

Radiated Emissions

Limits

FCC §90.691:

For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

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.

The EUT was placed on a 1 meter high non-conductive stand 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_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log(P_o)$, and the level in dBm relative P_o becomes:

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

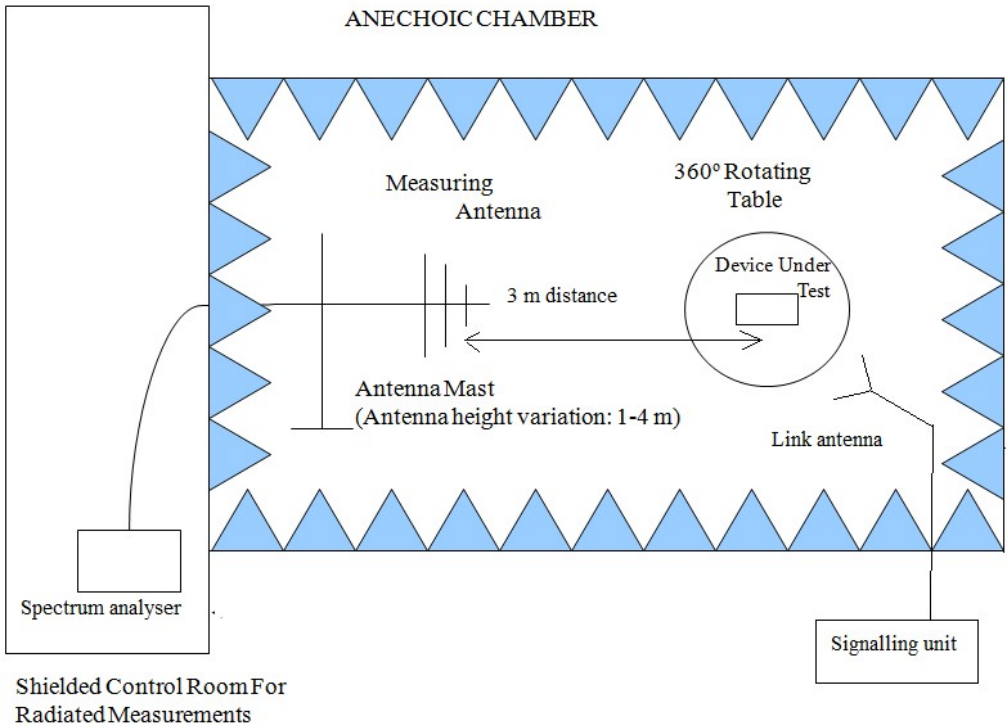
The maximum field strength (dB μ V/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

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

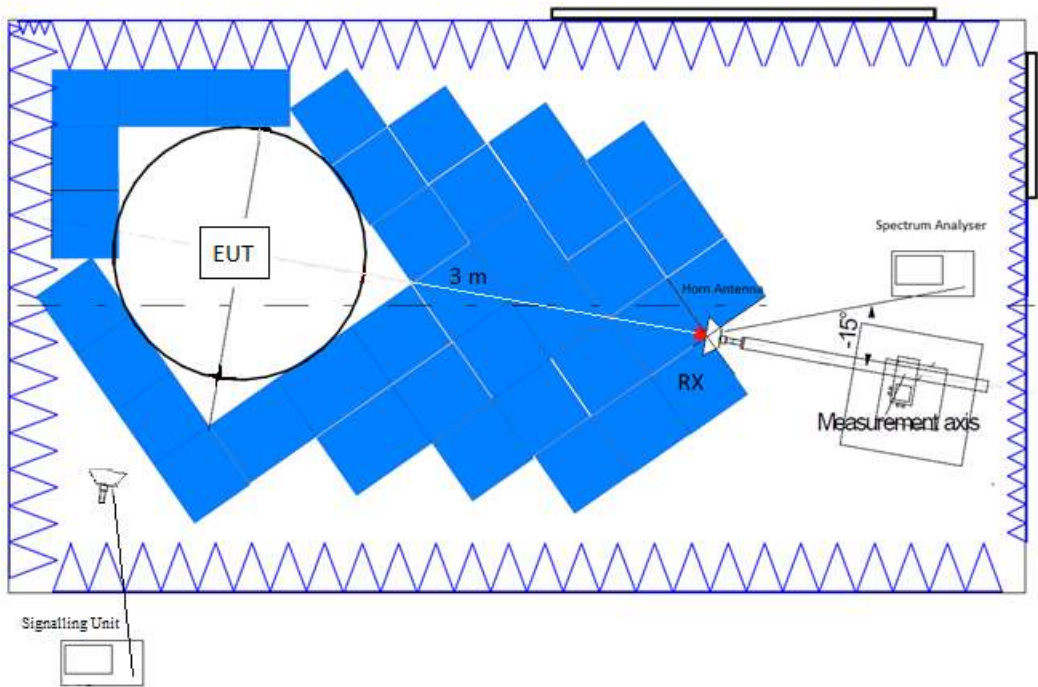
A resolution bandwidth / video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

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 NB1 Band 26. Sub-band 814-824 MHz:

A preliminary scan determined the Pi/2-BPSK, BW=15 kHz, Tone Number=1, Tone Offset=11, MSC/TBS=0 as the worst case. The following 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 - 8.5 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 - 8.5 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 - 8.5 GHz

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

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

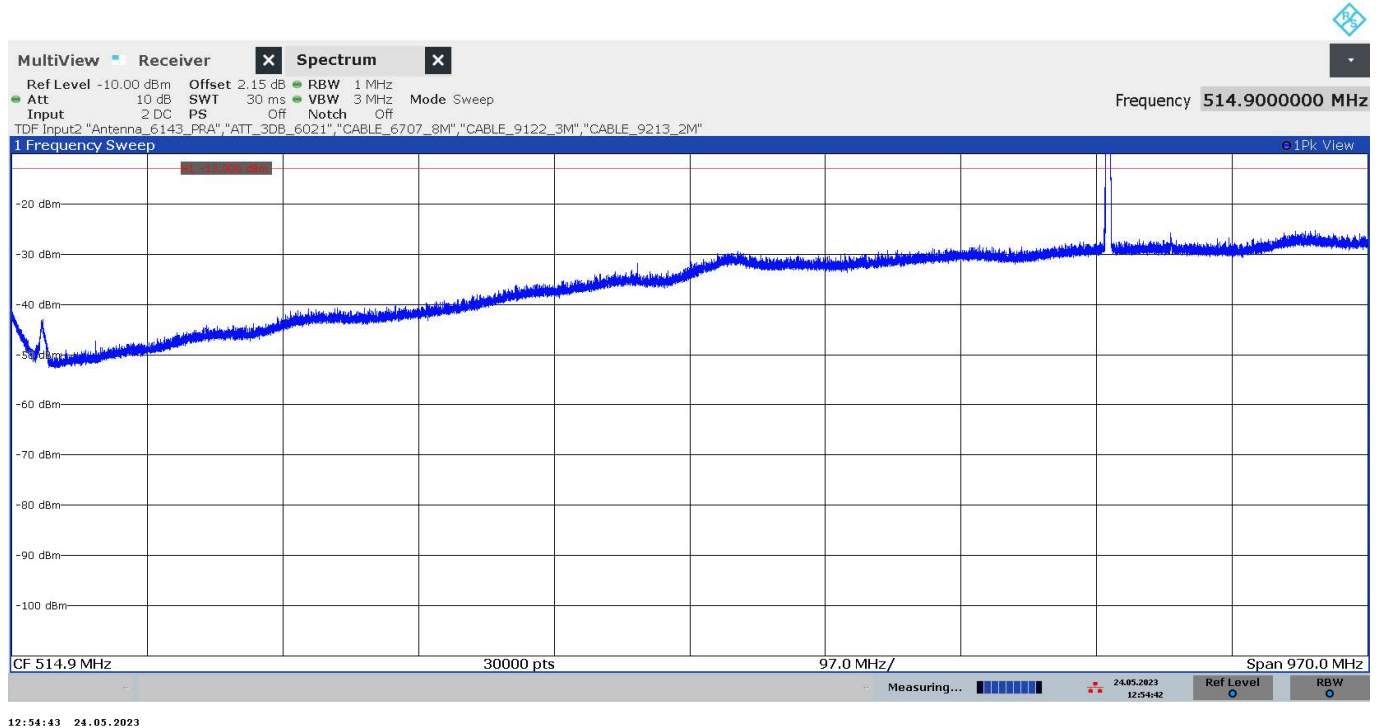
Verdict

Pass

LTE Cat NB1 Band 26. Sub-band 814-824 MHz:

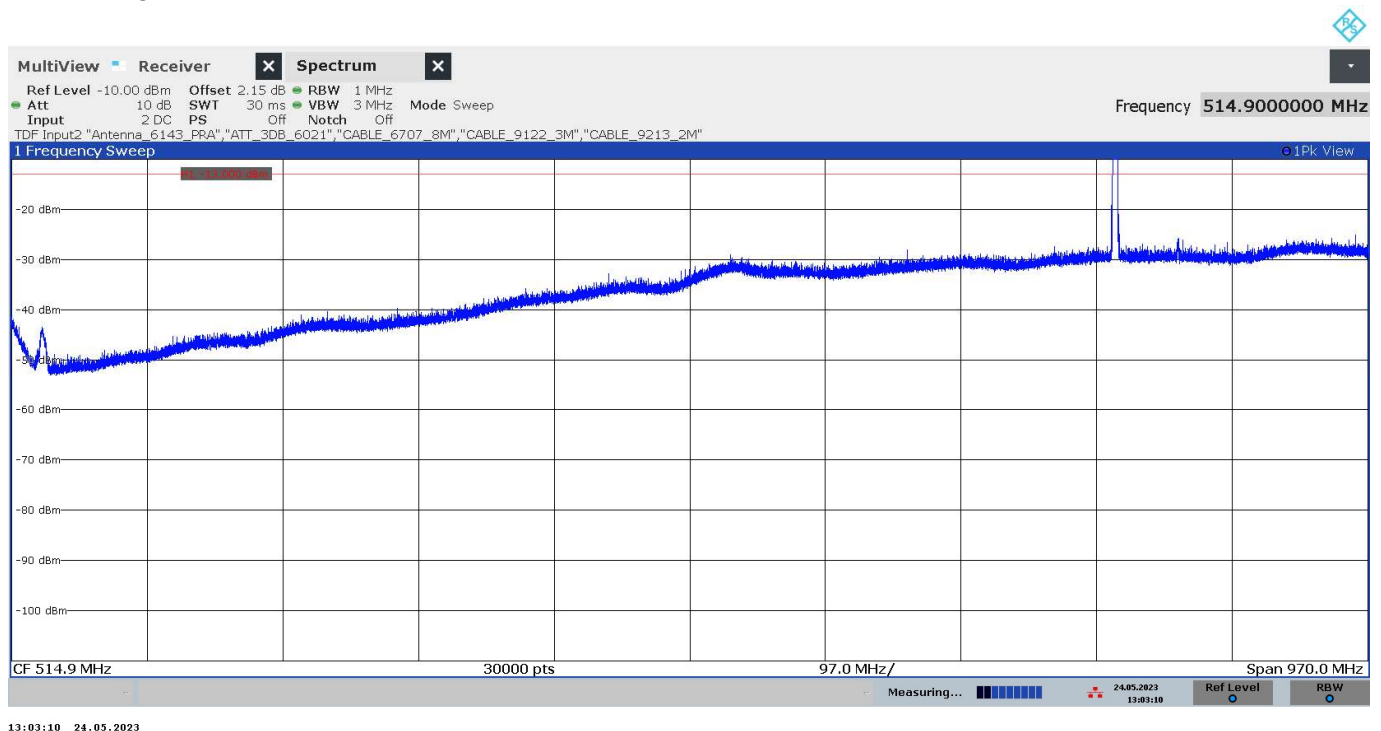
FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



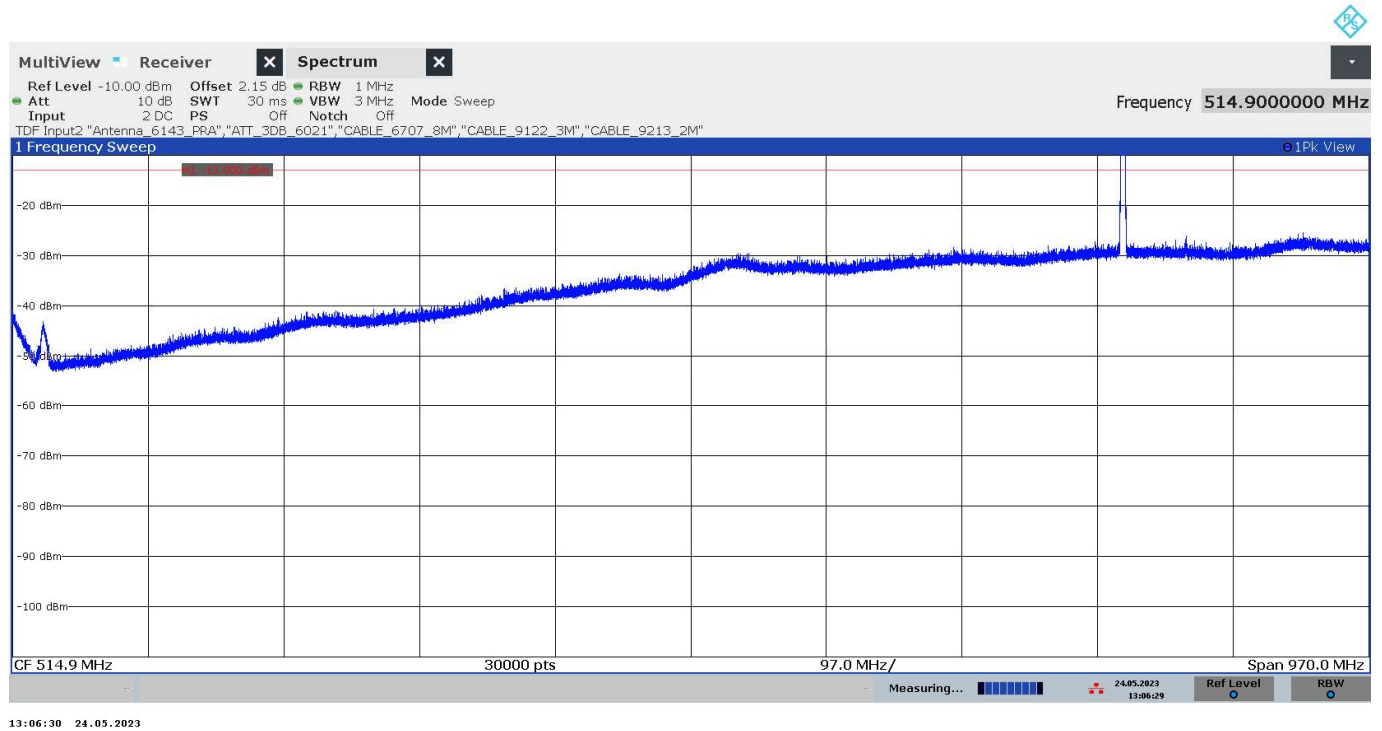
The peak above the limit is the carrier frequency:
LTE Cat NB1 Band 26. Sub-band 814-824 MHz, 819 MHz

- MIDDLE CHANNEL:



The peak above the limit is the carrier frequency:
LTE Cat NB1 Band 26. Sub-band 814-824 MHz, 819 MHz

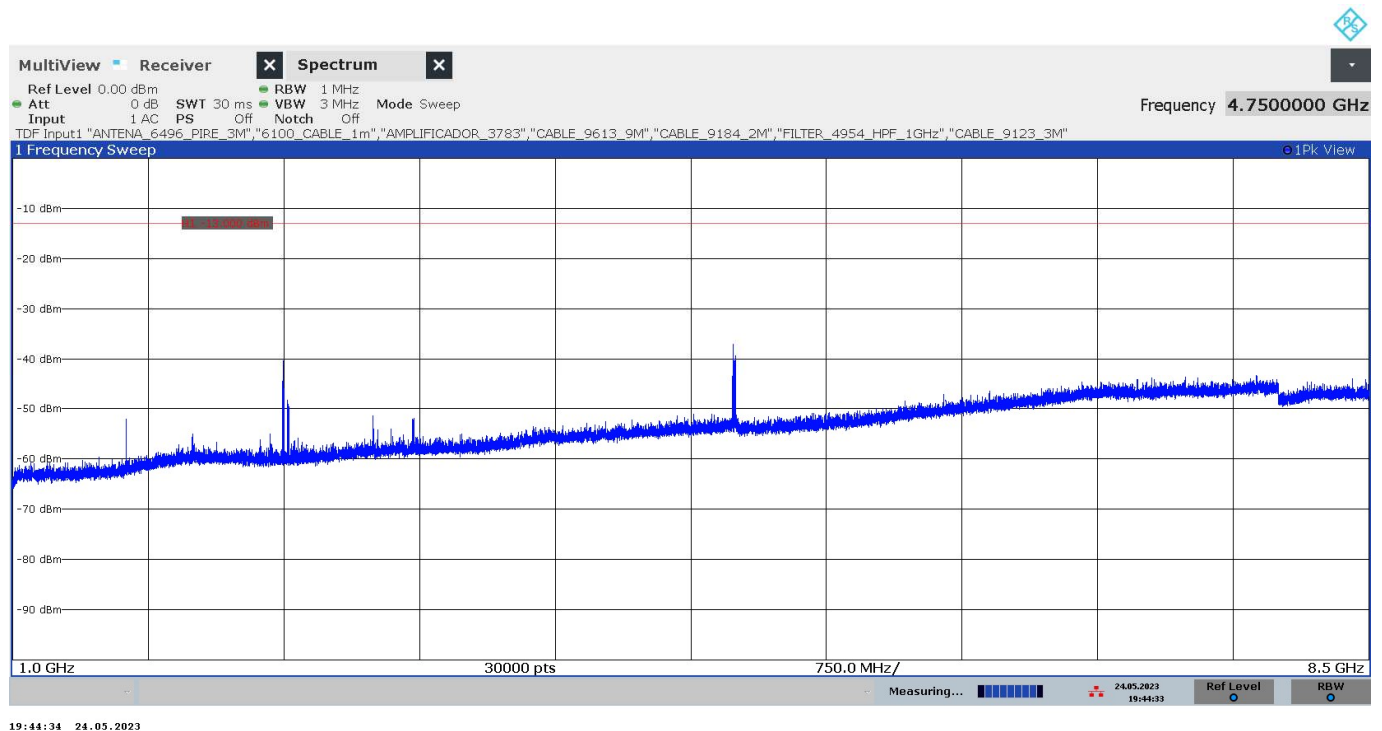
- HIGH CHANNEL:



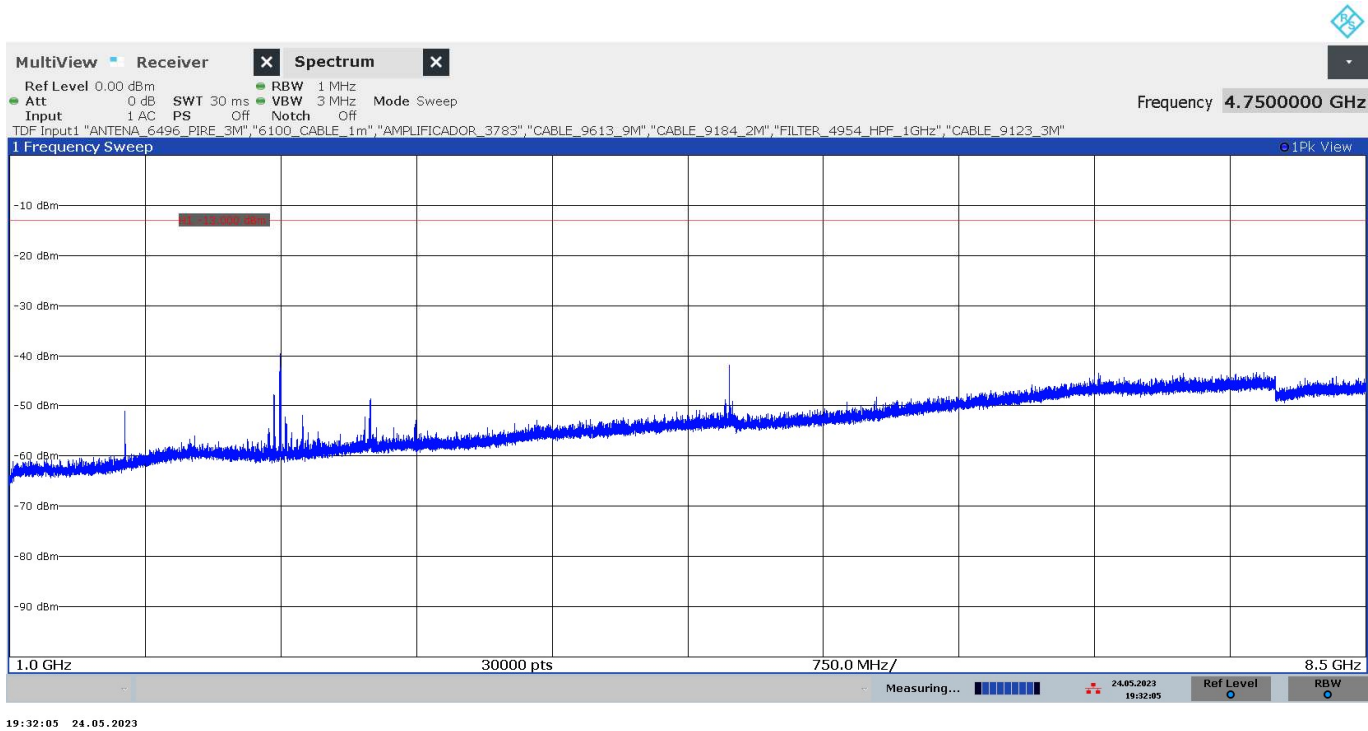
The peak above the limit is the carrier frequency:
LTE Cat NB1 Band 26. Sub-band 814-824 MHz, 819 MHz

FREQUENCY RANGE 1 - 8.5 GHz:

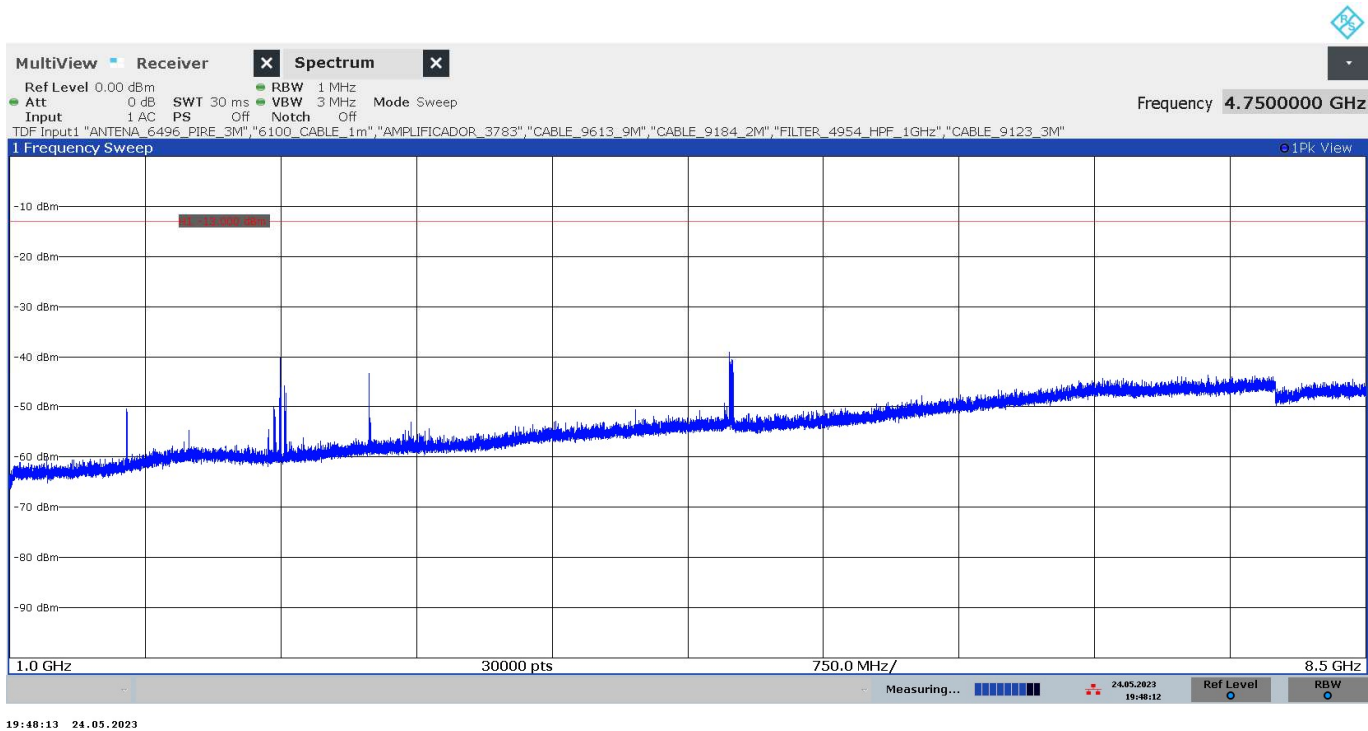
- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:



LTE Cat NB1 Band 26. Cross-rule Channel 824 MHz:

A preliminary scan determined the Pi/2-BPSK, BW=15 kHz, Tone Number=1, Tone Offset=0, MSC/TBS=0 as the worst case. The following results are for this worst-case configuration.

- CROSS-RULE CHANNEL 824 MHz:

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 8.5 GHz:

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

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

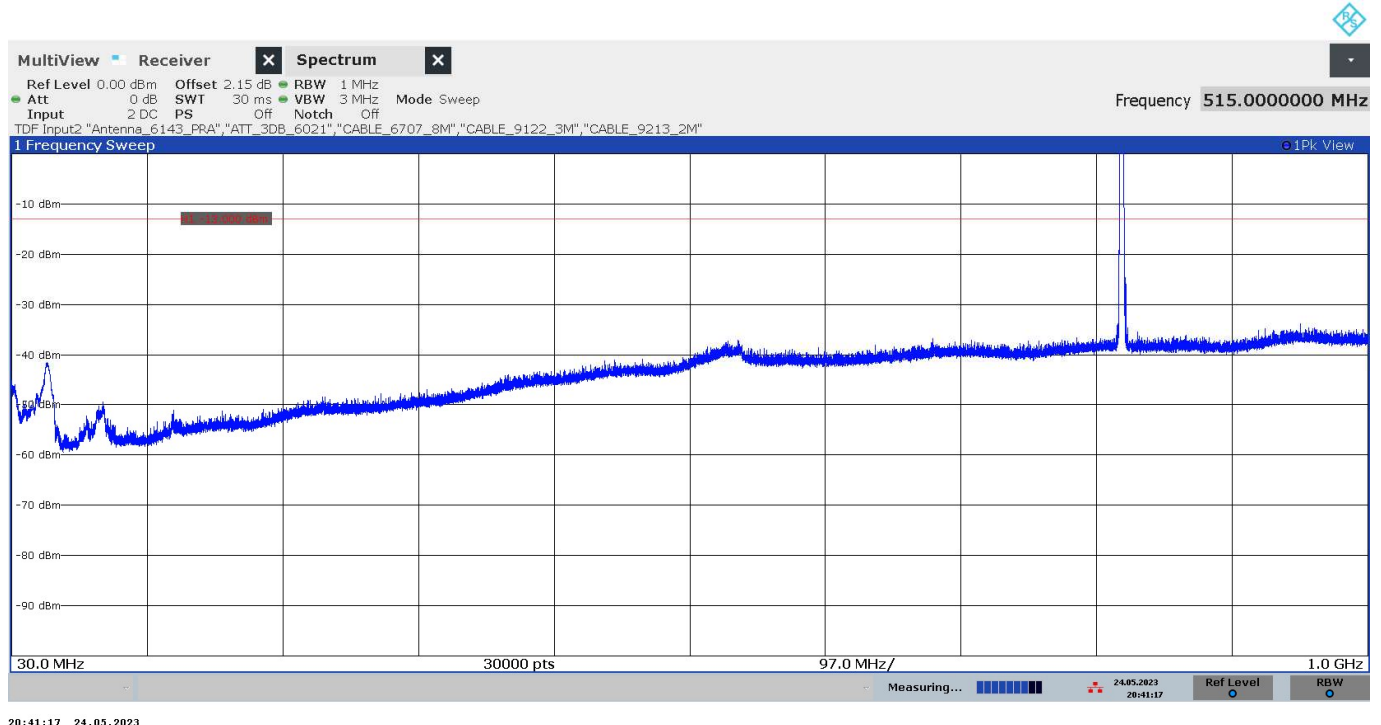
Verdict

Pass

LTE Cat NB1 Band 26. Cross-rule Channel 824 MHz:

FREQUENCY RANGE 30 MHz - 1 GHz:

- SINGLE CHANNEL (Cross-rule Channel 824 MHz):



The peak above the limit is the carrier frequency:
LTE Cat NB1 Band 26, 824 MHz

FREQUENCY RANGE 1 - 8.5 GHz:

- SINGLE CHANNEL (Cross-rule Channel 824 MHz):

