2.7 CONDUCTED SPURIOUS EMISSIONS

2.7.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 27, Clause 27.53(h)(1)(3)
FCC 47 CFR Part 27, Clause 27.53(c)(2)(4)(5)&(f)
FCC 47 CFR Part 27, Clause 27.53(m)(4)(6)
RSS-139, Clause 6.6
RSS-130, Clause 4.6
RSS-199, Clause 4.5

2.7.2 Standard Applicable

FCC 47 CFR Part 27.53
(h)(1) AWS emission limits – (1) General protection levels. Except as otherwise specified below, for operatios 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 MHz 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.

(m)(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log(P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section.

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band)s) of operatio, measured in watts, in accordance with the following:
(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 + 1010 log10 (P) dB.

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

(f) For operations in the 746-758 MHz and 775-788 MHz and 805-806 MHz bands, emissions in the band 1559-1610 MHz be limited to -70 dBW/MHz equivalent isotropically radiated poewr (EIRP) for wideband signals, and -80dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

RSS-139, Clause 6.6:
(i) In the first 1.0 MHz bands immediatel outside and adjacent to the equipment's smallest opreating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (dBW), by at least 43 + 10 $\log_{10}$ p (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output ower P (dBW), by at least 43 + 10 $\log_{10}$ p (watts) dB.

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RSS-199, Clause 4.5:
In the 1 MHz band immediatel outside and adjacent to the channel edge, the unwanted emission power shall be measured with a resolution bandwidth of at 1% of the occupied bandwidth for base station and fixed subscriber equipment, and 2% for mobile subscriber equipment. Beyond the 1 MHz band, a resolution bandwidth of 1 MHz shall be used.
(b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:
(i) 40 + 10 $\log_{10}$ p from the channel edges to 5 MHz away.
(ii) 43 + 10 $\log_{10}$ p between 5 MHz and X MHz from the channel edges, and
(iii) 55 + 10 log10 p at X MHz and beyond from the channel edges
Note: X is 6 MHz or the equipment occupied bandwidth, whichever is greater

RSS-130:
4.6.1 The power of any unwanted emissios 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.

4.6.2 In addition to the limit outlined in Section 4.6.1 (RSS-139 Issue 3: 2015), 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/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

2.7.3 Equipment Under Test and Modification State

Serial No: AZ280418A00044 / Test Configuration A

2.7.4 Date of Test/Initial of test personnel who performed the test

June 21,23 and July 20, 2018 / XYZ

2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.3 - 25.6 °C
Relative Humidity	51.6 – 56.4 %
ATM Pressure	98.6 - 99.0 kPa

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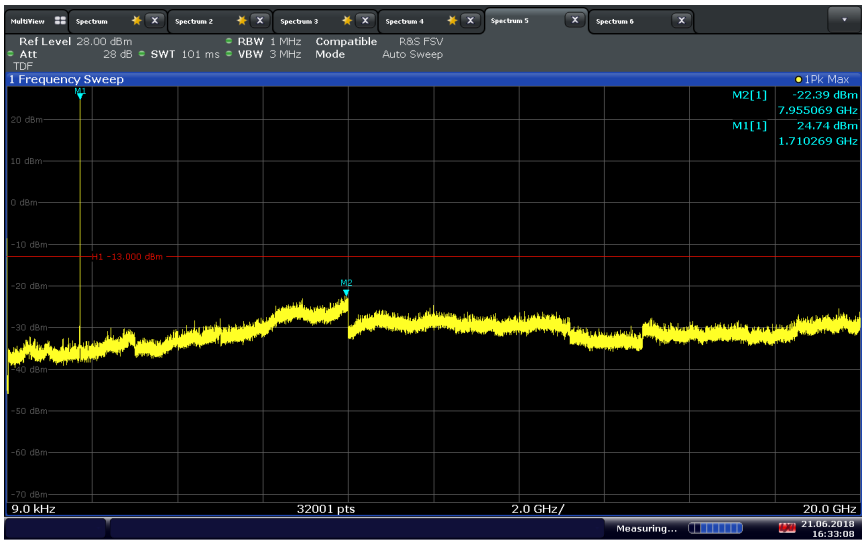
2.7.7 Additional Observations

- This is a conducted test.
- The spectrum was searched from 9 kHz to the 10th harmonic.
- The path loss was measured and entered as a transducer factor (TDF).
- Low, Middle and High channels on all channel bandwidth and modulation are verified. Only the worst case channel of each band presented.

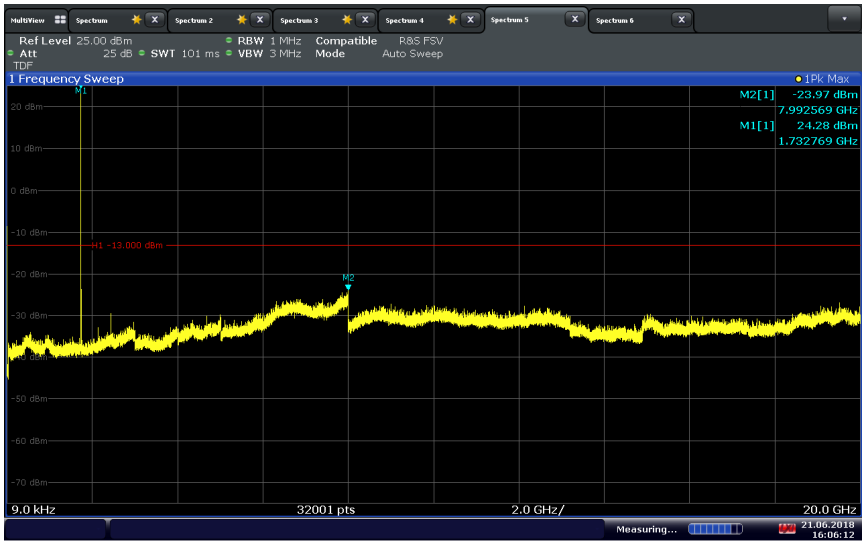
2.7.8 Test Results

LTE Band 4 (1.4 MHz BW)/QPSK/Low Channel 1710.7 MHz



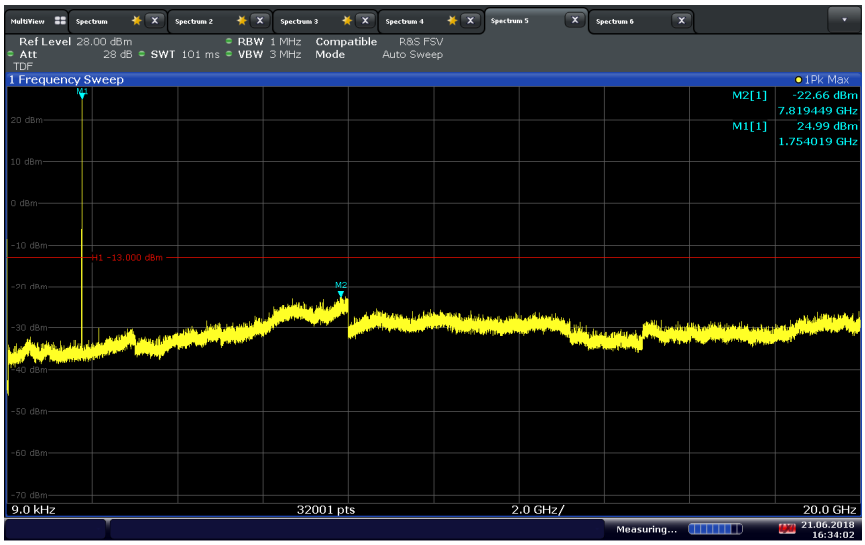
16:33:08 21.06.2018

LTE Band 4 (1.4 MHz BW)/QPSK/Middle Channel 1732.5 MHz



16:06:13 21.06.2018

LTE Band 4 (1.4 MHz BW)/QPSK/High Channel 1754.3 MHz



16:34:03 21.06.2018

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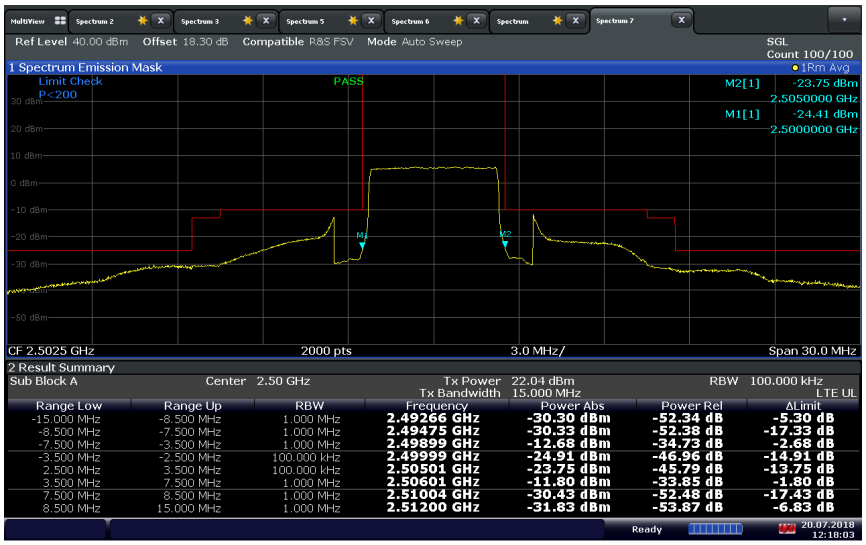
LTE Band 7 (5 MHz BW)/QPSK/Low Channel 2502.5 MHz

09:55:18 20.07.2018

LTE Band 7 (5 MHz BW)/QPSK/Low Channel 2502.5 MHz Mask



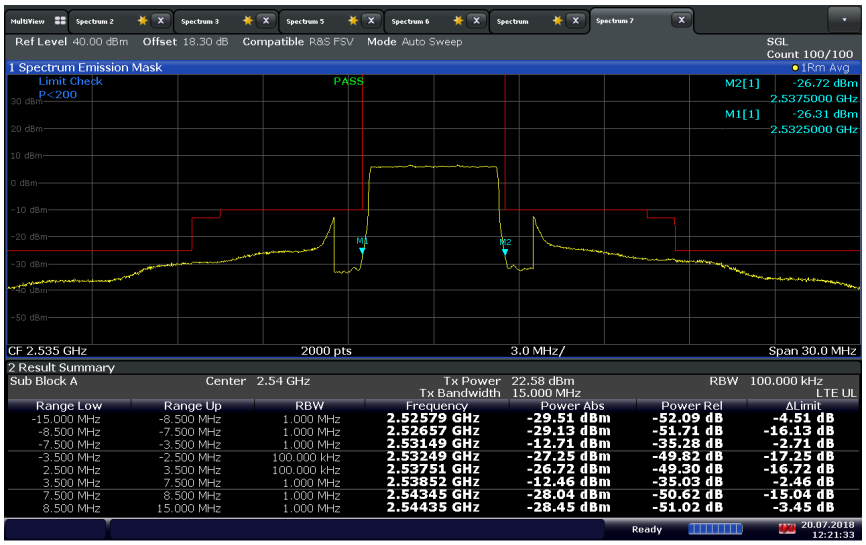
12:18:04 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (5 MHz BW)/QPSK/Middle Channel 2535 MHz

10:04:08 20.07.2018

LTE Band 7 (5 MHz BW)/QPSK/Middle Channel 2535 MHz Mask



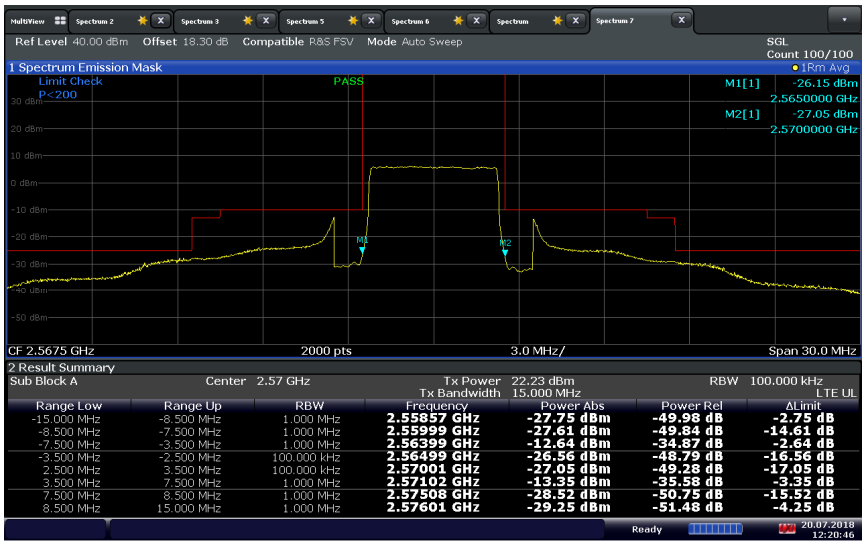
12:21:34 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (5 MHz BW)/QPSK/High Channel 2567.5 MHz

10:02:10 20.07.2018

LTE Band 7 (5 MHz BW)/QPSK/High Channel 2567.5 MHz Mask



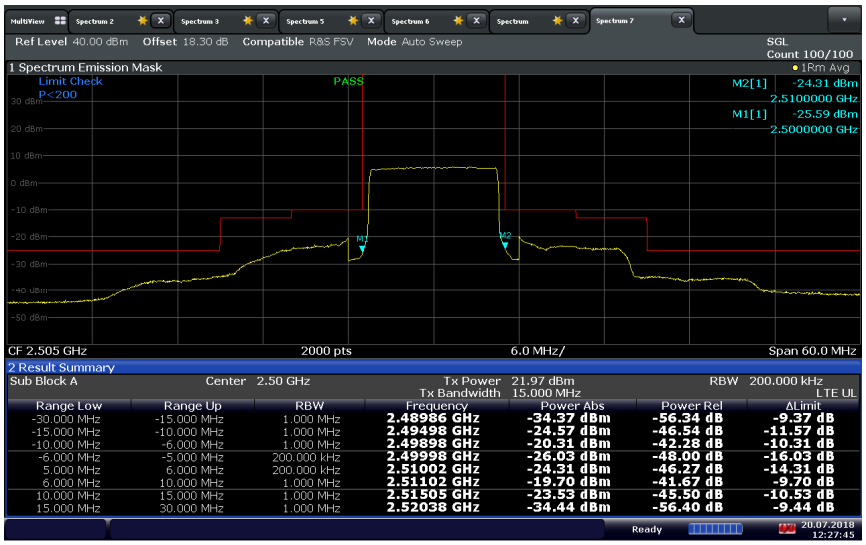
12:20:46 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (10 MHz BW)/QPSK/Low Channel 2505 MHz

10:07:24 20.07.2018

LTE Band 7 (10 MHz BW)/QPSK/Low Channel 2505 MHz Mask



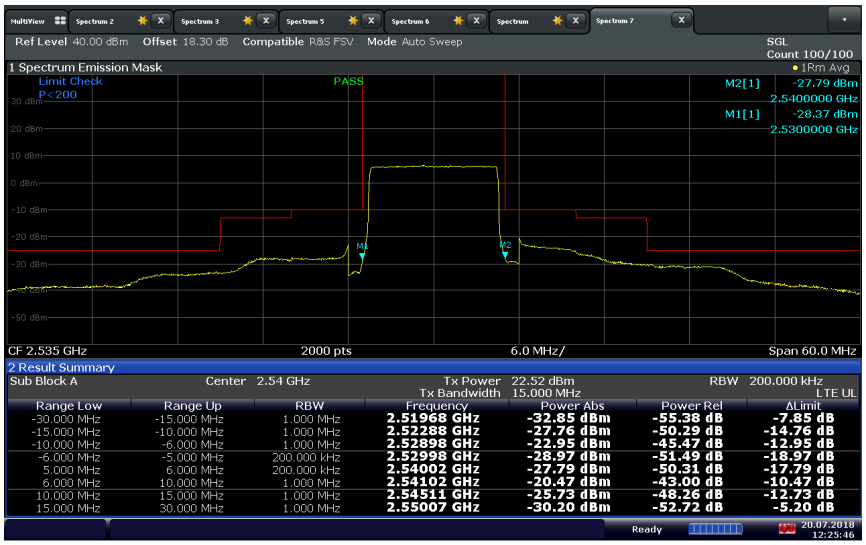
12:27:46 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (10 MHz BW)/QPSK/Middle Channel 2535 MHz

10:13:49 20.07.2018

LTE Band 7 (10 MHz BW)/QPSK/Middle Channel 2535 MHz



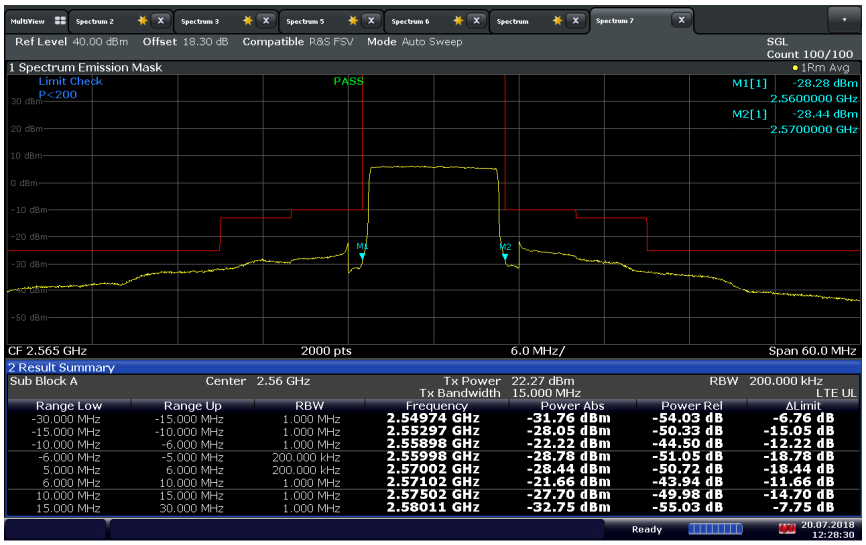
12:25:46 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (10 MHz BW)/QPSK/High Channel 2565 MHz

10:12:52 20.07.2018

LTE Band 7 (10 MHz BW)/QPSK/High Channel 2565 MHz



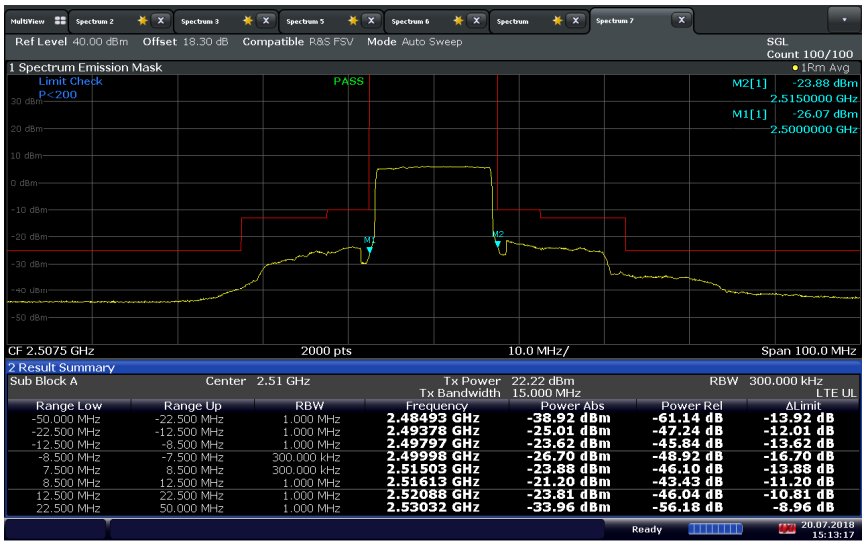
12:28:30 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (15 MHz BW)/QPSK/Low Channel 2507.5 MHz

10:18:24 20.07.2018

LTE Band 7 (15 MHz BW)/QPSK/Low Channel 2507.5 MHz Mask



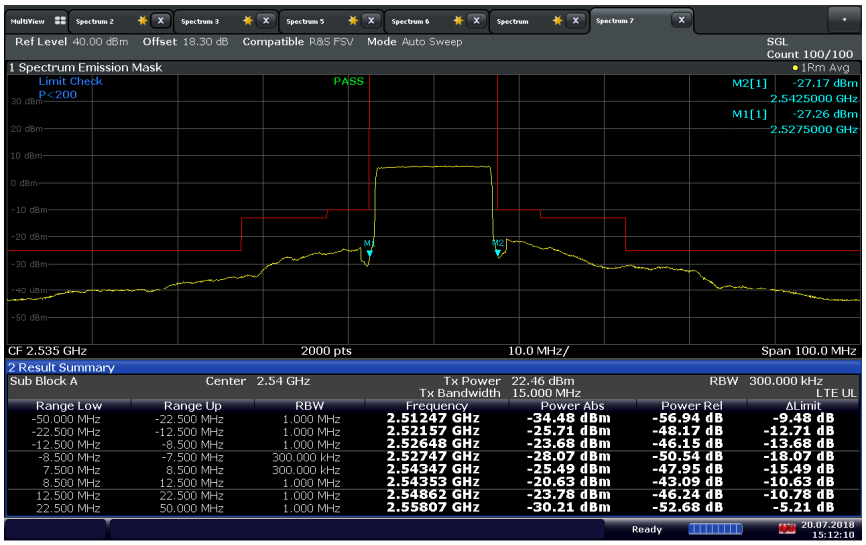
15:13:17 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (15 MHz BW)/QPSK/Middle Channel 2535 MHz

10:15:14 20.07.2018

LTE Band 7 (15 MHz BW)/QPSK/Middle Channel 2535 MHz Mask



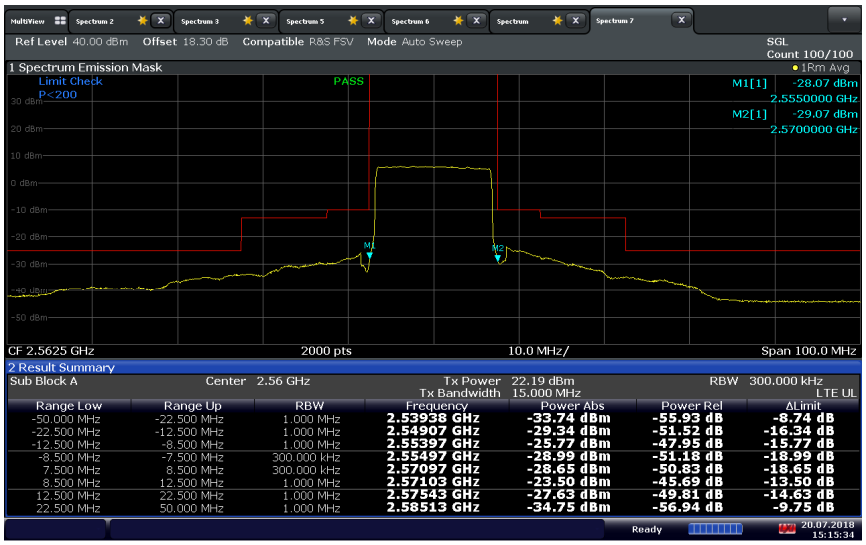
15:12:10 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (15 MHz BW)/QPSK/High Channel 2562.5 MHz

10:30:27 20.07.2018

LTE Band 7 (15 MHz BW)/QPSK/High Channel 2562.5 MHz Mask



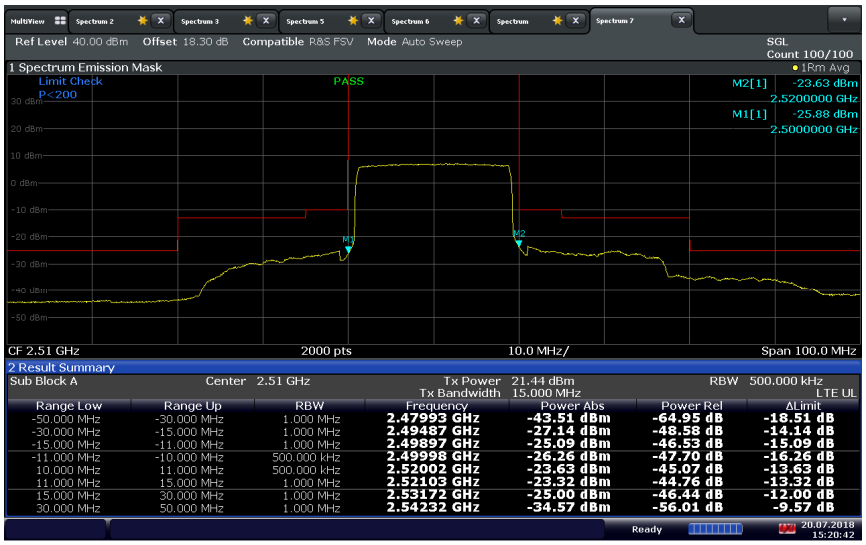
15:15:35 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (20 MHz BW)/QPSK/Low Channel 2510 MHz

10:36:08 20.07.2018

LTE Band 7 (20 MHz BW)/QPSK/Low Channel 2510 MHz Mask



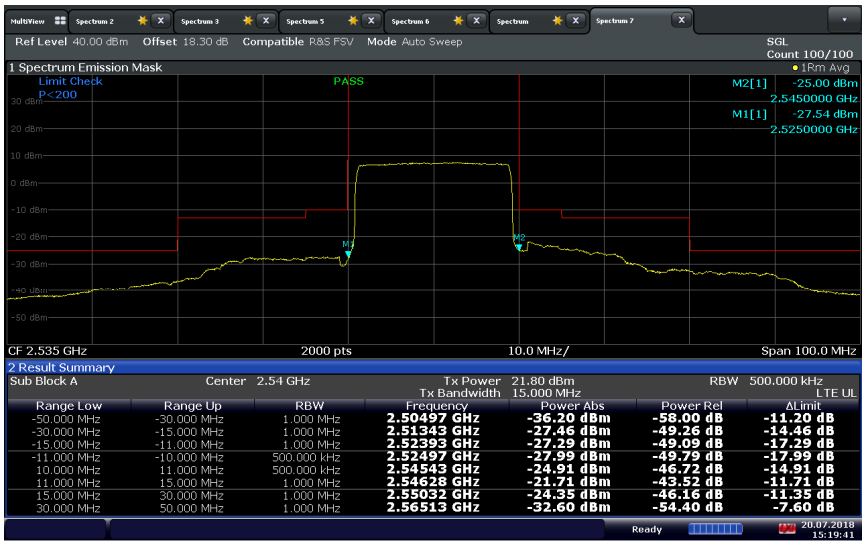
15:20:43 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (20 MHz BW)/QPSK/Middle Channel 2535 MHz Mask

10:32:53 20.07.2018

LTE Band 7 (20 MHz BW)/QPSK/Middle Channel 2535 MHz Mask



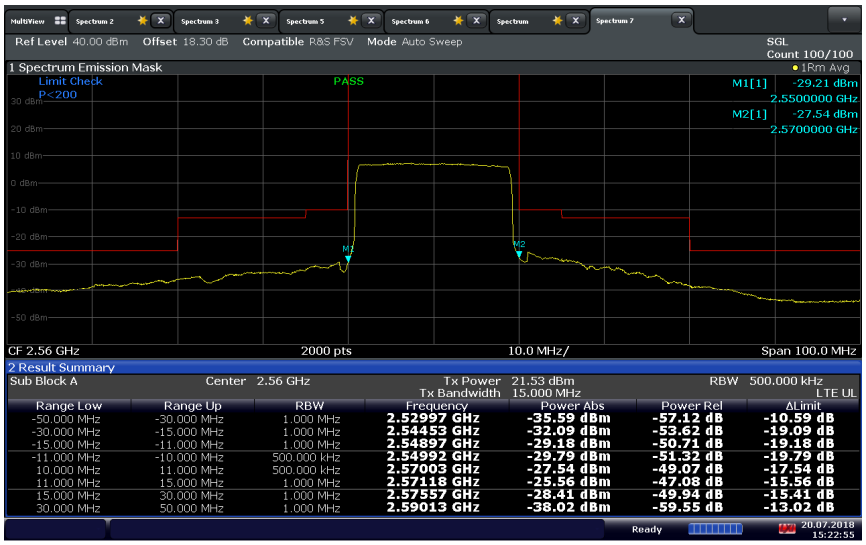
15:19:42 20.07.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 7 (20 MHz BW)/QPSK/High Channel 2560 MHz

10:37:27 20.07.2018

LTE Band 7 (20 MHz BW)/QPSK/High Channel 2560 MHz Mask



15:22:55 20.07.2018

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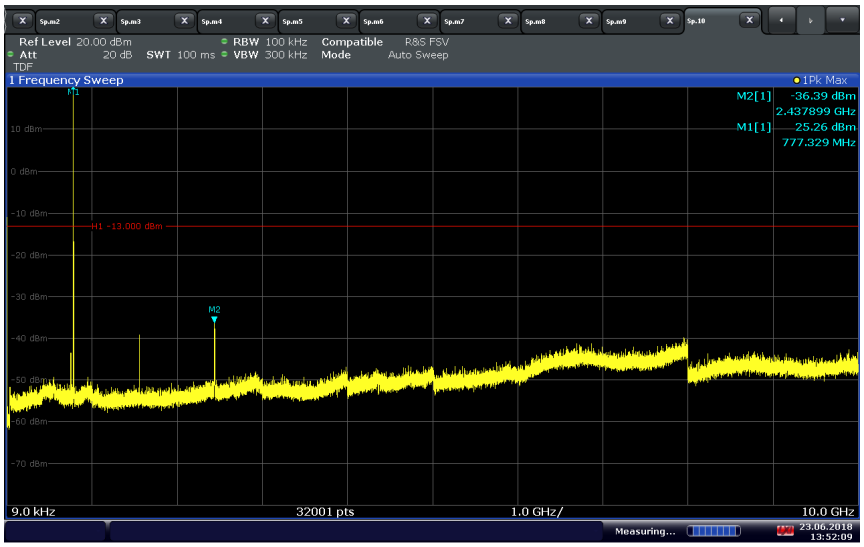
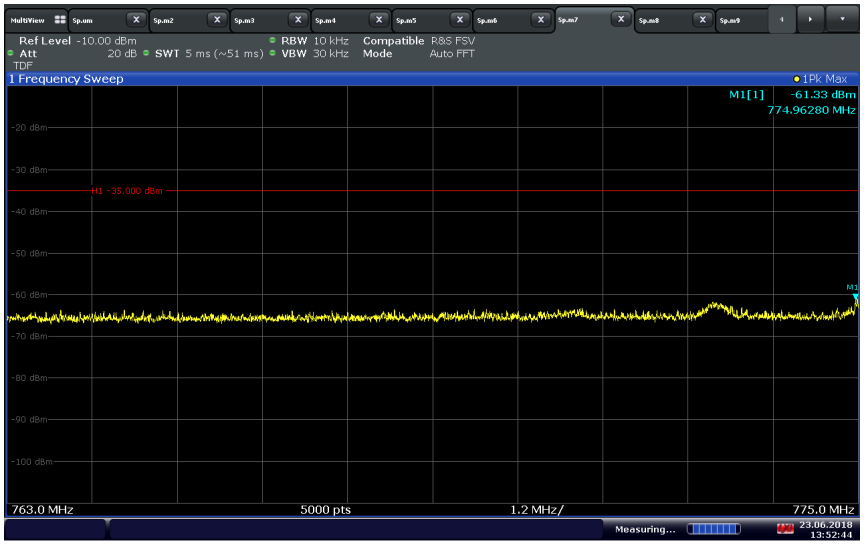
LTE Band 13 (5 MHz BW)/QPSK/Low Channel 779.5 MHz



13:52:10 23.06.2018

LTE Band 13 (5 MHz BW)/QPSK/Low Channel 779.5 MHz Conducted Spurious Emissions (763-775 MHz)



13:52:44 23.06.2018

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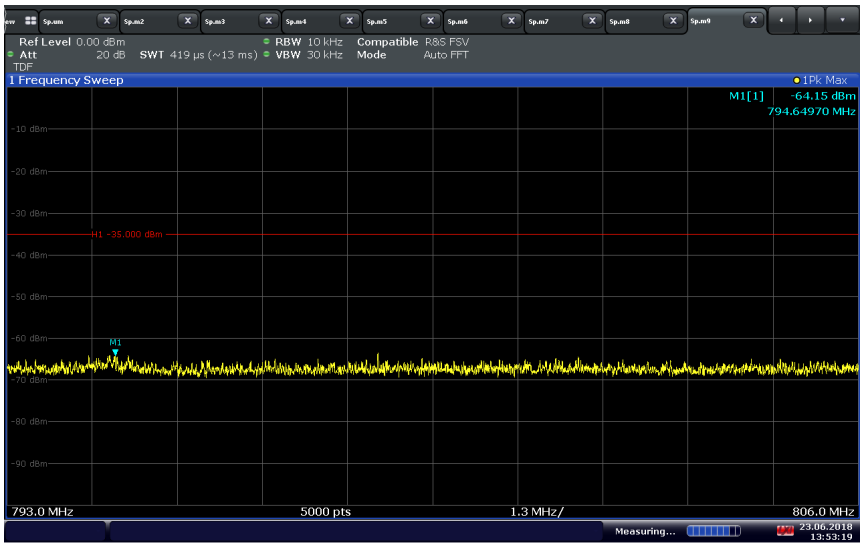
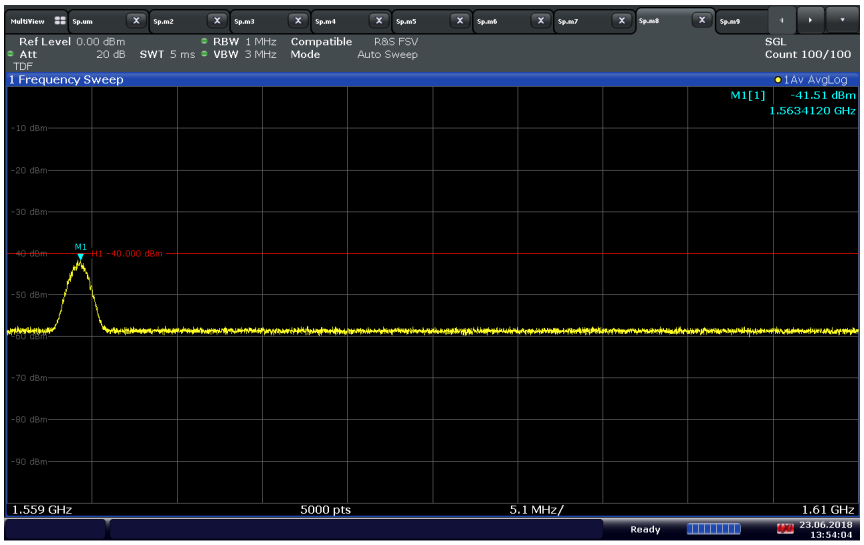
LTE Band 13 (5 MHz BW)/QPSK/Low Channel 779.5 MHz Conducted Spurious Emissions (793-806 MHz)



13:53:19 23.06.2018

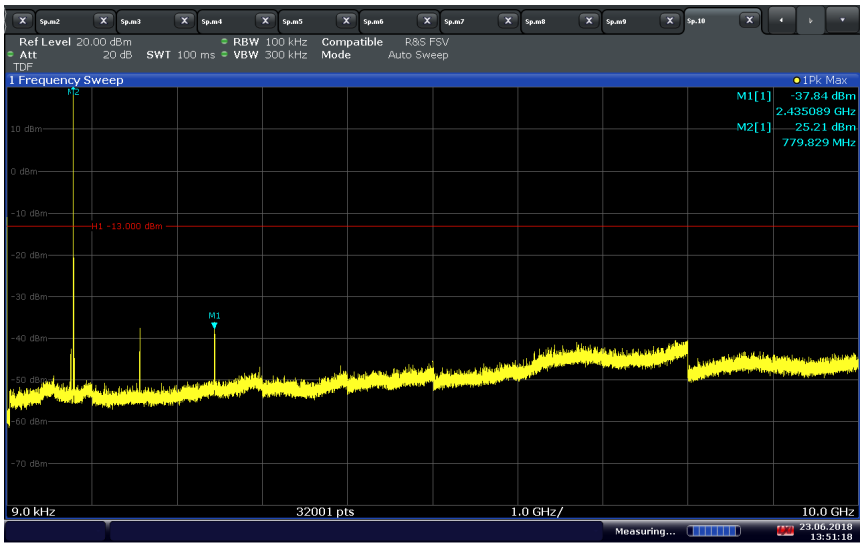
LTE Band 13 (5 MHz BW)/QPSK/Low Channel 779.5 MHz Conducted Spurious Emissions (1559-1610 MHz)



13:54:05 23.06.2018

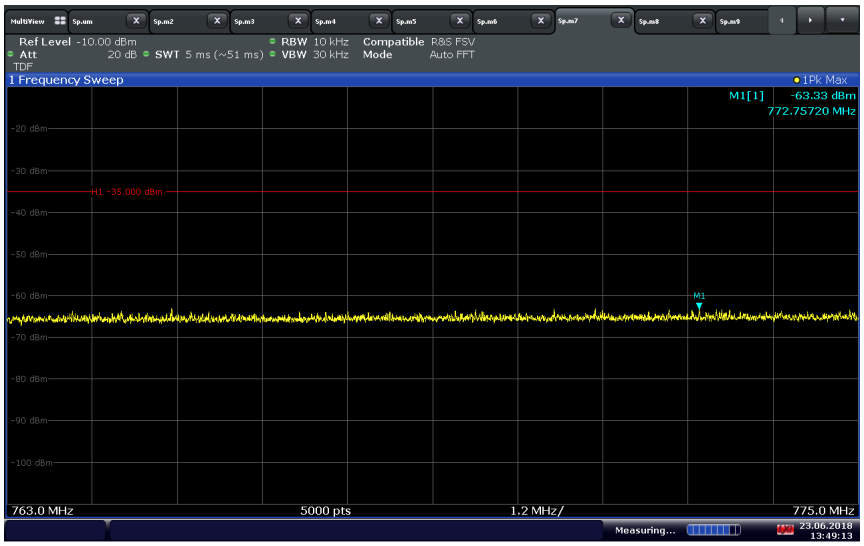
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 13 (5 MHz BW)/QPSK/Middle Channel 782 MHz



13:51:18 23.06.2018

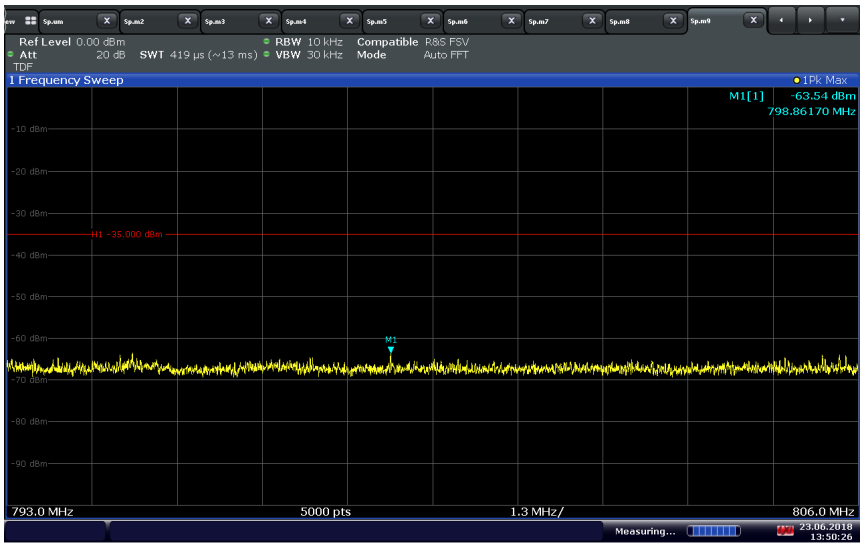
LTE Band 13 (5 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (763-775 MHz)



13:49:13 23.06.2018

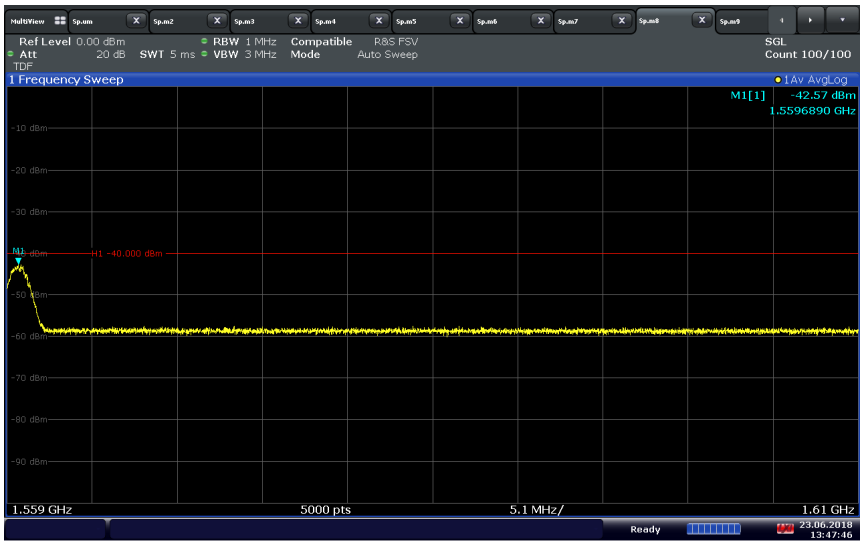
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 13 (5 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (793-806 MHz)



13:50:27 23.06.2018

LTE Band 13 (5 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (1559-1610 MHz)



13:47:47 23.06.2018

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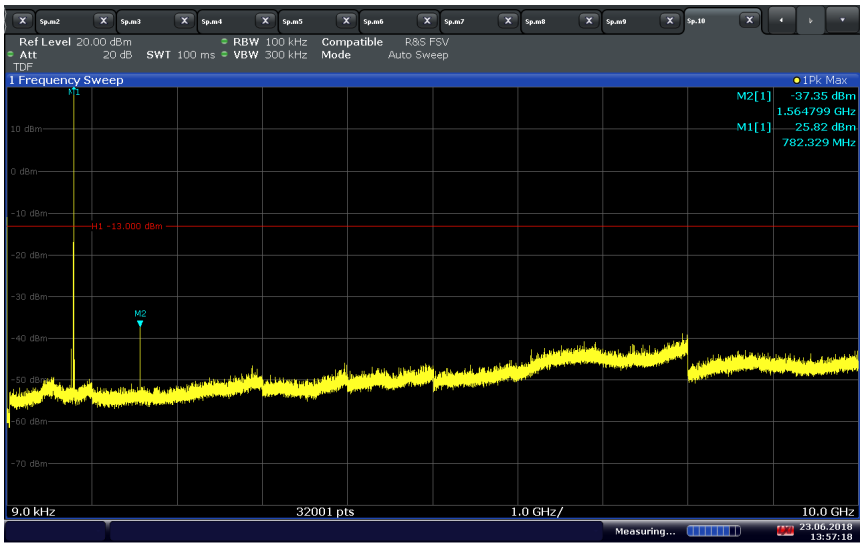
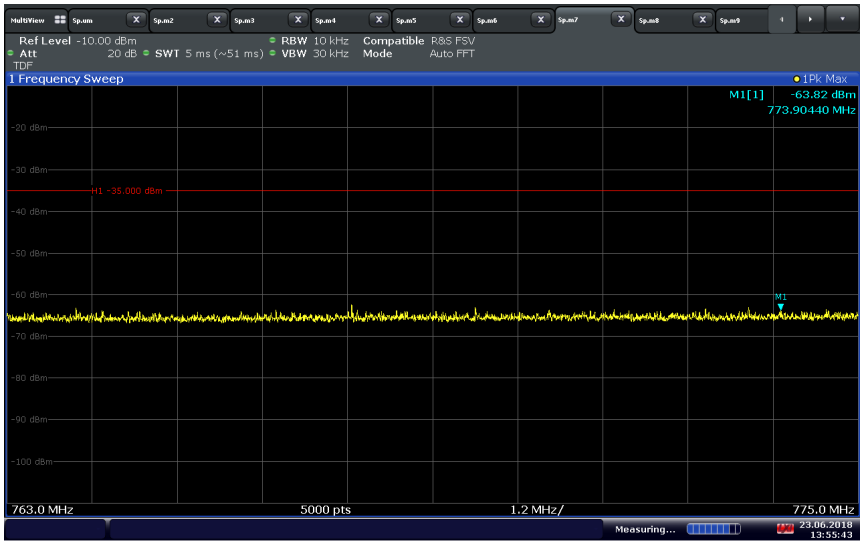
LTE Band 13 (5 MHz BW)/QPSK/High Channel 784.5 MHz



13:57:19 23.06.2018

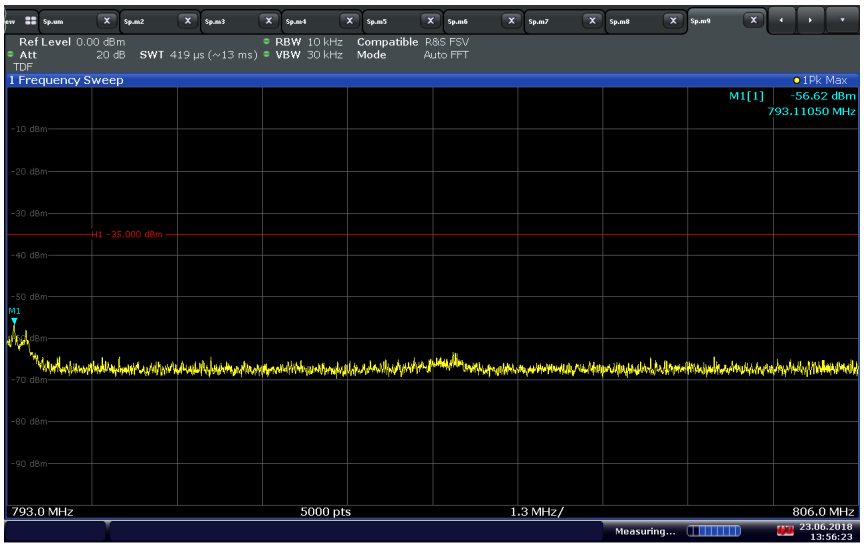
LTE Band 13 (5 MHz BW)/QPSK/High Channel 784.5 MHz Conducted Spurious Emissions (763-775 MHz)



13:55:44 23.06.2018

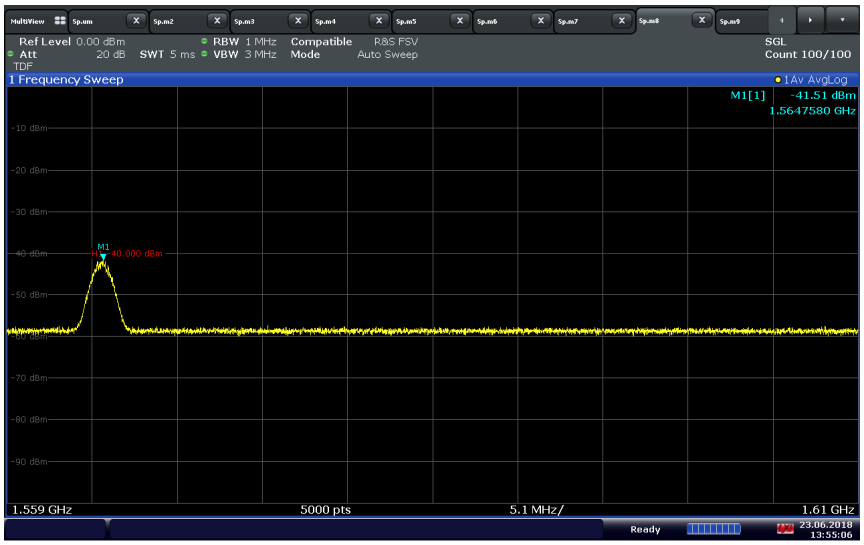
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 13 (5 MHz BW)/QPSK/High Channel 784.5 MHz Conducted Spurious Emissions (793-806 MHz)



13:56:23 23.06.2018

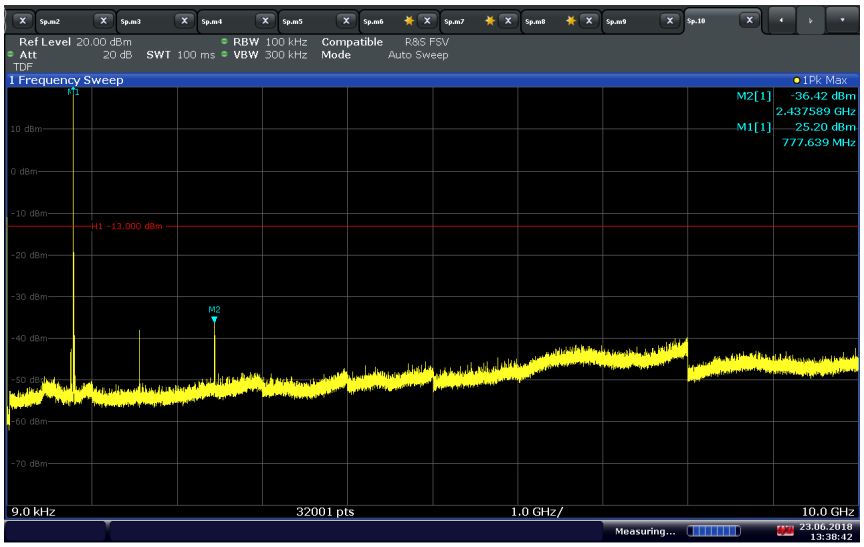
LTE Band 13 (5 MHz BW)/QPSK/High Channel 784.5 MHz Conducted Spurious Emissions (1559-1610 MHz)



13:55:06 23.06.2018

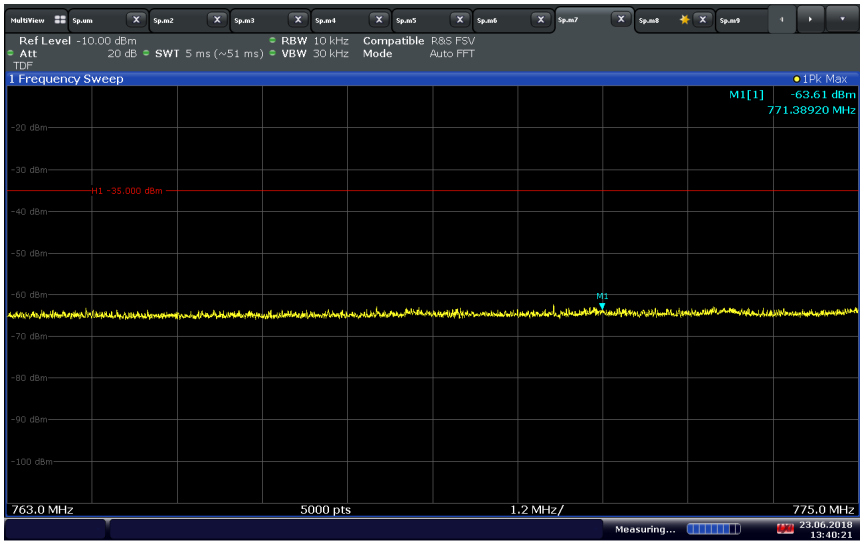
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 13 (10 MHz BW)/QPSK/Middle Channel782 MHz



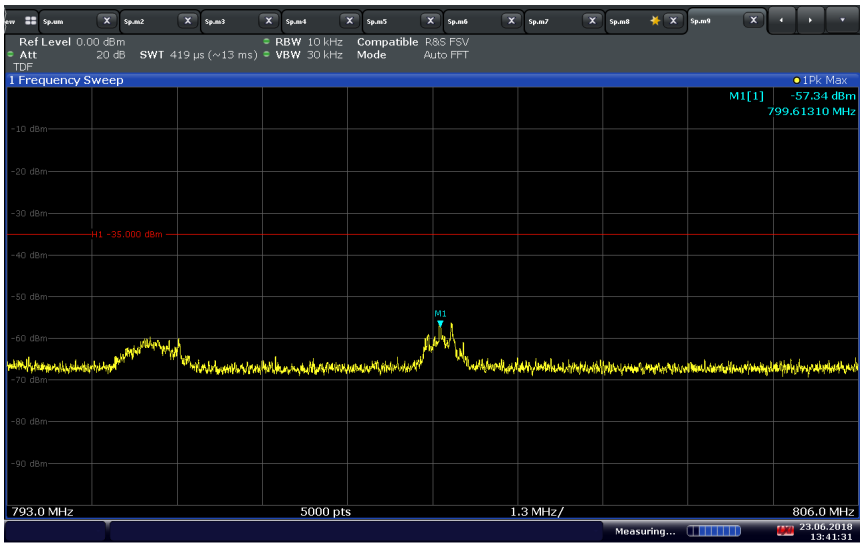
13:38:42 23.06.2018

LTE Band 13 (10 MHz BW)/QPSK/Middle Channel782 MHz Conducted Spurious Emissions (763-775 MHz)



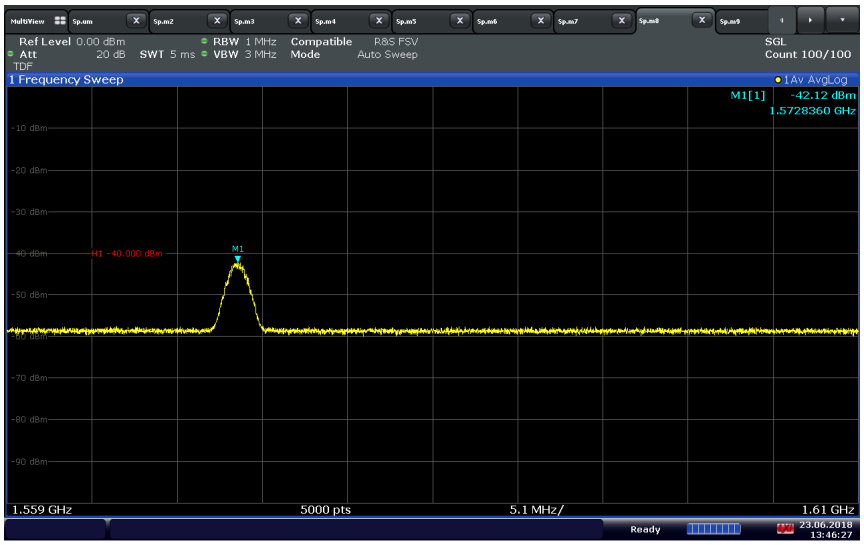
13:40:22 23.06.2018

LTE Band 13 (10 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (793-806 MHz)



13:41:32 23.06.2018

LTE Band 13 (10 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (1559-1610 MHz)



13:46:28 23.06.2018

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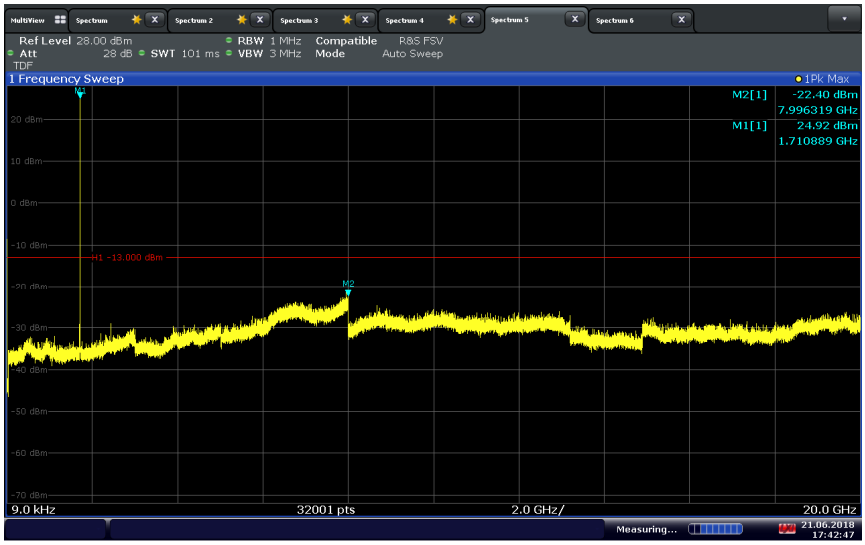
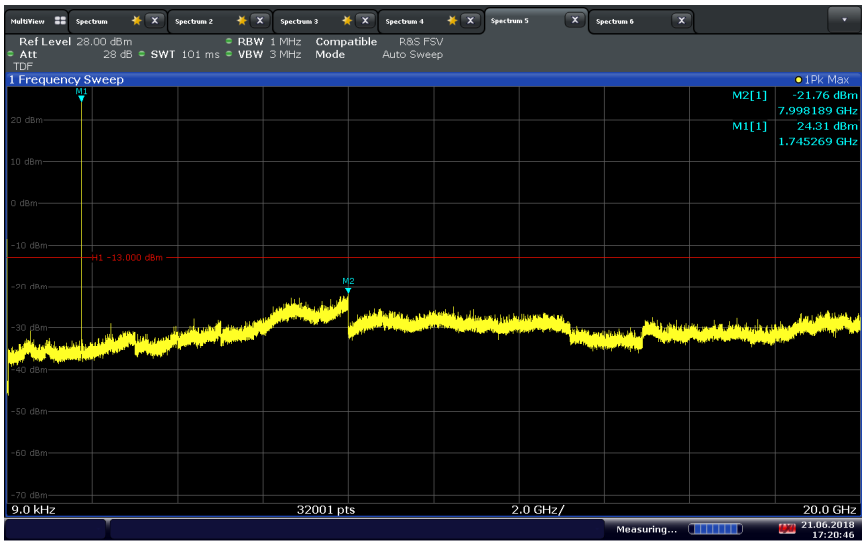
LTE Band 66 (1.4 MHz BW)/QPSK/Low Channel 1710.7 MHz



17:42:48 21.06.2018

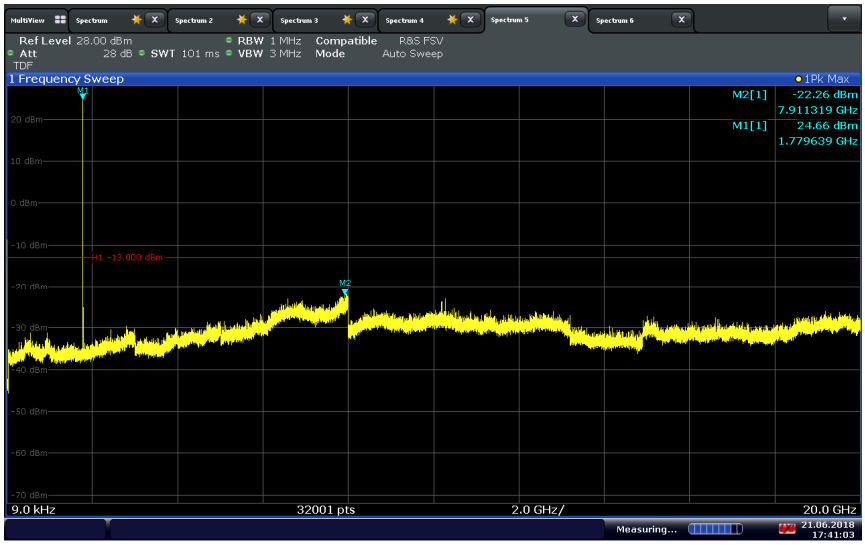
LTE Band 66 (1.4 MHz BW)/QPSK/Middle Channel 1745 MHz



17:20:46 21.06.2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 66 (1.4 MHz BW)/QPSK/High Channel 1779.3 MHz



17:41:04 21.06.2018

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2.8 FIELD STRENGTH OF SPURIOUS RADIATION

2.8.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053
FCC 47 CFR Part 27, Clause 27.53(h)(1)
FCC 47 CFR Part 27, Clause 27.53(m)(4)
FCC 47 CFR Part 27, Clause 27.53(c)(2)
RSS-139, Clause 6.6
RSS-199, Clause 4.5
RSS-130, Clause 4.6

2.8.2 Standard Applicable

FCC 47 CFR Part 27.53
(h)(1) AWS emission limits – (1) General protection levels. Except as otherwise specified below, for operatios 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 MHz 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.

(m)(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log(P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section.

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band)s) of operatio, measured in watts, in accordance with the following:
(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 + 1010 log10 (P) dB.

RSS-139, Clause 6.6:
(i) In the first 1.0 MHz bands immediatel outside and adjacent to the equipment's smallest opreating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (dBW), by at least 43 + 10 $\log_{10}$ p (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output ower P (dBW), by at least 43 + 10 $\log_{10}$ p (watts) dB.

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RSS-199, Clause 4.5:
In the 1 MHz band immediatel outside and adjacent to the channel edge, the unwanted emission power shall be measured with a resolution bandwidth of at 1% of the occupied bandwidth for base station and fixed subscriber equipment, and 2% for mobile subscriber equipment. Beyond the 1 MHz band, a resolution bandwidth of 1 MHz shall be used.
(b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:
(i) 40 + 10 $\log_{10}$ p from the channel edges to 5 MHz away.
(ii) 43 + 10 $\log_{10}$ p between 5 MHz and X MHz from the channel edges, and
(iii) 55 + 10 $\log_{10}$ p at X MHz and beyond from the channel edges

RSS-130:
4.6.1 The power of any unwanted emissios 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.

2.8.3 Equipment Under Test and Modification State

Serial No: AZ280418A00044 / Test Configuration B

2.8.4 Date of Test/Initial of test personnel who performed the test

July 14, 18 and 27, 2018 / XYZ

2.8.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.7 - 25.9 °C
Relative Humidity	54.8 - 57.2 %
ATM Pressure	98.7 - 99.1 kPa

2.8.7 Additional Observations

- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-C 2004, August 17, 2004.
- This is cabinet spurious emissions testing. Main antenna port was terminated during the test. Fundamental frequency measurement will be ignored for this test.
- Emissions within 6dB of the limit will be proven by substitution method.
- Only the worst case configuration presented in this test report.
- Only noise floor measurements observed above 18GHz.
- Measurement was done using EMC32 V8.52 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

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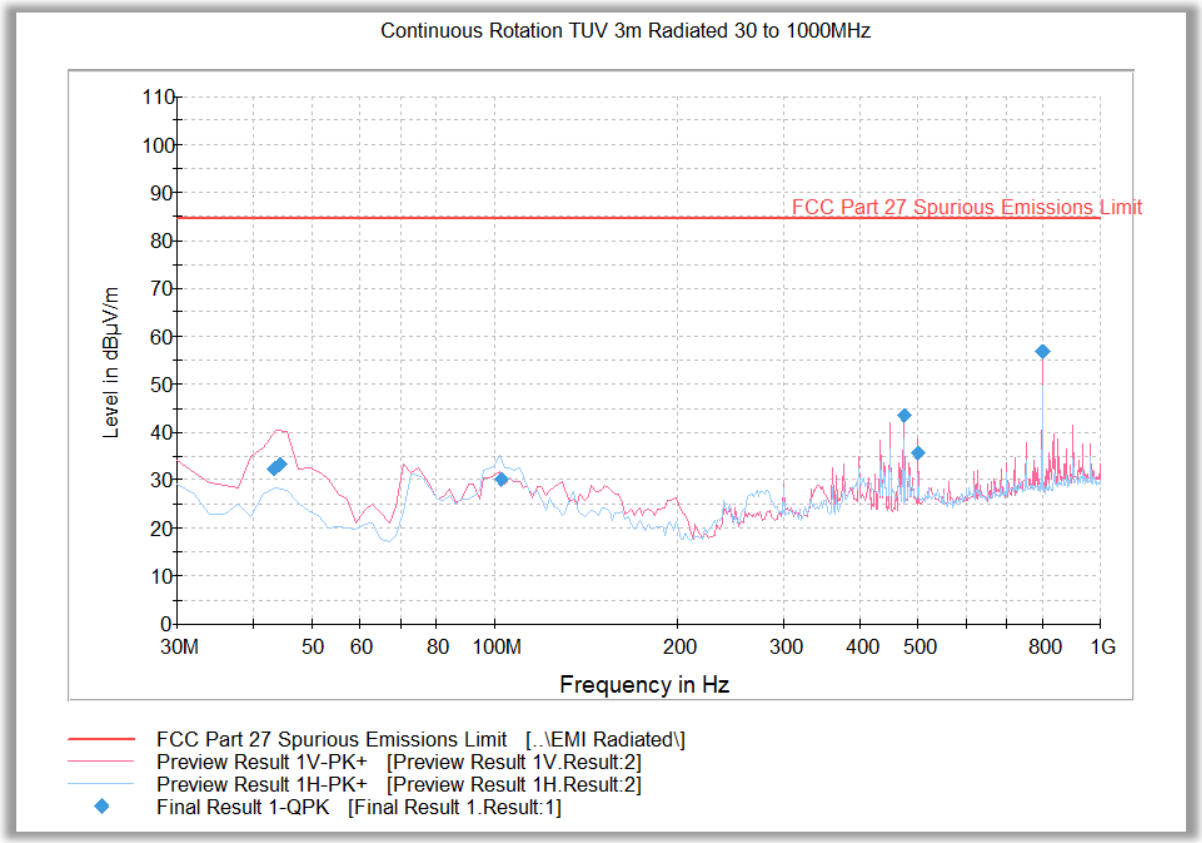
2.8.8 Test Results

Compliant. See attached plots.

2.8.9 Radiated Emission Test Results Below 1GHz – Worst Case LTE Band 4_20MHz Bandwidth_Low Channel 1720 MHz _1 RB 0 offset_QPSK



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
43.247214	32.5	1000.0	120.000	105.0	V	207.0	-13.6	51.9	84.4
44.263327	33.2	1000.0	120.000	100.0	V	105.0	-13.8	51.2	84.4
102.763848	30.1	1000.0	120.000	336.0	H	-14.0	-14.9	54.3	84.4
474.990301	43.5	1000.0	120.000	195.0	V	112.0	-1.4	40.9	84.4
499.980842	35.6	1000.0	120.000	170.0	V	131.0	-1.6	48.8	84.4
800.003447	56.8	1000.0	120.000	105.0	V	183.0	4.1	27.6	84.4

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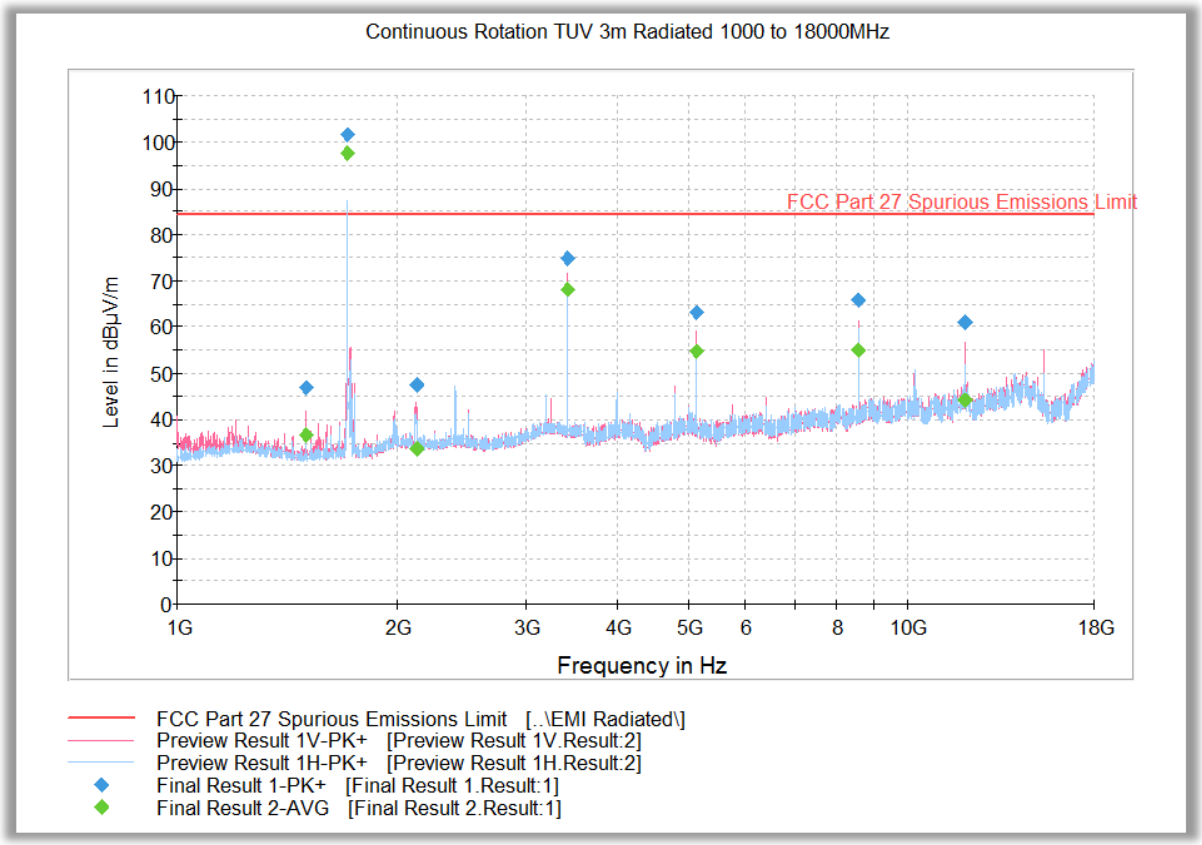
2.8.10 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 4_20MHz Bandwidth_Low Channel 1720 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	46.9	1000.0	1000.000	252.3	V	203.0	-9.0	35.3	82.2
1711.000000	101.6	1000.0	1000.000	146.7	H	-19.0	-7.7	Fundamental Carrier*	
2124.833333	47.4	1000.0	1000.000	102.8	V	-1.0	-5.6	34.8	82.2
3422.133333	74.9	1000.0	1000.000	208.5	V	273.0	-0.8	7.3	82.2
5133.466667	63.1	1000.0	1000.000	200.5	V	243.0	3.1	19.2	82.2
8555.566667	65.9	1000.0	1000.000	270.3	V	202.0	8.6	16.3	82.2
11977.433333	60.9	1000.0	1000.000	235.4	V	202.0	13.3	21.3	82.2

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	36.7	1000.0	1000.000	252.3	V	203.0	-9.0	45.5	82.2
1711.000000	97.8	1000.0	1000.000	146.7	H	-19.0	-7.7	Fundamental Carrier*	
2124.833333	33.8	1000.0	1000.000	102.8	V	-1.0	-5.6	48.4	82.2
3422.133333	68.4	1000.0	1000.000	208.5	V	273.0	-0.8	13.9	82.2
5133.466667	54.6	1000.0	1000.000	200.5	V	243.0	3.1	27.6	82.2
8555.566667	55.0	1000.0	1000.000	270.3	V	202.0	8.6	27.2	82.2
11977.433333	44.2	1000.0	1000.000	235.4	V	202.0	13.3	38.1	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

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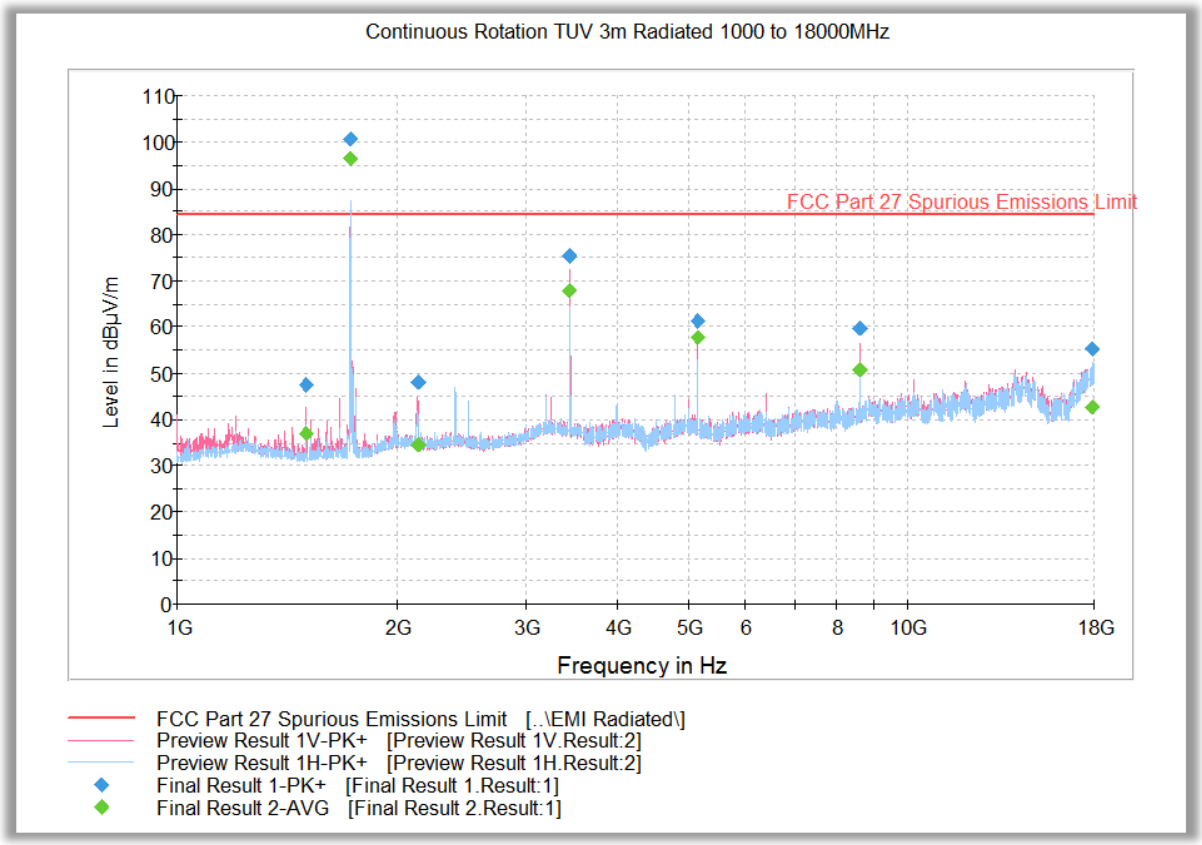
2.8.11 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 4_20MHz Bandwidth _Middle Channel 1732.5 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	47.4	1000.0	1000.000	250.5	V	182.0	-9.0	34.8	82.2
1723.433333	100.7	1000.0	1000.000	139.7	V	243.0	-7.5	Fundamental Carrier*	
2133.133333	48.0	1000.0	1000.000	115.7	V	6.0	-5.6	34.3	82.2
3447.066667	75.5	1000.0	1000.000	207.5	V	273.0	-0.8	6.7	82.2
5170.866667	61.4	1000.0	1000.000	204.5	V	188.0	3.3	20.9	82.2
8617.900000	59.8	1000.0	1000.000	177.6	V	193.0	8.8	22.4	82.2
17926.333333	55.4	1000.0	1000.000	142.7	H	20.0	21.3	26.8	82.2

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	36.9	1000.0	1000.000	250.5	V	182.0	-9.0	45.4	82.2
1723.433333	96.5	1000.0	1000.000	139.7	V	243.0	-7.5	Fundamental Carrier*	
2133.133333	34.7	1000.0	1000.000	115.7	V	6.0	-5.6	47.6	82.2
3447.066667	67.8	1000.0	1000.000	207.5	V	273.0	-0.8	14.4	82.2
5170.866667	57.7	1000.0	1000.000	204.5	V	188.0	3.3	24.6	82.2
8617.900000	50.7	1000.0	1000.000	177.6	V	193.0	8.8	31.5	82.2
17926.333333	42.6	1000.0	1000.000	142.7	H	20.0	21.3	39.7	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

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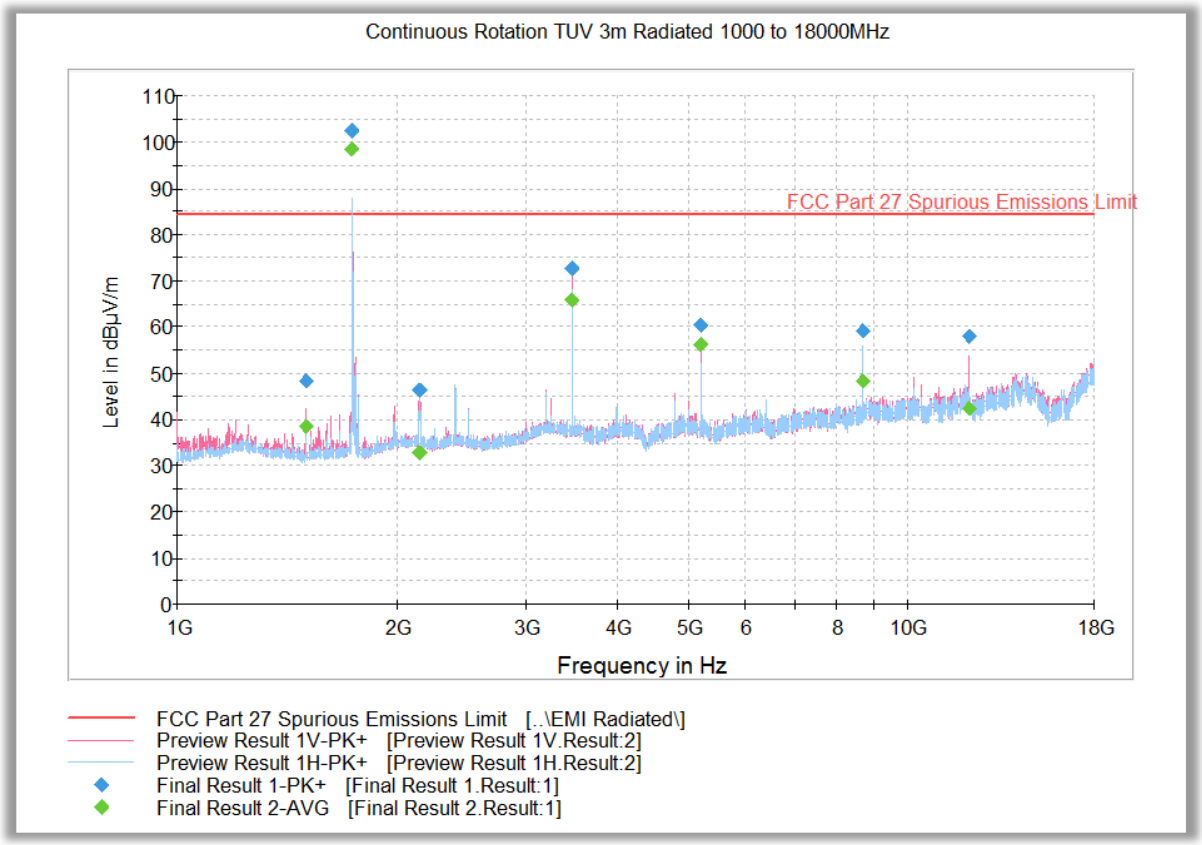
2.8.12 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 4_20MHz Bandwidth_High Channel 1745 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	48.4	1000.0	1000.000	250.5	V	196.0	-9.0	33.8	82.2
1735.900000	102.6	1000.0	1000.000	252.3	V	287.0	-7.2	Fundamental Carrier*	
2151.266667	46.2	1000.0	1000.000	352.7	H	-19.0	-5.6	36.0	82.2
3472.000000	72.6	1000.0	1000.000	204.5	V	259.0	-0.8	9.6	82.2
5208.266667	60.5	1000.0	1000.000	140.7	V	204.0	3.4	21.8	82.2
8680.433333	59.2	1000.0	1000.000	191.5	H	-2.0	8.9	23.0	82.2
12152.533333	58.0	1000.0	1000.000	231.4	V	209.0	13.0	24.2	82.2

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	38.4	1000.0	1000.000	250.5	V	196.0	-9.0	43.8	82.2
1735.900000	98.7	1000.0	1000.000	252.3	V	287.0	-7.2	Fundamental Carrier*	
2151.266667	32.7	1000.0	1000.000	352.7	H	-19.0	-5.6	49.5	82.2
3472.000000	65.7	1000.0	1000.000	204.5	V	259.0	-0.8	16.5	82.2
5208.266667	56.1	1000.0	1000.000	140.7	V	204.0	3.4	26.2	82.2
8680.433333	48.5	1000.0	1000.000	191.5	H	-2.0	8.9	33.8	82.2
12152.533333	42.2	1000.0	1000.000	231.4	V	209.0	13.0	40.0	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

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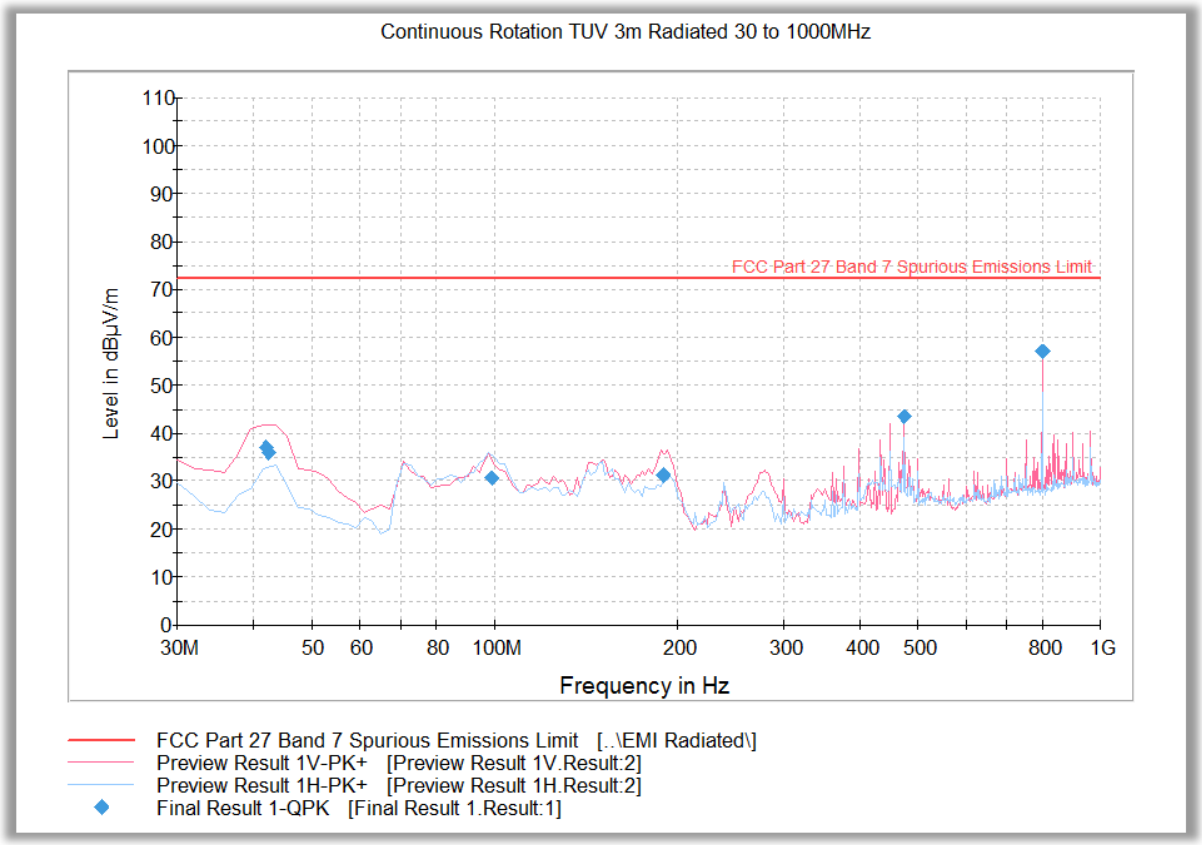
2.8.13 Radiated Emission Test Results Below 1GHz – Worst Case LTE Band 7_5MHz Bandwidth_Middle Channel 2535MHz_1 RB 13 offset_QPSK



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
43.247214	32.5	1000.0	120.000	105.0	V	207.0	-13.6	35.4	72.4
44.263327	33.2	1000.0	120.000	100.0	V	105.0	-13.8	36.6	72.4
102.763848	30.1	1000.0	120.000	336.0	H	-14.0	-14.9	41.8	72.4
474.990301	43.5	1000.0	120.000	195.0	V	112.0	-1.4	41.0	72.4
499.980842	35.6	1000.0	120.000	170.0	V	131.0	-1.6	29.1	72.4
800.003447	56.8	1000.0	120.000	105.0	V	183.0	4.1	15.3	72.4

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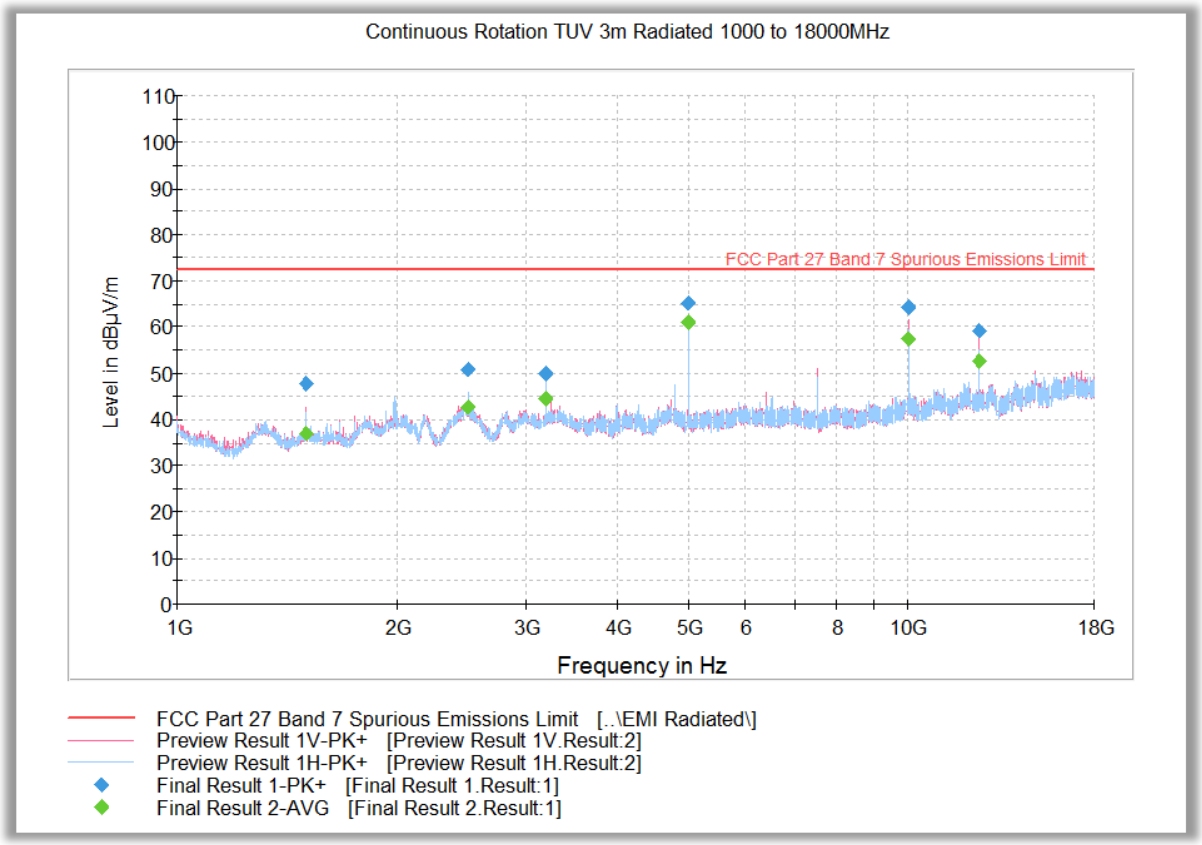
2.8.14 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 7_5MHz Bandwidth_Low Channel 2502.5 MHz_1 RB 13 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	47.7	1000.0	1000.000	232.4	V	207.0	-6.1	24.7	72.4
2502.633333	50.7	1000.0	1000.000	169.6	H	279.0	-0.4	21.7	72.4
3200.000000	49.8	1000.0	1000.000	102.7	H	34.0	1.0	22.6	72.4
5005.400000	65.3	1000.0	1000.000	112.7	V	192.0	3.7	7.1	72.4
10010.766667	64.5	1000.0	1000.000	290.2	V	180.0	9.5	8.0	72.4
12513.333333	59.3	1000.0	1000.000	209.4	V	153.0	13.2	13.1	72.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	37.0	1000.0	1000.000	232.4	V	207.0	-6.1	35.4	72.4
2502.633333	42.6	1000.0	1000.000	169.6	H	279.0	-0.4	29.8	72.4
3200.000000	44.4	1000.0	1000.000	102.7	H	34.0	1.0	28.0	72.4
5005.400000	61.0	1000.0	1000.000	112.7	V	192.0	3.7	11.4	72.4
10010.766667	57.3	1000.0	1000.000	290.2	V	180.0	9.5	15.1	72.4
12513.333333	52.7	1000.0	1000.000	209.4	V	153.0	13.2	19.7	72.4

Test Note: 2.5 - 2.7GHz Notch filter used when testing.

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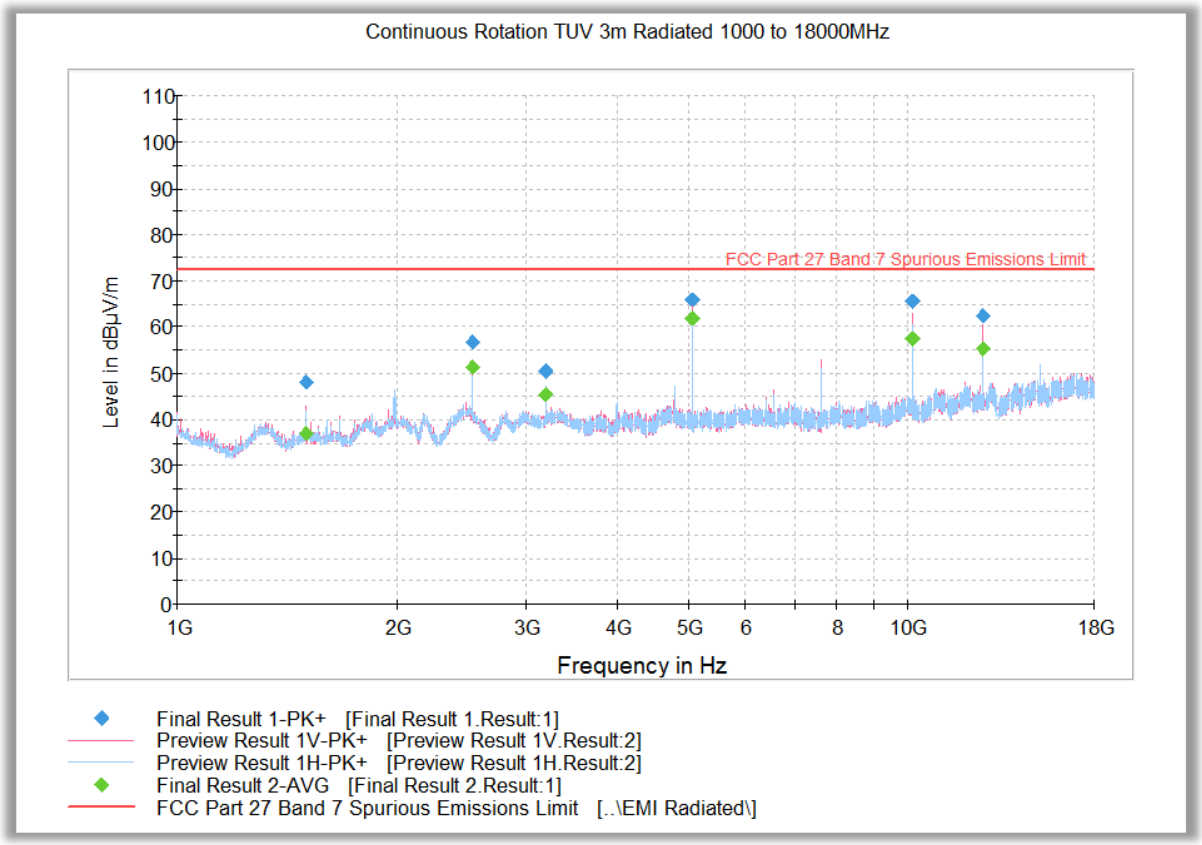
2.8.15 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 7_5MHz Bandwidth_Middle Channel 2535 MHz_1 RB 13 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	48.0	1000.0	1000.000	252.3	V	201.0	-6.1	24.4	72.4
2535.300000	56.9	1000.0	1000.000	120.7	V	96.0	-0.5	15.5	72.4
3200.000000	50.5	1000.0	1000.000	102.8	H	40.0	1.0	21.9	72.4
5070.166667	65.9	1000.0	1000.000	116.7	V	183.0	3.8	6.5	72.4
10140.700000	65.5	1000.0	1000.000	216.5	V	168.0	9.8	6.9	72.4
12676.000000	62.4	1000.0	1000.000	165.6	V	201.0	13.2	10.0	72.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	36.8	1000.0	1000.000	252.3	V	201.0	-6.1	35.6	72.4
2535.300000	51.4	1000.0	1000.000	120.7	V	96.0	-0.5	21.0	72.4
3200.000000	45.4	1000.0	1000.000	102.8	H	40.0	1.0	27.0	72.4
5070.166667	62.0	1000.0	1000.000	116.7	V	183.0	3.8	10.4	72.4
10140.700000	57.4	1000.0	1000.000	216.5	V	168.0	9.8	15.0	72.4
12676.000000	55.2	1000.0	1000.000	165.6	V	201.0	13.2	17.2	72.4

Test Note: 2.5 - 2.7GHz Notch filter used when testing.

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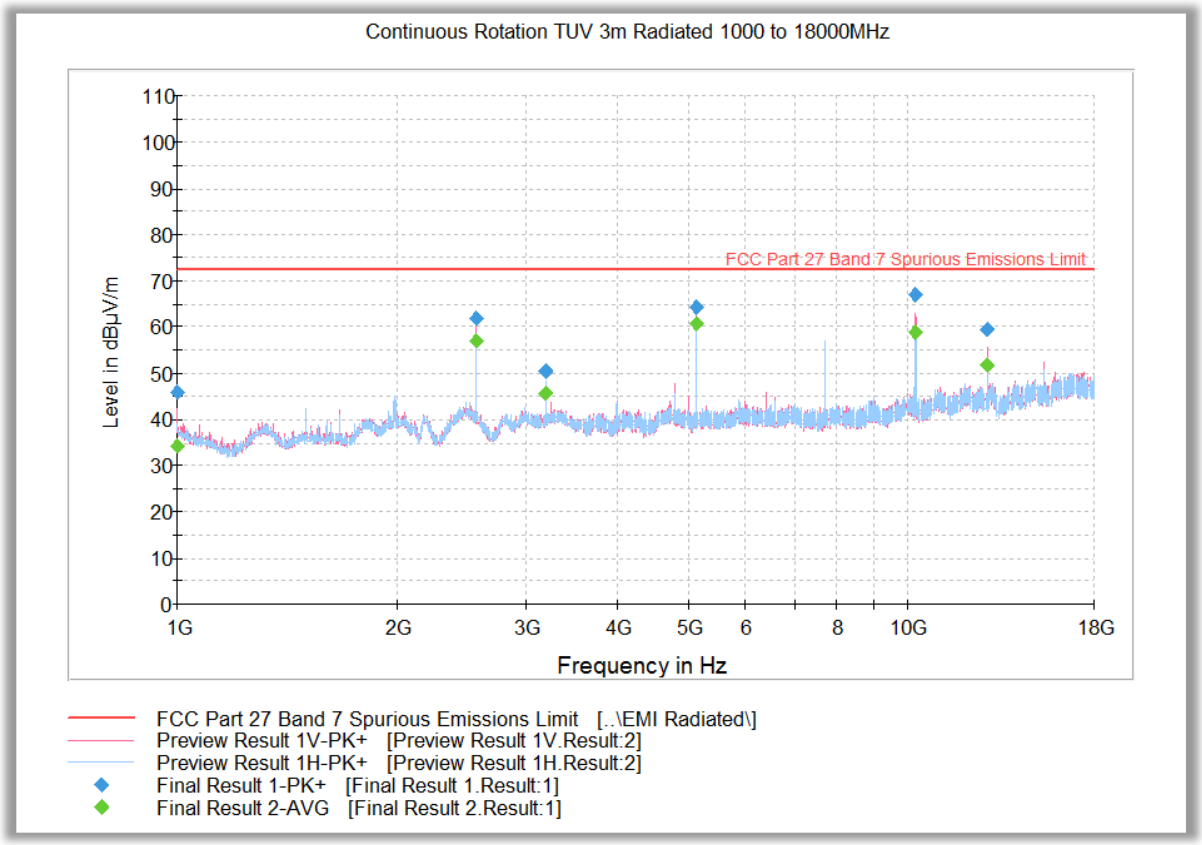
2.8.16 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 7_5MHz Bandwidth_High Channel 2567.5 MHz_1 RB 13 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	46.0	1000.0	1000.000	195.5	V	183.0	-7.0	26.4	72.4
2567.600000	61.9	1000.0	1000.000	120.7	V	95.0	-0.5	10.5	72.4
3200.000000	50.5	1000.0	1000.000	102.7	H	35.0	1.0	21.9	72.4
5135.166667	64.2	1000.0	1000.000	103.7	V	180.0	4.0	8.2	72.4
10270.866667	66.9	1000.0	1000.000	225.4	V	159.0	10.0	5.5	72.4
12838.233333	59.6	1000.0	1000.000	112.7	V	101.0	13.3	12.9	72.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	34.3	1000.0	1000.000	195.5	V	183.0	-7.0	38.1	72.4
2567.600000	57.0	1000.0	1000.000	120.7	V	95.0	-0.5	15.4	72.4
3200.000000	45.6	1000.0	1000.000	102.7	H	35.0	1.0	26.8	72.4
5135.166667	60.6	1000.0	1000.000	103.7	V	180.0	4.0	11.8	72.4
10270.866667	58.8	1000.0	1000.000	225.4	V	159.0	10.0	13.6	72.4
12838.233333	51.8	1000.0	1000.000	112.7	V	101.0	13.3	20.6	72.4

Test Note: 2.5 - 2.7GHz Notch filter used when testing.

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Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dbµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance
10270.866667	66.9	9.3	12.1	-31.2	-28.4	-25	Yes

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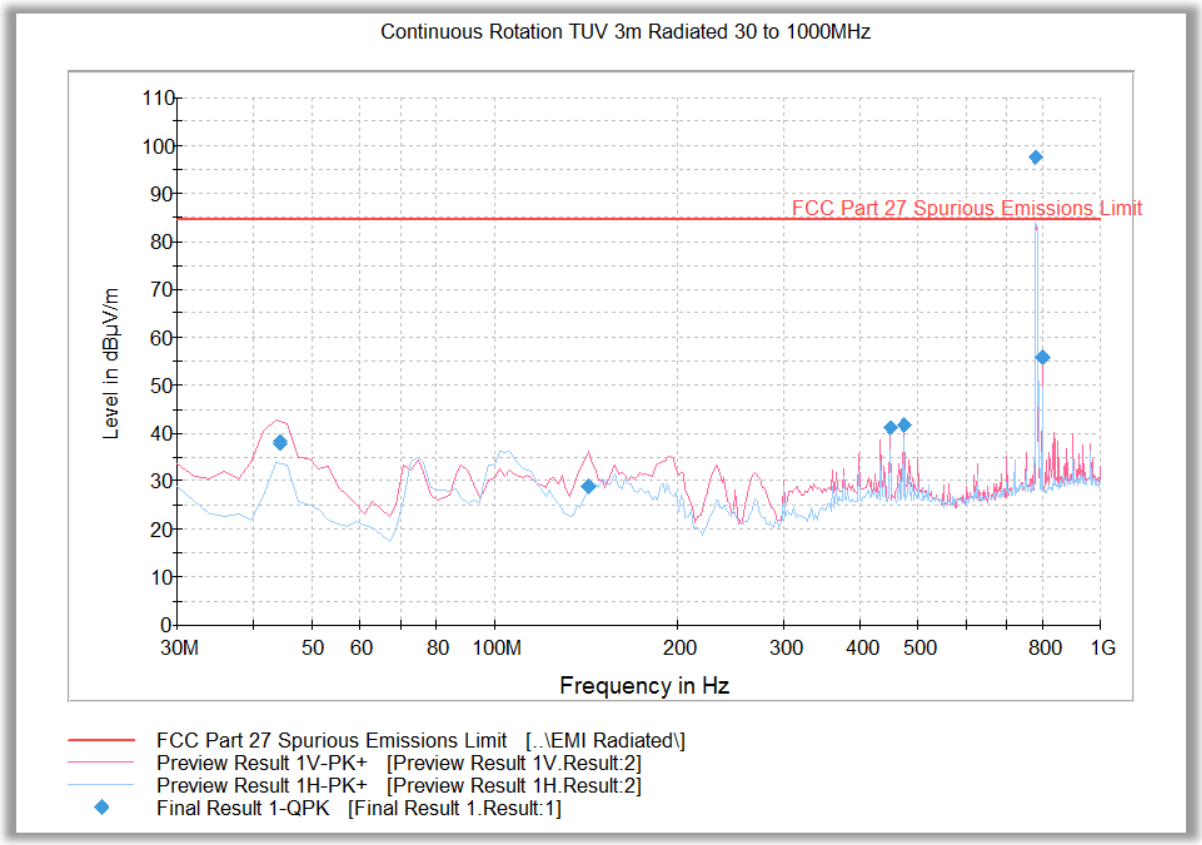
2.8.17 Radiated Emission Test Results Below 1GHz – Worst Case LTE Band 13_5MHz Bandwidth_High Channel 784.5 MHz_1 RB 0 offset_QPSK



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
44.207214	38.1	1000.0	120.000	100.0	V	175.0	-13.8	46.3	84.4
44.263327	38.1	1000.0	120.000	100.0	V	159.0	-13.8	46.3	84.4
142.785491	28.9	1000.0	120.000	100.0	V	328.0	-14.9	55.5	84.4
449.999760	41.0	1000.0	120.000	188.0	V	92.0	-3.1	43.4	84.4
474.990301	41.7	1000.0	120.000	207.0	V	120.0	-1.4	42.7	84.4
782.404569	97.5	1000.0	120.000	100.0	H	329.0	4.4	Fundamental Carrier*	
800.003447	55.9	1000.0	120.000	106.0	V	181.0	4.1	28.5	84.4

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

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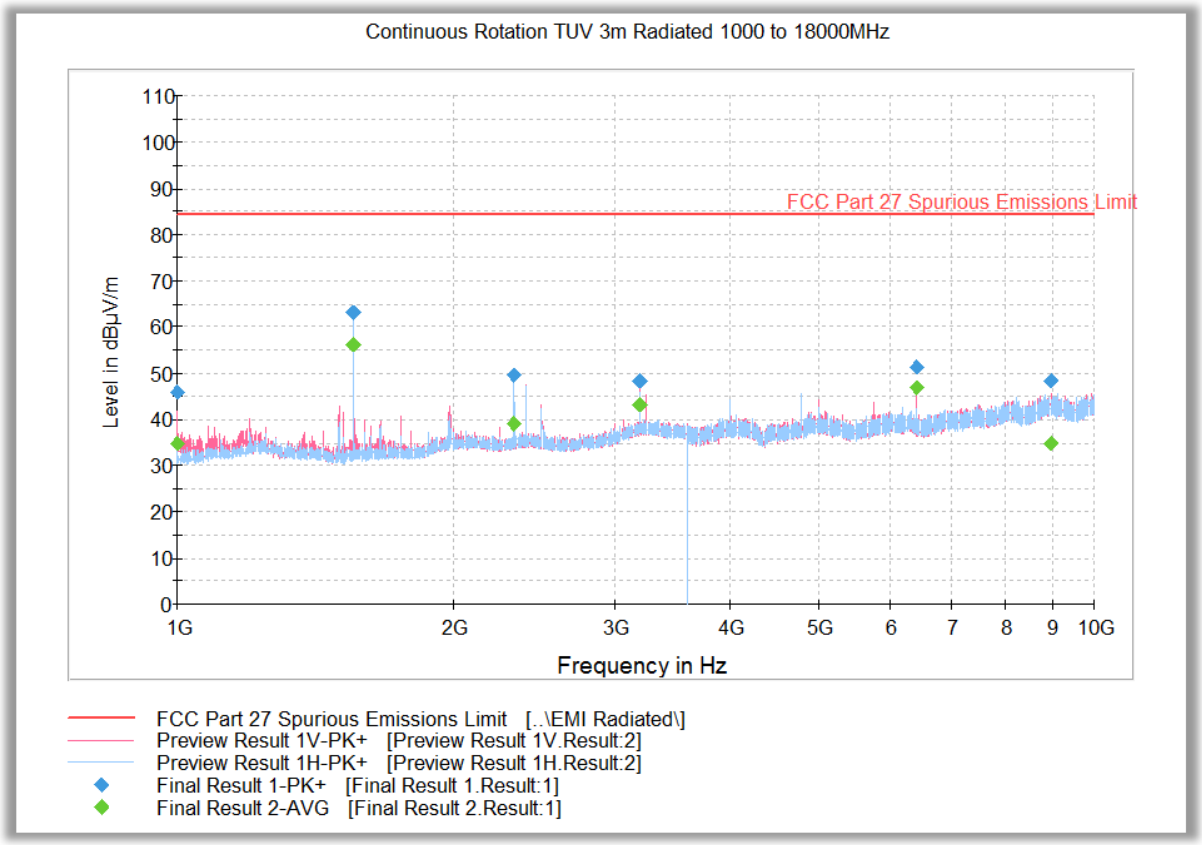
2.8.18 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 13_5MHz Bandwidth_Low Channel 779.5 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	46.0	1000.0	1000.000	208.5	V	195.0	-10.7	38.3	84.4
1554.500000	63.0	1000.0	1000.000	200.5	H	190.0	-8.6	21.4	84.4
2331.800000	49.6	1000.0	1000.000	195.5	H	186.0	-5.3	34.7	84.4
3200.100000	48.4	1000.0	1000.000	195.5	V	256.0	-1.1	36.0	84.4
6399.800000	51.3	1000.0	1000.000	302.2	V	234.0	4.6	33.1	84.4
8974.500000	48.4	1000.0	1000.000	280.2	V	116.0	9.4	36.0	84.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	34.9	1000.0	1000.000	208.5	V	195.0	-10.7	49.4	84.4
1554.500000	56.2	1000.0	1000.000	200.5	H	190.0	-8.6	28.2	84.4
2331.800000	39.2	1000.0	1000.000	195.5	H	186.0	-5.3	45.2	84.4
3200.100000	43.2	1000.0	1000.000	195.5	V	256.0	-1.1	41.1	84.4
6399.800000	46.8	1000.0	1000.000	302.2	V	234.0	4.6	37.5	84.4
8974.500000	34.8	1000.0	1000.000	280.2	V	116.0	9.4	49.6	84.4

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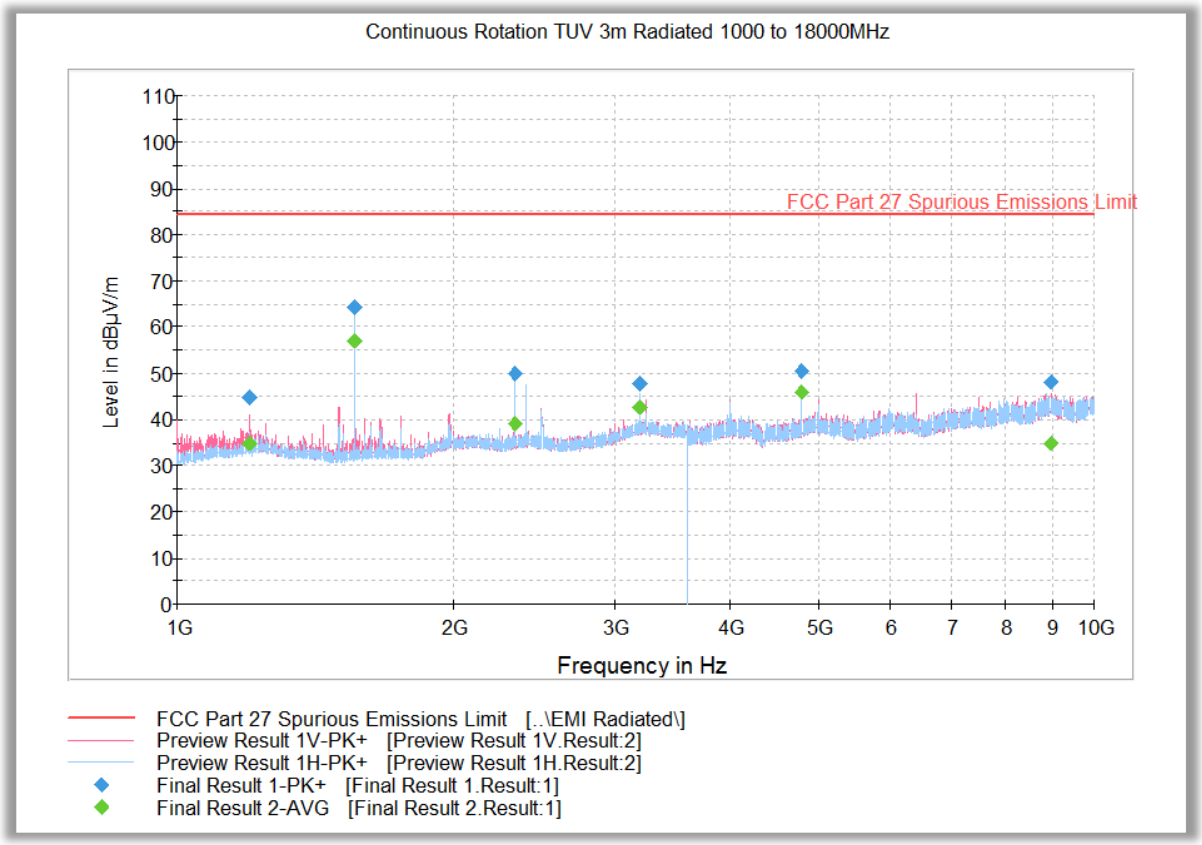
2.8.19 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 13_5MHz Bandwidth_Middle Channel 782 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1200.000000	44.8	1000.0	1000.000	151.6	V	196.0	-9.4	39.6	84.4
1559.700000	64.4	1000.0	1000.000	195.5	H	186.0	-8.5	20.0	84.4
2339.700000	50.0	1000.0	1000.000	200.5	H	190.0	-5.2	34.4	84.4
3199.700000	47.9	1000.0	1000.000	212.4	V	256.0	-1.1	36.5	84.4
4799.900000	50.5	1000.0	1000.000	311.2	V	154.0	2.2	33.9	84.4
8986.300000	48.2	1000.0	1000.000	250.5	V	149.0	9.4	36.2	84.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1200.000000	35.0	1000.0	1000.000	151.6	V	196.0	-9.4	49.4	84.4
1559.700000	57.1	1000.0	1000.000	195.5	H	186.0	-8.5	27.3	84.4
2339.700000	39.1	1000.0	1000.000	200.5	H	190.0	-5.2	45.3	84.4
3199.700000	42.7	1000.0	1000.000	212.4	V	256.0	-1.1	41.7	84.4
4799.900000	46.1	1000.0	1000.000	311.2	V	154.0	2.2	38.3	84.4
8986.300000	34.9	1000.0	1000.000	250.5	V	149.0	9.4	49.5	84.4

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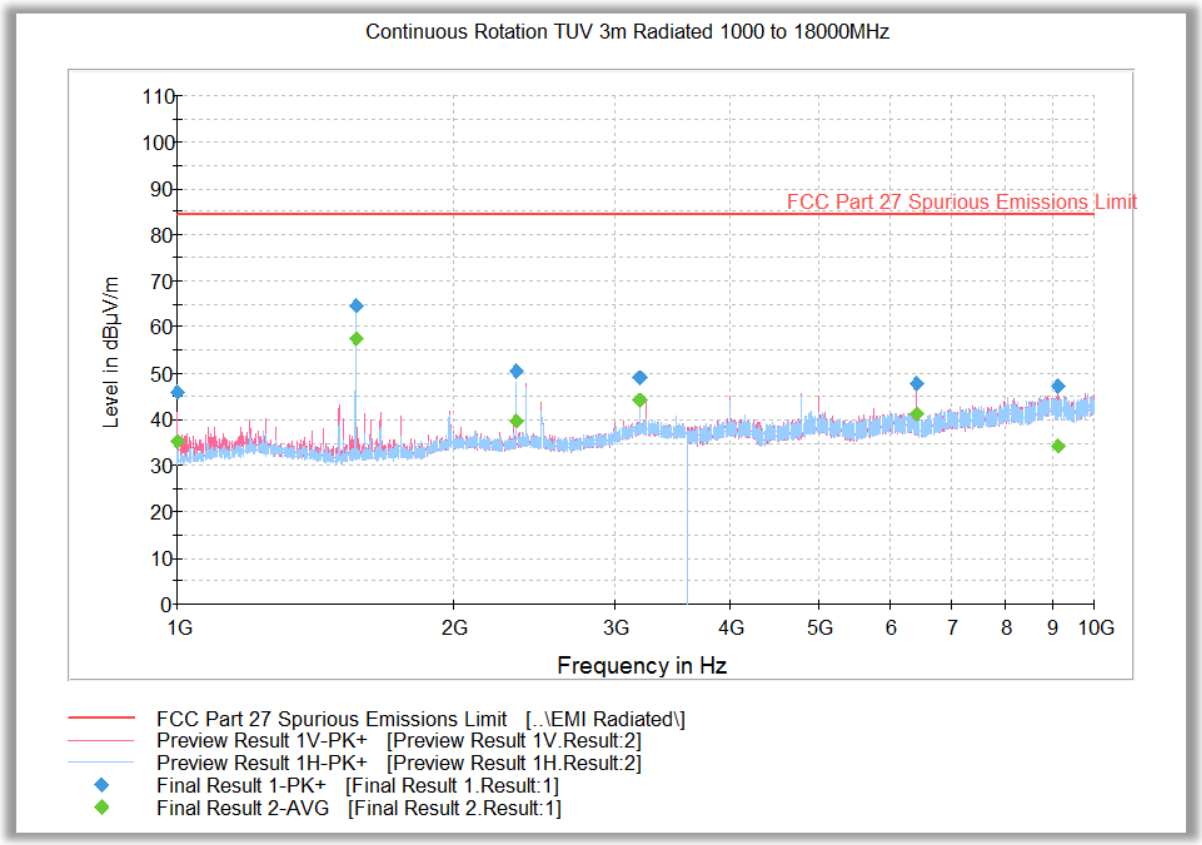
2.8.20 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 13_5MHz Bandwidth_High Channel 784.5 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	45.9	1000.0	1000.000	200.5	V	193.0	-10.7	38.5	84.4
1564.800000	64.6	1000.0	1000.000	195.5	H	189.0	-8.5	19.8	84.4
2347.200000	50.6	1000.0	1000.000	196.5	H	184.0	-5.1	33.8	84.4
3200.000000	49.1	1000.0	1000.000	205.5	V	257.0	-1.1	35.3	84.4
6400.100000	47.7	1000.0	1000.000	307.2	V	229.0	4.6	36.7	84.4
9131.200000	47.2	1000.0	1000.000	103.7	V	209.0	9.4	37.2	84.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	35.0	1000.0	1000.000	200.5	V	193.0	-10.7	49.3	84.4
1564.800000	57.3	1000.0	1000.000	195.5	H	189.0	-8.5	27.1	84.4
2347.200000	39.6	1000.0	1000.000	196.5	H	184.0	-5.1	44.8	84.4
3200.000000	44.1	1000.0	1000.000	205.5	V	257.0	-1.1	40.3	84.4
6400.100000	41.3	1000.0	1000.000	307.2	V	229.0	4.6	43.1	84.4
9131.200000	34.3	1000.0	1000.000	103.7	V	209.0	9.4	50.1	84.4

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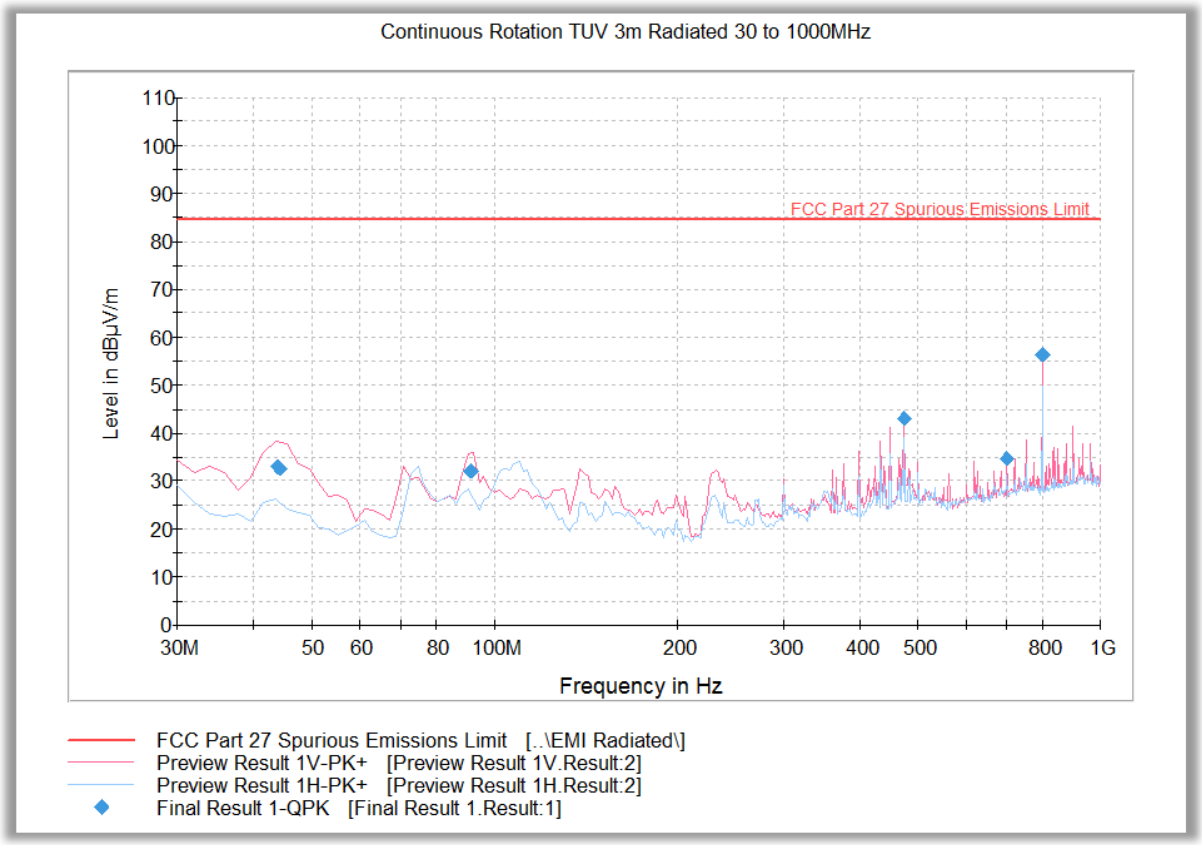
2.8.21 Radiated Emission Test Results Below 1GHz – Worst Case LTE Band 66_10MHz Bandwidth_Low Channel 1715 MHz_1 RB 0 offset_QPSK



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
43.743327	33.1	1000.0	120.000	100.0	V	163.0	-13.7	51.3	84.4
44.327214	32.9	1000.0	120.000	105.0	V	216.0	-13.8	51.5	84.4
91.284409	32.1	1000.0	120.000	100.0	V	121.0	-15.9	52.3	84.4
474.990301	43.1	1000.0	120.000	214.0	V	116.0	-1.4	41.3	84.4
699.961283	34.7	1000.0	120.000	116.0	V	213.0	2.9	49.7	84.4
800.003447	56.3	1000.0	120.000	100.0	V	183.0	4.1	28.1	84.4

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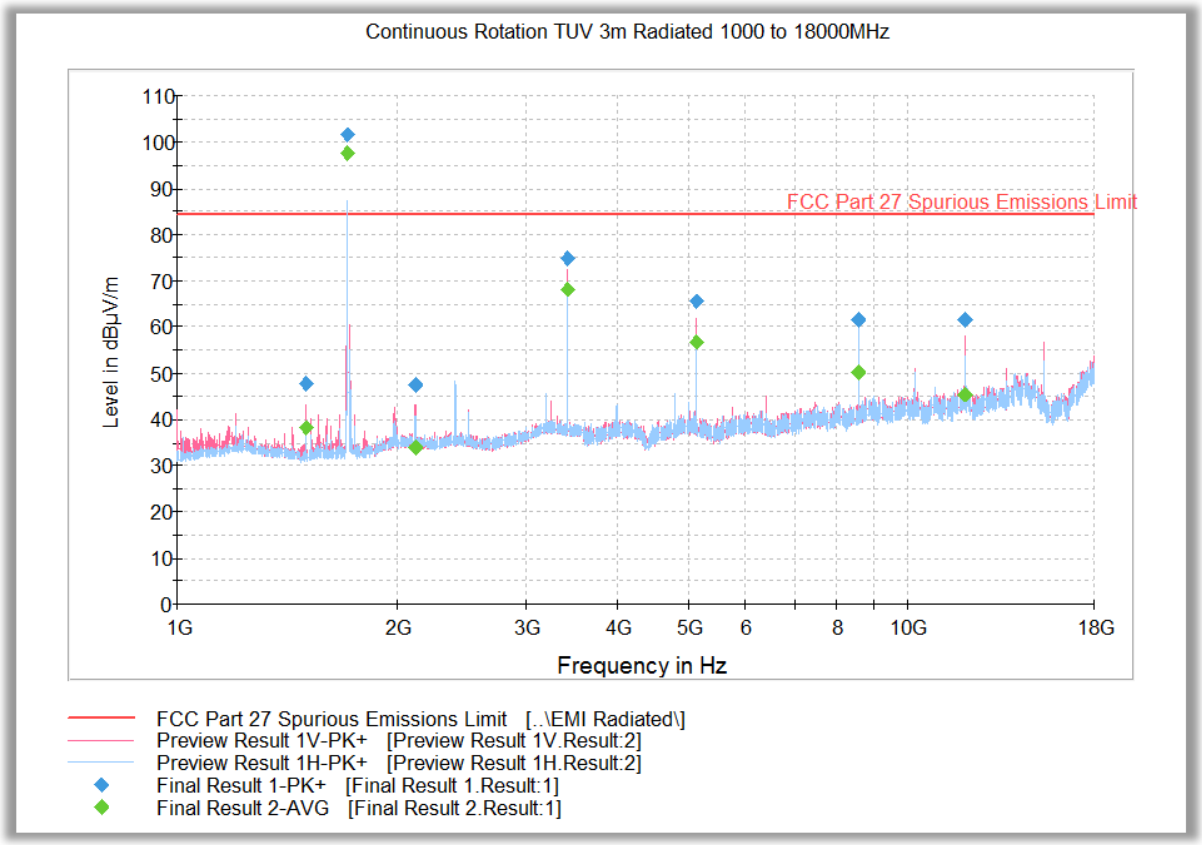
2.8.22 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 66_10MHz Bandwidth_Low Channel 1715 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	47.7	1000.0	1000.000	252.3	V	203.0	-9.0	34.5	82.2
1710.400000	101.5	1000.0	1000.000	252.3	V	289.0	-7.7	Fundamental Carrier*	
2117.500000	47.6	1000.0	1000.000	103.7	V	-5.0	-5.7	34.6	82.2
3421.000000	74.7	1000.0	1000.000	209.4	V	272.0	-0.8	7.5	82.2
5131.766667	65.6	1000.0	1000.000	205.5	V	271.0	3.1	16.6	82.2
8552.900000	61.6	1000.0	1000.000	204.5	H	-7.0	8.6	20.6	82.2
11974.266667	61.7	1000.0	1000.000	252.3	V	212.0	13.3	20.6	82.2

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	38.2	1000.0	1000.000	252.3	V	203.0	-9.0	44.1	82.2
1710.400000	97.7	1000.0	1000.000	252.3	V	289.0	-7.7	Fundamental Carrier*	
2117.500000	33.9	1000.0	1000.000	103.7	V	-5.0	-5.7	48.3	82.2
3421.000000	68.1	1000.0	1000.000	209.4	V	272.0	-0.8	14.1	82.2
5131.766667	56.7	1000.0	1000.000	205.5	V	271.0	3.1	25.6	82.2
8552.900000	50.2	1000.0	1000.000	204.5	H	-7.0	8.6	32.0	82.2
11974.266667	45.5	1000.0	1000.000	252.3	V	212.0	13.3	36.7	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

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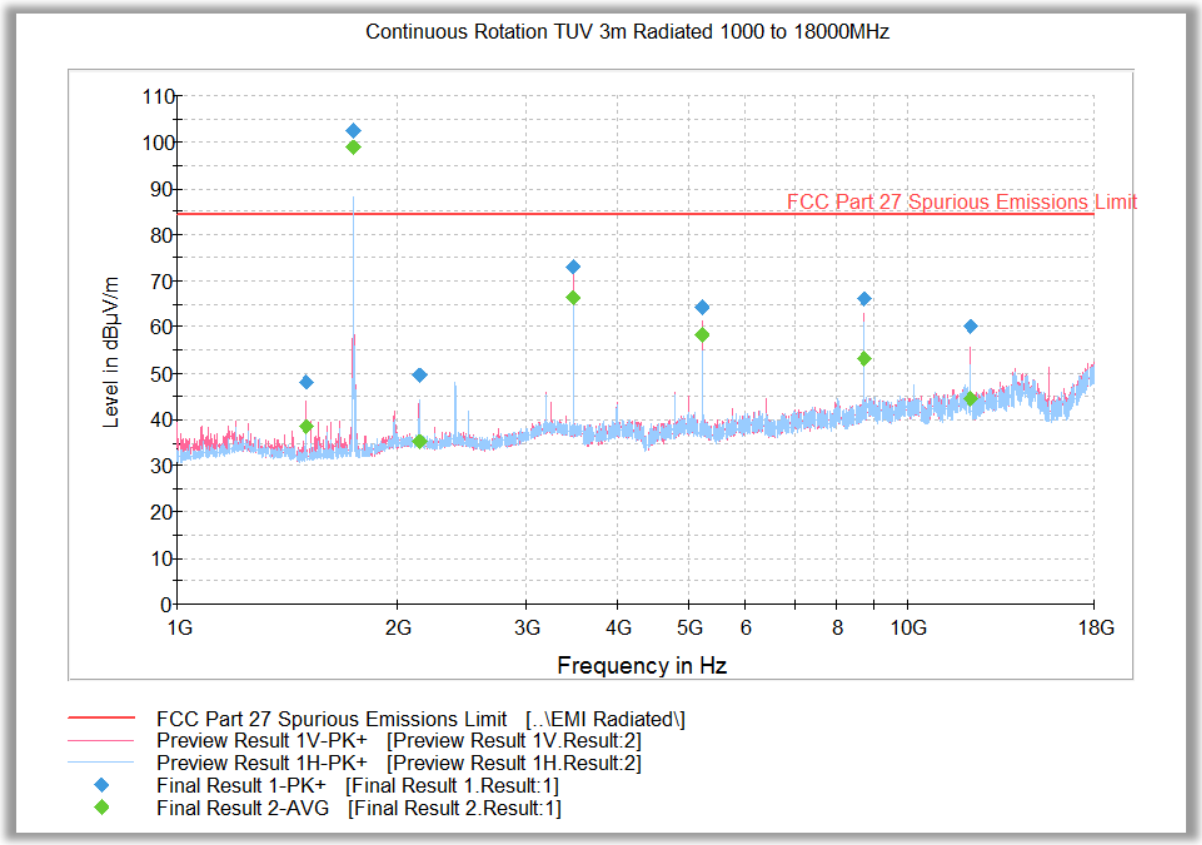
2.8.23 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 66_10MHz Bandwidth_Middle Channel 1745 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	48.1	1000.0	1000.000	232.4	V	199.0	-9.0	34.1	82.2
1740.433333	102.6	1000.0	1000.000	139.7	H	-12.0	-7.1	Fundamental Carrier*	
2146.000000	49.6	1000.0	1000.000	130.7	V	4.0	-5.6	32.7	82.2
3481.066667	73.0	1000.0	1000.000	200.5	V	258.0	-0.7	9.2	82.2
5221.866667	64.2	1000.0	1000.000	195.5	V	190.0	3.4	18.0	82.2
8702.900000	66.1	1000.0	1000.000	200.5	V	358.0	9.0	16.1	82.2
12184.100000	60.1	1000.0	1000.000	296.2	V	206.0	12.9	22.1	82.2

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	38.4	1000.0	1000.000	232.4	V	199.0	-9.0	43.8	82.2
1740.433333	98.9	1000.0	1000.000	139.7	H	-12.0	-7.1	Fundamental Carrier*	
2146.000000	35.0	1000.0	1000.000	130.7	V	4.0	-5.6	47.2	82.2
3481.066667	66.6	1000.0	1000.000	200.5	V	258.0	-0.7	15.7	82.2
5221.866667	58.2	1000.0	1000.000	195.5	V	190.0	3.4	24.0	82.2
8702.900000	53.0	1000.0	1000.000	200.5	V	358.0	9.0	29.2	82.2
12184.100000	44.4	1000.0	1000.000	296.2	V	206.0	12.9	37.9	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

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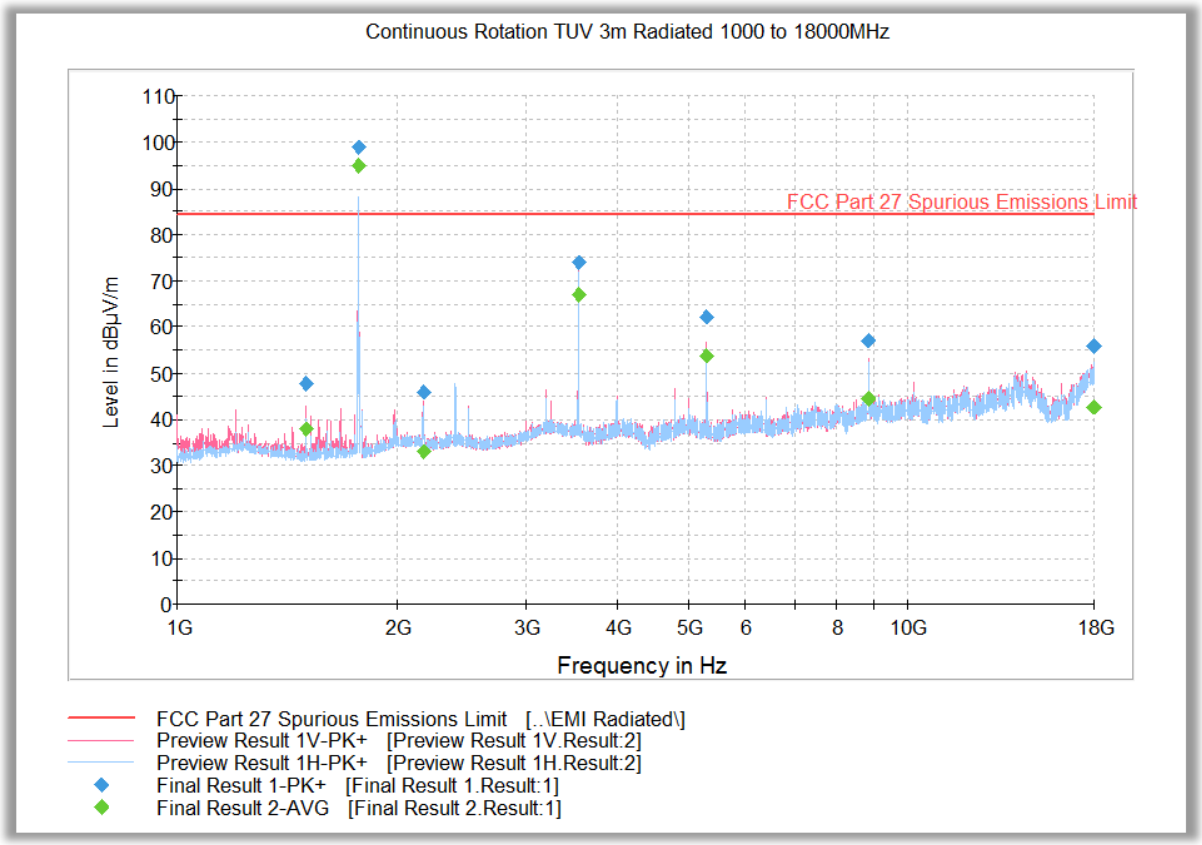
2.8.24 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 66_10MHz Bandwidth_High Channel 1775 MHz_1 RB 0 offset_QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	47.7	1000.0	1000.000	250.5	V	185.0	-9.0	34.6	82.2
1770.500000	99.0	1000.0	1000.000	205.5	V	147.0	-6.9	Fundamental Carrier*	
2177.566667	45.9	1000.0	1000.000	252.3	H	-19.0	-5.7	36.3	82.2
3541.133333	74.0	1000.0	1000.000	296.2	V	236.0	-0.6	8.3	82.2
5311.600000	62.2	1000.0	1000.000	290.2	V	236.0	3.6	20.1	82.2
8853.066667	57.1	1000.0	1000.000	270.3	V	203.0	9.4	25.1	82.2
17994.466667	55.9	1000.0	1000.000	252.3	H	71.0	21.4	26.3	82.2

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	37.8	1000.0	1000.000	250.5	V	185.0	-9.0	44.4	82.2
1770.500000	95.1	1000.0	1000.000	205.5	V	147.0	-6.9	Fundamental Carrier*	
2177.566667	32.9	1000.0	1000.000	252.3	H	-19.0	-5.7	49.3	82.2
3541.133333	67.0	1000.0	1000.000	296.2	V	236.0	-0.6	15.3	82.2
5311.600000	53.9	1000.0	1000.000	290.2	V	236.0	3.6	28.3	82.2
8853.066667	44.4	1000.0	1000.000	270.3	V	203.0	9.4	37.8	82.2
17994.466667	42.8	1000.0	1000.000	252.3	H	71.0	21.4	39.5	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

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2.9 FREQUENCY STABILITY

2.9.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055
FCC 47 CFR Part 27, Clause 27.54
RSS-139, Clause 6.4
RSS-199, Clause 4.3
RSS-130, Clause 4.3

2.9.2 Standard Applicable

FCC Part 27, Clause 27.54:
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

RSS-139, Clause 6.4:
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS-199, Clause 4.3:
The transmitter frequency stability limit shall be determined as follows:
(a) The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;
(b) Using a resolution bandwidth equal to that permitted within the 1 MHz band immediately outside the channel edge, as found in section 4.5, reference points will be selected at the unwanted emission limits, which comply with the attenuatio specified in section 4.5 for the type of device under test, on the emission mask of the lowerest and highest channels. The frquency points shall be recorded as f_L and f_H respectively.
The applicant shall ensure compliance with frequency stability requirements by showing that f_L minus the frequency offset and f_H plus the frequency offset is within the frequency range in which the equipment is designed to operate.

RSS-130, Clasue 4.3:
The transmitter frequency stability limit shall be determined as follows:
(a) The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;
(b) Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of 43 + 10 log10 p (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as f_L and f_H respectively.
The applicant shall ensure frequency stability by showing that f_L minus the frequency offset and f_H plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

2.9.3 Equipment Under Test and Modification State

Serial No: AZ280418A00044 / Test Configuration A

2.9.4 Date of Test/Initial of test personnel who performed the test

July 3, 10 and 11, 2018 / XYZ

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2.9.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.7 - 26.8°C
Relative Humidity	44.4 - 54.1%
ATM Pressure	98.7 - 99.0 kPa

2.9.7 Additional Observations

- This is a conducted test. The EUT was operated at 3.7VDC nominal voltage and was placed in the temperature chamber for this evaluation. The EUT was controlled by a CMW500 and utilizing a spectrum analyzer for measurement.
- Test performed in 5 MHz Bandwidth Middle channel as the representative configuration.
- Measurement was done using the CMW 500 measurement function.
- The EUT was tested over the temperature -30℃ to +50℃ in 10°C steps and allowed to sit for 1 hour to allow the equipment and chamber temperature to stabilize. The measurements were then performed.
- Voltage variation was also performed at voltage 3.3VDC and higher 4.3VDC of the nominal voltage at 20℃.

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2.9.8 Test Results

LTE Band 4 – QPSK 5 MHz BW-Middle Channel 1732.5 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)*
3.7	-30	-14.05	-0.0081	± 0.1
	-20	-15.68	-0.0091	± 0.1
	-10	-12.76	-0.0074	± 0.1
	0	-11.34	-0.0066	± 0.1
	+10	-12.8	-0.0074	± 0.1
	+20	15.15	0.0087	± 0.1
	+30	-12.06	-0.0070	± 0.1
	+40	-15.15	-0.0087	± 0.1
	+50	-14.9	-0.0086	± 0.1
3.3	20	15.55	0.0090	± 0.1
4.3		14.33	0.0083	± 0.1

*Limit according to 3GPP TS 36 010 V14.4.0

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval and voltage variations across the measured range.

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LTE Band 7 – QPSK 5 MHz BW-Middle Channel 2535 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)*
3.7	-30	-15.48	-0.0061	± 0.1
	-20	15.05	0.0059	± 0.1
	-10	15.29	0.0060	± 0.1
	0	16.11	0.0064	± 0.1
	+10	15.65	0.0062	± 0.1
	+20	16.52	0.0065	± 0.1
	+30	15.05	0.0059	± 0.1
	+40	15.01	0.0059	± 0.1
	+50	15.56	0.0061	± 0.1
3.3	20	17.28	0.0068	± 0.1
4.3		15.65	0.0062	± 0.1

LTE Band 7 – QPSK 5 MHz BW						
Voltage (VDC)	Temperature (°C)	F_L (MHz)	F_L – Freq Error (MHz)	F_H (MHz)	F_L + Freq Error (MHz)	Compliance
3.7	-30	2500.0928	2500.0928	2569.9203	2569.9203	Yes
	+20	2500.0699	2500.0699	2569.9138	2569.9138	Yes
	+50	2500.0970	2500.0970	2569.9306	2569.9306	Yes
3.3	20	2500.0919	2500.0919	2569.9182	2569.9182	Yes
4.3		2500.0713	2500.0713	2569.9299	2569.9299	Yes

*Limit according to 3GPP TS 36 010 V14.4.0

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval and voltage variations across the measured range.

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LTE Band 13 – QPSK 5 MHz BW-Middle Channel 782 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)*
3.7	-30	10.44	0.013	± 0.1
	-20	15.46	0.020	± 0.1
	-10	14.19	0.018	± 0.1
	0	14.05	0.018	± 0.1
	+10	-13.33	-0.017	± 0.1
	+20	-7.82	-0.010	± 0.1
	+30	13.86	0.018	± 0.1
	+40	13.8	0.018	± 0.1
	+50	14.75	0.019	± 0.1
3.3	20	-12.14	-0.016	± 0.1
4.3		-10.71	-0.014	± 0.1

LTE Band 13 – QPSK 5 MHz BW						
Voltage (VDC)	Temperature (°C)	F_L (MHz)	F_L – Freq Error (MHz)	F_H (MHz)	F_L + Freq Error (MHz)	Compliance
3.7	-30	777.0719	777.0719	786.9318	786.9318	Yes
	+20	777.0968	777.0968	786.9337	786.9337	Yes
	+50	777.0823	777.0823	786.8882	786.8882	Yes
3.3	20	777.0959	777.0959	786.9168	786.9168	Yes
4.3		777.0912	777.0912	786.9496	786.9496	Yes

*Limit according to 3GPP TS 36 010 V14.4.0

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval and voltage variations across the measured range.

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LTE Band 66 – QPSK 5 MHz BW-Middle Channel 1745 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)*
3.7	-30	13.66	0.0078	± 0.1
	-20	15.01	0.0086	± 0.1
	-10	13.92	0.0080	± 0.1
	0	15.66	0.0090	± 0.1
	+10	12.47	0.0071	± 0.1
	+20	10.59	0.0061	± 0.1
	+30	15.86	0.0091	± 0.1
	+40	13.12	0.0075	± 0.1
	+50	12.86	0.0074	± 0.1
3.3	20	10.63	0.0061	± 0.1
4.3		10.84	0.0062	± 0.1

*Limit according to 3GPP TS 36 010 V14.4.0

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval and voltage variations across the measured range.

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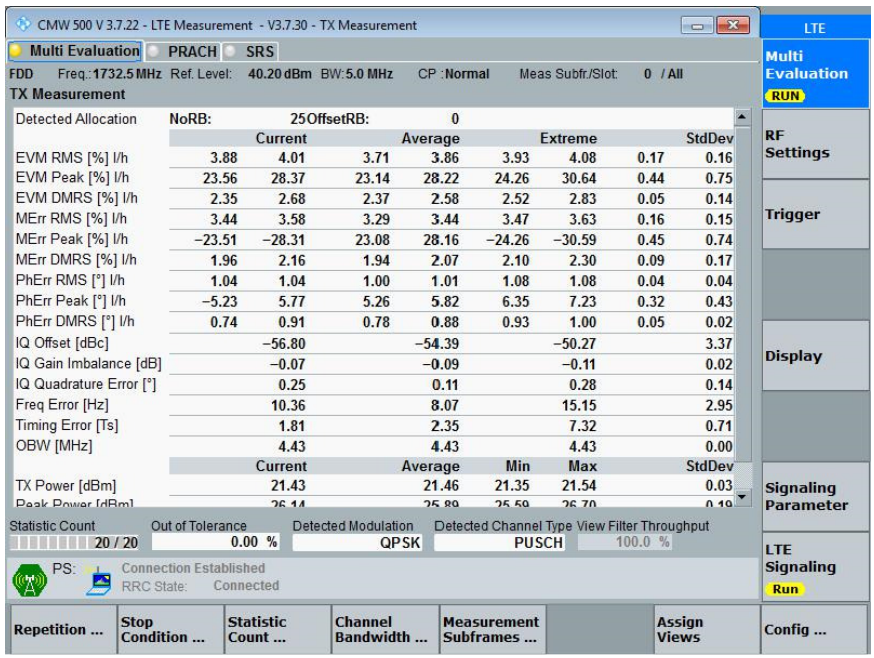
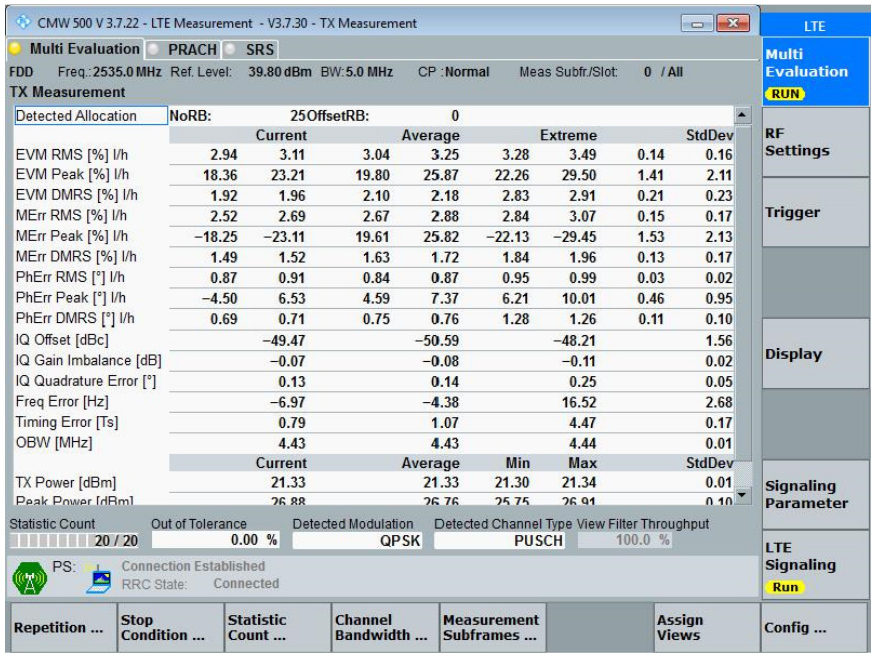
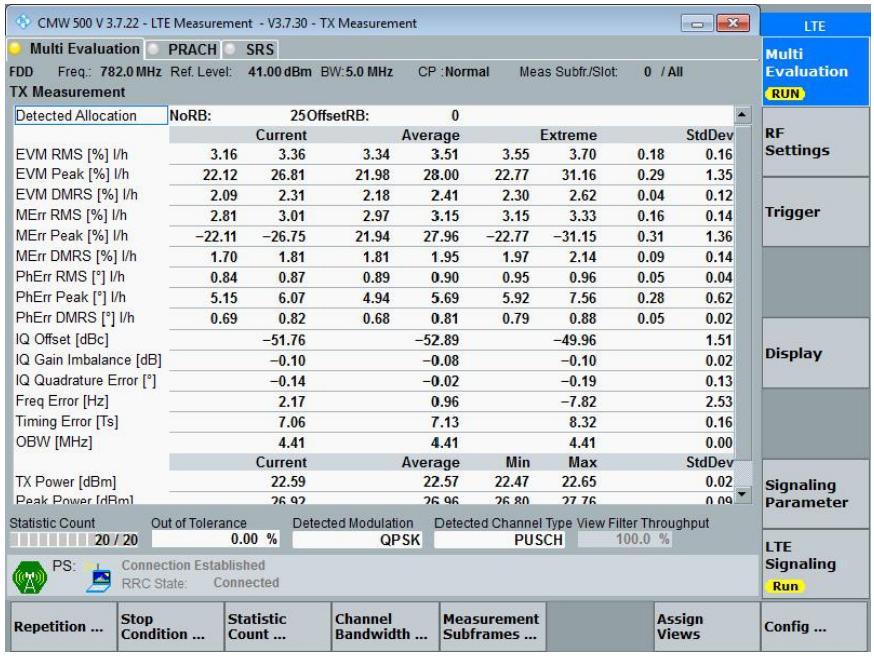
2.9.9 Sample Test plot



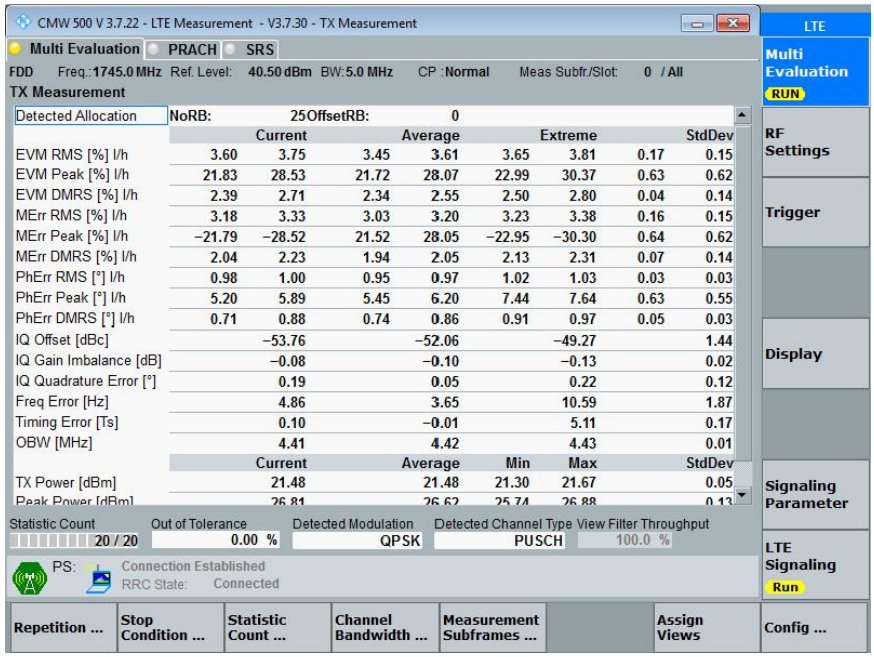
LTE Band 4_5 MHz Bandwidth_Middle Channel @20°C



LTE Band 7_5 MHz Bandwidth_Middle Channel @20°C



LTE Band 13_5 MHz Bandwidth_Middle Channel @20°C



LTE Band 66_5 MHz Bandwidth_Middle Channel @20°C

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2.10 CONDUCTED EMISSIONS

2.10.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.207(a)
RSS-Gen, Section 8.8

2.10.2 Standard Applicable

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

**Decreases with the logarithm of the frequency.*

2.10.3 Equipment Under Test and Modification State

Serial No: AZ280418A00044/Test Configuration B

2.10.4 Date of Test/Initial of test personnel who performed the test

July 16, 2018/XYZ

2.10.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.1 °C
Relative Humidity	53.7 %
ATM Pressure	99.0 kPa

2.10.7 Additional Observations

Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.1.8 for sample computation.

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2.10.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbµV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7568 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbµV) @ 150kHz			**26.2**

2.10.9 Test Results

Compliant. See attached plots and tables.

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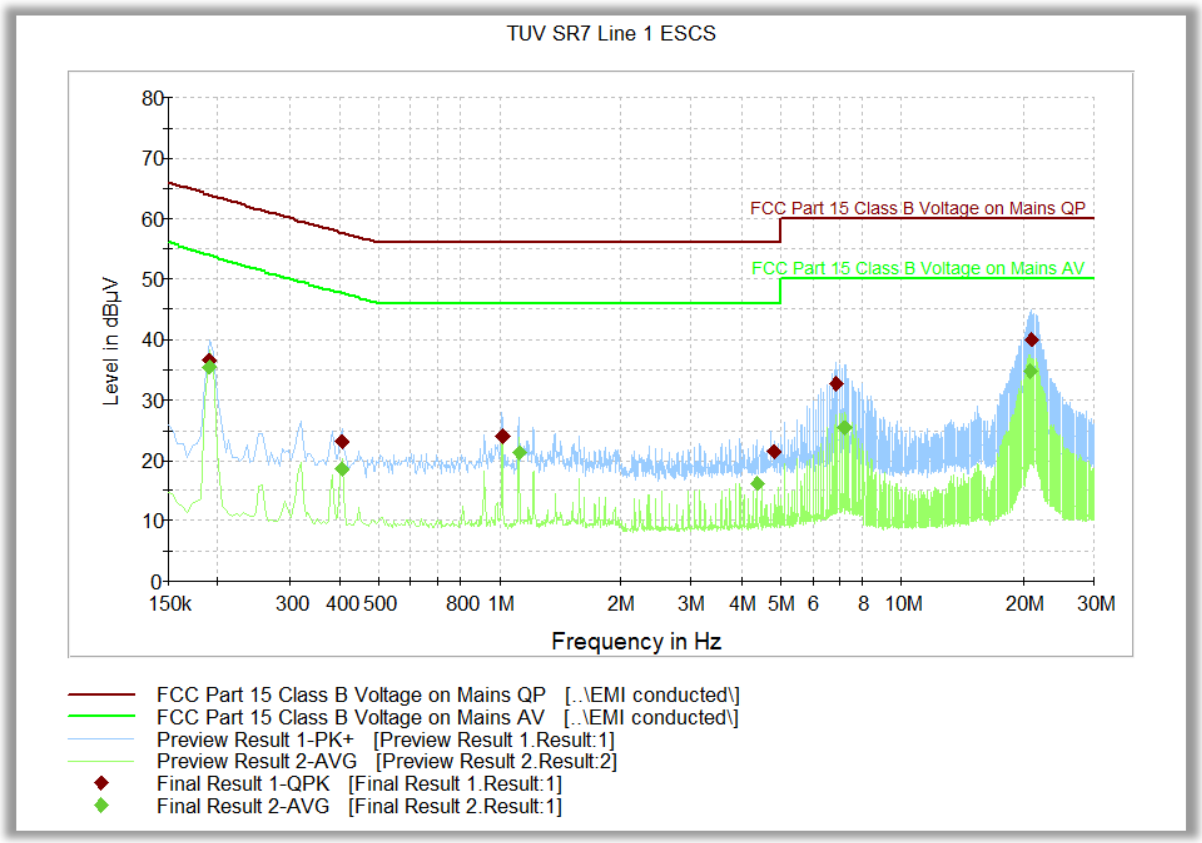
2.10.10 MIFI8800L 120VAC 60Hz (Line 1)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.190500	36.6	1000.0	9.000	Off	L1	20.2	27.3	63.9
0.406500	23.1	1000.0	9.000	Off	L1	20.2	34.6	57.6
1.018500	23.9	1000.0	9.000	Off	L1	20.2	32.1	56.0
4.830000	21.4	1000.0	9.000	Off	L1	20.4	34.6	56.0
6.900000	32.6	1000.0	9.000	Off	L1	20.5	27.4	60.0
20.998500	40.1	1000.0	9.000	Off	L1	20.8	19.9	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.190500	35.4	1000.0	9.000	Off	L1	20.2	18.4	53.9
0.406500	18.6	1000.0	9.000	Off	L1	20.2	29.0	47.6
1.117500	21.3	1000.0	9.000	Off	L1	20.2	24.7	46.0
4.366500	16.2	1000.0	9.000	Off	L1	20.4	29.8	46.0
7.197000	25.4	1000.0	9.000	Off	L1	20.5	24.6	50.0
20.800500	34.7	1000.0	9.000	Off	L1	20.7	15.3	50.0

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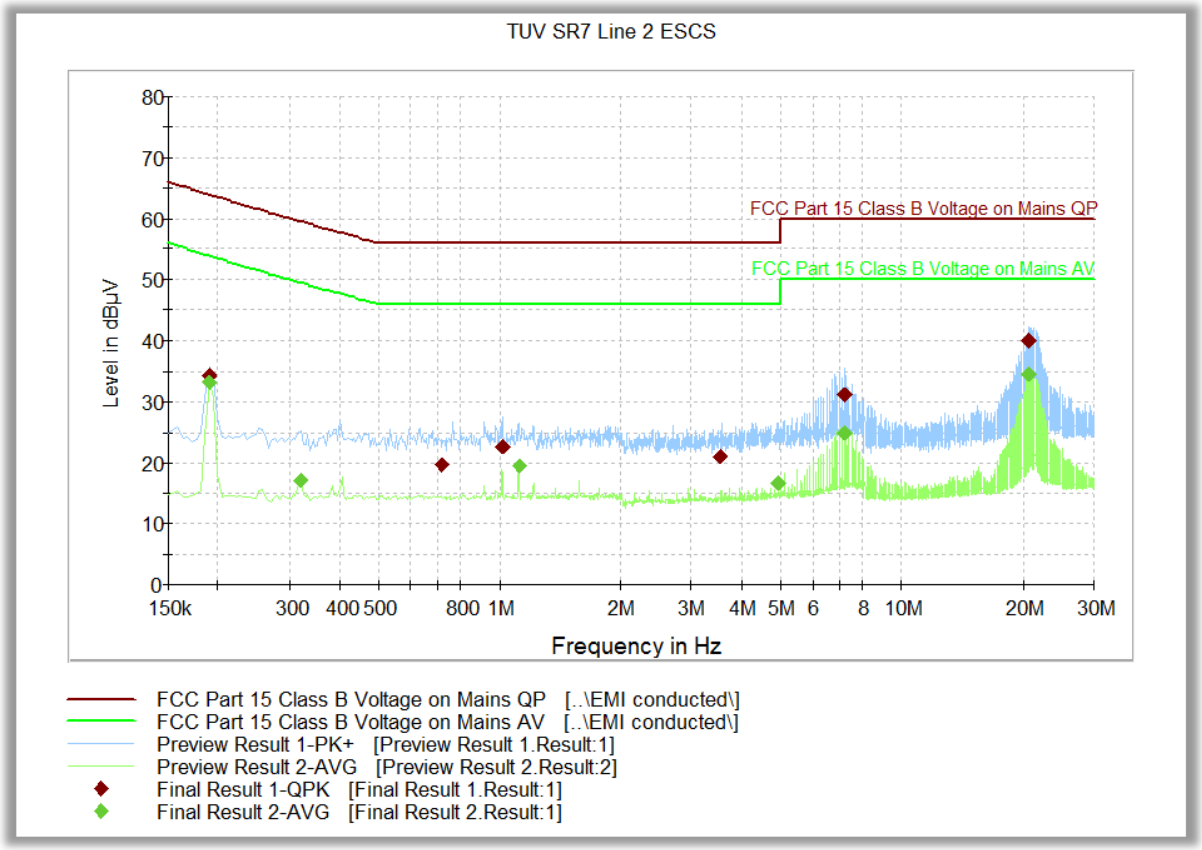
2.10.11 MIFI8800L 120VAC 60Hz (Line 2)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.190500	34.3	1000.0	9.000	Off	N	20.2	29.6	63.9
0.717000	19.5	1000.0	9.000	Off	N	20.2	36.5	56.0
1.018500	22.7	1000.0	9.000	Off	N	20.2	33.3	56.0
3.547500	21.0	1000.0	9.000	Off	N	20.4	35.0	56.0
7.197000	31.0	1000.0	9.000	Off	N	20.4	29.0	60.0
20.701500	39.9	1000.0	9.000	Off	N	20.7	20.1	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.190500	33.1	1000.0	9.000	Off	N	20.2	20.8	53.9
0.321000	17.1	1000.0	9.000	Off	N	20.3	32.4	49.5
1.117500	19.5	1000.0	9.000	Off	N	20.3	26.5	46.0
4.929000	16.6	1000.0	9.000	Off	N	20.5	29.4	46.0
7.197000	24.9	1000.0	9.000	Off	N	20.4	25.1	50.0
20.701500	34.4	1000.0	9.000	Off	N	20.7	15.6	50.0

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SECTION 3

3TEST EQUIPMENT USED

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7662	P-Series Power Meter	N1911A	MY45100951	Agilent	06/15/18	06/15/19
7661	50MHz-18GHz Wideband Power Sensor	N1921A	MY45241383	Agilent	06/15/18	06/15/19
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
-	Wideband Radio Communication Tester	CMW 500	158164	Rhode & Schwarz	04/04/18	04/04/19
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7608 and 7582	
-	10dB Attenuator	VAT-10W2+2W	N/A	MCL	Verified by 7608 and 7582	
AC Conducted Emissions Test Setup						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	09/15/17	09/15/18
7567	LISN	FCC-LISN-50-25-2	120304	Fischer Custom Comm.	12/14/17	12/14/19
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7608 and 7582	
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7608 and 7582	
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
-	Wideband Radio Communication Tester	CMW 500	158164	Rhode & Schwarz	04/04/18	04/04/19
Radiated Test Setup						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/16/18	06/16/20
1193	Pre-amplifier	PAM-0202	185	A.H. Systems, Inc.	04/11/18	04/11/19
8921	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7608 and 7582	
8923	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7608 and 7582	
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/25/17	10/25/18
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	07/13/18	07/13/19
8628	Pre-amplifier	QLI-01182835-JO	8986002	Quinstar	02/06/18	02/06/19
8815	2.5GHz Notch Filter	BRM50702	008	Mircro-Tronics	Verified by 7608 and 7582	

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-	Wideband Radio Communication Tester	CMW 500	158164	Rhode & Schwarz	04/04/18	04/04/19
Miscellaneous						
6708	Multimeter	34401A	US36086974	Hewlett Packard	07/18/18	07/18/19
7579	Temperature Chamber	115	151617	TestQuity	08/22/17	08/22/18
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	02/26/18	02/26/19
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

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3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.52	1.44	2.07
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (uc):	1.68
				Coverage Factor (k):	2
				Expanded Uncertainty:	3.36

3.2.2 Radiated Emission Measurements (Above 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.00	1.22	1.50
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.49
				Coverage Factor (k):	2
				Expanded Uncertainty:	2.99

3.2.3 Conducted Antenna Port Measurement

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.34	0.20	0.04
2	Cables	Rectangular	0.30	0.17	0.03
3	EUT Setup	Rectangular	0.50	0.29	0.08
				Combined Uncertainty (u_c):	0.39
				Coverage Factor (k):	1.96
				Expanded Uncertainty:	0.76

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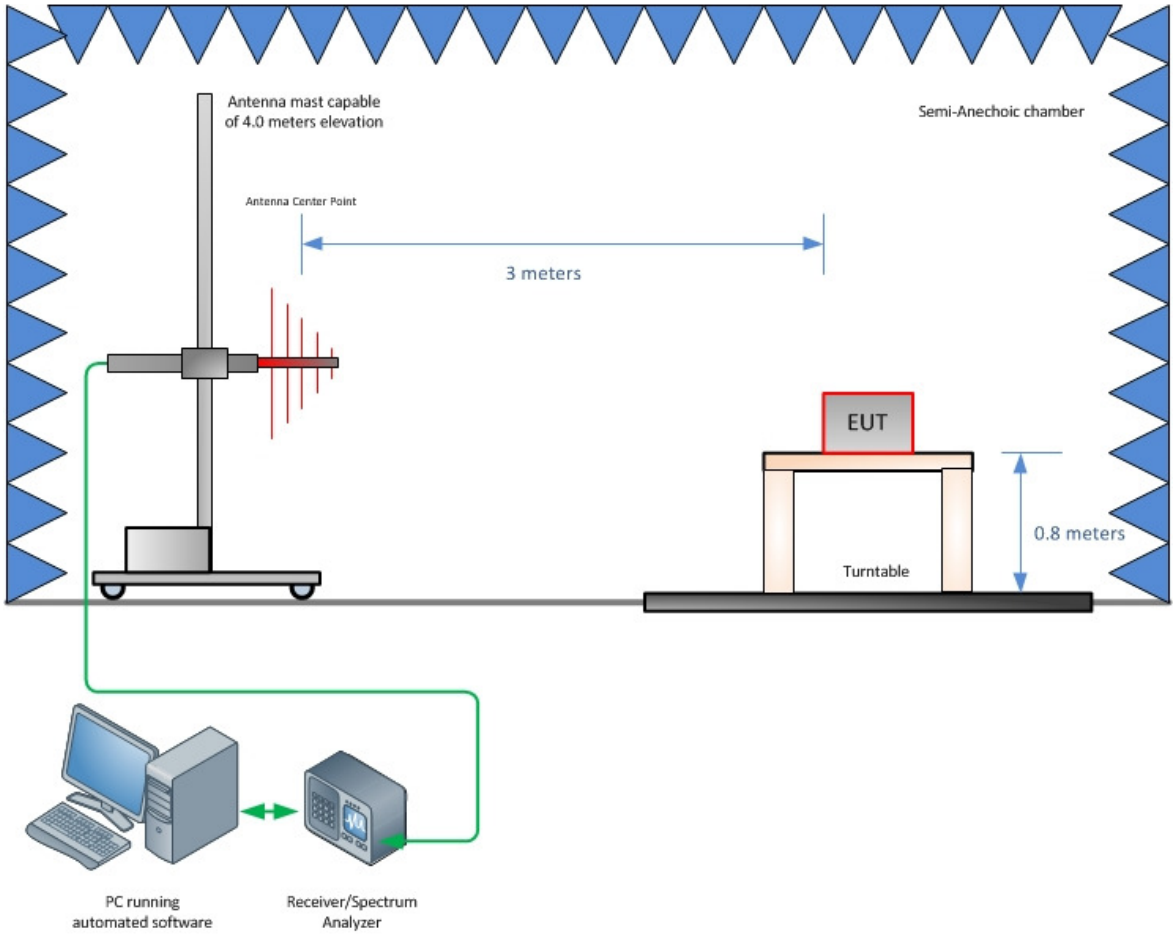
SECTION 4

4DIAGRAM OF TEST SETUP

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)

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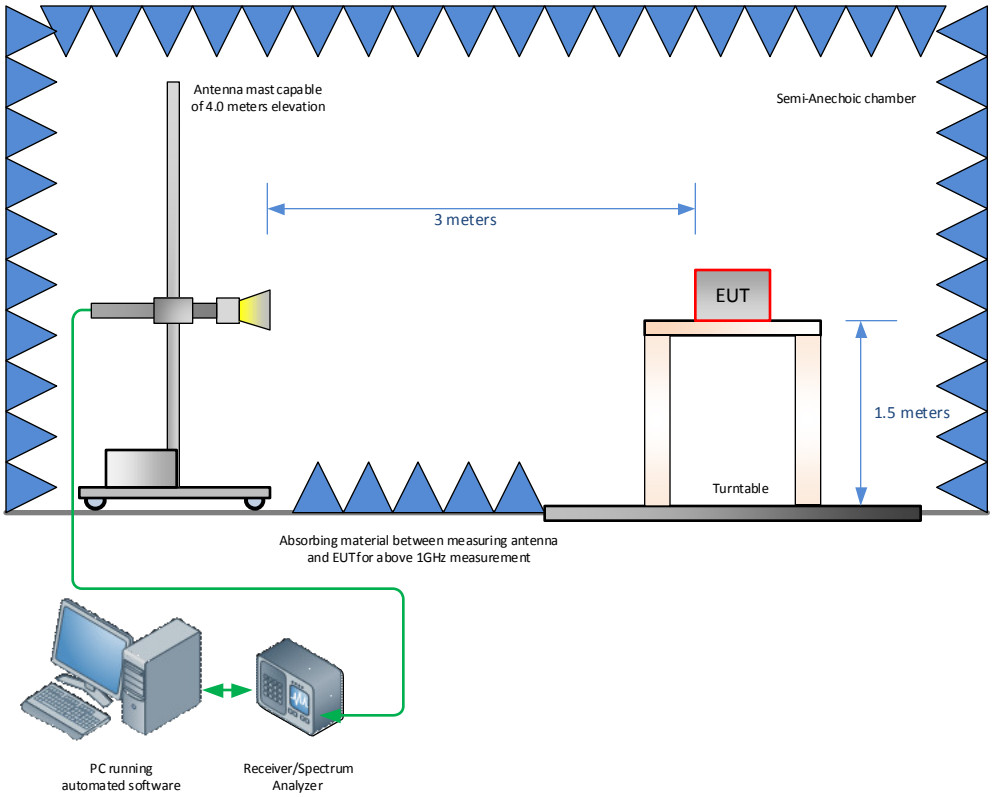
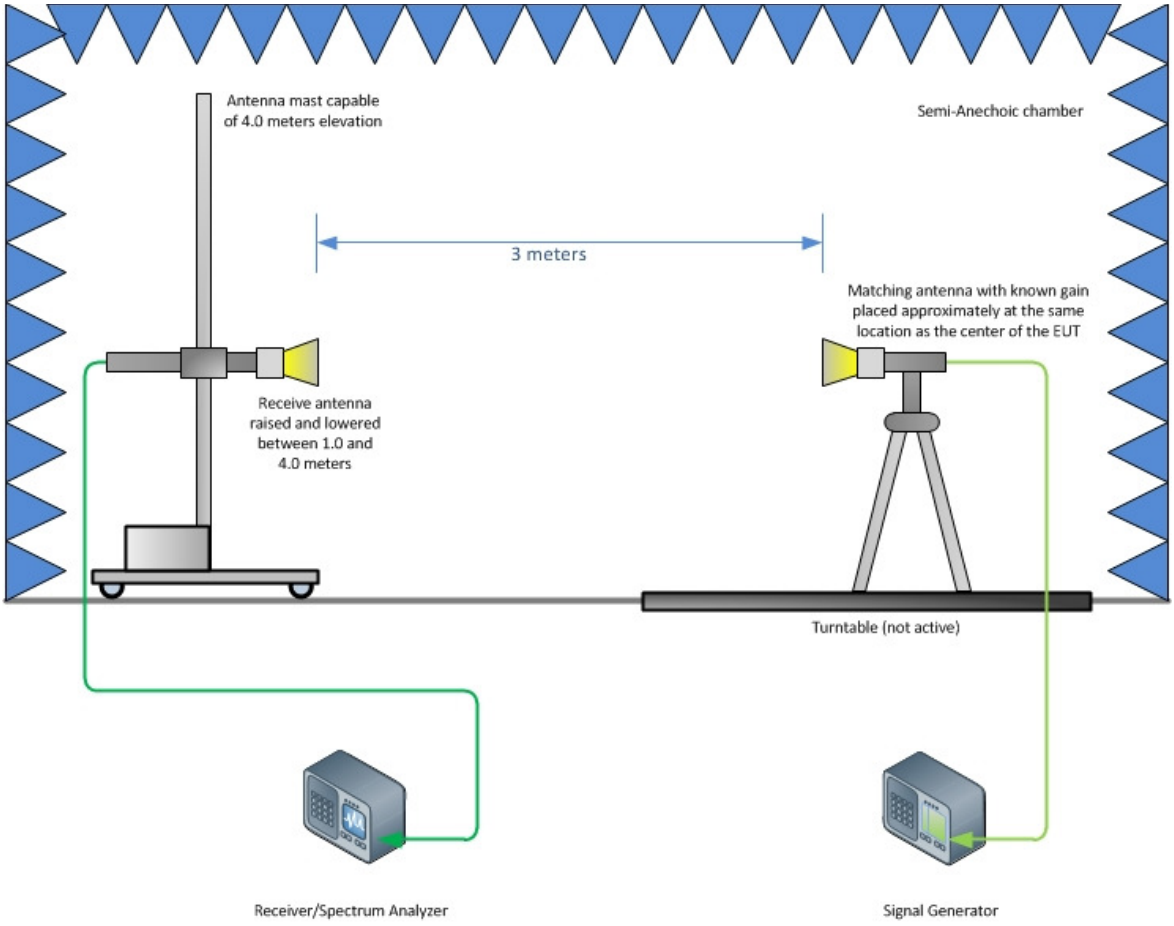


Radiated Emission Test Setup (Above 1GHz)

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364



Substitution Test Method (Above 1GHz)

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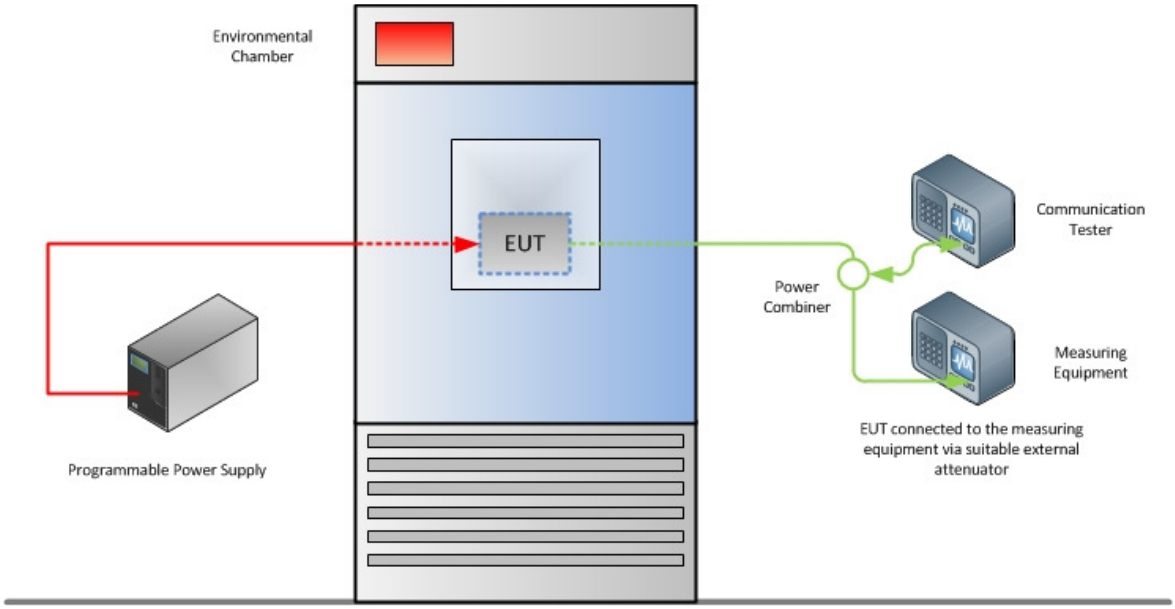

Frequency Stability Test Comfiguration

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SECTION 5

5ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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