

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

Where OB is the occupied bandwidth.

4. LTE Cat-M1 71 & LTE Cat-M1 Band 85. FCC §2.1053 & §27.53 (g) / RSS-130 Issue 2 Clause 4.7.

FCC §27.53 (g):

(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. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-130 Issue 2 Clause 4.7:

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. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

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 highest frequency generated within the equipment.

The EUT was placed on a non-conductive stand at 3-meter distance from the measuring antenna for the frequency range 30 MHz to 18 GHz.

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 Limits:

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

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

At P_o transmitting power, the specified minimum attenuation $65 + 10 \log_{10} p$ (watts) becomes:

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

For operation in band 13, the e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW (-40 dBm) per MHz for wideband signals, and -80 dBW (-50 dBm) for discrete emissions of less than 700 Hz bandwidth.

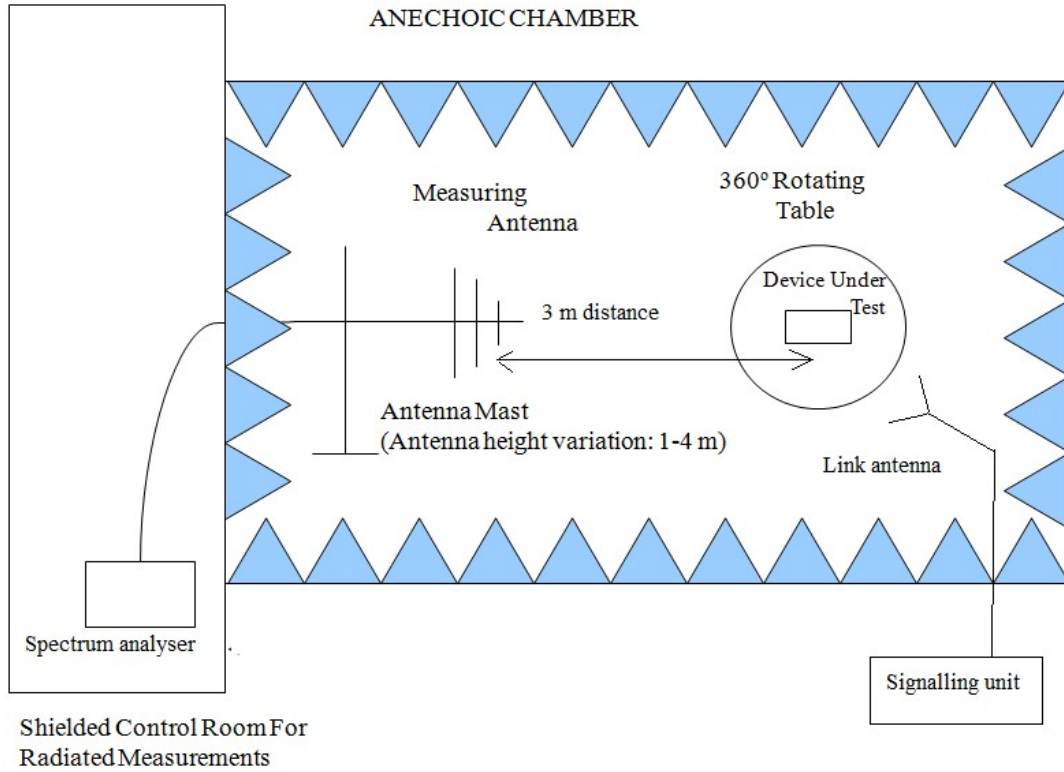
The maximum field strength (dB μ V/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

$$\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20 \log(D) - 104.8;$$

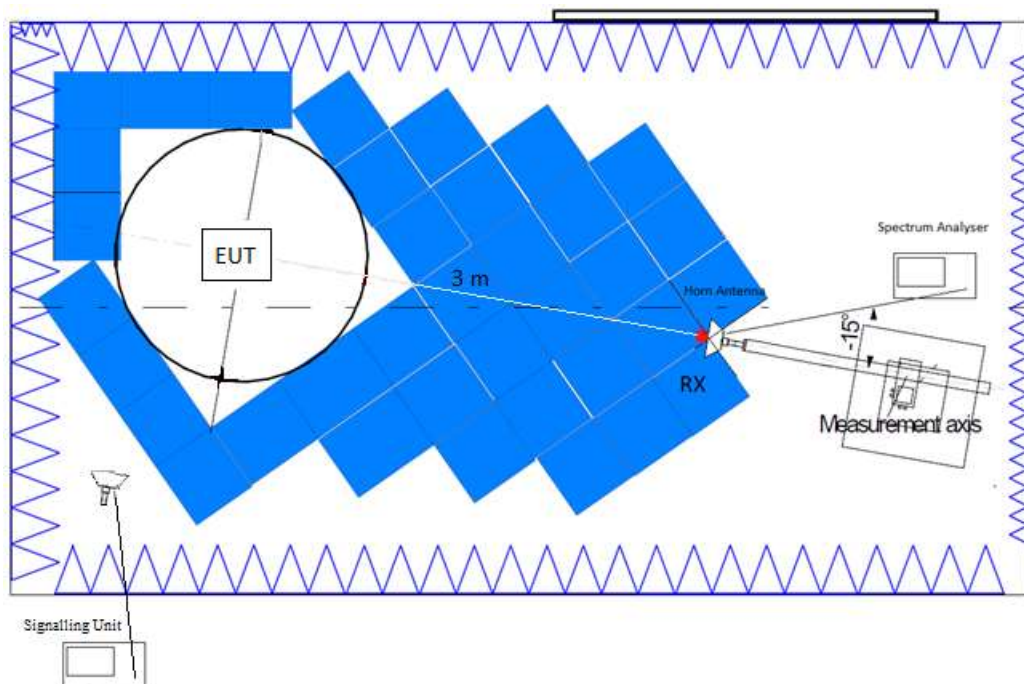
where D is the measurement distance (in the far field region) in m. D = 3m.

Test Setup

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 18 GHz:



Results

Test was performed on worst-case channel in terms of radiated spurious emissions, determined by a preliminary scan for each band.

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	1 s	0 dB
1 GHz - 3 GHz	62.5 kHz	PK+	1 MHz	1 s	0 dB
3 GHz - 18 GHz	468.75 kHz	PK+	1 MHz	1 s	0 dB

LTE Cat-M1 Band 8:

A preliminary scan determined the QPSK, BW=1.4 MHz, RB=1, Offset=2, Narrow Band=0 as the worst case. The next results are for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 10 GHz:

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 10 GHz:

No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB) < ± 5.35 for $f < 1$ GHz
< ± 4.32 for $f \geq 1$ GHz up to 8 GHz

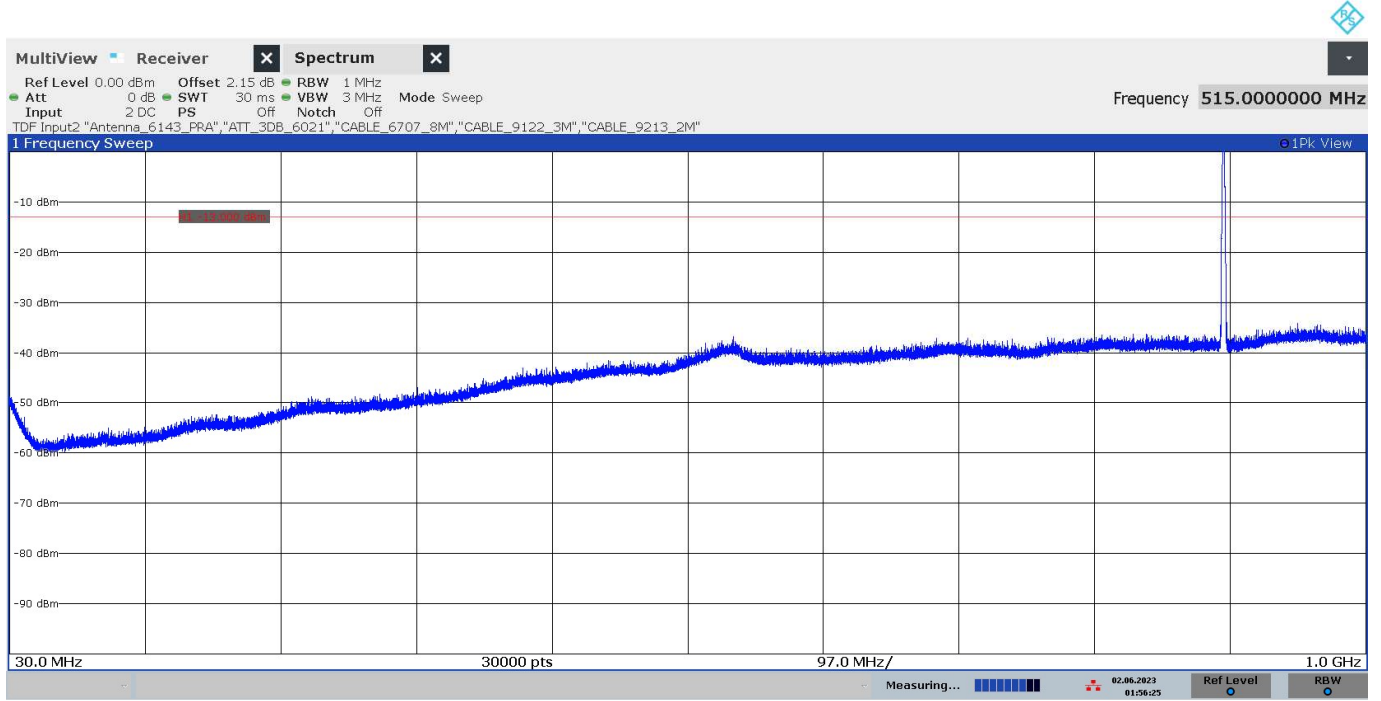
Verdict

Pass

LTE Cat-M1 Band 8:

FREQUENCY RANGE 30 MHz - 1 GHz:

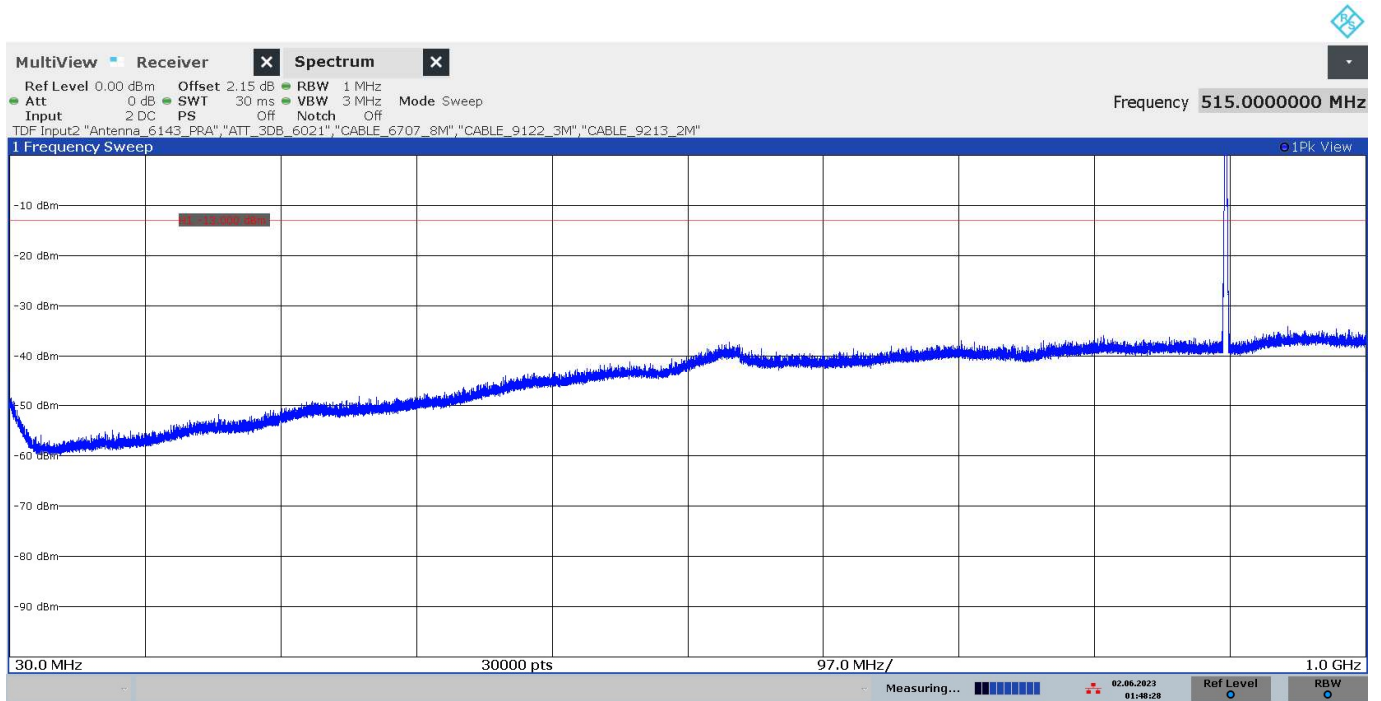
- LOW CHANNEL:



01:56:25 02.06.2023

The peak above the limit is the LTE Cat-M1 Band 8 carrier frequency.

- HIGH CHANNEL:

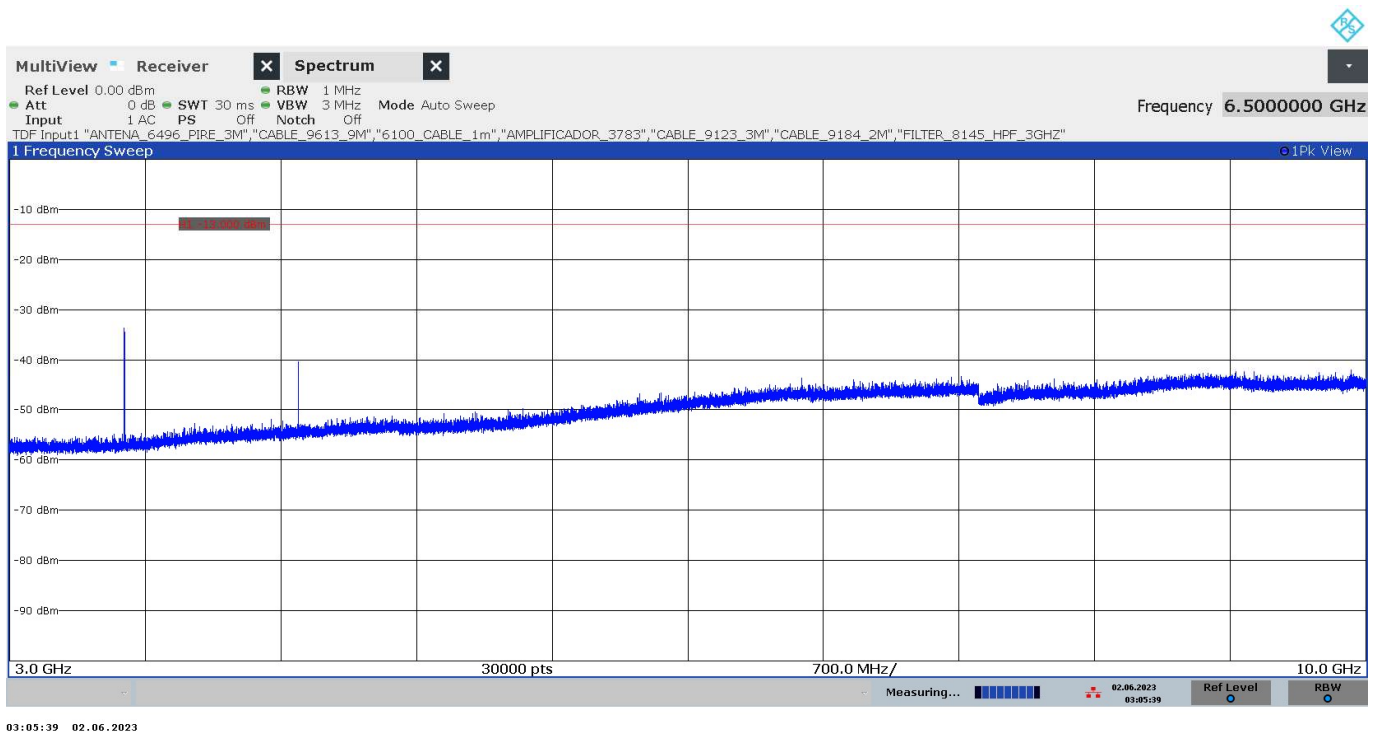
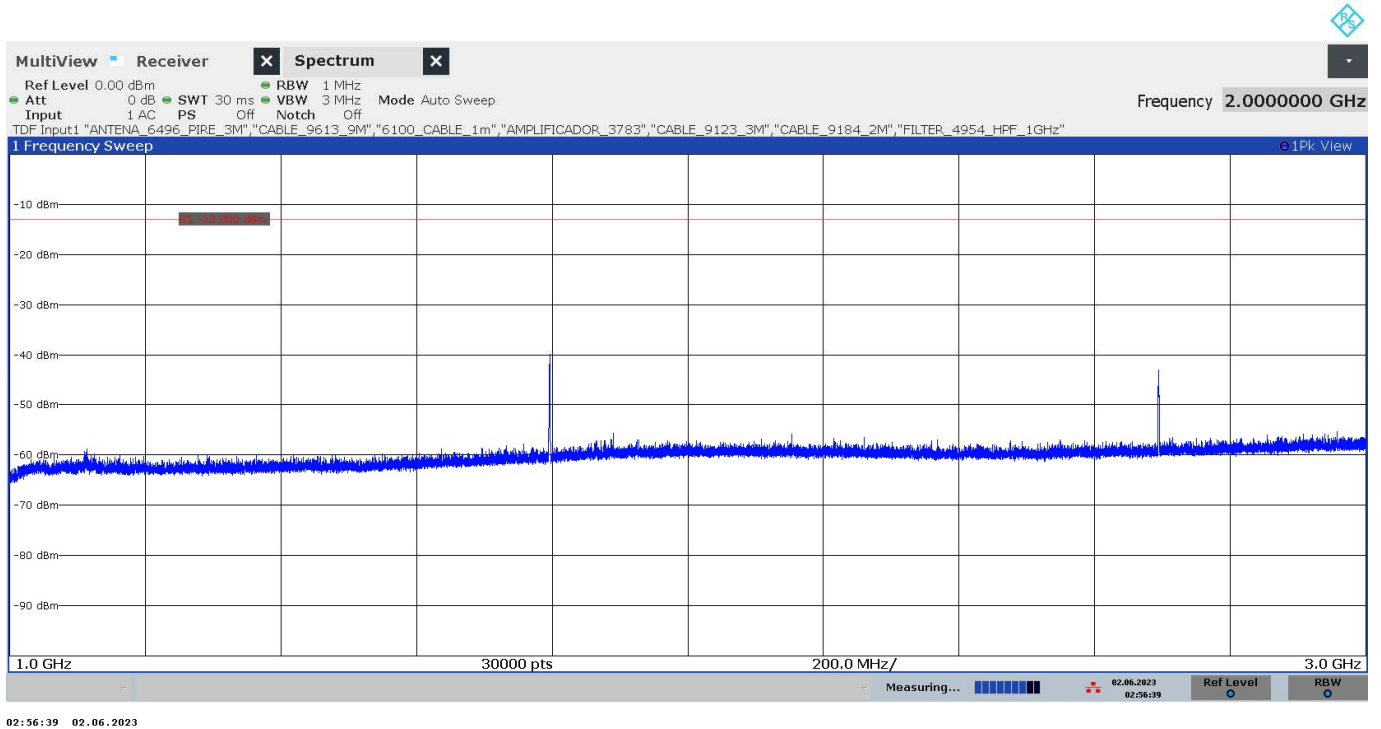


01:40:28 02.06.2023

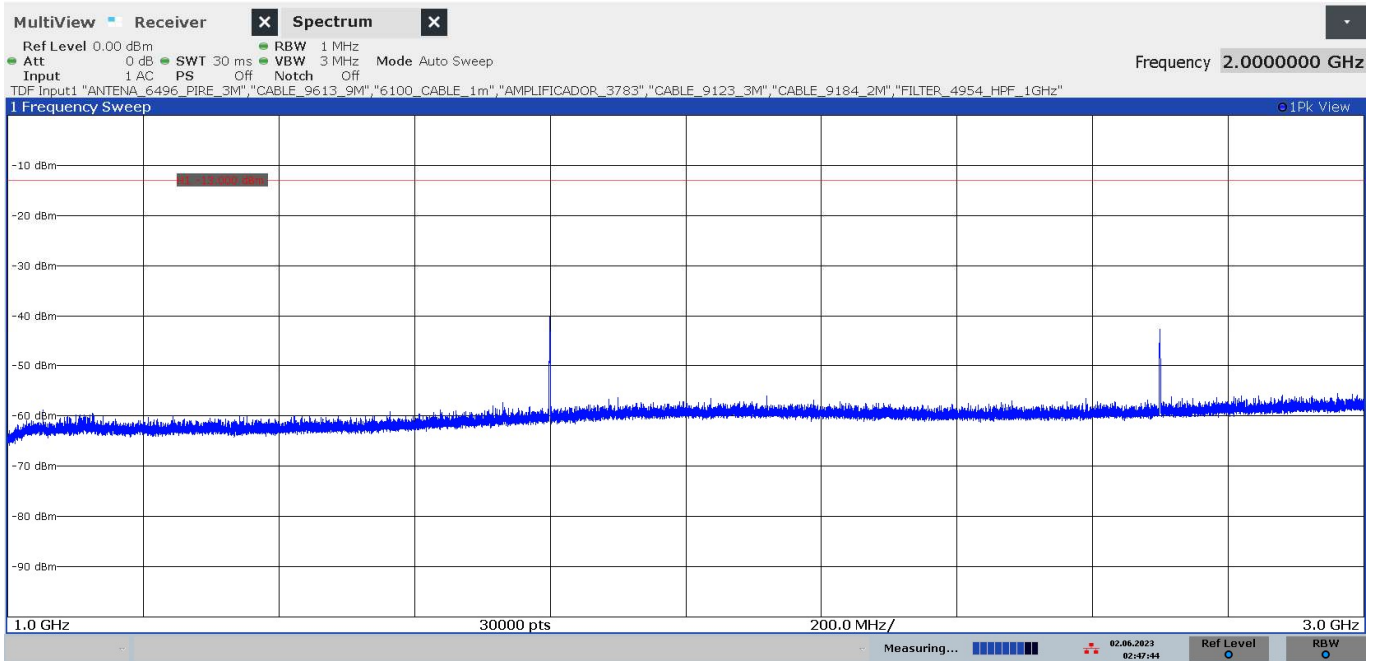
The peak above the limit is the LTE Cat-M1 Band 8 carrier frequency.

FREQUENCY RANGE 1 GHz - 10 GHz

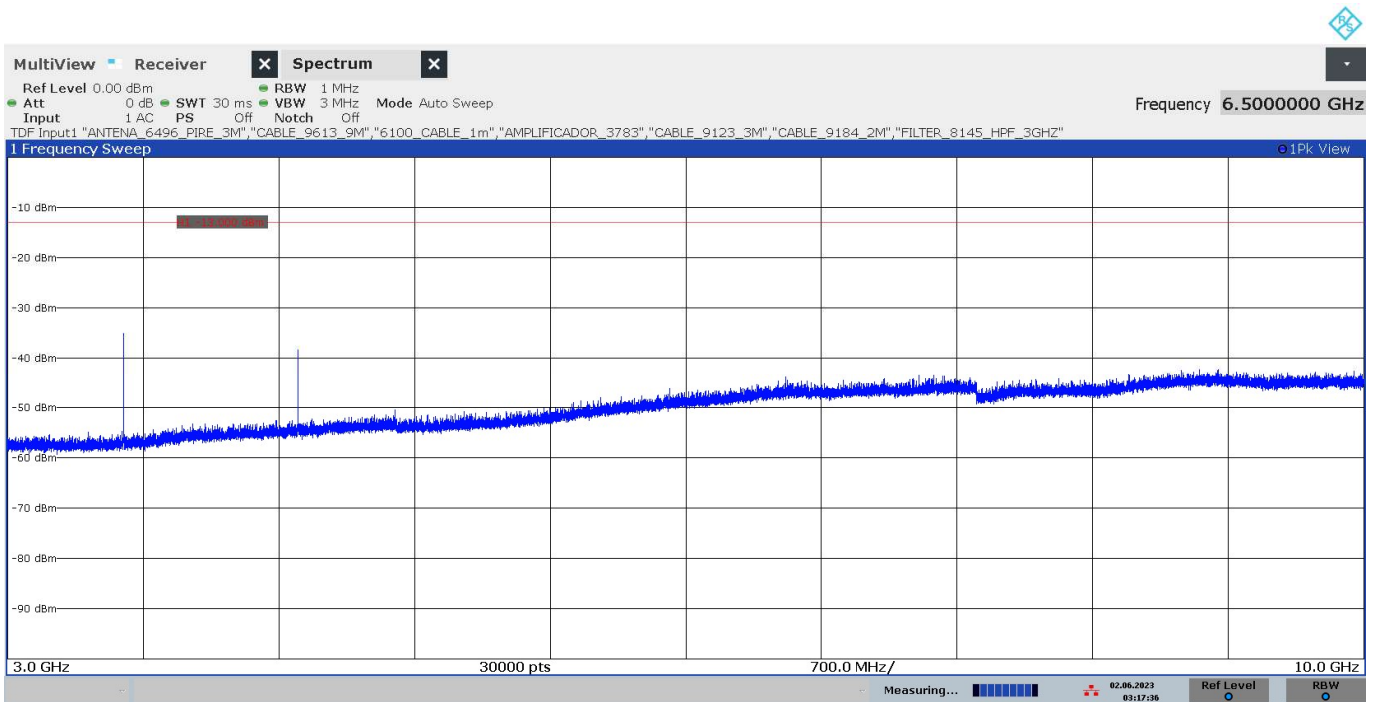
- LOW CHANNEL:



- HIGH CHANNEL:



02:47:45 02.06.2023



03:17:37 02.06.2023

LTE Cat-M1 Band 13:

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

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 763 - 775 MHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 793 - 806 MHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1559 - 1610 MHz:

No spurious frequencies at less than 20 dB below the limit.

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 763 - 775 MHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 793 - 806 MHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1559 - 1610 MHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
1.561729	-47.57	H	Peak

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 763 - 775 MHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 793 - 806 MHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1559 - 1610 MHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
1.566778	-46.95	H	Peak

Measurement uncertainty (dB) < ± 5.35 for $f < 1$ GHz
< ± 4.32 for $f \geq 1$ GHz up to 8 GHz

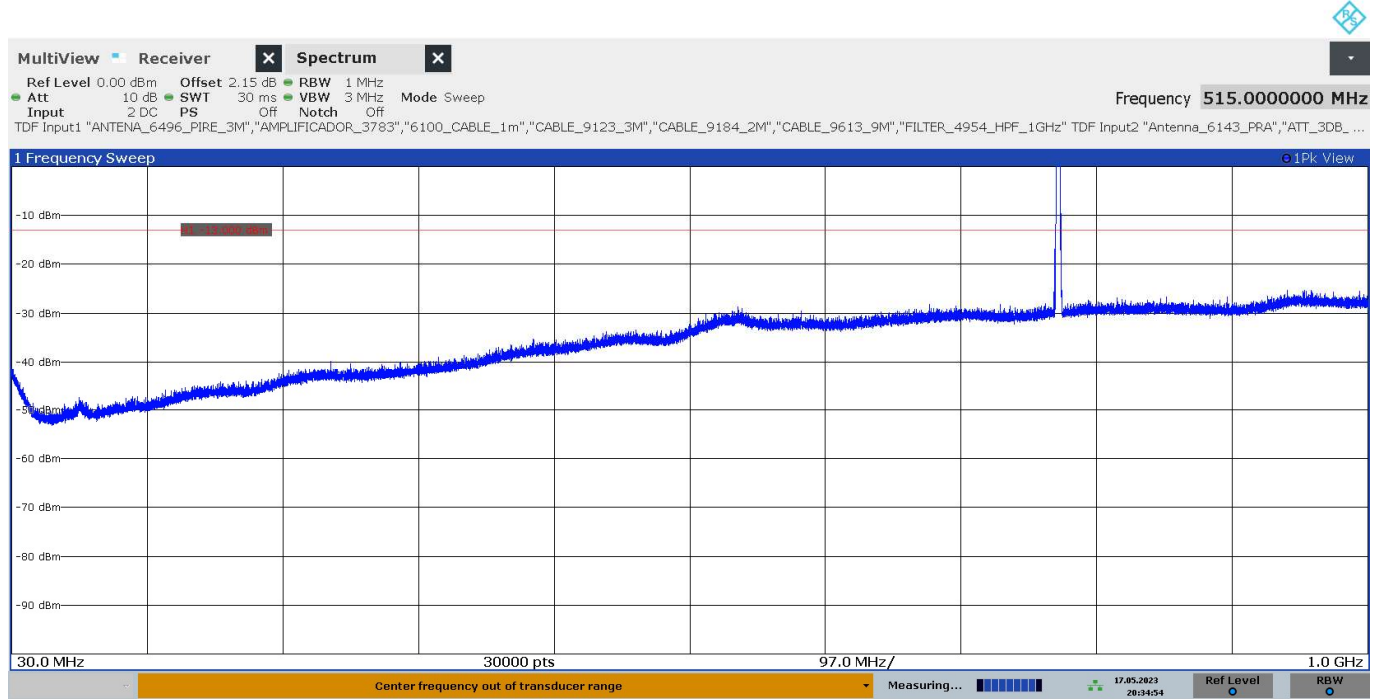
Verdict

Pass

LTE Cat-M1 Band 13:

FREQUENCY RANGE 30 MHz - 1 GHz:

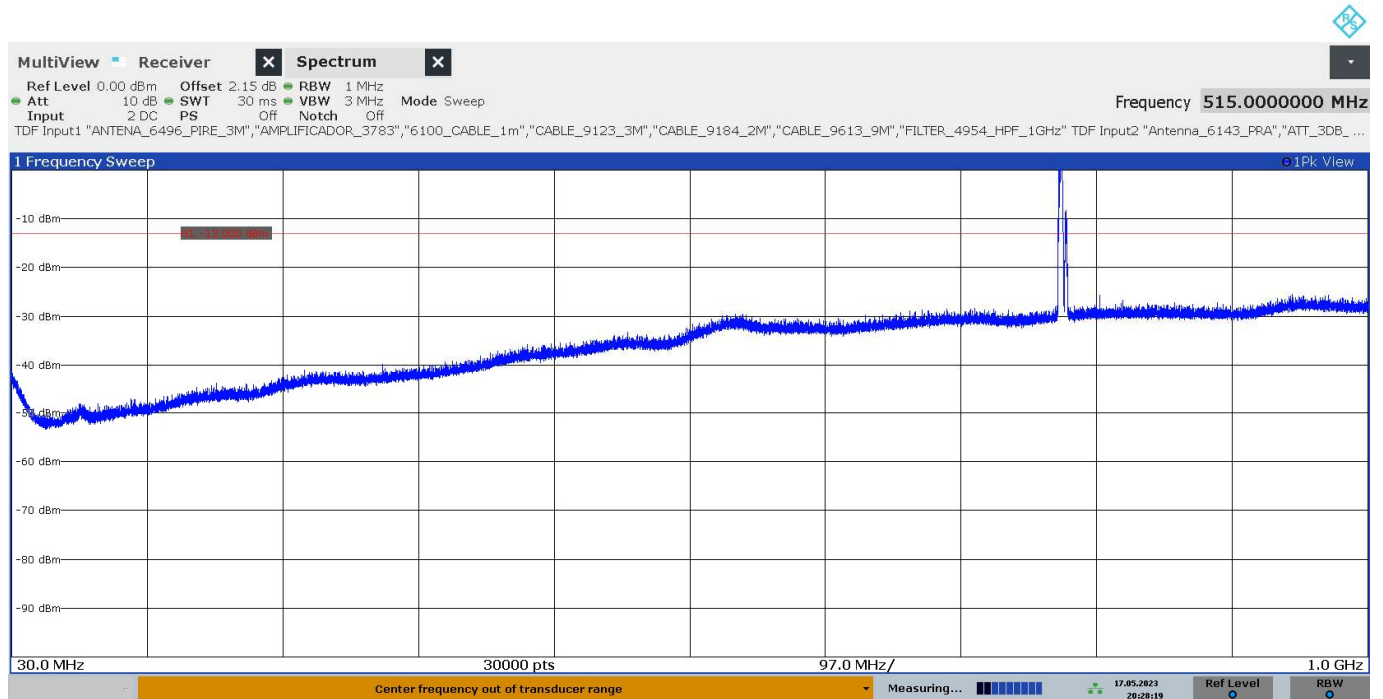
- LOW CHANNEL:



20:34:55 17.05.2023

The peak above the limit is the carrier frequency.

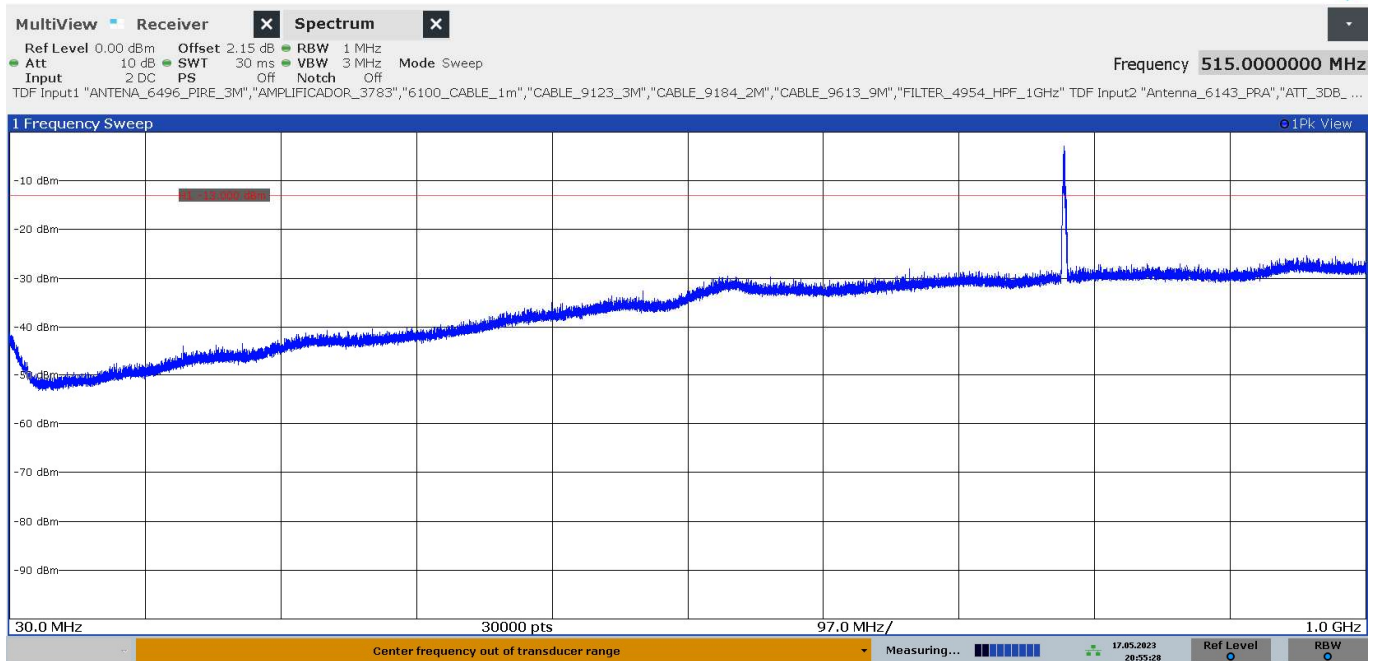
- MIDDLE CHANNEL:



20:28:20 17.05.2023

The peak above the limit is the carrier frequency.

- HIGH CHANNEL:

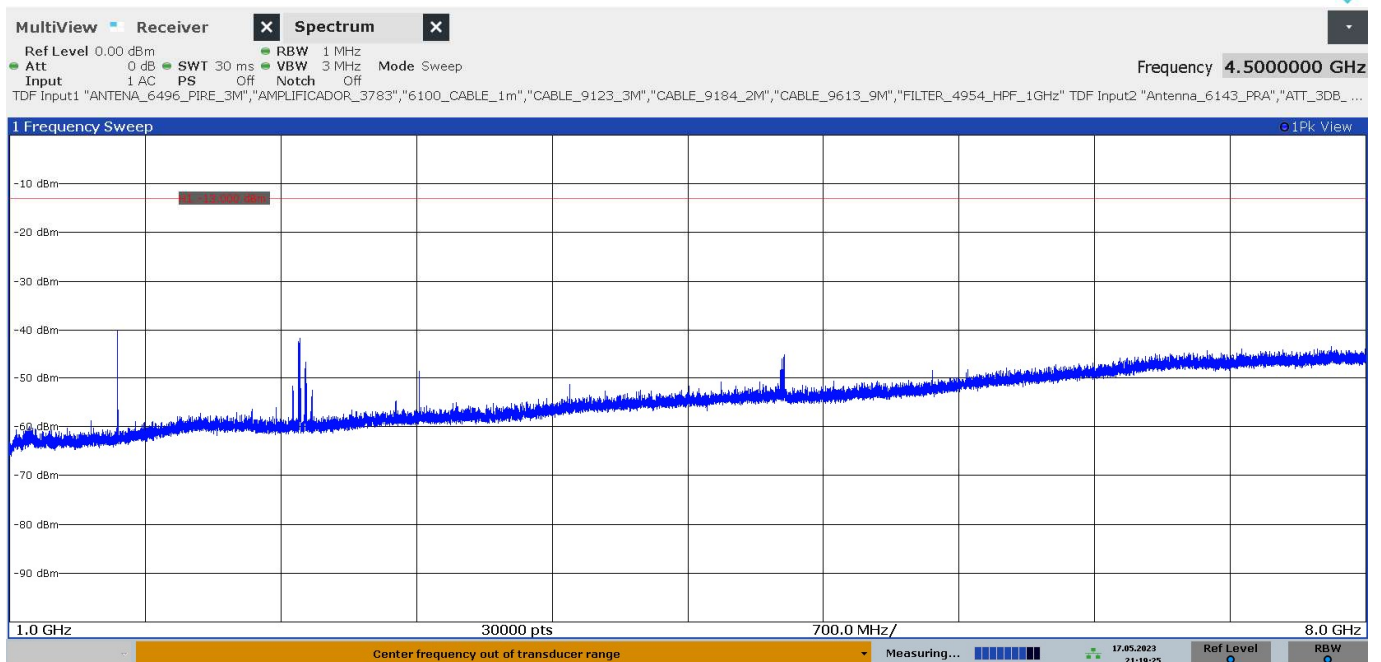


20:55:28 17.05.2023

The peak above the limit is the carrier frequency.

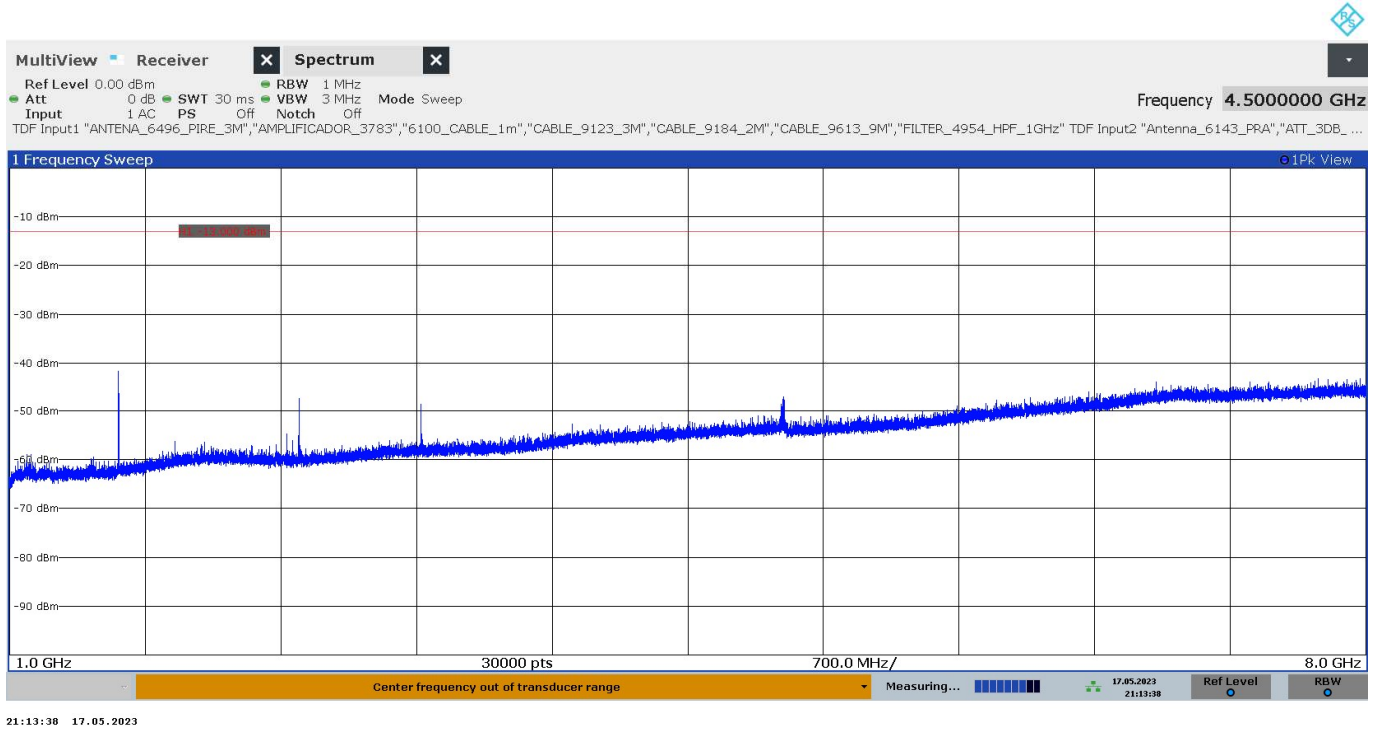
FREQUENCY RANGE 1 - 8 GHz:

- LOW CHANNEL:

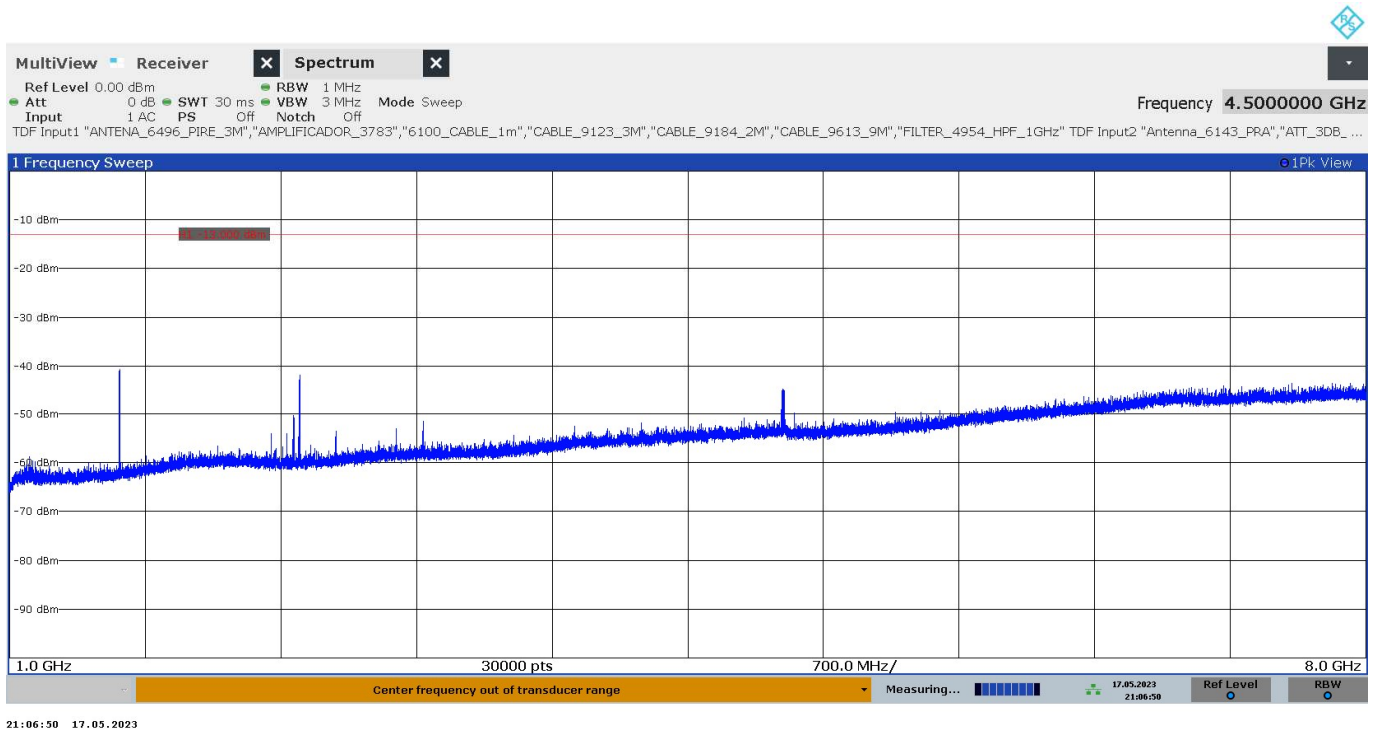


21:19:25 17.05.2023

- MIDDLE CHANNEL:

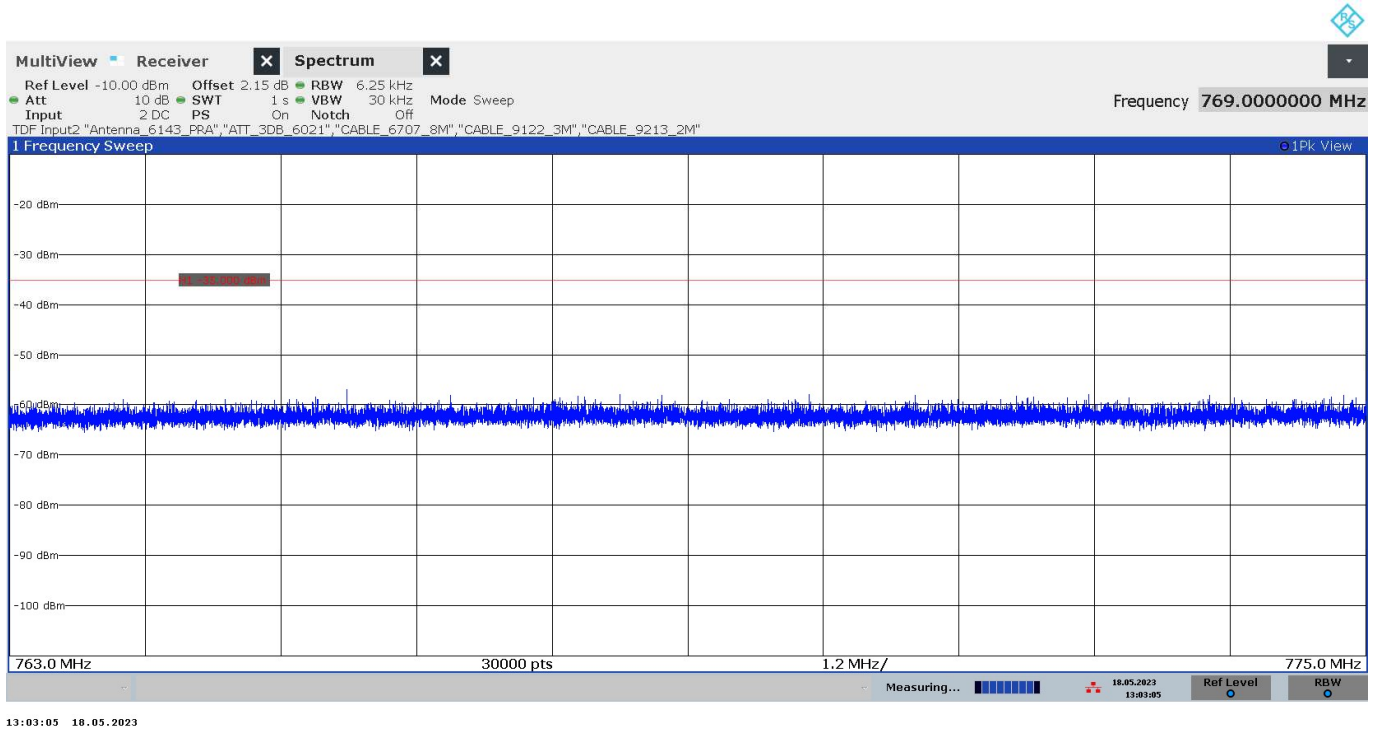


- HIGH CHANNEL:

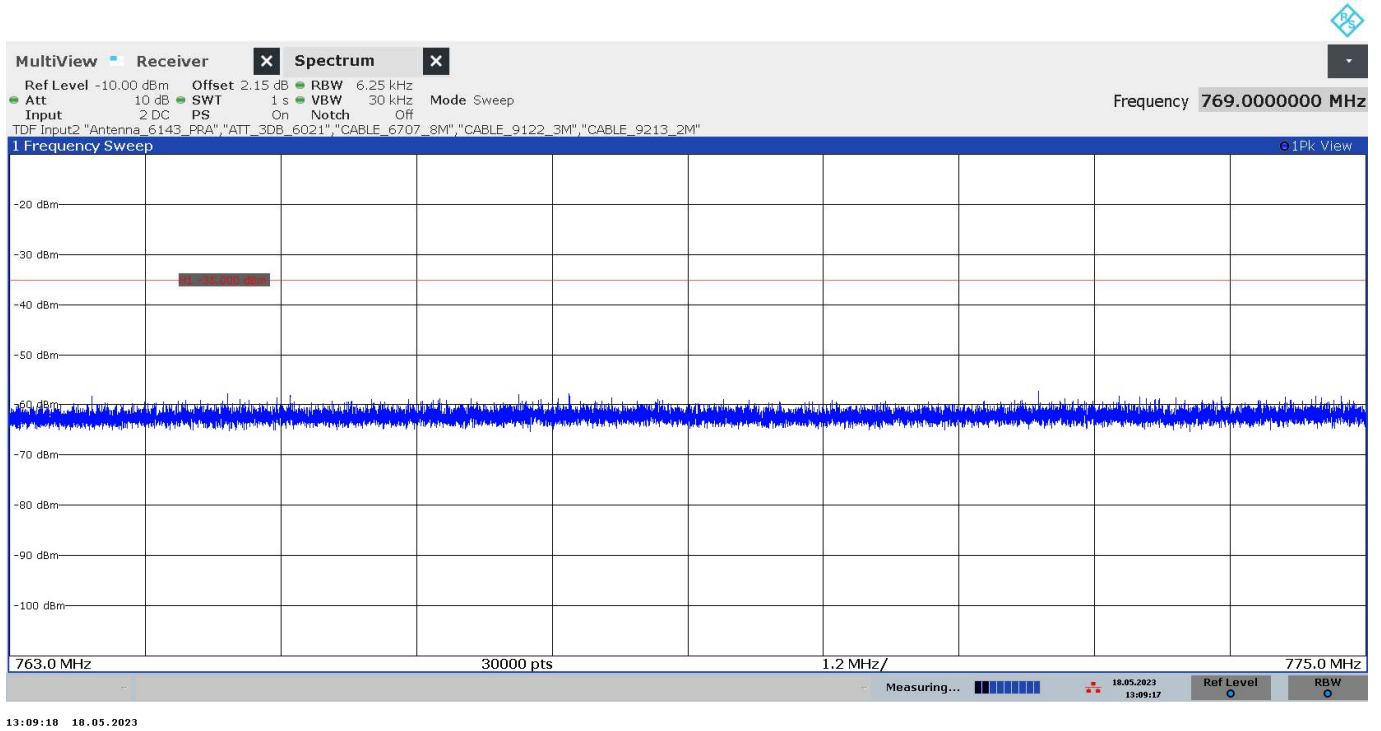


FREQUENCY RANGE 763 - 775 MHz:

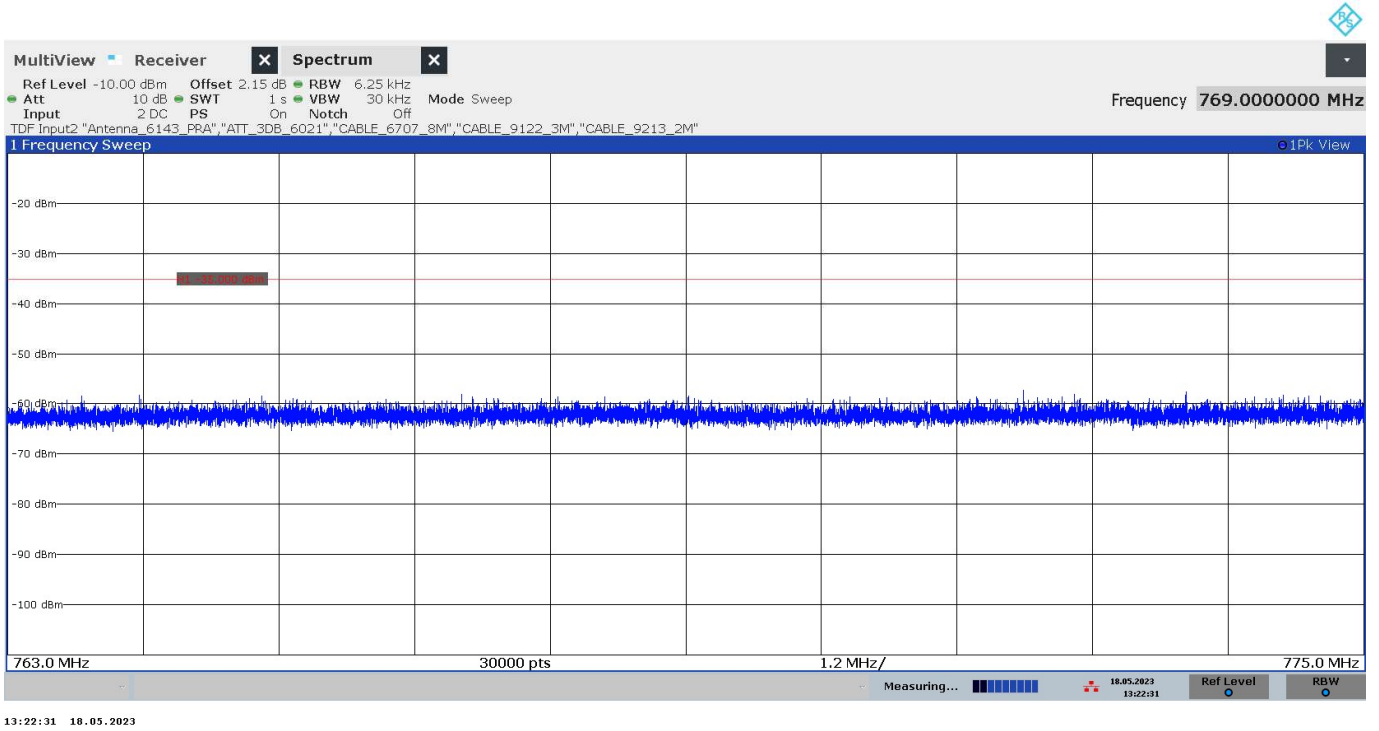
- LOW CHANNEL:



- MIDDLE CHANNEL:

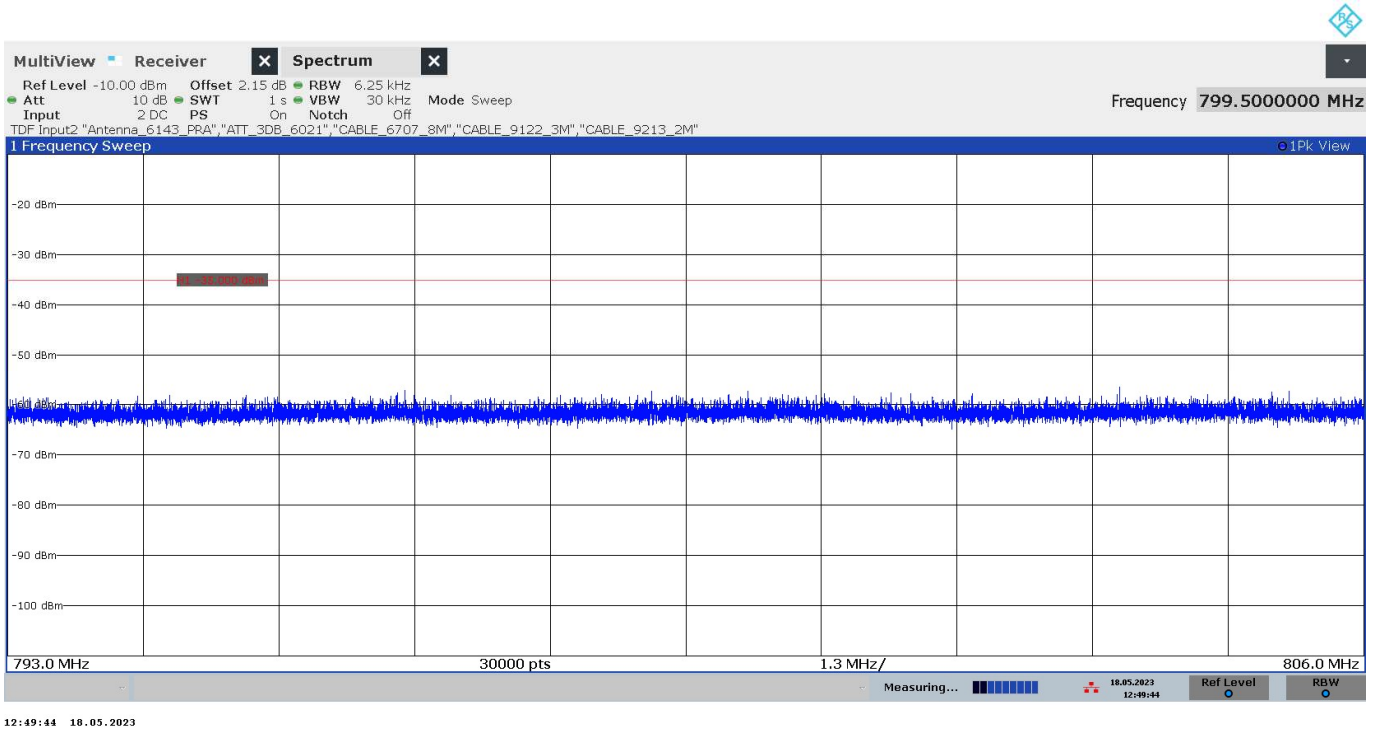


- HIGH CHANNEL:

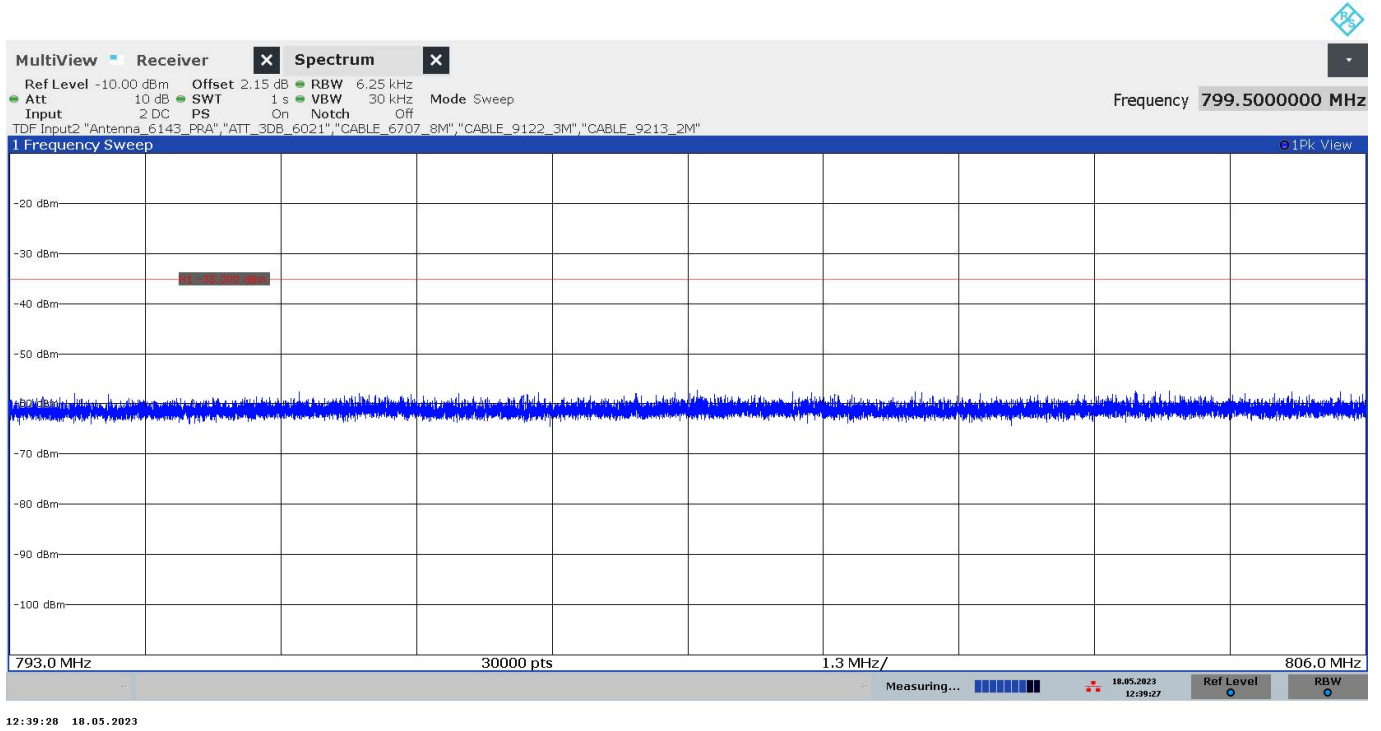


FREQUENCY RANGE 793 - 806 MHz:

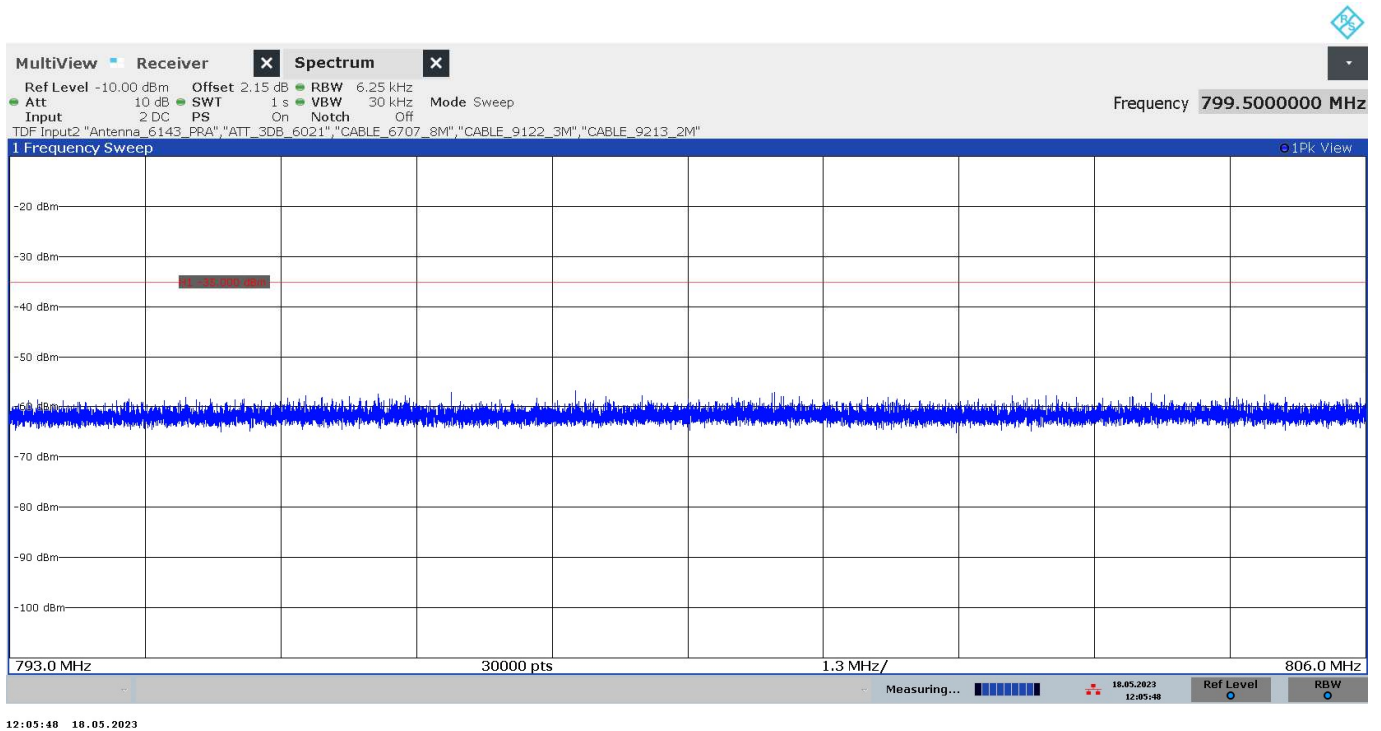
- LOW CHANNEL:



- MIDDLE CHANNEL:

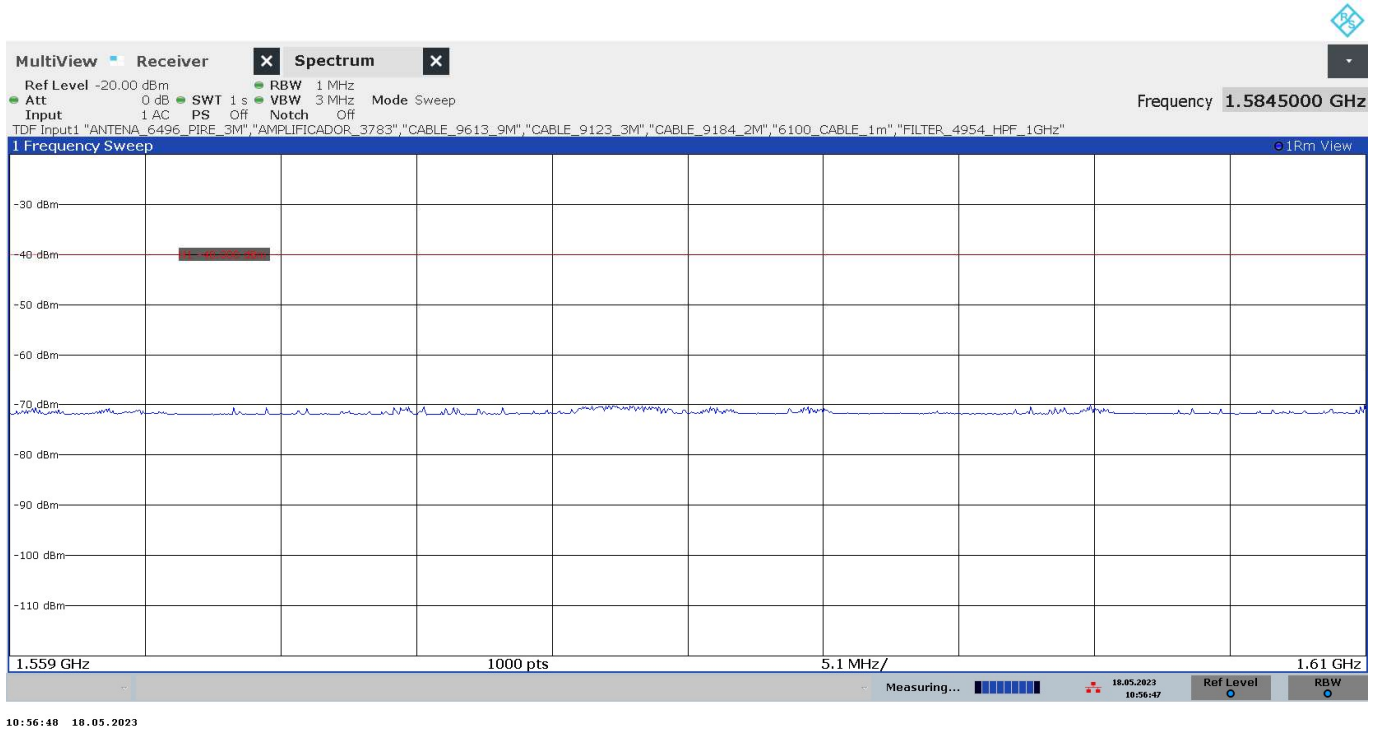


- HIGH CHANNEL:

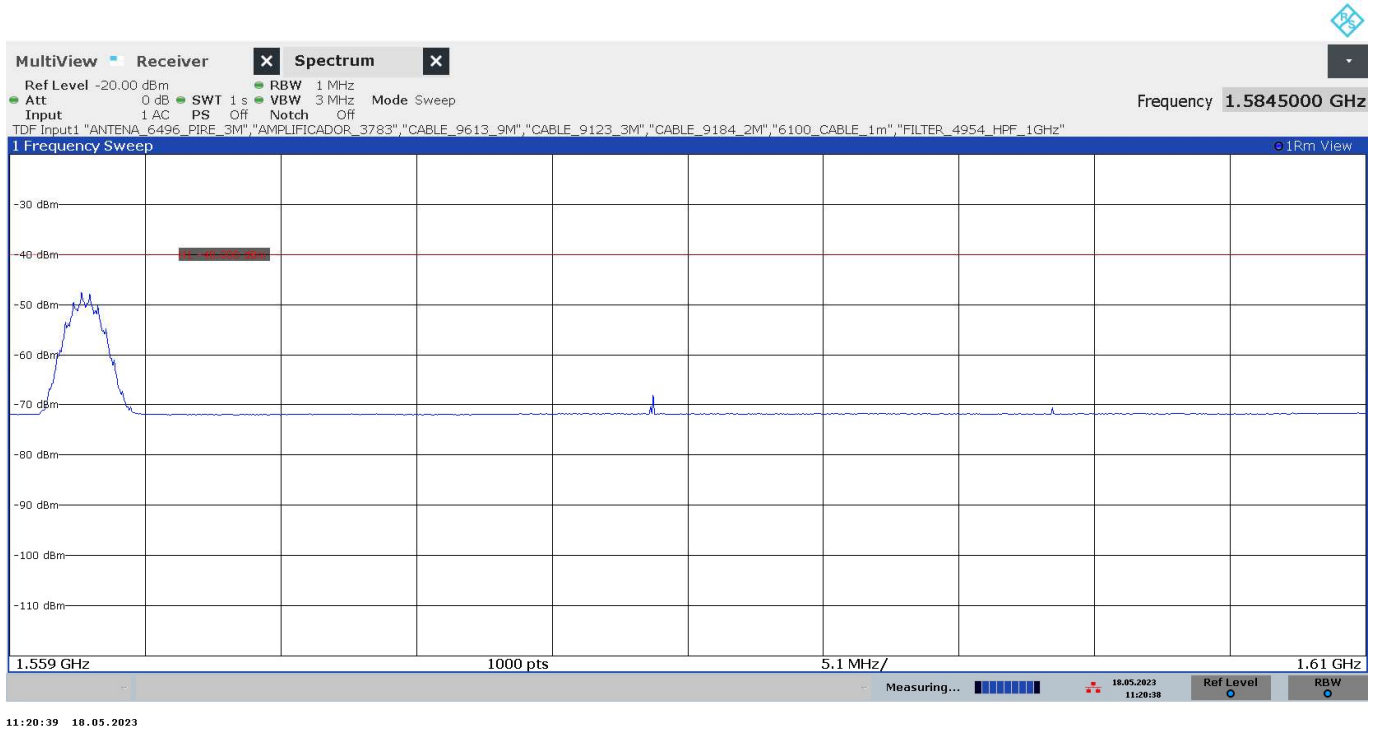


FREQUENCY RANGE 1559 - 1610 MHZ:

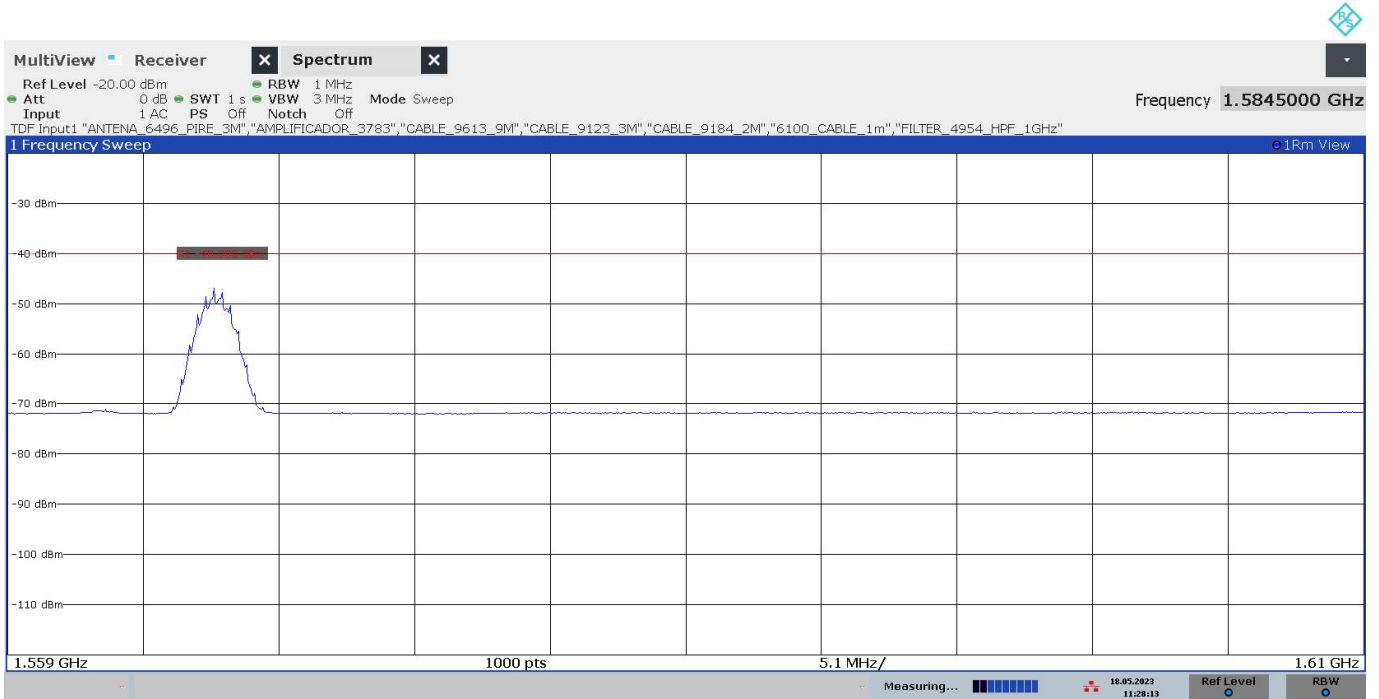
- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:



11:28:13 18.05.2023

LTE Cat-M1 Band 66:

A preliminary scan determined the 16QAM modulation, BW=10 MHz, RB=1, RB Offset=2, Narrow Band=0 as the worst-case. The next results are for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 18 GHz:

No spurious frequencies at less than 20 dB below the limit.

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 18 GHz:

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 18 GHz:

No spurious frequencies at less than 20 dB below the limit.

Measurement Uncertainty (dB) $< \pm 5.35$ for $f < 1$ GHz
 $< \pm 4.32$ for $f \geq 1$ GHz up to 18 GHz

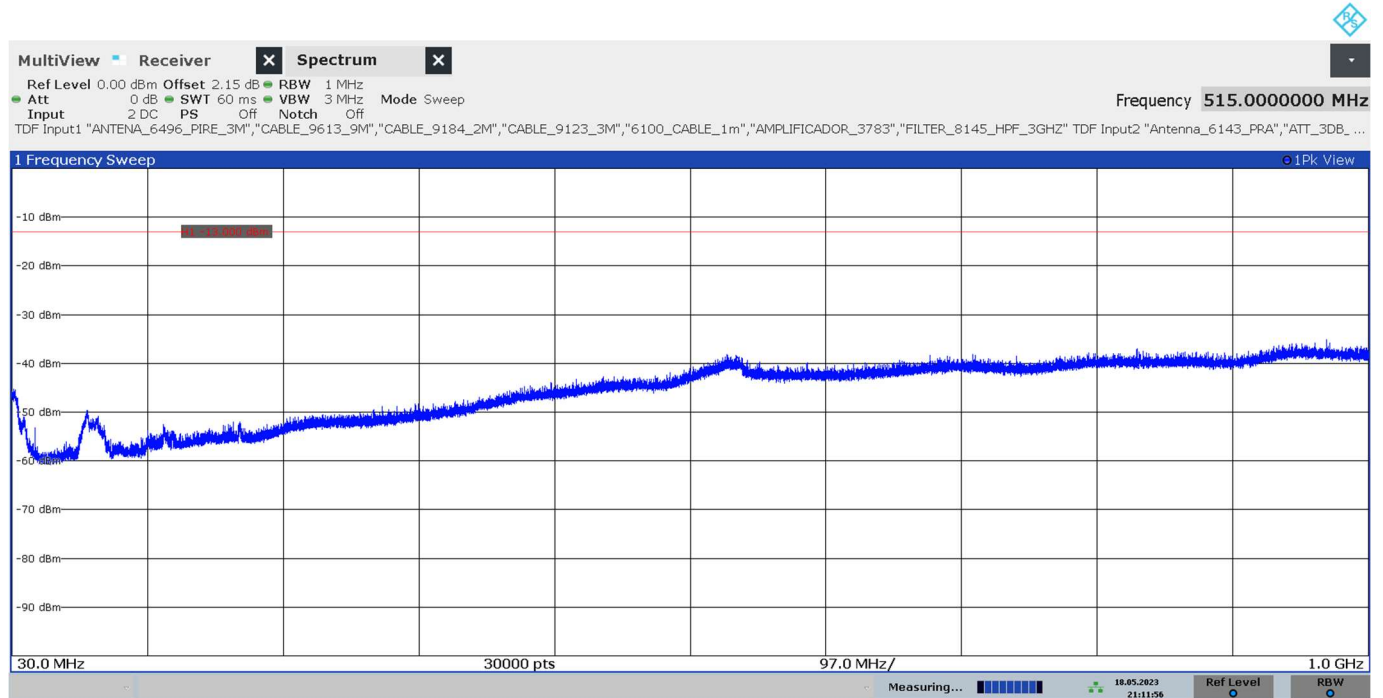
Verdict

Pass

LTE Cat-M1 Band 66:

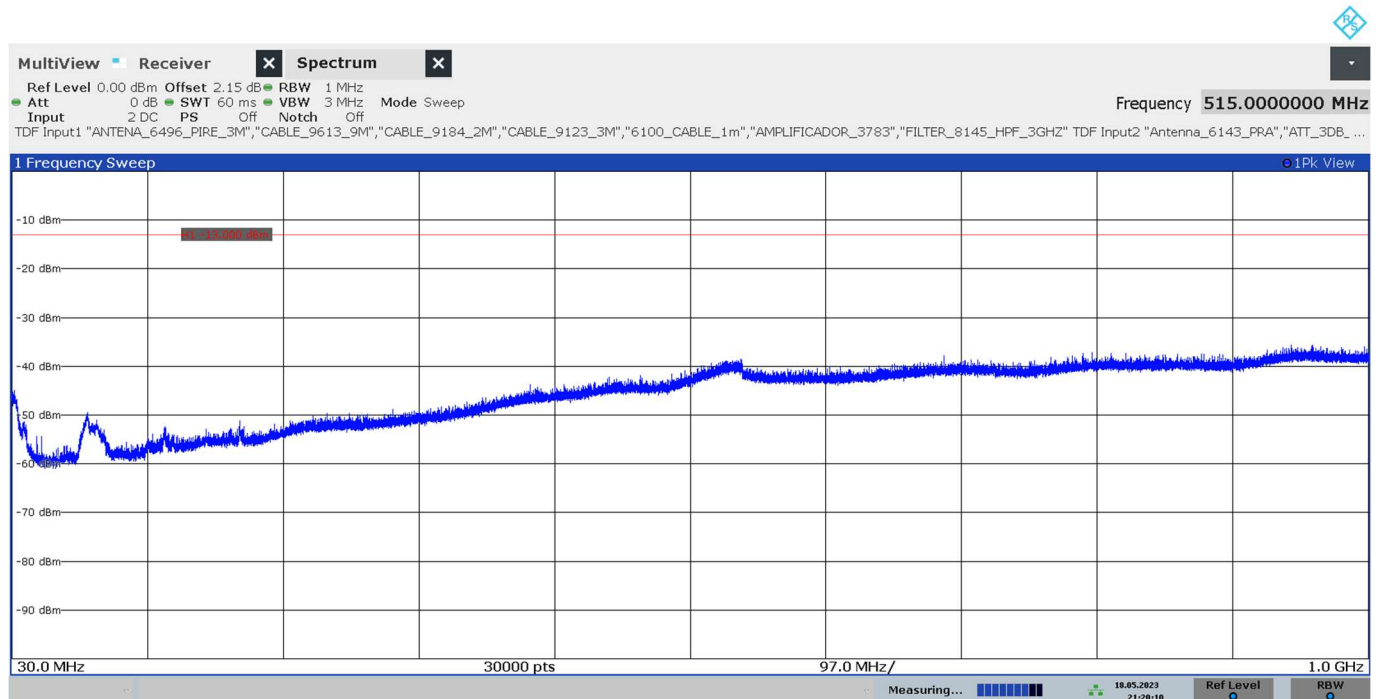
FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



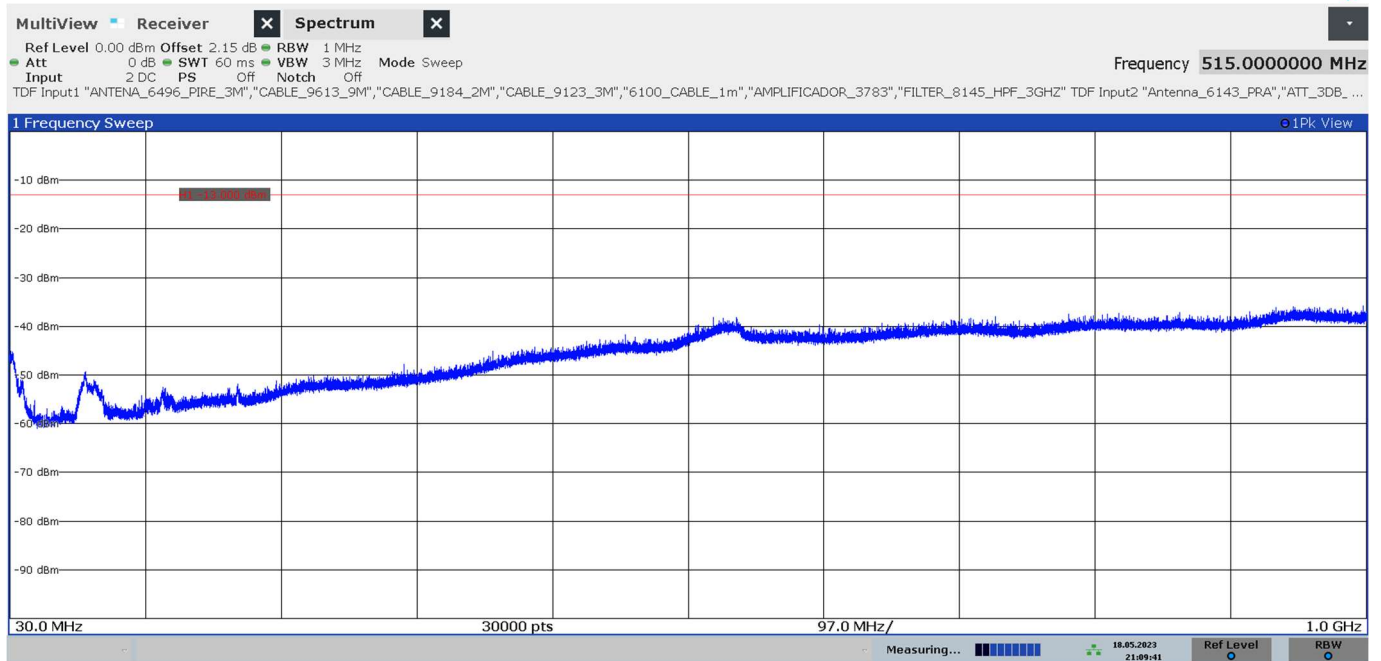
21:11:57 18.05.2023

- MIDDLE CHANNEL:



21:20:11 18.05.2023

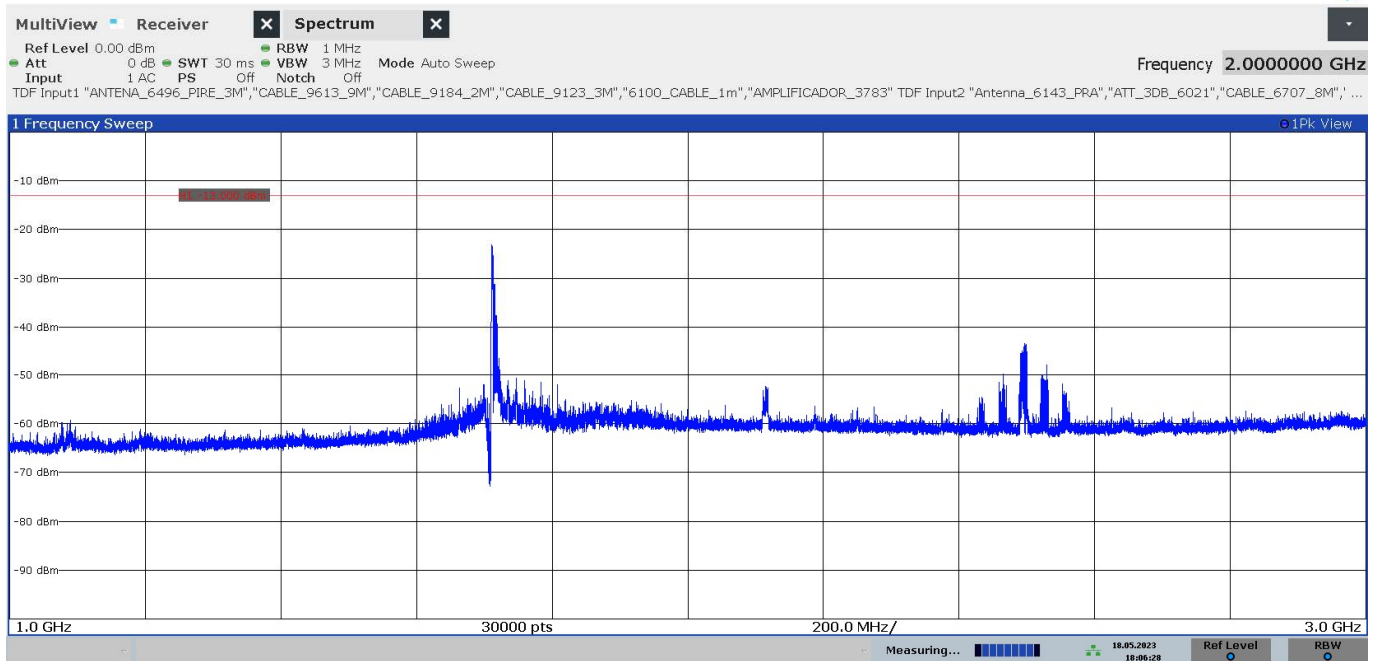
- HIGH CHANNEL:



21:09:42 18.05.2023

FREQUENCY RANGE 1 - 3 GHz:

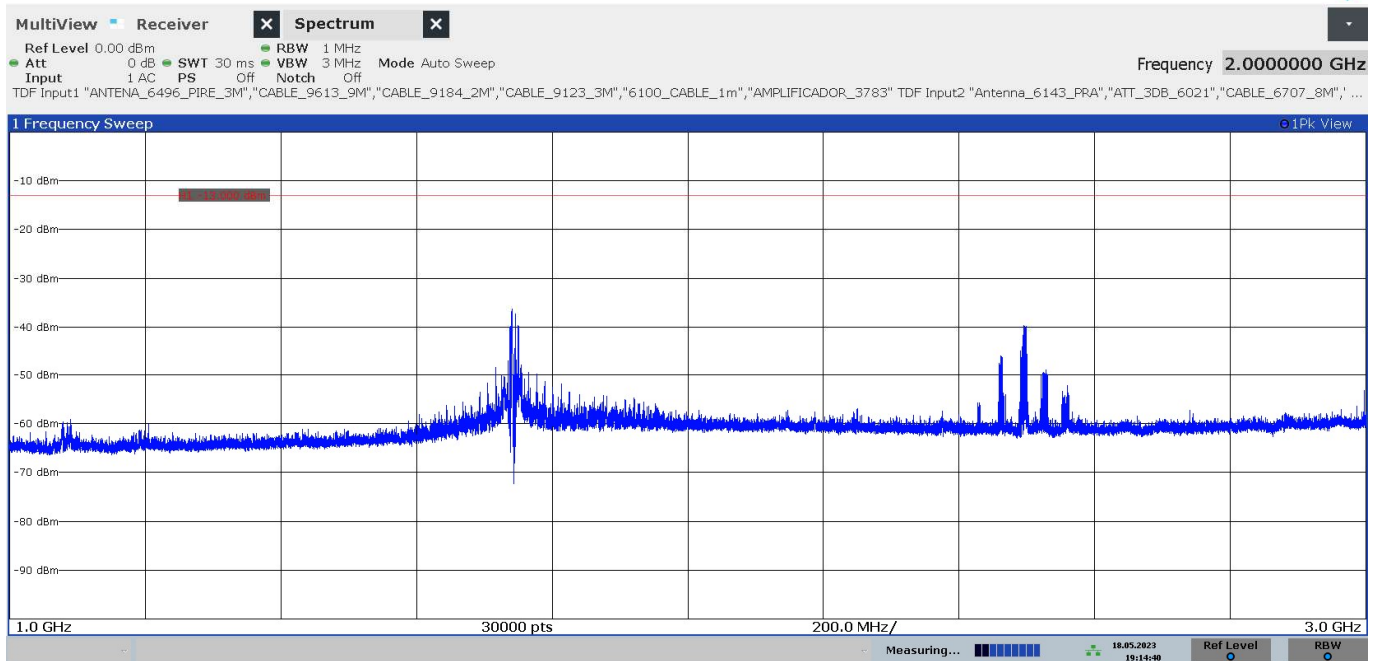
- LOW CHANNEL:



18:06:29 18.05.2023

The higher peak is the carrier frequency.

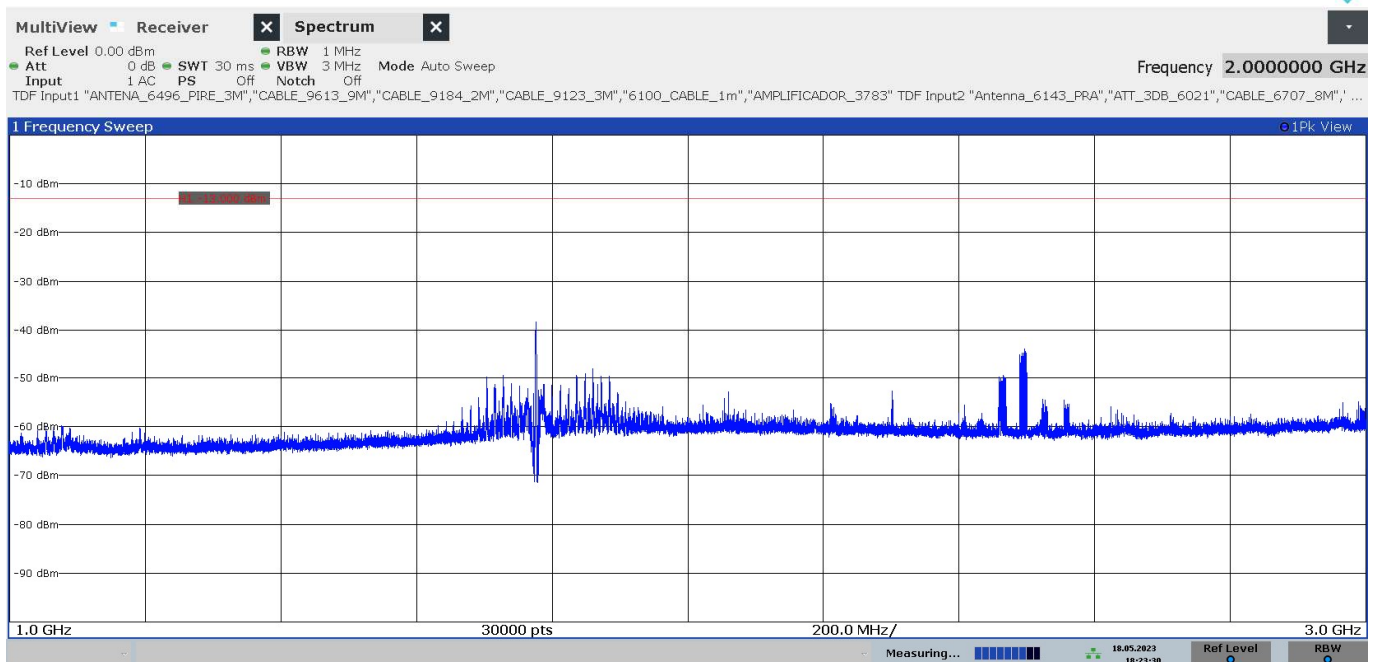
- MIDDLE CHANNEL:



19:14:41 18.05.2023

The higher peak is the carrier frequency.

- HIGH CHANNEL:

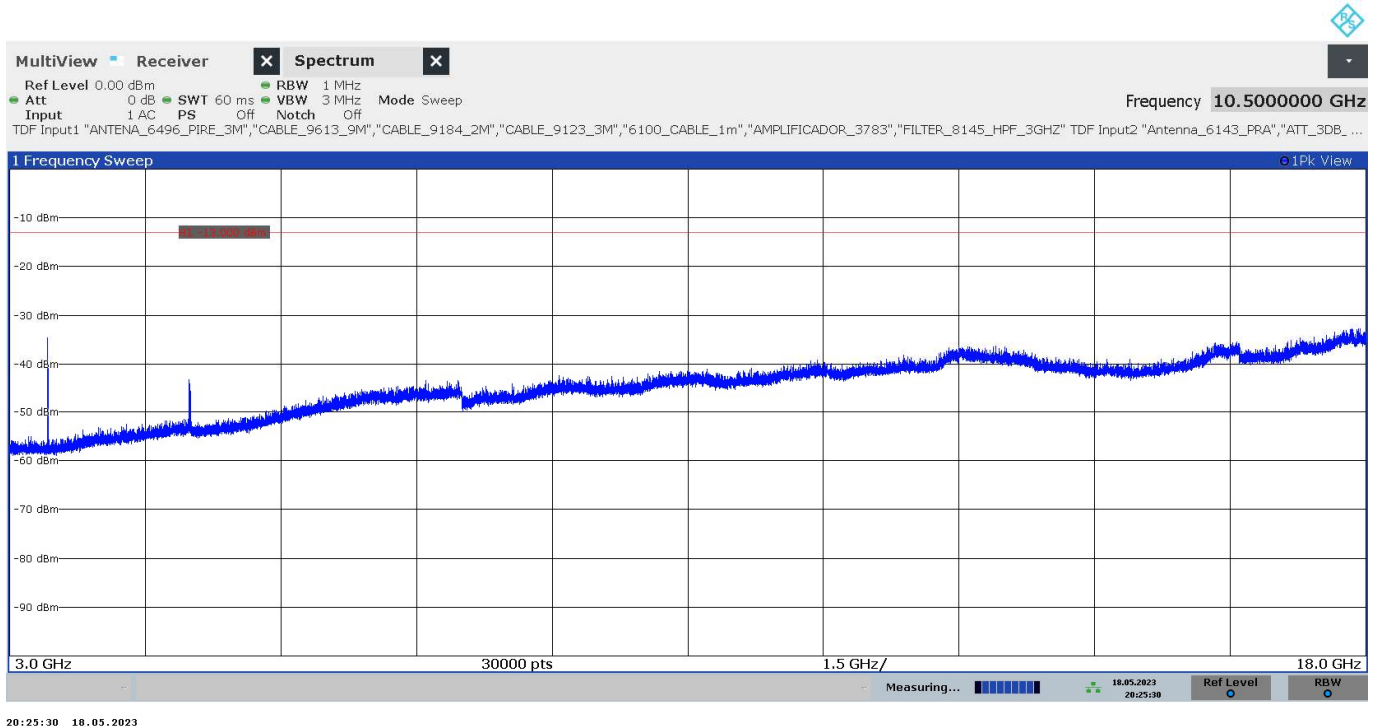


18:23:31 18.05.2023

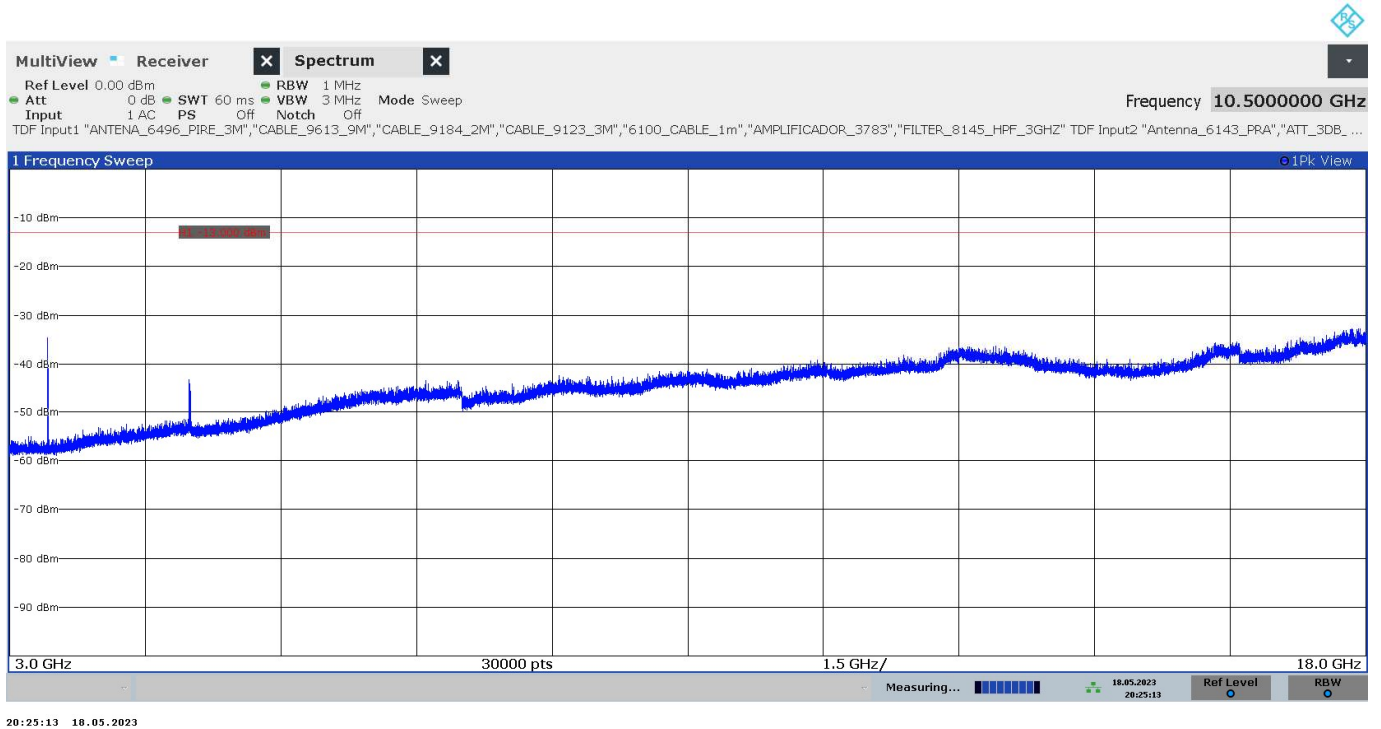
The higher peak is the carrier frequency.

FREQUENCY RANGE 3 - 18 GHz:

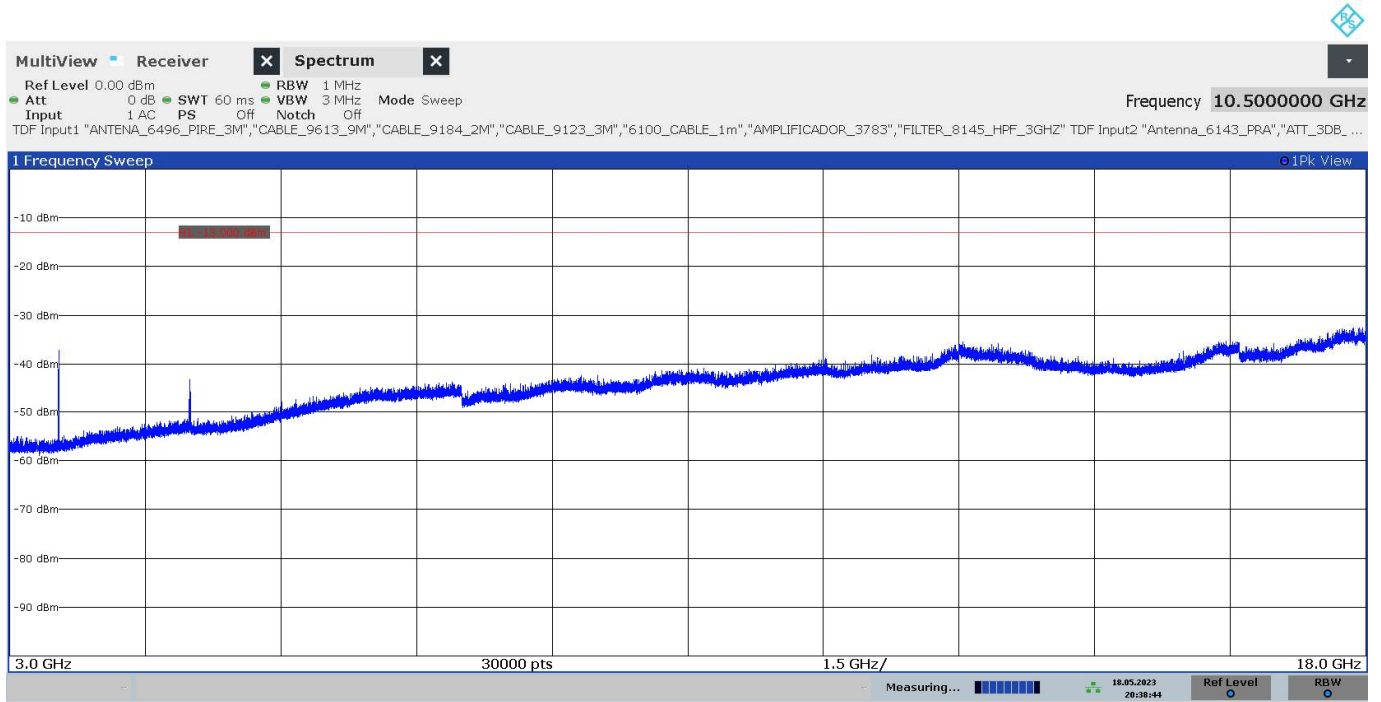
- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:



20:38:45 18.05.2023

LTE Cat-M1 Band 71:

A preliminary scan determined the 16QAM modulation, BW=10 MHz, RB=1, RB Offset=2, Narrow Band=3 as the worst-case. The next results are for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz:

No spurious frequencies at less than 20 dB below the limit.

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz:

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz:

No spurious frequencies at less than 20 dB below the limit.

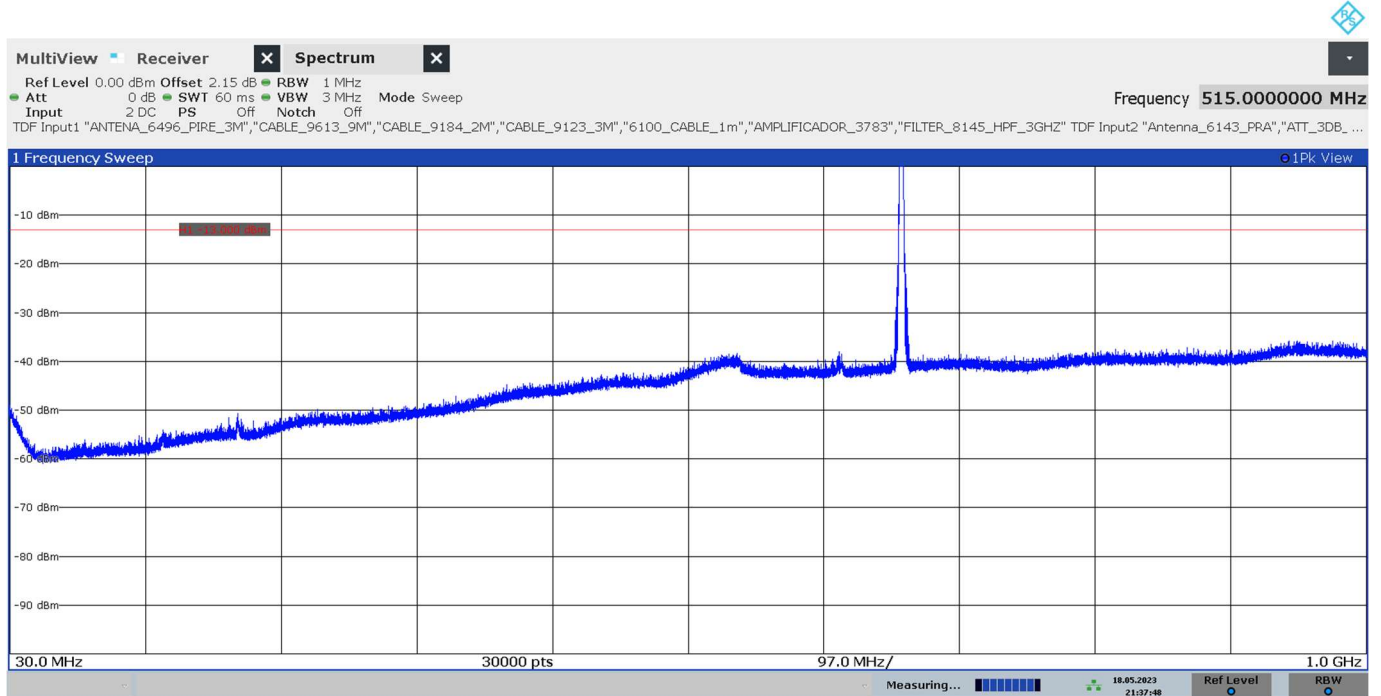
Measurement Uncertainty (dB)	<± 4.99 for f < 1 GHz <± 4.98 for f ≥ 1 GHz up to 8 GHz
------------------------------	--

Verdict: PASS

LTE Cat-M1 Band 71:

FREQUENCY RANGE 30 MHz - 1 GHz (worst-case):

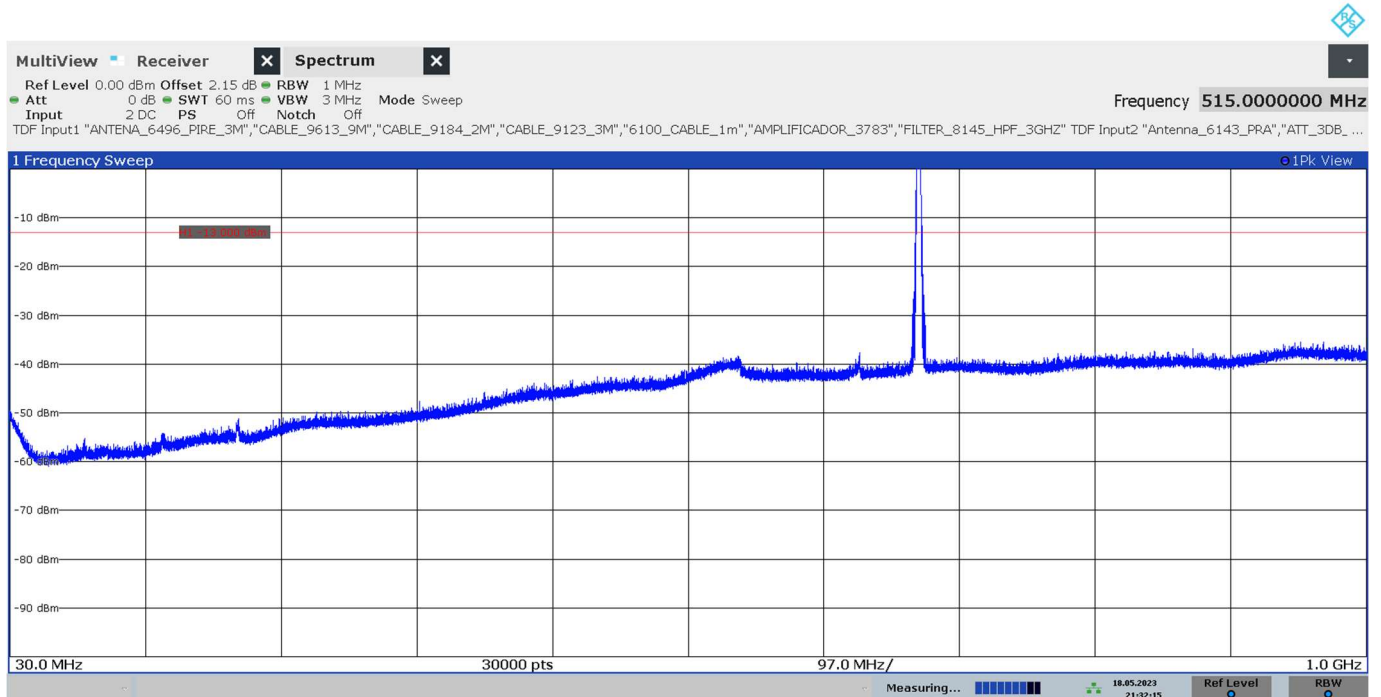
- LOW CHANNEL:



21:37:49 18.05.2023

The peak above the limit is the carrier frequency.

- MIDDLE CHANNEL:



21:32:16 18.05.2023

The peak above the limit is the carrier frequency.