

3.2 FREQUENCY STABILITY MEASUREMENT

3.2.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

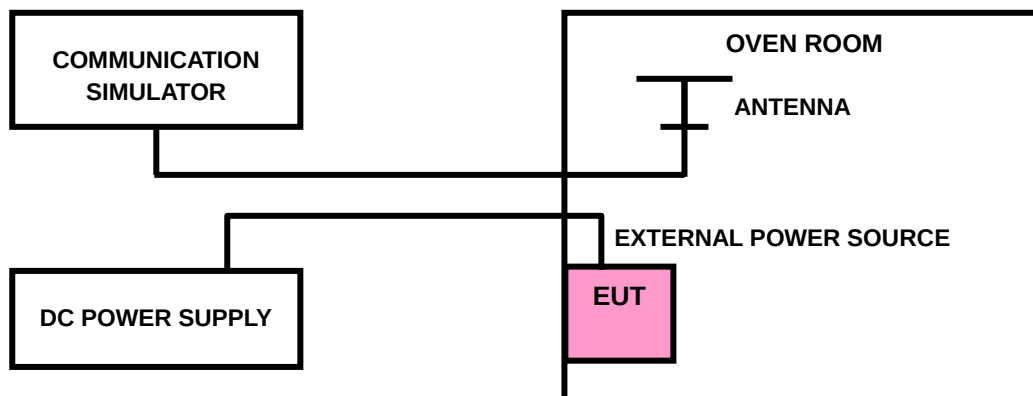
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

3.2.2 TEST PROCEDURE

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

NOTE: The frequency error was recorded frequency error from the communication simulator.

3.2.3 TEST SETUP



3.2.4 TEST RESULTS

LTE BAND 7

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	5MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0021	0.0025	2.5
V _{min}	-0.0024	-0.0030	2.5
V _{max}	0.0021	0.0021	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} Vdc to V_{max} Vdc.

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	5MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0123	-0.0114	2.5
-20	-0.0106	-0.0108	2.5
-10	-0.0084	-0.0080	2.5
0	-0.0073	-0.0076	2.5
10	-0.0055	-0.0045	2.5
20	-0.0040	-0.0040	2.5
30	-0.0027	-0.0036	2.5
40	-0.0019	-0.0019	2.5
50	-0.0003	-0.0005	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	10MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0026	0.0025	2.5
V _{min}	-0.0031	-0.0030	2.5
V _{max}	0.0026	0.0025	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} Vdc to V_{max} Vdc.

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	10MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0115	-0.0110	2.5
-20	-0.0108	-0.0106	2.5
-10	-0.0083	-0.0081	2.5
0	-0.0075	-0.0073	2.5
10	-0.0052	-0.0051	2.5
20	-0.0044	-0.0040	2.5
30	-0.0034	-0.0030	2.5
40	-0.0018	-0.0019	2.5
50	-0.0003	-0.0003	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	15MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0025	0.0024	2.5
V _{min}	-0.0031	-0.0030	2.5
V _{max}	0.0026	0.0026	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} Vdc to V_{max} Vdc.

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	15MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0122	-0.0113	2.5
-20	-0.0099	-0.0099	2.5
-10	-0.0081	-0.0082	2.5
0	-0.0077	-0.0074	2.5
10	-0.0046	-0.0052	2.5
20	-0.0043	-0.0038	2.5
30	-0.0030	-0.0031	2.5
40	-0.0022	-0.0018	2.5
50	-0.0001	-0.0002	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	20MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0026	0.0026	2.5
V _{min}	-0.0031	-0.0030	2.5
V _{max}	0.0025	0.0026	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} Vdc to V_{max} Vdc.

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	20MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0112	-0.0113	2.5
-20	-0.0109	-0.0110	2.5
-10	-0.0082	-0.0081	2.5
0	-0.0077	-0.0073	2.5
10	-0.0046	-0.0055	2.5
20	-0.0044	-0.0039	2.5
30	-0.0040	-0.0038	2.5
40	-0.0017	-0.0022	2.5
50	-0.0005	-0.0003	2.5

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FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	5MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0022	0.0025	2.5
V _{min}	-0.0024	-0.0030	2.5
V _{max}	0.0021	0.0021	2.5

NOTE: The applicant defined the normal working voltage of the battery is from 3.6Vdc to 4.4Vdc.

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	5MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0123	-0.0112	2.5
-20	-0.0105	-0.0097	2.5
-10	-0.0085	-0.0081	2.5
0	-0.0075	-0.0075	2.5
10	-0.0047	-0.0051	2.5
20	-0.0038	-0.0042	2.5
30	-0.0040	-0.0027	2.5
40	-0.0021	-0.0021	2.5
50	-0.0005	-0.0004	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	10MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0026	0.0025	2.5
V _{min}	-0.0031	-0.0030	2.5
V _{max}	0.0026	0.0024	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} Vdc to V_{max} Vdc.

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	10MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0123	-0.0119	2.5
-20	-0.0112	-0.0100	2.5
-10	-0.0085	-0.0080	2.5
0	-0.0077	-0.0075	2.5
10	-0.0050	-0.0045	2.5
20	-0.0043	-0.0044	2.5
30	-0.0029	-0.0028	2.5
40	-0.0023	-0.0021	2.5
50	-0.0005	-0.0004	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	15MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0024	0.0025	2.5
V _{min}	-0.0031	-0.0031	2.5
V _{max}	0.0024	0.0024	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} Vdc to V_{max} Vdc.

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	15MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0117	-0.0118	2.5
-20	-0.0106	-0.0099	2.5
-10	-0.0084	-0.0080	2.5
0	-0.0076	-0.0073	2.5
10	-0.0046	-0.0047	2.5
20	-0.0040	-0.0037	2.5
30	-0.0041	-0.0025	2.5
40	-0.0023	-0.0017	2.5
50	-0.0006	-0.0004	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	20MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0024	0.0024	2.5
V _{min}	-0.0031	-0.0030	2.5
V _{max}	0.0025	0.0025	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} Vdc to V_{max} Vdc.

FREQUENCY ERROR vs. TEMPERATURE.

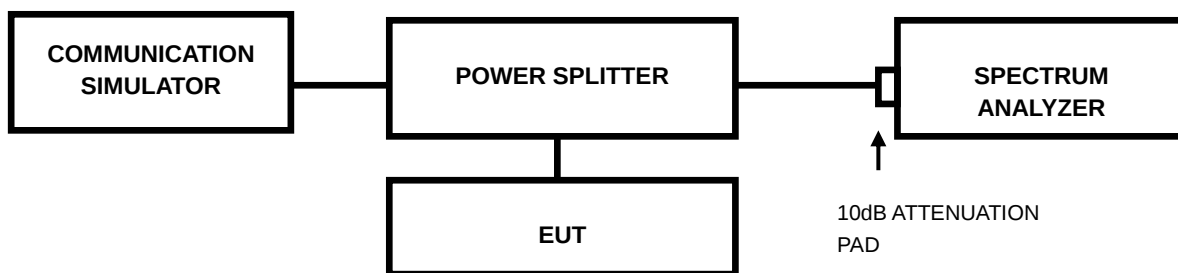
TEMP. (°C)	20MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0113	-0.0111	2.5
-20	-0.0102	-0.0109	2.5
-10	-0.0082	-0.0081	2.5
0	-0.0076	-0.0075	2.5
10	-0.0056	-0.0051	2.5
20	-0.0044	-0.0038	2.5
30	-0.0031	-0.0035	2.5
40	-0.0016	-0.0017	2.5
50	-0.0003	-0.0004	2.5

3.3 OCCUPIED BANDWIDTH MEASUREMENT

3.3.1 LIMITS OF OCCUPIED BANDWIDTH MEASUREMENT

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

3.3.2 TEST SETUP



3.3.3 TEST PROCEDURES

- The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

3.3.4 TEST RESULTS

LTE BAND 7				
CHANNEL BANDWIDTH: 5MHz				
CHANNEL	FREQUENCY (MHz)	99% OCCUPIED BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
20775	2502.5	4.47	4.49	4.47
21100	2535	4.49	4.47	4.47
21425	2567.5	4.47	4.48	4.47
CHANNEL	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
20775	2502.5	4.87	4.91	4.89
21100	2535	4.92	4.86	4.83
21425	2567.5	4.91	4.94	4.89



LTE BAND 7				
CHANNEL BANDWIDTH: 10MHz				
CHANNEL	FREQUENCY (MHz)	99% OCCUPIED BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
20800	2505	8.94	8.95	8.95
21100	2535	8.96	8.96	8.94
21400	2565	8.95	8.95	8.95
CHANNEL	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
20800	2505	9.70	9.63	9.68
21100	2535	9.62	9.62	9.64
21400	2565	9.71	9.63	9.66



LTE BAND 7				
CHANNEL BANDWIDTH: 15MHz				
CHANNEL	FREQUENCY (MHz)	99% OCCUPIED BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
20825	2507.5	13.45	13.36	13.37
21100	2535	13.41	13.40	13.39
21375	2562.5	13.38	13.37	13.38
CHANNEL	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
20825	2507.5	14.73	14.39	14.38
21100	2535	14.45	14.42	14.36
21375	2562.5	14.48	14.33	14.39



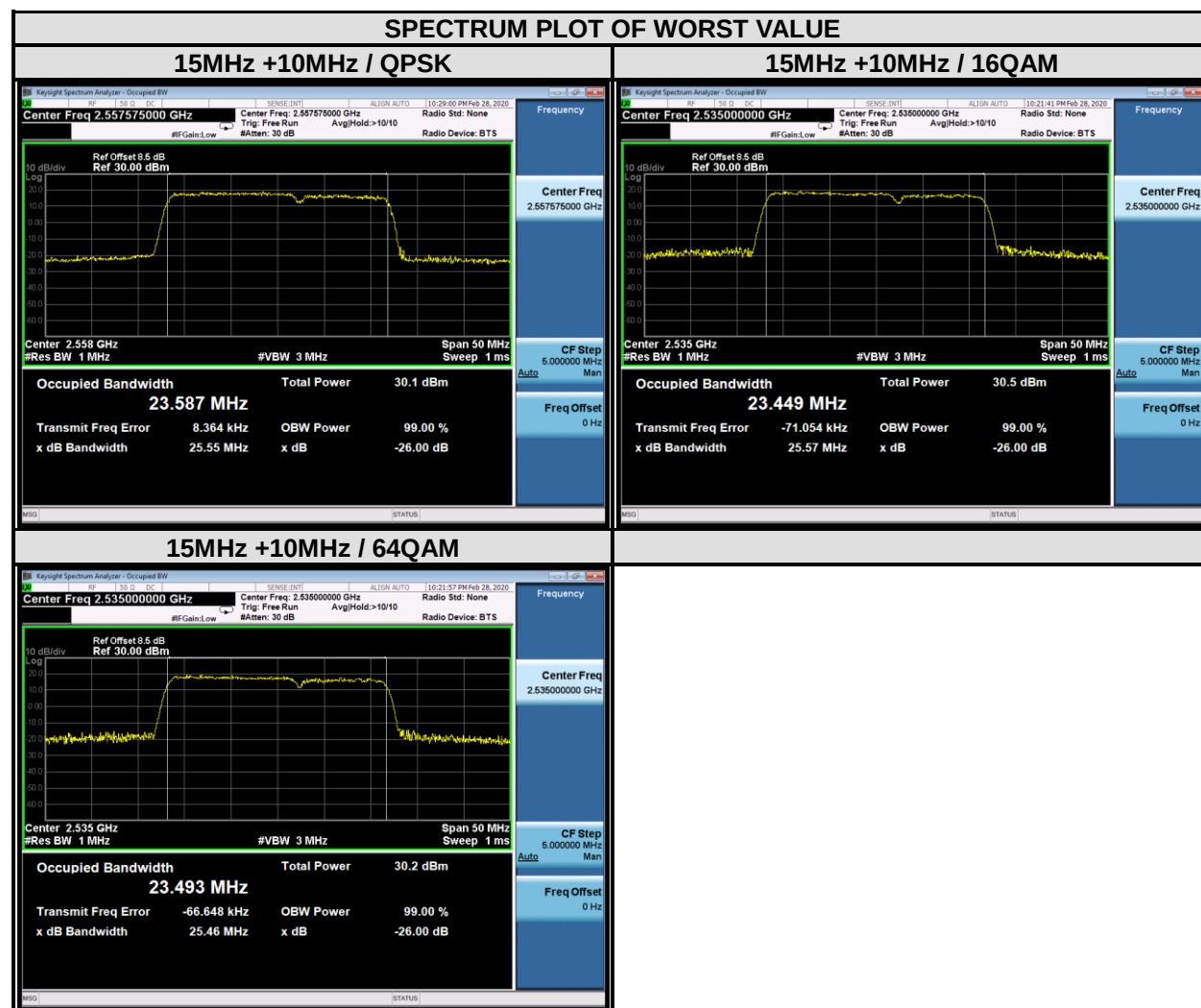
LTE BAND 7				
CHANNEL BANDWIDTH: 20MHz				
CHANNEL	FREQUENCY (MHz)	99% OCCUPIED BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
20850	2510	17.85	17.89	17.89
21100	2535	17.89	17.96	17.90
21350	2560	17.89	17.87	17.89
CHANNEL	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
20850	2510	19.14	19.21	19.19
21100	2535	19.23	19.22	19.19
21350	2560	19.39	19.07	19.18



LTE BAND 7 CA				
CHANNEL BANDWIDTH: 10MHz+20MHz				
CHANNEL		99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20805	20949	27.935	27.861	27.845
21006	21150	28.169	28.069	28.115
21206	21350	28.018	27.888	27.951
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20805	20949	29.93	29.98	29.92
21006	21150	30.10	29.98	29.94
21206	21350	30.10	29.92	29.89



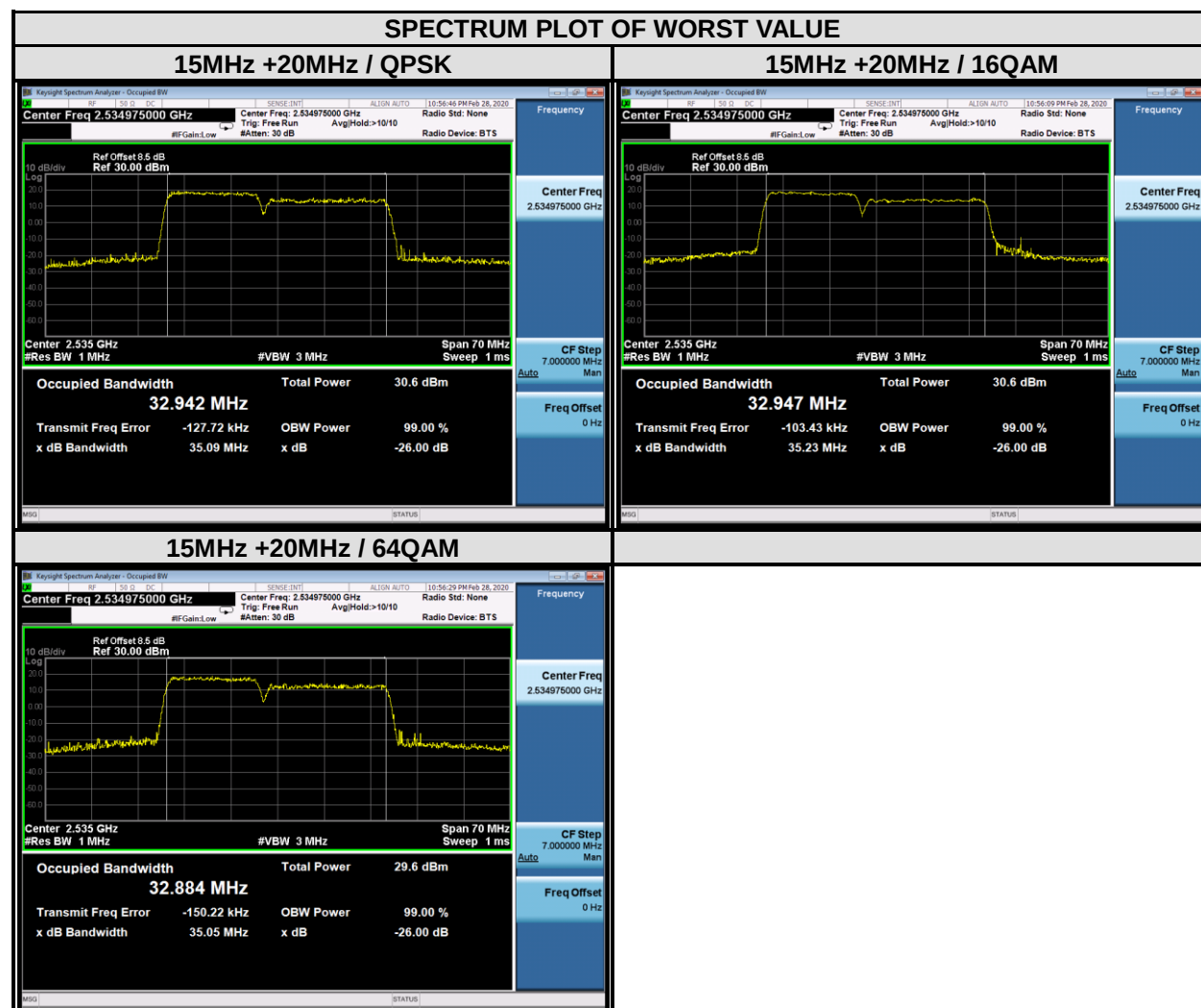
LTE BAND 7 CA				
CHANNEL BANDWIDTH: 15MHz +10MHz				
CHANNEL	CHANNEL	99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20825	20975	23.435	23.337	23.337
21051	21171	23.540	23.449	23.493
21277	21397	23.587	23.439	23.409
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20825	20975	25.51	25.39	25.40
21051	21171	25.50	25.57	25.46
21277	21397	25.55	25.56	25.50



LTE BAND 7 CA				
CHANNEL BANDWIDTH: 15MHz +15MHz				
CHANNEL	CHANNEL	99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20825	20975	28.568	28.467	28.477
21025	21175	28.613	28.703	28.678
21225	21375	28.526	28.583	28.586
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20825	20975	30.69	30.68	30.69
21025	21175	30.77	30.77	30.94
21225	21375	30.72	30.82	30.73



LTE BAND 7 CA				
CHANNEL BANDWIDTH: 15MHz +20MHz				
CHANNEL	CHANNEL	99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20828	20999	32.820	32.716	32.719
21003	21174	32.942	32.947	32.884
21179	21350	32.879	32.717	32.687
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20828	20999	35.08	34.88	34.97
21003	21174	35.09	35.23	35.05
21179	21350	35.00	34.90	34.81



LTE BAND 7 CA				
CHANNEL BANDWIDTH: 20MHz +10MHz				
CHANNEL	CHANNEL	99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20850	20994	27.950	27.850	27.820
21051	21195	28.141	28.035	28.059
21251	21395	27.984	27.965	27.900
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20850	20994	30.38	30.07	30.05
21051	21195	30.16	30.18	30.28
21251	21395	30.24	30.26	30.23



LTE BAND 7 CA				
CHANNEL BANDWIDTH: 20MHz +15MHz				
CHANNEL	CHANNEL	99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20850	21021	32.682	32.665	32.728
21026	21197	32.828	32.908	32.892
21201	21372	32.734	32.747	32.725
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20850	21021	35.04	34.99	34.97
21026	21197	35.17	35.18	35.08
21201	21372	35.22	35.09	35.18



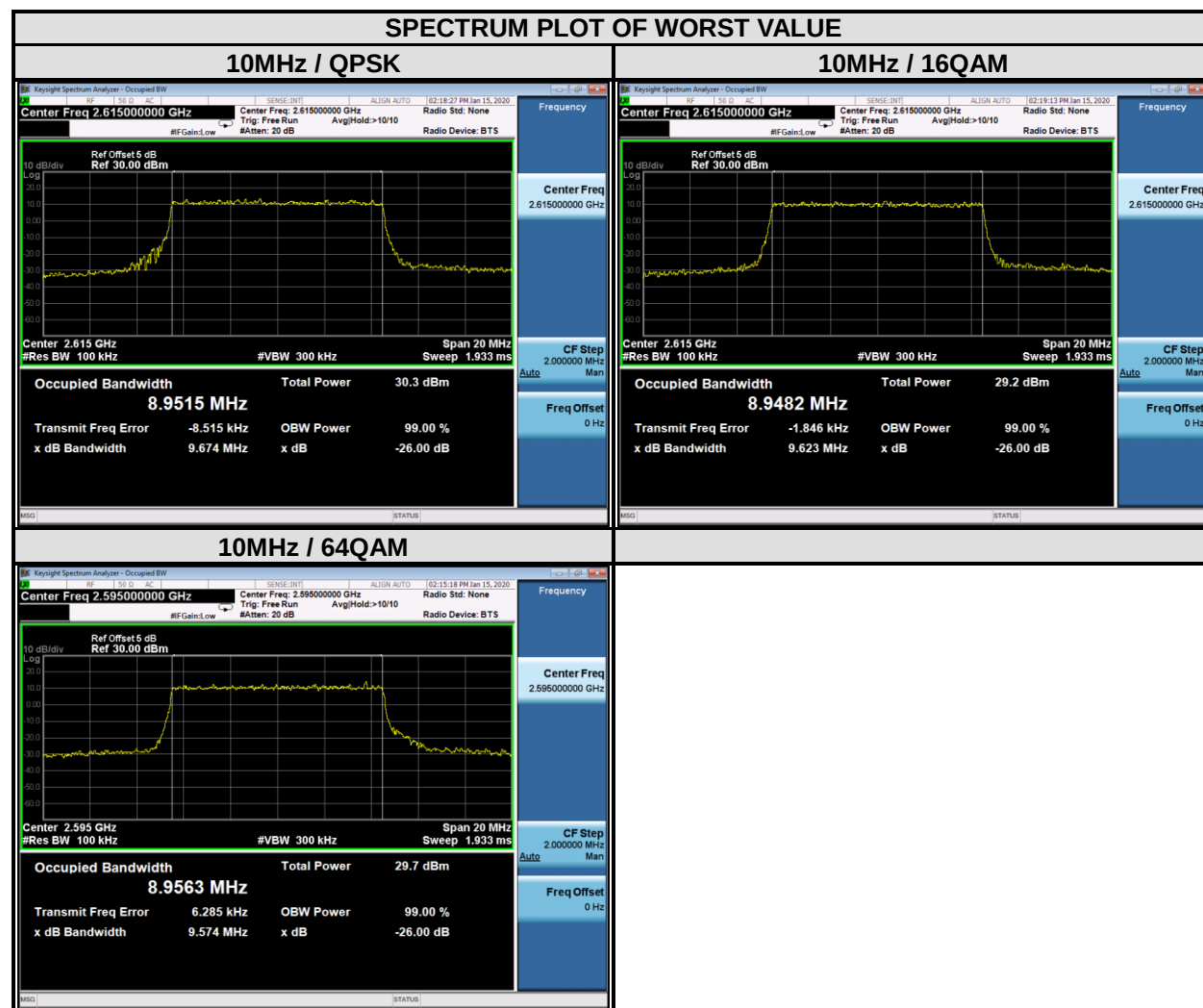
LTE BAND 7 CA				
CHANNEL BANDWIDTH: 20MHz +20MHz				
CHANNEL	CHANNEL	99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20850	21048	37.584	37.559	37.526
21001	21199	37.787	37.673	37.713
21152	21350	37.602	37.629	37.542
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
20850	21048	39.95	40.08	39.99
21001	21199	40.06	40.06	40.08
21152	21350	40.02	40.06	40.07



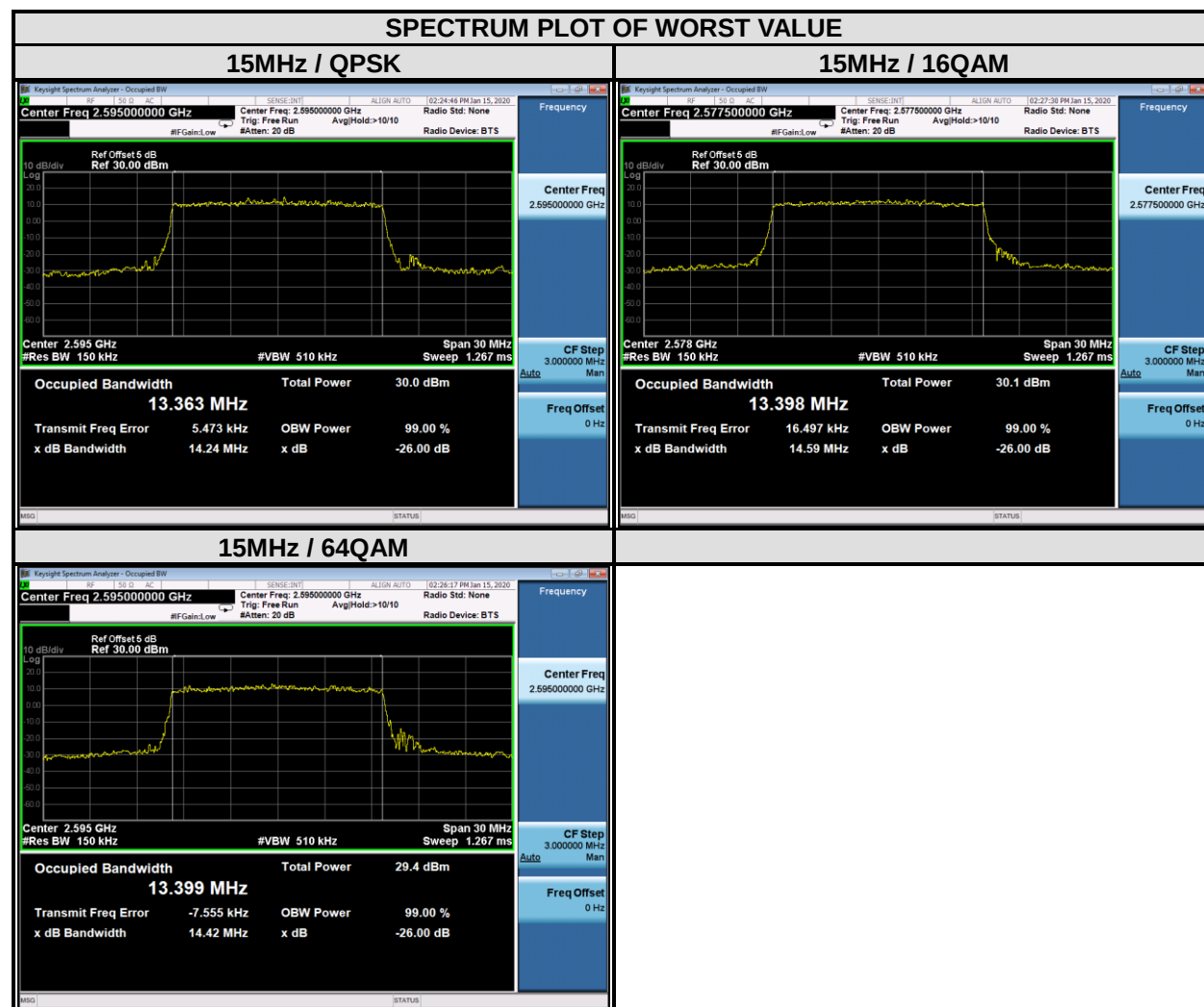
LTE BAND 38				
CHANNEL BANDWIDTH:5MHz				
CHANNEL	FREQUENCY (MHz)	99% OCCUPIED BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
37775	2572.5	4.48	4.47	4.69
38000	2595	4.47	4.47	4.46
38225	2617.5	4.47	4.48	4.47
CHANNEL	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
37775	2572.5	4.80	4.86	4.84
38000	2595	4.99	4.87	4.85
38225	2617.5	4.84	4.88	4.88



LTE BAND 38				
CHANNEL BANDWIDTH:10MHz				
CHANNEL	FREQUENCY (MHz)	99% OCCUPIED BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
37800	2575	8.95	8.94	8.94
38000	2595	8.95	8.94	8.96
38200	2615	8.95	8.95	8.94
CHANNEL	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
37800	2575	9.71	9.51	9.56
38000	2595	9.73	9.58	9.57
38200	2615	9.67	9.62	9.62



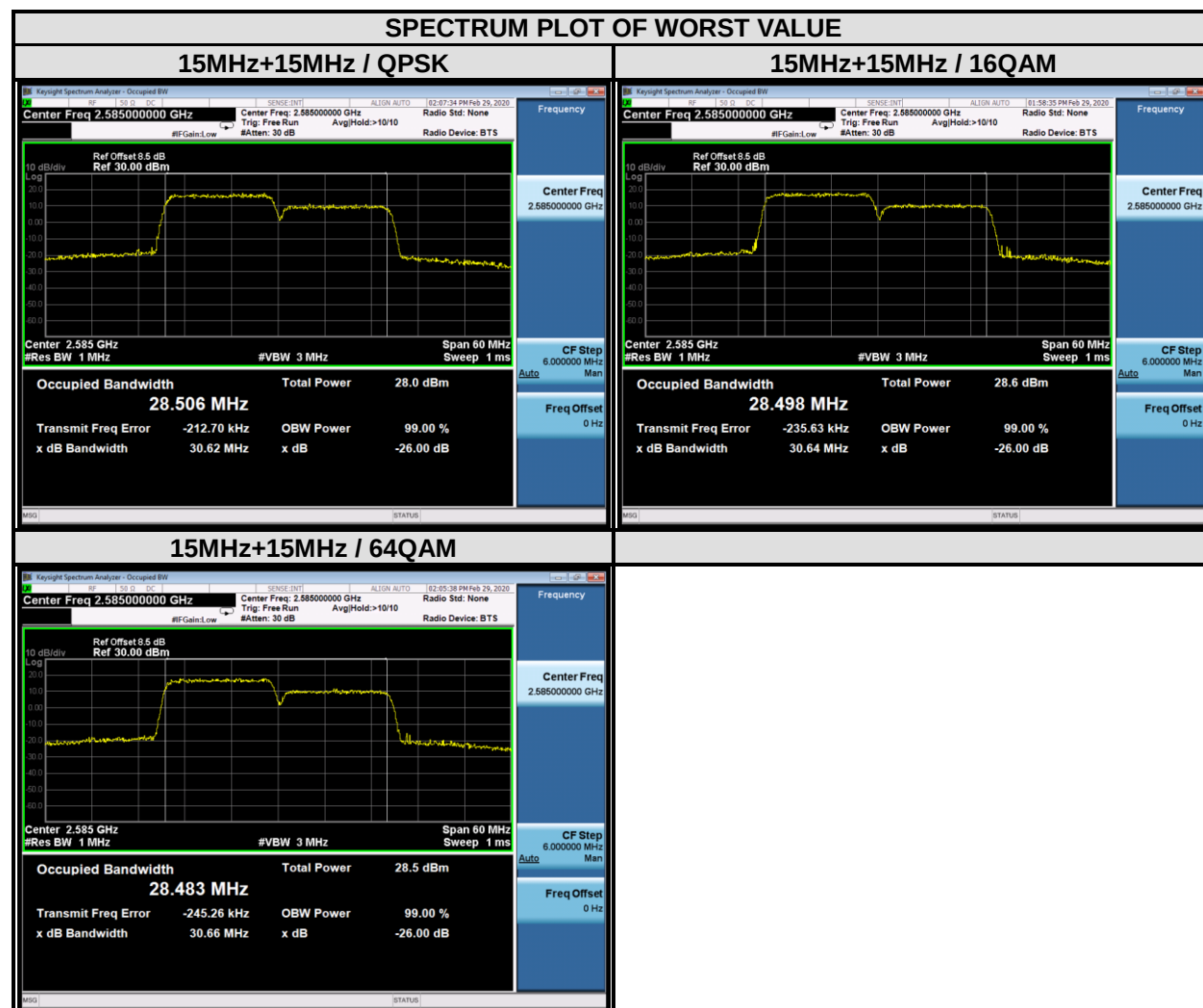
LTE BAND 38				
CHANNEL BANDWIDTH:15MHz				
CHANNEL	FREQUENCY (MHz)	99% OCCUPIED BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
37825	2577.5	13.35	13.40	13.39
38000	2595	13.36	13.39	13.40
38175	2612.5	13.33	13.39	13.38
CHANNEL	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
37825	2577.5	14.44	14.59	14.57
38000	2595	14.24	14.24	14.42
38175	2612.5	14.55	14.38	14.72



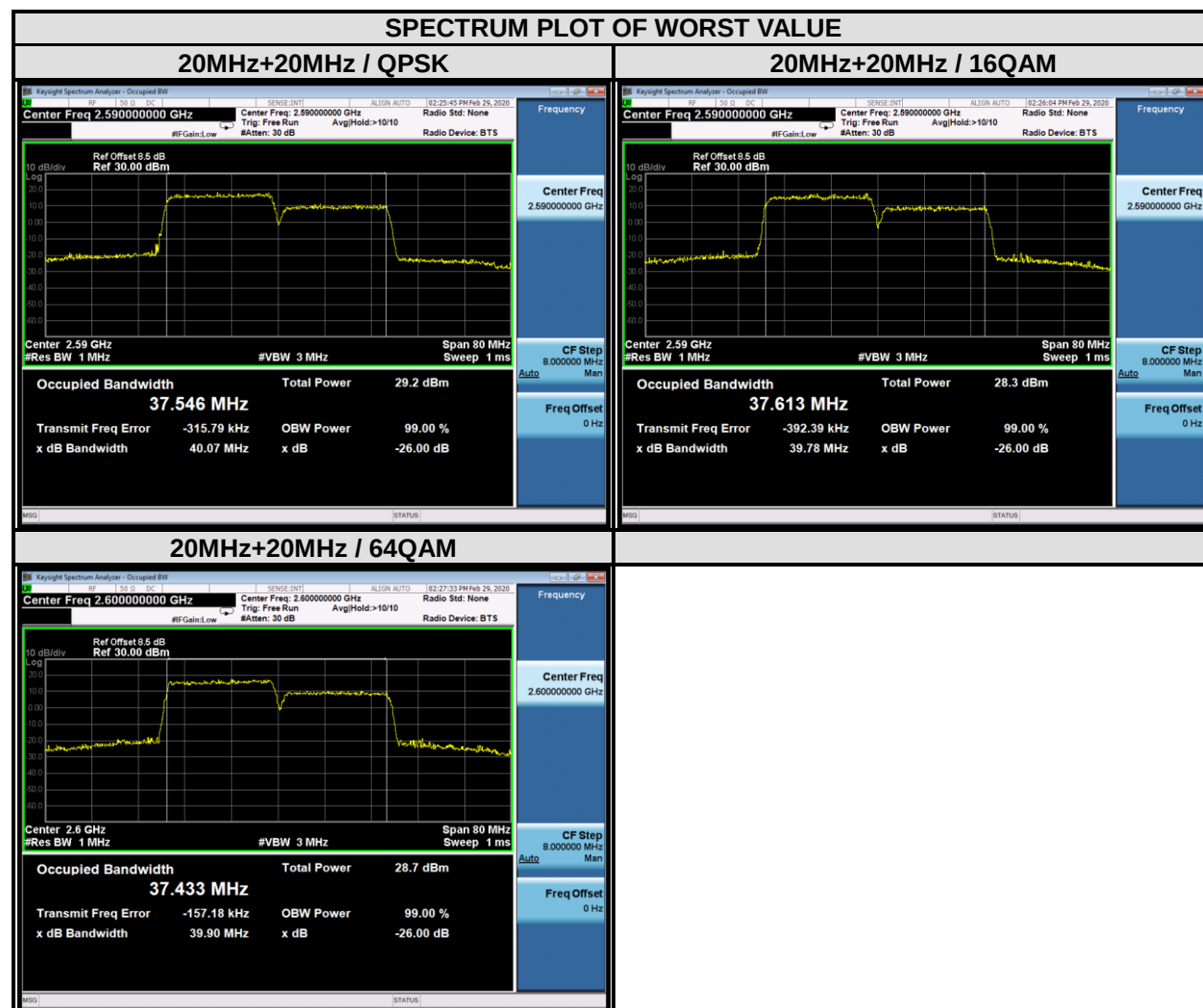
LTE BAND 38				
CHANNEL BANDWIDTH:20MHz				
CHANNEL	FREQUENCY (MHz)	99% OCCUPIED BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
37850	2580	17.89	17.92	17.88
38000	2595	17.90	17.87	17.89
38150	2610	17.86	17.86	17.87
CHANNEL	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)		
		QPSK	16QAM	64QAM
37850	2580	19.21	19.13	19.05
38000	2595	18.99	19.12	19.18
38150	2610	19.39	19.14	19.16



LTE BAND CA_38C				
CHANNEL BANDWIDTH: 15MHz+15MHz				
CHANNEL	CHANNEL	99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
37825	37975	28.506	28.498	28.483
37925	38075	28.447	28.370	28.421
38025	38175	28.322	28.444	28.346
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
37825	37975	30.62	30.64	30.66
37925	38075	30.43	30.55	30.60
38025	38175	30.54	30.45	30.54



LTE BAND CA_38C				
CHANNEL BANDWIDTH: 20MHz+20MHz				
CHANNEL	CHANNEL	99% OCCUPIED BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
37850	38048	37.546	37.613	37.403
37901	38099	37.365	37.422	37.414
37952	38150	37.485	37.454	37.433
CHANNEL	CHANNEL	26dB BANDWIDTH (MHz)		
PCC	SCC	QPSK	16QAM	64QAM
37850	38048	40.07	39.78	39.81
37901	38099	39.79	40.03	39.83
37952	38150	39.93	39.90	39.90

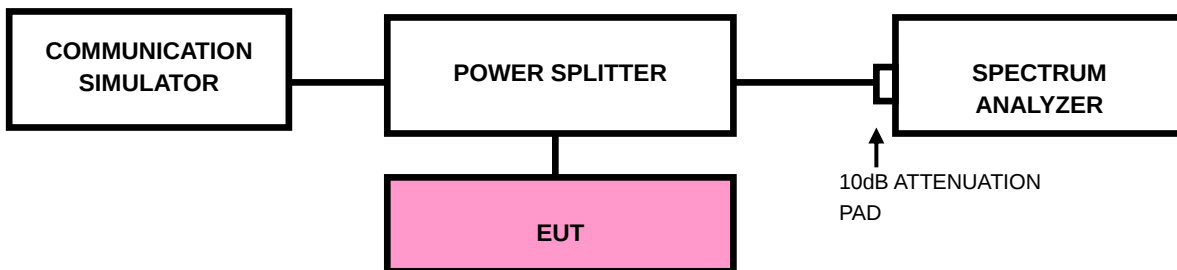


3.5 BAND EDGE MEASUREMENT

3.5.1 LIMITS OF BAND EDGE MEASUREMENT

According to FCC 27.53(m)(4) specified that For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees. For mobile digital stations, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed.

3.5.2 TEST SETUP



3.5.3 TEST PROCEDURES

- a. The EUT was set up for the maximum peak power with LTE link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 2 channels (low and high operational frequency range.).
- b. The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- c. The center frequency of spectrum is the band edge frequency and span is 35MHz. RBW of the spectrum is 100kHz and VBW of the spectrum is 300kHz (Channel bandwidth 5MHz).
- d. The center frequency of spectrum is the band edge frequency and span is 50MHz. RBW of the spectrum is 200kHz and VBW of the spectrum is 1MHz (Channel bandwidth 10MHz).
- e. The center frequency of spectrum is the band edge frequency and span is 60MHz. RBW of the spectrum is 300kHz and VBW of the spectrum is 1MHz (Channel bandwidth 15MHz).
- f. The center frequency of spectrum is the band edge frequency and span is 80MHz. RBW of the spectrum is 500kHz and VBW of the spectrum is 2MHz (Channel bandwidth 20MHz).
- g. Record the max trace plot into the test report.

3.5.4 TEST RESULTS

