

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

Ambient condition

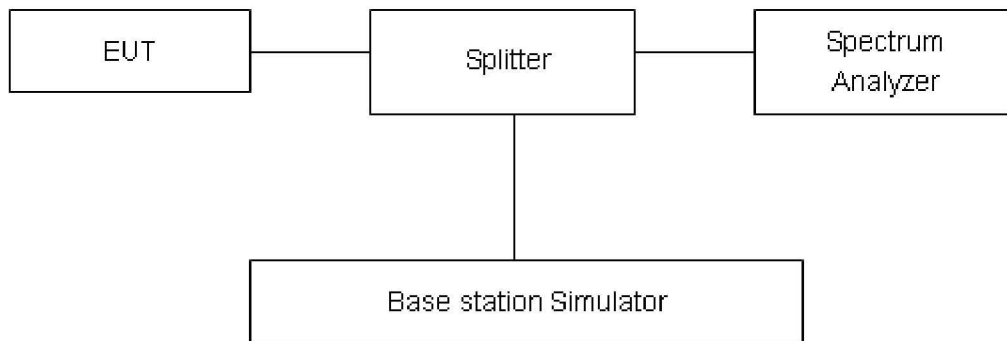
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

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

$$PAPR (dB) = P_{Pk} (dBm) - P_{Avg} (dBm).$$

Test Setup



Limits

According to the Sec. 22.913(d), The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

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	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Conclusion
GPRS 850 (GMSK)	128	824.2	30.69	30.01	0.68	≤13	PASS
	190	836.6	30.82	30.11	0.71	≤13	PASS
	251	848.8	30.92	30.28	0.64	≤13	PASS
EGPRS 850 (8-PSK)	128	824.2	26.84	26.05	0.79	≤13	PASS
	190	836.6	26.97	26.06	0.91	≤13	PASS
	251	848.8	27.00	26.19	0.81	≤13	PASS

LTE Band 5								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Conclusion
QPSK	1.4	20407	824.7	32.89	22.62	10.27	≤13	PASS
		20525	836.5	32.98	22.71	10.27	≤13	PASS
		20643	848.3	34.59	22.86	11.73	≤13	PASS
	3	20415	825.5	32.71	22.70	10.01	≤13	PASS
		20525	836.5	32.95	22.73	10.22	≤13	PASS
		20635	847.5	34.52	22.90	11.62	≤13	PASS
	5	20425	826.5	32.69	22.68	10.01	≤13	PASS
		20525	836.5	33.21	22.69	10.52	≤13	PASS
		20625	846.5	32.99	22.85	10.14	≤13	PASS
	10	20450	829	32.56	22.65	9.91	≤13	PASS
		20525	836.5	32.60	22.64	9.96	≤13	PASS
		20600	844	32.87	22.81	10.06	≤13	PASS
16QAM	1.4	20407	824.7	33.44	22.67	10.77	≤13	PASS
		20525	836.5	34.24	23.20	11.04	≤13	PASS
		20643	848.3	34.79	23.00	11.79	≤13	PASS
	3	20415	825.5	34.01	22.70	11.31	≤13	PASS
		20525	836.5	34.24	23.25	10.99	≤13	PASS
		20635	847.5	35.15	23.04	12.11	≤13	PASS
	5	20425	826.5	33.86	22.67	11.19	≤13	PASS
		20525	836.5	34.41	23.20	11.21	≤13	PASS
		20625	846.5	33.85	23.00	10.85	≤13	PASS
	10	20450	829	33.35	22.65	10.70	≤13	PASS
		20525	836.5	33.28	23.16	10.12	≤13	PASS
		20600	844	32.99	22.97	10.02	≤13	PASS

LTE Band 26								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Conclusion
QPSK	1.4	26797	824.7	33.12	22.76	10.36	≤13	PASS
		26915	836.5	34.32	22.74	11.58	≤13	PASS
		27033	848.3	34.27	22.75	11.52	≤13	PASS
	3	26805	825.5	32.83	22.74	10.09	≤13	PASS
		26915	836.5	34.86	22.73	12.13	≤13	PASS
		27025	847.5	34.05	22.73	11.32	≤13	PASS
	5	26815	826.5	33.04	22.82	10.22	≤13	PASS
		26915	836.5	32.82	22.75	10.07	≤13	PASS
		27015	846.5	33.18	22.77	10.41	≤13	PASS
	10	26840	829	33.13	22.80	10.33	≤13	PASS
		26915	836.5	33.01	22.71	10.30	≤13	PASS
		26990	844	32.72	22.72	10.00	≤13	PASS
	15	26865	831.5	31.94	22.77	9.17	≤13	PASS
		26915	836.5	32.64	22.66	9.98	≤13	PASS
		26965	841.5	33.86	22.68	11.18	≤13	PASS
16QAM	1.4	26797	824.7	34.28	23.10	11.18	≤13	PASS
		26915	836.5	36.11	23.19	12.92	≤13	PASS
		27033	848.3	35.77	22.87	12.90	≤13	PASS
	3	26805	825.5	34.12	23.08	11.04	≤13	PASS
		26915	836.5	35.43	23.15	12.28	≤13	PASS
		27025	847.5	35.59	22.82	12.77	≤13	PASS
	5	26815	826.5	33.94	23.11	10.83	≤13	PASS
		26915	836.5	34.20	23.20	11.00	≤13	PASS
		27015	846.5	33.77	22.86	10.91	≤13	PASS
	10	26840	829	33.08	23.08	10.00	≤13	PASS
		26915	836.5	33.76	23.15	10.61	≤13	PASS
		26990	844	33.41	22.82	10.59	≤13	PASS
	15	26865	831.5	32.47	23.06	9.41	≤13	PASS
		26915	836.5	32.80	23.11	9.69	≤13	PASS
		26965	841.5	33.03	22.79	10.24	≤13	PASS

5.6. Frequency Stability

Ambient condition

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

Method of Measurement

1. 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)

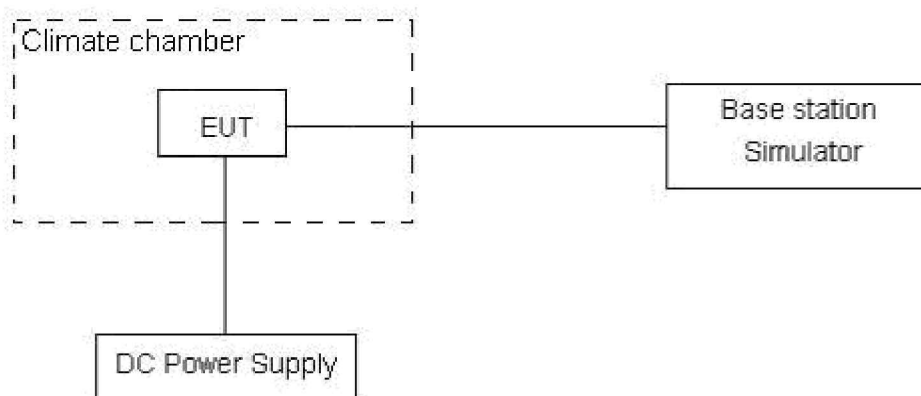
The frequency stability shall be measured with variation of primary supply voltage as follows:

(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

According to the Sec. 22.355, the frequency stability of the carrier shall be accurate to within 2.5 ppm of the received frequency for mobile stations.

Limits	≤ 2.5 ppm
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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 $k = 3$, $U = 0.01$ ppm.

Test Result

Mode	Test status	Test Results (ppm)		Limit (ppm)	Conclusion
		GPRS (GMSK)	EGPRS (8PSK)		
GSM 850 Middle Channel	-40°C/Normal Voltage	0.0211	0.0202	2.5	PASS
	-30°C/Normal Voltage	0.0294	0.0242	2.5	PASS
	-20°C/Normal Voltage	0.0297	0.0257	2.5	PASS
	-10°C/Normal Voltage	0.0292	0.0253	2.5	PASS
	0°C/Normal Voltage	0.0301	0.0250	2.5	PASS
	10°C/Normal Voltage	0.0333	0.0241	2.5	PASS
	20°C/Normal Voltage	0.0395	0.0317	2.5	PASS
	30°C/Normal Voltage	0.0312	0.0262	2.5	PASS
	40°C/Normal Voltage	0.0343	0.0248	2.5	PASS
	50°C/Normal Voltage	0.0355	0.0288	2.5	PASS
	60°C/Normal Voltage	0.0325	0.0302	2.5	PASS
	70°C/Normal Voltage	0.0349	0.0273	2.5	PASS
	80°C/Normal Voltage	0.0350	0.0266	2.5	PASS
	85°C/Normal Voltage	0.0338	0.0279	2.5	PASS
	20°C/Minimum Voltage	0.0273	0.0234	2.5	PASS
	20°C/Maximum Voltage	0.0217	0.0208	2.5	PASS



Bandwidth	Test status	LTE Band 5 Middle Channel Test Results (ppm)			
		QPSK	16QAM	Limit (ppm)	Conclusion
1.4MHz	-40°C/Normal Voltage	-0.00147	-0.01488	2.5	PASS
	-30°C/Normal Voltage	-0.00025	-0.01676	2.5	PASS
	-20°C/Normal Voltage	-0.00142	-0.01840	2.5	PASS
	-10°C/Normal Voltage	-0.00279	-0.01732	2.5	PASS
	0°C/Normal Voltage	-0.00198	-0.02276	2.5	PASS
	10°C/Normal Voltage	-0.00053	-0.02736	2.5	PASS
	20°C/Normal Voltage	-0.00059	-0.01711	2.5	PASS
	30°C/Normal Voltage	0.00234	-0.01736	2.5	PASS
	40°C/Normal Voltage	0.00104	-0.02404	2.5	PASS
	50°C/Normal Voltage	0.00429	-0.01883	2.5	PASS
	60°C/Normal Voltage	0.00430	-0.02723	2.5	PASS
	70°C/Normal Voltage	-0.00128	-0.02343	2.5	PASS
	80°C/Normal Voltage	-0.00143	-0.01695	2.5	PASS
	85°C/Normal Voltage	0.00212	-0.01592	2.5	PASS
	20°C/Minimum Voltage	-0.00146	-0.01522	2.5	PASS
	20°C/Maximum Voltage	0.00099	-0.02527	2.5	PASS
3MHz	-40°C/Normal Voltage	-0.00178	-0.01886	2.5	PASS
	-30°C/Normal Voltage	-0.00259	-0.01704	2.5	PASS
	-20°C/Normal Voltage	-0.00334	-0.01677	2.5	PASS
	-10°C/Normal Voltage	-0.00158	-0.02166	2.5	PASS
	0°C/Normal Voltage	-0.00031	-0.01933	2.5	PASS
	10°C/Normal Voltage	-0.00438	-0.01900	2.5	PASS
	20°C/Normal Voltage	-0.00491	-0.01522	2.5	PASS
	30°C/Normal Voltage	-0.00392	-0.00512	2.5	PASS
	40°C/Normal Voltage	-0.00197	-0.00279	2.5	PASS
	50°C/Normal Voltage	-0.00160	0.00207	2.5	PASS
	60°C/Normal Voltage	-0.00361	0.00385	2.5	PASS
	70°C/Normal Voltage	-0.00209	-0.00123	2.5	PASS
	80°C/Normal Voltage	-0.00061	0.00393	2.5	PASS
	85°C/Normal Voltage	-0.00164	0.00286	2.5	PASS
	20°C/Minimum Voltage	-0.00197	0.00123	2.5	PASS
	20°C/Maximum Voltage	0.00099	0.00146	2.5	PASS
5MHz	-40°C/Normal Voltage	-0.00219	-0.02227	2.5	PASS
	-30°C/Normal Voltage	-0.00092	-0.01994	2.5	PASS
	-20°C/Normal Voltage	-0.00499	-0.01961	2.5	PASS



	-10°C/Normal Voltage	-0.00552	-0.01583	2.5	PASS
	0°C/Normal Voltage	-0.00453	-0.00573	2.5	PASS
	10°C/Normal Voltage	-0.00258	-0.00340	2.5	PASS
	20°C/Normal Voltage	-0.00221	0.00146	2.5	PASS
	30°C/Normal Voltage	-0.00422	0.00324	2.5	PASS
	40°C/Normal Voltage	-0.00056	-0.01977	2.5	PASS
	50°C/Normal Voltage	-0.00463	-0.01600	2.5	PASS
	60°C/Normal Voltage	-0.00516	-0.00589	2.5	PASS
	70°C/Normal Voltage	-0.00417	-0.00356	2.5	PASS
	80°C/Normal Voltage	-0.00222	0.00129	2.5	PASS
	85°C/Normal Voltage	-0.00185	0.00307	2.5	PASS
	20°C/Minimum Voltage	-0.00386	-0.02244	2.5	PASS
	20°C/Maximum Voltage	-0.00183	-0.02011	2.5	PASS
	10MHz	-40°C/Normal Voltage	-0.00252	0.01378	2.5
-30°C/Normal Voltage		-0.00126	0.00426	2.5	PASS
-20°C/Normal Voltage		-0.00532	-0.00082	2.5	PASS
-10°C/Normal Voltage		-0.00586	0.01753	2.5	PASS
0°C/Normal Voltage		-0.00487	0.00326	2.5	PASS
10°C/Normal Voltage		-0.00292	0.00164	2.5	PASS
20°C/Normal Voltage		-0.00255	0.00186	2.5	PASS
30°C/Normal Voltage		-0.00455	-0.01739	2.5	PASS
40°C/Normal Voltage		-0.00090	-0.01339	2.5	PASS
50°C/Normal Voltage		-0.00496	-0.01176	2.5	PASS
60°C/Normal Voltage		-0.00550	-0.01542	2.5	PASS
70°C/Normal Voltage		-0.00243	-0.00532	2.5	PASS
80°C/Normal Voltage		-0.00094	-0.00299	2.5	PASS
85°C/Normal Voltage		-0.00197	0.00186	2.5	PASS
20°C/Minimum Voltage	-0.00231	0.00365	2.5	PASS	
20°C/Maximum Voltage	0.00066	-0.01578	2.5	PASS	

Bandwidth	Test status	LTE Band 26 Middle Channel Test Results (ppm)			
		QPSK	16QAM	Limit (ppm)	Conclusion
1.4MHz	-40°C/Normal Voltage	-0.00255	-0.00904	2.5	PASS
	-30°C/Normal Voltage	-0.00082	-0.00258	2.5	PASS
	-20°C/Normal Voltage	-0.00245	-0.00454	2.5	PASS
	-10°C/Normal Voltage	-0.00195	-0.00467	2.5	PASS
	0°C/Normal Voltage	-0.00237	-0.00055	2.5	PASS
	10°C/Normal Voltage	-0.00209	-0.00196	2.5	PASS



	20°C/Normal Voltage	-0.00316	0.00197	2.5	PASS
	30°C/Normal Voltage	0.00110	0.00117	2.5	PASS
	40°C/Normal Voltage	0.00018	-0.01288	2.5	PASS
	50°C/Normal Voltage	-0.00241	-0.01149	2.5	PASS
	60°C/Normal Voltage	-0.00175	-0.00275	2.5	PASS
	70°C/Normal Voltage	-0.00218	-0.00581	2.5	PASS
	80°C/Normal Voltage	-0.00326	-0.00439	2.5	PASS
	85°C/Normal Voltage	-0.00109	-0.00863	2.5	PASS
	20°C/Minimum Voltage	-0.00053	-0.00961	2.5	PASS
	20°C/Maximum Voltage	-0.00207	-0.01095	2.5	PASS
3MHz	-40°C/Normal Voltage	-0.00073	-0.01100	2.5	PASS
	-30°C/Normal Voltage	-0.00258	-0.01870	2.5	PASS
	-20°C/Normal Voltage	-0.00261	-0.01069	2.5	PASS
	-10°C/Normal Voltage	-0.00302	-0.01623	2.5	PASS
	0°C/Normal Voltage	-0.00081	-0.00377	2.5	PASS
	10°C/Normal Voltage	-0.00209	-0.01283	2.5	PASS
	20°C/Normal Voltage	-0.00219	-0.01866	2.5	PASS
	30°C/Normal Voltage	-0.00185	-0.02007	2.5	PASS
	40°C/Normal Voltage	-0.00112	-0.01834	2.5	PASS
	50°C/Normal Voltage	0.00104	-0.01458	2.5	PASS
	60°C/Normal Voltage	-0.00322	-0.01830	2.5	PASS
	70°C/Normal Voltage	-0.00081	-0.01652	2.5	PASS
	80°C/Normal Voltage	-0.00292	-0.01957	2.5	PASS
	85°C/Normal Voltage	-0.00253	-0.01998	2.5	PASS
20°C/Minimum Voltage	-0.00082	-0.02011	2.5	PASS	
20°C/Maximum Voltage	-0.00062	-0.01874	2.5	PASS	
5MHz	-40°C/Normal Voltage	-0.00377	-0.01621	2.5	PASS
	-30°C/Normal Voltage	-0.00441	-0.01817	2.5	PASS
	-20°C/Normal Voltage	-0.00294	-0.01724	2.5	PASS
	-10°C/Normal Voltage	-0.00087	-0.01276	2.5	PASS
	0°C/Normal Voltage	-0.00381	-0.02108	2.5	PASS
	10°C/Normal Voltage	-0.00455	-0.01305	2.5	PASS
	20°C/Normal Voltage	-0.00348	-0.00441	2.5	PASS
	30°C/Normal Voltage	-0.00316	-0.00631	2.5	PASS
	40°C/Normal Voltage	-0.00092	-0.00910	2.5	PASS
	50°C/Normal Voltage	0.00149	-0.00814	2.5	PASS
	60°C/Normal Voltage	0.00143	-0.00483	2.5	PASS
	70°C/Normal Voltage	-0.00383	-0.00781	2.5	PASS
	80°C/Normal Voltage	-0.00246	-0.00750	2.5	PASS
85°C/Normal Voltage	0.00236	-0.01982	2.5	PASS	



	20°C/Minimum Voltage	-0.00310	-0.01586	2.5	PASS	
	20°C/Maximum Voltage	0.00005	-0.01339	2.5	PASS	
10MHz	-40°C/Normal Voltage	0.00022	0.00374	2.5	PASS	
	-30°C/Normal Voltage	-0.00258	0.00269	2.5	PASS	
	-20°C/Normal Voltage	-0.00281	-0.00081	2.5	PASS	
	-10°C/Normal Voltage	-0.00347	-0.00122	2.5	PASS	
	0°C/Normal Voltage	-0.00201	-0.00212	2.5	PASS	
	10°C/Normal Voltage	-0.00300	-0.00171	2.5	PASS	
	20°C/Normal Voltage	-0.00126	-0.00060	2.5	PASS	
	30°C/Normal Voltage	-0.00228	-0.00116	2.5	PASS	
	40°C/Normal Voltage	-0.00081	0.00389	2.5	PASS	
	50°C/Normal Voltage	0.00237	0.00440	2.5	PASS	
	60°C/Normal Voltage	-0.00122	0.00307	2.5	PASS	
	70°C/Normal Voltage	-0.00100	0.00085	2.5	PASS	
	80°C/Normal Voltage	-0.00336	-0.00016	2.5	PASS	
	85°C/Normal Voltage	-0.00024	0.00495	2.5	PASS	
	20°C/Minimum Voltage	-0.00279	0.00288	2.5	PASS	
	20°C/Maximum Voltage	-0.00112	0.00154	2.5	PASS	
	15MHz	-40°C/Normal Voltage	-0.00257	-0.01834	2.5	PASS
		-30°C/Normal Voltage	-0.00241	0.00308	2.5	PASS
-20°C/Normal Voltage		-0.00202	0.03394	2.5	PASS	
-10°C/Normal Voltage		-0.00255	0.04132	2.5	PASS	
0°C/Normal Voltage		-0.00128	-0.02313	2.5	PASS	
10°C/Normal Voltage		-0.00300	0.03032	2.5	PASS	
20°C/Normal Voltage		-0.00127	0.03543	2.5	PASS	
30°C/Normal Voltage		-0.00165	0.03247	2.5	PASS	
40°C/Normal Voltage		-0.00200	0.03540	2.5	PASS	
50°C/Normal Voltage		-0.00130	0.03388	2.5	PASS	
60°C/Normal Voltage		-0.00353	0.03145	2.5	PASS	
70°C/Normal Voltage		-0.00329	0.04016	2.5	PASS	
80°C/Normal Voltage		-0.00313	0.04157	2.5	PASS	
85°C/Normal Voltage		-0.00331	0.03741	2.5	PASS	
20°C/Minimum Voltage		-0.00288	0.03040	2.5	PASS	
20°C/Maximum Voltage		-0.00172	0.02449	2.5	PASS	

5.7. Spurious Emissions at Antenna Terminals

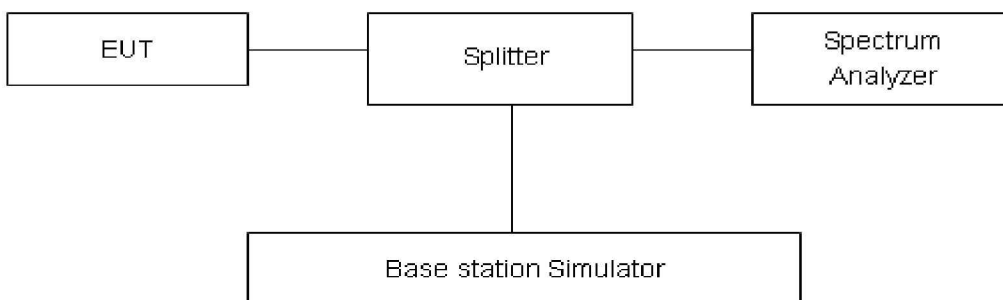
Ambient condition

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 are set to 100 kHz and VBW are set to 300 kHz for below 1G, RBW are set to 1MHz and VBW are set to 3MHz for above 1G, Sweep is set to ATUO.

Test setup



Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm
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Measurement Uncertainty

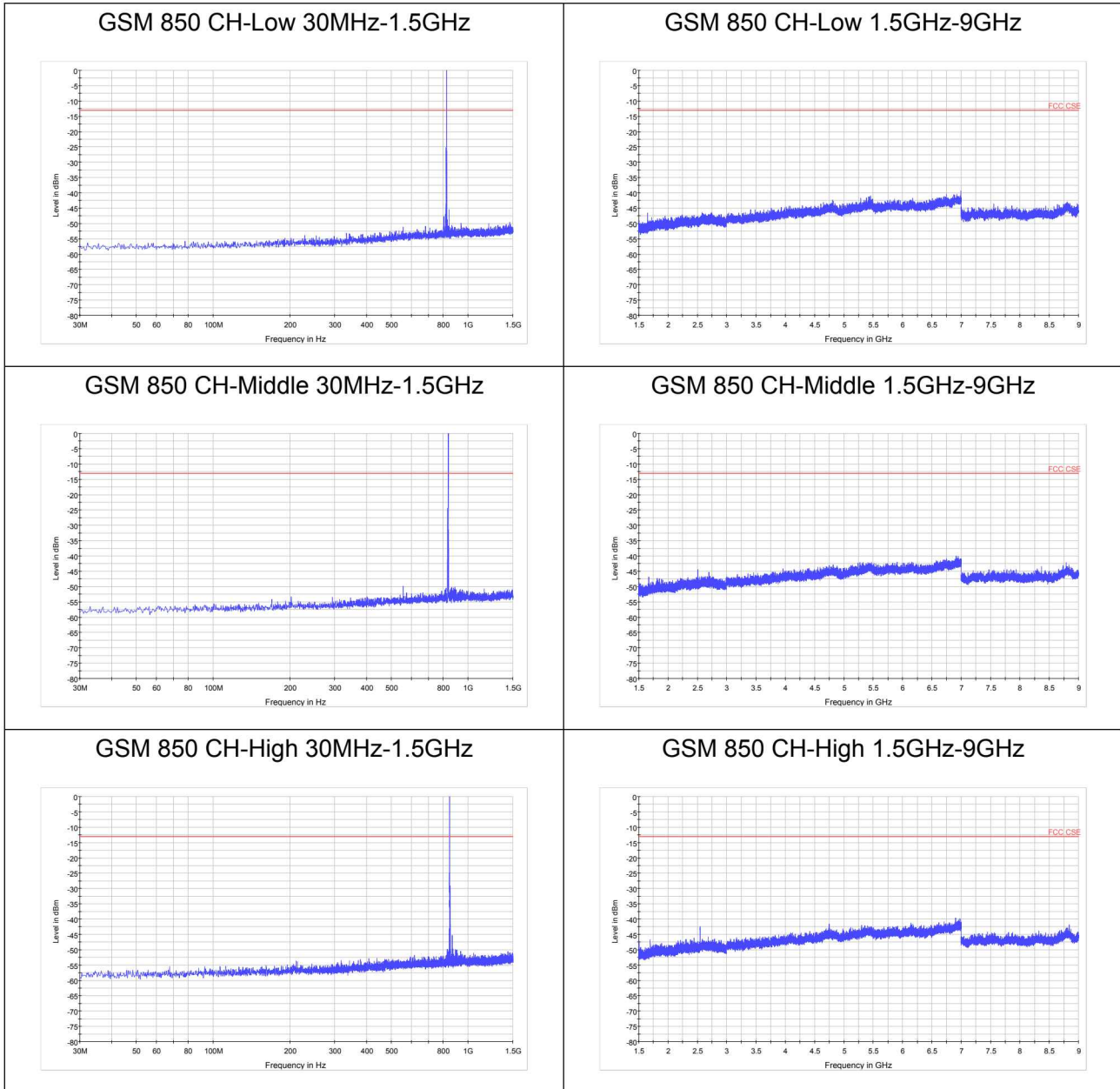
The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-12.75GHz	1.407 dB

Test Result

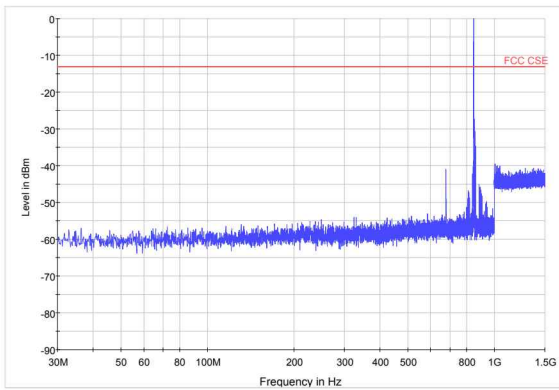
Sweep from 9 kHz to 30MHz, and the emissions more than 20 dB below the permissible value are not reported.

If disturbances were found more than 20dB below limit line, the mark is not required for the EUT. The signal beyond the limit is carrier.

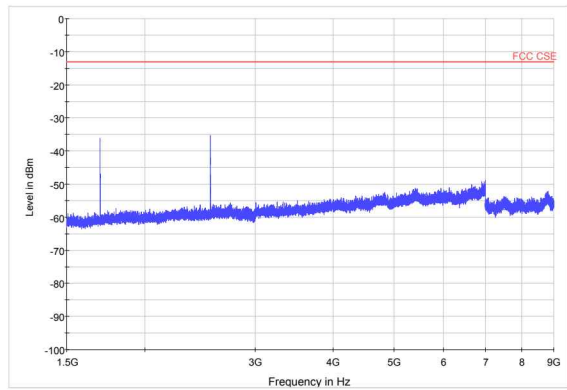




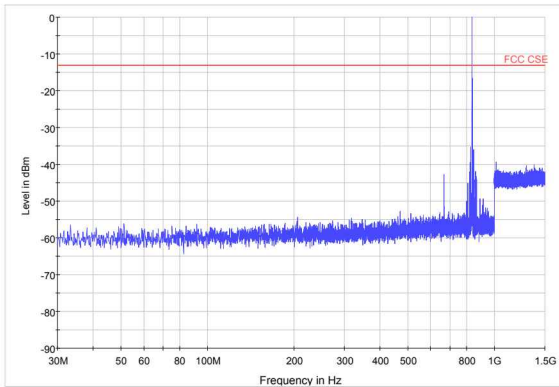
LTE Band 5 1.4MHz CH-Low 30MHz-1.5GHz



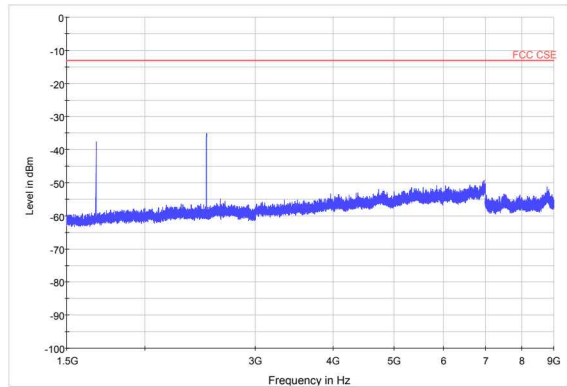
LTE Band 5 1.4MHz CH-Low 1.5GHz-9GHz



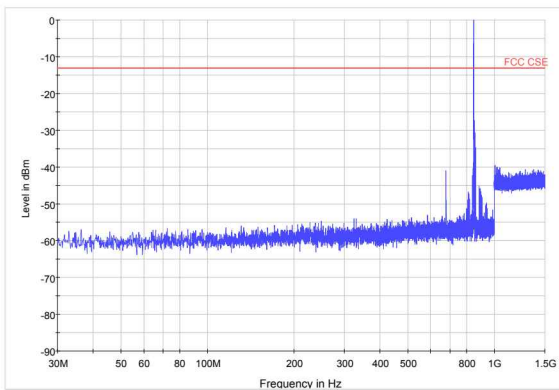
LTE Band 5 1.4MHz CH-Middle 30MHz-1.5GHz



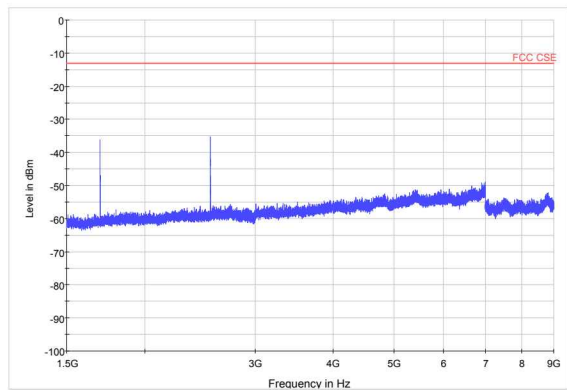
LTE Band 5 1.4MHz CH-Middle 1.5GHz-9GHz



LTE Band 5 1.4MHz CH-High 30MHz-1.5GHz

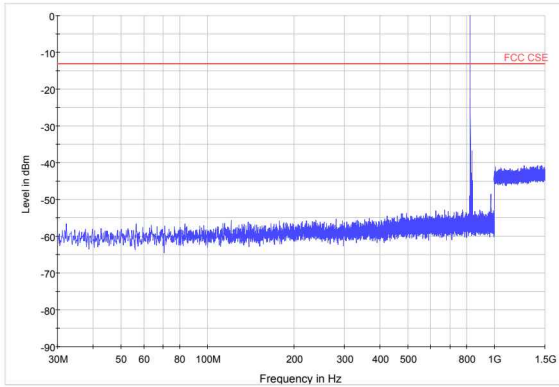


LTE Band 5 1.4MHz CH-High 1.5GHz-9GHz z

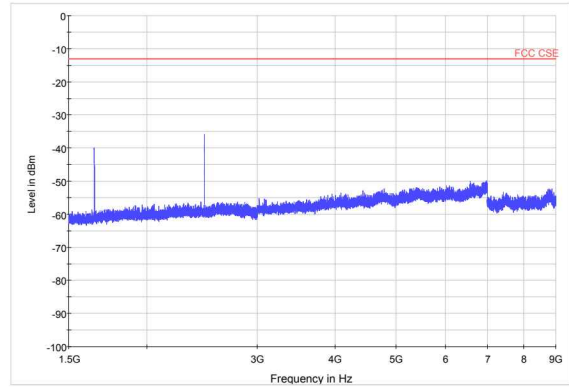




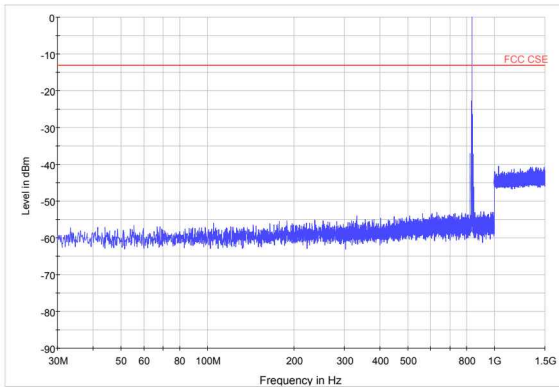
LTE Band 5 3MHz CH-Low 30MHz-1.5GHz



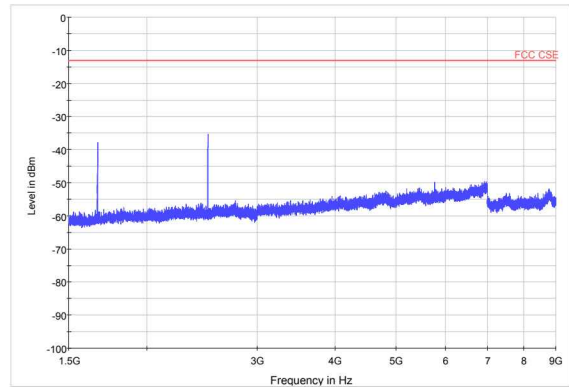
LTE Band 5 3MHz CH-Low 1.5GHz-9GHz z



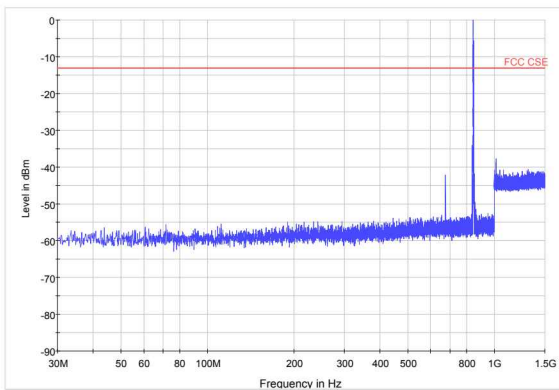
LTE Band 5 3MHz CH-Middle 30MHz-1.5GHz



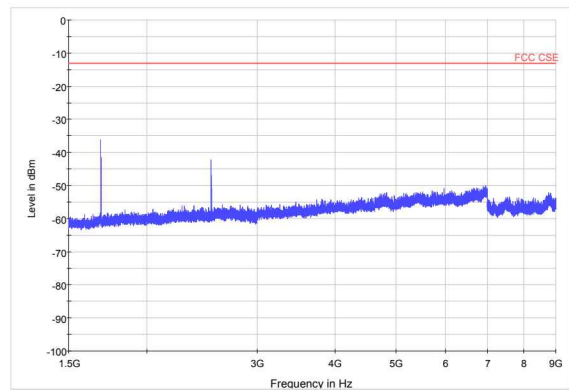
LTE Band 5 3MHz CH-Middle 1.5GHz-9GHz



LTE Band 5 3MHz CH-High 30MHz-1.5GHz

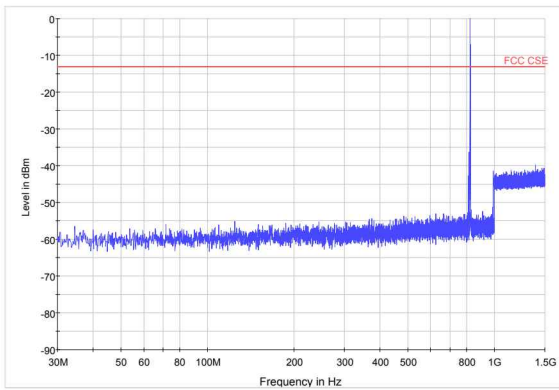


LTE Band 5 3MHz CH-High 1.5GHz-9GHz

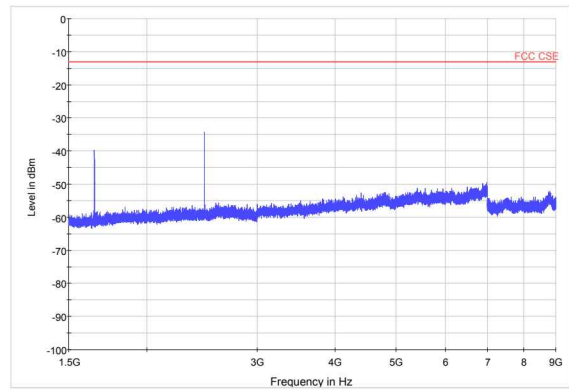




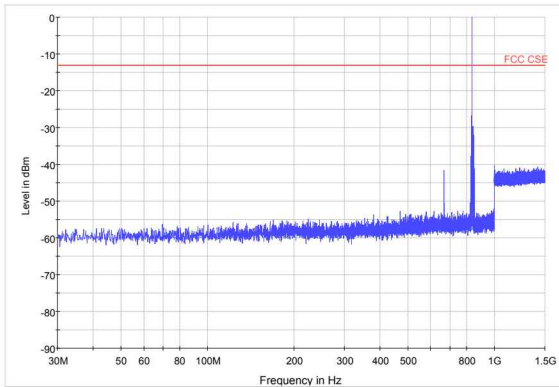
LTE Band 5 5MHz CH-Low 30MHz-1.5GHz



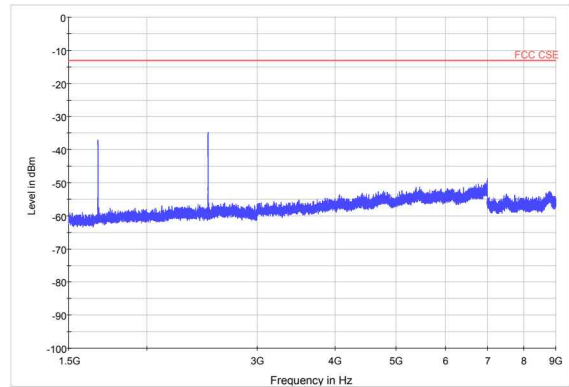
LTE Band 5 5MHz CH-Low 1.5GHz-9GHz



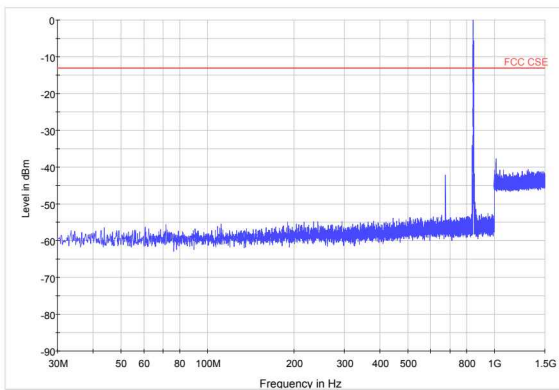
LTE Band 5 5MHz CH-Middle 30MHz-1.5GHz



LTE Band 5 5MHz CH-Middle 1.5GHz-9GHz



LTE Band 5 5MHz CH-High 30MHz-1.5GHz



LTE Band 5 5MHz CH-High 1.5GHz-9GHz

