

9. PEAK-TO-AVERAGE RATIO

9.1 PROVISIONS APPLICABLE

① CCDF Procedure for PAPR :

1. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Set the measurement interval as follows:
 - for continuous transmissions, set to 1 ms,
 - or burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
4. Record the maximum PAPR level associated with a probability of 0.1%.

② Alternate Procedure for PAPR:

Use one of the procedures presented in 5.2(ANSI C63.26-2015) to measure the total peak power and record as PPk. Use one of the applicable procedures presented 5.2(ANSI C63.26-2015) to measure the total average power and record as PAvg. Determine the P.A.R. from:

$$\text{P.A.R(dB)} = \text{PPk (dBm)} - \text{PAvg (dBm)} \quad (\text{PAvg} = \text{Average Power} + \text{Duty cycle Factor})$$

9.2 MEASUREMENT METHOD

Test Settings(Peak Power):

The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW $\geq 3 \times$ RBW.

1. Set the RBW \geq OBW.
2. Set VBW $\geq 3 \times$ RBW.
3. Set span $\geq 2 \times$ OBW.
4. Sweep time $\geq 10 \times$ (number of points in sweep) \times (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the peak amplitude level.

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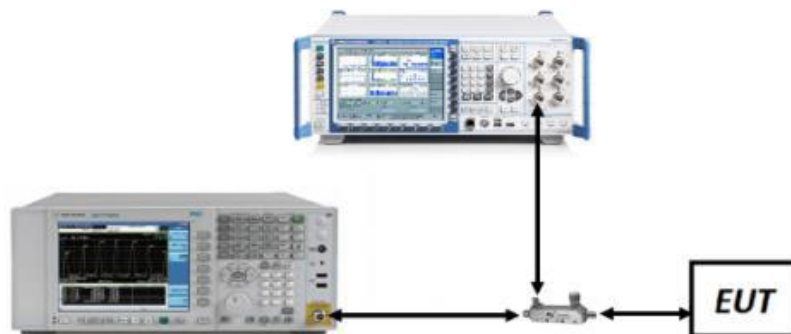
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Test Settings(Average Power)

1. Set span to $2 \times$ to $3 \times$ the OBW.
2. Set RBW \geq OBW.
3. Set VBW $\geq 3 \times$ RBW.
4. Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
5. Sweep time: Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$ for single sweep (automation-compatible) measurement. The transmission period is the (on + off) time.
6. Detector = power averaging (rms).
7. Set sweep trigger to "free run."
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. (To accurately determine the average power over the on and off period of the transmitter, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.)
9. Use the peak marker function to determine the maximum amplitude level.
10. Add $[10 \log (1/\text{duty cycle})]$ to the measured maximum power level to compute the average power during continuous transmission. For example, add $[10 \log (1/0.25)] = 6 \text{ dB}$ if the duty cycle is a constant 25%.

9.3 MEASUREMENT SETUP



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9.4 MEASUREMENT RESULT

LTE Band 2

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dB)	Limit(dB)	Verdict
Band2	1.4MHz	QPSK	18607	6RB#0	4.65	13	PASS
Band2	1.4MHz	QPSK	18900	6RB#0	4.89	13	PASS
Band2	1.4MHz	QPSK	19193	6RB#0	4.72	13	PASS
Band2	1.4MHz	16QAM	18607	6RB#0	5.48	13	PASS
Band2	1.4MHz	16QAM	18900	6RB#0	5.71	13	PASS
Band2	1.4MHz	16QAM	19193	6RB#0	5.51	13	PASS
Band2	3MHz	QPSK	18615	15RB#0	4.57	13	PASS
Band2	3MHz	QPSK	18900	15RB#0	4.78	13	PASS
Band2	3MHz	QPSK	19185	15RB#0	4.64	13	PASS
Band2	3MHz	16QAM	18615	15RB#0	5.46	13	PASS
Band2	3MHz	16QAM	18900	15RB#0	5.66	13	PASS
Band2	3MHz	16QAM	19185	15RB#0	5.50	13	PASS
Band2	5MHz	QPSK	18625	25RB#0	4.59	13	PASS
Band2	5MHz	QPSK	18900	25RB#0	4.91	13	PASS
Band2	5MHz	QPSK	19175	25RB#0	4.79	13	PASS
Band2	5MHz	16QAM	18625	25RB#0	5.38	13	PASS
Band2	5MHz	16QAM	18900	25RB#0	5.67	13	PASS
Band2	5MHz	16QAM	19175	25RB#0	5.52	13	PASS
Band2	10MHz	QPSK	18650	50RB#0	4.67	13	PASS
Band2	10MHz	QPSK	18900	50RB#0	4.93	13	PASS
Band2	10MHz	QPSK	19150	50RB#0	4.68	13	PASS
Band2	10MHz	16QAM	18650	50RB#0	5.45	13	PASS
Band2	10MHz	16QAM	18900	50RB#0	5.71	13	PASS
Band2	10MHz	16QAM	19150	50RB#0	5.49	13	PASS
Band2	15MHz	QPSK	18675	75RB#0	4.97	13	PASS
Band2	15MHz	QPSK	18900	75RB#0	5.12	13	PASS
Band2	15MHz	QPSK	19125	75RB#0	4.84	13	PASS
Band2	15MHz	16QAM	18675	75RB#0	5.67	13	PASS
Band2	15MHz	16QAM	18900	75RB#0	5.78	13	PASS
Band2	15MHz	16QAM	19125	75RB#0	5.57	13	PASS
Band2	20MHz	QPSK	18700	100RB#0	4.81	13	PASS
Band2	20MHz	QPSK	18900	100RB#0	5.03	13	PASS
Band2	20MHz	QPSK	19100	100RB#0	4.85	13	PASS
Band2	20MHz	16QAM	18700	100RB#0	5.64	13	PASS
Band2	20MHz	16QAM	18900	100RB#0	5.79	13	PASS
Band2	20MHz	16QAM	19100	100RB#0	5.61	13	PASS

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LTE Band 4

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dB)	Limit(dB)	Verdict
Band4	1.4MHz	QPSK	19957	6RB#0	8.46	13	PASS
Band4	1.4MHz	QPSK	20175	6RB#0	8.43	13	PASS
Band4	1.4MHz	QPSK	20393	6RB#0	8.43	13	PASS
Band4	1.4MHz	16QAM	19957	6RB#0	8.43	13	PASS
Band4	1.4MHz	16QAM	20175	6RB#0	8.45	13	PASS
Band4	1.4MHz	16QAM	20393	6RB#0	8.46	13	PASS
Band4	3MHz	QPSK	19965	15RB#0	8.41	13	PASS
Band4	3MHz	QPSK	20175	15RB#0	8.45	13	PASS
Band4	3MHz	QPSK	20385	15RB#0	8.44	13	PASS
Band4	3MHz	16QAM	19965	15RB#0	8.44	13	PASS
Band4	3MHz	16QAM	20175	15RB#0	8.44	13	PASS
Band4	3MHz	16QAM	20385	15RB#0	8.43	13	PASS
Band4	5MHz	QPSK	19975	25RB#0	8.45	13	PASS
Band4	5MHz	QPSK	20175	25RB#0	8.41	13	PASS
Band4	5MHz	QPSK	20375	25RB#0	8.43	13	PASS
Band4	5MHz	16QAM	19975	25RB#0	8.42	13	PASS
Band4	5MHz	16QAM	20175	25RB#0	8.44	13	PASS
Band4	5MHz	16QAM	20375	25RB#0	8.42	13	PASS
Band4	10MHz	QPSK	20000	50RB#0	8.45	13	PASS
Band4	10MHz	QPSK	20175	50RB#0	8.43	13	PASS
Band4	10MHz	QPSK	20350	50RB#0	8.46	13	PASS
Band4	10MHz	16QAM	20000	50RB#0	8.42	13	PASS
Band4	10MHz	16QAM	20175	50RB#0	8.43	13	PASS
Band4	10MHz	16QAM	20350	50RB#0	8.41	13	PASS
Band4	15MHz	QPSK	20025	75RB#0	8.43	13	PASS
Band4	15MHz	QPSK	20175	75RB#0	8.48	13	PASS
Band4	15MHz	QPSK	20325	75RB#0	8.44	13	PASS
Band4	15MHz	16QAM	20025	75RB#0	8.42	13	PASS
Band4	15MHz	16QAM	20175	75RB#0	8.43	13	PASS
Band4	15MHz	16QAM	20325	75RB#0	8.44	13	PASS
Band4	20MHz	QPSK	20050	100RB#0	8.43	13	PASS
Band4	20MHz	QPSK	20175	100RB#0	8.45	13	PASS
Band4	20MHz	QPSK	20300	100RB#0	8.47	13	PASS
Band4	20MHz	16QAM	20050	100RB#0	8.43	13	PASS
Band4	20MHz	16QAM	20175	100RB#0	8.43	13	PASS
Band4	20MHz	16QAM	20300	100RB#0	8.46	13	PASS

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LTE BAND 5

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dB)	Limit(dB)	Verdict
Band5	1.4MHz	QPSK	20407	6RB#0	8.42	13	PASS
Band5	1.4MHz	QPSK	20525	6RB#0	8.43	13	PASS
Band5	1.4MHz	QPSK	20643	6RB#0	8.45	13	PASS
Band5	1.4MHz	16QAM	20407	6RB#0	8.44	13	PASS
Band5	1.4MHz	16QAM	20525	6RB#0	8.43	13	PASS
Band5	1.4MHz	16QAM	20643	6RB#0	8.44	13	PASS
Band5	3MHz	QPSK	20415	15RB#0	8.42	13	PASS
Band5	3MHz	QPSK	20525	15RB#0	8.42	13	PASS
Band5	3MHz	QPSK	20635	15RB#0	8.41	13	PASS
Band5	3MHz	16QAM	20415	15RB#0	8.44	13	PASS
Band5	3MHz	16QAM	20525	15RB#0	8.42	13	PASS
Band5	3MHz	16QAM	20635	15RB#0	8.42	13	PASS
Band5	5MHz	QPSK	20425	25RB#0	8.47	13	PASS
Band5	5MHz	QPSK	20525	25RB#0	8.42	13	PASS
Band5	5MHz	QPSK	20625	25RB#0	8.39	13	PASS
Band5	5MHz	16QAM	20425	25RB#0	8.43	13	PASS
Band5	5MHz	16QAM	20525	25RB#0	8.44	13	PASS
Band5	5MHz	16QAM	20625	25RB#0	8.45	13	PASS
Band5	10MHz	QPSK	20450	50RB#0	8.46	13	PASS
Band5	10MHz	QPSK	20525	50RB#0	8.42	13	PASS
Band5	10MHz	QPSK	20600	50RB#0	8.44	13	PASS
Band5	10MHz	16QAM	20450	50RB#0	8.42	13	PASS
Band5	10MHz	16QAM	20525	50RB#0	8.43	13	PASS
Band5	10MHz	16QAM	20600	50RB#0	8.46	13	PASS

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LTE BAND 7

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dB)	Limit(dB)	Verdict
Band7	5MHz	QPSK	20775	25RB#0	8.40	13	PASS
Band7	5MHz	QPSK	21100	25RB#0	8.40	13	PASS
Band7	5MHz	QPSK	21425	25RB#0	8.40	13	PASS
Band7	5MHz	16QAM	20775	25RB#0	8.40	13	PASS
Band7	5MHz	16QAM	21100	25RB#0	8.42	13	PASS
Band7	5MHz	16QAM	21425	25RB#0	8.44	13	PASS
Band7	10MHz	QPSK	20800	50RB#0	8.43	13	PASS
Band7	10MHz	QPSK	21100	50RB#0	8.42	13	PASS
Band7	10MHz	QPSK	21400	50RB#0	8.41	13	PASS
Band7	10MHz	16QAM	20800	50RB#0	8.44	13	PASS
Band7	10MHz	16QAM	21100	50RB#0	8.43	13	PASS
Band7	10MHz	16QAM	21400	50RB#0	8.41	13	PASS
Band7	15MHz	QPSK	20825	75RB#0	8.46	13	PASS
Band7	15MHz	QPSK	21100	75RB#0	8.44	13	PASS
Band7	15MHz	QPSK	21375	75RB#0	8.39	13	PASS
Band7	15MHz	16QAM	20825	75RB#0	8.40	13	PASS
Band7	15MHz	16QAM	21100	75RB#0	8.44	13	PASS
Band7	15MHz	16QAM	21375	75RB#0	8.39	13	PASS
Band7	20MHz	QPSK	20850	100RB#0	8.46	13	PASS
Band7	20MHz	QPSK	21100	100RB#0	8.43	13	PASS
Band7	20MHz	QPSK	21350	100RB#0	8.39	13	PASS
Band7	20MHz	16QAM	20850	100RB#0	8.43	13	PASS
Band7	20MHz	16QAM	21100	100RB#0	8.41	13	PASS
Band7	20MHz	16QAM	21350	100RB#0	8.44	13	PASS

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LTE BAND 38

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dB)	Limit(dB)	Verdict
Band38	5MHz	QPSK	37775	25RB#0	6.24	13	PASS
Band38	5MHz	QPSK	38000	25RB#0	5.82	13	PASS
Band38	5MHz	QPSK	38225	25RB#0	6.73	13	PASS
Band38	5MHz	16QAM	37775	25RB#0	6.70	13	PASS
Band38	5MHz	16QAM	38000	25RB#0	6.39	13	PASS
Band38	5MHz	16QAM	38225	25RB#0	6.78	13	PASS
Band38	10MHz	QPSK	37800	50RB#0	4.63	13	PASS
Band38	10MHz	QPSK	38000	50RB#0	3.87	13	PASS
Band38	10MHz	QPSK	38200	50RB#0	3.45	13	PASS
Band38	10MHz	16QAM	37800	50RB#0	5.49	13	PASS
Band38	10MHz	16QAM	38000	50RB#0	4.71	13	PASS
Band38	10MHz	16QAM	38200	50RB#0	4.38	13	PASS
Band38	15MHz	QPSK	37825	75RB#0	4.90	13	PASS
Band38	15MHz	QPSK	38000	75RB#0	4.24	13	PASS
Band38	15MHz	QPSK	38175	75RB#0	3.86	13	PASS
Band38	15MHz	16QAM	37825	75RB#0	5.68	13	PASS
Band38	15MHz	16QAM	38000	75RB#0	5.04	13	PASS
Band38	15MHz	16QAM	38175	75RB#0	4.73	13	PASS
Band38	20MHz	QPSK	37850	100RB#0	4.81	13	PASS
Band38	20MHz	QPSK	38000	100RB#0	4.35	13	PASS
Band38	20MHz	QPSK	38150	100RB#0	4.06	13	PASS
Band38	20MHz	16QAM	37850	100RB#0	5.62	13	PASS
Band38	20MHz	16QAM	38000	100RB#0	5.14	13	PASS
Band38	20MHz	16QAM	38150	100RB#0	4.91	13	PASS

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LTE BAND 40

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dB)	Limit(dB)	Verdict
Band40	5MHz	QPSK	38725	25RB#0	4.74	13	PASS
Band40	5MHz	QPSK	38750	25RB#0	5.01	13	PASS
Band40	5MHz	QPSK	38775	25RB#0	5.00	13	PASS
Band40	5MHz	16QAM	38725	25RB#0	5.89	13	PASS
Band40	5MHz	16QAM	38750	25RB#0	5.72	13	PASS
Band40	5MHz	16QAM	38775	25RB#0	5.72	13	PASS
Band40	10MHz	QPSK	38750	50RB#0	4.91	13	PASS
Band40	10MHz	16QAM	38750	50RB#0	5.74	13	PASS

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LTE BAND 41

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dB)	Limit(dB)	Verdict
Band41	5MHz	QPSK	39675	25RB#0	4.68	13	PASS
Band41	5MHz	QPSK	40620	25RB#0	3.72	13	PASS
Band41	5MHz	QPSK	41565	25RB#0	3.94	13	PASS
Band41	5MHz	16QAM	39675	25RB#0	5.51	13	PASS
Band41	5MHz	16QAM	40620	25RB#0	4.60	13	PASS
Band41	5MHz	16QAM	41565	25RB#0	4.83	13	PASS
Band41	10MHz	QPSK	39700	50RB#0	4.74	13	PASS
Band41	10MHz	QPSK	40620	50RB#0	3.73	13	PASS
Band41	10MHz	QPSK	41540	50RB#0	3.98	13	PASS
Band41	10MHz	16QAM	39700	50RB#0	5.59	13	PASS
Band41	10MHz	16QAM	40620	50RB#0	4.63	13	PASS
Band41	10MHz	16QAM	41540	50RB#0	4.89	13	PASS
Band41	15MHz	QPSK	39725	75RB#0	4.90	13	PASS
Band41	15MHz	QPSK	40620	75RB#0	4.12	13	PASS
Band41	15MHz	QPSK	41515	75RB#0	4.43	13	PASS
Band41	15MHz	16QAM	39725	75RB#0	5.78	13	PASS
Band41	15MHz	16QAM	40620	75RB#0	4.98	13	PASS
Band41	15MHz	16QAM	41515	75RB#0	5.25	13	PASS
Band41	20MHz	QPSK	39750	100RB#0	4.69	13	PASS
Band41	20MHz	QPSK	40620	100RB#0	4.26	13	PASS
Band41	20MHz	QPSK	41490	100RB#0	4.61	13	PASS
Band41	20MHz	16QAM	39750	100RB#0	5.61	13	PASS
Band41	20MHz	16QAM	40620	100RB#0	5.07	13	PASS
Band41	20MHz	16QAM	41490	100RB#0	5.38	13	PASS

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10. SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL

10.1 PROVISIONS APPLICABLE

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

10.2 MEASUREMENT METHOD

For Band 2/Band 4/Band 5/Band 7/Band 12/Band 13/Band 17/ Band 25/Band 26/Band 38/Band 40/Band 41/Band 66/Band 71:

The minimum permissible attenuation level of any spurious emission is $43 + \log_{10}(P[\text{Watts}])$, where P is the transmitter power in Watts.

For Band 7:

- (i) $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
- (ii) $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
- (iii) $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges

For Band 14:

On all frequencies between 769-775 MHz and 799-805 MHz: $< 65 + 10 \log_{10} (P[\text{Watts}])$

For Band 38/41:

1. 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,
2. $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge.
3. $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge.
4. The attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz.
5. $55 + 10 \log (P)$ dB at or below 2490.5 MHz.
6. X is the greater of 6MHz or the actual emission bandwidth.

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least $10 \times$ the fundamental frequency (separated into at least two plots per channel)
1. RBW = 1 MHz
2. VBW \geq 3 MHz
3. Detector = RMS
4. Trace Mode = Average
5. Sweep time = auto
6. Number of points in sweep $\geq 2 \times \text{Span} / \text{RBW}$

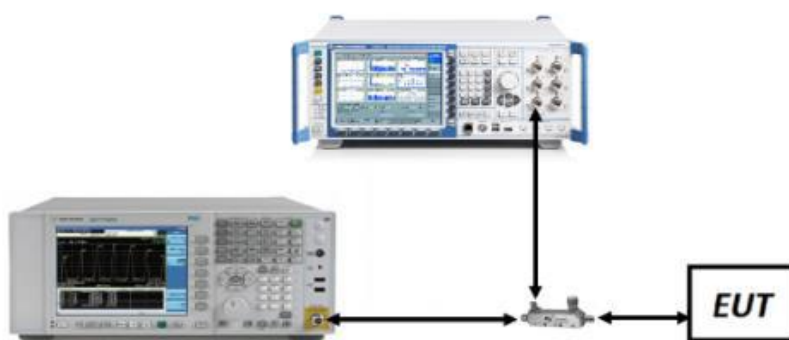
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Test Note

Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

10.3 MEASUREMENT SETUP



10.4 MEASUREMENT RESULT

Please refer to: appendix a test plots for spurious and harmonic emissions at antenna terminal

Note: 1. No transmission signal is found in standby or receiving mode, and the default value is lower than the limit of 20dB, which is not recorded in this report.

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11. RADIATED SPURIOUS EMISSION

11.1 PROVISIONS APPLICABLE

(A) On any frequency outside a licensee's frequency block (e.g. A, D, B, etc.) within the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least $43+10\log(P)$ dB. The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm.

At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

(B) For specific criteria, please refer to the description in section 9.2 of the report for corresponding evaluation.

11.2 MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.

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9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.
11. For spurious emissions above 1GHz, a horn antenna is substituted in place of the EUT.
The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.
The spurious emissions is calculated by the following formula;

$$\text{Result(dBm)} = \text{Pg(dBm)} + \text{Factor(dB)}$$

$$\text{Factor(dB)} = \text{Ant Gain(dB)} - \text{Cable Loss(dB)} + \text{Power Splitter(dB)} \text{ (Above 1GHz)}$$

$$\text{Factor(dB)} = \text{Ant Gain(dB)} - \text{Cable Loss(dB)} \text{ (Below 1GHz)}$$

Where: P_g is the generator output power into the substitution antenna.

If the fundamental frequency is below 1GHz, RF output power has been converted to EIRP.

$$\text{EIRP(dBm)} = \text{ERP(dBm)} + 2.15$$

12. Examples of Factor parameters for testing radiation spurious:

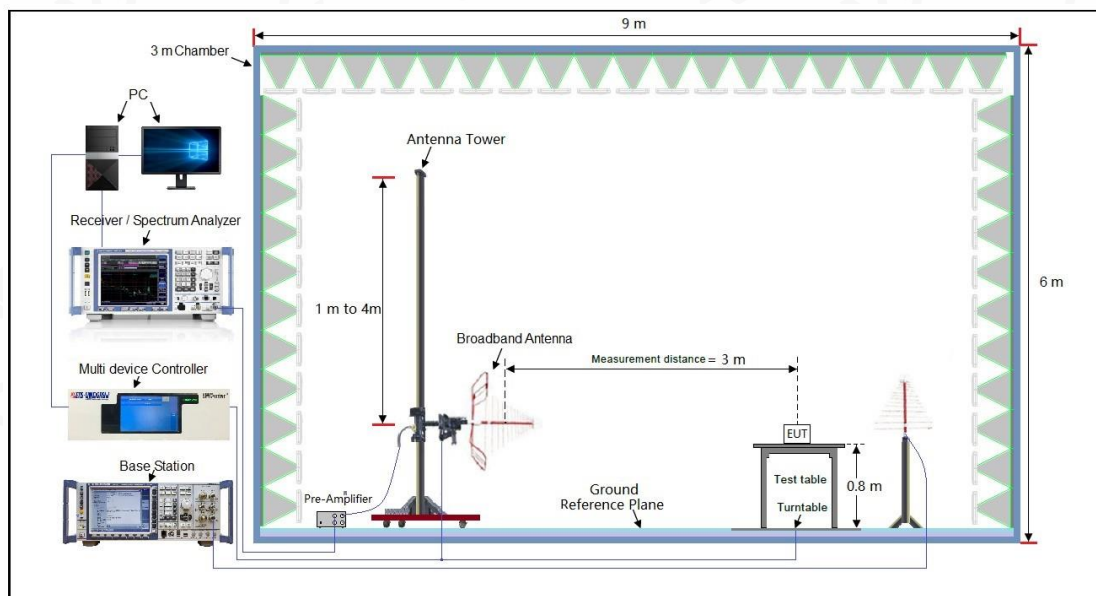
Frequency Range(MHz)	Factor(dB)
30-500	6.18
500-1000	9.37
1000-1500	27.56
1500-2000	28.27
2000-3000	29.45
3000-5000	30.15
5000-10000	31.26
10000-15000	32.78
15000-20000	33.99
Above 20GHz	35.04

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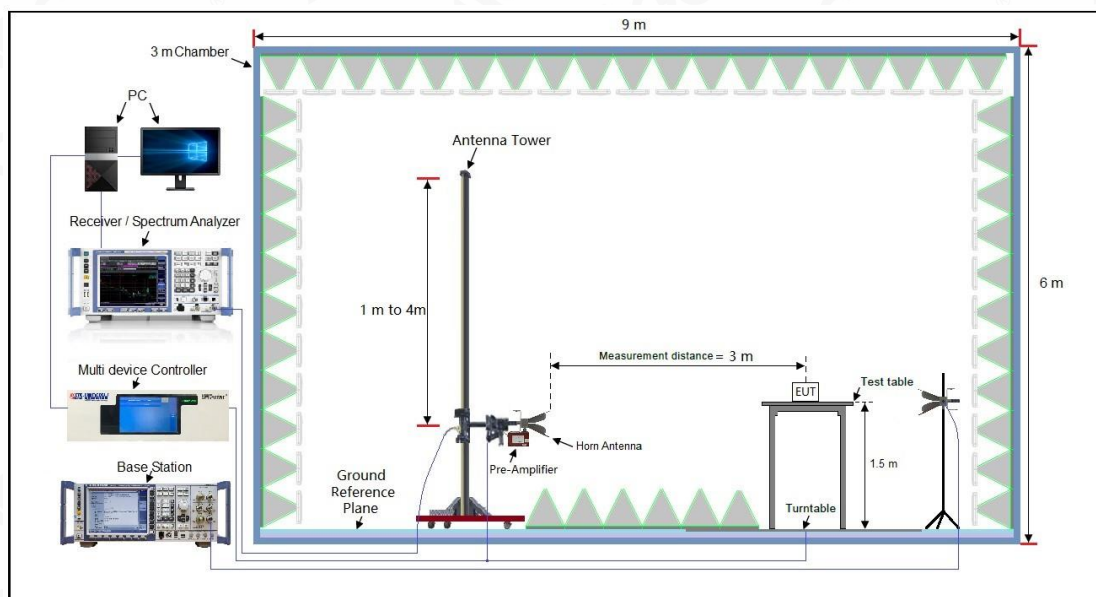


11.3 MEASUREMENT SETUP

Radiated Emissions 30MHz to 1GHz Test setup



Radiated Emissions Above 1GHz Test setup



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11.4 MEASUREMENT RESULT

LTE Band 2 Low channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
5552.1	V	-42.18	-13	-29.18
3701.4	V	-40.49	-13	-27.49
695.5	V	-47.56	-13	-34.56
412.1	V	-50.73	-13	-37.73
5552.1	H	-40.95	-13	-27.95
3701.4	H	-40.64	-13	-27.64
678.3	H	-49.04	-13	-36.04
452.1	H	-51.39	-13	-38.39

Middle channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
5640	V	-42.89	-13	-29.89
3760	V	-40.81	-13	-27.81
885.1	V	-48.06	-13	-35.06
618.7	V	-49.56	-13	-36.56
5640	H	-49.60	-13	-36.60
3760	H	-41.36	-13	-28.36
851.3	H	-45.44	-13	-32.44
732.5	H	-49.45	-13	-36.45

High channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
5727.9	V	-42.35	-13	-29.35
3818.6	V	-42.76	-13	-29.76
664.5	V	-47.54	-13	-34.54
525.8	V	-47.04	-13	-34.04
5727.9	H	-40.26	-13	-27.26
3818.6	H	-40.81	-13	-27.81
669.8	H	-49.21	-13	-36.21
574.4	H	-49.00	-13	-36.00

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LTE Band 4 Low channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
5132.1	V	-41.26	-13	-28.26
3421.4	V	-40.98	-13	-27.98
745.5	V	-44.64	-13	-31.64
528.1	V	-48.69	-13	-35.69
5132.1	H	-40.69	-13	-27.69
3421.4	H	-41.05	-13	-28.05
520.5	H	-48.53	-13	-35.53
395.8	H	-43.52	-13	-30.52

Middle channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
5197.5	V	-39.34	-13	-26.34
3465	V	-39.16	-13	-26.16
669.4	V	-47.36	-13	-34.36
512.5	V	-49.20	-13	-36.20
5197.5	H	-39.51	-13	-26.51
3465	H	-41.53	-13	-28.53
569.4	H	-47.69	-13	-34.69
469.3	H	-47.23	-13	-34.23

High channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
5262.9	V	-38.66	-13	-25.66
3508.6	V	-39.73	-13	-26.73
711.1	V	-47.50	-13	-34.50
528.7	V	-47.30	-13	-34.30
5262.9	H	-38.87	-13	-25.87
3508.6	H	-38.02	-13	-25.02
612.5	H	-45.70	-13	-32.70
553.9	H	-47.02	-13	-34.02

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LTE Band 5 Low channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
2474.1	V	-43.17	-13	-30.17
1649.4	V	-42.84	-13	-29.84
512.2	V	-47.80	-13	-34.80
365.5	V	-47.40	-13	-34.40
2474.1	H	-40.53	-13	-27.53
1649.4	H	-40.61	-13	-27.61
521.1	H	-44.98	-13	-31.98
336.5	H	-46.06	-13	-33.06

Middle channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
2509.5	V	-44.58	-13	-31.58
1673	V	-43.66	-13	-30.66
725.8	V	-47.40	-13	-34.40
616.6	V	-47.24	-13	-34.24
2509.5	H	-40.77	-13	-27.77
1673	H	-43.09	-13	-30.09
705.5	H	-45.69	-13	-32.69
558.9	H	-46.79	-13	-33.79

High channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
2544.9	V	-41.56	-13	-28.56
1696.6	V	-40.60	-13	-27.60
648.3	V	-46.73	-13	-33.73
482.7	V	-47.60	-13	-34.60
2544.9	H	-41.41	-13	-28.41
1696.6	H	-41.85	-13	-28.85
785.6	H	-46.24	-13	-33.24
615.7	H	-47.97	-13	-34.97

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LTE Band 7 Low channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7507.5	V	-45.18	-25	-20.18
5005	V	-44.34	-25	-19.34
925.7	V	-50.26	-25	-25.26
678.9	V	-53.03	-25	-28.03
7507.5	H	-42.67	-25	-17.67
5005	H	-43.05	-25	-18.05
873.6	H	-49.64	-25	-24.64
662.7	H	-51.39	-25	-26.39

Middle channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBc)	Margin (dB)
7605	V	-44.27	-25	-16.70
5070	V	-41.70	-25	-26.11
833.7	V	-51.11	-25	-27.13
521.2	V	-52.13	-25	-17.32
7605	H	-42.32	-25	-17.64
5070	H	-42.64	-25	-26.13
819.6	H	-51.13	-25	-24.95
520.5	H	-49.95	-25	-16.70

High channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7702.5	V	-44.70	-25	-44.70
5135	V	-45.01	-25	-45.01
752.6	V	-53.05	-25	-53.05
511.4	V	-52.51	-25	-52.51
7702.5	H	-41.61	-25	-41.61
5135	H	-44.44	-25	-44.44
701.1	H	-49.26	-25	-49.26
507.1	H	-50.41	-25	-50.41

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LTE Band 38 Low channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7717.5	V	-51.30	-25	-26.30
5145	V	-46.45	-25	-21.45
881.2	V	-50.71	-25	-25.71
594.3	V	-53.72	-25	-28.72
7717.5	H	-48.90	-25	-23.90
5145	H	-45.56	-25	-20.56
463.8	H	-56.27	-25	-31.27
367.5	H	-50.49	-25	-25.49

Middle channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7785	V	-47.32	-25	-22.32
5190	V	-48.18	-25	-23.18
674.1	V	-54.85	-25	-29.85
493.2	V	-55.35	-25	-30.35
7785	H	-48.10	-25	-23.10
5190	H	-49.46	-25	-24.46
421.8	H	-49.75	-25	-24.75
203.1	H	-54.32	-25	-29.32

High channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7851	V	-47.90	-25	-22.90
5235	V	-48.39	-25	-23.39
745.3	V	-50.20	-25	-25.20
582.6	V	-53.56	-25	-28.56
7851	H	-46.33	-25	-21.33
5235	H	-46.78	-25	-21.78
742.1	H	-53.94	-25	-28.94
652.7	H	-53.32	-25	-28.32

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**LTE Band 40-Lower Side
Low channel**

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
6922.5	V	-52.07	-40	-12.07
4615.0	V	-49.44	-40	-9.44
857.3	V	-52.89	-40	-12.89
921.6	V	-55.91	-40	-15.91
6922.5	H	-51.22	-40	-11.22
4615.0	H	-47.36	-40	-7.36
584.3	H	-57.01	-40	-17.01
462.8	H	-52.13	-40	-12.13

Middle channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
6930	V	-48.89	-40	-8.89
4620	V	-49.26	-40	-9.26
587.6	V	-55.22	-40	-15.22
415.9	V	-55.58	-40	-15.58
6930	H	-48.88	-40	-8.88
4620	H	-51.18	-40	-11.18
469.5	H	-51.86	-40	-11.86
351.2	H	-54.11	-40	-14.11

High channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
6937.5	V	-49.81	-40	-9.81
4625.0	V	-49.59	-40	-9.59
785.4	V	-54.28	-40	-14.28
569.3	V	-54.67	-40	-14.67
6937.5	H	-47.35	-40	-7.35
4625.0	H	-48.72	-40	-8.72
699.7	H	-55.63	-40	-15.63
512.0	H	-54.70	-40	-14.70

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LTE Band 40-Upper Side Low channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7057.5	V	-49.96	-40	-9.96
4705.0	V	-48.00	-40	-8.00
763.5	V	-50.17	-40	-10.17
512.8	V	-54.76	-40	-14.76
7057.5	H	-47.45	-40	-7.45
4705.0	H	-45.42	-40	-5.42
496.8	H	-56.24	-40	-16.24
359.2	H	-51.68	-40	-11.68

Middle channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7065	V	-48.79	-40	-8.79
4710	V	-47.93	-40	-7.93
887.4	V	-54.32	-40	-14.32
746.3	V	-54.27	-40	-14.27
7065	H	-46.69	-40	-6.69
4710	H	-47.85	-40	-7.85
649.7	H	-50.87	-40	-10.87
523.1	H	-54.62	-40	-14.62

High channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7072.5	V	-47.58	-40	-7.58
4715.0	V	-48.59	-40	-8.59
469.8	V	-50.44	-40	-10.44
321.7	V	-54.47	-40	-14.47
7072.5	H	-44.51	-40	-4.51
4715.0	H	-45.63	-40	-5.63
447.5	H	-53.85	-40	-13.85
369.3	H	-52.65	-40	-12.65

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LTE Band 41 Low channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7495.5	V	-48.40	-25	-23.40
4997	V	-45.42	-25	-20.42
612.1	V	-48.66	-25	-23.66
483.6	V	-54.57	-25	-29.57
7495.5	H	-46.17	-25	-21.17
4997	H	-45.45	-25	-20.45
742.8	H	-54.53	-25	-29.53
563.7	H	-50.47	-25	-25.47

Middle channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
7779	V	-45.47	-25	-20.47
5186	V	-47.41	-25	-22.41
568.2	V	-51.81	-25	-26.81
341.5	V	-54.66	-25	-29.66
7779	H	-44.33	-25	-19.33
5186	H	-46.49	-25	-21.49
552.7	H	-49.25	-25	-24.25
421.5	H	-53.87	-25	-28.87

High channel

Frequency (MHz)	Polarity (H/V)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
8062.5	V	-46.52	-25	-21.52
5375	V	-45.81	-25	-20.81
642.9	V	-49.13	-25	-24.13
471.6	V	-52.50	-25	-27.50
8062.5	H	-43.88	-25	-18.88
5375	H	-45.21	-25	-20.21
363.2	H	-50.73	-25	-25.73
274.6	H	-50.41	-25	-25.41

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Note: 1. Margin (dB) = Emission Level(dBm) -Limit(dBm)

Emission Level(dBm)= Measurement Reading(dBm)+Factor(dB)

Factor(dB) = ANT Gain -Cable Loss + Power Splitter

2. The test refers to the value of Factor, please refer to the results listed in the test method in this section of the report.
3. Radiated Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0.
4. Below 30MHz, no spurious emission was found, and only the worst mode data above 30MHz is recorded in the report.

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12. FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

12.1 PROVISIONS APPLICABLE

12.1.1 For Hand carried battery powered equipment

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

- a.) Temperature: The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

For Part 22, the frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency. For Part 24 and Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

12.1.2 For equipment powered by primary supply voltage

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

12.2 MEASUREMENT METHOD

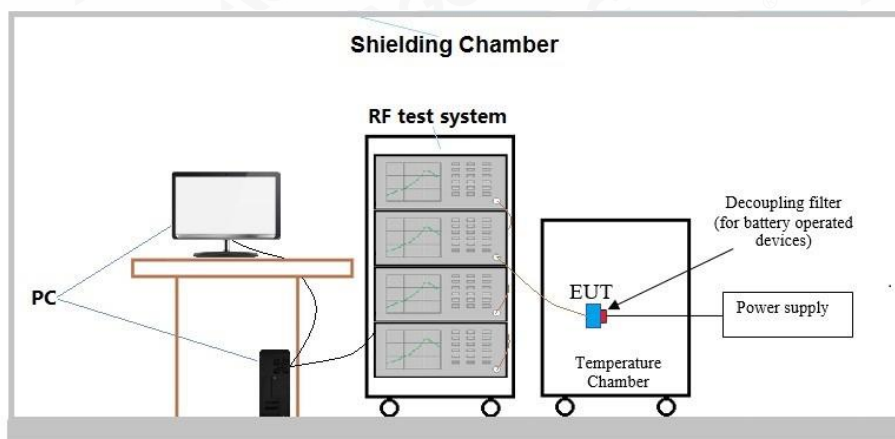
In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.

- 1 Measure the carrier frequency at room temperature.
- 2 Subject the EUT to overnight soak at -30°C. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on channel 20175 for LTE band 4 measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
- 3 Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
- 4 Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.



- 5 Subject the EUT to overnight soak at +50°C.
- 6 With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
- 7 Repeat the above measurements at 10°C increments from +50°C to -30°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
- 8 At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

12.3 MEASUREMENT SETUP



12.4 MEASUREMENT RESULT

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LTE Band 2

Middle Channel, $f_0 = 1880$ MHz			
Temperature (°C)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-30	3.70	-4.41	-0.002383
-20		-7.55	-0.004080
-10		-4.25	-0.002296
0		-6.29	-0.003346
10		4.98	0.002649
20		4.52	0.002404
30		-3.56	-0.001865
40		-9.77	-0.005117
50		4.43	0.002320
25	4.20	4.76	0.002572
	3.15	3.98	0.002151

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

LTE Band 4

Middle Channel, $f_0 = 1732.5$ MHz				
Temperature (°C)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Temperature (°C)
-30	3.70	7.32	0.004279	±2.5
-20		13.33	0.007792	±2.5
-10		8.45	0.004939	±2.5
0		-5.14	-0.002967	±2.5
10		-4.75	-0.002742	±2.5
20		-2.68	-0.001547	±2.5
30		-3.25	-0.001853	±2.5
40		-6.58	-0.003751	±2.5
50		8.14	0.004640	±2.5
25	4.20	5.15	0.003010	±2.5
	3.15	5.91	0.003455	±2.5

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LTE Band 5

Middle Channel, $f_0 = 836.5$ MHz				
Temperature (°C)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Temperature (°C)
-30	3.70	8.51	0.010319	±2.5
-20		13.16	0.015957	±2.5
-10		5.52	0.006693	±2.5
0		5.85	0.006993	±2.5
10		-6.11	-0.007304	±2.5
20		4.78	0.005714	±2.5
30		6.91	0.008146	±2.5
40		9.44	0.011128	±2.5
50		-3.91	-0.004609	±2.5
25	4.20	5.46	0.006621	±2.5
	3.15	9.91	0.012016	±2.5

LTE Band 7

Middle Channel, $f_0 = 2535$ MHz			
Temperature (°C)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-30	3.70	5.08	0.002030
-20		5.44	0.002174
-10		4.02	0.001606
0		-1.69	-0.000667
10		2.23	0.000880
20		6.52	0.002572
30		3.46	0.001348
40		4.05	0.001577
50		4.28	0.001667
25	4.20	4.85	0.001938
	3.15	2.80	0.001119

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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LTE Band 38

Middle Channel, $f_0 = 2595.0$ MHz			
Temperature (°C)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
	3.70	6.08	0.002363
		3.66	0.001423
-10		2.29	0.000890
0		3.93	0.001514
10		4.46	0.001719
20		3.35	0.001291
30		4.59	0.001754
40		3.71	0.001417
50		3.26	0.001245
25	4.20	2.79	0.001085
	3.15	5.42	0.002107

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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LTE Band 40-Lower Side

Middle Channel, $f_0 = 2310.0\text{MHz}$			
Temperature (°C)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
	3.70	-5.54	-0.002401
		3.83	0.001660
-10		-5.64	-0.002444
0		-7.07	-0.003061
10		-4.42	-0.001913
20		-4.78	-0.002069
30		-6.34	-0.002742
40		-7.45	-0.003222
50		-5.14	-0.002223
25	4.20	-8.44	-0.003658
	3.15	-9.07	-0.003931

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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LTE Band 40-Upper Side

Middle Channel, $f_0 = 2355.0$ MHz			
Temperature (°C)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-30	3.70	-11.27	-0.004791
-20		-10.31	-0.004383
-10		-9.56	-0.004064
0		-11.84	-0.005028
10		-11.66	-0.004951
20		-13.78	-0.005851
30		-15.38	-0.006524
40		-13.29	-0.005637
50		-12.07	-0.005120
25	4.20	-10.09	-0.004289
	3.15	-7.87	-0.003345

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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LTE Band 41

Middle Channel, $f_0 = 2593.0$ MHz			
Temperature (°C)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
	3.70	-9.31	-0.003726
		-12.32	-0.004931
-10		-12.09	-0.004839
0		-10.61	-0.004092
10		-13.09	-0.005048
20		-11.22	-0.004327
30		-9.76	-0.003632
40		-8.53	-0.003174
50		-10.39	-0.003866
25	4.20	-10.16	-0.004066
	3.15	-12.06	-0.004827

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

Note:1. The device under test maintains the minimum and maximum operating temperature and the required limit voltage according to the manufacturer's requirements.

2. Only the worst working mode data is recorded in the report.

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13. OCCUPIED BANDWIDTH

13.1 PROVISIONS APPLICABLE

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. The EUT makes a call to the communication simulator.

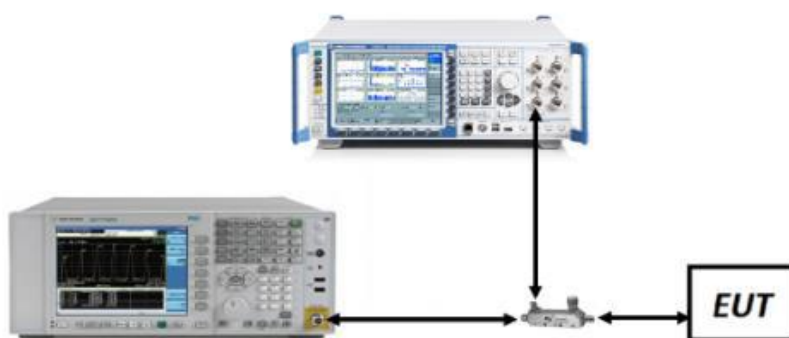
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

13.2 MEASUREMENT METHOD

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

13.3 MEASUREMENT SETUP



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13.4 MEASUREMENT RESULT

LTE Band 2

Channel Bandwidth: 1.4 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	6	0	1.0911	1.266	PASS
	MCH	6	0	1.0866	1.223	PASS
	HCH	6	0	1.0899	1.220	PASS
16QAM	LCH	6	0	1.0900	1.233	PASS
	MCH	6	0	1.0912	1.234	PASS
	HCH	6	0	1.0893	1.198	PASS

Channel Bandwidth: 3 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	15	0	2.6977	2.911	PASS
	MCH	15	0	2.6991	2.930	PASS
	HCH	15	0	2.6943	2.904	PASS
16QAM	LCH	15	0	2.6956	2.908	PASS
	MCH	15	0	2.6944	2.929	PASS
	HCH	15	0	2.6980	2.934	PASS

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	25	0	4.5043	4.888	PASS
	MCH	25	0	4.5058	4.845	PASS
	HCH	25	0	4.5113	4.864	PASS
16QAM	LCH	25	0	4.5064	4.872	PASS
	MCH	25	0	4.5036	4.884	PASS
	HCH	25	0	4.5133	4.867	PASS

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Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	50	0	9.0066	9.534	PASS
	MCH	50	0	8.9966	9.552	PASS
	HCH	50	0	8.9919	9.547	PASS
16QAM	LCH	50	0	8.9894	9.548	PASS
	MCH	50	0	8.9856	9.537	PASS
	HCH	50	0	8.9855	9.534	PASS

Channel Bandwidth: 15 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	75	0	13.474	14.29	PASS
	MCH	75	0	13.470	14.30	PASS
	HCH	75	0	13.466	14.27	PASS
16QAM	LCH	75	0	13.463	14.25	PASS
	MCH	75	0	13.477	14.26	PASS
	HCH	75	0	13.459	14.24	PASS

Channel Bandwidth: 20 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	100	0	17.911	18.93	PASS
	MCH	100	0	17.948	19.00	PASS
	HCH	100	0	17.941	19.02	PASS
16QAM	LCH	100	0	17.906	18.92	PASS
	MCH	100	0	17.974	18.98	PASS
	HCH	100	0	17.935	19.02	PASS

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LTE Band 4

Channel Bandwidth: 1.4 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	6	0	1.0960	1.224	PASS
	MCH	6	0	1.0944	1.218	PASS
	HCH	6	0	1.0907	1.223	PASS
16QAM	LCH	6	0	1.0934	1.229	PASS
	MCH	6	0	1.0915	1.232	PASS
	HCH	6	0	1.0899	1.221	PASS

Channel Bandwidth: 3 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	15	0	2.6958	2.895	PASS
	MCH	15	0	2.6957	2.904	PASS
	HCH	15	0	2.6987	2.917	PASS
16QAM	LCH	15	0	2.6909	2.932	PASS
	MCH	15	0	2.6897	2.900	PASS
	HCH	15	0	2.6942	2.901	PASS

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	25	0	4.5029	4.885	PASS
	MCH	25	0	4.5014	4.865	PASS
	HCH	25	0	4.5024	4.890	PASS
16QAM	LCH	25	0	4.5085	4.847	PASS
	MCH	25	0	4.5089	4.867	PASS
	HCH	25	0	4.5073	4.886	PASS

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Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	50	0	8.9944	9.570	PASS
	MCH	50	0	8.9976	9.550	PASS
	HCH	50	0	8.9854	9.537	PASS
16QAM	LCH	50	0	8.9827	9.557	PASS
	MCH	50	0	8.9802	9.560	PASS
	HCH	50	0	8.9922	9.551	PASS

Channel Bandwidth: 15 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	75	0	13.520	14.34	PASS
	MCH	75	0	13.477	14.27	PASS
	HCH	75	0	13.457	14.32	PASS
16QAM	LCH	75	0	13.505	14.28	PASS
	MCH	75	0	13.464	14.29	PASS
	HCH	75	0	13.458	14.27	PASS

Channel Bandwidth: 20 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	100	0	18.000	19.01	PASS
	MCH	100	0	17.954	18.95	PASS
	HCH	100	0	17.927	19.02	PASS
16QAM	LCH	100	0	18.026	19.01	PASS
	MCH	100	0	17.942	18.98	PASS
	HCH	100	0	17.942	18.98	PASS

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LTE Band 5

Channel Bandwidth: 1.4 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	6	0	1.0882	1.217	PASS
	MCH	6	0	1.0905	1.219	PASS
	HCH	6	0	1.0865	1.222	PASS
16QAM	LCH	6	0	1.0892	1.213	PASS
	MCH	6	0	1.0888	1.231	PASS
	HCH	6	0	1.0891	1.216	PASS

Channel Bandwidth: 3 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	15	0	2.6960	2.868	PASS
	MCH	15	0	2.6901	2.902	PASS
	HCH	15	0	2.6945	2.912	PASS
16QAM	LCH	15	0	2.6972	2.931	PASS
	MCH	15	0	2.6887	2.896	PASS
	HCH	15	0	2.6922	2.914	PASS

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	25	0	4.5043	4.874	PASS
	MCH	25	0	4.4998	4.888	PASS
	HCH	25	0	4.4928	4.848	PASS
16QAM	LCH	25	0	4.5083	4.864	PASS
	MCH	25	0	4.5041	4.860	PASS
	HCH	25	0	4.4940	4.856	PASS

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Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	50	0	8.9977	9.557	PASS
	MCH	50	0	8.9647	9.523	PASS
	HCH	50	0	8.9880	9.507	PASS
16QAM	LCH	50	0	8.9867	9.529	PASS
	MCH	50	0	8.9677	9.526	PASS
	HCH	50	0	8.9948	9.525	PASS

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LTE Band 7

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	25	0	4.5053	4.879	PASS
	MCH	25	0	4.5045	4.866	PASS
	HCH	25	0	4.5064	4.898	PASS
16QAM	LCH	25	0	4.5067	4.849	PASS
	MCH	25	0	4.5058	4.882	PASS
	HCH	25	0	4.5096	4.856	PASS

Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	50	0	8.9900	9.542	PASS
	MCH	50	0	9.0039	9.592	PASS
	HCH	50	0	8.9887	9.574	PASS
16QAM	LCH	50	0	8.9803	9.537	PASS
	MCH	50	0	8.9976	9.565	PASS
	HCH	50	0	8.9925	9.536	PASS

Channel Bandwidth: 15 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	75	0	13.467	14.30	PASS
	MCH	75	0	13.496	14.32	PASS
	HCH	75	0	13.487	14.35	PASS
16QAM	LCH	75	0	13.440	14.24	PASS
	MCH	75	0	13.501	14.29	PASS
	HCH	75	0	13.468	14.28	PASS

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Channel Bandwidth: 20 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	100	0	17.904	18.95	PASS
	MCH	100	0	18.019	19.01	PASS
	HCH	100	0	17.967	19.03	PASS
16QAM	LCH	100	0	17.876	18.96	PASS
	MCH	100	0	18.026	19.03	PASS
	HCH	100	0	17.950	18.99	PASS

Note: Please refers to Appendix B for compliance test plots for Occupied Bandwidth & Emission Bandwidth.

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LTE Band 38

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	25	0	4.5010	4.881	PASS
	MCH	25	0	4.5049	4.864	PASS
	HCH	25	0	4.5119	4.825	PASS
16QAM	LCH	25	0	4.4984	4.835	PASS
	MCH	25	0	4.5100	4.835	PASS
	HCH	25	0	4.5016	4.865	PASS

Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	50	0	8.9894	9.530	PASS
	MCH	50	0	9.0017	9.523	PASS
	HCH	50	0	8.9807	9.600	PASS
16QAM	LCH	50	0	8.9931	9.541	PASS
	MCH	50	0	8.9901	9.522	PASS
	HCH	50	0	8.9753	9.523	PASS

Channel Bandwidth: 15 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	75	0	13.505	14.32	PASS
	MCH	75	0	13.494	14.40	PASS
	HCH	75	0	13.474	14.49	PASS
16QAM	LCH	75	0	13.484	14.32	PASS
	MCH	75	0	13.473	14.25	PASS
	HCH	75	0	13.461	14.29	PASS

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Channel Bandwidth: 20 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	100	0	17.978	18.99	PASS
	MCH	100	0	17.950	19.00	PASS
	HCH	100	0	17.943	19.00	PASS
16QAM	LCH	100	0	17.967	18.97	PASS
	MCH	100	0	17.954	18.96	PASS
	HCH	100	0	17.938	19.00	PASS

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LTE Band 40 Lower Side

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	25	0	4.5042	4.867	PASS
	MCH	25	0	4.5051	4.815	PASS
	HCH	25	0	4.5141	4.802	PASS
16QAM	LCH	25	0	4.4977	4.826	PASS
	MCH	25	0	4.4988	4.832	PASS
	HCH	25	0	4.4999	4.824	PASS

Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	MCH	50	0	8.9997	9.532	PASS
16QAM	MCH	50	0	8.9949	9.512	PASS

LTE Band 40 Upper Side

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	25	0	4.5035	4.891	PASS
	MCH	25	0	4.5051	4.827	PASS
	HCH	25	0	4.5077	4.853	PASS
16QAM	LCH	25	0	4.4988	4.853	PASS
	MCH	25	0	4.5022	4.834	PASS
	HCH	25	0	4.5011	4.850	PASS

Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	MCH	50	0	8.9977	9.523	PASS
16QAM	MCH	50	0	8.9858	9.523	PASS

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LTE Band 41

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	25	0	4.5023	4.890	PASS
	MCH	25	0	4.5059	4.932	PASS
	HCH	25	0	4.5058	4.920	PASS
16QAM	LCH	25	0	4.5026	4.838	PASS
	MCH	25	0	4.4990	4.858	PASS
	HCH	25	0	4.5061	4.882	PASS

Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	50	0	8.9694	9.549	PASS
	MCH	50	0	8.9900	9.588	PASS
	HCH	50	0	8.9900	9.549	PASS
16QAM	LCH	50	0	8.9935	9.529	PASS
	MCH	50	0	8.9842	9.537	PASS
	HCH	50	0	8.9933	9.538	PASS

Channel Bandwidth: 15 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	75	0	13.468	14.25	PASS
	MCH	75	0	13.489	14.48	PASS
	HCH	75	0	13.486	14.35	PASS
16QAM	LCH	75	0	13.461	14.22	PASS
	MCH	75	0	13.476	14.28	PASS
	HCH	75	0	13.484	14.28	PASS

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Channel Bandwidth: 20 MHz						
Modulation	Channel	RB Configuration		Occupied Bandwidth (MHz)	-26dB Bandwidth (MHz)	Verdict
		Size	Offset			
QPSK	LCH	100	0	17.890	18.90	PASS
	MCH	100	0	17.953	19.02	PASS
	HCH	100	0	17.955	18.97	PASS
16QAM	LCH	100	0	17.900	18.90	PASS
	MCH	100	0	17.951	19.00	PASS
	HCH	100	0	17.956	18.96	PASS

Note: Please refers to Appendix B for compliance test plots for Occupied Bandwidth & Emission Bandwidth.

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14. BAND EDGE

14.1 PROVISIONS APPLICABLE

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

14.2 MEASUREMENT METHOD

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 1% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points $\geq 2 \times \text{Span/RBW}$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

TEST NOTE

§90.543(e)

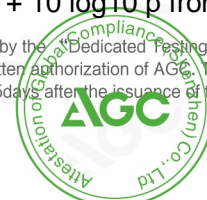
1. On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $76 + 10 \log(P)$ dB in a 6.25 kHz band segment, for base and fixed stations.
 2. On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.
 3. On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least $43 + 10 \log(P)$ dB.
 4. Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.
 5. Compliance with the provisions of paragraph (e)(3) 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 30kHz may be employed.

§27.53(m)

Equipment shall comply with the following unwanted emission limits:

- a) for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$
- b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least: $40 + 10 \log_{10} p$ from the channel

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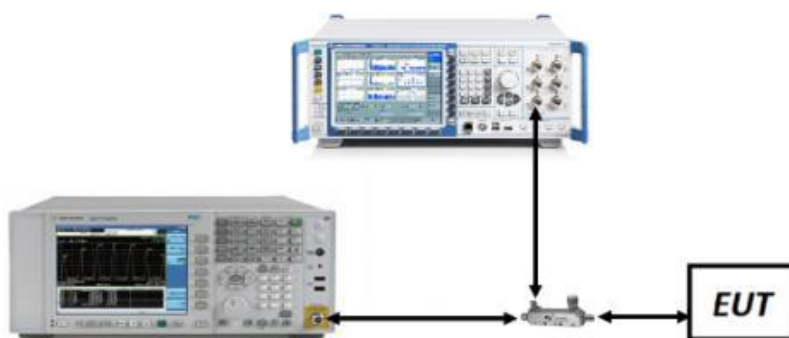
edges to 5 MHz away $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges. In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ at or below 2490.5 MHz.

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

According to FCC 22.917, 24.238, 27.53 specified that 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. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. All measurements were done at 2 channels (low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

14.3 MEASUREMENT METHOD



14.4 MEASUREMENT RESULT

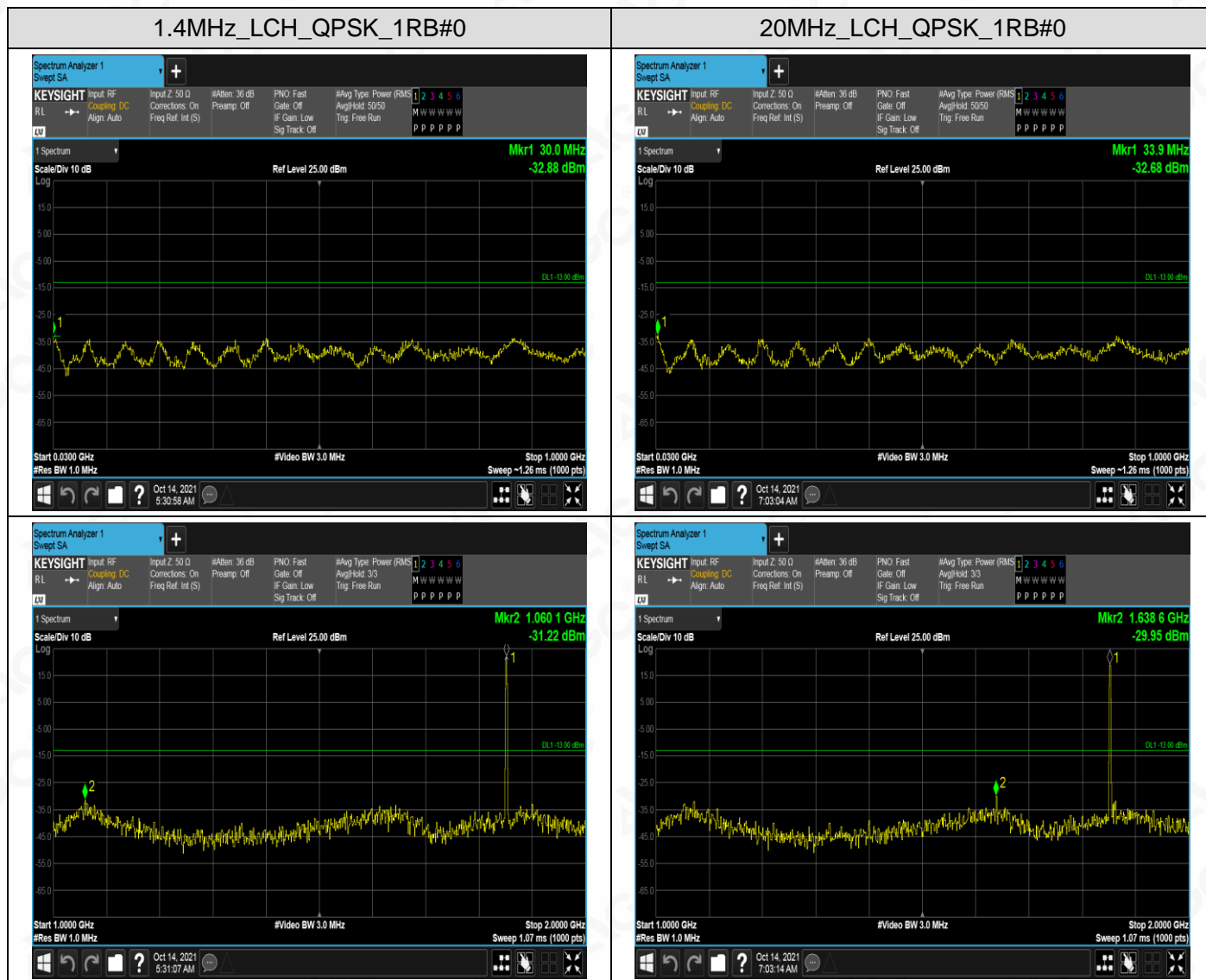
NOTE: Please refers to Appendix C for compliance test plots for band edge

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APPENDIX A TEST PLOTS FOR SPURIOUS EMISSIONS AT ANTENNA TERMINALS LTE BAND 2



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