

FCC CFR47 PART 22H, 24E, 27 CERTIFICATION TEST REPORT

FCC ID: RBP-RD52

Product: Boha Handheld Scanner

Trade Mark: BOHA!TM

Model Number: RD52

Family Model: BOHA!TM Handheld 2

Report No.: S19111503202005

Prepared for

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TEST RESULT CERTIFICATION

Applicant's name : TransAct Technologies Incorporated
Address: 2319 Whitney Avenue, Suite 3B Hamden, Connecticut 06518-3509, United States.
Manufacturer's Name: TransAct Technologies Incorporated
Address: 2319 Whitney Avenue, Suite 3B Hamden, Connecticut 06518-3509, United States.
Product name: Boha Handheld Scanner
Model and/or type reference ..: RD52
Family Model: BOHA!™ Handheld 2
Standards: FCC CFR 47 Part 22H, Part 24E, Part 27
Test procedure : ANSI C63.26:2015
ANSI/TIA-603-E-2016

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test
Date (s) of performance of tests..... 19 Nov. 2019 ~ 20 Dec, 2019
Date of Issue 23 Dec, 2019
Test Result..... Pass

Testing Engineer : [Signature: Jerry Xie]
(Jerry Xie)
Technical Manager : [Signature: Jason Chen]
(Jason Chen)
Authorized Signatory : [Signature: Sam Chen]
(Sam Chen)

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1. GENERAL INFORMATION

1.1 PRODUCT DESCRIPTION

A major technical description of EUT is described as following:

Product Designation:	Boha Handheld Scanner
Trade Mark	BOHA!™
Model Name	RD52
Family Model	BOHA!™ Handheld 2
Model Difference	All models are the same circuit and RF module, except the different models sell to different customers.
FCC ID:	RBP-RD52
Frequency Bands:	U.S. Bands: <input checked="" type="checkbox"/> LTE FDD Band 2,4,5, 17
Frequency Range:	LTE FDD Band 2 Uplink: 1850MHz-1910MHz, Downlink: 1930MHz-1990MHz; LTE FDD Band 4 Uplink: 1710MHz-1755MHz, Downlink: 2110MHz-2155MHz; LTE FDD Band 5 Uplink: 824MHz-849MHz, Downlink: 869MHz-894MHz; LTE FDD Band 17 Uplink: 704MHz-716MHz, Downlink: 734MHz-746MHz;
Type of Modulation:	QPSK/16QAM
Antenna:	FPC Antenna
Antenna gain:	LTE FDD Band 2: 1.5dBi LTE FDD Band 4: 1.5dBi LTE FDD Band 5: 1.5dBi LTE FDD Band 17: 1.5dBi
Power Supply:	DC 3.8V/4000mAh from Battery or DC 5V from USB Port.
Adapter:	Model: AW010WR-0500200UU Input: 100-240V~50/60Hz 0.4A Output: 5V---2A
Extreme Vol. Limits:	DC 3.4V to DC 4.35V (Nominal DC 3.8V) (Note 1)
HW Version	N/A
SW Version	Android 8.1
Firmware version	20181206.150521
** Note1: The High Voltage DC 4.35V and Low Voltage 3.4V was declared by manufacturer, The EUT couldn't be operate normally with higher or lower voltage.	

1.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: RBP-RD52** filing to comply with the FCC Part 22H&24E &27.

1.3 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI/TIA-603-E-2016, FCC CFR 47 Part 2, Part 22, Part 24, Part 27, ANSI C63.26:2015.

1.4 TEST FACILITY

The test site used to collect the radiated data is located at:

ShenZhen NTEK Testing Technology Co., Ltd.

1/F, Building E, Fenda Science Park Sanwei, Xixiang, Bao'an District

Shenzhen, Guangdong, China

The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.26:2015& ANSI C63.4: 2014.

FCC Registration No.:463705

IC Registration No.:9270A-1,

CNAS Registration No.:L5516

MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.5dB

1.5 SPECIAL ACCESSORIES

The battery and the charger, earphone supplied by the applicant were used as accessories and being tested with EUT intended for FCC grant together.

1.6 WORST-CASE CONFIGURATION AND MODE

The worst-case scenario for all measurements is based on the investigation results.

The device has LTE Bands of: Band 2, Band 4, Band 5, Band 7, Band 12, Band 17.

The RB Size was selected to measure for peak or average ERP and EIRP, which was based on the conducted power verification baseline data.

For the fundamental investigation of radiated emissions, the EUT is investigated for vertical and horizontal antenna orientations and X Y and Z orientations of the EUT alone. After the investigations the worst case was determined to be at X orientation for all LTE bands.

2. SYSTEM TEST CONFIGURATION

2.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT EXERCISE

The Transmitter was operated in the maximum output power mode through Communication Tester. The TX frequency was fixed which was for the purpose of the measurements.

2.3 CONFIGURATION OF EUT SYSTEM

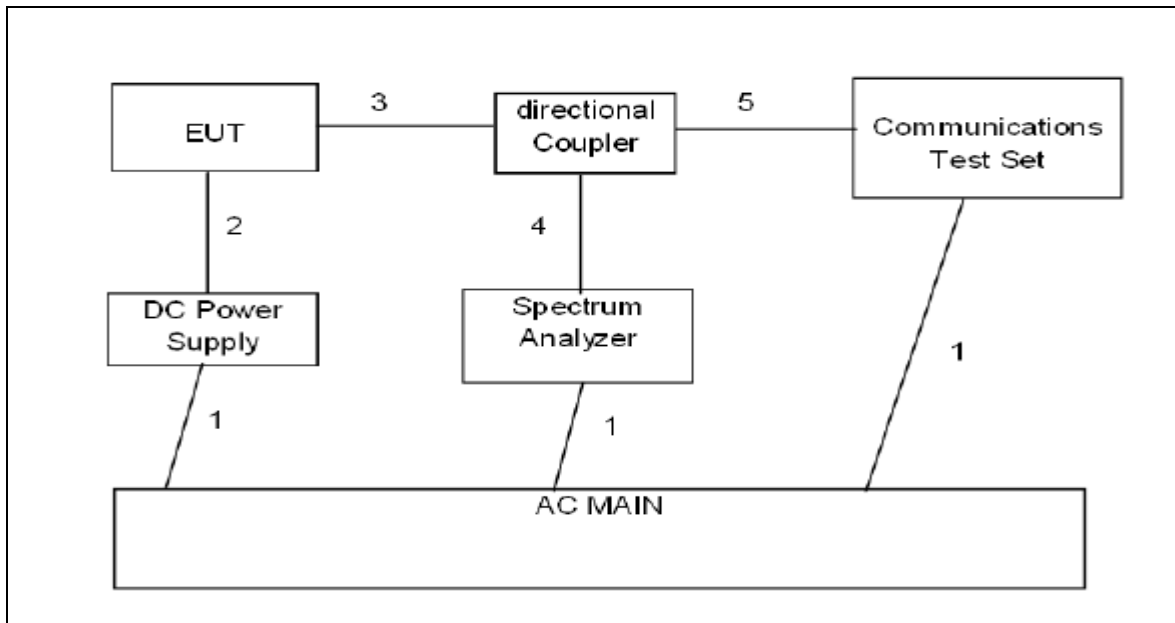
Table 2-1 Equipment Used in EUT System

Item	Equipment	Model No.	ID or Specification	Note
1	Boha Handheld Scanner	RD52	FCC ID: RBP-RD52	EUT

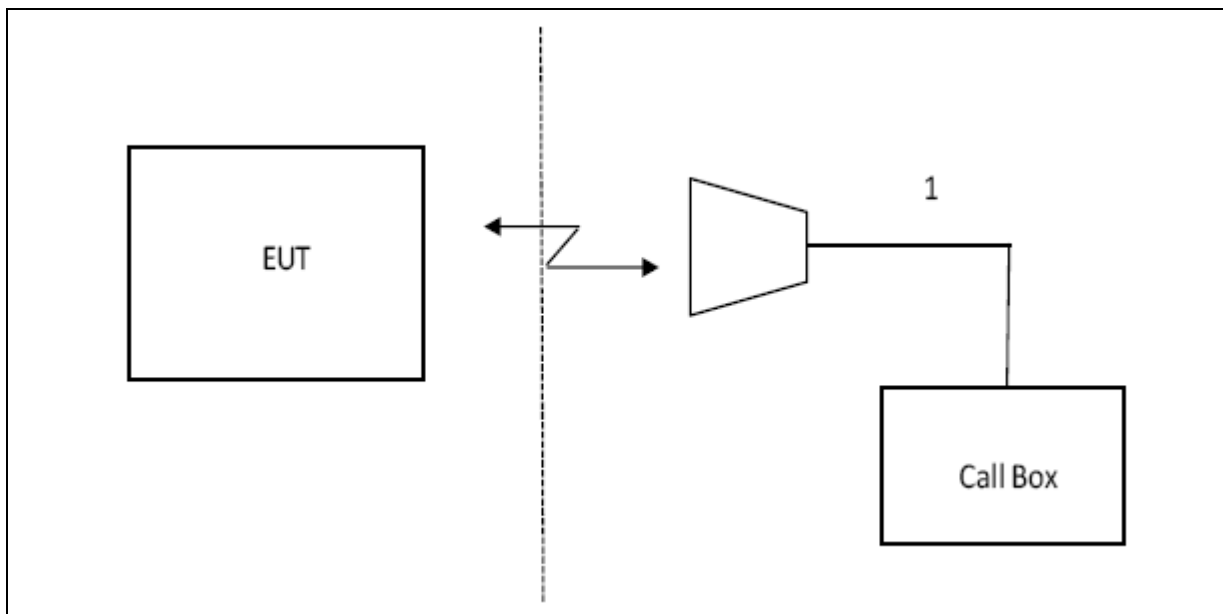
*Note: All the accessories have been used during the test.
the following "EUT" in setup diagram means EUT system.*

2.4 TEST SETUP

CONDUCTED SETUP DIAGRAM FOR TESTS



RADIATED SETUP DIAGRAM FOR TESTS



3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

NAME OF EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	NEXT CAL. DATE
SPECTRUM ANALYZER	AGILENT	N9020A	MY49100060	2020.08.27
TEST RECEIVER	R&S	ESCI	A0304218	2020.05.12
COMMUNICATION TESTER	R&S	CMU200	117858	2020.05.12
COMMUNICATION TESTER	R&S	CMW500	148500	2020.05.12
TEST RECEIVER	R&S	ESPI	101318	2020.05.12
LISN	SCHWARZBECK	NSLK8127	A0304233	2020.05.12
CLIMATE CHAMBER	ALBATROSS	--	--	2020.05.12
Loop Antenna	ARA	PLA-1030/B	1029	2020.05.12
Biological Antenna	TESEQ	CBL6111D	31216	2020.05.12
Horn Antenna	EM	EM-AH-10180	2011071402	2020.05.12
DC Power Source	N/A	PS-6005D	20170402923	2020.05.12

4. OUTPUT POWER

4.1 OUTPUT POWER MEASUREMENT

LTE Measurement Procedure:

All LTE bands conducted power peak and average are obtained from the CMW500 telecommunication test set. The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01".3

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4, 10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10, 15, 20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3	13	10	Table 6.2.4-2	Table 6.2.4-2
	6.6.3.3.2				
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23 ¹	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-

Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

Test data reference attachment.

5. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

MODES TESTED

- LTE Band 2
- LTE Band 4
- LTE Band 5
- LTE Band 17

RESULTS

PASS

Test data reference attachment.

6. BANDEDGE AND EMISSION MASK

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238, §27.53, and §90.691

FCC: §22.359

LIMITS

FCC: §22.359, §24.238,

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

(m)(4) 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. Show citation box.

TEST PROCEDURE

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

Set the spectrum analyzer span to include the block edge frequency (704, 716, 824, 849, 1710 and 1755, 1850 and 1910MHz)

Set a marker to point the corresponding band edge frequency in each test case.

Set display line at -13 dBm

Set resolution bandwidth to at least 1% of emission bandwidth.

MODES TESTED

- LTE Band 2
- LTE Band 4
- LTE Band 5
- LTE Band 17

RESULTS

Test data reference attachment.

7. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238 and §27.53

LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

For each out of band emissions measurement:

- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

MODES TESTED

- LTE Band 2
LTE Band 4
- LTE Band 5
LTE Band 17

7.1 MEASUREMENT METHOD

The test set up and general procedure is similar to conducted peak output power test. Only different for setting the measurement configuration of the measuring instrument of Spectrum Analyzer.

Test data reference attachment.

8. RADIATED MEASUREMENT

8.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913, §24.232 and §27.50

LIMITS:

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

27.50 (c) (10) the following power and antenna height requirements apply to stations transmitting in the 698–746 MHz band, the portable stations (hand-held devices) are limited to 3 watts ERP.

27.50 (b)(10) Portable stations (hand-held devices) transmitting in the 746–757 MHz, 758–763 MHz, 776–793 MHz, and 805–806 MHz bands are limited to 3 watts ERP.

27.50 (d)(4) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands: Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

TEST PROCEDURE

ANSI/TIA-603-E Clause 2.2.17

KDB 971168 v02r01 RF power output using broadband peak and average power meter method.

KDB 971168 D01 Power Meas License Digital Systems v02r01, "Measurement Guidance for Certification of Licensed Digital Transmitters"

MODES TESTED

- LTE Band 2
- LTE Band 4
- LTE Band 5
- LTE Band 17

RESULTS

Pass

8.2 LTE BAND 2

Radiated Power (EIRP) for Band 2										
Mode	RB/RB SIZE	Frequency	Result						Polarization Of Max. ERP	Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)			
1.4MHz Band QPSK	6/0	1850.7	-3.89	3.76	28.24	20.59	114.608	Horizontal	Pass	
		1880	-3.63	3.91	28.22	20.68	116.933	Horizontal	Pass	
		1909.3	-3.64	3.93	28.2	20.63	115.588	Horizontal	Pass	
3.0MHz Band QPSK	15/0	1851.5	-3.89	3.77	28.23	20.57	114.016	Horizontal	Pass	
		1880	-3.76	3.91	28.24	20.57	114.149	Horizontal	Pass	
		1908.5	-3.68	3.94	28.25	20.63	115.624	Horizontal	Pass	
5.0MHz Band QPSK	25/0	1852.5	-4.03	3.77	28.31	20.51	112.556	Horizontal	Pass	
		1880	-3.74	3.91	28.22	20.57	114.148	Horizontal	Pass	
		1907.5	-3.84	3.94	28.2	20.42	110.100	Horizontal	Pass	
10.0MHz Band QPSK	50/0	1855	-4.00	3.79	28.33	20.54	113.199	Horizontal	Pass	
		1880	-3.63	3.95	28.22	20.64	115.769	Horizontal	Pass	
		1905	-3.53	3.97	28.19	20.69	117.177	Horizontal	Pass	
15.0MHz Band QPSK	75/0	1857.5	-3.75	3.79	28.34	20.80	120.342	Horizontal	Pass	
		1880	-3.47	3.95	28.22	20.80	120.196	Horizontal	Pass	
		1902.5	-3.38	3.97	28.18	20.83	120.962	Horizontal	Pass	
20.0MHz Band QPSK	100/0	1860	-3.95	3.81	28.35	20.59	114.525	Horizontal	Pass	
		1880	-3.72	3.96	28.22	20.54	113.111	Horizontal	Pass	
		1900	-3.42	4	28.16	20.74	118.665	Horizontal	Pass	
1.4MHz Band QPSK	6/0	1850.7	-3.93	3.76	28.24	20.55	113.598	Vertical	Pass	
		1880	-3.73	3.91	28.22	20.58	114.277	Vertical	Pass	
		1909.3	-3.74	3.93	28.2	20.53	113.097	Vertical	Pass	
3.0MHz Band QPSK	15/0	1851.5	-3.75	3.77	28.23	20.71	117.773	Vertical	Pass	
		1880	-3.60	3.91	28.24	20.73	118.243	Vertical	Pass	
		1908.5	-3.53	3.94	28.25	20.78	119.771	Vertical	Pass	
5.0MHz Band QPSK	25/0	1852.5	-3.95	3.77	28.31	20.59	114.534	Vertical	Pass	
		1880	-3.65	3.91	28.22	20.66	116.532	Vertical	Pass	
		1907.5	-3.82	3.94	28.2	20.44	110.710	Vertical	Pass	
10.0MHz Band	50/0	1855	-3.89	3.79	28.33	20.65	116.261	Vertical	Pass	
		1880	-3.68	3.95	28.22	20.59	114.568	Vertical	Pass	

QPSK		1905	-3.71	3.97	28.19	20.51	112.408	Vertical	Pass
15.0MHz Band QPSK	75/0	1857.5	-3.86	3.79	28.34	20.69	117.353	Vertical	Pass
		1880	-3.61	3.95	28.22	20.66	116.291	Vertical	Pass
		1902.5	-3.33	3.97	28.18	20.88	122.415	Vertical	Pass
20.0MHz Band QPSK	100/0	1860	-3.87	3.81	28.35	20.67	116.740	Vertical	Pass
		1880	-3.77	3.96	28.22	20.49	111.831	Vertical	Pass
		1900	-3.25	4	28.16	20.91	123.446	Vertical	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

Radiated Power (EIRP) for Band 2									
Mode	RB/RB SIZE	Frequency	Result					Polarization Of Max. ERP	Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP		
							Average (mW)		
1.4MHz Band 16 QAM	6/0	1850.7	-3.75	3.76	28.24	20.73	118.171	Horizontal	Pass
		1880	-3.52	3.91	28.22	20.79	120.016	Horizontal	Pass
		1909.3	-3.46	3.93	28.2	20.81	120.549	Horizontal	Pass
3.0MHz Band 16 QAM	15/0	1851.5	-3.75	3.77	28.23	20.71	117.835	Horizontal	Pass
		1880	-3.71	3.91	28.24	20.62	115.472	Horizontal	Pass
		1908.5	-3.56	3.94	28.25	20.75	118.794	Horizontal	Pass
5.0MHz Band 16 QAM	25/0	1852.5	-3.84	3.77	28.31	20.70	117.363	Horizontal	Pass
		1880	-3.44	3.91	28.22	20.87	122.052	Horizontal	Pass
		1907.5	-3.56	3.94	28.2	20.70	117.600	Horizontal	Pass
10.0MHz Band 16 QAM	50/0	1855	-3.78	3.79	28.33	20.76	119.088	Horizontal	Pass
		1880	-3.46	3.95	28.22	20.81	120.620	Horizontal	Pass
		1905	-3.51	3.97	28.19	20.71	117.674	Horizontal	Pass
15.0MHz Band 16 QAM	75/0	1857.5	-3.84	3.79	28.34	20.71	117.857	Horizontal	Pass
		1880	-3.57	3.95	28.22	20.70	117.525	Horizontal	Pass
		1902.5	-3.48	3.97	28.18	20.73	118.392	Horizontal	Pass
20.0MHz Band 16 QAM	100/0	1860	-3.80	3.81	28.35	20.74	118.655	Horizontal	Pass
		1880	-3.43	3.96	28.22	20.83	121.036	Horizontal	Pass
		1900	-3.54	4	28.16	20.62	115.359	Horizontal	Pass
1.4MHz Band 16 QAM	6/0	1850.7	-3.69	3.76	28.24	20.79	119.834	Vertical	Pass
		1880	-3.62	3.91	28.22	20.69	117.260	Vertical	Pass
		1909.3	-3.41	3.93	28.2	20.86	121.844	Vertical	Pass
3.0MHz Band 16 QAM	15/0	1851.5	-3.77	3.77	28.23	20.69	117.309	Vertical	Pass
		1880	-3.70	3.91	28.24	20.63	115.737	Vertical	Pass
		1908.5	-3.54	3.94	28.25	20.77	119.500	Vertical	Pass
5.0MHz Band 16 QAM	25/0	1852.5	-3.79	3.77	28.31	20.75	118.943	Vertical	Pass
		1880	-3.64	3.91	28.22	20.67	116.770	Vertical	Pass
		1907.5	-3.43	3.94	28.2	20.83	121.178	Vertical	Pass
10.0MHz Band 16 QAM	50/0	1855	-3.95	3.79	28.33	20.59	114.470	Vertical	Pass
		1880	-3.64	3.95	28.22	20.63	115.638	Vertical	Pass
		1905	-3.73	3.97	28.19	20.49	111.825	Vertical	Pass
15.0MHz Band	75/0	1857.5	-3.96	3.79	28.34	20.59	114.482	Vertical	Pass
		1880	-3.61	3.95	28.22	20.66	116.505	Vertical	Pass

16 QAM		1902.5	-3.56	3.97	28.18	20.65	116.251	Vertical	Pass
20.0MH	100/0	1860	-3.75	3.81	28.35	20.79	119.884	Vertical	Pass
z Band		1880	-3.38	3.96	28.22	20.88	122.580	Vertical	Pass
16 QAM		1900	-3.42	4	28.16	20.74	118.700	Vertical	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

8.3 LTE BAND 4

Radiated Power (EIRP) for Band 4										
Mode	RB/RB SIZE	Frequency	Result						Polarization Of Max. ERP	Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)			
1.4MHz Band QPSK	6/0	1710.7	-4.13	3.12	27.58	20.33	107.895	Horizontal	Pass	
		1732.5	-4.19	3.27	27.61	20.15	103.514	Horizontal	Pass	
		1754.3	-3.30	3.29	27.63	21.04	127.198	Horizontal	Pass	
3.0MHz Band QPSK	15/0	1711.5	-3.69	3.13	27.61	20.79	119.979	Horizontal	Pass	
		1732.5	-3.46	3.27	27.61	20.88	122.572	Horizontal	Pass	
		1753.5	-3.38	3.3	27.62	20.94	124.091	Horizontal	Pass	
5.0MHz Band QPSK	25/0	1712.5	-3.36	3.13	27.63	21.14	130.028	Horizontal	Pass	
		1732.5	-3.06	3.27	27.61	21.28	134.145	Horizontal	Pass	
		1752.5	-3.12	3.3	27.6	21.18	131.095	Horizontal	Pass	
10.0MHz Band QPSK	50/0	1715	-3.40	3.15	27.64	21.09	128.561	Horizontal	Pass	
		1732.5	-3.39	3.31	27.61	20.91	123.276	Horizontal	Pass	
		1750	-3.29	3.33	27.59	20.97	125.165	Horizontal	Pass	
15.0MHz Band QPSK	75/0	1717.5	-3.71	3.15	27.65	20.79	119.926	Horizontal	Pass	
		1732.5	-3.29	3.31	27.61	21.01	126.183	Horizontal	Pass	
		1747.5	-3.31	3.33	27.57	20.93	123.876	Horizontal	Pass	
20.0MHz Band QPSK	100/0	1720	-3.53	3.17	27.66	20.96	124.611	Horizontal	Pass	
		1732.5	-3.30	3.32	27.61	20.99	125.552	Horizontal	Pass	
		1745	-3.41	3.36	27.56	20.79	119.847	Horizontal	Pass	
1.4MHz Band QPSK	6/0	1710.7	-3.52	3.12	27.58	20.94	124.116	Vertical	Pass	
		1732.5	-3.46	3.27	27.61	20.88	122.385	Vertical	Pass	
		1754.3	-3.44	3.29	27.63	20.90	122.999	Vertical	Pass	
3.0MHz Band QPSK	15/0	1711.5	-3.50	3.13	27.61	20.98	125.280	Vertical	Pass	
		1732.5	-3.32	3.27	27.61	21.02	126.495	Vertical	Pass	
		1753.5	-3.48	3.3	27.62	20.84	121.434	Vertical	Pass	
5.0MHz Band QPSK	25/0	1712.5	-3.24	3.13	27.63	21.26	133.710	Vertical	Pass	
		1732.5	-3.15	3.27	27.61	21.19	131.399	Vertical	Pass	
		1752.5	-3.07	3.3	27.6	21.23	132.627	Vertical	Pass	
10.0MHz Band QPSK	50/0	1715	-3.51	3.15	27.64	20.98	125.197	Vertical	Pass	
		1732.5	-3.36	3.31	27.61	20.94	124.238	Vertical	Pass	
		1750	-3.29	3.33	27.59	20.97	125.091	Vertical	Pass	

15.0MH z Band QPSK	75/0	1717.5	-3.64	3.15	27.65	20.86	121.847	Vertical	Pass
		1732.5	-3.24	3.31	27.61	21.06	127.732	Vertical	Pass
		1747.5	-3.18	3.33	27.57	21.06	127.530	Vertical	Pass
20.0MH z Band QPSK	100/0	1720	-3.15	3.17	27.66	21.34	136.035	Vertical	Pass
		1732.5	-3.33	3.32	27.61	20.96	124.654	Vertical	Pass
		1745	-3.30	3.36	27.56	20.90	123.141	Vertical	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

Radiated Power (EIRP) for Band 4									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP	Max. EIRP	Polarization Of Max. ERP	
						Average (dBm)	Average (mW)		
1.4MHz Band 16 QAM	6/0	1710.7	-4.42	3.12	27.58	20.04	100.920	Horizontal	Pass
		1732.5	-4.29	3.27	27.61	20.05	101.074	Horizontal	Pass
		1754.3	-4.41	3.29	27.63	19.93	98.504	Horizontal	Pass
3.0MHz Band 16 QAM	15/0	1711.5	-5.21	3.13	27.61	19.27	84.607	Horizontal	Pass
		1732.5	-5.07	3.27	27.61	19.27	84.573	Horizontal	Pass
		1753.5	-4.98	3.3	27.62	19.34	85.809	Horizontal	Pass
5.0MHz Band 16 QAM	25/0	1712.5	-5.35	3.13	27.63	19.15	82.265	Horizontal	Pass
		1732.5	-5.22	3.27	27.61	19.12	81.596	Horizontal	Pass
		1752.5	-4.23	3.3	27.6	20.07	101.592	Horizontal	Pass
10.0MHz Band 16 QAM	50/0	1715	-4.58	3.15	27.64	19.91	97.962	Horizontal	Pass
		1732.5	-4.28	3.31	27.61	20.02	100.409	Horizontal	Pass
		1750	-4.49	3.33	27.59	19.77	94.797	Horizontal	Pass
15.0MHz Band 16 QAM	75/0	1717.5	-4.42	3.15	27.65	20.08	101.762	Horizontal	Pass
		1732.5	-4.25	3.31	27.61	20.05	101.122	Horizontal	Pass
		1747.5	-4.15	3.33	27.57	20.09	101.994	Horizontal	Pass
20.0MHz Band 16 QAM	100/0	1720	-4.67	3.17	27.66	19.82	96.037	Horizontal	Pass
		1732.5	-4.45	3.32	27.61	19.84	96.353	Horizontal	Pass
		1745	-4.28	3.36	27.56	19.92	98.238	Horizontal	Pass
1.4MHz Band 16 QAM	6/0	1710.7	-4.47	3.12	27.58	19.99	99.877	Vertical	Pass
		1732.5	-4.34	3.27	27.61	20.00	99.920	Vertical	Pass
		1754.3	-4.35	3.29	27.63	19.99	99.738	Vertical	Pass
3.0MHz Band 16 QAM	15/0	1711.5	-5.06	3.13	27.61	19.42	87.419	Vertical	Pass
		1732.5	-5.01	3.27	27.61	19.33	85.737	Vertical	Pass
		1753.5	-4.94	3.3	27.62	19.38	86.732	Vertical	Pass
5.0MHz Band 16 QAM	25/0	1712.5	-5.27	3.13	27.63	19.23	83.777	Vertical	Pass
		1732.5	-5.05	3.27	27.61	19.29	84.995	Vertical	Pass
		1752.5	-5.17	3.3	27.6	19.13	81.924	Vertical	Pass
10.0MHz Band 16 QAM	50/0	1715	-4.46	3.15	27.64	20.03	100.642	Vertical	Pass
		1732.5	-4.25	3.31	27.61	20.05	101.103	Vertical	Pass
		1750	-4.44	3.33	27.59	19.82	95.878	Vertical	Pass
15.0MHz Band	75/0	1717.5	-4.61	3.15	27.65	19.89	97.496	Vertical	Pass
		1732.5	-4.46	3.31	27.61	19.84	96.421	Vertical	Pass

16 QAM		1747.5	-4.47	3.33	27.57	19.77	94.872	Vertical	Pass
20.0MH	100/0	1720	-4.53	3.17	27.66	19.96	99.190	Vertical	Pass
z Band		1732.5	-4.37	3.32	27.61	19.92	98.213	Vertical	Pass
16 QAM		1745	-4.07	3.36	27.56	20.13	103.116	Vertical	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

8.4 LTE BAND 5

Radiated Power (ERP) for Band 5											
Mode	RB/ RB SIZE	Freque ncy	Result							Polarizati on Of Max. ERP	Conclu sion
			SG Level (dBm)	Cable Loss (dBm)	Anten na Gain (dB)	Corre ction (dB)	Max. ERP Averag e (dBm)	Max. ERP Averag e (mW)			
1.4MHz Band QPSK	6/0	824.7	4.63	2.01	19.68	2.15	20.15	103.514	Horizontal	Pass	
		836.5	4.65	2.01	19.77	2.15	20.26	106.170	Horizontal	Pass	
		848.3	4.51	2.02	19.82	2.15	20.16	103.753	Horizontal	Pass	
3.0MHz Band QPSK	15/0	825.5	4.68	2.01	19.7	2.15	20.22	105.196	Horizontal	Pass	
		836.5	4.62	2.01	19.77	2.15	20.23	105.439	Horizontal	Pass	
		847.5	4.55	2.02	19.81	2.15	20.19	104.472	Horizontal	Pass	
5.0MHz Band QPSK	25/0	826.5	4.56	2.01	19.71	2.15	20.11	102.565	Horizontal	Pass	
		836.5	4.60	2.01	19.77	2.15	20.21	104.954	Horizontal	Pass	
		846.5	4.54	2.02	19.79	2.15	20.16	103.753	Horizontal	Pass	
10.0MHz z Band QPSK	50/0	829	4.50	2.01	19.73	2.15	20.07	101.625	Horizontal	Pass	
		836.5	4.52	2.01	19.77	2.15	20.13	103.039	Horizontal	Pass	
		844	4.42	2.02	19.78	2.15	20.03	100.693	Horizontal	Pass	
1.4MHz Band QPSK	6/0	824.7	4.70	2.01	19.68	2.15	20.22	105.196	Vertical	Pass	
		836.5	4.60	2.01	19.77	2.15	20.21	104.954	Vertical	Pass	
		848.3	4.47	2.02	19.82	2.15	20.12	102.802	Vertical	Pass	
3.0MHz Band QPSK	15/0	825.5	4.71	2.01	19.7	2.15	20.25	105.925	Vertical	Pass	
		836.5	4.63	2.01	19.77	2.15	20.24	105.682	Vertical	Pass	
		847.5	4.72	2.02	19.81	2.15	20.36	108.643	Vertical	Pass	
5.0MHz Band QPSK	25/0	826.5	4.46	2.01	19.71	2.15	20.01	100.231	Vertical	Pass	
		836.5	4.50	2.01	19.77	2.15	20.11	102.565	Vertical	Pass	
		846.5	4.51	2.02	19.79	2.15	20.13	103.039	Vertical	Pass	
10.0MHz z Band QPSK	50/0	829	5.19	2.01	19.73	2.15	20.76	119.124	Vertical	Pass	
		836.5	5.42	2.01	19.77	2.15	21.03	126.765	Vertical	Pass	
		844	4.90	2.02	19.78	2.15	20.51	112.460	Vertical	Pass	

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

Radiated Power (ERP) for Band 5											
Mode	RB/ RB SIZE	Freque ncy	Result							Polarizati on Of Max. ERP	Conclu sion
			SG Level	Cable Loss (dBm)	Anten na Gain (dB)	Corre ction (dB)	Max. ERP	Max. ERP			
			(dBm)				Averag e	Averag e			
							(dBm)	(mW)			
1.4MHz Band 16 QAM	6/0	824.7	4.49	2.01	19.68	2.15	20.01	100.231	Horizontal	Pass	
		836.5	4.54	2.01	19.77	2.15	20.15	103.514	Horizontal	Pass	
		848.3	4.48	2.02	19.82	2.15	20.13	103.039	Horizontal	Pass	
3.0MHz Band 16 QAM	15/0	825.5	4.72	2.01	19.7	2.15	20.26	106.170	Horizontal	Pass	
		836.5	4.63	2.01	19.77	2.15	20.24	105.682	Horizontal	Pass	
		847.5	4.47	2.02	19.81	2.15	20.11	102.565	Horizontal	Pass	
5.0MHz Band 16 QAM	25/0	826.5	4.51	2.01	19.71	2.15	20.06	101.391	Horizontal	Pass	
		836.5	4.74	2.01	19.77	2.15	20.35	108.393	Horizontal	Pass	
		846.5	4.49	2.02	19.79	2.15	20.11	102.565	Horizontal	Pass	
10.0MH z Band 16 QAM	50/0	829	4.85	2.01	19.73	2.15	20.42	110.154	Horizontal	Pass	
		836.5	4.52	2.01	19.77	2.15	20.13	103.039	Horizontal	Pass	
		844	4.60	2.02	19.78	2.15	20.21	104.954	Horizontal	Pass	
1.4MHz Band 16 QAM	6/0	824.7	4.70	2.01	19.68	2.15	20.22	105.196	Vertical	Pass	
		836.5	4.55	2.01	19.77	2.15	20.16	103.753	Vertical	Pass	
		848.3	4.59	2.02	19.82	2.15	20.24	105.682	Vertical	Pass	
3.0MHz Band 16 QAM	15/0	825.5	4.77	2.01	19.7	2.15	20.31	107.399	Vertical	Pass	
		836.5	4.65	2.01	19.77	2.15	20.26	106.170	Vertical	Pass	
		847.5	4.52	2.02	19.81	2.15	20.16	103.753	Vertical	Pass	
5.0MHz Band 16 QAM	25/0	826.5	4.67	2.01	19.71	2.15	20.22	105.196	Vertical	Pass	
		836.5	4.52	2.01	19.77	2.15	20.13	103.039	Vertical	Pass	
		846.5	4.64	2.02	19.79	2.15	20.26	106.170	Vertical	Pass	
10.0MH z Band 16 QAM	50/0	829	4.99	2.01	19.73	2.15	20.56	113.763	Vertical	Pass	
		836.5	4.55	2.01	19.77	2.15	20.16	103.753	Vertical	Pass	
		844	5.14	2.02	19.78	2.15	20.75	118.850	Vertical	Pass	

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

8.5 LTE BAND 17

Radiated Power (ERP) for Band 17											
Mode	RB/ RB SIZE	Freque ncy	Result							Polarizati on Of Max. ERP	Conclu sion
			SG Level	Cable Loss (dBm)	Anten na Gain (dB)	Corre ction (dB)	Max. ERP	Max. ERP			
			(dBm)				Averag e	Averag e			
							(dBm)	(mW)			
5.0MHz Band QPSK	25/0	706.5	5.39	1.91	19.23	2.15	20.56	113.654	Vertical	Pass	
		710	5.28	1.91	19.26	2.15	20.48	111.750	Vertical	Pass	
		713.5	5.30	1.92	19.33	2.15	20.56	113.684	Vertical	Pass	
10.0MH z Band QPSK	50/0	709	5.52	1.91	19.25	2.15	20.71	117.738	Vertical	Pass	
		710	5.56	1.91	19.26	2.15	20.76	119.020	Vertical	Pass	
		711	5.28	1.92	19.32	2.15	20.53	113.039	Vertical	Pass	
5.0MHz Band QPSK	25/0	706.5	5.50	1.91	19.23	2.15	20.67	116.665	Horizontal	Pass	
		710	5.34	1.91	19.26	2.15	20.54	113.171	Horizontal	Pass	
		713.5	5.35	1.92	19.33	2.15	20.61	114.956	Horizontal	Pass	
10.0MH z Band QPSK	50/0	709	5.48	1.91	19.25	2.15	20.67	116.664	Horizontal	Pass	
		710	5.59	1.91	19.26	2.15	20.79	119.873	Horizontal	Pass	
		711	5.23	1.92	19.32	2.15	20.48	111.610	Horizontal	Pass	

Radiated Power (ERP) for Band 17											
Mode	RB/ RB SIZE	Freque ncy	Result							Polarizati on Of Max. ERP	Conclu sion
			SG Level	Cable Loss (dBm)	Anten na Gain (dB)	Corre ction (dB)	Max. ERP	Max. ERP			
			(dBm)				Averag e	Averag e			
							(dBm)	(mW)			
5.0MHz Band 16 QAM	25/0	706.5	5.29	1.91	19.23	2.15	20.46	111.108	Vertical	Pass	
		710	5.26	1.91	19.26	2.15	20.46	111.240	Vertical	Pass	
		713.5	5.20	1.92	19.33	2.15	20.46	111.056	Vertical	Pass	
10.0MH z Band 16 QAM	50/0	709	5.18	1.91	19.25	2.15	20.37	108.984	Vertical	Pass	
		710	5.08	1.91	19.26	2.15	20.28	106.630	Vertical	Pass	
		711	5.11	1.92	19.32	2.15	20.36	108.628	Vertical	Pass	
5.0MHz Band 16 QAM	25/0	706.5	5.19	1.91	19.23	2.15	20.36	108.575	Horizontal	Pass	
		710	5.26	1.91	19.26	2.15	20.46	111.218	Horizontal	Pass	
		713.5	5.21	1.92	19.33	2.15	20.47	111.384	Horizontal	Pass	
10.0MH z Band 16 QAM	50/0	709	5.16	1.91	19.25	2.15	20.35	108.432	Horizontal	Pass	
		710	5.37	1.91	19.26	2.15	20.57	114.096	Horizontal	Pass	
		711	5.04	1.92	19.32	2.15	20.29	106.955	Horizontal	Pass	

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

9. SPURIOUS RADIATION EMISSION

RULE PART(S)

FCC: §2.1053, §22.917, §24.238 and §27.53

LIMIT

§22.917 (e) and §24.238 (a): Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

§27.53 (g) For operations in 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.

§27.53 (h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). 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 emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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 emissions are attenuated at least 26 dB below the transmitter power.

The unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth in the 1 MHz band immediately outside and adjacent to the channel edge of the equipment. Beyond the 1 MHz band immediately outside the channel edge of the equipment, a resolution bandwidth of 1 MHz shall be employed. A narrower resolution bandwidth is allowed to be used provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz or 1% of the occupied bandwidth as applicable.

The power of any unwanted emissions measured from the channel edge of the equipment shall be attenuated below the transmitter power, P (dBW), as follows:

- a. for base station and subscriber equipment, other than mobile subscriber equipment, the attenuation shall not be less than $43 + 10 \text{ Log}_{10} (p)$, dB; and
- b. for mobile subscriber equipment, the attenuation shall not be less than $43 + 10 \text{ Log}_{10} (p)$, dB at the channel edges and $55 + 10 \text{ Log}_{10} (p)$ at 5.5 MHz away and beyond the channel edges where p in (a) and (b) is the transmitter power measured in watts.

MODES TESTED

- LTE Band 2
LTE Band 4
- LTE Band 5
LTE Band 17

RESULTS

PASS

9.1 LTE BAND 2

QPSK EIRP POWER FOR LTE BAND 2 (1.4MHZ BANDWIDTH)

Test Results for Low Channel 1850.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
3701.4	-57.55	4.04	33.51	-28.08	-13	-15.08	Horizontal
3701.4	-56.36	4.04	33.51	-26.89	-13	-13.89	Vertical
5552.1	-57.48	5.24	35.84	-26.88	-13	-13.88	Vertical
5552.1	-58.36	5.24	35.84	-27.76	-13	-14.76	Horizontal
Test Results for Mid Channel 1880MHz							
3760	-58.16	4.04	33.56	-28.64	-13	-15.64	Horizontal
3760	-55.38	4.04	33.56	-25.86	-13	-12.86	Vertical
5640	-56.52	5.24	35.91	-25.85	-13	-12.85	Vertical
5640	-57.66	5.24	35.91	-26.99	-13	-13.99	Horizontal
Test Results for High Channel 1909.3MHz							
3818.6	-59.18	4.04	34.00	-29.22	-13	-16.22	Horizontal
3818.6	-57.46	4.04	34.00	-27.50	-13	-14.50	Vertical
5727.9	-57.75	5.24	36.04	-26.95	-13	-13.95	Vertical
5727.9	-56.52	5.24	36.04	-25.72	-13	-12.72	Horizontal

QPSK EIRP POWER FOR LTE BAND 2 (20.0MHZ BANDWIDTH)

Test Results for Low Channel 1860MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
3720	-56.75	4.07	33.54	-27.28	-13	-14.28	Horizontal
3720	-56.36	4.07	33.54	-26.89	-13	-13.89	Vertical
5580	-56.47	5.28	35.86	-25.89	-13	-12.89	Vertical
5580	-57.45	5.28	35.86	-26.87	-13	-13.87	Horizontal
Test Results for Mid Channel 1880MHz							
3760	-57.62	4.04	33.56	-28.10	-13	-15.10	Horizontal
3760	-57.27	4.04	33.56	-27.75	-13	-14.75	Vertical
5640	-56.38	5.24	35.91	-25.71	-13	-12.71	Vertical
5640	-56.22	5.24	35.91	-25.55	-13	-12.55	Horizontal
Test Results for High Channel 1900MHz							
3800	-56.56	4.04	34.00	-26.60	-13	-13.60	Horizontal
3800	-56.58	4.04	34.00	-26.62	-13	-13.62	Vertical
5700	-56.25	5.24	36.04	-25.45	-13	-12.45	Vertical
5700	-57.50	5.24	36.04	-26.70	-13	-13.70	Horizontal

Note: $P_{Mea}(dBm) = Power(dBm) + ARpl (dBm)$

. Over Limit = $P_{Mea}(dBm) - Limit(dBm)$

. Both QPSK and 16QAM has been tested, the worst case is QPSK mode, the report just reported the worst case.

9.2 LTE BAND 4

QPSK EIRP POWER FOR LTE BAND 4 (1.4MHZ BANDWIDTH)

Test Results for Low Channel 1710.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
3421.4	-53.64	4.02	29.80	-27.86	-13	-14.86	Horizontal
3421.4	-55.21	4.02	29.80	-29.43	-13	-16.43	Vertical
5132.1	-56.14	5.24	35.84	-25.54	-13	-12.54	Vertical
5132.1	-57.52	5.24	35.84	-26.92	-13	-13.92	Horizontal
Test Results for Mid Channel 1732.5MHz							
3465	-54.62	4.03	30.00	-28.65	-13	-15.65	Horizontal
3465	-54.14	4.03	30.00	-28.17	-13	-15.17	Vertical
5197.5	-57.55	5.25	35.86	-26.94	-13	-13.94	Vertical
5197.5	-57.66	5.25	35.86	-27.05	-13	-14.05	Horizontal
Test Results for High Channel 1754.3MHz							
3508.6	-55.47	4.05	30.01	-29.51	-13	-16.51	Horizontal
3508.6	-56.38	4.05	30.01	-30.42	-13	-17.42	Vertical
5262.9	-56.65	5.26	35.86	-26.05	-13	-13.05	Vertical
5262.9	-57.89	5.26	35.86	-27.29	-13	-14.29	Horizontal

QPSK EIRP POWER FOR LTE BAND 4 (20.0MHZ BANDWIDTH)

Test Results for Low Channel 1720MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
3440	-57.45	4.02	29.80	-31.67	-13	-18.67	Horizontal
3440	-55.21	4.02	29.80	-29.43	-13	-16.43	Vertical
5160	-56.38	5.24	35.84	-25.78	-13	-12.78	Vertical
5160	-57.65	5.24	35.84	-27.05	-13	-14.05	Horizontal
Test Results for Mid Channel 1732.5MHz							
3465	-54.37	4.03	30.00	-28.40	-13	-15.40	Horizontal
3465	-55.56	4.03	30.00	-29.59	-13	-16.59	Vertical
5197.5	-57.76	5.25	35.86	-27.15	-13	-14.15	Vertical
5197.5	-57.88	5.25	35.86	-27.27	-13	-14.27	Horizontal
Test Results for High Channel 1745MHz							
3490	-54.36	2.91	27.68	-29.59	-13	-16.59	Horizontal
3490	-55.38	2.91	27.68	-30.61	-13	-17.61	Vertical
5235	-58.37	5.26	35.86	-27.77	-13	-14.77	Vertical
5235	-57.18	5.26	35.86	-26.58	-13	-13.58	Horizontal

Note: P_{Mea}(dBm)= Power(dBm)+ AR_{pl} (dBm)

. Over Limit= : P_{Mea}(dBm)-Limit(dBm)

. Both QPSK and 16QAM has been tested, the worst case is QPSK mode, the report just reported the worst case.

9.3 LTE BAND 5

QPSK EIRP POWER FOR LTE BAND 5 (1.4MHZ BANDWIDTH)

Test Results for Low Channel 824.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
1649.4	-52.18	2.78	27.50	-27.46	-13	-14.46	Horizontal
1649.4	-53.53	2.78	27.50	-28.81	-13	-15.81	Vertical
2474.1	-55.18	2.90	27.80	-30.28	-13	-17.28	Vertical
2474.1	-54.00	2.90	27.80	-29.10	-13	-16.10	Horizontal
Test Results For Mid Channel 836.5MHz							
1673	-56.62	2.80	27.48	-31.94	-13	-18.94	Horizontal
1673	-53.11	2.80	27.48	-28.43	-13	-15.43	Vertical
2509.5	-57.48	2.91	27.70	-32.69	-13	-19.69	Vertical
2509.5	-55.16	2.91	27.70	-30.37	-13	-17.37	Horizontal
Test Results for High Channel 848.3MHz							
1696.6	-54.09	2.82	27.43	-29.48	-13	-16.48	Horizontal
1696.6	-53.77	2.82	27.43	-29.16	-13	-16.16	Vertical
2544.9	-54.29	2.92	27.74	-29.47	-13	-16.47	Vertical
2544.9	-53.65	2.92	27.74	-28.83	-13	-15.83	Horizontal

QPSK EIRP POWER FOR LTE BAND 5 (10MHZ BANDWIDTH)

Test Results for Low Channel 829MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
1658	-56.98	2.78	27.50	-32.26	-13	-19.26	Horizontal
1658	-55.08	2.78	27.50	-30.36	-13	-17.36	Vertical
2487	-57.68	2.90	27.80	-32.78	-13	-19.78	Vertical
2487	-52.76	2.90	27.80	-27.86	-13	-14.86	Horizontal
Test Results For Mid Channel 836.5MHz							
1673	-56.09	2.80	27.48	-31.41	-13	-18.41	Horizontal
1673	-53.06	2.80	27.48	-28.38	-13	-15.38	Vertical
2509.5	-58.94	2.91	27.70	-34.15	-13	-21.15	Vertical
2509.5	-57.33	2.91	27.70	-32.54	-13	-19.54	Horizontal
Test Results for High Channel 844MHz							
1688	-56.20	2.82	27.43	-31.59	-13	-18.59	Horizontal
1688	-55.15	2.82	27.43	-30.54	-13	-17.54	Vertical
2532	-57.66	2.92	27.74	-32.84	-13	-19.84	Vertical
2532	-55.00	2.92	27.74	-30.18	-13	-17.18	Horizontal

Note: $P_{Mea}(dBm) = Power(dBm) + ARpl(dBm)$

. Over Limit = $P_{Mea}(dBm) - Limit(dBm)$

. Both QPSK and 16QAM has been tested, the worst case is QPSK mode, the report just reported the worst case.

9.4 LTE BAND 17

QPSK EIRP POWER FOR LTE BAND 17 (5MHZ BANDWIDTH)

Test Results for Low Channel 706.5MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
1413	-53.22	2.61	27.28	-28.55	-13	-15.55	Horizontal
1413	-54.33	2.61	27.28	-29.66	-13	-16.66	Vertical
2119.5	-53.76	2.87	27.59	-29.04	-13	-16.04	Vertical
2119.5	-52.35	2.87	27.59	-27.63	-13	-14.63	Horizontal
Test Results For Mid Channel 710MHz							
1420	-52.63	2.62	27.30	-27.95	-13	-14.95	Horizontal
1420	-54.58	2.62	27.30	-29.90	-13	-16.90	Vertical
2130	-55.31	2.87	27.62	-30.56	-13	-17.56	Vertical
2130	-56.68	2.87	27.62	-31.93	-13	-18.93	Horizontal
Test Results for High Channel 713.5MHz							
1427	-55.85	2.66	27.28	-31.23	-13	-18.23	Horizontal
1427	-56.37	2.66	27.28	-31.75	-13	-18.75	Vertical
2140.5	-54.34	2.88	27.60	-29.62	-13	-16.62	Vertical
2140.5	-55.72	2.88	27.60	-31.00	-13	-18.00	Horizontal

QPSK EIRP POWER FOR LTE BAND 17 (10MHZ BANDWIDTH)

Test Results for Low Channel 709MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
1418	-55.48	2.62	27.30	-30.80	-13	-17.80	Horizontal
1418	-52.78	2.62	27.30	-28.10	-13	-15.10	Vertical
2127	-54.66	2.87	27.62	-29.91	-13	-16.91	Vertical
2127	-55.68	2.87	27.62	-30.93	-13	-17.93	Horizontal
Test Results for Mid Channel 710MHz							
1420	-54.20	2.62	27.30	-29.52	-13	-16.52	Horizontal
1420	-51.62	2.62	27.30	-26.94	-13	-13.94	Vertical
2130	-54.73	2.87	27.62	-29.98	-13	-16.98	Vertical
2130	-52.94	2.87	27.62	-28.19	-13	-15.19	Horizontal
Test Results for High Channel 711MHz							
1422	-51.54	2.62	27.30	-26.86	-13	-13.86	Horizontal
1422	-52.35	2.62	27.30	-27.67	-13	-14.67	Vertical
2133	-53.58	2.87	27.62	-28.83	-13	-15.83	Vertical
2133	-56.57	2.87	27.62	-31.82	-13	-18.82	Horizontal

Note: $P_{Mea}(dBm) = Power(dBm) + AR_{pl}(dBm)$

. Over Limit = $P_{Mea}(dBm) - Limit(dBm)$

. Both QPSK and 16QAM has been tested, the worst case is QPSK mode, the report just reported the worst case.

10. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, §27.54

LIMITS

§22.355 - The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

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

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = -30° to $+50^{\circ}\text{C}$
- Voltage = low voltage, DC 3.3V, Normal, DC 3.8V and High voltage, DC 4.4V.

Frequency Stability vs Temperature:

The EUT is placed inside a temperature chamber. The temperature is set to -30°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until $+50^{\circ}\text{C}$ is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

MODES TESTED

- LTE Band 2
LTE Band 4
- LTE Band 5
LTE Band 17

RESULTS

See the following pages.

10.1 LTE BAND 2

QPSK, (20MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 2 QPSK, (CH 18900 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
3.4	1880	-17.96	-0.009556	2.5
3.8	1880	-17.60	-0.009364	2.5
4.35	1880	-17.56	-0.009341	2.5

Frequency error vs. Temperature

Temperature [° C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 2 QPSK, (CH 18900 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	1880	-17.90	-0.009523	2.5
Extreme (50C)	1880	-15.63	-0.008311	2.5
Extreme (40C)	1880	-16.18	-0.008608	2.5
Extreme (30C)	1880	-17.65	-0.009390	2.5
Extreme (10C)	1880	-17.97	-0.009559	2.5
Extreme (0C)	1880	-18.35	-0.009763	2.5
Extreme (-10C)	1880	-20.29	-0.010791	2.5
Extreme (-20C)	1880	-19.38	-0.010310	2.5
Extreme (-30C)	1880	-20.22	-0.010756	2.5

16QAM, (20MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 2 16QAM, (CH 18900 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
3.4	1880	-23.3	-0.012400	2.5
3.8	1880	-19.7	-0.010479	2.5
4.35	1880	-23.7	-0.012581	2.5

Frequency error vs. Temperature

Temperature [° C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 2 16QAM, (CH 18900 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	1880	-23.95	-0.012741	2.5
Extreme (50C)	1880	-24.92	-0.013258	2.5
Extreme (40C)	1880	-24.23	-0.012887	2.5
Extreme (30C)	1880	-23.29	-0.012390	2.5
Extreme (10C)	1880	-24.12	-0.012830	2.5
Extreme (0C)	1880	-22.62	-0.012032	2.5
Extreme (-10C)	1880	-22.36	-0.011894	2.5
Extreme (-20C)	1880	-22.31	-0.011865	2.5
Extreme (-30C)	1880	-21.39	-0.011380	2.5

*Note: Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

10.2 LTE BAND 4

QPSK, (10MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 4 QPSK, (CH 20175 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
3.4	1732.5	-16.37	-0.009449	2.5
3.8	1732.5	-16.16	-0.009329	2.5
4.35	1732.5	-16.54	-0.009546	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 4 QPSK, (CH 20175 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	1732.5	-16.60	-0.009583	2.5
Extreme (50C)	1732.5	-18.58	-0.010726	2.5
Extreme (40C)	1732.5	-17.81	-0.010283	2.5
Extreme (30C)	1732.5	-17.59	-0.010150	2.5
Extreme (10C)	1732.5	-15.98	-0.009225	2.5
Extreme (0C)	1732.5	-15.39	-0.008881	2.5
Extreme (-10C)	1732.5	-15.31	-0.008838	2.5
Extreme (-20C)	1732.5	-19.46	-0.011234	2.5
Extreme (-30C)	1732.5	-18.66	-0.010771	2.5

16QAM, (20MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 4 16QAM, (CH 20175 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
3.4	1732.5	-17.68	-0.010207	2.5
3.8	1732.5	-17.95	-0.010362	2.5
4.35	1732.5	-17.35	-0.010012	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 4 16QAM, (CH 20175 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	1732.5	-17.82	-0.010285	2.5
Extreme (50C)	1732.5	-15.02	-0.008667	2.5
Extreme (40C)	1732.5	-15.55	-0.008973	2.5
Extreme (30C)	1732.5	-16.95	-0.009782	2.5
Extreme (10C)	1732.5	-17.02	-0.009825	2.5
Extreme (0C)	1732.5	-17.36	-0.010020	2.5
Extreme (-10C)	1732.5	-15.49	-0.008942	2.5
Extreme (-20C)	1732.5	-16.87	-0.009740	2.5
Extreme (-30C)	1732.5	-16.74	-0.009662	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

10.3 LTE BAND 5

QPSK, (10MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 5 QPSK, (CH 20525 RB size 50 RB Offset 0 10MHz BANDWIDTH)				
3.4	836.5	-13.61	-0.016270	2.5
3.8	836.5	-13.50	-0.016141	2.5
4.35	836.5	-14.11	-0.016863	2.5

Frequency error vs. Temperature

Temperature [° C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 5 QPSK, (CH 20525 RB size 50 RB Offset 0 10MHz BANDWIDTH)				
Normal (25C)	836.5	-13.41	-0.016032	2.5
Extreme (50C)	836.5	-14.48	-0.017310	2.5
Extreme (40C)	836.5	-13.76	-0.016448	2.5
Extreme (30C)	836.5	-13.45	-0.016082	2.5
Extreme (10C)	836.5	-13.45	-0.016075	2.5
Extreme (0C)	836.5	-12.27	-0.014665	2.5
Extreme (-10C)	836.5	-14.63	-0.017488	2.5
Extreme (-20C)	836.5	-17.51	-0.020932	2.5
Extreme (-30C)	836.5	-18.29	-0.021867	2.5

16QAM, (10MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 5 16QAM, (CH 20525 RB size 50 RB Offset 0 10MHz BANDWIDTH)				
3.4	836.5	-14.51	-0.017350	2.5
3.8	836.5	-14.30	-0.017095	2.5
4.35	836.5	-14.97	-0.017900	2.5

Frequency error vs. Temperature

Temperature [° C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 5 16QAM, (CH 20525 RB size 50 RB Offset 0 10MHz BANDWIDTH)				
Normal (25C)	836.5	-14.53	-0.017376	2.5
Extreme (50C)	836.5	-15.86	-0.018957	2.5
Extreme (40C)	836.5	-16.33	-0.019522	2.5
Extreme (30C)	836.5	-15.50	-0.018531	2.5
Extreme (10C)	836.5	-13.81	-0.016504	2.5
Extreme (0C)	836.5	-13.07	-0.015624	2.5
Extreme (-10C)	836.5	-15.55	-0.018588	2.5
Extreme (-20C)	836.5	-15.31	-0.018305	2.5
Extreme (-30C)	836.5	-13.97	-0.016700	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

10.4 LTE BAND 17

QPSK, (10MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 17 QPSK, (CH 23790 RB size 50 RB Offset 0 10MHz BANDWIDTH)				
3.4	710.0	-13.85	-0.019514	2.5
3.8	710.0	-13.83	-0.019476	2.5
4.35	710.0	-12.75	-0.017964	2.5

Frequency error vs. Temperature

Temperature [° C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 17 QPSK, (CH 23790 RB size 50 RB Offset 0 10MHz BANDWIDTH)				
Normal (25C)	710.0	-12.92	-0.018195	2.5
Extreme (50C)	710.0	-13.93	-0.019626	2.5
Extreme (40C)	710.0	-13.47	-0.018977	2.5
Extreme (30C)	710.0	-12.87	-0.018127	2.5
Extreme (10C)	710.0	-13.78	-0.019404	2.5
Extreme (0C)	710.0	-14.27	-0.020099	2.5
Extreme (-10C)	710.0	-14.15	-0.019930	2.5
Extreme (-20C)	710.0	-13.78	-0.019402	2.5
Extreme (-30C)	710.0	-13.60	-0.019155	2.5

16QAM, (10MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 17 16QAM, (CH 23790 RB size 50 RB Offset 0 10MHz BANDWIDTH)				
3.4	710.0	-7.59	-0.010690	2.5
3.8	710.0	-7.81	-0.011001	2.5
4.35	710.0	-5.26	-0.007402	2.5

Frequency error vs. Temperature

Temperature [° C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 17 QPSK, (CH 23790 RB size 50 RB Offset 0 10MHz BANDWIDTH)				
Normal (25C)	710.0	-9.66	-0.013605	2.5
Extreme (50C)	710.0	-7.56	-0.010642	2.5
Extreme (40C)	710.0	-8.75	-0.012327	2.5
Extreme (30C)	710.0	-9.19	-0.012944	2.5
Extreme (10C)	710.0	-5.39	-0.007591	2.5
Extreme (0C)	710.0	-9.19	-0.012939	2.5
Extreme (-10C)	710.0	-9.75	-0.013728	2.5
Extreme (-20C)	710.0	-5.51	-0.007755	2.5
Extreme (-30C)	710.0	-5.09	-0.007164	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

11. Peak-to-Average Ratio

11.1 Description of the PAR Measurement

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

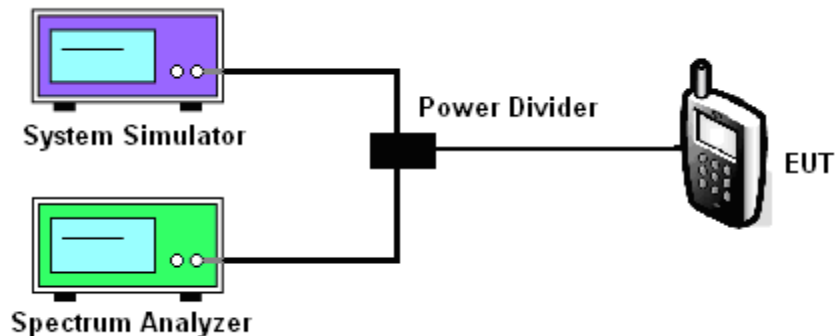
11.2 Measuring Instruments

See list of measuring instruments of this test report.

11.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. For GSM/EGPRS operating modes:
 - a. Set the RBW = 1MHz, VBW = 1MHz, Peak detector in spectrum analyzer.
 - b. Set EUT in maximum power output, and triggered the burst signal.
 - c. Measured respectively the Peak level and Mean level, and the deviation was recorded as Peak to Average Ratio.
4. For UMTS operating modes:
 - a. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
 - b. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.

11.4 Test Setup



MODES TESTED

- LTE Band2
- LTE Band 4
- LTE Band5
- LTE Band 17

Test data reference attachment.

----END OF REPORT----