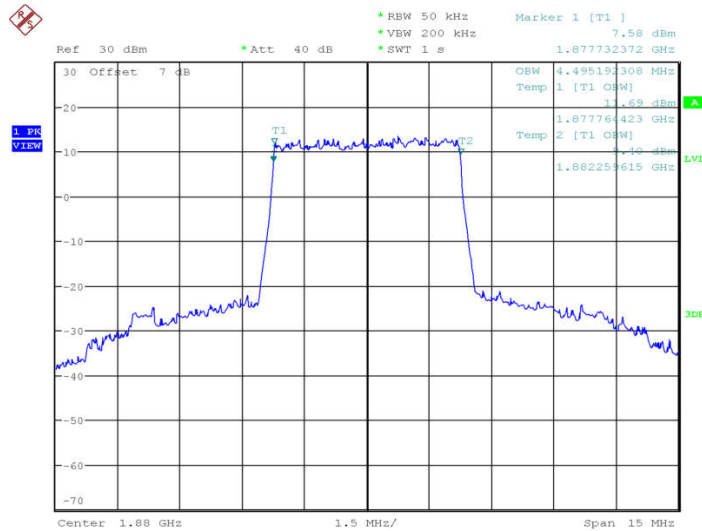


IF Overload  
 Date: 6.JAN.2003 06:28:35

## LTE band 2, 5MHz (99%)

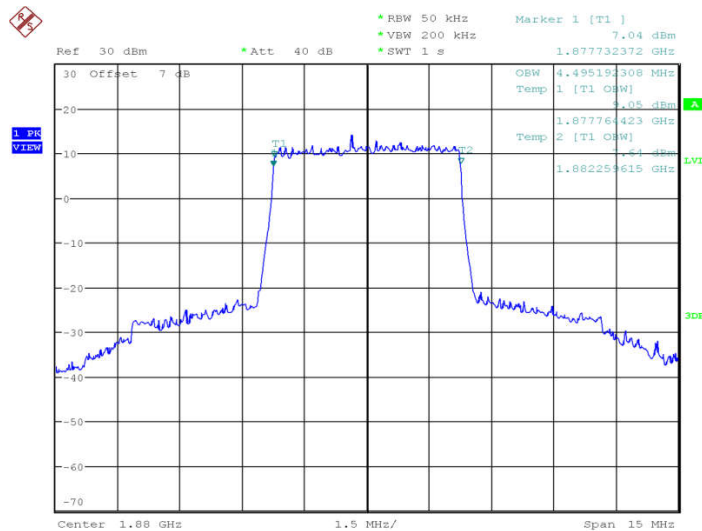
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1880.0	QPSK	16QAM
	4.495	4.495

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



IF Overload  
Date: 6.JAN.2003 06:29:10

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



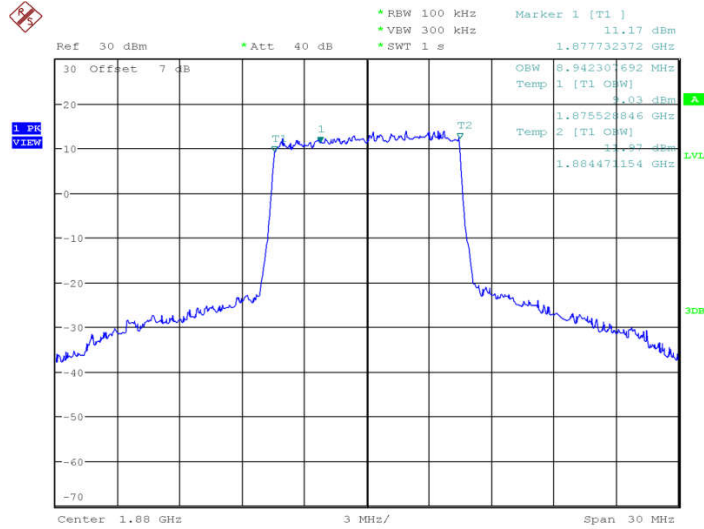
IF Overload  
Date: 6.JAN.2003 06:29:37



### LTE band 2, 10MHz (99%)

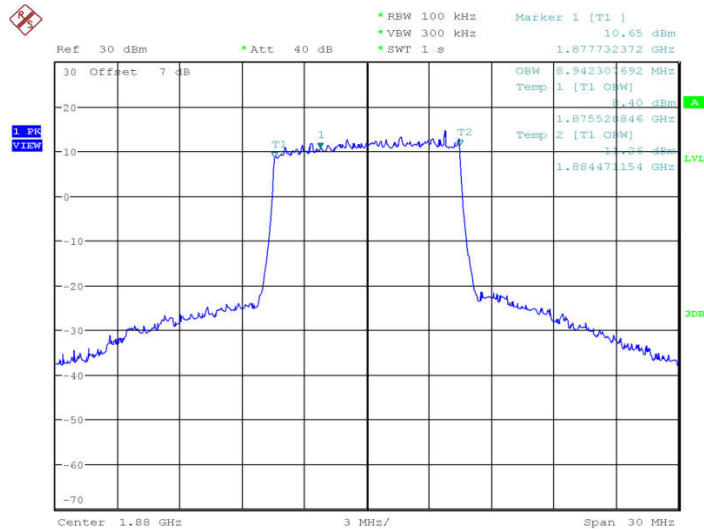
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1880.0	QPSK	16QAM
	8.942	8.942

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



IF Overload  
 Date: 6.JAN.2003 06:30:11

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

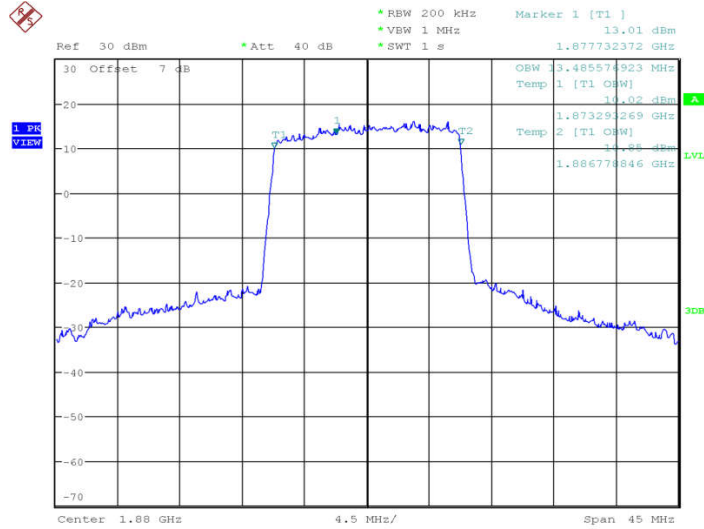


IF Overload  
 Date: 6.JAN.2003 06:30:37

### LTE band 2, 15MHz (99%)

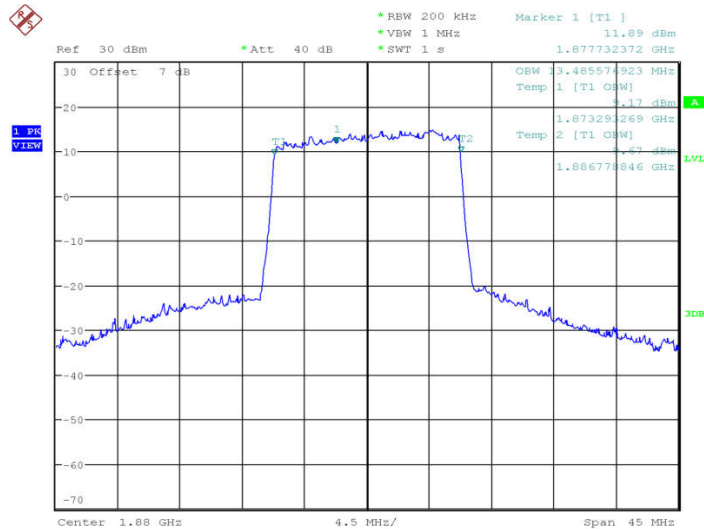
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1880.0	QPSK	16QAM
	13.486	18.486

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



IF Overload  
Date: 6.JAN.2003 06:31:11

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

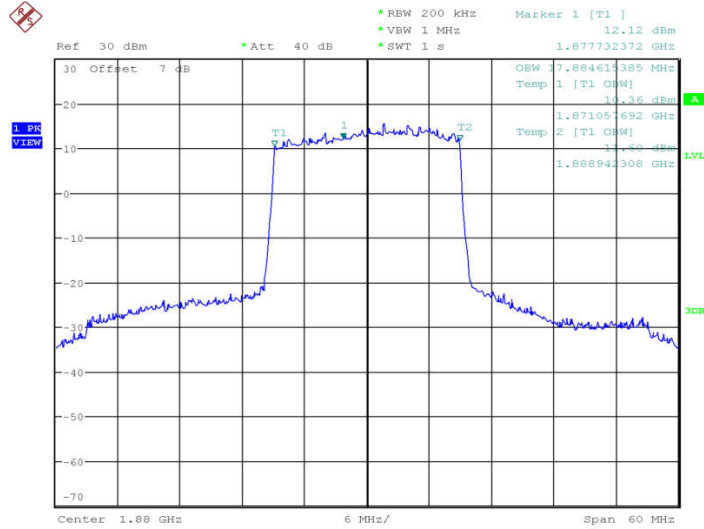


IF Overload  
Date: 6.JAN.2003 06:31:38

### LTE band 2, 20MHz (99%)

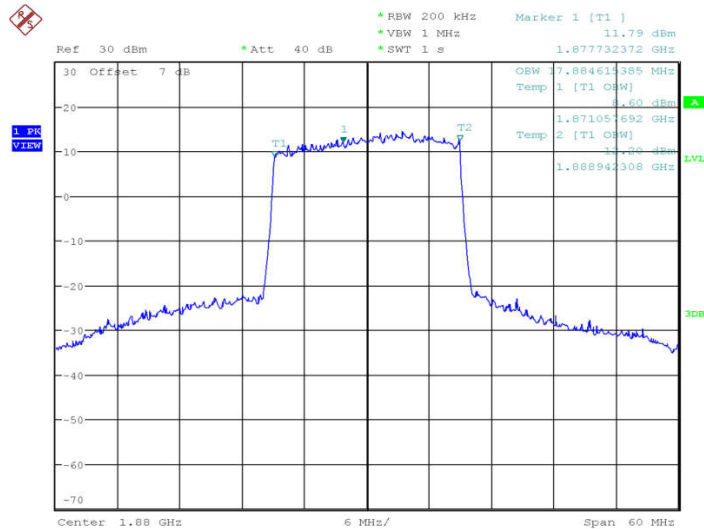
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1880.0	QPSK	16QAM
	17.885	17.885

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



IF Overload  
Date: 6.JAN.2003 06:32:12

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

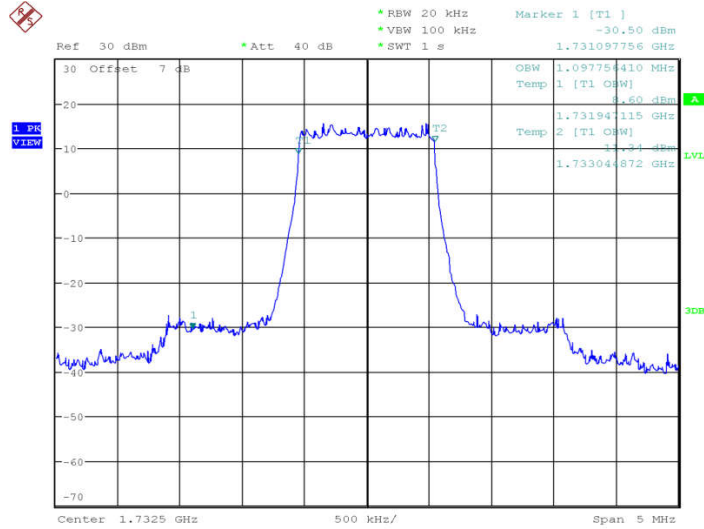


IF Overload  
Date: 6.JAN.2003 06:32:38

### LTE band 4, 1.4MHz (99%)

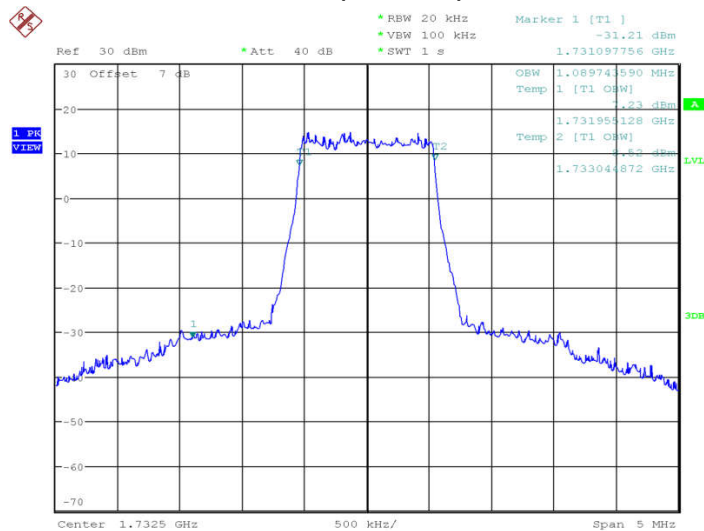
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	1.098	1.090

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



IF Overload  
Date: 27.MAR.2018 11:35:07

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

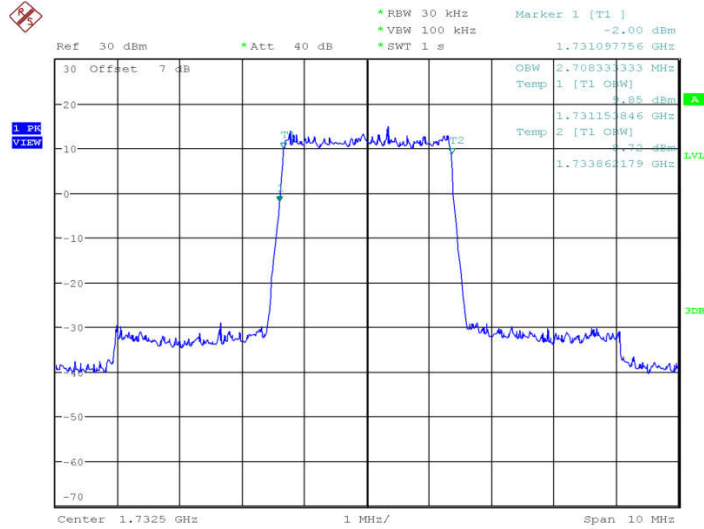


IF Overload  
Date: 27.MAR.2018 11:35:34

### LTE band 4, 3MHz (99%)

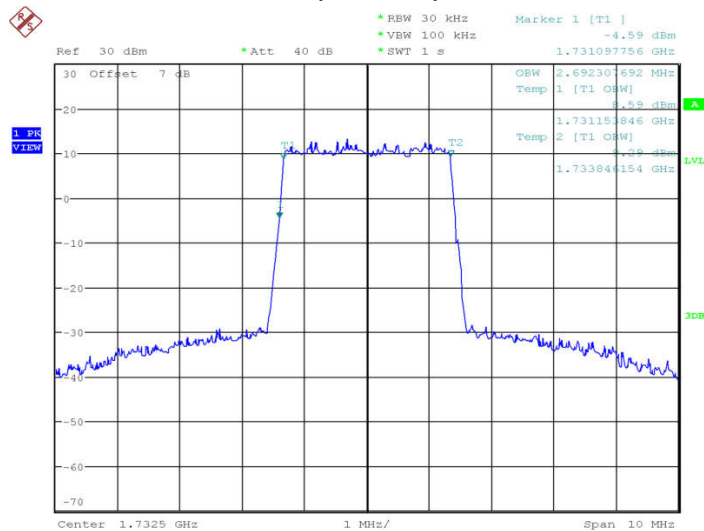
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	2.708	2.692

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



IF Overload  
Date: 27.MAR.2018 11:36:08

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

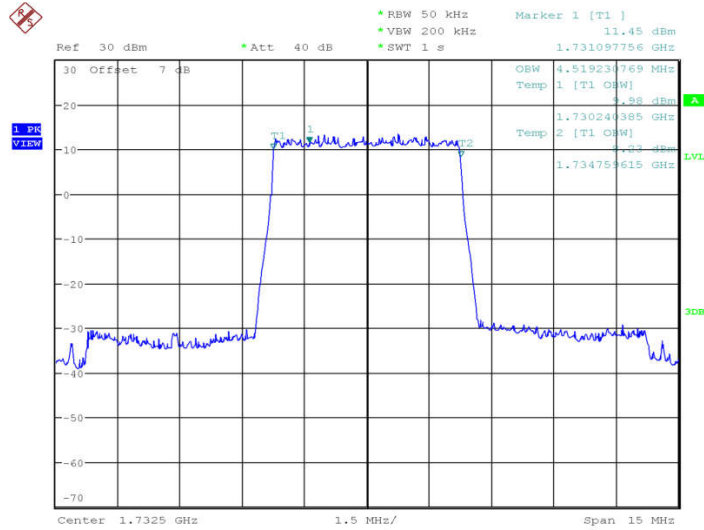


IF Overload  
Date: 27.MAR.2018 11:36:35

## LTE band 4, 5MHz (99%)

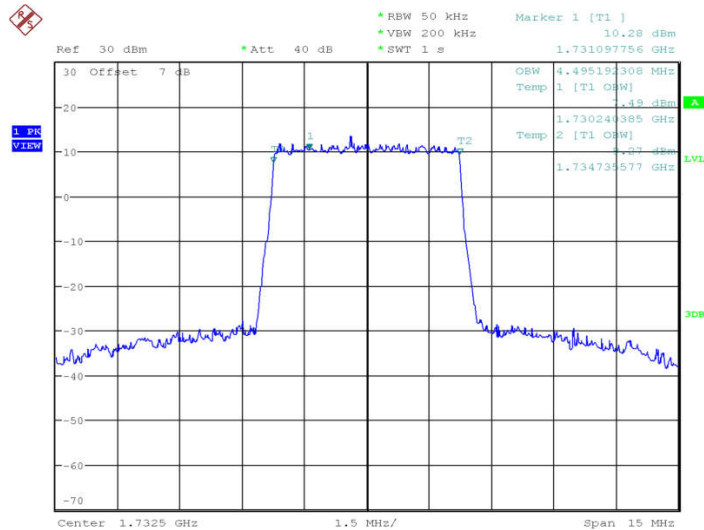
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	4.519	4.495

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



IF Overload  
Date: 27.MAR.2018 11:37:09

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

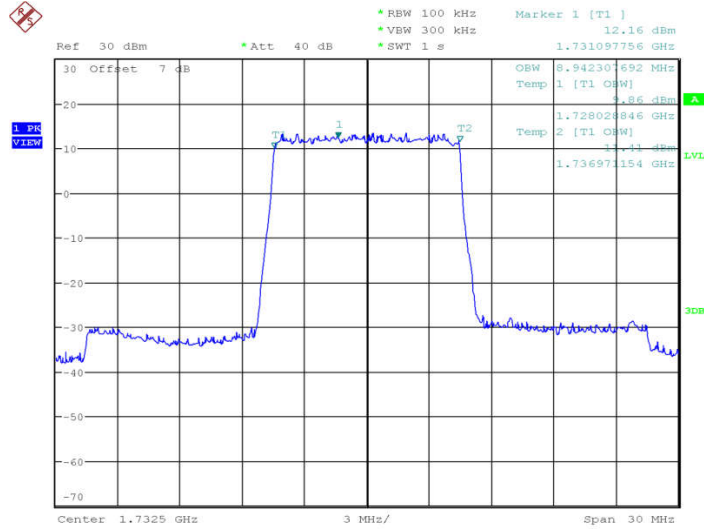


IF Overload  
Date: 27.MAR.2018 11:37:37

### LTE band 4, 10MHz (99%)

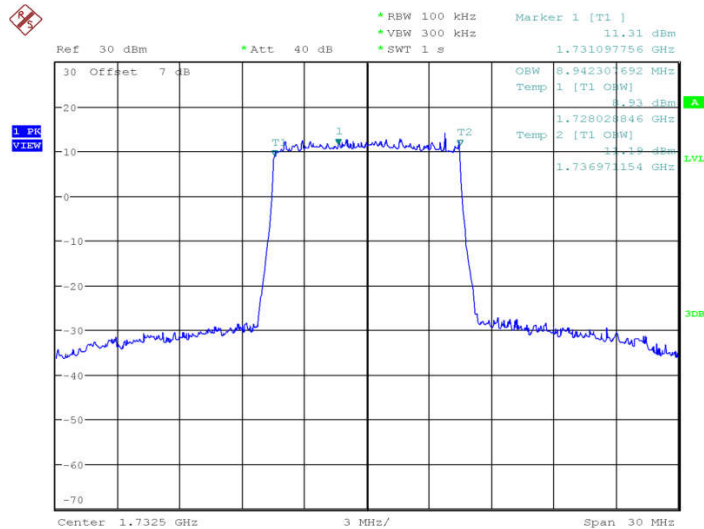
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	8.942	8.942

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



IF Overload  
Date: 27.MAR.2018 11:38:11

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

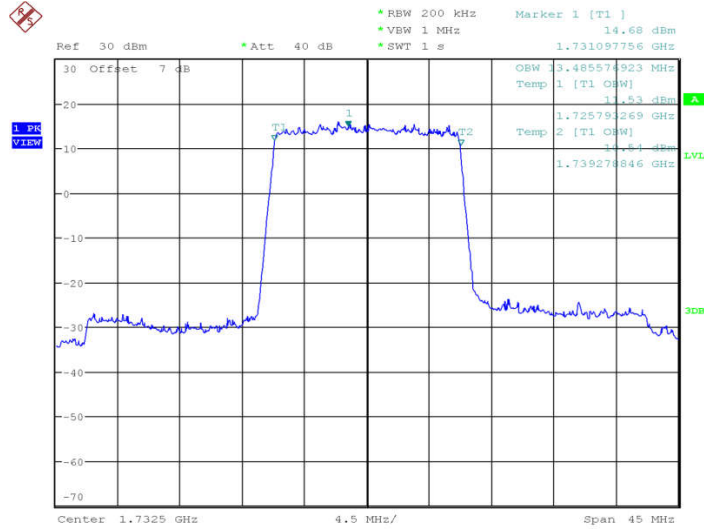


IF Overload  
Date: 27.MAR.2018 11:38:38

### LTE band 4, 15MHz (99%)

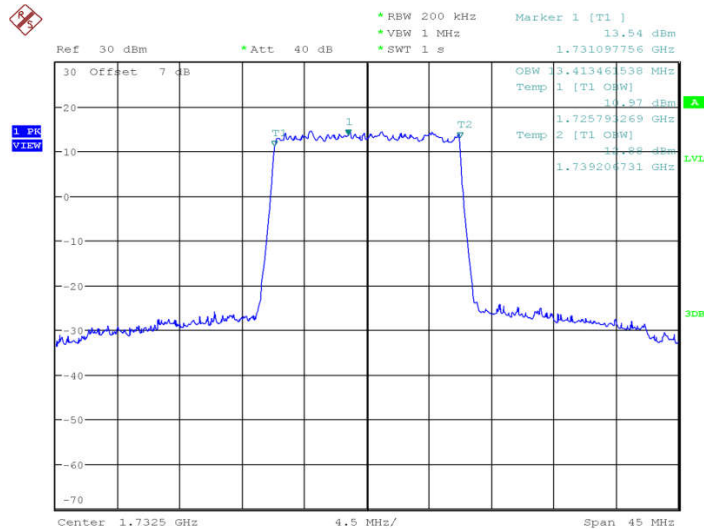
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	13.486	13.413

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



IF Overload  
Date: 27.MAR.2018 11:39:12

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



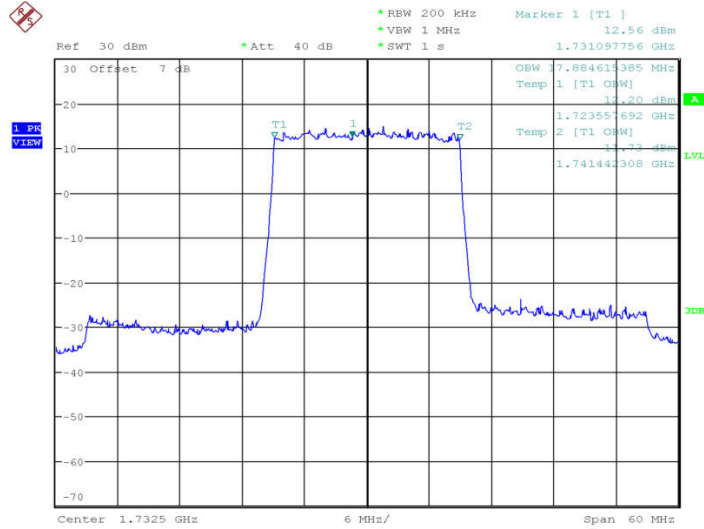
IF Overload  
Date: 27.MAR.2018 11:39:39



### LTE band 4, 20MHz (99%)

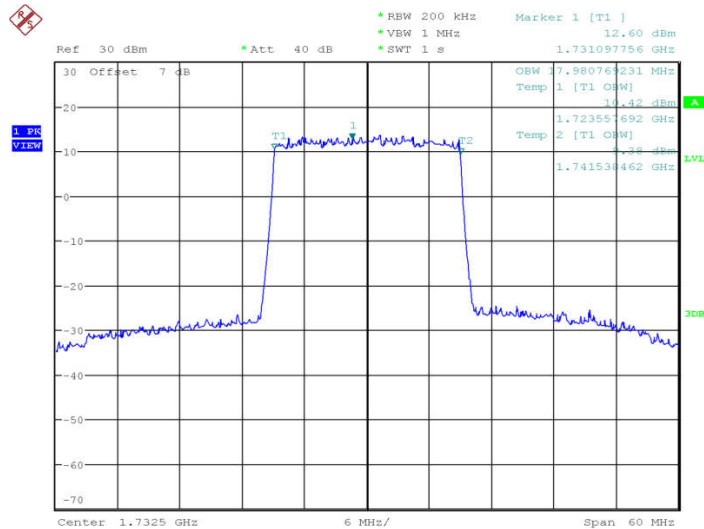
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	17.885	17.981

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



IF Overload  
Date: 27.MAR.2018 11:40:13

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

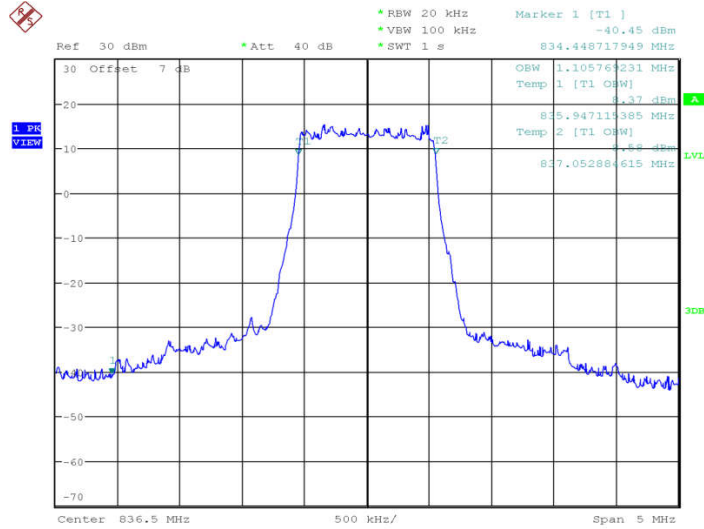


IF Overload  
Date: 27.MAR.2018 11:40:40

### LTE band 5, 1.4MHz (99%)

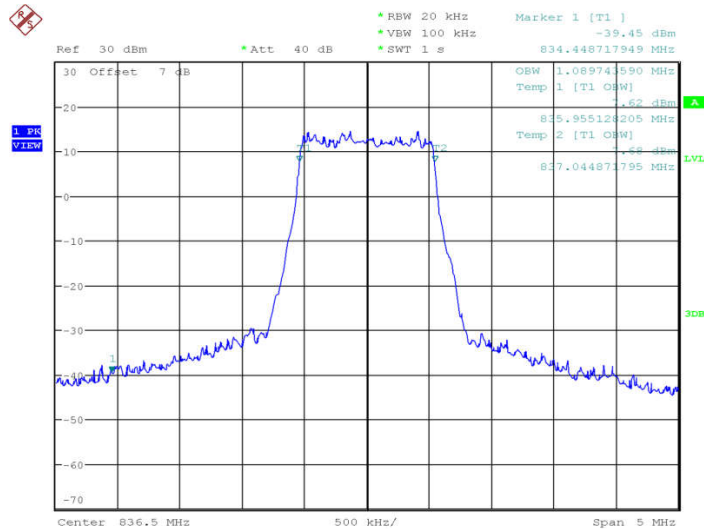
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
836.5	QPSK	16QAM
	1.106	1.090

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



IF Overload  
Date: 27.MAR.2018 12:08:01

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

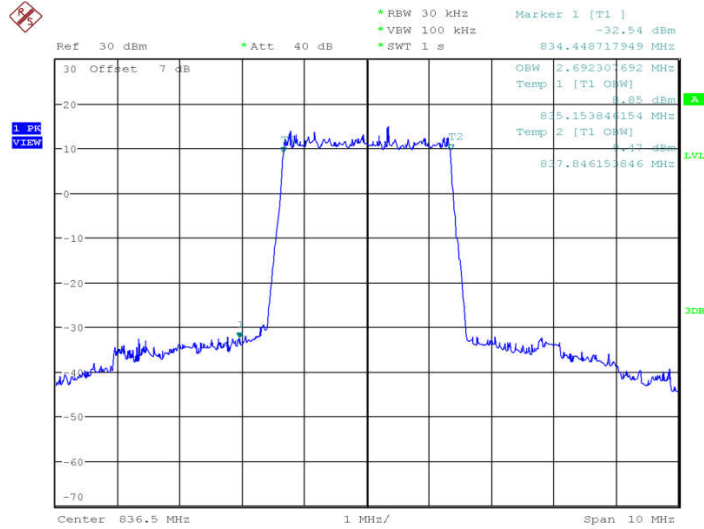


IF Overload  
Date: 27.MAR.2018 12:08:28

## LTE band 5, 3MHz (99%)

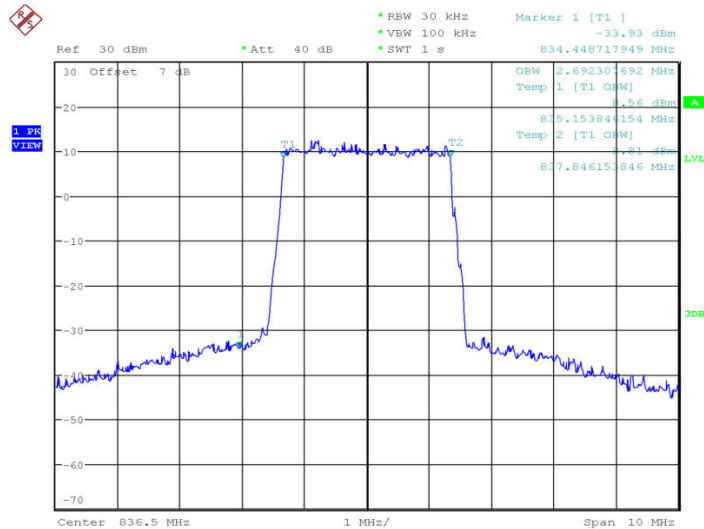
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
836.5	QPSK	16QAM
	2.692	2.692

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



IF Overload  
Date: 27.MAR.2018 12:09:02

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

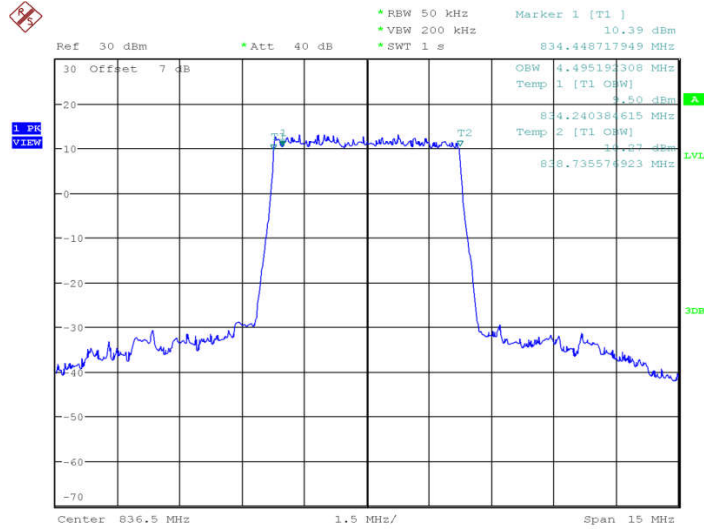


IF Overload  
Date: 27.MAR.2018 12:09:29

### LTE band 5, 5MHz (99%)

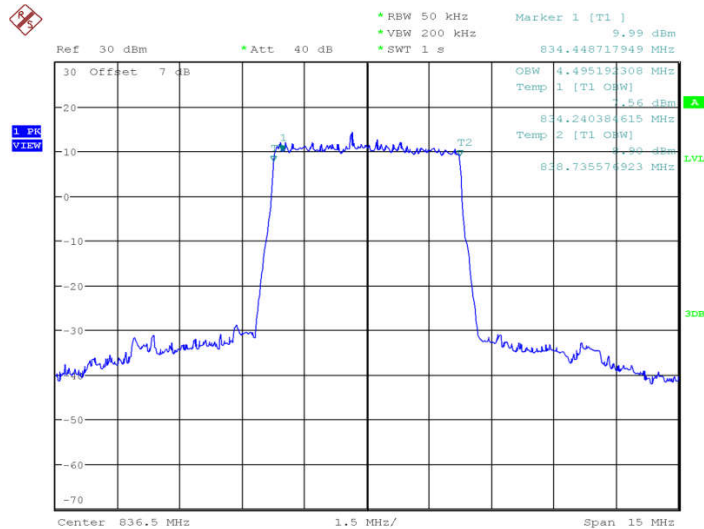
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
836.5	QPSK	16QAM
	4.495	4.495

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



IF Overload  
Date: 27.MAR.2018 12:10:04

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

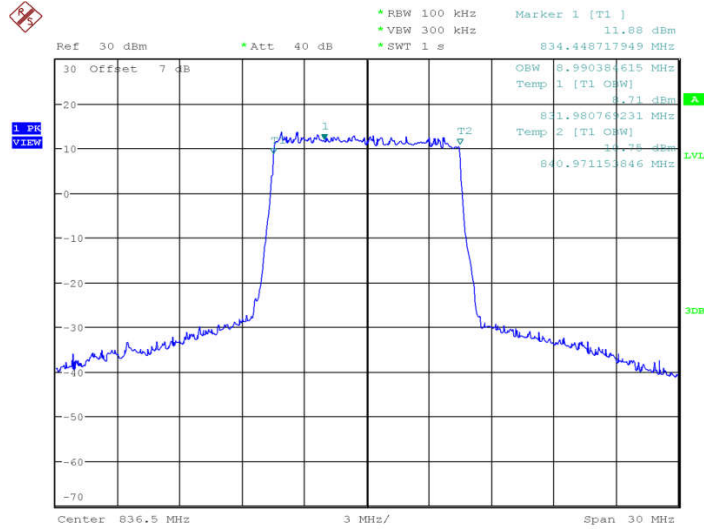


IF Overload  
Date: 27.MAR.2018 12:10:31

### LTE band 5, 10MHz (99%)

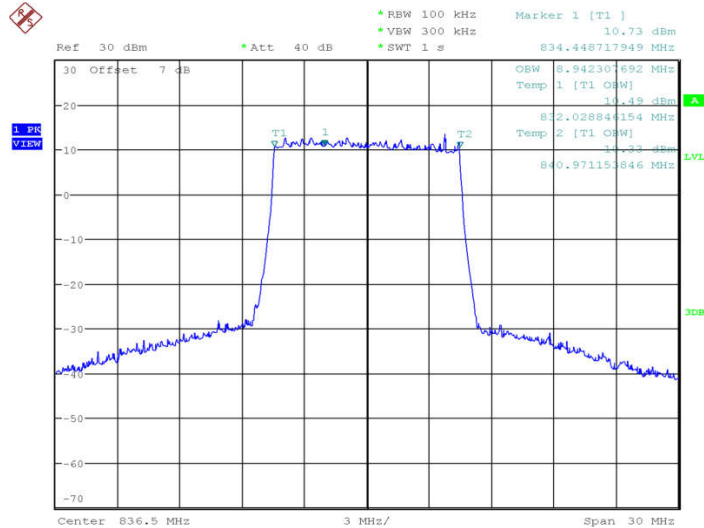
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
836.5	QPSK	16QAM
	8.990	8.942

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



IF Overload  
Date: 27.MAR.2018 12:11:05

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

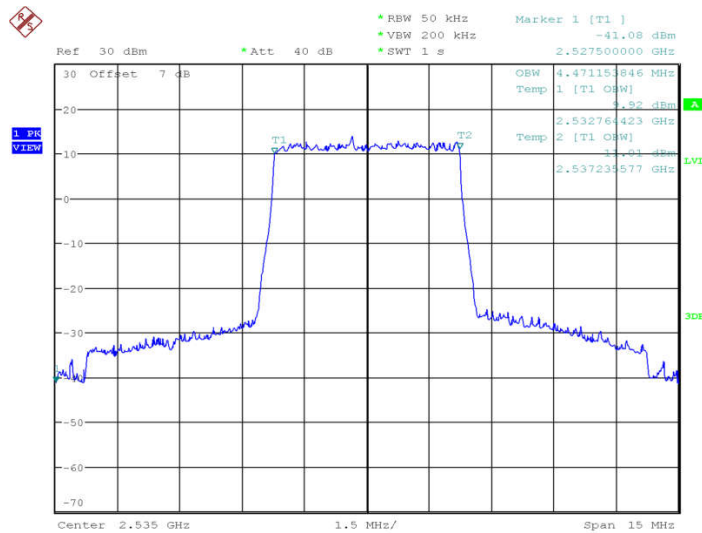


IF Overload  
Date: 27.MAR.2018 12:11:31

## LTE band 7, 5MHz (99%)

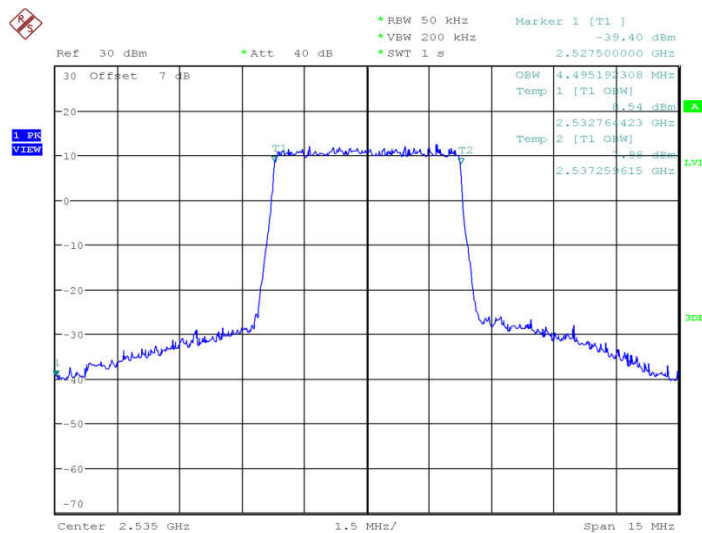
Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
2535.0	QPSK	16QAM
	4.471	4.495

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



IF Overload  
 Date: 27.MAR.2018 12:24:40

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



IF Overload  
 Date: 27.MAR.2018 12:25:07