



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)
RSS-139, Clause 6.6
RSS-130, Clause 4.7

2.7.2 Standard Applicable

FCC 47 CFR Part 27.53

(h) AWS emission limits – (1) General protection levels. Except as otherwise specified below, 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 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 $43 + 10 \log_{10}(P)$ dB.

(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 operation, 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 $43 + 10 \log_{10}(P)$ dB.

(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 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 power (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 immediately outside and adjacent to the equipment's smallest operating 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 power P (dBW), by at least $43 + 10 \log_{10} p$ (watts) dB.

RSS-130:

4.7.1 The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

4.7.2 Additional unwanted emissions limits

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:



a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- (i) $76 + 10 \log_{10} p$ (watts), dB, for base and fixed equipment, and
- (ii) $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/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: FF161218B00106, FF130219B00478 and FF130219B00624/Test Configuration A

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

March 05, 06 and 13, 2019 / 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

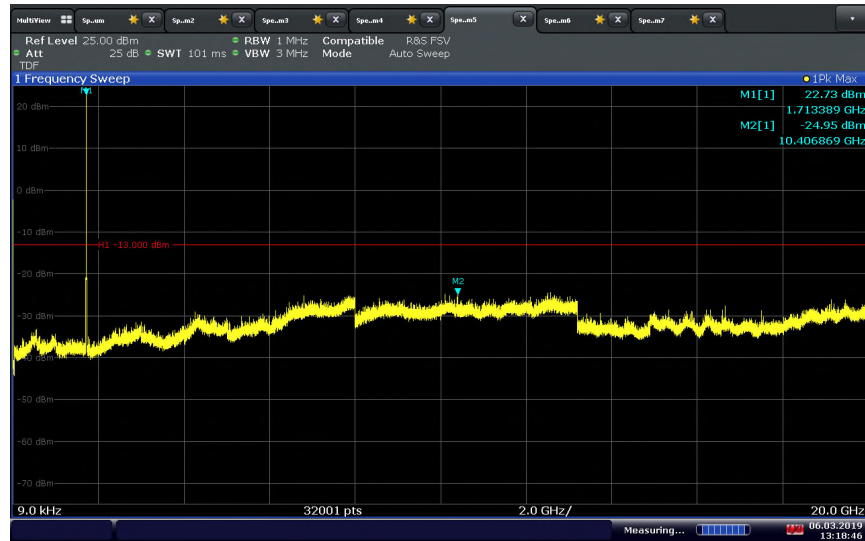
Ambient Temperature	21.8 – 22.3°C
Relative Humidity	41.8 – 48.8%
ATM Pressure	99.0 – 99.1 kPa

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.

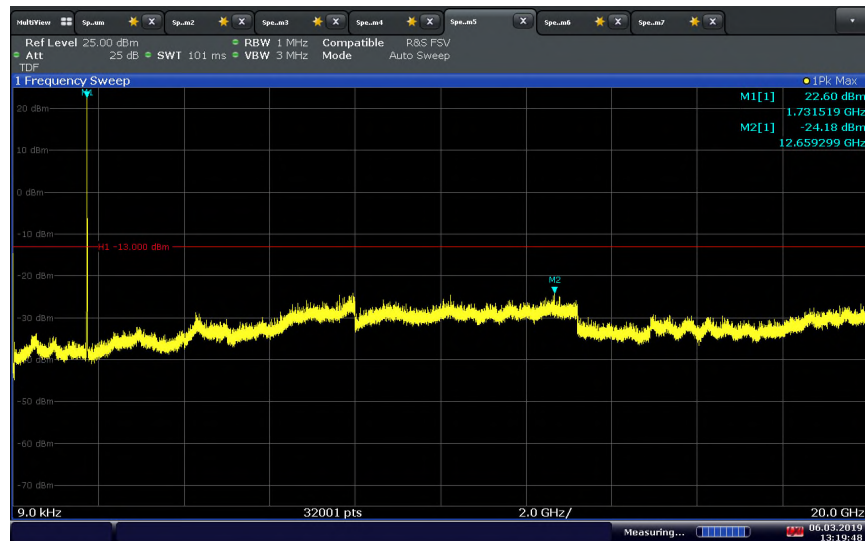
2.7.8 Test Results

WCDMA Band 4 / Low Channel 1712.4 MHz



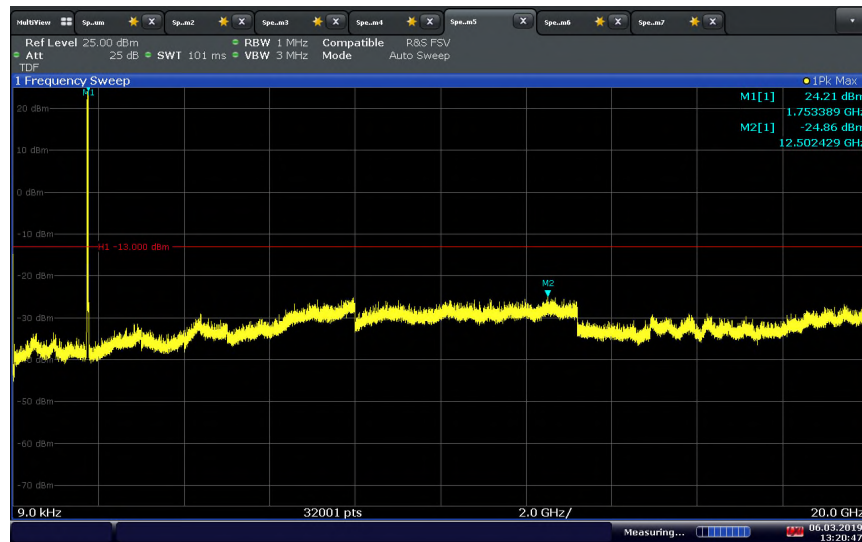
13:18:47 06.03.2019

WCDMA Band 4 / Middle Channel 1732.6 MHz

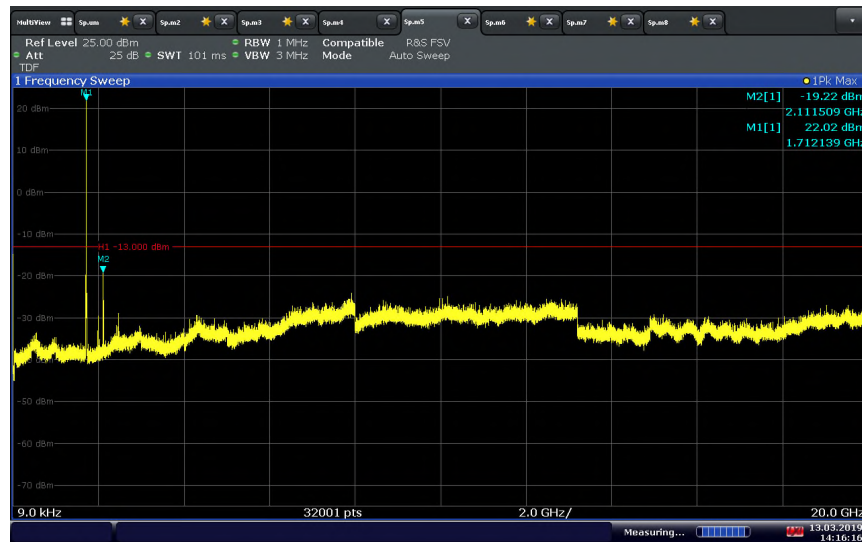


13:19:48 06.03.2019

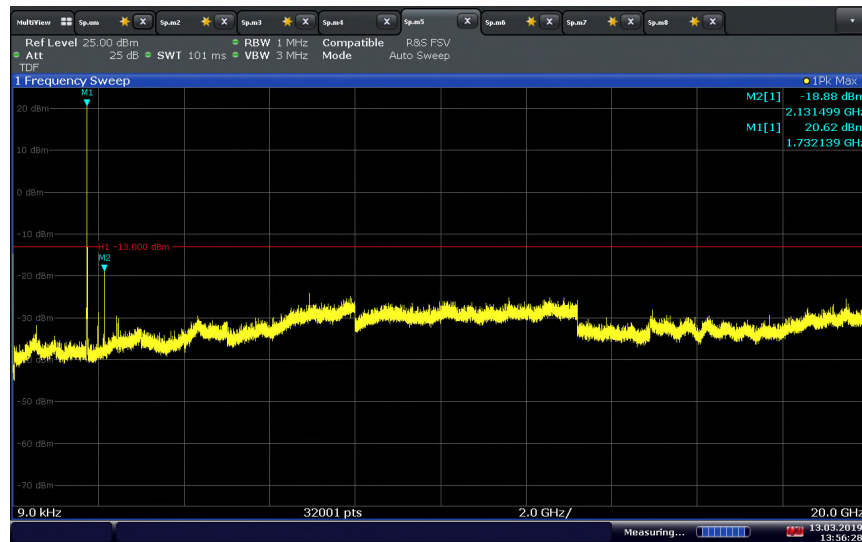
WCDMA Band 4 / High Channel 1752.6 MHz



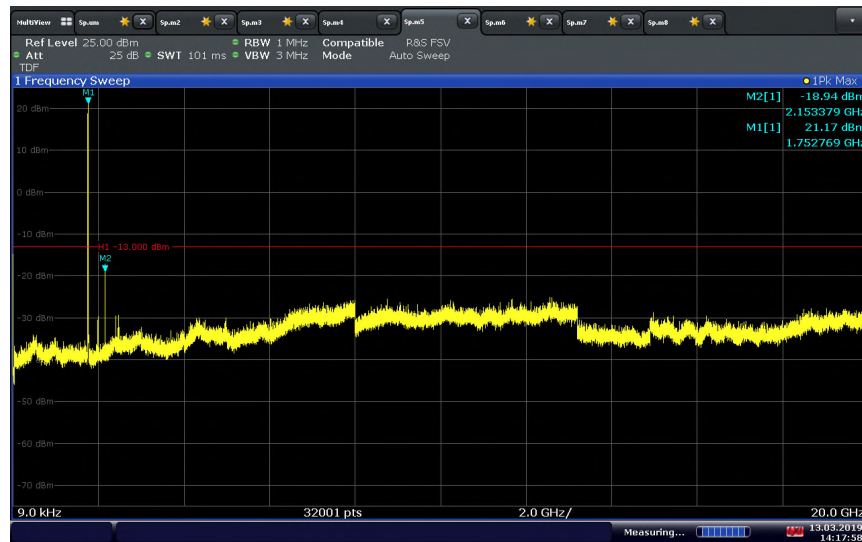
LTE Band 4 (3 MHz BW)/QPSK/Low Channel 1711.5 MHz



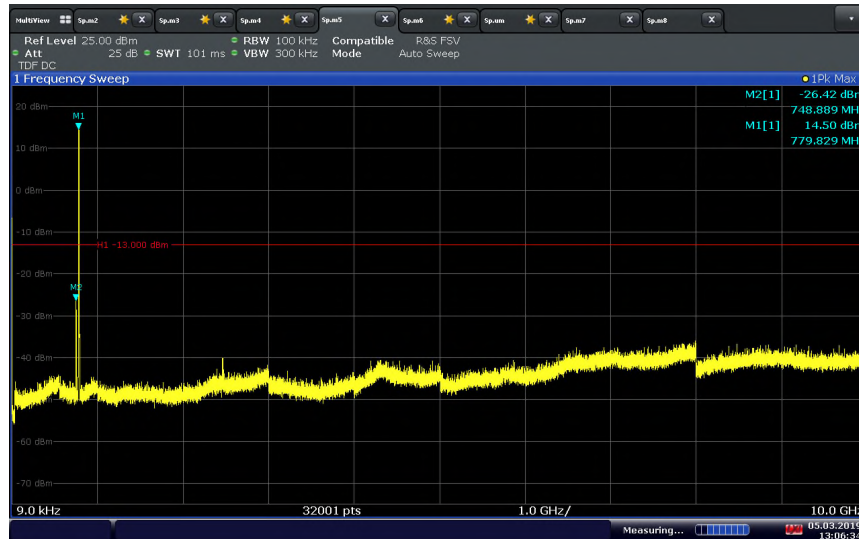
LTE Band 4 (1.4 MHz BW)/QPSK/Middle Channel 1732.5 MHz



LTE Band 4 (3 MHz BW)/QPSK/High Channel 1753.5 MHz

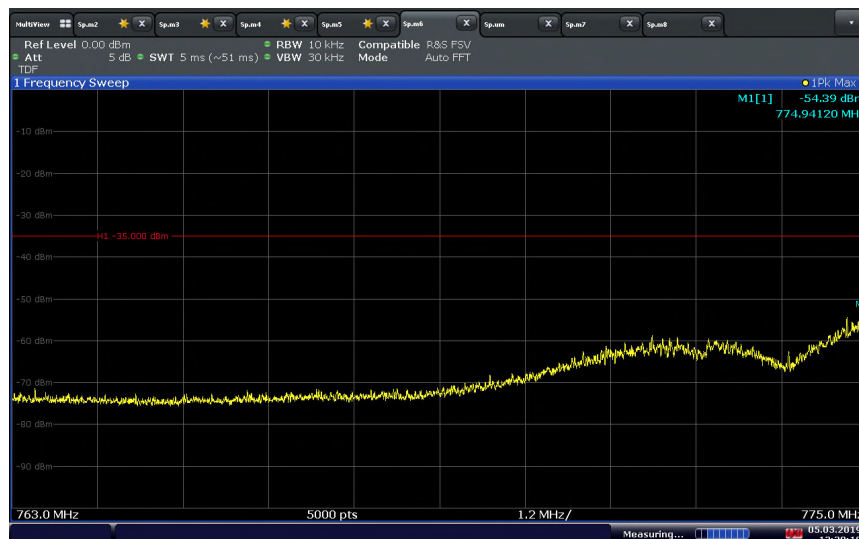


LTE Band 13 (5 MHz BW)/QPSK/Low Channel 779.5 MHz



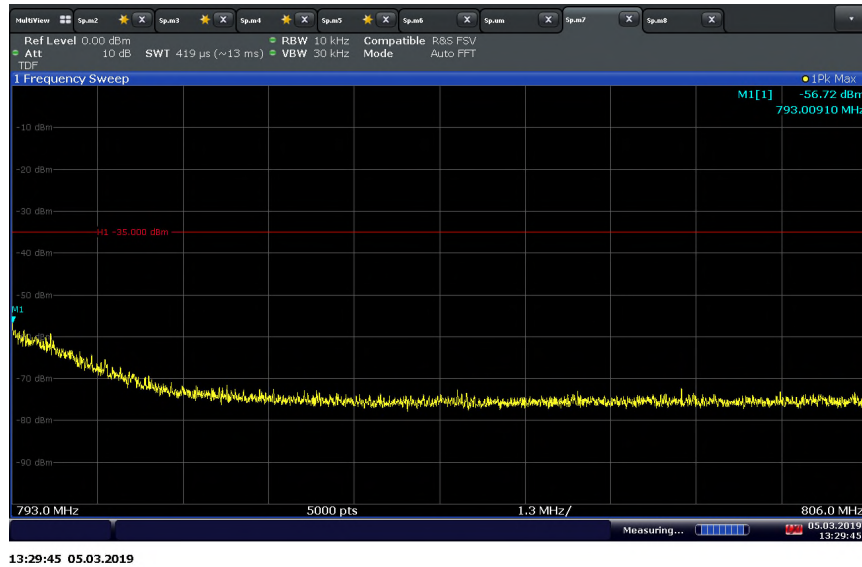
13:06:34 05.03.2019

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

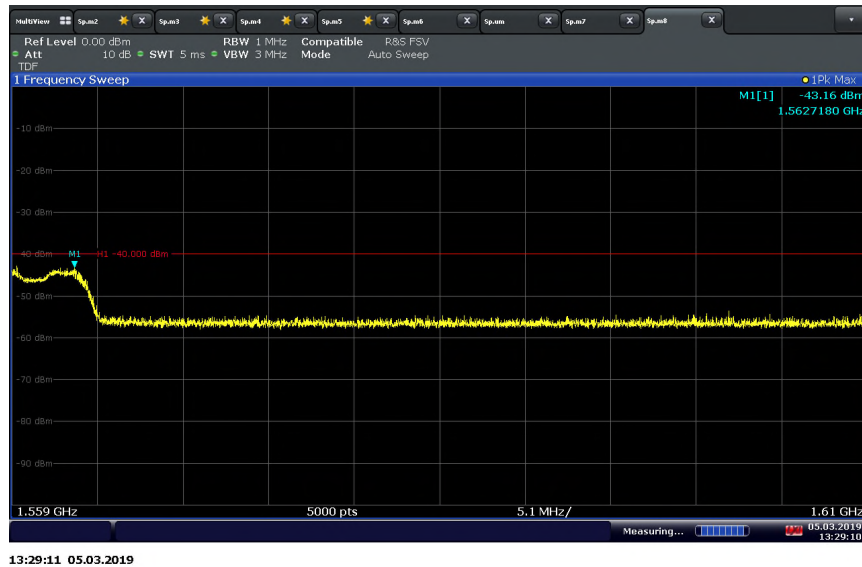


13:30:20 05.03.2019

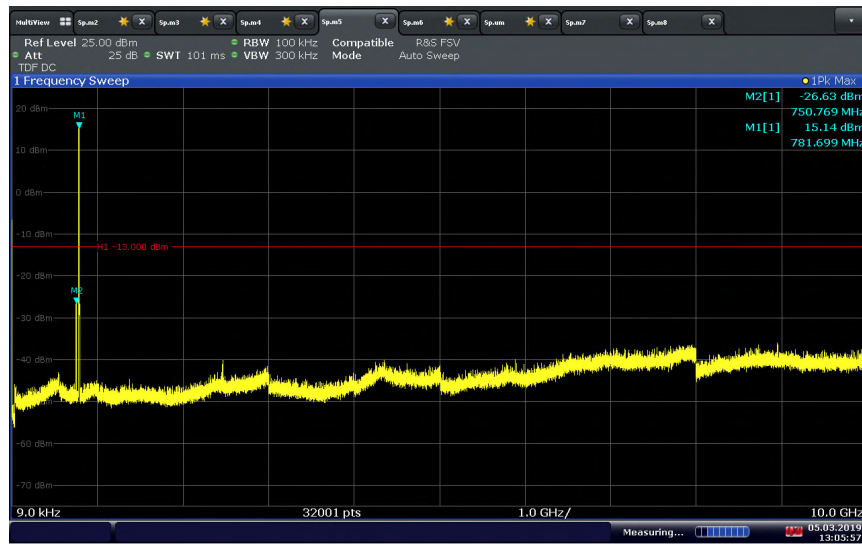
LTE Band 13 (5 MHz BW)/QPSK/Low Channel 779.5 MHz Conducted Spurious Emissions (793-806 MHz)



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

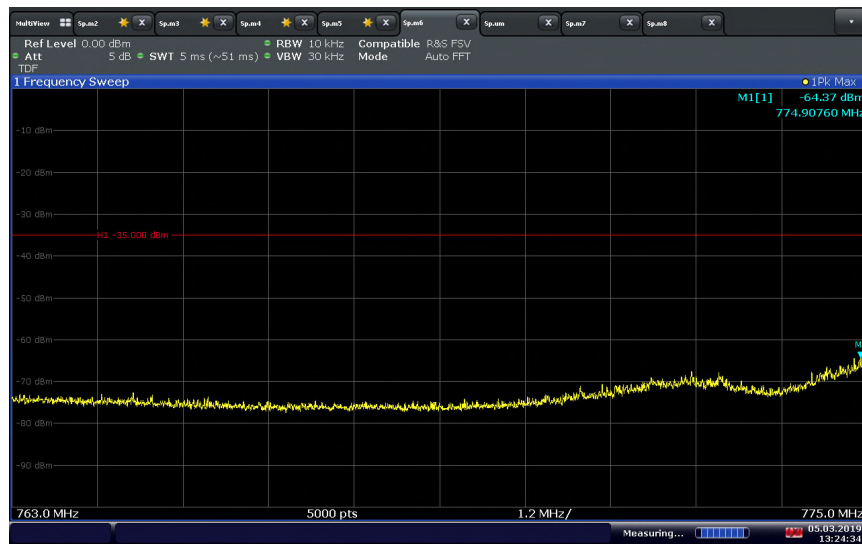


LTE Band 13 (5 MHz BW)/QPSK/Middle Channel 782 MHz



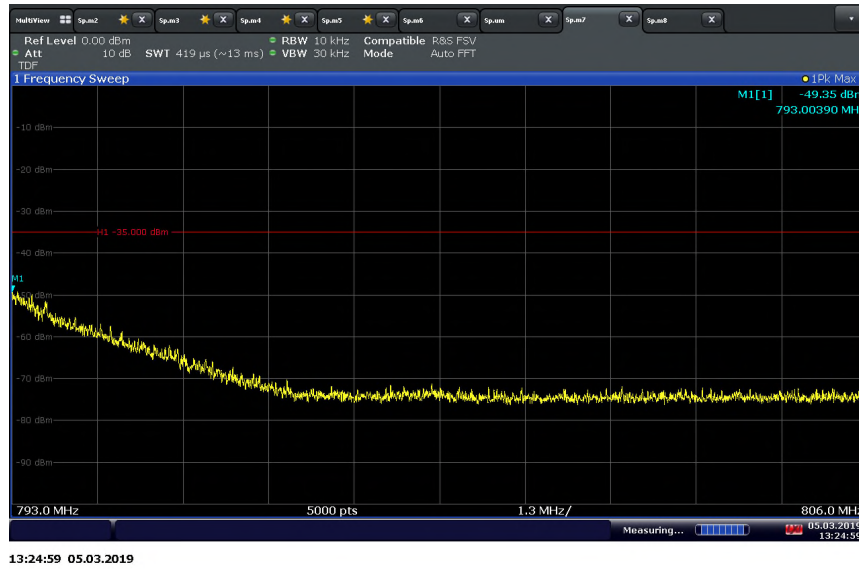
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LTE Band 13 (5 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (763-775 MHz)

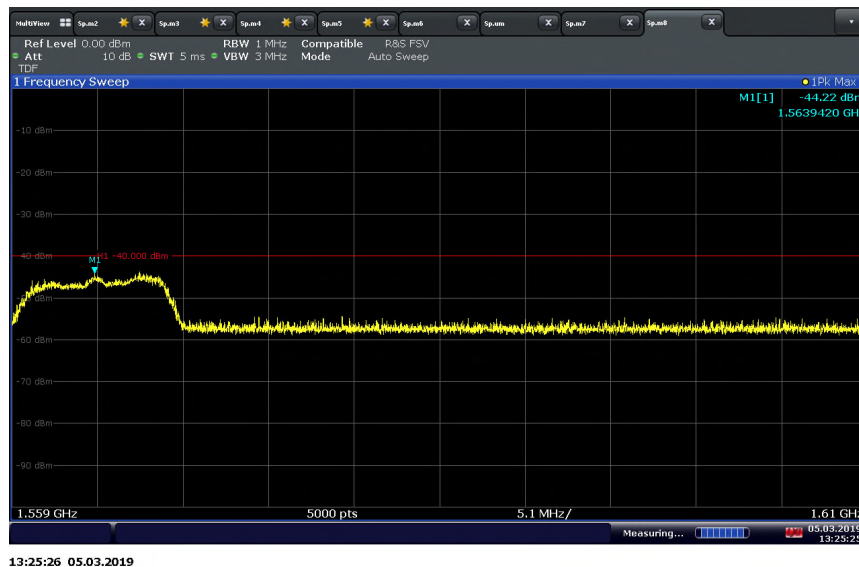


13:24:35 05.03.2019

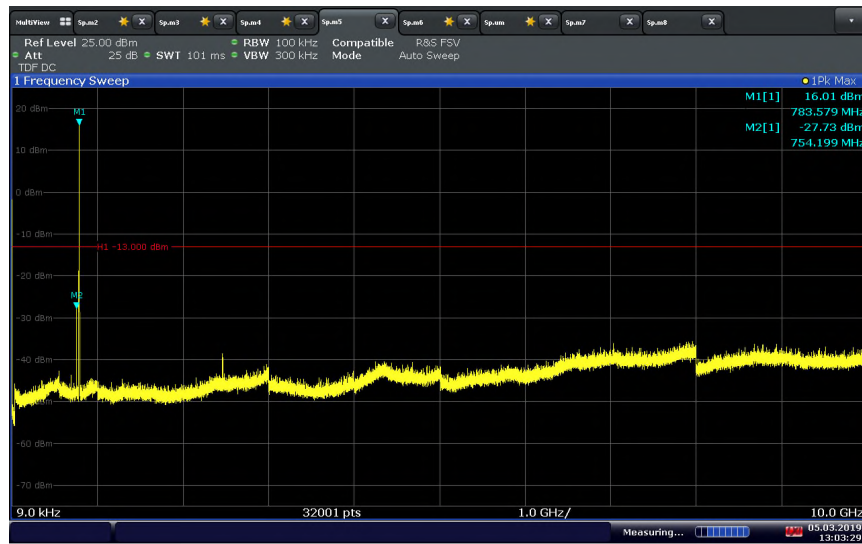
LTE Band 13 (5 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (793-806 MHz)



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

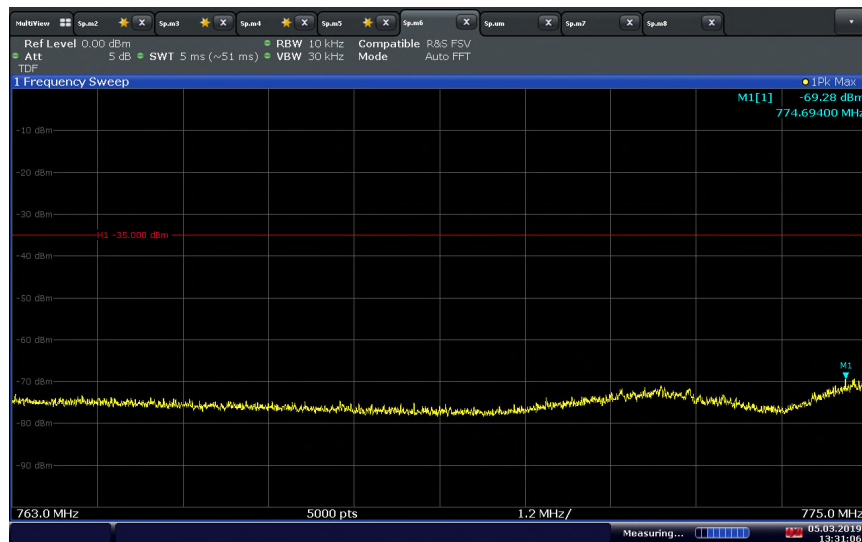


LTE Band 13 (5 MHz BW)/QPSK/High Channel 784.5 MHz



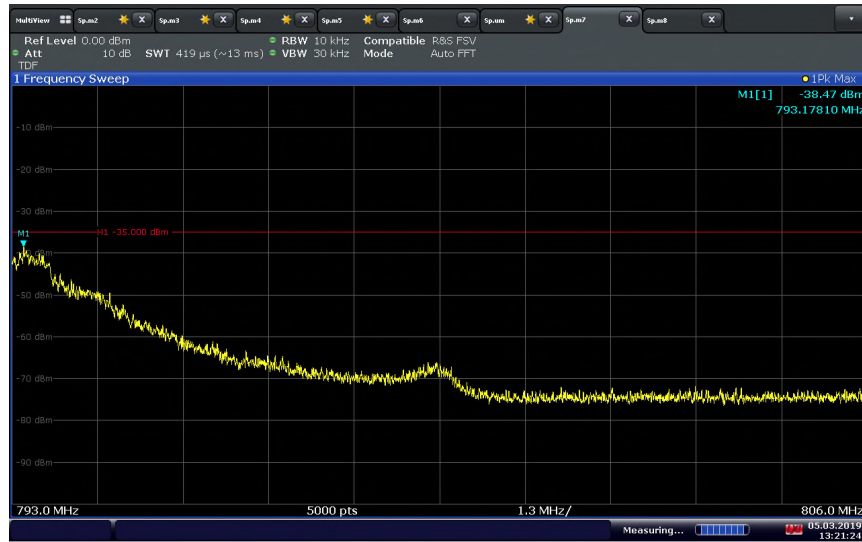
13:03:30 05.03.2019

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



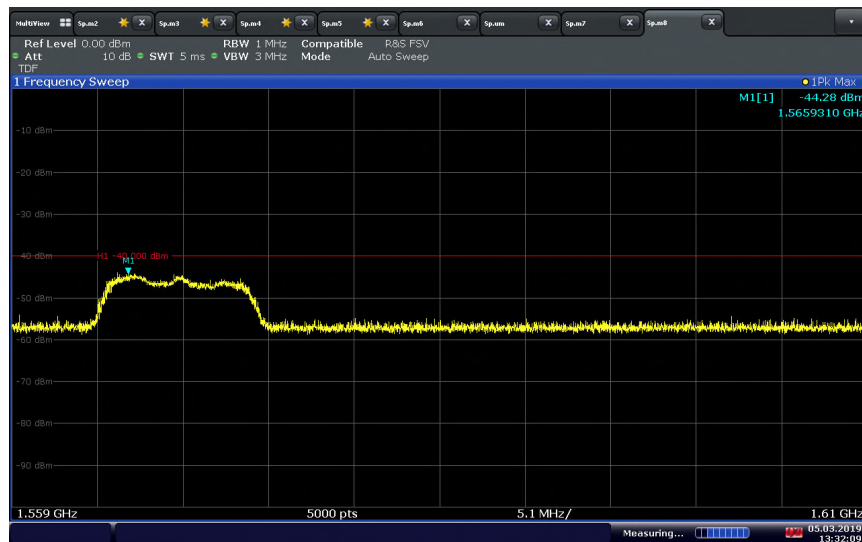
13:31:06 05.03.2019

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



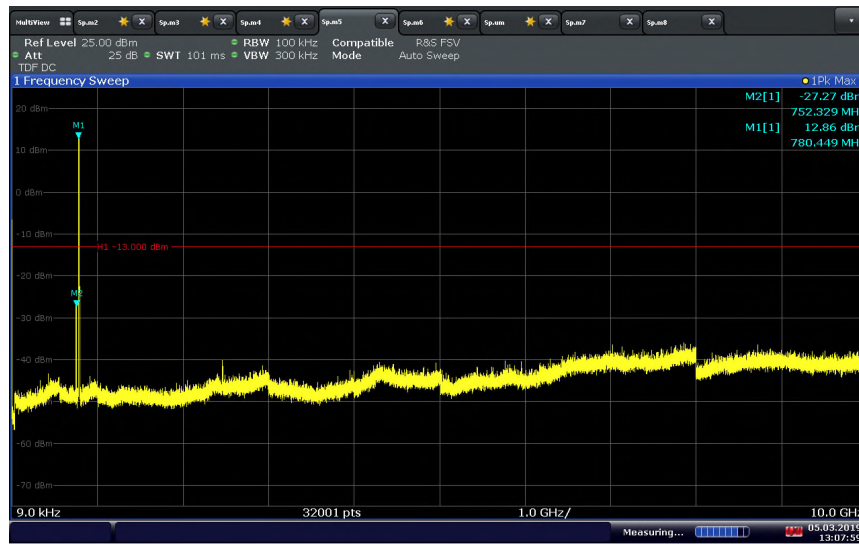
13:21:24 05.03.2019

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



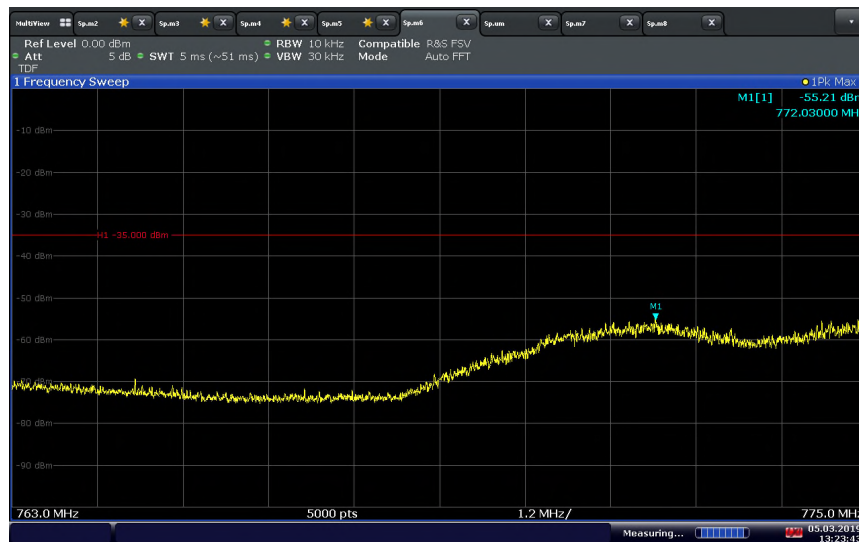
13:32:09 05.03.2019

LTE Band 13 (10 MHz BW)/QPSK/Middle Channel 782 MHz



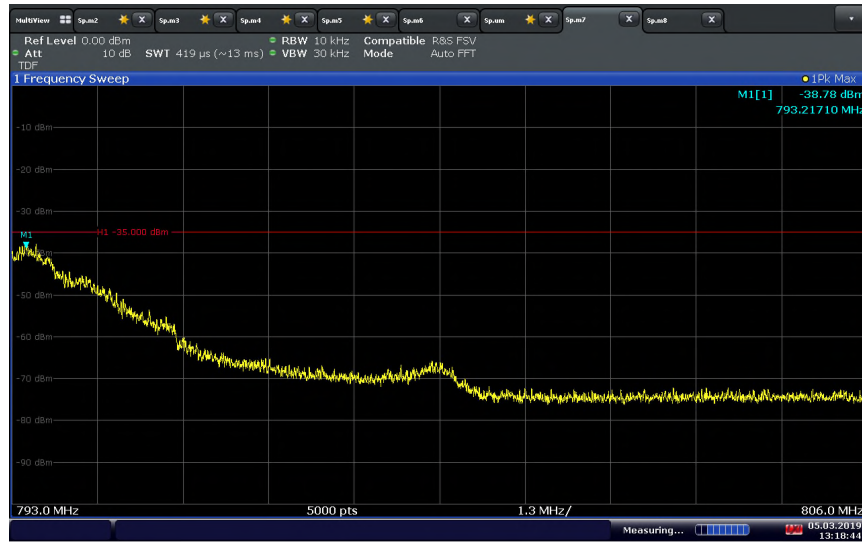
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LTE Band 13 (10 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (763-775 MHz)



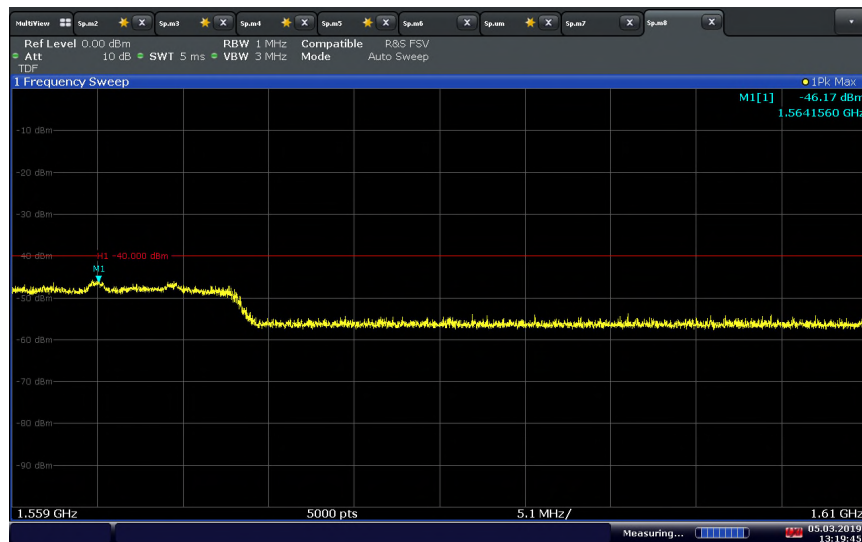
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LTE Band 13 (10 MHz BW)/QPSK/Middle Channel 782 MHz Conducted Spurious Emissions (793-806 MHz)



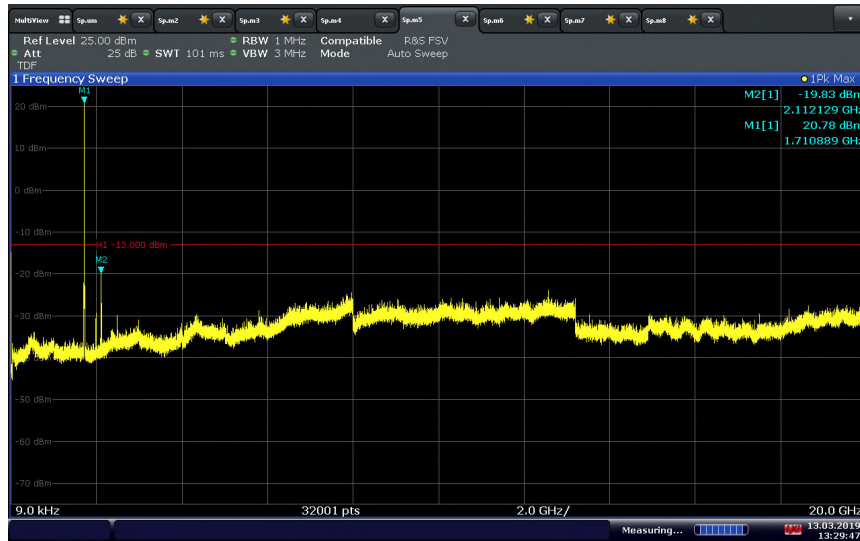
13:18:45 05.03.2019

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



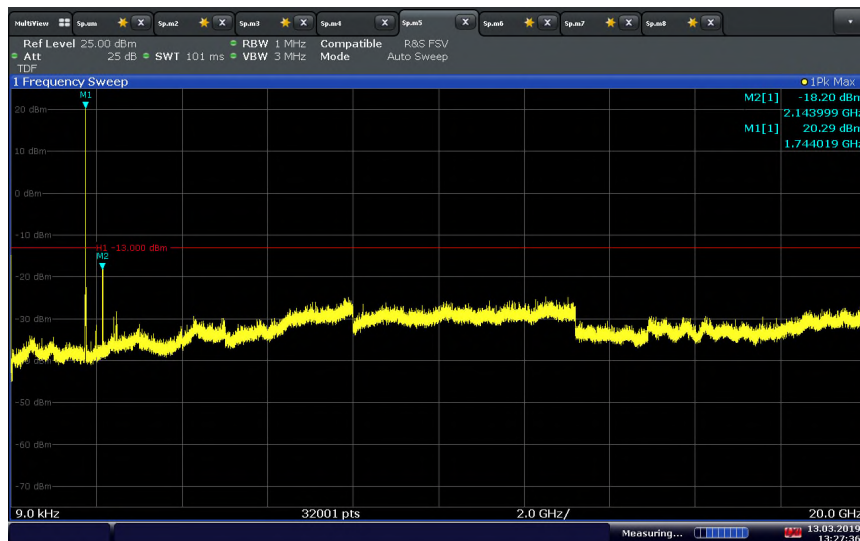
13:19:46 05.03.2019

LTE Band 66 (3 MHz BW)/QPSK/Low Channel 1711.5 MHz



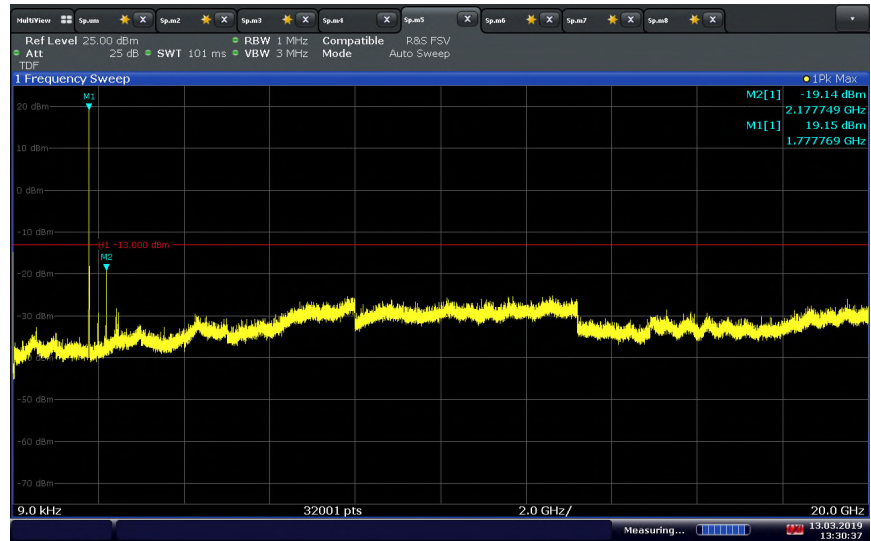
13:29:47 13.03.2019

LTE Band 66 (3 MHz BW)/QPSK/Middle Channel 1745 MHz



13:27:37 13.03.2019

LTE Band 66 (3 MHz BW)/QPSK/High Channel 1778.5 MHz



13:30:37 13.03.2019



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(c)(2)
RSS-139, Clause 6.6
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 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 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 $43 + 10 \log_{10}(P)$ dB.

(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 operation, 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 $43 + 10 \log_{10}(P)$ dB.

RSS-139, Clause 6.6:

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating 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 power P (dBW), by at least $43 + 10 \log_{10} p$ (watts) dB.

RSS-130:

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

2.8.3 Equipment Under Test and Modification State

Serial No: FF161218B00106 / Test Configuration B

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

March 08, 13 and 17, 2019 / 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	21.8 - 23.2 °C
Relative Humidity	22.9 - 42.6 %
ATM Pressure	99.1 - 99.6 kPa

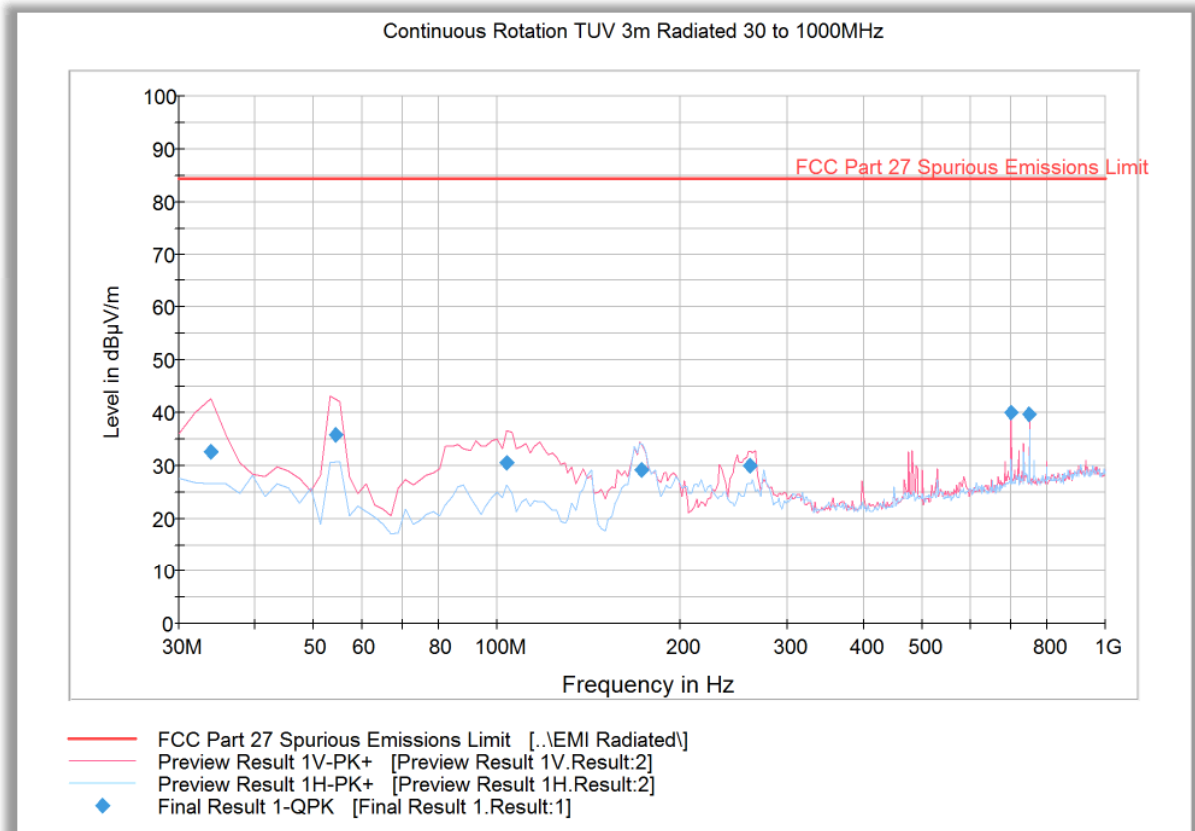
2.8.7 Additional Observations

- 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 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.8.8 Test Results

Compliant. See attached plots.

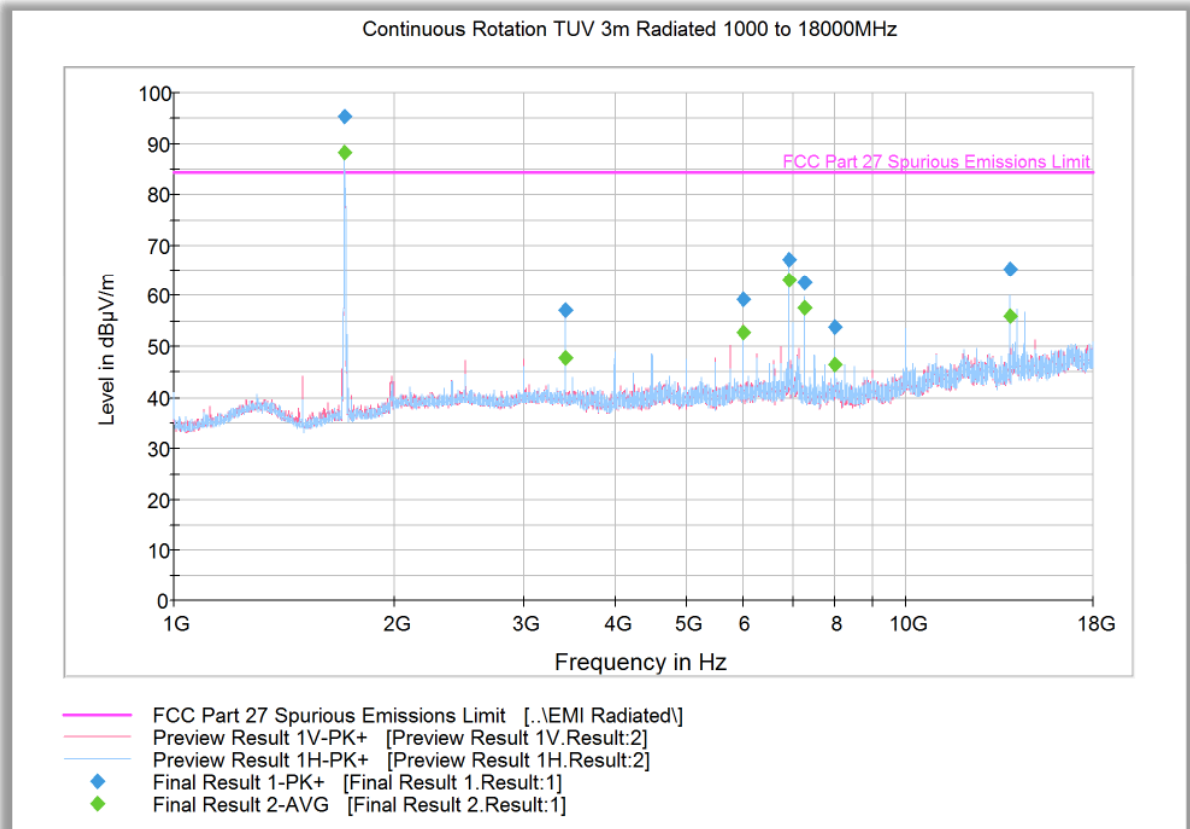
2.8.9 Radiated Emission Test Results Below 1GHz – Worst Case Configuration_WCDMA Band 4 High Channel



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)
33.807776	32.7	1000.0	120.000	138.0	V	106.0	-9.4	51.7	84.4
54.246653	35.9	1000.0	120.000	105.0	V	58.0	-15.7	48.5	84.4
103.507735	30.5	1000.0	120.000	105.0	V	181.0	-13.1	53.9	84.4
172.503808	29.2	1000.0	120.000	100.0	V	153.0	-11.6	55.2	84.4
260.666533	30.1	1000.0	120.000	109.0	V	89.0	-8.4	54.3	84.4
700.001283	40.1	1000.0	120.000	176.0	V	19.0	2.6	44.3	84.4
749.982365	39.6	1000.0	120.000	109.0	V	21.0	2.9	44.8	84.4

2.8.10 Radiated Emission Test Results Above 1GHz –WCDMA Band 4 Low Channel



Peak Data

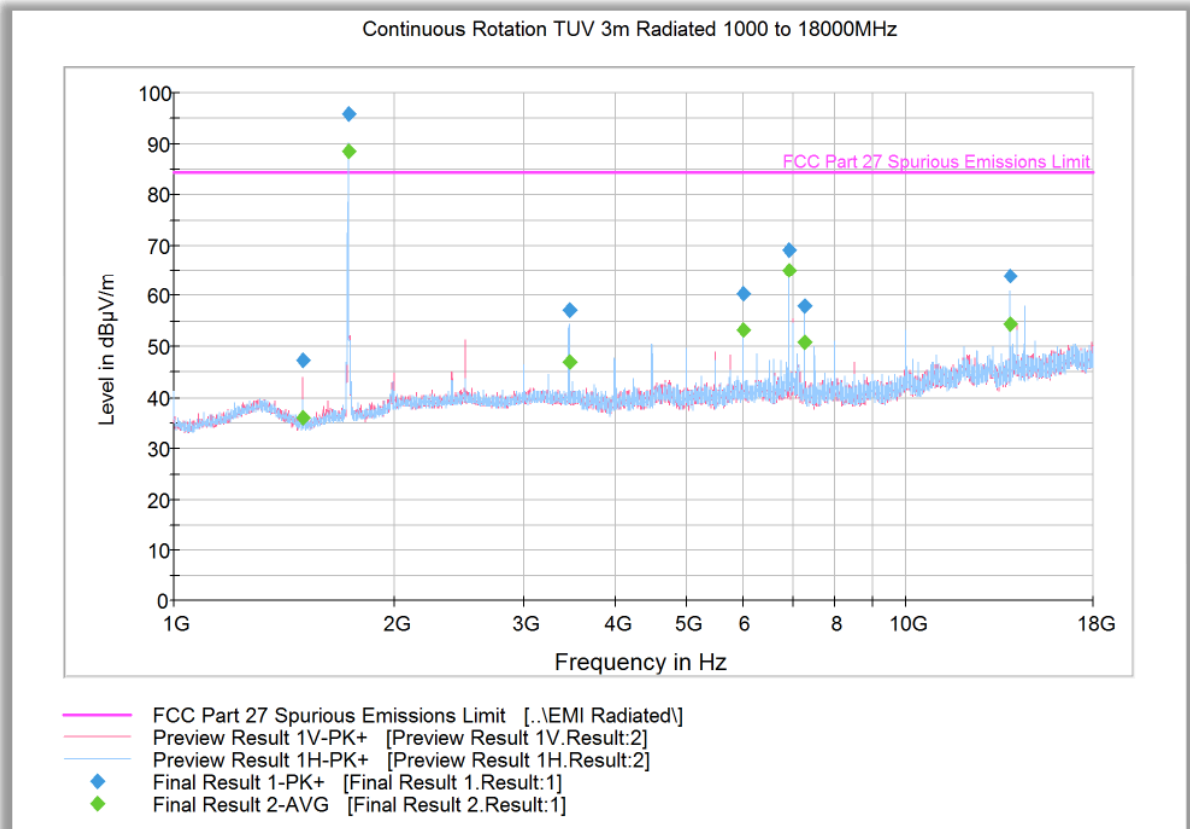
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1713.266667	95.2	1000.0	1000.000	102.8	H	11.0	-4.8	Fundamental Carrier*	
3426.833333	57.0	1000.0	1000.000	204.5	V	132.0	0.9	27.4	84.4
5999.900000	59.4	1000.0	1000.000	152.7	V	170.0	5.7	25.0	84.4
6918.100000	67.3	1000.0	1000.000	305.2	H	111.0	6.7	17.1	84.4
7252.566667	62.5	1000.0	1000.000	127.7	H	64.0	7.0	21.9	84.4
7999.833333	53.9	1000.0	1000.000	103.7	H	37.0	6.9	30.5	84.4
13835.533333	65.3	1000.0	1000.000	209.5	H	49.0	14.1	19.1	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)
1713.266667	88.2	1000.0	1000.000	102.8	H	11.0	-4.8	Fundamental Carrier*	
3426.833333	47.7	1000.0	1000.000	204.5	V	132.0	0.9	36.7	84.4
5999.900000	52.6	1000.0	1000.000	152.7	V	170.0	5.7	31.8	84.4
6918.100000	63.0	1000.0	1000.000	305.2	H	111.0	6.7	21.4	84.4
7252.566667	57.6	1000.0	1000.000	127.7	H	64.0	7.0	26.8	84.4
7999.833333	46.4	1000.0	1000.000	103.7	H	37.0	6.9	38.0	84.4
13835.533333	55.9	1000.0	1000.000	209.5	H	49.0	14.1	28.5	84.4

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

2.8.11 Radiated Emission Test Results Above 1GHz –WCDMA Band 4 Middle Channel



Peak Data

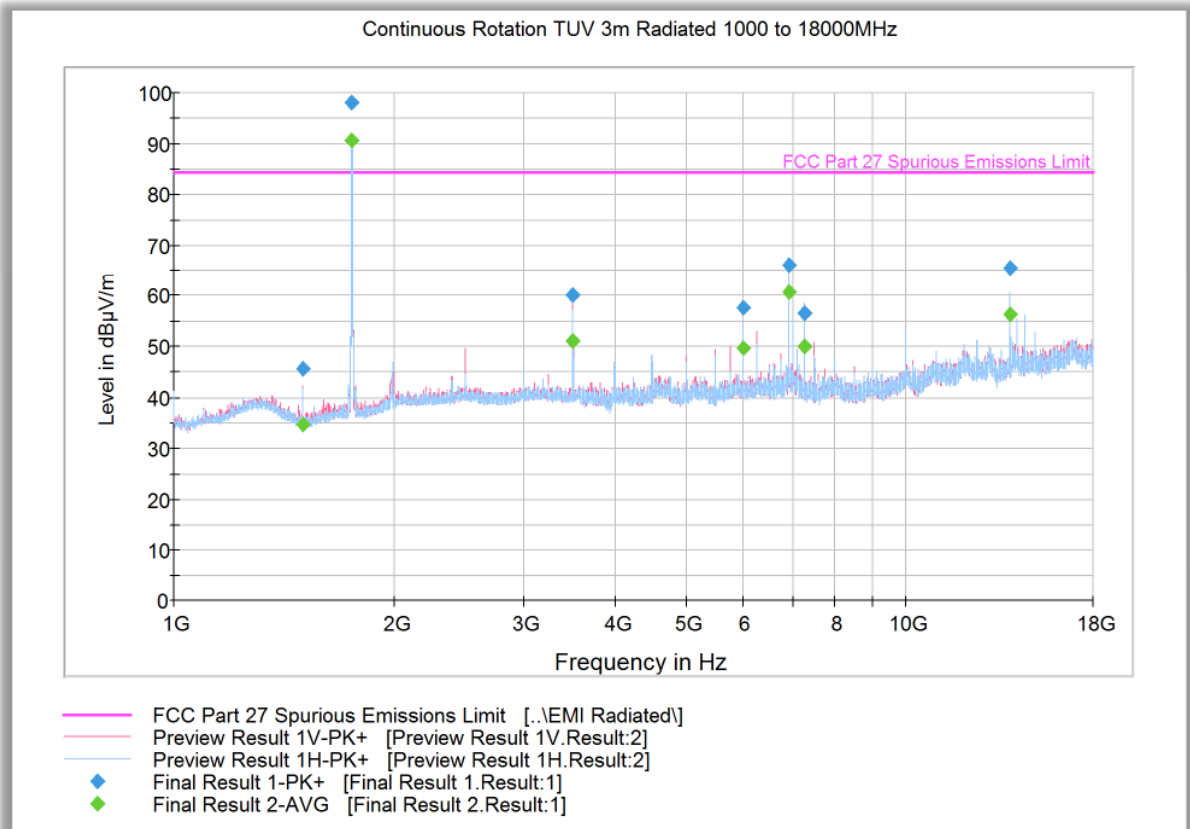
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	47.1	1000.0	1000.000	103.7	V	50.0	-6.1	37.3	84.4
1731.366667	95.8	1000.0	1000.000	152.2	V	169.0	-4.6	Fundamental Carrier*	
3467.666667	57.1	1000.0	1000.000	188.5	H	242.0	1.1	27.3	84.4
5999.900000	60.3	1000.0	1000.000	252.3	V	205.0	5.7	24.1	84.4
6918.133333	69.1	1000.0	1000.000	301.2	H	113.0	6.7	15.3	84.4
7252.566667	58.0	1000.0	1000.000	103.7	V	257.0	7.0	26.4	84.4
13836.700000	63.9	1000.0	1000.000	152.6	H	48.0	14.1	20.5	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)
1500.000000	36.1	1000.0	1000.000	103.7	V	50.0	-6.1	48.3	84.4
1731.366667	88.5	1000.0	1000.000	152.2	V	169.0	-4.6	Fundamental Carrier*	
3467.666667	46.9	1000.0	1000.000	188.5	H	242.0	1.1	37.5	84.4
5999.900000	53.3	1000.0	1000.000	252.3	V	205.0	5.7	31.1	84.4
6918.133333	65.0	1000.0	1000.000	301.2	H	113.0	6.7	19.4	84.4
7252.566667	50.8	1000.0	1000.000	103.7	V	257.0	7.0	33.6	84.4
13836.700000	54.4	1000.0	1000.000	152.6	H	48.0	14.1	30.0	84.4

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

2.8.12 Radiated Emission Test Results Above 1GHz –WCDMA Band 4 High Channel



Peak Data

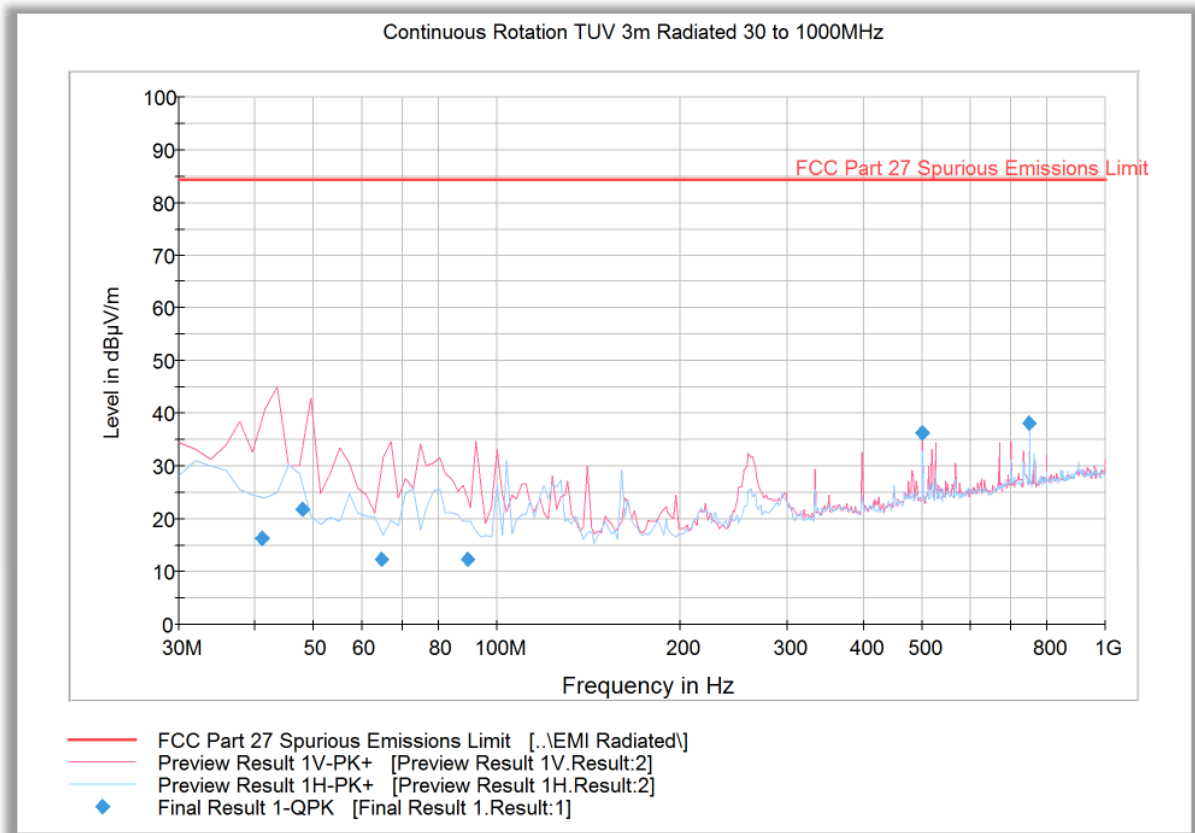
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	45.7	1000.0	1000.000	102.8	V	47.0	-6.1	38.7	84.4
1751.600000	98.0	1000.0	1000.000	191.5	V	133.0	-4.2	Fundamental Carrier*	
3503.166667	60.2	1000.0	1000.000	187.6	V	133.0	1.2	24.2	84.4
5999.900000	57.6	1000.0	1000.000	111.7	H	77.0	5.7	26.8	84.4
6918.066667	66.1	1000.0	1000.000	285.3	V	218.0	6.7	18.3	84.4
7252.966667	56.5	1000.0	1000.000	295.3	V	341.0	7.0	27.9	84.4
13835.133333	65.6	1000.0	1000.000	300.2	V	106.0	14.1	18.8	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)
1500.000000	34.6	1000.0	1000.000	102.8	V	47.0	-6.1	49.8	84.4
1751.600000	90.8	1000.0	1000.000	191.5	V	133.0	-4.2	Fundamental Carrier*	
3503.166667	51.1	1000.0	1000.000	187.6	V	133.0	1.2	33.3	84.4
5999.900000	49.7	1000.0	1000.000	111.7	H	77.0	5.7	34.7	84.4
6918.066667	60.8	1000.0	1000.000	285.3	V	218.0	6.7	23.6	84.4
7252.966667	49.9	1000.0	1000.000	295.3	V	341.0	7.0	34.5	84.4
13835.133333	56.4	1000.0	1000.000	300.2	V	106.0	14.1	28.0	84.4

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

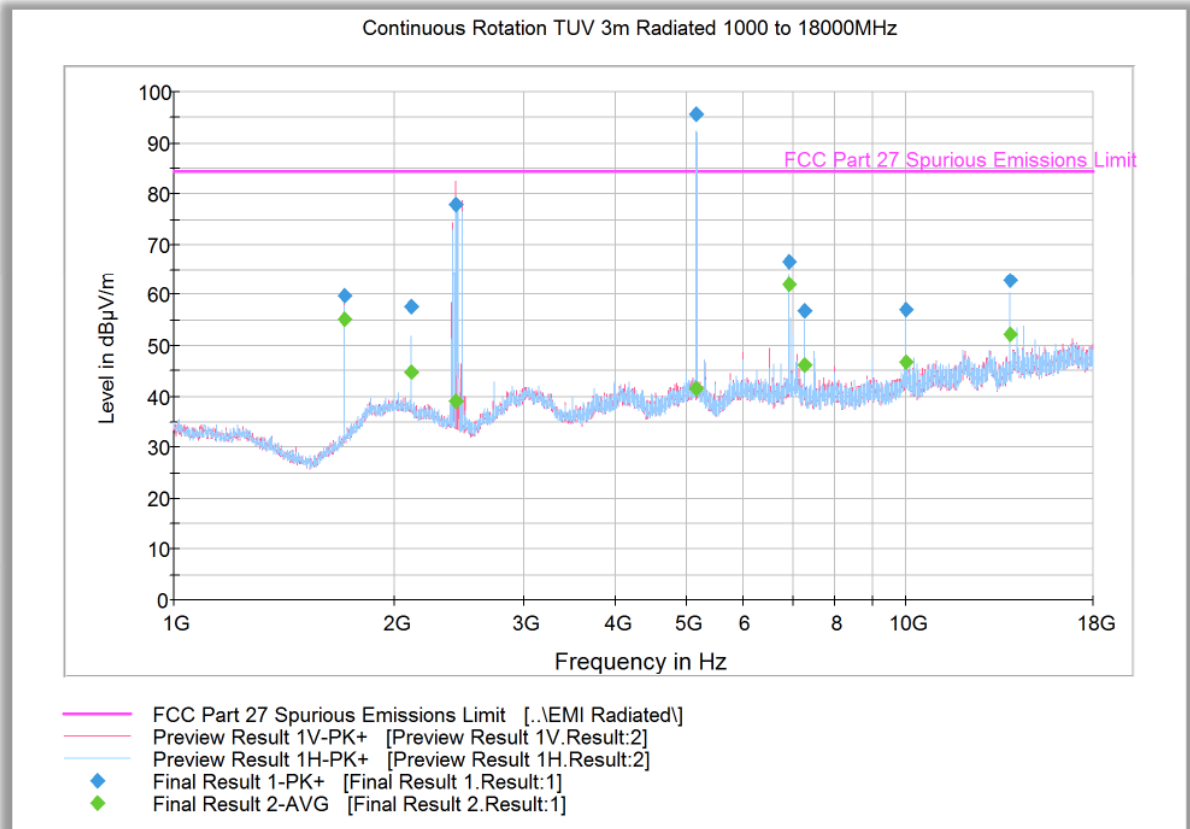
2.8.13 Radiated Emission Test Results Below 1GHz – Worst Case LTE Band 4_3 MHz Bandwidth_Middle Channel 1720 MHz_1 RB 7 offset_QPSK



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)
41.127214	16.4	1000.0	120.000	133.0	V	34.0	-12.3	68.0	84.4
47.838878	21.8	1000.0	120.000	134.0	V	-7.0	-14.4	62.6	84.4
64.493868	12.3	1000.0	120.000	128.0	V	76.0	-16.5	72.1	84.4
89.444409	12.4	1000.0	120.000	134.0	V	81.0	-15.1	72.0	84.4
500.020842	36.2	1000.0	120.000	132.0	V	34.0	-2.0	48.2	84.4
749.982365	38.2	1000.0	120.000	189.0	V	189.0	2.9	46.2	84.4

2.8.14 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 4_3 MHz Bandwidth_Low Channel 1720 MHz_1 RB 7 offset_QPSK



Peak Data

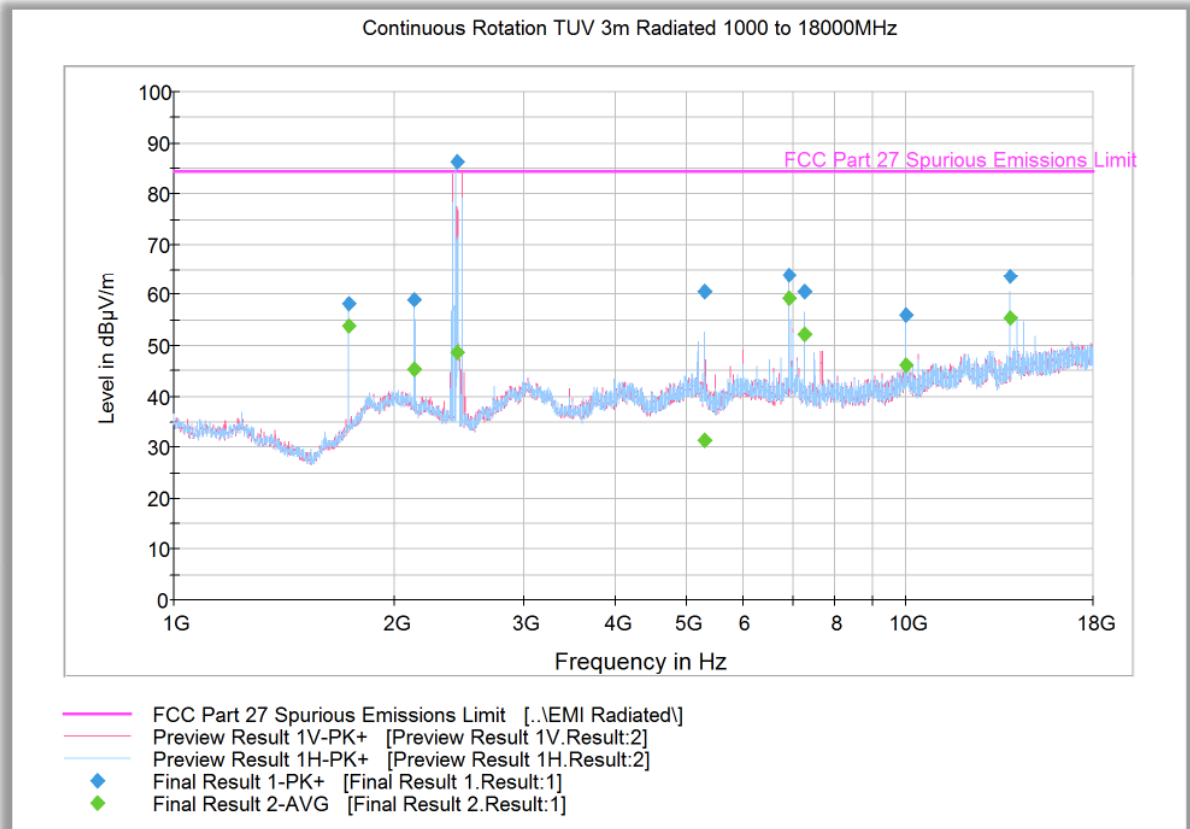
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1711.566667	59.9	1000.0	1000.000	302.2	H	209.0	-4.9	Fundamental Carrier*	
2111.433333	57.7	1000.0	1000.000	250.5	V	92.0	-2.2	26.7	84.4
2425.933333	78.0	1000.0	1000.000	155.2	V	118.0	-0.8	WIFI 2.4G Signal	
5173.733333	95.8	1000.0	1000.000	111.7	H	-1.0	4.2	WIFI 52G Signal	
6915.800000	66.5	1000.0	1000.000	306.2	H	208.0	6.7	17.9	84.4
7250.000000	56.9	1000.0	1000.000	99.7	V	108.0	7.0	27.5	84.4
9999.800000	57.2	1000.0	1000.000	191.5	V	238.0	9.6	27.2	84.4
13829.900000	62.8	1000.0	1000.000	312.2	H	28.0	14.1	21.6	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)
1711.566667	55.2	1000.0	1000.000	302.2	H	209.0	-4.9	Fundamental Carrier*	
2111.433333	44.9	1000.0	1000.000	250.5	V	92.0	-2.2	39.5	84.4
2425.933333	39.2	1000.0	1000.000	155.2	V	118.0	-0.8	WIFI 2.4G Signal	
5173.733333	41.5	1000.0	1000.000	111.7	H	-1.0	4.2	WIFI 52G Signal	
6915.800000	62.0	1000.0	1000.000	306.2	H	208.0	6.7	22.4	84.4
7250.000000	46.1	1000.0	1000.000	99.7	V	108.0	7.0	38.3	84.4
9999.800000	46.6	1000.0	1000.000	191.5	V	238.0	9.6	37.8	84.4
13829.900000	52.1	1000.0	1000.000	312.2	H	28.0	14.1	32.3	84.4

* The fundamental frequency and WIFI signals are not part of spurious emission evaluation. Data provided for information purpose only.

2.8.15 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 4_3 MHz Bandwidth _Middle Channel 1732.5 MHz_1 RB 7 offset_QPSK



Peak Data

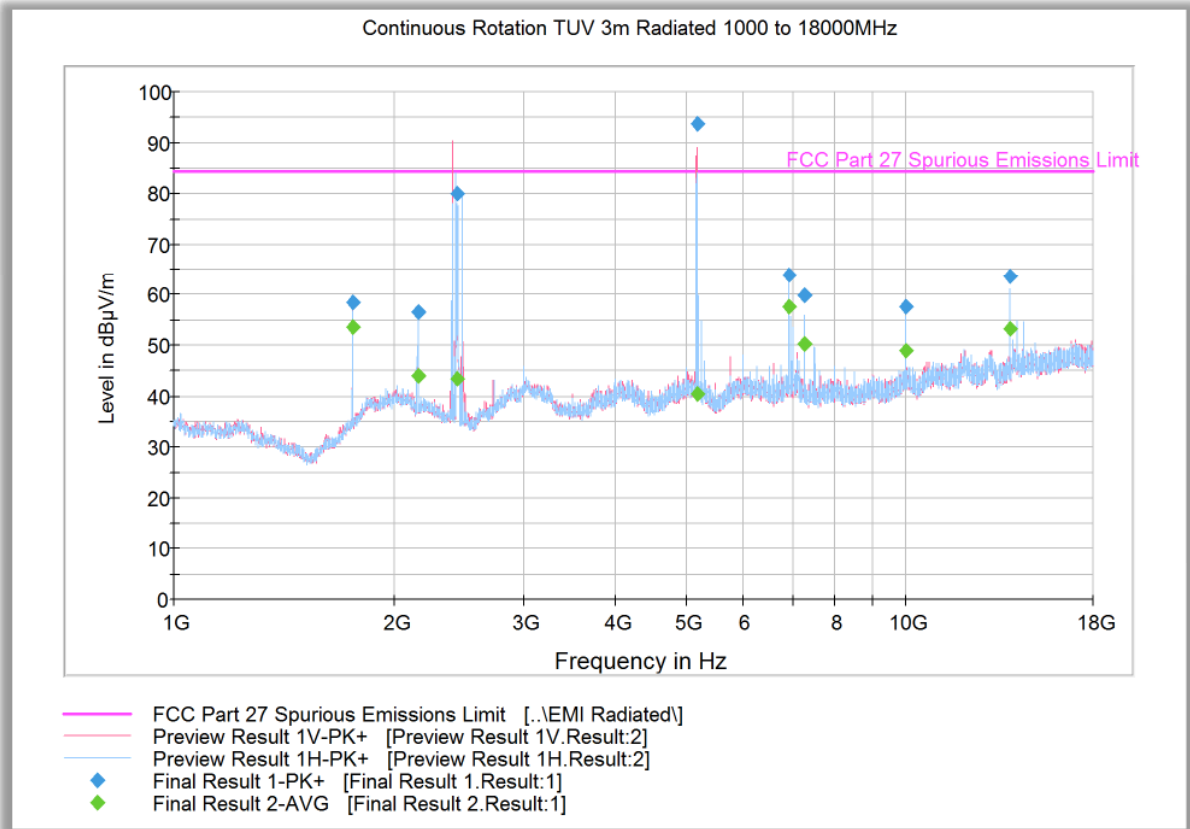
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1732.500000	58.3	1000.0	1000.000	103.7	V	63.0	-4.6	Fundamental Carrier*	
2132.433333	59.1	1000.0	1000.000	103.7	H	15.0	-2.2	25.3	84.4
2440.833333	86.2	1000.0	1000.000	208.5	V	21.0	-0.7	WIFI 2.4G Signal	
5301.233333	60.6	1000.0	1000.000	250.5	H	53.0	4.6	23.8	84.4
6915.433333	63.9	1000.0	1000.000	332.1	H	221.0	6.7	20.5	84.4
7248.266667	60.5	1000.0	1000.000	151.6	H	13.0	7.0	23.9	84.4
10000.000000	56.0	1000.0	1000.000	103.7	H	201.0	9.6	28.4	84.4
13831.266667	63.6	1000.0	1000.000	203.5	H	16.0	14.1	20.8	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)
1732.500000	53.7	1000.0	1000.000	103.7	V	63.0	-4.6	Fundamental Carrier*	
2132.433333	45.4	1000.0	1000.000	103.7	H	15.0	-2.2	39.0	84.4
2440.833333	48.7	1000.0	1000.000	208.5	V	21.0	-0.7	WIFI 2.4G Signal	
5301.233333	31.4	1000.0	1000.000	250.5	H	53.0	4.6	53.0	84.4
6915.433333	59.3	1000.0	1000.000	332.1	H	221.0	6.7	25.1	84.4
7248.266667	52.3	1000.0	1000.000	151.6	H	13.0	7.0	32.1	84.4
10000.000000	46.1	1000.0	1000.000	103.7	H	201.0	9.6	38.3	84.4
13831.266667	55.4	1000.0	1000.000	203.5	H	16.0	14.1	29.0	84.4

* The fundamental frequency and WIFI 2.4 GHz signals are not part of spurious emission evaluation. Data provided for information purpose only.

2.8.16 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 4_3 MHz Bandwidth_High Channel 1745 MHz_1 RB 7 offset_QPSK



Peak Data

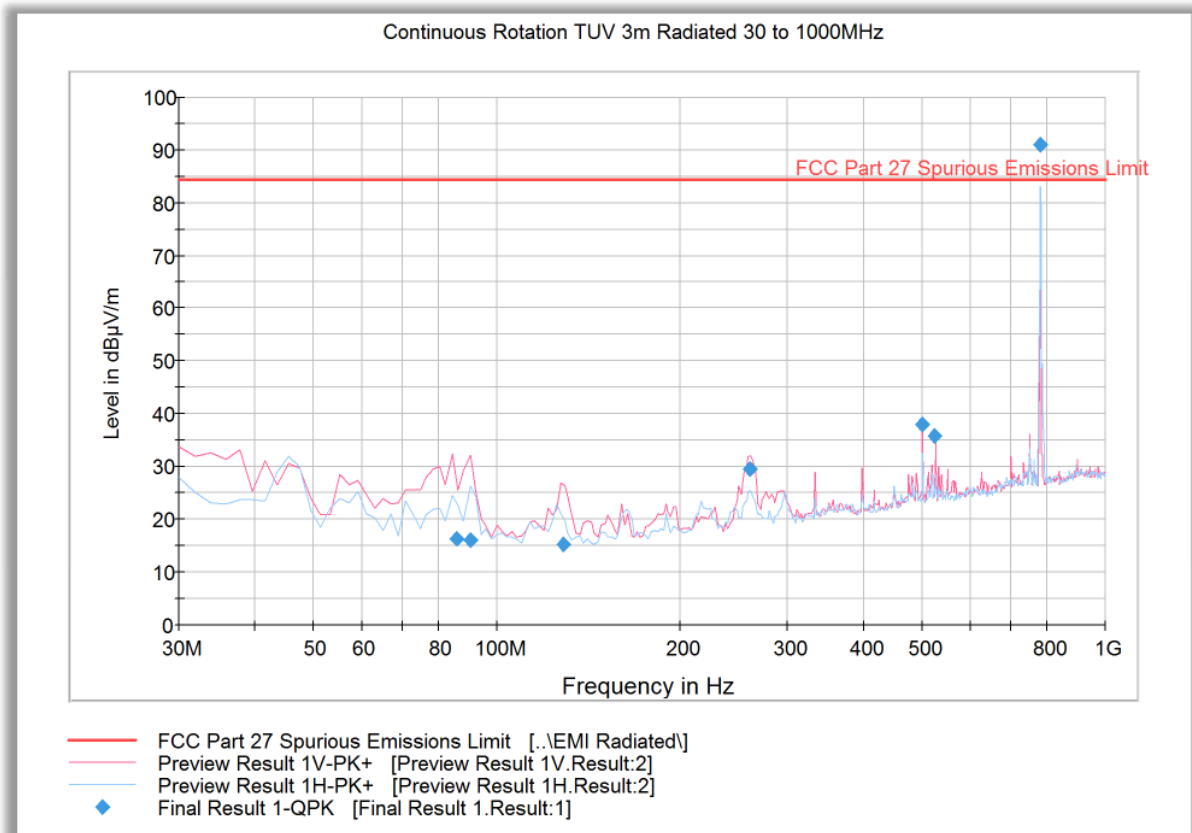
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1753.500000	58.6	1000.0	1000.000	203.5	H	351.0	-4.2	Fundamental Carrier*	
2153.600000	56.6	1000.0	1000.000	103.7	H	337.0	-2.1	27.8	84.4
2440.833333	80.2	1000.0	1000.000	99.7	H	357.0	-0.7	WIFI 2.4G Signal	
5177.700000	93.7	1000.0	1000.000	286.2	V	10.0	4.3	WIFI 5.2G Signal	
6915.866667	63.9	1000.0	1000.000	151.6	H	37.0	6.7	20.5	84.4
7249.966667	59.7	1000.0	1000.000	128.7	H	158.0	7.0	24.7	84.4
10000.000000	57.5	1000.0	1000.000	204.5	H	48.0	9.6	26.9	84.4
13830.033333	63.7	1000.0	1000.000	315.2	H	28.0	14.1	20.7	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)
1753.500000	53.5	1000.0	1000.000	203.5	H	351.0	-4.2	Fundamental Carrier*	
2153.600000	44.0	1000.0	1000.000	103.7	H	337.0	-2.1	40.4	84.4
2440.833333	43.4	1000.0	1000.000	99.7	H	357.0	-0.7	WIFI 2.4G Signal	
5177.700000	40.5	1000.0	1000.000	286.2	V	10.0	4.3	WIFI 5.2G Signal	
6915.866667	57.7	1000.0	1000.000	151.6	H	37.0	6.7	26.7	84.4
7249.966667	50.2	1000.0	1000.000	128.7	H	158.0	7.0	34.2	84.4
10000.000000	48.9	1000.0	1000.000	204.5	H	48.0	9.6	35.5	84.4
13830.033333	53.4	1000.0	1000.000	315.2	H	28.0	14.1	31.0	84.4

* The fundamental frequency and WIFI 2.4 and 5.2 GHz signals are not part of spurious emission evaluation. Data provided for information purpose only.

2.8.17 Radiated Emission Test Results Below 1GHz – Worst Case LTE Band 13_5 MHz Bandwidth_Middle Channel 782 MHz_1 RB 12 offset_QPSK

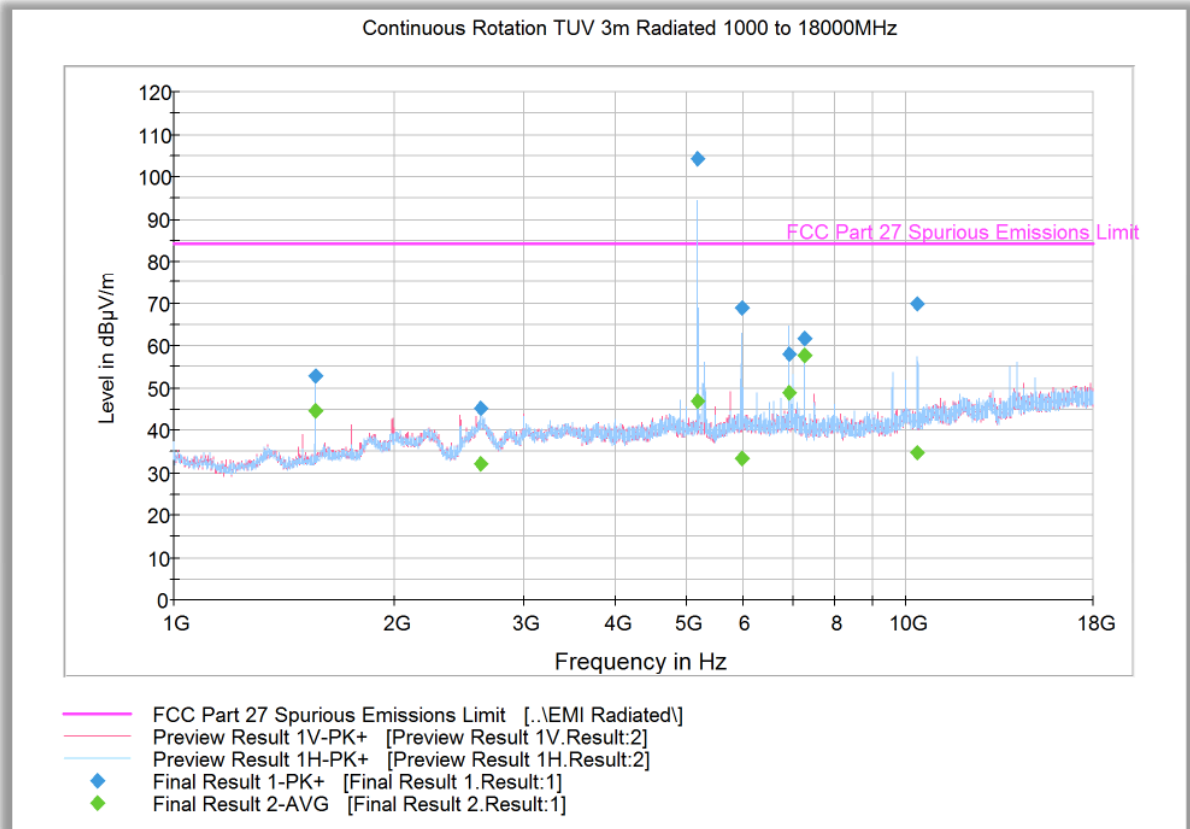


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
85.868858	16.2	1000.0	120.000	150.0	V	9.0	-15.7	68.2	84.4
90.500521	16.0	1000.0	120.000	122.0	V	127.0	-14.9	68.4	84.4
128.754389	15.2	1000.0	120.000	100.0	V	19.0	-14.3	69.2	84.4
260.042645	29.4	1000.0	120.000	100.0	V	168.0	-8.4	55.0	84.4
500.020842	37.8	1000.0	120.000	100.0	V	39.0	-2.0	46.6	84.4
525.011383	35.9	1000.0	120.000	116.0	V	52.0	-1.0	48.5	84.4
782.244569	91.1	1000.0	120.000	100.0	H	152.0	3.4	Fundamental Carrier*	

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

2.8.18 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 13_5 MHz Bandwidth_Low Channel 779.5 MHz_1 RB 12 offset_QPSK



Peak Data

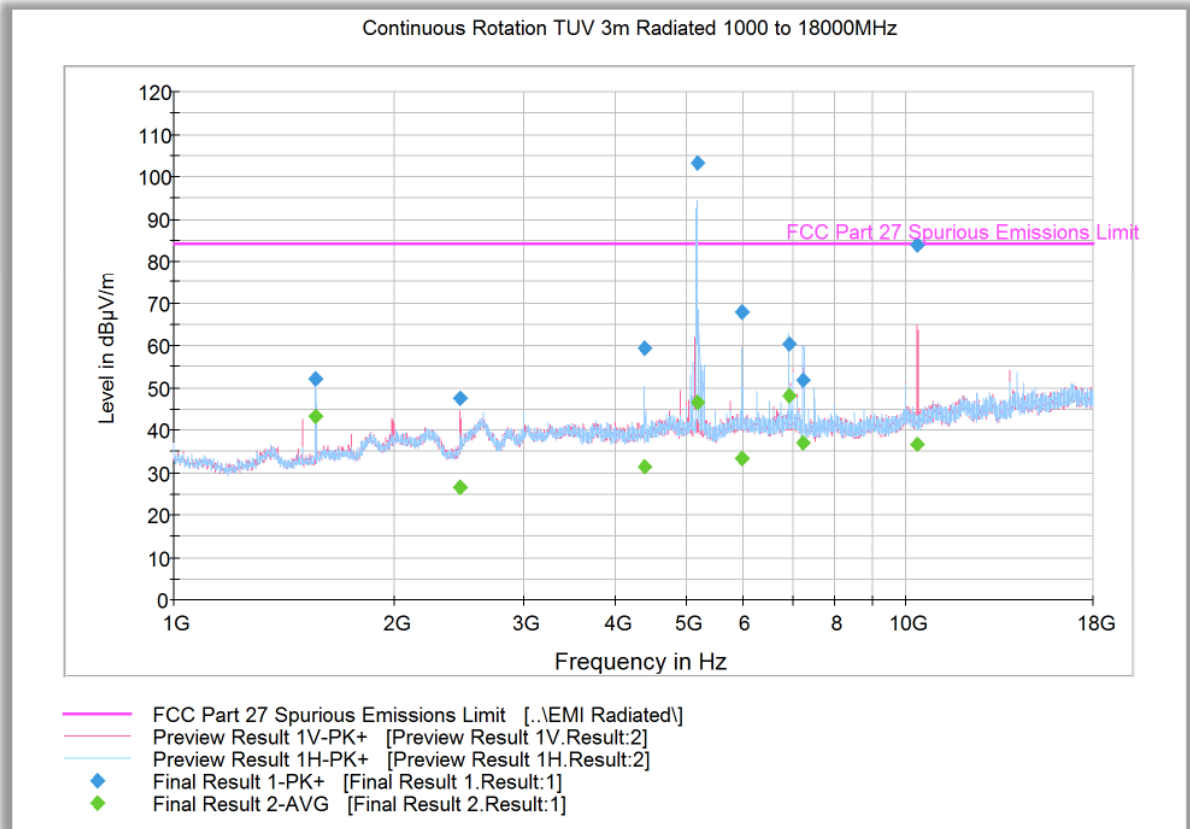
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1559.500000	52.8	1000.0	1000.000	208.5	H	201.0	-5.9	31.6	84.4
2629.933333	45.3	1000.0	1000.000	152.2	V	184.0	-0.3	39.1	84.4
5185.833333	104.2	1000.0	1000.000	133.7	H	278.0	4.3	WIFI 5.2GHz Signal	
5964.200000	68.7	1000.0	1000.000	281.3	H	10.0	5.7	15.7	84.4
6916.966667	58.1	1000.0	1000.000	103.7	H	205.0	6.7	26.3	84.4
7247.333333	61.5	1000.0	1000.000	103.7	V	110.0	7.0	22.9	84.4
10360.766667	69.7	1000.0	1000.000	151.6	H	232.0	10.4	14.7	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)
1559.500000	44.6	1000.0	1000.000	208.5	H	201.0	-5.9	39.8	84.4
2629.933333	32.0	1000.0	1000.000	152.2	V	184.0	-0.3	52.4	84.4
5185.833333	47.0	1000.0	1000.000	133.7	H	278.0	4.3	WIFI 5.2GHz Signal	
5964.200000	33.3	1000.0	1000.000	281.3	H	10.0	5.7	51.1	84.4
6916.966667	48.9	1000.0	1000.000	103.7	H	205.0	6.7	35.5	84.4
7247.333333	57.8	1000.0	1000.000	103.7	V	110.0	7.0	26.6	84.4
10360.766667	34.7	1000.0	1000.000	151.6	H	232.0	10.4	49.7	84.4

Test Note: 2.4 GHz Notch filter used when testing. The WIFI 5.2 GHz signal is not part of spurious emission evaluation. Data provided for information purpose only.

2.8.19 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 13_5 MHz Bandwidth_Middle Channel 782 MHz_1 RB 12 offset_QPSK



Peak Data

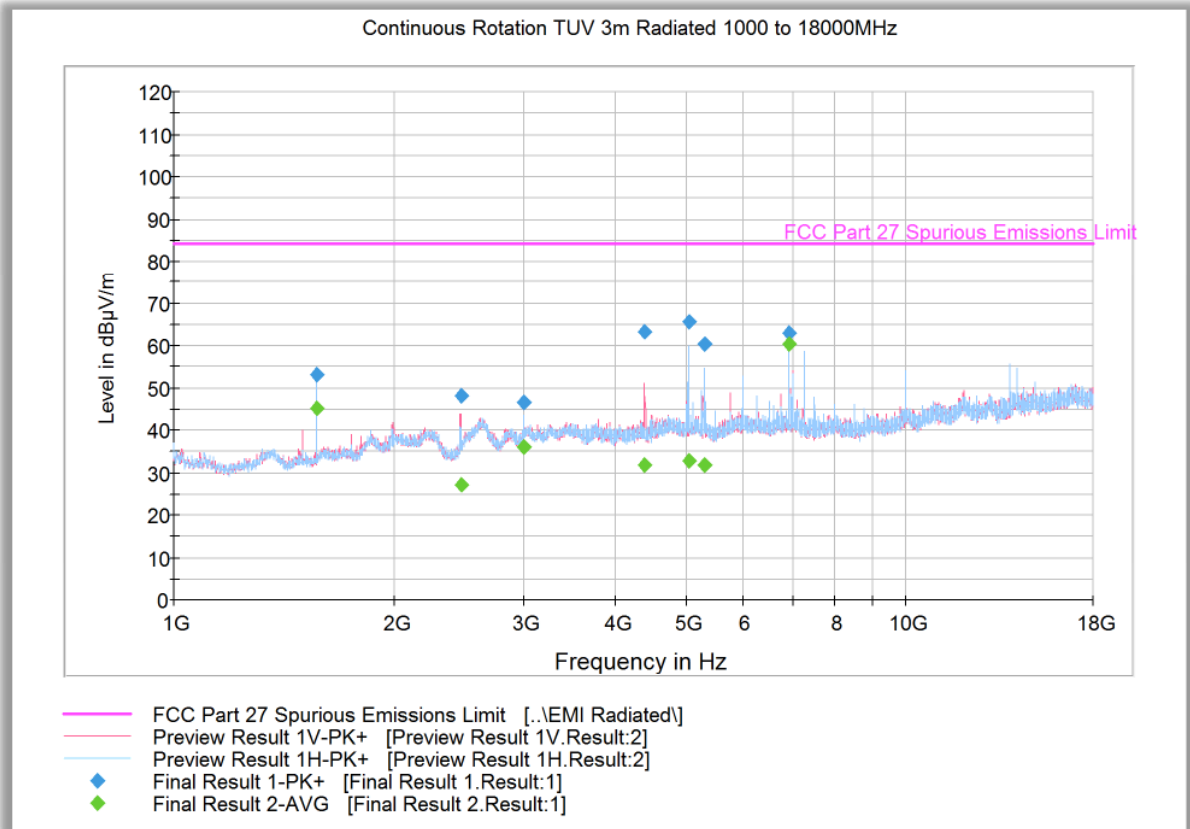
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1564.200000	52.1	1000.0	1000.000	209.4	H	198.0	-5.9	32.3	84.4
2461.266667	47.5	1000.0	1000.000	108.7	V	71.0	-0.6	36.9	84.4
4397.033333	59.4	1000.0	1000.000	116.7	H	219.0	3.2	25.0	84.4
5176.566667	103.3	1000.0	1000.000	167.6	H	278.0	4.2	WIFI 5.2GHz Signal	
5958.200000	67.8	1000.0	1000.000	151.2	H	83.0	5.7	16.6	84.4
6915.433333	60.2	1000.0	1000.000	103.7	V	63.0	6.7	24.2	84.4
7242.833333	51.9	1000.0	1000.000	102.8	H	53.0	7.0	32.5	84.4
10355.633333	84.0	1000.0	1000.000	152.2	V	98.0	10.4	0.4	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)
1564.200000	43.2	1000.0	1000.000	209.4	H	198.0	-5.9	41.2	84.4
2461.266667	26.7	1000.0	1000.000	108.7	V	71.0	-0.6	57.7	84.4
4397.033333	31.5	1000.0	1000.000	116.7	H	219.0	3.2	52.9	84.4
5176.566667	46.7	1000.0	1000.000	167.6	H	278.0	4.2	WIFI 5.2GHz Signal	
5958.200000	33.4	1000.0	1000.000	151.2	H	83.0	5.7	51.0	84.4
6915.433333	48.2	1000.0	1000.000	103.7	V	63.0	6.7	36.2	84.4
7242.833333	36.9	1000.0	1000.000	102.8	H	53.0	7.0	47.5	84.4
10355.633333	36.8	1000.0	1000.000	152.2	V	98.0	10.4	47.6	84.4

Test Note: 2.4 GHz Notch filter used when testing. The WIFI 5.2 GHz signal is not part of spurious emission evaluation. Data provided for information purpose only.

2.8.20 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 13_5 MHz Bandwidth_High Channel 784.5 MHz_1 RB 12 offset_QPSK



Peak Data

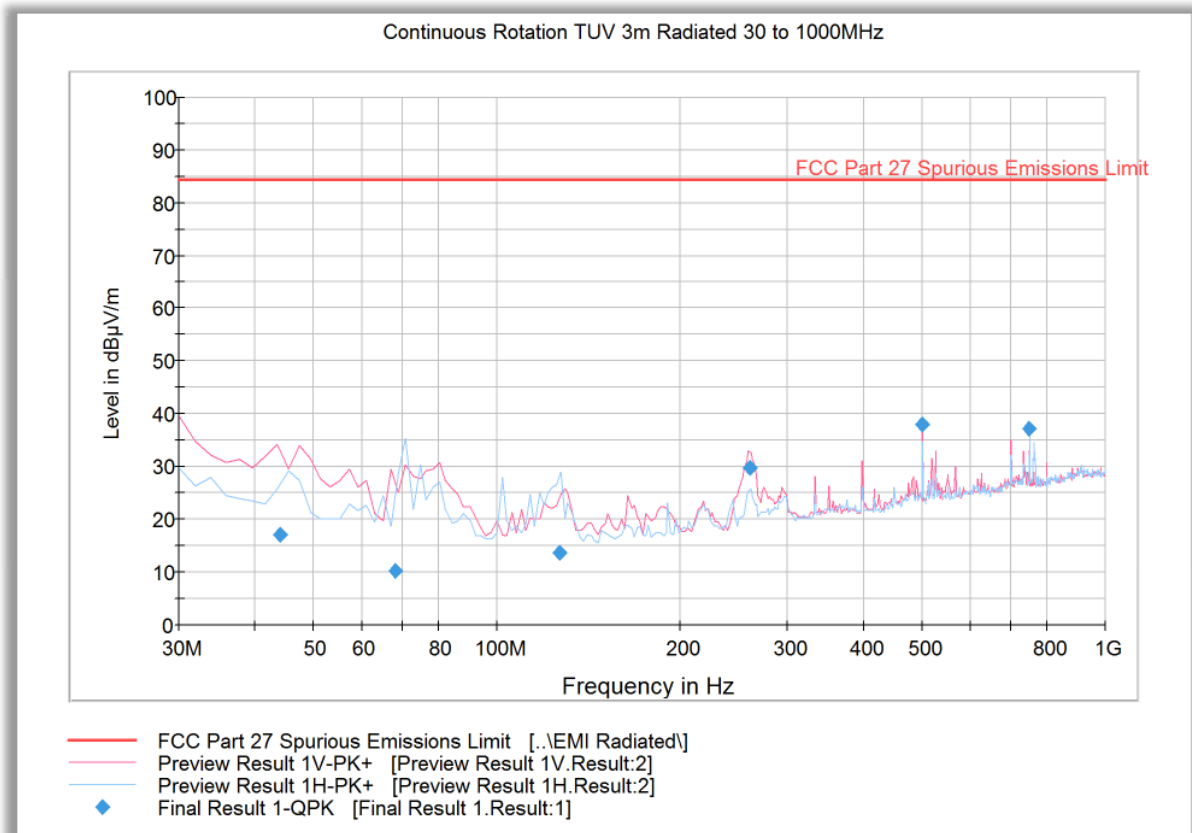
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1569.533333	53.2	1000.0	1000.000	209.4	H	199.0	-5.9	31.2	84.4
2463.566667	48.3	1000.0	1000.000	252.3	V	332.0	-0.6	36.1	84.4
2999.966667	46.5	1000.0	1000.000	127.7	H	-2.0	0.9	37.9	84.4
4393.566667	63.2	1000.0	1000.000	147.7	V	184.0	3.2	21.2	84.4
5050.933333	65.7	1000.0	1000.000	137.7	H	1.0	3.9	18.7	84.4
5309.166667	60.3	1000.0	1000.000	128.7	H	200.0	4.7	24.1	84.4
6916.566667	63.1	1000.0	1000.000	102.7	H	53.0	6.7	21.3	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)
1569.533333	45.2	1000.0	1000.000	209.4	H	199.0	-5.9	39.2	84.4
2463.566667	27.1	1000.0	1000.000	252.3	V	332.0	-0.6	57.3	84.4
2999.966667	36.2	1000.0	1000.000	127.7	H	-2.0	0.9	48.2	84.4
4393.566667	31.8	1000.0	1000.000	147.7	V	184.0	3.2	52.6	84.4
5050.933333	32.7	1000.0	1000.000	137.7	H	1.0	3.9	51.7	84.4
5309.166667	31.7	1000.0	1000.000	128.7	H	200.0	4.7	52.7	84.4
6916.566667	60.3	1000.0	1000.000	102.7	H	53.0	6.7	24.1	84.4

Test Note: 2.4 GHz Notch filter used when testing.

2.8.21 Radiated Emission Test Results Below 1GHz – Worst Case LTE Band 66_20 MHz Bandwidth_Low Channel 1720 MHz_1 RB 49 offset_QPSK

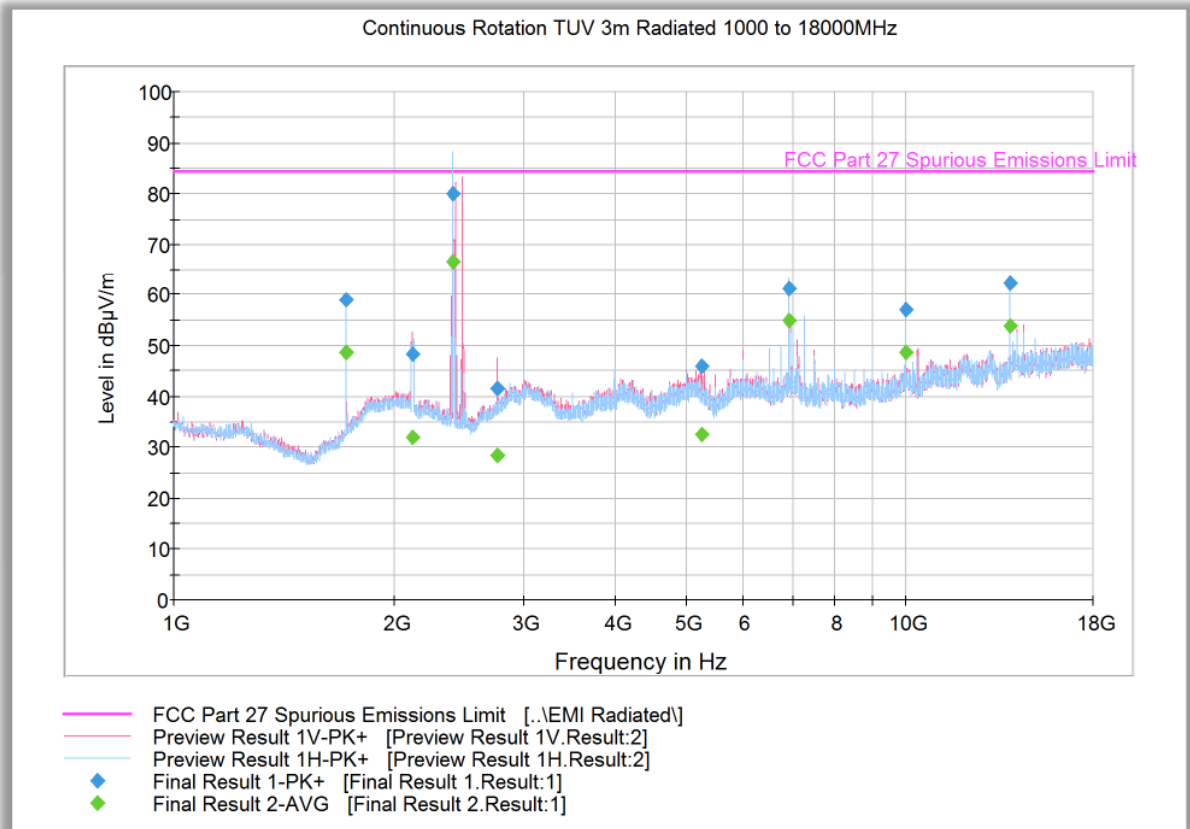


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
43.927214	17.0	1000.0	120.000	133.0	V	180.0	-13.1	67.4	84.4
68.221643	10.2	1000.0	120.000	371.0	H	52.0	-16.7	74.2	84.4
126.850501	13.6	1000.0	120.000	144.0	H	153.0	-14.3	70.8	84.4
260.378758	29.7	1000.0	120.000	100.0	V	173.0	-8.4	54.7	84.4
500.020842	37.8	1000.0	120.000	106.0	V	107.0	-2.0	46.6	84.4
750.022365	37.2	1000.0	120.000	209.0	V	183.0	2.9	47.2	84.4

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

2.8.22 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 66_20 MHz Bandwidth_Low Channel 1720 MHz_1 RB 49 offset_QPSK



Peak Data

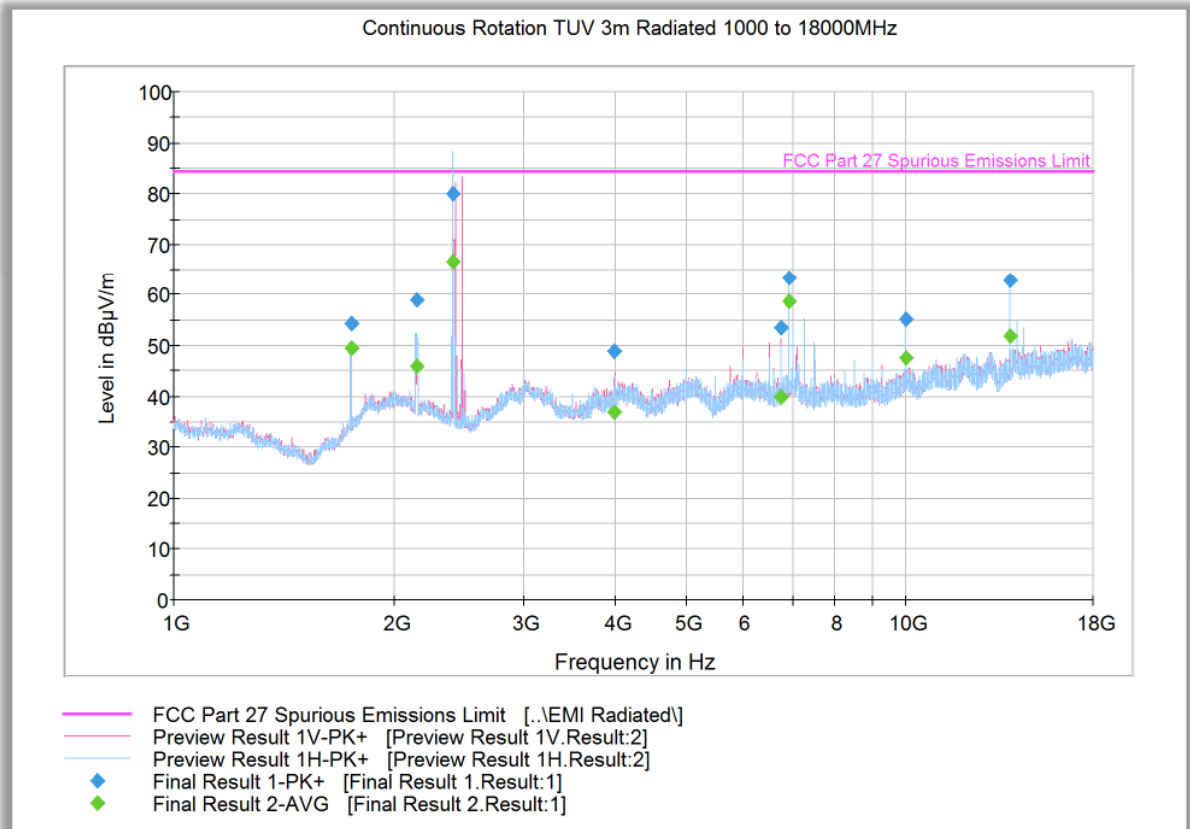
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1719.666667	59.2	1000.0	1000.000	131.7	V	300.0	-4.8	Fundamental frequency*	
2116.333333	48.4	1000.0	1000.000	275.3	V	293.0	-2.2	36.0	84.4
2403.300000	80.0	1000.0	1000.000	338.2	H	87.0	-1.1	WIFI 2.4 GHz signals*	
2765.866667	41.5	1000.0	1000.000	226.4	V	314.0	-0.1	42.9	84.4
5244.900000	45.8	1000.0	1000.000	333.2	V	44.0	4.4	38.6	84.4
6915.400000	61.3	1000.0	1000.000	252.4	H	220.0	6.7	23.1	84.4
10000.166667	57.2	1000.0	1000.000	205.5	H	48.0	9.6	27.2	84.4
13830.833333	62.4	1000.0	1000.000	311.2	H	29.0	14.1	22.0	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)
1719.666667	48.7	1000.0	1000.000	131.7	V	300.0	-4.8	Fundamental frequency*	
2116.333333	31.9	1000.0	1000.000	275.3	V	293.0	-2.2	52.5	84.4
2403.300000	66.7	1000.0	1000.000	338.2	H	87.0	-1.1	WIFI 2.4 GHz signals*	
2765.866667	28.4	1000.0	1000.000	226.4	V	314.0	-0.1	56.0	84.4
5244.900000	32.5	1000.0	1000.000	333.2	V	44.0	4.4	51.9	84.4
6915.400000	54.8	1000.0	1000.000	252.4	H	220.0	6.7	29.6	84.4
10000.166667	48.7	1000.0	1000.000	205.5	H	48.0	9.6	35.7	84.4
13830.833333	53.8	1000.0	1000.000	311.2	H	29.0	14.1	30.6	84.4

* The fundamental frequency and WIFI 2.4 GHz signals are not part of spurious emission evaluation. Data provided for information purpose only.

2.8.23 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 66_20 MHz Bandwidth_Middle Channel 1745 MHz_1 RB 49 offset_QPSK



Peak Data

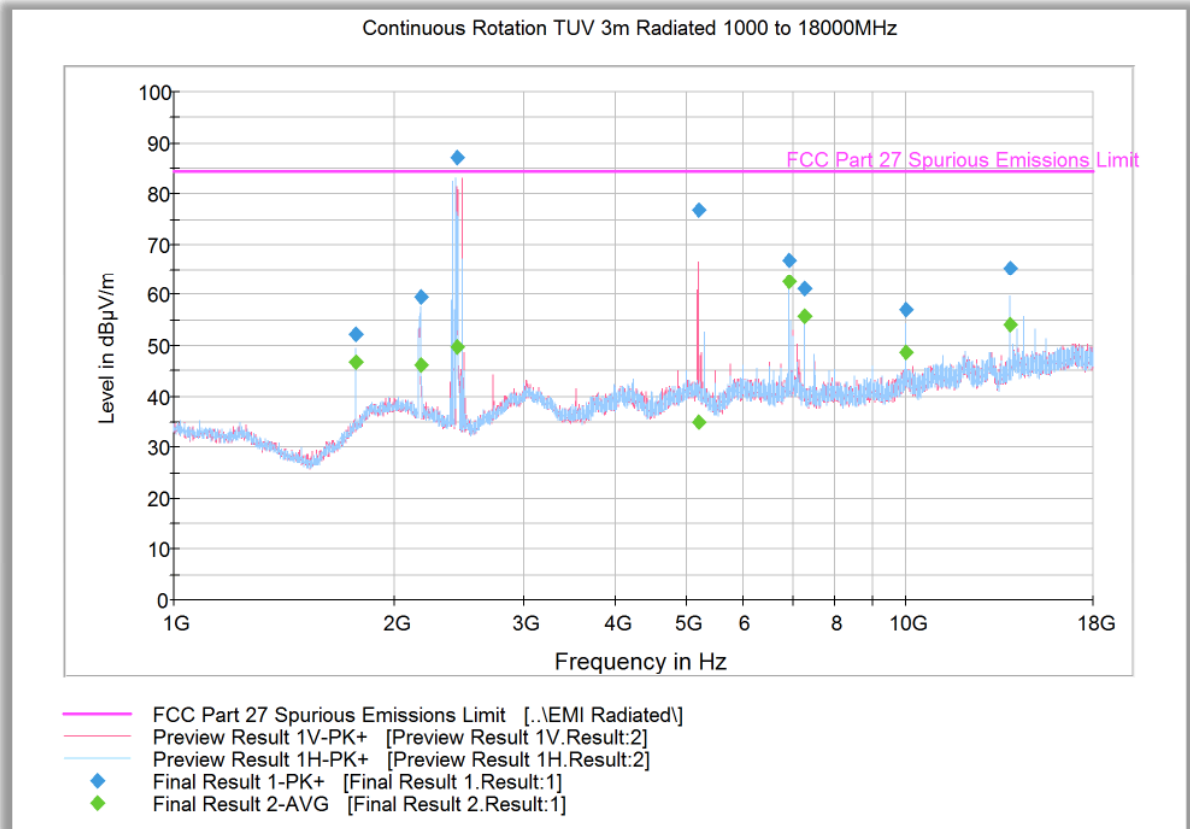
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1745.000000	54.2	1000.0	1000.000	119.8	H	-2.0	-4.4	Fundamental frequency*	
2145.633333	59.0	1000.0	1000.000	102.8	H	15.0	-2.2	25.4	84.4
3999.733333	48.9	1000.0	1000.000	147.7	V	131.0	2.5	35.5	84.4
2403.300000	80.2	1000.0	1000.000	338.2	H	86.0	-1.1	WIFI 2.4 GHz signals*	
6750.166667	53.6	1000.0	1000.000	194.5	V	191.0	6.4	30.8	84.4
6915.233333	63.5	1000.0	1000.000	333.1	H	221.0	6.7	20.9	84.4
10000.000000	55.3	1000.0	1000.000	152.6	V	118.0	9.6	29.1	84.4
13829.700000	62.9	1000.0	1000.000	312.2	H	29.0	14.1	21.5	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)
1745.000000	49.3	1000.0	1000.000	119.8	H	-2.0	-4.4	Fundamental frequency*	
2145.633333	46.0	1000.0	1000.000	102.8	H	15.0	-2.2	38.4	84.4
3999.733333	36.9	1000.0	1000.000	147.7	V	131.0	2.5	47.5	84.4
2403.300000	66.5	1000.0	1000.000	338.2	H	86.0	-1.1	WIFI 2.4 GHz signals*	
6750.166667	40.0	1000.0	1000.000	194.5	V	191.0	6.4	44.4	84.4
6915.233333	58.8	1000.0	1000.000	333.1	H	221.0	6.7	25.6	84.4
10000.000000	47.5	1000.0	1000.000	152.6	V	118.0	9.6	36.9	84.4
13829.700000	52.0	1000.0	1000.000	312.2	H	29.0	14.1	32.4	84.4

* The fundamental frequency and WIFI 2.4 GHz signals are not part of spurious emission evaluation. Data provided for information purpose only.

2.8.24 Radiated Emission Test Results Above 1GHz – Worst Case LTE Band 66_20 MHz Bandwidth_High Channel 1770 MHz_1 RB 49 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)
1769.900000	52.1	1000.0	1000.000	204.5	H	345.0	-3.9	Fundamental frequency*	
2178.300000	59.6	1000.0	1000.000	301.2	V	106.0	-1.8	24.8	84.4
2440.833333	87.3	1000.0	1000.000	139.7	V	10.0	-0.7	WIFI 2.4 GHz signals*	
5210.166667	76.6	1000.0	1000.000	161.6	V	-12.0	4.3	WIFI 5.2 GHz signals*	
6915.466667	66.9	1000.0	1000.000	207.5	V	253.0	6.7	17.5	84.4
7248.600000	61.3	1000.0	1000.000	151.6	H	14.0	7.0	23.1	84.4
10000.000000	57.1	1000.0	1000.000	207.5	H	48.0	9.6	27.3	84.4
13832.566667	65.2	1000.0	1000.000	178.6	H	20.0	14.1	19.2	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)
1769.900000	46.6	1000.0	1000.000	204.5	H	345.0	-3.9	Fundamental frequency*	
2178.300000	46.2	1000.0	1000.000	301.2	V	106.0	-1.8	38.2	84.4
2440.833333	49.8	1000.0	1000.000	139.7	V	10.0	-0.7	WIFI 2.4 GHz signals*	
5210.166667	35.0	1000.0	1000.000	161.6	V	-12.0	4.3	WIFI 5.2 GHz signals*	
6915.466667	62.6	1000.0	1000.000	207.5	V	253.0	6.7	21.8	84.4
7248.600000	55.7	1000.0	1000.000	151.6	H	14.0	7.0	28.7	84.4
10000.000000	48.5	1000.0	1000.000	207.5	H	48.0	9.6	35.9	84.4
13832.566667	54.0	1000.0	1000.000	178.6	H	20.0	14.1	30.4	84.4

* The fundamental frequency and WIFI signals are not part of spurious emission evaluation. Data provided for information purpose only.



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-130, Clause 4.5

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-130, Clause 4.5:

For equipment that is capable of transmitting numerous channels simultaneously for different applications (e.g. LTE and narrowband – internet of things (IoT)), the occupied bandwidth shall be the bandwidth representing the sum of the occupied bandwidths of these channels.

The frequency stability shall be sufficient to ensure that the occupied bandwidth remains within each frequency block range when tested at the temperature and supply voltage variations specified in RSS-Gen.

2.9.3 Equipment Under Test and Modification State

Serial No: FF161218B00106, FF130219B00600 and FF130219B00624 / Test Configuration A

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

March 17 and 18, April 24, 2019 / XYZ

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	22.4 - 23.2 °C
Relative Humidity	29.0 - 39.0 %
ATM Pressure	99.0 - 99.1 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°C to +50°C 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°C.

2.9.8 Test Results

WCDMA Band 4 – QPSK 5 MHz BW-Middle Channel 1732.6 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)*
3.8	-30	16.24	0.0094	± 0.1
	-20	-12.73	-0.0074	± 0.1
	-10	14.12	0.0082	± 0.1
	0	-13.58	-0.0078	± 0.1
	+10	14.84	0.0086	± 0.1
	+20	22.19	0.0128	± 0.1
	+30	17.62	0.0102	± 0.1
	+40	14.81	0.0085	± 0.1
	+50	-15.73	0.0091	± 0.1
3.3	20	-15.48	-0.0089	± 0.1
4.2		-18.36	-0.0106	± 0.1

* Limit for WCDM Band 4 is according to 3GPP TS 25 101 V11.14.0

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.

LTE Band 4 – QPSK 5 MHz BW-Middle Channel 1732.5 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)*
3.8	-30	-12.76	-0.0074	± 0.1
	-20	-14.03	-0.0081	± 0.1
	-10	-14.55	-0.0084	± 0.1
	0	-14.95	-0.0086	± 0.1
	+10	-13.76	-0.0079	± 0.1
	+20	-15.03	-0.0087	± 0.1
	+30	-14.73	-0.0085	± 0.1
	+40	-14.08	-0.0081	± 0.1
	+50	12.67	0.0073	± 0.1
3.3	20	12.56	0.0073	± 0.1
4.2		-14.03	-0.0081	± 0.1

* Limit for LTE Band 4 is according to 3GPP TS 36 101 V11.25.0

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.

LTE Band 13 – QPSK 5 MHz BW-Middle Channel 782 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)*
3.8	-30	-10.24	-0.0131	± 0.1
	-20	8.75	0.0112	± 0.1
	-10	10.17	0.0130	± 0.1
	0	-7.35	-0.0094	± 0.1
	+10	7.78	0.0099	± 0.1
	+20	-7.47	-0.0095	± 0.1
	+30	-9.80	-0.0125	± 0.1
	+40	-8.30	-0.0106	± 0.1
	+50	-8.37	-0.0107	± 0.1
3.3	20	7.97	0.0102	± 0.1
4.2		7.42	0.0095	± 0.1

* Limit for LTE Band 13 is according to 3GPP TS 36 101 V11.25.0

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
3.8	-30	777.2485	777.2485	786.7292	786.7292	Yes
	+20	777.2550	777.2550	786.7247	786.7247	Yes
	+50	777.2543	777.2543	786.7324	786.7324	Yes
3.3	20	777.2502	777.2502	786.7206	786.7206	Yes
4.2		777.2494	777.2494	786.7294	786.7294	Yes

** F_L and F_H were confirmed by T1 of Low Channel Occupied Bandwidth and T2 of High Channel Occupied Bandwidth.

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.

LTE Band 66 – QPSK 5 MHz BW-Middle Channel 1745 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)*
3.8	-30	14.15	0.0081	± 0.1
	-20	-13.79	-0.0079	± 0.1
	-10	-13.33	-0.0076	± 0.1
	0	-13.80	-0.0079	± 0.1
	+10	15.38	0.0088	± 0.1
	+20	-12.97	-0.0074	± 0.1
	+30	-14.08	-0.0081	± 0.1
	+40	-14.31	-0.0082	± 0.1
	+50	-12.69	-0.0073	± 0.1
3.3	20	-14.69	-0.0084	± 0.1
4.2		-13.12	-0.0075	± 0.1

* Limit for LTE Band 13 is according to 3GPP TS 36 101 V11.25.0

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.

CMW 500 V 3.7.22 - LTE Measurement - V3.7.30 - TX Measurement

Multi Evaluation

PRACH

SRS

FDD Freq.: 782.0 MHz Ref. Level: 41.90 dBm BW: 5.0 MHz CP: Normal Meas Subfr./Slot: 0 / All

TX Measurement

Detected Allocation	NoRB:	25OffsetRB:		0					
		Current	Average	Extreme	StdDev				
EVM RMS [%] I/h		3.20	3.40	3.27	3.49	3.37	3.60	0.06	0.07
EVM Peak [%] I/h		14.30	25.22	18.41	31.26	23.83	38.31	4.20	5.77
EVM DMRS [%] I/h		2.66	2.93	2.69	2.87	2.81	3.10	0.03	0.11
MErr RMS [%] I/h		2.50	2.68	2.59	2.80	2.70	2.92	0.08	0.10
MErr Peak [%] I/h		-13.57	-24.22	17.66	29.91	-23.07	-36.76	4.37	5.45
MErr DMRS [%] I/h		2.10	2.30	2.14	2.28	2.25	2.42	0.04	0.05
PhErr RMS [%] I/h		1.15	1.21	1.15	1.21	1.18	1.24	0.01	0.01
PhErr Peak [%] I/h		4.92	-9.22	4.25	10.41	5.20	-12.53	0.32	0.74
PhErr DMRS [%] I/h		0.94	1.04	0.93	1.00	1.03	1.15	0.02	0.06
IQ Offset [dBc]		-31.95	-32.10	-31.61	0.22				
IQ Gain Imbalance [dB]		0.01	0.01	0.02	0.00				
IQ Quadrature Error [°]		-0.20	-0.13	-0.24	0.06				
Freq Error [Hz]		-1.85	-1.86	-7.47	2.42				
Timing Error [Ts]		7.38	7.31	10.55	0.25				
OBW [MHz]		4.43	4.42	4.43	0.01				
		Current	Average	Min	Max	StdDev			
TX Power [dBm]		23.02	23.07	22.99	23.24	0.05			
Peak Power [dBm]		28.19	28.76	27.63	29.12	0.20			

Statistic Count

Out of Tolerance

Detected Modulation

Detected Channel Type

View Filter Throughput

20 / 20

0.00 %

QPSK

PUSCH

100.0 %

PS: Connection Established RRC State: Connected

Select View ...

LTE Band 13_5 MHz Bandwidth_Middle Channel @20°C

CMW 500 V 3.7.22 - LTE Measurement - V3.7.30 - TX Measurement

Multi Evaluation

PRACH

SRS

FDD Freq.: 1745.0 MHz Ref. Level: 27.00 dBm BW: 5.0 MHz CP: Normal Meas Subfr./Slot: 0 / All

TX Measurement

Detected Allocation

NoRB:

25OffsetRB:

0

Current

Average

Extreme

StdDev

EVM RMS [%] I/h

2.97

3.14

2.81

3.05

3.21

3.37

0.16

0.10

EVM Peak [%] I/h

17.04

30.13

18.15

29.01

24.00

35.78

0.66

1.05

EVM DMRS [%] I/h

2.23

2.25

2.12

2.26

2.52

2.55

0.05

0.11

MErr RMS [%] I/h

1.97

2.21

1.91

2.21

2.35

2.54

0.14

0.08

MErr Peak [%] I/h

-17.01

-30.01

17.65

28.75

-21.84

-35.10

0.37

1.17

MErr DMRS [%] I/h

1.54

1.56

1.50

1.58

1.81

1.82

0.04

0.07

PhErr RMS [%] I/h

1.27

1.29

1.18

1.22

1.28

1.30

0.06

0.04

PhErr Peak [%] I/h

-4.79

-6.87

4.51

8.33

6.76

-11.23

0.28

1.45

PhErr DMRS [%] I/h

0.93

0.93

0.86

0.92

1.15

1.16

0.03

0.05

IQ Offset [dBc]

-61.08

-60.60

-54.59

2.24

IQ Gain Imbalance [dB]

0.02

0.03

0.05

0.01

IQ Quadrature Error [°]

0.44

0.39

0.51

0.04

Freq Error [Hz]

-4.53

-6.27

-12.97

2.20

Timing Error [Ts]

3.40

3.44

6.32

0.15

OBW [MHz]

4.44

4.43

4.44

0.01

Current

Average

Min

Max

StdDev

TX Power [dBm]

20.17

20.20

19.95

20.45

0.04

Peak Power [dBm]

25.34

25.33

25.01

26.30

0.07

Statistic Count

Out of Tolerance

Detected Modulation

Detected Channel Type

View Filter Throughput

20 / 20

0.00 %

QPSK

PUSCH

100.0 %

PS:

Connection Established

RRC State

Connected

LTE

Multi Evaluation

RUN

RF Settings

Trigger

Display

Signaling Parameter

LTE Signaling

Run

Repetition ...

Stop Condition ...

Statistic Count ...

Channel Bandwidth ...

Measurement Subframes ...

Assign Views

Config ...

LTE Band 66_5 MHz Bandwidth_Middle Channel @20°C

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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	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: FF161218B00106/Test Configuration B

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

April 26, 2019/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	23.1 °C
Relative Humidity	53.6 %
ATM Pressure	99.1 kPa

2.10.7 Additional Observations

Measurement was done using EMC32 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 2.10.8 for sample computation.

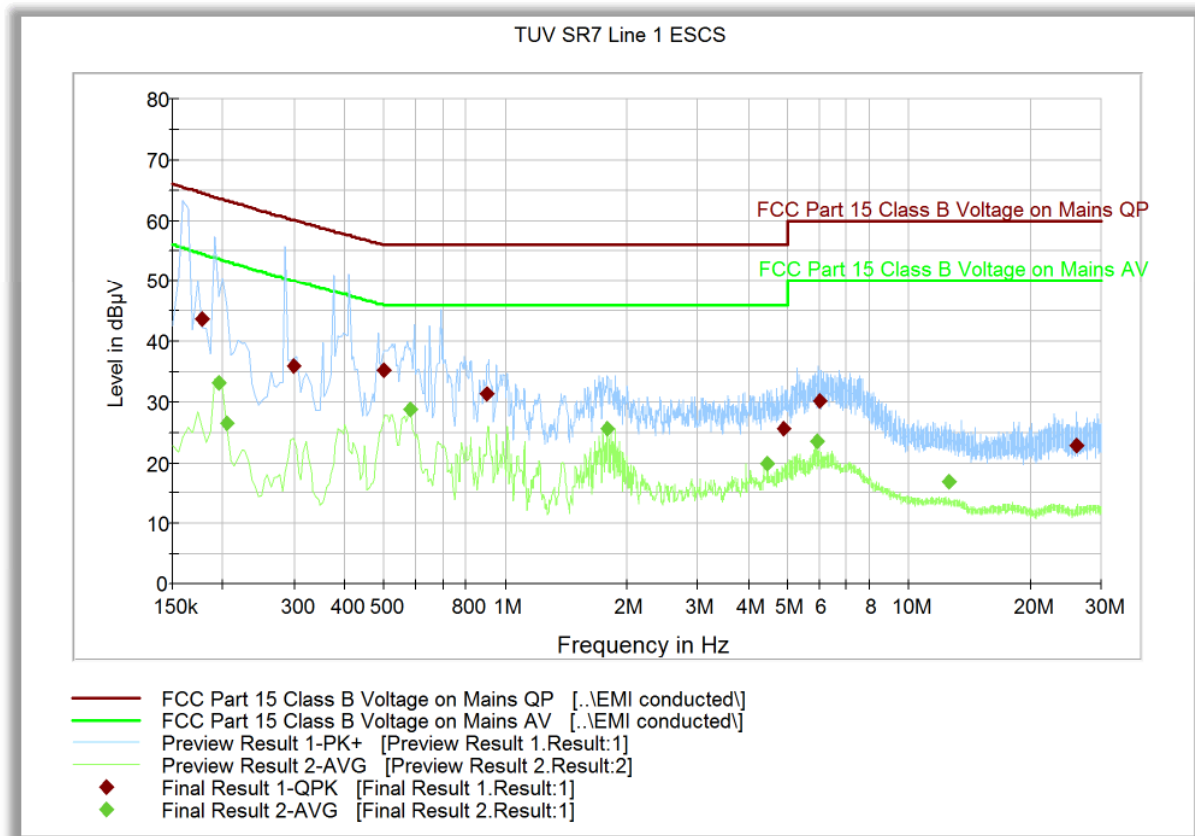
2.10.8 Sample Computation (Conducted Emission – Quasi Peak)

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

2.10.9 Test Results

Compliant. See attached plots and tables.

2.10.10 M1000 120VAC 60Hz (Line 1)



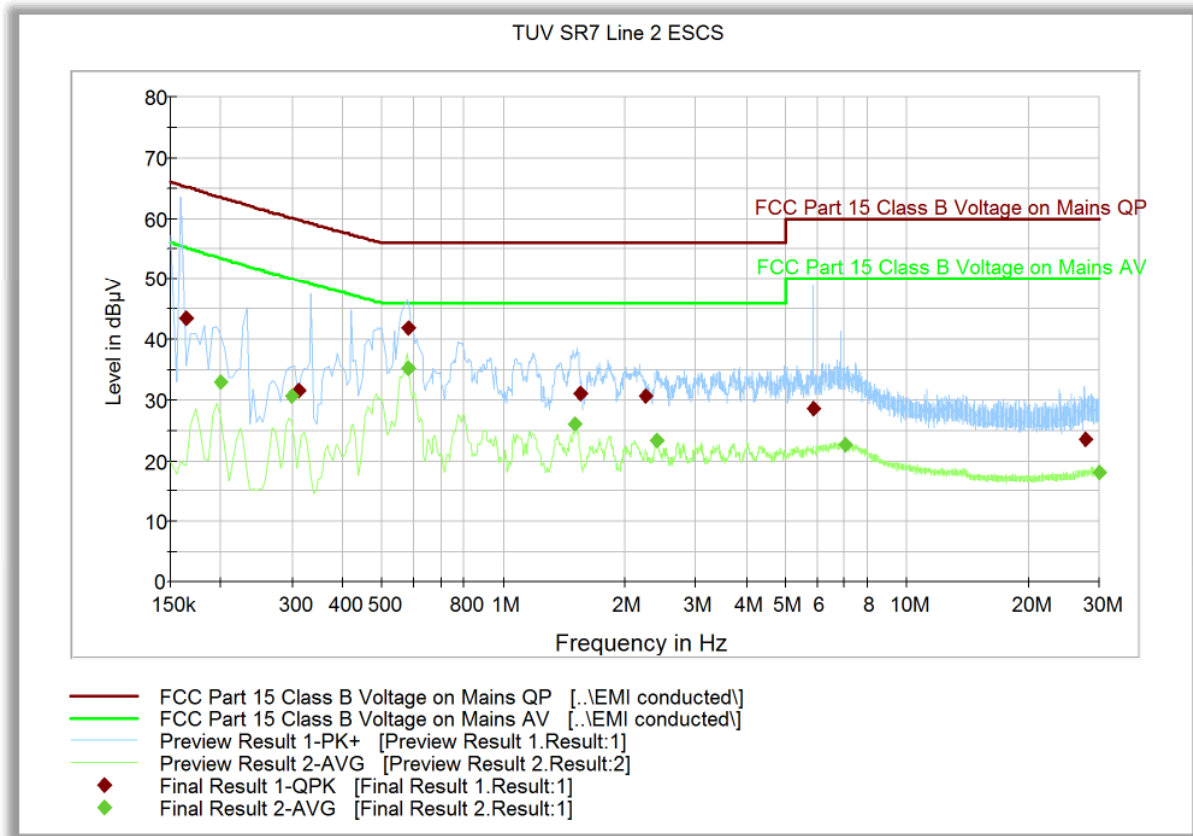
Quasi Peak

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)
0.177000	43.6	1000.0	9.000	Off	L1	20.2	20.9	64.5
0.298500	35.8	1000.0	9.000	Off	L1	20.2	24.3	60.1
0.501000	35.2	1000.0	9.000	Off	L1	20.1	20.8	56.0
0.901500	31.4	1000.0	9.000	Off	L1	20.2	24.6	56.0
4.902000	25.5	1000.0	9.000	Off	L1	20.5	30.5	56.0
5.991000	30.1	1000.0	9.000	Off	L1	20.4	29.9	60.0
25.953000	23.0	1000.0	9.000	Off	N	20.7	37.0	60.0

Average

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBμV)
0.195000	33.1	1000.0	9.000	Off	L1	20.2	20.5	53.7
0.204000	26.4	1000.0	9.000	Off	L1	20.2	26.8	53.3
0.582000	28.8	1000.0	9.000	Off	L1	20.2	17.2	46.0
1.783500	25.5	1000.0	9.000	Off	L1	20.1	20.5	46.0
4.465500	19.8	1000.0	9.000	Off	L1	20.4	26.2	46.0
5.914500	23.5	1000.0	9.000	Off	L1	20.4	26.5	50.0
12.529500	16.9	1000.0	9.000	Off	N	20.7	33.1	60.0

2.10.11 M1000 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)
0.163500	43.4	1000.0	9.000	Off	N	20.1	21.9	65.2
0.312000	31.6	1000.0	9.000	Off	N	20.1	28.1	59.7
0.582000	41.8	1000.0	9.000	Off	N	20.1	14.2	56.0
1.554000	31.2	1000.0	9.000	Off	N	20.1	24.8	56.0
2.251500	30.6	1000.0	9.000	Off	N	20.4	25.4	56.0
5.887500	28.6	1000.0	9.000	Off	N	20.4	31.4	60.0
27.672000	23.6	1000.0	9.000	Off	N	20.7	36.4	60.0

Average

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBμV)
0.163500	43.4	1000.0	9.000	Off	N	20.1	21.9	65.2
0.312000	31.6	1000.0	9.000	Off	N	20.1	28.1	59.7
0.582000	41.8	1000.0	9.000	Off	N	20.1	14.2	56.0
1.554000	31.2	1000.0	9.000	Off	N	20.1	24.8	56.0
2.251500	30.6	1000.0	9.000	Off	N	20.4	25.4	56.0
5.887500	28.6	1000.0	9.000	Off	N	20.4	31.4	60.0
27.672000	23.6	1000.0	9.000	Off	N	20.7	36.4	60.0



SECTION 3

TEST EQUIPMENT USED

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	01/07/19	01/07/20
-	Wideband Radio Communication Tester	CMW 500	158164	Rhode & Schwarz	11/16/18	11/16/19
-	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	09/19/18	09/19/19
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	01/07/19	01/07/20
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
-	Wideband Radio Communication Tester	CMW 500	158164	Rhode & Schwarz	11/16/18	11/16/19
Radiated Test Setup						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/07/19	01/07/20
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/20/17	11/20/19
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/16/18	06/16/20
1016	Pre-amplifier	PAM-0202	187	A.H. Systems, Inc.	03/08/19	03/08/20
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	10/15/18	10/15/19
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	07/13/18	07/13/19
8628	Pre-amplifier	QLI-01182835-JO	8986002	Quinstar	03/07/19	03/07/20
-	Wideband Radio Communication Tester	CMW 500	158164	Rhode & Schwarz	11/16/18	11/16/19



Miscellaneous						
6708	Multimeter	34401A	US36086974	Hewlett Packard	07/18/18	07/18/19
7579	Temperature Chamber	115	151617	TestQuity	08/24/18	08/24/19
7554	Barometer/Temperature /Humidity Transmitter	iBTHX-W	0400706	Omega	05/25/18	05/25/19
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 Conducted Antenna Port Measurement

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Cable attenuation	1.00 dB	Normal, k=2	2.000	0.50	0.25
3	Receiver sinewave accuracy	0.08 dB	Normal, k=2	2.000	0.04	0.00
4	Receiver pulse amplitude	0.00 dB	Rectangular	1.732	0.00	0.00
5	Receiver pulse repetition rate	0.00 dB	Rectangular	1.732	0.00	0.00
6	Noise floor proximity	0.00 dB	Rectangular	1.732	0.00	0.00
7	Frequency interpolation	0.10 dB	Rectangular	1.732	0.06	0.00
8	Mismatch	0.07 dB	U-shaped	1.414	0.05	0.00
Combined standard uncertainty			Normal		0.52 dB	
Expanded uncertainty			Normal, k=2		1.03 dB	

3.2.2 Radiated Emission Measurements (Below 1GHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.75 dB	Normal, k=2	2.000	0.38	0.14
4	Receiver sinewave accuracy	0.45 dB	Normal, k=2	2.000	0.23	0.05
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12 dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00 dB	Rectangular	1.732	0.58	0.33
13	Cross-polarisation	0.90 dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.76 dB	Triangular	2.449	1.54	2.36
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.77 dB	Rectangular	1.732	0.44	0.20
18	Table height at 3 m	0.10 dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00 dB				0.00
Combined standard uncertainty			Normal		2.95 dB	
Expanded uncertainty			Normal, k=2		5.90 dB	

3.2.3 Radiated Emission Measurements (Above 1GHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.75 dB	Normal, k=2	2.000	0.38	0.14
4	Receiver sinewave accuracy	0.45 dB	Normal, k=2	2.000	0.23	0.05
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12 dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00 dB	Rectangular	1.732	0.58	0.33
13	Cross-polarisation	0.90 dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.25 dB	Triangular	2.449	1.33	1.76
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.77 dB	Rectangular	1.732	0.44	0.20
18	Table height at 3 m	0.10 dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00 dB				0.00
	Combined standard uncertainty			Normal	2.85 dB	
	Expanded uncertainty			Normal, k=2	5.70 dB	

3.2.4 Conducted Measurements

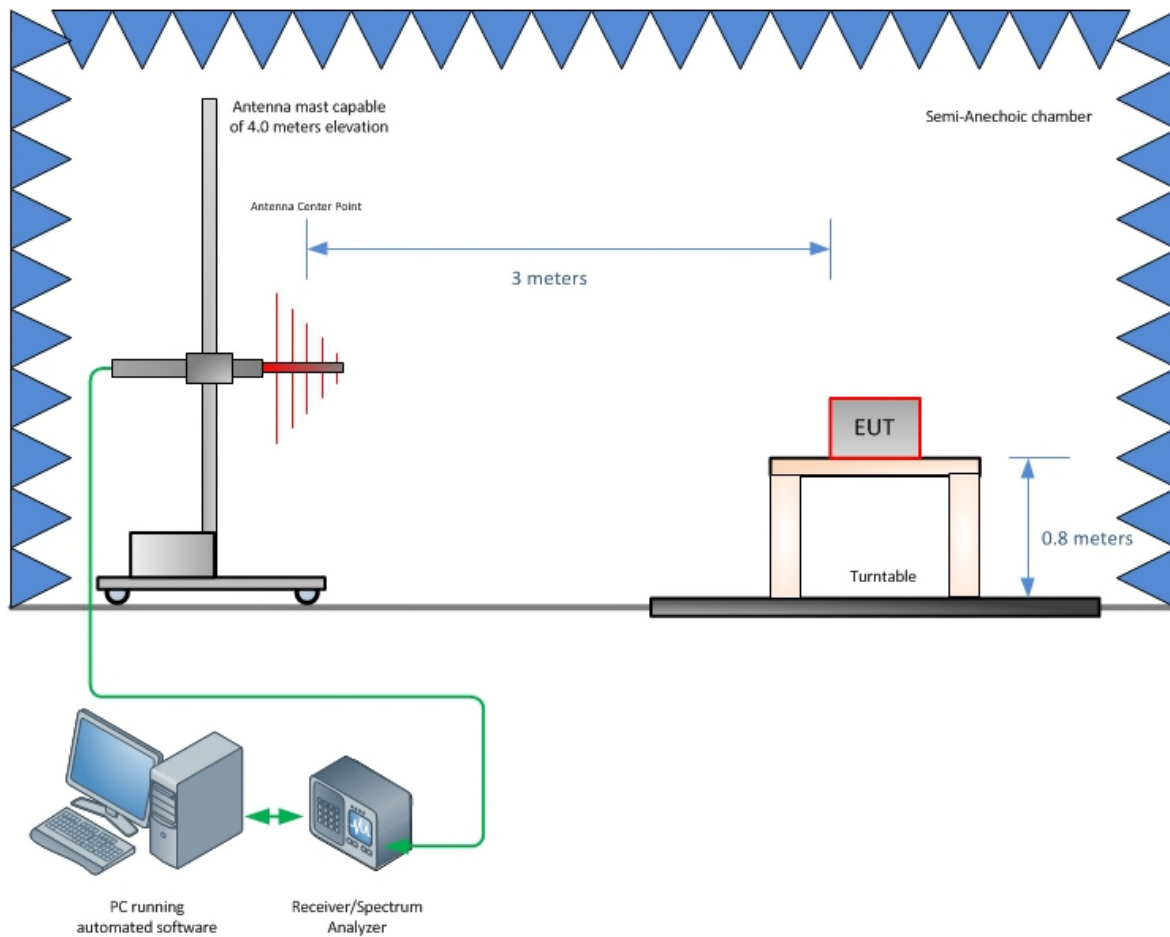
	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	LISN-receiver attenuation	0.10 dB	Normal, k=2	2.000	0.05	0.00
3	LISN voltage division factor	0.30 dB	Normal, k=2	2.000	0.15	0.02
4	Receiver sinewave accuracy	0.36 dB	Normal, k=2	2.000	0.18	0.03
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.00 dB	Rectangular	1.732	0.00	0.00
8	AMN VDF frequency interpolation	0.10 dB	Rectangular	1.732	0.06	0.00
9	Mismatch	0.07 dB	U-shaped	1.414	0.05	0.00
10	LISN impedance	2.65 dB	Triangular	2.449	1.08	1.17
11	Effect of mains disturbance	0.00 dB			0.00	0.00
12	Effect of the environment					
Combined standard uncertainty				Normal	1.66 dB	
Expanded uncertainty				Normal, k=2	3.31 dB	



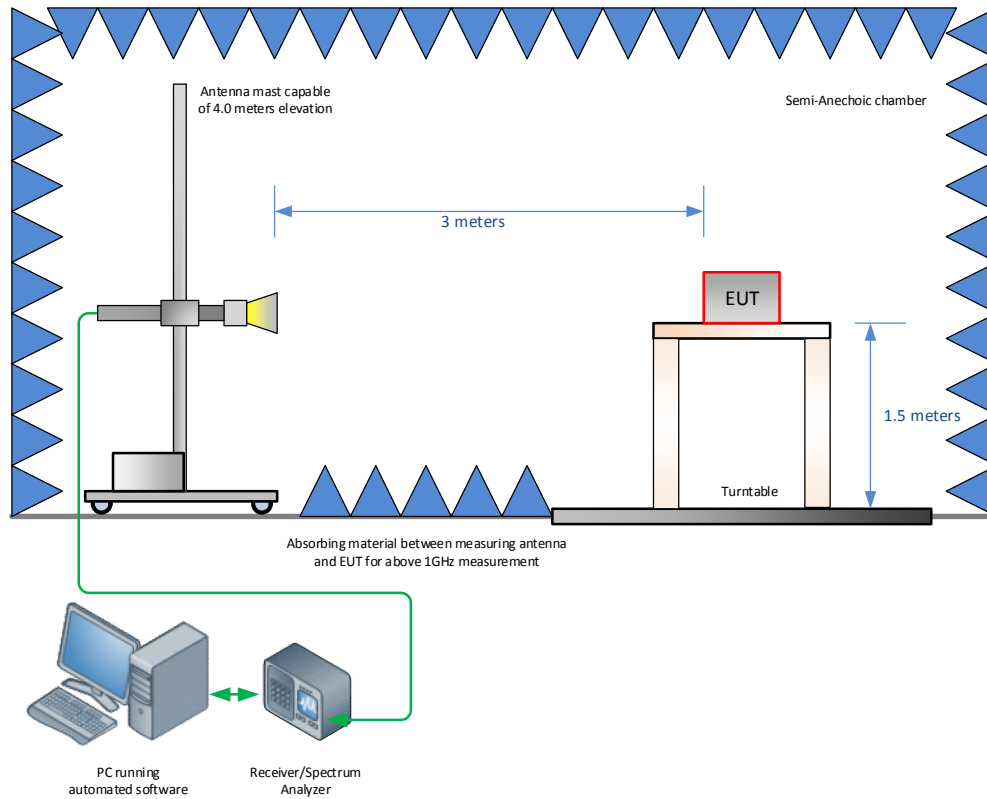
SECTION 4

DIAGRAM OF TEST SETUP

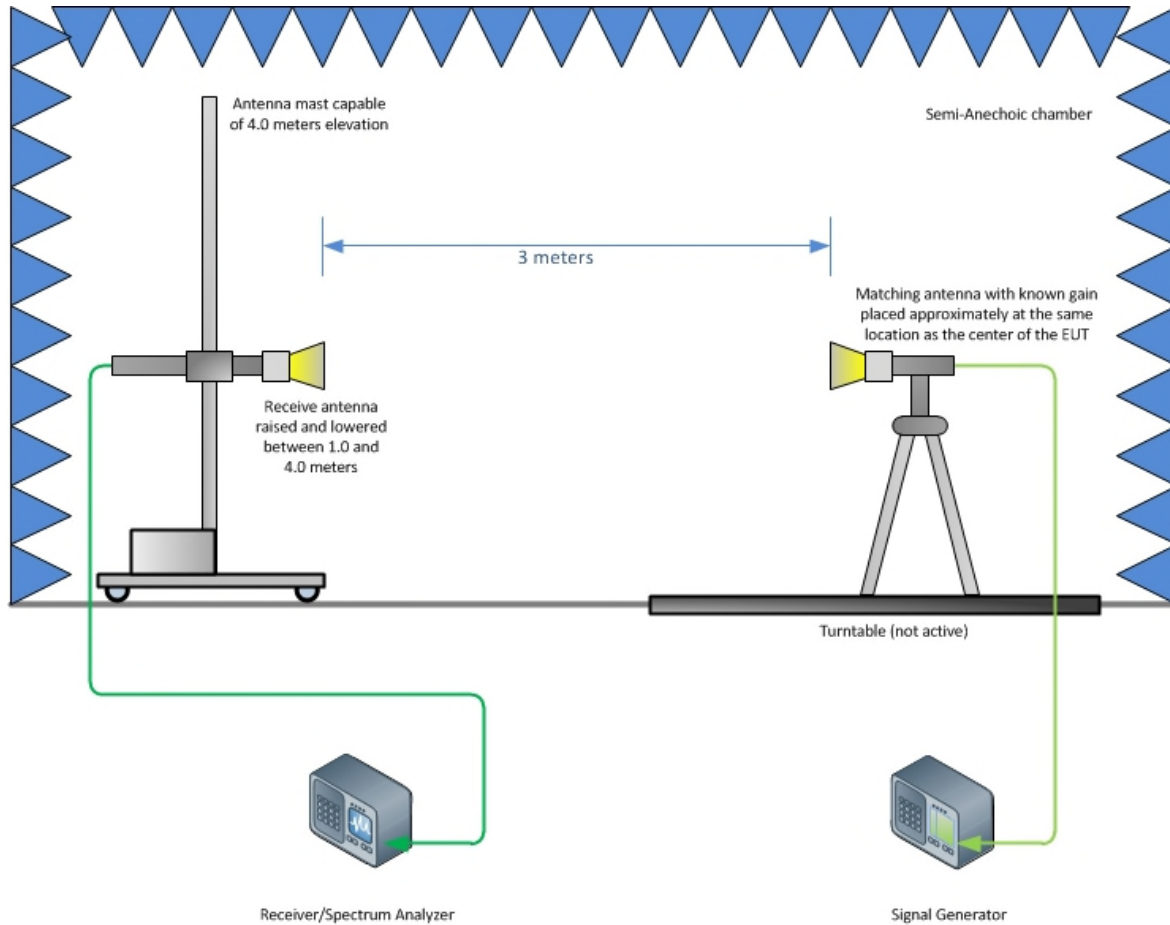
4.1 TEST SETUP DIAGRAM



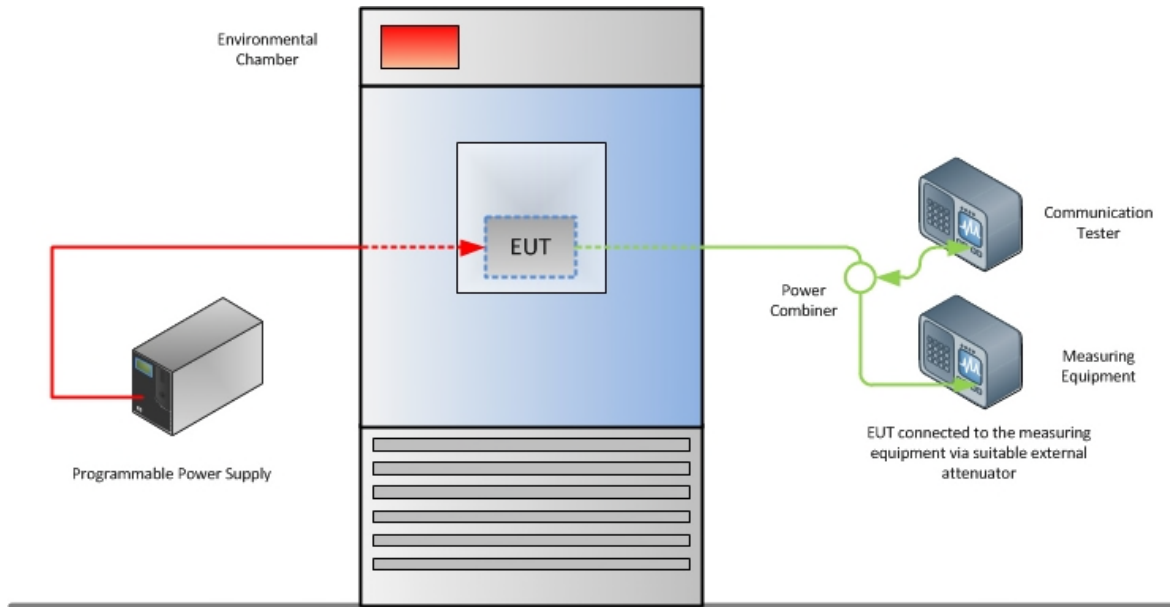
Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz)



Frequency Stability Test Configuration



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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