Shenzhen Global Test Service Co.,Ltd.

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road,

Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

FCC PART 27TEST REPORT

FCC Part 27

Report Reference No.....:	**GTS20200612012-1-3-9**
FCC ID.....:	**U7GBBGRM**
Compiled by (position+printed name+signature)..:	File administrators Jimmy Wang
Supervised by (position+printed name+signature)..:	Test Engineer Aaron Tan
Approved by (position+printed name+signature)..:	Manager Jason Hu
Date of issue.....:	Jun.16, 2020

Representative Laboratory Name .:	**Shenzhen Global Test Service Co.,Ltd.**
Address.....:	No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

Applicant's name.....:	**Klein Electronics, Inc.**
Address .....:	349 North Vinewood Street, Escondido, California, USA 92029

Test specification .....**:**	
Standard .....:	**FCC CFR Title 47 Part 2, Part 27** **EIA/TIA 603-D: 2010** **KDB 971168 D01**
TRF Originator.....:	Shenzhen Global Test Service Co.,Ltd.

Test item description .....:	Global IOT mobile radio
Trade Mark .....:	blackbox
Manufacturer.....:	**Klein Electronics, Inc.**
Model/Type reference.....:	Blackbox-BBGR-M
Listed Models .....:	N/A
Modulation Type .....:	QPSK, 16QAM
LTE Band.....	2500~2570 MHz
ANT Gain.....	2.50dBi
Rating .....:	DC 12V
Hardware version .....:	DJ018_MB_V1.3
Software version.....:	T56
Result.....:	**PASS**

T E S T R E P O R T

Test Report No. :	**GTS20200612012-1-3-9**	Jun.16.2020 Date of issue

Equipment under Test	:	Global IOT mobile radio
Model /Type	:	Blackbox-BBGR-M
Listed Models	:	N/A
Applicant	:	**Klein Electronics, Inc.**
Address	:	349 North Vinewood Street, Escondido, California, USA 92029
Manufacturer	:	**Klein Electronics, Inc.**
Address	:	349 North Vinewood Street, Escondido, California, USA 92029

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

FCC Part 27(10-1-12 Edition):MISCELLANEOUS WIRELESSCOMMUNICATIONS SERVICES
TIA/EIA 603 D June 2010:Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
47 CFR FCC Part 15 Subpart B: - Unintentional Radiators
FCC Part 2:FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS
ANSI C63.4:2014: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
FCCKDB971168D01PowerMeasLicenseDigitalSystems

2 . SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	May.25, 2020
Testing commenced on	:	May.25, 2020
Testing concluded on	:	Jun.16, 2020

2.2. Equipment under Test

Power supply system utilised

Power supply voltage	:	○	120V/ 60 Hz	○	115V/60Hz
		●	12 V DC	○	24 V DC
		○	Other (specified in blank below)		

/

2.3. Short description of the Equipment under Test (EUT)

This is a Global IOT mobile radio .

For more details, refer to the user's manual of the EUT.

2.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

○	/	M/N :	/
		Manufacturer:	/

2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for**FCC ID: U7GBBGRM**filing to comply with FCC Part 27, Rules.

2.6. Modifications

No modifications were implemented to meet testing criteria.

2.7. Test Environment

EnvironmentParameter	SelectedValuesDuringTests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	10.8V
	VN	12.0V
	VH	13.2V

NOTE:VL=lowerextreme testvoltageVN=nominalvoltage
VH=upperextreme testvoltageTN=normaltemperature

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 165725

Shenzhen Global Test Service Co.,Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

A2LA-Lab Cert. No.: 4758.01

Shenzhen Global Test Service Co.,Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

CNAS-Lab Code: L8169

Shenzhen Global Test Service Co.,Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories. Date of Registration: Dec. 11, 2015. Valid time is until Dec. 10, 2024.

3.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Radiated Emission:

Temperature:	25 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

Conducted testing：

Temperature:	25 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

Testing sample ID：	GTS20200612012-1-3-1#(Engineer sample), GTS20200612012-1-3-2#(Normal sample)

3.3. Test Description

Test Item	FCCRuleNo.	Requirements	Verdict
Effective(Isotropic)RadiatedOutput Power	§2.1046, §27.50(d)	EIRP ≤ 1W;	Pass
Peak-AverageRatio	§2.1046, §27.50(d)	Limit≤13dB	Pass
ModulationCharacteristics	§2.1047	Digitalmodulation	N/A
Bandwidth	§2.1049	OBW: Nolimit. EBW: Nolimit.	Pass
BandEdgesCompliance	§2.1051, §27.53(h)	≤ -13dBm/1%*EBW,in1MHzbandsimmediately outsideandadjacent to Thefrequency block.	Pass
SpuriousEmissionatAntennaTerminals	§2.1051, §27.53(h)	≤ -13dBm/1MHz, from9kHzto10thharmonicsbutoutsideauthorized operatingfrequency ranges.	Pass
Field Strengthof Spurious Radiation	§2.1055, §27.54	Withinauthorizedbands of operation/frequency block.	Pass
Frequency Stability	§2.1053, §27.53(h)	≤ -13dBm/1MHz.	Pass
NOTE 1:For theverdict,the“N/A”denotes“not applicable”,the“N/T”denotes “nottested”.			

3.4. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2019/09/20	2020/09/19
LISN	R&S	ESH2-Z5	893606/008	2019/09/20	2020/09/19
EMI Test Receiver	R&S	ESPI3	101841-cd	2019/09/20	2020/09/19
EMI Test Receiver	R&S	ESCI7	101102	2019/09/20	2020/09/19
Spectrum Analyzer	Agilent	N9020A	MY48010425	2019/09/20	2020/09/19
Spectrum Analyzer	R&S	FSV40	100019	2019/09/20	2020/09/19
Vector Signal generator	Agilent	N5181A	MY49060502	2019/09/20	2020/09/19
Signal generator	Agilent	E4421B	3610AO1069	2019/09/20	2020/09/19
Climate Chamber	ESPEC	EL-10KA	A20120523	2019/09/20	2020/09/19
Controller	EM Electronics	Controller EM 1000	N/A	N/A	N/A
Horn Antenna	Schwarzbeck	BBHA 9120D	01622	2019/09/23	2020/09/22
Active Loop Antenna	Beijing Da Ze Technology Co.,Ltd.	ZN30900C	15006	2019/10/12	2020/10/11
Bilog Antenna	Schwarzbeck	VULB9163	000976	2020/05/25	2021/05/24
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2019/09/20	2020/09/19
Amplifier	Schwarzbeck	BBV 9743	#202	2019/09/20	2020/09/19
Amplifier	Schwarzbeck	BBV9179	9719-025	2019/09/20	2020/09/19
Amplifier	EMCI	EMC051845B	980355	2019/09/20	2020/09/19
Temperature/Humidity Meter	Gangxing	CTH-608	02	2019/09/20	2020/09/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	KL142031	2019/09/20	2020/09/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	KL142032	2019/09/20	2020/09/19
RF Cable(below 1GHz)	HUBER+SUHNER	RG214	RE01	2019/09/20	2020/09/19
RF Cable(above 1GHz)	HUBER+SUHNER	RG214	RE02	2019/09/20	2020/09/19
Data acquisition card	Agilent	U2531A	TW53323507	2019/09/20	2020/09/19
Power Sensor	Agilent	U2021XA	MY5365004	2019/09/20	2020/09/19
Test Control Unit	Tonscend	JS0806-1	178060067	2019/06/20	2020/06/19
Automated filter bank	Tonscend	JS0806-F	19F8060177	2019/06/20	2020/06/19
Universal Radio Communication	R&S	CMU200	114353	2019/09/20	2020/09/19
Wireless Commnunication Tester	R&S	CMW500	125408	2019/09/20	2020/09/19
EMI Test Software	Tonscend	JS1120-1	Ver 2.6.8.0518	/	/
EMI Test Software	Tonscend	JS1120-3	Ver 2.5.77.0418	/	/
EMI Test Software	Tonscend	JS32-CE	Ver 2.5	/	/
EMI Test Software	Tonscend	JS32-RE	Ver 2.5.1.8	/	/

Note: The calibration interval was one year.

4. TEST CONDITIONS AND RESULTS

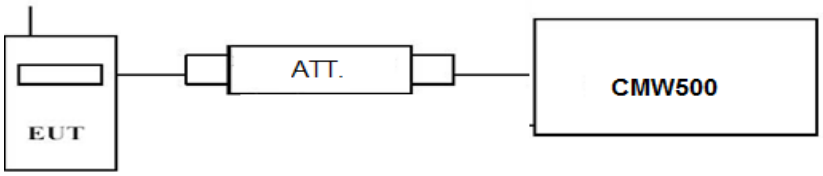
4.1. Output Power

TEST APPLICABLE

During the process of testing, the EUT was controlled via R&S Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation. This result contains output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits

4.1.1. Conducted Output Power

TEST CONFIGURATION



TEST PROCEDURE

Conducted Power Measurement:
a) Place the EUT on a bench and set it in transmitting mode.
b) Connect a low loss RF cable from the antenna port to a CMW500 by an Att.
c) EUT Communicate with CMW500 then selects a channel for testing.
d) Add a correction factor to the display CMW500, and then test.

TEST RESULTS

Remark:
1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 7;

LTE FDD Band 7				
TX Channel Bandwidth	Frequency (MHz)	RB Size/Offset	Average Power [dBm]	
			QPSK	16QAM
5 MHz	2502.5	1 RB low	22.29	21.31
		1 RB mid	22.44	21.30
		1 RB high	22.08	21.21
		50% RB low	21.47	20.28
		50% Rb mid	21.59	20.40
		50% RB high	21.34	21.26
		100% RB	21.17	20.09
	2535.0	1 RB low	22.36	21.33
		1 RB mid	22.22	21.34
		1 RB high	22.53	21.32
		50% RB low	21.54	20.55
		50% Rb mid	21.63	20.61
		50% RB high	21.70	20.26
		100% RB	21.24	20.11
	2567.5	1 RB low	22.39	21.21
		1 RB mid	22.38	21.10
		1 RB high	22.34	20.36
		50% RB low	21.82	20.55
		50% Rb mid	21.69	21.56
		50% RB high	21.88	21.68
		100% RB	21.39	20.05
10 MHz	2505.0	1 RB low	22.57	21.36
		1 RB mid	22.55	21.16

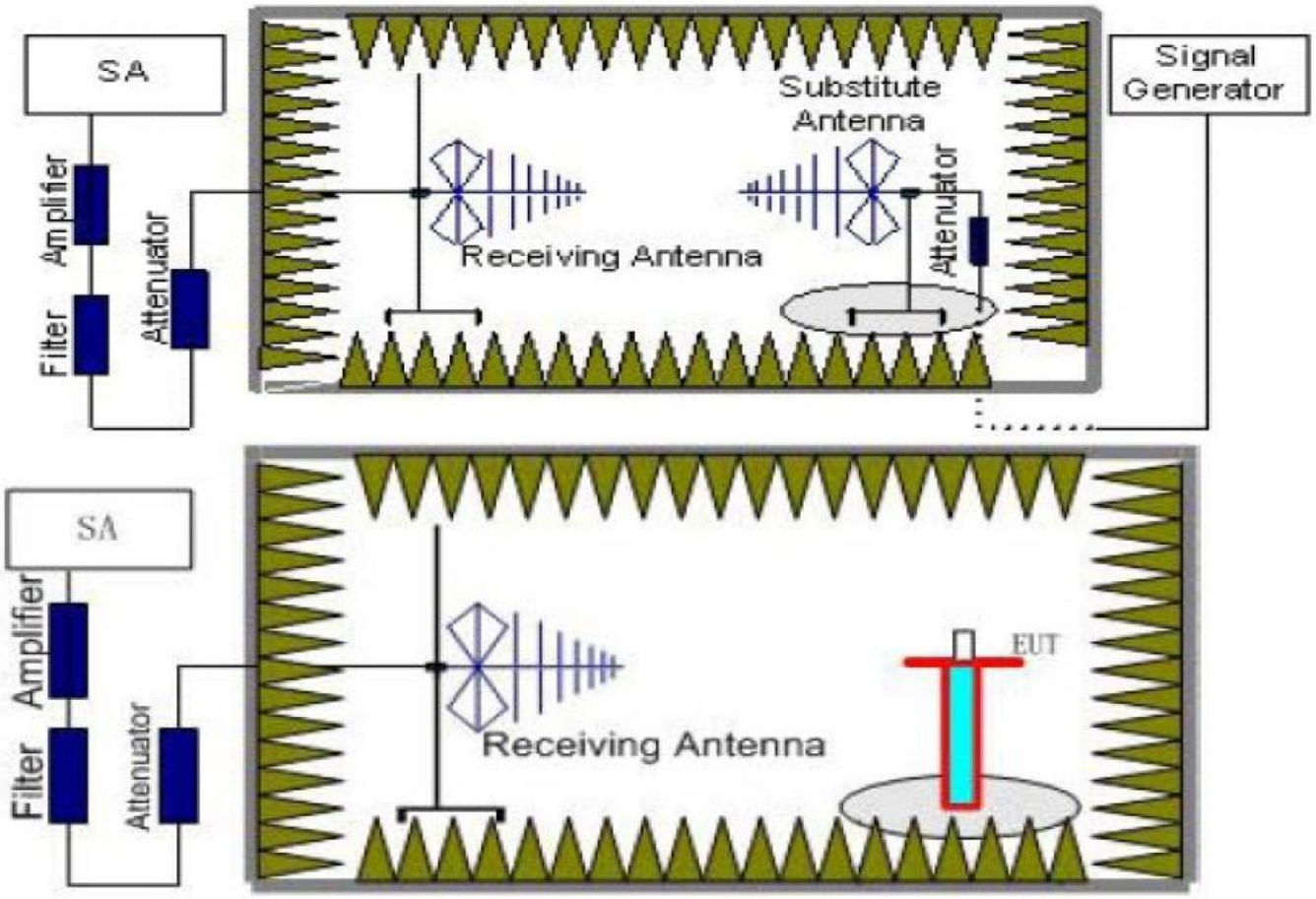
		1 RB high	22.40	20.33
		50% RB low	22.00	20.81
		50% Rb mid	21.91	20.51
		50% RB high	21.85	20.65
		100% RB	21.50	20.23
	2535.0	1 RB low	22.56	21.11
		1 RB mid	22.43	21.25
		1 RB high	22.67	21.26
		50% RB low	22.72	20.66
		50% Rb mid	21.65	20.54
		50% RB high	21.84	20.35
		100% RB	21.41	20.04
	2565.0	1 RB low	22.56	21.25
		1 RB mid	22.63	21.30
		1 RB high	22.40	21.32
		50% RB low	21.79	20.47
		50% Rb mid	21.64	20.45
		50% RB high	21.77	20.46
		100% RB	21.21	19.89
15 MHz	2507.5	1 RB low	22.47	21.31
		1 RB mid	22.63	21.34
		1 RB high	22.35	21.24
		50% RB low	21.64	20.51
		50% Rb mid	21.76	20.50
		50% RB high	21.53	20.41
		100% RB	21.32	20.08
	2535.0	1 RB low	22.55	21.13
		1 RB mid	22.51	21.27
		1 RB high	22.57	21.28
		50% RB low	21.50	20.48
		50% Rb mid	21.57	20.46
		50% RB high	21.58	20.27
		100% RB	21.25	20.10
	2562.5	1 RB low	22.64	21.26
		1 RB mid	22.74	21.43
		1 RB high	22.45	21.43
		50% RB low	21.84	20.52
		50% Rb mid	21.68	20.34
		50% RB high	21.65	20.43
		100% RB	21.34	20.08
20 MHz	2510.0	1 RB low	22.80	21.86
		1 RB mid	22.79	21.87
		1 RB high	22.75	21.86
		50% RB low	21.96	21.03
		50% Rb mid	21.99	21.02
		50% RB high	21.81	20.75
		100% RB	21.62	20.74
	2535.0	1 RB low	22.95	22.06
		1 RB mid	22.96	21.99
		1 RB high	23.00	22.05
		50% RB low	22.01	22.05
		50% Rb mid	22.06	21.04
		50% RB high	22.08	21.13
		100% RB	21.69	20.71
	2560.0	1 RB low	22.90	21.92
		1 RB mid	23.01	22.04
		1 RB high	22.81	21.74
		50% RB low	22.07	21.15
		50% Rb mid	22.09	21.08
		50% RB high	21.99	20.97
		100% RB	21.75	20.82

4.1.2. Radiated Output Power

LIMIT

According to §27.50 (d) (4): Fixed, mobile, and portable (hand- held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna.In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest isconnected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}) ,the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.
   The measurement results are obtained as described below:
   Power(EIRP)=P_{Mea}- P_{Ag} - P_{cl}+ G_a
   We used SMF100A micowave signal generator which signal level can up to 33dBm,so we not used power Amplifier for substituation test; The measurement results are amend as described below:
   Power(EIRP)=P_{Mea}- P_{cl}+ G_a
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

TEST RESULTS

Remark:
1. We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 7; recorded worst case for each Channel Bandwidth of LTE FDD Band 7.
2. EIRP=P_{Mea}(dBm)-P_{cl}(dB)+P_{Ag}(dB)+G_a(dBi)
3. We measured both Horizontal and Vertical direction, recorded worst case direction.

LTE FDD Band 7_Channel Bandwidth 5MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
2502.5	-21.80	3.06	9.68	34.80	19.62	30.00	10.38	V
2535	-21.80	3.17	9.68	34.80	19.51	30.00	10.49	V
2567.5	-21.80	3.22	9.75	34.80	19.53	30.00	10.47	V

LTE FDD Band *7_Channel Bandwidth* 10MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
2505	-22.45	3.06	9.68	34.80	18.97	30.00	11.03	V
2535	-21.07	3.17	9.68	34.80	20.24	30.00	9.76	V
2565	-22.52	3.22	9.75	34.80	18.81	30.00	11.19	V

LTE FDD Band *7_Channel Bandwidth* 15MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
2507.5	-22.01	3.06	9.68	34.80	19.41	30.00	10.59	V
2535	-20.97	3.17	9.68	34.80	20.34	30.00	9.66	V
2562.5	-21.54	3.22	9.75	34.80	19.79	30.00	10.21	V

LTE FDD Band *7_Channel Bandwidth* 20MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
2510	-21.96	3.06	9.68	34.80	19.46	30.00	10.54	V
2535	-21.32	3.17	9.68	34.80	19.99	30.00	10.01	V
2560	-22.24	3.22	9.75	34.80	19.09	30.00	10.91	V

LTE FDD Band 7_Channel Bandwidth 5MHz_16QAM

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
2502.5	-22.27	3.06	9.68	34.80	19.15	30.00	10.85	V
2535	-21.69	3.17	9.68	34.80	19.62	30.00	10.38	V
2567.5	-22.65	3.22	9.75	34.80	18.68	30.00	11.32	V

LTE FDD Band 7_Channel Bandwidth 10MHz_16QAM

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
2505	-22.56	3.06	9.68	34.80	18.86	30.00	11.14	V
2535	-22.14	3.17	9.68	34.80	19.17	30.00	10.83	V
2565	-22.32	3.22	9.75	34.80	19.01	30.00	10.99	V

LTE FDD Band 7_Channel Bandwidth 15MHz_16QAM

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
2507.5	-22.58	3.06	9.68	34.80	18.84	30.00	11.16	V
2535	-22.21	3.17	9.68	34.80	19.10	30.00	10.90	V
2562.5	-22.34	3.22	9.75	34.80	18.99	30.00	11.01	V

LTE FDD Band 7_Channel Bandwidth 20MHz_16QAM

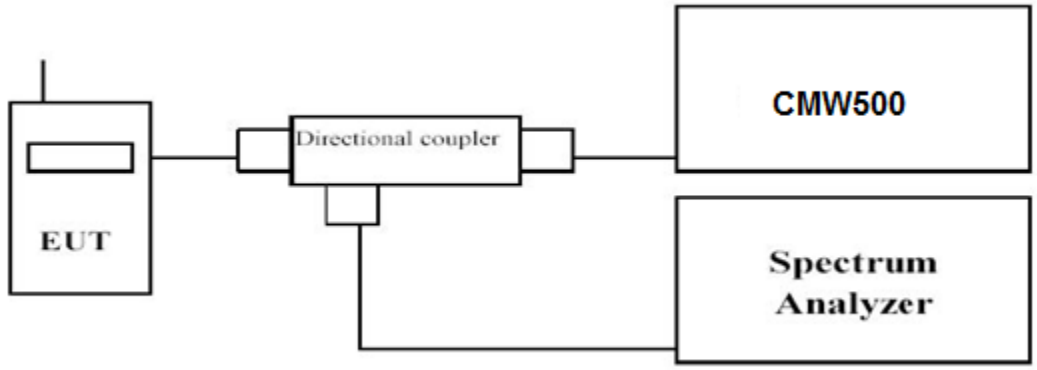
Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
2510	-22.15	3.06	9.68	34.80	19.27	30.00	10.73	V
2535	-21.40	3.17	9.68	34.80	19.91	30.00	10.09	V
2560	-21.97	3.22	9.75	34.80	19.36	30.00	10.64	V

4.2. Peak-to-Average Ratio (PAR)

LIMIT

The Peak-to-Average Ratio (PAR) of the transmission may not exceed 13 dB.

TEST CONFIGURATION



TEST PROCEDURE

1. Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
2. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
3. Set the number of counts to a value that stabilizes the measured CCDF curve;
4. Set the measurement interval as follows:
   1). for continuous transmissions, set to 1 ms,
   2). for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
5. Record the maximum PAPR level associated with a probability of 0.1%.

TEST RESULTS

Remark: We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 7; recorded worst case for each Channel Bandwidth of LTE FDD Band 7.

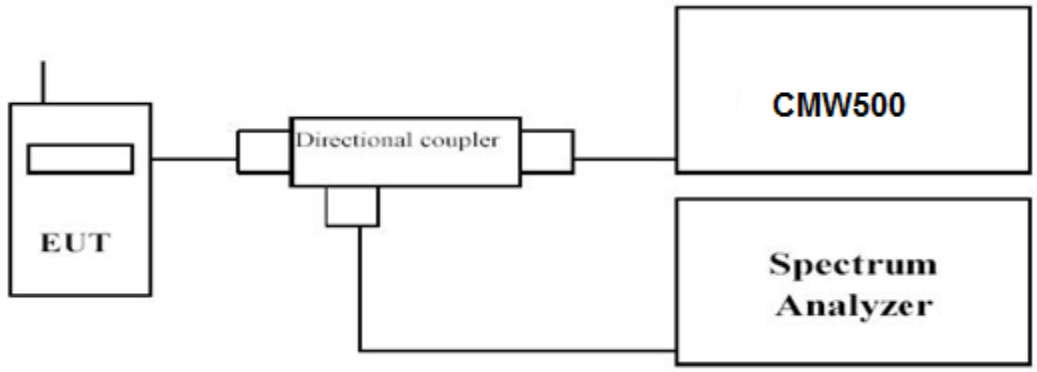
For reporting purpose only.
Please refer to Appendix LTE Band 7.

4.3. Occupied Bandwidth and Emission Bandwidth

LIMIT

N/A

TEST CONFIGURATION



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 low, middle and high channel in each band. The -26dBc Emission bandwidth was also measured and recorded.
Set RBWwas set to about 1% of emission BW, VBW≥3 times RBW.
-26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth isthe delta frequency between the two points where the display line intersects the signal trace.

TEST RESULTS

Remark: We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 7; recorded worst case for each Channel Bandwidth of LTE FDD Band 7.

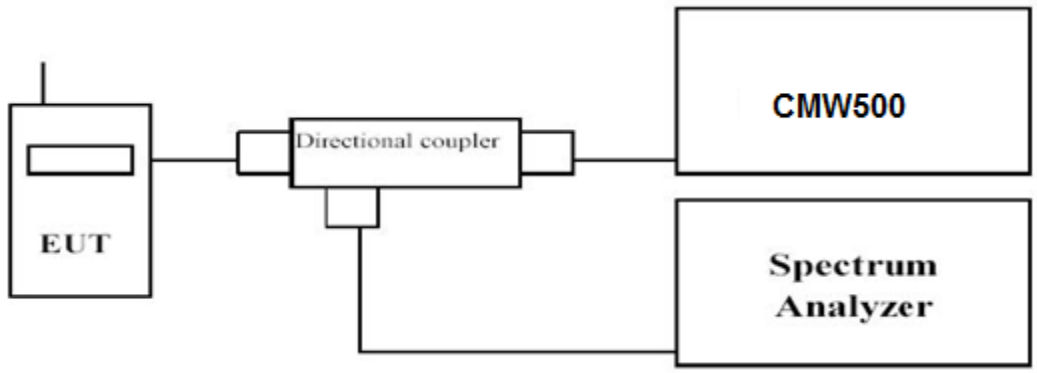
For reporting purpose only.
Please refer to Appendix LTE Band 7.

4.4. Band Edge compliance

LIMIT

According to §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 CONFIGURATION



TEST PROCEDURE

1. The transmitter output port was connected to base station.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowestand highest channels for each band and different modulation.
5. Measure Band edge using RMS (Average) detector by spectrum

TEST RESULTS

Remark:.We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 7; recorded worst case for each Channel Bandwidth of LTE FDD Band 7.

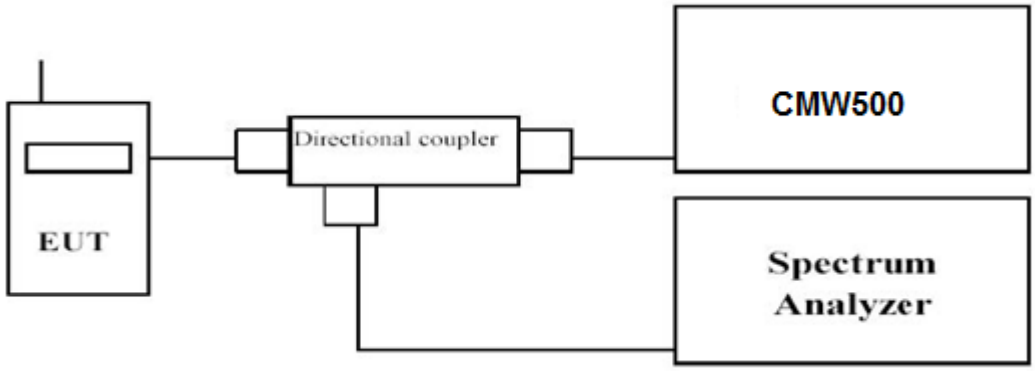
For reporting purpose only.
Please refer to Appendix LTE Band 7.

4.5. Spurious Emission on Antenna Port

LIMIT

According to §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 CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

a. Place the EUT on a bench and set it in transmitting mode.
b. Connect a low loss RF cable from the antenna port to a spectrum analyzer andCMW500 by a Directional Couple.
c. EUT Communicate with CMW500, then select a channel for testing.
d. Add a correction factor to the display of spectrum, and then test.
e. The resolution bandwidth of the spectrum analyzer was setsufficient scans were taken to show the out of band Emission if any up to10^{th} harmonic.
f. Please refer to following tables for test antenna conducted emissions.

Working Frequency	Sub range (GHz)	RBW	VBW	Sweep time (s)
LTE FDD Band 7	0.000009~0.000015	1KHz	3KHz	Auto
	0.000015~0.03	10KHz	30KHz	Auto
	0.03~4	1 MHz	3 MHz	Auto
	4~26	1 MHz	3 MHz	Auto

TEST RESULTS

Remark:.We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 7; recorded worst case for each Channel Bandwidth of LTE FDD Band 7.

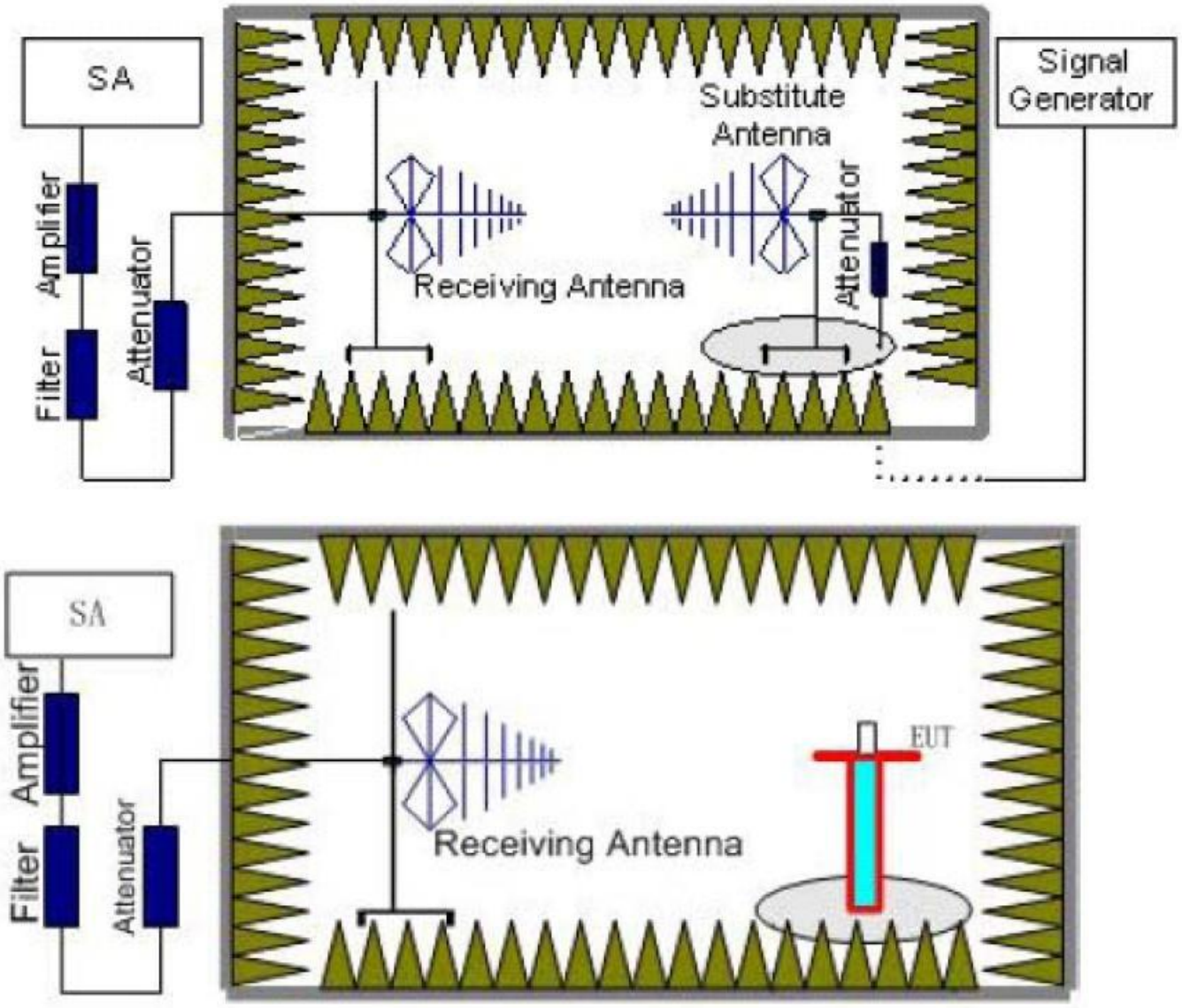
For reporting purpose only.
Please refer to Appendix LTE Band 7.

4.6. Radiated Spurious Emission

LIMIT

According to §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 CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50 meter. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.

3. The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna.In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest isconnected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}) ,the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.
   The measurement results are obtained as described below:
   Power(EIRP)=P_{Mea}- P_{Ag} - P_{cl}+ G_a
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi.
8. In order to make sure test results more clearly,we set frequency range and sweep time for difference frequency range as follows table:

Working Frequency	Subrange (GHz)	RBW	VBW	Sweep time (s)
LTE FDD Band 7	0.00009~0.15	1KHz	3KHz	30
	0.00015~0.03	10KHz	30KHz	10
	0.03~1	100KHz	300KHz	10
	1~2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~11	1 MHz	3 MHz	3
	11~14	1 MHz	3 MHz	3
	14~18	1 MHz	3 MHz	3
	18~20	1 MHz	3 MHz	2
	20~26	1 MHz	3 MHz	2

TEST LIMITS

According to 27.53(h) specify that 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.
The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Frequency	Channel	Frequency Range	Verdict
LTE FDD Band 7	Low	9KHz -26GHz	PASS
	Middle	9KHz -26GHz	PASS
	High	9KHz -26GHz	PASS

Radiated Measurement:

Remark:
1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 7; recorded worst case for each Channel Bandwidth of LTE FDD Band 7
2 EIRP=PMea(dBm)-Pcl(dB) +Ga(dBi)
3 We were not recorded other points as values lower than limits.
4 Margin = Limit – EIRP

LTE FDD Band 7_Channel Bandwidth 5MHz_QPSK_ Low Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5005.00	-44.19	5.11	3.00	13.38	-35.92	-13.00	22.92	H
7507.50	-49.56	6.02	3.00	13.98	-41.60	-13.00	28.60	H
5005.00	-44.81	5.11	3.00	13.38	-36.54	-13.00	23.54	V
7507.50	-50.78	6.02	3.00	13.98	-42.82	-13.00	29.82	V

LTE FDD Band 7_Channel Bandwidth 5MHz_QPSK_ Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5070.00	-40.71	5.11	3.00	13.38	-32.44	-13.00	19.44	H
7605.00	-48.60	6.02	3.00	13.98	-40.64	-13.00	27.64	H
5070.00	-44.22	5.11	3.00	13.38	-35.95	-13.00	22.95	V
7605.00	-50.51	6.02	3.00	13.98	-42.55	-13.00	29.55	V

LTE FDD Band 7_Channel Bandwidth 5MHz_QPSK_ High Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5135.00	-42.79	5.11	3.00	13.38	-34.52	-13.00	21.52	H
7702.50	-46.50	6.02	3.00	13.98	-38.54	-13.00	25.54	H
5135.00	-50.17	5.11	3.00	13.38	-41.90	-13.00	28.90	V
7702.50	-52.07	6.02	3.00	13.98	-44.11	-13.00	31.11	V

LTE FDD Band 7_Channel Bandwidth 10MHz_QPSK_ Low Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5010.00	-45.75	5.11	3.00	13.38	-37.48	-13.00	24.48	H
7515.00	-50.15	6.02	3.00	13.98	-42.19	-13.00	29.19	H
5010.00	-44.76	5.11	3.00	13.38	-36.49	-13.00	23.49	V
7515.00	-52.19	6.02	3.00	13.98	-44.23	-13.00	31.23	V

LTE FDD Band 7_Channel Bandwidth 10MHz_QPSK_ Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5070.00	-43.58	5.11	3.00	13.38	-35.31	-13.00	22.31	H
7605.00	-48.48	6.02	3.00	13.98	-40.52	-13.00	27.52	H
5070.00	-46.35	5.11	3.00	13.38	-38.08	-13.00	25.08	V
7605.00	-48.69	6.02	3.00	13.98	-40.73	-13.00	27.73	V

LTE FDD Band 7_Channel Bandwidth 10MHz_QPSK_ High Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5130.00	-42.95	5.11	3.00	13.38	-34.68	-13.00	21.68	H
7695.00	-48.27	6.02	3.00	13.98	-40.31	-13.00	27.31	H
5130.00	-46.49	5.11	3.00	13.38	-38.22	-13.00	25.22	V
7695.00	-49.83	6.02	3.00	13.98	-41.87	-13.00	28.87	V

LTE FDD Band 7_Channel Bandwidth 15MHz_QPSK_ Low Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5015.00	-43.79	5.11	3.00	13.38	-35.52	-13.00	22.52	H
7522.50	-46.54	6.02	3.00	13.98	-38.58	-13.00	25.58	H
5015.00	-45.88	5.11	3.00	13.38	-37.61	-13.00	24.61	V
7522.50	-48.75	6.02	3.00	13.98	-40.79	-13.00	27.79	V

LTE FDD Band 7_Channel Bandwidth 15MHz_QPSK_ Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5070.00	-43.09	5.11	3.00	13.38	-34.82	-13.00	21.82	H
7605.00	-49.52	6.02	3.00	13.98	-41.56	-13.00	28.56	H
5070.00	-43.71	5.11	3.00	13.38	-35.44	-13.00	22.44	V
7605.00	-51.51	6.02	3.00	13.98	-43.55	-13.00	30.55	V

LTE FDD Band 7_Channel Bandwidth 15MHz_QPSK_ High Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5125.00	-43.29	5.11	3.00	13.38	-35.02	-13.00	22.02	H
7687.50	-49.60	6.02	3.00	13.98	-41.64	-13.00	28.64	H
5125.00	-44.34	5.11	3.00	13.38	-36.07	-13.00	23.07	V
7687.50	-51.38	6.02	3.00	13.98	-43.42	-13.00	30.42	V

LTE FDD Band 7_Channel Bandwidth 20MHz_QPSK_ Low Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5020.00	-44.02	5.11	3.00	13.38	-35.75	-13.00	22.75	H
7530.00	-50.79	6.02	3.00	13.98	-42.83	-13.00	29.83	H
5020.00	-46.69	5.11	3.00	13.38	-38.42	-13.00	25.42	V
7530.00	-52.82	6.02	3.00	13.98	-44.86	-13.00	31.86	V

LTE FDD Band 7_Channel Bandwidth 20MHz_QPSK_ Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5070.00	-46.12	5.11	3.00	13.38	-37.85	-13.00	24.85	H
7605.00	-49.25	6.02	3.00	13.98	-41.29	-13.00	28.29	H
5070.00	-46.52	5.11	3.00	13.38	-38.25	-13.00	25.25	V
7605.00	-49.87	6.02	3.00	13.98	-41.91	-13.00	28.91	V

LTE FDD 7_Channel Bandwidth 20MHz_QPSK_ High Channel

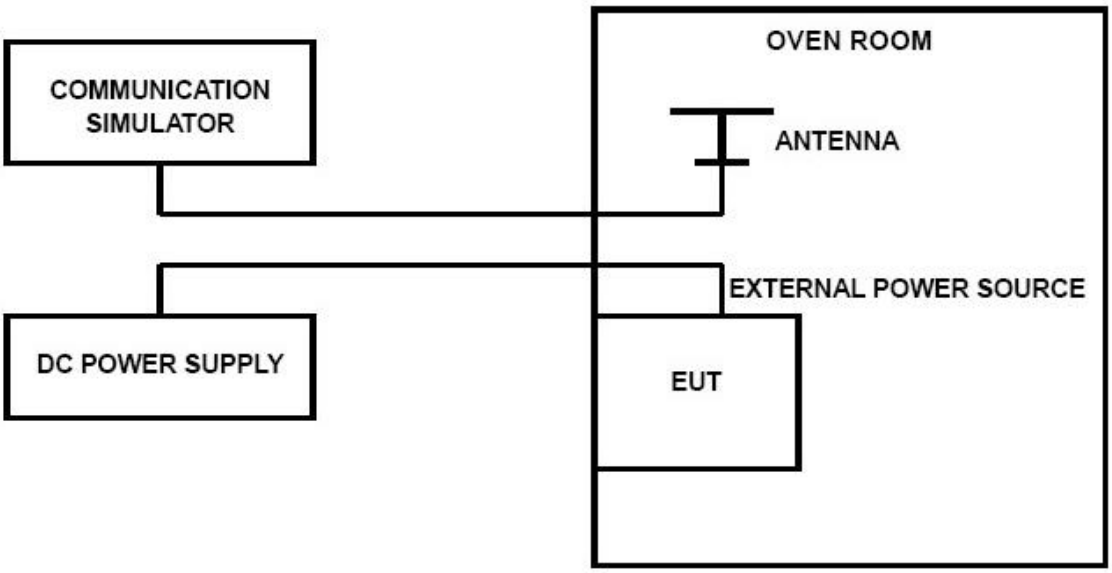
Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5120.00	-45.19	5.11	3.00	13.38	-36.92	-13.00	23.92	H
7680.00	-49.84	6.02	3.00	13.98	-41.88	-13.00	28.88	H
5120.00	-46.05	5.11	3.00	13.38	-37.78	-13.00	24.78	V
7680.00	-51.62	6.02	3.00	13.98	-43.66	-13.00	30.66	V

4.7. Frequency Stability

LIMIT

According to §27.54, §2.1055 requirement, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation and should not exceed 2.5ppm.

TEST CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

Frequency Stability Under Temperature Variations:
In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE band 4, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 ℃ increments from +50℃ to -30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.
Frequency Stability Under Voltage Variations:
Set chamber temperature to 20℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, recordthe maximum frequency change.

TEST RESULTS

Remark:.We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 7; recorded worst case for each Channel Bandwidth of LTE FDD Band 7.

LTE Band 7 5 MHz bandwidth (worst case of all bandwidths) at 1RB#0 for Mid channel

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)		Limit (ppm)
	QPSK	16QAM	QPSK	16QAM	
10.8	29	28	0.0114	0.0110	2.50
12.0	26	25	0.0103	0.0099	2.50
13.2	31	27	0.0122	0.0107	2.50

Frequency Error vs Temperature

Temperature (℃)	Frequency error (Hz)		Frequency error (ppm)		Limit (ppm)
	QPSK	16QAM	QPSK	16QAM	
-30°	30	29	0.0118	0.0114	2.50
-20°	25	30	0.0099	0.0118	2.50
-10°	29	35	0.0114	0.0138	2.50
0°	31	42	0.0122	0.0166	2.50
10°	28	37	0.0110	0.0146	2.50
20°	35	39	0.0138	0.0154	2.50
30°	42	42	0.0166	0.0166	2.50
40°	28	28	0.0110	0.0110	2.50
50°	31	37	0.0122	0.0146	2.50

5. Test Setup Photos of the EUT

6. External and Internal Photos of the EUT

Reference to the test report No. GTS20200612012-1-3-1

.....End of Report.....