

FCC CFR47 PART 22H, 24E, 27 CERTIFICATION TEST REPORT FCC ID: 2AVE6TG4422

Product: Tractive GPS DOG LTE

Trade Mark: N/A

Model No.: TG4422

Family Model: N/A

Report No.: S22111600205004

Issue Date: Dec 26, 2022

Prepared for

Tractive GmbH

Poststrasse 4, 4061 Pasching, Austria

Prepared by

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

Tel. 400-800-6106, 0755-2320 0050, 0755-2320 0090

Website: <http://www.ntek.org.cn>

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 GPS DOG LTE
Model and/or type reference ..	: TG4422
Trade Mark.....	: N/A
Family Model.....	: N/A
Test Sample Number.....	: S221116002006
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..... Nov 16, 2022 ~ Dec 26, 2022

Date of Issue Dec 26, 2022

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 GPS DOG LTE
Trade Mark	N/A
Model Name	TG4422
Family Model	N/A
Model Difference	N/A
FCC ID:	2AVE6TG4422
Frequency Bands:	U.S. Bands: <input checked="" type="checkbox"/> 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: -1.9 dBi, Band 4: -1.9 dBi, Band 5: -2.8 dBi, Band 12: -2.8 dBi, Band 13: -2.8 dBi;
Adapter	N/A
Battery	DC 3.8V, 810mAh, 3.08Wh
Power supply	DC 3.8V from battery or DC 5V from USB port
Extreme Vol. Limits:	DC 3.2V to DC 4.35V (Nominal DC 3.8V) (Note 1)
Hardware Version	TRV4-7
Firmware version	004.116
Software Version	N/A
** Note1: The High Voltage DC 4.35V and Low Voltage 3.2V 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: 2AVE6TG4422** 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 GPS DOG LTE	TG4422	FCC ID: 2AVE6TG4422	EUT

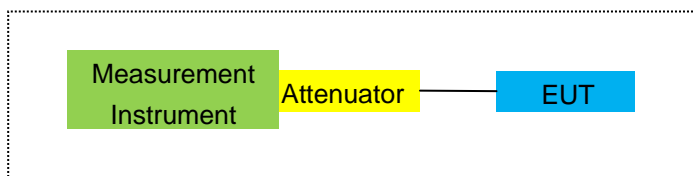
*Note: All the accessories have been used during the test.
the following "EUT" in setup diagram means EUT system.*

2.4 TEST SETUP

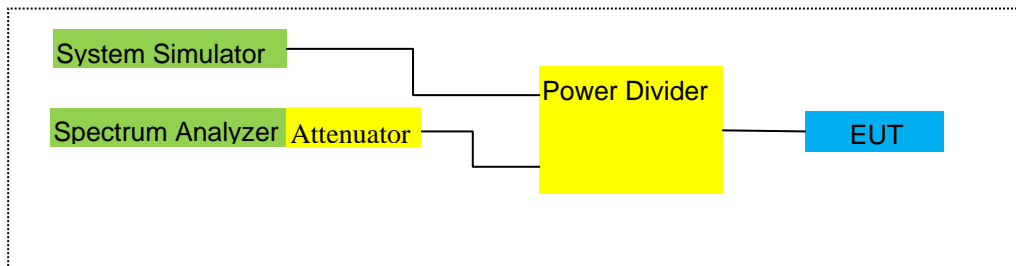
For Radiated Test Cases



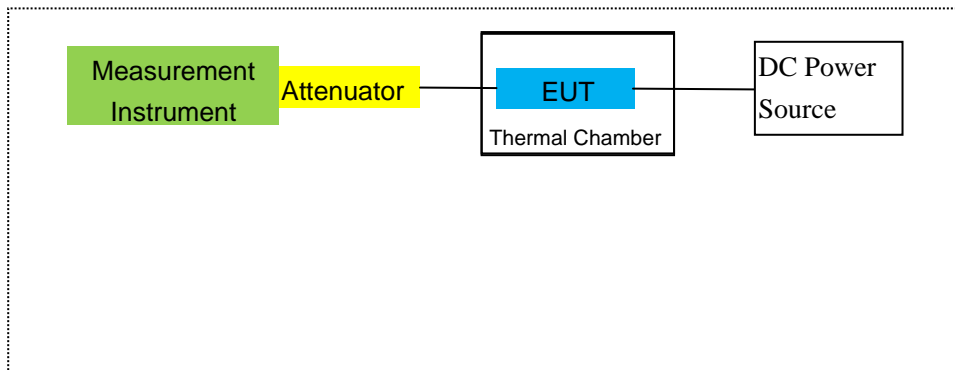
For Conducted Output Power



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	20170402923	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 than $43 + 10 \log (P)$ 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 $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ 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 $43 + 10 \log_{10}(P)$ 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	Cable Loss	Factor	Max. EIRP	Max. EIRP	Polarization	
			(dBm)	(dBm)	(dB)	Average	Average	Of Max. ERP	
						(dBm)	(mW)		
1.4MHz	1/#Mid	1850.7	-4.03	3.76	28.24	20.45	110.917	Horizontal	Pass
Band		1880	-3.78	3.91	28.22	20.53	112.980	Horizontal	Pass
QPSK		1909.3	-3.77	3.93	28.20	20.50	112.202	Horizontal	Pass
1.4MHz	1/#Mid	1850.7	-3.91	3.76	28.24	20.57	114.025	Vertical	Pass
Band		1880	-3.85	3.91	28.22	20.46	111.173	Vertical	Pass
QPSK		1909.3	-3.82	3.93	28.20	20.45	110.917	Vertical	Pass

Radiated Power (EIRP) for Band 2									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level	Cable Loss	Factor	Max. EIRP	Max. EIRP	Polarization	
			(dBm)	(dBm)	(dB)	Average	Average	Of Max. ERP	
						(dBm)	(mW)		
1.4MHz	1/#Mid	1850.7	-4.84	3.76	28.24	19.64	92.045	Horizontal	Pass
Band 16		1880	-4.61	3.91	28.22	19.70	93.325	Horizontal	Pass
QAM		1909.3	-4.70	3.93	28.20	19.57	90.573	Horizontal	Pass
1.4MHz	1/#Mid	1850.7	-4.85	3.76	28.24	19.63	91.833	Vertical	Pass
Band 16		1880	-4.76	3.91	28.22	19.55	90.157	Vertical	Pass
QAM		1909.3	-4.66	3.93	28.20	19.61	91.411	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	Cable Loss	Factor	Max. EIRP	Max. EIRP	Polarization	
			(dBm)	(dBm)	(dB)	Average	Average	Of Max. ERP	
						(dBm)	(mW)		
1.4MHz	1/#Mid	1710.7	-3.89	3.12	27.58	20.57	114.025	Horizontal	Pass
Band		1732.5	-3.80	3.27	27.61	20.54	113.240	Horizontal	Pass
QPSK		1754.3	-3.75	3.29	27.63	20.59	114.551	Horizontal	Pass
1.4MHz	1/#Mid	1710.7	-3.96	3.12	27.58	20.50	112.202	Vertical	Pass
Band		1732.5	-3.89	3.27	27.61	20.45	110.917	Vertical	Pass
QPSK		1754.3	-3.82	3.29	27.63	20.52	112.720	Vertical	Pass

Radiated Power (EIRP) for Band 4									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level	Cable Loss	Factor	Max. EIRP	Max. EIRP	Polarization	
			(dBm)	(dBm)	(dB)	Average	Average	Of Max. ERP	
						(dBm)	(mW)		
1.4MHz	1/#Mid	1710.7	-4.84	3.12	27.58	19.62	91.622	Horizontal	Pass
Band		1732.5	-4.75	3.27	27.61	19.59	90.991	Horizontal	Pass
16		1754.3	-4.66	3.29	27.63	19.68	92.897	Horizontal	Pass
QAM									
1.4MHz	1/#Mid	1710.7	-4.82	3.12	27.58	19.64	92.045	Vertical	Pass
Band		1732.5	-4.73	3.27	27.61	19.61	91.411	Vertical	Pass
16		1754.3	-4.74	3.29	27.63	19.60	91.201	Vertical	Pass
QAM									

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 (ERP) for Band 5										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level(dBm)	Cable Loss (dBm)	Factor (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/#Midd	824.7	2.94	2.01	19.68	2.15	18.46	70.146	Horizontal	Pass
		836.5	2.77	2.01	19.77	2.15	18.38	68.865	Horizontal	Pass
		848.3	2.72	2.02	19.82	2.15	18.37	68.707	Horizontal	Pass
1.4MHz Band QPSK	1/#Midd	824.7	2.87	2.01	19.68	2.15	18.39	69.024	Vertical	Pass
		836.5	2.74	2.01	19.77	2.15	18.35	68.391	Vertical	Pass
		848.3	2.80	2.02	19.82	2.15	18.45	69.984	Vertical	Pass

Radiated Power (ERP) for Band 5										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level(dBm)	Cable Loss (dBm)	Factor (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band 16 QAM	1/#Midd	824.7	1.95	2.01	19.68	2.15	17.47	55.847	Horizontal	Pass
		836.5	1.96	2.01	19.77	2.15	17.57	57.148	Horizontal	Pass
		848.3	1.94	2.02	19.82	2.15	17.59	57.412	Horizontal	Pass
1.4MHz Band 16 QAM	1/#Midd	824.7	2.04	2.01	19.68	2.15	17.56	57.016	Vertical	Pass
		836.5	1.92	2.01	19.77	2.15	17.53	56.624	Vertical	Pass
		848.3	1.86	2.02	19.82	2.15	17.51	56.364	Vertical	Pass

Note:

ERP=EIRP-2.15

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 (ERP) for Band 12										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level(dBm)	Cable Loss (dBm)	Factor (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/#Midd	699.7	4.77	1.91	19.21	2.15	19.92	98.175	Vertical	Pass
		707.5	4.80	1.91	19.26	2.15	20.00	100.000	Vertical	Pass
		715.3	4.60	1.93	19.34	2.15	19.86	96.828	Vertical	Pass
1.4MHz Band QPSK	1/#Midd	699.7	4.83	1.91	19.21	2.15	19.98	99.541	Horizontal	Pass
		707.5	4.78	1.91	19.26	2.15	19.98	99.541	Horizontal	Pass
		715.3	4.65	1.93	19.34	2.15	19.91	97.949	Horizontal	Pass

Radiated Power (ERP) for Band 12										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level(dBm)	Cable Loss (dBm)	Factor (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band 16 QAM	1/#Midd	699.7	3.45	1.91	19.21	2.15	18.60	72.444	Vertical	Pass
		707.5	3.48	1.91	19.26	2.15	18.68	73.790	Vertical	Pass
		715.3	3.40	1.93	19.34	2.15	18.66	73.451	Vertical	Pass
1.4MHz Band 16 QAM	1/#Midd	699.7	3.40	1.91	19.21	2.15	18.55	71.614	Horizontal	Pass
		707.5	3.47	1.91	19.26	2.15	18.67	73.621	Horizontal	Pass
		715.3	3.41	1.93	19.34	2.15	18.67	73.621	Horizontal	Pass

Note:

ERP=EIRP-2.15

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 (ERP) for Band 13										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level(dBm)	Cable Loss (dBm)	Factor (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
5.0MHz Band QPSK	1/16Mi	779.5	4.76	1.95	19.23	2.15	19.89	97.499	Vertical	Pass
		782	4.77	1.95	19.26	2.15	19.93	98.401	Vertical	Pass
		784.5	4.75	1.96	19.33	2.15	19.97	99.312	Vertical	Pass
5.0MHz Band QPSK	1/16Mi	779.5	4.77	1.95	19.23	2.15	19.90	97.724	Horizontal	Pass
		782	4.81	1.95	19.26	2.15	19.97	99.312	Horizontal	Pass
		784.5	4.65	1.96	19.33	2.15	19.87	97.051	Horizontal	Pass

Radiated Power (ERP) for Band 13										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level(dBm)	Cable Loss (dBm)	Factor (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
5.0MHz Band 16 QAM	1/16Mi	779.5	4.22	1.95	19.23	2.15	19.35	86.099	Vertical	Pass
		782	4.20	1.95	19.26	2.15	19.36	86.298	Vertical	Pass
		784.5	4.08	1.96	19.33	2.15	19.30	85.114	Vertical	Pass
5.0MHz Band 16 QAM	1/16Mi	779.5	4.13	1.95	19.23	2.15	19.26	84.333	Horizontal	Pass
		782	4.11	1.95	19.26	2.15	19.27	84.528	Horizontal	Pass
		784.5	4.12	1.96	19.33	2.15	19.34	85.901	Horizontal	Pass

Note:

ERP=EIRP-2.15

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 $43 + 10 \log_{10}(P)$ 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 $43 + 10 \log_{10}(p)$, dB; and
- b. for mobile subscriber equipment, the attenuation shall not be less than $43 + 10 \log_{10}(p)$, dB at the channel edges and $55 + 10 \log_{10}(p)$ 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

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	-45.48	4.04	33.51	-16.01	-13	-3.01	Horizontal
3701.4	-46.38	4.04	33.51	-16.91	-13	-3.91	Vertical
5552.1	-49.89	5.24	35.84	-19.29	-13	-6.29	Vertical
5552.1	-49.94	5.24	35.84	-19.34	-13	-6.34	Horizontal
184.1	-40.16	1.43	16.02	-25.57	-13	-12.57	Vertical
279.6	-44.76	1.30	17.99	-28.07	-13	-15.07	Horizontal
Test Results for Mid Channel 1880MHz							
3760.0	-44.38	4.04	33.56	-14.86	-13	-1.86	Horizontal
3760.0	-51.96	4.04	33.56	-22.44	-13	-9.44	Vertical
5640.0	-44.85	5.24	35.91	-14.18	-13	-1.18	Vertical
5640.0	-52.66	5.24	35.91	-21.99	-13	-8.99	Horizontal
207.0	-36.65	1.62	16.97	-21.30	-13	-8.30	Vertical
416.2	-44.75	1.74	15.98	-30.52	-13	-17.52	Horizontal
Test Results for High Channel 1909.3MHz							
3818.6	-46.23	4.04	34.00	-16.27	-13	-3.27	Horizontal
3818.6	-46.13	4.04	34.00	-16.17	-13	-3.17	Vertical
5727.9	-51.44	5.24	36.04	-20.64	-13	-7.64	Vertical
5727.9	-53.05	5.24	36.04	-22.25	-13	-9.25	Horizontal
195.2	-39.10	1.42	17.29	-23.23	-13	-10.23	Vertical
241.6	-40.37	1.50	17.90	-23.96	-13	-10.96	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.

9.2 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	-46.94	4.02	29.80	-21.16	-13	-8.16	Horizontal
3421.4	-53.05	4.02	29.80	-27.27	-13	-14.27	Vertical
5132.1	-46.16	5.24	35.84	-15.56	-13	-2.56	Vertical
5132.1	-52.80	5.24	35.84	-22.20	-13	-9.20	Horizontal
182.6	-35.43	1.68	16.04	-21.07	-13	-8.07	Vertical
240.4	-36.18	1.78	17.74	-20.22	-13	-7.22	Horizontal
Test Results for Mid Channel 1732.5MHz							
3465.0	-52.76	4.03	30.00	-26.79	-13	-13.79	Horizontal
3465.0	-53.44	4.03	30.00	-27.47	-13	-14.47	Vertical
5197.5	-51.63	5.25	35.86	-21.02	-13	-8.02	Vertical
5197.5	-52.11	5.25	35.86	-21.50	-13	-8.50	Horizontal
181.1	-42.57	1.72	17.69	-26.60	-13	-13.60	Vertical
385.2	-39.20	1.62	16.02	-24.79	-13	-11.79	Horizontal
Test Results for High Channel 1754.3MHz							
3508.6	-50.44	4.05	30.01	-24.48	-13	-11.48	Horizontal
3508.6	-52.08	4.05	30.01	-26.12	-13	-13.12	Vertical
5262.9	-53.91	5.26	35.86	-23.31	-13	-10.31	Vertical
5262.9	-50.43	5.26	35.86	-19.83	-13	-6.83	Horizontal
177.9	-34.43	1.80	16.69	-19.54	-13	-6.54	Vertical
240.0	-42.70	1.75	16.66	-27.80	-13	-14.80	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 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	-47.42	2.78	27.50	-22.70	-13	-9.70	Horizontal
1649.4	-49.15	2.78	27.50	-24.43	-13	-11.43	Vertical
2474.1	-46.20	2.90	27.80	-21.30	-13	-8.30	Vertical
2474.1	-53.55	2.90	27.80	-28.65	-13	-15.65	Horizontal
182.2	-34.21	1.76	17.59	-18.38	-13	-5.38	Vertical
280.9	-34.43	1.63	15.87	-20.19	-13	-7.19	Horizontal
Test Results For Mid Channel 836.5MHz							
1673.0	-48.98	2.80	27.48	-24.30	-13	-11.30	Horizontal
1673.0	-47.56	2.80	27.48	-22.88	-13	-9.88	Vertical
2509.5	-53.36	2.91	27.70	-28.57	-13	-15.57	Vertical
2509.5	-50.33	2.91	27.70	-25.54	-13	-12.54	Horizontal
190.5	-38.09	1.61	15.68	-24.02	-13	-11.02	Vertical
360.4	-35.69	1.59	17.52	-19.77	-13	-6.77	Horizontal
Test Results for High Channel 848.3MHz							
1696.6	-51.80	2.82	27.43	-27.19	-13	-14.19	Horizontal
1696.6	-47.72	2.82	27.43	-23.11	-13	-10.11	Vertical
2544.9	-45.31	2.92	27.74	-20.49	-13	-7.49	Vertical
2544.9	-50.28	2.92	27.74	-25.46	-13	-12.46	Horizontal
190.3	-44.09	1.69	16.67	-29.10	-13	-16.10	Vertical
390.9	-34.22	1.70	17.18	-18.74	-13	-5.74	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.

9.4 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	-45.74	2.60	27.20	-21.14	-13	-8.14	Horizontal
1399.4	-46.65	2.60	27.20	-22.05	-13	-9.05	Vertical
2099.1	-46.15	2.85	27.54	-21.46	-13	-8.46	Vertical
2099.1	-51.76	2.85	27.54	-27.07	-13	-14.07	Horizontal
200.7	-40.57	1.49	17.78	-24.28	-13	-11.28	Vertical
256.6	-42.66	1.36	17.33	-26.69	-13	-13.69	Horizontal
Test Results For Mid Channel 707.5MHz							
1415.0	-49.37	2.61	27.28	-24.70	-13	-11.70	Horizontal
1415.0	-47.44	2.61	27.28	-22.77	-13	-9.77	Vertical
2122.5	-46.74	2.87	27.59	-22.02	-13	-9.02	Vertical
2122.5	-51.00	2.87	27.59	-26.28	-13	-13.28	Horizontal
191.8	-36.89	1.73	15.74	-22.88	-13	-9.88	Vertical
429.9	-40.26	1.62	15.79	-26.09	-13	-13.09	Horizontal
Test Results for High Channel 715.3MHz							
1430.6	-53.29	2.63	27.28	-28.64	-13	-15.64	Horizontal
1430.6	-49.24	2.63	27.28	-24.59	-13	-11.59	Vertical
2145.9	-47.87	2.88	27.60	-23.15	-13	-10.15	Vertical
2145.9	-50.90	2.88	27.60	-26.18	-13	-13.18	Horizontal
191.4	-34.43	1.61	18.00	-18.04	-13	-5.04	Vertical
419.7	-40.05	1.45	15.49	-26.02	-13	-13.02	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.

9.5 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	-67.67	2.61	27.28	-43.00	-40	-3.00	Horizontal
1559.0	-69.59	2.61	27.28	-44.92	-40	-4.92	Vertical
2338.5	-71.40	2.87	27.59	-46.68	-13	-33.68	Vertical
2338.5	-69.49	2.87	27.59	-44.77	-13	-31.77	Horizontal
194.7	-71.32	1.71	16.15	-56.88	-13	-43.88	Vertical
336.7	-69.72	1.41	17.32	-53.81	-13	-40.81	Horizontal
Test Results For Mid Channel 782MHz							
1564.0	-74.76	2.62	27.30	-50.08	-40	-10.08	Horizontal
1564.0	-72.77	2.62	27.30	-48.09	-40	-8.09	Vertical
2346.0	-74.29	2.87	27.62	-49.54	-13	-36.54	Vertical
2346.0	-72.43	2.87	27.62	-47.68	-13	-34.68	Horizontal
176.7	-70.91	1.42	15.25	-57.09	-13	-44.09	Vertical
439.3	-67.27	1.36	17.19	-51.44	-13	-38.44	Horizontal
Test Results for High Channel 784.5MHz							
1569.0	-67.87	2.66	27.28	-43.25	-40	-3.25	Horizontal
1569.0	-69.36	2.66	27.28	-44.74	-40	-4.74	Vertical
2353.5	-74.45	2.88	27.60	-49.73	-13	-36.73	Vertical
2353.5	-68.56	2.88	27.60	-43.84	-13	-30.84	Horizontal
188.2	-70.83	1.32	17.29	-54.86	-13	-41.86	Vertical
341.2	-67.12	1.72	16.89	-51.95	-13	-38.95	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 3.2V, Normal, DC 3.8V and High voltage, DC 4.35V.

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

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	0.006938	2.5
3.80	1880	13.8	0.007347	2.5
4.35	1880	13.2	0.007009	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	1880	12.3	0.006526	2.5
Extreme (50C)	1880	12.0	0.006366	2.5
Extreme (40C)	1880	13.8	0.007354	2.5
Extreme (30C)	1880	13.7	0.007304	2.5
Extreme (10C)	1880	14.4	0.007659	2.5
Extreme (0C)	1880	12.4	0.006614	2.5
Extreme (-10C)	1880	13.0	0.006894	2.5
Extreme (-20C)	1880	14.2	0.007538	2.5
Extreme (-30C)	1880	14.3	0.007596	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	10.1	0.005390	2.5
3.80	1880	9.1	0.004819	2.5
4.35	1880	7.9	0.004225	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	1880	9.7	0.005176	2.5
Extreme (50C)	1880	8.4	0.004481	2.5
Extreme (40C)	1880	7.6	0.004060284	2.5
Extreme (30C)	1880	9.4	0.005023852	2.5
Extreme (10C)	1880	9.0	0.004769816	2.5
Extreme (0C)	1880	7.8	0.00413857	2.5
Extreme (-10C)	1880	9.3	0.004962762	2.5
Extreme (-20C)	1880	8.6	0.004578653	2.5
Extreme (-30C)	1880	8.1	0.004305408	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	8.8	0.005078	2.5
3.80	1732.5	8.5	0.004912	2.5
4.35	1732.5	8.6	0.004955	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	1732.5	8.8	0.005075	2.5
Extreme (50C)	1732.5	8.4	0.004874	2.5
Extreme (40C)	1732.5	7.5	0.004318	2.5
Extreme (30C)	1732.5	6.2	0.003587	2.5
Extreme (10C)	1732.5	7.2	0.004173	2.5
Extreme (0C)	1732.5	9.2	0.005308	2.5
Extreme (-10C)	1732.5	8.8	0.005081	2.5
Extreme (-20C)	1732.5	6.5	0.003762	2.5
Extreme (-30C)	1732.5	8.1	0.004671	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	9.5	0.005485	2.5
3.80	1732.5	8.4	0.004862	2.5
4.35	1732.5	8.0	0.004636	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	1732.5	10.1	0.005831	2.5
Extreme (50C)	1732.5	9.2	0.005322	2.5
Extreme (40C)	1732.5	8.2	0.004760	2.5
Extreme (30C)	1732.5	9.4	0.005423	2.5
Extreme (10C)	1732.5	8.5	0.004933	2.5
Extreme (0C)	1732.5	7.9	0.004541	2.5
Extreme (-10C)	1732.5	8.9	0.005121	2.5
Extreme (-20C)	1732.5	8.7	0.005014	2.5
Extreme (-30C)	1732.5	8.4	0.004875	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	5.4	0.006472	2.5
3.80	836.5	6.6	0.007937	2.5
4.35	836.5	4.8	0.005692	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	836.5	6.6	0.007858	2.5
Extreme (50C)	836.5	6.2	0.007426	2.5
Extreme (40C)	836.5	6.5	0.007725	2.5
Extreme (30C)	836.5	6.8	0.008110	2.5
Extreme (10C)	836.5	5.0	0.006035	2.5
Extreme (0C)	836.5	5.5	0.006619	2.5
Extreme (-10C)	836.5	5.8	0.006904	2.5
Extreme (-20C)	836.5	6.1	0.007296	2.5
Extreme (-30C)	836.5	6.1	0.007285	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	5.9	0.007005	2.5
3.80	836.5	6.5	0.007729	2.5
4.35	836.5	5.1	0.006045	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	836.5	5.8	0.006962	2.5
Extreme (50C)	836.5	5.6	0.006693	2.5
Extreme (40C)	836.5	6.4	0.007648	2.5
Extreme (30C)	836.5	6.7	0.008048	2.5
Extreme (10C)	836.5	5.5	0.006634	2.5
Extreme (0C)	836.5	5.3	0.006313	2.5
Extreme (-10C)	836.5	5.5	0.006586	2.5
Extreme (-20C)	836.5	6.3	0.007474	2.5
Extreme (-30C)	836.5	6.5	0.007747	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	8.8	0.012410	2.5
3.80	707.5	9.5	0.013441	2.5
4.35	707.5	8.1	0.011508	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	707.5	8.9	0.012514	2.5
Extreme (50C)	707.5	7.1	0.010102	2.5
Extreme (40C)	707.5	7.6	0.010705	2.5
Extreme (30C)	707.5	8.2	0.011565	2.5
Extreme (10C)	707.5	7.3	0.010335	2.5
Extreme (0C)	707.5	9.0	0.012774	2.5
Extreme (-10C)	707.5	8.7	0.012324	2.5
Extreme (-20C)	707.5	8.5	0.012059	2.5
Extreme (-30C)	707.5	7.6	0.010714	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	7.0	0.009949	2.5
3.80	707.5	8.6	0.012177	2.5
4.35	707.5	7.3	0.010313	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	707.5	8.8	0.012496	2.5
Extreme (50C)	707.5	8.0	0.011331	2.5
Extreme (40C)	707.5	8.6	0.012104	2.5
Extreme (30C)	707.5	8.2	0.011625	2.5
Extreme (10C)	707.5	9.2	0.012982	2.5
Extreme (0C)	707.5	7.5	0.010558	2.5
Extreme (-10C)	707.5	7.2	0.010211	2.5
Extreme (-20C)	707.5	9.4	0.013321	2.5
Extreme (-30C)	707.5	8.1	0.011500	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	12.3	0.015722	2.5
3.80	782.0	13.8	0.017691	2.5
4.35	782.0	13.5	0.017296	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	782.0	14.5	0.018596	2.5
Extreme (50C)	782.0	14.0	0.017912	2.5
Extreme (40C)	782.0	15.2	0.019392	2.5
Extreme (30C)	782.0	13.8	0.017664	2.5
Extreme (10C)	782.0	13.9	0.017799	2.5
Extreme (0C)	782.0	13.8	0.017677	2.5
Extreme (-10C)	782.0	13.5	0.017322	2.5
Extreme (-20C)	782.0	13.6	0.017434	2.5
Extreme (-30C)	782.0	13.2	0.016899	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	12.4	0.015881	2.5
3.80	782.0	14.0	0.017856	2.5
4.35	782.0	13.2	0.016864	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
Normal (25C)	782.0	12.4	0.015876	2.5
Extreme (50C)	782.0	11.8	0.015051	2.5
Extreme (40C)	782.0	13.4	0.017087	2.5
Extreme (30C)	782.0	13.4	0.017082	2.5
Extreme (10C)	782.0	13.4	0.017150	2.5
Extreme (0C)	782.0	12.1	0.015474	2.5
Extreme (-10C)	782.0	12.8	0.016412	2.5
Extreme (-20C)	782.0	14.1	0.018035	2.5
Extreme (-30C)	782.0	15.1	0.019301	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.

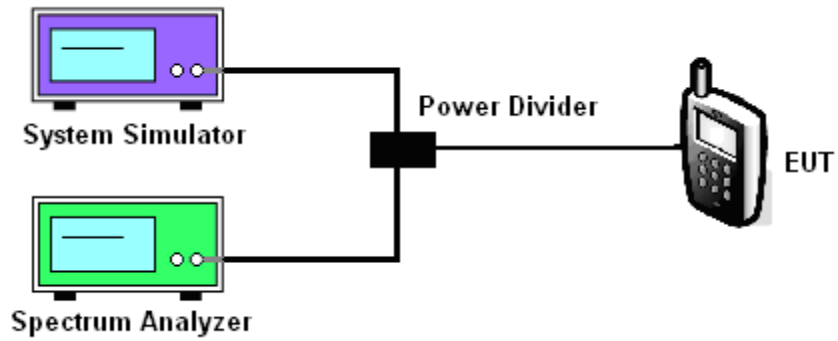
11.2 Measuring Instruments

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-----