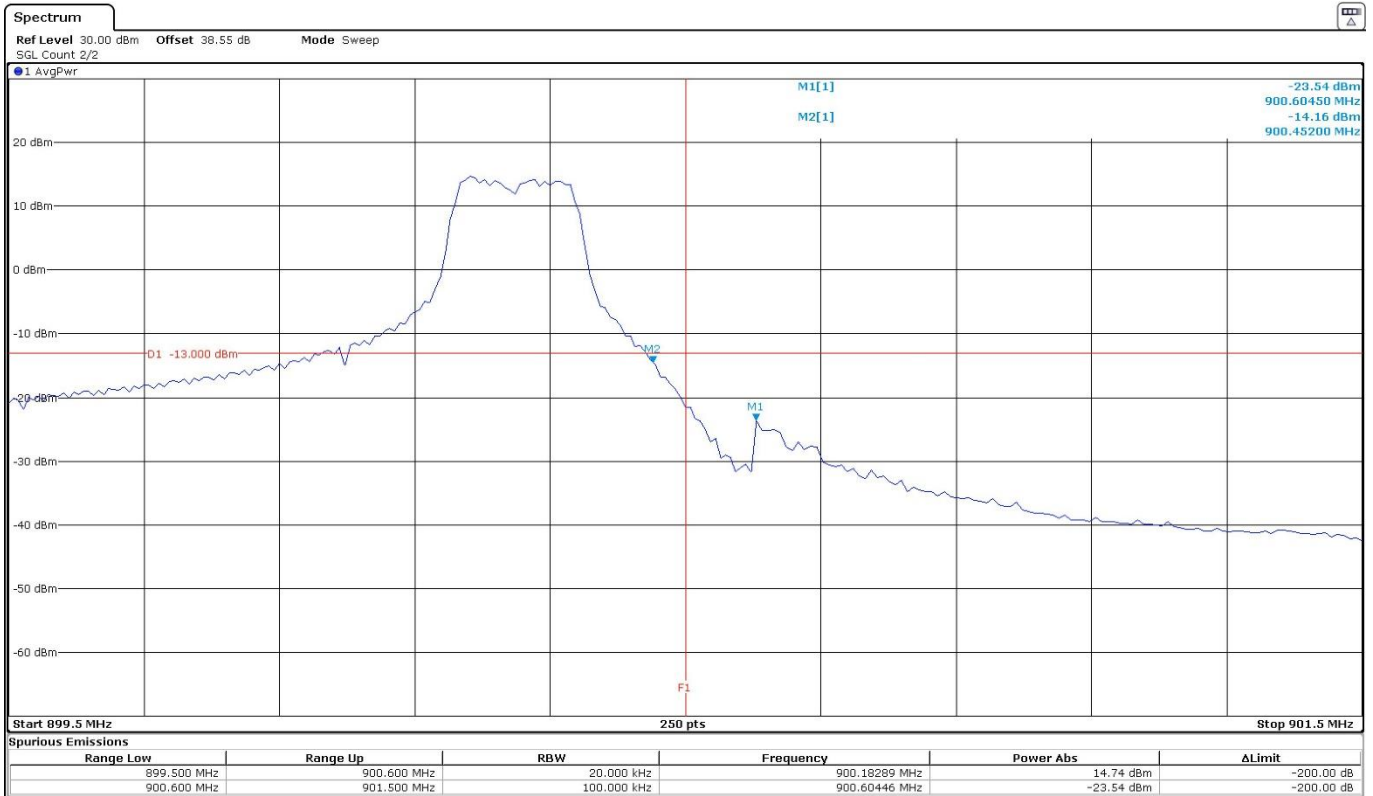
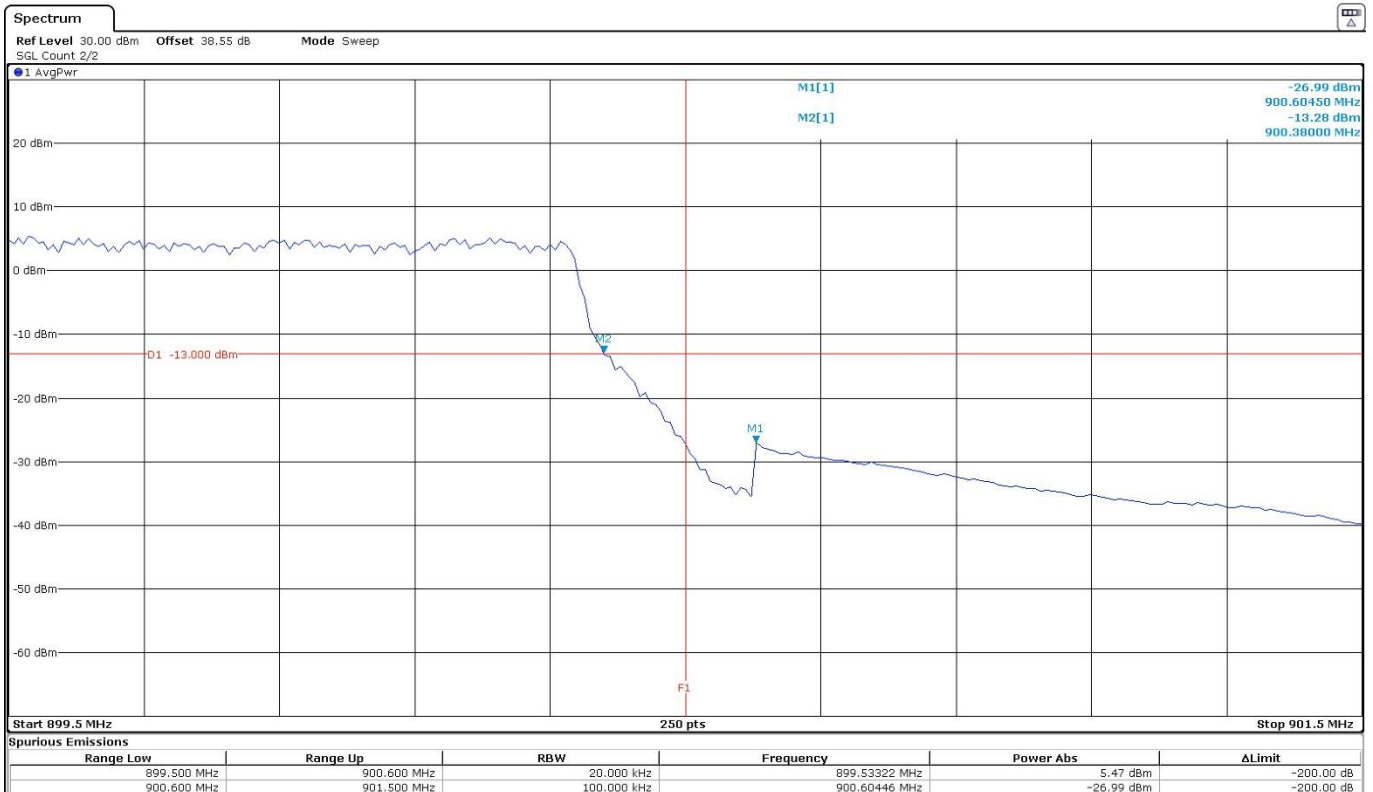


LTE Cat-M1 Band 8. BW=1.4 MHz. QPSK. RB=1. Offset=Max. Narrowband=Max. High Block Edge:



The equipment transmits at the maximum output power

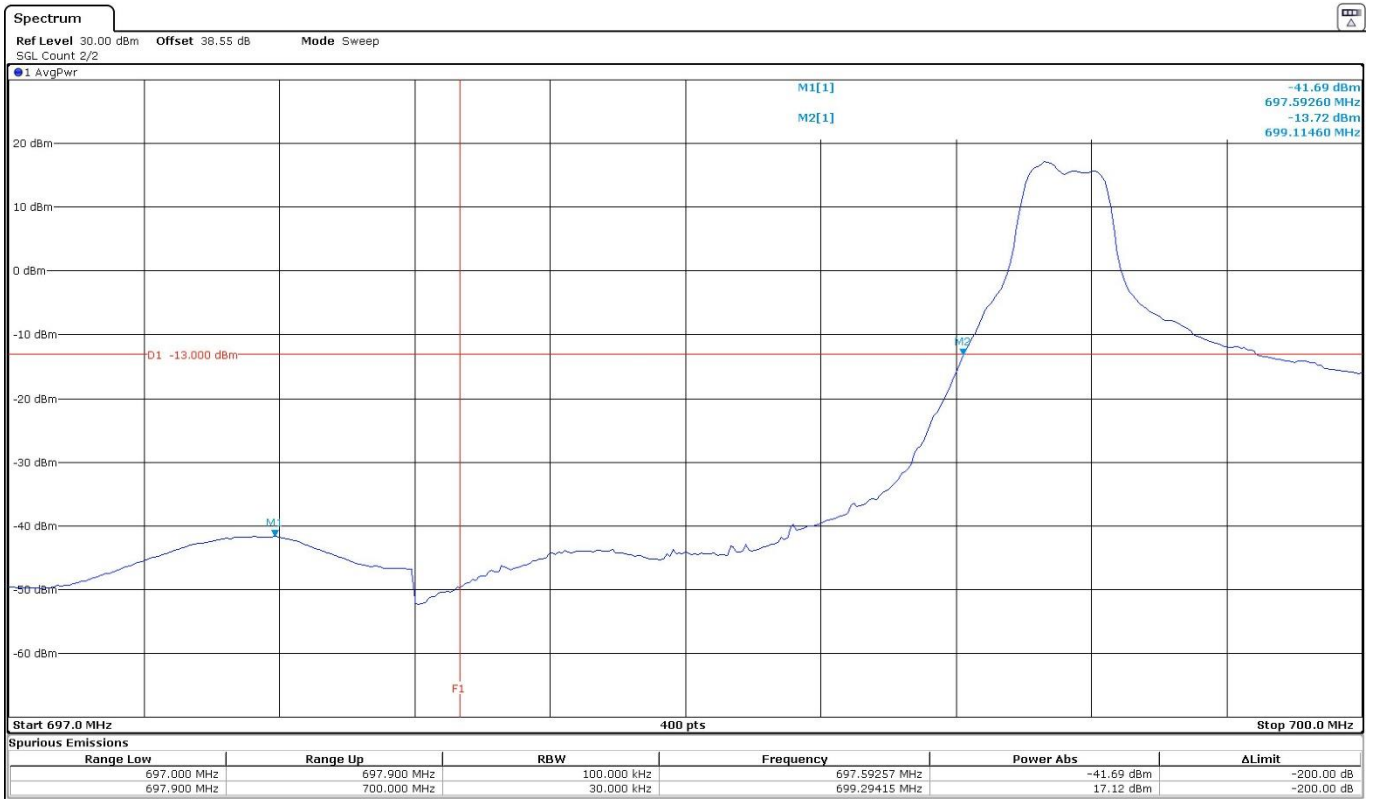
LTE Cat-M1 Band 8. BW=1.4 MHz. QPSK. RB=All. Offset=0. Narrowband=Max. High Block Edge:



The equipment transmits at the maximum output power

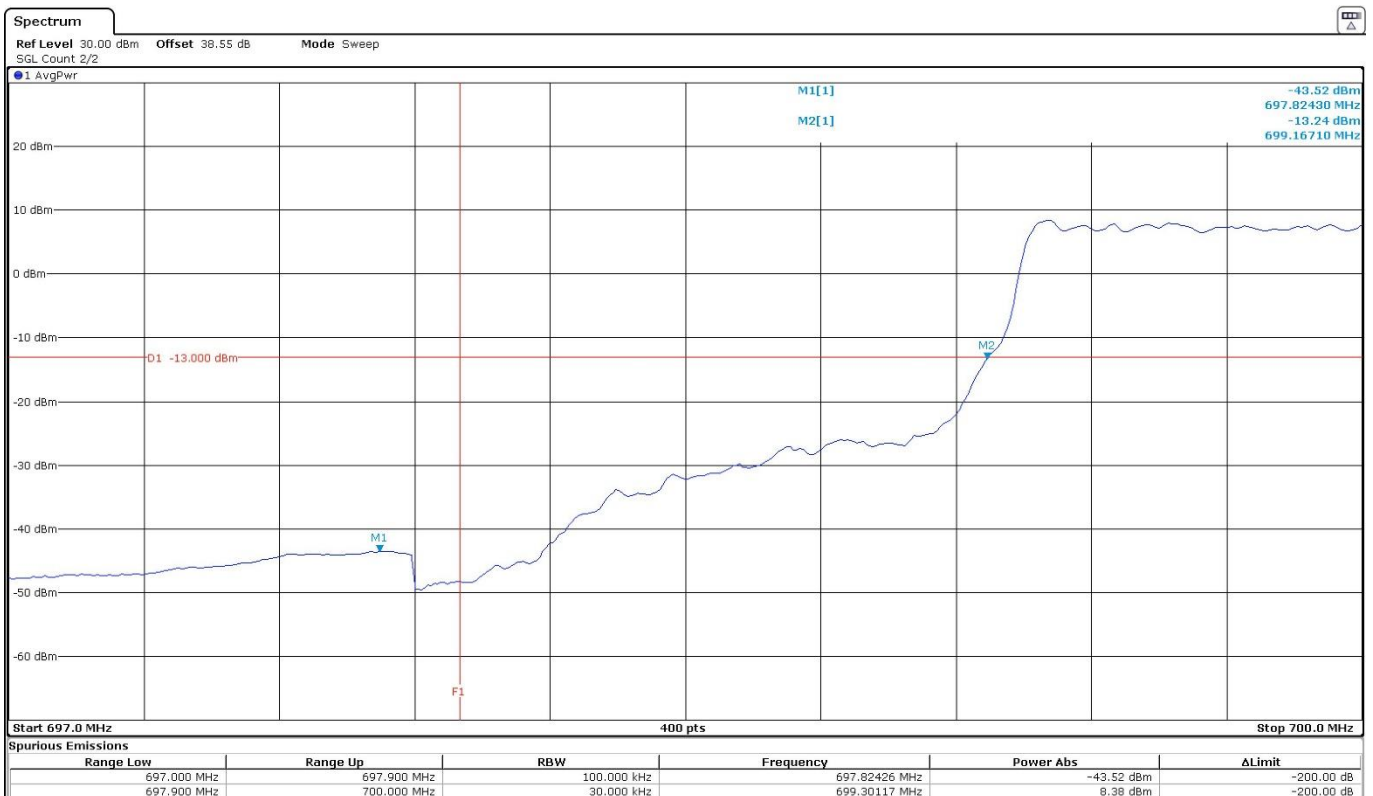
LTE Cat-M1 Band 12:

LTE Cat-M1 Band 12. BW=5 MHz. QPSK. RB=1. Offset=0. Narrowband=0. Low Block Edge:



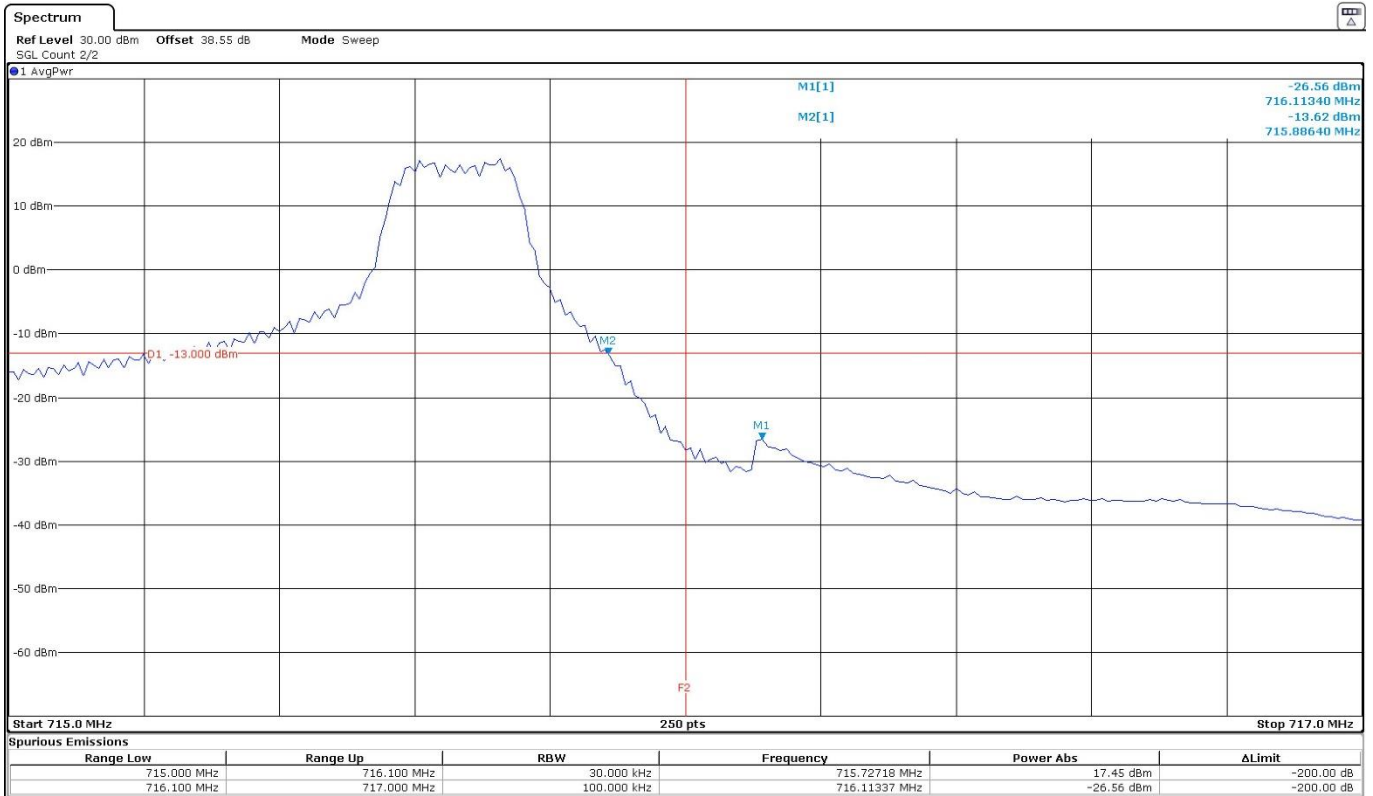
The equipment transmits at the maximum output power

LTE Cat-M1 Band 12. BW=5 MHz. QPSK. RB=All. Offset=0. Narrowband=Max. Low Block Edge:



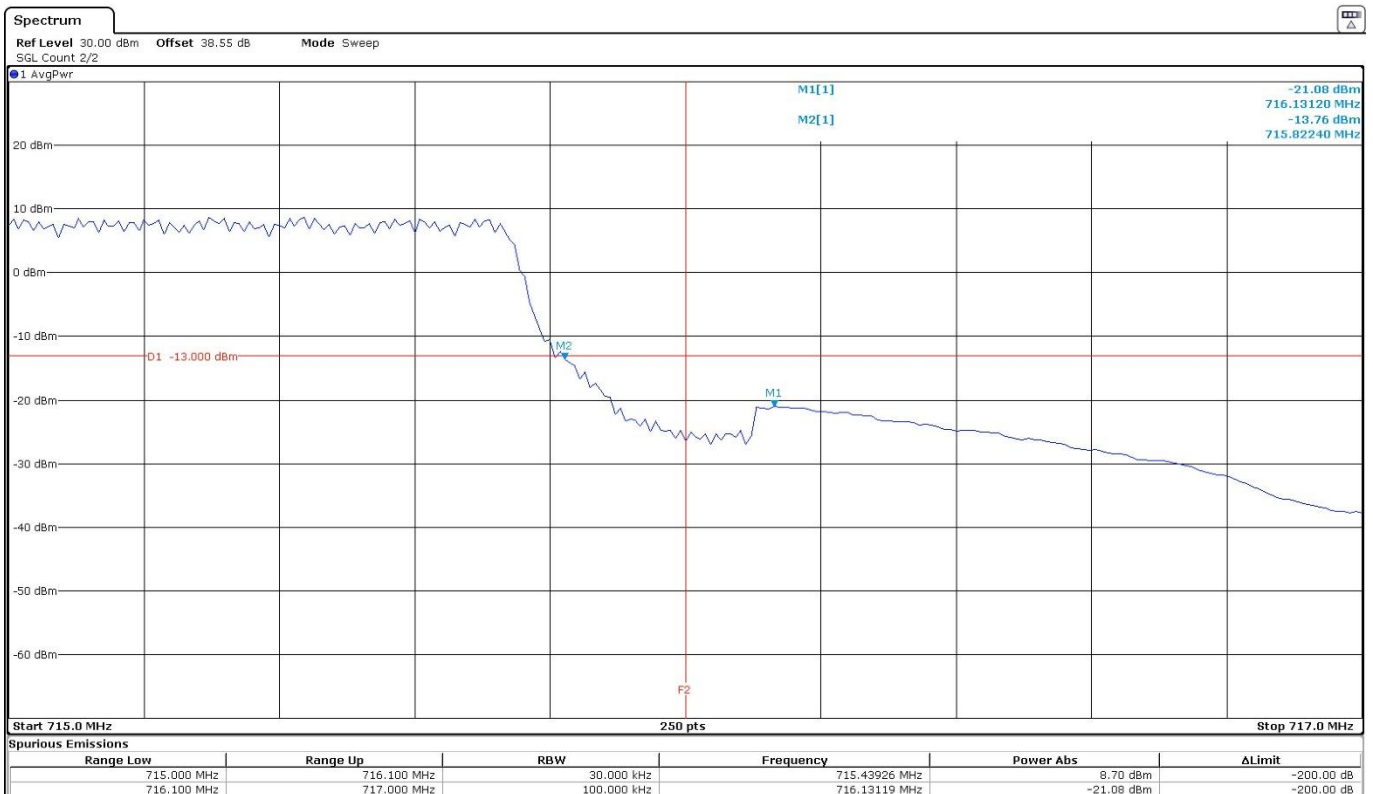
The equipment transmits at the maximum output power

LTE Cat-M1 Band 12. BW=5 MHz. QPSK. RB=1. Offset=Max. Narrowband=Max. High Block Edge:



The equipment transmits at the maximum output power

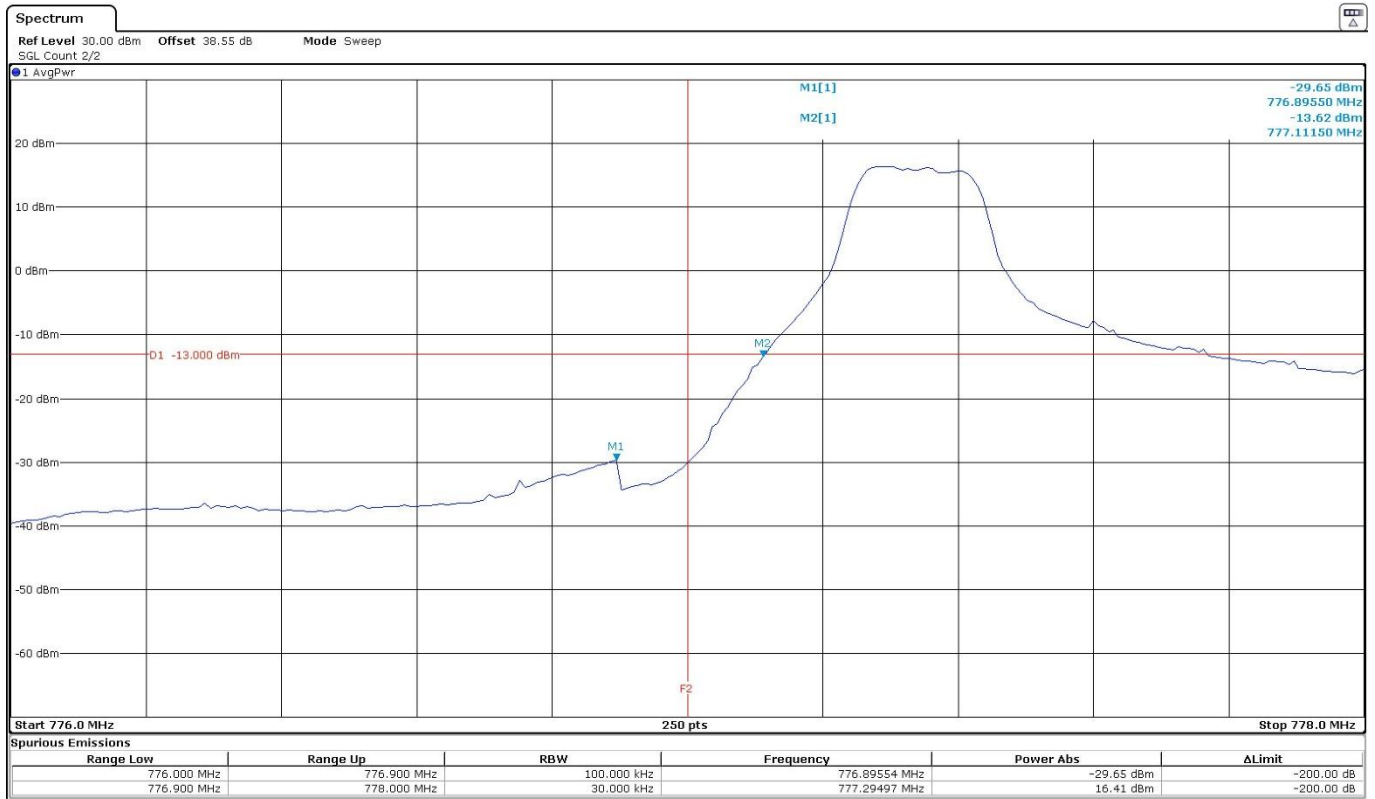
LTE Cat-M1 Band 12. BW=5 MHz. QPSK. RB=All. Offset=0. Narrowband=Max. High Block Edge:



The equipment transmits at the maximum output power

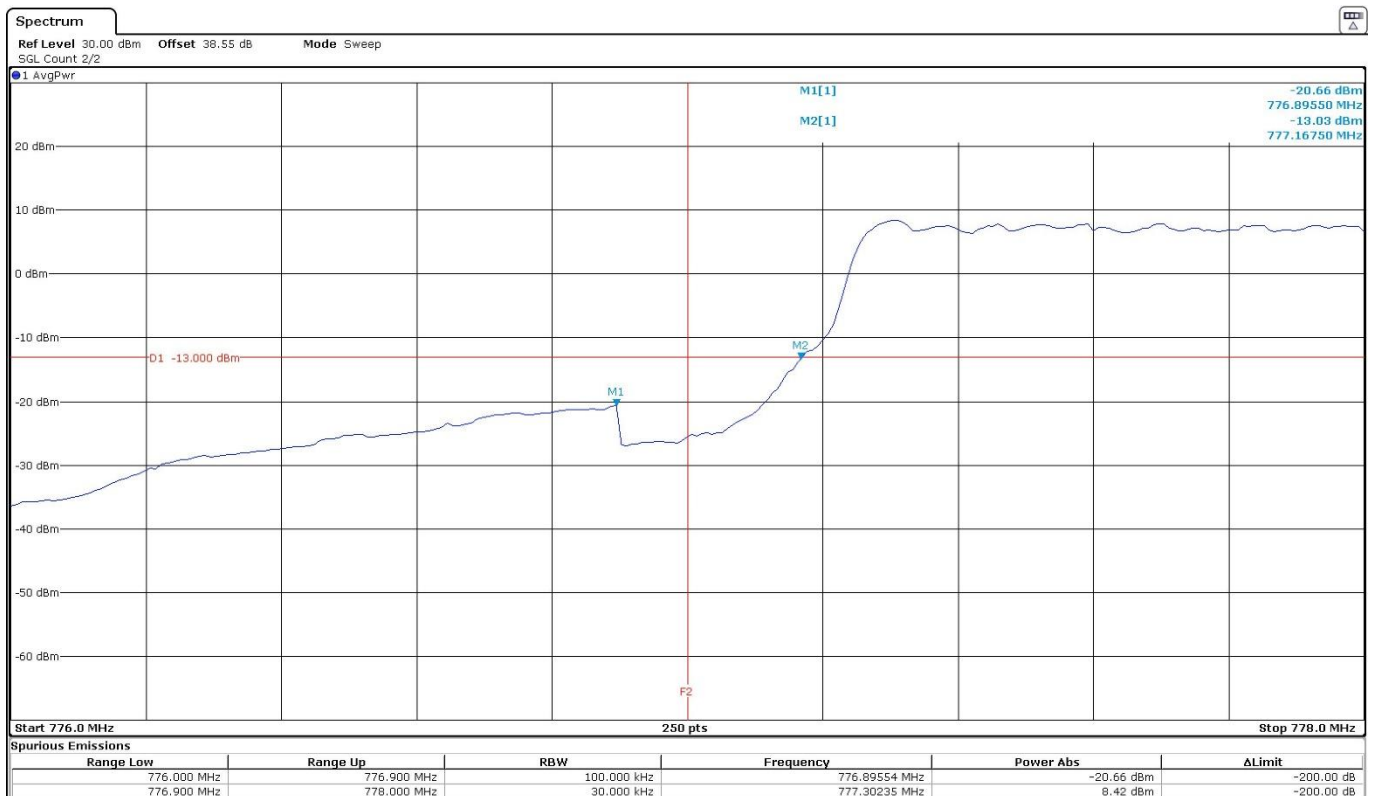
LTE Cat-M1 Band 13:

LTE Cat-M1 Band 13. BW=5 MHz. QPSK. RB=1. Offset=0. Narrowband=0. Low Block Edge:



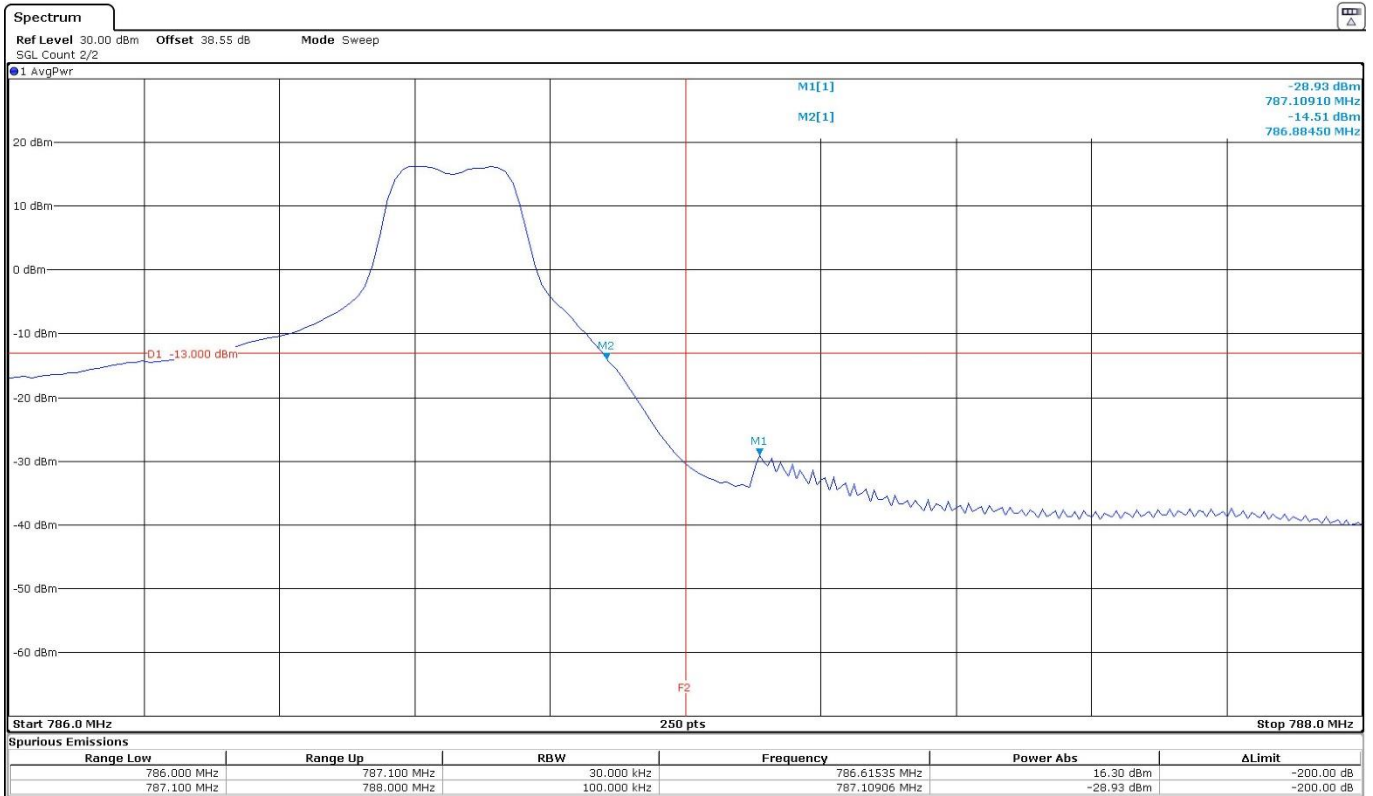
The equipment transmits at the maximum output power

LTE Cat-M1 Band 13. BW=5 MHz. QPSK. RB=All. Offset=0. Narrowband=0. Low Block Edge:



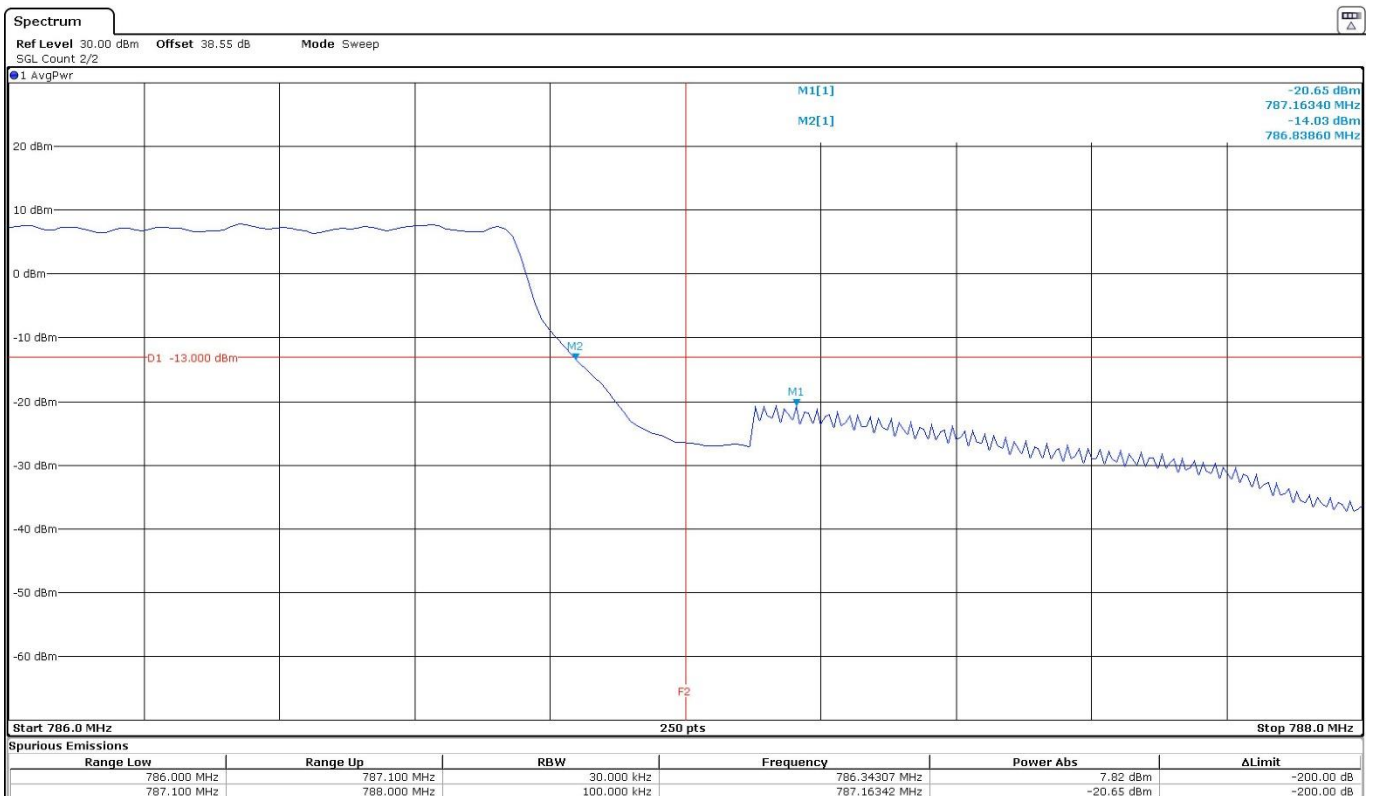
The equipment transmits at the maximum output power

LTE Cat-M1 Band 13. BW=5 MHz. QPSK. RB=1. Offset=Max. Narrowband=Max. High Block Edge:



The equipment transmits at the maximum output power

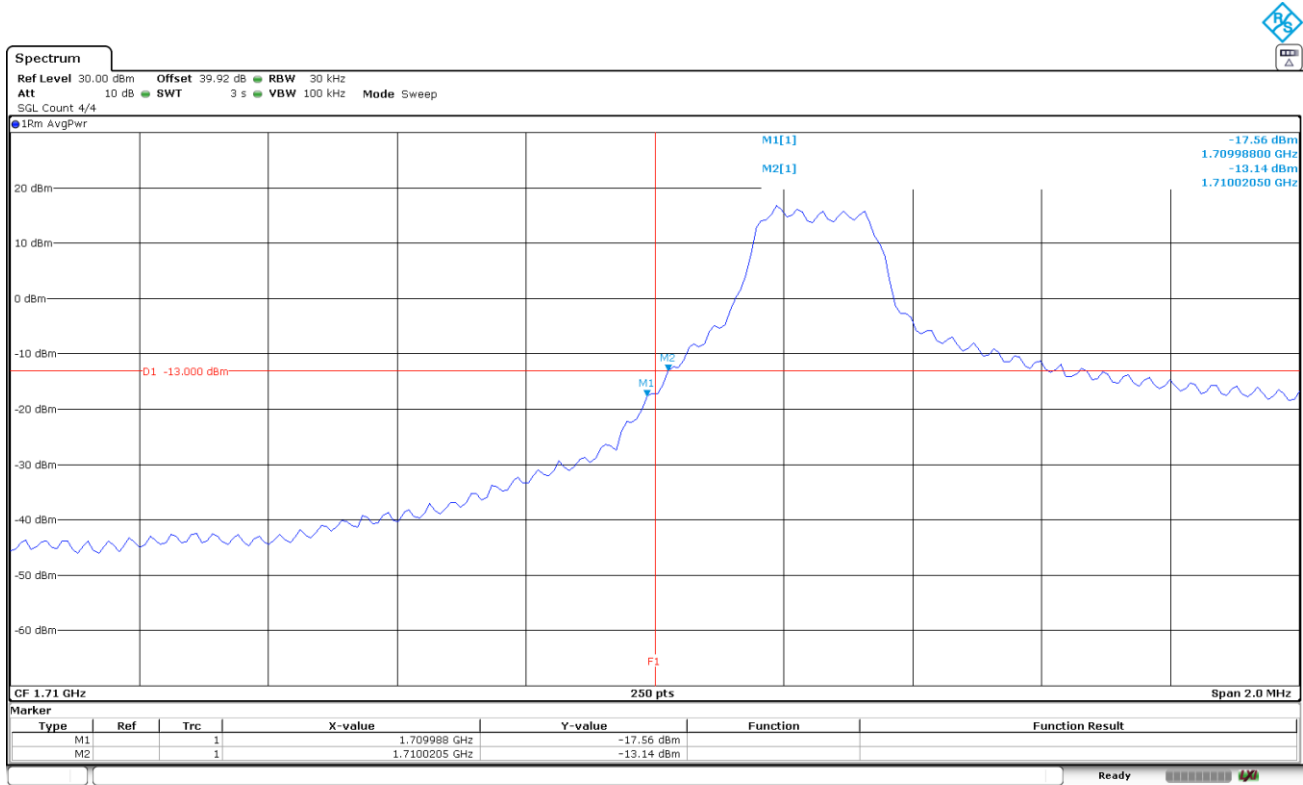
LTE Cat-M1 Band 13. BW=5 MHz. QPSK. RB=All. Offset=0. Narrowband=Max. High Block Edge:



The equipment transmits at the maximum output power

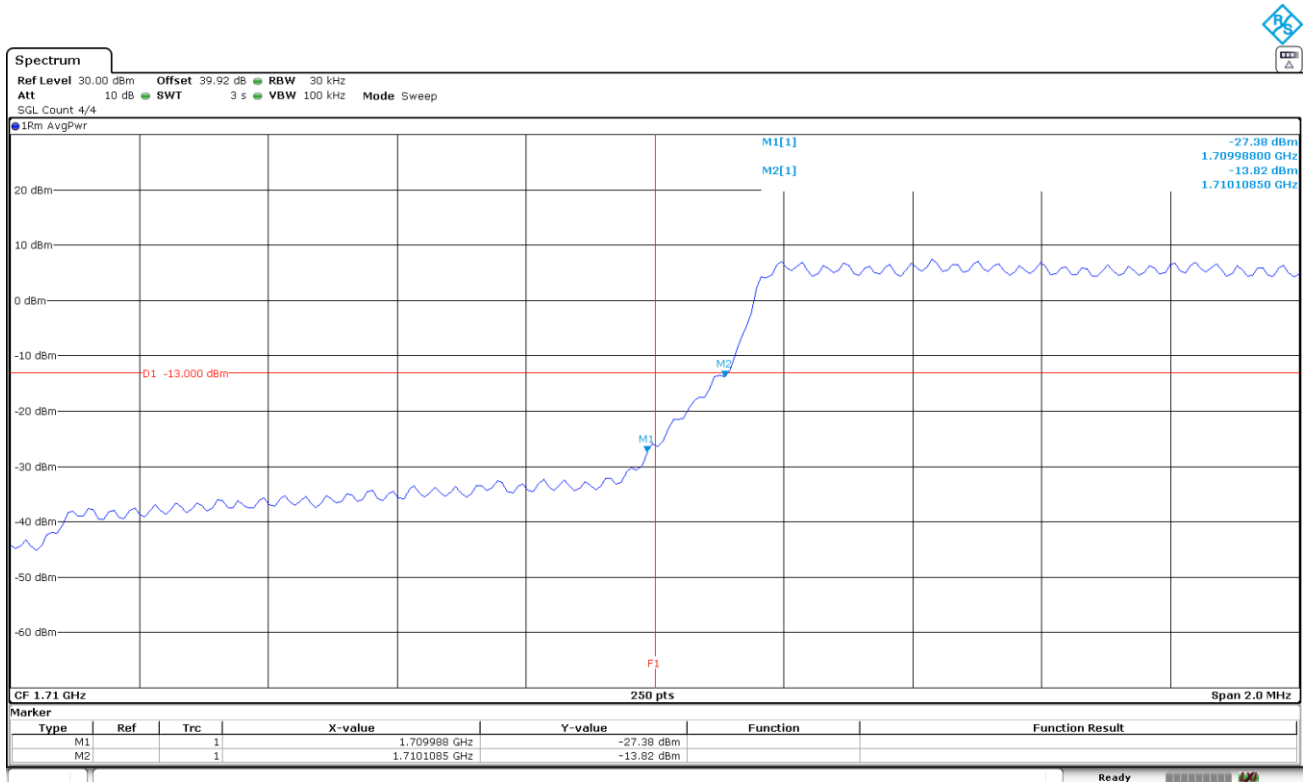
LTE Cat-M1 Band 66:

LTE Cat-M1 Band 66. BW=1.4 MHz. QPSK. RB=1. Offset=0. Narrowband=0. Low Block Edge:



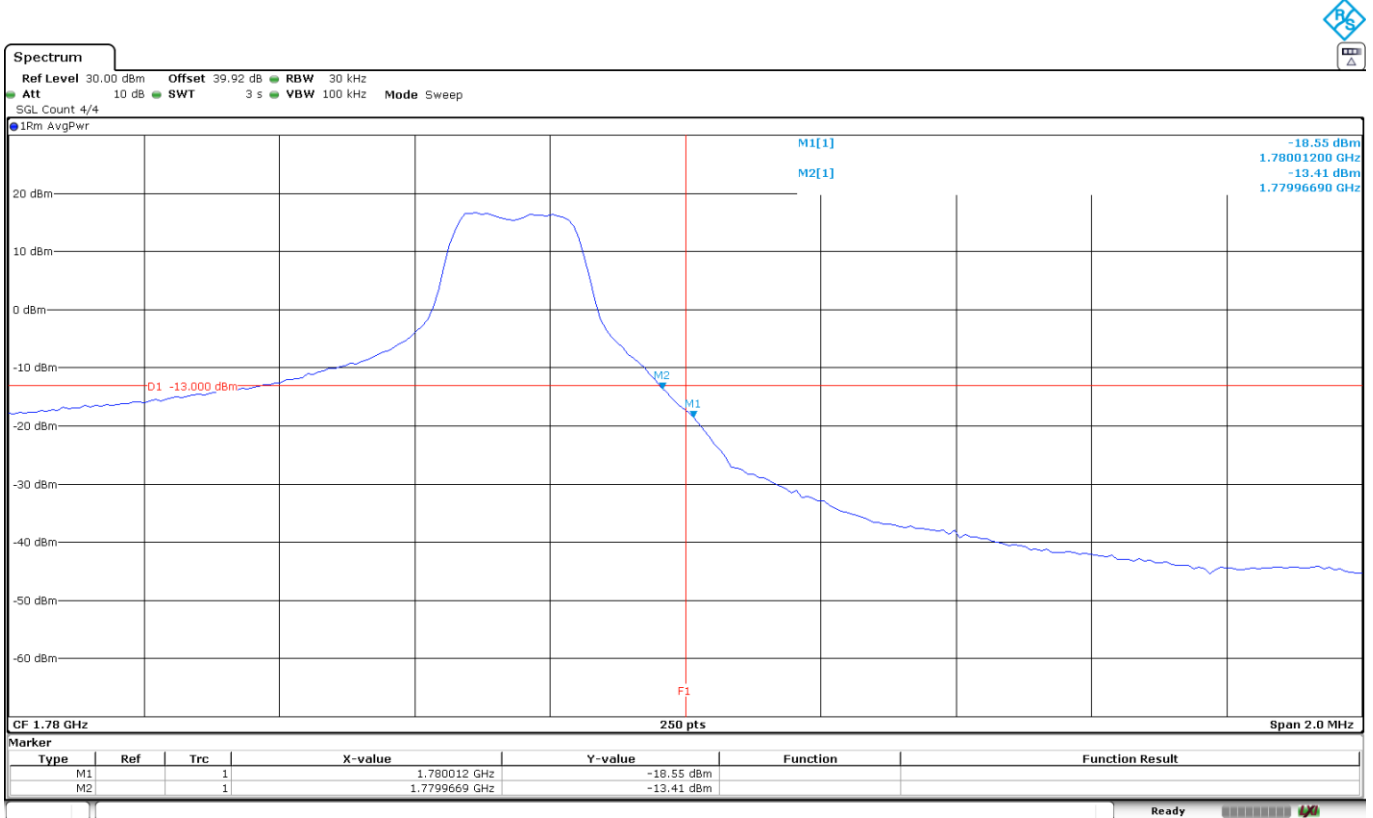
The equipment transmits at the maximum output power

LTE Cat-M1 Band 66. BW=1.4 MHz. QPSK. RB=All. Offset=1. Narrowband=0. Low Block Edge:



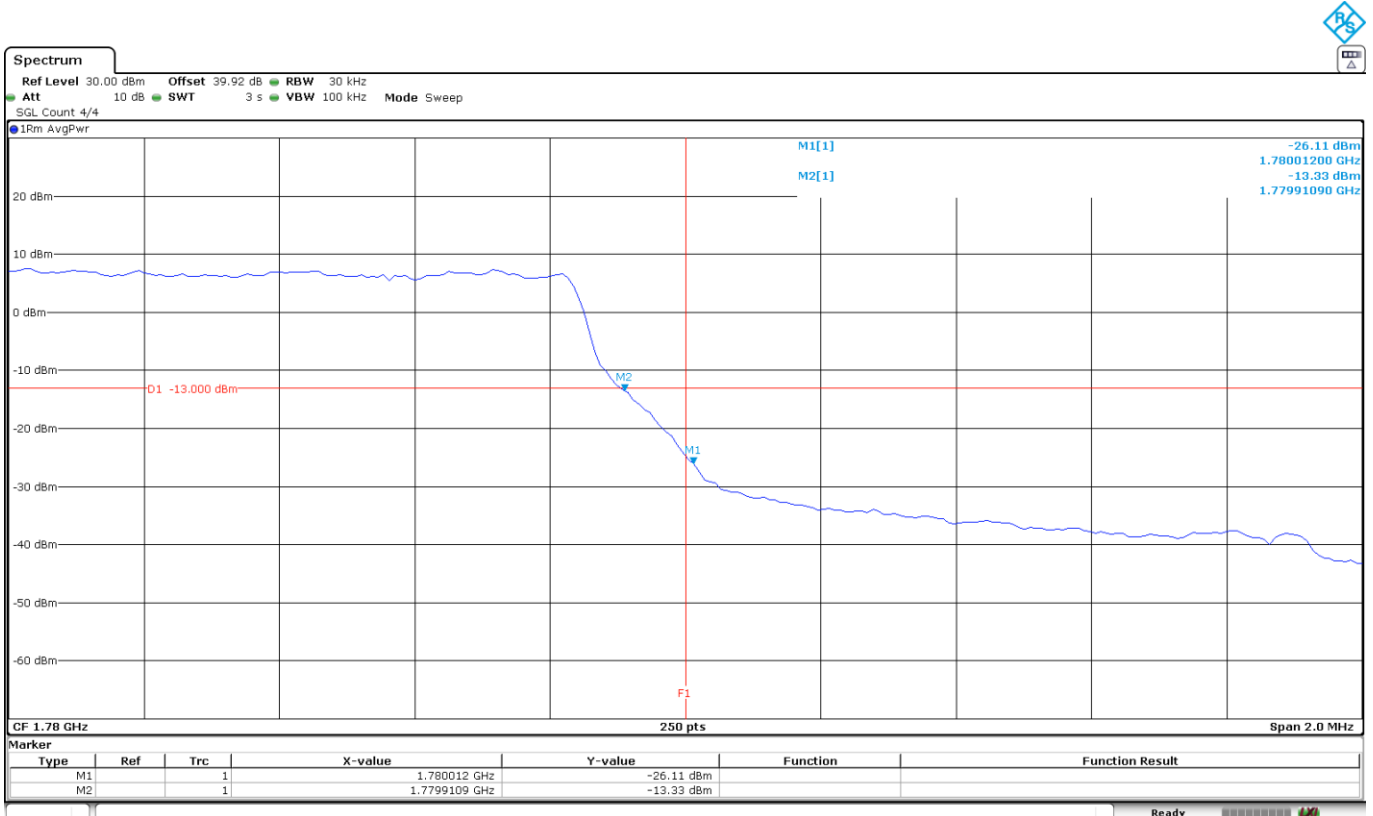
The equipment transmits at the maximum output power

LTE Cat-M1 Band 66. BW=1.4 MHz. QPSK. RB=1. Offset=Max. Narrowband=Max. High Block Edge:



The equipment transmits at the maximum output power

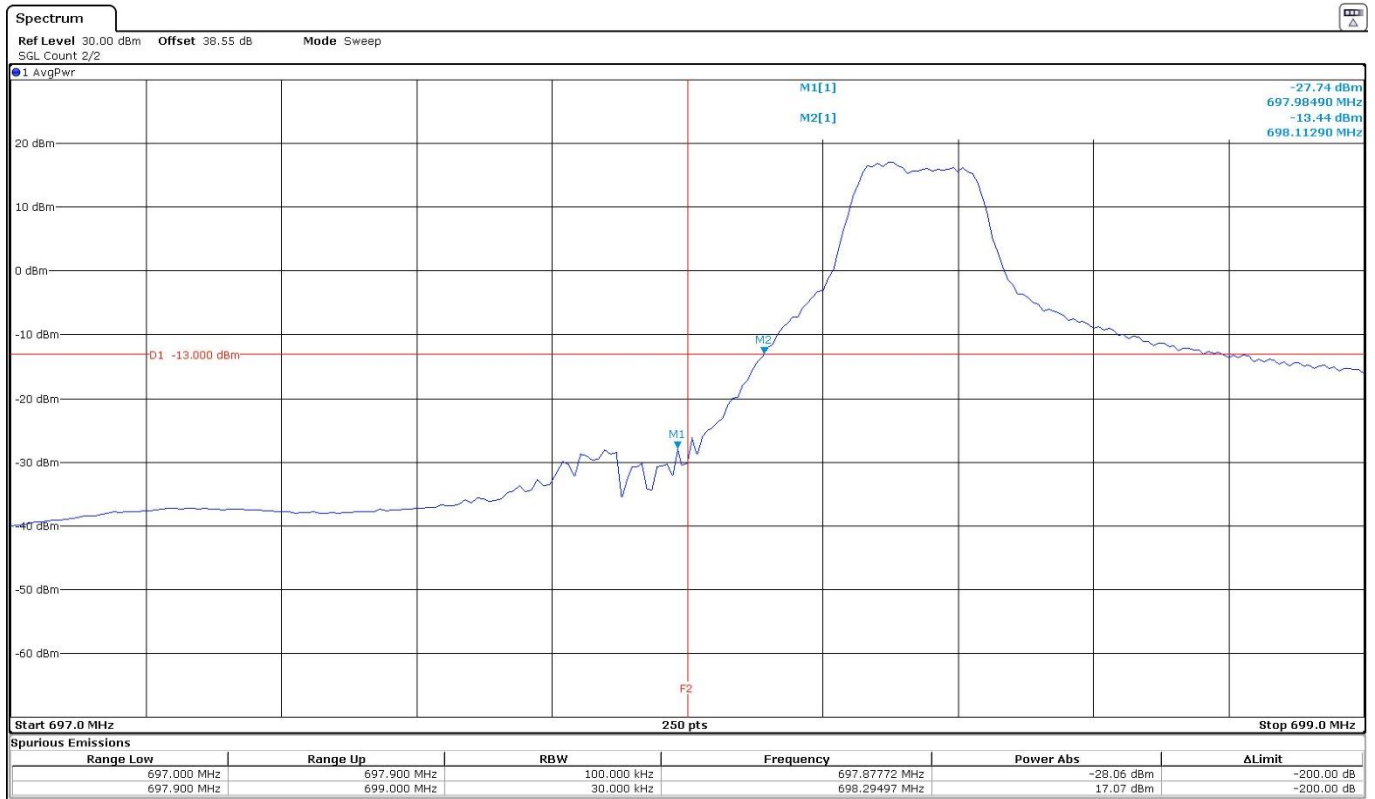
LTE Cat-M1 Band 66. BW=1.4 MHz. QPSK. RB=All. Offset=0. Narrowband=Max. High Block Edge:



The equipment transmits at the maximum output power

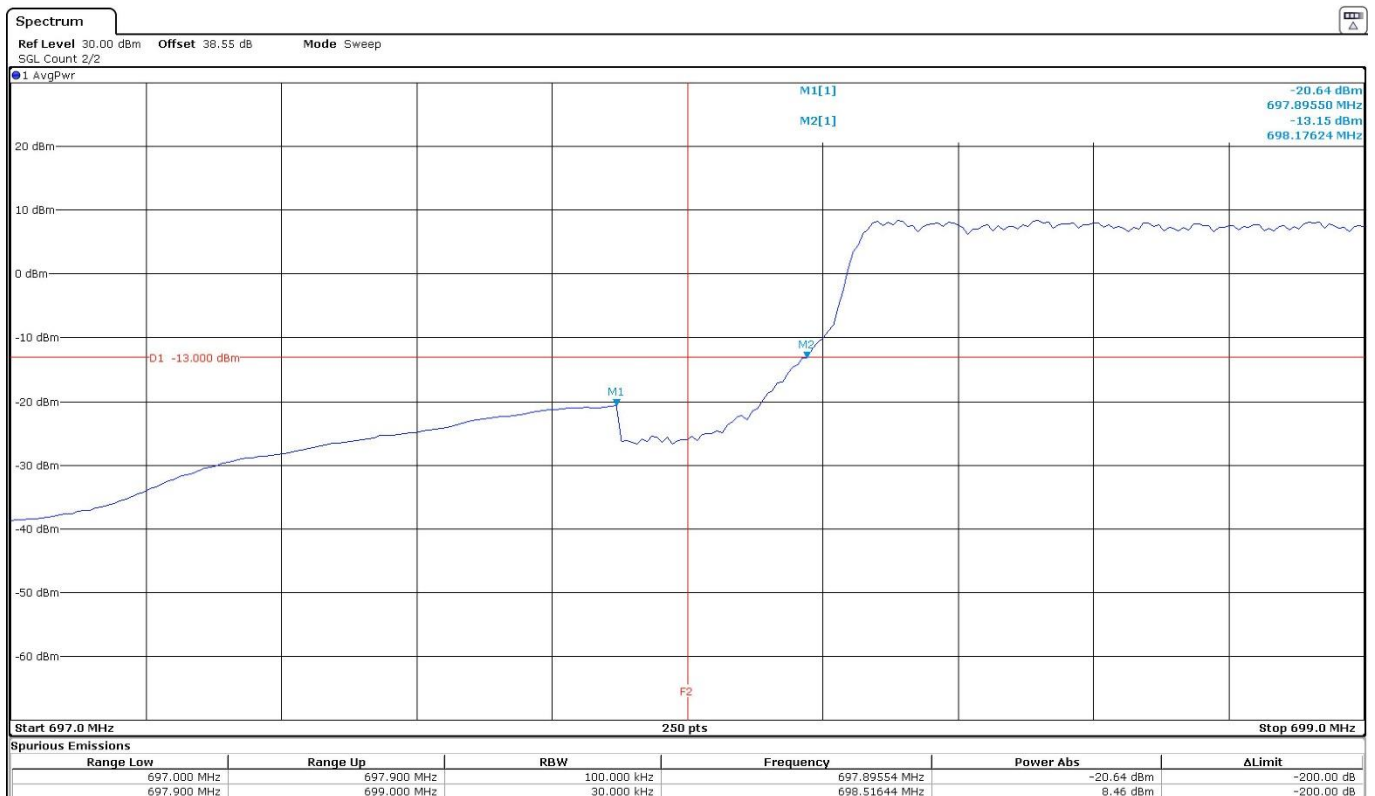
LTE Cat-M1 Band 85:

LTE Cat-M1 Band 85. BW=5 MHz. QPSK. RB=1. Offset=0. Narrowband=0. Low Block Edge:



The equipment transmits at the maximum output power

LTE Cat-M1 Band 85. BW=5 MHz. QPSK. RB=All. Offset=0. Narrowband=0. Low Block Edge:



The equipment transmits at the maximum output power

Radiated Emissions

Limits

1. LTE Cat-M1 Band 8. FCC §27.1509 (a).

FCC §27.1509:

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:

(a) For 900 MHz broadband operations in 897.5–900.5 MHz band by at least $43 + 10 \log (P)$ dB.

2. LTE Cat-M1 Band 13. FCC §2.1053 & §27.53 (c) (2) (4) & (f) / RSS-130 Issue 2 Clause 4.7.1. & 4.7.2.

FCC §27.53 (c) (2) (4) & (f):

(c) (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.

(c) (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.

(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 (-40 dBm)/MHz equivalent isotropically radiated power (EIRP) for wideband signals. and -80 dBW (-50 dBm) 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 Issue 2 Clause 4.7.1 and 4.7.2:

4.7.1. The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power. P (dBW). by at least $43 + 10 \log_{10} p$ (watts). dB. However. in the 100 kHz band immediately outside the equipment's operating frequency range. a resolution bandwidth of 30 kHz may be employed.

4.7.2. 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. $76 + 10 \log_{10} p$ (watts). dB. for base and fixed equipment and

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

b. the e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW (-40 dBm) /MHz for wideband signal and -80 dBW (-50 dBm) for discrete emission with bandwidth less than 700 Hz.

3. LTE Cat-M1 66. FCC §2.1053 & §27.53 (h) / RSS-139 Issue 4 Clause 5.6.

FCC §27.53 (h):

(h) 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.

RSS-139 Issue 4 Clause 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 bandwidth.

4. LTE Cat-M1 Band 85. FCC §2.1053 & §27.53 (g) / RSS-130 Issue 2 Clause 4.7.

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 Issue 2 Clause 4.7:

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. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

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 non-conductive stand at 3-meter distance from the measuring antenna for measurements up to 17 GHz. Measurements above 17 GHz require the distance to be reduced to 1.5 meters.

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 P_o transmitting power, the specified minimum attenuation $43 + 10 \log_{10} p$ (watts) becomes:

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

At P_o transmitting power, the specified minimum attenuation $65 + 10 \log_{10} p$ (watts) becomes:

$$P_o \text{ (dBm)} - [65 + 10 \log(P_o \text{ in mwatts}) - 30] = -35 \text{ dBm}$$

For operation in 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.

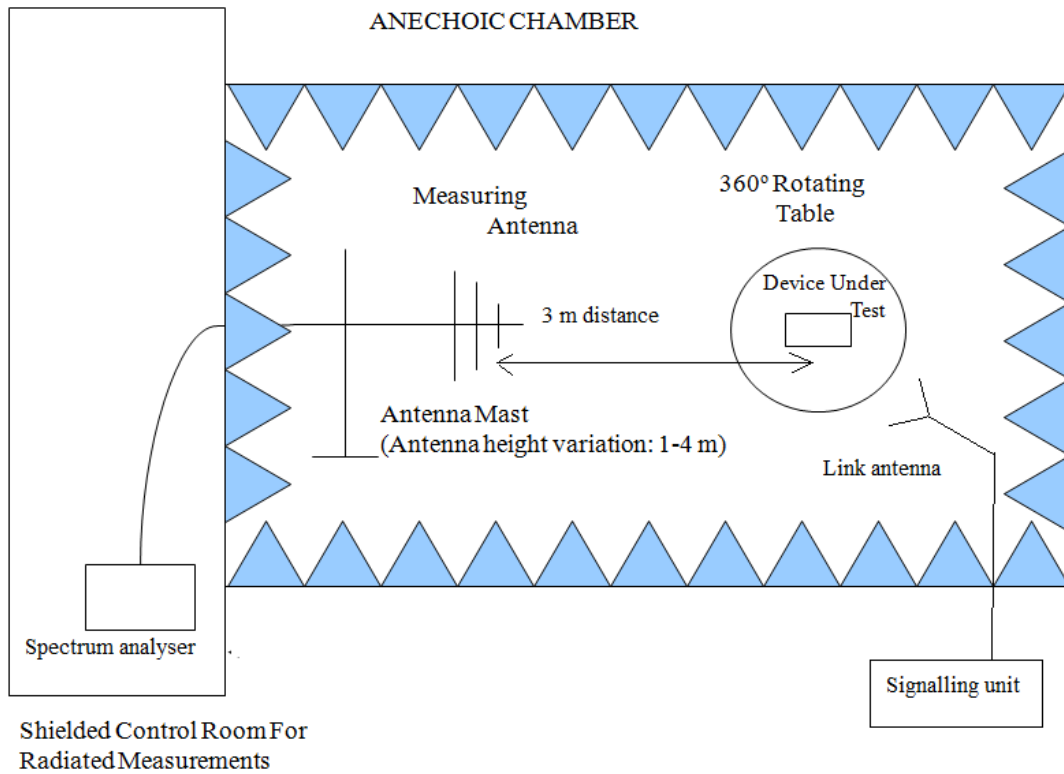
The maximum field strength (dBμV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

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

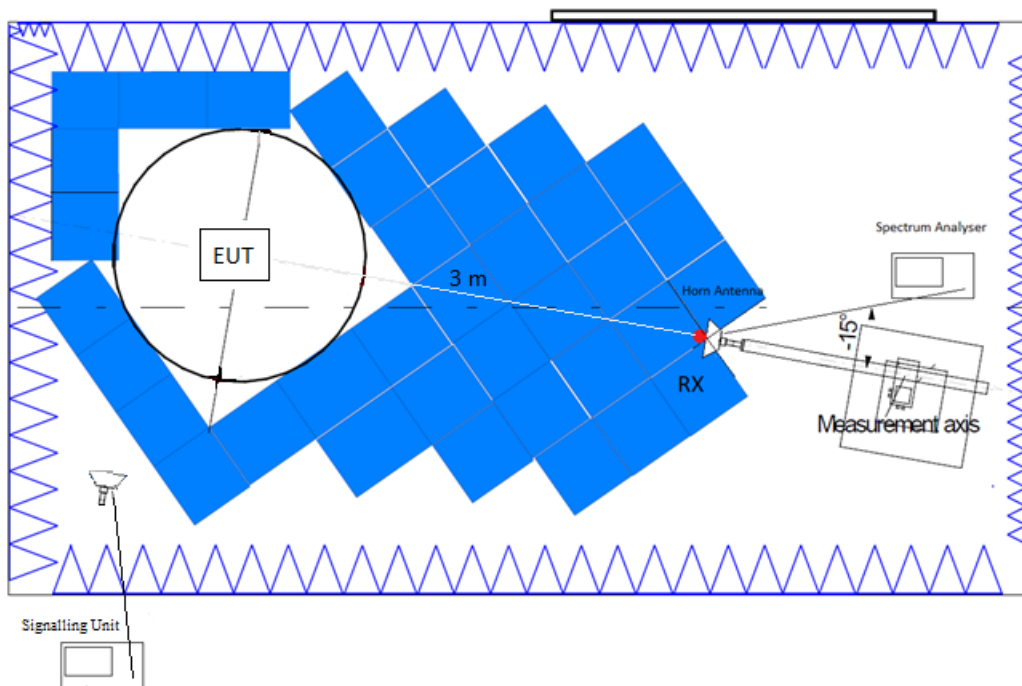
where D is the measurement distance (in the far field region) in m. $D = 3\text{m}$.

Test Setup

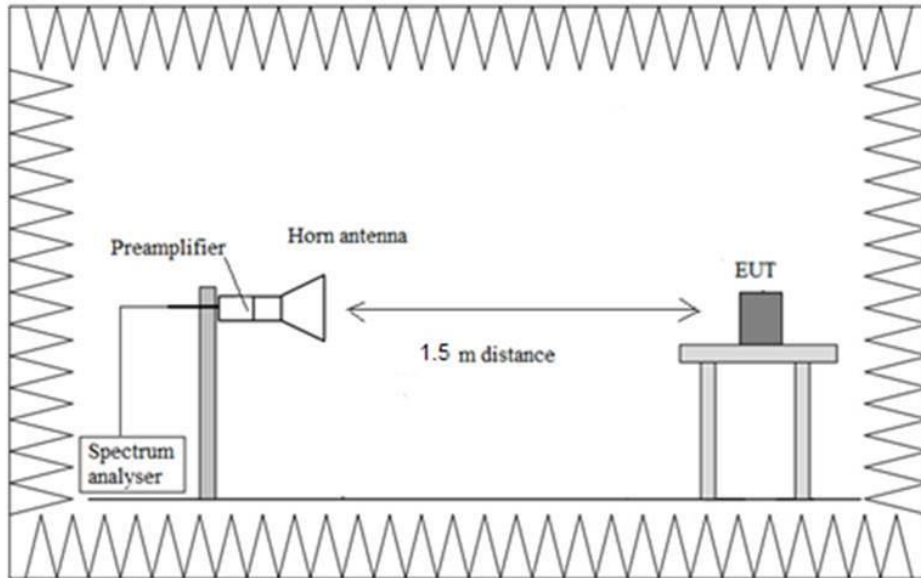
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements above 17 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-M1 Band 8:

A preliminary scan determined the QPSK. BW=1.4 MHz. RB Size=1. RB Offset=2. Narrowband=0 as the worst case. The next results are for this worst-case configuration.

Frequency range 30 MHz - 1 GHz:

- LOW CHANNEL:

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

- HIGH CHANNEL:

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

Frequency range 1 - 10 GHz:

- LOW CHANNEL:

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

- HIGH CHANNEL:

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

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

Verdict

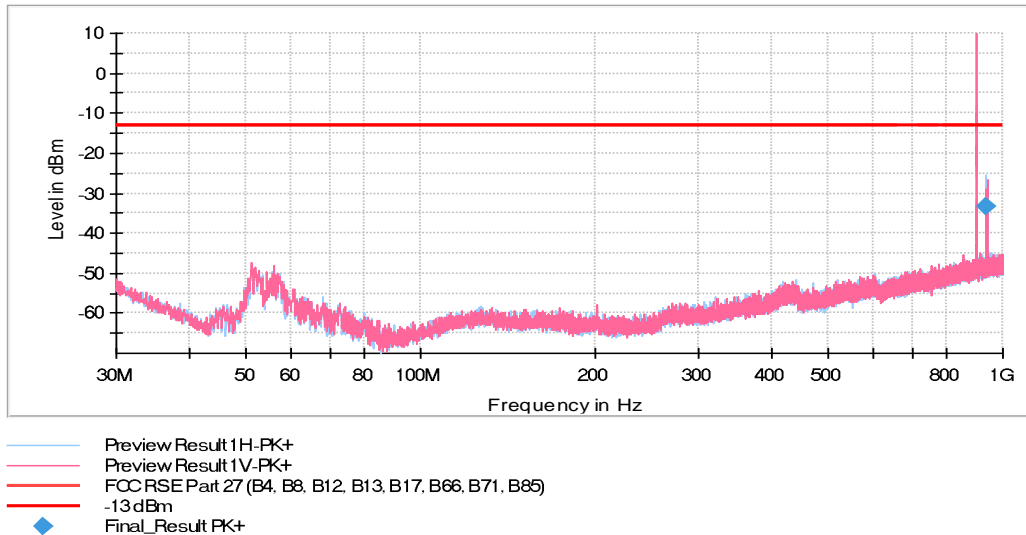
Pass

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	Coupled	0 dB
1 GHz - 10 GHz	281.25 kHz	PK+	100 kHz	1 s	0 dB

LTE Cat-M1 Band 8:

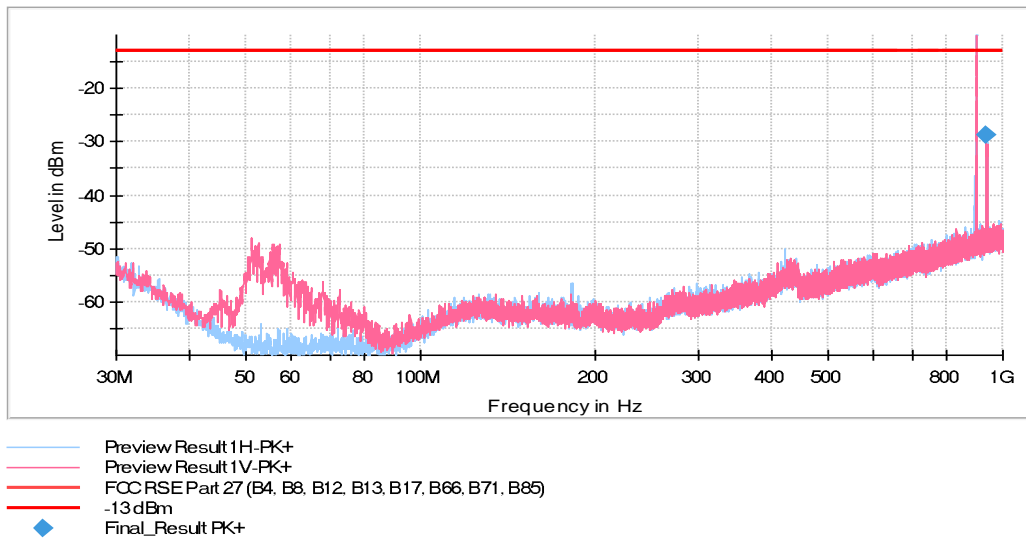
FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



The peak above the limit is the LTE Cat-M1 Band 8 carrier frequency.

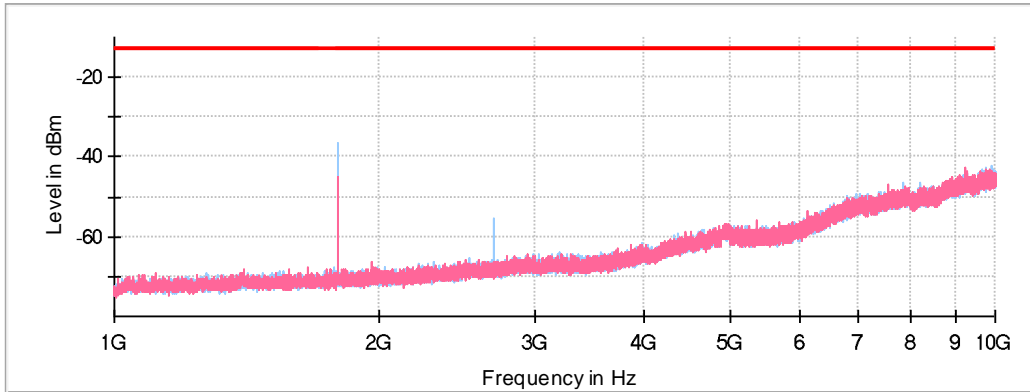
- HIGH CHANNEL:



The peak above the limit is the LTE Cat-M1 Band 8 carrier frequency.

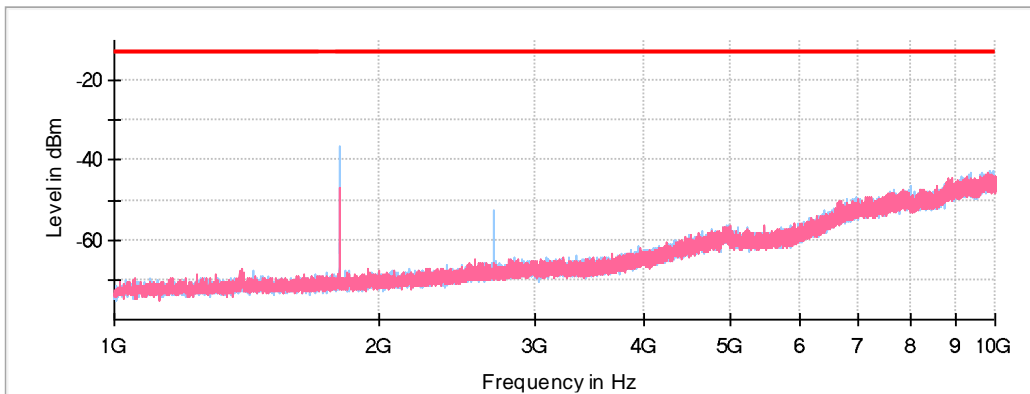
FREQUENCY RANGE 1 GHz - 10 GHz

- LOW CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- 13 dBm
- ◆ Final_Result PK+

- HIGH CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- 13 dBm
- ◆ Final_Result PK+

LTE Cat-M1 Band 13:

A preliminary scan determined the QPSK. BW=5 MHz. RB Size=1. RB Offset=0. Narrowband=0 as the worst case. The next results are for this worst-case configuration.

Frequency range 30 MHz - 1 GHz:

- LOW CHANNEL:

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

- HIGH CHANNEL:

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

Frequency range 1 - 8 GHz:

- LOW CHANNEL:

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

- HIGH CHANNEL:

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
1564.627531	-46.97	H	Peak
1565.838781	-49.95	H	Peak
1565.908906	-50.75	H	Peak
1566.147969	-51.35	H	Peak
1566.189406	-52.98	H	Peak

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

Verdict

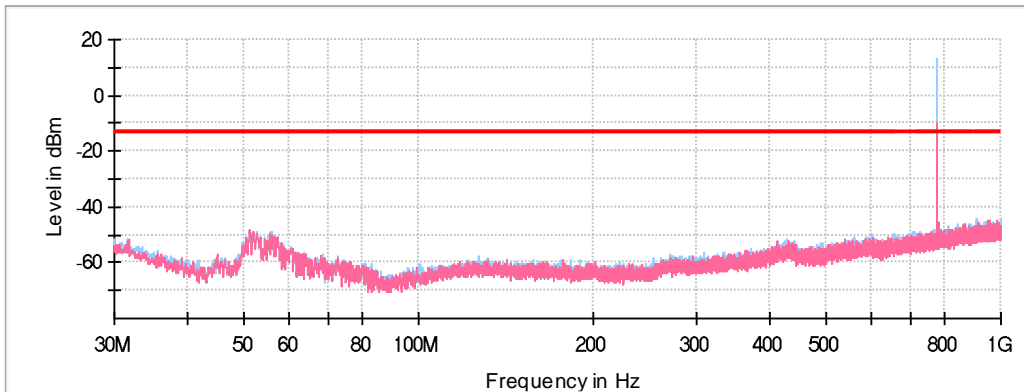
Pass

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	Coupled	0 dB
763 MHz - 806 MHz	1.344 kHz	PK+	6.25 kHz	Coupled	0 dB
1 GHz - 8 GHz	218.75 kHz	PK+	100 kHz	1 s	0 dB
1.559 GHz - 1.61 GHz	1.594 kHz	PK+	1 MHz	1 s	0 dB

LTE Cat-M1 Band 13:

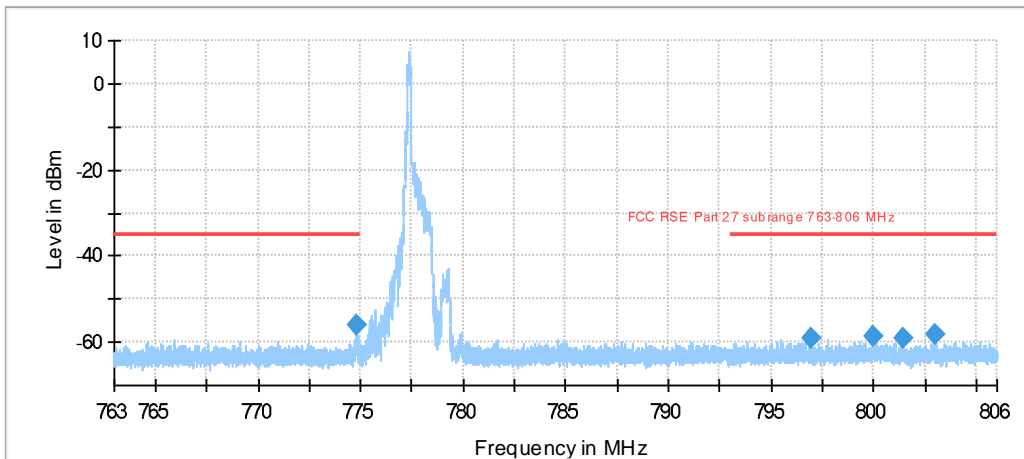
FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



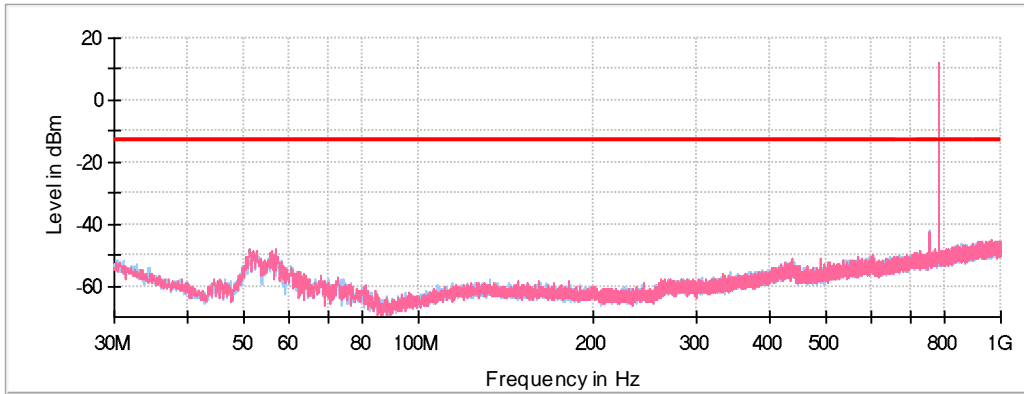
- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCCRSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13dBm
- ◆ Final_Result PK+

The peak above the limit is the carrier frequency.



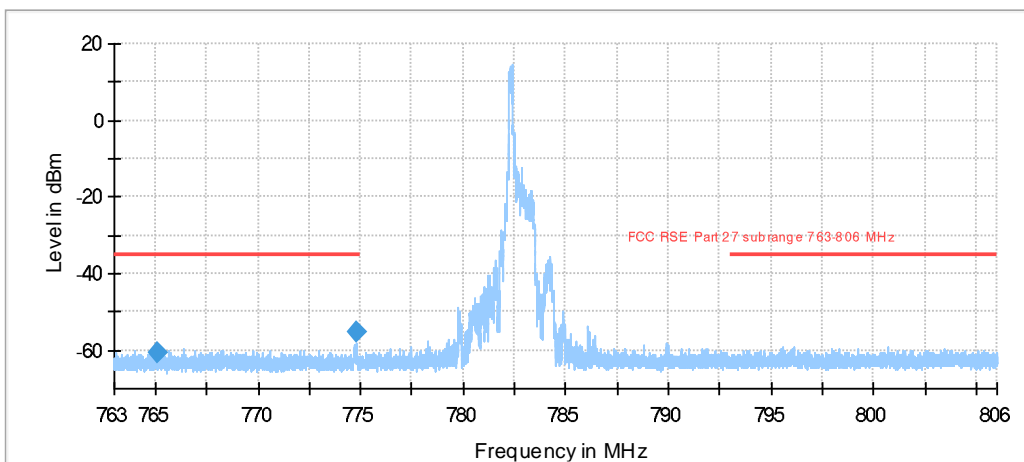
- Preview Result 1-PK+
- FCCRSE Part 27 subrange 763-806 MHz
- ◆ Final_Result PK+

- HIGH CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+

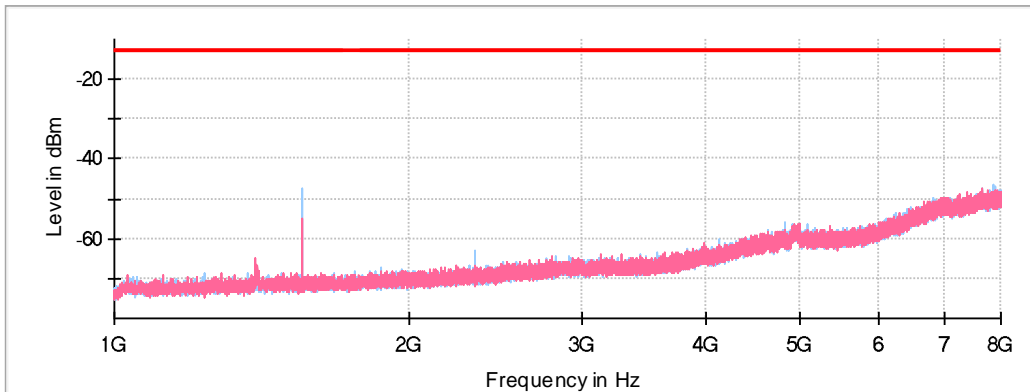
The peak above the limit is the carrier frequency.



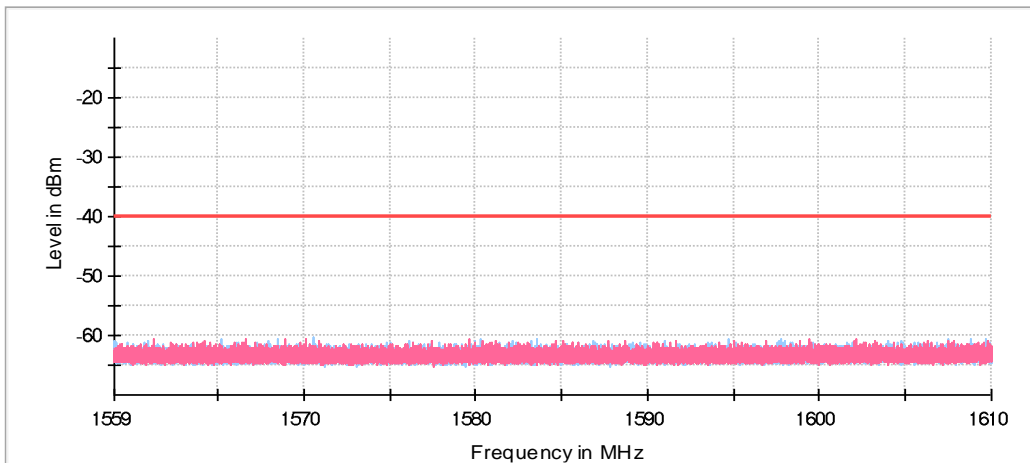
- Preview Result 1-PK+
- FCC RSE Part 27 subrange 763-806 MHz
- ◆ Final_Result PK+

FREQUENCY RANGE 1 - 8 GHz:

- LOW CHANNEL:

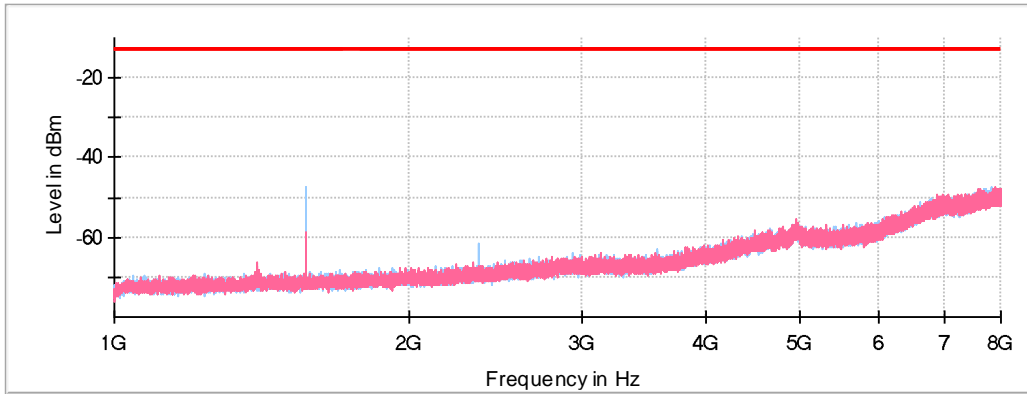


- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13dBm
- ◆ Final_Result PK+

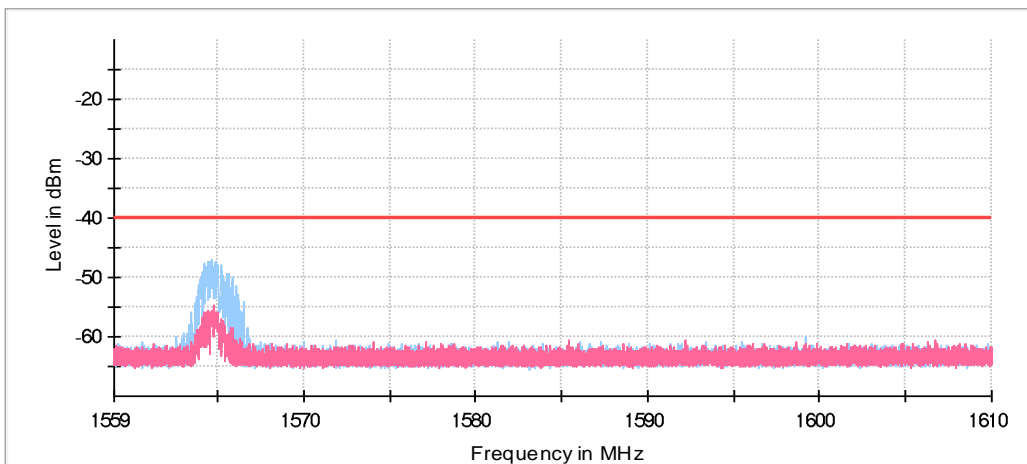


- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27, 90 subrange 1559-1610 MHz
- ◆ Final_Result PK+

- HIGH CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCCRSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13dBm
- ◆ Final_Result PK+



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCCRSE Part 27, 90 subrange 1559-1610 MHz
- ◆ Final_Result PK+

LTE Cat-M1 Band 66:

A preliminary scan determined the QPSK. BW=15 MHz. RB=6. RB Offset=0. Narrowband=0 as the worst-case. The next results are for this worst-case configuration.

Frequency range 30 MHz - 1 GHz:

- LOW CHANNEL:

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

- MIDDLE CHANNEL:

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

- HIGH CHANNEL:

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

Frequency range 1 - 18 GHz:

- LOW CHANNEL:

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

- MIDDLE CHANNEL:

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

- HIGH CHANNEL:

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

Measurement Uncertainty (dB) $< \pm 5.35$ for $f < 1$ GHz
 $< \pm 4.32$ for $f \geq 1$ GHz up to 18 GHz

Verdict

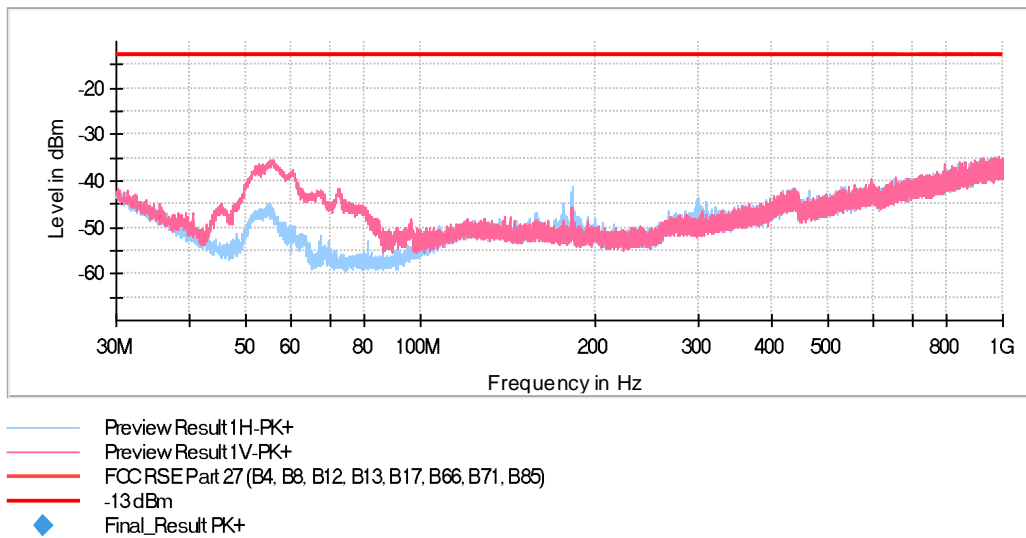
Pass

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	Coupled	0 dB
1 GHz - 3 GHz	62.5 kHz	PK+	1 MHz	1 s	0 dB
3 GHz - 17 GHz	437.5 kHz	PK+	1 MHz	1 s	0 dB
17 GHz - 18 GHz	31.25 kHz	PK+	1 MHz	1 s	0 dB

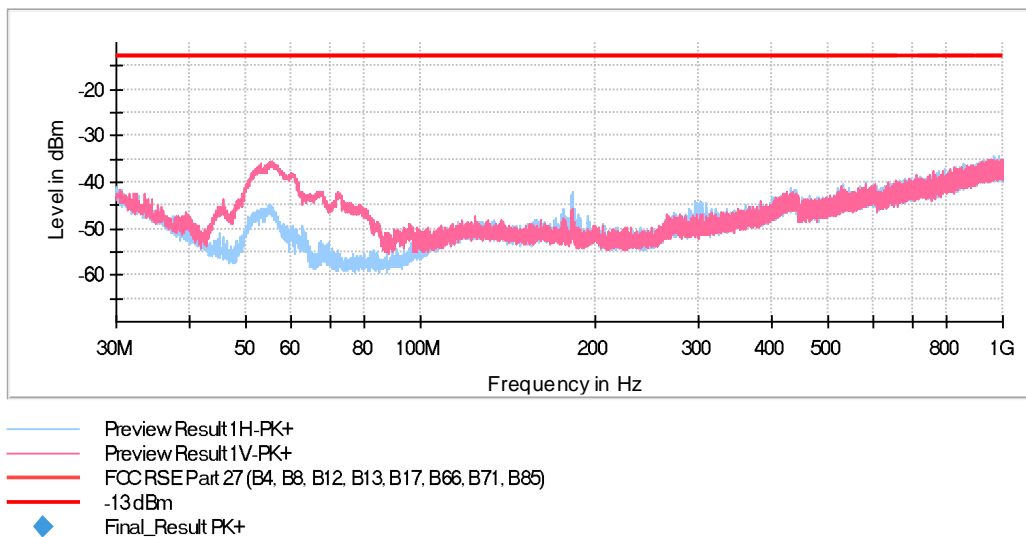
LTE Cat-M1 Band 66:

FREQUENCY RANGE 30 MHz - 1 GHz:

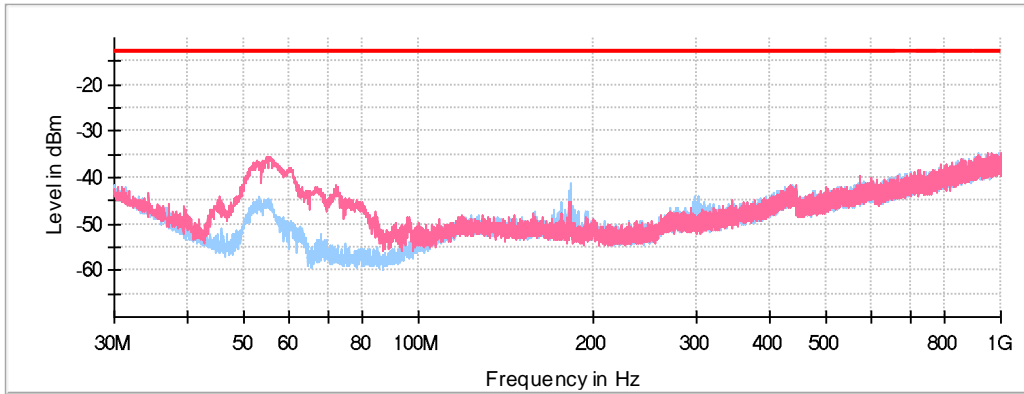
- LOW CHANNEL:



- MIDDLE CHANNEL:



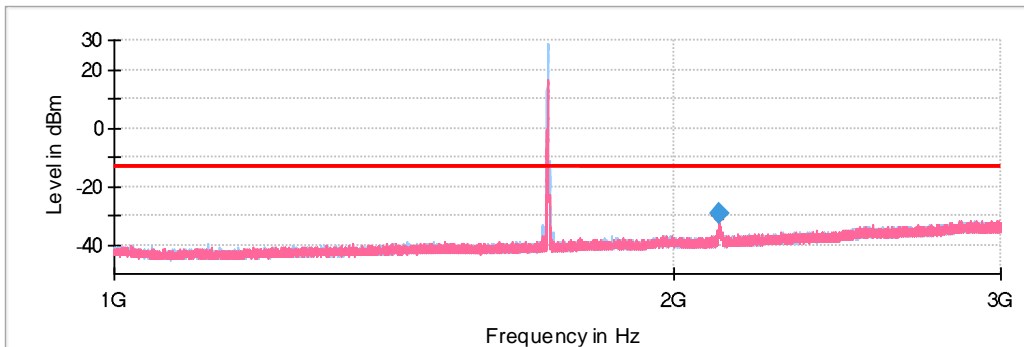
- HIGH CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+

FREQUENCY RANGE 1 - 3 GHz:

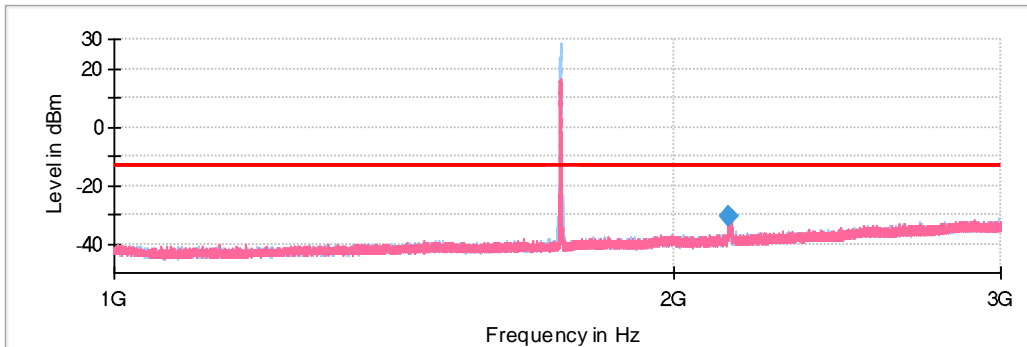
- LOW CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- * Critical_Freqs PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+
- × MaxPeak-PK+(Single)

The higher peak is the carrier frequency.

- MIDDLE CHANNEL:

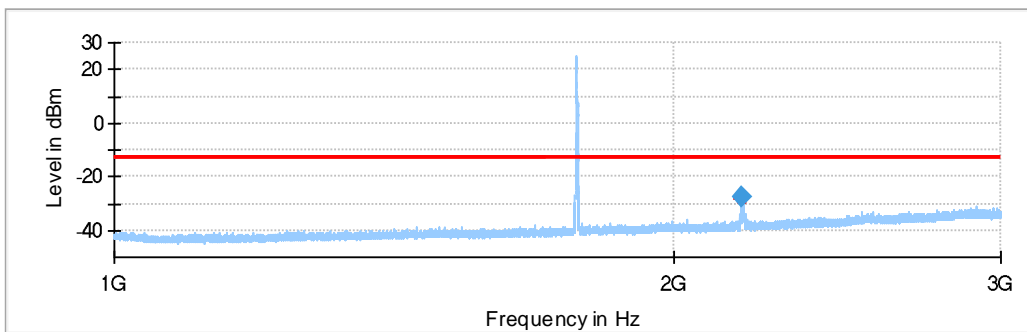


- Preview Result 1H-PK+
- Preview Result 1V-PK+
- * Critical_Freqs PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+
- × MaxPeak-PK+(Single)

The higher peak is the carrier frequency.

- HIGH CHANNEL:

Full Spectrum

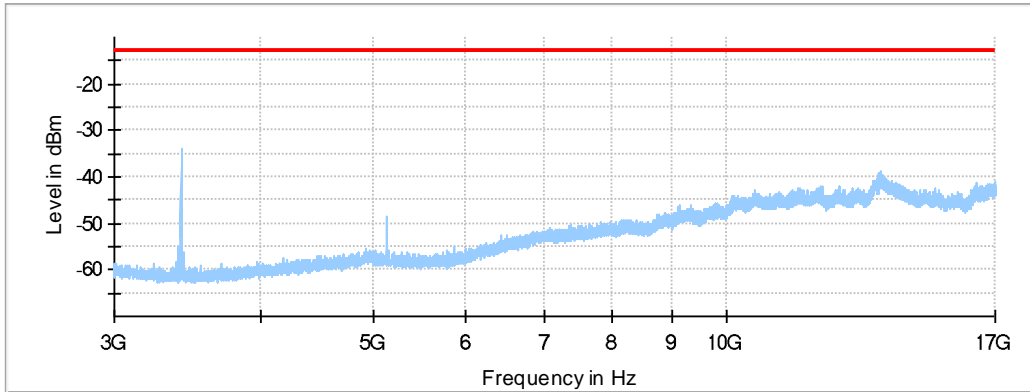


- Preview Result 1-PK+
- * Critical_Freqs PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+

The higher peak is the carrier frequency.

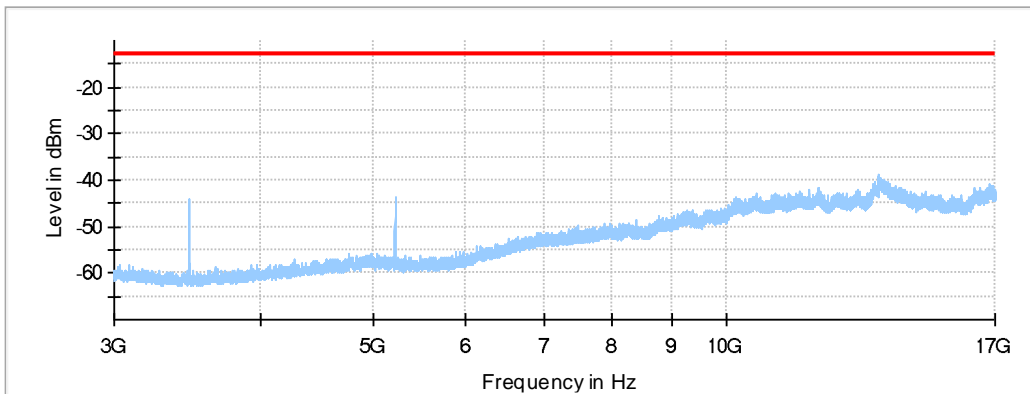
FREQUENCY RANGE 3 - 17 GHz:

- LOW CHANNEL:



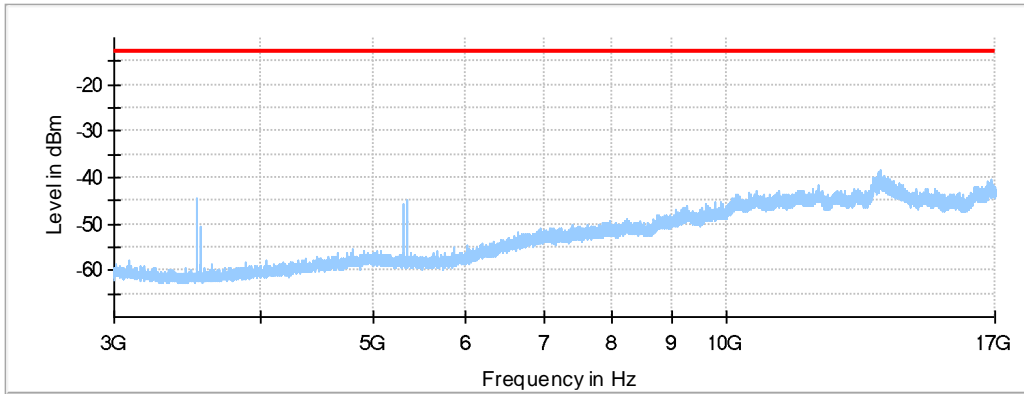
- Preview Result 1-PK+
- * Critical_Freqs PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85) -13 dBm
- ◆ Final_Result PK+

- MIDDLE CHANNEL:



- Preview Result 1-PK+
- * Critical_Freqs PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85) -13 dBm
- ◆ Final_Result PK+

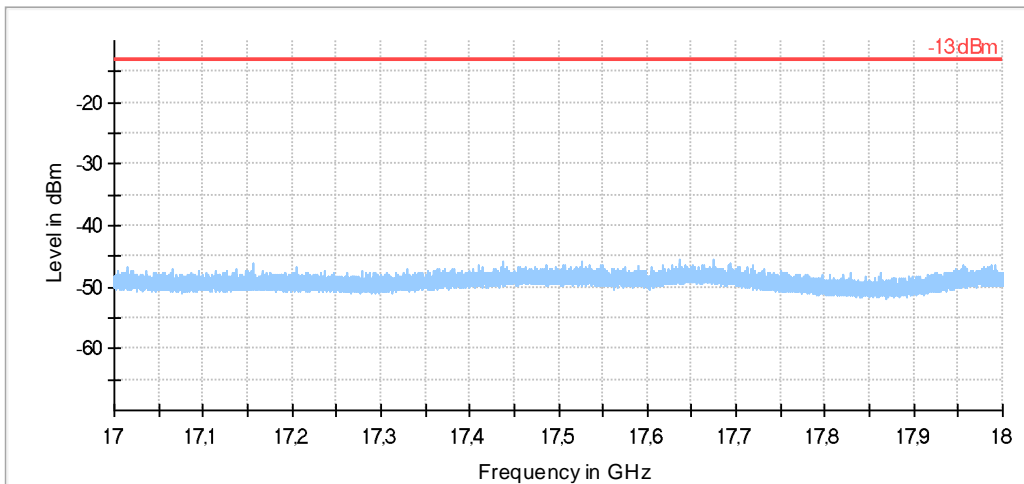
- HIGH CHANNEL:



- Preview Result 1-PK+
- * Critical_Freqs PK+
- FCCRSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- 13dBm
- ◆ Final_Result PK+

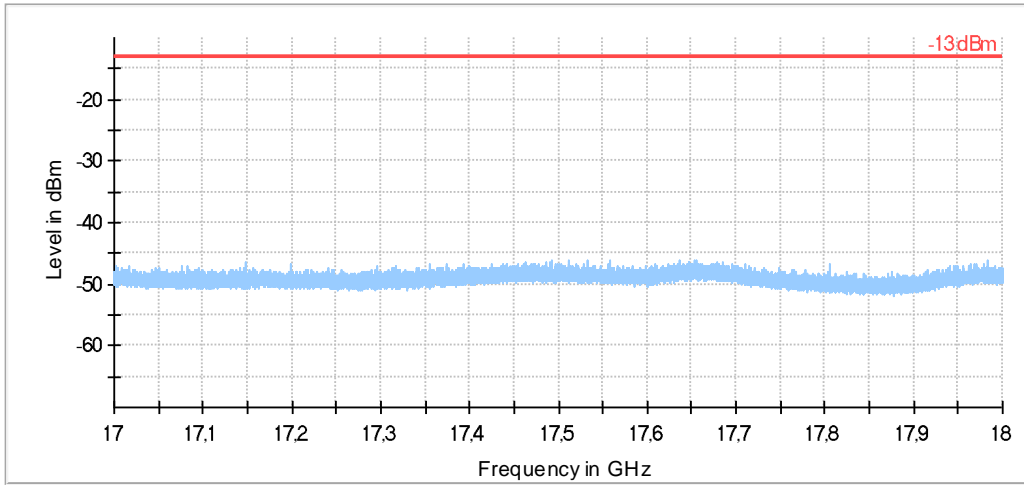
FREQUENCY RANGE 17 - 18 GHz:

- LOW CHANNEL:



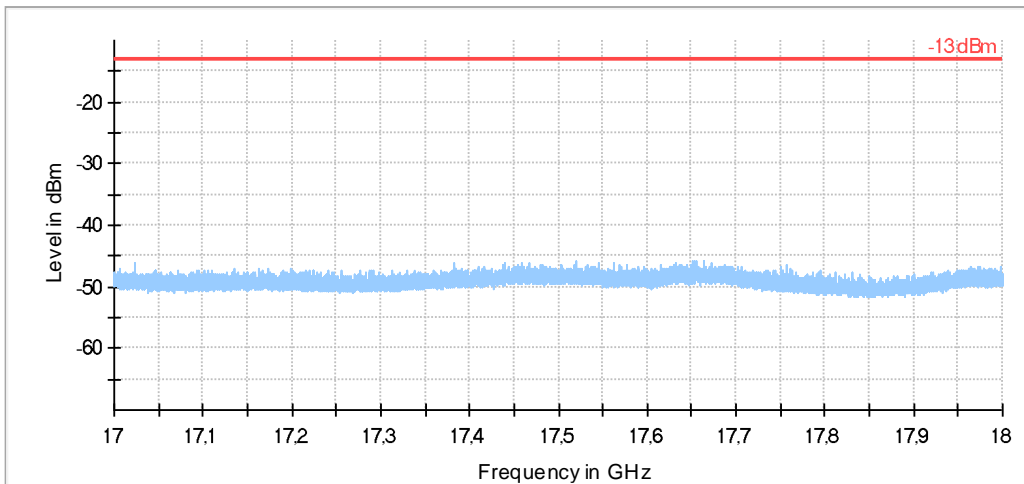
- Preview Result 1-PK+
- 13dBm
- ◆ Final_Result PK+

- MIDDLE CHANNEL:



Preview Result 1-PK+ -13dBm ◆ Final_Result PK+

- HIGH CHANNEL:



Preview Result 1-PK+ -13dBm ◆ Final_Result PK+

LTE Cat-M1 Band 85:

A preliminary scan determined the QPSK. BW=5 MHz. RB Size=1. RB Offset=2. Narrowband=1 as the worst case. The next results are for this worst-case configuration.

Frequency range 30 MHz - 1 GHz:

- LOW CHANNEL:

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

- MIDDLE CHANNEL:

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

- HIGH CHANNEL:

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

Frequency range 1 - 8 GHz:

- LOW CHANNEL:

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

- MIDDLE CHANNEL:

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

- HIGH CHANNEL:

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

Measurement uncertainty (dB) $< \pm 5.35$ for $f < 1$ GHz
 $< \pm 4.32$ for $f \geq 1$ GHz up to 8 GHz

Verdict

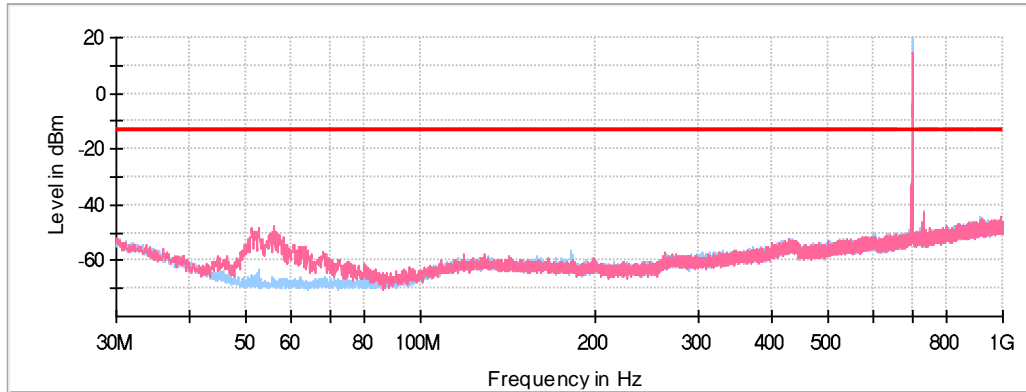
Pass

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	Coupled	0 dB
1 GHz - 8.5 GHz	234.375 kHz	PK+	100 kHz	1 s	0 dB

LTE Cat-M1 Band 85:

FREQUENCY RANGE 30 MHz - 1 GHz:

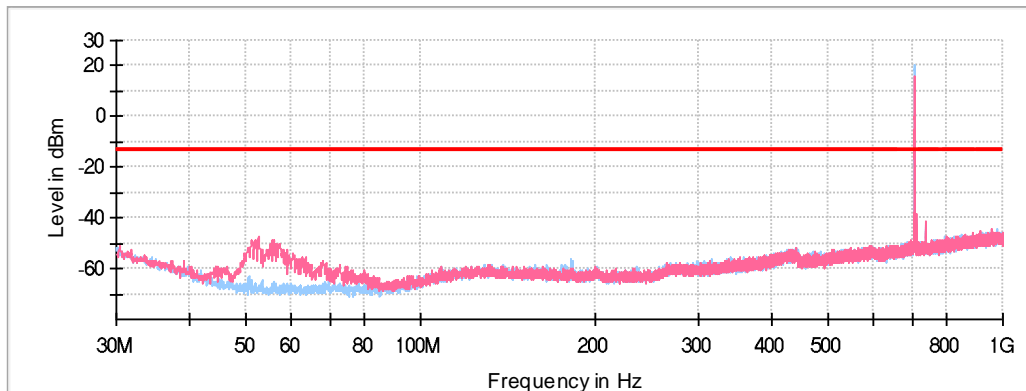
- LOW CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+

The peak above the limit is the LTE Cat-M1 Band 85 carrier frequency.

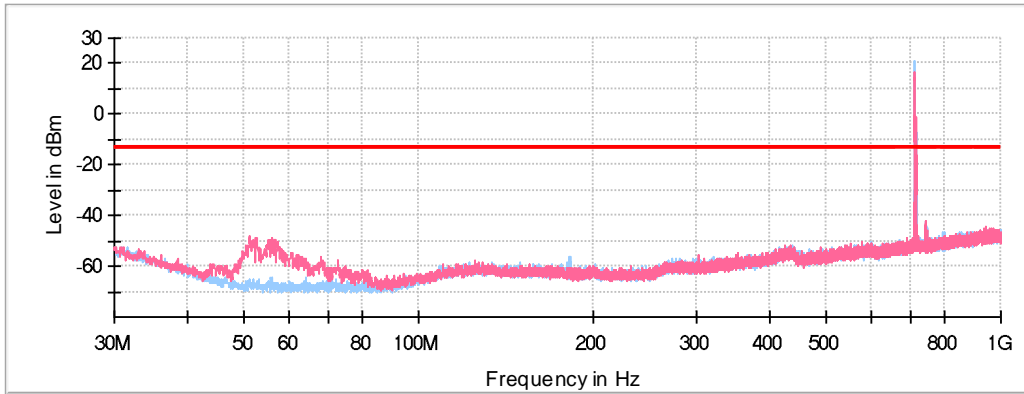
- MIDDLE CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+

The peak above the limit is the LTE Cat-M1 Band 85 carrier frequency.

- HIGH CHANNEL:

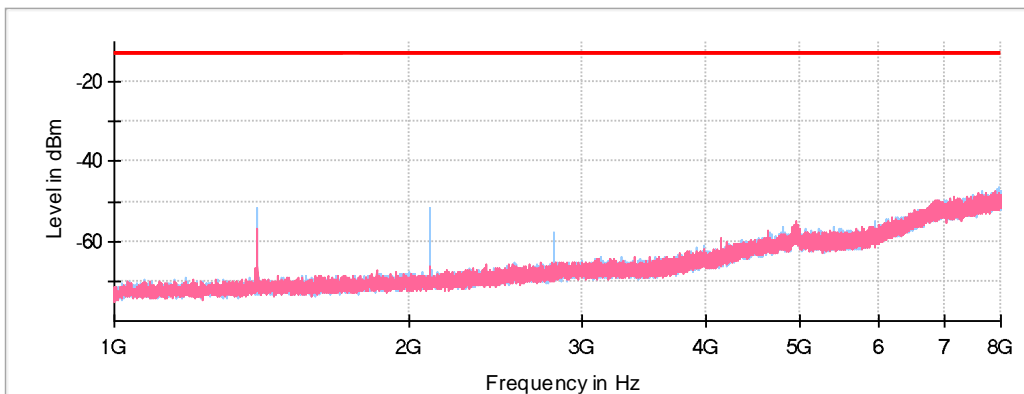


- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCCRSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+

The peak above the limit is the LTE Cat-M1 Band 85 carrier frequency.

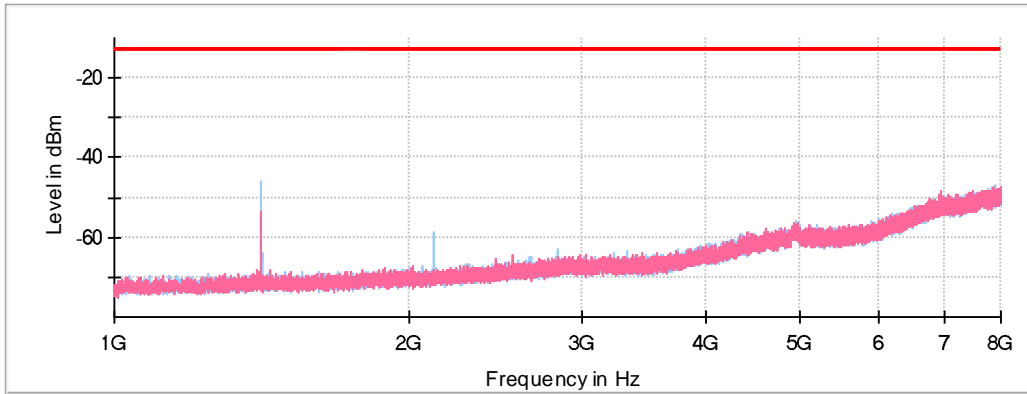
FREQUENCY RANGE 1 GHz - 8 GHz

- LOW CHANNEL:



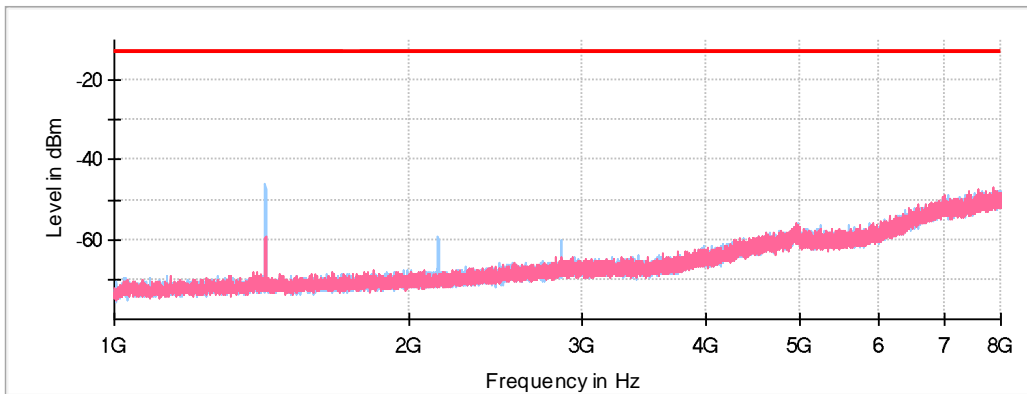
- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCCRSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- -13 dBm
- ◆ Final_Result PK+

- MIDDLE CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- 13 dBm
- Final_Result PK+

- HIGH CHANNEL:



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC RSE Part 27 (B4, B8, B12, B13, B17, B66, B71, B85)
- 13 dBm
- Final_Result PK+

Appendix B: Test results for FCC 27 / RSS-130. RSS-139: LTE Cat NB2 Bands 4, 8, 12, 13, 17, 66, 85

INDEX

TEST CONDITIONS	114
RF Output Power	117
Frequency Stability	126
Modulation Characteristics	141
Occupied Bandwidth	144
Spurious emissions at antenna terminals	157
Spurious emissions at antenna terminals at Block Edges	210
Radiated emissions.....	227

TEST CONDITIONS

(*): Data provided by the Applicant.

POWER SUPPLY (*):

Vnormal: 3.8 Vdc.
 Vminimum: 3 Vdc
 Vmaximum: 5 Vdc
 Type of Power Supply: Internal DC.

ANTENNA (*):

Low Bands	Gain (dBi)	Type of Antenna
LTE NB2 8	+2.70	SMD
LTE NB2 12	+1.56	SMD
LTE NB2 13	+1.56	SMD
LTE NB2 17	+1.56	SMD
LTE NB2 85	+1.56	SMD
High Bands	Gain (dBi)	Type
LTE NB2 4	+3.0	SMD
LTE NB2 66	+3.0	SMD

TEST FREQUENCIES:

LTE Cat NB2 Band 4. Pi/2-BPSK. Pi/4-QPSK. QPSK modulations:

Channel. Number (Frequency. MHz)		
Low	Middle	High
19952 (1710.2)*	20175 (1732.5)	20398 (1754.8)*
*The outermost channel which is in compliance with Block edge testing.		

NOTE: LTE Cat NB2 Band 4 is completely included in LTE Cat NB2 Band 66, so the channels of LTE Cat NB2 Band 66 were tested to give conformity to the assigned block.

LTE Cat NB2 Band 8. Pi/2-BPSK. Pi/4-QPSK. QPSK modulations:

Channel (Frequency. MHz)		
Low	Middle	High
21628 (897.80)*	21640 (899)	21652 (900.20)*
*The outermost channel which is in compliance with Block edge testing.		

LTE Cat NB2 Band 12. Pi/2-BPSK. Pi/4-QPSK. QPSK modulations:

Channel. Number (Frequency. MHz)		
Low	Middle	High
23012 (699.20)*	23095 (707.5)	23179 (715.8)*
*The outermost channel which is in compliance with Block edge testing.		

NOTE: LTE Cat NB2 Band 12 is completely included in LTE Cat NB2 Band 85, so the channels of LTE Cat NB2 Band 85 were tested to give conformity to the assigned block.

LTE Cat NB2 Band 13. Pi/2-BPSK. Pi/4-QPSK. QPSK modulations:

Channel (Frequency. MHz)		
Low	Middle	High
23182 (777.20)*	23230 (782)	23278 (786.80)*
*The outermost channel which is in compliance with Block edge testing.		

LTE Cat NB2 Band 17. Pi/2-BPSK. Pi/4-QPSK. QPSK modulations:

Channel. Number (Frequency. MHz)		
Low	Middle	High
23732 (704.20)*	23790 (710)	23848 (715.80)*
*The outermost channel which is in compliance with Block edge testing.		

NOTE: LTE Cat NB2 Band 17 is completely included in LTE Cat NB2 Band 85, so the channels of LTE Cat NB2 Band 85 were tested to give conformity to the assigned block.

LTE Cat NB2 Band 66. Pi/2-BPSK. Pi/4-QPSK. QPSK modulations:

Channel (Frequency. MHz)		
Low	Middle	High
131974 (1710.2)	132322 (1745)	132670 (1779.8)
*The outermost channel which is in compliance with Block edge testing.		

LTE Cat NB2 Band 85. Pi/2-BPSK. Pi/4-QPSK. QPSK modulations:

Channel (Frequency. MHz)		
Low	Middle	High
134004 (698.2)*	134092 (707)	134180 (715.8)*
*The outermost channel which is in compliance with Block edge testing.		

RF Output Power

Limits

1. LTE Cat NB2 Band 8. FCC §27.1507 (a) & (d).

FCC §27.1507 (a) & (d):

(a) *Maximum ERP.* The power limits specified in this section are applicable to operations in areas more than 110 km (68.4 miles) from the U.S./Mexico border and 140 km (87 miles) from the U.S./Canada border.

(3) *Mobile, control and auxiliary test stations.* Mobile, control and auxiliary test stations must not exceed 10 watts ERP.

(4) *Portable stations.* Portable stations must not exceed 3 watts ERP.

(d) *PAR limit.* The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

2. LTE Cat NB2 Band 13. FCC §27.50 (b) (10) / RSS-130 4.6.

FCC §27.50 (b) (10):

Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

RSS-130 4.6:

4.6.1 General

The transmitter output power shall be measured in terms of average power. In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the High PAPR during periods of continuous transmission.

4.6.3 Frequency bands 698-756 MHz and 777-787 MHz

The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

3. LTE Cat NB2 Band 66. FCC §27.50 (d) / RSS-139 5.5.

FCC §27.50 (d):

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

(5) In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

RSS-139 Clause 5.5:

The maximum output power of the equipment shall comply with the limits specified below. In the tables, maximum power refers to the equivalent isotropically radiated power (e.i.r.p.) or total radiated power (TRP), measured in terms of average values.

The limits in this RSS are specified for the purpose of certification and may not apply to all deployment scenarios. Consult SRSP-513 and SRSP-519 for more details on the bands 2110-2180 MHz and 2180-2200 MHz respectively.

Table 3: Maximum power of equipment in the band 1710-1780 MHz	
Equipment type	Maximum power
Fixed station and base station	30 dBm e.i.r.p./channel bandwidth
Subscriber equipment	30 dBm e.i.r.p./channel bandwidth

Table 4: Maximum power of equipment in the band 2110-2180 MHz	
Equipment type	Maximum power
Non-AAS fixed station and base station	65 dBm e.i.r.p./MHz
AAS fixed station and base station	46 dBm TRP/MHz
Subscriber equipment	30 dBm e.i.r.p./channel bandwidth

Table 5: Maximum power of equipment in the band 2180-2200 MHz	
Equipment type	Maximum power
Non-AAS base station	65 dBm e.i.r.p./MHz
AAS base station	46 dBm TRP/MHz

In addition, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

4. LTE Cat NB2 Band 85. FCC §27.50 (c) (10) / RSS-130 4.6.

FCC §27.50 (c) (10):

Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band. and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

RSS-130 4.6:

4.6.1 General

The transmitter output power shall be measured in terms of average power. In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the High PAPR during periods of continuous transmission.

4.6.3 Frequency bands 698-756 MHz and 777-787 MHz

The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

Method

The conducted RF output power measurements were made at the RF output terminals of the EUT using the power meter of the Universal Radio Communication tester CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

The peak-to-average power ratio (PAPR) is measured using an attenuator, power splitter and spectrum analyser with a Complementary Cumulative Distribution Function implemented.

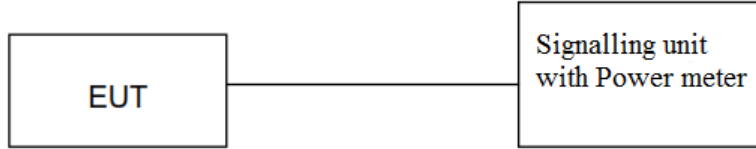
The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

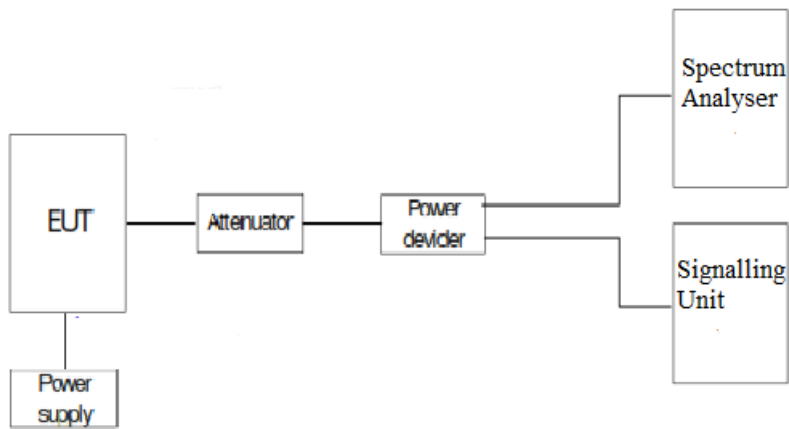
$$E.R.P. = E.I.R.P. - 2.15 \text{ dB}$$

Test Setup

1. CONDUCTED AVERAGE POWER:



2. PEAK-TO-AVERAGE POWER RATIO (PAPR) and Conducted Average power:



Results

1. CONDUCTED AVERAGE POWER

LTE Cat NB2 Band 8:

Worst-case of RF Power is Low Channel. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=11. MSC/TBS=3.

CHANNEL	FREQUENCY (MHz)	MODULATION	BW	Tone Number	Tone Offset (Start SubCarrier)	MSC / TBS	AVERAGE POWER (dBm)
Low 21627	897.7 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	22.31
				1	47	0	22.23
			15 kHz	1	0	0	22.29
				1	11	0	22.27
		Pi/4-QPSK	3.75 kHz	1	0	3	22.14
				1	47	3	22.27
			15 kHz	1	0	3	22.29
				1	11	3	22.32
		QPSK	15 kHz	3	0	5	22.13
				3	9	5	22.11
				6	0	5	21.31
				6	6	5	21.34
			12	0	5	20.29	
High 21653	900.3 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	22.28
				1	47	0	22.2
			15 kHz	1	0	0	22.27
				1	11	0	22.22
		Pi/4-QPSK	3.75 kHz	1	0	3	22.2
				1	47	3	22.18
			15 kHz	1	0	3	22.24
				1	11	3	22.25
		QPSK	15 kHz	3	0	5	22.09
				3	9	5	22.08
				6	0	5	21.27
				6	6	5	21.32
			12	0	5	20.26	

MAX POWER	COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG. EIRP (dBm)	RAD. POWER AVG. ERP (dBm)
LOW	22.32	2.70	25.02	22.87
HIGH	22.28	2.70	24.98	22.83
MAX:	22.32		25.02	22.87