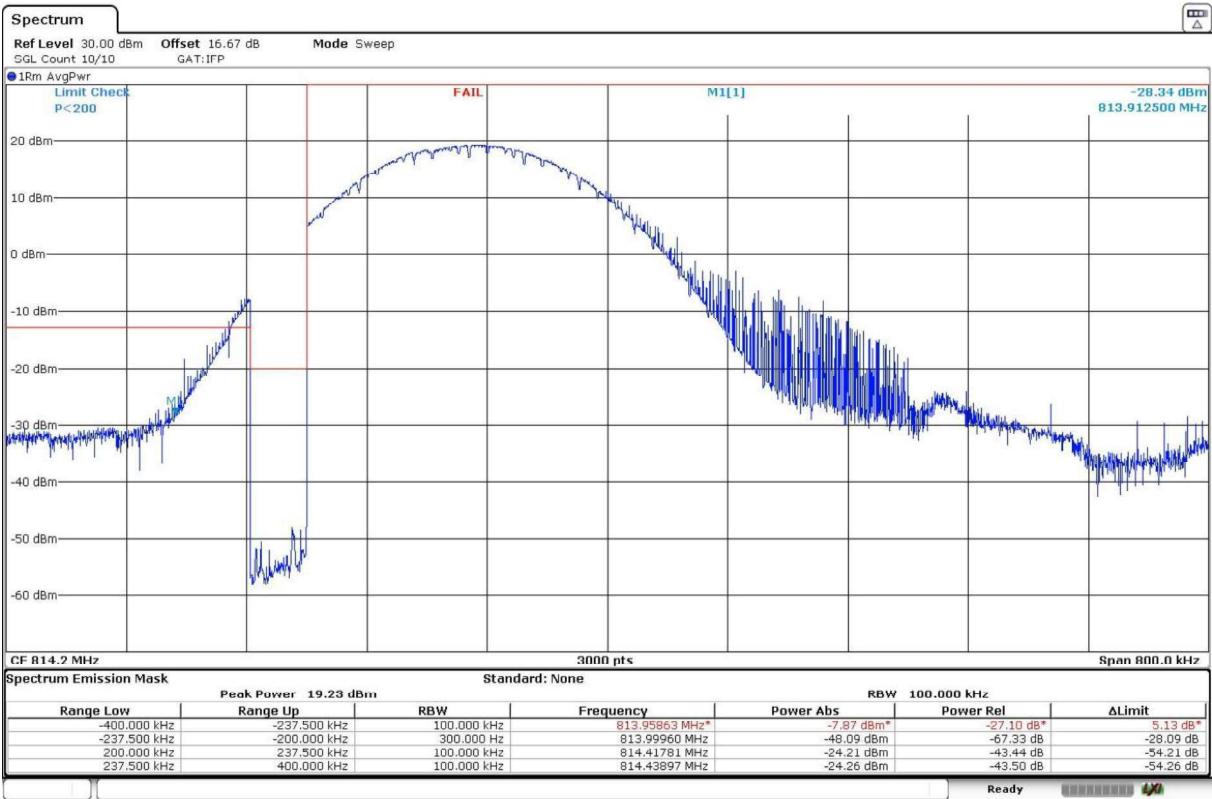
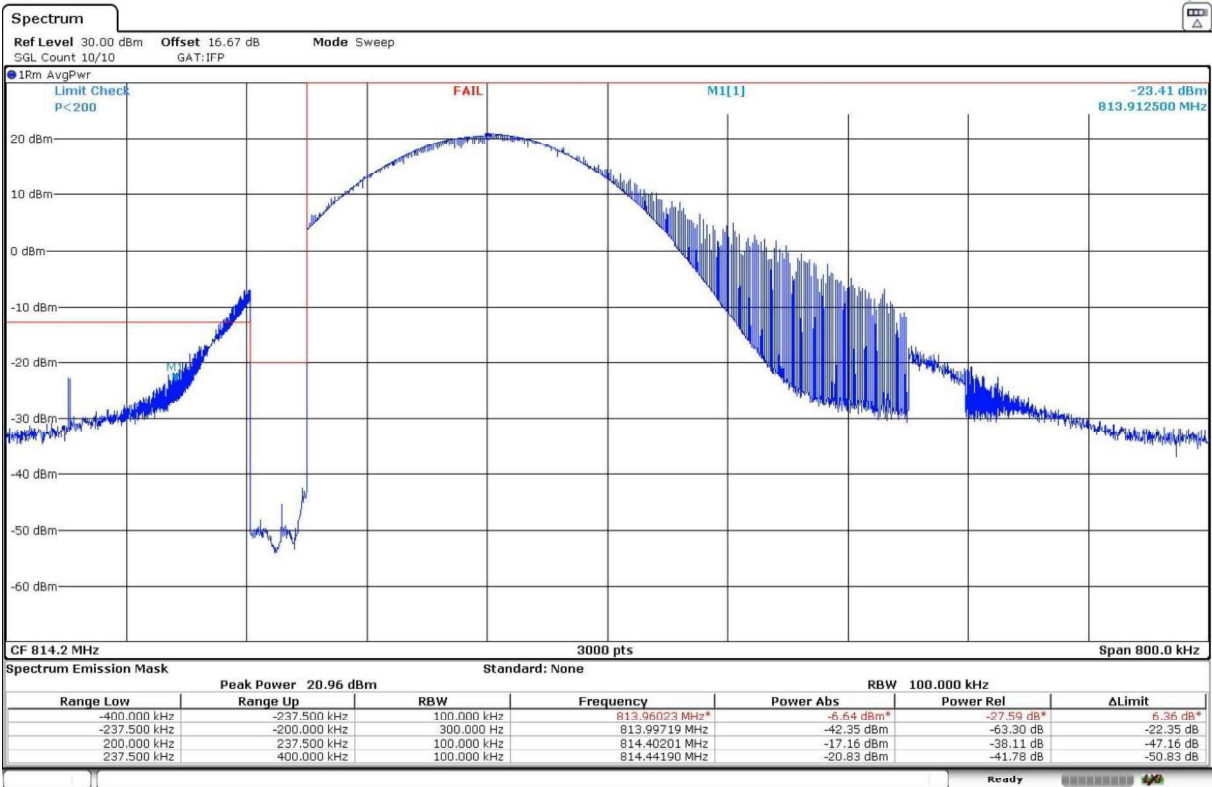


NB IoT 814 – 824 MHz Band. EA MASK.

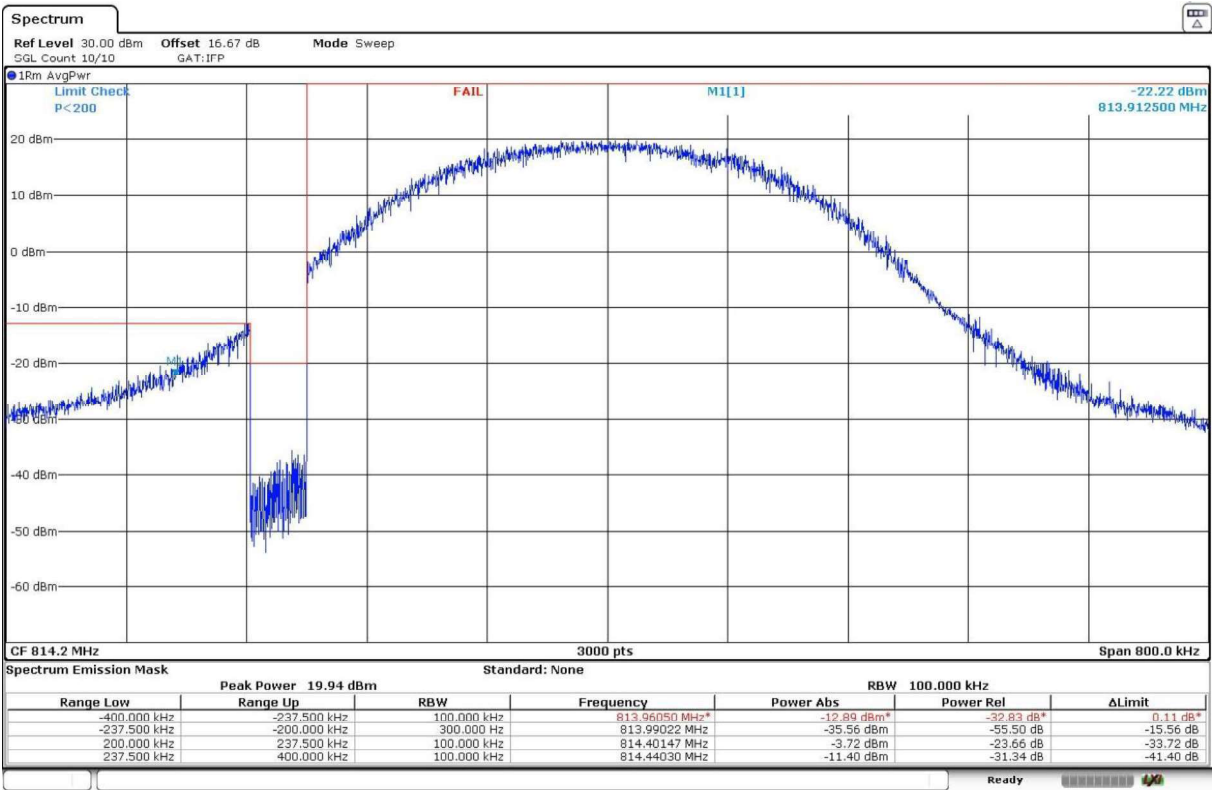
1 Tone 3.75 kHz, Offset Tone = 0. $\pi/4$ - QPSK modulation. Low Channel:



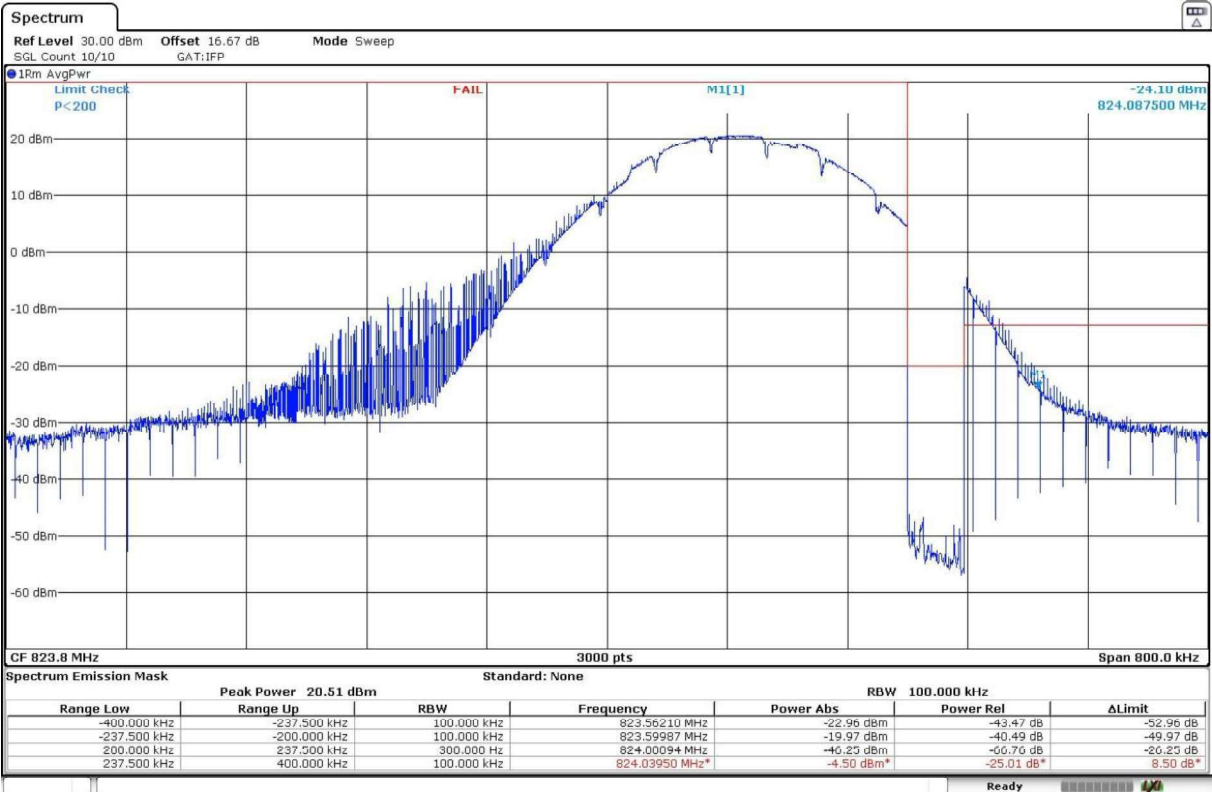
1 Tone 15 kHz, Offset Tone = 0. $\pi/2$ - BPSK modulation. Low Channel:



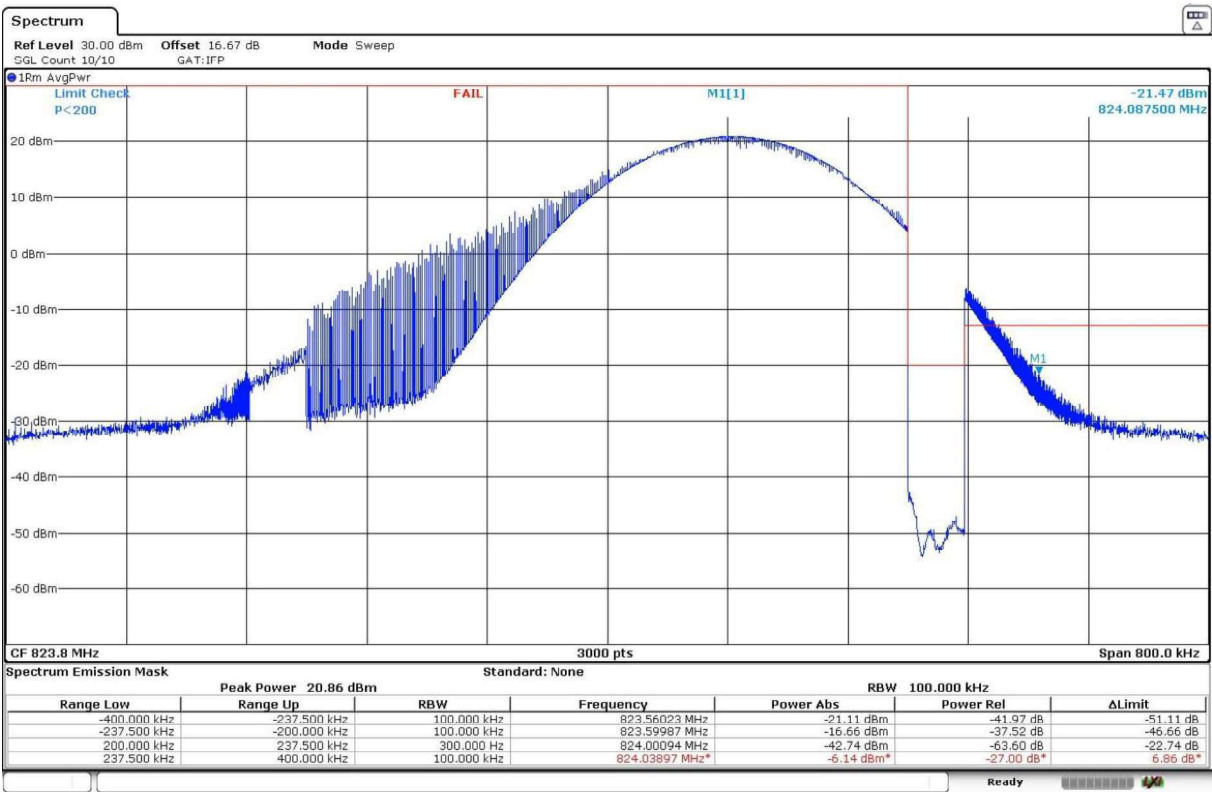
12 Tones 15 kHz, Offset Tone = 0. $\pi/4$ - QPSK modulation. Low Channel:



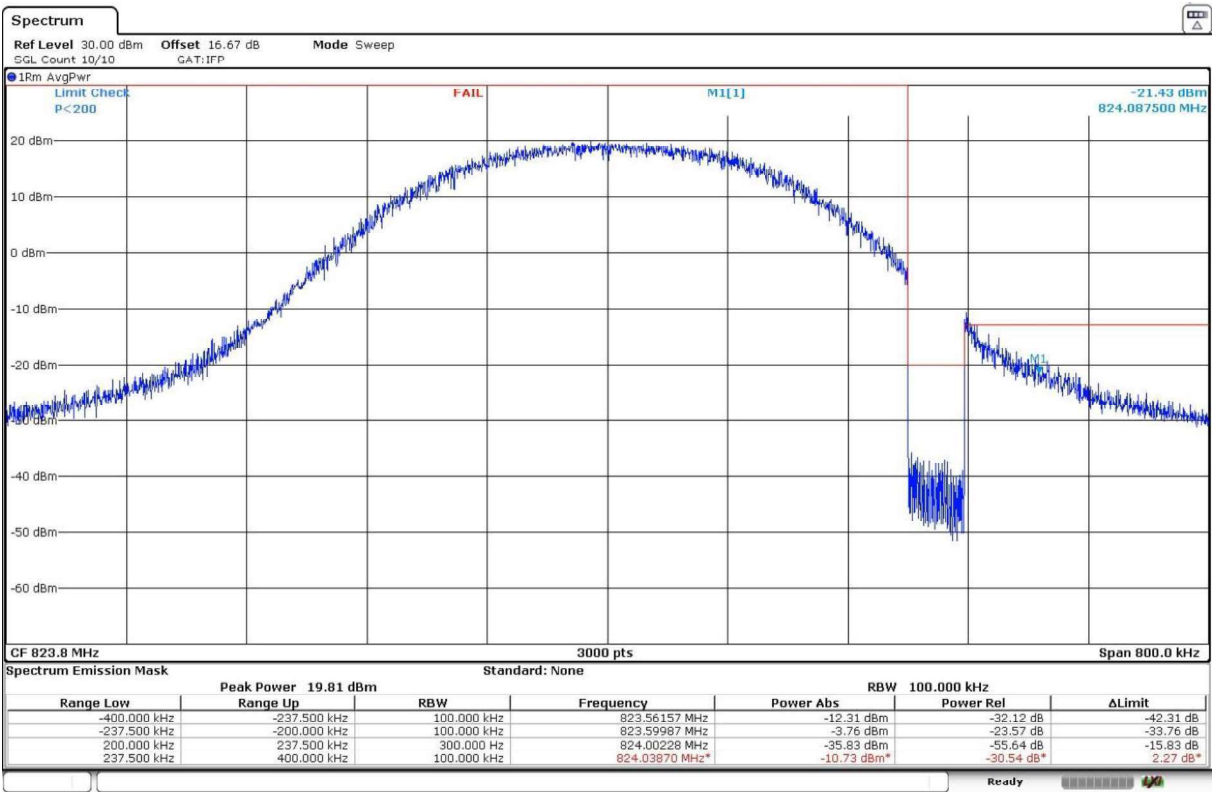
1 Tone 3.75 kHz, Offset Tone = 47. $\pi/4$ - QPSK modulation. High Channel:



1 Tone 15 kHz, Offset Tone = 11. $\pi/2$ - BPSK modulation. High Channel:



12 Tones 15 kHz, Offset Tone = 0. $\pi/4$ - QPSK modulation. High Channel:



Radiated Emissions

Limits

FCC §2.1051 and §22.917. RSS-132 Clause 5.5.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

FCC §90.691.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ 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 12.5 kHz.

(2) 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.

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

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

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 a 3-meter distance from the measuring antenna for measurements from 30 MHz up 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.

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:

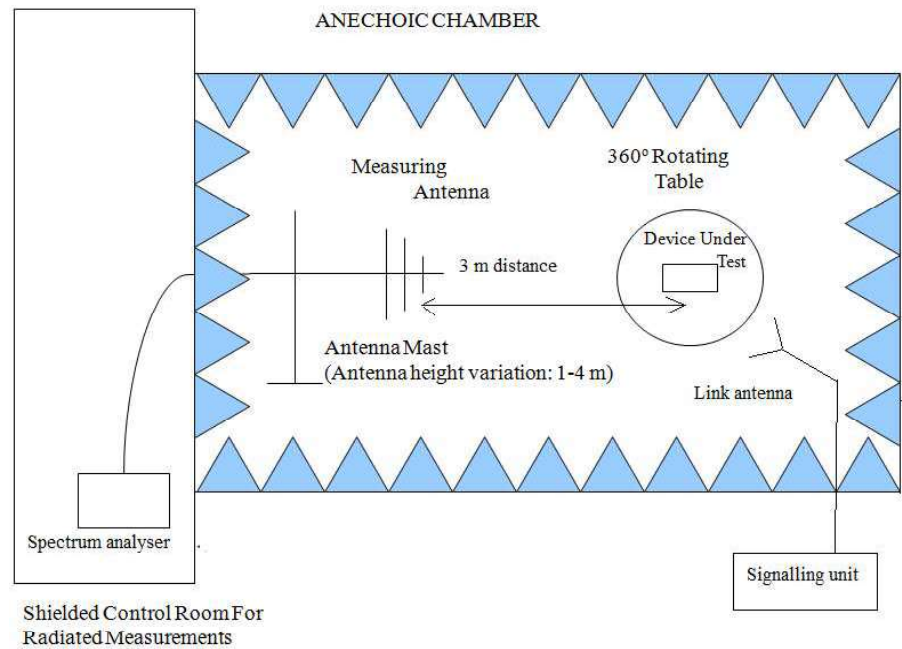
$$\text{EIRP (dBm)} = E(\text{dB}\mu\text{V/m}) + 20 \log(D) - 104.8$$

Where D is the measurement distance (in the far field region) in m. $D = 3 \text{ m}$.

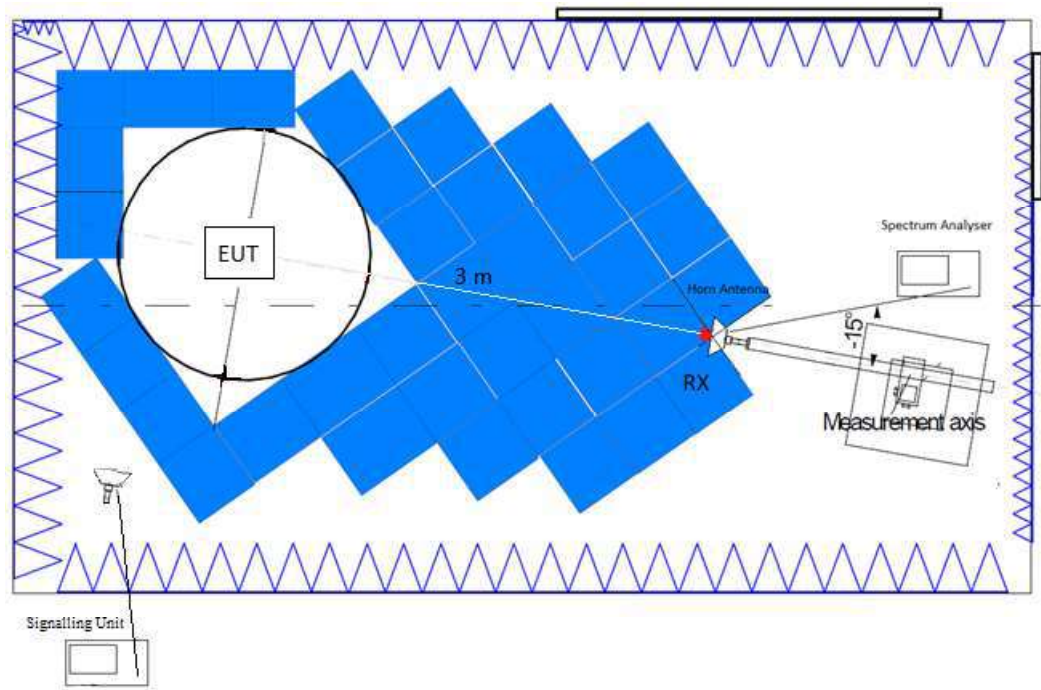
The configuration of tones and modulation which is the worst case for conducted power was used.

Test setup

Radiated measurements below 1 GHz.



Radiated measurements between 1 GHz and 18 GHz.



Results

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

NBLoT 814 – 824 MHz Band:

$\pi/4$ - QPSK modulation. 3 tones 15 kHz, Offset Tone = 6.

- Low Channel:

Frequency range 30 MHz – 1 GHz

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

Frequency range 1 GHz – 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 GHz – 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 GHz – 8.5 GHz

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

Verdict

Pass

NBLoT 824 – 849 MHz Band:

$\pi/4$ - QPSK modulation. 3 tones 15 kHz, Offset Tone = 6.

- Low Channel:

Frequency range 30 MHz – 1 GHz

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

Frequency range 1 GHz – 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 GHz – 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 GHz – 8.5 GHz

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

Verdict

Pass

NBLoT Cross-rule channel (824 MHz):

$\pi/4$ - QPSK modulation. 3 tones 15 kHz, Offset Tone = 6.

Frequency range 30 MHz – 1 GHz

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

Frequency range 1 GHz – 8.5 GHz

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

Verdict

Pass

Attachments

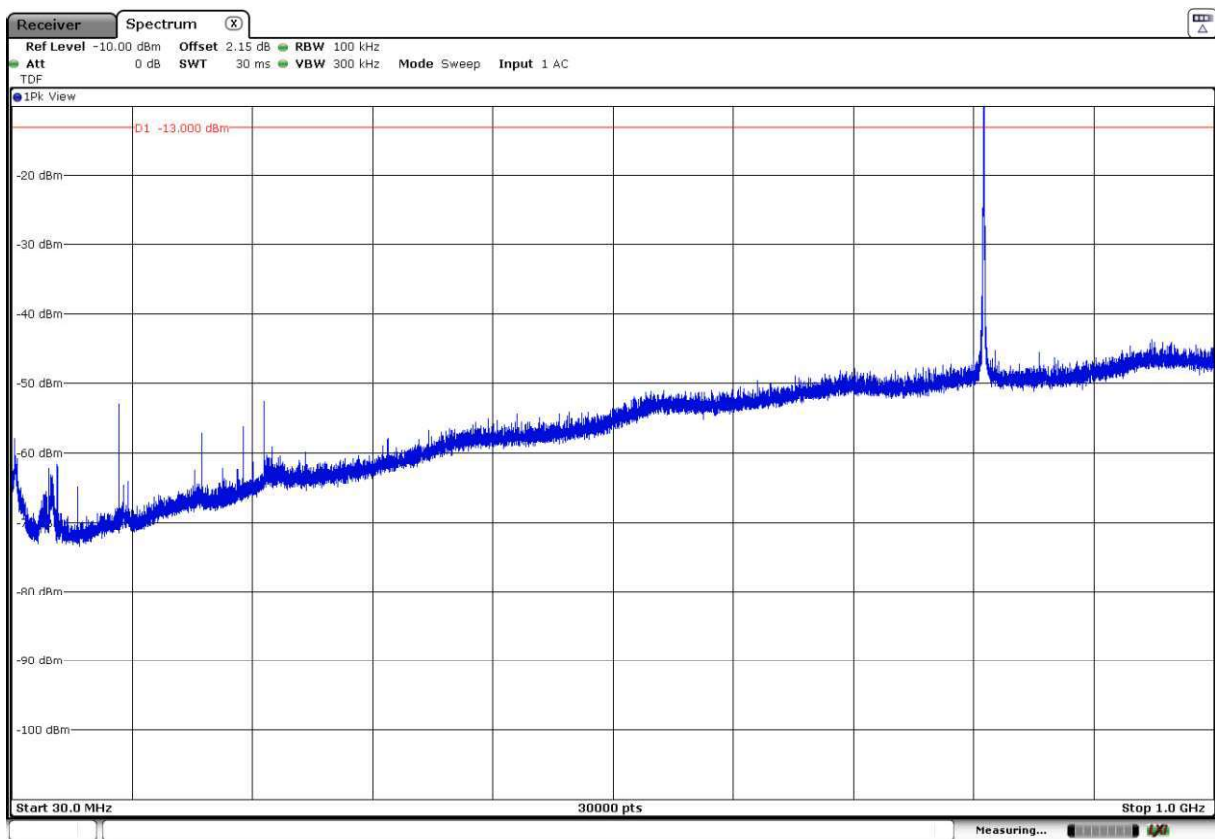
The peak above the limit is the carrier frequency.

NB IoT 814 – 824 MHz Band.

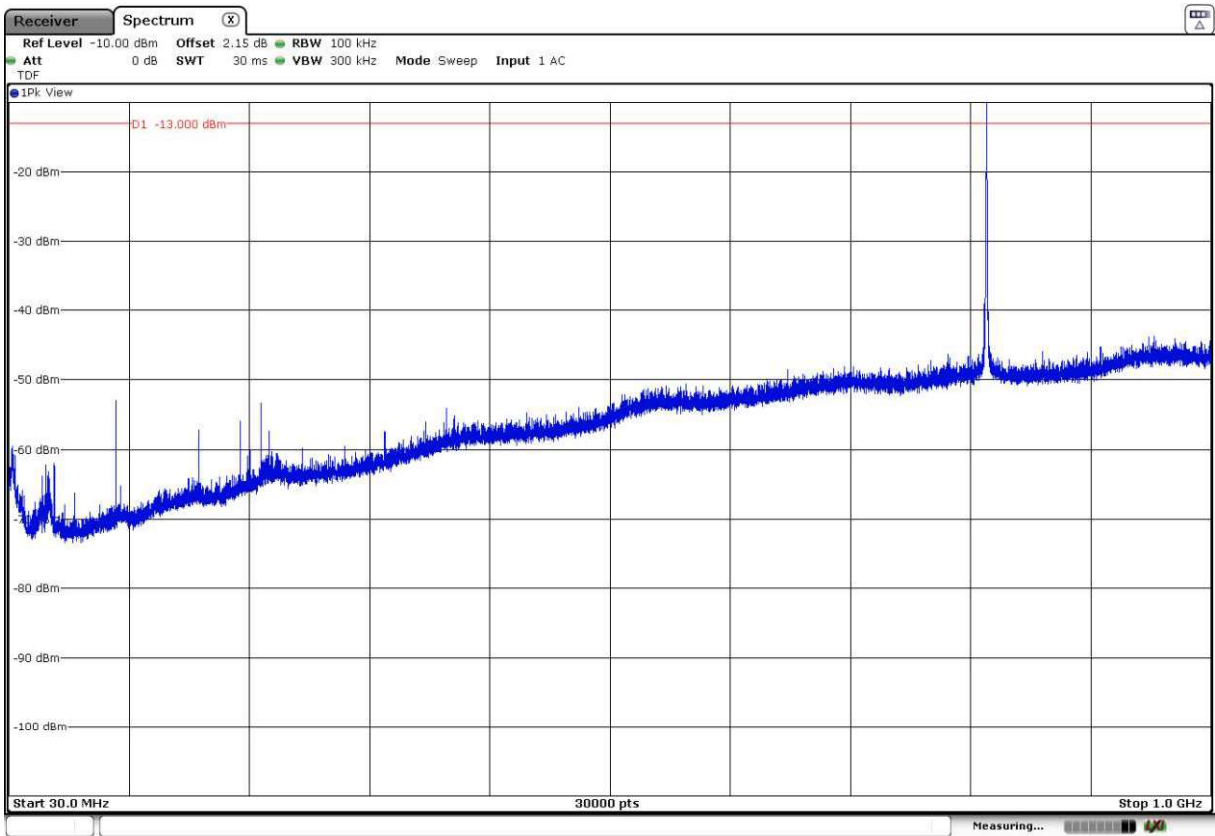
$\pi/4$ - QPSK modulation. 3 tones 15 kHz, Offset Tone = 6.

FREQUENCY RANGE 30 MHz – 1 GHz

- Low Channel:



- Middle Channel:



- High Channel:

