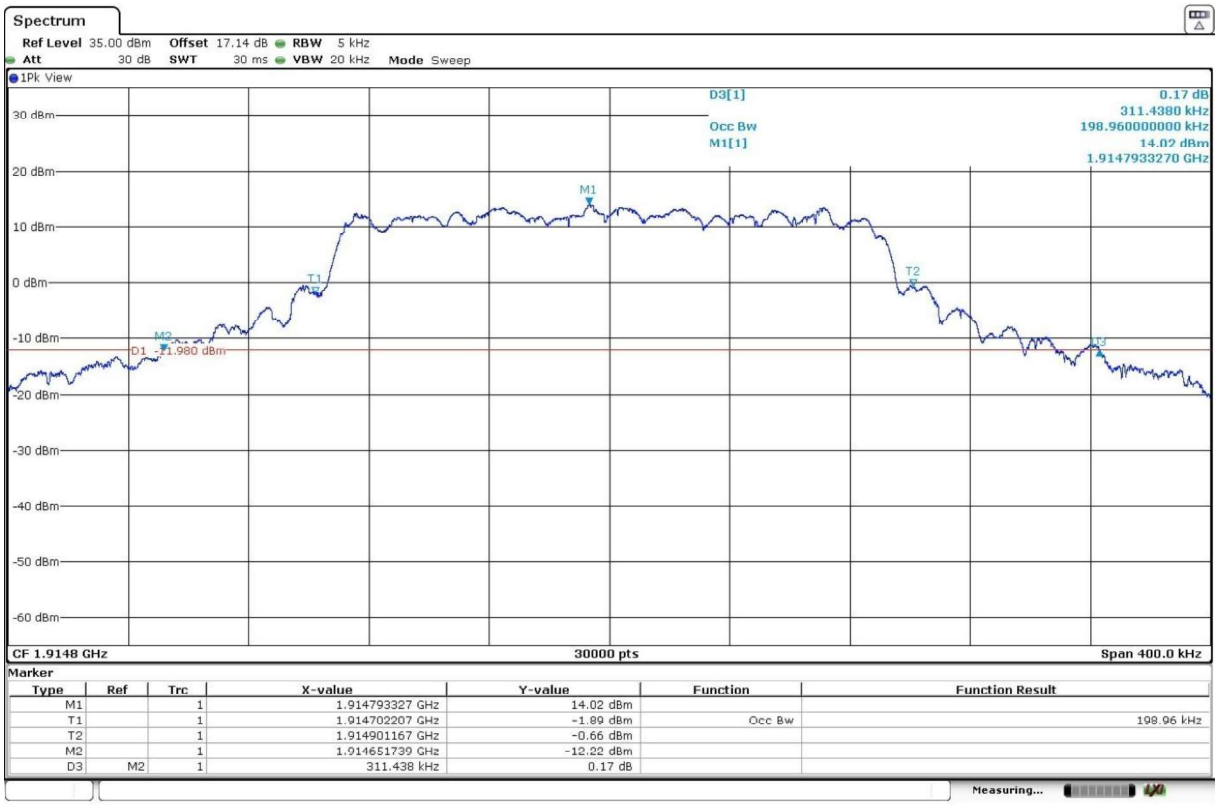
- High Channel:



Spurious Emissions at Antenna Terminals

Limits

FCC §2.1051 and §24.238. RSS-133, Clause 6.5.

> 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.
>
> Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater.

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

$$Po\ (dBm) - [43 + 10 \log (Po\ in\ mW) - 30] = -13\ dBm$$

Method

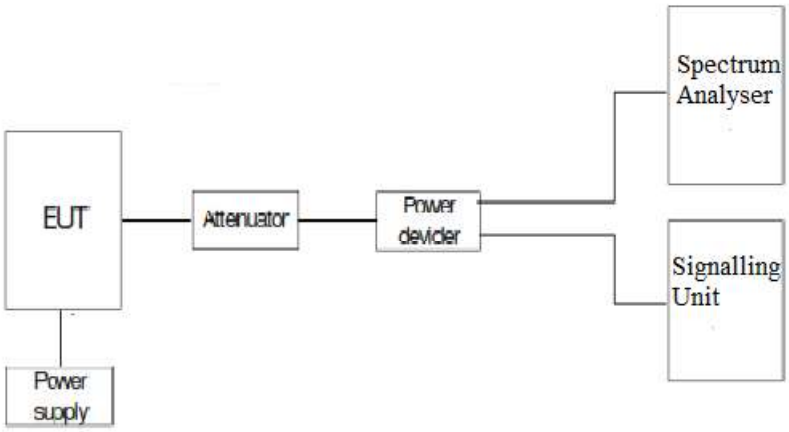
The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50-Ohm attenuator and a power divider.

The spectrum was investigated from 9 kHz to 20 GHz.

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

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

Test setup



Results

NBIoT Band 25:

Preliminary measurements determined π/4 - QPSK modulation, 3 tones 15 kHz, Offset Tone = 6, as the worst case. The next results are for this worst-case configuration.

- Low Channel: No spurious signals found at less than 20dB below the limit.
- Middle Channel: No spurious signals found at less than 20dB below the limit.
- High Channel: No spurious signals found at less than 20dB below the limit.

Verdict

Pass

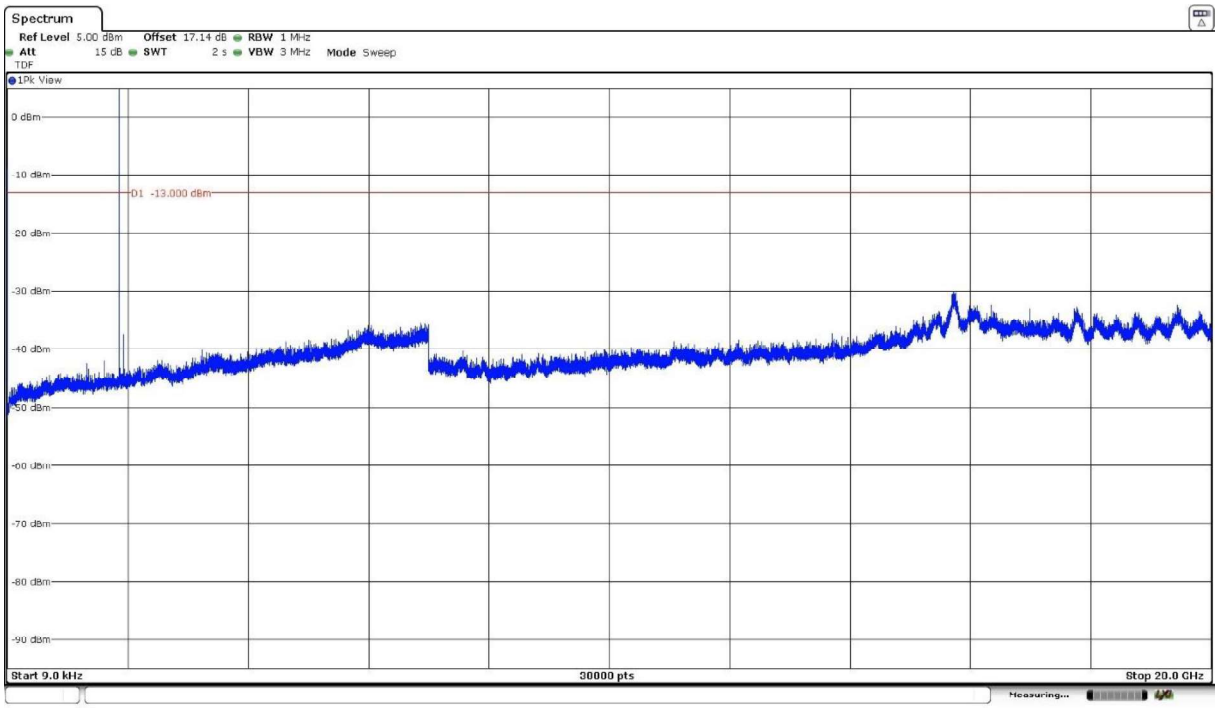
Attachments

The peak above the limit on all plots below is the carrier frequency.

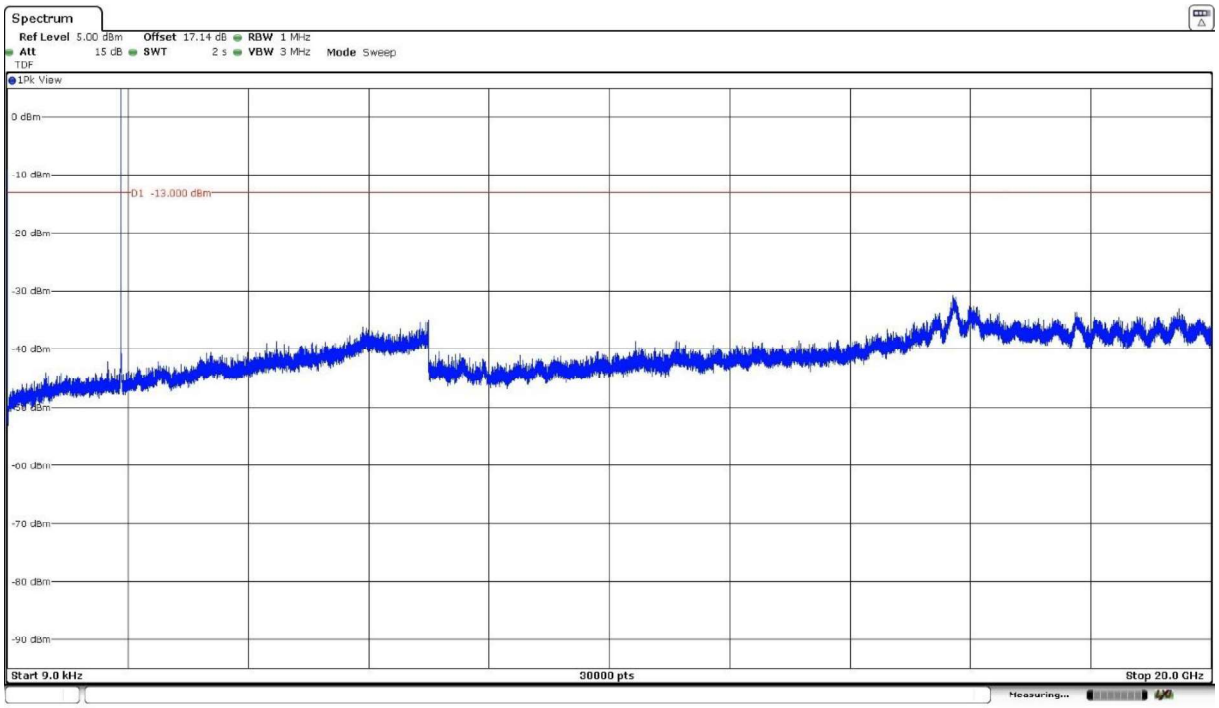
NBIoT Band 25.

π/4 - QPSK modulation. 3 tones 15 kHz, Offset Tone = 6.

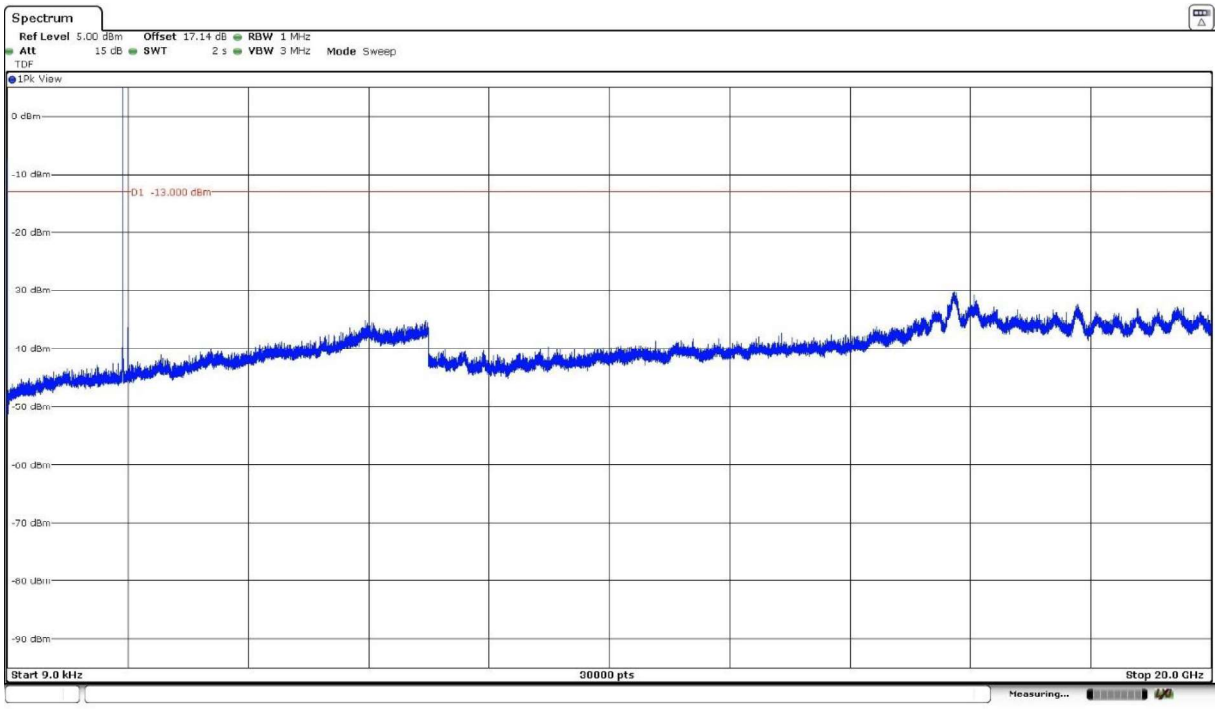
- Low Channel:



- Middle Channel:



- High Channel:



Spurious Emissions at Antenna Terminals at Block Edges

Limits

FCC §2.1051 and §24.238. RSS-133, Clause 6.5.

> 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.
>
> Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater.

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

$$Po\ (dBm) - [43 + 10 \log (Po\ in\ mW) - 30] = -13\ dBm$$

Method

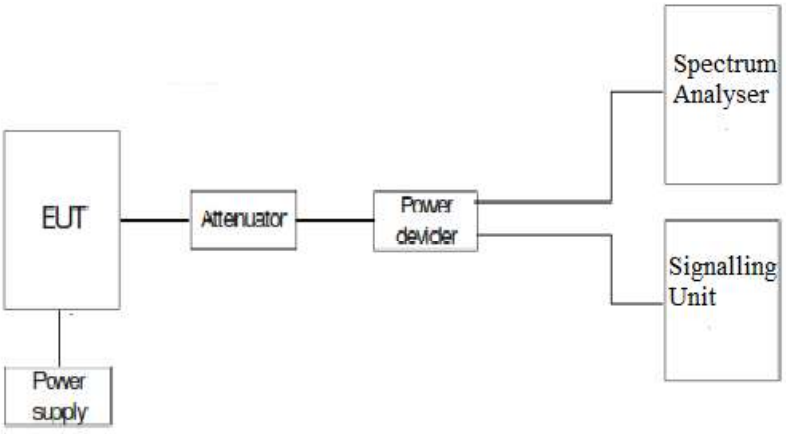
The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50-Ohm attenuator and a power splitter.

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

The configuration of modulation which is the worst case for conducted power was used. Lowest and highest channels were tested to show compliance with low and high block edges respectively.

As stated in FCC part 24.238 / RSS-133 Clause 6.5, in the 1 MHz bands immediately outside and adjacent to the frequency block or band a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Test setup



Results

NBIoT Band 25:

A preliminary measurement determined π/4 - QPSK modulation as the worst case for 1 tone of 3.75 kHz.

A preliminary measurement determined π/4 - QPSK modulation as the worst case for 1 tone of 15 kHz.

The next results are for these worst-case modulations.

NBIoT configuration	Maximum measured level at lowest Block Edge at antenna port (dBm)
1 Tone 3.75 kHz, Offset Tone = 0 π/4 - QPSK	-28.19
1 Tone 15 kHz, Offset Tone = 0 π/4 - QPSK	-29.09
12 Tones 15kHz, Offset Tone = 0 π/4 - QPSK	-27.21

NBIoT configuration	Maximum measured level at highest Block Edge at antenna port (dBm)
1 Tone 3.75 kHz, Offset Tone = 47 π/4 - QPSK	-28.88
1 Tone 15 kHz, Offset Tone = 11 π/4 - QPSK	-28.40
12 Tones 15kHz, Offset Tone = 0 π/4 - QPSK	-24.17

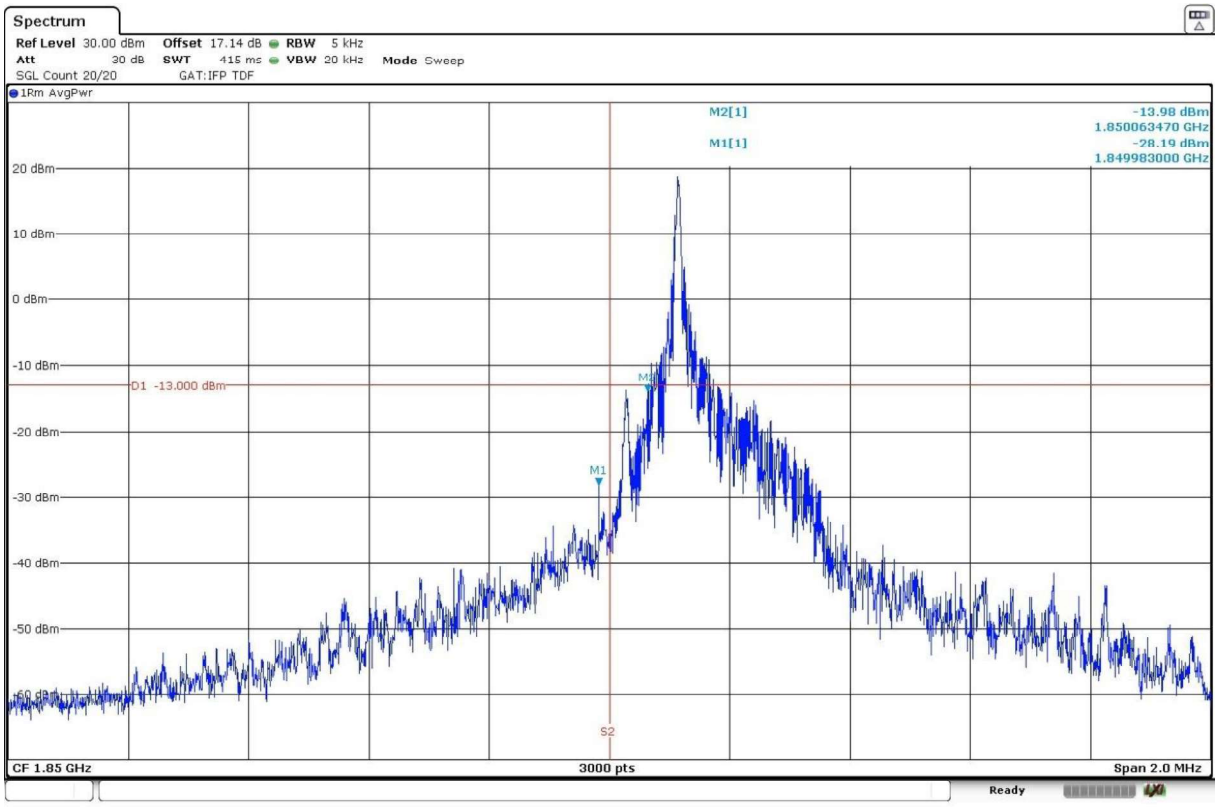
Verdict

Pass

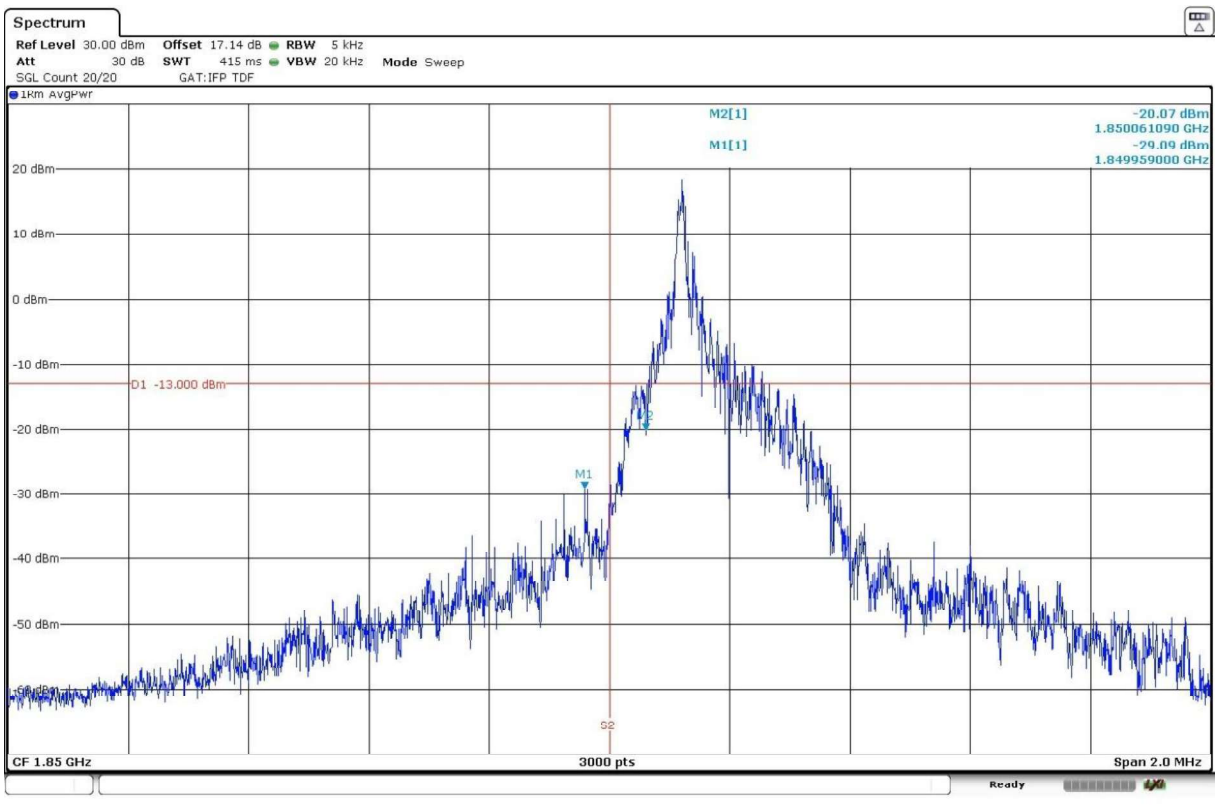
Attachments

NBIoT Band 25.

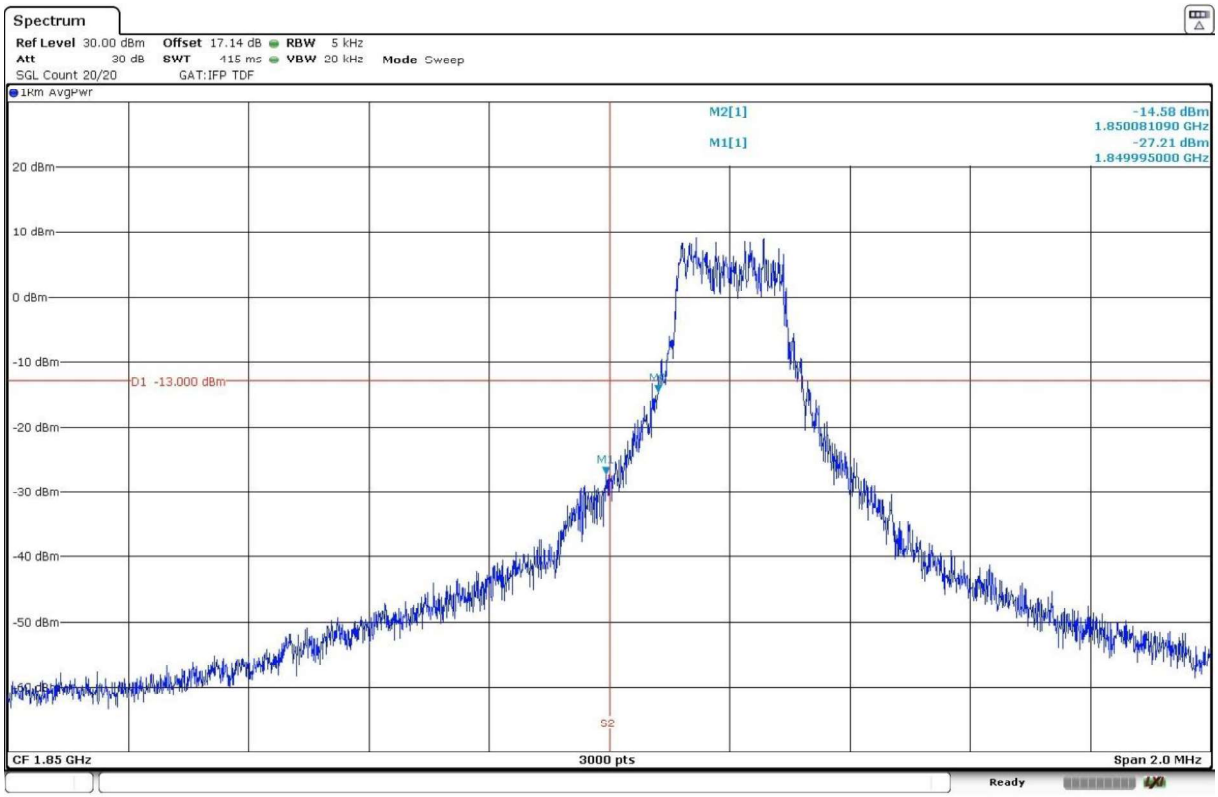
1 Tone 3.75 kHz, Offset Tone = 0. π/4 - QPSK modulation. Low Block Edge:



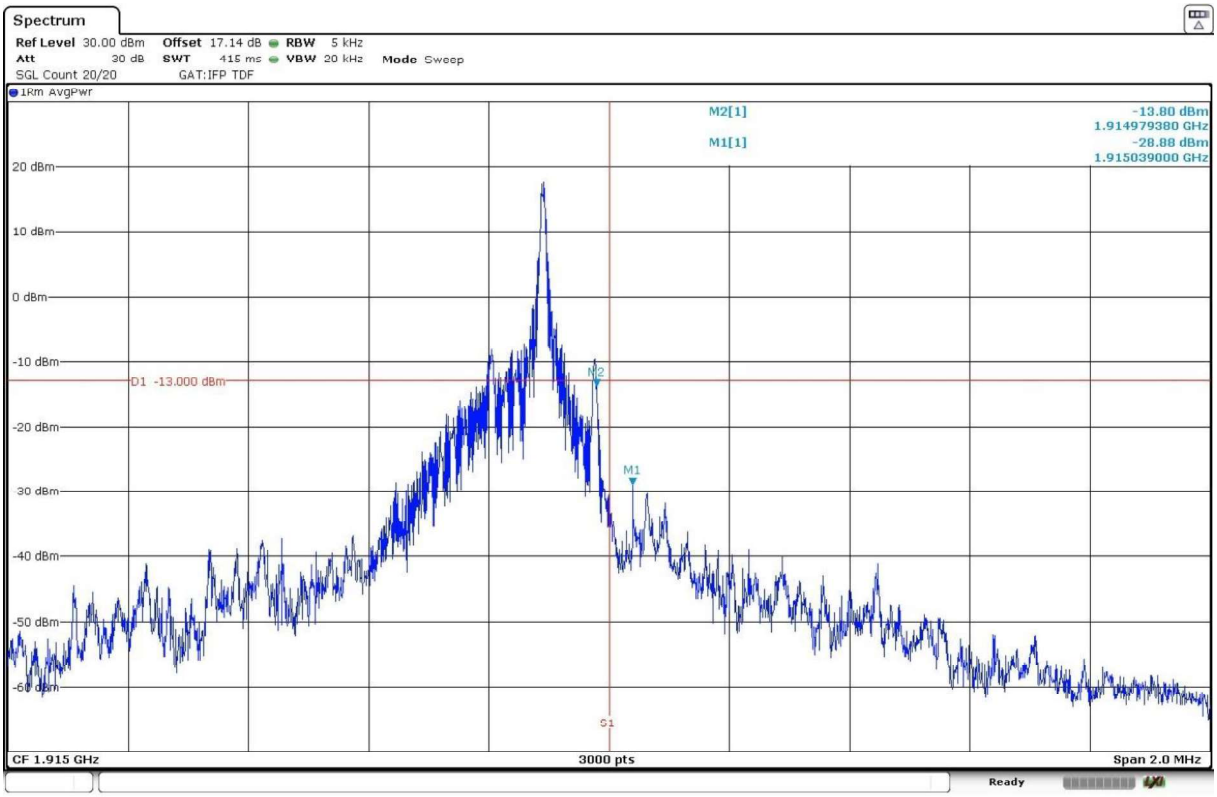
1 Tone 15 kHz, Offset Tone = 0. π/4 – QPSK modulation. Low Block Edge:



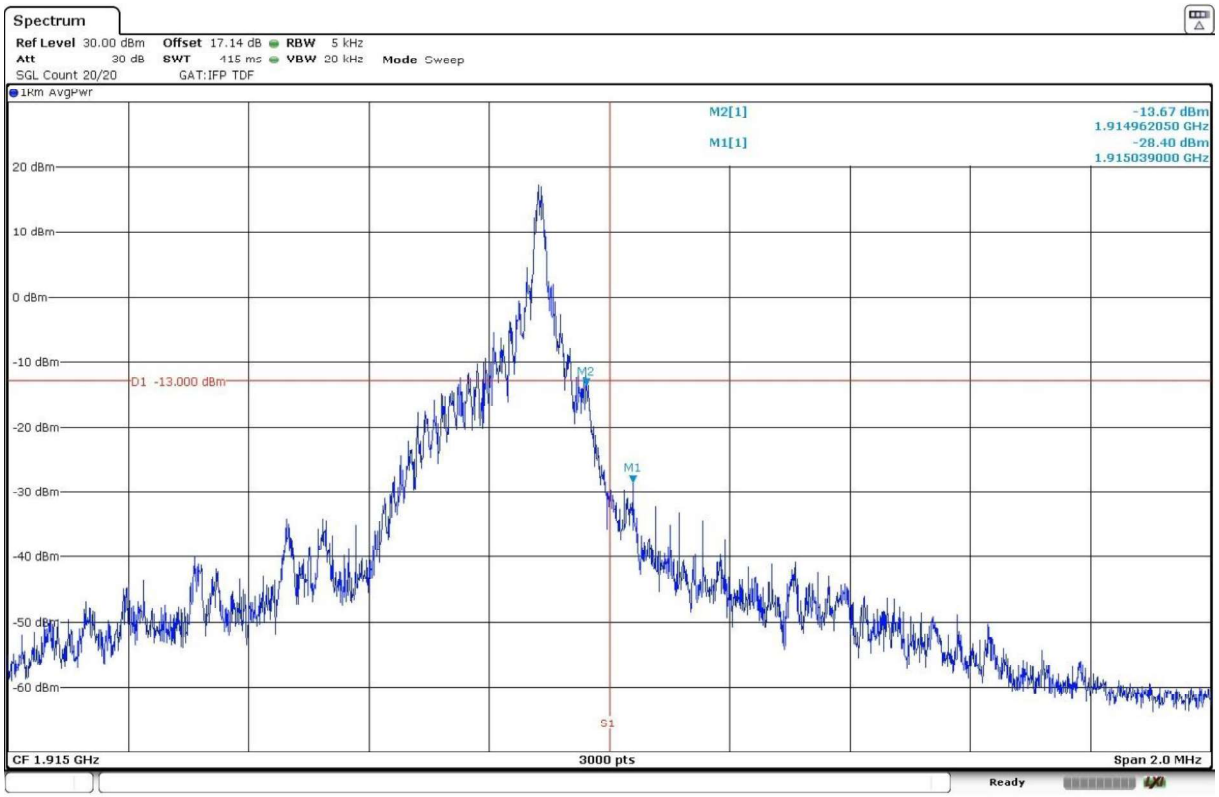
12 Tones 15 kHz, Offset Tone = 0. π/4 - QPSK modulation. Low Block Edge:



1 Tone 3.75 kHz, Offset Tone = 47. π/4 - QPSK modulation. High Block Edge:



1 Tone 15 kHz, Offset Tone = 11. π/4 - QPSK modulation. High Block Edge:



12 Tones 15 kHz, Offset Tone = 0. π/4 - QPSK modulation. High Block Edge: