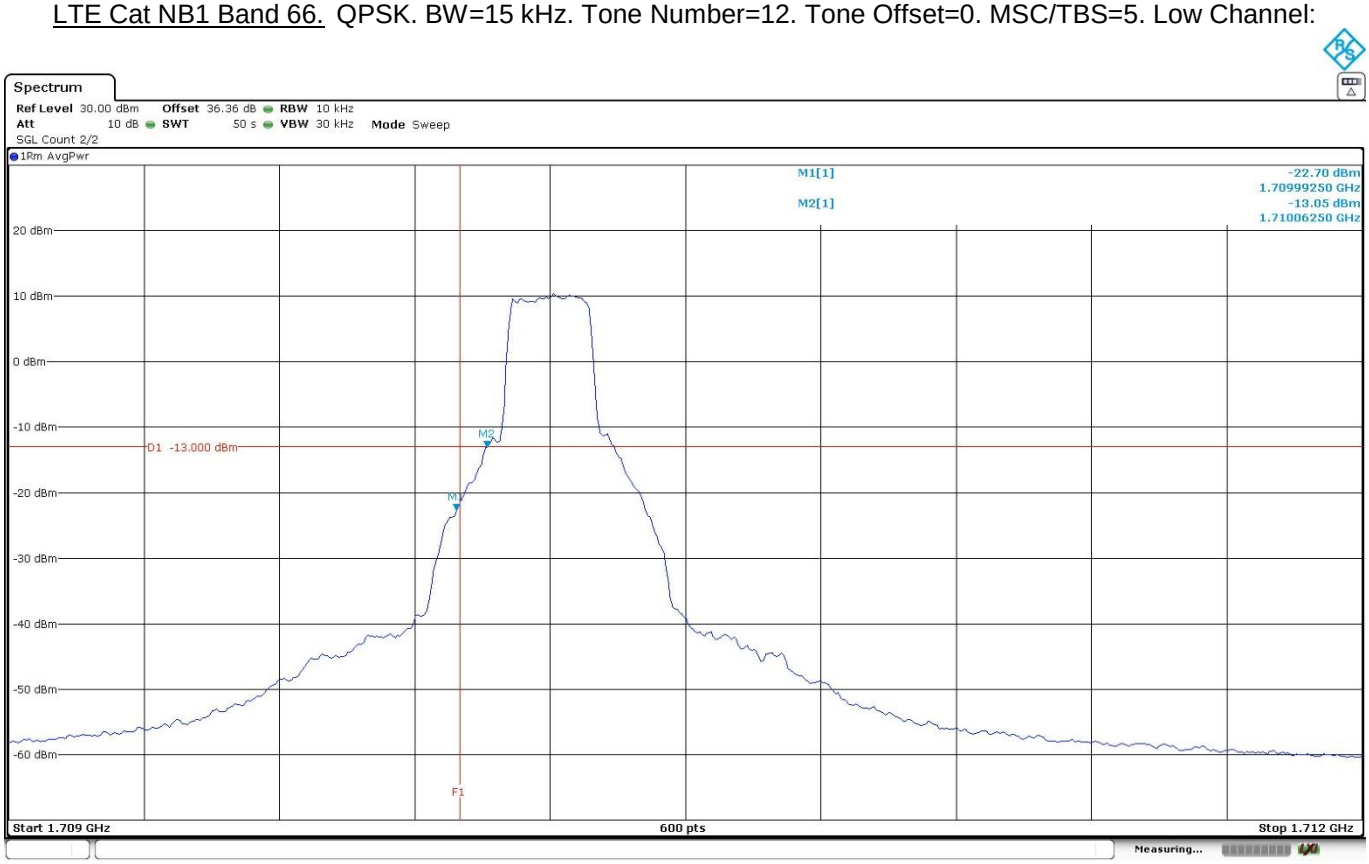
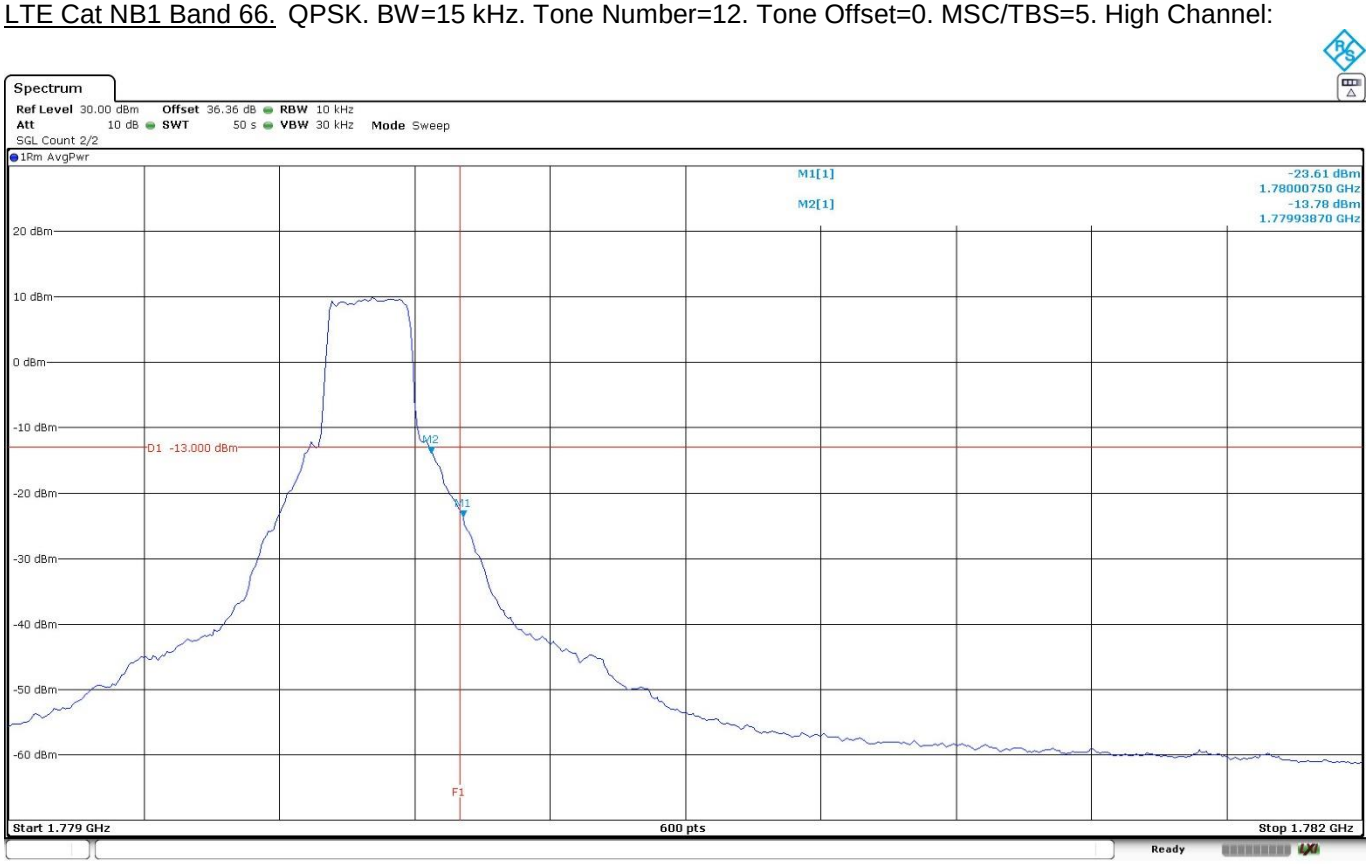
LTE Cat NB1 Band 66. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5. Low Channel:



The equipment transmits at the maximum output power.

LTE Cat NB1 Band 66. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5. High Channel:



The equipment transmits at the maximum output power.

LTE Cat NB1 Band 85:

Preliminary measurements determined the worst-case. Results attached are for this worst-case configuration.

LTE Cat NB1 Band 85	Pi/4-QPSK BW=3.75 kHz Tone Number=1 Tone Offset=0 MSC/TBS=3	Pi/4-QPSK BW=15 kHz Tone Number=1 Tone Offset=0 MSC/TBS=3	QPSK BW=15 kHz Tone Number=12 Tone Offset=0 MSC/TBS=5
Maximum measured level at Low Block Edge at antenna port (dBm)	-19.87	-19.88	-20.02

LTE Cat NB1 Band 85	Pi/4-QPSK BW=3.75 kHz Tone Number=1 Tone Offset=47 MSC/TBS=3	Pi/4-QPSK BW=15 kHz Tone Number=1 Tone Offset=11 MSC/TBS=3	QPSK BW=15 kHz Tone Number=12 Tone Offset=0 MSC/TBS=5
Maximum measured level at High Block Edge at antenna port (dBm)	-19.46	-19.71	-19.44

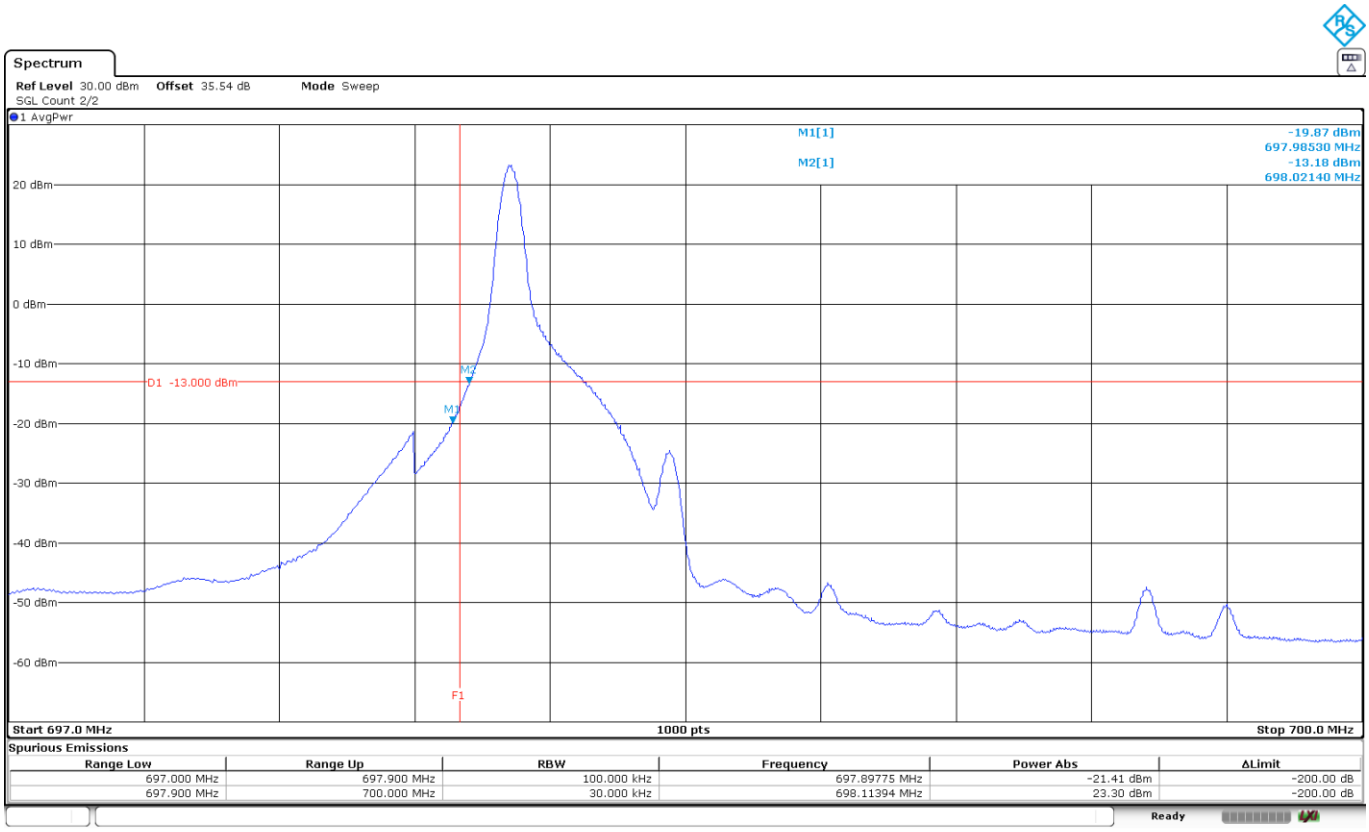
Measurement uncertainty (dB): <±2.76

Verdict

Pass

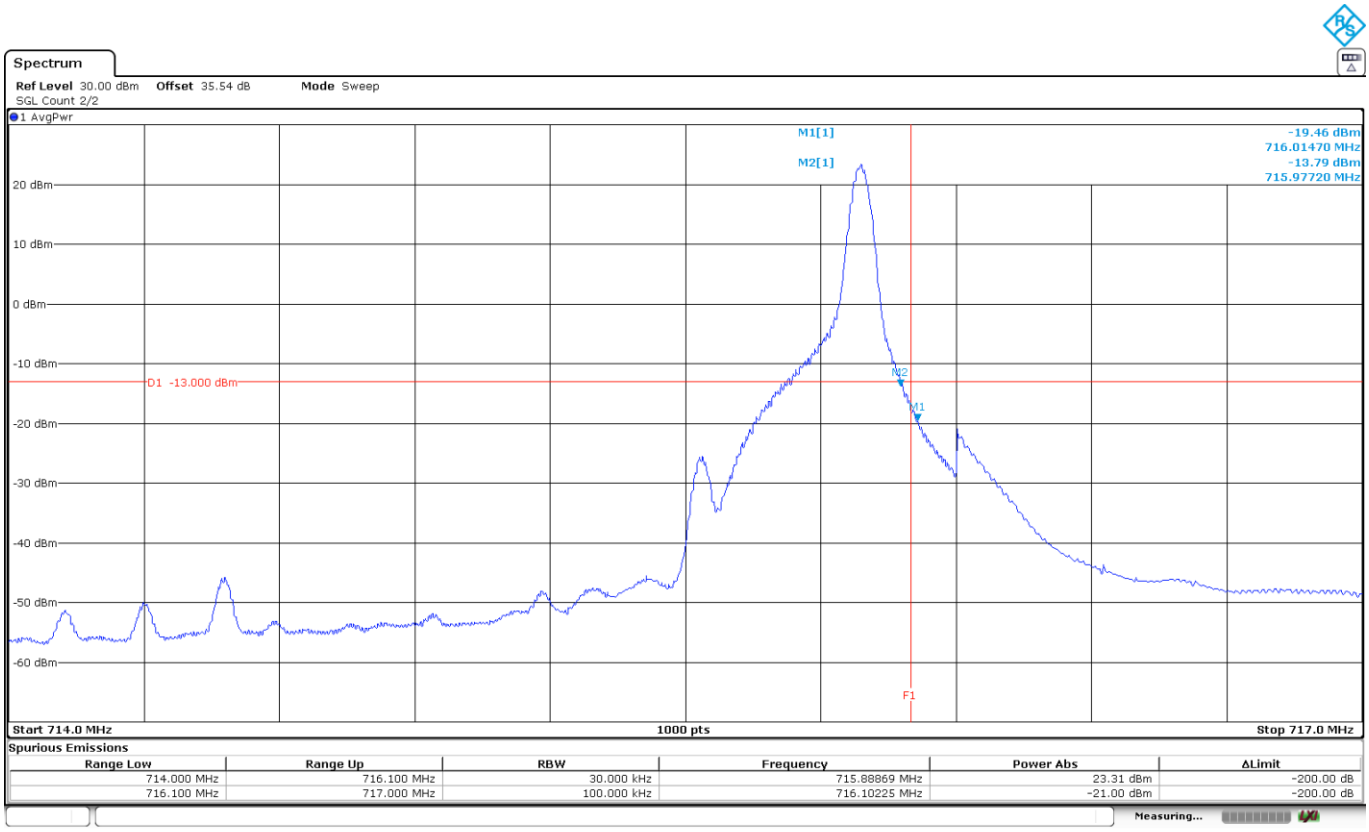
LTE Cat NB1 Band 85:

LTE Cat NB1 Band 85. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=0. MSC/TBS=3. Low Channel:



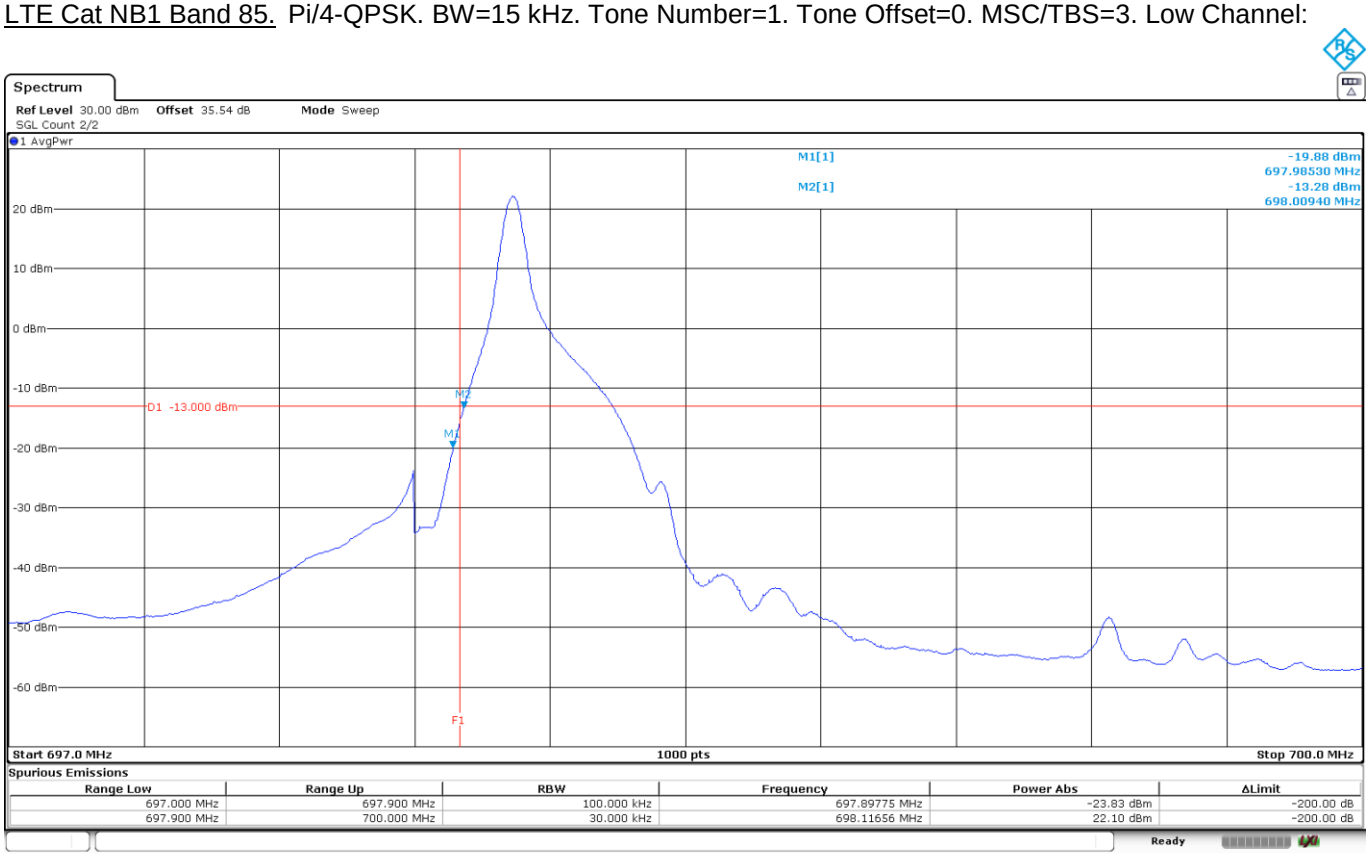
The equipment transmits at the maximum output power.

LTE Cat NB1 Band 85. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=47. MSC/TBS=3. High Channel:



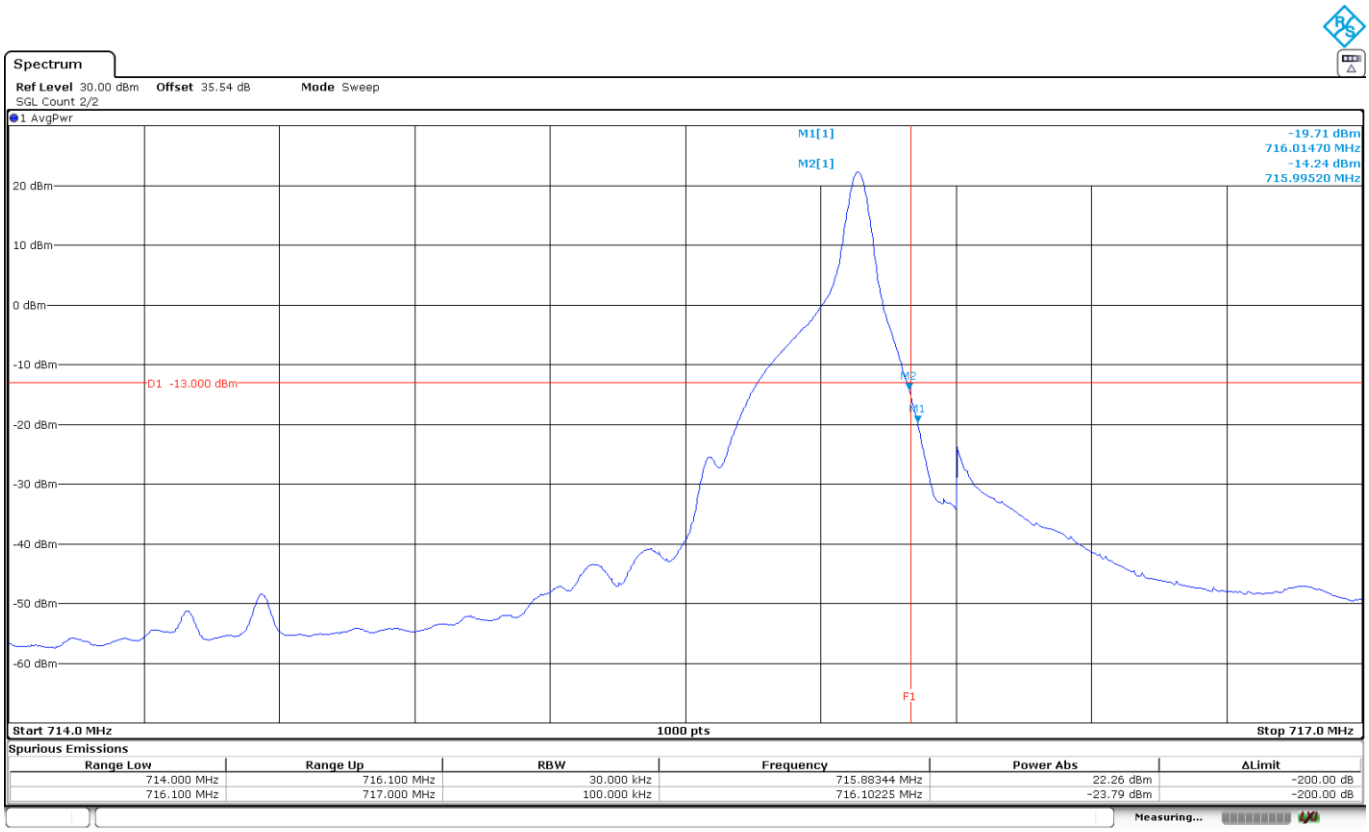
The equipment transmits at the maximum output power.

LTE Cat NB1 Band 85. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=0. MSC/TBS=3. Low Channel:



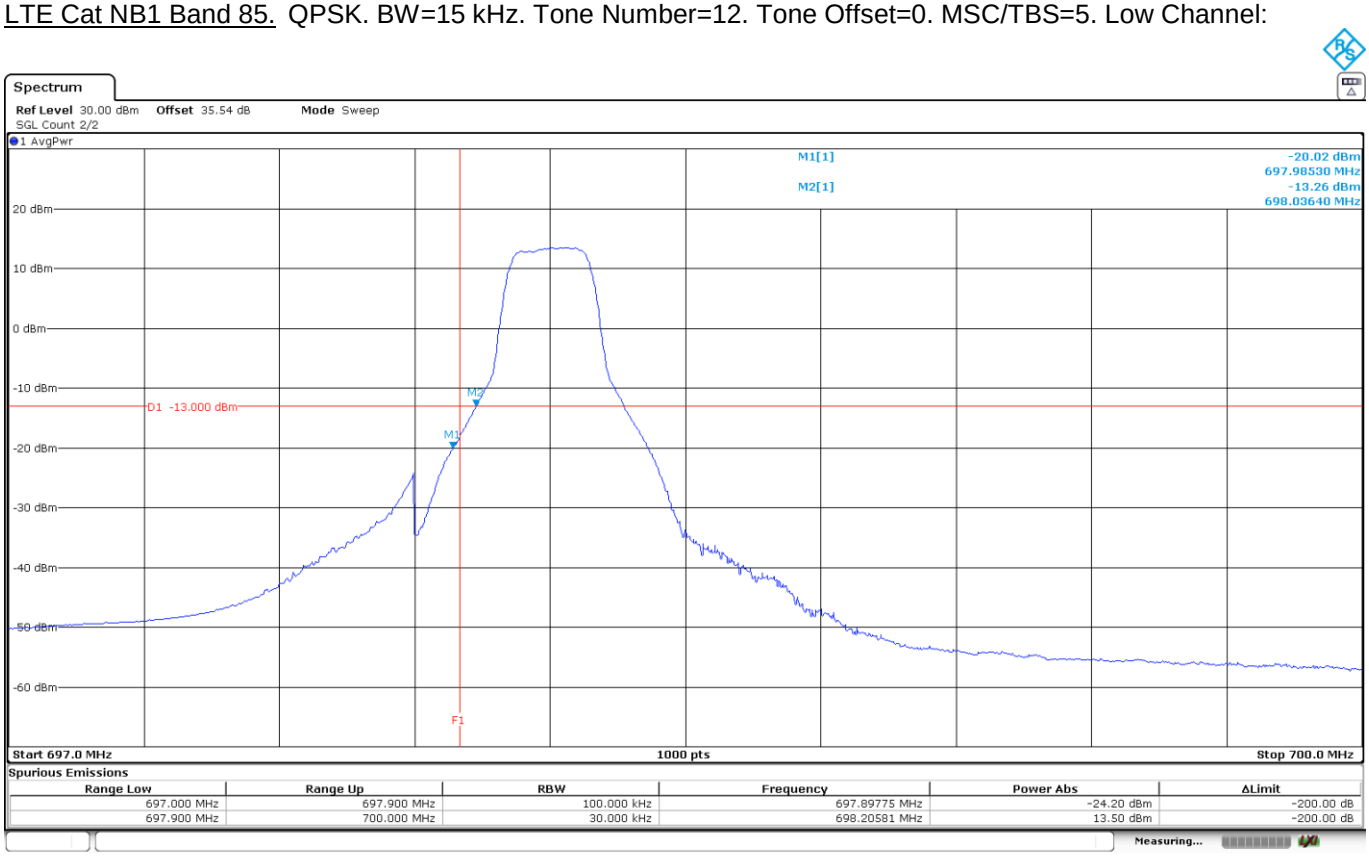
The equipment transmits at the maximum output power.

LTE Cat NB1 Band 85. Pi/4-QPSK. BW=15 kHz. Tone Number=1. Tone Offset=11. MSC/TBS=3. High Channel:



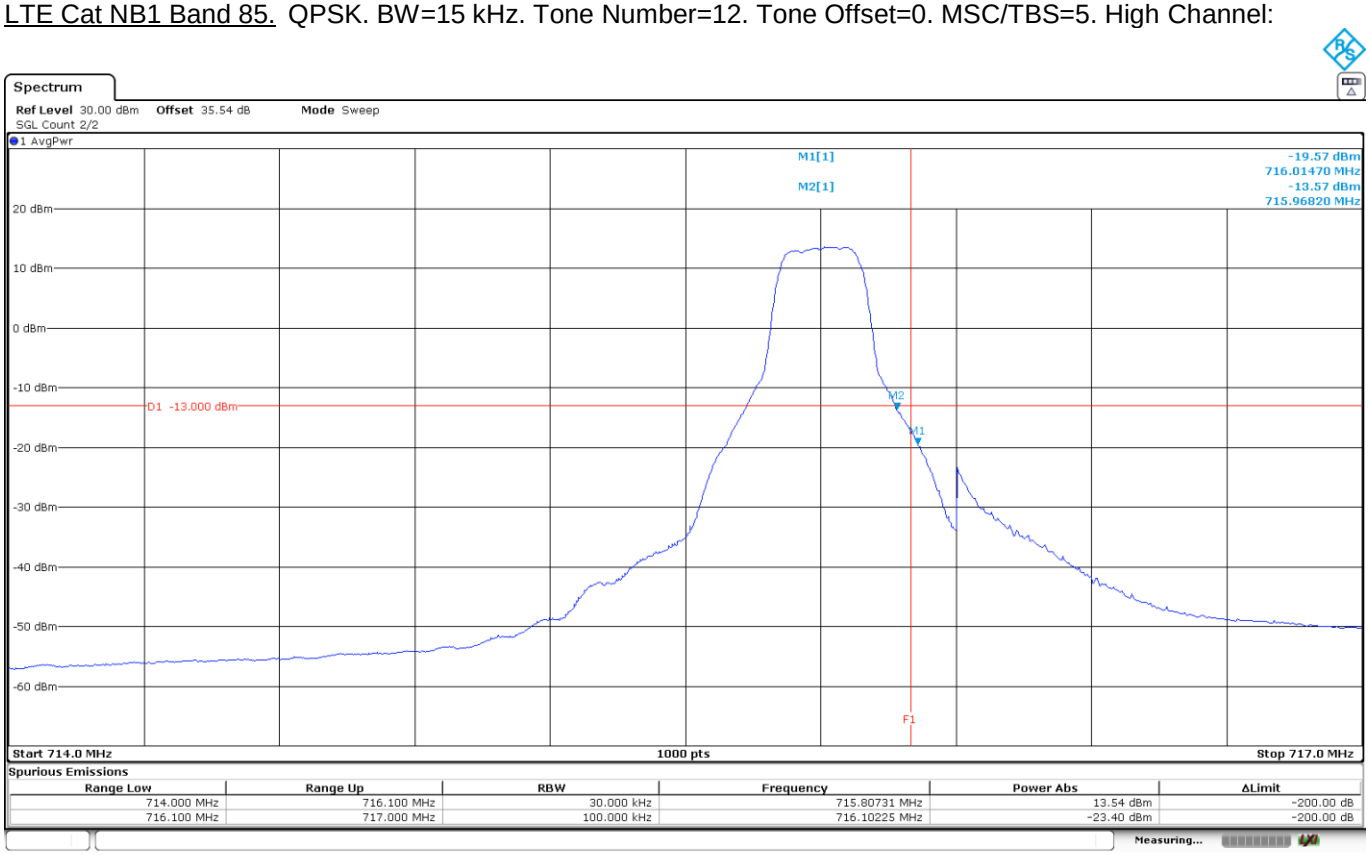
The equipment transmits at the maximum output power.

LTE Cat NB1 Band 85. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5. Low Channel:



The equipment transmits at the maximum output power.

LTE Cat NB1 Band 85. QPSK. BW=15 kHz. Tone Number=12. Tone Offset=0. MSC/TBS=5. High Channel:



The equipment transmits at the maximum output power.

Radiated emissions

Limits

1. LTE Cat NB1 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 NB1 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 log10 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 log10 p (watts). dB. for base and fixed equipment and

ii. 65 + 10 log10 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 NB1 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 log10 (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 NB1 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 log10 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 highest 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 Po transmitting power. the specified minimum attenuation 43 + 10 log10 p (watts) becomes:

Po (dBm) - [43 + 10 log (Po in mwatts) - 30] = -13 dBm

At Po transmitting power. the specified minimum attenuation 65 + 10 log10 p (watts) becomes:

Po (dBm) - [65 + 10 log (Po in mwatts) - 30] = -35 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.

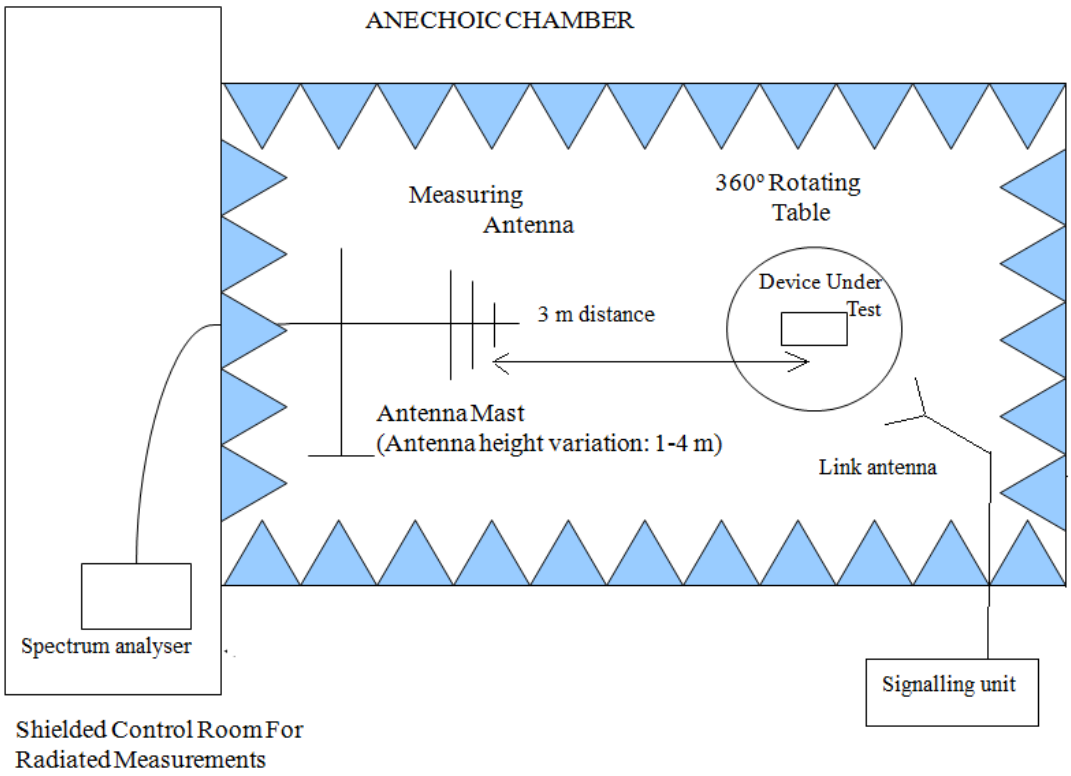
The maximum field strength (dBµV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

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

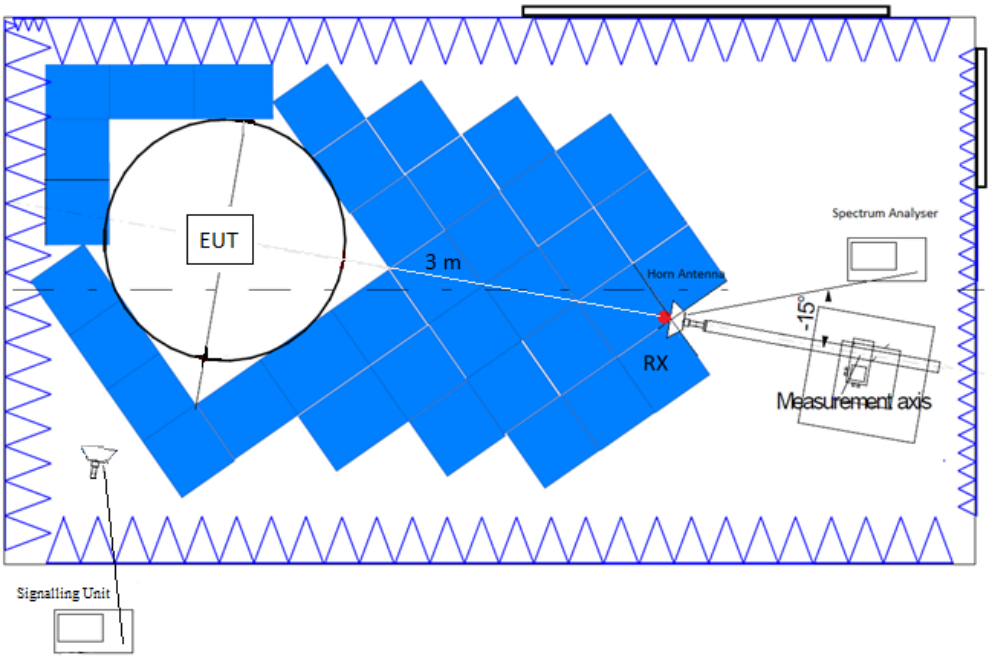
where D is the measurement distance (in the far field region) in m. D = 3m.

Test Setup

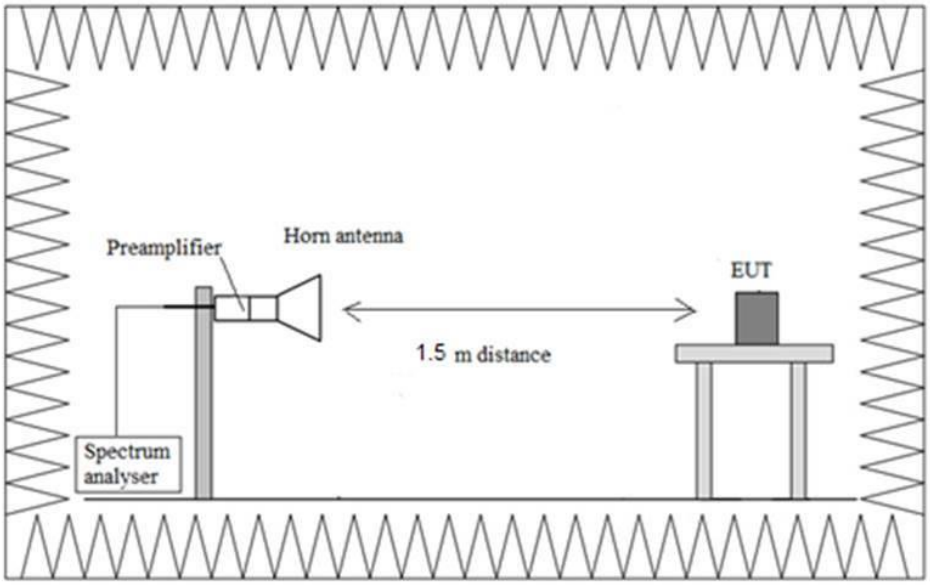
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements above 1 GHz up 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 NB1 Band 8:

A preliminary scan determined the QPSK. BW=15 kHz. Tone Number=1. Tone Offset=11. MSC/TBS=3 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 - 10 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 - 10 GHz:

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

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

Verdict

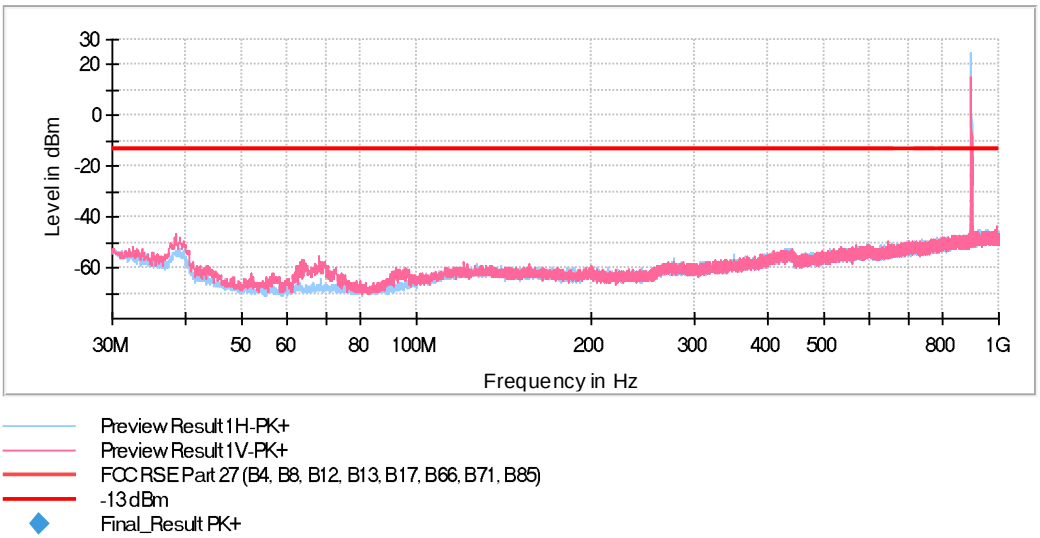
Pass

LTE Cat NB1 Band 8:

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

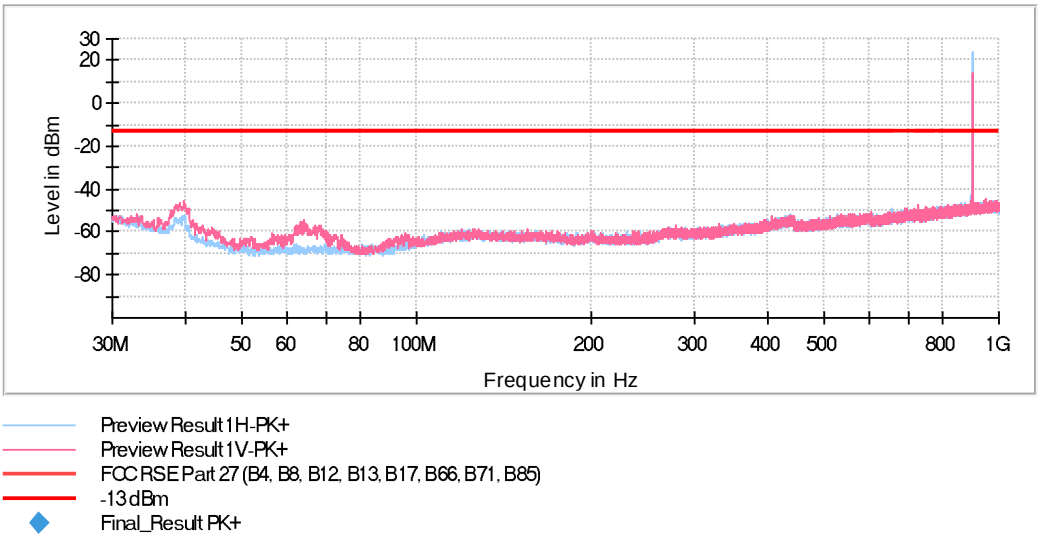
FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



The peak above the limit is the LTE Cat NB1 Band 8 carrier frequency.

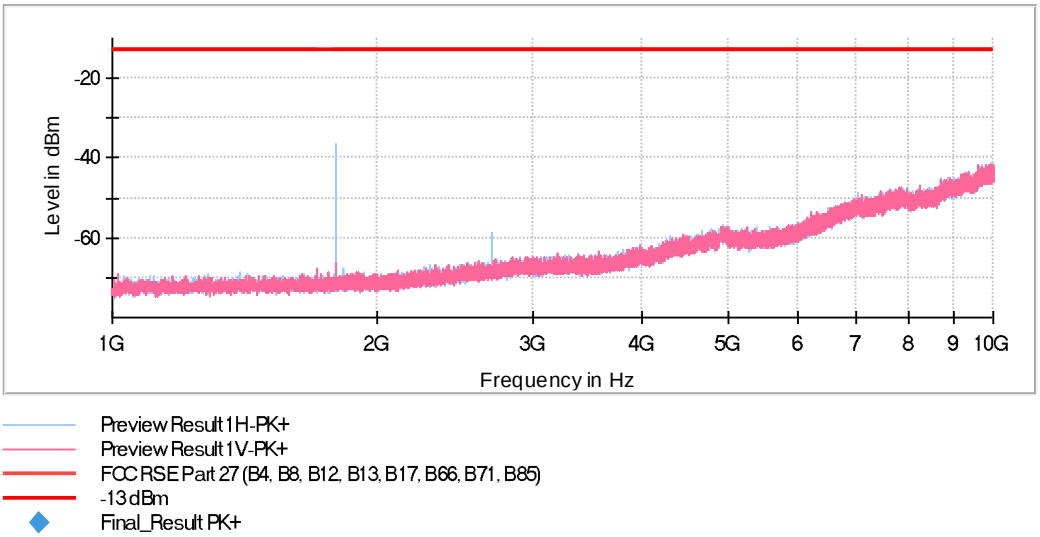
- HIGH CHANNEL:



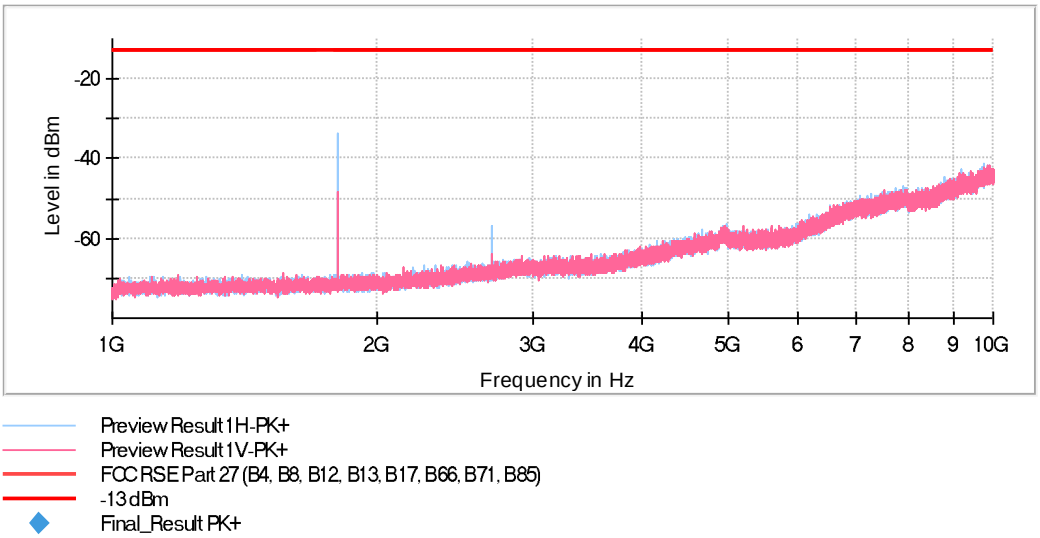
The peak above the limit is the LTE Cat NB1 Band 8 carrier frequency.

FREQUENCY RANGE 1 GHz - 10 GHz

- LOW CHANNEL:



- HIGH CHANNEL:



LTE Cat NB1 Band 13:

A preliminary scan determined the QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=0. MSC/TBS=3 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:

Frequency (MHz)	E.I.R.P (dBm)	Detector	Polarization
773.076781	-52.47	Peak	H
774.569688	-44.74	Peak	H
774.994313	-53.21	Peak	H

Frequency range 1 - 8 GHz:

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

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

Spurious frequencies at less than 20 dB below the limit:

Frequency (MHz)	E.I.R.P (dBm)	Detector	Polarization
794.310719	-52.52	Peak	H
794.328188	-51.25	Peak	H

Frequency range 1 - 8 GHz:

Spurious frequencies at less than 20 dB below the limit:

Frequency (MHz)	E.I.R.P (dBm)	Detector	Polarization
1573.382000	-47.69	Peak	H

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

Verdict

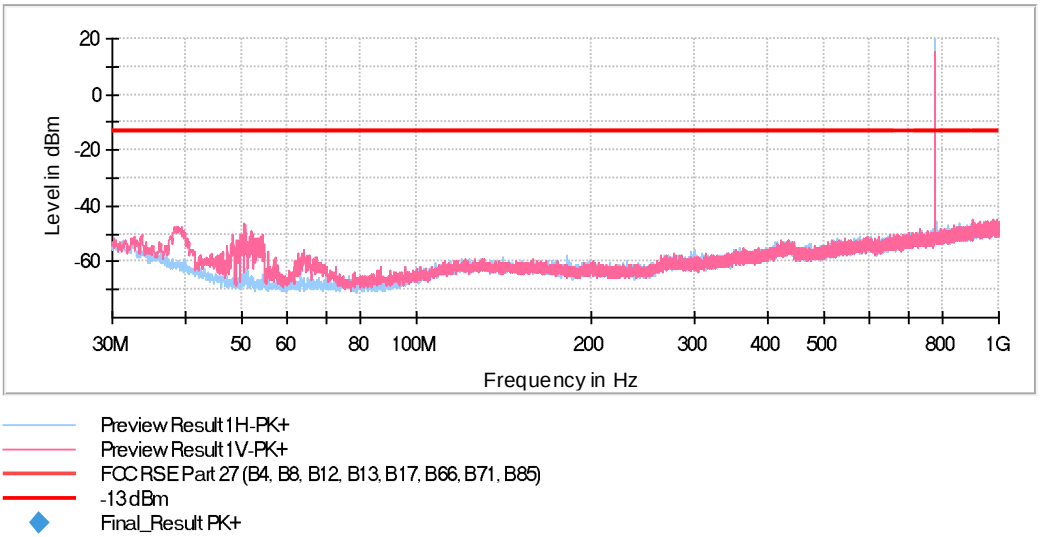
Pass

LTE Cat NB1 Band 13:

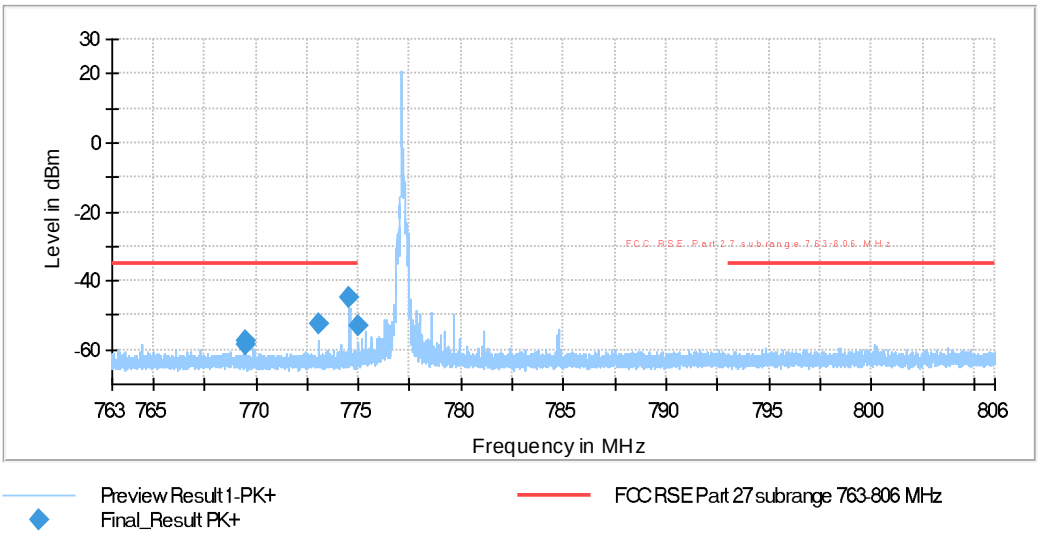
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	Coupled	0 dB
763 MHz - 806 MHz	1.344 kHz	PK+	6.25 kHz	Coupled	0 dB
1 GHz - 8 GHz	218.75 kHz	PK+	100 kHz	1 s	0 dB
1.559 GHz - 1.61 GHz	1.594 kHz	PK+	1 MHz	1 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz:

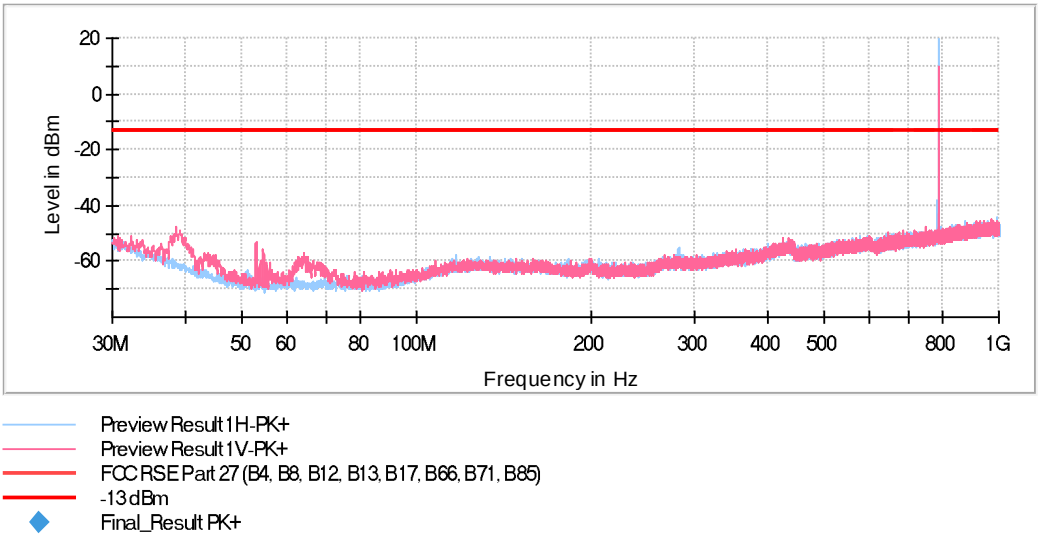
- LOW CHANNEL:



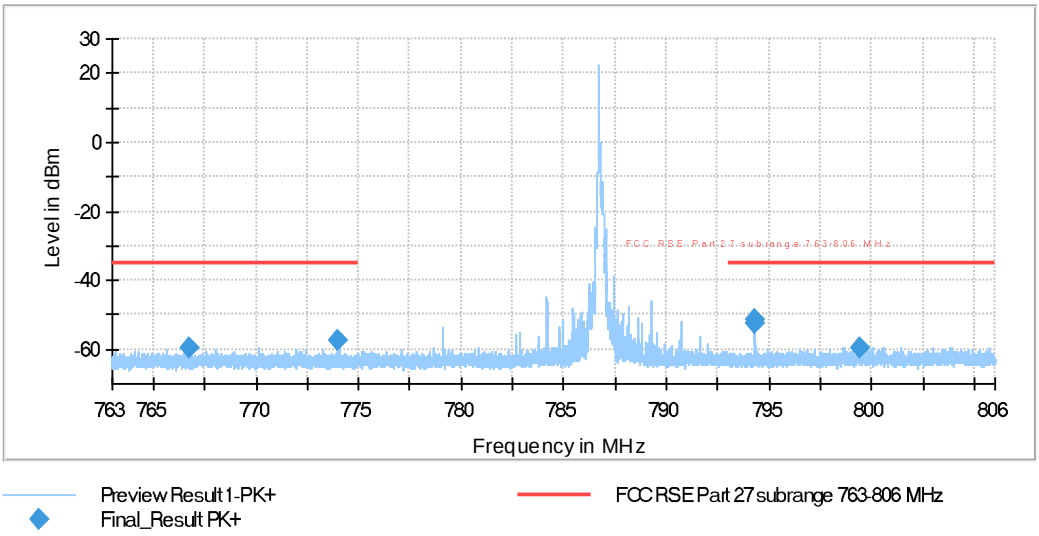
The peak above the limit is the carrier frequency.



- HIGH CHANNEL:

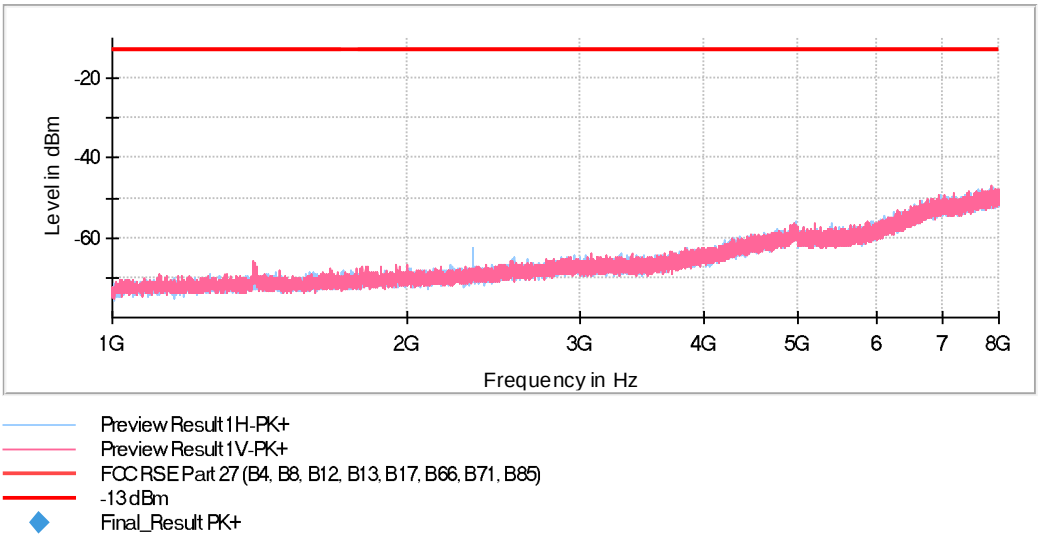


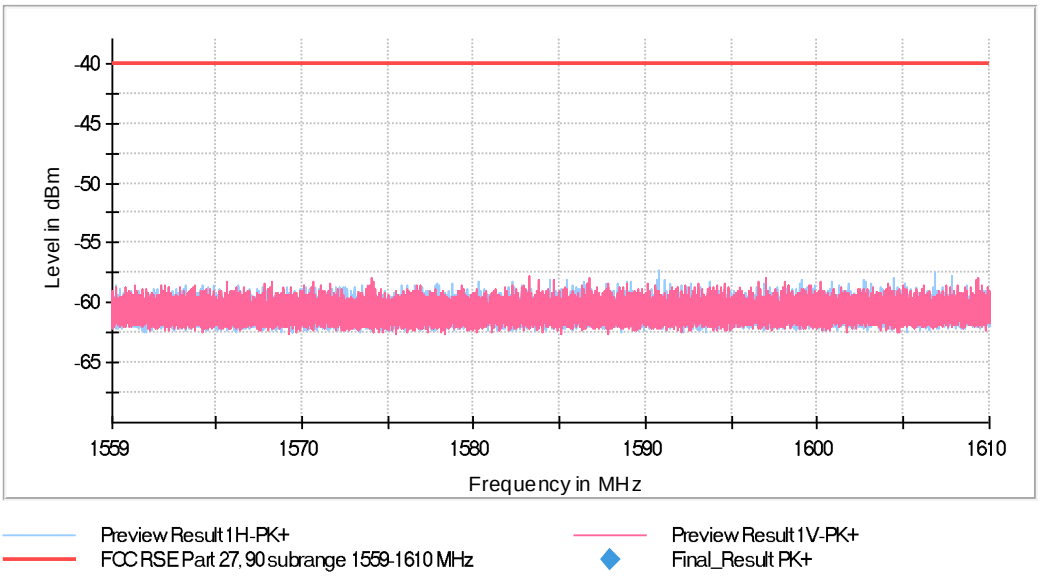
The peak above the limit is the carrier frequency.



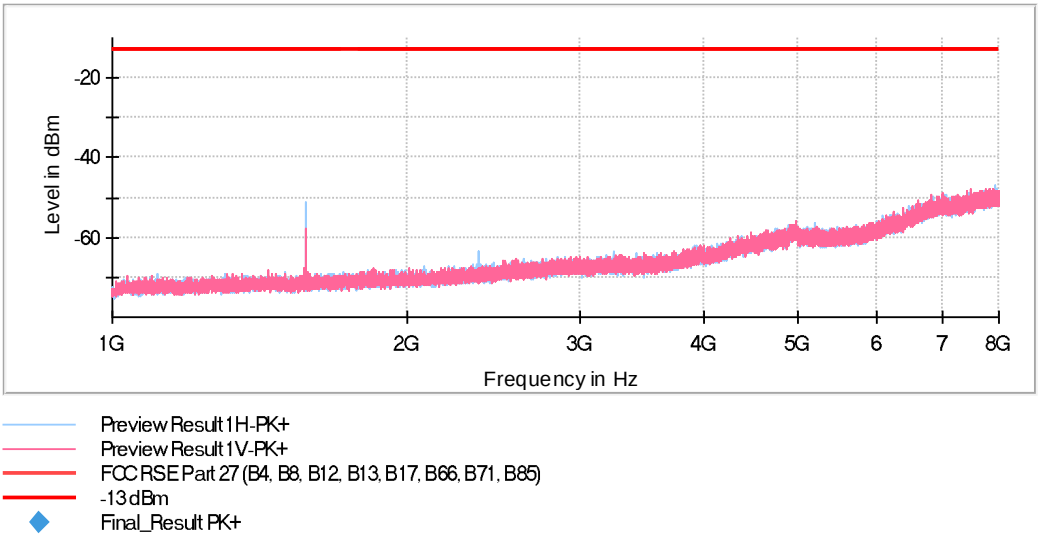
FREQUENCY RANGE 1 - 8 GHz:

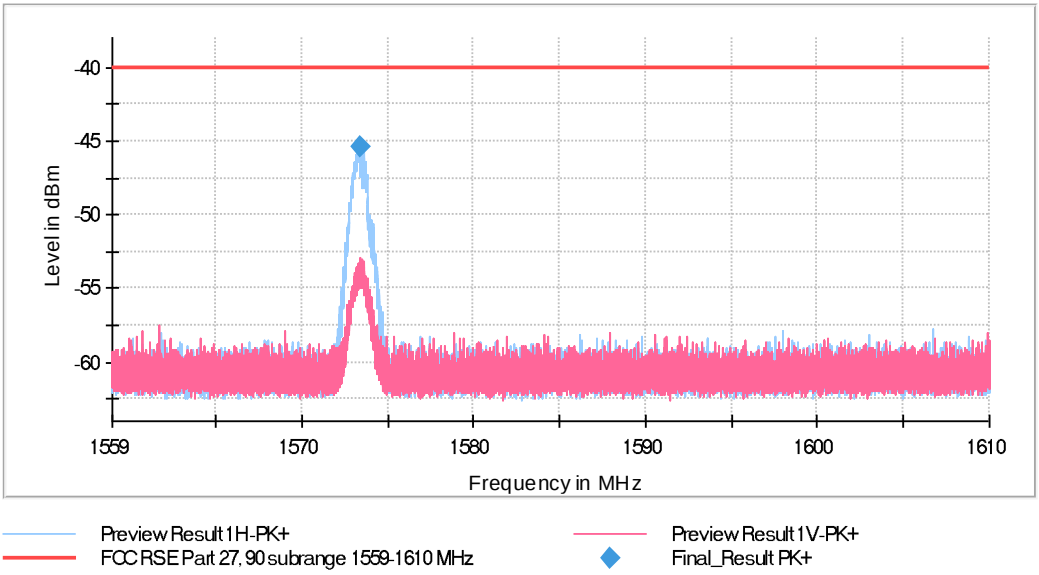
- LOW CHANNEL:





- HIGH CHANNEL:





LTE Cat NB1 Band 66:

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 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:

Frequency (MHz)	E.I.R.P (dBm)	Detector	Polarization
39.367563	-31.43	Peak	H

Frequency range 1 - 18 GHz:

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

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

Spurious frequencies at less than 20 dB below the limit:

Frequency (MHz)	E.I.R.P (dBm)	Detector	Polarization
39.366563	-31.49	Peak	H

Frequency range 1 - 18 GHz:

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

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

Spurious frequencies at less than 20 dB below the limit:

Frequency (MHz)	E.I.R.P (dBm)	Detector	Polarization
39.336250	-30.21	Peak	H

Frequency range 1 - 18 GHz:

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

Measurement Uncertainty (dB)	<± 5.35 for f < 1 GHz <± 4.32 for f ≥ 1 GHz up to 18 GHz

Verdict

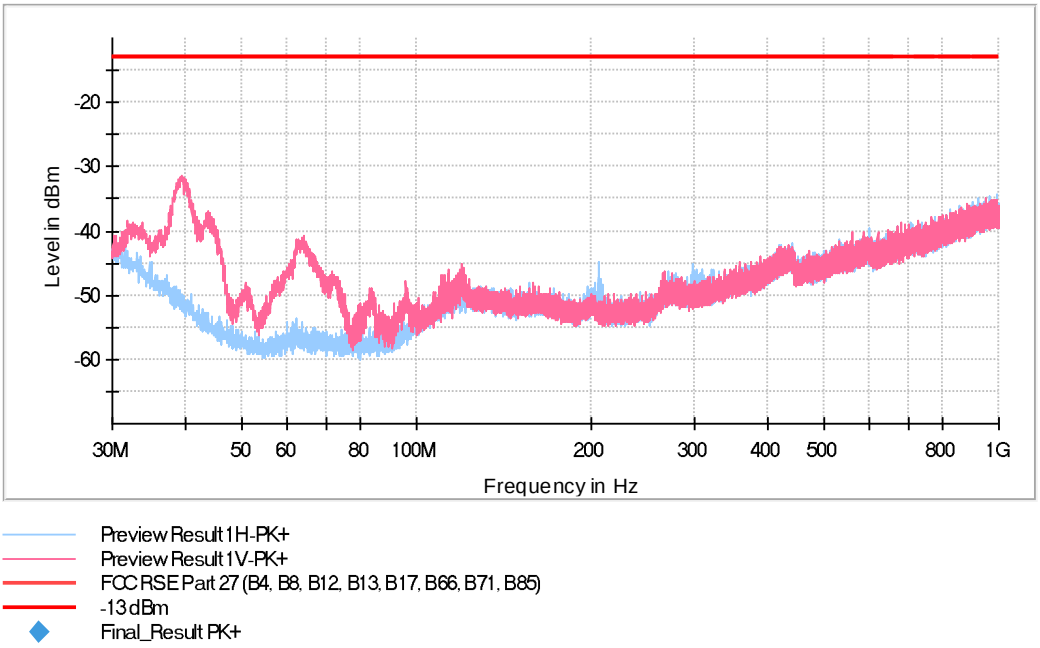
Pass

LTE Cat NB1 Band 66:

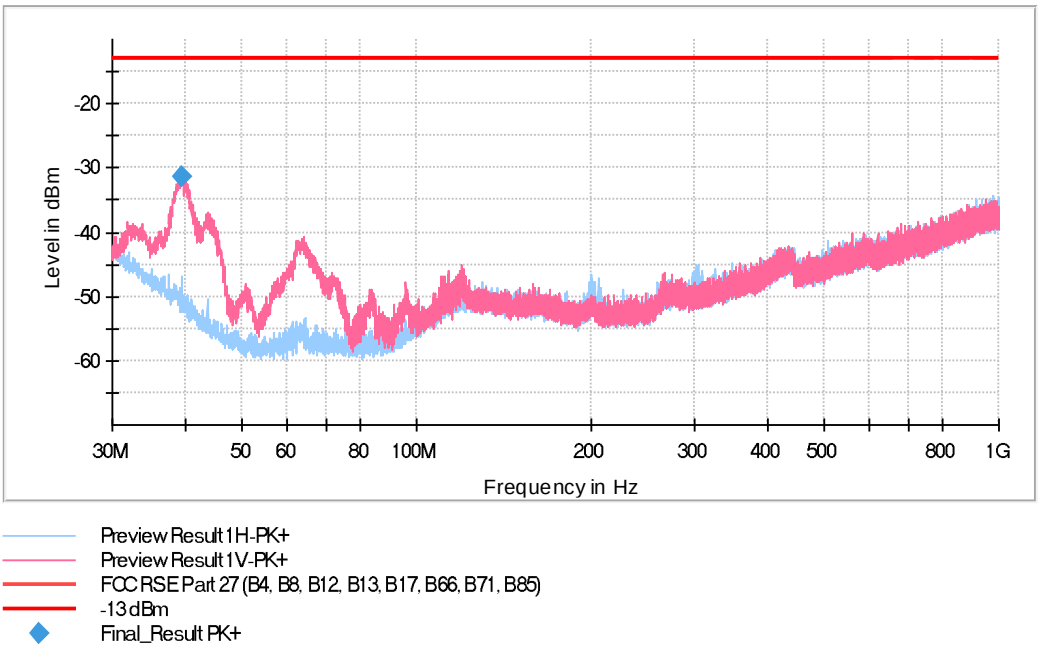
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	Coupled	0 dB
1 GHz - 3 GHz	62.5 kHz	PK+	1 MHz	1 s	0 dB
3 GHz - 17 GHz	437.5 kHz	PK+	1 MHz	1 s	0 dB
17 GHz - 18 GHz	31.25 kHz	PK+	1 MHz	1 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz:

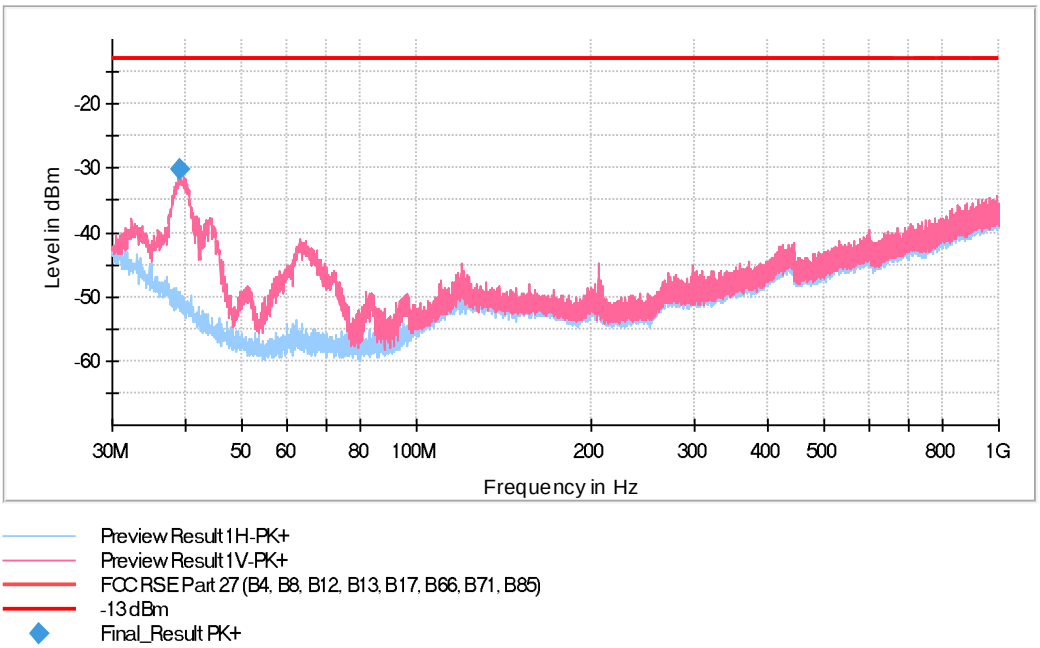
- LOW CHANNEL:



- MIDDLE CHANNEL:

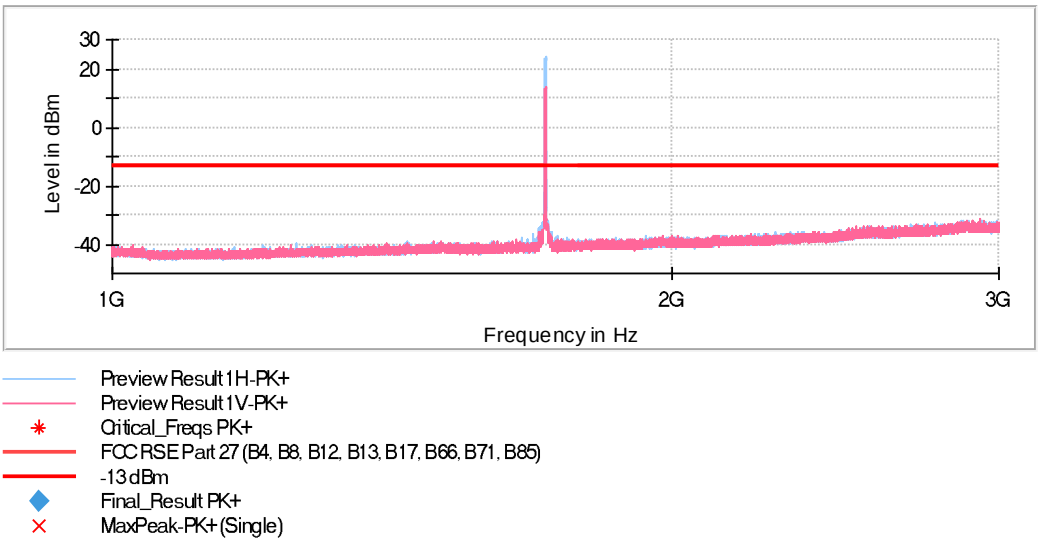


- HIGH CHANNEL:



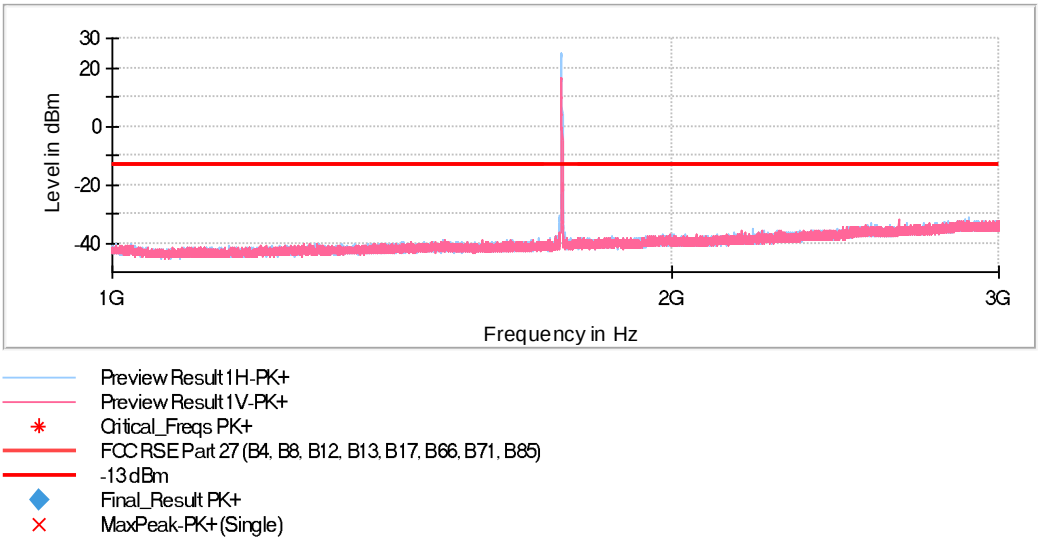
FREQUENCY RANGE 1 - 3 GHz:

- LOW CHANNEL:



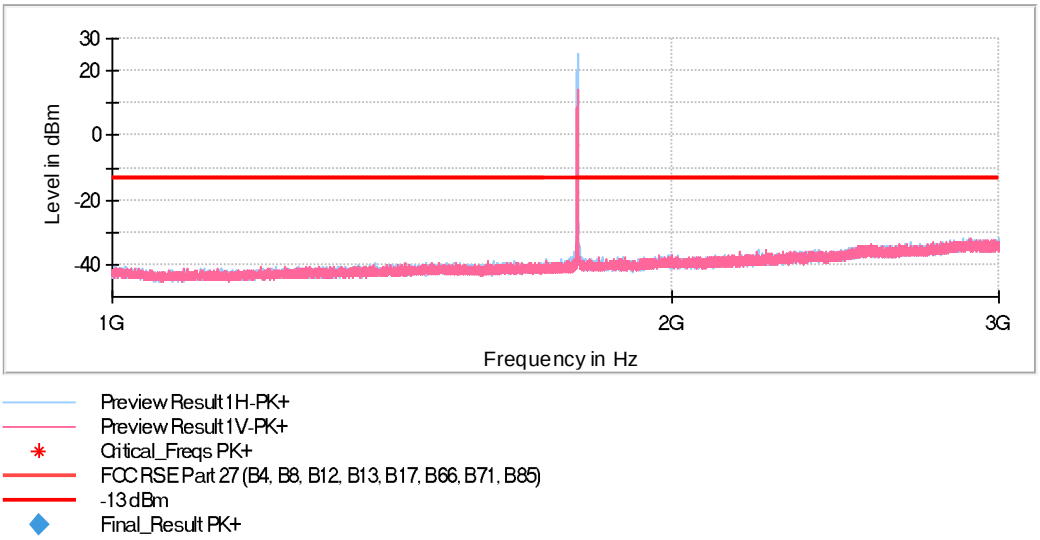
The peak above the limit is the carrier frequency.

- MIDDLE CHANNEL:



The peak above the limit is the carrier frequency.

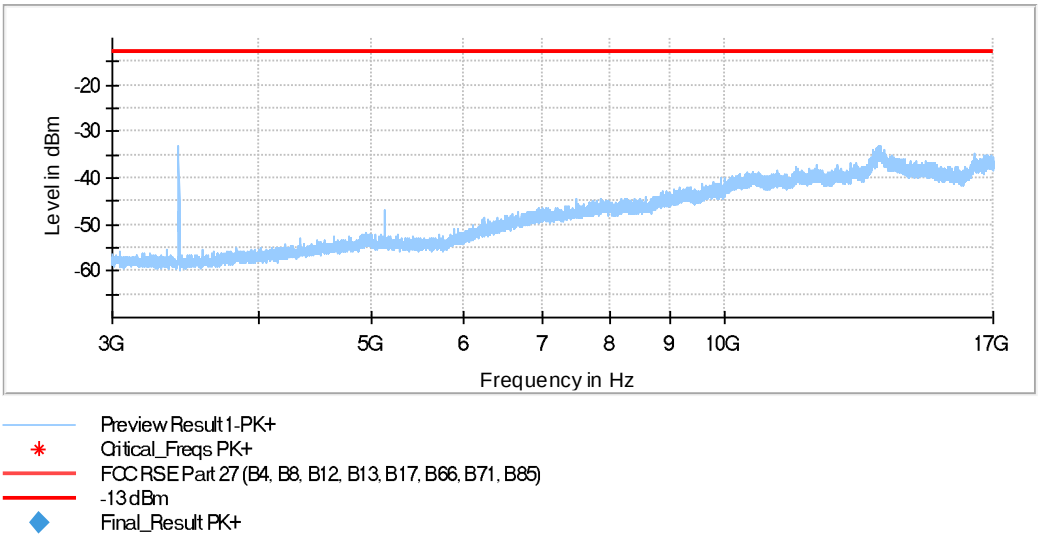
- HIGH CHANNEL:

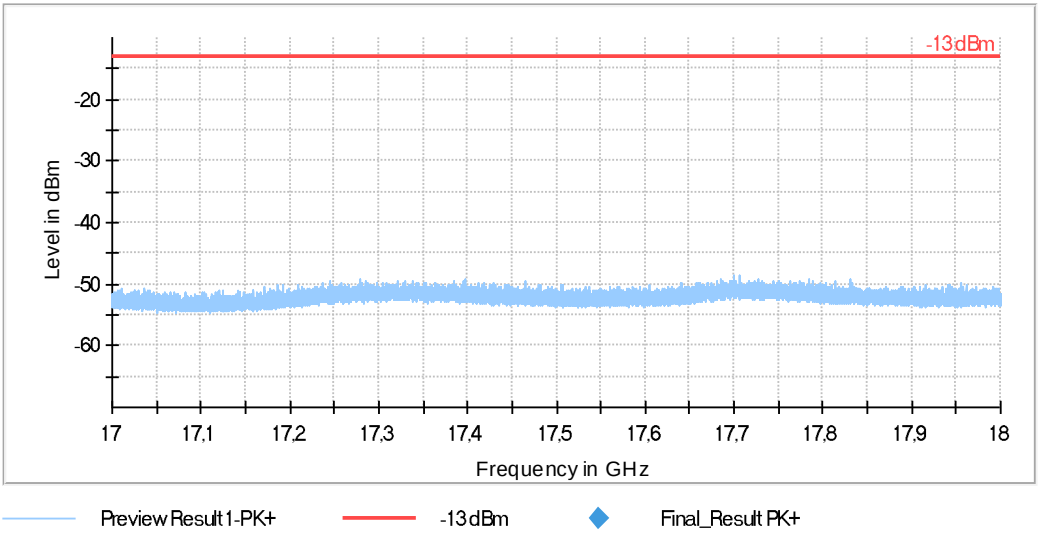


The peak above the limit is the carrier frequency.

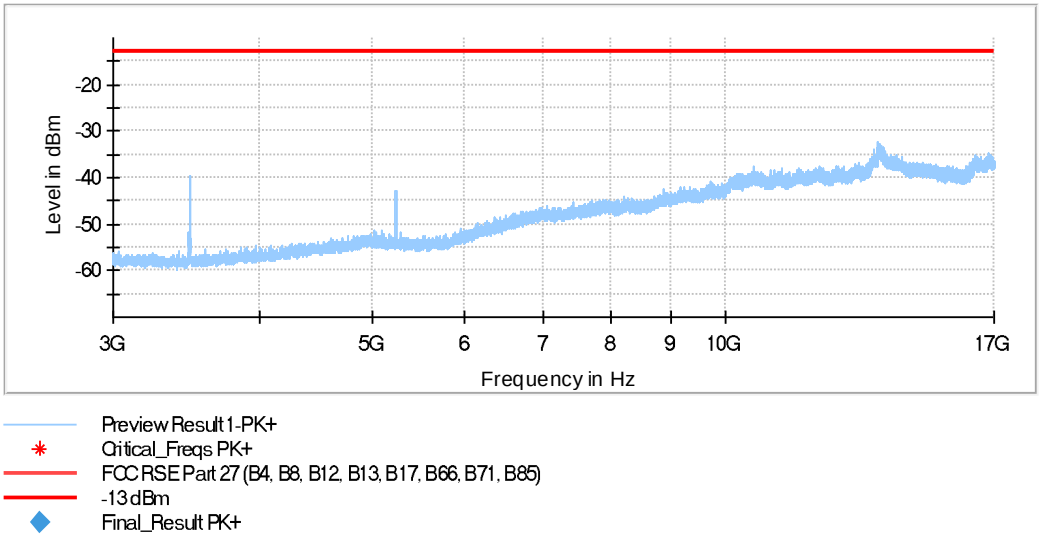
FREQUENCY RANGE 3 - 18 GHz:

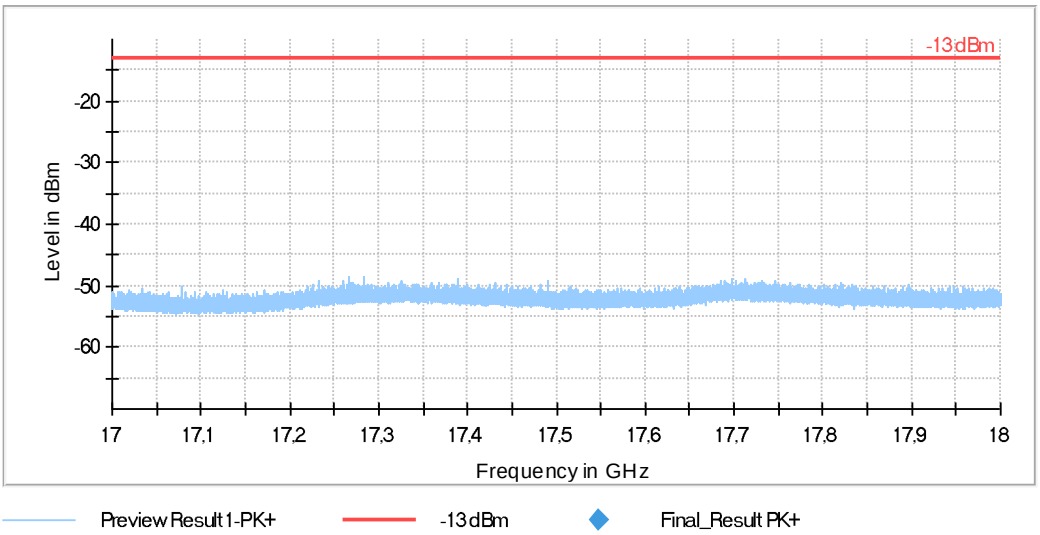
- LOW CHANNEL:



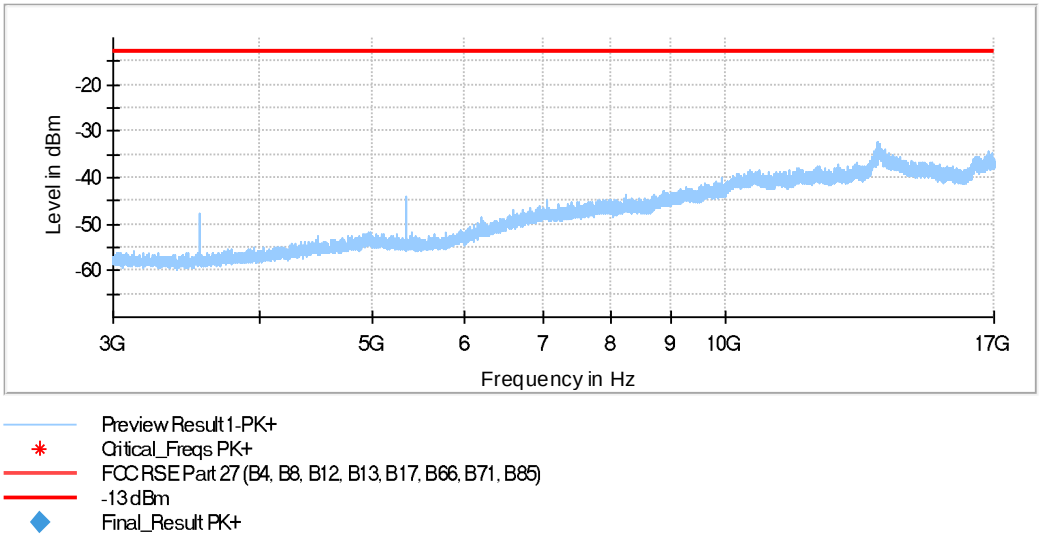


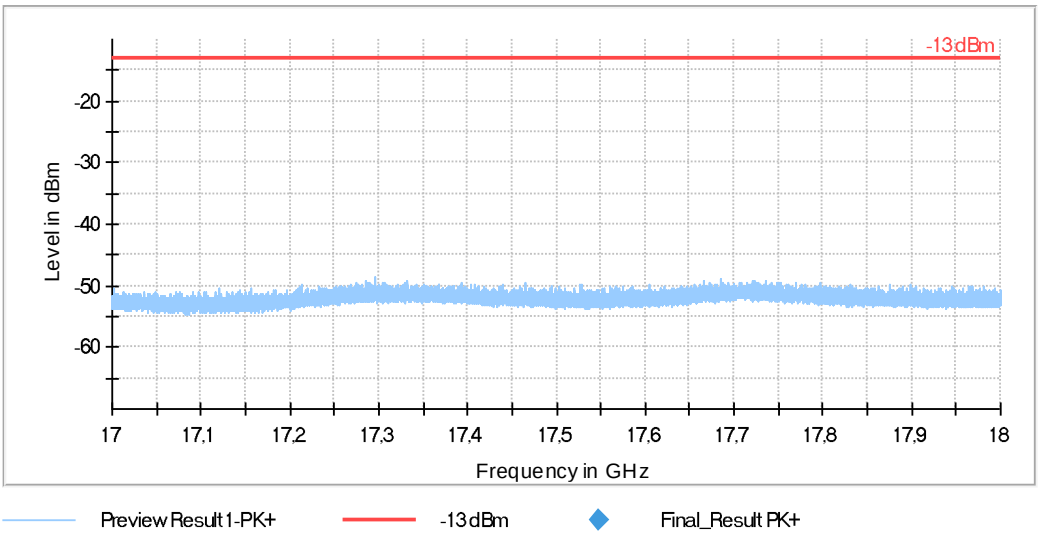
- MIDDLE CHANNEL:





- HIGH CHANNEL:





LTE Cat NB1 Band 85:

NOTE: testing performed on S/02

A preliminary scan determined the QPSK. BW=15 kHz. Tone Number=1. Tone Offset=0. MSC/TBS=3 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 - 8 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 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 GHz:

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

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

Verdict

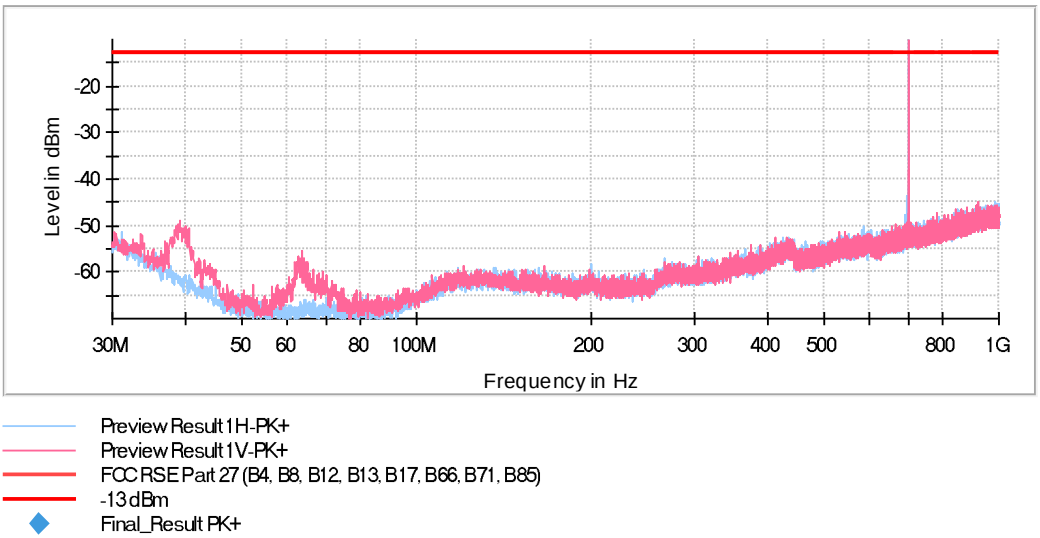
Pass

LTE Cat NB1 Band 85:

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	Coupled	0 dB
1 GHz - 8 GHz	218.75 kHz	PK+	100 kHz	1 s	0 dB

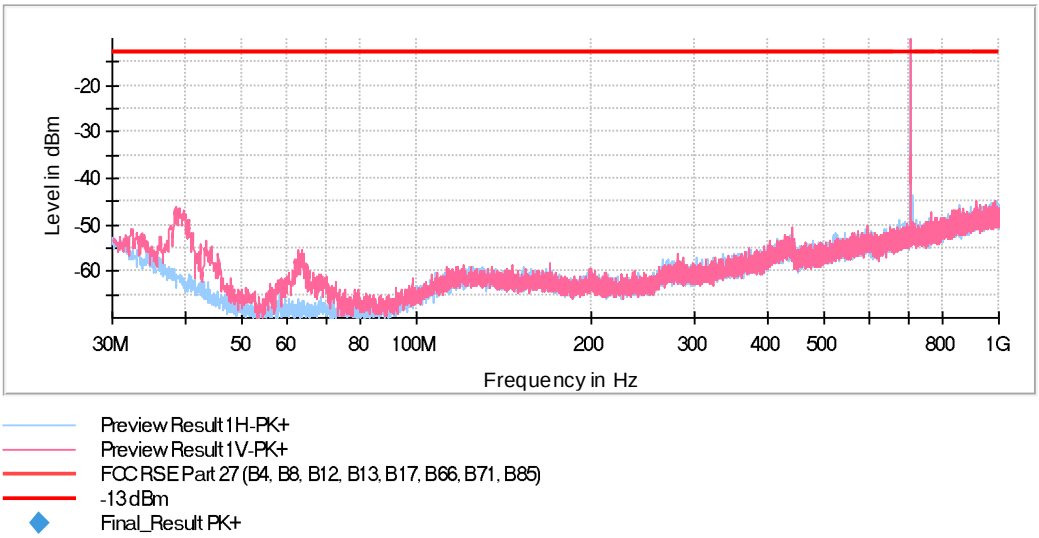
FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



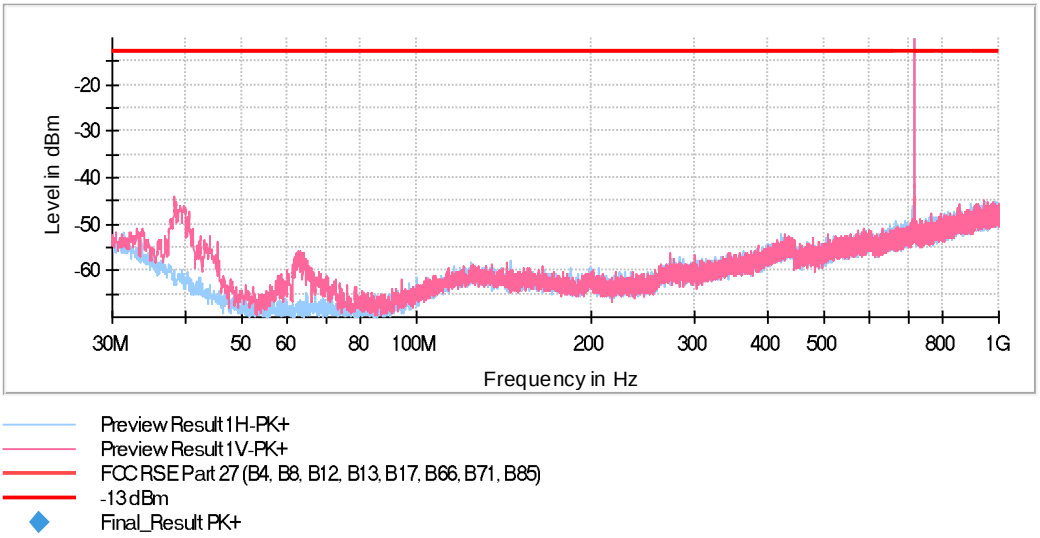
The peak above the limit is the LTE Cat NB1 Band 85 carrier frequency.

- MIDDLE CHANNEL:



The peak above the limit is the LTE Cat NB1 Band 85 carrier frequency.

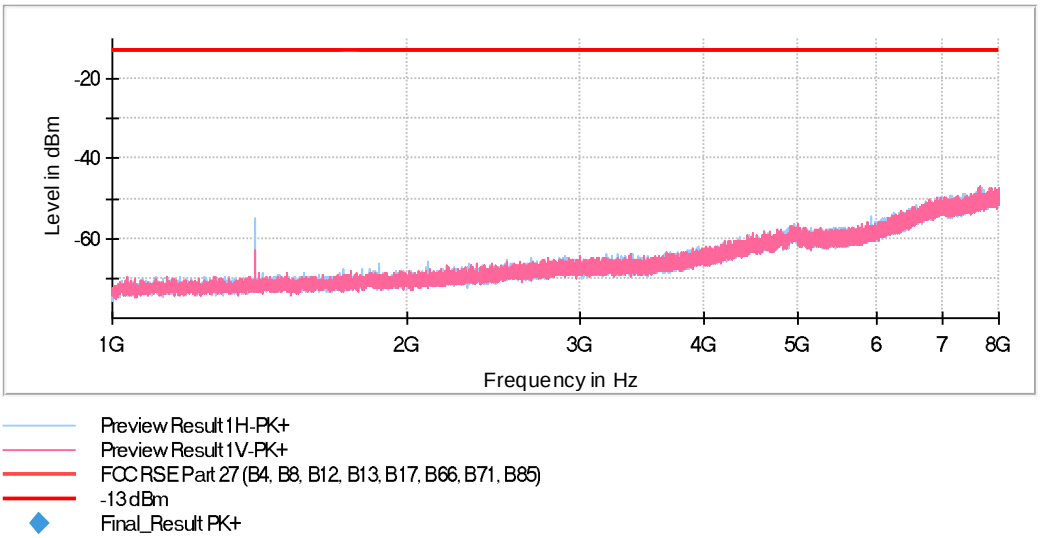
- HIGH CHANNEL:



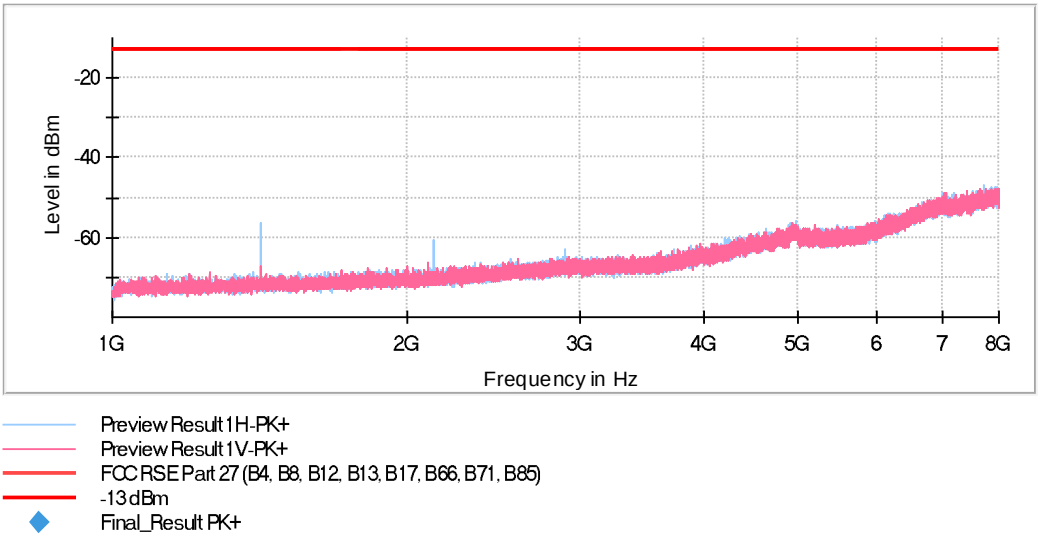
The peak above the limit is the LTE Cat NB1 Band 85 carrier frequency.

FREQUENCY RANGE 1 GHz - 8 GHz

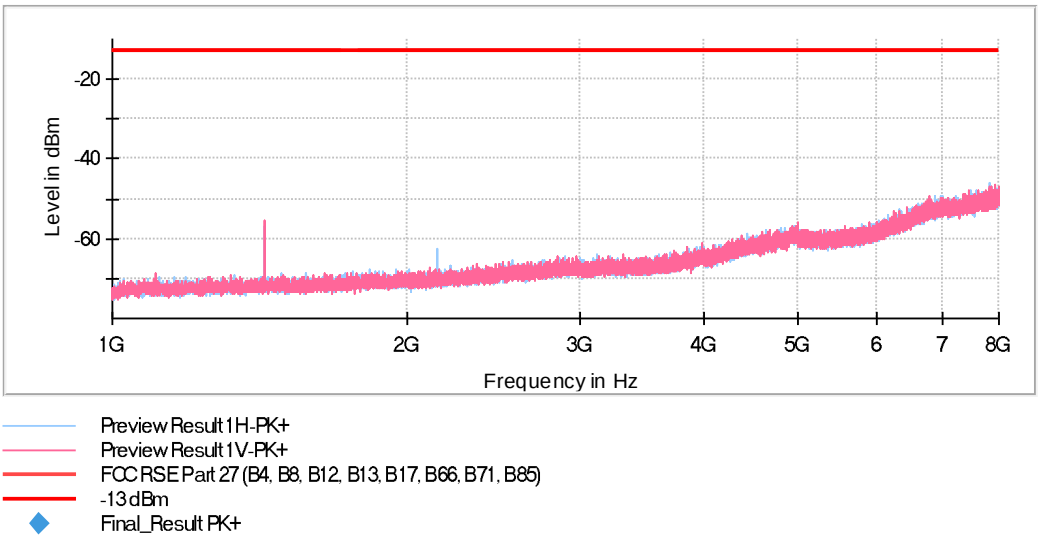
- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:



LTE Cat NB1 Band 85:

NOTE: testing performed on S/04

A preliminary scan determined the QPSK. BW=15 kHz. Tone Number=1. Tone Offset=0. MSC/TBS=3 as the worst case. The next results are for this worst-case configuration.

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 8 GHz:

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

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

Verdict

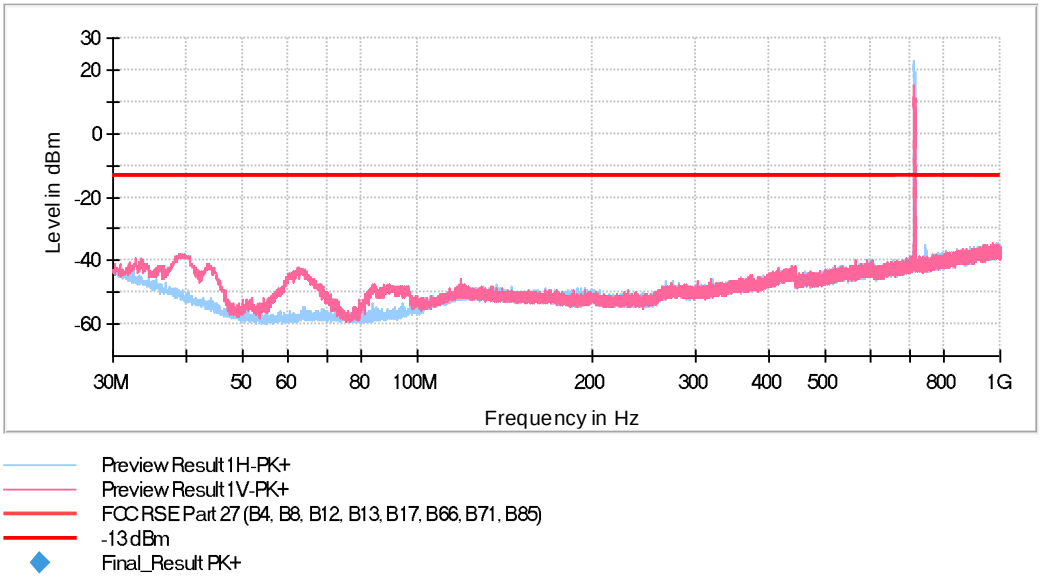
Pass

LTE Cat NB1 Band 85:

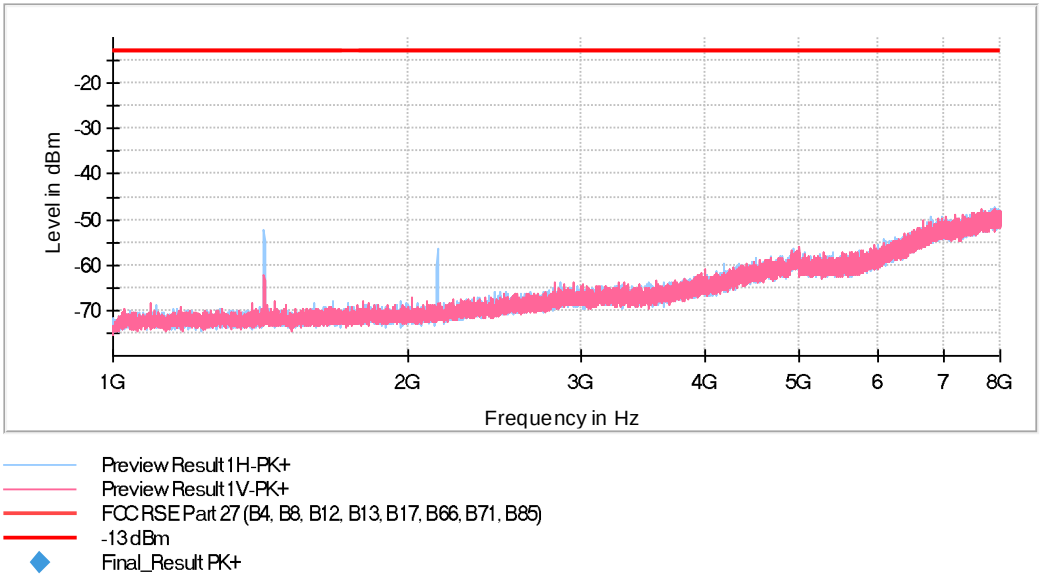
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	Coupled	0 dB
1 GHz - 8 GHz	218.75 kHz	PK+	100 kHz	1 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz:

- HIGH CHANNEL:



The peak above the limit is the LTE Cat NB1 Band 85 carrier frequency.

FREQUENCY RANGE 1 GHz - 8 GHz

- HIGH CHANNEL: