Radiated Emissions

Limits

1. LTE Cat 1bis Band 12.

* 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, 4.7:

4.7.1 General unwanted emissions limits:

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

4.7.2 Additional unwanted emissions limits:

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

a. the power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:
    i. 76 + 10 log10 p (watts), dB, for base and fixed equipment and
    ii. 65 + 10 log10 p (watts), dB, for mobile and portable equipment
b. the e.i.r.p. in the band 1559-1610 MHz shall not exceed −70 dBW/MHz for wideband signal and −80 dBW for discrete emission with bandwidth less than 700 Hz.

2. LTE Cat 1bis Band 13.

* FCC §27.53 (c) & (f):

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, 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 any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(4) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) 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 at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) 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.

(f) For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions 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-130, 4.7:

4.7.1 General unwanted emissions limits:

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

4.7.2 Additional unwanted emissions limits:

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

a. the power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:
    i. 76 + 10 log10 p (watts), dB, for base and fixed equipment and
    ii. 65 + 10 log10 p (watts), dB, for mobile and portable equipment
b. the e.i.r.p. in the band 1559-1610 MHz shall not exceed −70 dBW/MHz for wideband signal and −80 dBW for discrete emission with bandwidth less than 700 Hz.

3. LTE Cat 1bis Band 66.

* FCC §27.53 (h):

AWS emission limits:

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center

frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

* RSS-139, 5.6:

Unwanted emissions shall be measured in terms of average value.
Equipment shall have the TRP or conducted power (all antenna connectors), of unwanted emissions outside the frequency block or frequency block group not exceeding the limits shown in the next table:

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 bandwith.

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 Po transmitting power, the specified minimum attenuation 43 + 10 log10 p (watts) becomes:

Po (dBm) - [43 + 10 log (Po in mwatts) - 30] = -13 dBm

At Po transmitting power, the specified minimum attenuation 65 + 10 log10 p (watts) becomes:

Po (dBm) - [65 + 10 log (Po in mwatts) - 30] = -35 dBm

For operation in LTE Cat 1bis 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.

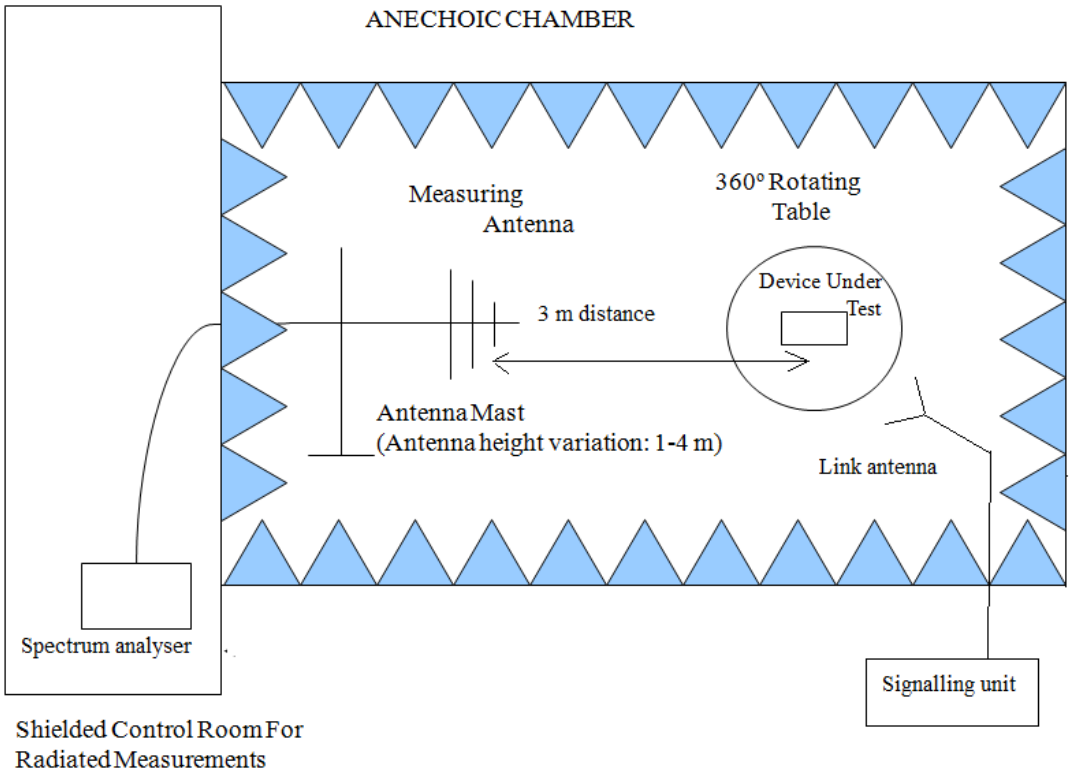
The maximum field strength (dBµV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

EIRP (dBm) = E (dBµV/m) + 20 log(D) - 104.8;

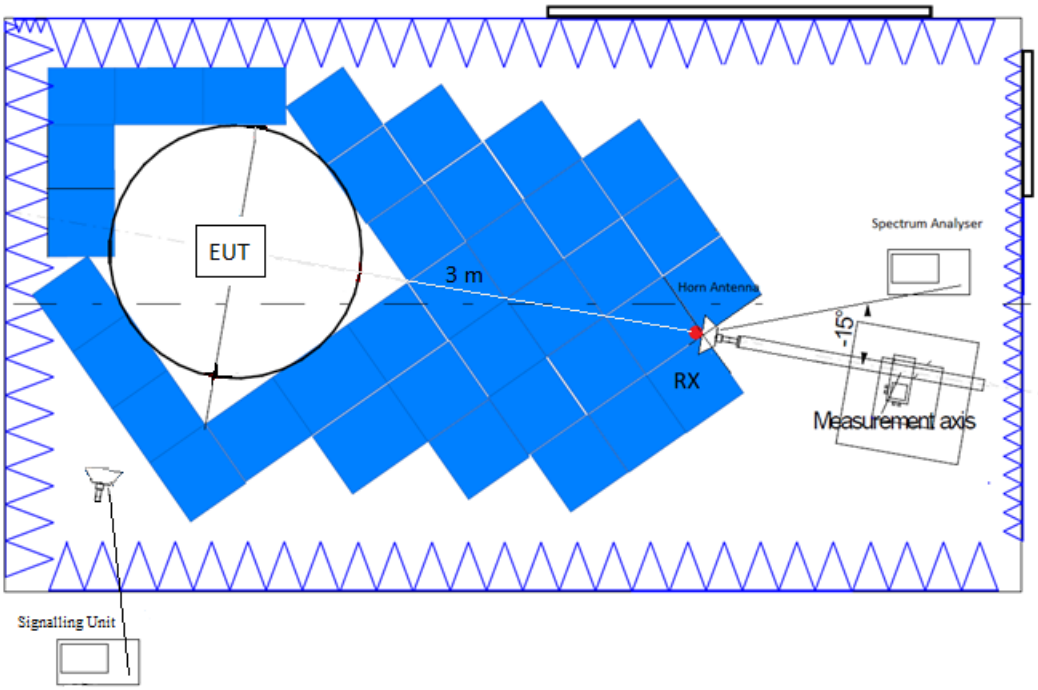
where D is the measurement distance (in the far field region) in m. D = 3m.

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.

LTE Cat 1bis Band 12:

A preliminary scan determined the QPSK modulation, BW=10 MHz, RB=1, Offset=24 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)	< ±5.35 for f < 1 GHz < ±4.32 for f ≥ 1 GHz up to 8 GHz

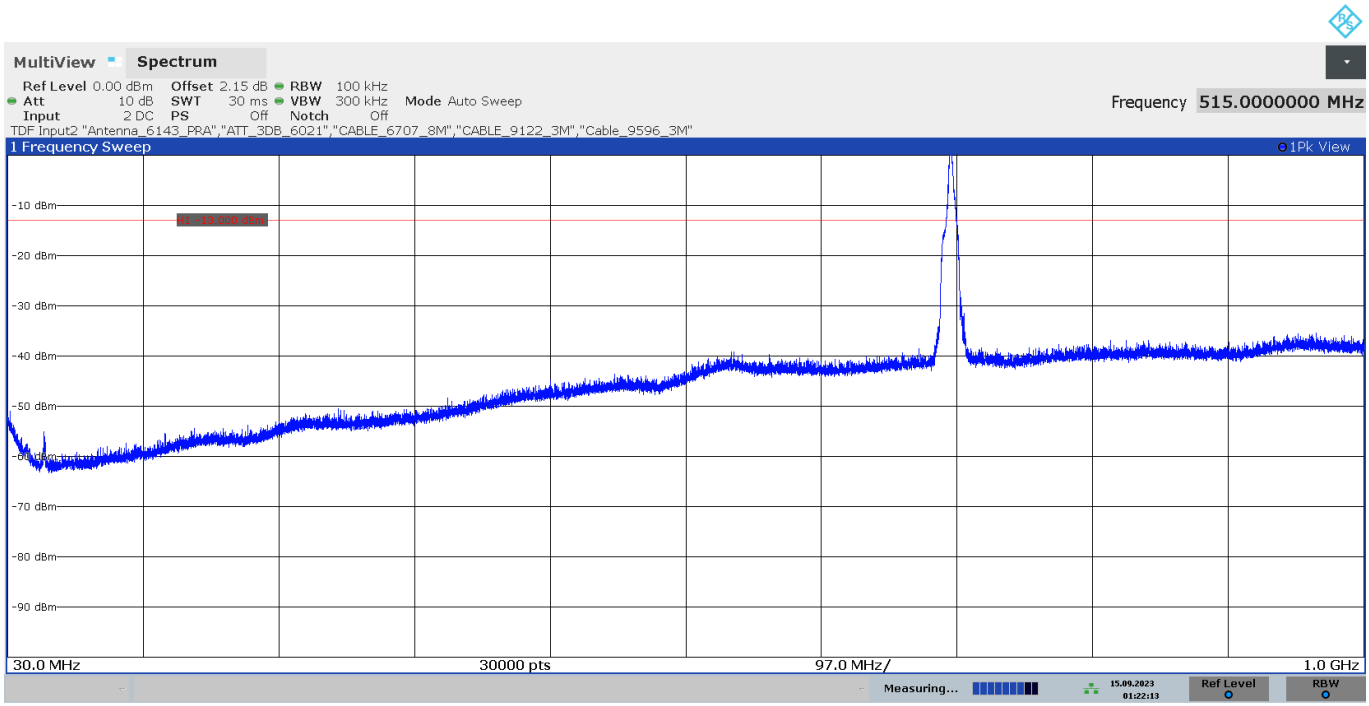
Verdict

Pass

LTE Cat 1bis Band 12:

FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



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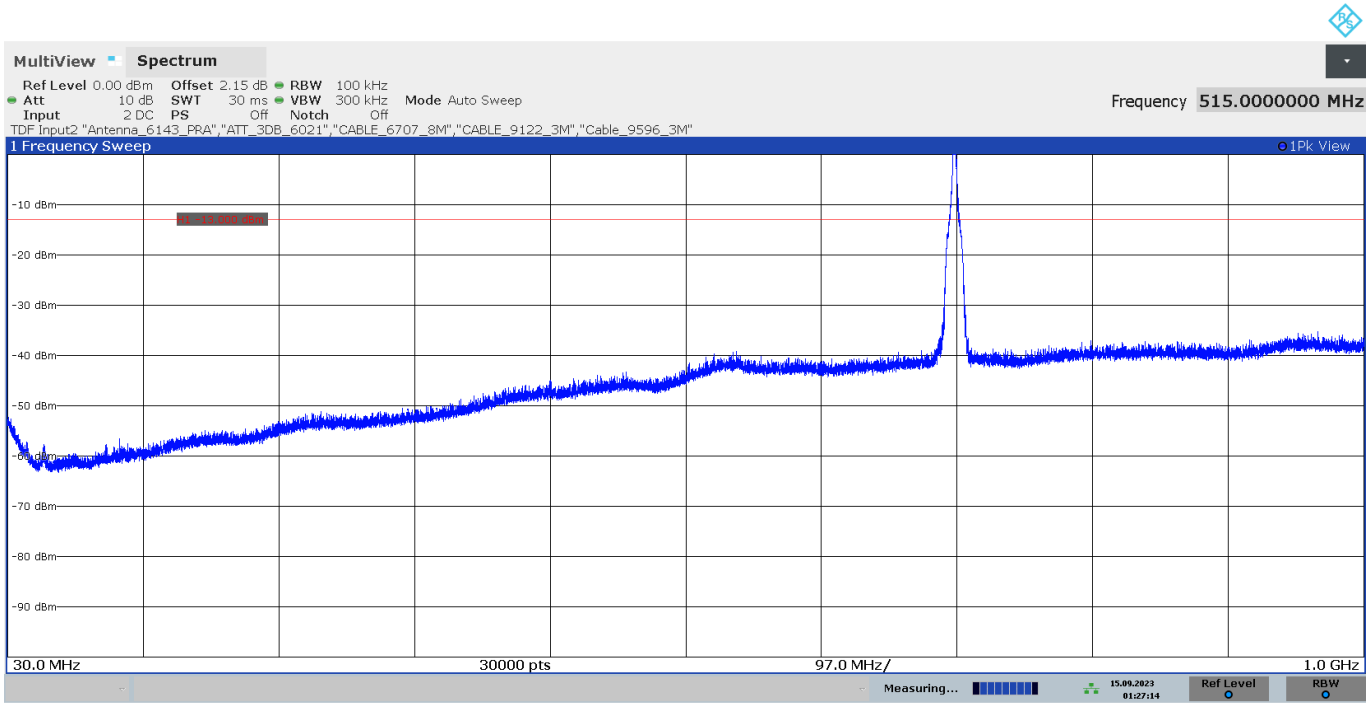
The peak above the limit is the LTE Cat 1bis Band 12 carrier frequency.

- MIDDLE CHANNEL:



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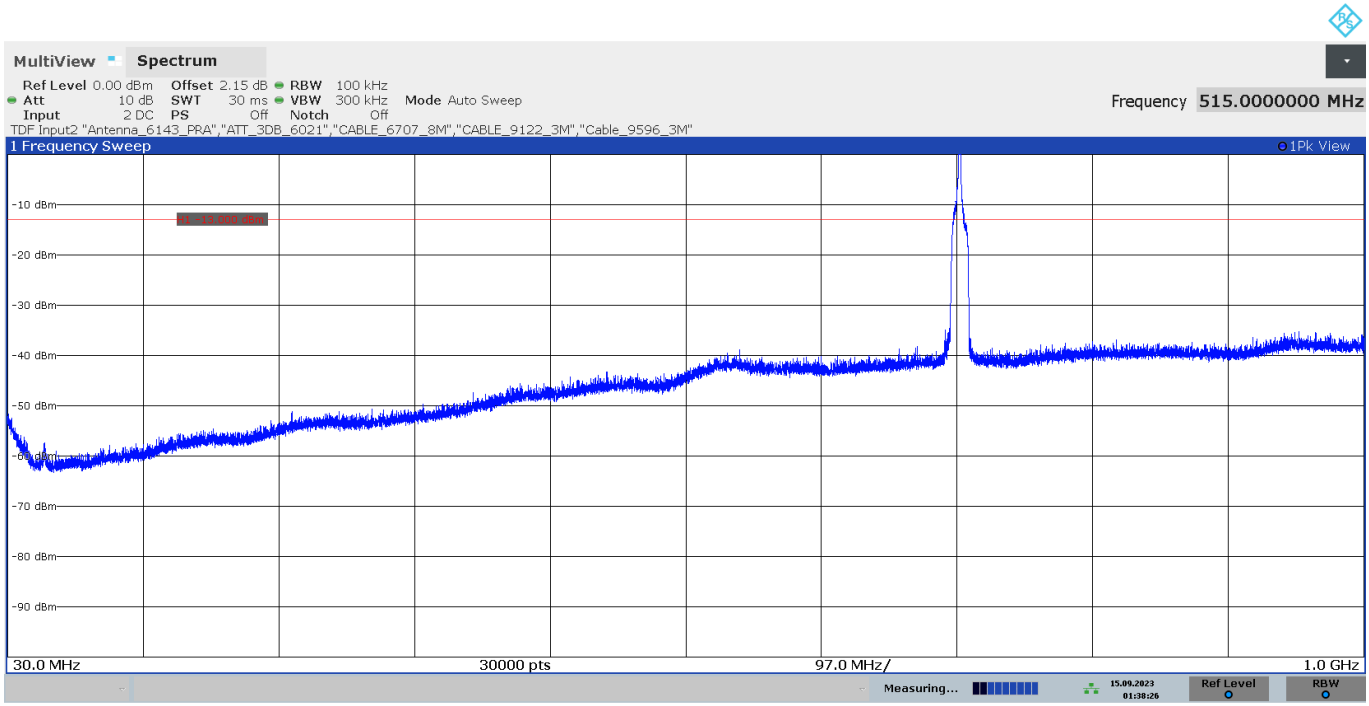
The peak above the limit is the LTE Cat 1bis Band 12 carrier frequency.

- HIGH CHANNEL:



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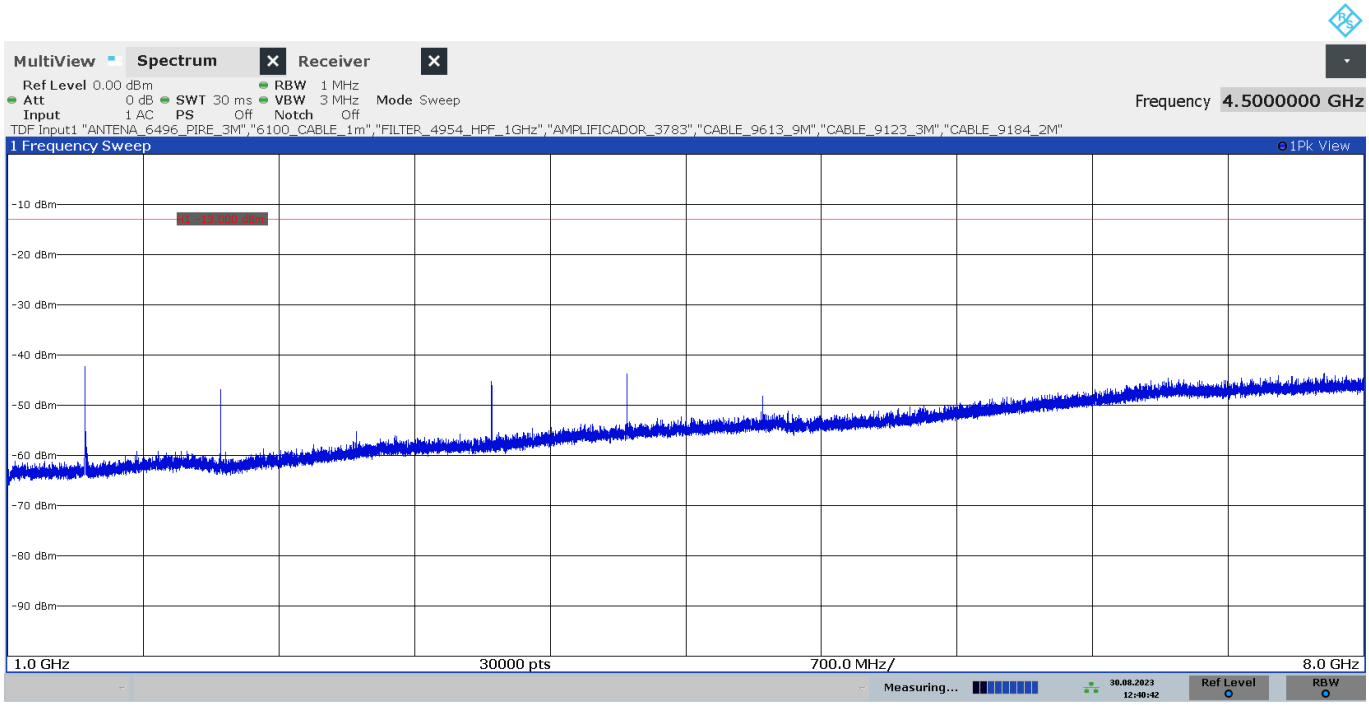
The peak above the limit is the LTE Cat 1bis Band 12 carrier frequency.

FREQUENCY RANGE 1 GHz - 8 GHz

- LOW CHANNEL:



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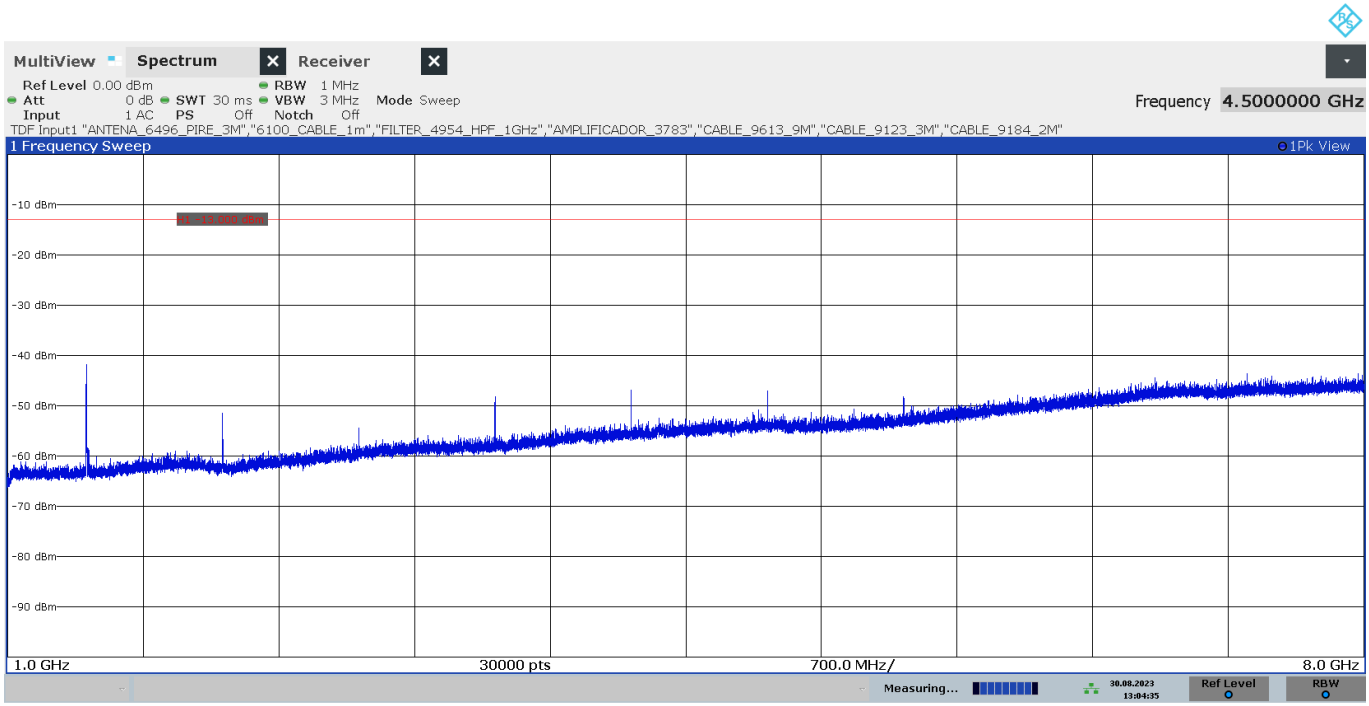
- MIDDLE CHANNEL:



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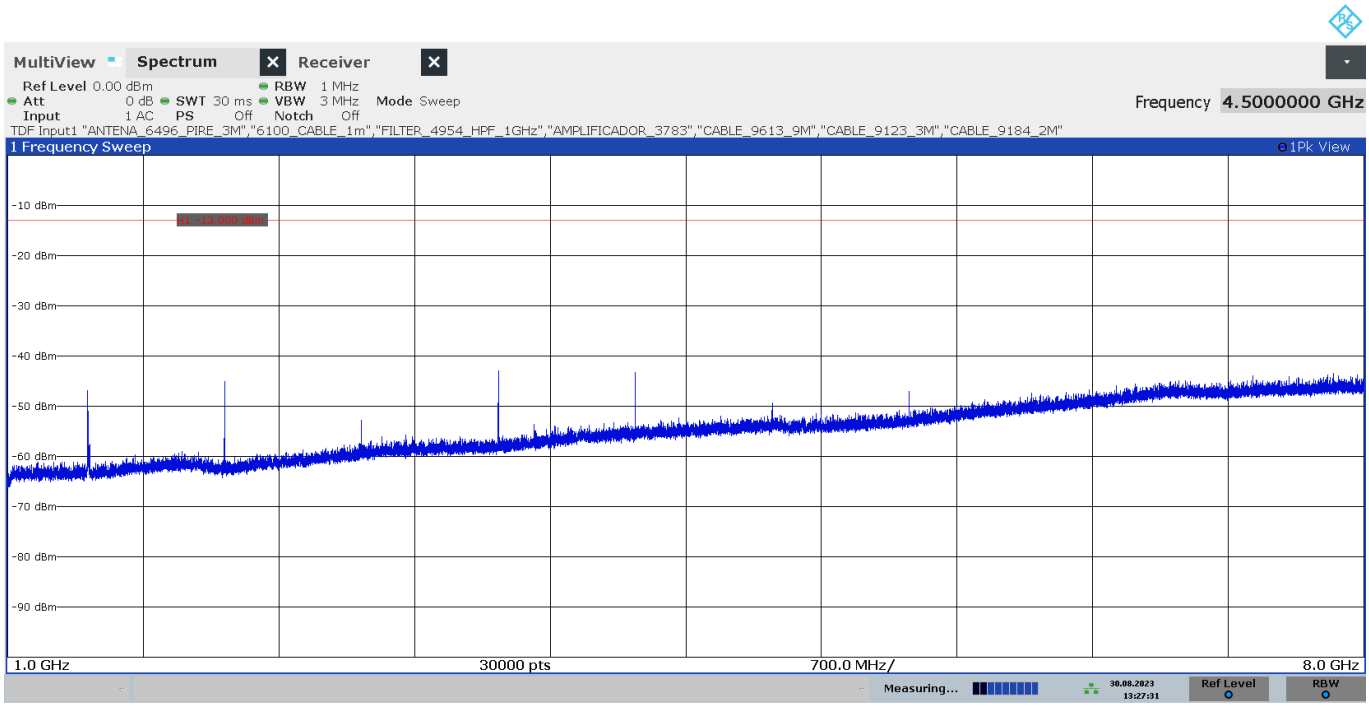
- HIGH CHANNEL:



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LTE Cat 1bis Band 13:

A preliminary scan determined the QPSK, BW=5 MHz, RB=1, Offset=12 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.

- 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 (GHz)	E.I.R.P (dBm)	Polarization	Detector
1.5690156	-50.8	H	Peak

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

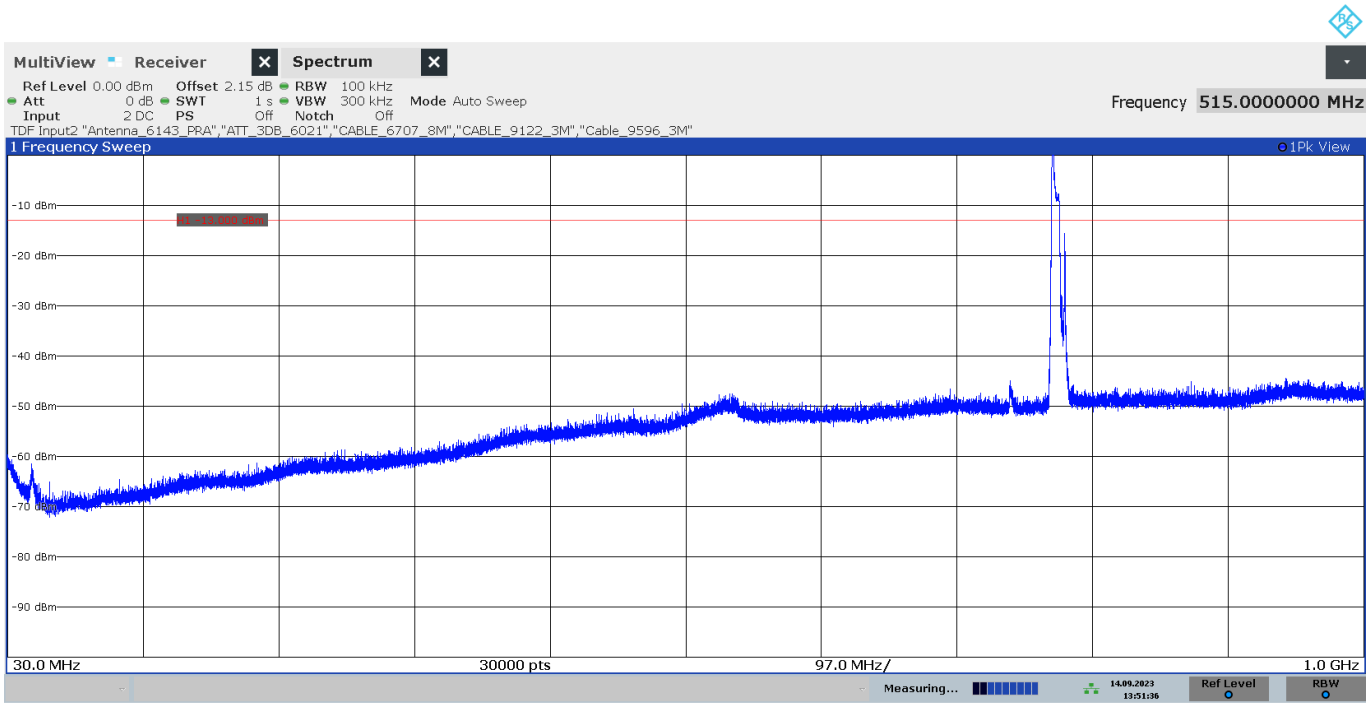
Verdict

Pass

LTE Cat 1bis Band 13:

FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



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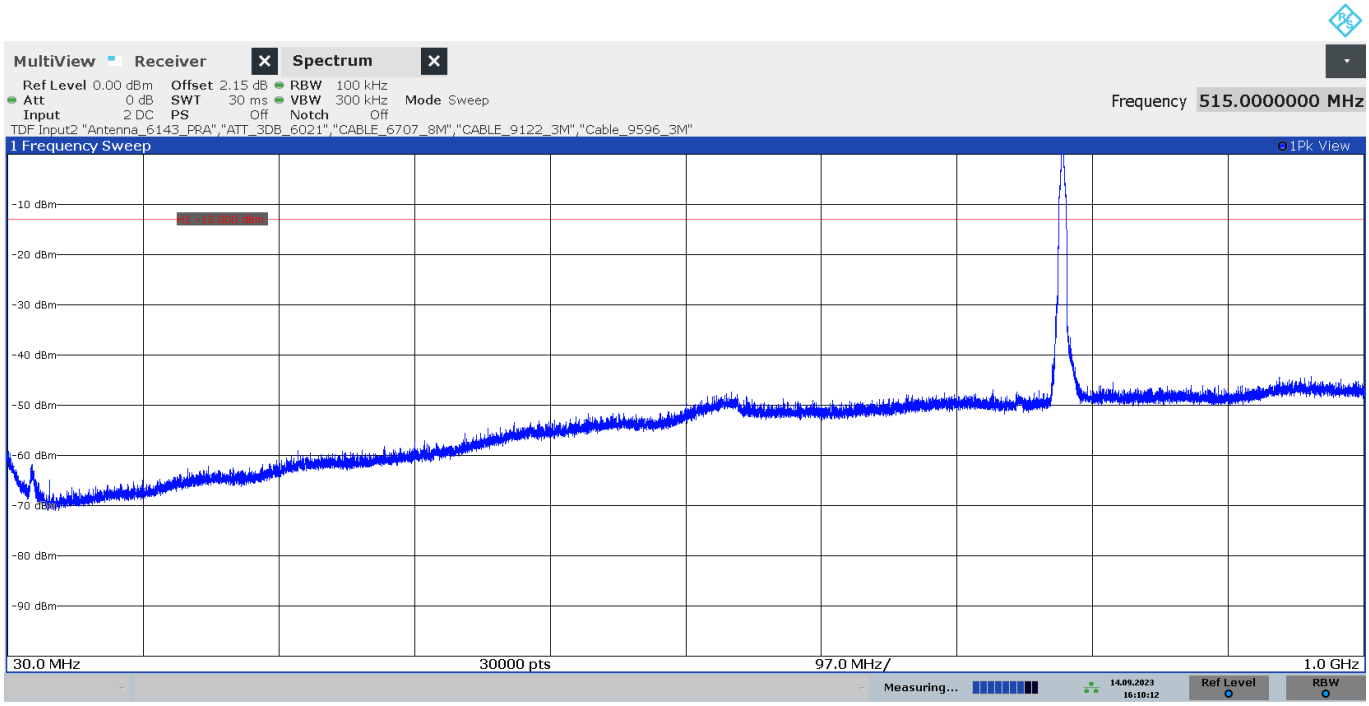
The peak above the limit is the carrier frequency.

- HIGH CHANNEL:



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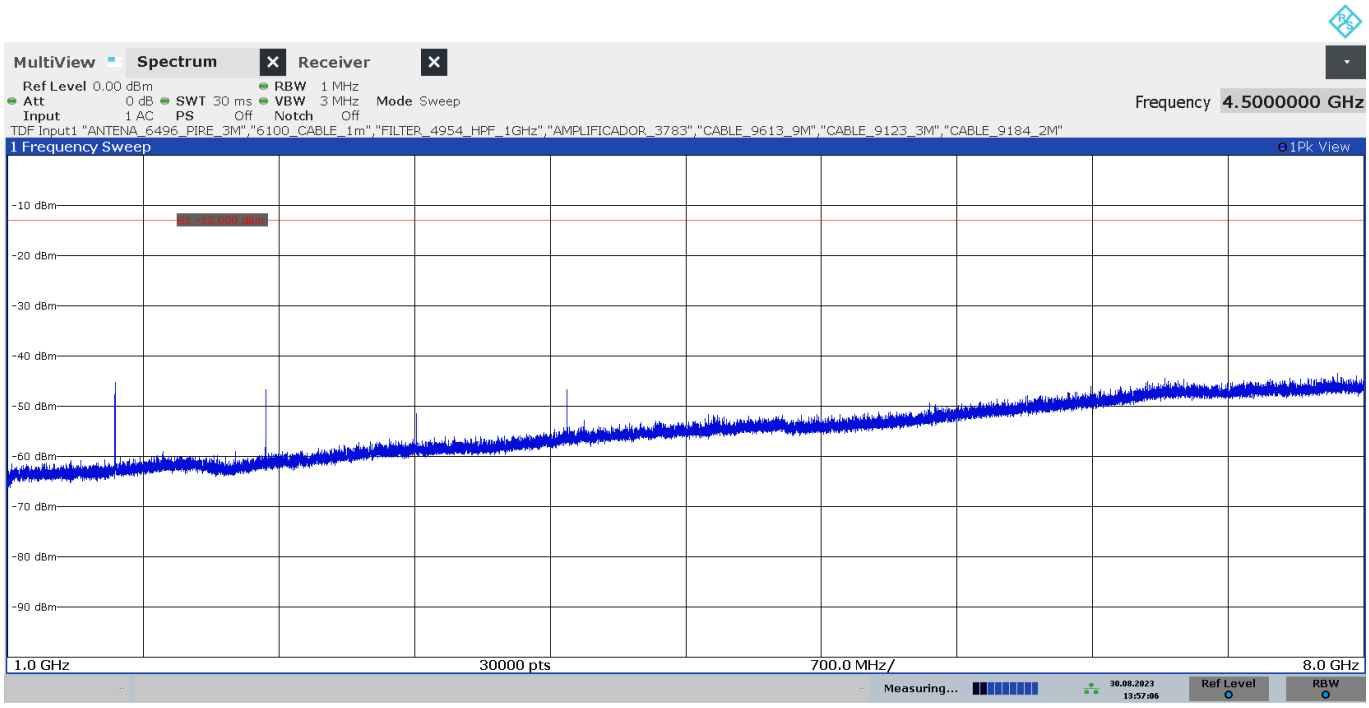
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 - 8 GHz:

- LOW CHANNEL:



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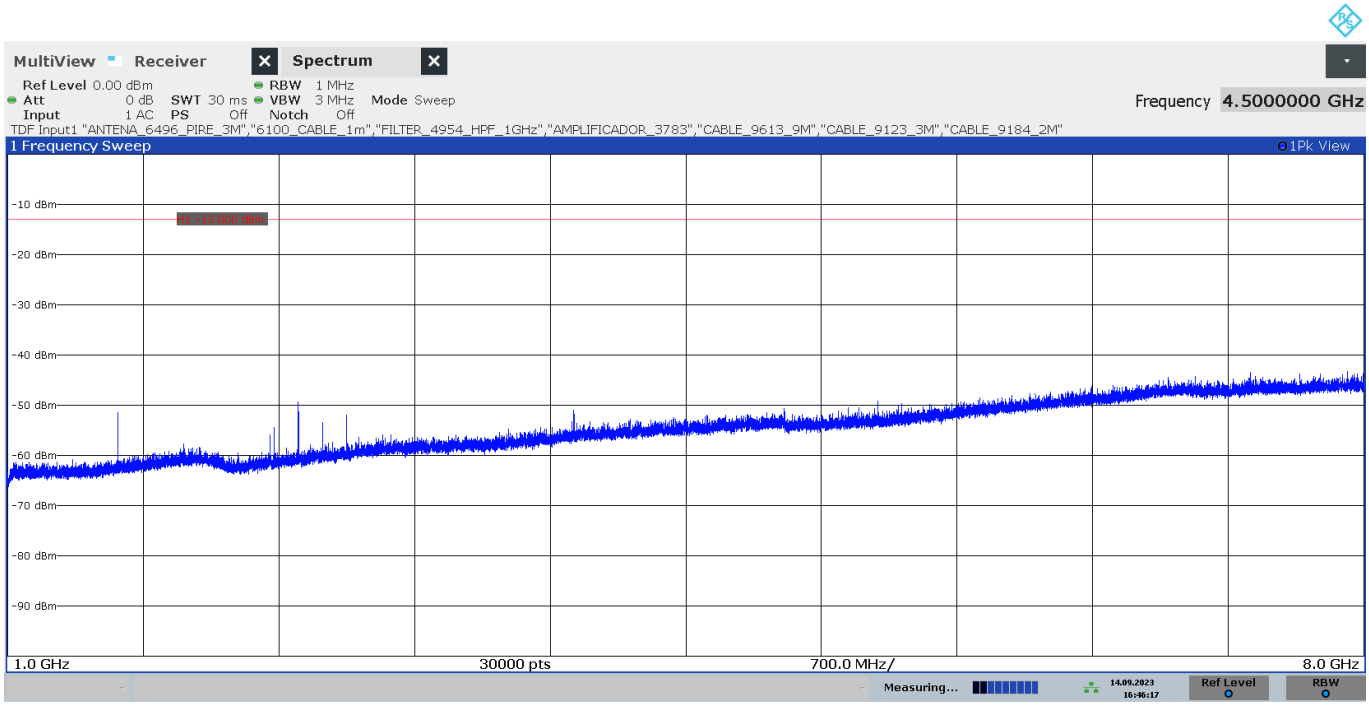
- HIGH CHANNEL:



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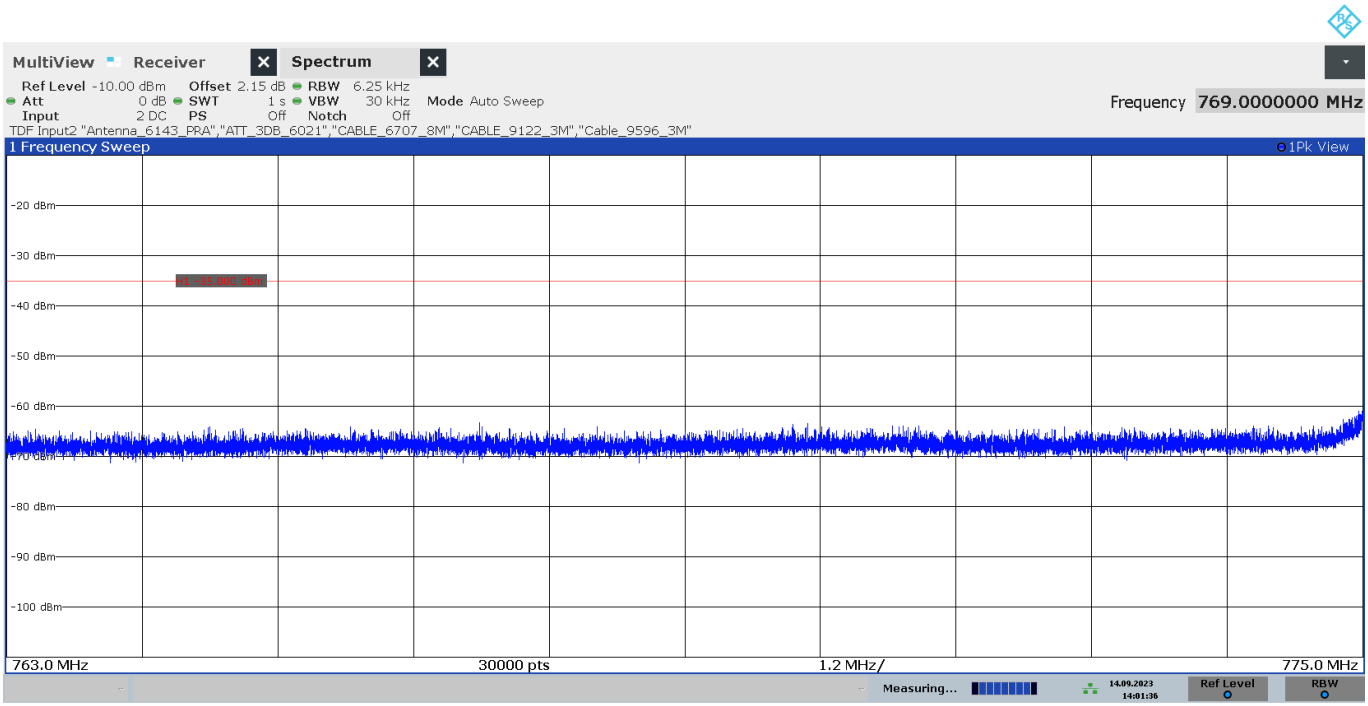
FREQUENCY RANGE 763 - 775 MHz:

- LOW CHANNEL:



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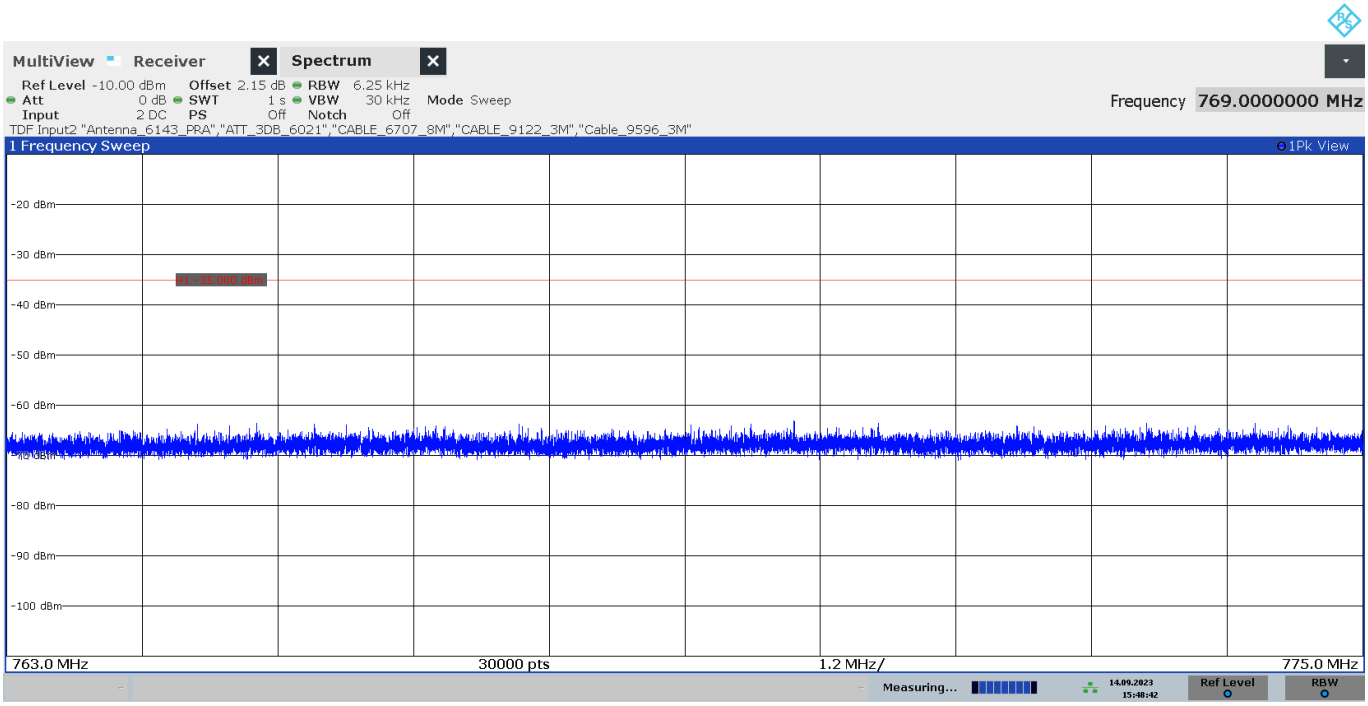
- HIGH CHANNEL:



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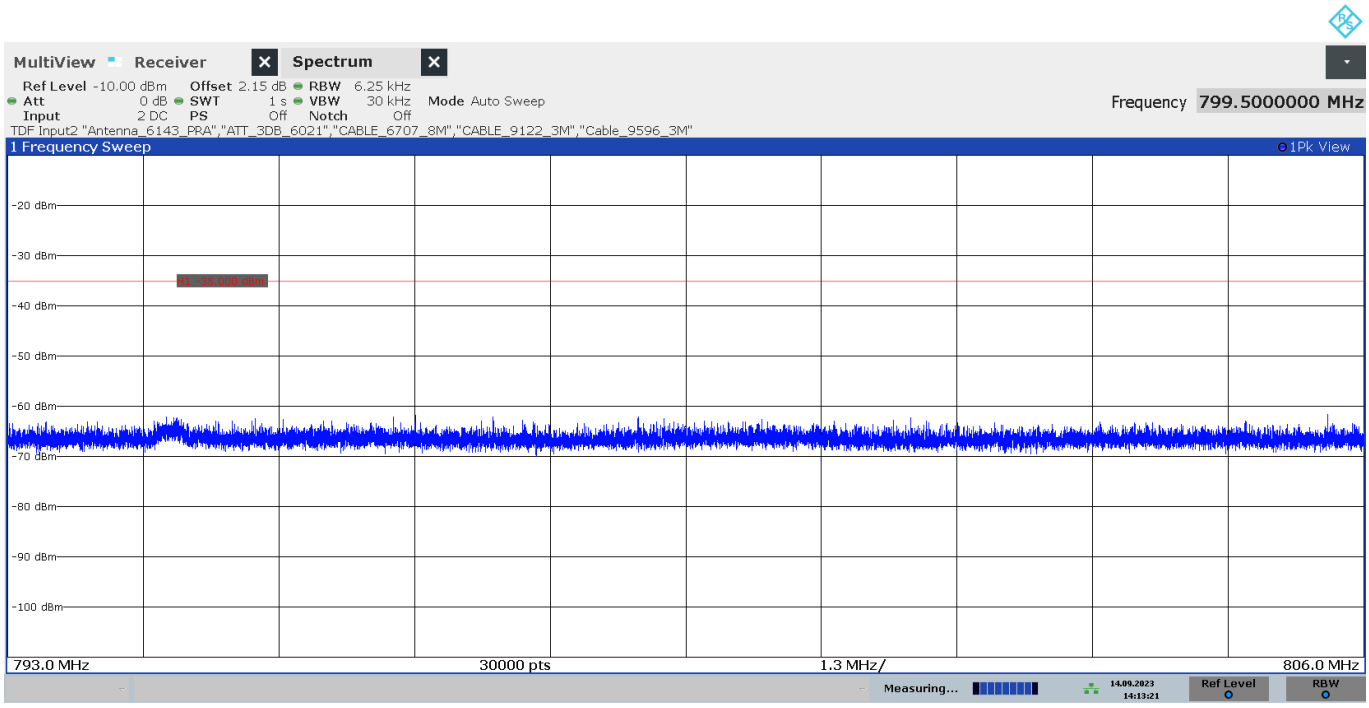
FREQUENCY RANGE 793 - 806 MHz:

- LOW CHANNEL:



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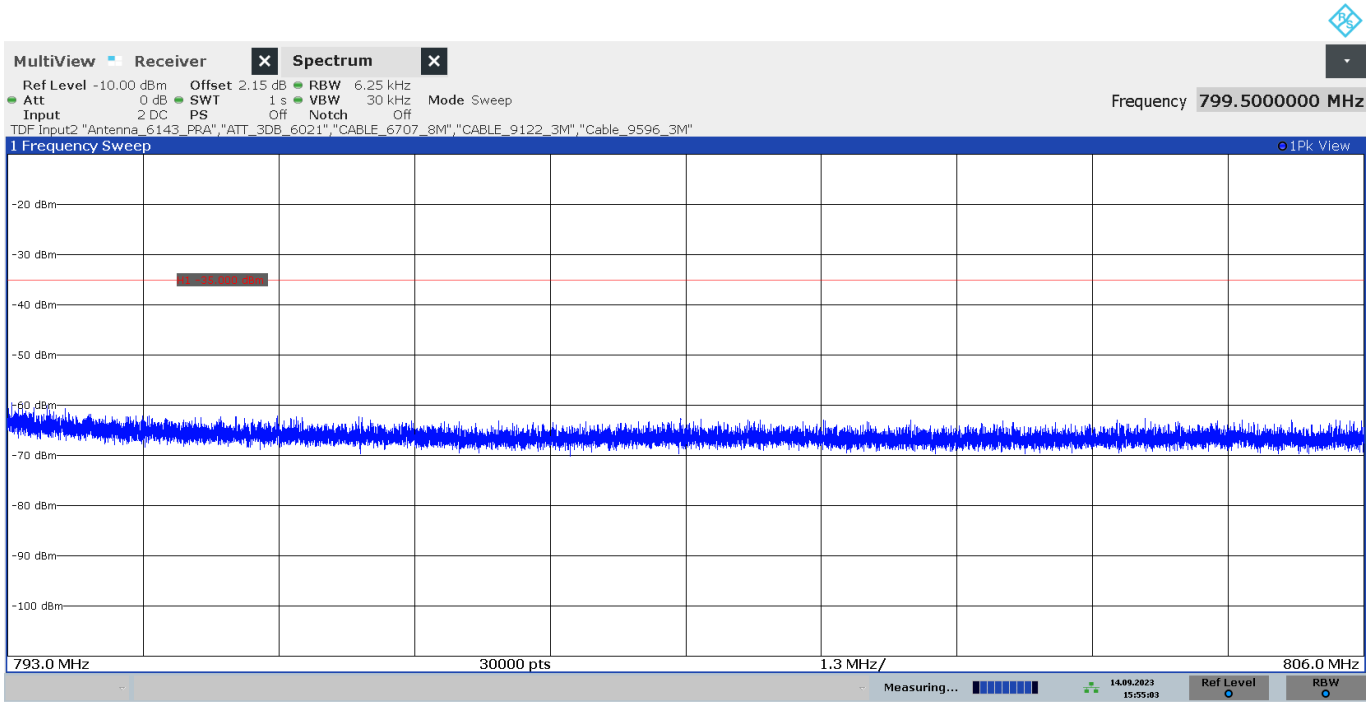
- HIGH CHANNEL:



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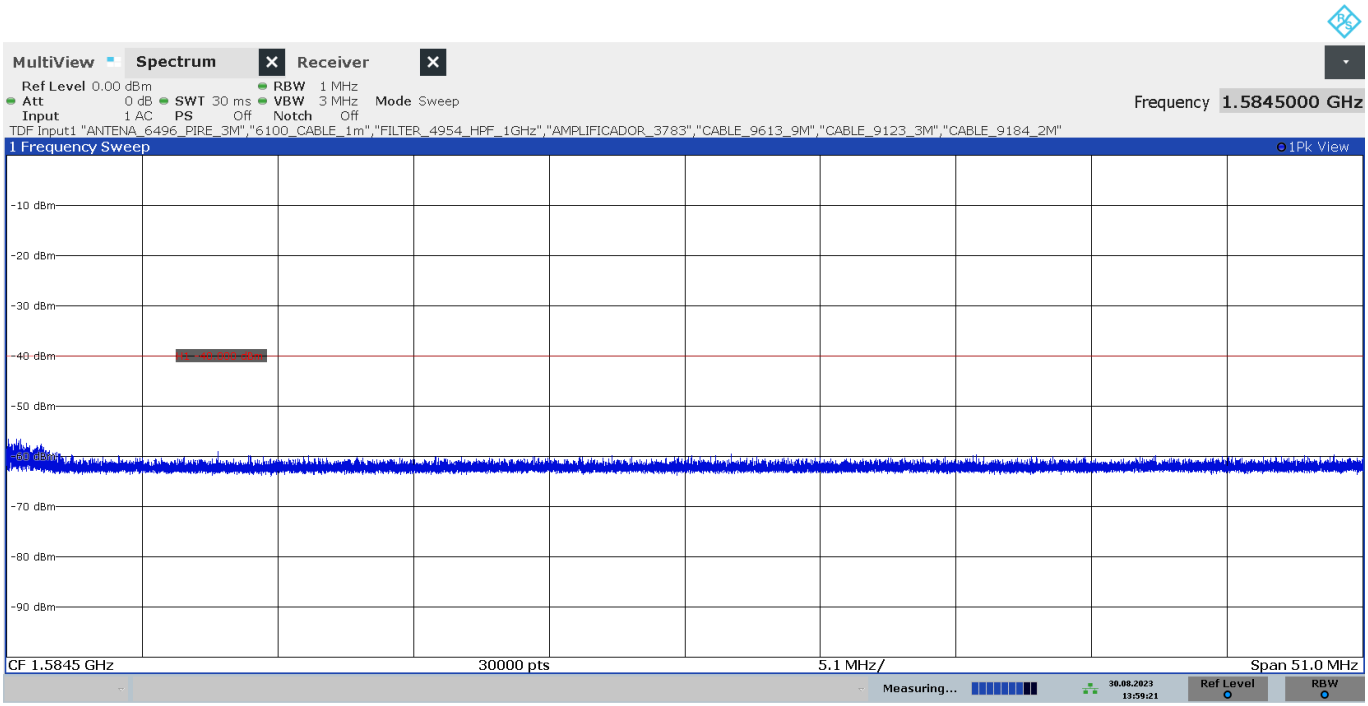
FREQUENCY RANGE 1559 - 1610 MHz:

- LOW CHANNEL:



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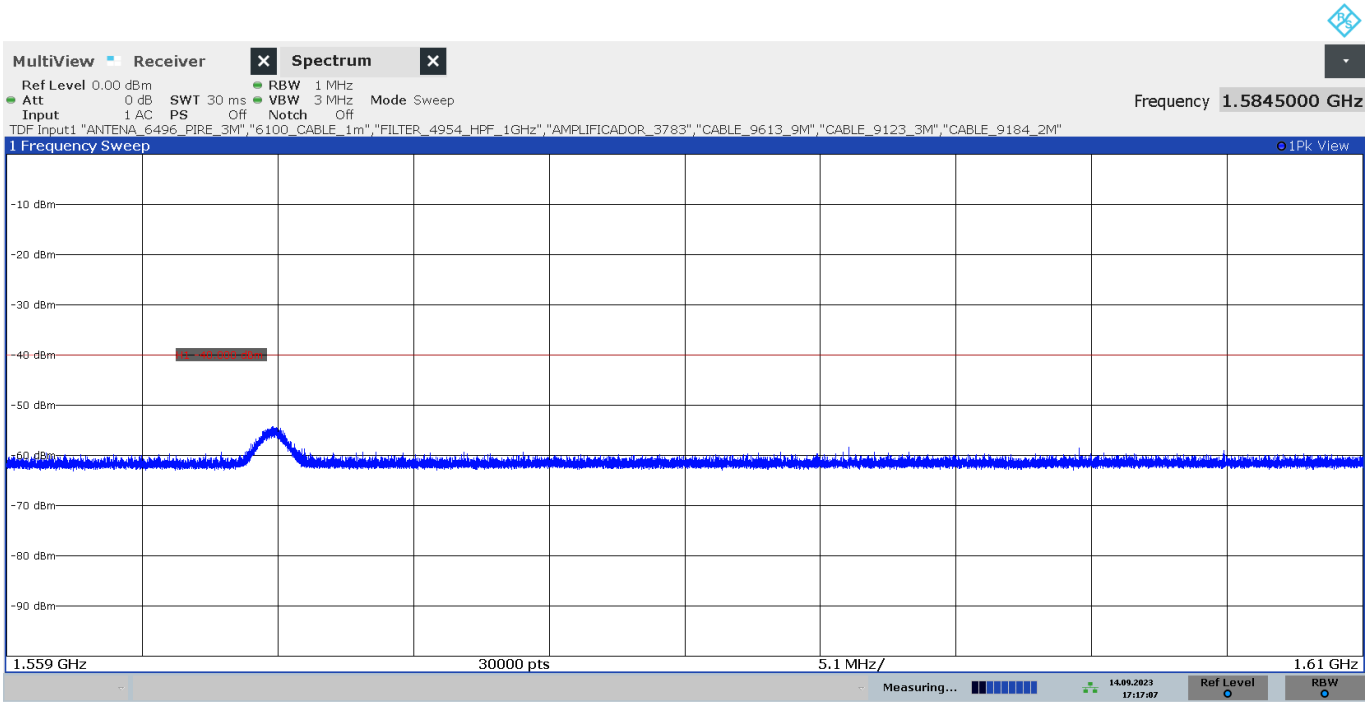
- HIGH CHANNEL:



17:17:08 14.09.2023

LTE Cat 1bis Band 66:

A preliminary scan determined the QPSK modulation, BW=5 MHz, RB=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:

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

Frequency range 1 - 18 GHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
5.13075	-27.9	V	Peak

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 18 GHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
5.22875	-26.32	V	Peak

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 18 GHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
5.32625	-27.43	V	Peak

Measurement Uncertainty (dB)	<± 5.35 for f < 1 GHz <± 4.32 for f ≥ 1 GHz up to 18 GHz

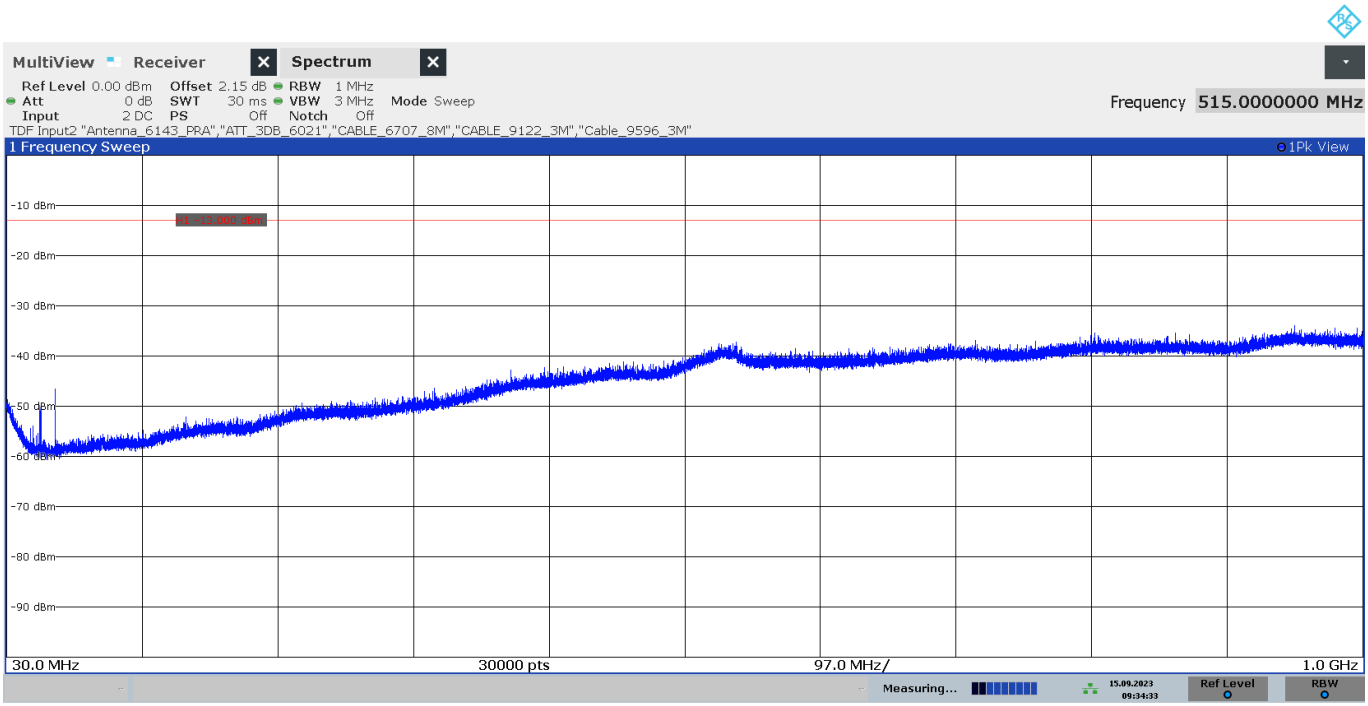
Verdict

Pass

LTE Cat 1bis Band 66:

FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



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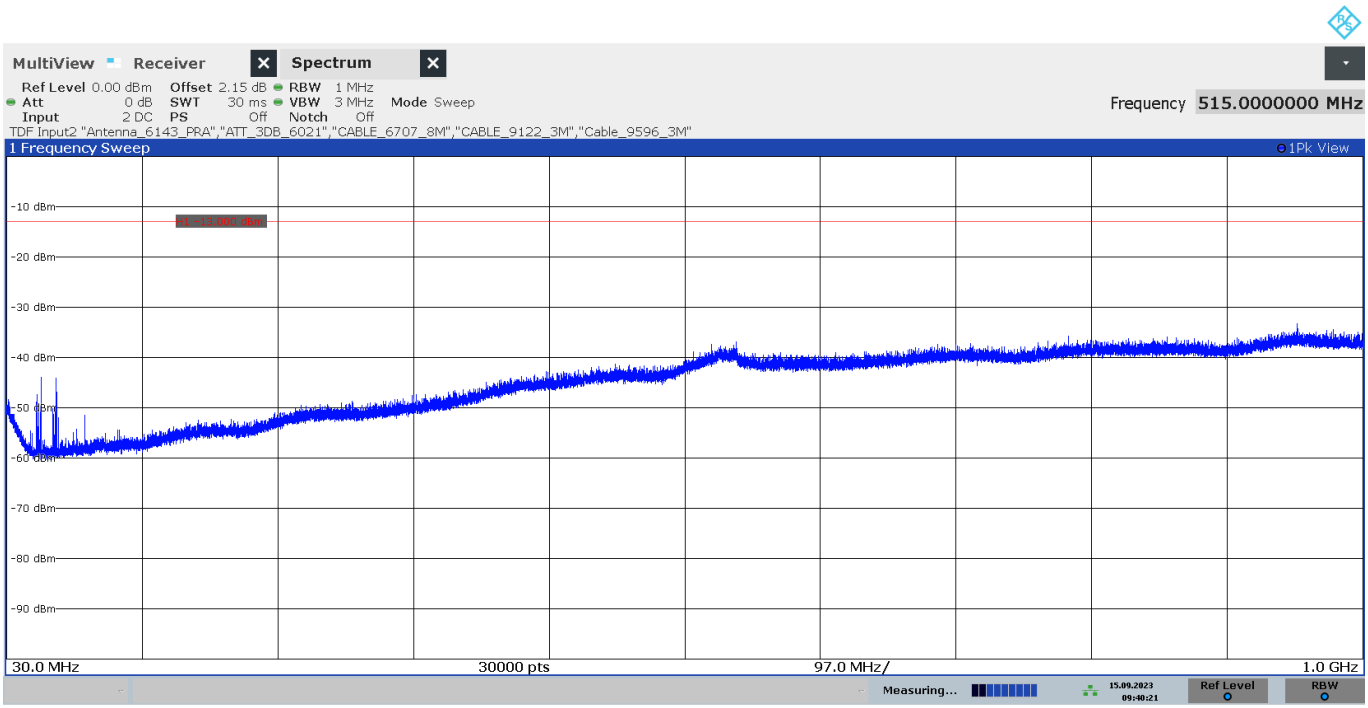
- MIDDLE CHANNEL:



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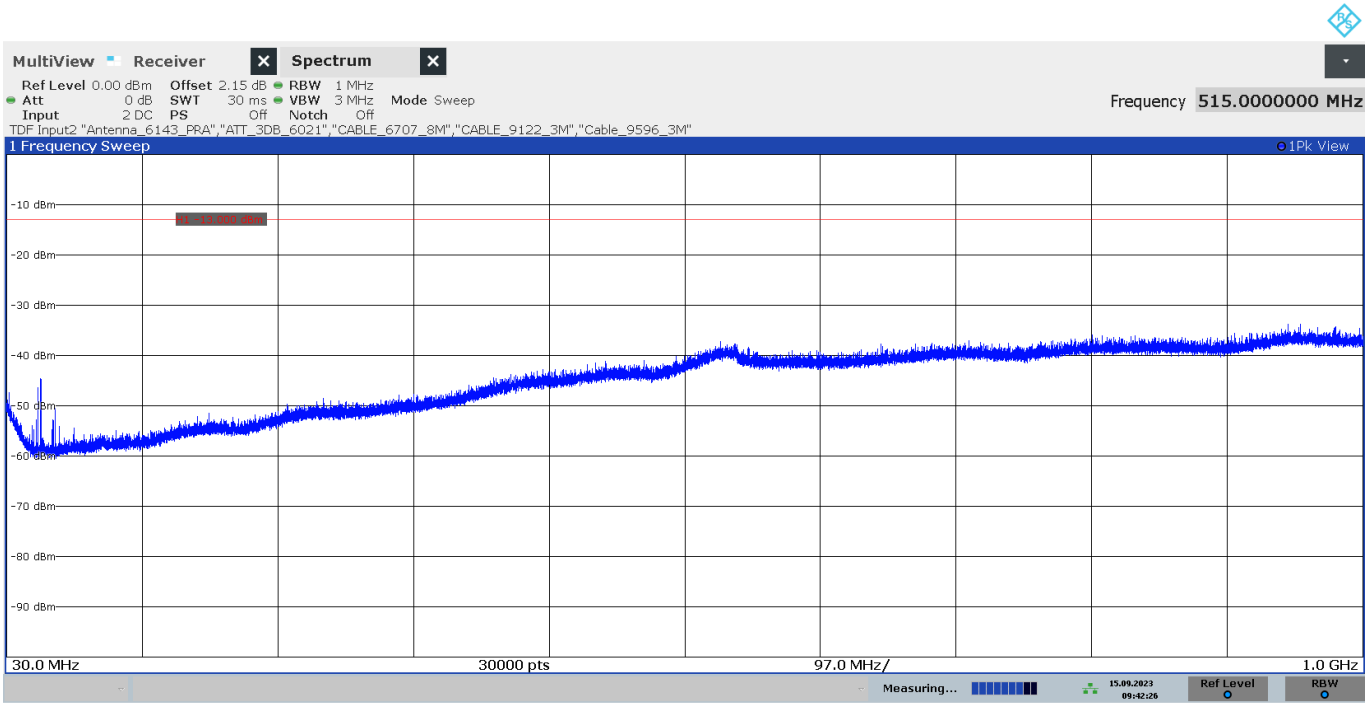
- HIGH CHANNEL:



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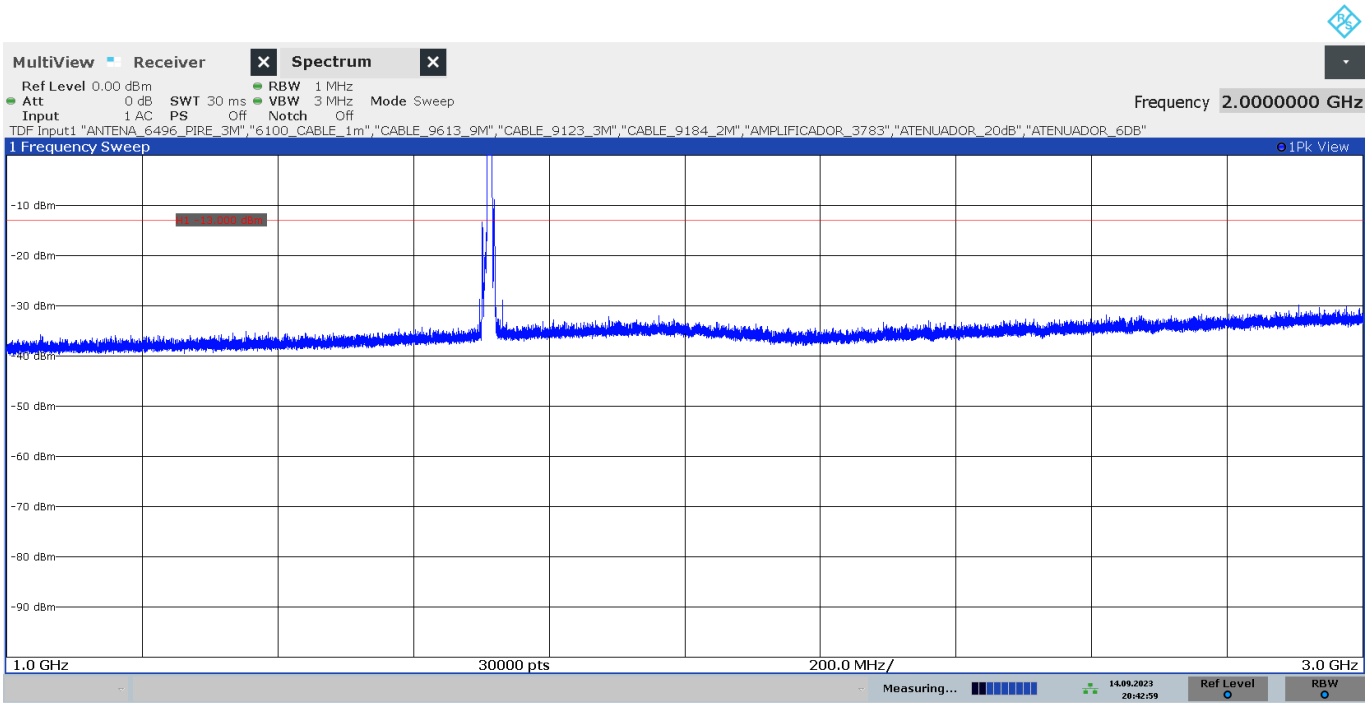
FREQUENCY RANGE 1 - 3 GHz:

- LOW CHANNEL:



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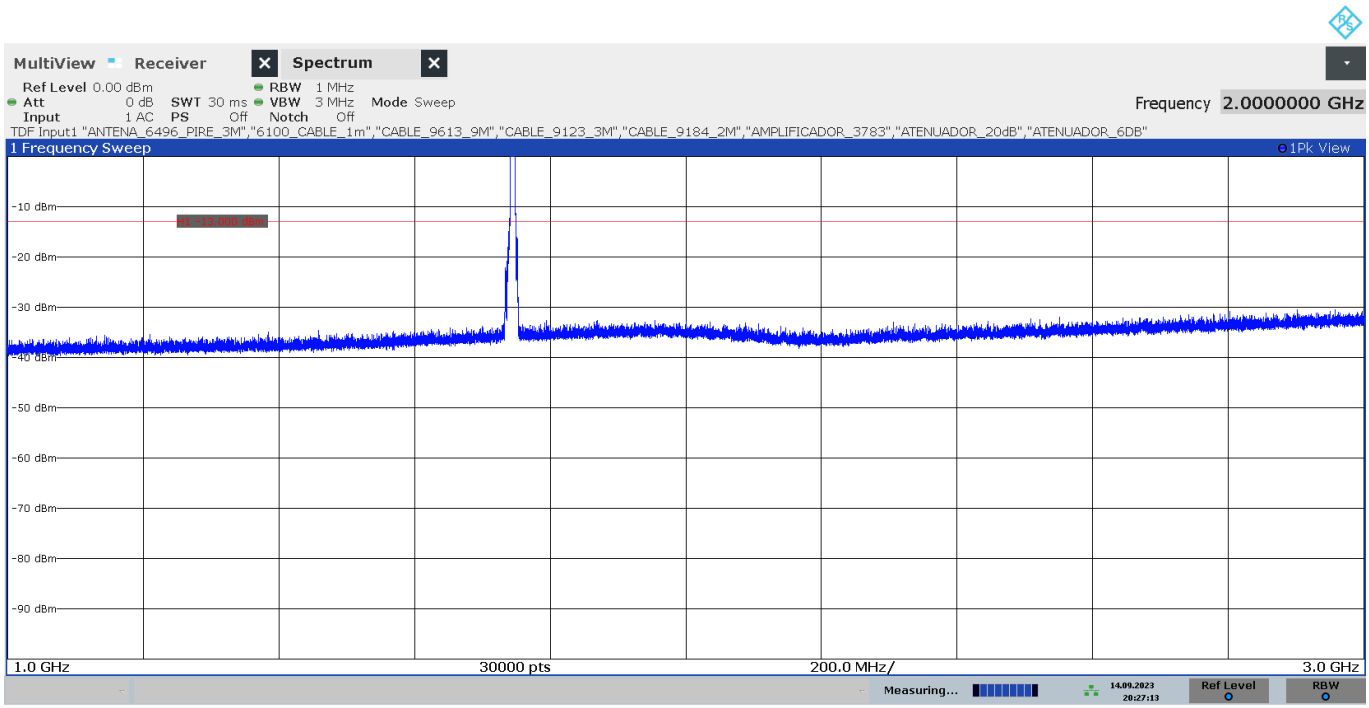
The higher peak is the carrier frequency.

- MIDDLE CHANNEL:



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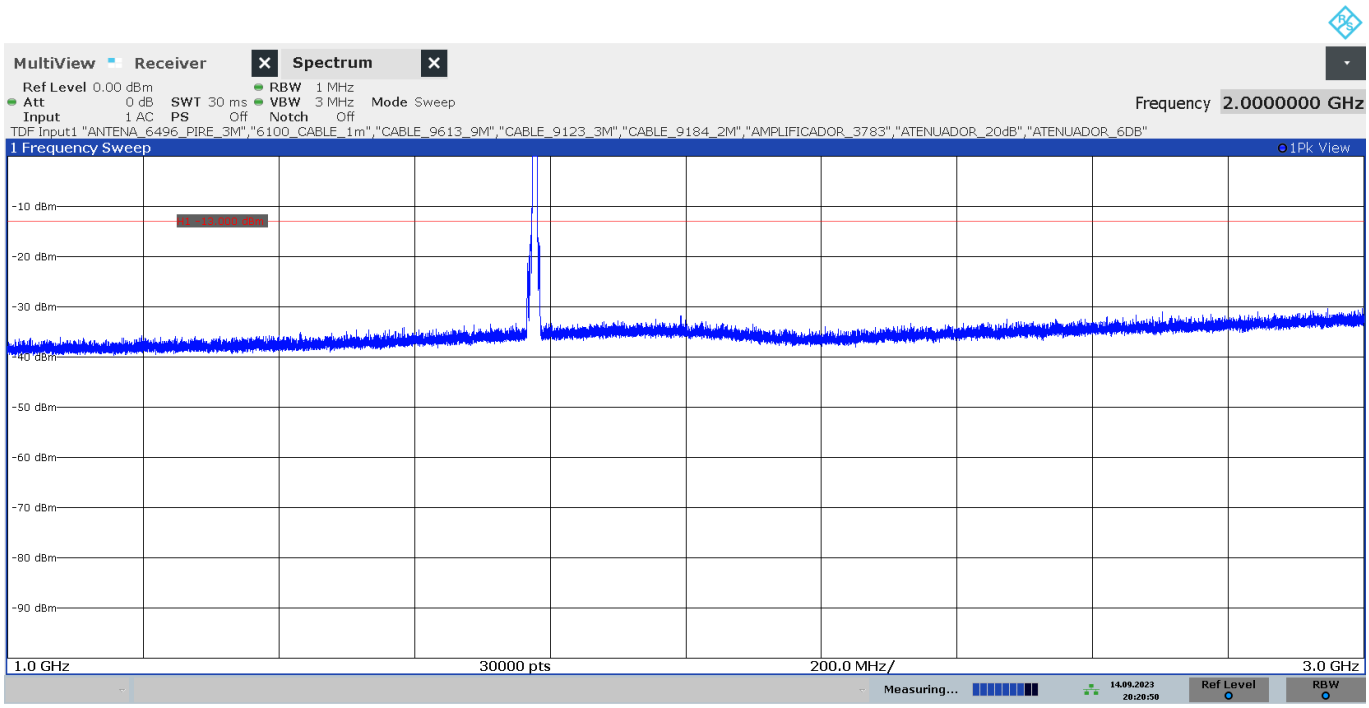
The higher peak is the carrier frequency.

- HIGH CHANNEL:



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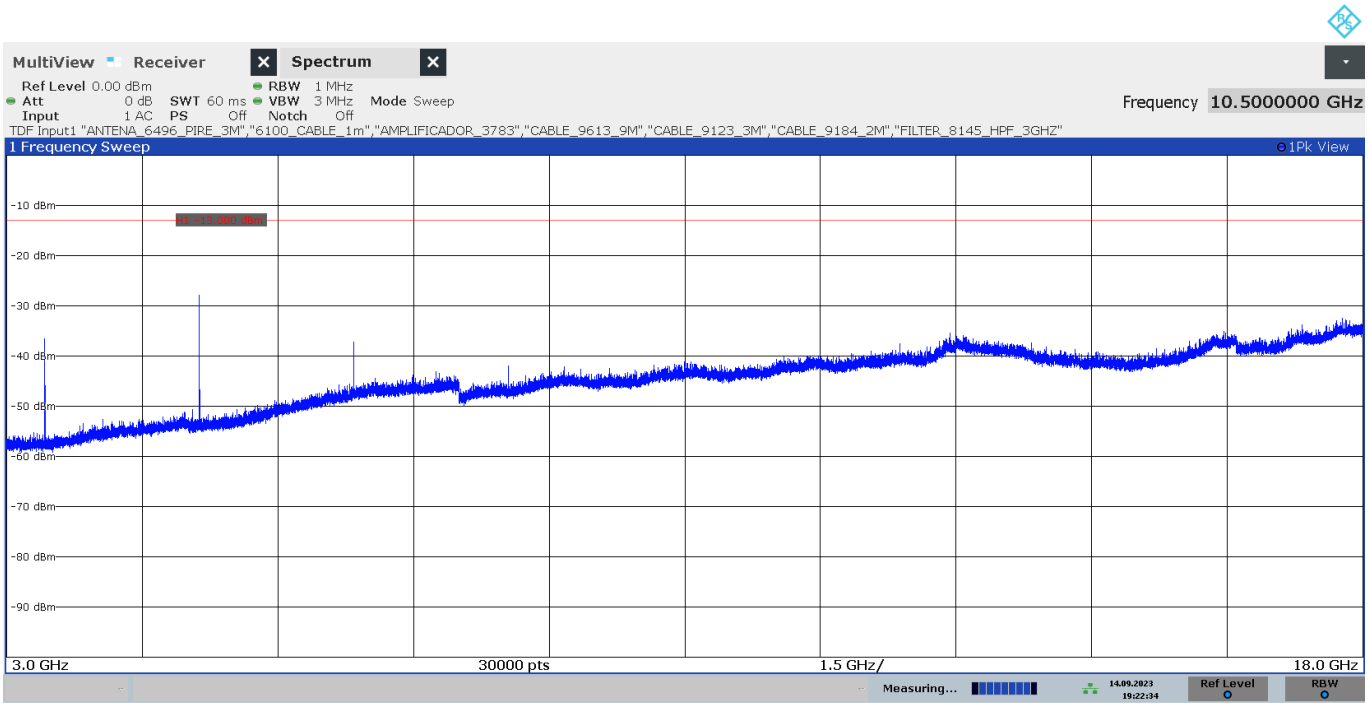
The higher peak is the carrier frequency.

FREQUENCY RANGE 3 - 18 GHz:

- LOW CHANNEL:



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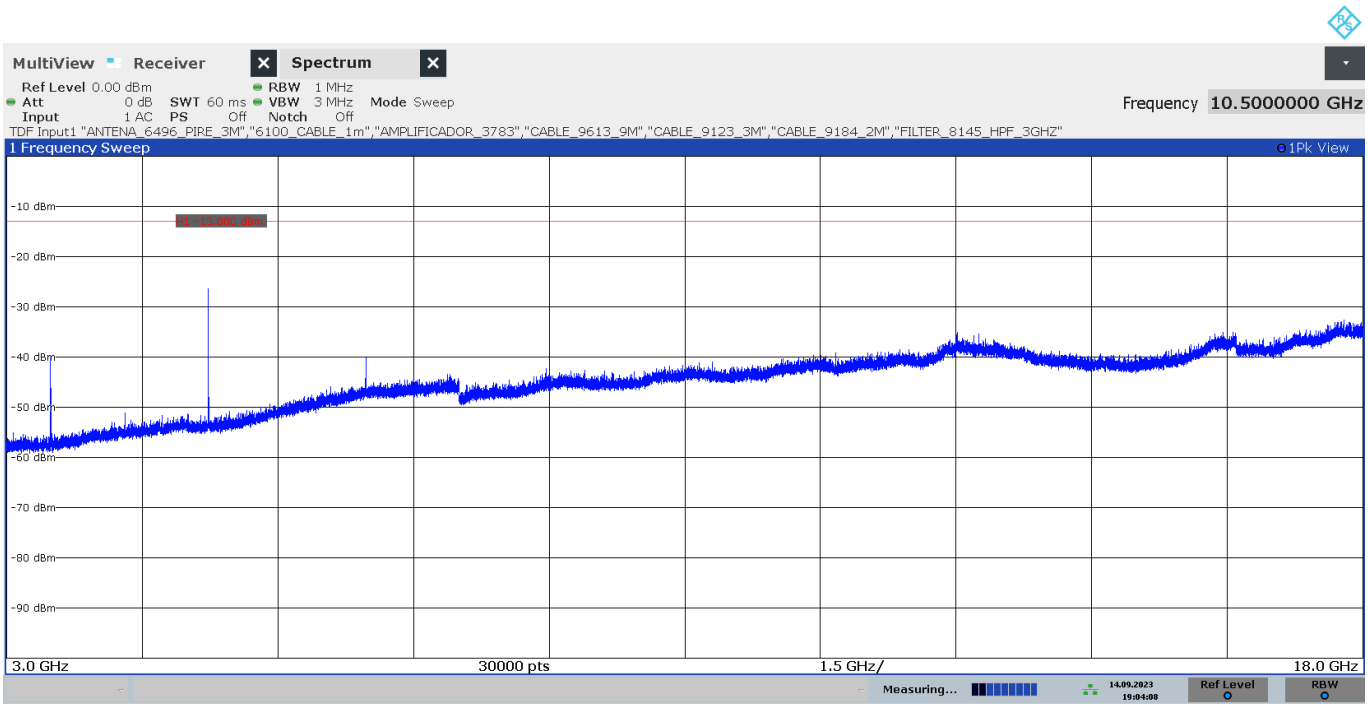
- MIDDLE CHANNEL:



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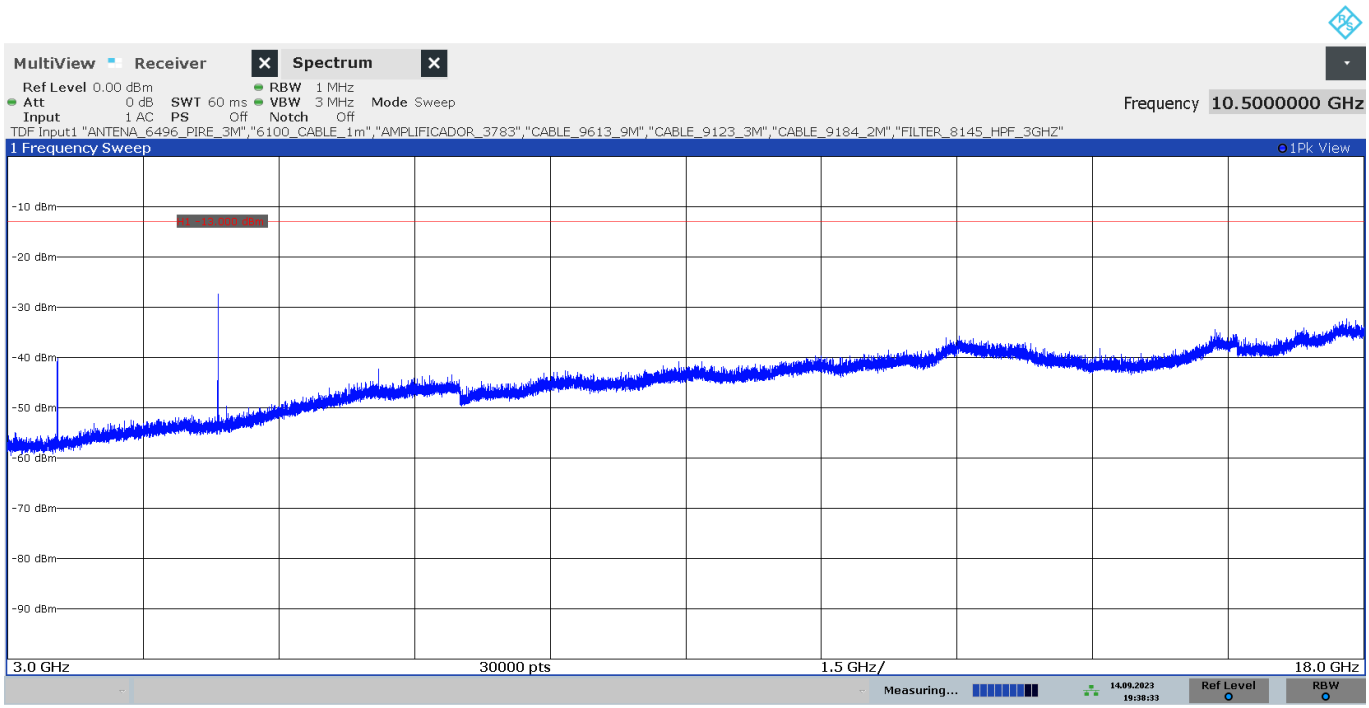
- HIGH CHANNEL:



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