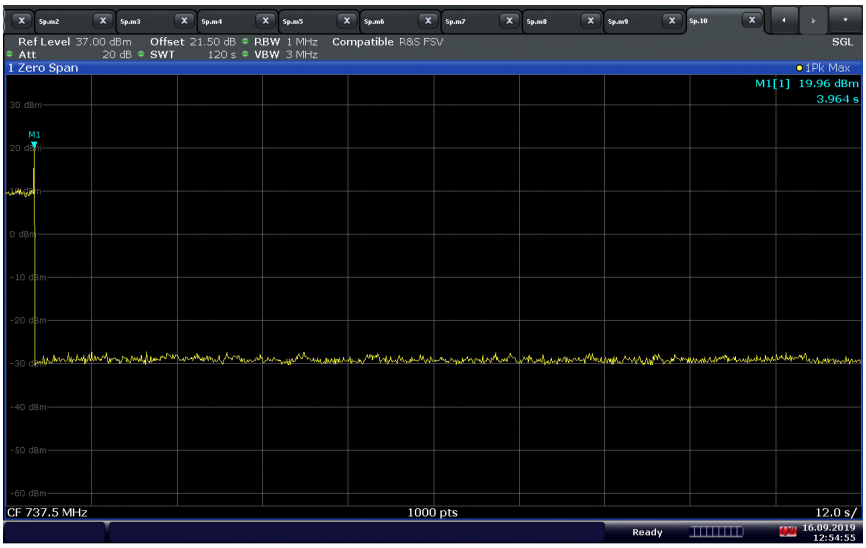
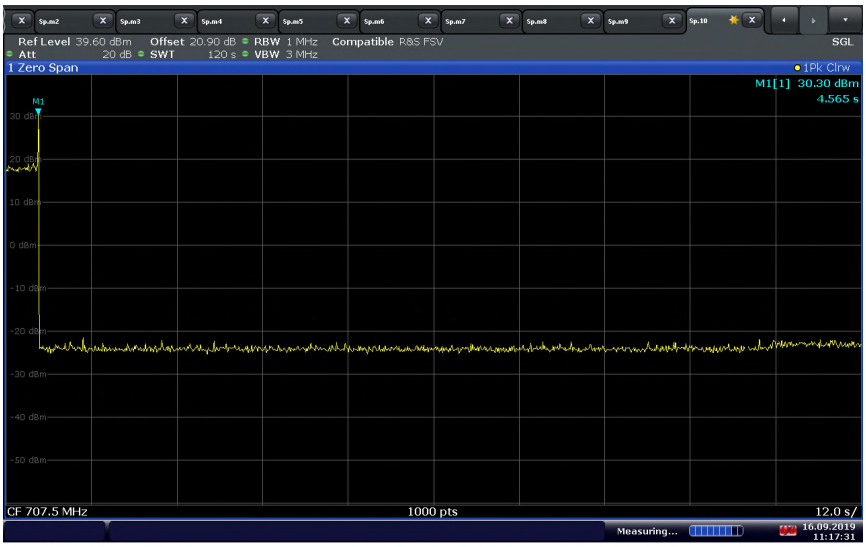
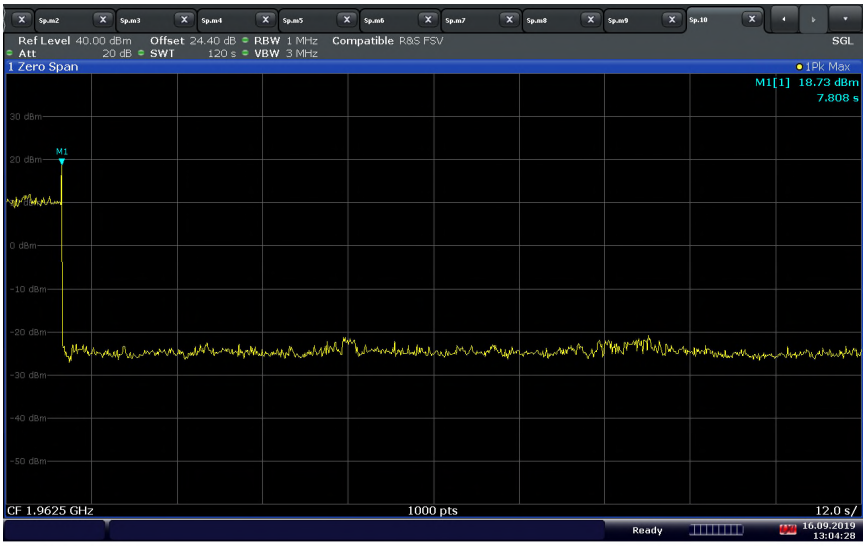
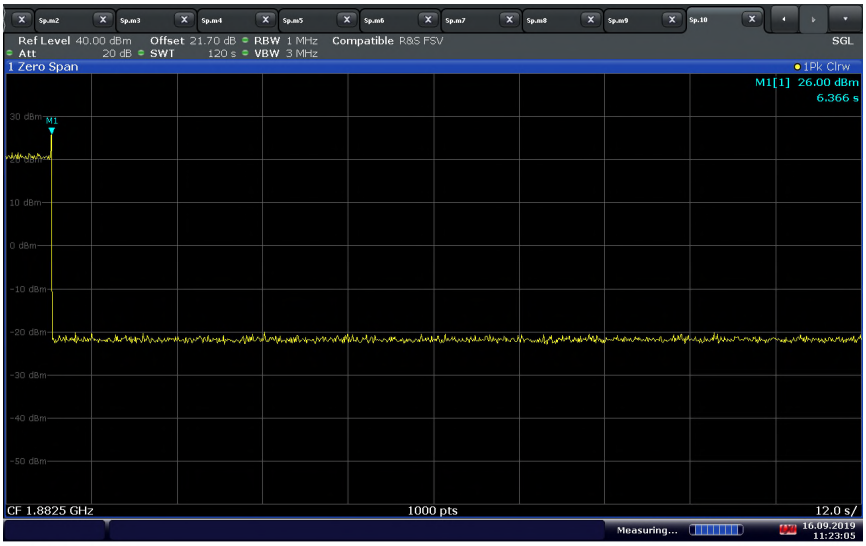
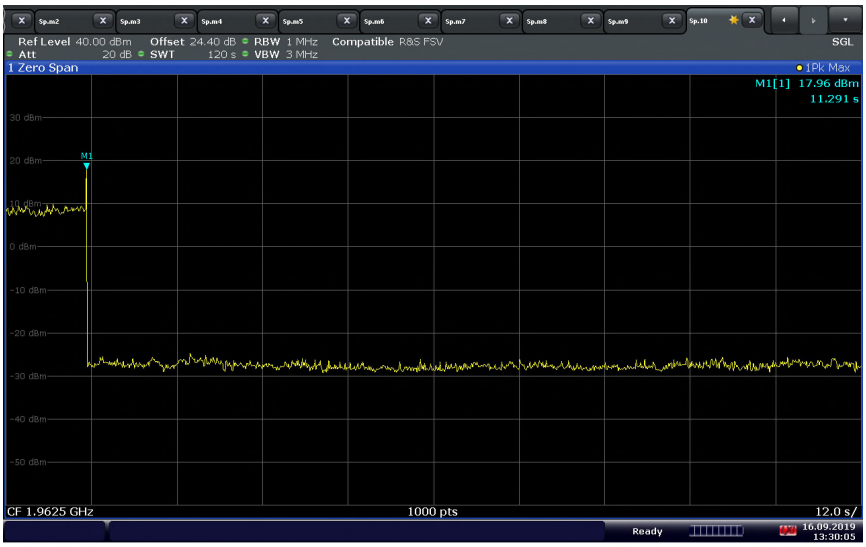
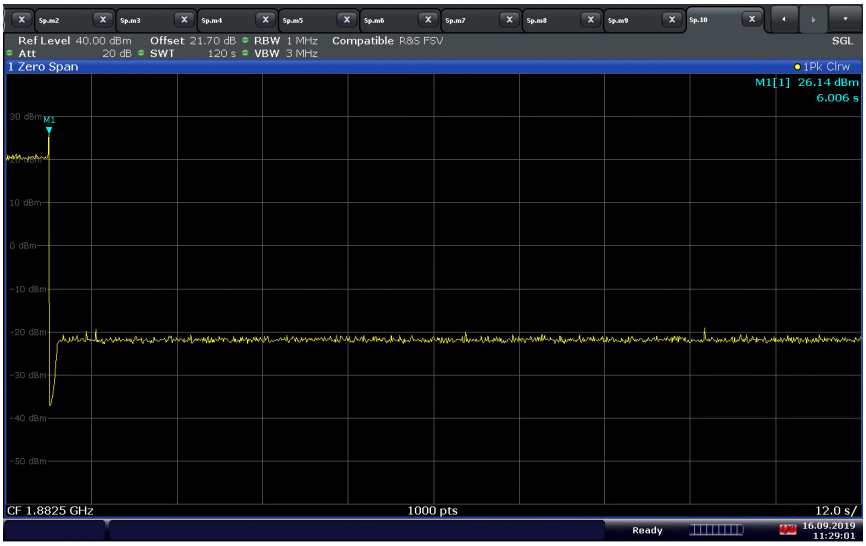
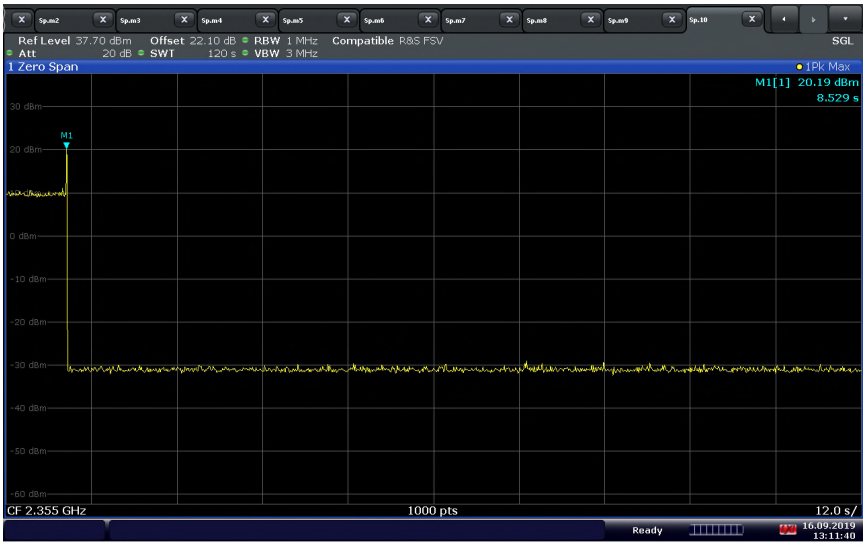
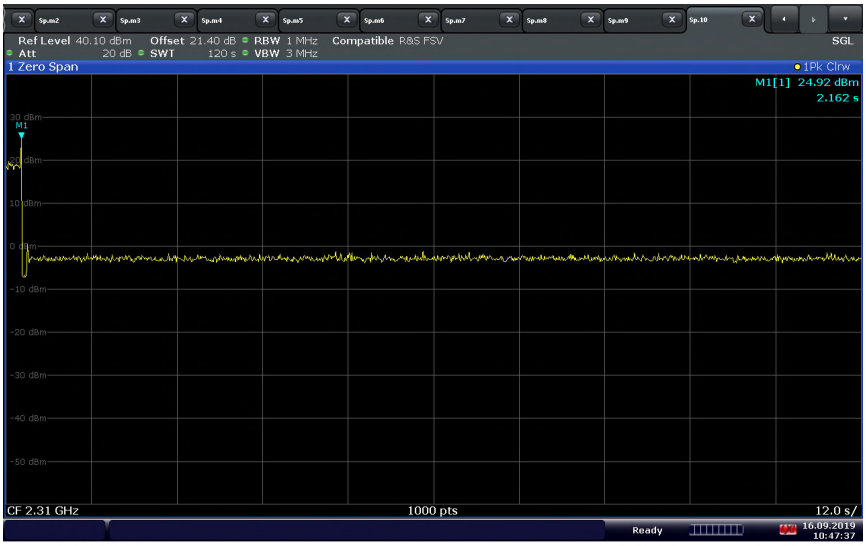
Retry Event - LTE Band 12 Downlink 5MHz Bandwidth Mid Channel - CU with NU Port A
 12:54:56 16.09.2019
Retry Event - LTE Band 12 Uplink 5MHz Bandwidth Mid Channel - NU Port A
 11:17:31 16.09.2019

Retry Event - LTE Band 25 Downlink 5MHz Bandwidth Mid Channel - CU with NU Port A
   13:04:29 16.09.2019
Retry Event - LTE Band 25 Uplink 5MHz Bandwidth Mid Channel - NU Port A
   11:23:06 16.09.2019

Retry Event - LTE Band 25 Downlink 5MHz Bandwidth Mid Channel - CU with NU Port C
 13:30:05 16.09.2019

Retry Event - LTE Band 25 Uplink 5MHz Bandwidth Mid Channel - NU Port C
 11:29:02 16.09.2019

Retry Event - LTE Band 30 Downlink 5MHz Bandwidth Mid Channel - CU with NU Port A
 13:11:41 16.09.2019

Retry Event - LTE Band 30 Uplink 5MHz Bandwidth Mid Channel - NU Port A
 10:47:37 16.09.2019

2.12 Field Strength of Spurious Radiation

2.12.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053
FCC 47 CFR Part 22, Clause 22.917(a)
FCC 47 CFR Part 24, Clause 24.238(a)
KDB 484596 D01

2.12.2 Standard Applicable

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

FCC 47 CFR Part 27, Clause 27.53:
(h) 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.

(g) For operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth
of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

(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:
(1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(a) For operations in the 2305–2320 MHz band and the 2345–2360 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power P (with averaging performed only during periods of transmission) within the licensed band(s) of operation, in watts, by the following amounts:
(1) For base and fixed stations' operations in the 2305–2320 MHz band and the 2345–2360 MHz band:
(i) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, and not less than 75 + 10 log (P) dB on all frequencies between 2320 and 2345 MHz;
(ii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2300 and 2305 MHz, 70 + 10 log (P) dB on all frequencies between 2287.5 and 2300 MHz, 72 + 10 log (P) dB on all frequencies between 2285 and 2287.5 MHz, and 75 + 10 log (P) dB below 2285 MHz;

(iii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2362.5 MHz, 55 + 10 log (P) dB on all frequencies between 2362.5 and 2365 MHz, 70 + 10 log (P) dB on all frequencies between 2365 and 2367.5 MHz, 72 + 10 log (P) dB on all frequencies between 2367.5 and 2370 MHz, and 75 + 10 log (P) dB above 2370 MHz.

2.12.3 Equipment Under Test and Modification State

Serial No: 544421000144(NU I42-36CNU) &541421000038(CU I41-WXCU) / Test Configuration I

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

October 19, 2024 / MARG

2.12.5 Test Equipment Used

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

2.12.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.9°C
Relative Humidity	51.6%
ATM Pressure	98.9kPa

2.12.7 Additional Observations

- This is a radiated test. The spectrum was searched covering 30MHz up to the 10th harmonic of the highest frequency radio from each configuration
- The EUT was tested on Burning Mode which consists in all antennas transmitting at the same time as worst case scenario
- Measurement was done using EMC 32 automated software for radiated method. Reported level is the actual level with all the correction factors factored in. the Correction Factor column is for informational purposes only
- Fundamental from Bluetooth and LTE radios are ignored
- No significant emissions were observed above 18G
- FCC Part 90 Limit is identical to FCC Part 27 Limit
-

2.12.8 Test Results

Compliant. See attached plots.

2.12.9 Limit Conversion Example.

-13dBm erp to Field strength at 3m

Using equation: E (dBµV/m) = ERP (dBm) - 20log(D) + 104.8 + 2.15; where D is the measurement distance (in the far field region) in m.

-13dBm ERP = 84.4 dBµV/m at 3m distance.

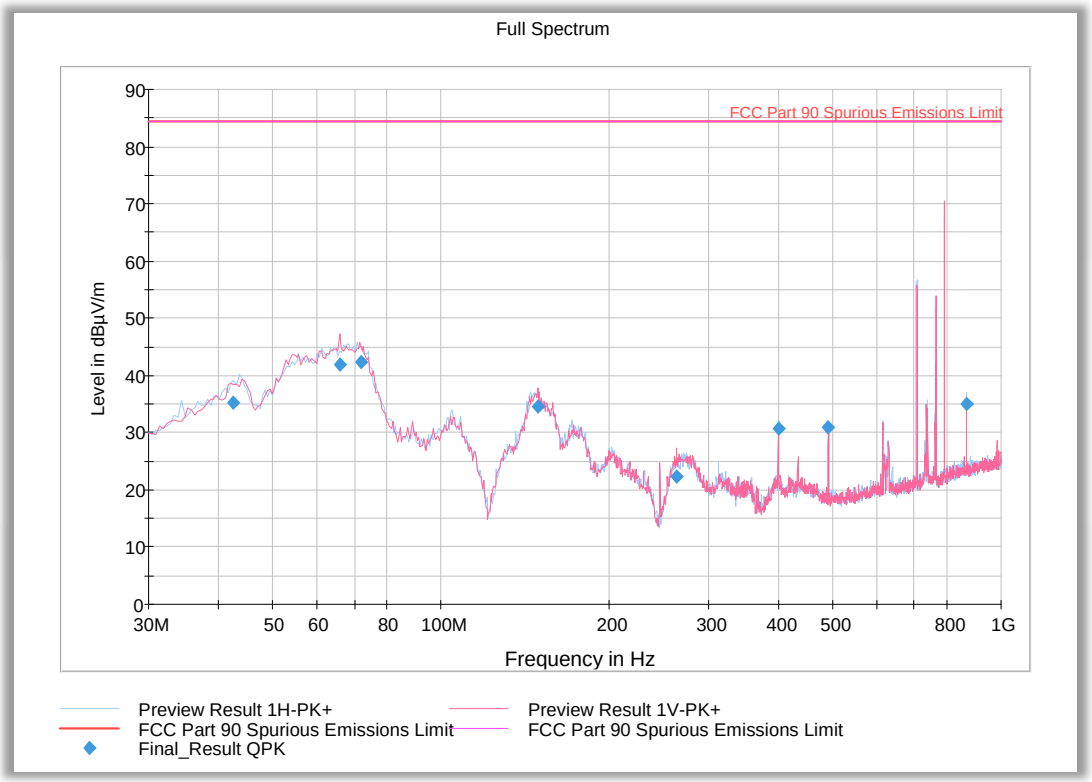
2.12.10 Sample Computation (Radiated Emission 30 MHz to 1 GHz).

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB/m)	Asset# 1026 (cable)	0.8	-7.0
	Asset# 1057 (cable)	0.2	
	Asset# 1016 (preamplifier)	-30.8	
	Asset# 8850 (cable)	0.2	
	Asset# 1033 (antenna)	17.2	
	Asset# 8771 (6-dB attenuator)	5.4	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**17.4**

2.12.11 Sample Computation (Radiated Emissions above 1 GHz).

Measuring equipment raw measurement (dbµV) @ 2629 MHz			37.59
Correction Factor (dB/m)	Asset# 1016 (preamplifier)	-31.9	3
	Asset# 1175(cable)	2.5	
	Asset# 7631 (antenna)	32.4	
Reported Peak Final Measurement (dbµV/m) @ 30MHz			**40.59**

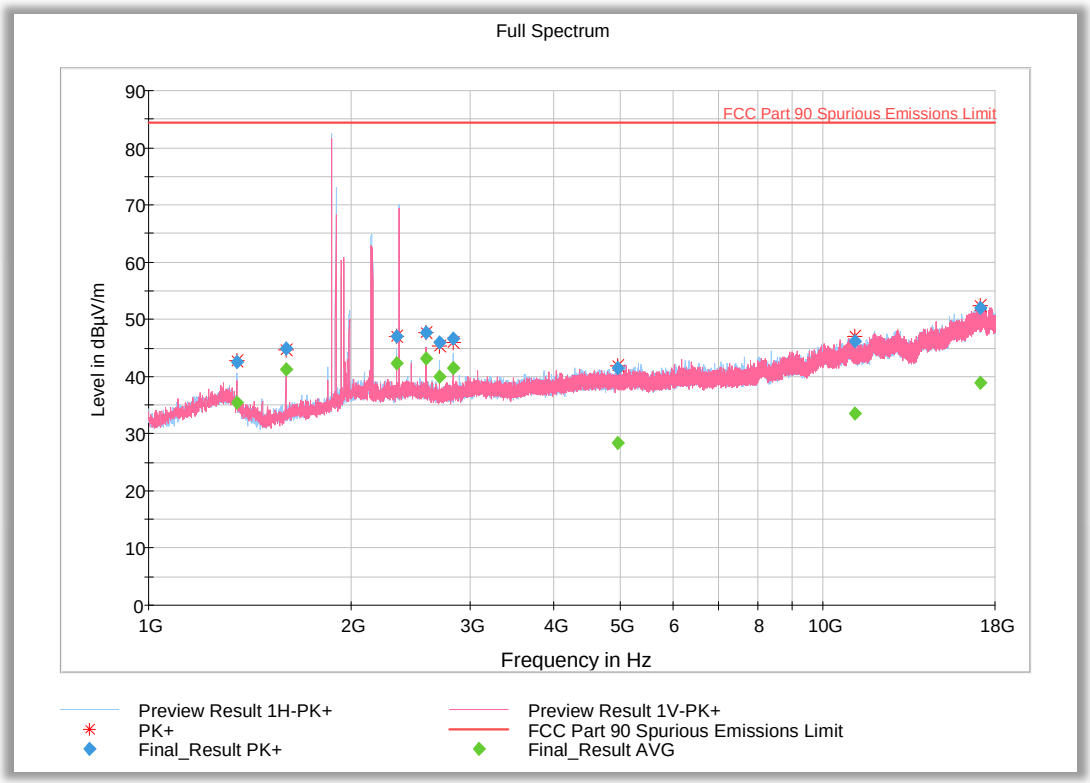
2.12.12 Field Strength of Spurious Radiation Test Results 30 MHz to 1 GHz (NU).



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
42.490000	35.29	84.40	49.11	1000.0	120.000	116.0	H	198.0	-11.0
66.130000	41.83	84.40	42.57	1000.0	120.000	112.0	V	216.0	-14.4
71.790000	42.27	84.40	42.13	1000.0	120.000	150.0	V	238.0	-15.3
148.905000	34.53	84.40	49.87	1000.0	120.000	104.0	V	153.0	-13.9
263.125000	22.27	84.40	62.13	1000.0	120.000	185.0	V	41.0	-8.6
400.015000	30.80	84.40	53.60	1000.0	120.000	113.0	H	347.0	-5.3
491.520000	30.84	84.40	53.56	1000.0	120.000	104.0	V	106.0	-3.4
867.070000	35.04	84.40	49.36	1000.0	120.000	103.0	H	274.0	3.8

2.12.13 Field Strength of Spurious Radiation Test Results 1GHz to 18GHz (NU).



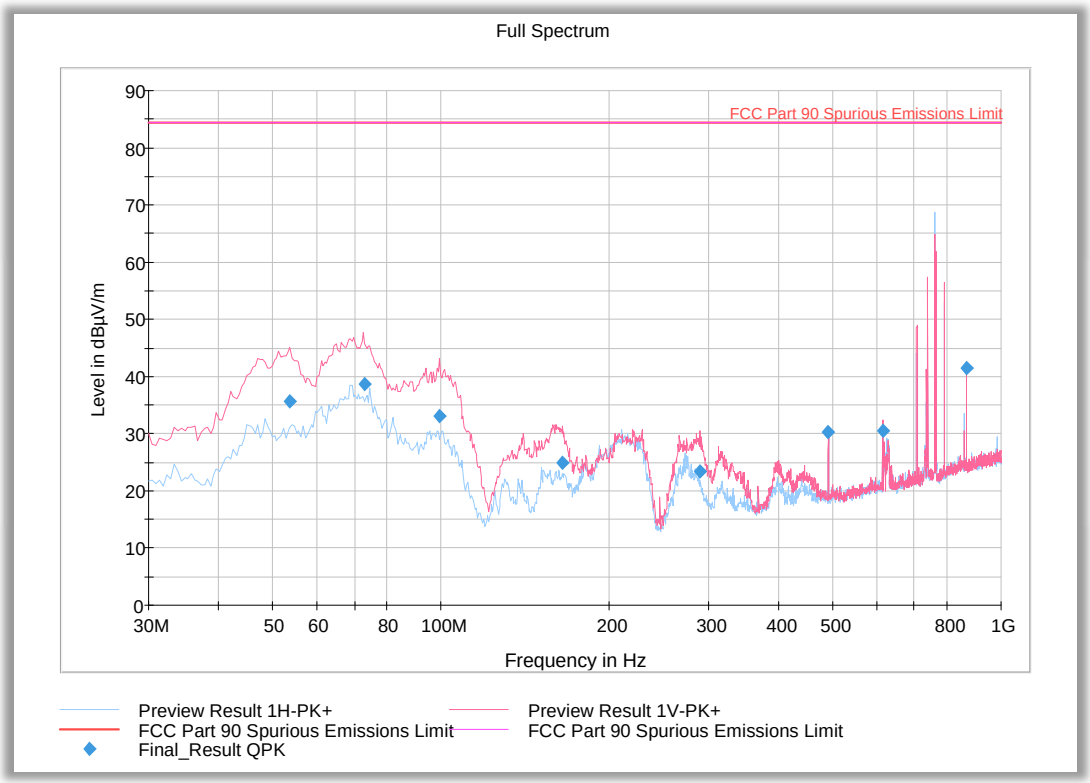
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1351.733333	42.48	84.40	41.92	1000.0	1000.000	378.0	H	86.0	-5.4
1597.266667	44.82	84.40	39.58	1000.0	1000.000	191.0	H	33.0	-6.3
2334.900000	46.99	84.40	37.41	1000.0	1000.000	136.0	H	118.0	-1.3
2580.433333	47.72	84.40	36.68	1000.0	1000.000	201.0	V	160.0	-0.3
2703.233333	45.99	84.40	38.41	1000.0	1000.000	102.0	H	109.0	-0.3
2826.366667	46.60	84.40	37.80	1000.0	1000.000	227.0	H	63.0	-0.1
4974.600000	41.49	84.40	42.91	1000.0	1000.000	407.0	V	273.0	4.5
11159.766667	46.20	84.40	38.20	1000.0	1000.000	390.0	V	88.0	14.7

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1351.733333	35.38	84.40	49.02	1000.0	1000.000	378.0	H	86.0	-5.4
1597.266667	41.25	84.40	43.15	1000.0	1000.000	191.0	H	33.0	-6.3
2334.900000	42.35	84.40	42.05	1000.0	1000.000	136.0	H	118.0	-1.3
2580.433333	43.21	84.40	41.19	1000.0	1000.000	201.0	V	160.0	-0.3
2703.233333	39.90	84.40	44.5	1000.0	1000.000	102.0	H	109.0	-0.3
2826.366667	41.54	84.40	42.86	1000.0	1000.000	227.0	H	63.0	-0.1
4974.600000	28.35	84.40	56.05	1000.0	1000.000	407.0	V	273.0	4.5
11159.766667	33.61	84.40	50.79	1000.0	1000.000	390.0	V	88.0	14.7

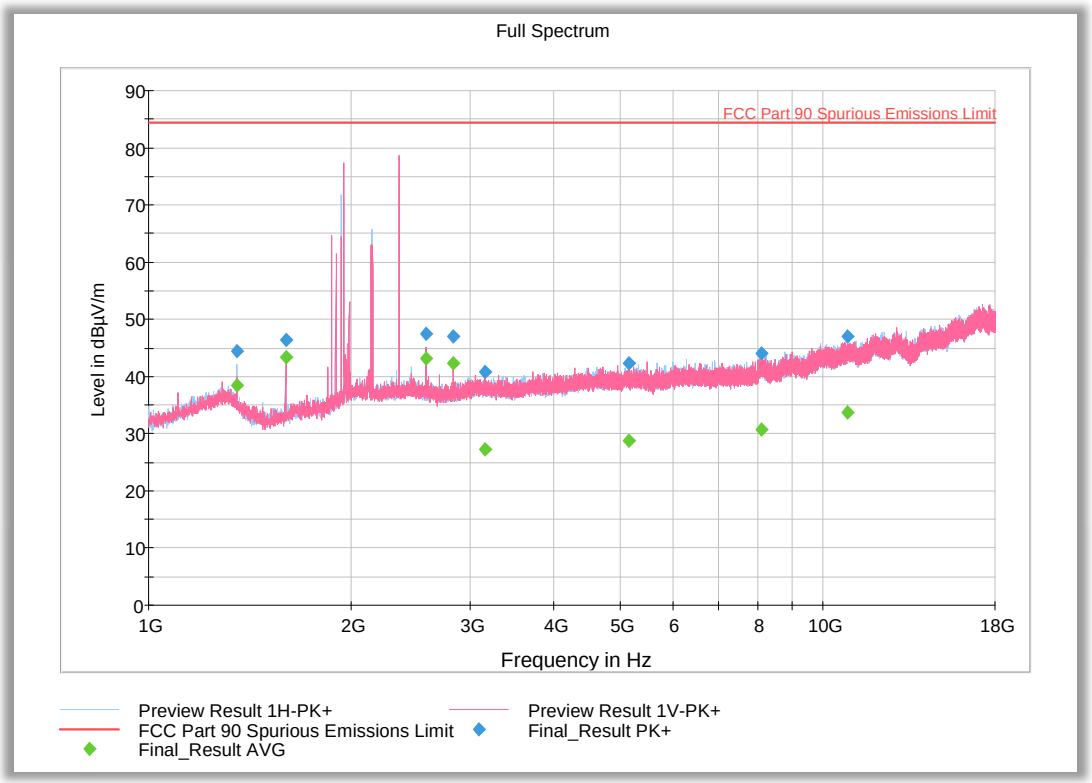
2.12.14 Field Strength of Spurious Radiation Test Results 30 MHz to 1 GHz (CU).



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
53.565000	35.57	84.40	48.83	1000.0	120.000	117.0	V	152.0	-11.0
72.880000	38.66	84.40	45.74	1000.0	120.000	108.0	V	240.0	-15.3
99.315000	33.08	84.40	51.32	1000.0	120.000	111.0	V	14.0	-9.8
164.470000	24.98	84.40	59.42	1000.0	120.000	100.0	V	173.0	-13.2
289.800000	23.46	84.40	60.94	1000.0	120.000	101.0	V	315.0	-8.2
491.520000	30.23	84.40	54.17	1000.0	120.000	103.0	V	7.0	-3.4
614.385000	30.49	84.40	53.91	1000.0	120.000	100.0	V	206.0	-1.1
867.070000	41.38	84.40	43.02	1000.0	120.000	103.0	V	262.0	3.8

2.12.15 FCC Part 90 Test Results 1 GHz to 18 GHz (CU).



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1351.733333	44.41	84.40	39.99	1000.0	1000.000	205.0	H	-11.0	-5.4
1597.266667	46.33	84.40	38.07	1000.0	1000.000	278.0	V	56.0	-6.3
2580.433333	47.51	84.40	36.89	1000.0	1000.000	189.0	V	62.0	-0.3
2826.200000	47.06	84.40	37.34	1000.0	1000.000	194.0	H	18.0	-0.1
3154.633333	40.74	84.40	43.66	1000.0	1000.000	229.0	H	56.0	0.9
5162.733333	42.40	84.40	42.00	1000.0	1000.000	150.0	V	2.0	5.1
8104.466667	43.96	84.40	40.44	1000.0	1000.000	291.0	H	50.0	8.9
10869.533333	46.95	84.40	37.45	1000.0	1000.000	399.0	H	-9.0	14.1

Average Data (§15.209 Limits)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1351.733333	38.53	84.40	45.87	1000.0	1000.000	205.0	H	-11.0	-5.4
1597.266667	43.29	84.40	41.11	1000.0	1000.000	278.0	V	56.0	-6.3
2580.433333	43.27	84.40	41.13	1000.0	1000.000	189.0	V	62.0	-0.3
2826.200000	42.26	84.40	42.14	1000.0	1000.000	194.0	H	18.0	-0.1
3154.633333	27.28	84.40	57.12	1000.0	1000.000	229.0	H	56.0	0.9
5162.733333	28.77	84.40	55.63	1000.0	1000.000	150.0	V	2.0	5.1
8104.466667	30.72	84.40	53.68	1000.0	1000.000	291.0	H	50.0	8.9
10869.533333	33.65	84.40	50.75	1000.0	1000.000	399.0	H	-9.0	14.1

2.13 Out of Band Gain Limit

2.13.1 Specification Reference

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(E)
KDB935210 D04, Clause 7.15

2.13.2 Standard Applicable

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(E) Out of Band Gain Limits:

(1) A frequency selective booster shall have the following minimum attenuation referenced to the gain in the center of the pass band of the booster:

(i) -20 dB at the band edge, where band edge is the end of the licensee's allocated spectrum,
(ii) -30 dB at 1 MHz offset from band edge,
(iii) -40 dB at 5 MHz offset from band edge.

(2) A frequency selective booster having maximum gain greater than 80 dB (referenced to the center of the pass band) shall limit the out of band gain to 60 dB at 0.2 MHz offset from the band edge, and 45 dB at 1 MHz offset from the band edge, where band edge is the end of the licensee's allocated spectrum.

2.13.3 Equipment Under Test and Modification State

Serial No: 370920000139 (NU)and 371929000156 (CU) / Test Configuration C and D

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

August 14 to September 06, and October 27, 2019/XYZ

2.13.5 Test Equipment Used

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

2.13.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Mira Mesa facility.

Ambient Temperature	25.8 - 26.4°C
Relative Humidity	31.1 - 53.7%
ATM Pressure	98.5 - 99.1kPa

2.13.7 Additional Observations

- This is conducted Test. Test procedure is per Section 7.15 of KDB935210 (D04 Provider Specific Booster Measurements v02r03). Appropriate offset (line losses) applied.
- Downlink was tested according to 7.15.1 of KDB935210. The signal generator was set to transmit a CW signal with output power level set to that as determined in clause 7.2.2 of KDB935210.

- Uplink which has narrowband protection function was tested according to 7.15.2 of KDB93521. One signal generator produced a band-limited AWGN signal with an OBW (99%) of 4.1 MHz with output power level set to that as determined in clause 7.2.2 of KDB935210. A second signal generator produced a band-limited AWGN signal with an OBW (99%) of 200 kHz with output power level set to a level that is 20 dB higher than the level determined from 7.2.2 of KDB935210.
- The EUT operated in Test Mode with the gain set to the maximum gain and a minimum bandwidth setting (5MHz).
- Setup the EUT according to Figure 2 or 3 of Section 6.3.3 of KDB935210 D04 as appropriate.
- Evaluations are conducted at CU and NU antenna ports.
- Operational uplink and downlink bands for WCDMA Band 5 and LTE Band 4, 12, 13, 25, 30, 71 were tested.

2.13.8 Test Results

Out of Band Gain Limit – WCDMA Band 5 Downlink (869 – 894 MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-82.16	10.45	92.61	-
0 (Low Band Edge)	-82.40	-65.03	17.37	72.61
-0.2	-82.52	-64.58	17.94	60
-1	-82.11	-64.27	17.84	45
-5	-82.25	-62.98	19.27	52.61
0 (High Band Edge)	-82.47	-65.53	16.94	72.61
+0.2	-82.04	-64.68	17.36	60
+1	-82.39	-64.32	18.07	45
+5	-82.17	-65.48	16.69	52.61

Out of Band Gain Limit - WCDMA Band 5 Uplink (824 – 849 MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-76.69	17.01	93.70	-
0 (Low Band Edge)	-72.16	-64.02	8.14	73.70
-0.2	-71.52	-64.66	6.86	60
-1	-70.76	-66.21	4.55	45
-5	-71.93	-64.56	7.37	53.70
0 (High Band Edge)	-70.62	-65.73	4.89	73.70
+0.2	-70.92	-65.80	5.12	60
+1	-70.59	-65.04	5.55	45
+5	-69.37	-63.25	6.12	53.70

Out of Band Gain Limit – LTE Band 4 Downlink (2110 – 2155 MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-85.30	10.87	96.17	-
0 (Low Band Edge)	-85.71	-46.81	38.90	76.17
-0.2	-84.72	-72.23	12.49	60
-1	-85.24	-70.78	14.46	45
-5	-85.74	-70.71	15.03	56.17
0 (High Band Edge)	-85.78	-70.13	15.65	76.17
+0.2	-85.62	-71.91	13.71	60
+1	-86.16	-71.81	14.35	45
+5	-85.39	-71.15	14.24	56.17

Out of Band Gain Limit - LTE Band 4 Uplink (1710 – 1755 MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-75.09	19.04	94.13	-
0 (Low Band Edge)	-69.63	-65.17	4.46	74.13
-0.2	-69.22	-65.53	3.69	60
-1	-69.88	-63.44	6.44	45
-5	-68.76	-65.53	3.23	54.13
0 (High Band Edge)	-69.24	-64.95	4.29	74.13
+0.2	-69.54	-65.35	4.19	60
+1	-69.23	-64.61	4.62	45
+5	-68.36	-64.01	4.35	74.13

Out of Band Gain Limit – LTE Band 12 Downlink (729 – 746MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-82.47	7.56	90.03	-
0 (Low Band Edge)	-82.75	-69.45	13.30	70.03
-0.2	-82.27	-68.46	13.81	60
-1	-82.66	-69.35	13.31	45
-5	-83.26	-69.58	13.68	50.03
0 (High Band Edge)	-82.91	-68.27	14.64	70.03
+0.2	-83.22	-69.79	13.43	60
+1	-82.77	-60.55	22.22	45
+5	-82.66	-60.34	22.32	50.03

Out of Band Gain Limit - LTE Band 12 Uplink (699 – 716MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-74.81	19.38	90.98	-
0 (Low Band Edge)	-72.37	-70.58	7.2	70.98
-0.2	-72.41	-68.72	6.88	60
-1	-72.15	-70.25	8.71	45
-5	-71.86	-70.46	6.33	50.98
0 (High Band Edge)	-72.89	-70.23	7.94	70.98
+0.2	-72.52	-70.50	7.17	60
+1	-72.10	-70.36	7.49	45
+5	-72.11	-69.87	8.1	50.98

Out of Band Gain Limit – LTE Band 25 Downlink (1930 – 1995 MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-86.59	7.62	94.21	-
0 (Low Band Edge)	-86.69	-64.25	22.44	74.21
-0.2	-86.48	-63.40	23.08	60
-1	-86.61	-63.30	23.31	45
-5	-86.65	-64.52	22.13	54.21
0 (High Band Edge)	-87.02	-64.61	22.41	74.21
+0.2	-86.96	-62.46	24.50	60
+1	-87.28	-63.93	23.35	45
+5	-87.06	-64.18	22.88	54.21

Out of Band Gain Limit - LTE Band 25 Uplink (1850 – 1915 MHz)

Offset (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)	Gain Limit (dB)
Centre Frequency	-71.38	19.08	90.46	-
0 (Low Band Edge)	-69.36	-65.33	4.03	70.46
-0.2	-69.13	-62.43	6.7	60
-1	-69.89	-63.39	6.5	45
-5	-69.12	-63.05	6.07	50.46
0 (High Band Edge)	-69.22	-65.58	3.64	70.46
+0.2	-69.94	-64.37	5.57	60
+1	-70.15	-65.32	4.83	45
+5	-69.93	-64.96	4.97	50.46

Out of Band Gain Limit – LTE Band 30 Downlink (2350 – 2360 MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-86.87	10.61	97.48	-
0 (Low Band Edge)	-86.71	-62.60	24.11	77.48
-0.2	-86.82	-62.25	24.57	60
-1	-86.30	-62.63	23.67	45
-5	-86.82	-64.66	22.16	57.48
0 (High Band Edge)	-86.33	-62.35	23.98	77.48
+0.2	-86.62	-61.72	24.90	60
+1	-86.79	-63.26	23.53	45
+5	-86.87	-63.95	22.92	57.48

Out of Band Gain Limit – LTE Band 30 Uplink (2305 – 2315 MHz)				
Offset (MHz)	**Input Power (dBm)**	**Output Power (dBm)**	**Gain (dB)**	**Gain Limit (dB)**
Centre Frequency	-76.8	16.17	92.97	-
0 (Low Band Edge)	-75.82	-60.28	15.54	72.97
-0.2	-76.38	-61.09	15.29	60
-1	-75.64	-64.66	10.98	45
-5	-75.90	-61.62	14.28	52.97
0 (High Band Edge)	-74.21	-63.90	10.31	72.97
+0.2	-75.36	-63.53	11.83	60
+1	-74.51	-62.59	11.92	45
+5	-75.25	-62.53	12.72	52.97

2.14 Frequency Stability

2.14.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055
FCC 47 CFR Part 22, Clause 22.355
FCC 47 CFR Part 24, Clause 24.235
FCC 47 CFR Part 27, Clause 27.54

2.14.2 Standard Applicable

FCC Part 22.355:
The carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C–1 of this section.

Table C-1 Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile >3 watts (ppm)	Mobile ≤3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	N/A	N/A
929 to 960	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

FCC Part 24.235:
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

FCC 47 CFR Part 27, Clause 27.54:
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

2.14.3 Equipment Under Test and Modification State

Serial No: 110222000051 and 481222000175 / Test Configuration A and B

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

December 03 and December 04, 2022 / FSC

2.14.5 Test Equipment Used

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

2.14.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Mira Mesa facility.

Ambient Temperature	22.4 °C	22.5 °C
Relative Humidity	42.7 %	44.2 %
ATM Pressure	100.7 kPa	100.8 kPa

2.14.7 Additional Observations

- This is a conducted test.
- The EUT was operated at 120 VAC nominal voltage and was placed in the temperature chamber for the series of temperature variation evaluations performed starting at ambient (20°C) temperature. Voltage variation is performed at 85% and 115% of the nominal voltage at 20 °C only.
- The Temperature is then set to 50°C and allowed to sit for 1 hour to allow the equipment and chamber temperature to stabilize. The measurements on both downlink and uplink were then performed. The temperature was then decreased by 10°C steps and allowed to settle before taking the next set of measurements.
- EUT was injected a CW signal from a Signal Generator and maximum frequency error was monitored using the spectrum analyser.
- 5MHz bandwidth Middle Channel was tested as the representative configuration.

2.14.8 Test Results Summary

WCDMA Band 5 Downlink			
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
120	-30	-0.01	1.5
	-20	-0.01	1.5
	-10	-0.01	1.5
	0	-0.01	1.5
	+10	-0.01	1.5
	+20	-0.01	1.5
	+30	-0.01	1.5
	+40	-0.01	1.5
	+50	-0.01	1.5

WCDMA Band 5 Downlink			
Temperature (°C)	***Voltage (VAC)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
20	102	-0.01	1.5
	138	-0.01	1.5

WCDMA Band 5 Uplink			
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
120	-30	-0.01	1.5
	-20	-0.01	1.5
	-10	-0.01	1.5
	0	-0.01	1.5
	+10	-0.01	1.5
	+20	-0.01	1.5
	+30	-0.01	1.5
	+40	-0.01	1.5
	+50	-0.01	1.5

WCDMA Band 5 Uplink			
Temperature (°C)	***Voltage (VAC)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
20	102	-0.01	1.5
	138	-0.01	1.5

LTE Band 25 Downlink			
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
120	-30	-0.01	1.0
	-20	-0.01	1.0
	-10	-0.01	1.0
	0	-0.01	1.0
	+10	-0.01	1.0
	+20	-0.01	1.0
	+30	-0.01	1.0
	+40	-0.01	1.0
	+50	-0.01	1.0

LTE Band 25 Downlink			
Temperature (°C)	***Voltage (VAC)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
20	102	-0.01	1.0
	138	-0.01	1.0

LTE Band 25 Uplink			
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
120	-30	-0.01	1.0
	-20	-0.01	1.0
	-10	-0.01	1.0
	0	-0.01	1.0
	+10	-0.01	1.0
	+20	-0.01	1.0
	+30	-0.01	1.0
	+40	-0.01	1.0
	+50	-0.01	1.0

LTE Band 25 Uplink			
Temperature (°C)	***Voltage (VAC)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
20	102	-0.01	1.0
	138	-0.01	1.0

LTE B4 Downlink – 5 MHz BW Middle Channel 2132.5 MHz			
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
120	-30	-0.01	-
	-20	-0.01	-
	-10	-0.01	-
	0	-0.01	-
	+10	-0.01	-
	+20	-0.01	-
	+30	-0.01	-
	+40	-0.01	-
	+50	-0.01	-
102	+20	-0.01	-
138		-0.01	-

LTE B4 Downlink Frequency Range – 5 MHz BW					
Channel	***Temperature (°C)***	***Voltage (VAC)***	***F_L (MHz)***	***F_H (MHz)***	***Limit (MHz)***
Low Channel	-30	120	2110.1880	-	>2110
	+20	102	2110.1872	-	
		120	2110.1874	-	
		138	2110.1874	-	
	+50	120	2110.1872	-	
High Channel	-30	120	-	2154.8158	<2155
	+20	102	-	2154.8150	
		120	-	2154.8152	
		138	-	2154.8150	
	+50	120	-	2154.8152	

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

LTE B4 Uplink – 5 MHz BW Middle Channel 1732.5 MHz			
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
120	-30	-0.01	-
	-20	-0.01	-
	-10	-0.01	-
	0	-0.01	-
	+10	-0.01	-
	+20	-0.01	-
	+30	-0.01	-
	+40	-0.01	-
	+50	-0.01	-
102	+20	-0.01	-
138		-0.01	-

LTE B4 Uplink Frequency Range – 5 MHz BW					
Channel	***Temperature (°C)***	***Voltage (VAC)***	***F_L (MHz)***	***F_H (MHz)***	***Limit (MHz)***
Low Channel	-30	120	1710.1855	-	>1710
	+20	102	1710.1852	-	
		120	1710.1850	-	
		138	1710.1855	-	
	+50	120	1710.1852	-	
High Channel	-30	120	-	1754.8084	<1755
	+20	102	-	1754.8087	
		120	-	1754.8087	
		138	-	1754.8085	
	+50	120	-	1754.8085	

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

LTE B12 Downlink – 5 MHz BW Middle Channel 737.5 MHz			
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
120	-30	-0.01	-
	-20	-0.01	-
	-10	-0.01	-
	0	-0.01	-
	+10	-0.01	-
	+20	-0.01	-
	+30	-0.01	-
	+40	-0.01	-
	+50	-0.01	-
102	+20	-0.01	-
138		-0.01	-

LTE B12 Downlink Frequency Range – 5 MHz BW					
Channel	***Temperature (°C)***	***Voltage (VAC)***	***F_L (MHz)***	***F_H (MHz)***	***Limit (MHz)***
Low Channel	-30	120	729.2050	-	>729
	+20	102	729.2047	-	
		120	729.2046	-	
		138	729.2046	-	
	+50	120	729.2048	-	
High Channel	-30	120	-	745.8251	<746
	+20	102	-	745.8245	
		120	-	745.8245	
		138	-	745.8245	
	+50	120	-	745.8247	

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

LTE B12 Uplink – 5 MHz BW Middle Channel 707.5 MHz			
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***Limit (ppm)***
120	-30	-0.01	-
	-20	-0.01	-
	-10	-0.01	-
	0	-0.01	-
	+10	-0.01	-
	+20	-0.01	-
	+30	-0.01	-
	+40	-0.01	-
	+50	-0.01	-
102	+20	-0.01	-
138		-0.01	-

LTE B12 Uplink Frequency Range – 5 MHz BW					
Channel	***Temperature (°C)***	***Voltage (VAC)***	***F_L (MHz)***	***F_H (MHz)***	***Limit (MHz)***
Low Channel	-30	120	699.1944	-	>699
	+20	102	699.1944	-	
		120	699.1943	-	
		138	699.1943	-	
	+50	120	699.1945	-	
High Channel	-30	120	-	715.8148	<716
	+20	102	-	715.8153	
		120	-	715.8153	
		138	-	715.8153	
	+50	120	-	715.8155	

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

LTE B30 Downlink – 5 MHz BW Middle Channel 2355 MHz				
Voltage (VAC)	***Temperature (°C)***	***Frequency Error (Hz)***	***Frequency Error (ppm)***	***Limit (ppm)***
120	-30	14.8	-0.01	-
	-20	14.8	-0.01	-
	-10	14.6	-0.01	-
	0	14.5	-0.01	-
	+10	14.5	-0.01	-
	+20	14.5	-0.01	-
	+30	14.9	-0.01	-
	+40	14.7	-0.01	-
	+50	14.7	-0.01	-
102	+20	14.5	-0.01	-
138		14.5	-0.01	-

LTE B30 Downlink Frequency Range – 5 MHz BW					
Channel	***Temperature (°C)***	***Voltage (VAC)***	***F_L (MHz)***	***F_H (MHz)***	***Limit (MHz)***
Low Channel	-30	120	2350.1620	-	>2350
	+20	102	2350.1617	-	
		120	2350.1615	-	
		138	2350.1615	-	
	+50	120	2350.1617	-	
High Channel	-30	120	-	2359.8268	<2359.9
	+20	102	-	2359.8269	
		120	-	2359.8267	
		138	-	2359.8268	
	+50	120	-	2359.8271	

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

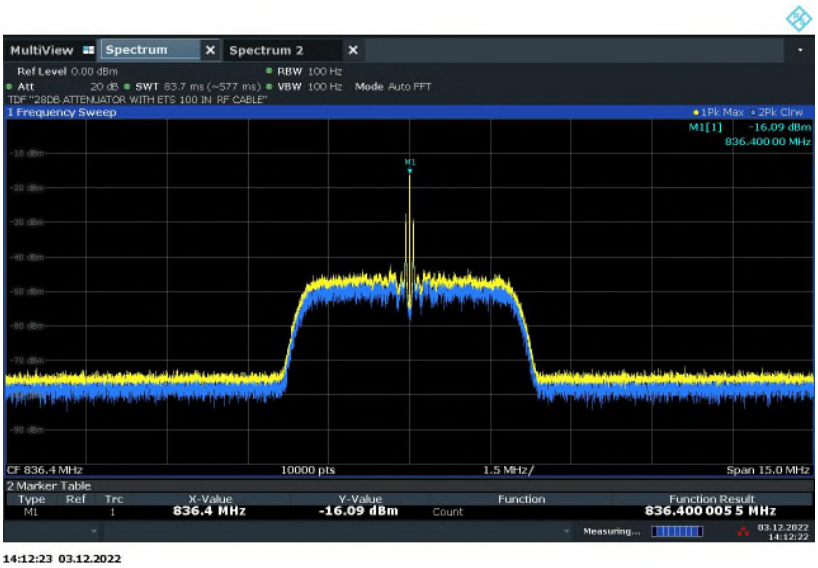
LTE B30 Uplink – 5 MHz BW Middle Channel 2310 MHz				
Voltage (VAC)	***Temperature (°C)***	***Frequency Error (Hz)***	***Frequency Error (ppm)***	***Limit (ppm)***
120	-30	15.2	-0.01	-
	-20	15.7	-0.01	-
	-10	14.8	-0.01	-
	0	14.4	-0.01	-
	+10	14.2	-0.01	-
	+20	14.7	-0.01	-
	+30	14.7	-0.01	-
	+40	14.5	-0.01	-
	+50	14.3	-0.01	-
102	+20	14.7	-0.01	-
138		14.7	-0.01	-

LTE B30 Uplink Frequency Range – 5 MHz BW					
Channel	***Temperature (°C)***	***Voltage (VAC)***	***F_L (MHz)***	***F_H (MHz)***	***Limit (MHz)***
Low Channel	-30	120	2305.1785	-	>2305
	+20	102	2305.1791	-	
		120	2305.1791	-	
		138	2305.1792	-	
	+50	120	2305.1789	-	
High Channel	-30	120	-	2314.8160	<2315
	+20	102	-	2314.8154	
		120	-	2314.8152	
		138	-	2314.8152	
	+50	120	-	2314.8156	

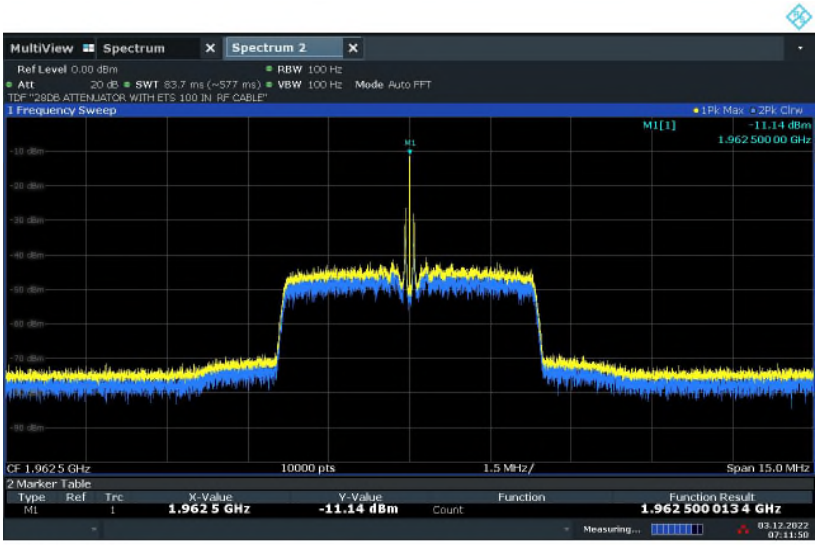
The frequency stability of the EUT is sufficient to keep it within the authorized frequency ranges at any temperature interval and voltage variations across the measured range.

2.14.9 Sample Test Plots

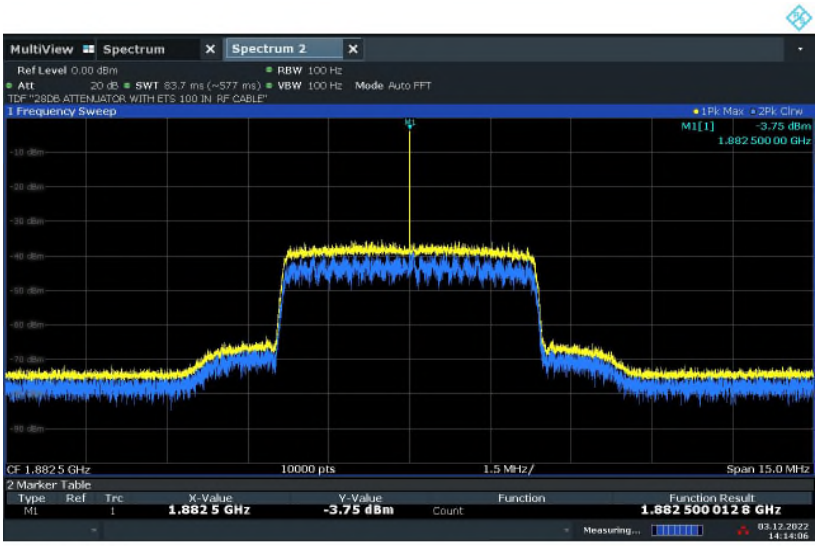
WCDMA B5 Downlink Middle Channel 120VAC @ 20°C



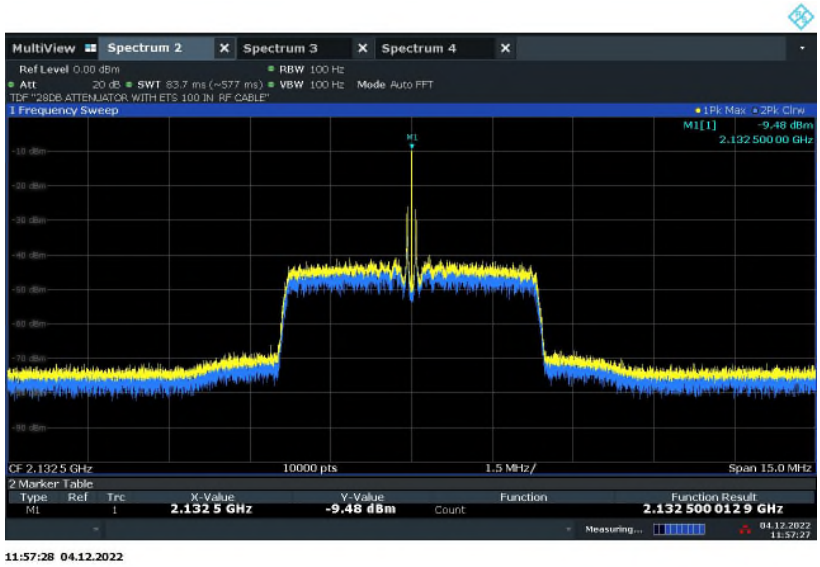
WCDMA B5 Uplink Middle Channel 120VAC @ -30°C



LTE B25 Downlink Middle Channel 120VAC @ 20°C

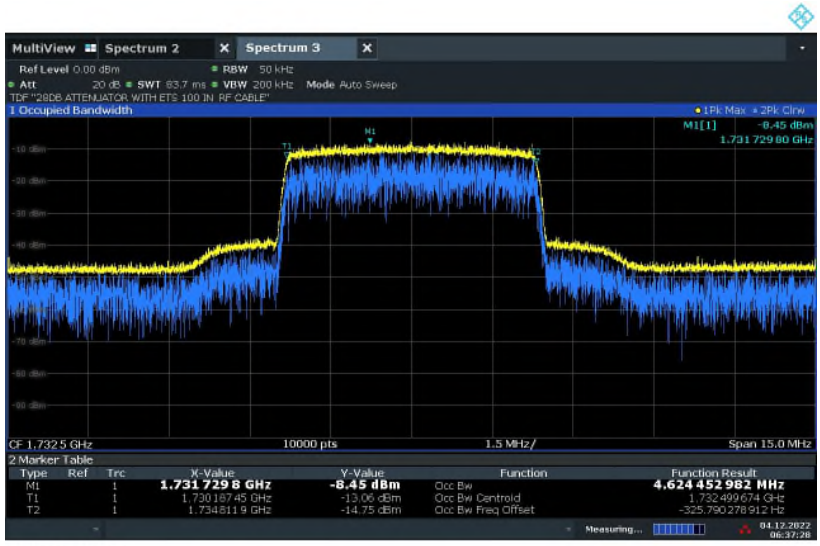


LTE B25 Uplink Middle Channel 120VAC @ -30°C



11:57:28 04.12.2022

LTE Band 4 Downlink Middle Channel 120VAC @ 30°C



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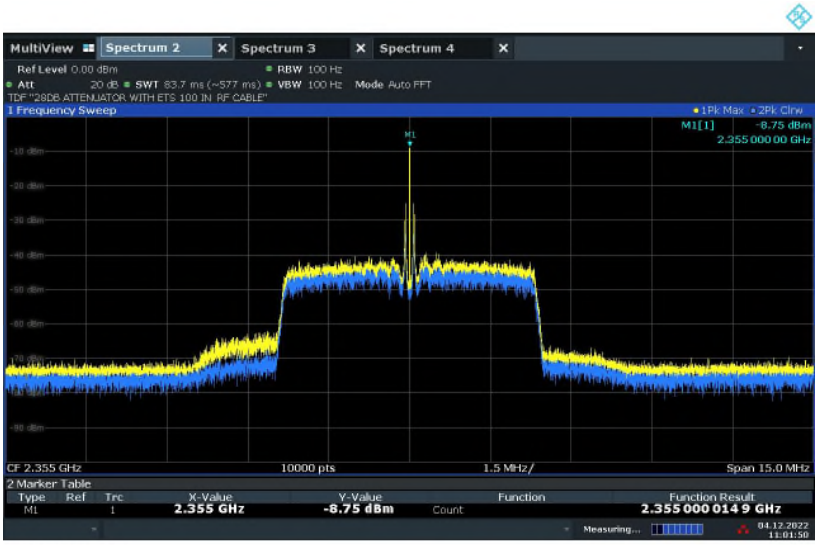
LTE Band 4 Uplink Middle Channel OBW 120VAC @ 20°C



LTE B30 Downlink Middle Channel @ 40°C Nominal Voltage

LTE B12 Uplink High Channel OBW @ 20°C Nominal Voltage

3 Test Equipment Used

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

Test Equipment List (Leveraged data)

Asset ID Number	Test Equipment	Type	Serial Number	Manufacturer	Cal Due Date
Antenna Conducted Port Setup					
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10/10/21
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/07/20
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50/ 103829	Rhode & Schwarz	For Signalling
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
Miscellaneous					
43003	True RMS Multimeter	85 III	96880143	Fluke	10/07/20
7619	Temp & Humidity Sensor	iBTHX-W	15050268	Omega	06/18/20

Test Equipment List (Leveraged data)

Asset ID Number	Test Equipment	Type	Serial Number	Manufacturer	Cal Due Date
Antenna Conducted Port Setup					
0618	ESG Vector Signal Generator	E4438C	MY49070886	Agilent	06/22/24
7611	Signal & Spectrum Analyzer	FSW26	102017	Rohde & Schwarz	02/09/23
6891	P-Series Power Meter	N1911A	MY45100905	Agilent	04/07/23
6892	50MHz Wideband Power Sensor	N1921A	SG45240281	Agilent	04/08/23
41493	4ft True Blue coax cable	R90-077-060	16-07-201	Teledyne	Verified by 0618 and 7611
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 0618 and 7611
Radiated Test Setup					
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	10/21/23
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	09/12/24
7611	Signal & Spectrum Analyzer	FSW26	102017	Rohde & Schwarz	02/09/23
1049	EMI Test Receiver	ESU40	100133	Rohde & Schwarz	09/21/23
46797	Preamplifier	PS-122	181925	Com Power	12/03/24
7619	Barometer/ Temperature/Humidity Transmitter	iBTHX-W	15250268	Omega	05/27/23
Conducted Emissions					
SDRB1049	EMI Test Receiver	ESU40	100133	Rohde & Schwarz	09/21/23
SDGE07567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	03/28/23
SDGE08870	Bi-Directional Attenuator	34-20-34	BP8030	MCE / Weinschel	02/28/23
Miscellaneous					
47045	True RMS Multimeter	87V	18290478	Fluke	03/29/23
6610	Environmental Chamber	SH27	09963481-S	Envirotronics	01/12/23
SDGE07619	Barometer/ Temperature/Humidity Transmitter	iBTHX-W	15250268	Omega	05/27/23
	Test Software	EMC32	V10.60.20	Rhode & Schwarz	N/A

All test equipment was within calibration during testing

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date
Antenna Conducted Port Setup					
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10/03/2025
7582	Signal/Spectrum Analyzer	FSW26	101614	Rohde & Schwarz	12/21/2023
-	Power Splitter	ZN2PD2-50-S+	SUU27701207	Mini Circuits	Verified with (7608) and (7582)
7610	DFS Radar Simulator and Analyzer*	Aeroflex 3005	30050A/09L	Aeroflex	NCR (for signaling purposes only)
-	20dB Attenuator	5W DC-18GHz 20dB (ATX3518-20)	N/A	MCL	Verified by 7608 and 7582
7662	Power Meter	N1911A	MY451000951	Agilent	04/04/2024
7605	Wideband Power Meter	N1921A	MY51100054	Agilent	04/14/2024
8848	Step Attenuator	RSP	834500/009	Rhode & Schwarz	Verified by 7608 and 7582
-	Directional Coupler	4226-20	N/A	Narda	Verified by 7608 and 7582
Radiated Spurious Emissions					
1033	BiConiLog Antenna	3142C	00044556	ETS Lindgren	10/16/25
68302	EMI Test Receiver	ESW44	103418	Rohde & Schwarz	07/02/25
51235	RF Pre-Amp (9kHz to 1GHz)	310	412802	Sonoma	08/14/25
68301	EMI Test Receiver	ESW44	103417	Rohde & Schwarz	07/05/25
30181	1-18GHz DRG Horn	3117	155511	ETS-Lindgren	08/20/26
8628	Pre-Amplifier	QLJ-01182835-JO	8986002	Quinstar	02/19/25
9001	Horn antenna (18-26.5GHz)	HO42S	101	Custom Microwave	10/26/25
40815	18GHz to 40GHz Low Noise Amplifier	SLKKa-30-6	19D18	Spacek Labs	10/22/25
Miscellaneous					
43003	True RMS Multimeter	85 III	96880143	Fluke	01/09/2025
68516	Barometric Pressure/Humidity/Temperature Sensor	SD700	A.107085	Extech Instruments	08/24/25
-	Test Software	EMC32	V11.50.0	Rhode & Schwarz	NCR

4 Measurement Uncertainty

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

4.1 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**	

4.2 Radiated Measurements (30MHz to 1 GHz).

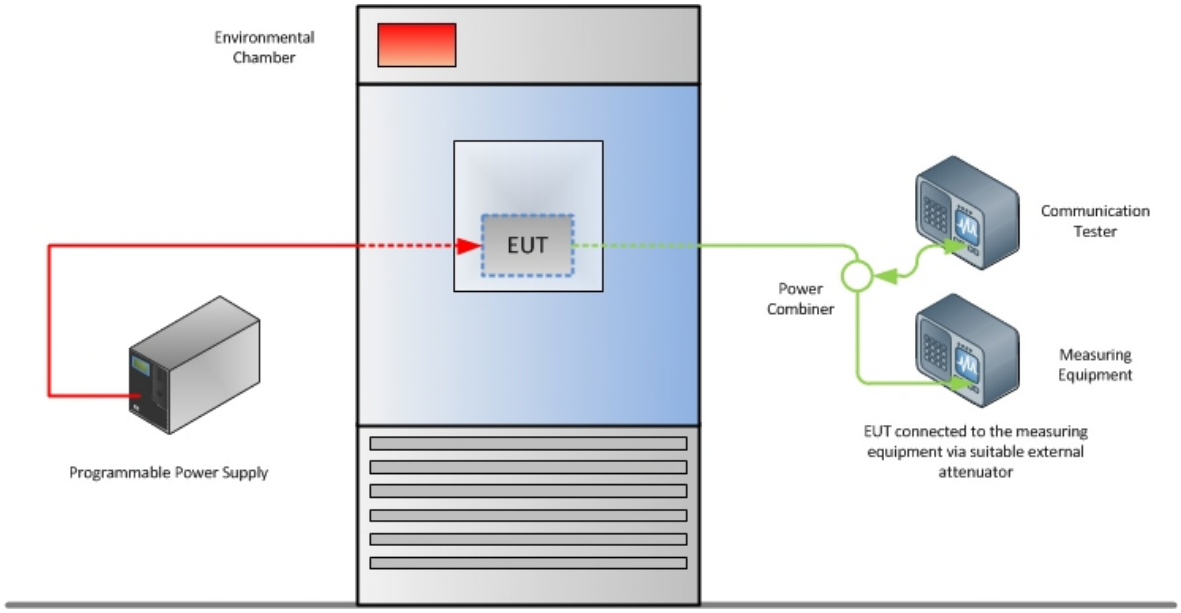
Input Quantity (Contribution) Xi	Value		Prob. Dist.	Divisor	ui(x)	ui(x)2
Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
Attenuation: antenna-receiver	0.20	dB	Normal, k=2	2.000	0.10	0.01
Antenna factor AF	0.75	dB	Normal, k=2	2.000	0.38	0.14
Receiver sinewave accuracy	1.10	dB	Normal, k=2	2.000	0.55	0.30
Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
Noise floor proximity	0.50	dB	Rectangular	1.732	0.29	0.08
Mismatch: antenna-receiver	0.95	dB	U-shaped	1.414	0.67	0.45
AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
AF height deviations	0.10	dB	Rectangular	1.732	0.06	0.00
Directivity difference at 3 m	3.12	dB	Rectangular	1.732	1.80	3.24
Phase center location at 3 m	1.00	dB	Rectangular	1.732	0.58	0.33
Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
Balance	0.00	dB	Rectangular	1.732	0.00	0.00
Site imperfections	3.64	dB	Triangular	2.449	1.49	2.21
Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
Effect of setup table material	0.40	dB	Rectangular	1.732	0.23	0.05
Table height at 3 m	0.10	dB	Normal, k=2	2.000	0.05	0.00
Near-field effects	0.00	dB	Triangular	2.449	0.00	0.00
Effect of ambient noise on OATS	0.00	dB				0.00
Combined standard uncertainty			Normal	2.95	dB	
Expanded uncertainty			Normal, k=2	5.89	dB	

4.3 Radiated Emissions Measurements (Above 1GHz).

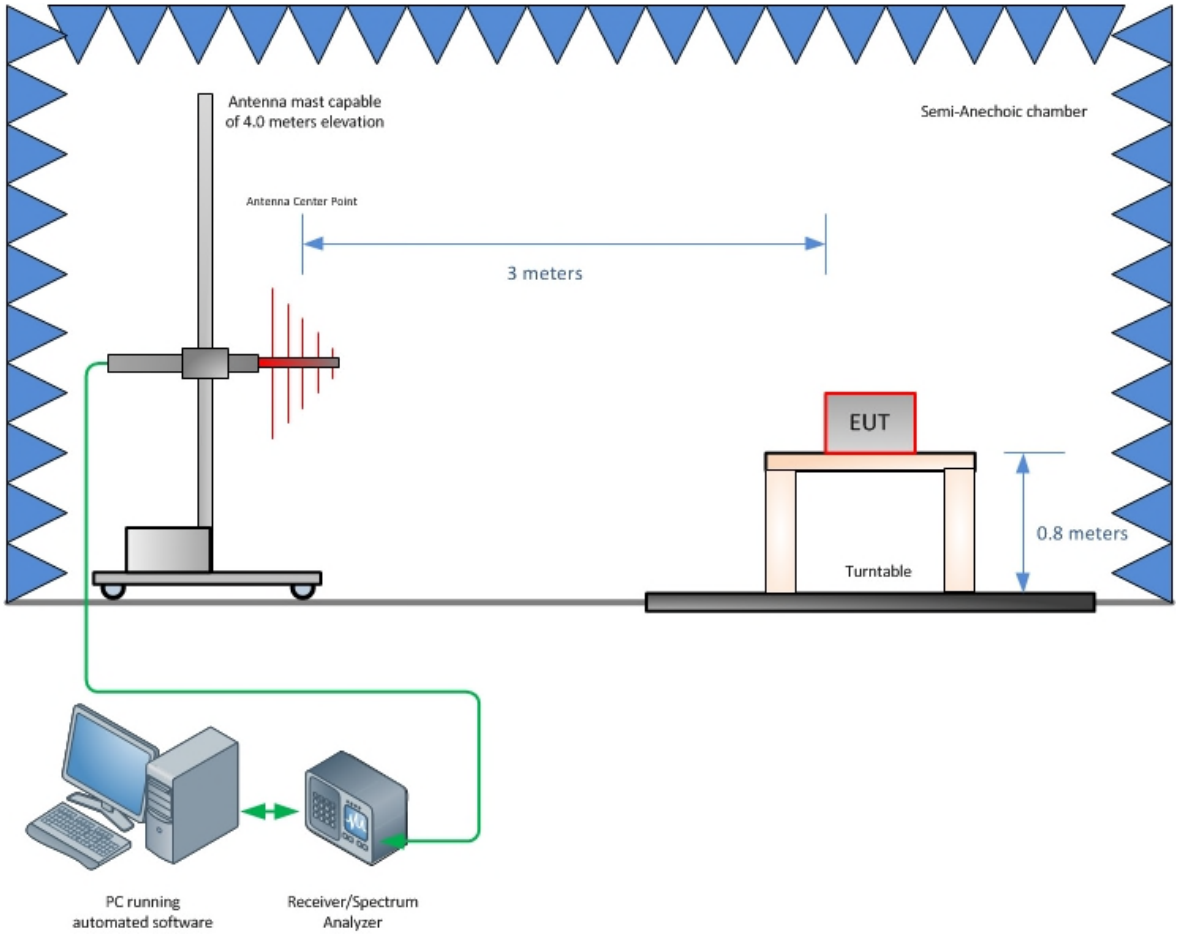
Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
Attenuation: antenna-receiver	0.30	dB	Normal, k=2	2.000	0.15	0.02
Preamplifier Gain	0.20	dB	Normal, k=2	2.000	0.10	0.01
Antenna factor AF	0.37	dB	Normal, k=2	2.000	0.19	0.03
Sinewave accuracy	0.57	dB	Normal, k=2	2.000	0.29	0.08
Instability of preamp gain	1.21	dB	Rectangular	1.732	0.70	0.49
Noise floor proximity	0.70	dB	Rectangular	1.732	0.40	0.16
Mismatch: antenna-preamplifier	1.41	dB	U-shaped	1.414	1.00	0.99
Mismatch: preamplifier-receiver	1.30	dB	U-shaped	1.414	0.92	0.85
AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
Directivity difference at 3 m	1.50	dB	Rectangular	1.732	0.87	0.75
Phase center location at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
Site imperfections VSWR (Method 2)	4.16	dB	Triangular	2.449	1.70	2.89
Effect of setup table material	1.15	dB	Rectangular	1.732	0.66	0.44
Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
Table height at 3 m	0.00	dB	Normal, k=1	2.000	0.00	0.00
Combined standard uncertainty			Normal	2.66	dB	
Expanded uncertainty			Normal, k=2	5.32	dB	

5 Diagram of test setup

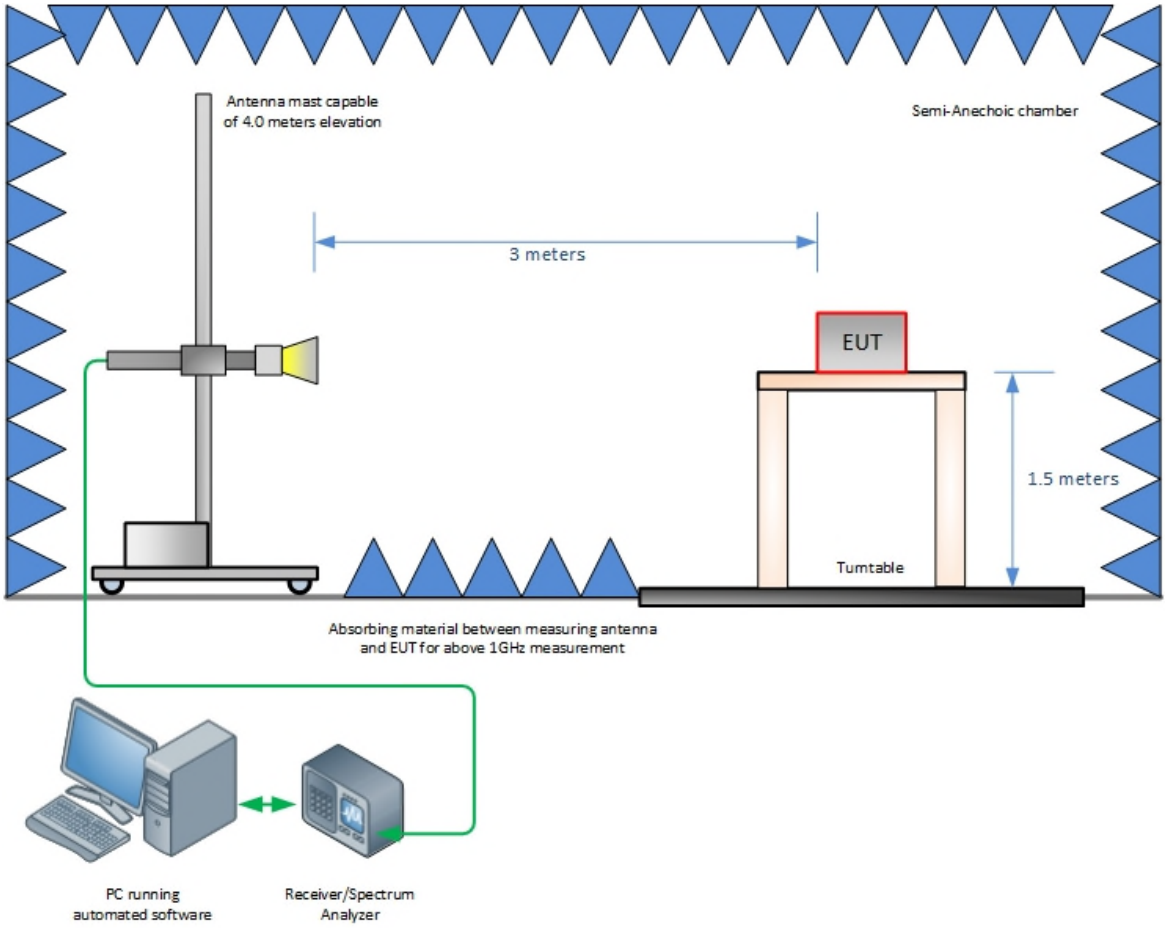
5.1 Test Setup Diagram



Frequency Stability Test Configuration



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)

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