

5.4. Peak-to-Average Power Ratio (PAPR)

Ambient condition

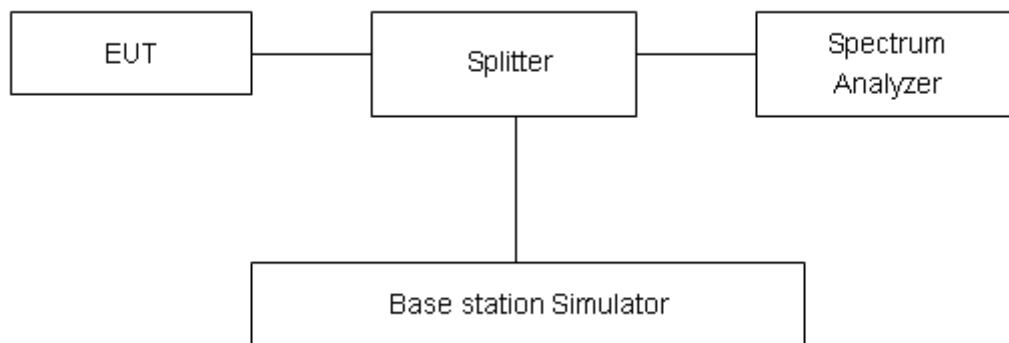
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

Measure the total peak power and record as PPk. And measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

$$\text{PAPR (dB)} = \text{PPk (dBm)} - \text{PAvg (dBm)}.$$

Test Setup



Limits

In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB in 24.232(d).

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.4$ dB.

Test Results

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
LTE Band 2	1.4MHz	QPSK	18900/1880	22.61	12.56	10.05	≤13	PASS
		16QAM	18900/1880	23.15	12.33	10.82	≤13	PASS
	3MHz	QPSK	18900/1880	22.60	12.43	10.17	≤13	PASS
		16QAM	18900/1880	23.24	12.70	10.54	≤13	PASS
	5MHz	QPSK	18900/1880	23.49	13.85	9.64	≤13	PASS
		16QAM	18900/1880	23.90	13.61	10.29	≤13	PASS
	10MHz	QPSK	18900/1880	23.35	13.73	9.62	≤13	PASS
		16QAM	18900/1880	24.24	14.33	9.91	≤13	PASS
	15MHz	QPSK	18900/1880	23.78	14.79	8.99	≤13	PASS
		16QAM	18900/1880	24.28	14.50	9.78	≤13	PASS
	20MHz	QPSK	18900/1880	23.98	14.70	9.28	≤13	PASS
		16QAM	18900/1880	24.36	14.30	10.06	≤13	PASS

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
LTE Band 25	1.4MHz	QPSK	26365/1882.5	22.74	11.22	11.52	≤13	PASS
		16QAM	26365/1882.5	23.68	11.48	12.20	≤13	PASS
	3MHz	QPSK	26365/1882.5	22.79	12.71	10.08	≤13	PASS
		16QAM	26365/1882.5	23.48	12.80	10.68	≤13	PASS
	5MHz	QPSK	26365/1882.5	23.58	13.83	9.75	≤13	PASS
		16QAM	26365/1882.5	24.22	14.09	10.13	≤13	PASS
	10MHz	QPSK	26365/1882.5	24.53	14.10	10.43	≤13	PASS
		16QAM	26365/1882.5	24.71	15.10	9.61	≤13	PASS
	15MHz	QPSK	26365/1882.5	24.16	15.32	8.84	≤13	PASS
		16QAM	26365/1882.5	24.70	15.23	9.47	≤13	PASS
	20MHz	QPSK	26365/1882.5	24.16	14.30	9.86	≤13	PASS
		16QAM	26365/1882.5	24.64	14.98	9.66	≤13	PASS

5.5.Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -40°C to +85°C in 10°C step size,

(1) With all power removed, the temperature was decreased to 0°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

(3) Repeat the above measurements at 10°C increments from -40°C to +85°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

Frequency Stability (Voltage Variation)

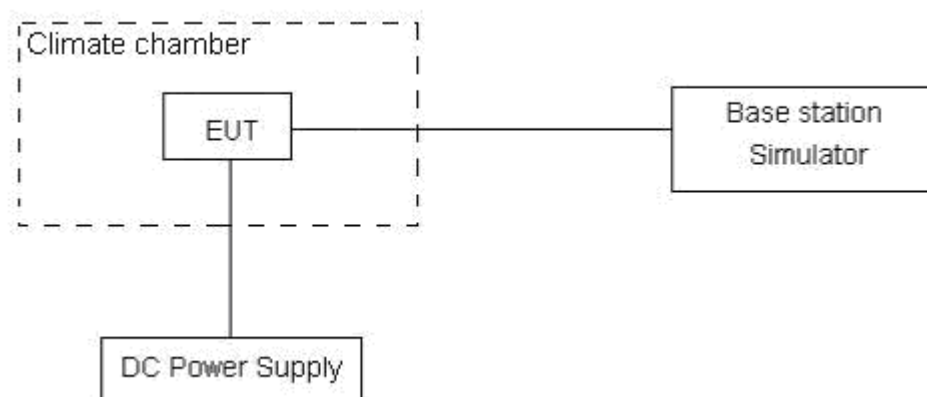
The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

This transceiver is specified to operate with an input voltage of between 3.3 V and 4.3 V, with a nominal voltage of 3.8V.

Test setup



Limits

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 3$, $U = 0.01\text{ppm}$.



Test Result

LTE Band 2						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	1.4MHz	16QAM	QPSK	16QAM	QPSK	
Temperature	Voltage					
Normal (25℃)	Normal	10.95	14.53	0.00583	0.00773	PASS
Extreme (85℃)		1.45	8.74	0.00077	0.00465	PASS
Extreme (80℃)		7.19	4.75	0.00382	0.00253	PASS
Extreme (70℃)		7.58	8.14	0.00403	0.00433	PASS
Extreme (60℃)		1.78	3.33	0.00095	0.00177	PASS
Extreme (50℃)		4.18	16.27	0.00222	0.00865	PASS
Extreme (40℃)		13.37	2.39	0.00711	0.00127	PASS
Extreme (30℃)		8.66	15.51	0.00460	0.00825	PASS
Extreme (20℃)		13.89	12.00	0.00739	0.00638	PASS
Extreme (10℃)		4.91	16.21	0.00261	0.00862	PASS
Extreme (0℃)		4.63	5.81	0.00246	0.00309	PASS
Extreme (-10℃)		6.34	8.13	0.00337	0.00433	PASS
Extreme (-20℃)		16.76	10.10	0.00891	0.00537	PASS
Extreme (-30℃)		17.00	1.97	0.00904	0.00105	PASS
Extreme (-40℃)		13.89	9.45	0.00739	0.00503	PASS
25℃	LV	11.55	9.13	0.00614	0.00486	PASS
	HV	1.98	4.36	0.00105	0.00232	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	3MHz	16QAM	QPSK	16QAM	QPSK	
Temperature	Voltage					
Normal (25℃)	Normal	11.73	17.35	0.00624	0.00923	PASS
Extreme (85℃)		16.83	6.42	0.00895	0.00341	PASS
Extreme (80℃)		17.98	7.21	0.00956	0.00384	PASS
Extreme (70℃)		5.00	10.04	0.00266	0.00534	PASS
Extreme (60℃)		3.22	16.38	0.00172	0.00872	PASS
Extreme (50℃)		13.16	7.49	0.00700	0.00399	PASS
Extreme (40℃)		5.56	8.51	0.00296	0.00453	PASS
Extreme (30℃)		6.44	2.85	0.00342	0.00152	PASS
Extreme (20℃)		14.84	3.83	0.00790	0.00204	PASS
Extreme (10℃)		16.96	17.61	0.00902	0.00936	PASS
Extreme (0℃)		10.82	12.38	0.00576	0.00658	PASS
Extreme (-10℃)		13.79	9.65	0.00734	0.00514	PASS
Extreme (-20℃)		14.09	7.02	0.00749	0.00373	PASS
Extreme (-30℃)		11.18	8.92	0.00595	0.00475	PASS



Extreme (-40℃)		9.71	12.04	0.00517	0.00640	PASS
25℃	LV	1.85	5.83	0.00098	0.00310	PASS
	HV	8.59	17.60	0.00457	0.00936	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	5MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	11.91	14.78	0.00633	0.00786	PASS
Extreme (85℃)		15.51	15.01	0.00825	0.00798	PASS
Extreme (80℃)		16.71	15.65	0.00889	0.00833	PASS
Extreme (70℃)		7.81	12.64	0.00415	0.00672	PASS
Extreme (60℃)		14.51	17.92	0.00772	0.00953	PASS
Extreme (50℃)		4.21	4.64	0.00224	0.00247	PASS
Extreme (40℃)		11.01	5.51	0.00586	0.00293	PASS
Extreme (30℃)		17.20	10.38	0.00915	0.00552	PASS
Extreme (20℃)		8.38	9.30	0.00446	0.00494	PASS
Extreme (10℃)		15.60	5.57	0.00830	0.00296	PASS
Extreme (0℃)		2.54	6.55	0.00135	0.00349	PASS
Extreme (-10℃)		11.99	8.98	0.00638	0.00477	PASS
Extreme (-20℃)		9.03	12.61	0.00480	0.00671	PASS
Extreme (-30℃)		4.83	14.84	0.00257	0.00789	PASS
Extreme (-40℃)		8.09	17.14	0.00430	0.00911	PASS
25℃	LV	16.58	11.14	0.00882	0.00593	PASS
	HV	16.18	12.14	0.00861	0.00646	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	10MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	1.01	11.07	0.00054	0.00589	PASS
Extreme (85℃)		13.38	6.21	0.00712	0.00330	PASS
Extreme (80℃)		12.82	2.90	0.00682	0.00154	PASS
Extreme (70℃)		16.24	11.17	0.00864	0.00594	PASS
Extreme (60℃)		10.68	1.31	0.00568	0.00070	PASS
Extreme (50℃)		6.61	17.45	0.00352	0.00928	PASS
Extreme (40℃)		6.06	17.85	0.00322	0.00949	PASS
Extreme (30℃)		17.71	3.57	0.00942	0.00190	PASS
Extreme (20℃)		2.95	16.44	0.00157	0.00874	PASS
Extreme (10℃)		15.85	1.38	0.00843	0.00073	PASS
Extreme (0℃)		16.79	9.14	0.00893	0.00486	PASS
Extreme (-10℃)		11.09	3.04	0.00590	0.00162	PASS
Extreme (-20℃)		4.78	13.34	0.00254	0.00710	PASS
Extreme (-30℃)		7.76	1.19	0.00413	0.00063	PASS



Extreme (-40℃)		15.86	10.30	0.00844	0.00548	PASS
25℃	LV	17.94	8.37	0.00954	0.00445	PASS
	HV	8.53	14.22	0.00454	0.00756	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	15MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	3.04	10.87	0.00162	0.00578	PASS
Extreme (85℃)		6.09	1.31	0.00324	0.00070	PASS
Extreme (80℃)		12.15	16.71	0.00646	0.00889	PASS
Extreme (70℃)		16.26	7.68	0.00865	0.00408	PASS
Extreme (60℃)		9.62	11.38	0.00512	0.00605	PASS
Extreme (50℃)		15.56	4.06	0.00828	0.00216	PASS
Extreme (40℃)		16.50	6.94	0.00878	0.00369	PASS
Extreme (30℃)		17.90	9.28	0.00952	0.00493	PASS
Extreme (20℃)		8.48	3.94	0.00451	0.00210	PASS
Extreme (10℃)		4.30	10.46	0.00229	0.00556	PASS
Extreme (0℃)		17.91	15.42	0.00953	0.00820	PASS
Extreme (-10℃)		9.93	1.79	0.00528	0.00095	PASS
Extreme (-20℃)		14.17	12.05	0.00753	0.00641	PASS
Extreme (-30℃)		16.89	5.59	0.00899	0.00297	PASS
Extreme (-40℃)		8.42	1.55	0.00448	0.00083	PASS
25℃	LV	1.02	15.90	0.00054	0.00846	PASS
	HV	6.73	13.43	0.00358	0.00714	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	20MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	16.63	1.77	0.00885	0.00094	PASS
Extreme (85℃)		13.33	16.03	0.00709	0.00853	PASS
Extreme (80℃)		5.42	5.10	0.00288	0.00271	PASS
Extreme (70℃)		6.05	3.37	0.00322	0.00179	PASS
Extreme (60℃)		12.77	5.60	0.00679	0.00298	PASS
Extreme (50℃)		10.68	3.89	0.00568	0.00207	PASS
Extreme (40℃)		14.67	3.00	0.00781	0.00160	PASS
Extreme (30℃)		14.10	15.73	0.00750	0.00837	PASS
Extreme (20℃)		15.60	4.79	0.00830	0.00255	PASS
Extreme (10℃)		1.66	7.24	0.00089	0.00385	PASS
Extreme (0℃)		3.17	16.04	0.00168	0.00853	PASS
Extreme (-10℃)		3.88	3.61	0.00207	0.00192	PASS
Extreme (-20℃)		12.72	15.03	0.00677	0.00800	PASS
Extreme (-30℃)		9.30	8.57	0.00495	0.00456	PASS



Extreme (-40℃)		5.88	8.75	0.00313	0.00465	PASS
25℃	LV	9.88	4.51	0.00525	0.00240	PASS
	HV	7.44	17.04	0.00396	0.00906	PASS

LTE Band 25						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	1.4MHz	16QAM	QPSK	16QAM	QPSK	
Temperature	Voltage					
Normal (25℃)	Normal	7.34	10.05	0.00390	0.00534	PASS
Extreme (85℃)		3.23	14.00	0.00172	0.00745	PASS
Extreme (80℃)		13.93	17.50	0.00741	0.00931	PASS
Extreme (70℃)		2.06	13.78	0.00109	0.00733	PASS
Extreme (60℃)		1.80	6.69	0.00096	0.00356	PASS
Extreme (50℃)		15.18	5.49	0.00807	0.00292	PASS
Extreme (40℃)		2.38	6.68	0.00127	0.00355	PASS
Extreme (30℃)		5.70	2.79	0.00303	0.00149	PASS
Extreme (20℃)		14.87	13.13	0.00791	0.00698	PASS
Extreme (10℃)		10.60	5.43	0.00564	0.00289	PASS
Extreme (0℃)		1.82	5.83	0.00097	0.00310	PASS
Extreme (-10℃)		2.46	17.32	0.00131	0.00921	PASS
Extreme (-20℃)		15.30	4.81	0.00814	0.00256	PASS
Extreme (-30℃)		10.54	16.12	0.00561	0.00857	PASS
Extreme (-40℃)		8.98	2.30	0.00478	0.00122	PASS
25℃	LV	12.19	14.89	0.00649	0.00792	PASS
	HV	6.20	4.23	0.00330	0.00225	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	3MHz	16QAM	QPSK	16QAM	QPSK	
Temperature	Voltage					
Normal (25℃)	Normal	1.98	7.65	0.00105	0.00407	PASS
Extreme (85℃)		6.89	16.87	0.00367	0.00897	PASS
Extreme (80℃)		16.61	9.36	0.00883	0.00498	PASS
Extreme (70℃)		17.34	8.99	0.00923	0.00478	PASS
Extreme (60℃)		2.25	8.85	0.00120	0.00471	PASS
Extreme (50℃)		10.79	9.96	0.00574	0.00530	PASS
Extreme (40℃)		15.10	13.10	0.00803	0.00697	PASS
Extreme (30℃)		1.66	5.43	0.00088	0.00289	PASS
Extreme (20℃)		16.73	7.10	0.00890	0.00378	PASS
Extreme (10℃)		4.42	5.24	0.00235	0.00279	PASS
Extreme (0℃)		6.04	13.36	0.00321	0.00710	PASS



Extreme (-10℃)		5.39	6.80	0.00287	0.00362	PASS
Extreme (-20℃)		11.17	11.86	0.00594	0.00631	PASS
Extreme (-30℃)		3.56	6.59	0.00189	0.00351	PASS
Extreme (-40℃)		17.79	15.67	0.00947	0.00833	PASS
25℃	LV	11.89	14.17	0.00633	0.00754	PASS
	HV	13.52	6.79	0.00719	0.00361	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	5MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	1.61	16.73	0.00086	0.00890	PASS
Extreme (85℃)		8.51	6.83	0.00453	0.00363	PASS
Extreme (80℃)		5.79	15.06	0.00308	0.00801	PASS
Extreme (70℃)		1.68	2.17	0.00090	0.00115	PASS
Extreme (60℃)		6.04	6.49	0.00321	0.00345	PASS
Extreme (50℃)		14.21	17.14	0.00756	0.00912	PASS
Extreme (40℃)		17.57	7.25	0.00935	0.00386	PASS
Extreme (30℃)		7.28	12.53	0.00387	0.00667	PASS
Extreme (20℃)		5.18	8.63	0.00275	0.00459	PASS
Extreme (10℃)		2.37	11.55	0.00126	0.00615	PASS
Extreme (0℃)		3.83	10.93	0.00204	0.00582	PASS
Extreme (-10℃)		16.31	13.97	0.00868	0.00743	PASS
Extreme (-20℃)		7.93	14.14	0.00422	0.00752	PASS
Extreme (-30℃)		1.43	15.89	0.00076	0.00845	PASS
Extreme (-40℃)		6.31	13.37	0.00336	0.00711	PASS
25℃	LV	14.29	7.93	0.00760	0.00422	PASS
	HV	15.69	12.34	0.00835	0.00657	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	10MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	14.31	7.42	0.00761	0.00395	PASS
Extreme (85℃)		14.07	11.29	0.00748	0.00600	PASS
Extreme (80℃)		11.21	8.90	0.00596	0.00473	PASS
Extreme (70℃)		9.32	13.77	0.00496	0.00733	PASS
Extreme (60℃)		11.24	16.37	0.00598	0.00871	PASS
Extreme (50℃)		13.45	14.87	0.00715	0.00791	PASS
Extreme (40℃)		12.22	9.13	0.00650	0.00485	PASS
Extreme (30℃)		9.32	17.35	0.00496	0.00923	PASS
Extreme (20℃)		7.87	6.27	0.00418	0.00334	PASS
Extreme (10℃)		2.18	4.25	0.00116	0.00226	PASS
Extreme (0℃)		1.97	2.08	0.00105	0.00111	PASS



Extreme (-10℃)		8.50	14.05	0.00452	0.00748	PASS
Extreme (-20℃)		9.90	1.92	0.00526	0.00102	PASS
Extreme (-30℃)		14.98	9.89	0.00797	0.00526	PASS
Extreme (-40℃)		3.45	7.90	0.00184	0.00420	PASS
25℃	LV	15.49	1.12	0.00824	0.00059	PASS
	HV	8.66	4.90	0.00461	0.00261	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	15MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	15.54	14.59	0.00827	0.00776	PASS
Extreme (85℃)		11.99	6.66	0.00638	0.00354	PASS
Extreme (80℃)		14.68	6.14	0.00781	0.00326	PASS
Extreme (70℃)		6.77	8.75	0.00360	0.00466	PASS
Extreme (60℃)		5.02	4.77	0.00267	0.00254	PASS
Extreme (50℃)		5.62	4.73	0.00299	0.00252	PASS
Extreme (40℃)		3.19	15.01	0.00170	0.00799	PASS
Extreme (30℃)		10.06	13.10	0.00535	0.00697	PASS
Extreme (20℃)		3.34	7.77	0.00178	0.00413	PASS
Extreme (10℃)		15.55	14.03	0.00827	0.00746	PASS
Extreme (0℃)		15.02	13.29	0.00799	0.00707	PASS
Extreme (-10℃)		10.50	4.98	0.00558	0.00265	PASS
Extreme (-20℃)		10.65	15.11	0.00566	0.00804	PASS
Extreme (-30℃)		11.91	5.08	0.00633	0.00270	PASS
Extreme (-40℃)		16.37	10.95	0.00871	0.00583	PASS
25℃	LV	14.82	3.32	0.00788	0.00177	PASS
	HV	5.59	17.77	0.00297	0.00945	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	20MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	14.07	12.06	0.00749	0.00641	PASS
Extreme (85℃)		14.00	4.58	0.00745	0.00244	PASS
Extreme (80℃)		16.56	13.39	0.00881	0.00712	PASS
Extreme (70℃)		11.86	11.89	0.00631	0.00633	PASS
Extreme (60℃)		11.68	2.99	0.00621	0.00159	PASS
Extreme (50℃)		9.26	2.88	0.00493	0.00153	PASS
Extreme (40℃)		4.83	5.87	0.00257	0.00312	PASS
Extreme (30℃)		13.49	8.94	0.00717	0.00475	PASS
Extreme (20℃)		12.19	1.99	0.00649	0.00106	PASS
Extreme (10℃)		7.11	10.75	0.00378	0.00572	PASS
Extreme (0℃)		7.42	7.86	0.00395	0.00418	PASS



Extreme (-10℃)		17.28	11.04	0.00919	0.00587	PASS
Extreme (-20℃)		4.42	12.93	0.00235	0.00688	PASS
Extreme (-30℃)		17.28	5.41	0.00919	0.00288	PASS
Extreme (-40℃)		5.36	15.48	0.00285	0.00823	PASS
25℃	LV	3.55	1.85	0.00189	0.00098	PASS
	HV	11.10	10.88	0.00590	0.00579	PASS

5.6. Spurious Emissions at Antenna Terminals

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

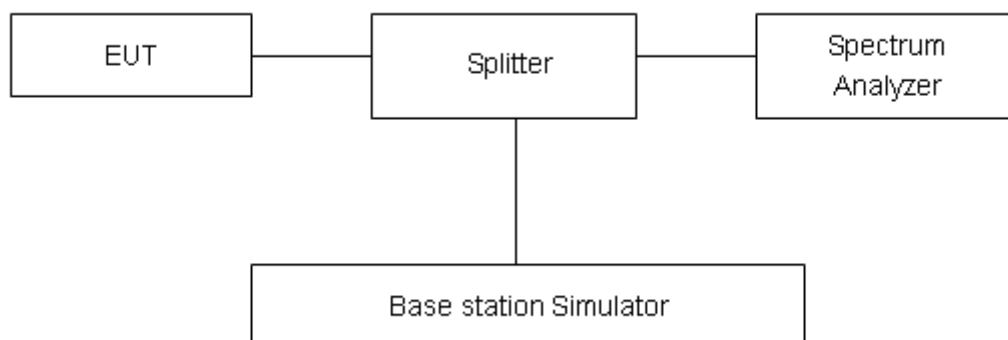
The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 9kHz to the 10th harmonic of the carrier. The peak detector is used.

RBW is set to 100kHz, VBW is set to 300kHz for 30MHz~1GHz

RBW is set to 1MHz, VBW is set to 3MHz for above 1GHz, Sweep is set to ATUO.

The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup



Limits

Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit	-13 dBm
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

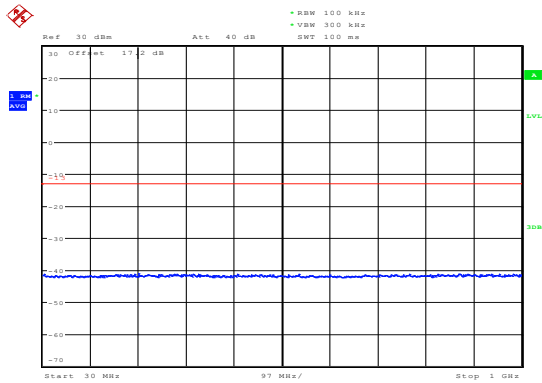
Frequency	Uncertainty
9kHz-1GHz	0.684 dB
1GHz-20GHz	1.407 dB

Test Result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions more than 20 dB below the limit are not reported.

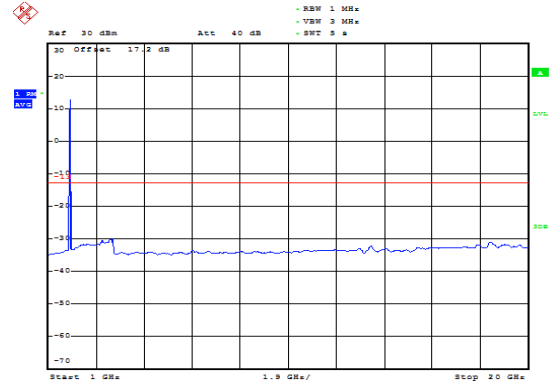
The signal beyond the limit is carrier.

LTE Band 2 1.4MHz CH-Low 30MHz~1GHz



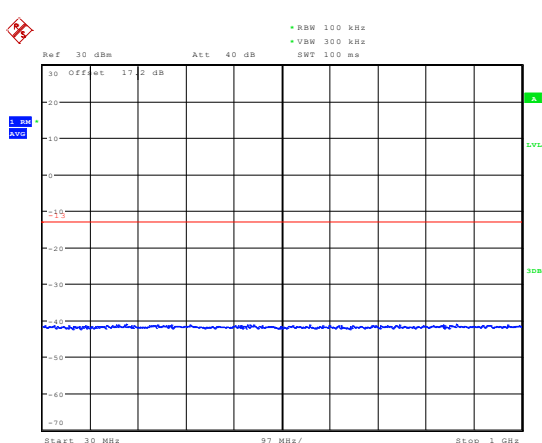
Date: 7.MAY.2020 10:22:24

LTE Band 2 1.4MHz CH-Low 1GHz~20GHz



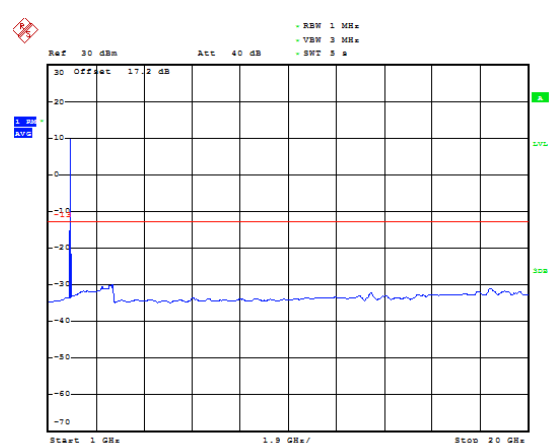
Date: 7.MAY.2020 14:25:39

LTE Band 2 1.4MHz CH-Middle 30MHz~1GHz



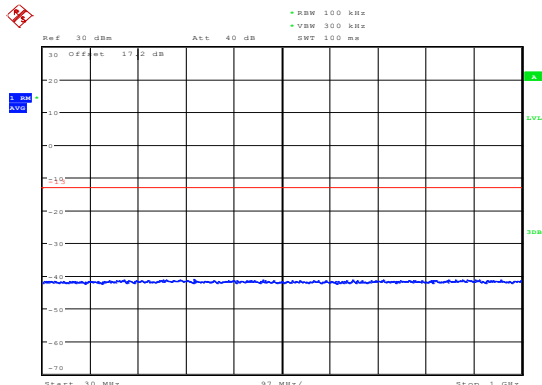
Date: 7.MAY.2020 10:22:39

LTE Band 2 1.4MHz CH-Middle 1GHz~20GHz



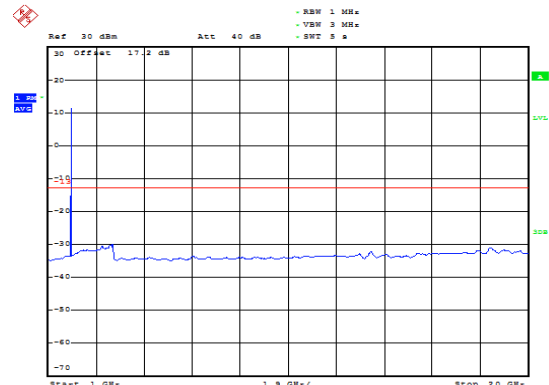
Date: 7.MAY.2020 14:25:25

LTE Band 2 1.4MHz CH-High 30MHz~1GHz



Date: 7.MAY.2020 10:22:47

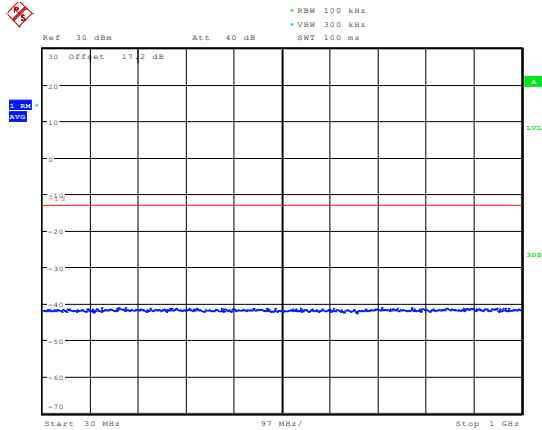
LTE Band 2 1.4MHz CH-High 1GHz~20GHz



Date: 7.MAY.2020 14:30:30

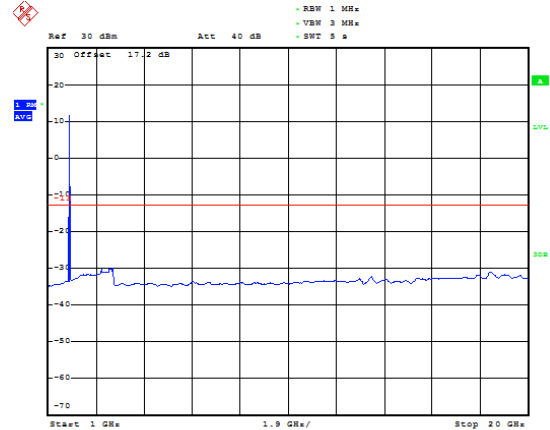


LTE Band 2 3MHz CH-Low 30MHz~1GHz



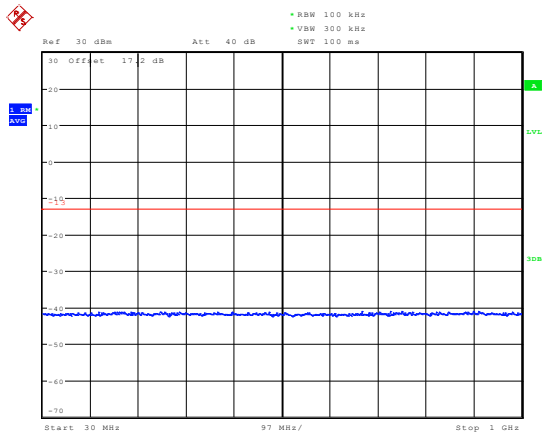
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LTE Band 2 3MHz CH-Low 1GHz~20GHz



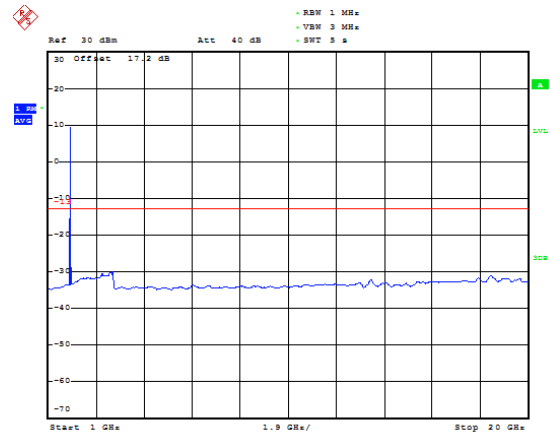
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LTE Band 2 3MHz CH-Middle 30MHz~1GHz



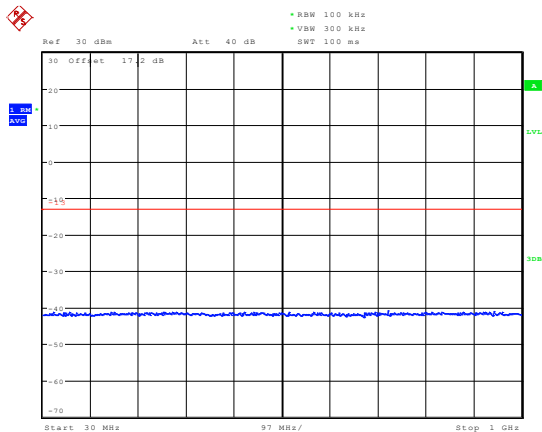
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LTE Band 2 3MHz CH-Middle 1GHz~20GHz



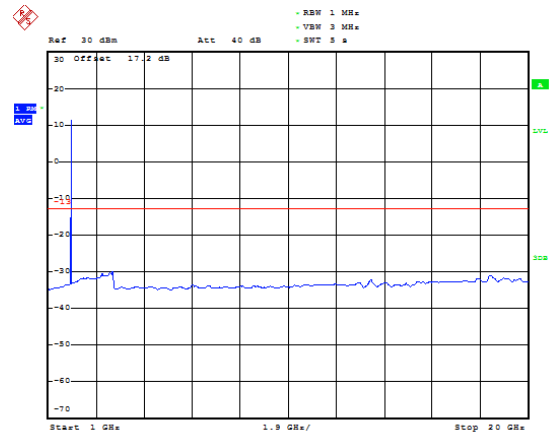
Date: 7.MAY.2020 14:35:07

LTE Band 2 3MHz CH-High 30MHz~1GHz



Date: 7.MAY.2020 10:23:57

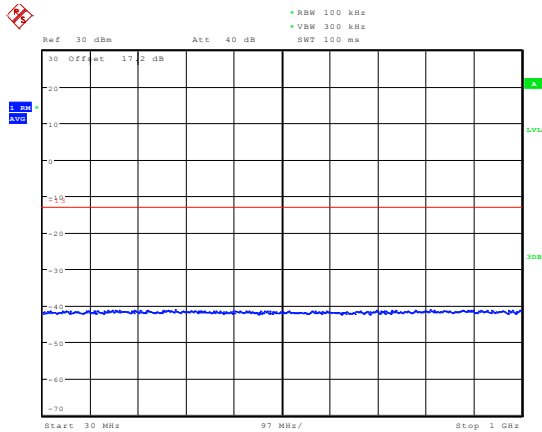
LTE Band 2 3MHz CH-High 1GHz~20GHz



Date: 7.MAY.2020 14:36:03

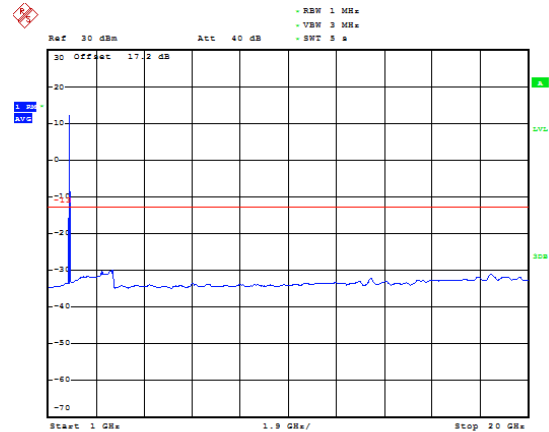


LTE Band 2 5MHz CH-Low 30MHz~1GHz



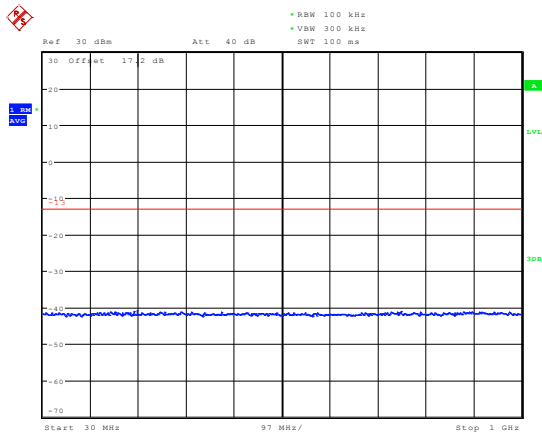
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LTE Band 2 5MHz CH-Low 1GHz~20GHz



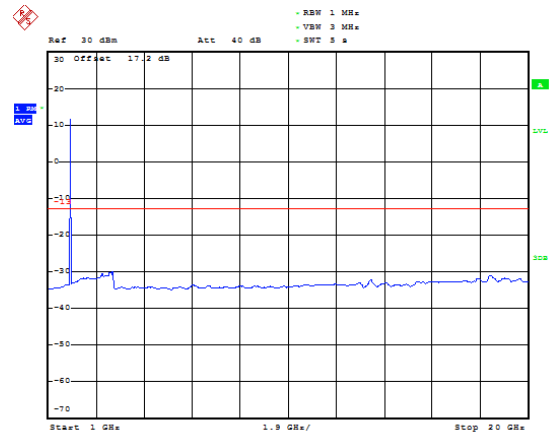
Date: 7.MAY.2020 14:37:09

LTE Band 2 5MHz CH-Middle 30MHz~1GHz



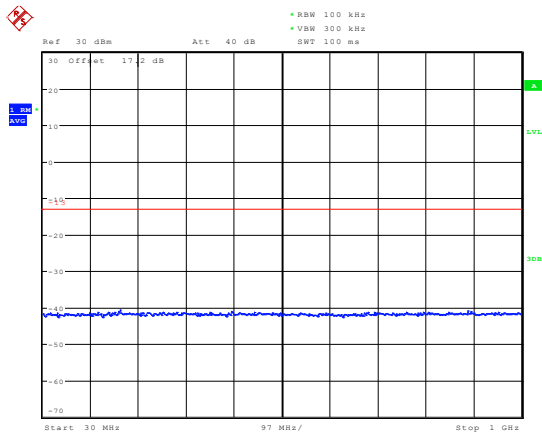
Date: 7.MAY.2020 10:25:29

LTE Band 2 5MHz CH-Middle 1GHz~20GHz



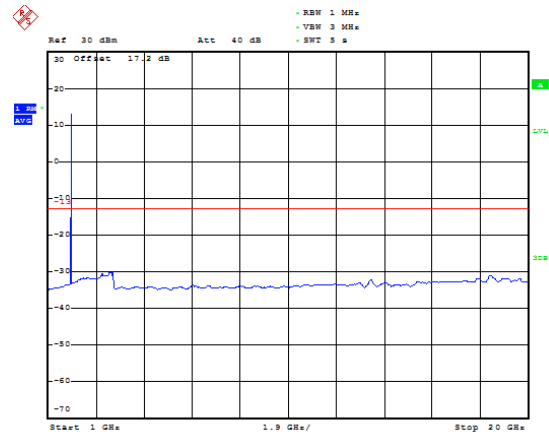
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LTE Band 2 5MHz CH-High 30MHz~1GHz



Date: 7.MAY.2020 10:26:17

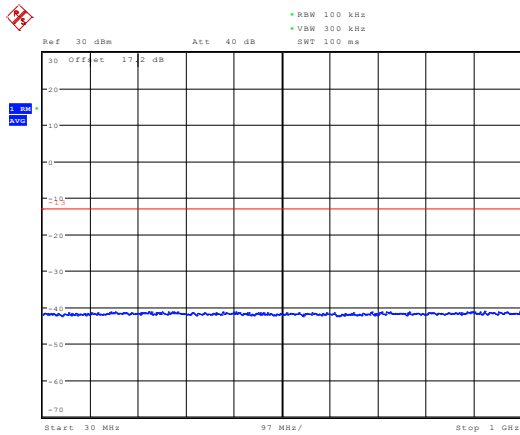
LTE Band 2 5MHz CH-High 1GHz~20GHz



Date: 7.MAY.2020 14:38:52

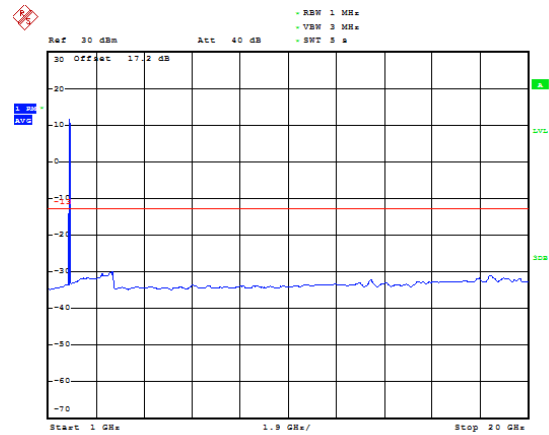


LTE Band 2 10MHz CH-Low 30MHz~1GHz



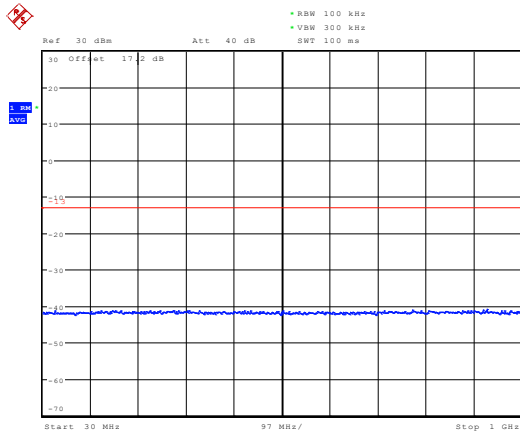
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LTE Band 2 10MHz CH-Low 1GHz~20GHz



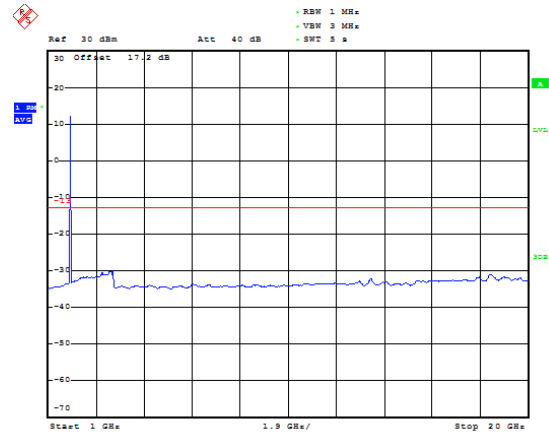
Date: 7.MAY.2020 14:39:29

LTE Band 2 10MHz CH-Middle 30MHz~1GHz



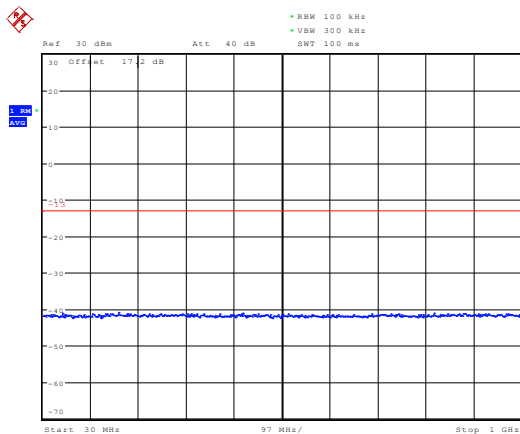
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LTE Band 2 10MHz CH-Middle 1GHz~20GHz



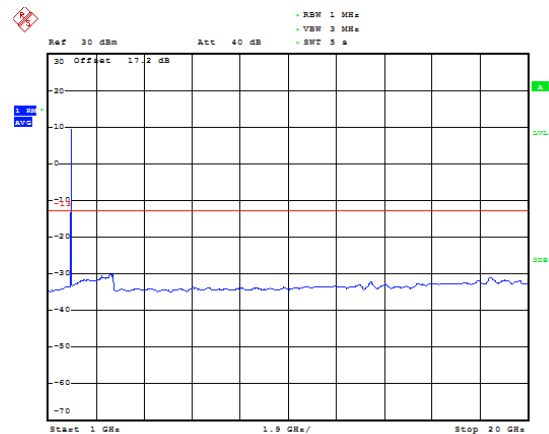
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LTE Band 2 10MHz CH-High 30MHz~1GHz



Date: 7.MAY.2020 10:27:52

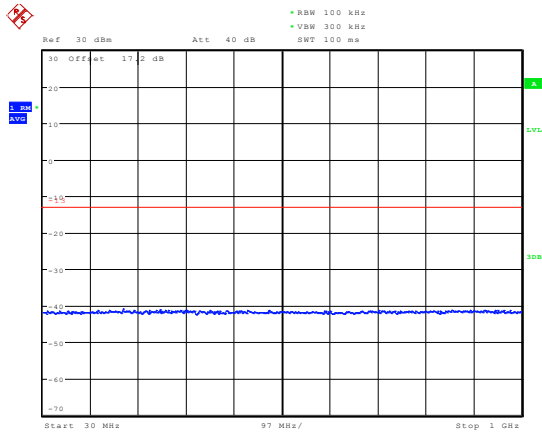
LTE Band 2 10MHz CH-High 1GHz~20GHz



Date: 7.MAY.2020 14:40:17

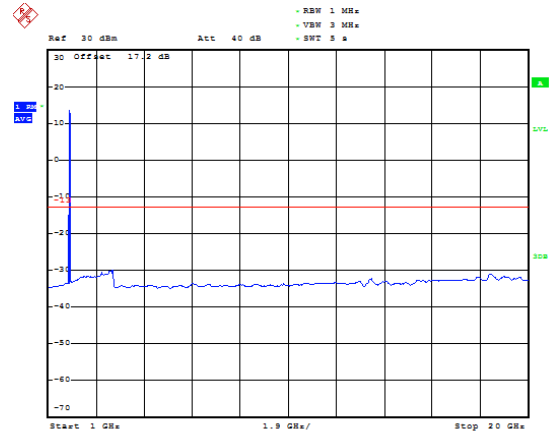


LTE Band 2 15MHz CH-Low 30MHz~1GHz



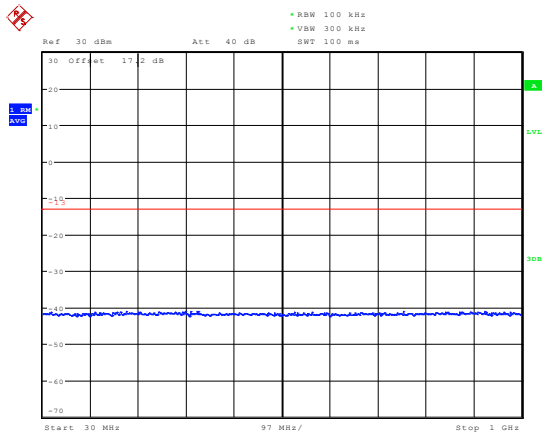
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LTE Band 2 15MHz CH-Low 1GHz~20GHz



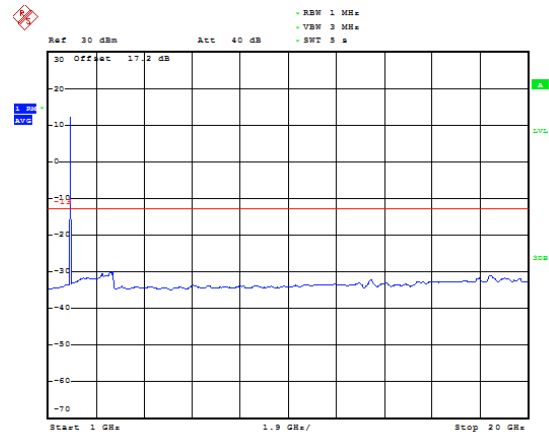
Date: 7.MAY.2020 14:41:24

LTE Band 2 15MHz CH-Middle 30MHz~1GHz



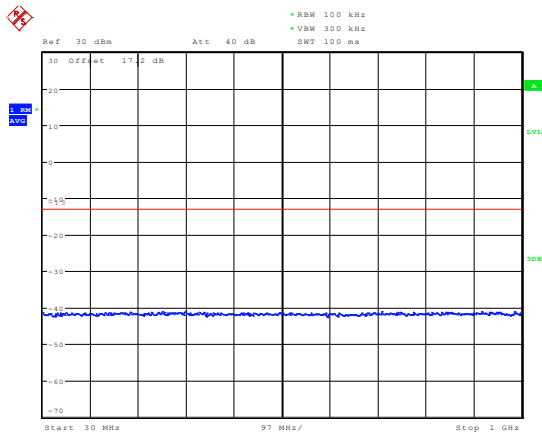
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LTE Band 2 15MHz CH-Middle 1GHz~20GHz



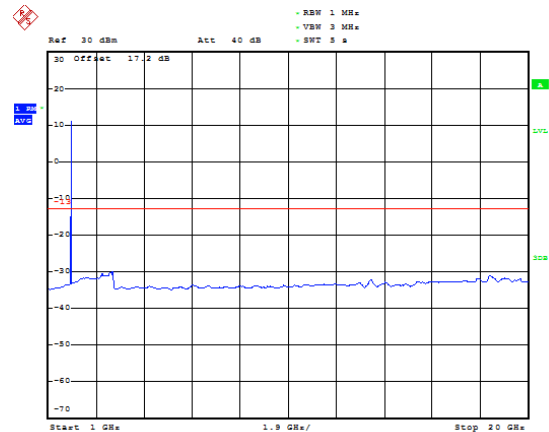
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LTE Band 2 15MHz CH-High 30MHz~1GHz



Date: 7.MAY.2020 10:29:32

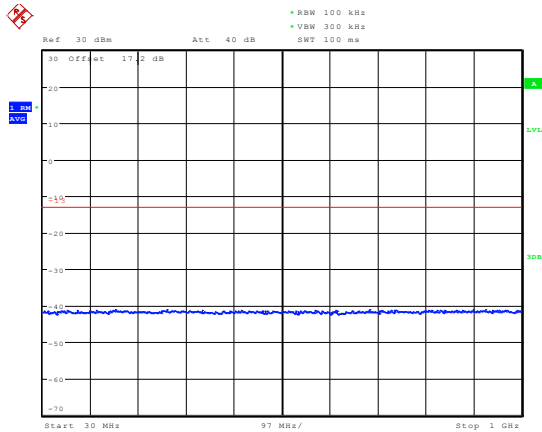
LTE Band 2 15MHz CH-High 1GHz~20GHz



Date: 7.MAY.2020 14:42:22

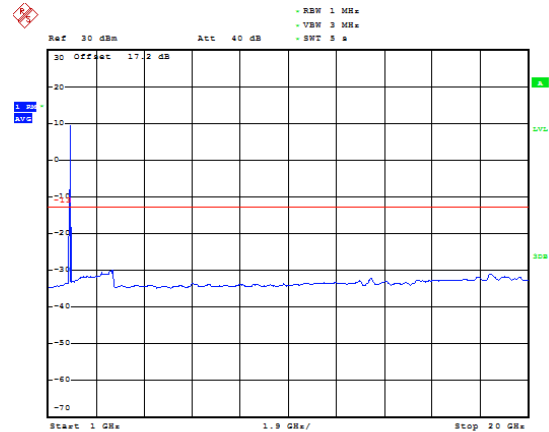


LTE Band 2 20MHz CH-Low 30MHz~1GHz



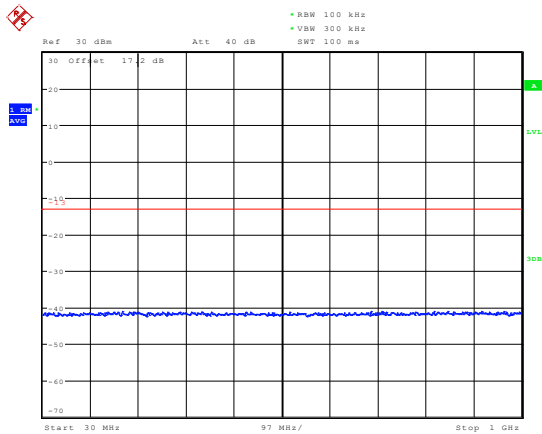
Date: 7.MAY.2020 10:30:46

LTE Band 2 20MHz CH-Low 1GHz~20GHz



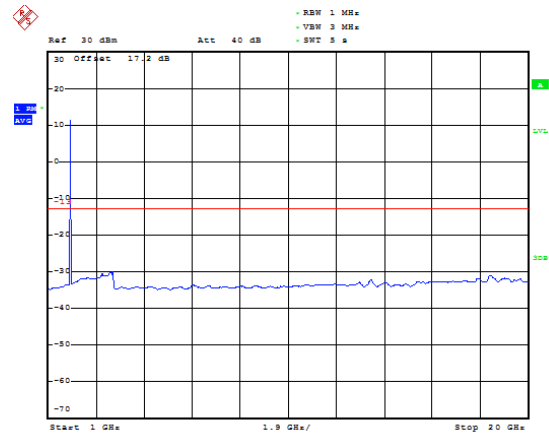
Date: 7.MAY.2020 14:44:36

LTE Band 2 20MHz CH-Middle 30MHz~1GHz



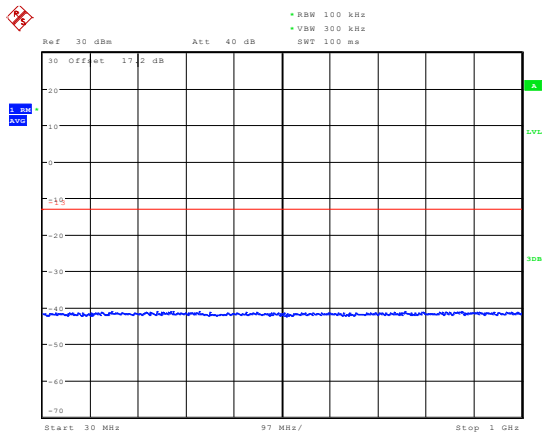
Date: 7.MAY.2020 10:30:54

LTE Band 2 20MHz CH-Middle 1GHz~20GHz



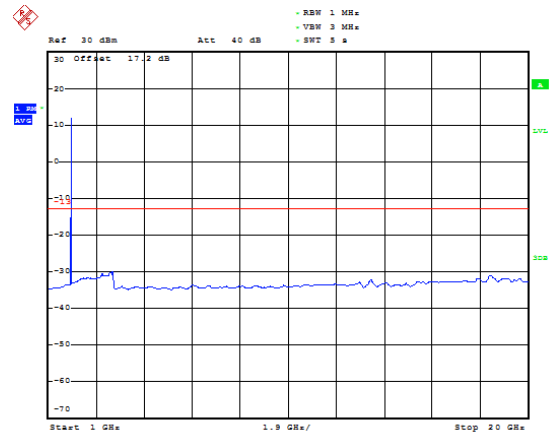
Date: 7.MAY.2020 14:45:12

LTE Band 2 20MHz CH-High 30MHz~1GHz



Date: 7.MAY.2020 10:31:00

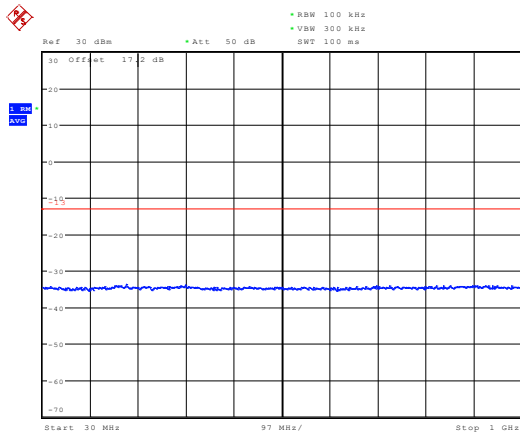
LTE Band 2 20MHz CH-High 1GHz~20GHz



Date: 7.MAY.2020 14:45:38

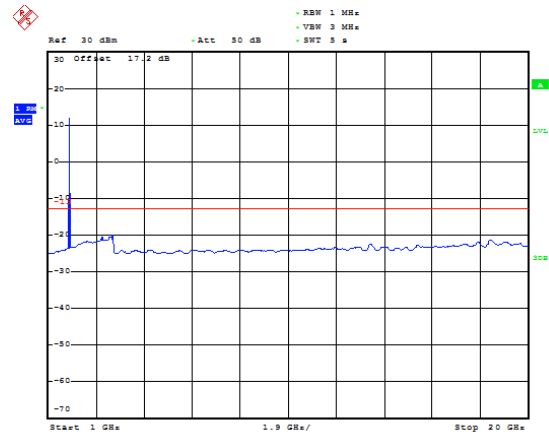


LTE Band 25 1.4MHz CH-Low 30MHz~1GHz



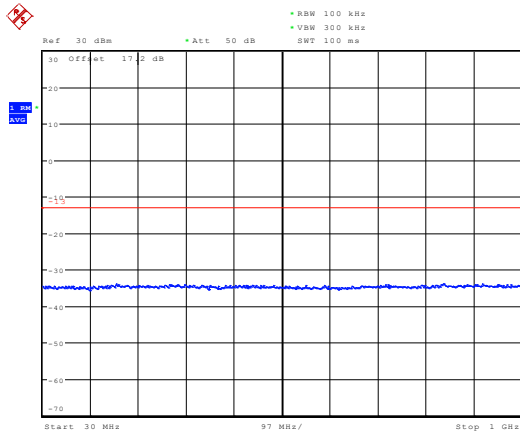
Date: 8.MAY.2020 11:35:17

LTE Band 25 1.4MHz CH-Low 1GHz~20GHz



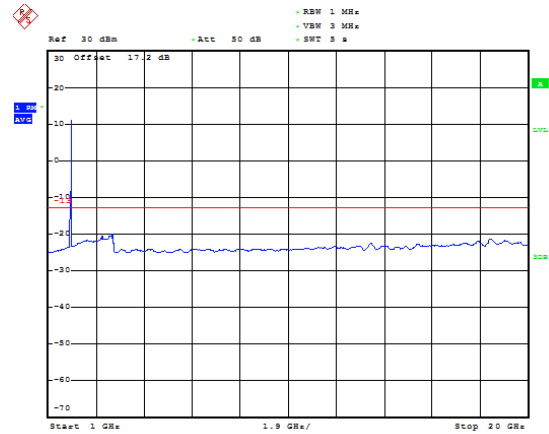
Date: 8.MAY.2020 11:49:59

LTE Band 25 1.4MHz CH-Middle 30MHz~1GHz



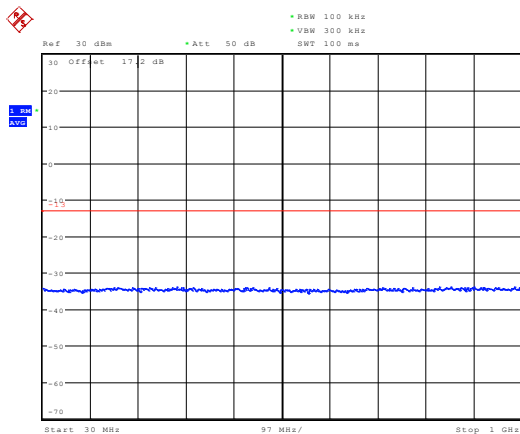
Date: 8.MAY.2020 11:35:25

LTE Band 25 1.4MHz CH-Middle 1GHz~20GHz



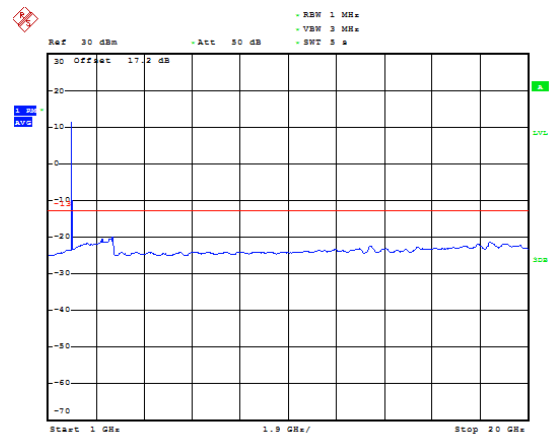
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LTE Band 25 1.4MHz CH-High 30MHz~1GHz



Date: 8.MAY.2020 11:35:33

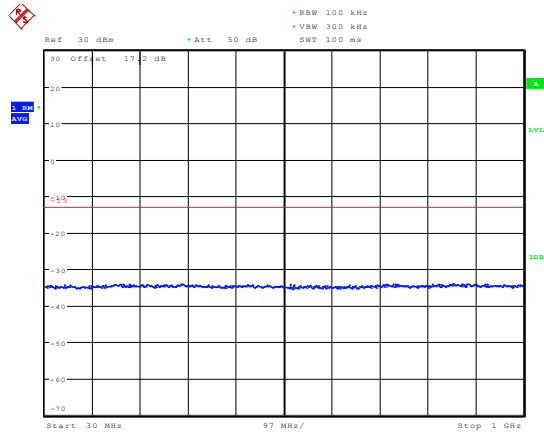
LTE Band 25 1.4MHz CH-High 1GHz~20GHz



Date: 8.MAY.2020 11:51:09

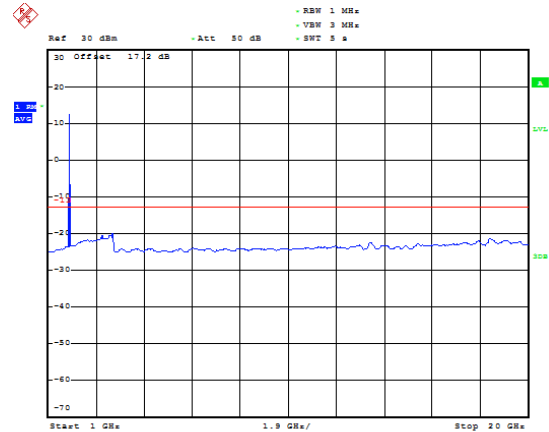


LTE Band 25 3MHz CH-Low 30MHz~1GHz



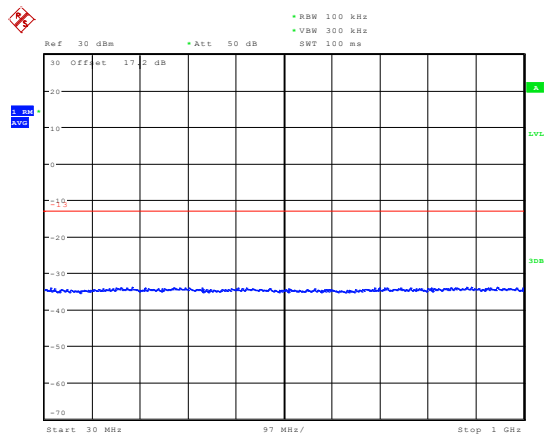
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LTE Band 25 3MHz CH-Low 1GHz~20GHz



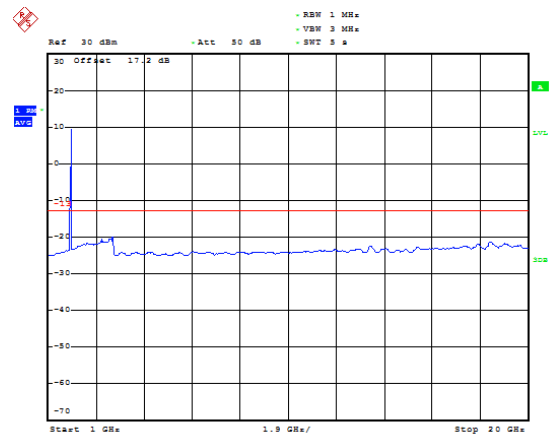
Date: 8.MAY.2020 11:51:39

LTE Band 25 3MHz CH-Middle 30MHz~1GHz



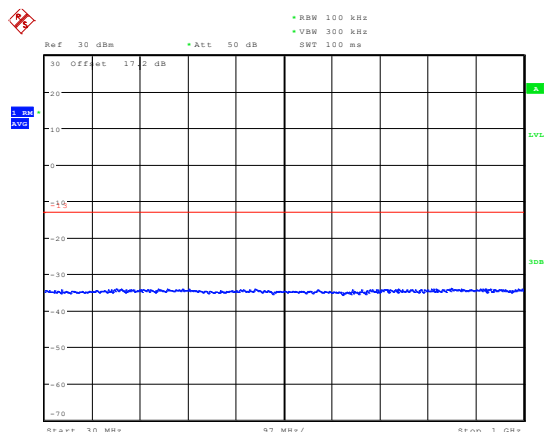
Date: 8.MAY.2020 11:37:10

LTE Band 25 3MHz CH-Middle 1GHz~20GHz



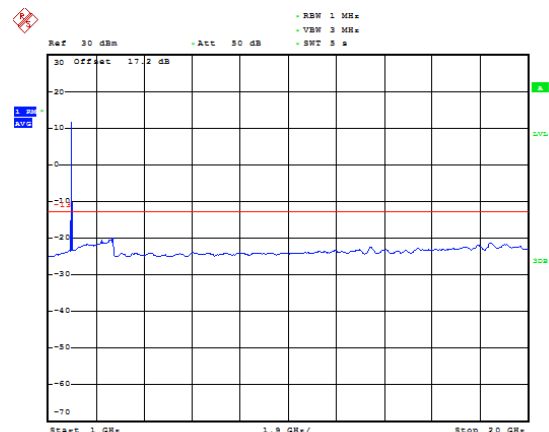
Date: 8.MAY.2020 11:52:09

LTE Band 25 3MHz CH-High 30MHz~1GHz



Date: 8.MAY.2020 11:37:18

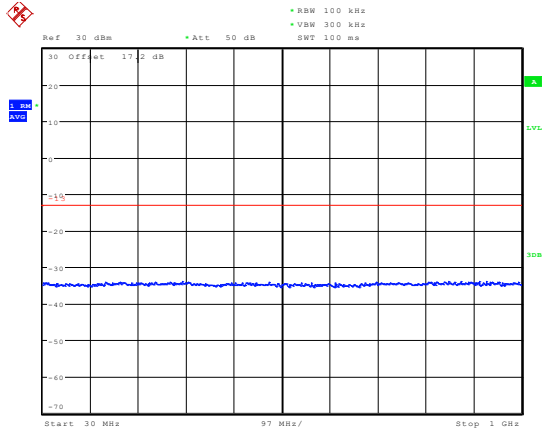
LTE Band 25 3MHz CH-High 1GHz~20GHz



Date: 8.MAY.2020 11:52:39

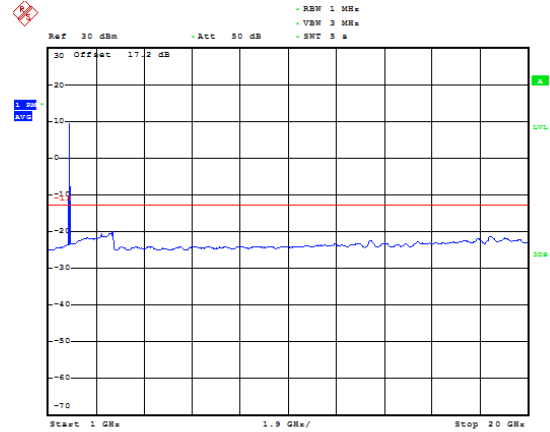


LTE Band 25 5MHz CH-Low 30MHz~1GHz



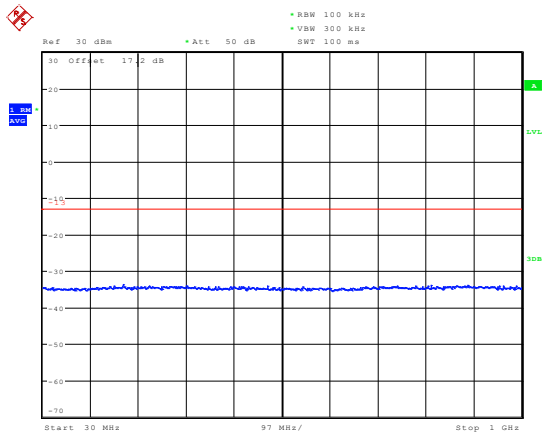
Date: 8.MAY.2020 11:37:43

LTE Band 25 5MHz CH-Low 1GHz~20GHz



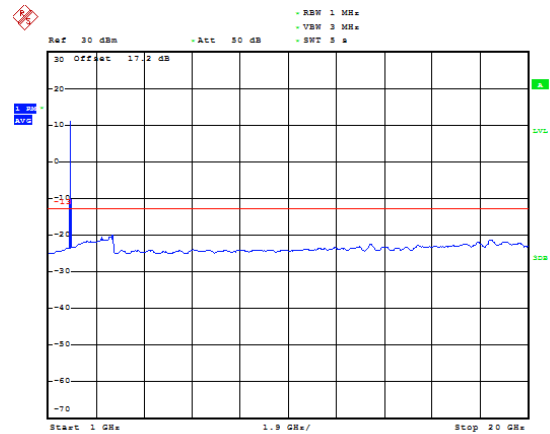
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LTE Band 25 5MHz CH-Middle 30MHz~1GHz



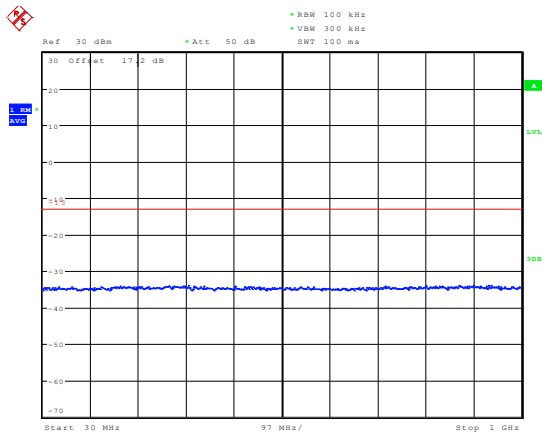
Date: 8.MAY.2020 11:37:51

LTE Band 25 5MHz CH-Middle 1GHz~20GHz



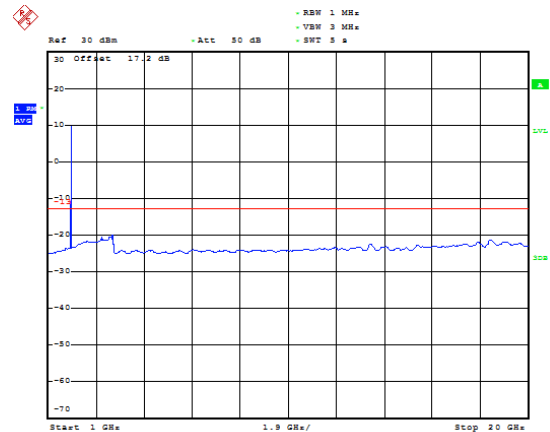
Date: 8.MAY.2020 11:58:20

LTE Band 25 5MHz CH-High 30MHz~1GHz



Date: 8.MAY.2020 11:37:59

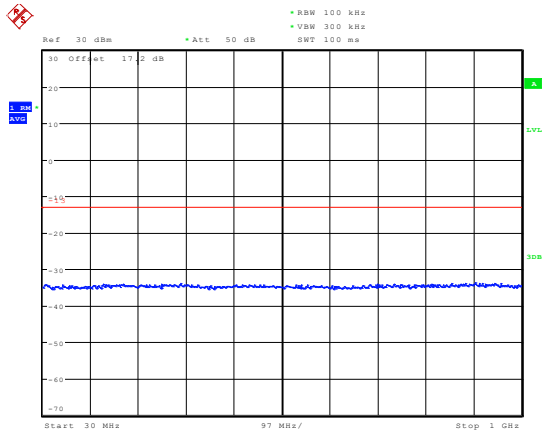
LTE Band 25 5MHz CH-High 1GHz~20GHz



Date: 8.MAY.2020 11:59:31

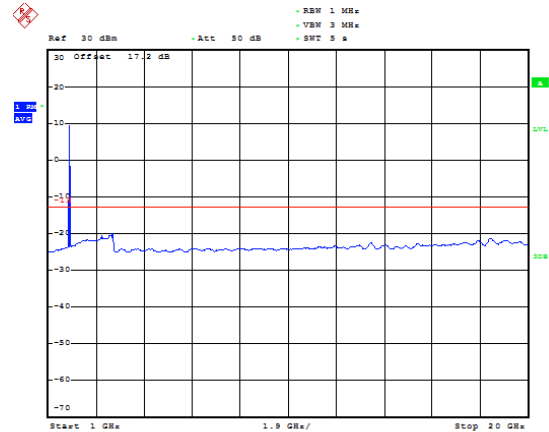


LTE Band 25 10MHz CH-Low 30MHz~1GHz



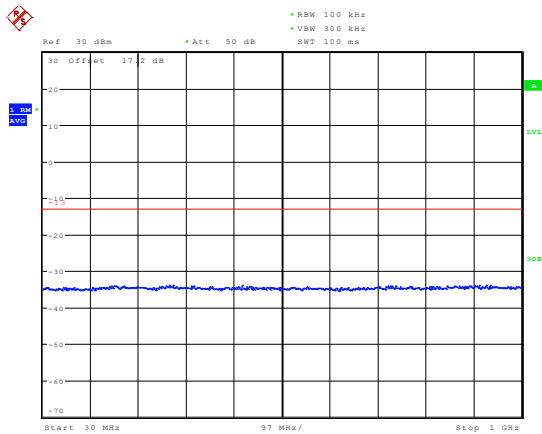
Date: 8.MAY.2020 11:38:21

LTE Band 25 10MHz CH-Low 1GHz~20GHz



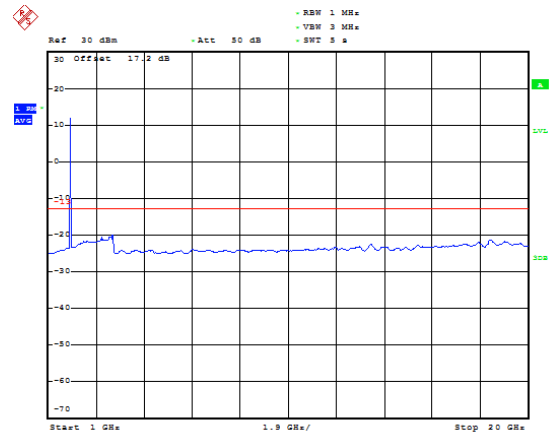
Date: 8.MAY.2020 12:00:19

LTE Band 25 10MHz CH-Middle 30MHz~1GHz



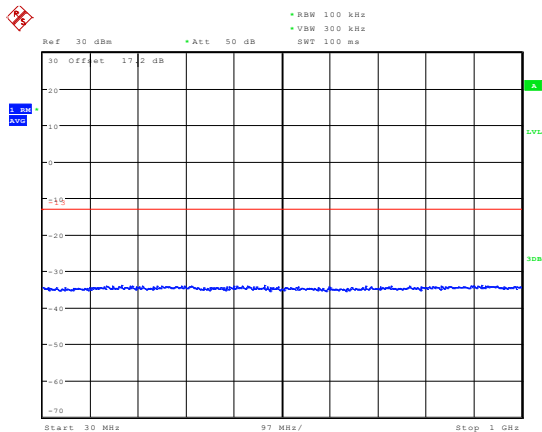
Date: 8.MAY.2020 11:38:29

LTE Band 25 10MHz CH-Middle 1GHz~20GHz



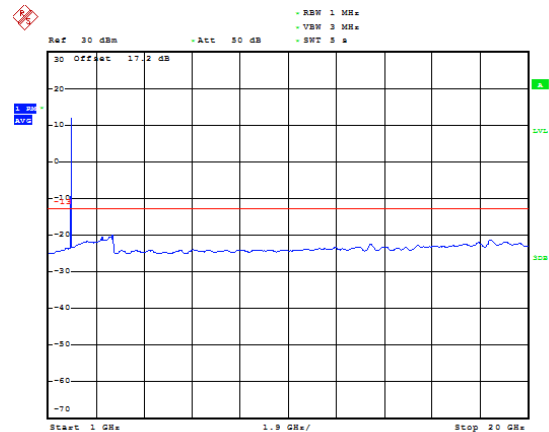
Date: 8.MAY.2020 12:01:24

LTE Band 25 10MHz CH-High 30MHz~1GHz



Date: 8.MAY.2020 11:38:37

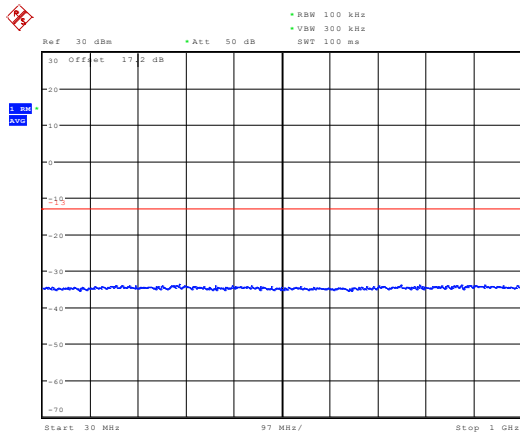
LTE Band 25 10MHz CH-High 1GHz~20GHz



Date: 8.MAY.2020 12:01:52

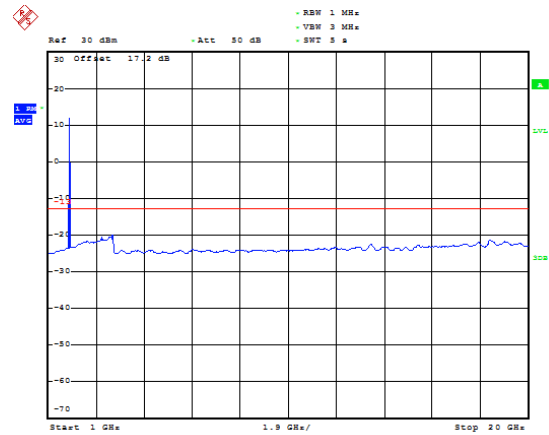


LTE Band 25 15MHz CH-Low 30MHz~1GHz



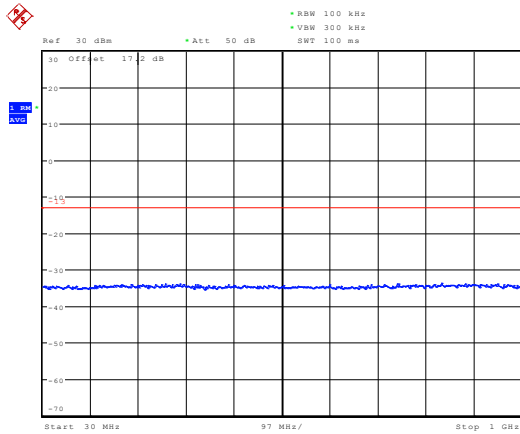
Date: 8.MAY.2020 11:46:28

LTE Band 25 15MHz CH-Low 1GHz~20GHz



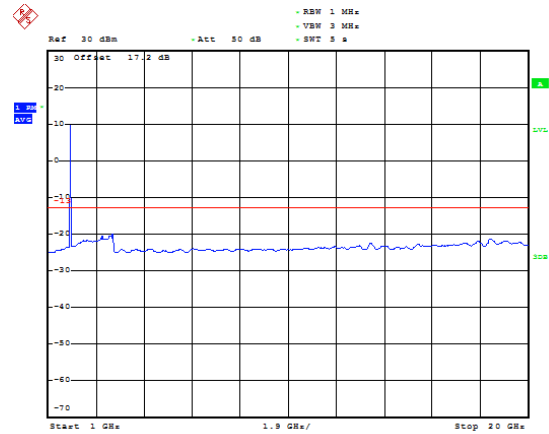
Date: 8.MAY.2020 12:04:16

LTE Band 25 15MHz CH-Middle 30MHz~1GHz



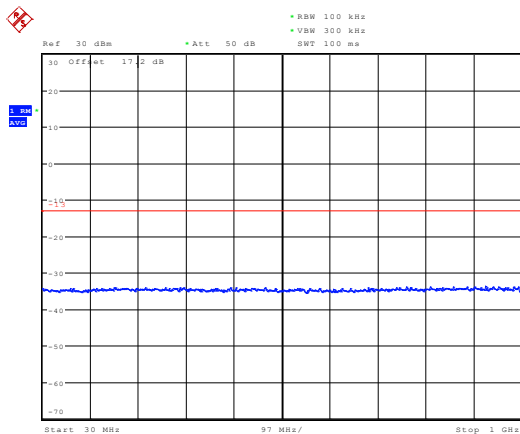
Date: 8.MAY.2020 11:46:46

LTE Band 25 15MHz CH-Middle 1GHz~20GHz



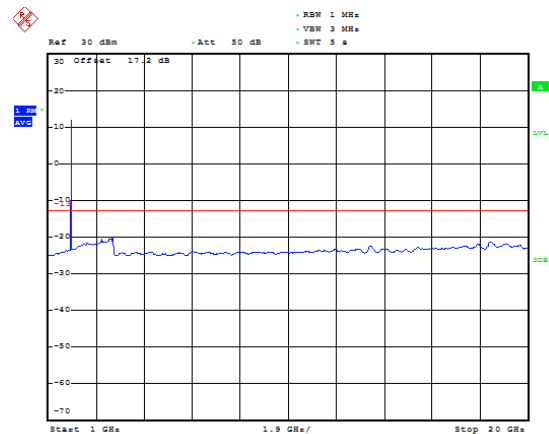
Date: 8.MAY.2020 12:04:46

LTE Band 25 15MHz CH-High 30MHz~1GHz



Date: 8.MAY.2020 11:46:54

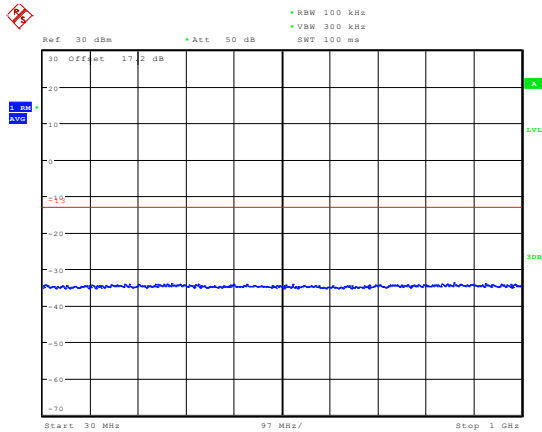
LTE Band 25 15MHz CH-High 1GHz~20GHz



Date: 8.MAY.2020 12:05:19

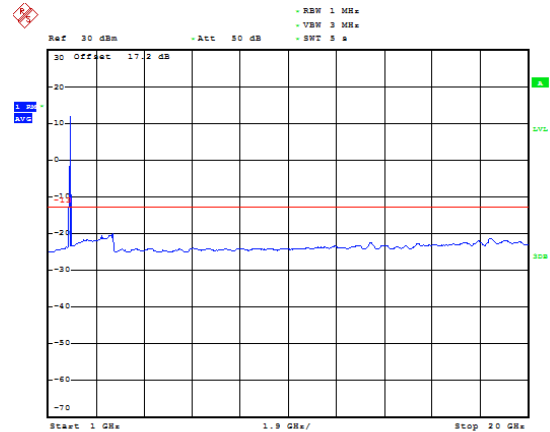


LTE Band 25 20MHz CH-Low 30MHz~1GHz



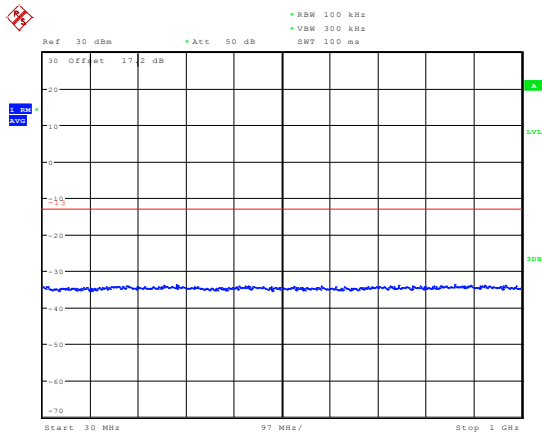
Date: 8.MAY.2020 11:47:26

LTE Band 25 20MHz CH-Low 1GHz~20GHz



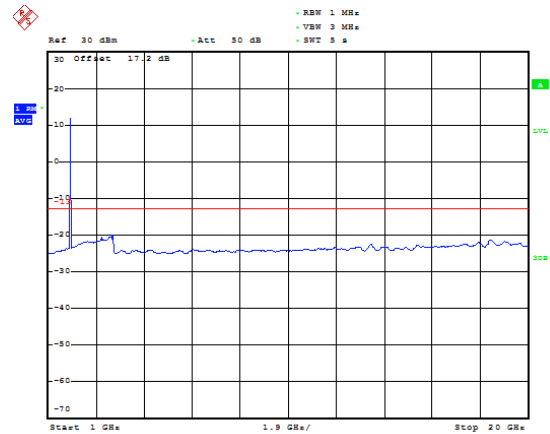
Date: 8.MAY.2020 12:05:45

LTE Band 25 20MHz CH-Middle 30MHz~1GHz



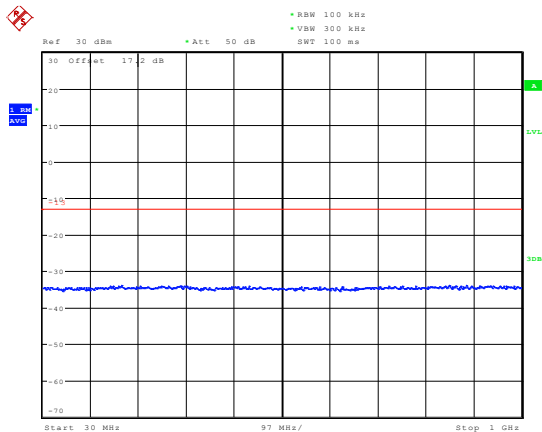
Date: 8.MAY.2020 11:47:34

LTE Band 25 20MHz CH-Middle 1GHz~20GHz



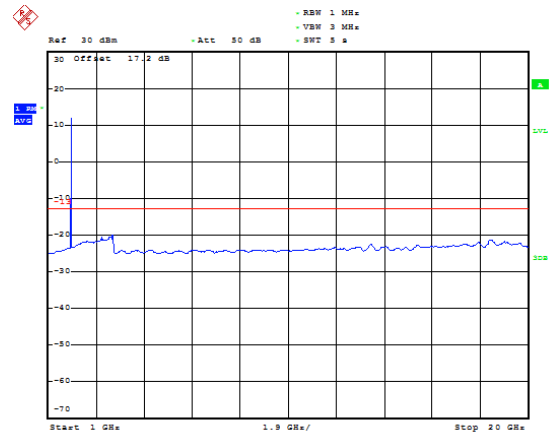
Date: 8.MAY.2020 12:06:24

LTE Band 25 20MHz CH-High 30MHz~1GHz



Date: 8.MAY.2020 11:47:42

LTE Band 25 20MHz CH-High 1GHz~20GHz



Date: 8.MAY.2020 12:06:53

5.7. Radiates Spurious Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

1. The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).
2. Below 1GHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H). Above 1GHz: (Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).
3. A loop antenna, A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
4. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=200Hz,VBW=600Hz for 9kHz150kHz , RBW=10kHz, VBW=30kHz 150kHz-30MHz , RBW=100kHz,VBW=300kHz for 30MHz to 1GHz and RBW=1MHz, VBW=3MHz for above 1GHz, And the maximum value of the receiver should be recorded as (Pr).
5. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
6. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
7. The measurement results are obtained as described below:

$$\text{Power(EIRP)} = \text{PMea} - \text{PAg} - \text{Pcl} + \text{Ga}$$
The measurement results are amend as described below:

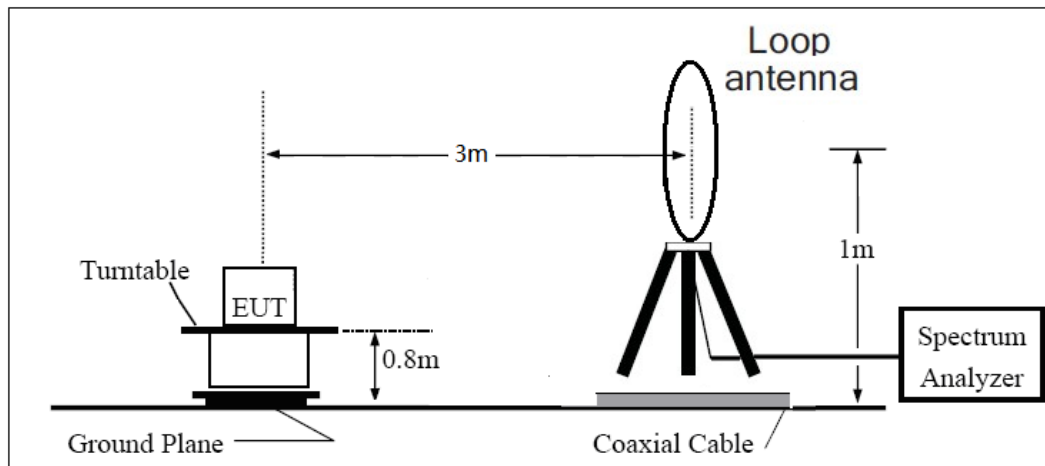
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi)

and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.

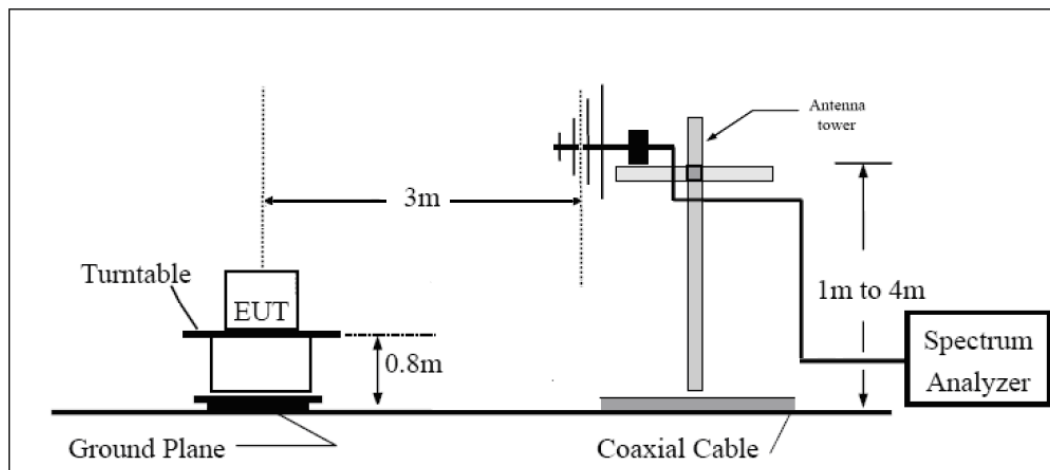
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

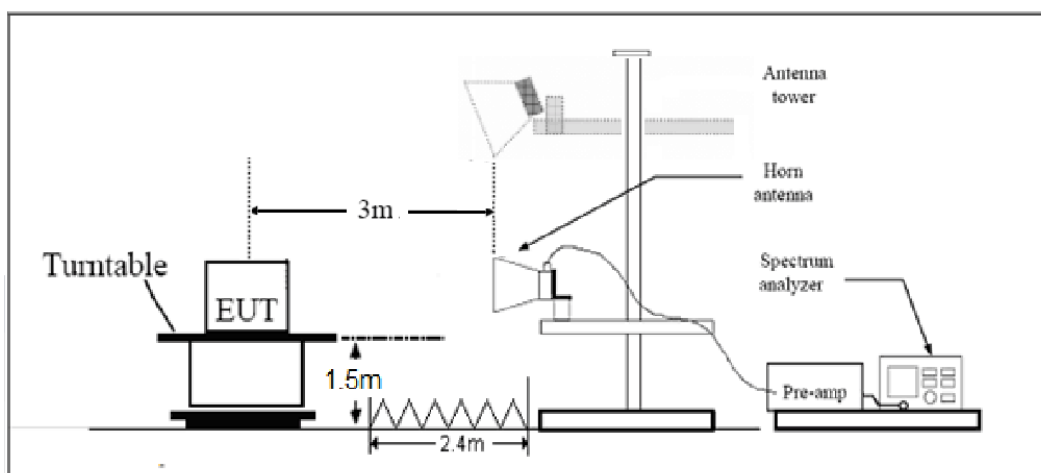
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz





Note: Area side: 2.4mX3.6m

Limits

Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit	-13 dBm
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U = 3.55$ dB.

Test Result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

LTE Band 2 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3759.0	-57.18	5.10	11.05	Horizontal	-51.23	-13.00	38.23	315
3	5638.9	-62.07	5.42	12.65	Horizontal	-54.84	-13.00	41.84	90
4	7520.0	-58.63	6.70	13.85	Horizontal	-51.48	-13.00	38.48	180
5	9400.0	-57.15	7.01	14.75	Horizontal	-49.41	-13.00	36.41	45
6	11280.0	-55.55	7.48	15.95	Horizontal	-47.08	-13.00	34.08	225
7	13160.0	-55.68	7.51	16.55	Horizontal	-46.64	-13.00	33.64	135
8	15040.0	-52.74	8.24	15.35	Horizontal	-45.63	-13.00	32.63	270
9	16920.0	-50.54	8.41	14.95	Horizontal	-44.00	-13.00	31.00	180
10	18800.0	/	/	/	/	/	/	/	/

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Horizontal position.

LTE Band 2 5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3755.6	-63.56	5.10	11.05	Horizontal	-57.61	-13.00	44.61	225
3	5633.6	-64.45	5.42	12.65	Horizontal	-57.22	-13.00	44.22	180
4	7520.0	-58.85	6.70	13.85	Horizontal	-51.70	-13.00	38.70	90
5	9400.0	-56.91	7.01	14.75	Horizontal	-49.17	-13.00	36.17	315
6	11280.0	-55.07	7.48	15.95	Horizontal	-46.60	-13.00	33.60	135
7	13160.0	-55.11	7.51	16.55	Horizontal	-46.07	-13.00	33.07	270
8	15040.0	-54.08	8.24	15.35	Horizontal	-46.97	-13.00	33.97	0
9	16920.0	-51.09	8.41	14.95	Horizontal	-44.55	-13.00	31.55	180
10	18800.0	/	/	/	/	/	/	/	/

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Horizontal position.

LTE Band 2 20MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3742.1	-56.74	5.10	11.05	Horizontal	-50.79	-13.00	37.79	315
3	5613.4	-61.81	5.42	12.65	Horizontal	-54.58	-13.00	41.58	45
4	7484.6	-58.48	6.70	13.85	Horizontal	-51.33	-13.00	38.33	225
5	9400.0	-57.04	7.01	14.75	Horizontal	-49.30	-13.00	36.30	90
6	11280.0	-55.73	7.48	15.95	Horizontal	-47.26	-13.00	34.26	0
7	13160.0	-55.31	7.51	16.55	Horizontal	-46.27	-13.00	33.27	180
8	15040.0	-53.18	8.24	15.35	Horizontal	-46.07	-13.00	33.07	225
9	16920.0	-51.61	8.41	14.95	Horizontal	-45.07	-13.00	32.07	270
10	18800.0	/	/	/	/	/	/	/	/
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2. The worst emission was found in the antenna is Horizontal position.									

LTE Band 25 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3765.0	-61.05	5.10	11.05	Horizontal	-55.10	-13.00	42.10	180
3	5647.5	-62.45	5.42	12.65	Horizontal	-55.22	-13.00	42.22	45
4	7530.0	-58.08	6.70	13.85	Horizontal	-50.93	-13.00	37.93	90
5	9412.5	-56.31	7.01	14.75	Horizontal	-48.57	-13.00	35.57	315
6	11295.0	-55.63	7.48	15.95	Horizontal	-47.16	-13.00	34.16	270
7	13177.5	-55.51	7.51	16.55	Horizontal	-46.47	-13.00	33.47	180
8	15060.0	-55.06	8.24	15.35	Horizontal	-47.95	-13.00	34.95	225
9	16942.5	-50.26	8.41	14.95	Horizontal	-43.72	-13.00	30.72	315
10	18825.0	/	/	/	/	/	/	/	/
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2. The worst emission was found in the antenna is Horizontal position.									



LTE Band 25 5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3765.0	-62.25	5.10	11.05	Horizontal	-54.17	-13.00	41.17	45
3	5647.5	-61.53	5.42	12.65	Horizontal	-55.41	-13.00	42.41	180
4	7530.0	-57.45	6.70	13.85	Horizontal	-50.73	-13.00	37.73	90
5	9412.5	-56.34	7.01	14.75	Horizontal	-48.43	-13.00	35.43	315
6	11295.0	-54.17	7.48	15.95	Horizontal	-48.29	-13.00	35.29	0
7	13177.5	-53.84	7.51	16.55	Horizontal	-46.63	-13.00	33.63	225
8	15060.0	-53.01	8.24	15.35	Horizontal	-45.45	-13.00	32.45	180
9	16942.5	-50.44	8.41	14.95	Horizontal	-44.44	-13.00	31.44	270
10	18825.0	/	/	/	/	/	/	/	/

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Horizontal position.

LTE Band 25 10MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3748.1	-60.75	5.10	11.05	Horizontal	-51.44	-13.00	38.44	180
3	5622.0	-62.13	5.42	12.65	Horizontal	-55.69	-13.00	42.69	315
4	7496.0	-57.65	6.70	13.85	Horizontal	-51.79	-13.00	38.79	45
5	9370.0	-56.24	7.01	14.75	Horizontal	-48.86	-13.00	35.86	135
6	11244.0	-55.17	7.48	15.95	Horizontal	-47.45	-13.00	34.45	225
7	13118.0	-53.84	7.51	16.55	Horizontal	-45.46	-13.00	32.46	270
8	14992.0	-51.91	8.24	15.35	Horizontal	-47.29	-13.00	34.29	180
9	16866.0	-50.24	8.41	14.95	Horizontal	-43.42	-13.00	30.42	0
10	18740.0	/	/	/	/	/	/	/	/

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Horizontal position.

6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMU200	118133	2019-05-19	2020-05-18
Base Station Simulator	R&S	CMU200	118133	2020-05-18	2021-05-17
Base Station Simulator	R&S	CMW500	113824	2019-05-19	2020-05-18
Base Station Simulator	R&S	CMW500	113824	2020-05-18	2021-05-17
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Spectrum Analyzer	Key sight	N9010A	MY50210259	2019-05-19	2020-05-18
Spectrum Analyzer	Key sight	N9010A	MY50210259	2020-05-18	2021-05-17
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2019-05-19	2020-05-18
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2020-05-18	2021-05-17
Signal Analyzer	R&S	FSV30	100815	2019-12-15	2020-12-14
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-09-26	2020-09-25
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2020-11-17
Horn Antenna	R&S	HF907	100126	2018-07-07	2020-07-06
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2020-06-19
Signal generator	R&S	SMB 100A	102594	2019-05-19	2020-05-18
Signal generator	R&S	SMB 100A	102594	2020-05-18	2021-05-17
Climatic Chamber	ESPEC	SU-242	93000506	2017-12-17	2020-12-16
Preamplifier	R&S	SCU18	102327	2019-05-19	2020-05-18
Preamplifier	R&S	SCU18	102327	2020-05-18	2021-05-17
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2019-05-19	2020-05-18



MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2020-05-18	2021-05-17
RF Cable	Agilent	SMA 15cm	0001	2019-12-13	2020-06-12
Software	R&S	EMC32	9.26.0	/	/

*****END OF REPORT *****