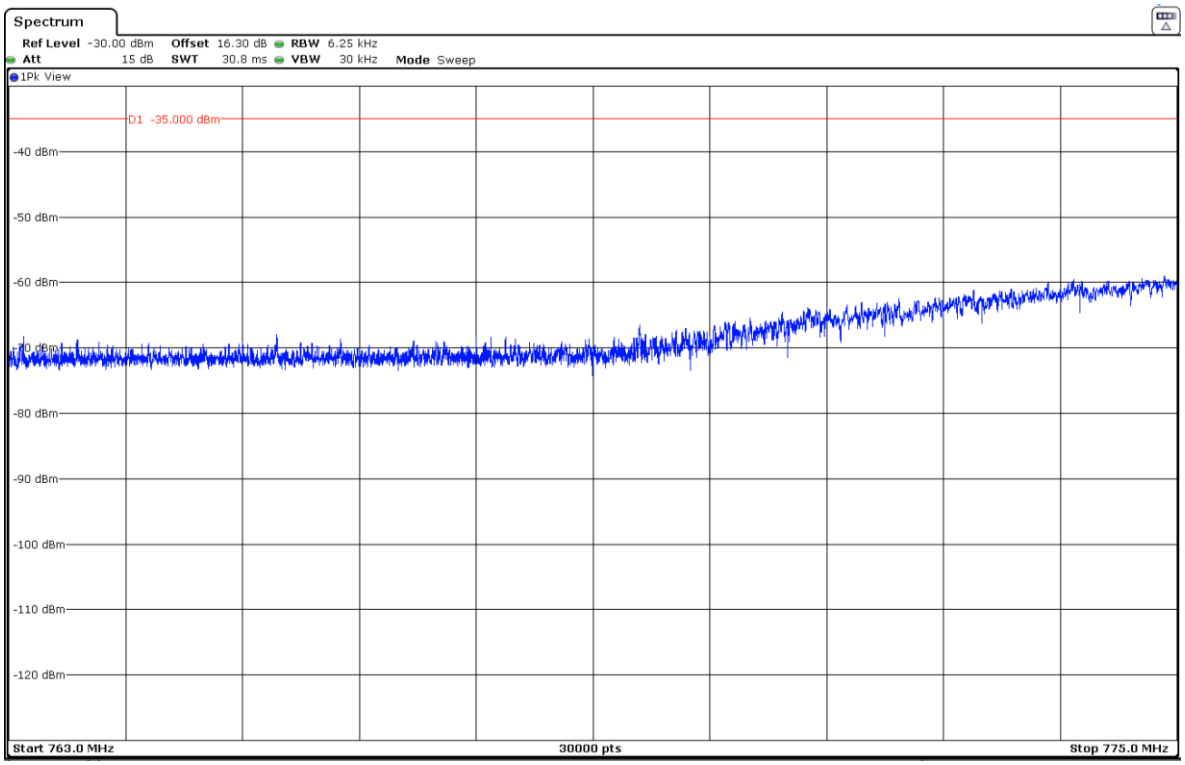
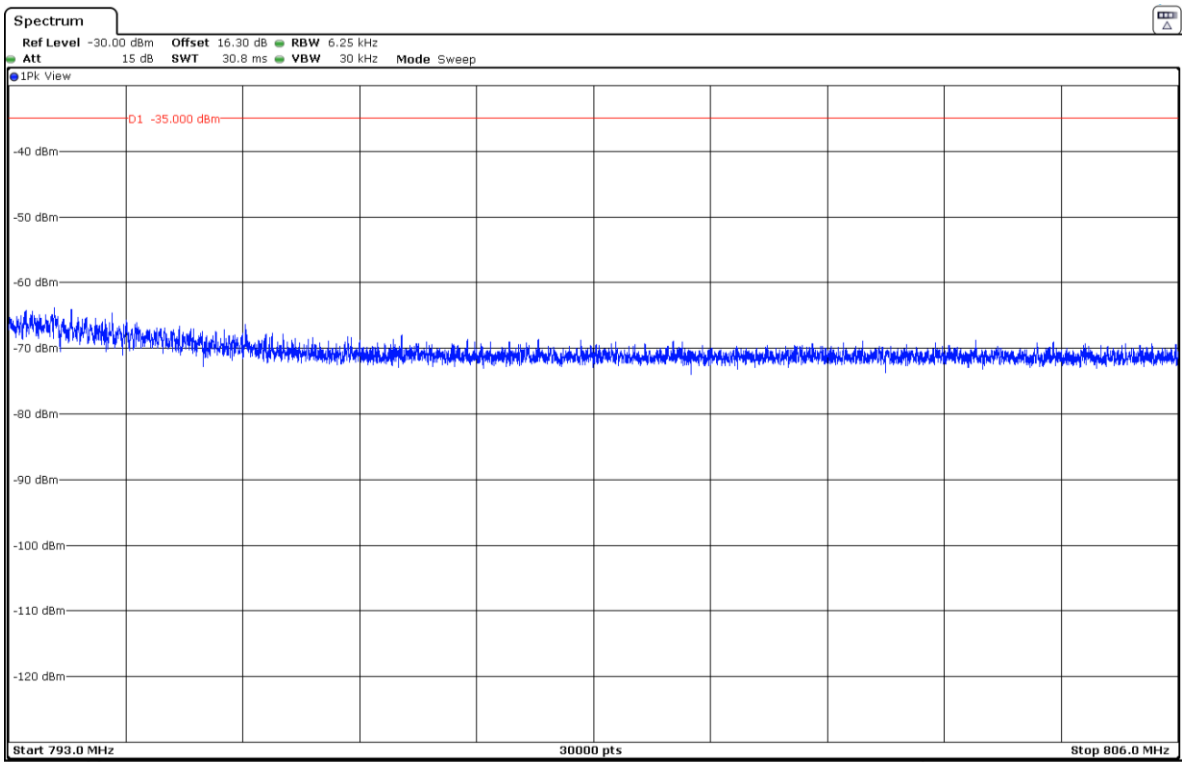
- Frequency range 763 MHz – 775 MHz:

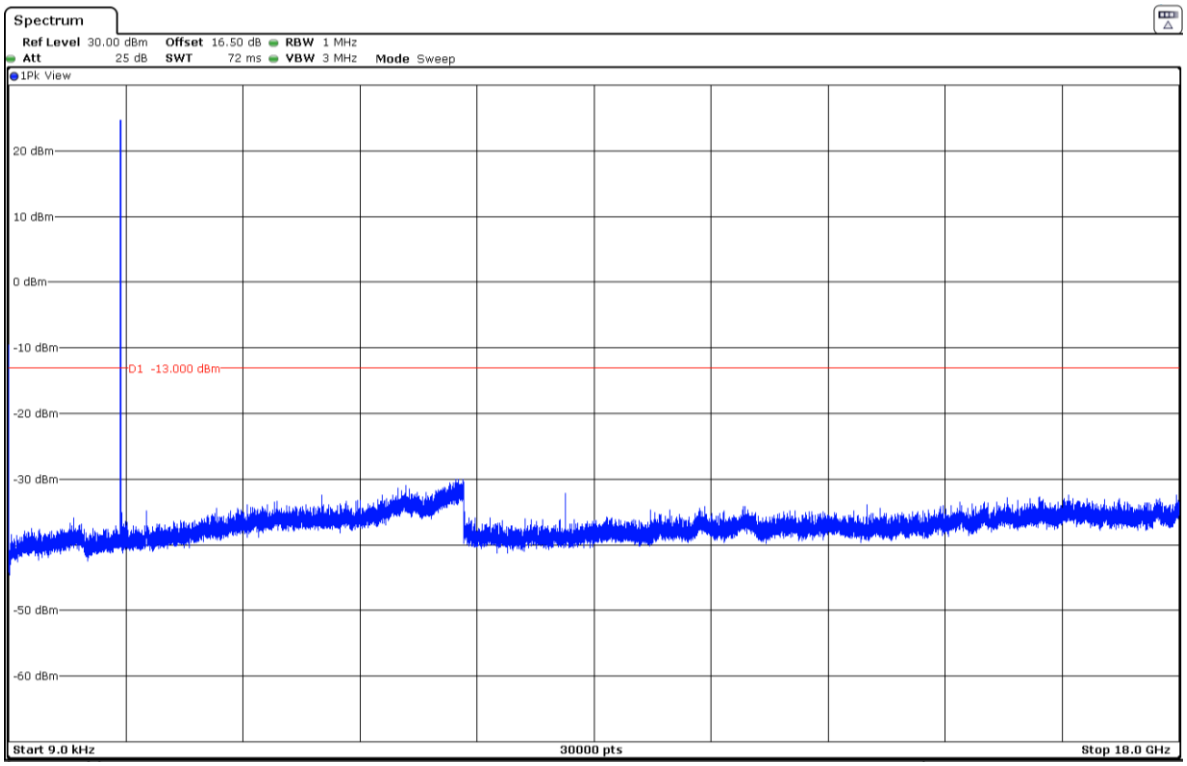


- Frequency range 793 MHz – 806 MHz:



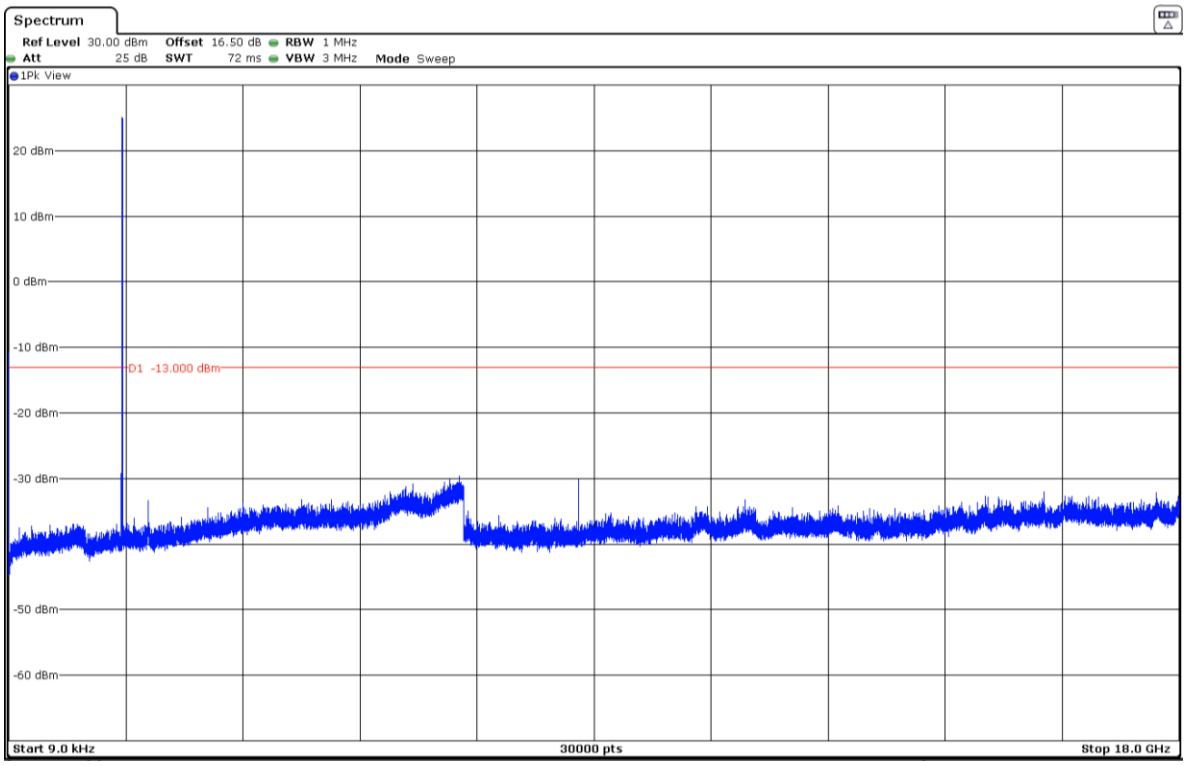
LTE Band 66. QPSK. Nominal Bandwidth 20 MHz. RB Size 1, RB Offset 0. Narrow band = 0, Position 1.

Low Channel:



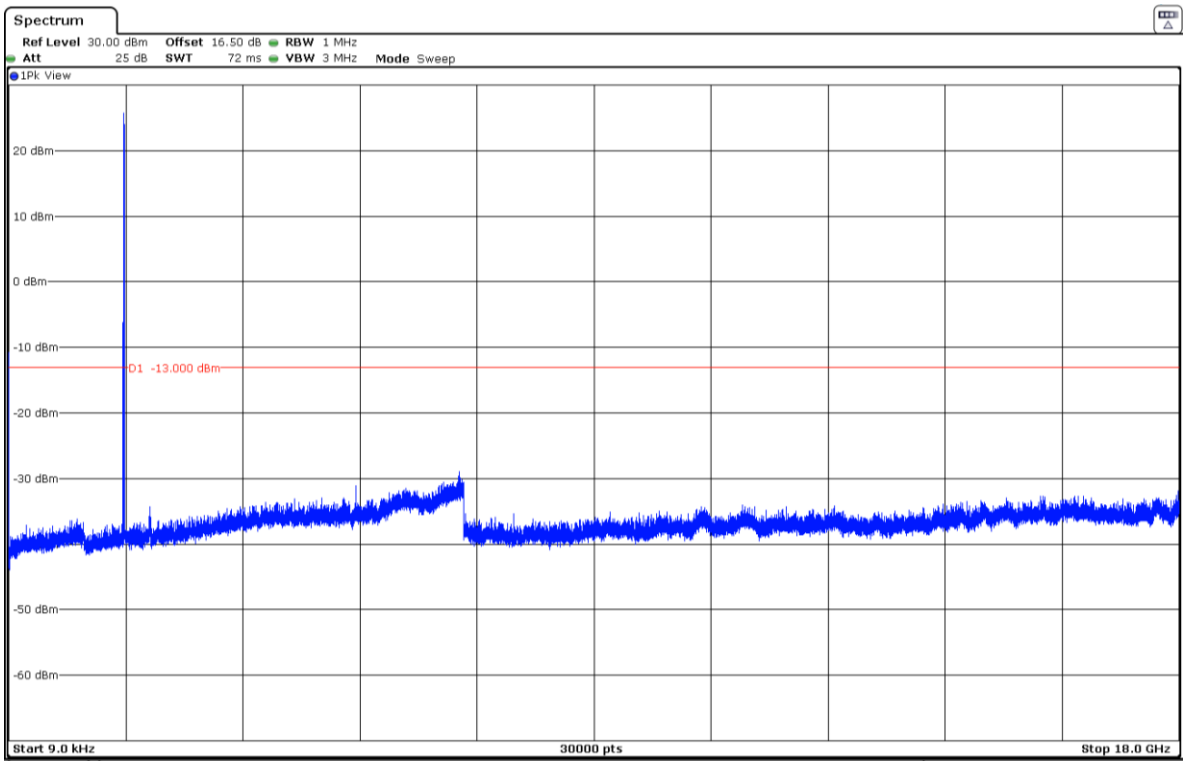
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

High Channel:



The peak above the limit is the carrier frequency.

Spurious Emissions at Antenna Terminals at Block Edges

SPECIFICATION

FCC §27.53 (c):

> 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.

FCC §27.53 (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.

RSS-130 Clause 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.

FCC §27.53 (h), RSS-139 Clause 6.6:

> According to specification, 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 $\log_{10}$ (P) dB.

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.

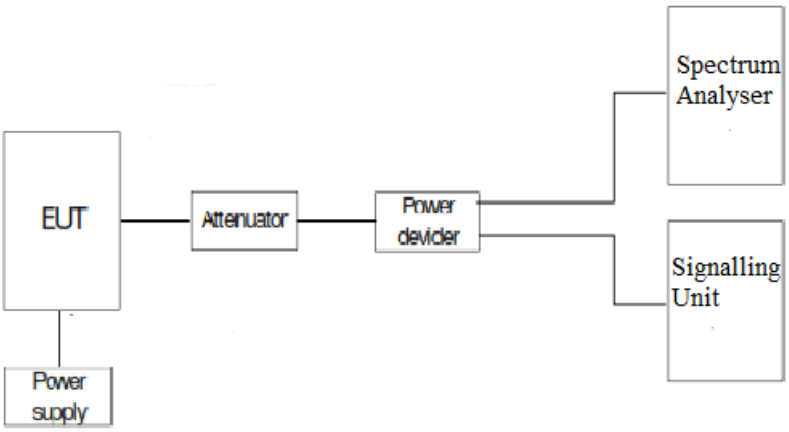
The configuration of modulation which is the worst case for conducted power was used.

For LTE Bands 4 and 66, as stated in FCC part 27.53 (h) (3) / RSS-139 Clause 6.6, in the 1 MHz 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.

For LTE Band 12, as stated in FCC part 27.53 (g) / RSS-130 Clause 4.7.1, in the 100 kHz bands immediately outside and adjacent to the licensee's frequency block or band, a resolution bandwidth of 30 kHz may be employed.

For LTE Band 13, as stated in FCC part 27.53 (c) (5) / RSS-130 Clause 4.7.1, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

TEST SETUP



RESULTS (see plots in next pages)

LTE Band 4:

Preliminary measurements determined the Nominal Bandwidth of 5 MHz, QPSK modulation as the worst case. The next results are for this worst-case configuration.

LTE QPSK MODULATION	RB = 1 Offset = Max. BW = 5 MHz Narrow band = 3
Maximum measured level at High Block Edge at antenna port (dBm)	-20.01

LTE QPSK MODULATION	RB = All Offset = 0 BW = 5 MHz Narrow band = 3
Maximum measured level at High Block Edge at antenna port (dBm)	-24.10

LTE Band 12:

Preliminary measurements determined the Nominal Bandwidth of 5 MHz, QPSK modulation as the worst case. The next results are for this worst-case configuration.

LTE QPSK MODULATION	RB = 1 Offset = 0 BW = 5 MHz Narrow band = 0
Maximum measured level at Low Block Edge at antenna port (dBm)	-31.60

LTE QPSK MODULATION	RB = All Offset = 0 BW = 5 MHz Narrow band = 0
Maximum measured level at Low Block Edge at antenna port (dBm)	-31.49

LTE QPSK MODULATION	RB = 1 Offset = Max. BW = 5 MHz Narrow band = 3
Maximum measured level at High Block Edge at antenna port (dBm)	-21.19

LTE QPSK MODULATION	RB = All Offset = 0 BW = 5 MHz Narrow band = 3
Maximum measured level at High Block Edge at antenna port (dBm)	-16.83

LTE Band 13:

Preliminary measurements determined the Nominal Bandwidth of 5 MHz, QPSK modulation as the worst case. The next results are for this worst-case configuration.

LTE QPSK MODULATION	RB = 1 Offset = 0 BW = 5 MHz Narrow band = 0
Maximum measured level at Low Block Edge at antenna port (dBm)	-16.03

LTE QPSK MODULATION	RB = All Offset = 0 BW = 5 MHz Narrow band = 0
Maximum measured level at Low Block Edge at antenna port (dBm)	-17.86

LTE QPSK MODULATION	RB = 1 Offset = Max. BW = 5 MHz Narrow band = 3
Maximum measured level at High Block Edge at antenna port (dBm)	-18.30

LTE QPSK MODULATION	RB = All Offset = 0 BW = 5 MHz Narrow band = 3
Maximum measured level at High Block Edge at antenna port (dBm)	-17.16

LTE Band 66:

Preliminary measurements determined the Nominal Bandwidth of 5 MHz, QPSK modulation as the worst case. The next results are for this worst-case configuration.

LTE QPSK MODULATION	RB = 1 Offset = 0 BW = 5 MHz Narrow band = 0
Maximum measured level at Low Block Edge at antenna port (dBm)	-21.26

LTE QPSK MODULATION	RB = All Offset = 0 BW = 5 MHz Narrow band = 0
Maximum measured level at Low Block Edge at antenna port (dBm)	-25.29

LTE QPSK MODULATION	RB = 1 Offset = Max. BW = 5 MHz Narrow band = 3
Maximum measured level at High Block Edge at antenna port (dBm)	-19.29

LTE QPSK MODULATION	RB = All Offset = 0 BW = 5 MHz Narrow band = 3
Maximum measured level at High Block Edge at antenna port (dBm)	-24.08

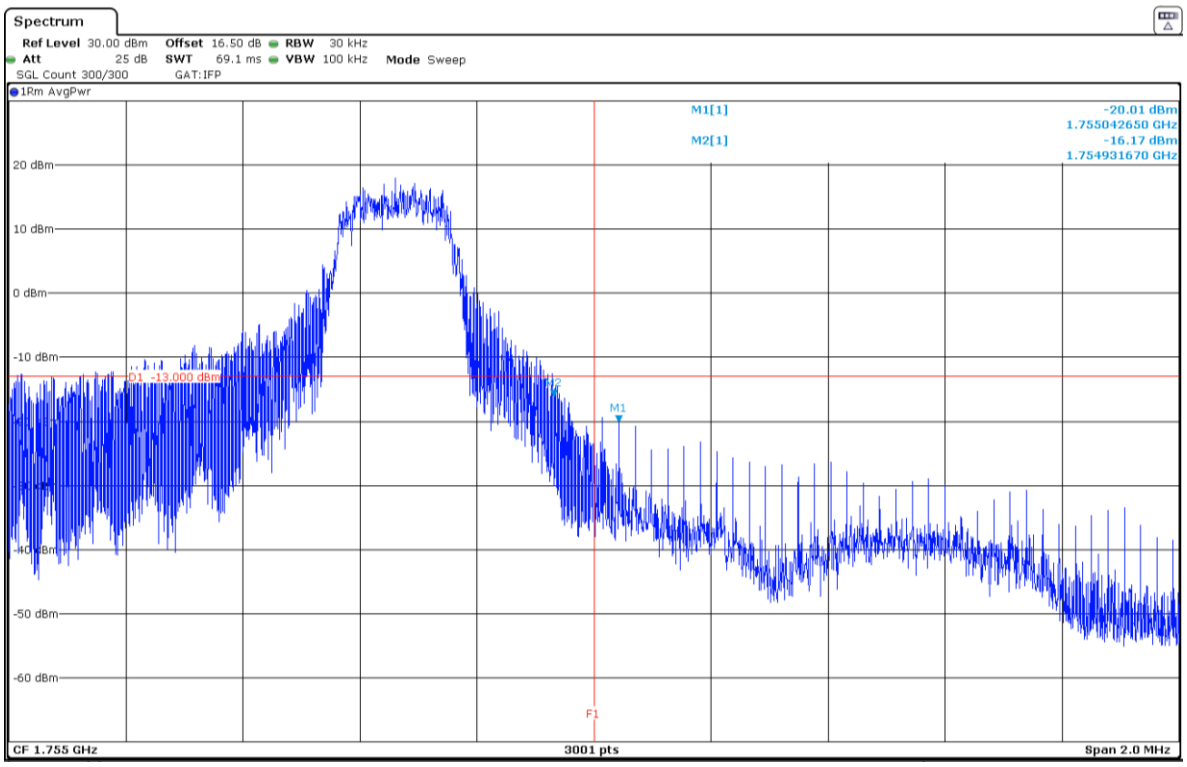
Measurement uncertainty (dB): <±2.76

Verdict: PASS

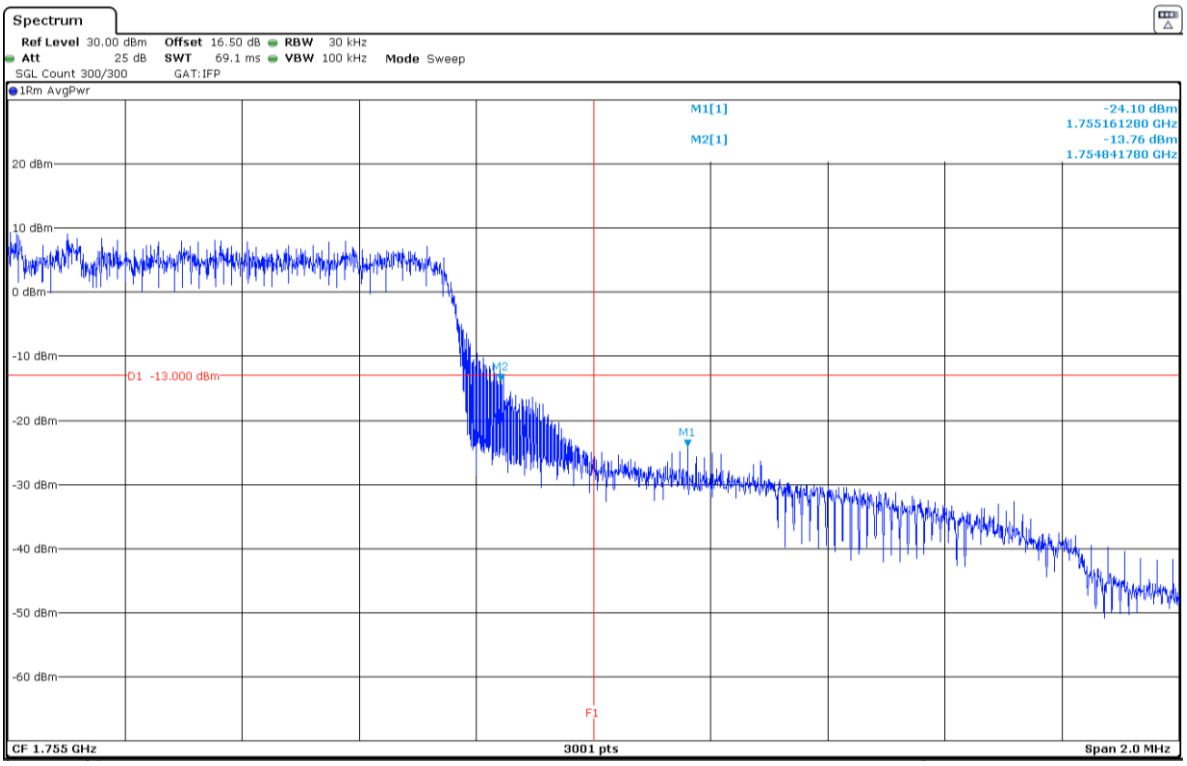
LTE Band 4:

NOTE: The equipment transmits at the maximum output power.

QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset Max. Narrow band = 3. High Block Edge:



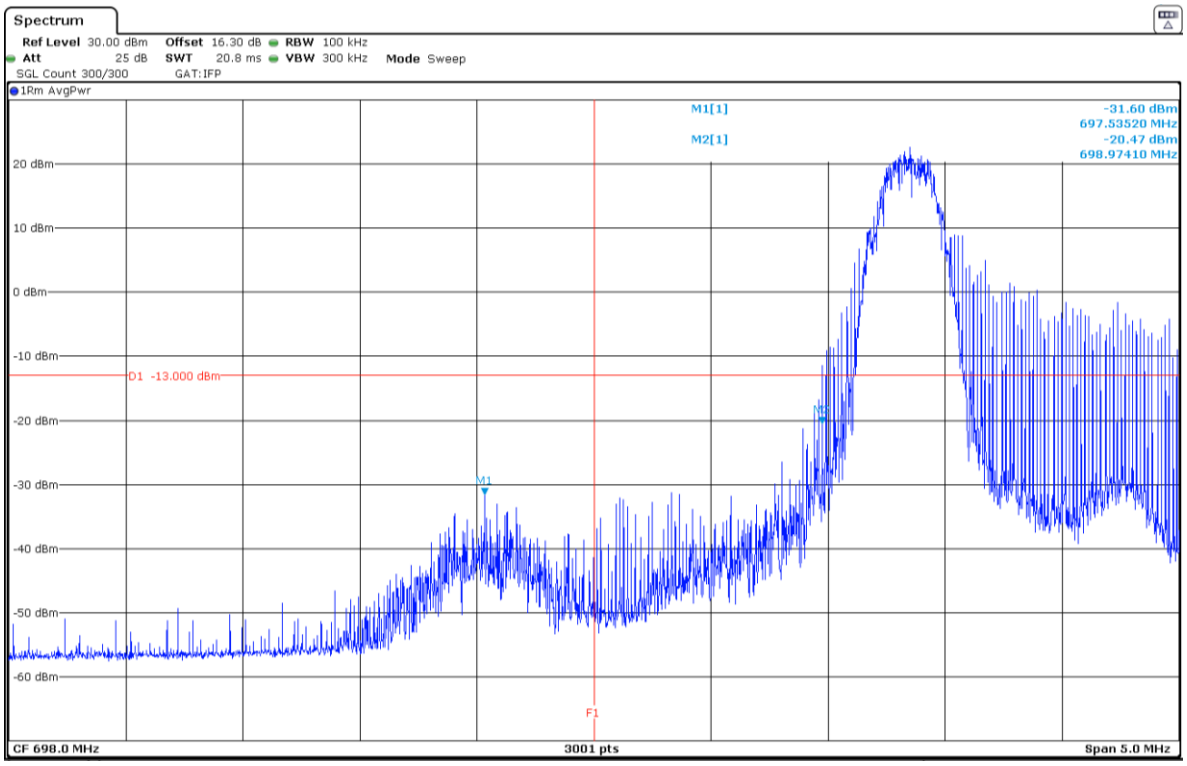
QPSK. Nominal Bandwidth 5 MHz. RB Size All, RB Offset 0. Narrow band = 3. High Block Edge:



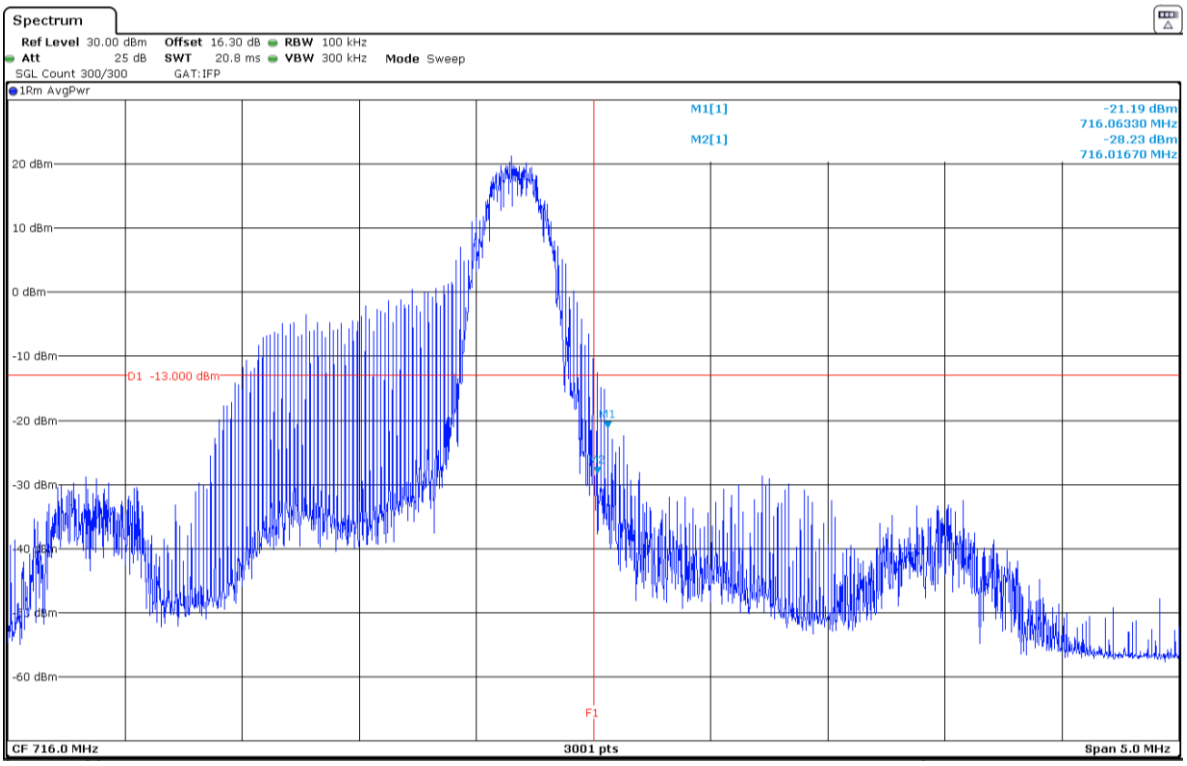
LTE Band 12:

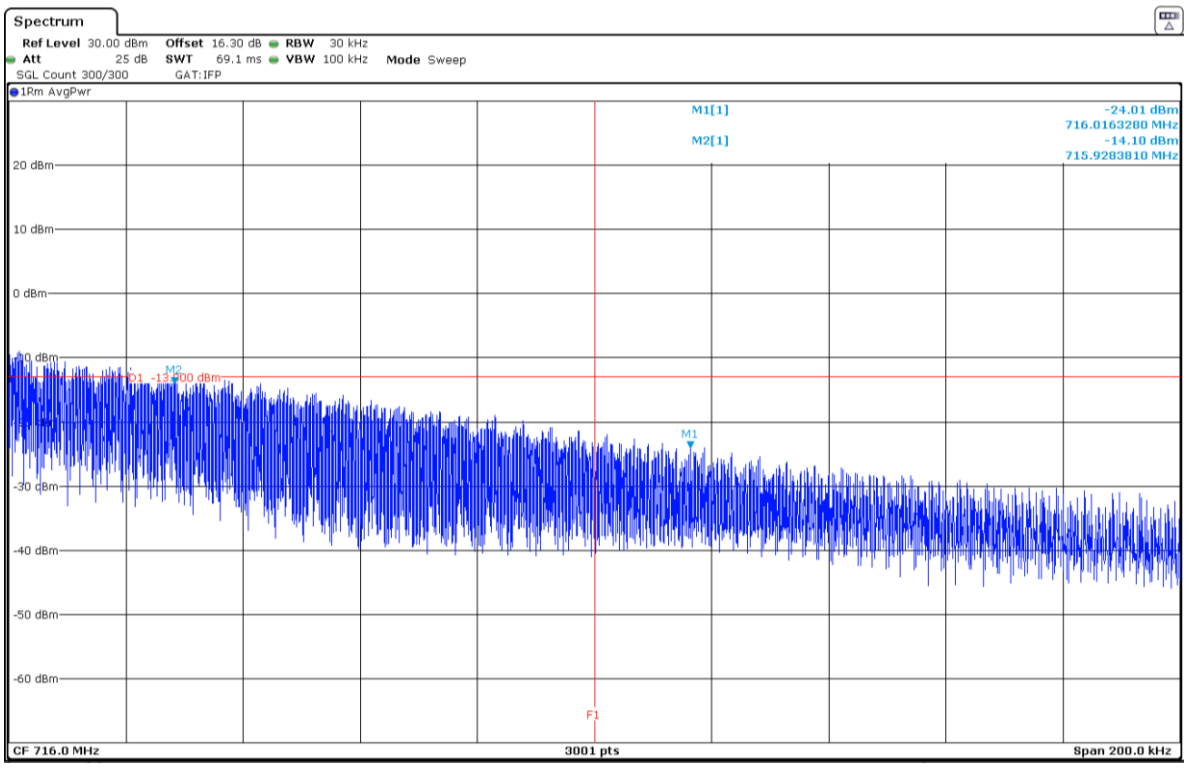
NOTE: The equipment transmits at the maximum output power.

QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset 0. Narrow band = 0. Low Block Edge:



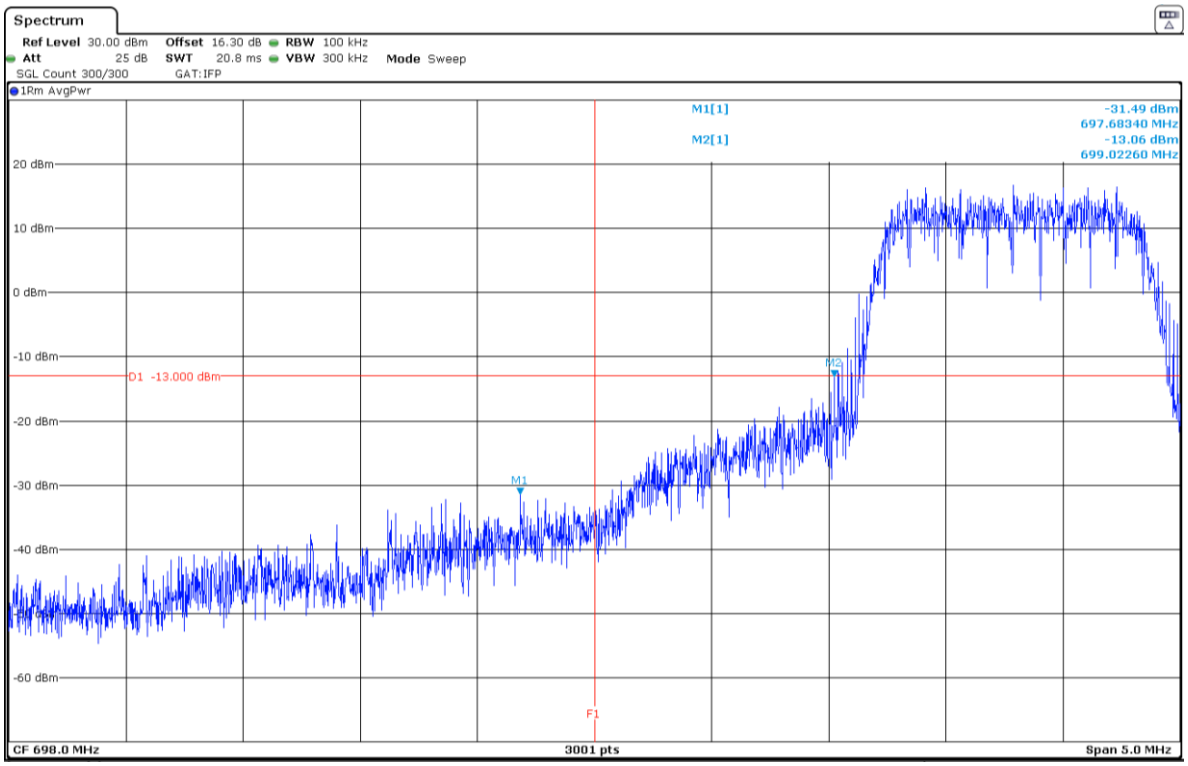
QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset Max. Narrow band = 3. High Block Edge:



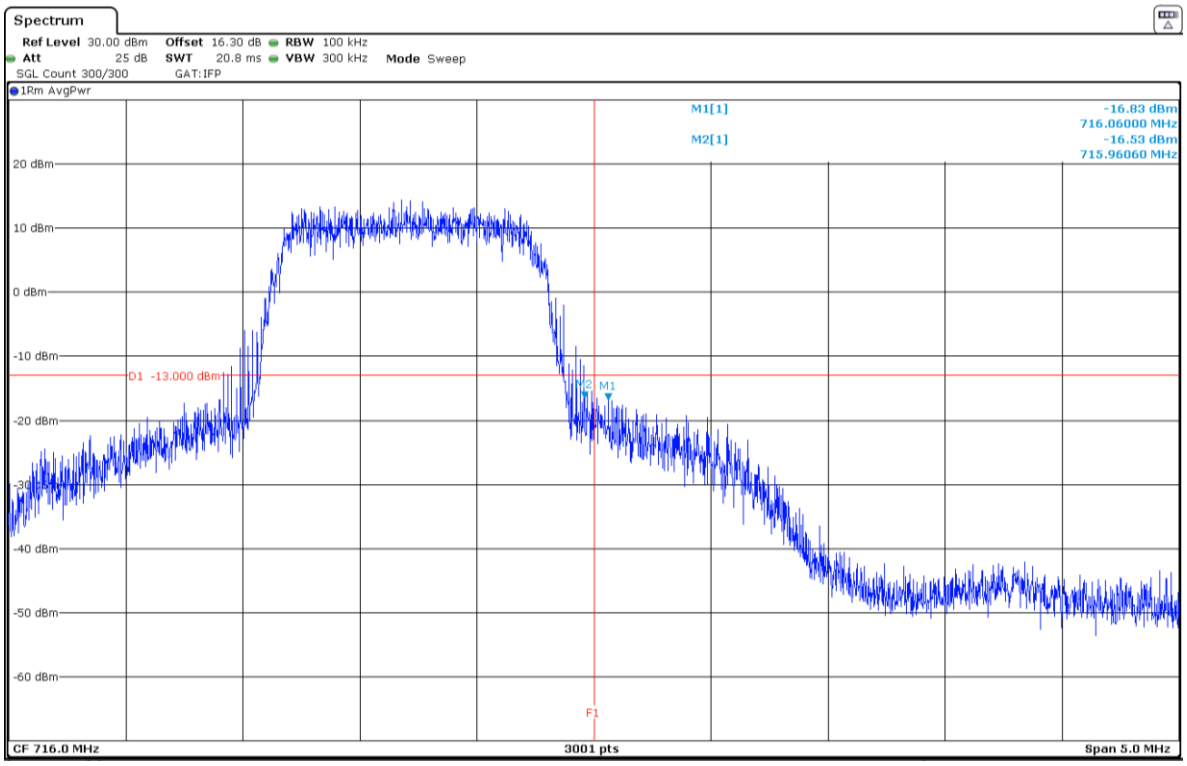


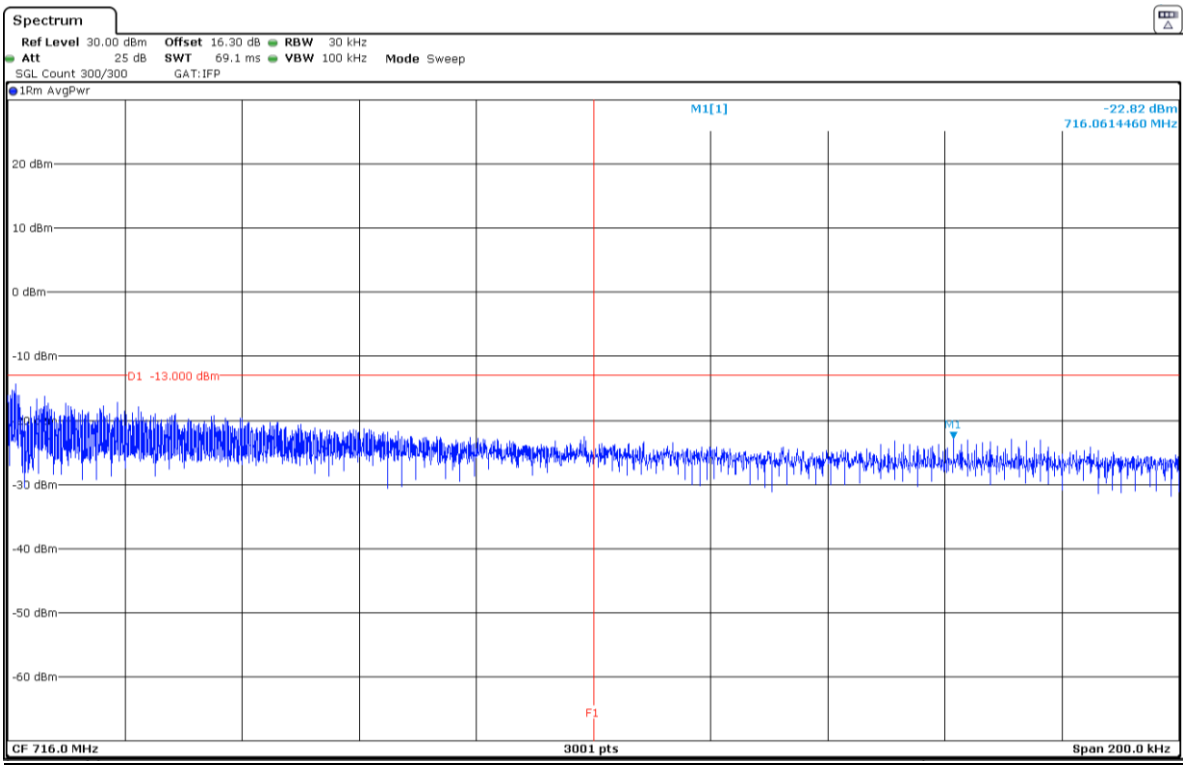
NOTE: Zoom (100kHz) with RBW=30kHz.

QPSK. Nominal Bandwidth 5 MHz. RB Size All, RB Offset 0. Narrow band = 0. Low Block Edge:



QPSK. Nominal Bandwidth 5 MHz. RB Size All, RB Offset 0. Narrow band = 3. High Block Edge:



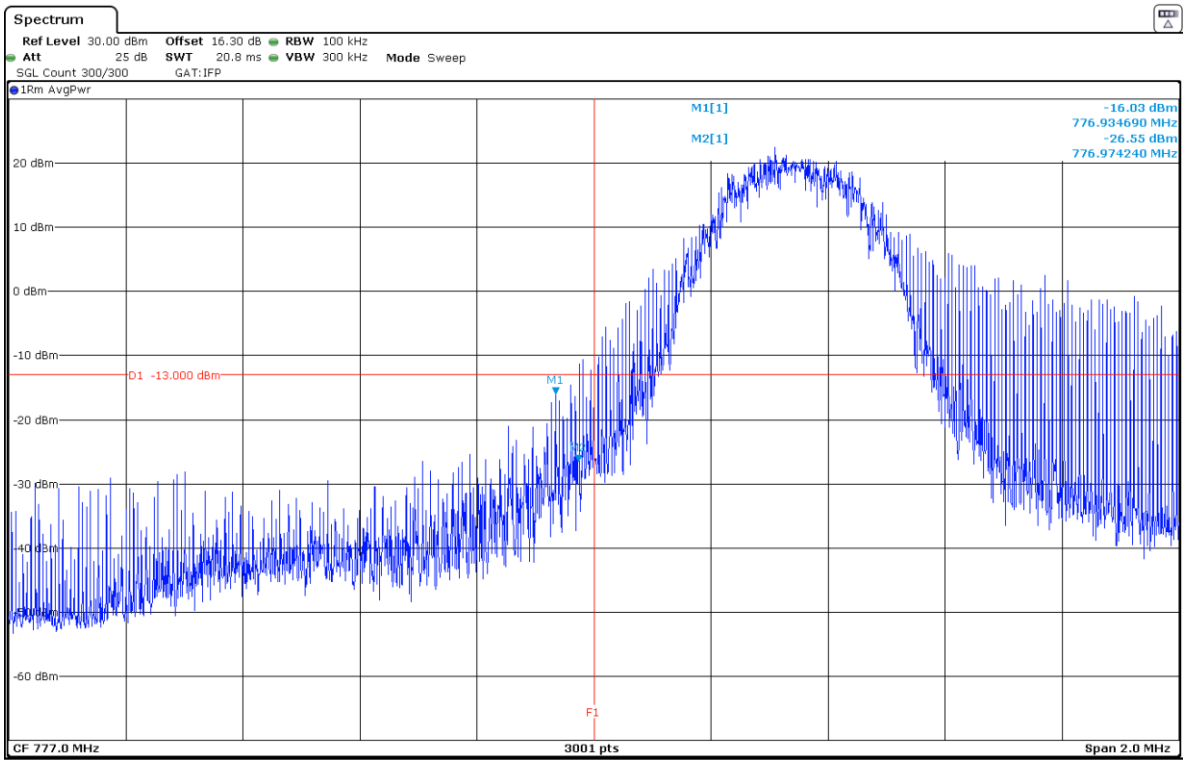


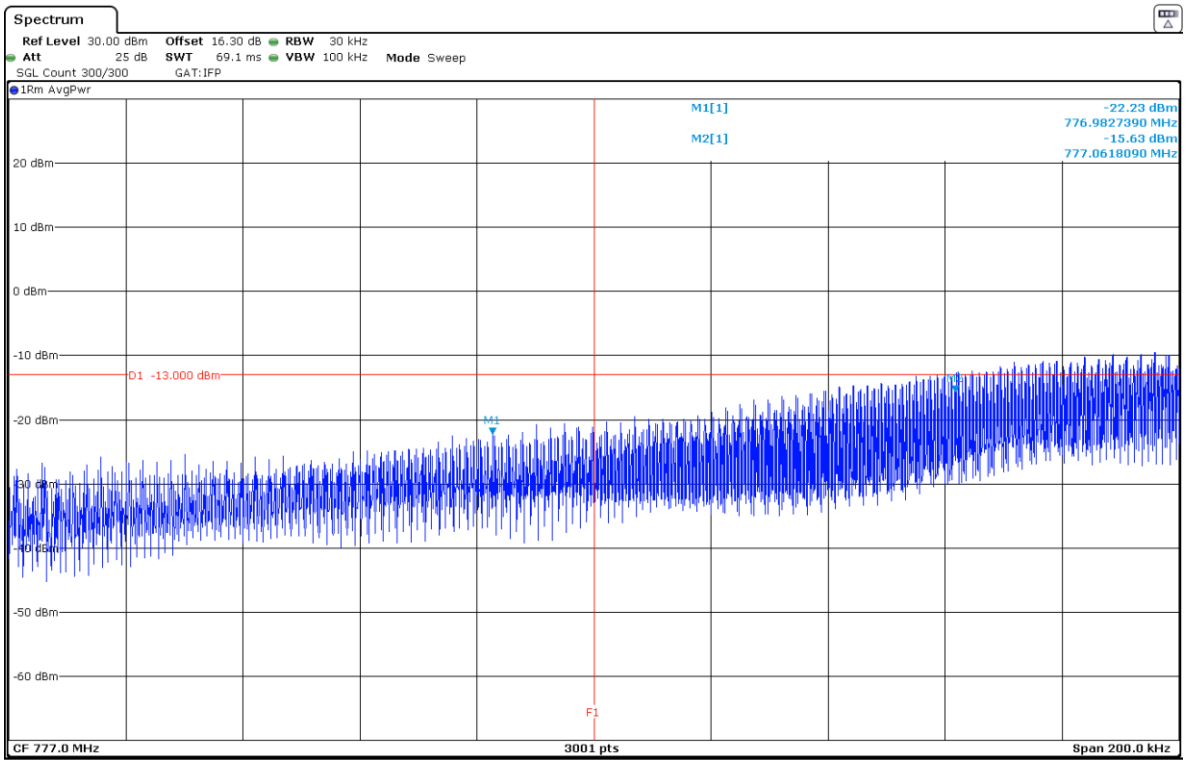
NOTE: Zoom (100kHz) with RBW=30kHz.

LTE Band 13:

NOTE: The equipment transmits at the maximum output power.

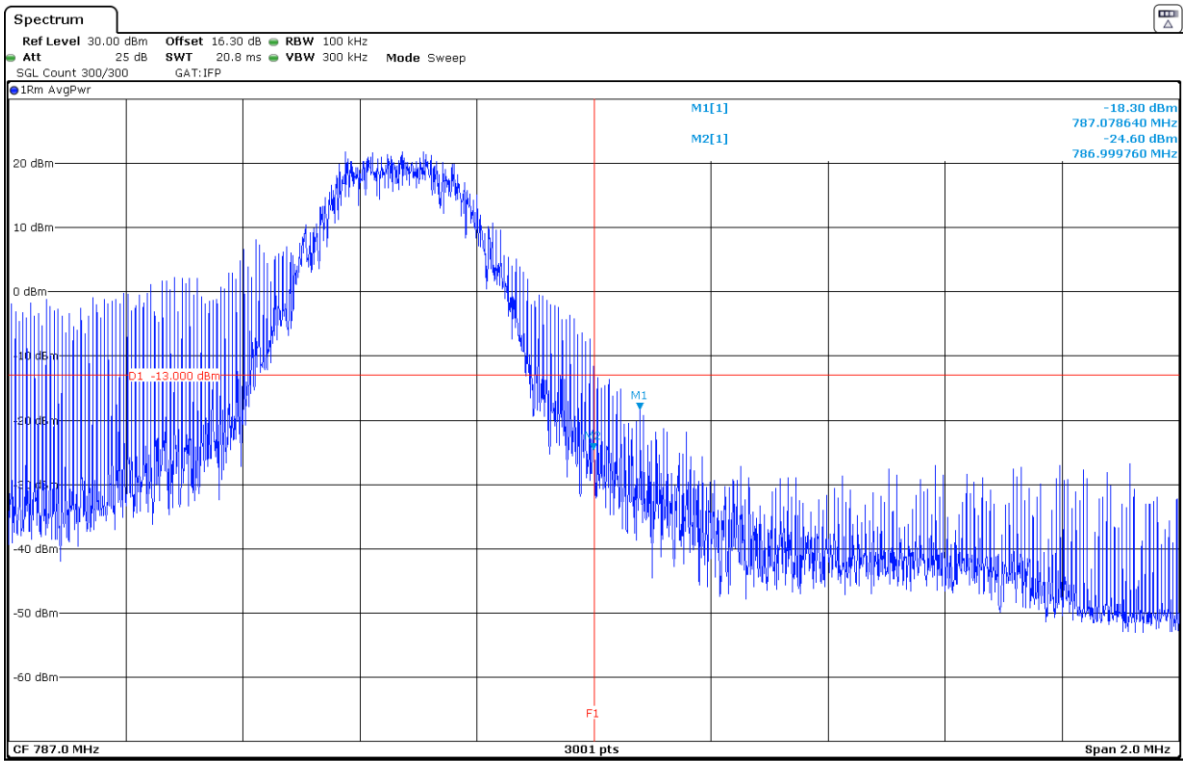
QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset 0. Narrow band = 0. Low Block Edge:

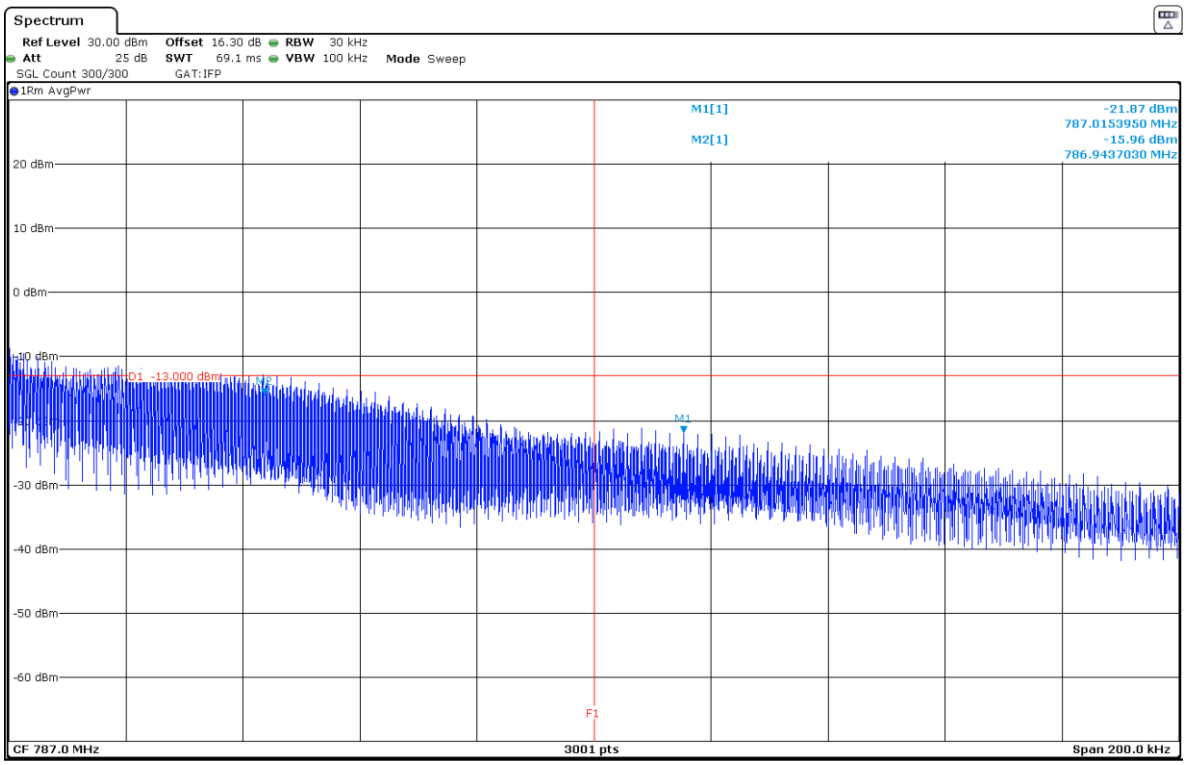




NOTE: Zoom (100kHz) with RBW=30kHz.

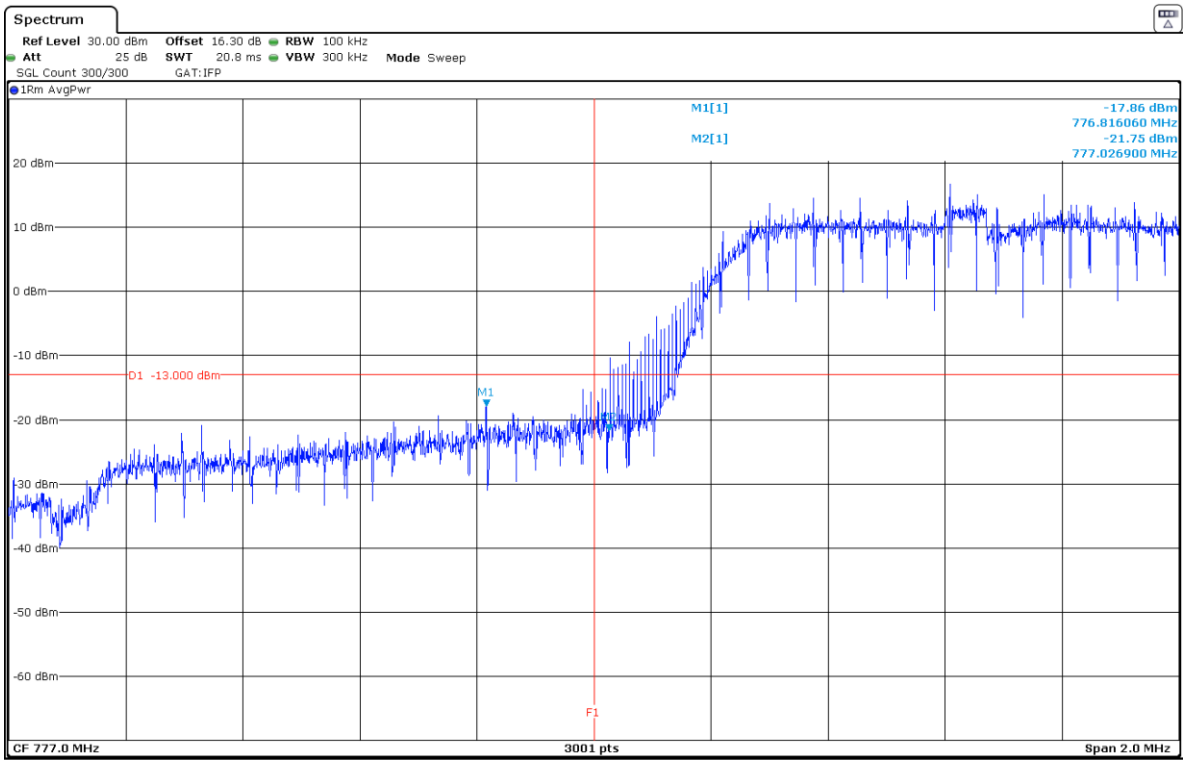
QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset Max. Narrow band = 3. High Block Edge:

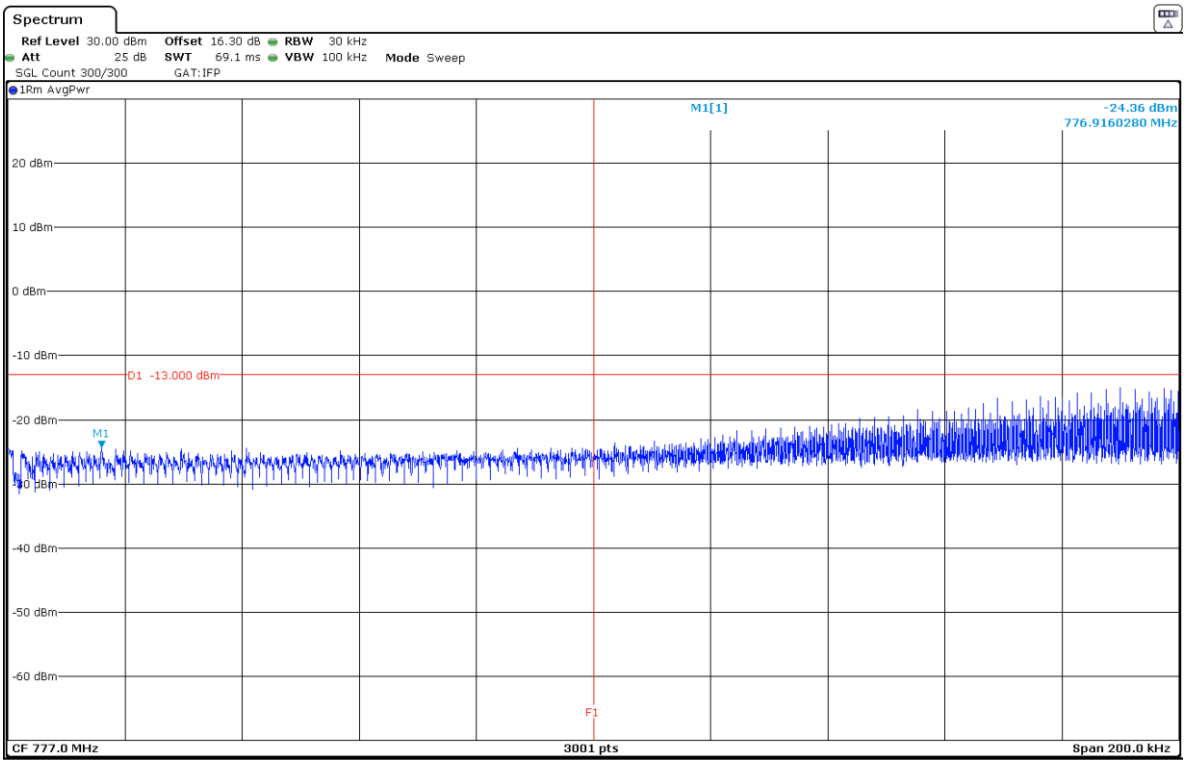




NOTE: Zoom (100kHz) with RBW=30kHz.

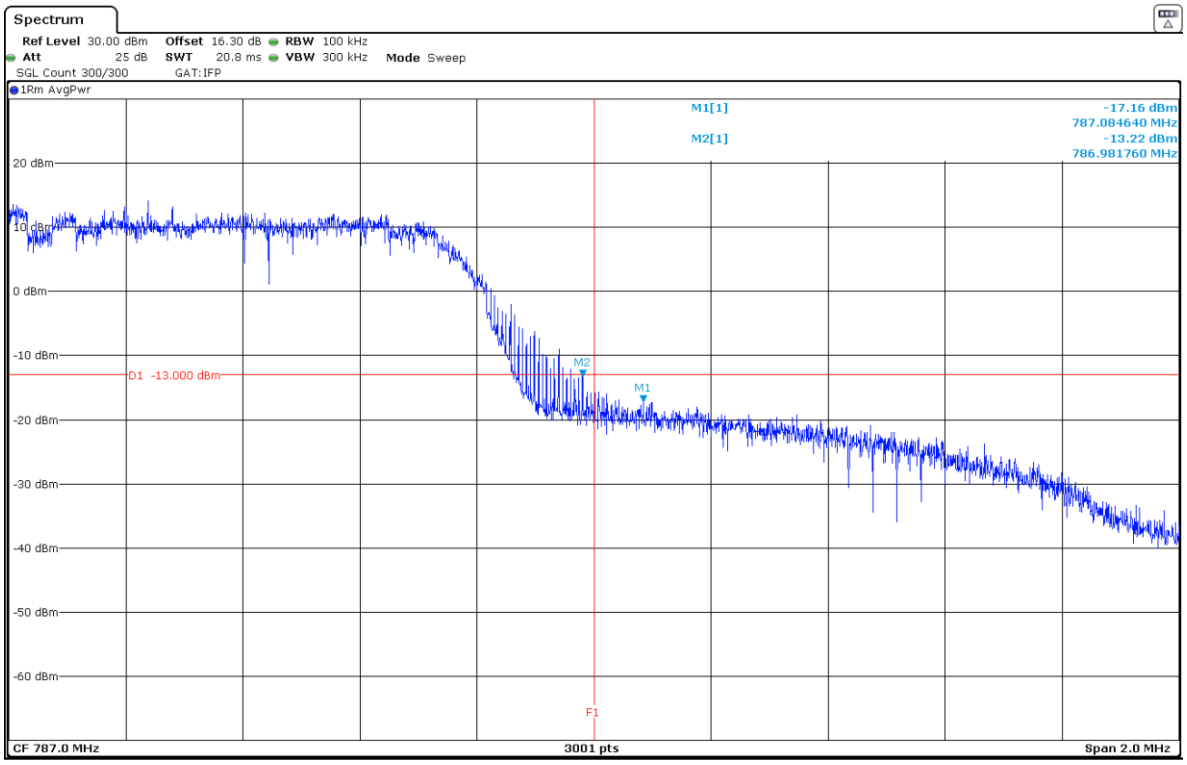
QPSK. Nominal Bandwidth 5 MHz. RB Size All, RB Offset 0. Narrow band = 0. Low Block Edge:

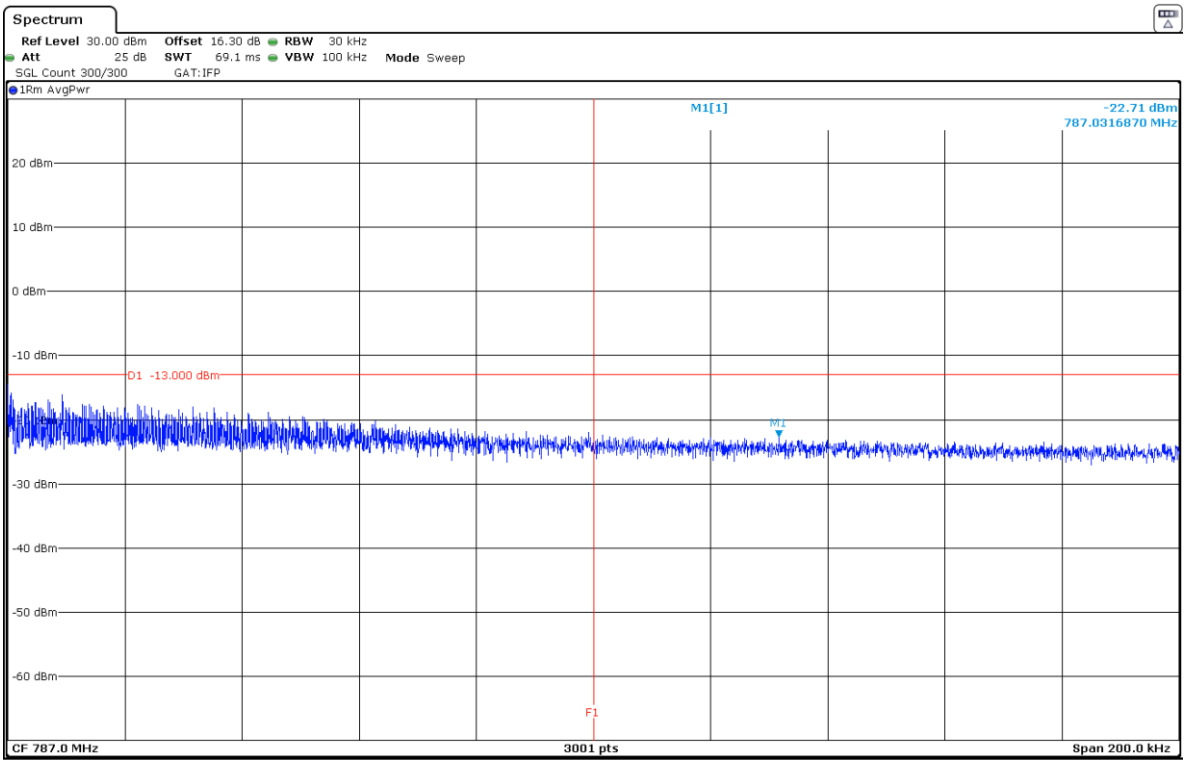




NOTE: Zoom (100kHz) with RBW=30kHz.

QPSK. Nominal Bandwidth 5 MHz. RB Size All, RB Offset 0. Narrow band = 3. High Block Edge:



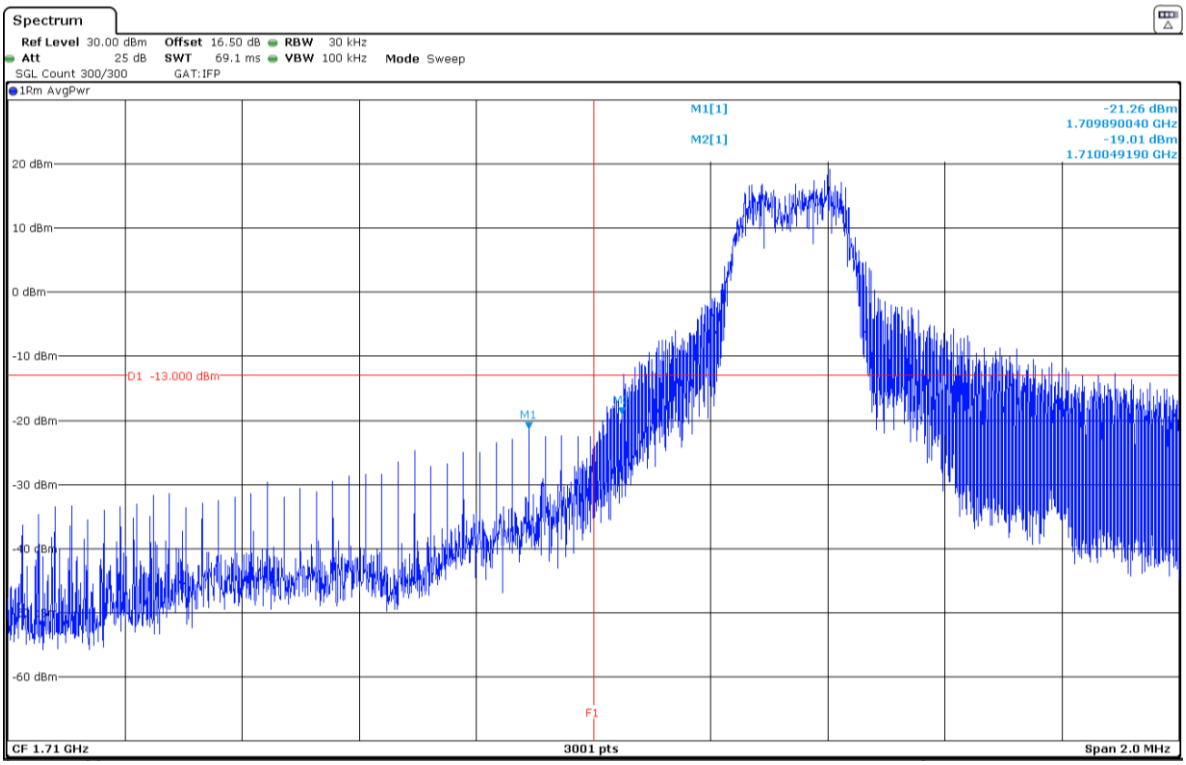


NOTE: Zoom (100kHz) with RBW=30kHz.

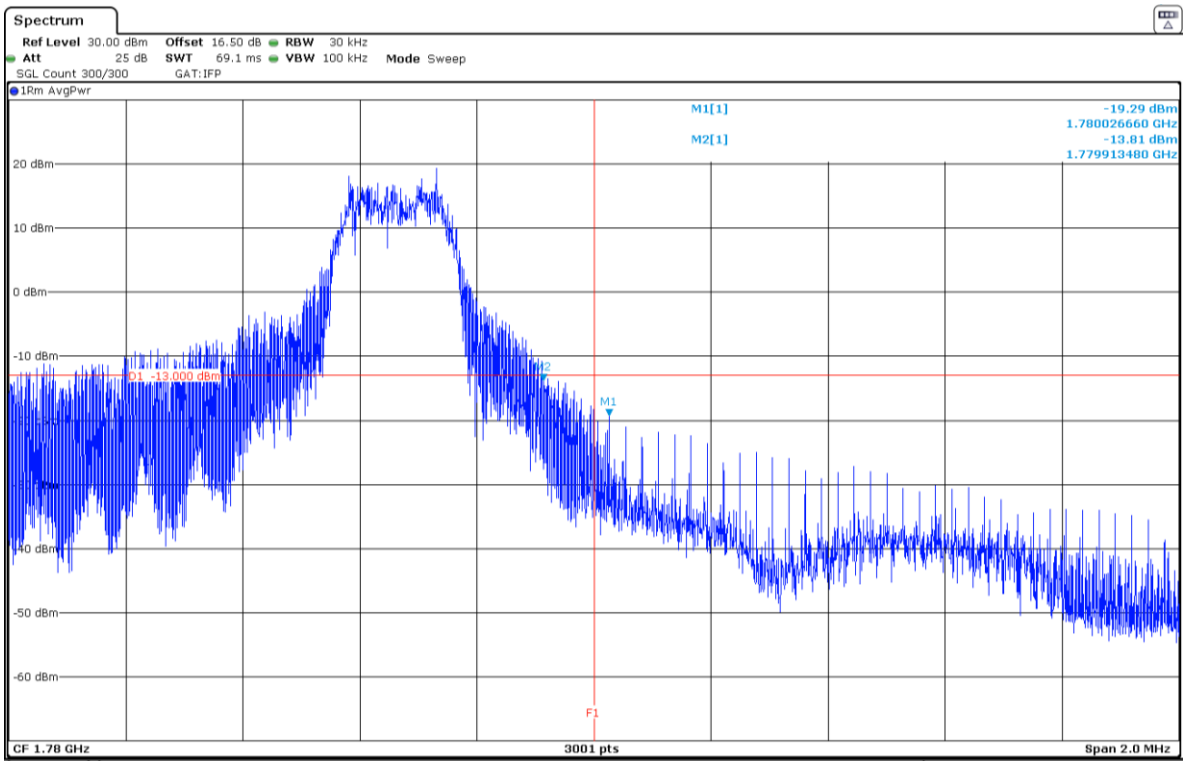
LTE Band 66:

NOTE: The equipment transmits at the maximum output power.

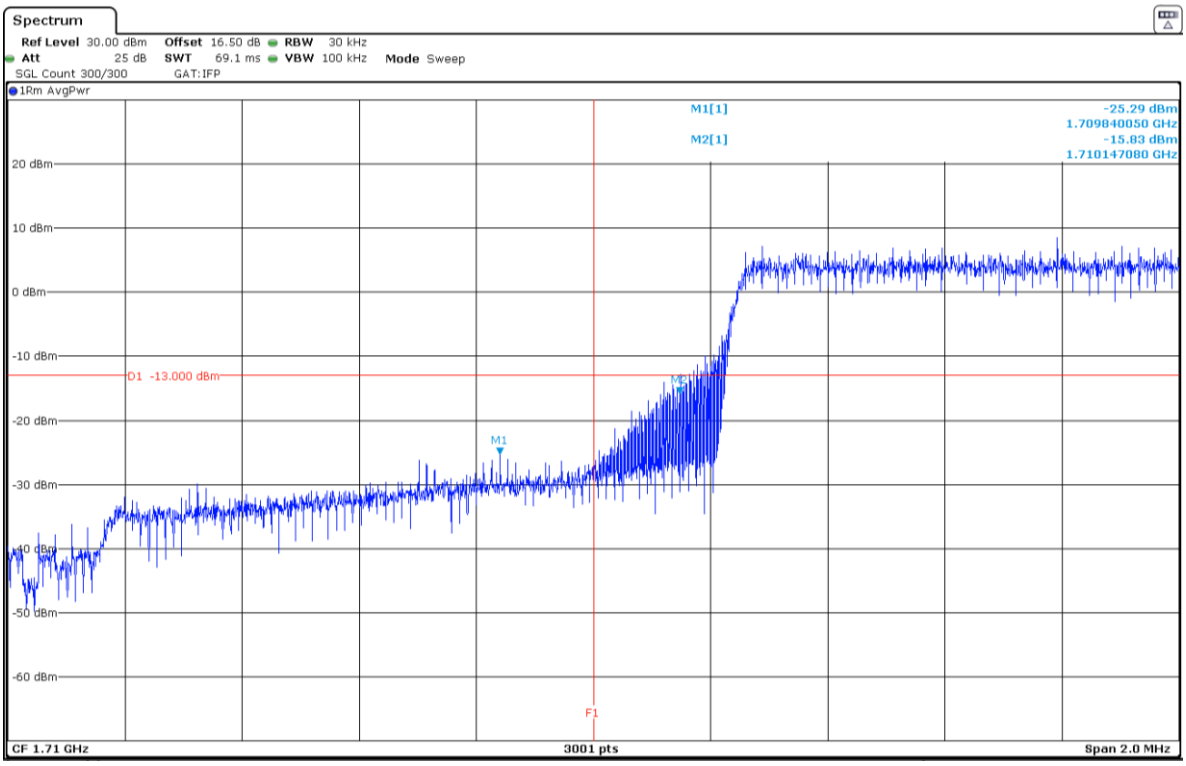
QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset 0. Narrow band = 0. Low Block Edge:



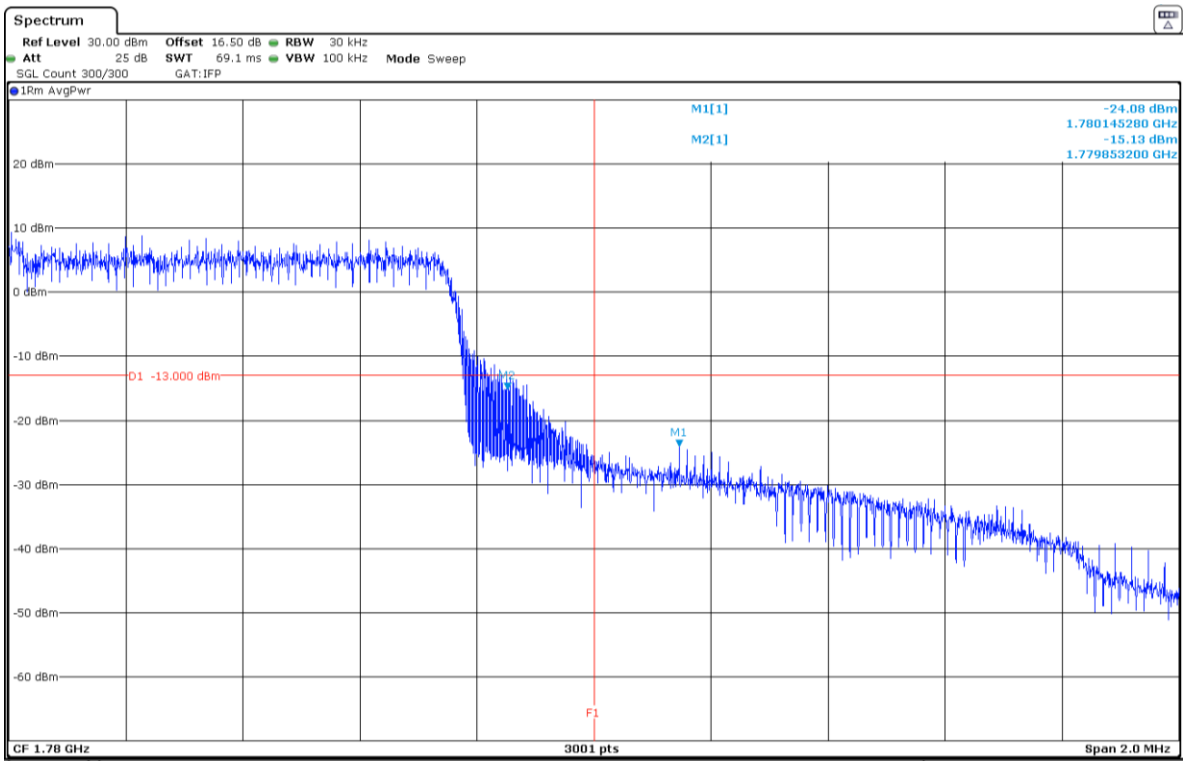
QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset Max. Narrow band = 3. High Block Edge:



QPSK. Nominal Bandwidth 5 MHz. RB Size All, RB Offset 0. Narrow band = 0. Low Block Edge:



QPSK. Nominal Bandwidth 5 MHz. RB Size All, RB Offset 0. Narrow band = 3. High Block Edge:



Radiated Emissions

SPECIFICATION

FCC §27.53 (c):

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. Compliance is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater.

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. Compliance 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.

FCC §27.53 (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.

FCC §27.53 (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.

RSS-130, Clause 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.

RSS-130, Clause 4.7.2:

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 65 + 10 $\log_{10}$ p(watts), dB, for mobile and portable equipment.

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.

FCC §27.53 (h), RSS-139, Clause 6.6:

According to specification, 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 $\log_{10}$ (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz 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

At Po transmitting power, the specified minimum attenuation becomes 65+10 log (Po), and the level in dBm relative to Po becomes:

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

METHOD

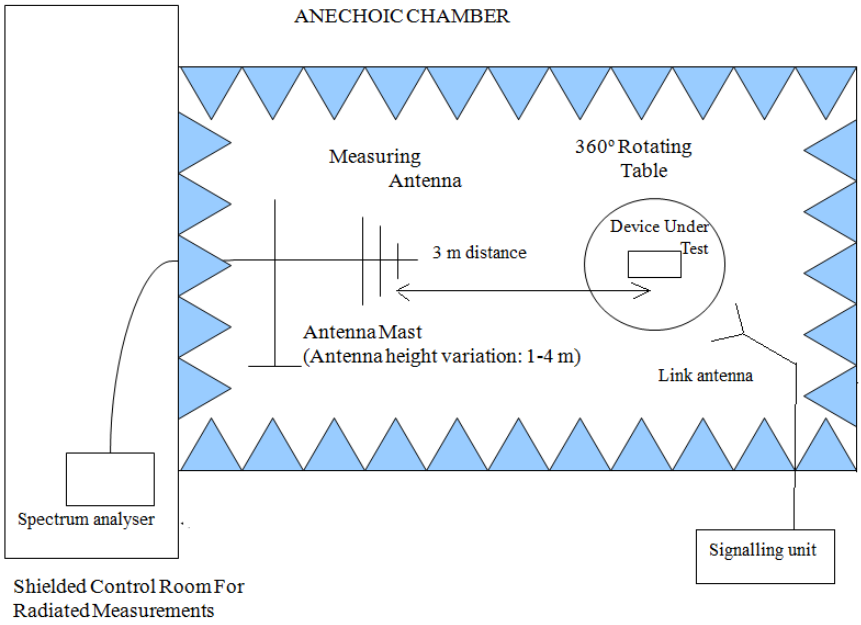
The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.

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.

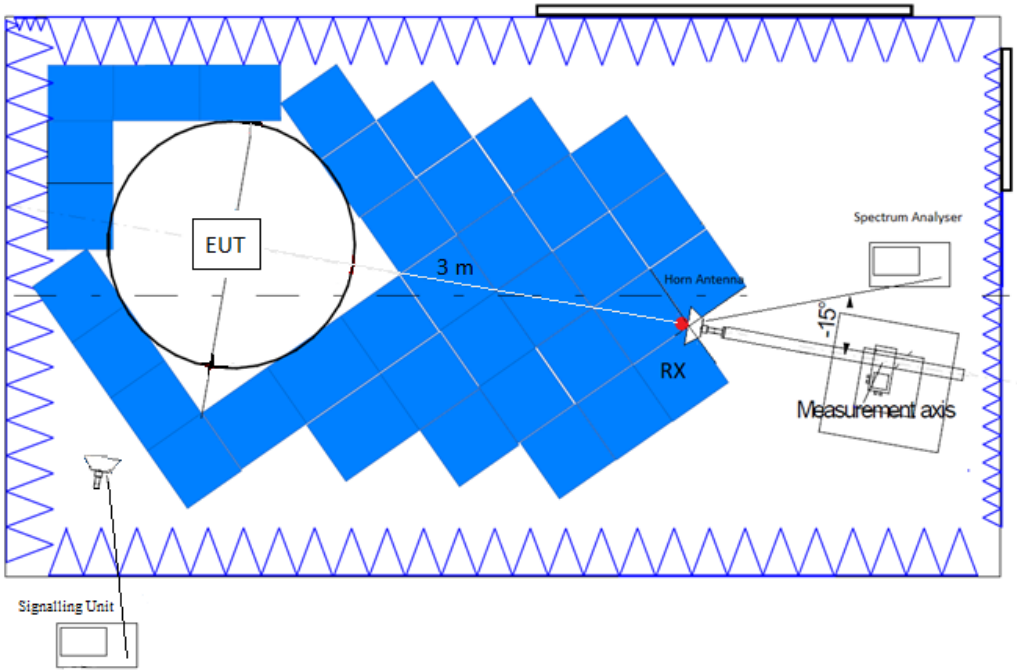
Detected emissions were maximized at each frequency by rotating the EUT and adjusting the height and polarization of the measuring antenna. The maximum meter reading was recorded.

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements between 1 GHz and 18 GHz.



RESULTS (see plots in next pages)

LTE Band 12:

Preliminary measurements determined QPSK modulation, Nominal Bandwidth of 5 MHz, RB Size 1, RB Offset 0, 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 GHz – 8 GHz

  Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
2.09562	-19.49	V	Peak

- **Middle Channel:**

  Frequency range 30 MHz – 1 GHz

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

  Frequency range 1 GHz – 8 GHz

  Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
2.11195	-25.22	V	Peak

- **High Channel:**

  Frequency range 30 MHz – 1 GHz

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

  Frequency range 1 GHz – 8 GHz

  Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
2.13412	-18.92	V	Peak

Measurement uncertainty (dB): <± 4.89 for f ≥ 30 MHz up to 1 GHz
<± 5.13 for f ≥ 1 GHz up to 8 GHz

Verdict: PASS

LTE Band 13:

Preliminary measurements determined QPSK modulation, Nominal Bandwidth of 5 MHz, RB Size 1, RB Offset 0, Narrow band = 0 as the worst case.

The next results are for this worst-case configuration.

- **Low Channel:**

Frequency range 30 MHz – 1 GHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
774.58220	-45.60	V	Peak	-35

Frequency range 1 GHz – 8.5 GHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
2.33263	-29.03	H	Peak	-13
6.21913	-32.79	V	Peak	

Frequency range 1559 MHz – 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 GHz – 8.5 GHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
2.33963	-30.72	V	Peak	-13

Frequency range 1559 MHz – 1610 MHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
1.55964	-51.80	H	RMS	-40

Only wideband signals were detected, no discrete signals.

- **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

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
2.34788	-31.82	H	Peak	-13

Frequency range 1559 MHz – 1610 MHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
1.56474	-51.75	H	RMS	-40

Only wideband signals were detected, no discrete signals.

Measurement uncertainty (dB): <± 4.89 for f ≥ 30 MHz up to 1 GHz
<± 5.13 for f ≥ 1 GHz up to 8.5 GHz

Verdict: PASS

LTE Band 66:

Preliminary measurements determined QPSK modulation, Nominal Bandwidth of 20 MHz, RB Size 1, RB Offset 0, 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 GHz – 18 GHz

  Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
5.13425	-29.81	V	Peak
11.98025	-31.73	V	Peak

- **Middle Channel:**

  Frequency range 30 MHz – 1 GHz

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

  Frequency range 1 GHz – 18 GHz

  Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
5.20925	-28.67	V	Peak
8.68275	-32.84	V	Peak

- **High Channel:**

  Frequency range 30 MHz –1 GHz

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

  Frequency range 1 GHz – 18 GHz

  Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
5.28425	-27.80	V	Peak

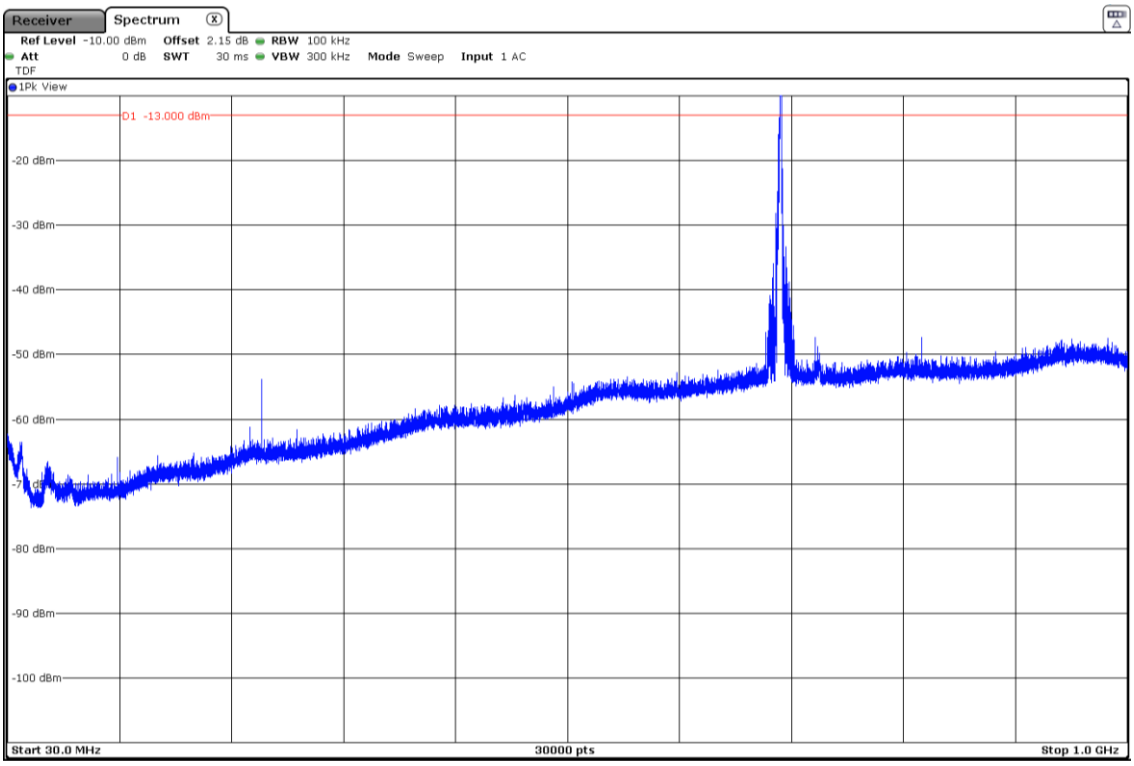
Measurement uncertainty (dB): <± 4.89 for f ≥ 30 MHz up to 1 GHz
<± 4.11 for f ≥ 1 GHz up to 3 GHz
<± 5.13 for f ≥ 3 GHz up to 18 GHz

Verdict: PASS

LTE Band 12. QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset 0. Narrow band = 0, Position 1.

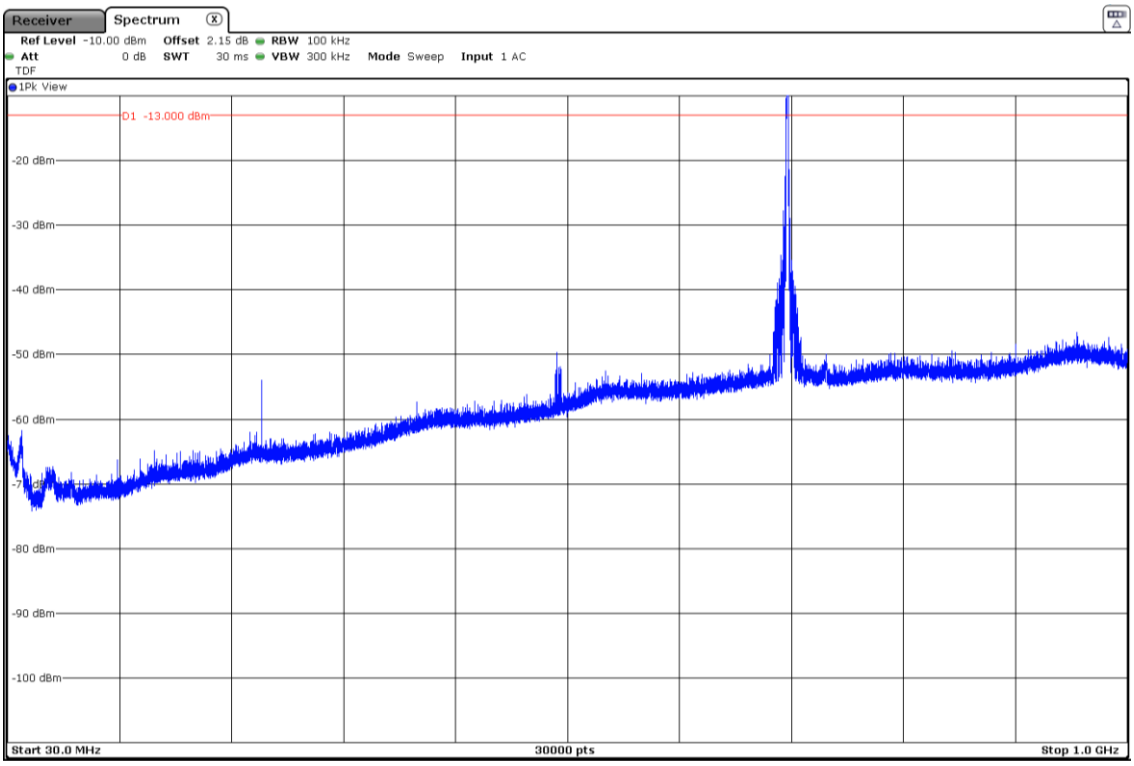
FREQUENCY RANGE 30 MHz – 1 GHz:

- Low Channel:



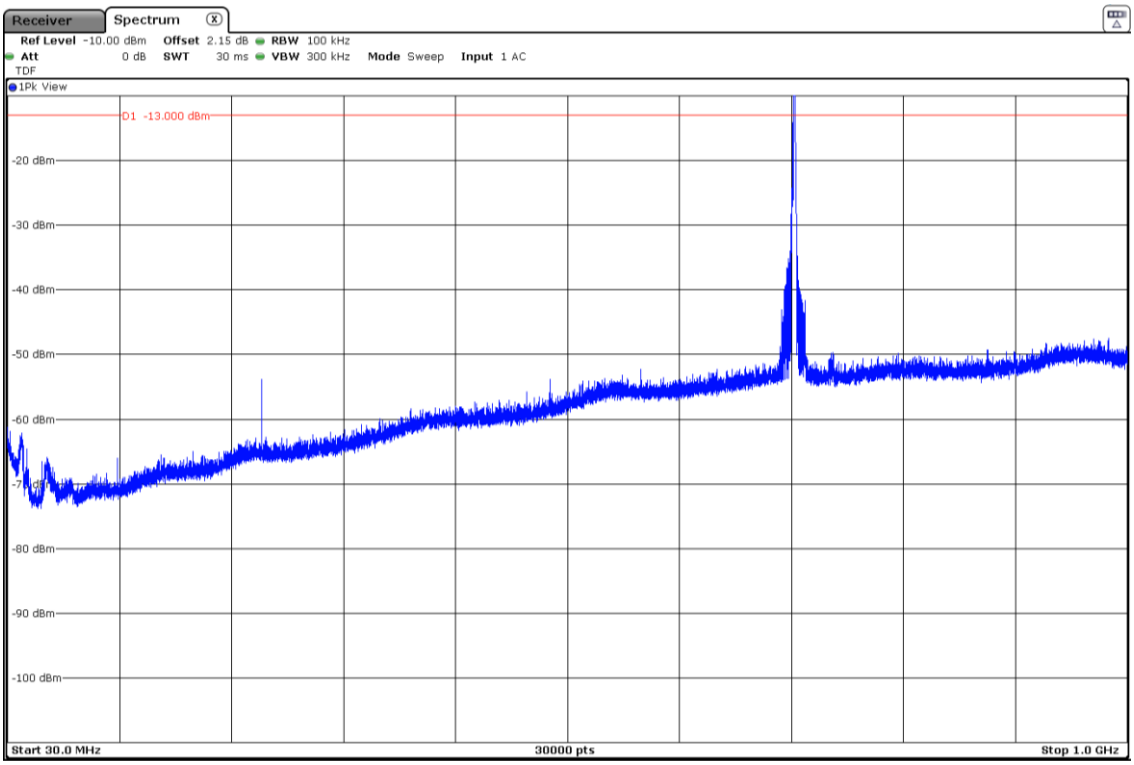
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

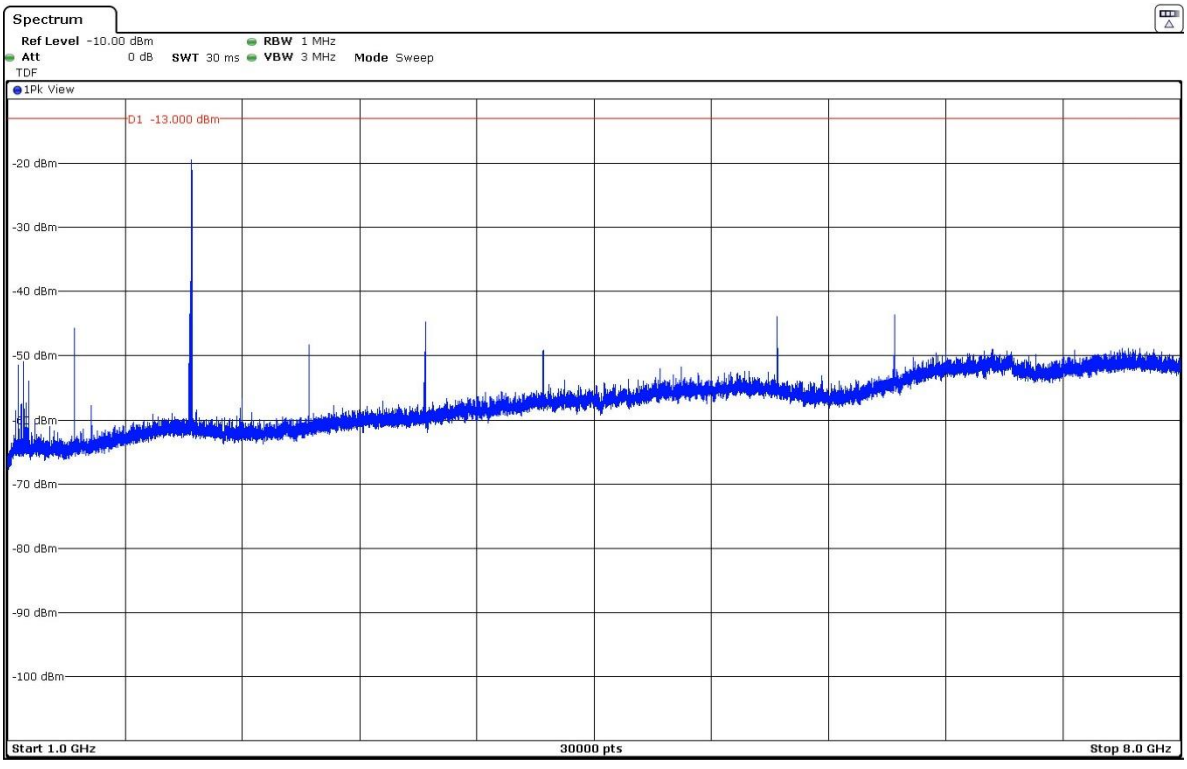
- High Channel:



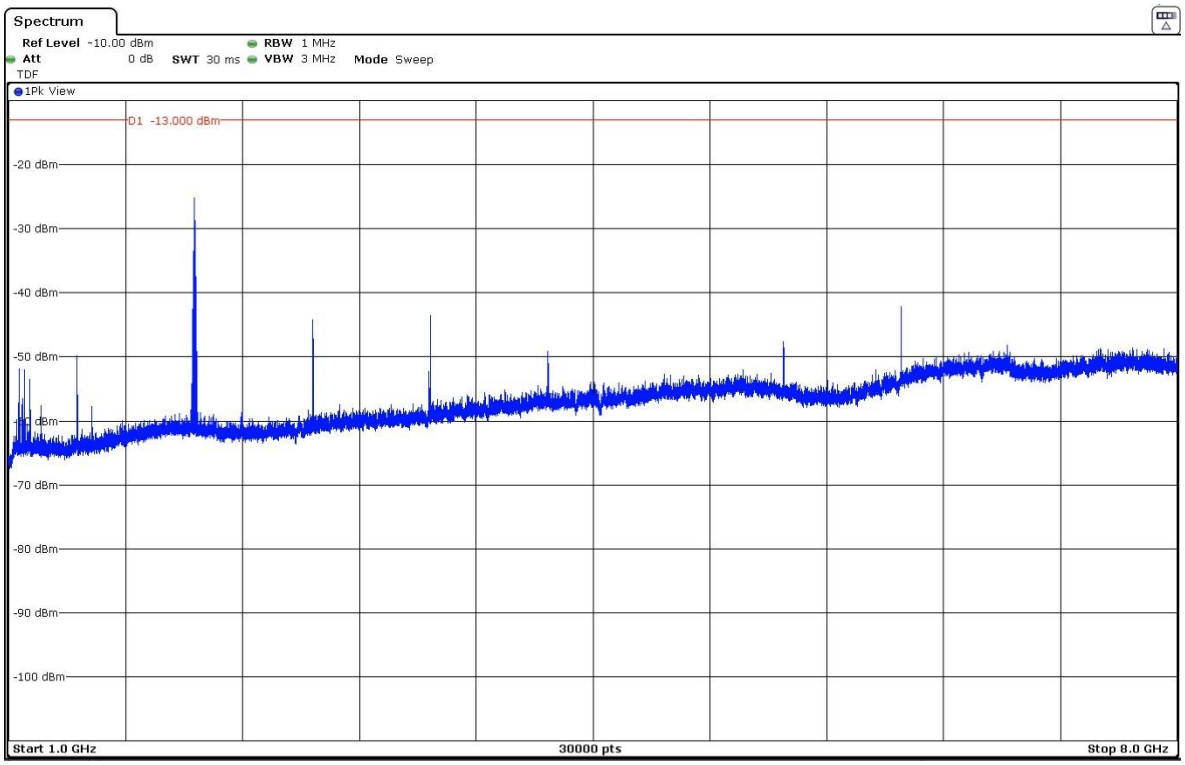
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz – 8 GHz:

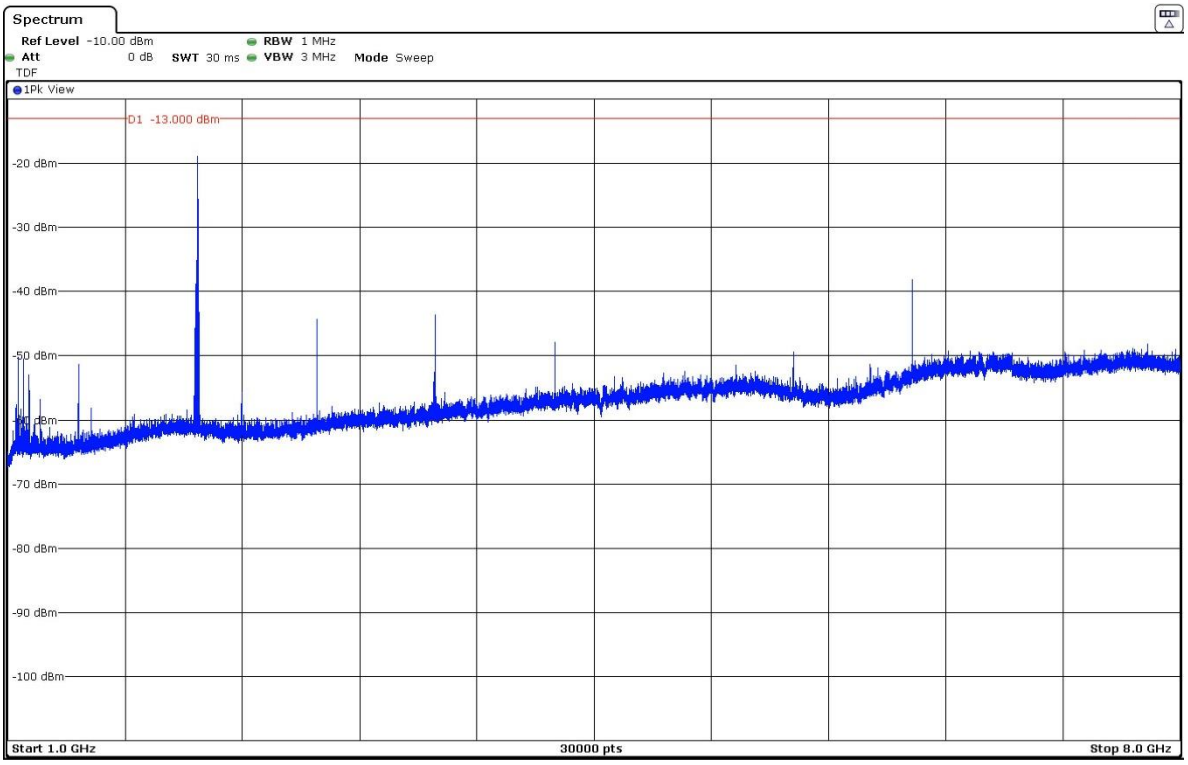
- Low Channel:



- Middle Channel:



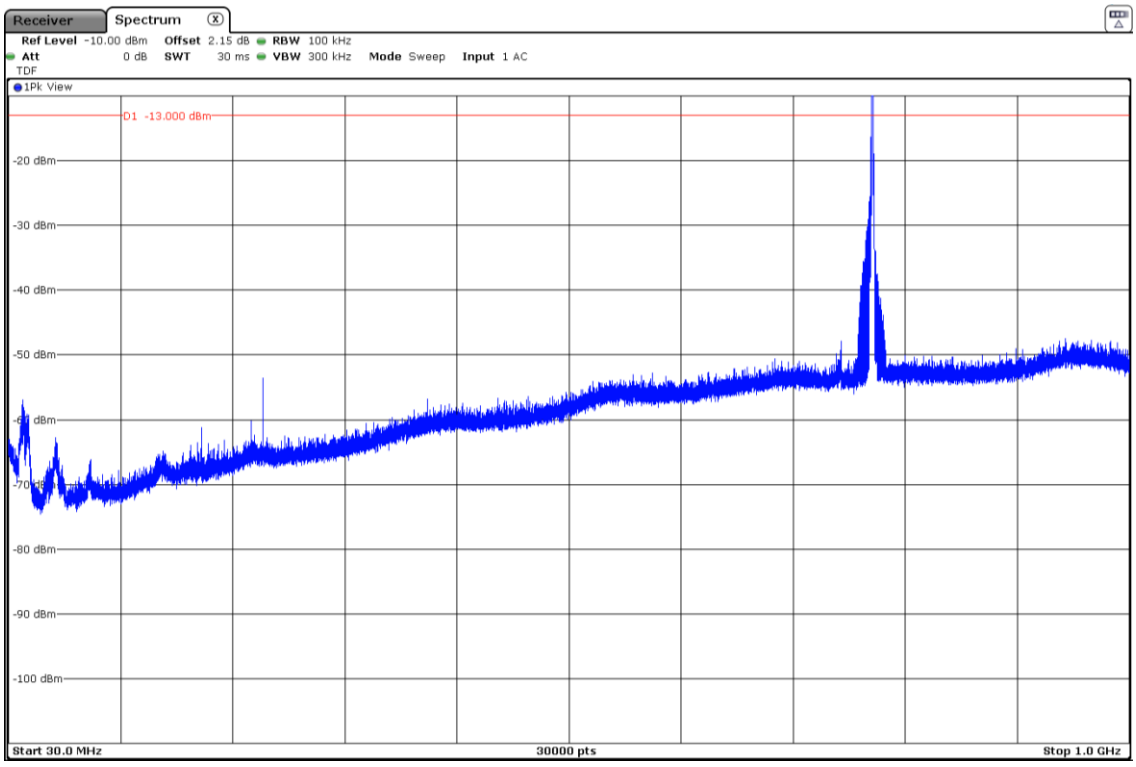
- High Channel:



LTE Band 13. QPSK. Nominal Bandwidth 5 MHz. RB Size 1, RB Offset 0. Narrow band = 0, Position 1.

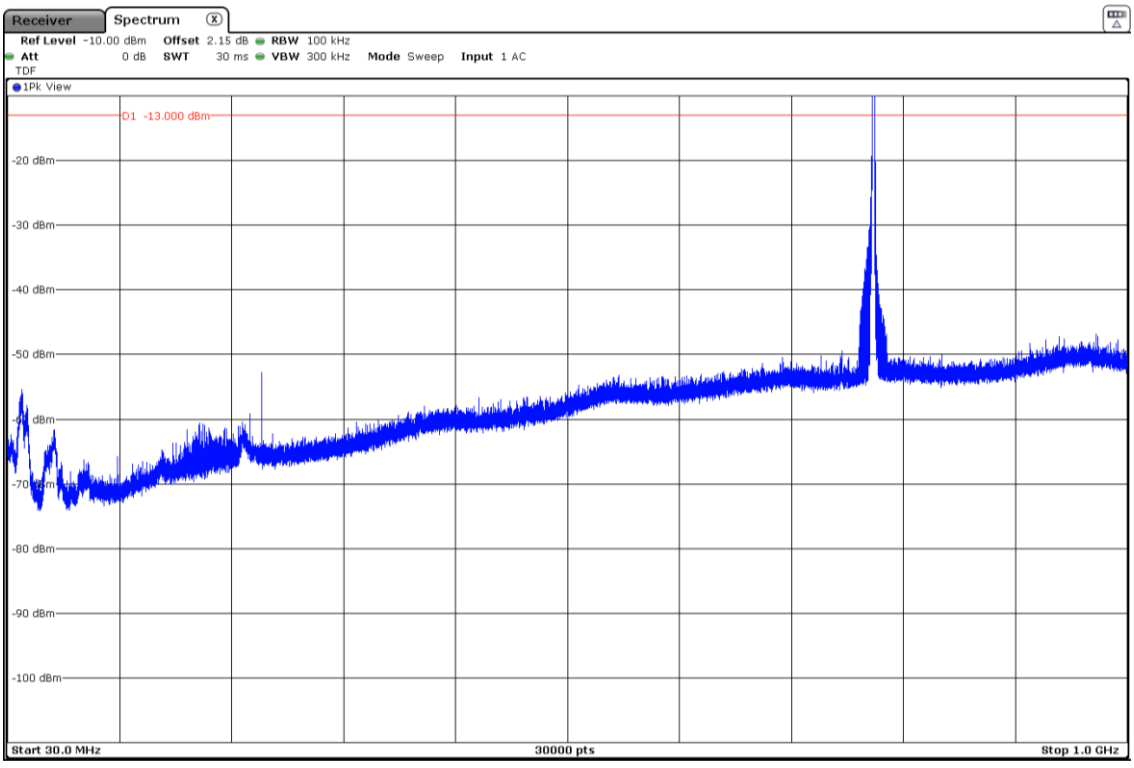
FREQUENCY RANGE 30 MHz – 1 GHz:

- Low Channel:



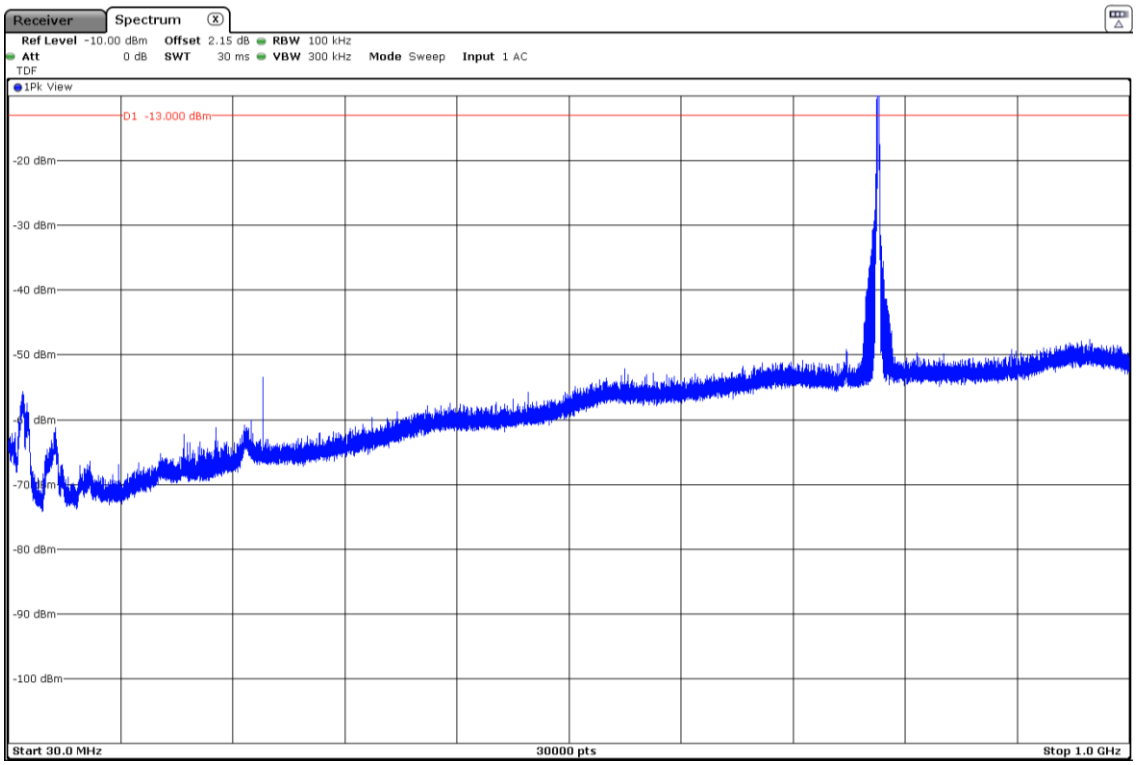
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

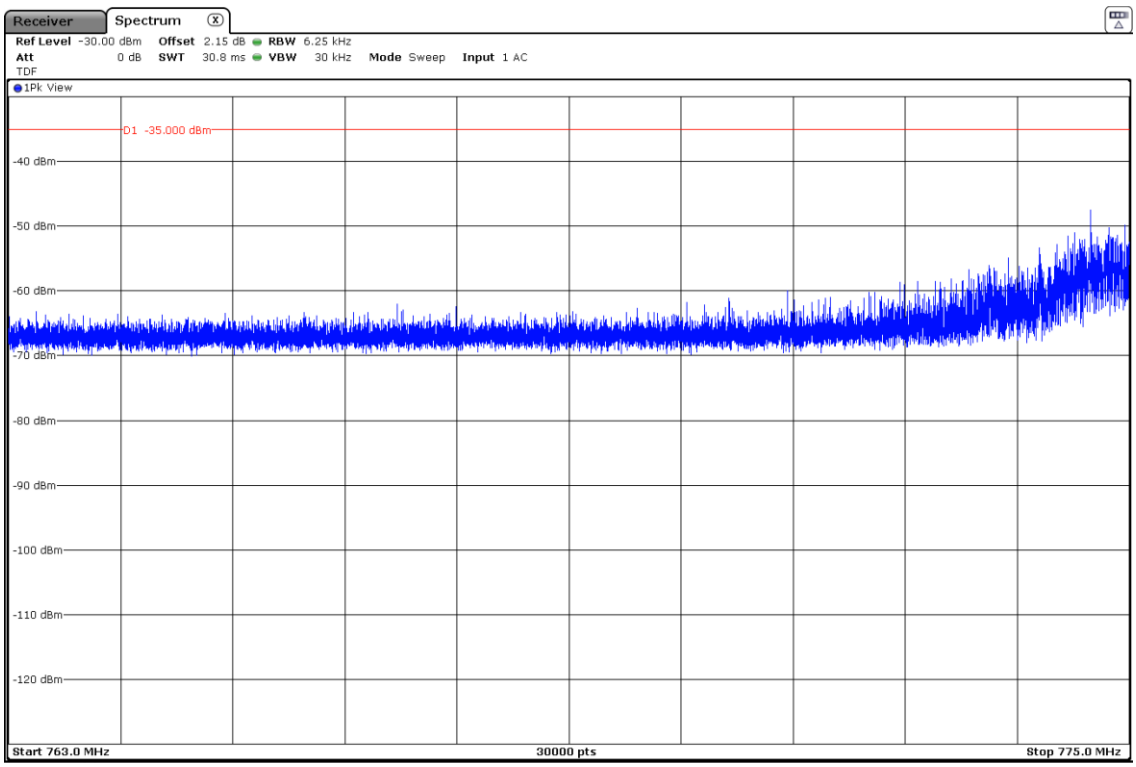
- High Channel:



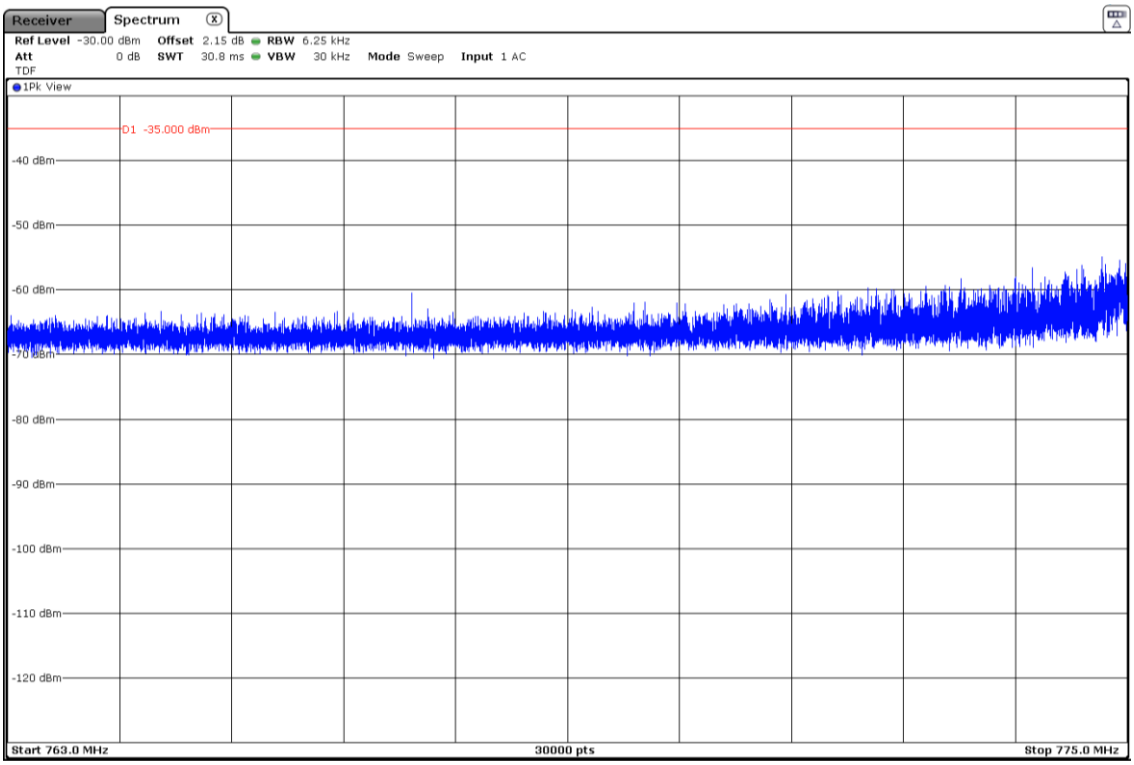
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 763 MHz – 775 MHz:

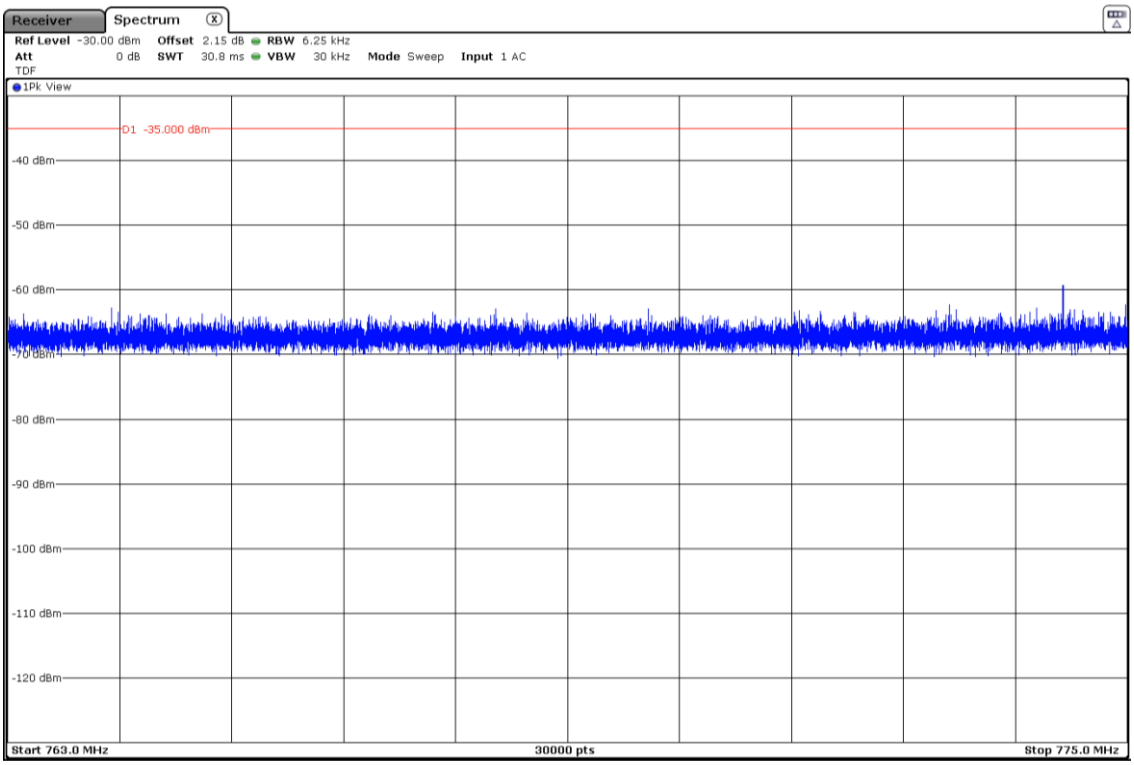
- Low Channel:



- Middle Channel:

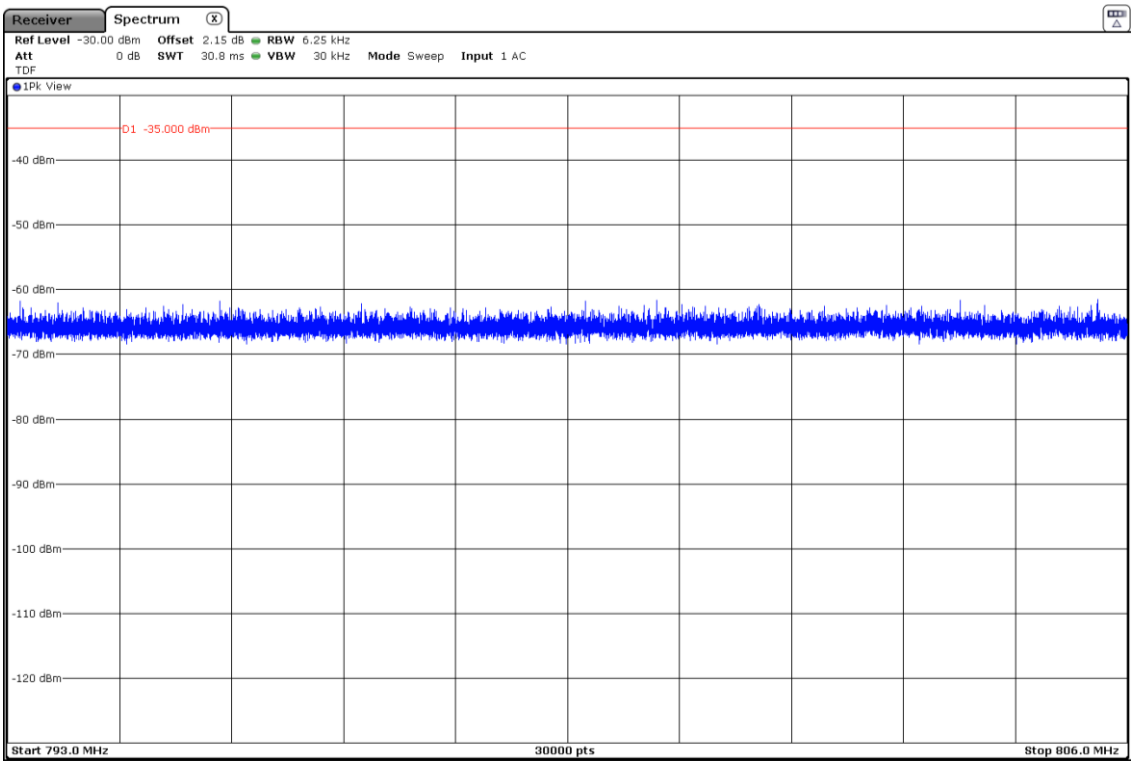


- High Channel:

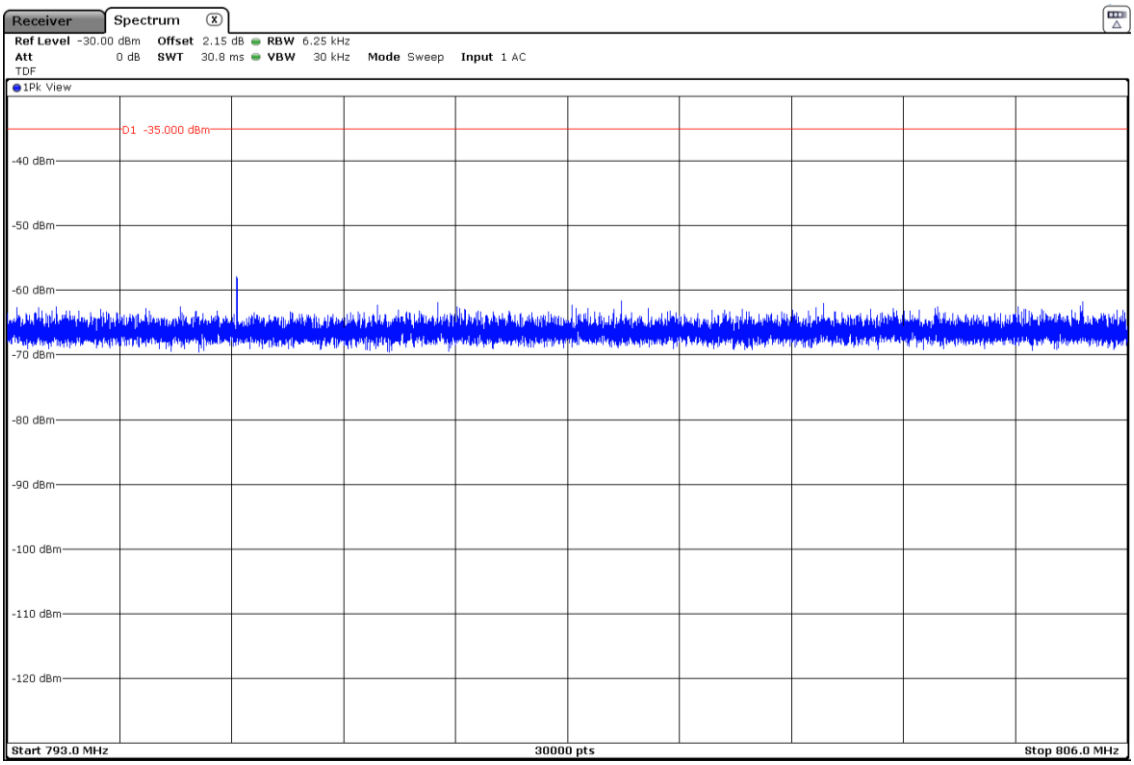


FREQUENCY RANGE 793 MHz – 806 MHz:

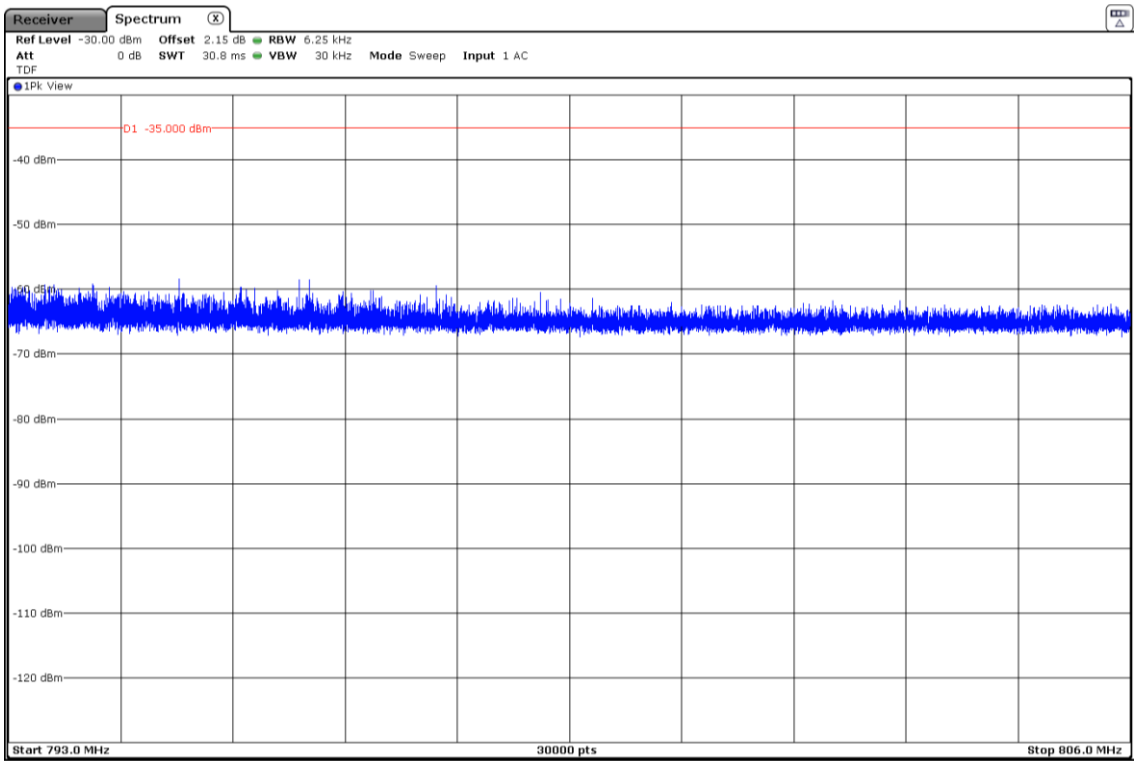
- Low Channel:



- Middle Channel:

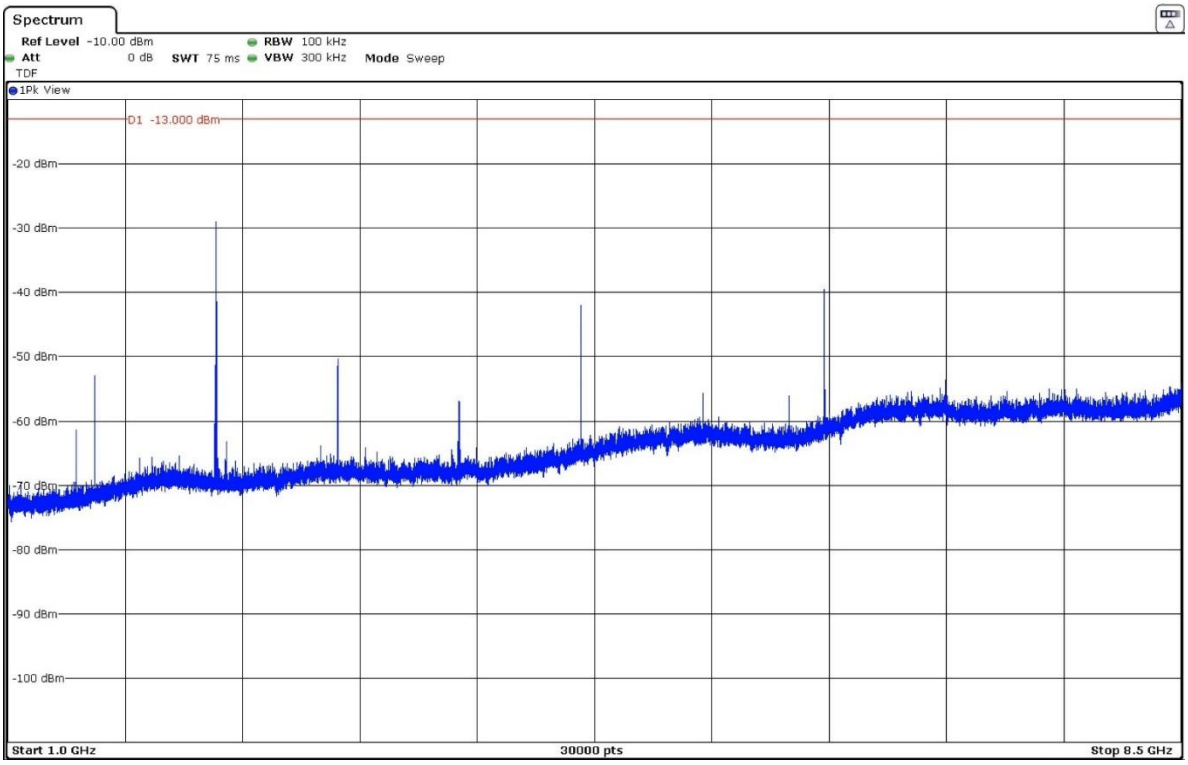


- High Channel:

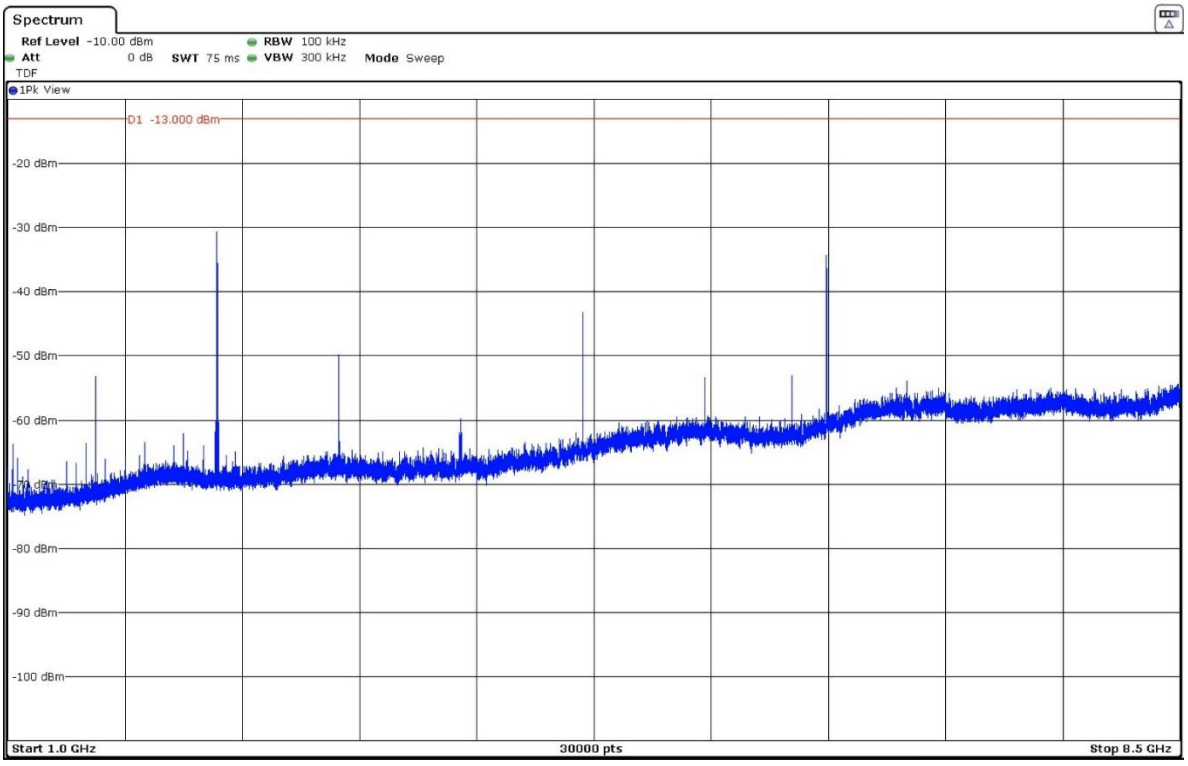


FREQUENCY RANGE 1 GHz – 8.5 GHz:

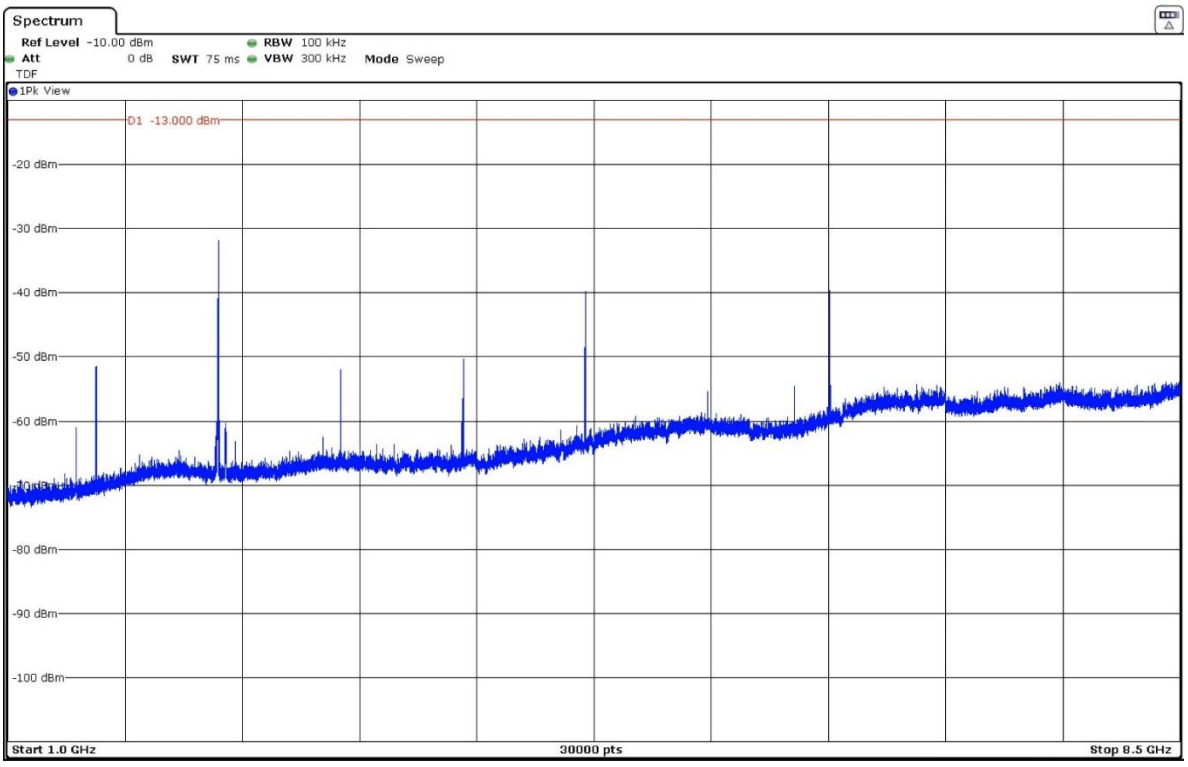
- Low Channel:



- Middle Channel:

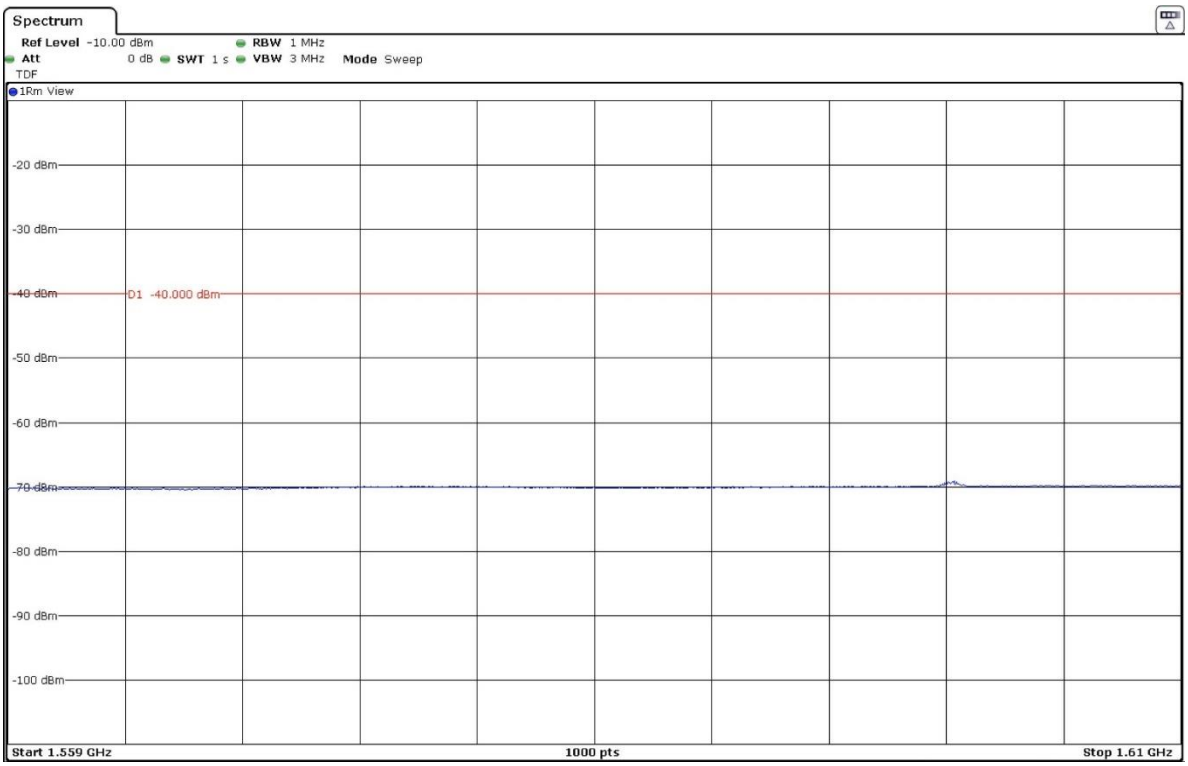


- High Channel:

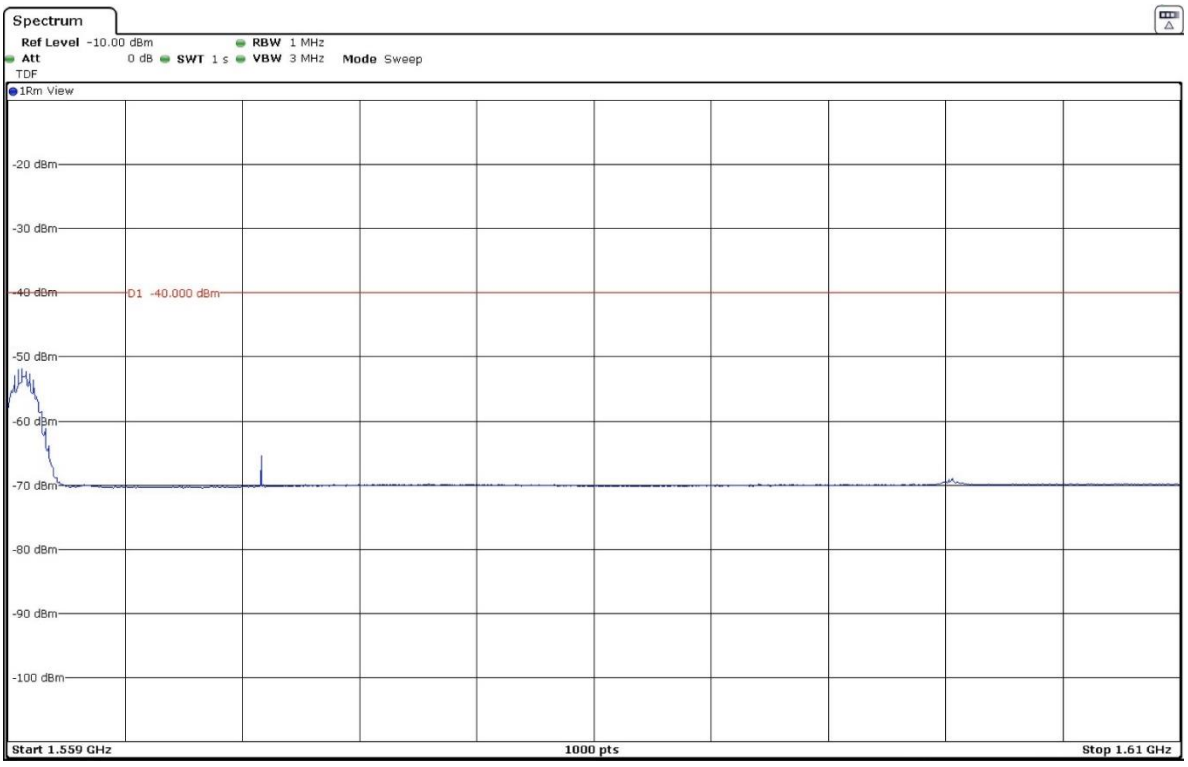


FREQUENCY RANGE 1559 MHz – 1610 MHz:

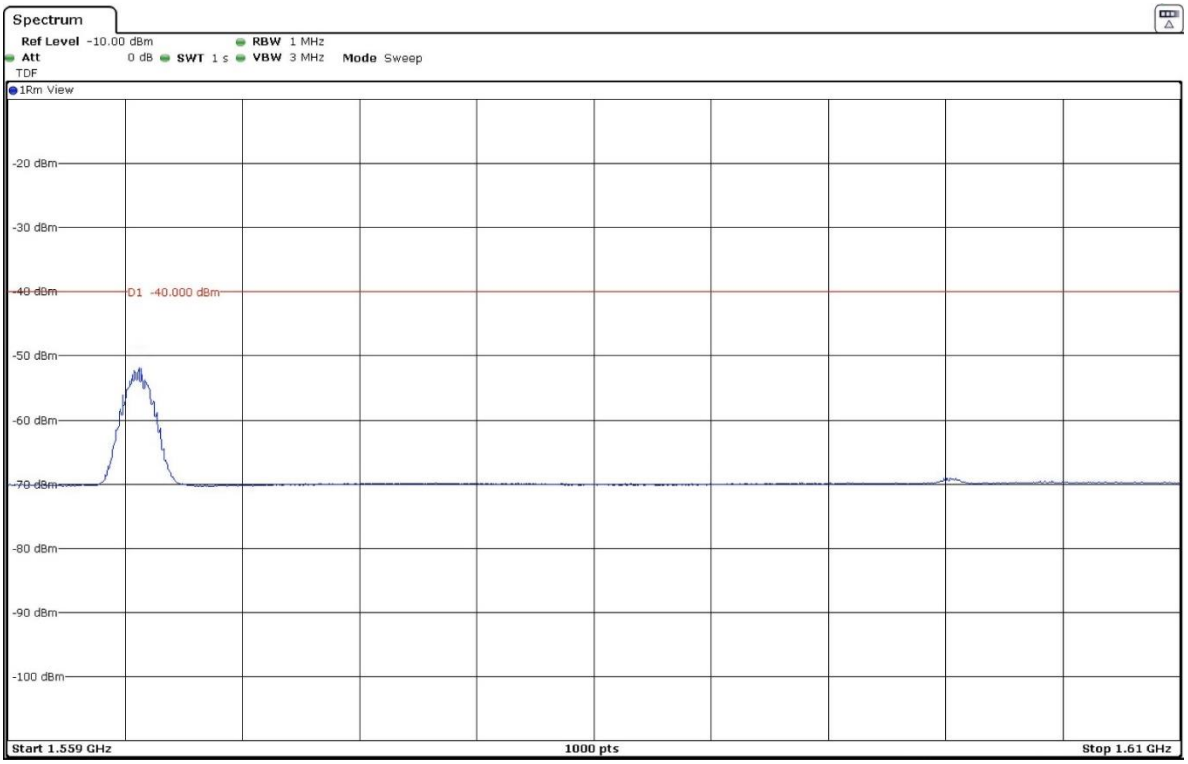
- Low Channel:



- Middle Channel:



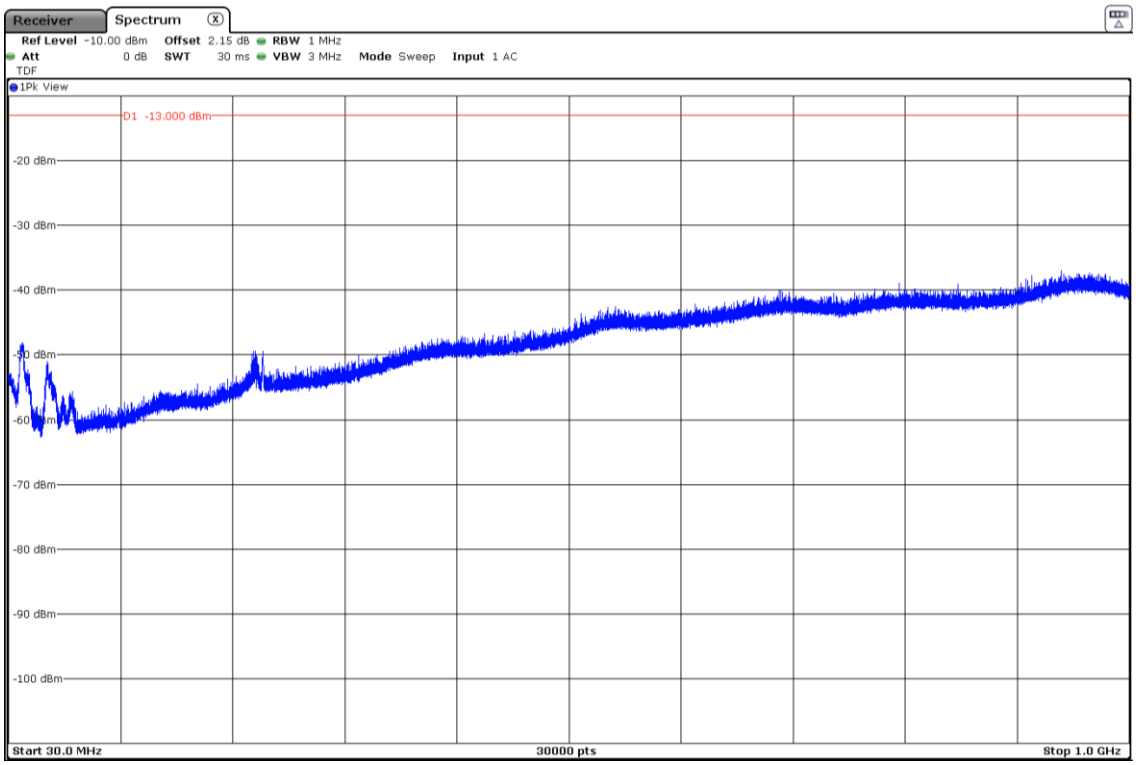
- High Channel:



LTE Band 66. QPSK. Nominal Bandwidth 20 MHz. RB Size 1, RB Offset 0. Narrow band = 0, Position 1.

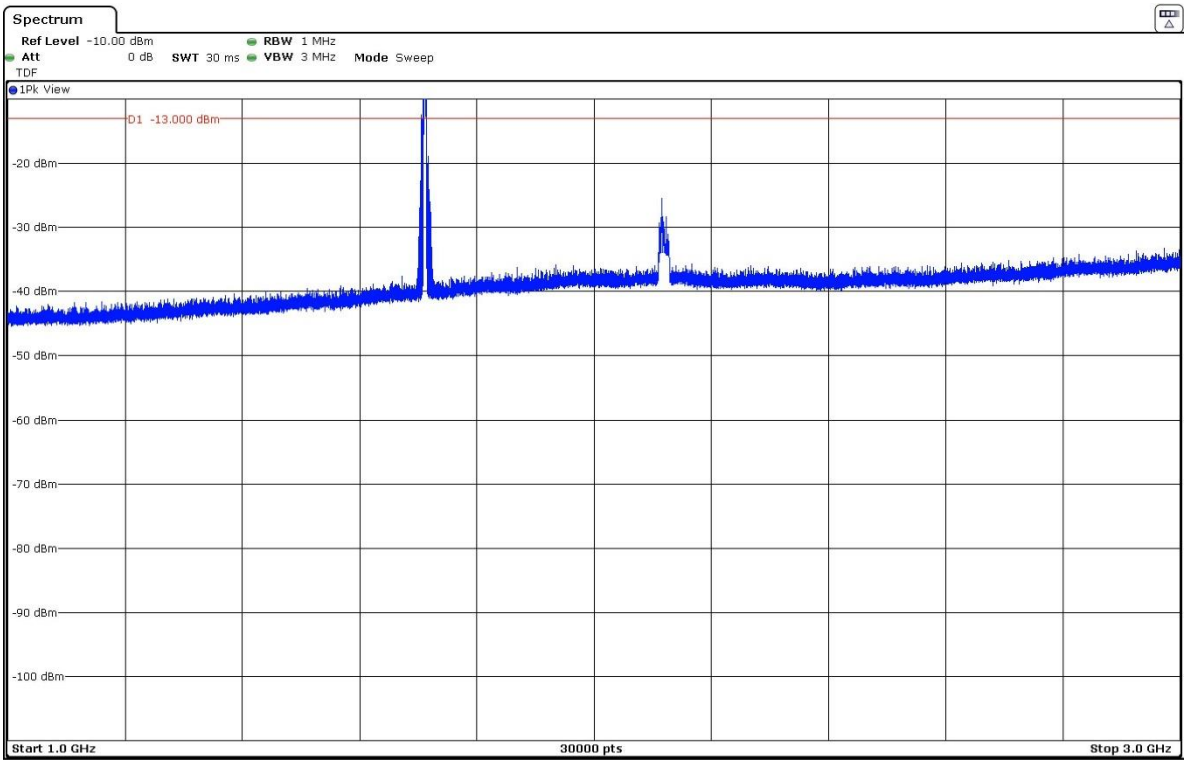
FREQUENCY RANGE 30 MHz – 1 GHz:

This plot is valid for the Low, Middle and High Channels:



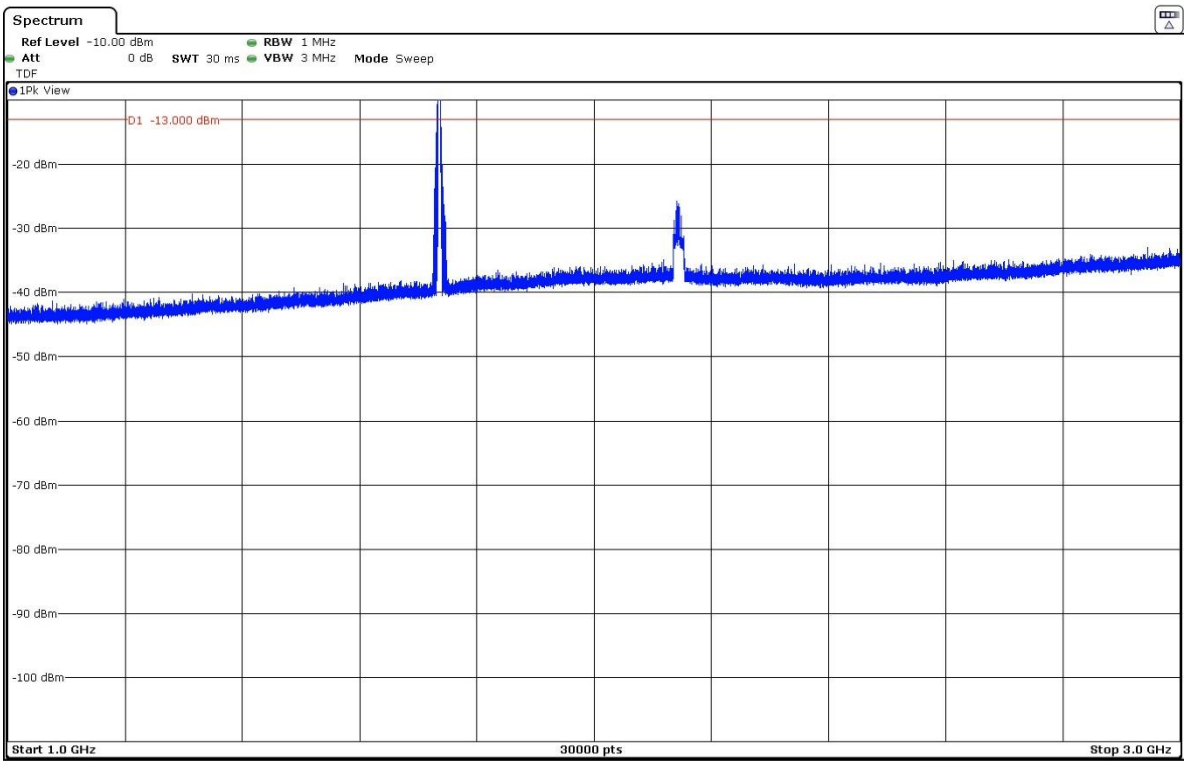
FREQUENCY RANGE 1 GHz – 3 GHz:

- Low Channel:



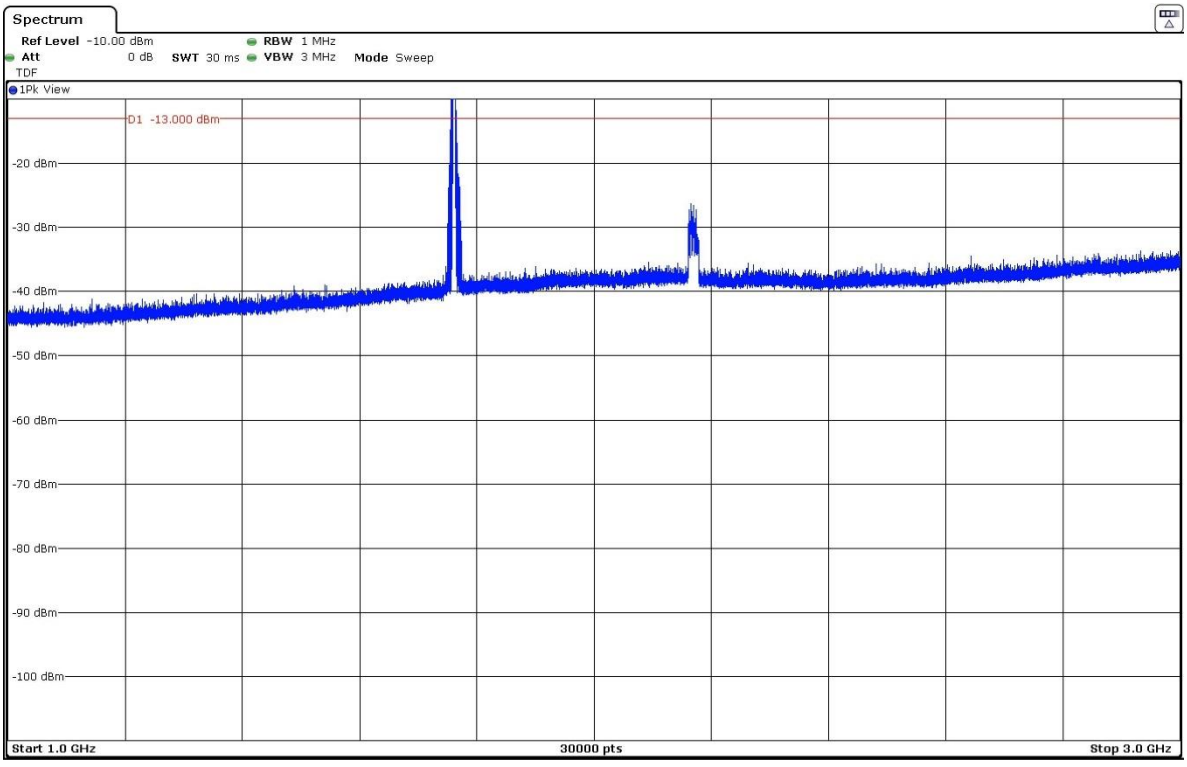
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

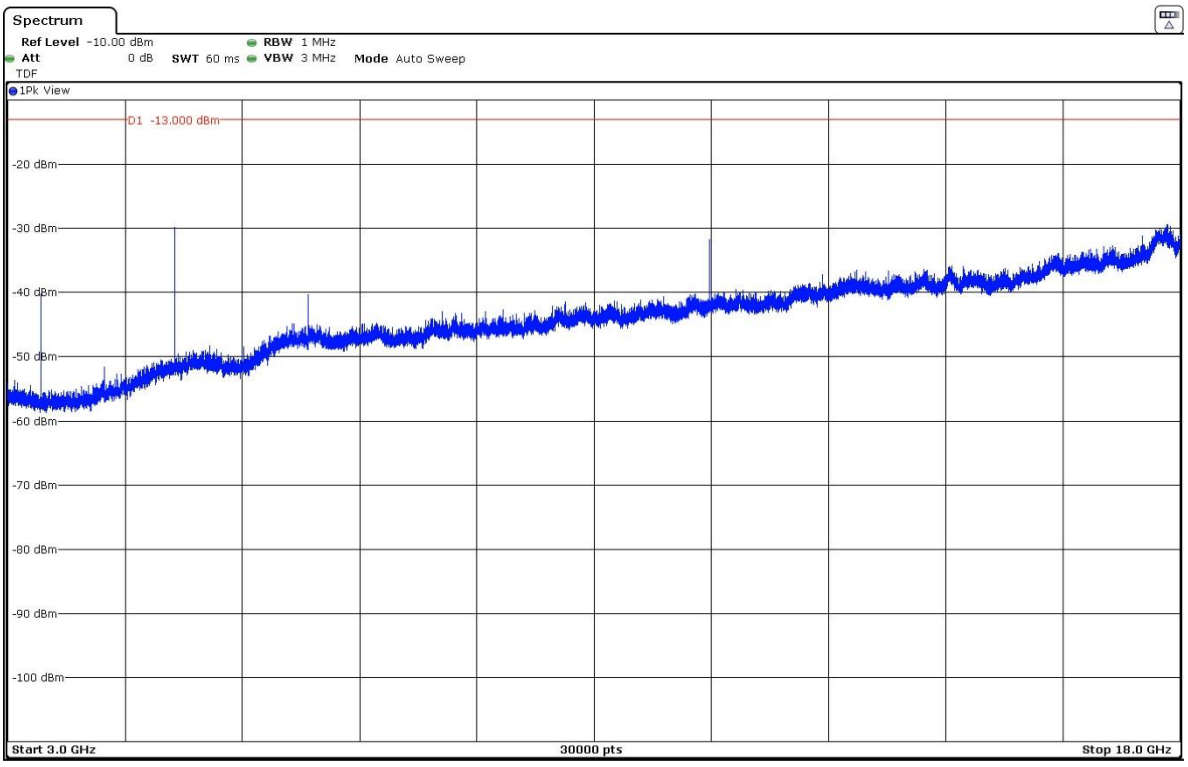
- High Channel:



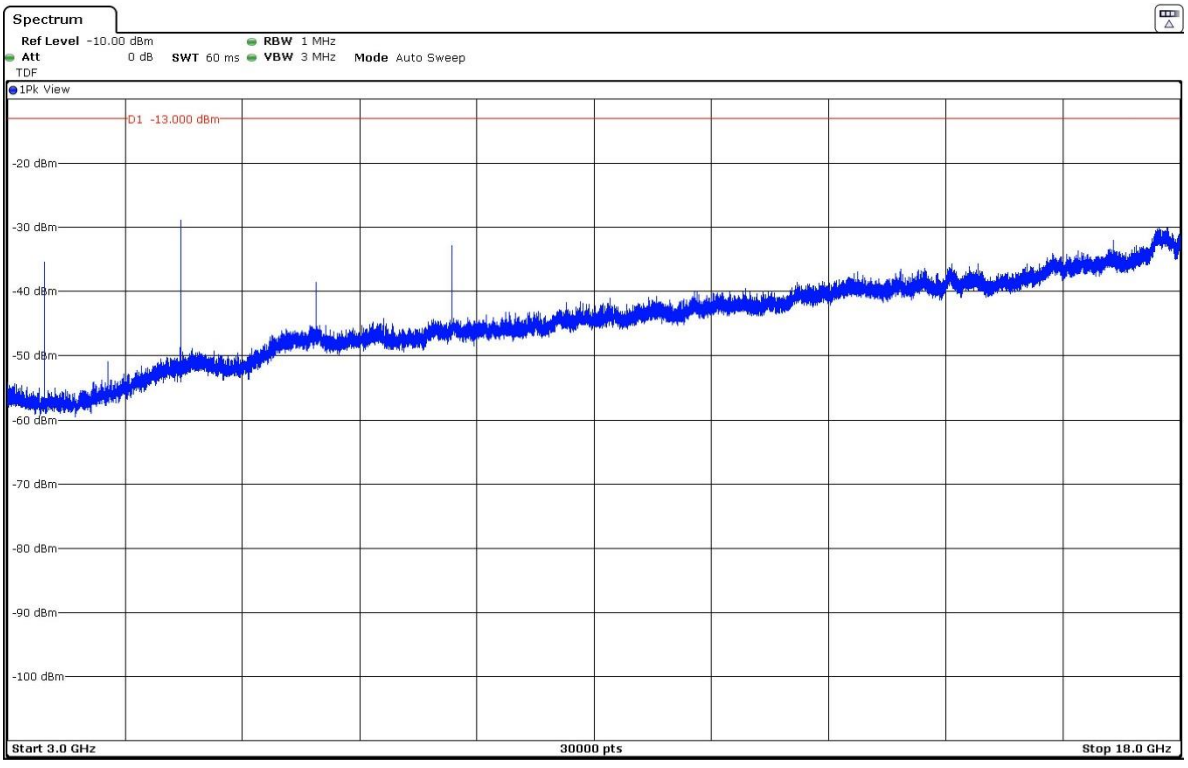
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz –18 GHz:

- Low Channel:



- Middle Channel:



- High Channel: