



Test Results

Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
Band 4 Standalone	BPSK	3.75	20175/1732.5	22.14	17.29	4.85	≤13	PASS
	QPSK	3.75	20175/1732.5	21.50	17.33	4.17	≤13	PASS
	BPSK	15	20175/1732.5	21.66	14.40	7.26	≤13	PASS
	QPSK	15	20175/1732.5	21.31	14.41	6.90	≤13	PASS
Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
Band 12 Standalone	BPSK	3.75	23095/707.5	22.55	17.74	4.81	≤13	PASS
	QPSK	3.75	23095/707.5	21.83	17.66	4.17	≤13	PASS
	BPSK	15	23095/707.5	22.11	14.92	7.19	≤13	PASS
	QPSK	15	23095/707.5	21.79	14.91	6.88	≤13	PASS
Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
Band 13 Standalone	BPSK	3.75	23230/782	22.82	17.97	4.85	≤13	PASS
	QPSK	3.75	23230/782	22.20	18.04	4.16	≤13	PASS
	BPSK	15	23230/782	22.38	15.17	7.21	≤13	PASS
	QPSK	15	23230/782	22.03	15.12	6.91	≤13	PASS
Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
Band 66 Standalone	BPSK	3.75	132322/1745	22.53	17.68	4.85	≤13	PASS
	QPSK	3.75	132322/1745	21.87	17.69	4.18	≤13	PASS
	BPSK	15	132322/1745	22.06	14.81	7.25	≤13	PASS
	QPSK	15	132322/1745	21.71	14.79	6.92	≤13	PASS
Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
Band 71 Standalone	BPSK	3.75	133297/680.5	22.85	18.07	4.78	≤13	PASS
	QPSK	3.75	133297/680.5	22.15	17.99	4.16	≤13	PASS
	BPSK	15	133297/680.5	22.45	15.26	7.19	≤13	PASS
	QPSK	15	133297/680.5	22.12	15.27	6.85	≤13	PASS
Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
Band 85 Standalone	BPSK	3.75	134092/707	22.41	17.60	4.81	≤13	PASS
	QPSK	3.75	134092/707	21.76	17.58	4.18	≤13	PASS
	BPSK	15	134092/707	22.02	14.83	7.19	≤13	PASS
	QPSK	15	134092/707	21.67	14.79	6.88	≤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 -10°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)

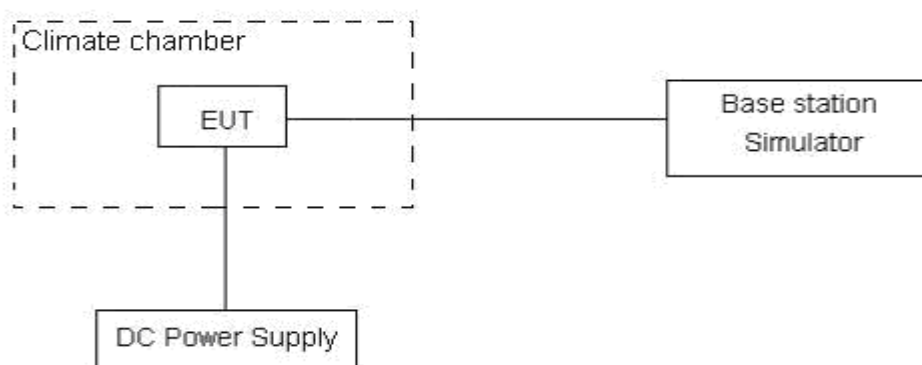
The frequency stability shall be measured with variation of primary supply voltage as follows:

(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 emissions stay within the authorized bands of operation.

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

NB-IOT Band 4						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)	3.75					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	11.00	11.44	0.00585	0.00608	PASS
Extreme(85°C)		7.44	16.37	0.00396	0.00871	PASS
Extreme(80°C)		9.30	2.62	0.00494	0.00140	PASS
Extreme(70°C)		4.50	17.49	0.00239	0.00931	PASS
Extreme(60°C)		6.87	17.62	0.00365	0.00937	PASS
Extreme(50°C)		3.94	11.97	0.00210	0.00637	PASS
Extreme(40°C)		7.32	15.70	0.00389	0.00835	PASS
Extreme(30°C)		9.02	5.31	0.00480	0.00282	PASS
Extreme(20°C)		2.48	11.26	0.00132	0.00599	PASS
Extreme(10°C)		3.96	2.58	0.00210	0.00137	PASS
Extreme(0°C)		11.60	3.16	0.00617	0.00168	PASS
Extreme(-10°C)		8.50	12.18	0.00452	0.00648	PASS
Extreme(-20°C)		4.95	9.53	0.00263	0.00507	PASS
Extreme(-30°C)		17.76	4.84	0.00945	0.00258	PASS
Extreme(-40°C)		7.04	8.56	0.00375	0.00455	PASS
25°C		LV	1.18	13.35	0.00063	0.00710
	HV	13.54	5.75	0.00720	0.00306	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)	15					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	3.58	3.39	0.00191	0.00180	PASS
Extreme(85°C)		5.88	3.14	0.00313	0.00167	PASS
Extreme(80°C)		13.97	5.39	0.00743	0.00287	PASS
Extreme(70°C)		10.71	14.26	0.00570	0.00759	PASS
Extreme(60°C)		13.39	15.95	0.00712	0.00848	PASS
Extreme(50°C)		3.82	3.08	0.00203	0.00164	PASS
Extreme(40°C)		16.67	14.49	0.00887	0.00771	PASS
Extreme(30°C)		5.44	9.89	0.00289	0.00526	PASS
Extreme(20°C)		15.38	13.25	0.00818	0.00705	PASS
Extreme(10°C)		11.25	2.53	0.00599	0.00134	PASS
Extreme(0°C)		5.30	4.01	0.00282	0.00213	PASS
Extreme(-10°C)		10.42	9.45	0.00554	0.00503	PASS
Extreme(-20°C)		10.15	6.82	0.00540	0.00363	PASS



Extreme(-30°C)		14.41	10.38	0.00767	0.00552	PASS
Extreme(-40°C)		17.66	8.48	0.00939	0.00451	PASS
25°C	LV	14.59	13.87	0.00776	0.00738	PASS
	HV	6.71	12.51	0.00357	0.00666	PASS

NB-IOT Band 12						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)	3.75					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	4.91	13.69	0.00261	0.00728	PASS
Extreme(85°C)		14.44	2.56	0.00768	0.00136	PASS
Extreme(80°C)		3.07	10.57	0.00163	0.00562	PASS
Extreme(70°C)		2.05	12.28	0.00109	0.00653	PASS
Extreme(60°C)		10.99	3.99	0.00584	0.00212	PASS
Extreme(50°C)		6.06	14.50	0.00322	0.00771	PASS
Extreme(40°C)		10.49	15.70	0.00558	0.00835	PASS
Extreme(30°C)		1.59	5.50	0.00084	0.00293	PASS
Extreme(20°C)		1.74	10.99	0.00093	0.00584	PASS
Extreme(10°C)		7.58	15.19	0.00403	0.00808	PASS
Extreme(0°C)		6.19	9.67	0.00329	0.00515	PASS
Extreme(-10°C)		1.75	6.55	0.00093	0.00348	PASS
Extreme(-20°C)		6.17	11.83	0.00328	0.00629	PASS
Extreme(-30°C)		15.78	15.68	0.00839	0.00834	PASS
Extreme(-40°C)		10.93	16.49	0.00582	0.00877	PASS
25°C		LV	12.66	3.75	0.00673	0.00199
	HV	14.21	7.96	0.00756	0.00423	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)	15					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	14.67	12.76	0.00780	0.00679	PASS
Extreme(85°C)		16.01	5.78	0.00851	0.00307	PASS
Extreme(80°C)		10.94	15.40	0.00582	0.00819	PASS
Extreme(70°C)		14.71	17.12	0.00782	0.00910	PASS
Extreme(60°C)		5.66	14.60	0.00301	0.00777	PASS
Extreme(50°C)		15.42	11.98	0.00820	0.00637	PASS
Extreme(40°C)		4.85	16.07	0.00258	0.00855	PASS
Extreme(30°C)		14.28	10.85	0.00759	0.00577	PASS



Extreme(20°C)		10.91	5.54	0.00580	0.00295	PASS
Extreme(10°C)		14.70	11.43	0.00782	0.00608	PASS
Extreme(0°C)		15.94	7.99	0.00848	0.00425	PASS
Extreme(-10°C)		12.92	6.85	0.00687	0.00364	PASS
Extreme(-20°C)		3.17	6.60	0.00169	0.00351	PASS
Extreme(-30°C)		3.76	9.70	0.00200	0.00516	PASS
Extreme(-40°C)		7.76	13.00	0.00413	0.00692	PASS
25°C	LV	11.56	17.51	0.00615	0.00932	PASS
	HV	1.02	7.16	0.00054	0.00381	PASS

NB-IOT Band 13						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)	3.75	BPSK	QPSK	BPSK	QPSK	
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	3.26	16.91	0.00173	0.00899	PASS
Extreme(85°C)		11.68	12.12	0.00621	0.00645	PASS
Extreme(80°C)		15.53	11.85	0.00826	0.00631	PASS
Extreme(70°C)		15.29	17.57	0.00813	0.00935	PASS
Extreme(60°C)		16.32	14.81	0.00868	0.00788	PASS
Extreme(50°C)		14.79	5.60	0.00787	0.00298	PASS
Extreme(40°C)		6.33	11.58	0.00337	0.00616	PASS
Extreme(30°C)		5.77	11.50	0.00307	0.00612	PASS
Extreme(20°C)		4.36	13.52	0.00232	0.00719	PASS
Extreme(10°C)		15.78	6.91	0.00839	0.00367	PASS
Extreme(0°C)		10.15	6.29	0.00540	0.00334	PASS
Extreme(-10°C)		15.72	11.63	0.00836	0.00619	PASS
Extreme(-20°C)		15.33	13.25	0.00816	0.00705	PASS
Extreme(-30°C)		13.89	15.28	0.00739	0.00813	PASS
Extreme(-40°C)		9.05	14.32	0.00481	0.00762	PASS
25°C	LV	11.77	11.33	0.00626	0.00603	PASS
	HV	13.12	12.56	0.00698	0.00668	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)	15	BPSK	QPSK	BPSK	QPSK	
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	16.82	4.72	0.00895	0.00251	PASS
Extreme(85°C)		10.52	17.33	0.00560	0.00922	PASS
Extreme(80°C)		12.30	3.25	0.00654	0.00173	PASS



Extreme(70°C)		17.10	8.83	0.00909	0.00470	PASS
Extreme(60°C)		15.83	3.22	0.00842	0.00171	PASS
Extreme(50°C)		1.73	9.15	0.00092	0.00487	PASS
Extreme(40°C)		4.54	13.92	0.00242	0.00741	PASS
Extreme(30°C)		15.53	10.47	0.00826	0.00557	PASS
Extreme(20°C)		5.59	10.59	0.00297	0.00563	PASS
Extreme(10°C)		6.02	1.75	0.00320	0.00093	PASS
Extreme(0°C)		17.15	6.53	0.00912	0.00347	PASS
Extreme(-10°C)		7.48	7.54	0.00398	0.00401	PASS
Extreme(-20°C)		17.73	7.74	0.00943	0.00412	PASS
Extreme(-30°C)		16.54	5.81	0.00880	0.00309	PASS
Extreme(-40°C)		8.16	13.55	0.00434	0.00721	PASS
25°C	LV	7.35	11.17	0.00391	0.00594	PASS
	HV	13.99	16.58	0.00744	0.00882	PASS

NB-IOT Band 66						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)	3.75	BPSK	QPSK	BPSK	QPSK	
Temperature	Voltage					
Normal(25°C)	Normal	4.95	15.19	0.00263	0.00808	PASS
Extreme(85°C)		5.37	15.81	0.00286	0.00841	PASS
Extreme(80°C)		14.44	17.73	0.00768	0.00943	PASS
Extreme(70°C)		16.68	16.99	0.00887	0.00904	PASS
Extreme(60°C)		11.17	9.66	0.00594	0.00514	PASS
Extreme(50°C)		8.93	12.76	0.00475	0.00679	PASS
Extreme(40°C)		7.95	1.63	0.00423	0.00087	PASS
Extreme(30°C)		11.45	4.91	0.00609	0.00261	PASS
Extreme(20°C)		17.67	7.72	0.00940	0.00411	PASS
Extreme(10°C)		15.13	6.00	0.00805	0.00319	PASS
Extreme(0°C)		2.54	17.36	0.00135	0.00923	PASS
Extreme(-10°C)		7.84	9.50	0.00417	0.00505	PASS
Extreme(-20°C)		2.45	1.23	0.00130	0.00066	PASS
Extreme(-30°C)		6.54	13.12	0.00348	0.00698	PASS
Extreme(-40°C)		3.07	3.98	0.00163	0.00212	PASS
25°C	LV	12.50	17.03	0.00665	0.00906	PASS
	HV	1.53	8.93	0.00081	0.00475	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing	15					



(KHz)						
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	16.82	5.30	0.00895	0.00282	PASS
Extreme(85°C)		15.57	10.07	0.00828	0.00536	PASS
Extreme(80°C)		17.64	2.24	0.00938	0.00119	PASS
Extreme(70°C)		12.03	11.12	0.00640	0.00592	PASS
Extreme(60°C)		3.27	15.43	0.00174	0.00821	PASS
Extreme(50°C)		11.27	9.68	0.00599	0.00515	PASS
Extreme(40°C)		9.56	1.91	0.00509	0.00101	PASS
Extreme(30°C)		9.88	8.83	0.00526	0.00470	PASS
Extreme(20°C)		1.28	5.36	0.00068	0.00285	PASS
Extreme(10°C)		15.19	2.21	0.00808	0.00118	PASS
Extreme(0°C)		2.02	6.03	0.00107	0.00321	PASS
Extreme(-10°C)		10.26	10.67	0.00546	0.00567	PASS
Extreme(-20°C)		12.93	11.33	0.00688	0.00603	PASS
Extreme(-30°C)		5.66	6.30	0.00301	0.00335	PASS
Extreme(-40°C)		5.12	9.69	0.00272	0.00516	PASS
25°C	LV	5.80	1.28	0.00309	0.00068	PASS
	HV	15.93	1.06	0.00847	0.00057	PASS

NB-IOT Band 71						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)	3.75					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	9.01	13.08	0.00479	0.00696	PASS
Extreme(85°C)		12.66	12.71	0.00673	0.00676	PASS
Extreme(80°C)		16.48	14.59	0.00877	0.00776	PASS
Extreme(70°C)		12.81	7.97	0.00681	0.00424	PASS
Extreme(60°C)		10.52	14.49	0.00559	0.00771	PASS
Extreme(50°C)		9.56	2.85	0.00509	0.00152	PASS
Extreme(40°C)		11.82	5.33	0.00629	0.00284	PASS
Extreme(30°C)		4.35	17.00	0.00232	0.00904	PASS
Extreme(20°C)		6.73	4.60	0.00358	0.00245	PASS
Extreme(10°C)		5.86	10.36	0.00312	0.00551	PASS
Extreme(0°C)		1.86	5.62	0.00099	0.00299	PASS
Extreme(-10°C)		3.50	10.27	0.00186	0.00547	PASS
Extreme(-20°C)		8.23	16.59	0.00438	0.00882	PASS
Extreme(-30°C)		17.71	9.49	0.00942	0.00505	PASS
Extreme(-40°C)		6.69	14.66	0.00356	0.00780	PASS



Condition	Sub-carrier spacing (KHz)	Voltage	Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
			BPSK	QPSK	BPSK	QPSK	
25°C		LV	13.42	11.76	0.00714	0.00626	PASS
		HV	4.50	3.60	0.00239	0.00192	PASS
Condition			Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)		15					
Temperature		Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal		11.59	10.52	0.00616	0.00560	PASS
Extreme(85°C)			14.79	1.17	0.00786	0.00062	PASS
Extreme(80°C)			15.42	2.01	0.00820	0.00107	PASS
Extreme(70°C)			9.18	14.99	0.00488	0.00797	PASS
Extreme(60°C)			8.09	6.07	0.00430	0.00323	PASS
Extreme(50°C)			17.68	7.05	0.00941	0.00375	PASS
Extreme(40°C)			15.42	16.03	0.00820	0.00853	PASS
Extreme(30°C)			17.46	12.74	0.00929	0.00678	PASS
Extreme(20°C)			15.99	12.48	0.00850	0.00664	PASS
Extreme(10°C)			15.34	9.16	0.00816	0.00487	PASS
Extreme(0°C)			12.38	3.11	0.00659	0.00165	PASS
Extreme(-10°C)			6.48	11.20	0.00345	0.00596	PASS
Extreme(-20°C)			14.67	5.74	0.00780	0.00305	PASS
Extreme(-30°C)			14.63	2.48	0.00778	0.00132	PASS
Extreme(-40°C)			10.34	14.47	0.00550	0.00770	PASS
25°C		LV	2.79	5.55	0.00149	0.00295	PASS
		HV	10.28	1.38	0.00547	0.00073	PASS

NB-IOT Band 85							
Condition	Sub-carrier spacing (KHz)	Voltage	Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
			BPSK	QPSK	BPSK	QPSK	
Condition			Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Sub-carrier spacing (KHz)		3.75					
Temperature		Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal		4.10	12.49	0.00218	0.00665	PASS
Extreme(85°C)			3.42	13.12	0.00182	0.00698	PASS
Extreme(80°C)			9.68	1.22	0.00515	0.00065	PASS
Extreme(70°C)			16.81	3.31	0.00894	0.00176	PASS
Extreme(60°C)			5.24	6.29	0.00279	0.00334	PASS
Extreme(50°C)			3.74	12.04	0.00199	0.00640	PASS
Extreme(40°C)			5.83	3.86	0.00310	0.00206	PASS
Extreme(30°C)			4.85	8.90	0.00258	0.00474	PASS
Extreme(20°C)			13.74	11.63	0.00731	0.00619	PASS
Extreme(10°C)			5.51	5.84	0.00293	0.00311	PASS



Extreme(0°C)		8.06	14.24	0.00428	0.00758	PASS
Extreme(-10°C)		13.84	15.10	0.00736	0.00803	PASS
Extreme(-20°C)		1.23	10.56	0.00065	0.00562	PASS
Extreme(-30°C)		15.31	14.62	0.00814	0.00778	PASS
Extreme(-40°C)		1.62	8.79	0.00086	0.00467	PASS
25°C	LV	2.01	6.62	0.00107	0.00352	PASS
	HV	12.05	10.59	0.00641	0.00563	PASS
Condition		Freq.Error	Freq.Error	Frequency	Frequency	Verdict
Sub-carrier spacing	15	(Hz)	(Hz)	Stability(ppm)	Stability(ppm)	
(KHz)						
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25°C)	Normal	6.47	3.69	0.00344	0.00196	PASS
Extreme(85°C)		3.39	16.86	0.00180	0.00897	PASS
Extreme(80°C)		16.39	1.30	0.00872	0.00069	PASS
Extreme(70°C)		3.25	11.05	0.00173	0.00588	PASS
Extreme(60°C)		10.89	17.13	0.00579	0.00911	PASS
Extreme(50°C)		12.98	9.65	0.00690	0.00513	PASS
Extreme(40°C)		2.35	2.48	0.00125	0.00132	PASS
Extreme(30°C)		1.44	15.75	0.00076	0.00838	PASS
Extreme(20°C)		3.37	13.70	0.00179	0.00729	PASS
Extreme(10°C)		4.46	1.33	0.00237	0.00071	PASS
Extreme(0°C)		9.28	1.92	0.00493	0.00102	PASS
Extreme(-10°C)		6.38	14.18	0.00339	0.00754	PASS
Extreme(-20°C)		3.33	16.33	0.00177	0.00869	PASS
Extreme(-30°C)		3.56	9.17	0.00189	0.00488	PASS
Extreme(-40°C)		6.46	6.82	0.00344	0.00363	PASS
25°C		LV	14.60	6.04	0.00777	0.00321
	HV	8.21	13.74	0.00437	0.00731	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.

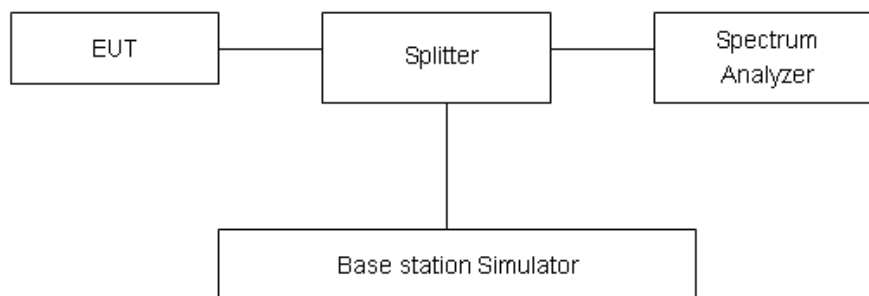
RBW is set to 100kHz, VBW is set to 300kHz for 30MHz~1GHz

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

Of those disturbances below (limit – 20 dB), the mark is not required for the EUT.

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

Test setup



Limits

Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB..”

Rule Part 27.53 (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.

Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands,

emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Part 27.53 (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;
- (3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations;
- (4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;
- (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

Part 27.53(h)/(g) Limit		-13 dBm
Part 27.53(f) Limit	Limit out of the band 1559-1610 MHz	-13 dBm
	Limit in the band 1559-1610 MHz	-40 dBm

Measurement Uncertainty

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

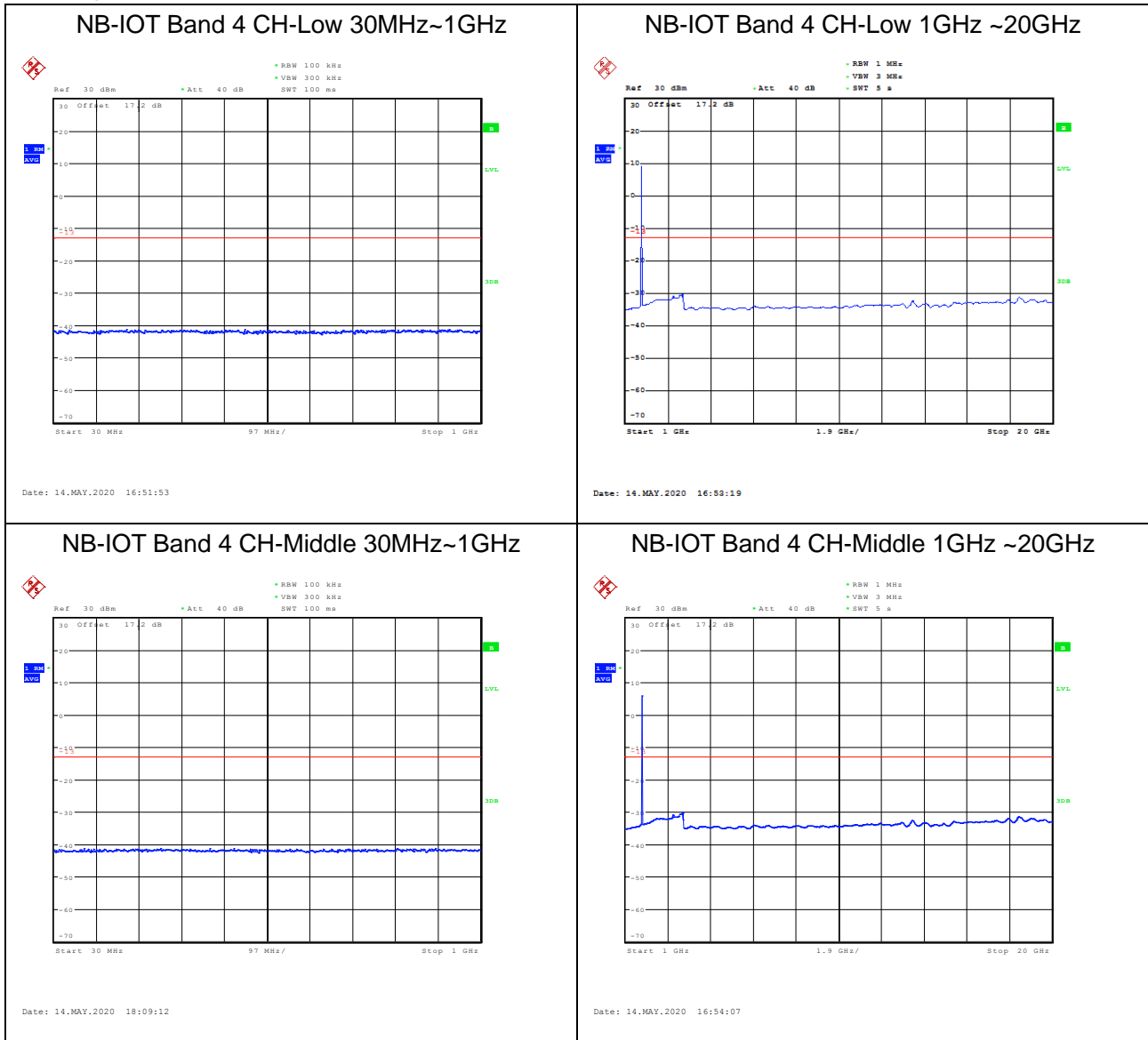
Frequency	Uncertainty
30MHz-1GHz	0.684 dB
1GHz-20GHz	1.407 dB



Test Result

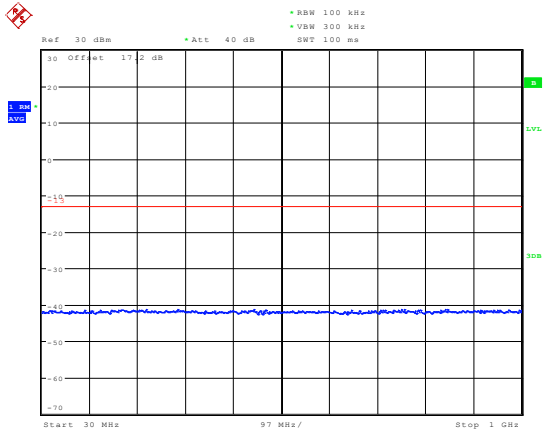
Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions more than 20 dB below the limit are not reported.

The signal beyond the limit is carrier.



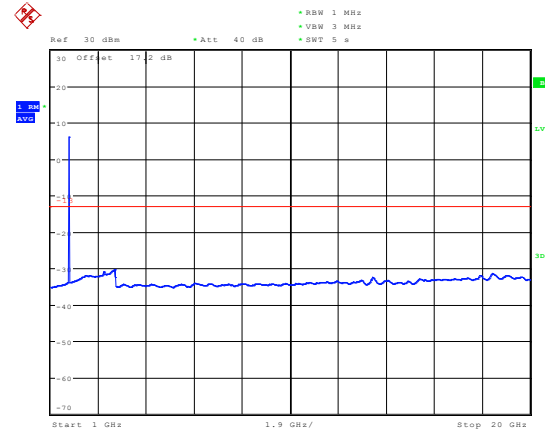


NB-IOT Band 4 CH-High 30MHz~1GHz



Date: 14.MAY.2020 16:52:13

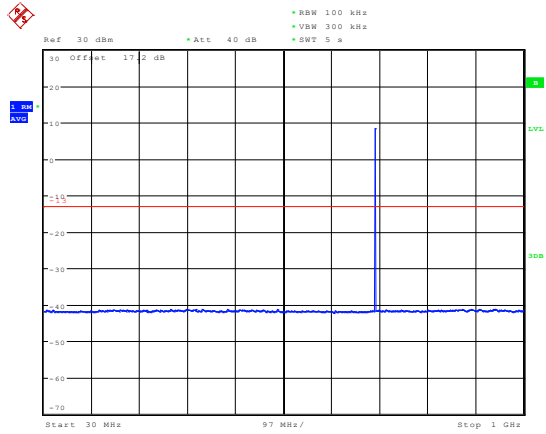
NB-IOT Band 4 CH-High 1GHz ~20GHz



Date: 14.MAY.2020 16:55:19

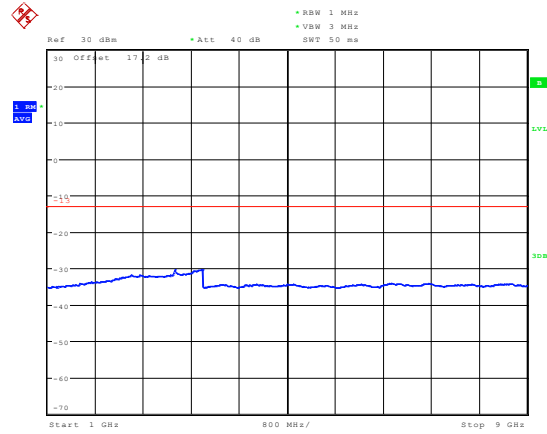


NB-IOT Band 12 CH-Low 30MHz~1GHz



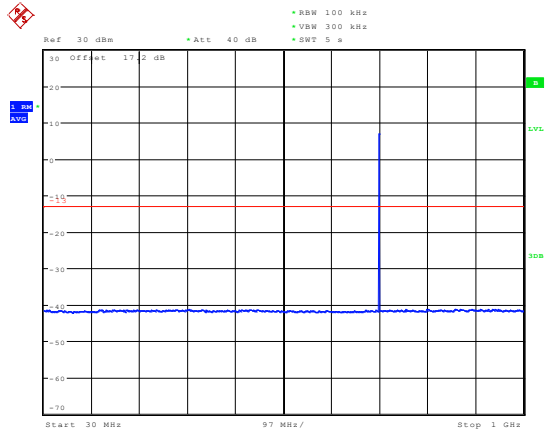
Date: 14.MAY.2020 17:17:50

NB-IOT Band 12 CH-Low 1GHz ~9GHz



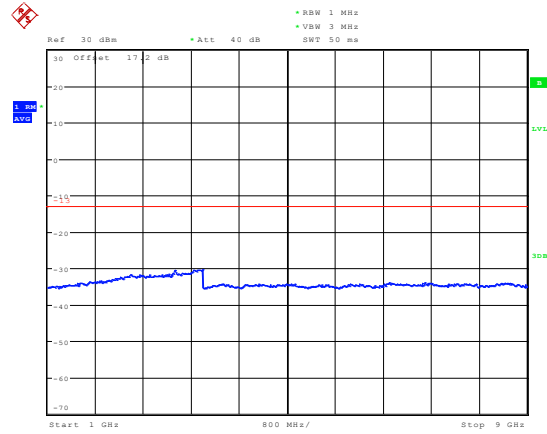
Date: 14.MAY.2020 17:20:42

NB-IOT Band 12 CH-Middle 30MHz~1GHz



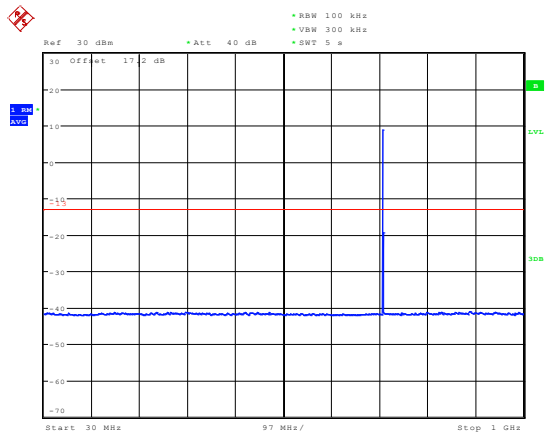
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NB-IOT Band 12 CH-Middle 1GHz ~9GHz



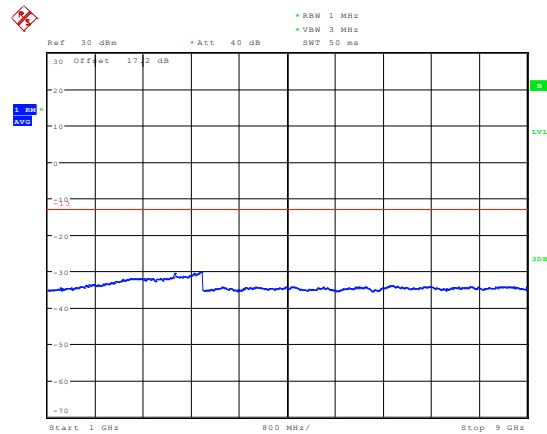
Date: 14.MAY.2020 17:20:50

NB-IOT Band 12 CH-High 30MHz~1GHz



Date: 14.MAY.2020 17:20:12

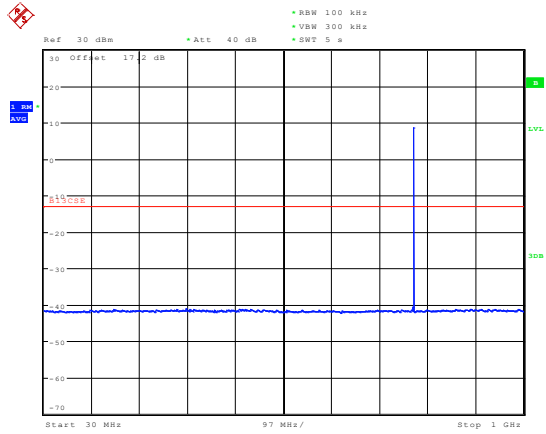
NB-IOT Band 12 CH-High 1GHz ~9GHz



Date: 14.MAY.2020 17:20:59

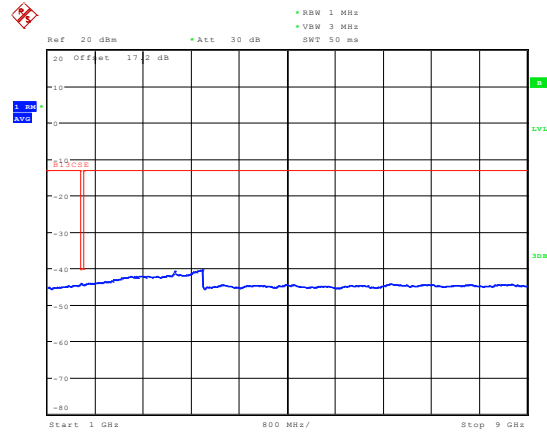


NB-IOT Band 13 CH-Low 30MHz~1GHz



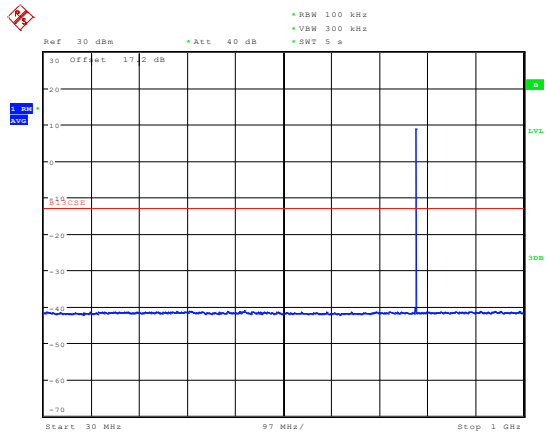
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NB-IOT Band 13 CH-Low 1GHz ~9GHz



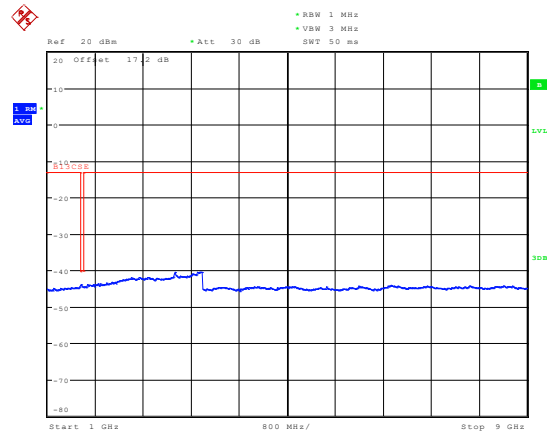
Date: 14.MAY.2020 17:28:09

NB-IOT Band 13 CH-Middle 30MHz~1GHz



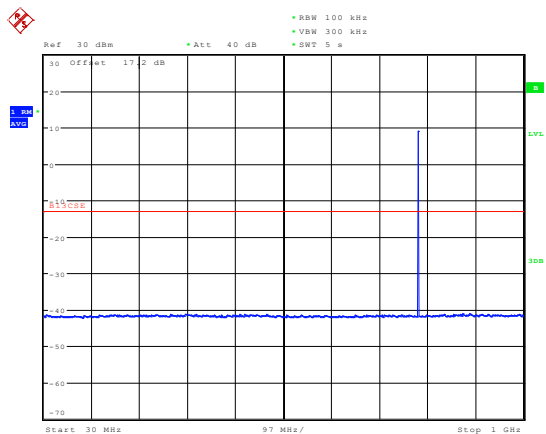
Date: 14.MAY.2020 17:26:06

NB-IOT Band 13 CH-Middle 1GHz ~9GHz



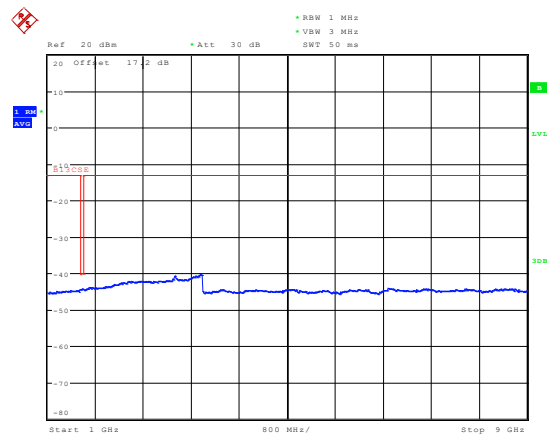
Date: 14.MAY.2020 17:28:17

NB-IOT Band 13 CH-High 30MHz~1GHz



Date: 14.MAY.2020 17:27:17

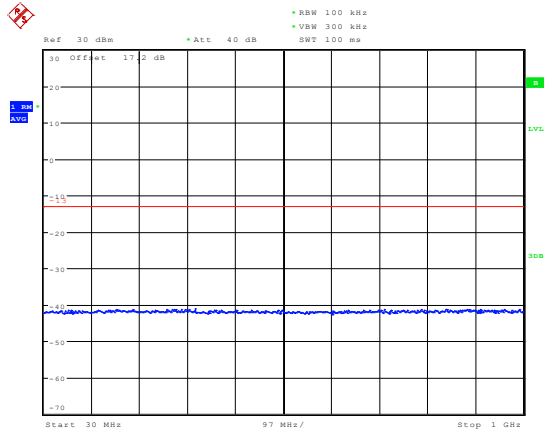
NB-IOT Band 13 CH-High 1GHz ~9GHz



Date: 14.MAY.2020 17:28:24

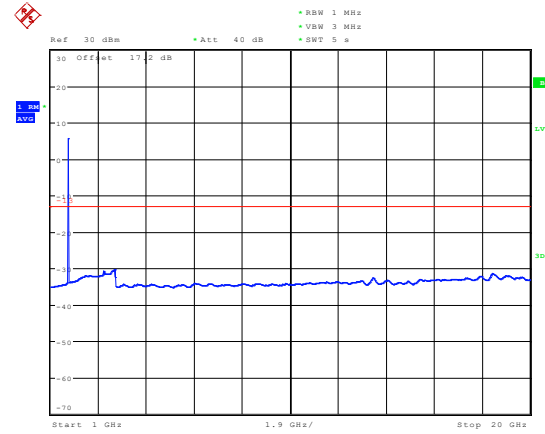


NB-IOT Band 66 CH-Low 30MHz~1GHz



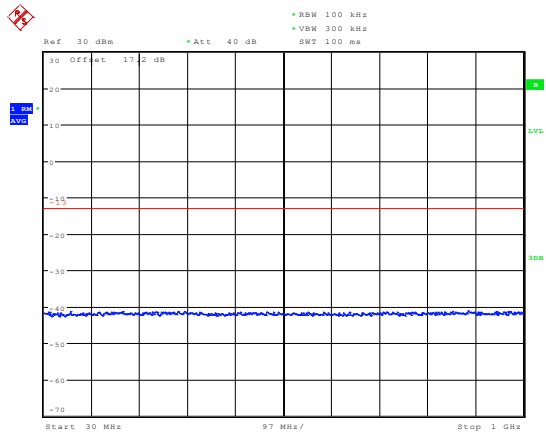
Date: 14.MAY.2020 17:36:52

NB-IOT Band 66 CH-Low 1GHz ~20GHz



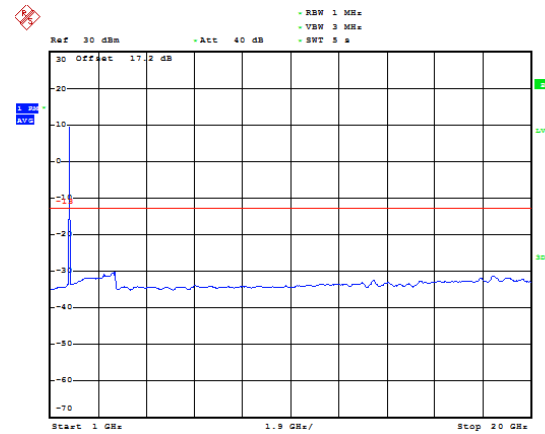
Date: 14.MAY.2020 17:38:13

NB-IOT Band 66 CH-Middle 30MHz~1GHz



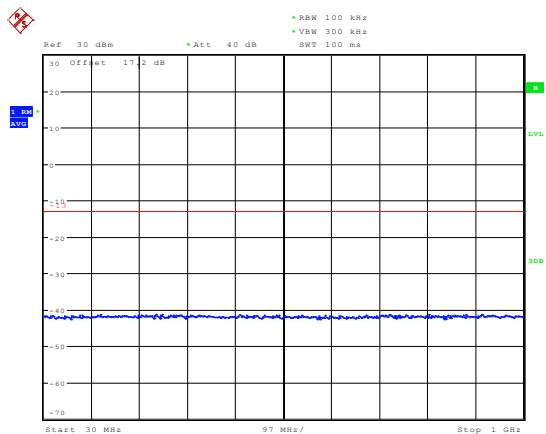
Date: 14.MAY.2020 17:37:02

NB-IOT Band 66 CH-Middle 1GHz ~20GHz



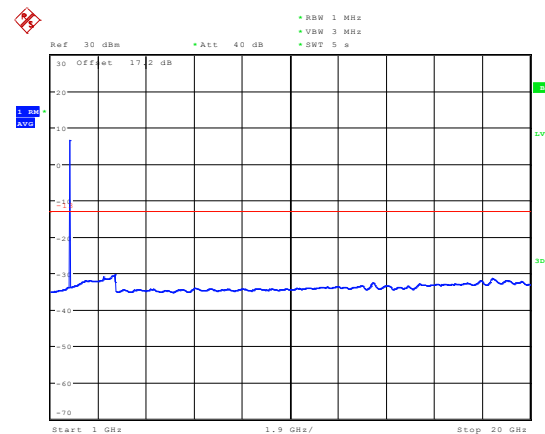
Date: 14.MAY.2020 17:40:29

NB-IOT Band 66 CH-High 30MHz~1GHz



Date: 14.MAY.2020 17:37:10

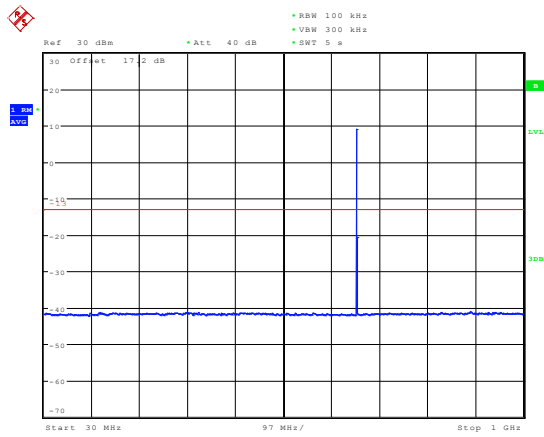
NB-IOT Band 66 CH-High 1GHz ~20GHz



Date: 14.MAY.2020 17:42:42

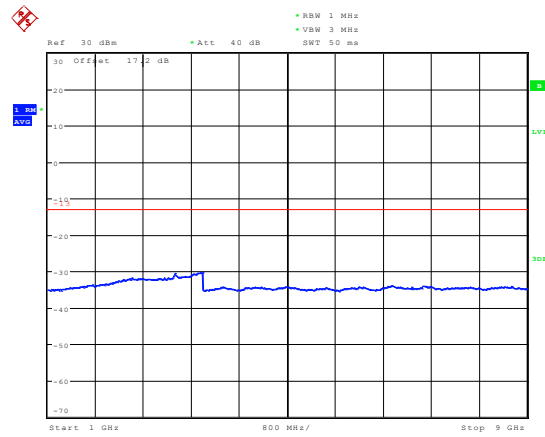


NB-IOT Band 71 CH-Low 30MHz~1GHz



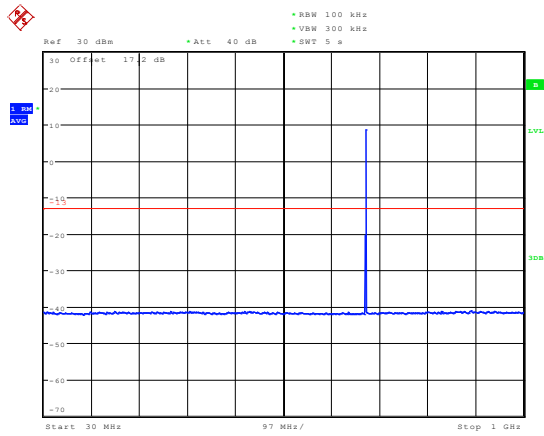
Date: 14.MAY.2020 17:50:34

NB-IOT Band 71 CH-Low 1GHz ~9GHz



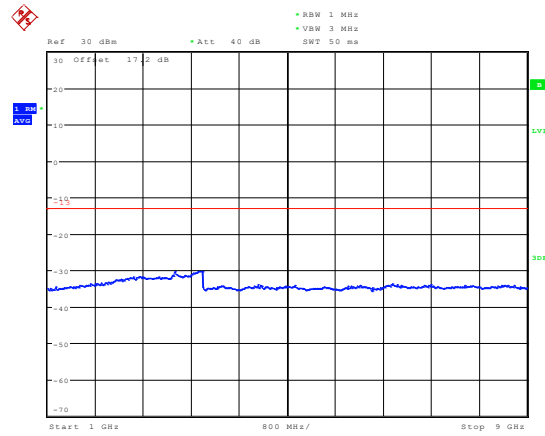
Date: 14.MAY.2020 17:59:10

NB-IOT Band 71 CH-Middle 30MHz~1GHz



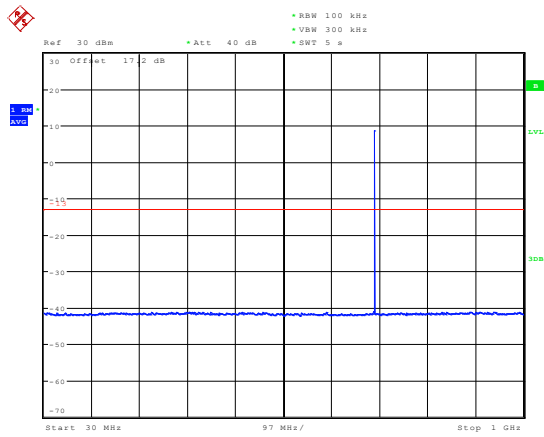
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NB-IOT Band 71 CH-Middle 1GHz ~9GHz



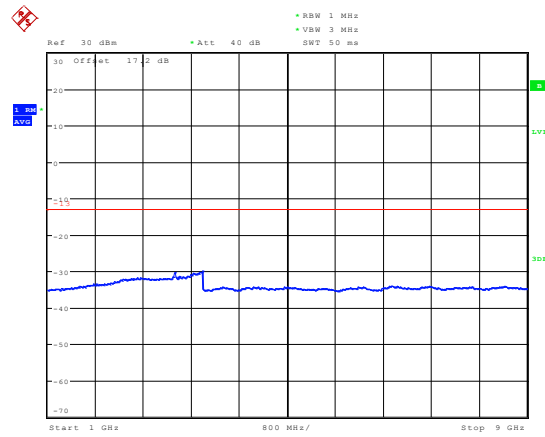
Date: 14.MAY.2020 17:59:23

NB-IOT Band 71 CH-High 30MHz~1GHz



Date: 14.MAY.2020 17:58:41

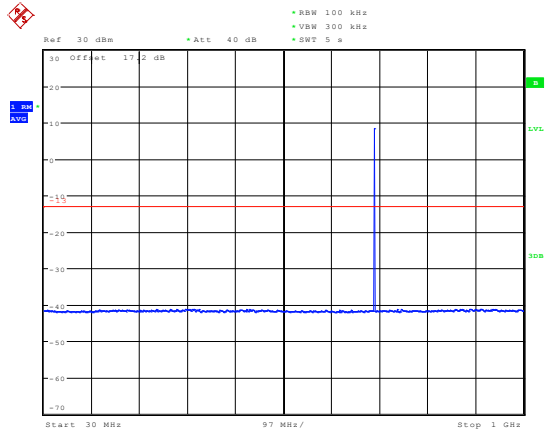
NB-IOT Band 71 CH-High 1GHz ~9GHz



Date: 14.MAY.2020 17:59:32

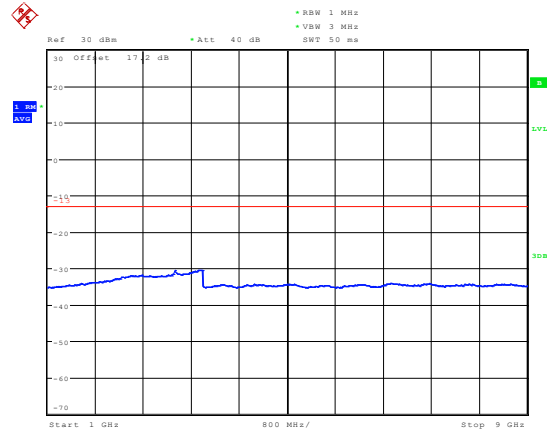


NB-IOT Band 85 CH-Low 30MHz~1GHz



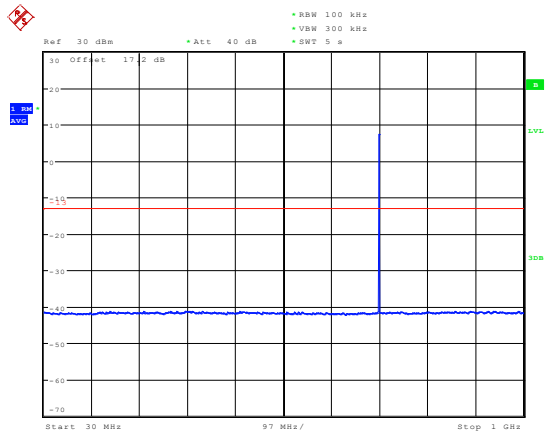
Date: 14.MAY.2020 18:03:13

NB-IOT Band 85 CH-Low 1GHz ~9GHz



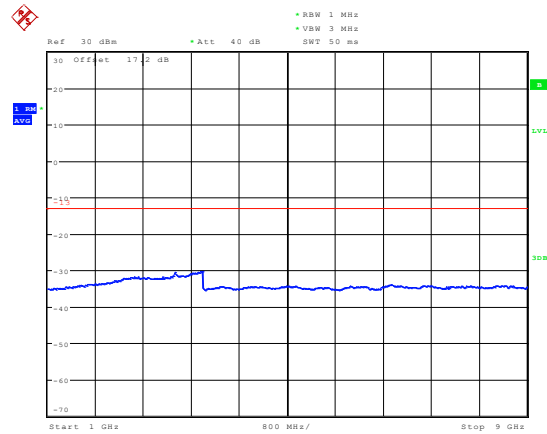
Date: 14.MAY.2020 18:07:08

NB-IOT Band 85 CH-Middle 30MHz~1GHz



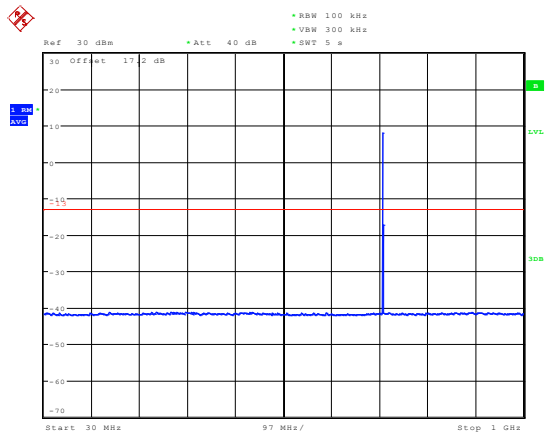
Date: 14.MAY.2020 18:05:36

NB-IOT Band 85 CH-Middle 1GHz ~9GHz



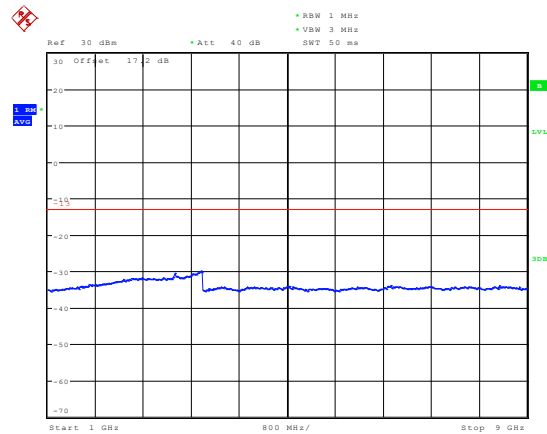
Date: 14.MAY.2020 18:07:17

NB-IOT Band 85 CH-High 30MHz~1GHz



Date: 14.MAY.2020 18:06:33

NB-IOT Band 85 CH-High 1GHz ~9GHz



Date: 14.MAY.2020 18:07:26



5.7 Radiates Spurious Emission

Ambient condition

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

Method of Measurement

- The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI C63.26 (2015).
- 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).
- 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.
- 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).
- 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.
- 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.
- 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:

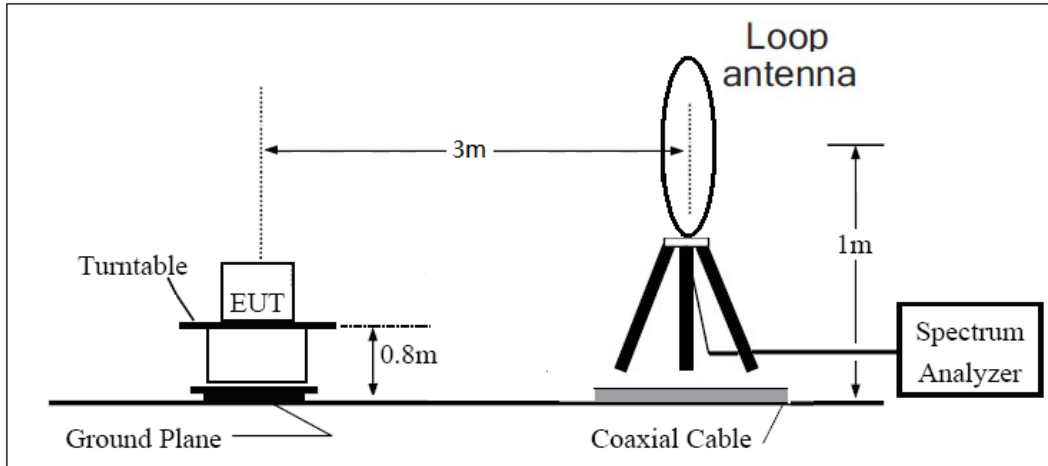
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
- This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP

= EIRP-2.15dBi.

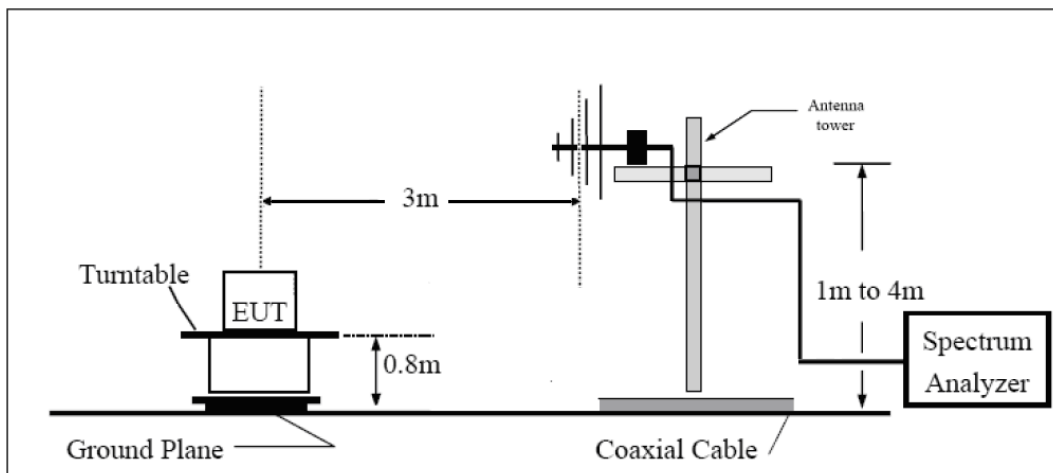
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

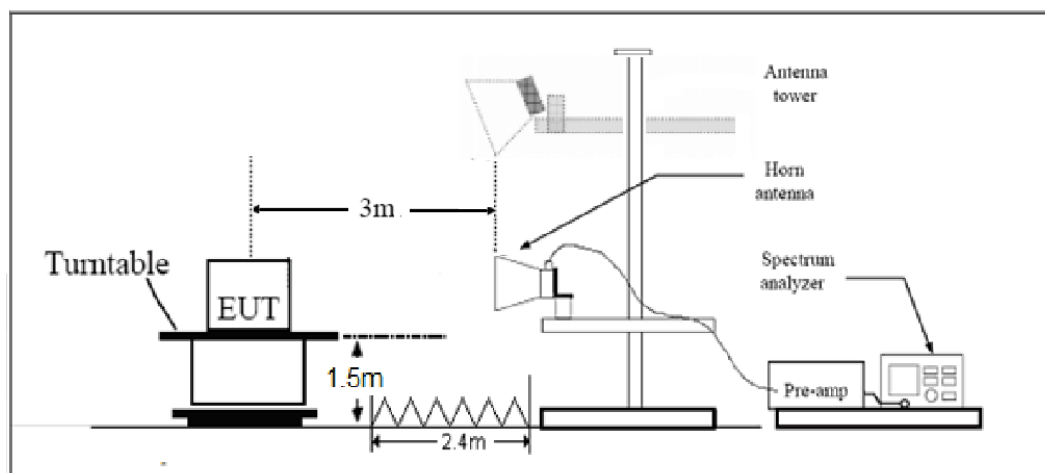
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

**Limits**

Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.”

Rule Part 27.53 (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.

Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Part 27.53 (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;
- (3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log(P)$ dB in a 6.25 kHz band segment, for base and fixed stations;
- (4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;
- (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

Part 27.53 (h)/(g) Limit		-13 dBm
Part 27.53(f) Limit	Limit out of the band 1559-1610 MHz	-13 dBm
	Limit in the band 1559-1610 MHz	-40 dBm



Measurement Uncertainty

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

NB-IOT Band 4 15kHz QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3420.0	-56.88	2.6	10.15	Horizontal	-49.33	-13.00	36.33	270
3	5130.0	-63.15	2.4	11.35	Horizontal	-54.20	-13.00	41.20	270
4	6840.0	-57.93	4.5	10.85	Horizontal	-51.58	-13.00	38.58	45
5	8550.0	-56.62	5.1	11.35	Horizontal	-50.37	-13.00	37.37	90
6	10260.0	-53.17	5.3	11.95	Horizontal	-46.52	-13.00	33.52	315
7	11970.0	-52.85	5.5	13.55	Horizontal	-44.80	-13.00	31.80	135
8	13680.0	-49.80	6.3	13.75	Horizontal	-42.35	-13.00	29.35	270
9	15390.0	-54.41	6.7	13.85	Horizontal	-47.26	-13.00	34.26	0
10	17100.0	-50.94	6.8	14.25	Horizontal	-43.49	-13.00	30.49	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.

NB-IOT Band 4 15kHz QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.0	-56.32	2.6	10.75	Horizontal	-48.17	-13.00	35.17	90
3	5197.5	-63.19	2.4	11.05	Horizontal	-54.54	-13.00	41.54	315
4	6930.0	-57.96	4.5	11.15	Horizontal	-51.31	-13.00	38.31	135
5	8662.5	-55.23	5.1	11.35	Horizontal	-48.98	-13.00	35.98	0
6	10395.0	-53.07	5.3	11.95	Horizontal	-46.42	-13.00	33.42	45
7	12127.5	-53.06	5.5	13.55	Horizontal	-45.01	-13.00	32.01	45
8	13860.0	-51.49	6.3	13.75	Horizontal	-44.04	-13.00	31.04	270
9	15592.5	-53.93	6.7	13.85	Horizontal	-46.78	-13.00	33.78	90
10	17325.0	-50.72	6.8	14.25	Horizontal	-43.27	-13.00	30.27	315

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.



NB-IOT Band 4 15kHz QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3509.8	-57.96	2.6	10.15	Horizontal	-50.41	-13.00	37.41	180
3	5264.7	-63.96	2.4	11.05	Horizontal	-55.31	-13.00	42.31	135
4	7019.6	-58.05	4.5	11.15	Horizontal	-51.40	-13.00	38.40	0
5	8774.5	-56.21	5.1	11.35	Horizontal	-49.96	-13.00	36.96	270
6	10529.4	-51.14	5.3	11.95	Horizontal	-44.49	-13.00	31.49	45
7	12284.3	-53.68	5.5	13.55	Horizontal	-45.63	-13.00	32.63	315
8	14039.2	-50.85	6.3	13.75	Horizontal	-43.40	-13.00	30.40	45
9	15794.1	-53.88	6.7	13.85	Horizontal	-46.73	-13.00	33.73	90
10	17549.0	-51.18	6.8	14.25	Horizontal	-43.73	-13.00	30.73	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.

NB-IOT Band 12 15kHz QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1398.2	-59.75	2.00	10.15	Horizontal	-53.75	-13.00	40.75	45
3	2097.3	-52.31	2.50	11.35	Horizontal	-45.61	-13.00	32.61	45
4	2796.4	-56.63	4.20	10.85	Horizontal	-52.13	-13.00	39.13	180
5	3495.5	-61.05	5.20	11.35	Horizontal	-57.05	-13.00	44.05	270
6	4194.6	-60.25	5.50	11.95	Horizontal	-55.95	-13.00	42.95	45
7	4893.7	-61.65	5.70	13.55	Horizontal	-55.95	-13.00	42.95	0
8	5592.8	-60.16	6.30	13.75	Horizontal	-54.86	-13.00	41.86	180
9	6291.9	-57.82	6.80	13.85	Horizontal	-52.92	-13.00	39.92	135
10	6991.0	-56.35	6.90	14.25	Horizontal	-51.15	-13.00	38.15	45

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.



NB-IOT Band 12 15kHz QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1410.2	-62.79	2.00	10.75	Horizontal	-56.19	-13.00	43.19	0
3	2115.3	-57.31	2.51	11.05	Horizontal	-50.92	-13.00	37.92	270
4	2820.4	-57.26	4.20	11.15	Horizontal	-52.46	-13.00	39.46	90
5	3525.5	-61.13	5.20	11.15	Horizontal	-57.33	-13.00	44.33	0
6	4230.6	-60.43	5.50	11.95	Horizontal	-56.13	-13.00	43.13	270
7	4935.7	-60.57	5.70	13.55	Horizontal	-54.87	-13.00	41.87	225
8	5640.8	-59.40	6.30	13.75	Horizontal	-54.10	-13.00	41.10	45
9	6345.9	-57.43	6.80	13.85	Horizontal	-52.53	-13.00	39.53	90
10	7051.0	-54.85	6.90	14.25	Horizontal	-49.65	-13.00	36.65	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.

NB-IOT Band 12 15kHz QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1431.8	-61.71	2.00	10.15	Horizontal	-55.71	-13.00	42.71	315
3	2147.7	-57.91	2.51	11.05	Horizontal	-51.52	-13.00	38.52	0
4	2863.6	-58.17	4.20	11.15	Horizontal	-53.37	-13.00	40.37	180
5	3579.5	-60.98	5.20	11.15	Horizontal	-57.18	-13.00	44.18	180
6	4295.4	-61.51	5.50	11.95	Horizontal	-57.21	-13.00	44.21	315
7	5011.3	-60.87	5.70	13.55	Horizontal	-55.17	-13.00	42.17	90
8	5727.2	-59.85	6.30	13.75	Horizontal	-54.55	-13.00	41.55	135
9	6443.1	-58.13	6.80	13.85	Horizontal	-53.23	-13.00	40.23	225
10	7159.0	-54.90	6.90	14.25	Horizontal	-49.70	-13.00	36.70	270

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.



NB-IOT Band 13 15kHz QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1554.2	-60.16	2.00	10.15	Horizontal	-54.16	-13.00	41.16	90
3	2331.3	-55.18	2.50	11.35	Horizontal	-48.48	-13.00	35.48	225
4	3108.4	-56.72	4.20	10.85	Horizontal	-52.22	-13.00	39.22	135
5	3885.5	-61.14	5.20	11.35	Horizontal	-57.14	-13.00	44.14	225
6	4662.6	-61.04	5.50	11.95	Horizontal	-56.74	-13.00	43.74	90
7	5439.7	-61.86	5.70	13.55	Horizontal	-56.16	-13.00	43.16	315
8	6216.8	-60.19	6.30	13.75	Horizontal	-54.89	-13.00	41.89	180
9	6993.9	-57.12	6.80	13.85	Horizontal	-52.22	-13.00	39.22	45
10	7771.0	-55.78	6.90	14.25	Horizontal	-50.58	-13.00	37.58	270

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.

NB-IOT Band 13 15kHz QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1564.0	-63.56	2.00	10.75	Horizontal	-54.81	-40.00	14.81	270
Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
3	2346.0	-54.92	2.51	11.05	Horizontal	-48.53	-13.00	35.53	315
4	3128.0	-56.78	4.20	11.15	Horizontal	-51.98	-13.00	38.98	45
5	3910.0	-57.85	5.20	11.15	Horizontal	-54.05	-13.00	41.05	90
6	4692.0	-60.57	5.50	11.95	Horizontal	-56.27	-13.00	43.27	315
7	5474.0	-61.17	5.70	13.55	Horizontal	-55.47	-13.00	42.47	180
8	6256.0	-60.10	6.30	13.75	Horizontal	-54.80	-13.00	41.80	225
9	7038.0	-55.47	6.80	13.85	Horizontal	-50.57	-13.00	37.57	135
10	7820.0	-56.36	6.90	14.25	Horizontal	-51.16	-13.00	38.16	270

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.



NB-IOT Band 13 15kHz QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1573.8	-62.95	2.00	10.15	Horizontal	-54.80	-40.00	14.80	180
Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
3	2360.7	-55.02	2.51	11.05	Horizontal	-48.63	-13.00	35.63	45
4	3147.6	-57.26	4.20	11.15	Horizontal	-52.46	-13.00	39.46	315
5	3934.5	-57.35	5.20	11.15	Horizontal	-53.55	-13.00	40.55	45
6	4721.4	-60.31	5.50	11.95	Horizontal	-56.01	-13.00	43.01	180
7	5508.3	-61.47	5.70	13.55	Horizontal	-55.77	-13.00	42.77	255
8	6295.2	-59.98	6.30	13.75	Horizontal	-54.68	-13.00	41.68	90
9	7082.1	-55.49	6.80	13.85	Horizontal	-50.59	-13.00	37.59	135
10	7869.0	-55.02	6.90	14.25	Horizontal	-49.82	-13.00	36.82	270

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.

NB-IOT Band 66 15kHz QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3420.2	-57.04	2.6	10.15	Horizontal	-49.49	-13.00	36.49	0
3	5130.3	-64.32	2.4	11.35	Horizontal	-55.37	-13.00	42.37	270
4	6840.4	-58.83	4.5	10.85	Horizontal	-52.48	-13.00	39.48	225
5	8550.5	-56.54	5.1	11.35	Horizontal	-50.29	-13.00	37.29	90
6	10260.6	-53.57	5.3	11.95	Horizontal	-46.92	-13.00	33.92	270
7	11970.7	-53.91	5.5	13.55	Horizontal	-45.86	-13.00	32.86	315
8	13680.8	-53.17	6.3	13.75	Horizontal	-45.72	-13.00	32.72	45
9	15390.9	-54.41	6.7	13.85	Horizontal	-47.26	-13.00	34.26	135
10	17101.0	-52.40	6.8	14.25	Horizontal	-44.95	-13.00	31.95	270

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.



NB-IOT Band 66 15kHz QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3490.0	-57.63	2.6	10.75	Horizontal	-49.48	-13.00	36.48	0
3	5235.0	-64.59	2.4	11.05	Horizontal	-55.94	-13.00	42.94	180
4	6980.0	-58.50	4.5	11.15	Horizontal	-51.85	-13.00	38.85	0
5	8725.0	-56.64	5.1	11.35	Horizontal	-50.39	-13.00	37.39	225
6	10470.0	-54.77	5.3	11.95	Horizontal	-48.12	-13.00	35.12	180
7	12215.0	-54.72	5.5	13.55	Horizontal	-46.67	-13.00	33.67	90
8	13960.0	-52.28	6.3	13.75	Horizontal	-44.83	-13.00	31.83	315
9	15705.0	-55.50	6.7	13.85	Horizontal	-48.35	-13.00	35.35	45
10	17450.0	-52.86	6.8	14.25	Horizontal	-45.41	-13.00	32.41	135

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.

NB-IOT Band 66 15kHz QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3559.8	-62.44	2.6	10.15	Horizontal	-54.89	-13.00	41.89	270
3	5339.7	-65.52	2.4	11.05	Horizontal	-56.87	-13.00	43.87	225
4	7119.6	-57.85	4.5	11.15	Horizontal	-51.20	-13.00	38.20	45
5	8899.5	-55.83	5.1	11.35	Horizontal	-49.58	-13.00	36.58	180
6	10679.4	-53.00	5.3	11.95	Horizontal	-46.35	-13.00	33.35	90
7	12459.3	-53.96	5.5	13.55	Horizontal	-45.91	-13.00	32.91	315
8	14239.2	-50.65	6.3	13.75	Horizontal	-43.20	-13.00	30.20	180
9	16019.1	-54.73	6.7	13.85	Horizontal	-47.58	-13.00	34.58	0
10	17799.0	-52.52	6.8	14.25	Horizontal	-45.07	-13.00	32.07	135

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.



NB-IOT Band 71 15kHz QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1326.2	-56.15	2.6	10.15	Horizontal	-50.75	-13.00	37.75	225
3	1989.3	-40.30	2.4	11.35	Horizontal	-33.50	-13.00	20.50	180
4	2652.4	-52.66	4.5	10.85	Horizontal	-48.46	-13.00	35.46	315
5	3315.5	-57.26	5.1	11.35	Horizontal	-53.16	-13.00	40.16	90
6	3978.6	-62.03	5.3	11.95	Horizontal	-57.53	-13.00	44.53	180
7	4641.7	-62.95	5.5	13.55	Horizontal	-57.05	-13.00	44.05	225
8	5304.8	-62.06	6.3	13.75	Horizontal	-56.76	-13.00	43.76	0
9	5967.9	-61.36	6.7	13.85	Horizontal	-56.36	-13.00	43.36	315
10	6631.0	-58.61	6.8	14.25	Horizontal	-53.31	-13.00	40.31	45

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.

NB-IOT Band 71 15kHz QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1361.0	-54.85	2.6	10.75	Horizontal	-48.85	-13.00	35.85	90
3	2041.5	-43.10	2.4	11.05	Horizontal	-36.60	-13.00	23.60	135
4	2722.0	-50.45	4.5	11.15	Horizontal	-45.95	-13.00	32.95	0
5	3402.5	-62.90	5.1	11.35	Horizontal	-58.80	-13.00	45.80	315
6	4083.0	-62.04	5.3	11.95	Horizontal	-57.54	-13.00	44.54	90
7	4763.5	-61.71	5.5	13.55	Horizontal	-55.81	-13.00	42.81	0
8	5444.0	-61.78	6.3	13.75	Horizontal	-56.48	-13.00	43.48	225
9	6124.5	-59.69	6.7	13.85	Horizontal	-54.69	-13.00	41.69	180
10	6805.0	-57.78	6.8	14.25	Horizontal	-52.48	-13.00	39.48	45

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.



NB-IOT Band 71 15kHz QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1359.8	-55.30	2.6	10.15	Horizontal	-49.90	-13.00	36.90	315
3	2039.7	-51.85	2.4	11.05	Horizontal	-45.35	-13.00	32.35	225
4	2719.6	-56.56	4.5	11.15	Horizontal	-52.06	-13.00	39.06	135
5	3399.5	-63.97	5.1	11.35	Horizontal	-59.87	-13.00	46.87	315
6	4079.4	-61.53	5.3	11.95	Horizontal	-57.03	-13.00	44.03	0
7	4759.3	-62.61	5.5	13.55	Horizontal	-56.71	-13.00	43.71	225
8	5439.2	-61.25	6.3	13.75	Horizontal	-55.95	-13.00	42.95	90
9	6119.1	-60.52	6.7	13.85	Horizontal	-55.52	-13.00	42.52	315
10	6799.0	-58.89	6.8	14.25	Horizontal	-53.59	-13.00	40.59	225

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.

NB-IOT Band 85 15kHz QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1396.2	-53.95	2.6	10.15	Horizontal	-48.55	-13.00	35.55	180
3	2094.3	-52.51	2.4	11.35	Horizontal	-45.71	-13.00	32.71	225
4	2792.4	-55.61	4.5	10.85	Horizontal	-51.41	-13.00	38.41	45
5	3490.5	-62.38	5.1	11.35	Horizontal	-58.28	-13.00	45.28	180
6	4188.6	-61.41	5.3	11.95	Horizontal	-56.91	-13.00	43.91	45
7	4886.7	-61.63	5.5	13.55	Horizontal	-55.73	-13.00	42.73	315
8	5584.8	-60.72	6.3	13.75	Horizontal	-55.42	-13.00	42.42	90
9	6282.9	-59.95	6.7	13.85	Horizontal	-54.95	-13.00	41.95	225
10	6981.0	-57.19	6.8	14.25	Horizontal	-51.89	-13.00	38.89	180

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.



NB-IOT Band 85 15kHz QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1411.8	-58.75	2.6	10.75	Horizontal	-52.75	-13.00	39.75	315
3	2117.7	-56.23	2.4	11.05	Horizontal	-49.73	-13.00	36.73	90
4	2823.6	-56.87	4.5	11.15	Horizontal	-52.37	-13.00	39.37	270
5	3529.5	-62.02	5.1	11.35	Horizontal	-57.92	-13.00	44.92	315
6	4235.4	-61.15	5.3	11.95	Horizontal	-56.65	-13.00	43.65	225
7	4941.3	-62.46	5.5	13.55	Horizontal	-56.56	-13.00	43.56	0
8	5647.2	-61.44	6.3	13.75	Horizontal	-56.14	-13.00	43.14	180
9	6353.1	-59.78	6.7	13.85	Horizontal	-54.78	-13.00	41.78	135
10	7059.0	-56.11	6.8	14.25	Horizontal	-50.81	-13.00	37.81	270

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.

NB-IOT Band 85 15kHz QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1431.8	-58.46	2.6	10.15	Horizontal	-53.06	-13.00	40.06	180
3	2147.7	-57.40	2.4	11.05	Horizontal	-50.90	-13.00	37.90	45
4	2863.6	-57.63	4.5	11.15	Horizontal	-53.13	-13.00	40.13	315
5	3579.5	-61.99	5.1	11.35	Horizontal	-57.89	-13.00	44.89	90
6	4295.4	-60.98	5.3	11.95	Horizontal	-56.48	-13.00	43.48	315
7	5011.3	-61.07	5.5	13.55	Horizontal	-55.17	-13.00	42.17	270
8	5727.2	-61.08	6.3	13.75	Horizontal	-55.78	-13.00	42.78	45
9	6443.1	-58.79	6.7	13.85	Horizontal	-53.79	-13.00	40.79	180
10	7159.0	-56.31	6.8	14.25	Horizontal	-51.01	-13.00	38.01	270

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	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	2019-12-15	2020-12-14
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 *****