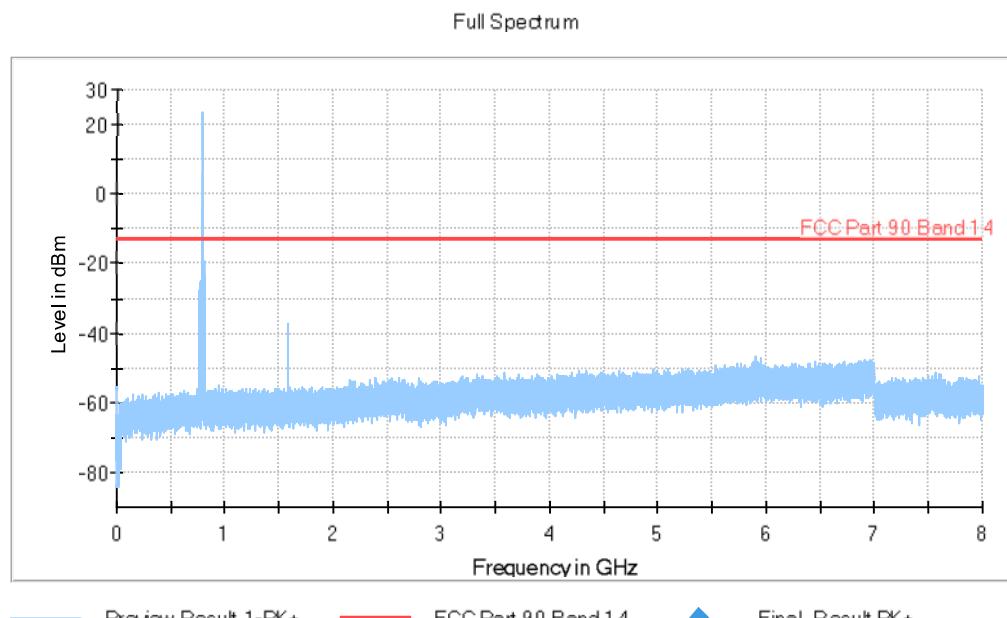
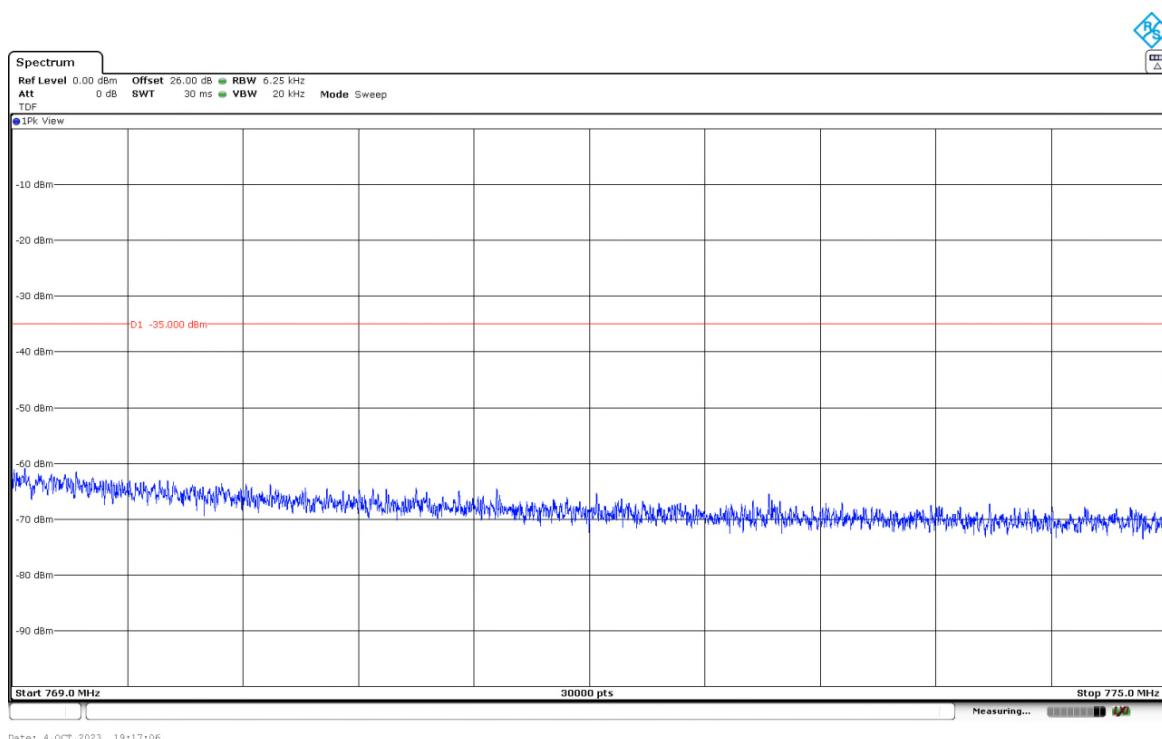
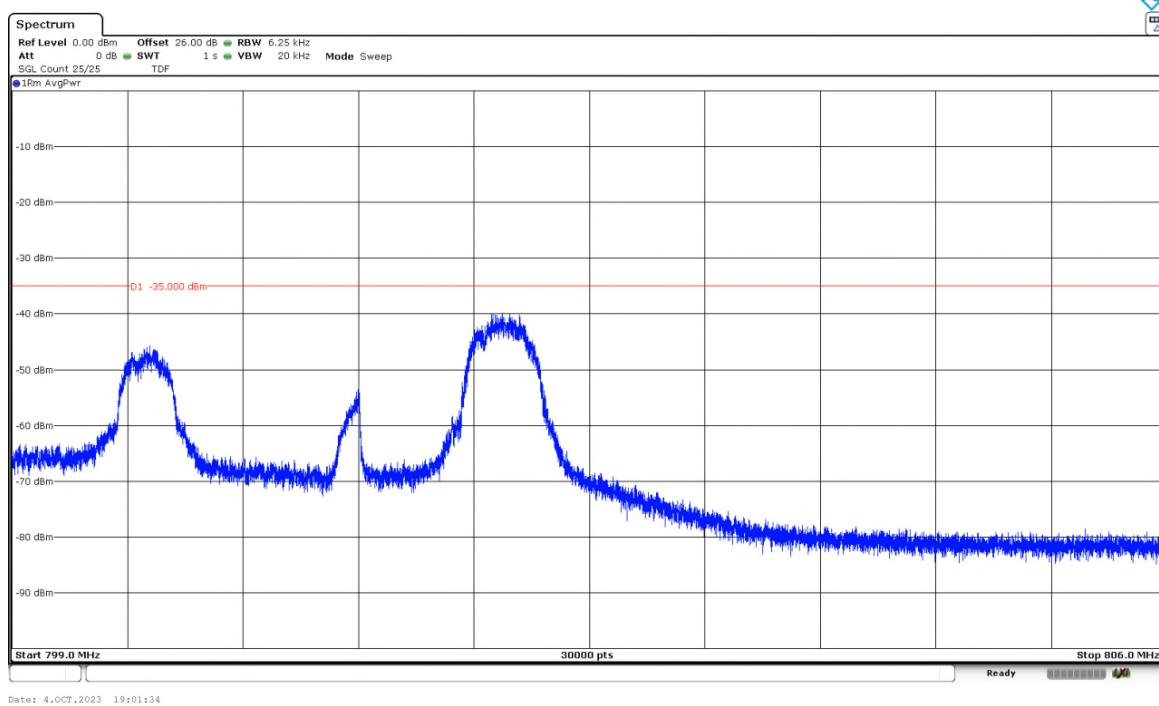


High Channel:



The peak above the limit is the carrier frequency.





## Spurious Emissions at Antenna Terminals at Block Edges

### **Limits**

#### **1. LTE Cat 1bis Band 14:**

\* FCC § 90.543 (e) (2) (3) & (5):

Transmitters operating in 758-768 MHz and 788-798 MHz bands must meet the emission limitations in (e) of this section.

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the 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, in accordance with the following:

- (1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations.
- (2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations.
- (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.
- (4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section 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.
- (5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

\* RSS-140 Clause 4.4:

The power of any unwanted emission outside the band 788-798 MHz shall be attenuated below the Transmitter output power P in dBW as follows, where p is the transmitter output power in watts:

- a. For any frequency between 769-775 MHz and 799-806 MHz:
  - i.  $76 + 10 \log (p)$ , dB in a 6.25 kHz band for fixed and base station equipment
  - ii.  $65 + 10 \log (p)$ , dB in a 6.25 kHz band for mobile and portable/hand-held equipment
- b. For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz:  $43 + 10 \log (p)$ , dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

### **Method**

The EUT RF output connector was connected to a spectrum analyzer 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 splitter.

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

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

As stated in FCC § 90.543, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

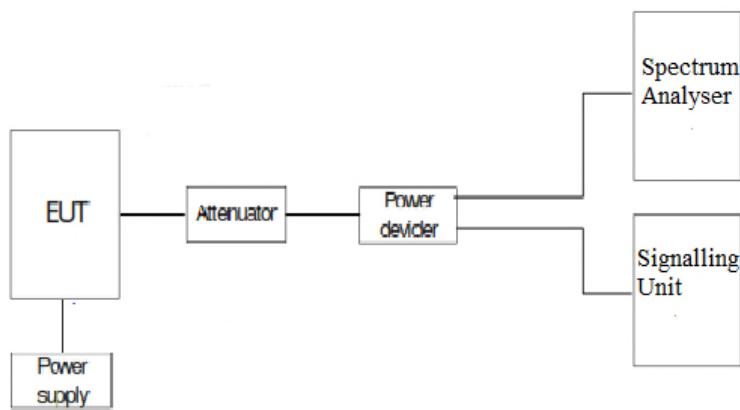
As stated in RSS-140, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

Measurement Limit:

At Po transmitting power, the specified minimum attenuation  $43 + 10 \log_{10} p$  (watts) becomes:

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

### Test Setup



## Results

### LTE Cat 1bis Band 14:

Preliminary measurements determined the BW=5 MHz, QPSK as the worst case.

LTE Cat 1bis Band 14. QPSK.	RB=1. Offset=0. BW=5 MHz	RB=1. Offset=0. BW=10 MHz
Maximum measured level at <u>Low Block Edge</u> at antenna port (dBm)	-13.14	-14.67

LTE Cat 1bis Band 14. QPSK.	RB=All. Offset=0. BW=5 MHz	RB=All. Offset=0. BW=10 MHz
Maximum measured level at <u>Low Block Edge</u> at antenna port (dBm)	-19.92	-24.13

LTE Cat 1bis Band 14. QPSK.	RB=1. Offset=Max. BW=5 MHz	RB=1. Offset=Max. BW=10 MHz
Maximum measured level at <u>High Block Edge</u> at antenna port (dBm)	-13.37	-14.78

LTE Cat 1bis Band 14. QPSK.	RB=All. Offset=0. BW=5 MHz	RB=All. Offset=0. BW=10 MHz
Maximum measured level at <u>High Block Edge</u> at antenna port (dBm)	-20.62	-24.69

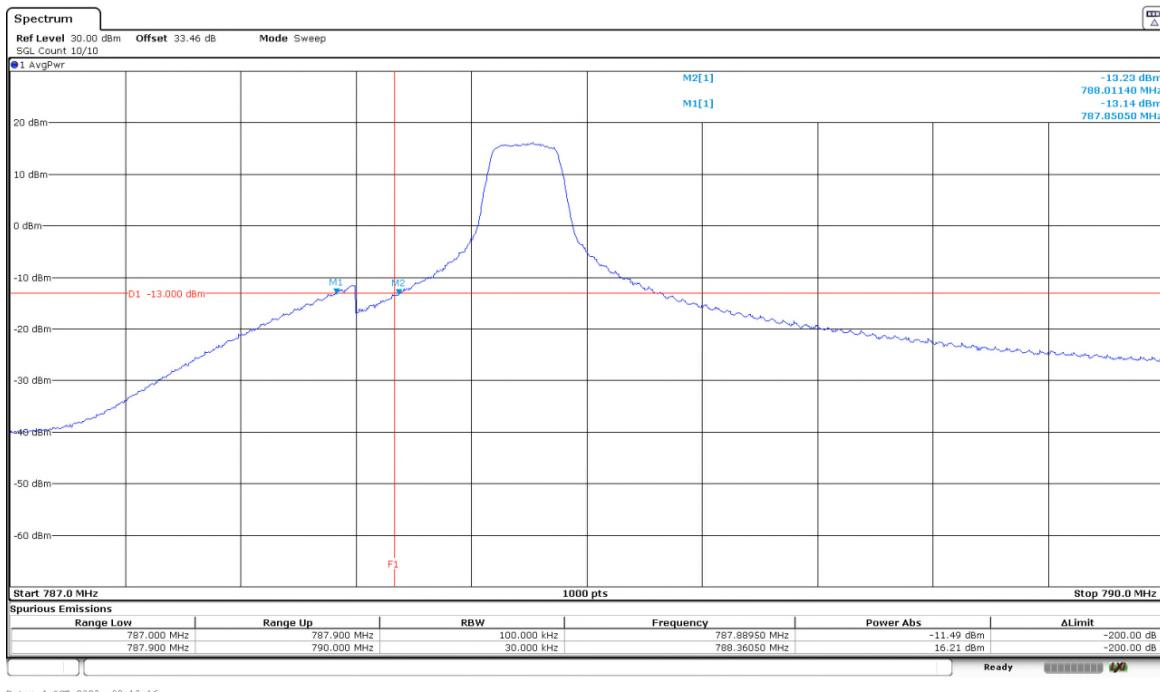
Measurement uncertainty (dB): <±2.76

## Verdict

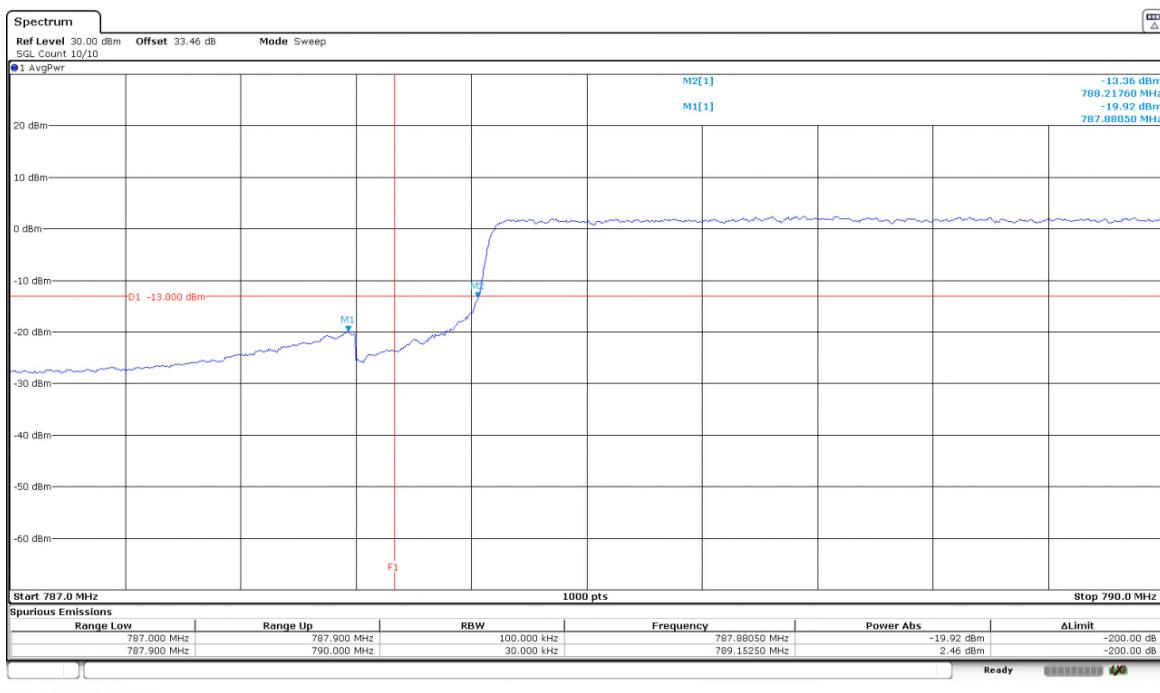
Pass

The plots below are for the worst case configuration specified before.

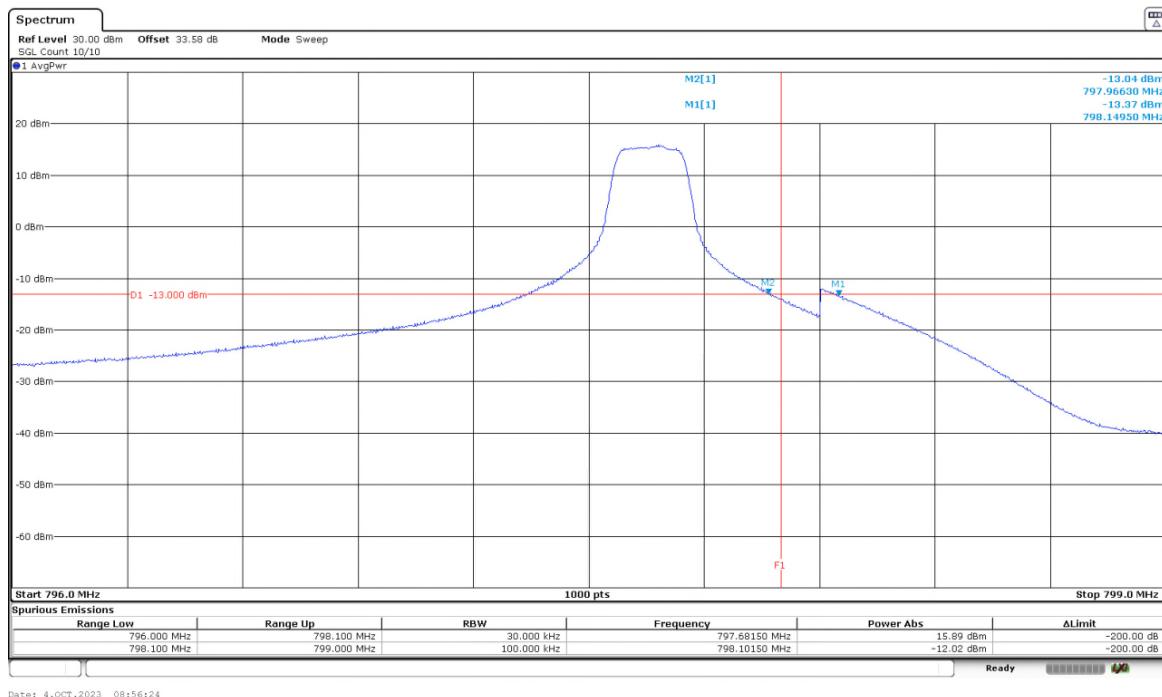
**LTE Cat 1bis Band 14: BW=5 MHz. QPSK. RB Size=1. RB Offset=0. Low Block Edge:**



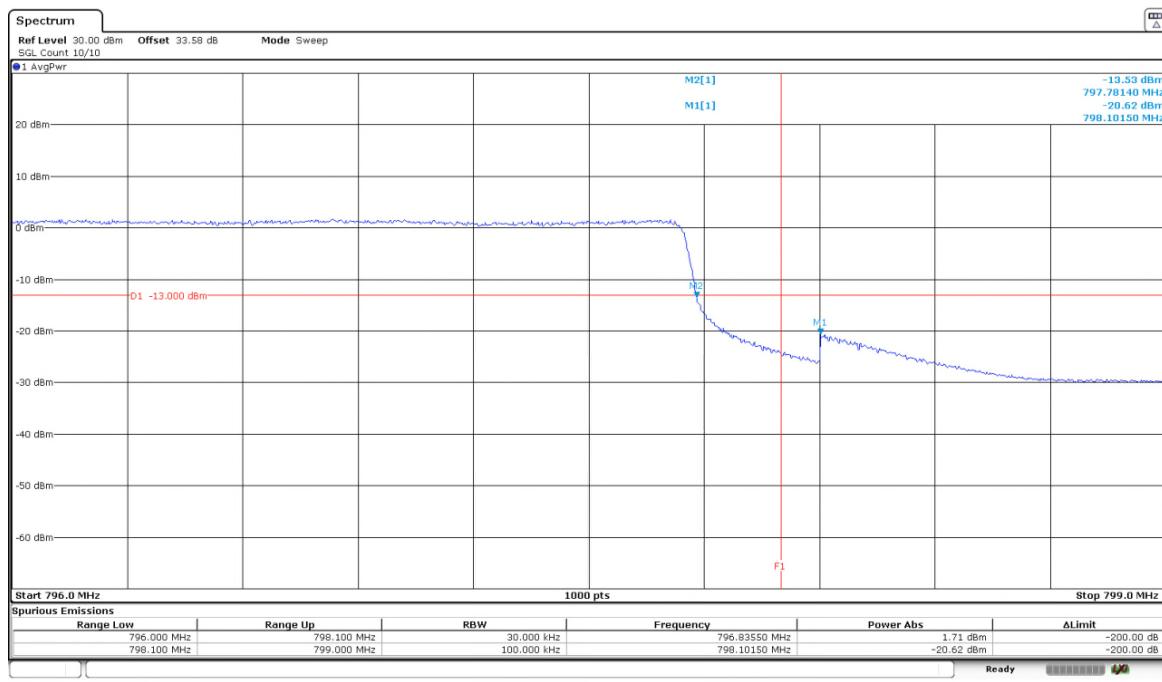
**LTE Cat 1bis Band 14: BW=5 MHz. QPSK. RB Size=All. RB Offset=0. Low Block Edge:**



**LTE Cat 1bis Band 14: BW=5 MHz. QPSK. RB Size=1. RB Offset=Max. High Block Edge:**



**LTE Cat 1bis Band 14: BW=5 MHz. QPSK. RB Size=All. RB Offset=0. High Block Edge:**



## Radiated Emissions

### Limits

#### 1. LTE Cat 1bis Band 14:

\* FCC § 90.543 (e) & (f):

Transmitters operating in 758-768 MHz and 788-798 MHz bands must meet the emission limitations in (e) of this section.

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the 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, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.

(4) Compliance with the provisions of paragraphs (e) (1) and (2) of this section 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.

(5) Compliance with the provisions of paragraph (e) (3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and  $-80$  dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

\* RSS-140 Clause 4.4:

The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:

a) For any frequency between 769-775 MHz and 799-806 MHz:

- i)  $76 + 10 \log (p)$ , dB in a 6.25 kHz band for fixed and base station equipment.
- ii)  $65 + 10 \log (p)$ , dB in a 6.25 kHz band for mobile and portable/hand-held equipment

b) For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz:

$43 + 10 \log (p)$ , dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

In addition, the equivalent isotropically radiated power (e.i.r.p.) of all emissions, including harmonics in the band 1559-1610 MHz, shall not exceed  $-70$  dBW/MHz for wideband emissions, and  $-80$  dBW/kHz for discrete emissions of less than 700 Hz bandwidth.

### **Method**

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the High frequency generated within the equipment.

For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, the EUT was placed on a RF-transparent table or support at a nominal height of 80 cm above the reference ground plane, at a 3 meter distance from the measuring antenna.

For radiated measurements performed at frequencies above 1 GHz, the EUT shall be placed on an RF transparent table or support at a nominal height of 1.5 m above the ground plane, at a 3 meter distance from the measuring antenna.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the height and polarization of the measuring antenna. The maximum meter reading was recorded.

#### **Measurement limit:**

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB, P in watts.

At  $P_0$  transmitting power, the specified minimum attenuation becomes  $43+10\log (P_0)$ , and the level in dBm relative  $P_0$  becomes:

$$P_0 \text{ (dBm)} - [43 + 10 \log (P_0 \text{ in mwatts}) - 30] = -13 \text{ dBm}$$

The maximum field strength ( $\text{dB}\mu\text{V/m}$ ) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

$EIRP \text{ (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20 \log(D) - 104.8$ ; where D is the measurement distance (in the far field region) in m. D = 3 m

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor not less  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment. P in watts.

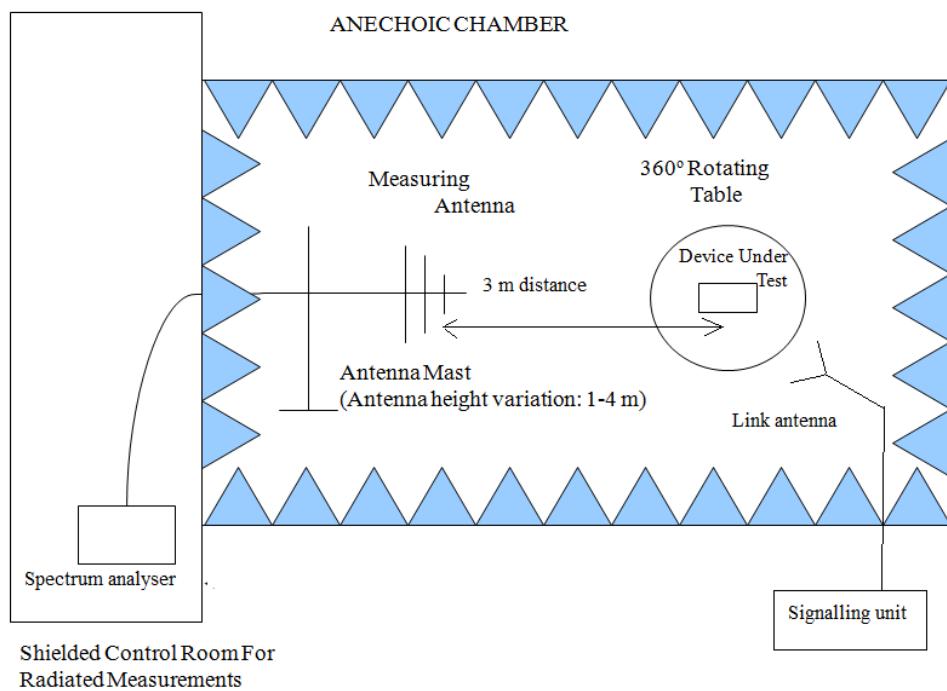
At  $P_0$  transmitting power, the specified minimum attenuation becomes  $65+10\log (P_0)$ , and the level in dBm relative  $P_0$  becomes:

$$P_0 \text{ (dBm)} - [65 + 10 \log (P_0 \text{ in mwatts}) - 30] = -35 \text{ dBm}$$

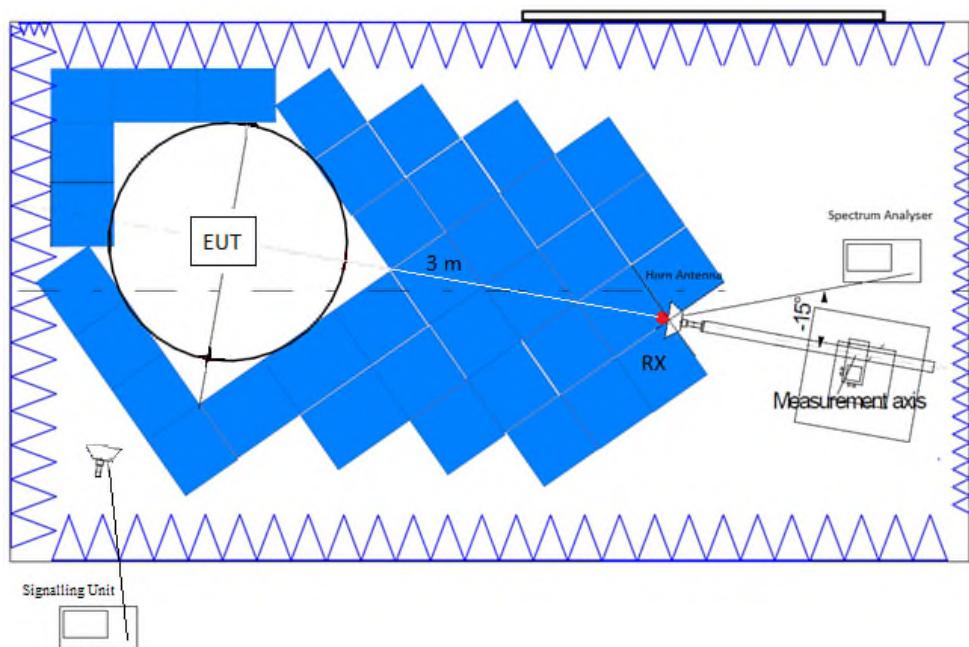
For the LTE Cat 1bis Band 14, a resolution bandwidth / video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

### Test Setup

Radiated measurements below 1 GHz:



Radiated measurements above 1 GHz:



## Results

Measurements required on one frequency near top channel and one frequency near bottom channel, according to FCC § 15.31 (m).

### LTE Cat 1bis Band 14:

A preliminary scan determined the BW=5 MHz, QPSK, RB Size=1, RB Offset=0 as the worst-case. The next results are for this worst-case configuration.

#### - LOW CHANNEL:

##### **Frequency range 30 MHz - 1 GHz:**

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
779.7121	-25.14	V	Peak

##### **Frequency range 1 - 8 GHz:**

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
1576.6469	-57.93	H	Peak

#### - HIGH CHANNEL:

##### **Frequency range 30 MHz - 1 GHz:**

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
784.6896	-22.41	V	Peak
802.0135	-38.65	V	Peak
799.8085	-43.69	V	Peak
801.1015	-53.1	V	Peak

##### **Frequency range 1 - 8 GHz:**

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
1586.6514	-58.6	H	Peak

Measurement uncertainty (dB): < ±5.35 for  $f \geq 30$  MHz up to 1 GHz  
< ±4.32 for  $f \geq 1$  GHz up to 8.5 GHz

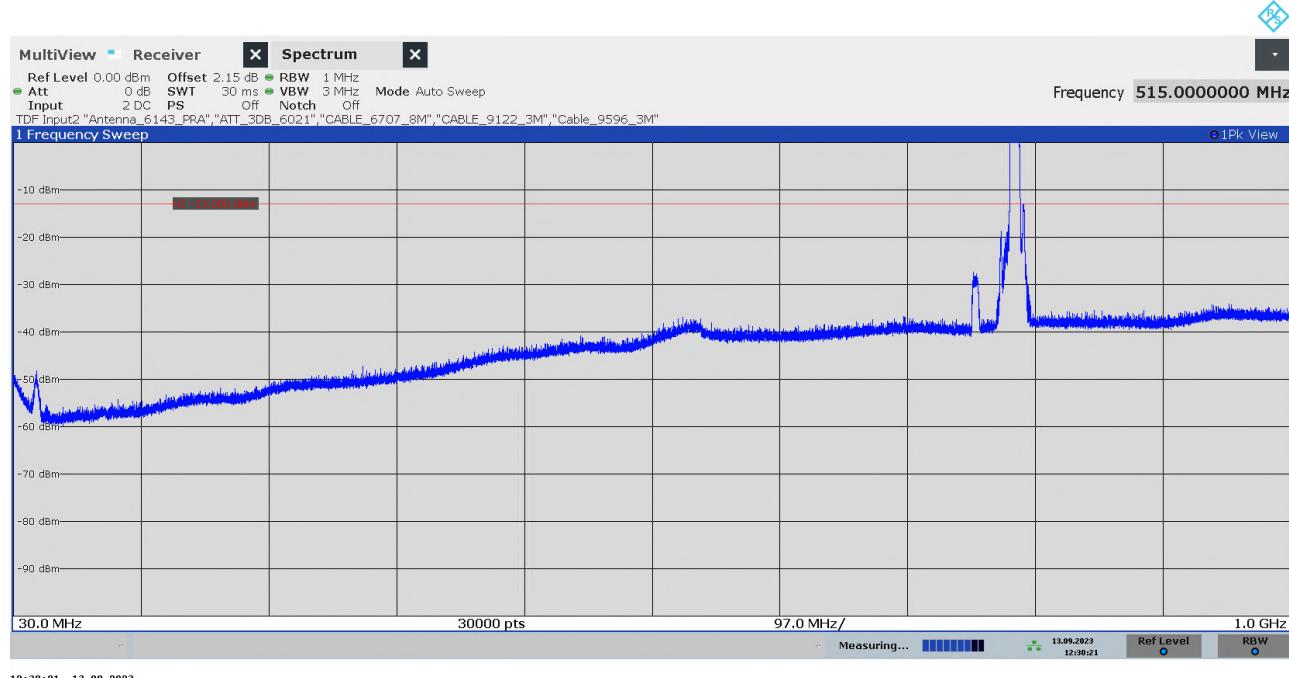
## Verdict

Pass

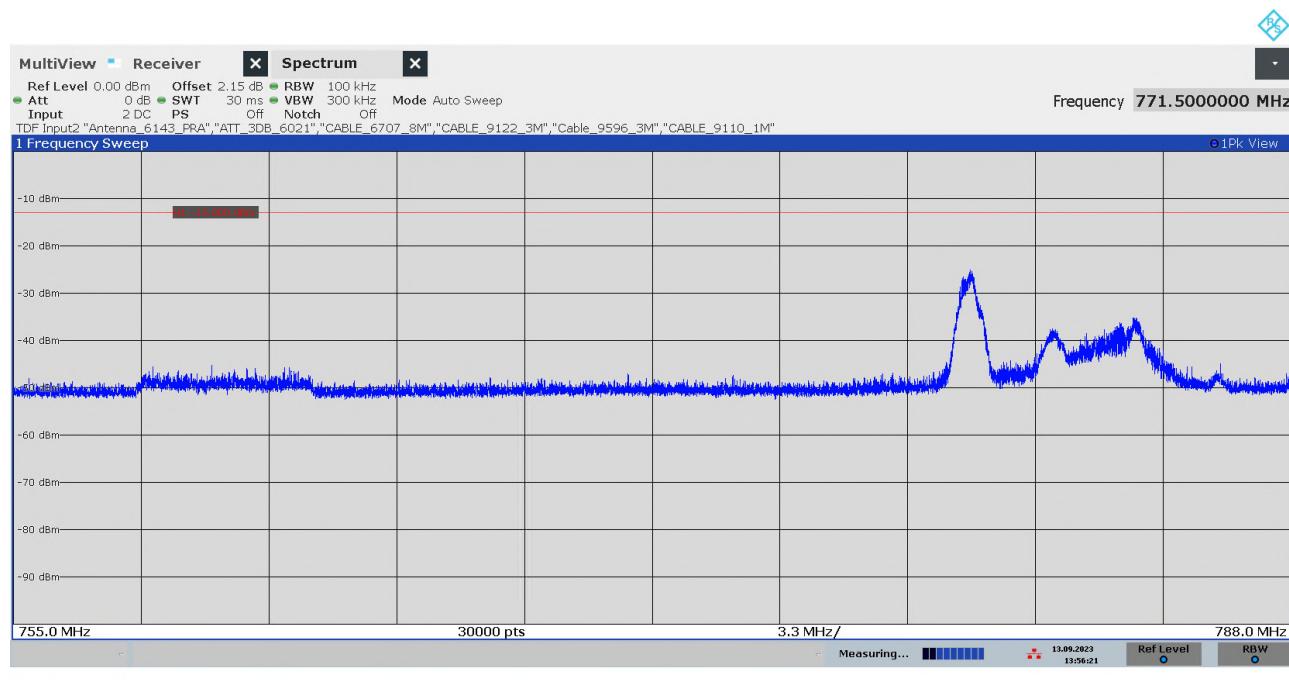
**LTE Cat 1bis Band 14:**

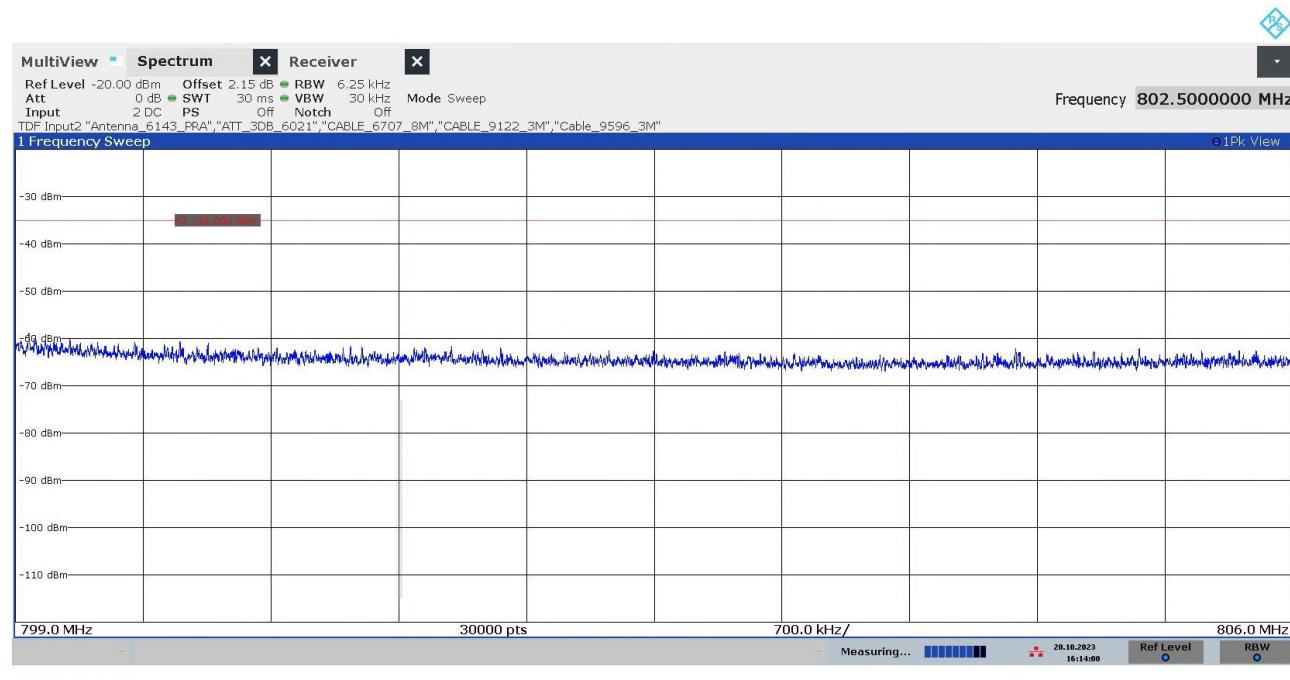
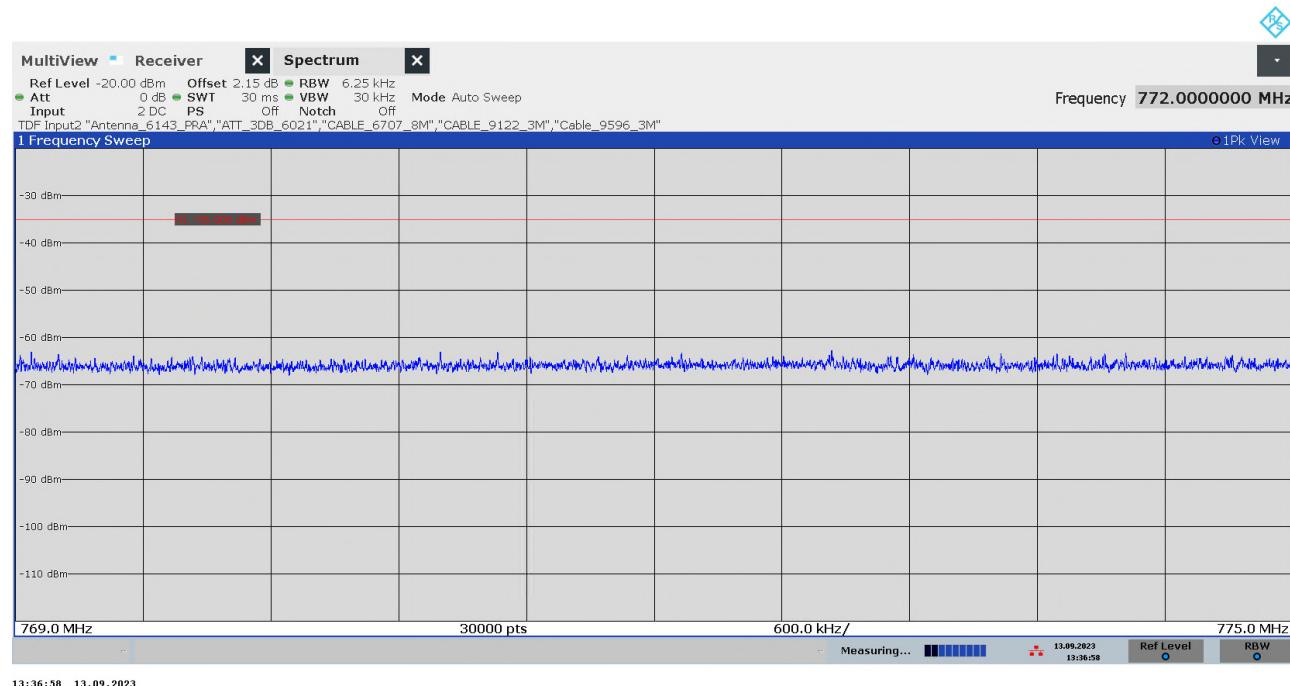
**FREQUENCY RANGE 30 MHz - 1 GHz:**

**- LOW CHANNEL:**

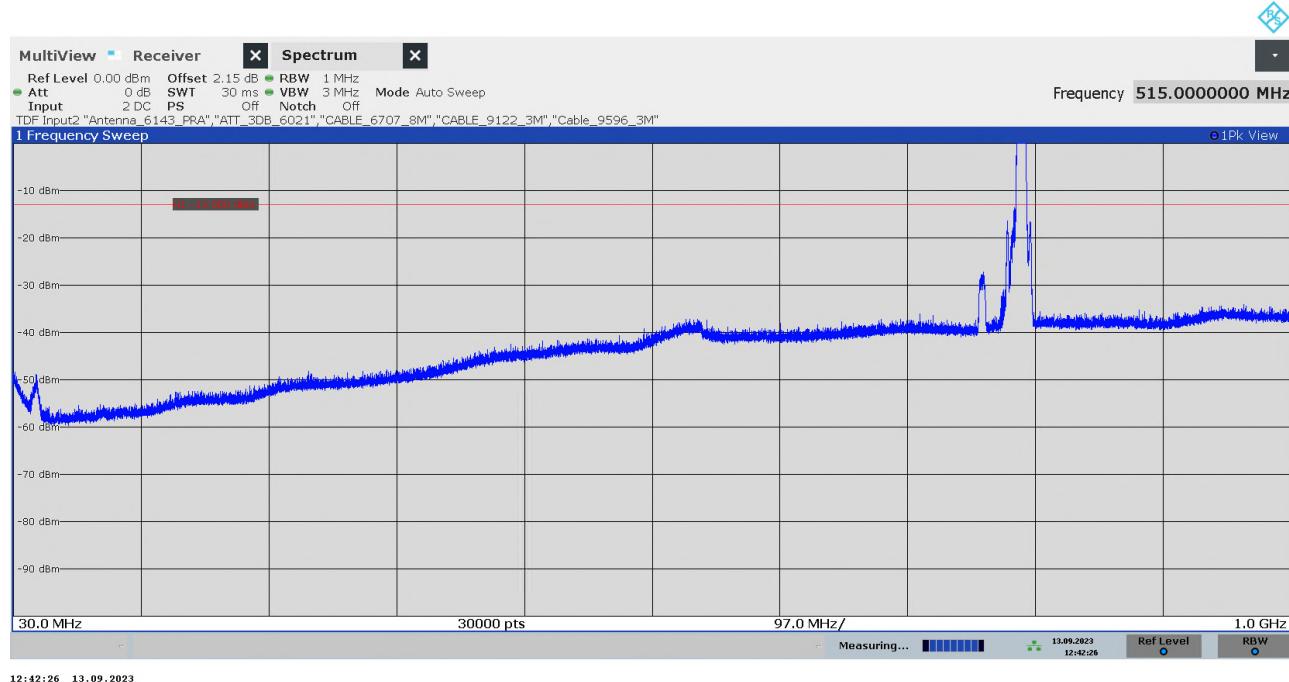


The peak above the limit is the carrier frequency:  
 LTE Cat 1bis Band 14, 790.5 MHz

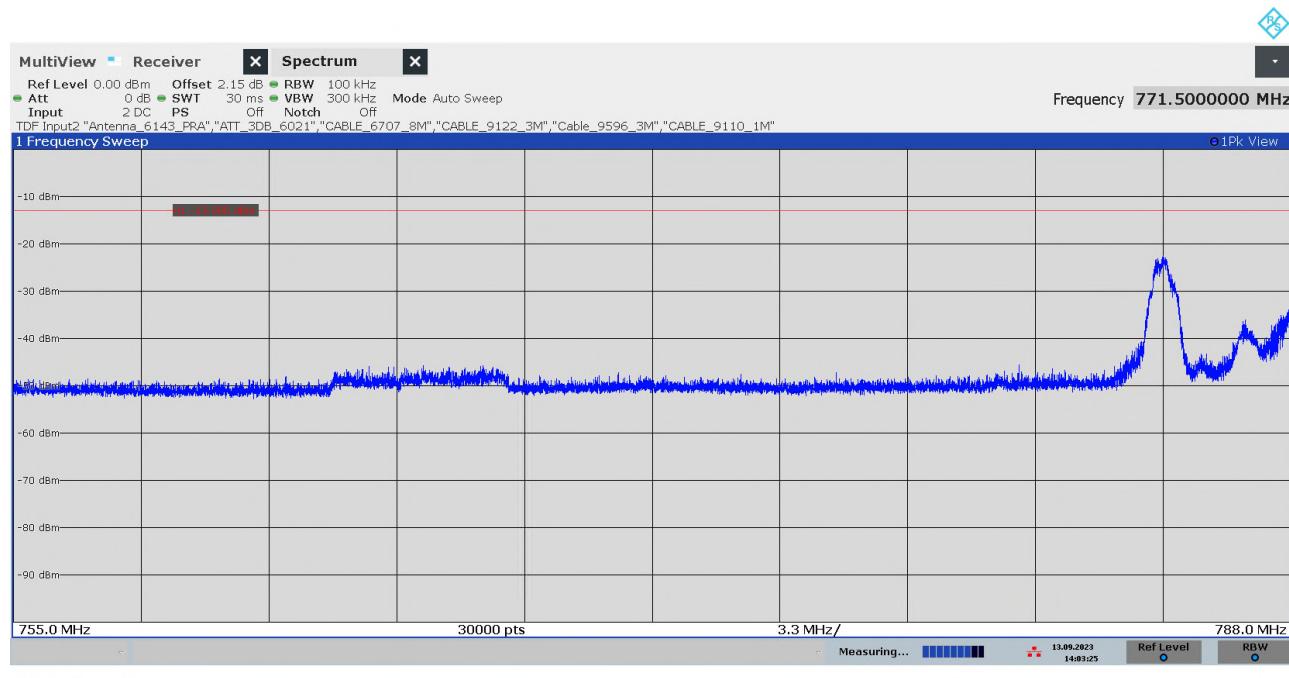


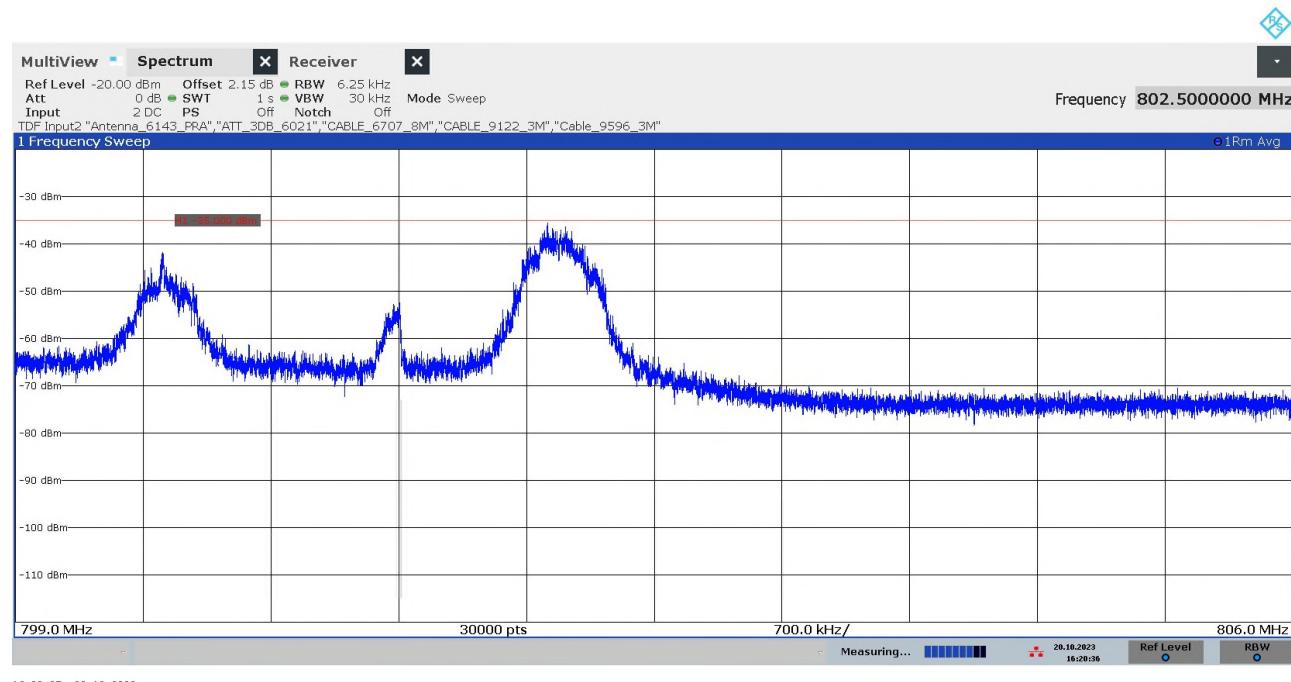
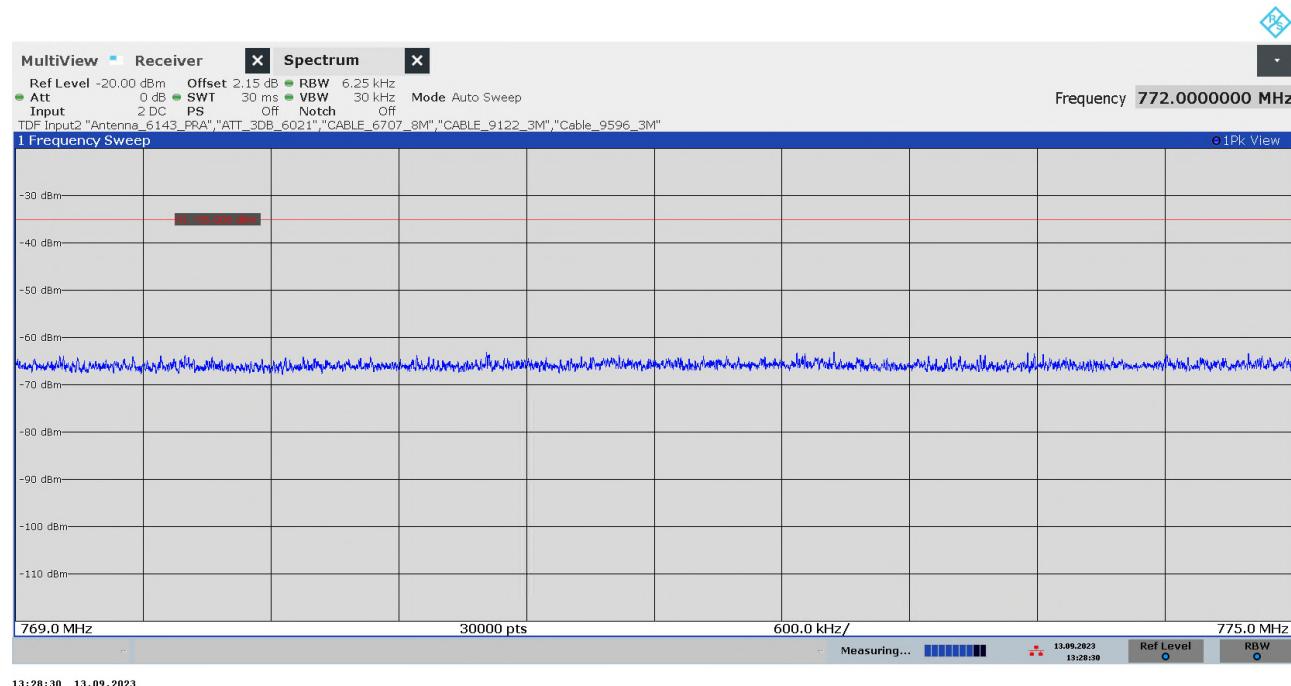


- HIGH CHANNEL:



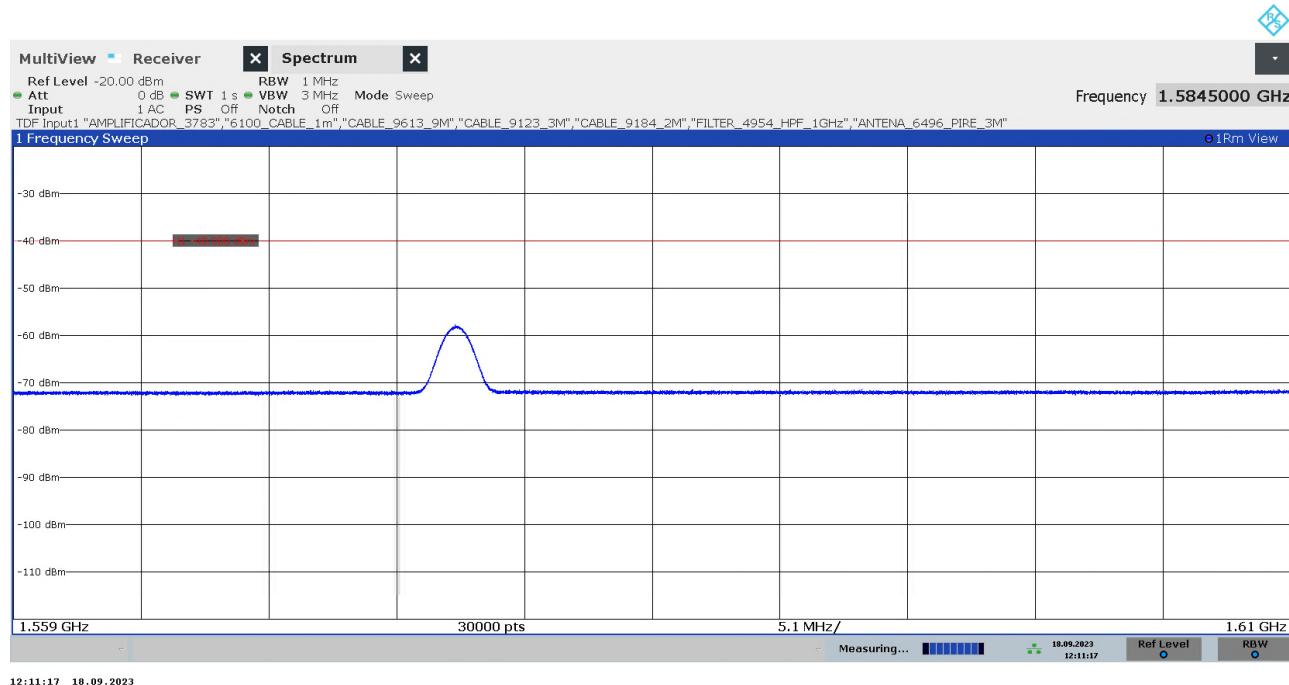
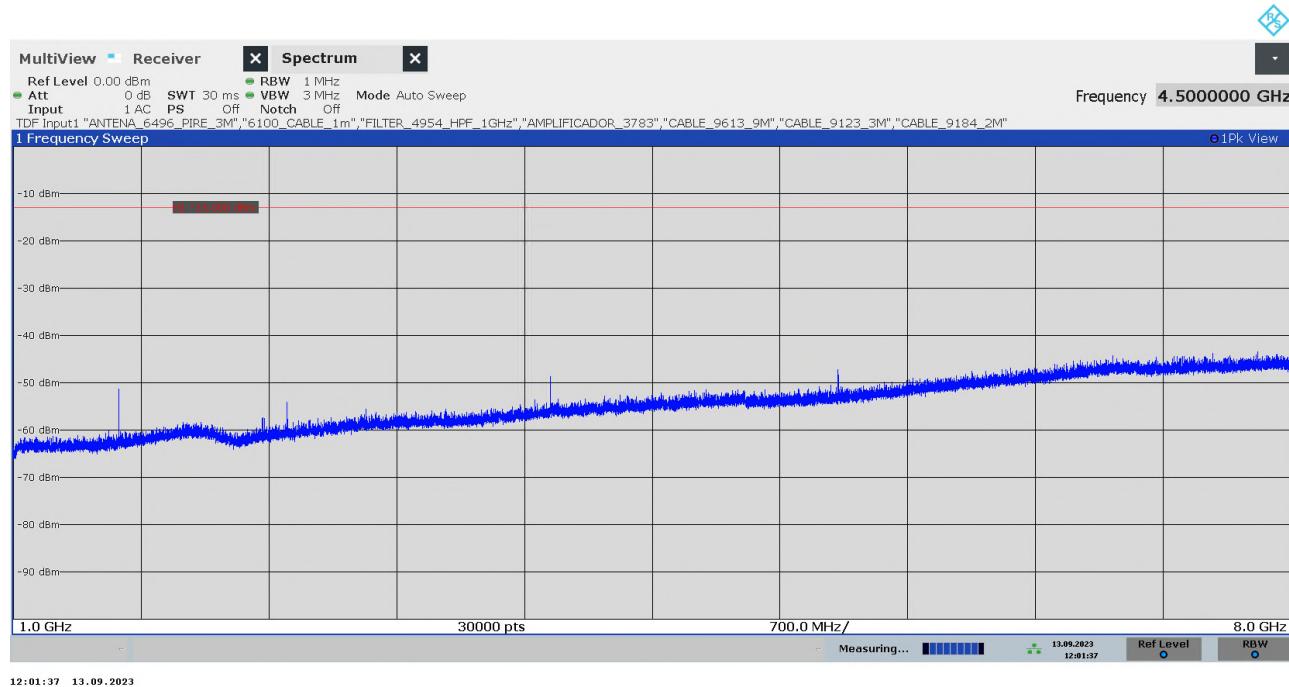
The peak above the limit is the carrier frequency:  
 LTE Cat 1bis Band 14, 795.5 MHz





**FREQUENCY RANGE 1 - 8 GHz:**

- LOW CHANNEL:



- HIGH CHANNEL:

