FCC CFR47 PART 22H, 24E, 27
CERTIFICATION TEST REPORT
FCC ID: 2AVE6TG4XL

Product: Tractive DOG XL

Trade Mark: N/A

Model No.: TG4XL

Family Model: N/A

Report No.: S23011301005004

Issue Date: Feb 27, 2023

Prepared for

Tractive GmbH

Poststrasse 4, 4061 Pasching, Austria

Prepared by

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TEST RESULT CERTIFICATION

Applicant's name	:	Tractive GmbH
Address	:	Poststrasse 4, 4061 Pasching, Austria
Manufacturer's Name	:	Tractive GmbH
Address	:	Poststrasse 4, 4061 Pasching, Austria
Product name	:	Tractive DOG XL
Model and/or type reference	:	TG4XL
Trade Mark	:	N/A
Family Model	:	N/A
Test Sample Number		S230113010005
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..... Jan 13, 2023 ~ Feb 27, 2023

Date of Issue..... Feb 27, 2023

Test Result..... **Pass**

Testing Engineer : Mukzi Lee

(Mukzi Lee)

Authorized Signatory : Alex

(Alex Li)

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1. GENERAL INFORMATION

1.1 PRODUCT DESCRIPTION

A major technical description of EUT is described as following:

Product Designation:	Tractive DOG XL
Trade Mark	N/A
Model Name	TG4XL
Family Model	N/A
Model Difference	N/A
FCC ID:	2AVE6TG4XL
Frequency Bands:	U.S. Bands: ☒eMTC Band 2,4,5,12,13,
Frequency Range:	Band 2 Uplink: 1850MHz-1910MHz, Downlink: 1930MHz-1990MHz; Band 4 Uplink: 1710MHz-1755MHz, Downlink: 2110MHz-2155MHz; Band 5 Uplink: 824MHz-849MHz, Downlink: 869MHz-894MHz; Band 12 Uplink: 699MHz-716MHz, Downlink: 729MHz-746MHz; Band 13 Uplink: 777MHz-787MHz, Downlink: 746MHz-756MHz;
Type of Modulation:	QPSK/16QAM
Power Class	Class 3
Antenna:	FPC Antenna
Antenna gain:	Band 2: -0.66 dBi, Band 4: -0.66dBi, Band 5: -3.45 dBi, Band 12: -3.45 dBi, Band 13: -3.45 dBi;
Adapter	N/A
Battery	DC 3.7V, 3000mAh, 11.1Wh
Power supply	DC 3.7V from battery or DC 5V from magnetic charging port
Extreme Vol. Limits:	DC 3.2V to DC 4.2V (Nominal DC 3.7V)（Note 1）
Hardware Version	TG4XL
Firmware version	004.xxx
Software Version	N/A
** Note1: The High Voltage DC 4.2V and Low Voltage 3.2V was declared by manufacturer, The EUT couldn’t be operate normally with higher or lower voltage. 2. The product only supports 1.4M.	

1.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AVE6TG4XL** filing to comply with the FCC Part 22H&24E&27&90S.

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 Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R.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 eMTC Bands of: Band 2/4/5/12/13

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 eMTC 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

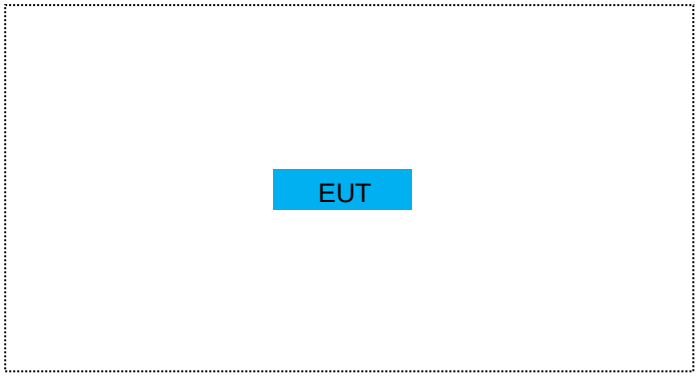
Table 2-1 Equipment Used in EUT System

Item	Equipment	Model No.	ID or Specification	Note
1	Tractive DOG XL	TG4XL	FCC ID: 2AVE6TG4XL	EUT

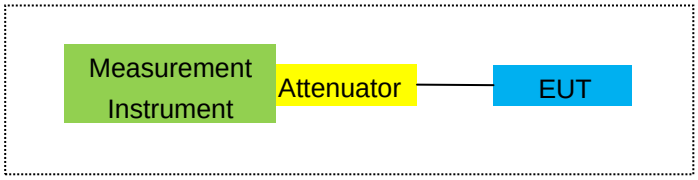
Note: All the accessories have been used during the test.
the following "EUT" in setup diagram means EUT system.

2.4 TEST SETUP

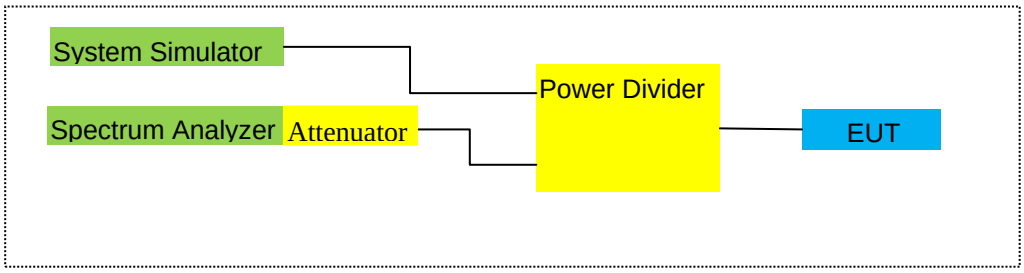
For Radiated Test Cases



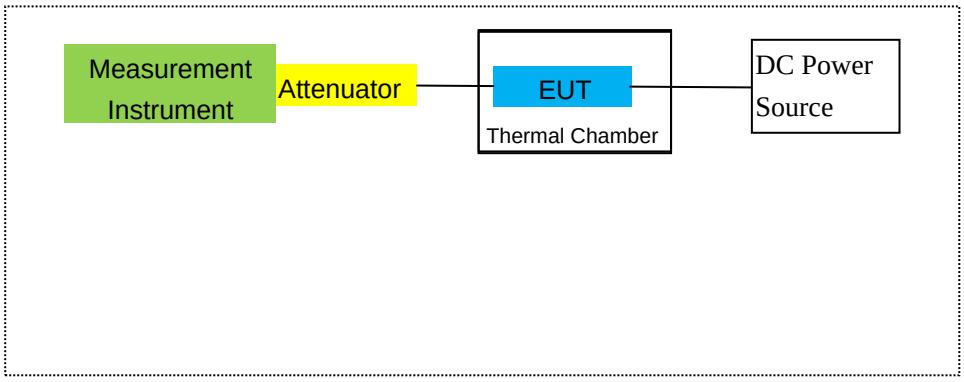
For Conducted Output Power



For Peak-to Average Ratio, Occupied Bandwidth, Conducted Band edge and Conducted Spurious Emission



For Frequency Stability



Note: EUT built-in battery-powered, the battery is fully-charged.

3.TEST AND MEASUREMENT EQUIPMENT

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

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	MXA Signal Analyzer	Agilent	N9020A	MY49100060	2022.06.16	2023.06.17	1 year
2	Test Receiver	R&S	ESPI	101318	2022.04.06	2023.04.05	1 year
3	Bilog Antenna	TESEQ	CBL6111D	31216	2022.03.30	2023.03.29	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200983705	2020.05.11	2023.05.10	3 year
5	Horn Antenna	EM	EM-AH-10180	2011071402	2022.03.31	2023.03.30	1 year
6	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2022.11.07	2023.11.06	1 year
7	Amplifier	EM	EM-30180	060538	2022.06.17	2023.06.16	1 year
8	Loop Antenna	ARA	PLA-1030/B	1029	2022.04.06	2023.04.05	1 year
9	Power Meter	R&S	NRVS	100696	2022.06.17	2023.06.16	1 year
10	Power Sensor	R&S	URV5-Z4	0395.1619.05	2022.04.06	2023.04.05	1 year
11	Test Cable	N/A	R-01	N/A	2022.06.17	2025.06.16	3 year
12	Test Cable	N/A	R-02	N/A	2022.06.17	2025.06.16	3 year
13	Test Cable	N/A	R-03	N/A	2022.06.17	2025.06.16	3 year
14	Test Receiver	R&S	ESCI	101160	2022.04.06	2023.04.05	1 year
15	LISN	R&S	ENV216	101313	2022.04.06	2023.04.05	1 year
16	LISN	EMCO	3816/2	00042990	2022.04.06	2023.04.05	1 year
17	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2022.04.06	2023.04.05	1 year
18	Passive Voltage Probe	R&S	ESH2-Z3	100196	2022.04.06	2023.04.05	1 year
19	Test Cable	N/A	C01	N/A	2020.05.11	2023.05.10	3 year
20	Test Cable	N/A	C02	N/A	2020.05.11	2023.05.10	3 year
21	Test Cable	N/A	C03	N/A	2020.05.11	2023.05.10	3 year
22	Attenuator	MCE	24-10-34	BN9258	2022.04.01	2023.03.31	1 year
23	Spectrum Analyzer	agilent	e4440a	us44300399	2022.04.01	2023.03.31	1 year
24	test receiver	R&S	ESCI	a0304218	2022.04.06	2023.04.05	1 year
25	Communication Tester	R&S	CMU200	A0304247	2022.06.16	2023.06.15	1 year

26	Thermal Chamber	Ten Billion	TTC-B3C	TBN-960502	2022.04.06	2023.04.05	1 year
27	DC Power Source	N/A	PS-6005D	2017040292 3	2020.05.11	2023.05.10	3 year
28	MXG Vector Signal Generator	Agilent	N5182A	MY47070317	2022.06.16	2023.06.15	1 year
29	Communication Tester	R&S	CMW500	148500	2022.06.16	2023.06.15	1 year

Note: Each piece of equipment is scheduled for calibration once a year except the Test Cable& DC Power Source which is scheduled for calibration every 3 years.

4. OUTPUT POWER

4.1 OUTPUT POWER MEASUREMENT

eMTC Measurement Procedure:

All eMTC 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 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
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

Band 2/4/5/12/13

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
FCC: §22.359

LIMITS

FCC: §22.917, §24.238, §27.53
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.
(c)(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

FCC: §90.691 Emission mask requirements for EA-based systems.
(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:
(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.
(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

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

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

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

MODES TESTED

Band 2/4/5/12/13

RESULTS

Test data reference attachment.

7. OUT OF BAND EMISSIONS

RULE PART(S)

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

LIMITS

1. 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.
2. The Band 7/41 emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 55 + 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 RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

MODES TESTED

□ Band 2/4/5/12/13

□

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, §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.
27.50 (h)(2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.
90.635(b) The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

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

Band 2/4/5/12/13

RESULTS

Pass

8.2 eMTC BAND 2

Radiated Power (EIRP) for Band 2									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/#Mid	1850.7	-3.22	3.76	28.24	21.26	133.660	Horizontal	Pass
		1880	-3.06	3.91	28.22	21.25	133.352	Horizontal	Pass
		1909.3	-2.95	3.93	28.20	21.32	135.519	Horizontal	Pass
1.4MHz Band QPSK	1/#Mid	1850.7	-3.23	3.76	28.24	21.25	133.352	Vertical	Pass
		1880	-3.02	3.91	28.22	21.29	134.586	Vertical	Pass
		1909.3	-3.06	3.93	28.20	21.21	132.130	Vertical	Pass

Radiated Power (EIRP) for Band 2									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band 16 QAM	1/#Mid	1850.7	-4.19	3.76	28.24	20.29	106.905	Horizontal	Pass
		1880	-4.03	3.91	28.22	20.28	106.660	Horizontal	Pass
		1909.3	-4.08	3.93	28.20	20.19	104.472	Horizontal	Pass
1.4MHz Band 16 QAM	1/#Mid	1850.7	-4.27	3.76	28.24	20.21	104.954	Vertical	Pass
		1880	-4.02	3.91	28.22	20.29	106.905	Vertical	Pass
		1909.3	-3.96	3.93	28.20	20.31	107.399	Vertical	Pass

Note:
SG Level= Signal generator output
Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)
Factor Gain(dB)=Antenna Gain(dB) + Amplifier Factor (dB)

8.3 eMTC BAND 4

Radiated Power (EIRP) for Band 4									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/#Mid	1710.7	-3.54	3.12	27.58	20.92	123.595	Horizontal	Pass
		1732.5	-3.56	3.27	27.61	20.78	119.674	Horizontal	Pass
		1754.3	-3.47	3.29	27.63	20.87	122.180	Horizontal	Pass
1.4MHz Band QPSK	1/#Mid	1710.7	-3.63	3.12	27.58	20.83	121.060	Vertical	Pass
		1732.5	-3.52	3.27	27.61	20.82	120.781	Vertical	Pass
		1754.3	-3.49	3.29	27.63	20.85	121.619	Vertical	Pass

Radiated Power (EIRP) for Band 4									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band 16 QAM	1/#Mid	1710.7	-4.77	3.12	27.58	19.69	93.111	Horizontal	Pass
		1732.5	-4.57	3.27	27.61	19.77	94.842	Horizontal	Pass
		1754.3	-4.65	3.29	27.63	19.69	93.111	Horizontal	Pass
1.4MHz Band 16 QAM	1/#Mid	1710.7	-4.70	3.12	27.58	19.76	94.624	Vertical	Pass
		1732.5	-4.54	3.27	27.61	19.80	95.499	Vertical	Pass
		1754.3	-4.60	3.29	27.63	19.74	94.189	Vertical	Pass

Note:
SG Level= Signal generator output
Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)
Factor Gain(dB)=Antenna Gain(dB) + Amplifier Factor (dB)

8.4 eMTC BAND 5

Radiated Power (EIRP) for Band 5									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/#Mid	824.7	5.10	2.01	19.68	2.15	20.62	115.345	Horizontal
		836.5	4.96	2.01	19.77	2.15	20.57	114.025	Horizontal
		848.3	5.04	2.02	19.82	2.15	20.69	117.220	Horizontal
1.4MHz Band QPSK	1/#Mid	824.7	5.15	2.01	19.68	2.15	20.67	116.681	Vertical
		836.5	5.06	2.01	19.77	2.15	20.67	116.681	Vertical
		848.3	4.98	2.02	19.82	2.15	20.63	115.611	Vertical

Radiated Power (EIRP) for Band 5									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band 16 QAM	1/#Mid	824.7	3.96	2.01	19.68	2.15	19.48	88.716	Horizontal
		836.5	3.81	2.01	19.77	2.15	19.42	87.498	Horizontal
		848.3	3.77	2.02	19.82	2.15	19.42	87.498	Horizontal
1.4MHz Band 16 QAM	1/#Mid	824.7	3.98	2.01	19.68	2.15	19.50	89.125	Vertical
		836.5	3.88	2.01	19.77	2.15	19.49	88.920	Vertical
		848.3	3.81	2.02	19.82	2.15	19.46	88.308	Vertical

Note:
SG Level= Signal generator output
Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)
Factor Gain(dB)=Antenna Gain(dB) + Amplifier Factor (dB)

8.5 eMTC BAND 12

Radiated Power (EIRP) for Band 12									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/#Mid	699.7	4.74	1.91	19.21	2.15	19.89	97.499	Vertical
		707.5	4.65	1.91	19.26	2.15	19.85	96.605	Vertical
		715.3	4.56	1.93	19.34	2.15	19.82	95.940	Vertical
1.4MHz Band QPSK	1/#Mid	699.7	4.68	1.91	19.21	2.15	19.83	96.161	Horizontal
		707.5	4.66	1.91	19.26	2.15	19.86	96.828	Horizontal
		715.3	4.49	1.93	19.34	2.15	19.75	94.406	Horizontal

Radiated Power (EIRP) for Band 12									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band 16 QAM	1/#Mid	699.7	3.56	1.91	19.21	2.15	18.71	74.302	Vertical
		707.5	3.53	1.91	19.26	2.15	18.73	74.645	Vertical
		715.3	3.39	1.93	19.34	2.15	18.65	73.282	Vertical
1.4MHz Band 16 QAM	1/#Mid	699.7	3.57	1.91	19.21	2.15	18.72	74.473	Horizontal
		707.5	3.57	1.91	19.26	2.15	18.77	75.336	Horizontal
		715.3	3.48	1.93	19.34	2.15	18.74	74.817	Horizontal

Note:
SG Level= Signal generator output
Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)
Factor Gain(dB)=Antenna Gain(dB) + Amplifier Factor (dB)

8.6 eMTC BAND 13

Radiated Power (EIRP) for Band 13									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
5.0MHz Band QPSK	1/#Mid	779.5	4.94	1.95	19.23	2.15	20.07	101.625	Vertical
		782	5.03	1.95	19.26	2.15	20.19	104.472	Vertical
		784.5	4.91	1.96	19.33	2.15	20.13	103.039	Vertical
5.0MHz Band QPSK	1/#Mid	779.5	5.06	1.95	19.23	2.15	20.19	104.472	Horizontal
		782	4.91	1.95	19.26	2.15	20.07	101.625	Horizontal
		784.5	4.87	1.96	19.33	2.15	20.09	102.094	Horizontal

Radiated Power (EIRP) for Band 13									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Factor (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band 16 QAM	1/#Mid	779.5	4.89	1.95	19.23	2.15	20.02	100.462	Vertical
		782	4.88	1.95	19.26	2.15	20.04	100.925	Vertical
		784.5	4.78	1.96	19.33	2.15	20.00	100.000	Vertical
1.4MHz Band 16 QAM	1/#Mid	779.5	4.84	1.95	19.23	2.15	19.97	99.312	Horizontal
		782	4.93	1.95	19.26	2.15	20.09	102.094	Horizontal
		784.5	4.74	1.96	19.33	2.15	19.96	99.083	Horizontal

Note:
SG Level= Signal generator output
Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)
Factor Gain(dB)=Antenna Gain(dB) + Amplifier Factor (dB)

9. SPURIOUS RADIATION EMISSION

RULE PART(S)

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

LIMIT

§22.917 (e) and §24.238 and §90.691 (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 log10(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 Log10 (p), dB; and
b. for mobile subscriber equipment, the attenuation shall not be less than 43 + 10 Log10 (p), dB at the channel edges and 55 + 10 Log10 (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

Band 2/4/5/12/13

RESULTS

PASS

9.1 eMTC BAND 2

eMTC 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	-48.86	4.04	33.51	-19.39	-13	-6.39	Horizontal
3701.4	-47.93	4.04	33.51	-18.46	-13	-5.46	Vertical
5552.1	-47.71	5.24	35.84	-17.11	-13	-4.11	Vertical
5552.1	-50.25	5.24	35.84	-19.65	-13	-6.65	Horizontal
204.2	-36.39	1.43	16.02	-21.80	-13	-8.80	Vertical
352.2	-44.97	1.30	17.99	-28.28	-13	-15.28	Horizontal
Test Results for Mid Channel 1880MHz							
3760.0	-50.80	4.04	33.56	-21.28	-13	-8.28	Horizontal
3760.0	-51.80	4.04	33.56	-22.28	-13	-9.28	Vertical
5640.0	-47.15	5.24	35.91	-16.48	-13	-3.48	Vertical
5640.0	-51.93	5.24	35.91	-21.26	-13	-8.26	Horizontal
199.0	-35.82	1.62	16.97	-20.47	-13	-7.47	Vertical
275.7	-35.81	1.74	15.98	-21.58	-13	-8.58	Horizontal
Test Results for High Channel 1909.3MHz							
3818.6	-44.59	4.04	34.00	-14.63	-13	-1.63	Horizontal
3818.6	-46.20	4.04	34.00	-16.24	-13	-3.24	Vertical
5727.9	-46.81	5.24	36.04	-16.01	-13	-3.01	Vertical
5727.9	-52.86	5.24	36.04	-22.06	-13	-9.06	Horizontal
208.9	-39.86	1.42	17.29	-23.99	-13	-10.99	Vertical
393.0	-34.80	1.50	17.90	-18.39	-13	-5.39	Horizontal

Note: PMea(dBm)= Power(dBm)+ ARpl (dBm)

. Over Limit= : PMea(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 eMTC BAND 4

eMTC 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	-44.40	4.02	29.80	-18.62	-13	-5.62	Horizontal
3421.4	-52.05	4.02	29.80	-26.27	-13	-13.27	Vertical
5132.1	-50.30	5.24	35.84	-19.70	-13	-6.70	Vertical
5132.1	-49.38	5.24	35.84	-18.78	-13	-5.78	Horizontal
207.0	-40.88	1.68	16.04	-26.52	-13	-13.52	Vertical
369.7	-44.56	1.78	17.74	-28.60	-13	-15.60	Horizontal
Test Results for Mid Channel 1732.5MHz							
3465.0	-47.78	4.03	30.00	-21.81	-13	-8.81	Horizontal
3465.0	-50.18	4.03	30.00	-24.21	-13	-11.21	Vertical
5197.5	-45.19	5.25	35.86	-14.58	-13	-1.58	Vertical
5197.5	-52.71	5.25	35.86	-22.10	-13	-9.10	Horizontal
179.1	-36.72	1.72	17.69	-20.75	-13	-7.75	Vertical
372.6	-34.37	1.62	16.02	-19.96	-13	-6.96	Horizontal
Test Results for High Channel 1754.3MHz							
3508.6	-53.65	4.05	30.01	-27.69	-13	-14.69	Horizontal
3508.6	-49.54	4.05	30.01	-23.58	-13	-10.58	Vertical
5262.9	-49.63	5.26	35.86	-19.03	-13	-6.03	Vertical
5262.9	-51.19	5.26	35.86	-20.59	-13	-7.59	Horizontal
205.4	-42.08	1.80	16.69	-27.19	-13	-14.19	Vertical
354.3	-44.80	1.75	16.66	-29.90	-13	-16.90	Horizontal

Note: PMea(dBm)= Power(dBm)+ ARpl (dBm)

. Over Limit= : PMea(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 eMTC BAND 5

eMTC 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	-46.47	2.78	27.50	-21.75	-13	-8.75	Horizontal
1649.4	-46.52	2.78	27.50	-21.80	-13	-8.80	Vertical
2474.1	-48.84	2.90	27.80	-23.94	-13	-10.94	Vertical
2474.1	-50.25	2.90	27.80	-25.35	-13	-12.35	Horizontal
187.4	-38.75	1.76	17.59	-22.92	-13	-9.92	Vertical
347.1	-35.20	1.63	15.87	-20.96	-13	-7.96	Horizontal
Test Results For Mid Channel 836.5MHz							
1673.0	-49.23	2.80	27.48	-24.55	-13	-11.55	Horizontal
1673.0	-48.65	2.80	27.48	-23.97	-13	-10.97	Vertical
2509.5	-53.82	2.91	27.70	-29.03	-13	-16.03	Vertical
2509.5	-49.45	2.91	27.70	-24.66	-13	-11.66	Horizontal
184.4	-36.99	1.61	15.68	-22.92	-13	-9.92	Vertical
434.0	-36.45	1.59	17.52	-20.53	-13	-7.53	Horizontal
Test Results for High Channel 848.3MHz							
1696.6	-50.72	2.82	27.43	-26.11	-13	-13.11	Horizontal
1696.6	-52.94	2.82	27.43	-28.33	-13	-15.33	Vertical
2544.9	-45.64	2.92	27.74	-20.82	-13	-7.82	Vertical
2544.9	-50.60	2.92	27.74	-25.78	-13	-12.78	Horizontal
207.7	-42.43	1.69	16.67	-27.44	-13	-14.44	Vertical
367.7	-40.52	1.70	17.18	-25.04	-13	-12.04	Horizontal

Note: PMea(dBm)= Power(dBm)+ ARpl (dBm)

. Over Limit= : PMea(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 eMTC BAND 12

eMTC BAND 12 (1.4MHZ BANDWIDTH)

Test Results for Low Channel 699.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit （dBm）	Margin(dBm)	Polarity
1399.4	-48.85	2.60	27.20	-24.25	-13	-11.25	Horizontal
1399.4	-45.66	2.60	27.20	-21.06	-13	-8.06	Vertical
2099.1	-47.93	2.85	27.54	-23.24	-13	-10.24	Vertical
2099.1	-51.84	2.85	27.54	-27.15	-13	-14.15	Horizontal
206.4	-43.23	1.49	17.78	-26.94	-13	-13.94	Vertical
299.8	-42.49	1.36	17.33	-26.52	-13	-13.52	Horizontal
Test Results For Mid Channel 707.5MHz							
1415.0	-46.72	2.61	27.28	-22.05	-13	-9.05	Horizontal
1415.0	-48.67	2.61	27.28	-24.00	-13	-11.00	Vertical
2122.5	-47.53	2.87	27.59	-22.81	-13	-9.81	Vertical
2122.5	-50.29	2.87	27.59	-25.57	-13	-12.57	Horizontal
210.5	-41.63	1.73	15.74	-27.62	-13	-14.62	Vertical
313.4	-37.21	1.62	15.79	-23.04	-13	-10.04	Horizontal
Test Results for High Channel 715.3MHz							
1430.6	-51.48	2.63	27.28	-26.83	-13	-13.83	Horizontal
1430.6	-46.44	2.63	27.28	-21.79	-13	-8.79	Vertical
2145.9	-46.32	2.88	27.60	-21.60	-13	-8.60	Vertical
2145.9	-52.16	2.88	27.60	-27.44	-13	-14.44	Horizontal
188.6	-40.22	1.61	18.00	-23.83	-13	-10.83	Vertical
317.7	-38.14	1.45	15.49	-24.11	-13	-11.11	Horizontal

Note: PMea(dBm)= Power(dBm)+ ARpl (dBm)

. Over Limit= : PMea(dBm)-Limit(dBm)

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

9.5 eMTC BAND 13

eMTC BAND 13 (5MHZ BANDWIDTH)

Test Results for Low Channel 779.5MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit （dBm）	Margin(dBm)	Polarity
1559.0	-67.47	2.61	27.28	-42.80	-40	-2.80	Horizontal
1559.0	-73.26	2.61	27.28	-48.59	-40	-8.59	Vertical
2338.5	-74.43	2.87	27.59	-49.71	-13	-36.71	Vertical
2338.5	-68.87	2.87	27.59	-44.15	-13	-31.15	Horizontal
199.0	-69.29	1.71	16.15	-54.85	-13	-41.85	Vertical
381.2	-73.58	1.41	17.32	-57.67	-13	-44.67	Horizontal
Test Results For Mid Channel 782MHz							
1564.0	-68.89	2.62	27.30	-44.21	-40	-4.21	Horizontal
1564.0	-70.98	2.62	27.30	-46.30	-40	-6.30	Vertical
2346.0	-69.39	2.87	27.62	-44.64	-13	-31.64	Vertical
2346.0	-70.06	2.87	27.62	-45.31	-13	-32.31	Horizontal
202.1	-68.48	1.42	15.25	-54.66	-13	-41.66	Vertical
440.0	-72.03	1.36	17.19	-56.20	-13	-43.20	Horizontal
Test Results for High Channel 784.5MHz							
1569.0	-77.78	2.66	27.28	-53.16	-40	-13.16	Horizontal
1569.0	-74.51	2.66	27.28	-49.89	-40	-9.89	Vertical
2353.5	-67.71	2.88	27.60	-42.99	-13	-29.99	Vertical
2353.5	-74.01	2.88	27.60	-49.29	-13	-36.29	Horizontal
196.6	-68.85	1.32	17.29	-52.88	-13	-39.88	Vertical
250.1	-73.38	1.72	16.89	-58.21	-13	-45.21	Horizontal

Note: PMea(dBm)= Power(dBm)+ ARpl (dBm)

. Over Limit= : PMea(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°C
- Voltage =low voltage, DC3.2V, Normal, DC 3.7V and High voltage, DC 4.2V.

Frequency Stability vs Temperature:

The EUT is place inside a temperature chamber. The temperature is set to -30ºC 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 +50ºC is reached.

Frequency Stability vs Voltage:

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

MODES TESTED

Band 2/4/5/12/13

RESULTS

See the following pages.

10.1 eMTC BAND 2

Band 2 QPSK, (1.4MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	1880	13.0	0.006892	2.5
3.70	1880	14.0	0.007463	2.5
4.2	1880	13.0	0.006897	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	1880	13.1	0.006973	2.5
Extreme (50C)	1880	12.0	0.006394	2.5
Extreme (40C)	1880	13.4	0.007106	2.5
Extreme (30C)	1880	13.3	0.007081	2.5
Extreme (10C)	1880	13.5	0.007201	2.5
Extreme (0C)	1880	11.8	0.006280	2.5
Extreme (-10C)	1880	13.3	0.007076	2.5
Extreme (-20C)	1880	13.7	0.007279	2.5
Extreme (-30C)	1880	14.7	0.007807	2.5

eMTC Band 2 16QAM, (1.4MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	1880	9.7	0.005156	2.5
3.70	1880	8.5	0.004511	2.5
4.2	1880	8.5	0.004504	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	1880	9.3	0.004936	2.5
Extreme (50C)	1880	8.5	0.004516	2.5
Extreme (40C)	1880	8.0	0.004253988	2.5
Extreme (30C)	1880	9.1	0.004817004	2.5
Extreme (10C)	1880	8.8	0.004704879	2.5
Extreme (0C)	1880	7.8	0.004151903	2.5
Extreme (-10C)	1880	8.8	0.004660197	2.5
Extreme (-20C)	1880	8.7	0.004623845	2.5
Extreme (-30C)	1880	8.5	0.00454226	2.5

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

10.2 eMTC BAND 4

eMTC Band 4 QPSK, (1.4MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	1732.5	8.6	0.004983	2.5
3.70	1732.5	9.1	0.005268	2.5
4.2	1732.5	8.5	0.004911	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	1732.5	8.8	0.005080	2.5
Extreme (50C)	1732.5	8.5	0.004924	2.5
Extreme (40C)	1732.5	7.3	0.004215	2.5
Extreme (30C)	1732.5	5.9	0.003403	2.5
Extreme (10C)	1732.5	7.1	0.004118	2.5
Extreme (0C)	1732.5	9.1	0.005241	2.5
Extreme (-10C)	1732.5	8.0	0.004598	2.5
Extreme (-20C)	1732.5	6.8	0.003901	2.5
Extreme (-30C)	1732.5	8.5	0.004906	2.5

eMTC Band 4 16QAM, (1.4MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	1732.5	9.9	0.005717	2.5
3.70	1732.5	9.0	0.005186	2.5
4.2	1732.5	7.8	0.004524	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	1732.5	9.7	0.005627	2.5
Extreme (50C)	1732.5	8.7	0.005046	2.5
Extreme (40C)	1732.5	8.2	0.004732	2.5
Extreme (30C)	1732.5	8.5	0.004921	2.5
Extreme (10C)	1732.5	9.0	0.005195	2.5
Extreme (0C)	1732.5	7.9	0.004535	2.5
Extreme (-10C)	1732.5	8.8	0.005083	2.5
Extreme (-20C)	1732.5	8.5	0.004898	2.5
Extreme (-30C)	1732.5	8.6	0.004954	2.5

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

10.3 eMTC BAND 5

eMTC Band 5 QPSK, (1.4MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	836.5	6.0	0.007210	2.5
3.70	836.5	6.8	0.008139	2.5
4.2	836.5	5.2	0.006219	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	836.5	6.3	0.007472	2.5
Extreme (50C)	836.5	5.8	0.006902	2.5
Extreme (40C)	836.5	6.0	0.007143	2.5
Extreme (30C)	836.5	6.2	0.007376	2.5
Extreme (10C)	836.5	5.7	0.006868	2.5
Extreme (0C)	836.5	5.5	0.006621	2.5
Extreme (-10C)	836.5	5.6	0.006652	2.5
Extreme (-20C)	836.5	6.3	0.007588	2.5
Extreme (-30C)	836.5	6.4	0.007646	2.5

eMTC Band 5 16QAM, (1.4MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	836.5	6.0	0.007161	2.5
3.70	836.5	6.5	0.007789	2.5
4.2	836.5	4.6	0.005508	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	836.5	5.6	0.006707	2.5
Extreme (50C)	836.5	5.7	0.006857	2.5
Extreme (40C)	836.5	6.3	0.007501	2.5
Extreme (30C)	836.5	5.9	0.007065	2.5
Extreme (10C)	836.5	5.6	0.006669	2.5
Extreme (0C)	836.5	5.0	0.005949	2.5
Extreme (-10C)	836.5	5.9	0.007087	2.5
Extreme (-20C)	836.5	5.6	0.006721	2.5
Extreme (-30C)	836.5	6.7	0.007977	2.5

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

10.4 eMTC BAND 12

eMTC Band 12 QPSK, (1.4MHz BANDWIDTH RB size 1 RB Offset 0

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	707.5	8.4	0.011883	2.5
3.70	707.5	10.0	0.014163	2.5
4.2	707.5	8.8	0.012398	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	707.5	8.5	0.012061	2.5
Extreme (50C)	707.5	7.8	0.011032	2.5
Extreme (40C)	707.5	7.6	0.010762	2.5
Extreme (30C)	707.5	8.3	0.011770	2.5
Extreme (10C)	707.5	6.9	0.009813	2.5
Extreme (0C)	707.5	9.0	0.012740	2.5
Extreme (-10C)	707.5	8.2	0.011588	2.5
Extreme (-20C)	707.5	8.5	0.012022	2.5
Extreme (-30C)	707.5	7.8	0.011009	2.5

eMTC Band 12 16QAM, (1.4MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	707.5	7.1	0.010035	2.5
3.70	707.5	8.0	0.011270	2.5
4.2	707.5	7.9	0.011137	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	707.5	9.0	0.012774	2.5
Extreme (50C)	707.5	8.5	0.012018	2.5
Extreme (40C)	707.5	9.3	0.013076	2.5
Extreme (30C)	707.5	7.5	0.010606	2.5
Extreme (10C)	707.5	8.8	0.012504	2.5
Extreme (0C)	707.5	7.3	0.010301	2.5
Extreme (-10C)	707.5	7.5	0.010635	2.5
Extreme (-20C)	707.5	9.3	0.013153	2.5
Extreme (-30C)	707.5	8.8	0.012404	2.5

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

10.5 eMTC BAND 13

eMTC Band 13 QPSK, (5MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	782.0	13.0	0.016621	2.5
3.70	782.0	14.0	0.017918	2.5
4.2	782.0	13.0	0.016592	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	782.0	14.3	0.018305	2.5
Extreme (50C)	782.0	13.7	0.017553	2.5
Extreme (40C)	782.0	15.6	0.019920	2.5
Extreme (30C)	782.0	14.6	0.018609	2.5
Extreme (10C)	782.0	14.1	0.018029	2.5
Extreme (0C)	782.0	14.2	0.018139	2.5
Extreme (-10C)	782.0	14.4	0.018413	2.5
Extreme (-20C)	782.0	14.6	0.018655	2.5
Extreme (-30C)	782.0	13.2	0.016930	2.5

eMTC Band 13 16QAM, (5MHz BANDWIDTH RB size 1 RB Offset 0)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
3.2	782.0	13.2	0.016849	2.5
3.70	782.0	13.4	0.017158	2.5
4.2	782.0	12.9	0.016481	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	782.0	13.1	0.016776	2.5
Extreme (50C)	782.0	12.0	0.015321	2.5
Extreme (40C)	782.0	13.9	0.017819	2.5
Extreme (30C)	782.0	13.4	0.017150	2.5
Extreme (10C)	782.0	13.6	0.017414	2.5
Extreme (0C)	782.0	12.5	0.016008	2.5
Extreme (-10C)	782.0	13.4	0.017098	2.5
Extreme (-20C)	782.0	13.9	0.017755	2.5
Extreme (-30C)	782.0	14.3	0.018287	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.

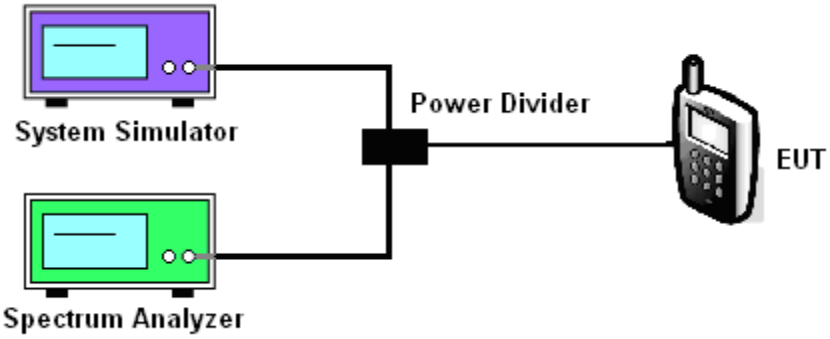
11.2 Measuring Instruments

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 eMTC 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

Band 2/4/5/12/13

Test data reference attachment.

----END OF REPORT----