FCC Part 22 Test Report
Part 22H Subpart E

Report Reference No.	:	HK2302270554-14E
FCC ID.	:	2A2FCBT4101
Compiled by (position+printedname+signature)	:	File administrators Gary Qian
Supervised by (position+printedname+signature)	:	Technique principal Eden Hu
Approved by (position+printedname+signature)	:	ManagerJason Zhou
Date of issue	:	Apr. 28, 2023
Testing Laboratory Name	:	**Shenzhen HUAK Testing Technology Co., Ltd.**
Address	:	1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation [illegible], Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Applicant's name	:	**PowUnity GmbH**
Address	:	Feldstrasse 9d Innsbruck, 6020 Austria
Test specification	:	
Standard	:	**FCC CFR Title 47 Part 2, Part 22H**
TRF Originator	:	Shenzhen HUAK Testing Technology Co., Ltd.

Test item description	:	GPS Tracker
Trade Mark	:	BikeTrax
Manufacturer	:	**PowUnity GmbH**
Model/Type reference	:	BT41-01
Series Models	:	T4101-03-04
Modulation Type	:	BPSK, QPSK
Rating	:	DC 3.7V from battery
Hardware version	:	V2.2
Software version	:	V2.2
Result	:	**PASS**

TEST REPORT

Test Report No. :	HK2302270554-14E	Apr. 28, 2023 Date of issue

Equipment under Test	:	GPS Tracker
Model /Type	:	BT41-01
Series Models	:	T4101-03-04
Applicant	:	**PowUnity GmbH**
Address	:	Feldstrasse 9d Innsbruck, 6020 Austria
Manufacturer	:	**PowUnity GmbH**
Address	:	Feldstrasse 9d Innsbruck, 6020 Austria

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

** Modified History **

Revision	Description	Issued Data	Remark
Revision 1.0	Initial Test Report Release	Apr. 28, 2023	Jason Zhou

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Add: 1-2F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

1 Test Standards

The tests were performed according to following standards:

FCC Part 2:FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS.

FCC Part 22Subpart H:PRIVATE LAND MOBILE RADIO SERVICES.

ANSI/TIA-603-E-2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

ANSI C63.26-2015: IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.

FCC KDB 971168D01 v03r01 Power Meas License Digital Systems.

2 Summary

2.1 General Remarks

Date of receipt of test sample	:	Feb. 27, 2023
Testing commenced on	:	Feb. 27, 2023
Testing concluded on	:	Apr. 28, 2023

2.2 Product Description

Name of EUT:	GPS Tracker
Model/Type reference:	BT41-01
Series Models:	T4101-03-04
Power supply:	DC 3.7V from battery
Modilation Type:	BPSK, QPSK
Antenna Type:	Internal Antenna
Antenna Gain:	1dBi
Operation Frequency Band:	LTE BAND 5
Operation frequency:	LTE BAND 5:824~849 MHz
LTE Release:	R8
Extreme temp. Tolerance:	-30°C to +50°C
Extreme vol. Limits:	3.15VDC to 4.26VDC (nominal: 3.7VDC)

2.3 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)		

DC 3.7V from battery

2.4 Normal Accessory Setting

Fully charged battery was used during the test.

2.5 EUT Configuration

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

● - supplied by the manufacturer

○ - supplied by the lab

○	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/
○	Multimeter	Manufacturer :	/
		Model No. :	/

2.6 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended filing to comply with FCC Part 22H, Rules.

2.7 Modifications

No modifications were implemented to meet testing criteria.

2.8 GeneralTest Conditions/Configurations

2.10.1 Test Environment

EnvironmentParameter	SelectedValuesDuringTests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	3.15V
	VN	3.70V
	VH	4.26V

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

3 Test Environment

3.1 Information of the Test Laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization:

A2LA Accreditation Code is 4781.01.
FCC Designation Number is CN1229.
Canada IC CAB identifier is CN0045.
CNAS Registration Number is L9589.

3.2 Environmental Conditions

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

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.3 Test Description

Band 5 (824~849 MHz)

Test Item	FCCRuleNo.	Requirements	Verdict
Effective(Isotropic) Radiated Output Power	§2.1046, §22.913(a)(2)	FCC: ERP ≤ 7W.	Pass
Peak-Average Ratio	§24.232(d)	FCC:Limit≤13dB	Pass
Modulation Characteristics	§2.1047	Digital modulation	Pass
Bandwidth	§2.1049	OBW: Nolimit. EBW: Nolimit.	Pass
Band Edges Compliance	§2.1051, §22.917	≤ -13dBm/1%*EBW, In1MHz bands immediately outside and adjacent to Thefrequency block.	Pass
Spurious Emission at AntennaTerminals	§2.1051, §22.917	≤-13dBm/1MHz, from9kHz to 10th harmonics but outside authorized Operating frequency ranges.	Pass
Field Strength of Spurious Radiation	§2.1053, §22.917	≤ -13dBm/1MHz.	Pass
Frequency Stability	§2.1055, §22.355,	FCC:within authorized frequency block.	Pass
NOTE 1:For theverdict, the"N/A"denotes"not applicable", the"N/T"denotes "nottested".			

Remark:
1. The measurement uncertainty is not included in the test result.

3.4 Equipments Used During The Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	HKE-059	2023/02/17	2024/02/16
LISN	R&S	ENV216	HKE-002	2023/02/17	2024/02/16
Receiver	R&S	ESR-7	HKE-010	2023/02/17	2024/02/16
Spectrum analyzer	R&S	FSP40	HKE-025	2023/02/17	2024/02/16
Spectrum analyzer	Agilent	N9020A	HKE-048	2023/02/17	2024/02/16
RF automatic control unit	Tonscend	JS0806-1	HKE-060	2023/02/17	2024/02/16
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	2023/02/17	2024/02/16
Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	2023/02/17	2024/02/16
Horn antenna	Schwarzbeck	9120D	HKE-013	2023/02/17	2024/02/16
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	2023/02/17	2024/02/16
Preamplifier	EMCI	EMC051845SE	HKE-015	2023/02/17	2024/02/16
Preamplifier	Agilent	83051A	HKE-016	2023/02/17	2024/02/16
Preamplifier	Schwarzbeck	BBV 9743	HKE-006	2023/02/17	2024/02/16
Temperature and humidity meter	Boyang	HTC-1	HKE-075	2023/02/17	2024/02/16
High-low temperature chamber	Guangke	HT-80L	HKE-118	2023/02/17	2024/02/16
High pass filter unit	Tonscend	JS0806-F	HKE-055	2023/02/17	2024/02/16
RF Cable(below1GHz)	Times	9kHz-1GHz	HKE-117	2023/02/17	2024/02/16
RF Cable(above 1GHz)	Times	1-40G	HKE-034	2023/02/17	2024/02/16
Power meter	Agilent	E4419B	HKE-085	2023/02/17	2024/02/16
Power Sensor	Agilent	E9300A	HKE-086	2023/02/17	2024/02/16
Conducted test software	Tonscend	TS+ Rev 2.5.0.0	HKE-081	N/A	N/A
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A	N/A
RF test software	Tonscend	JS1120-B Version 2.6	HKE-083	N/A	N/A
RF test software	Tonscend	JS1120-4	HKE-113	N/A	N/A
RF test software	Tonscend	JS1120-3	HKE-114	N/A	N/A
RF test software	Tonscend	JS1120-1	HKE-115	N/A	N/A
Wireless Communication Test Set	R&S	CMW500	HKE-026	2023/02/17	2024/02/16
Wireless Communication Test Set	R&S	CMU200	HKE-029	2023/02/17	2024/02/16
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	2023/02/17	2024/02/16
Horn antenna	Schwarzbeck	9120D	HKE-135	2023/02/17	2024/02/16
High gain antenna	Schwarzbeck	LB-180400KF	HKE-128	2023/02/17	2024/02/16
Broadband antenna	Schwarzbeck	VULB 9163	HKE-087	2023/02/17	2024/02/16
Signal generator	Agilent	E4433B	HKE-120	2023/02/17	2024/02/16
Signal generator	Agilent	E4421B	HKE-121	2023/02/17	2024/02/16

4 Test Conditions and Results

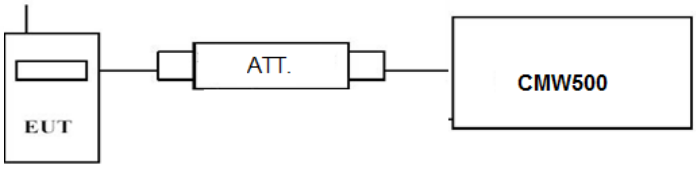
4.1 Output Power

4.1.1 Coducted 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.

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

compliance *

Remark:

1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5;*

LTE FDD Band 5				
Modulation	Sub-carrier spacing (KHz)	Tones	Frequency (MHz)	Average Power [dBm]
BPSK	3.75	1@0	824.1	20.48
		1@47	824.1	20.35
		1@0	836.5	20.91
		1@47	836.5	20.86
		1@0	848.9	20.87
		1@47	848.9	20.78
	15	1@0	824.1	21.54
		1@11	824.1	20.11
		12@0	824.1	21.51
		1@0	836.5	21.84
		1@11	836.5	21.57
		12@0	836.5	21.88
		1@0	848.9	20.44
		1@11	848.9	20.29
		12@0	848.9	21.87

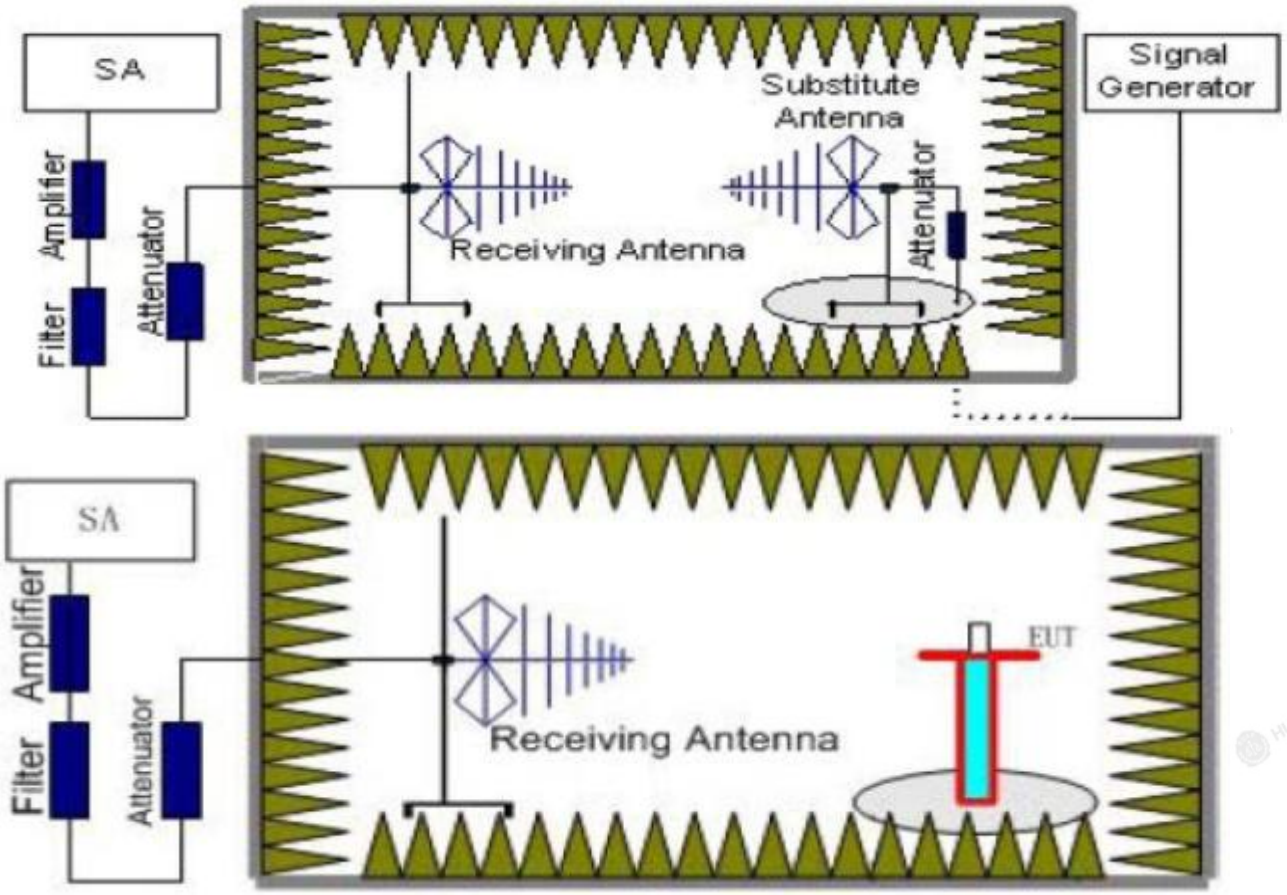
QPSK	3.75	1@0	824.1	20.46
		1@47	824.1	20.34
		1@0	836.5	21.02
		1@47	836.5	20.88
		1@0	848.9	20.97
		1@47	848.9	20.80
	15	1@0	824.1	21.25
		1@11	824.1	20.01
		12@0	824.1	21.53
		1@0	836.5	21.83
		1@11	836.5	21.53
		12@0	836.5	21.90
		1@0	848.9	20.62
		1@11	848.9	20.30
		12@0	848.9	21.80

4.1.2. Radiated Output Power

LIMIT

This is the test for the maximum radiated power from the EUT.
Rule Part 22H.913(a)(2) specifies, "Mobile/portable stations are limited to 7 watts ERP.

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 0.1 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 0.1m. 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.

5. 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.
6. 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
7. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
8. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

TEST RESULTS

Radiated Measurement:

Remark:

1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*
2. *EIRP=P_{Mea}(dBm)-P_{cl}(dB)+P_{Ag}(dB)+G_a(dBi)*
3. *Margin=Limit-ERP*
4. *We measured both Horizontal and Vertical direction, recorded worst case direction.*

LTE FDDBand 5-3.75KHz-BPSK

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	EIRP (dBm)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
824.1	-18.94	2.42	8.45	36.82	23.91	21.76	38.45	16.69	V
836.5	-17.85	3.46	8.45	36.82	23.96	21.81	38.45	16.64	V
848.9	-18.95	2.53	8.36	36.82	23.7	21.55	38.45	16.9	V

LTE FDDBand 5-15KHz-BPSK

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	EIRP (dBm)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
824.1	-19.12	2.42	8.45	36.82	23.73	21.58	38.45	16.87	V
836.5	-17.57	3.46	8.45	36.82	24.24	22.09	38.45	16.36	V
848.9	-17.88	2.53	8.36	36.82	24.77	22.62	38.45	15.83	V

LTE FDDBand 5-3.75KHz-QPSK

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	EIRP (dBm)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
824.1	-18.82	2.42	8.45	36.82	24.03	21.88	38.45	16.57	V
836.5	-17.65	3.46	8.45	36.82	24.16	22.01	38.45	16.44	V
848.9	-17.67	2.53	8.36	36.82	24.98	22.83	38.45	15.62	V

LTE FDDBand 5-15KHz-QPSK

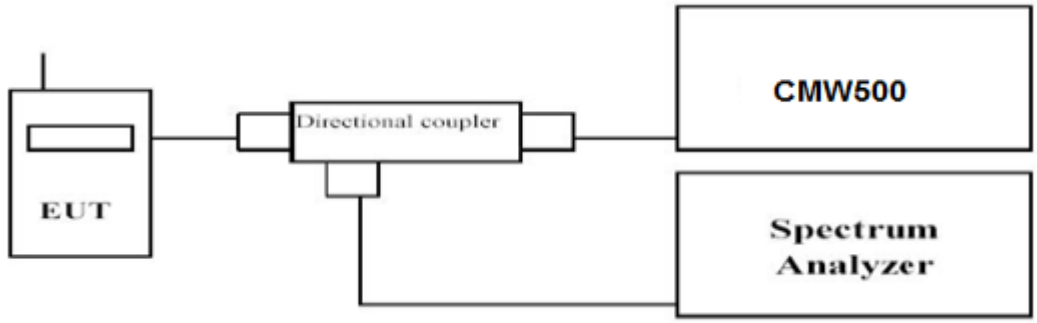
Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	EIRP (dBm)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
824.1	-17.62	2.42	8.45	36.82	25.23	23.08	38.45	15.37	V
836.5	-17.77	3.46	8.45	36.82	24.04	21.89	38.45	16.56	V
848.9	-19.25	2.53	8.36	36.82	23.4	21.25	38.45	17.2	V

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

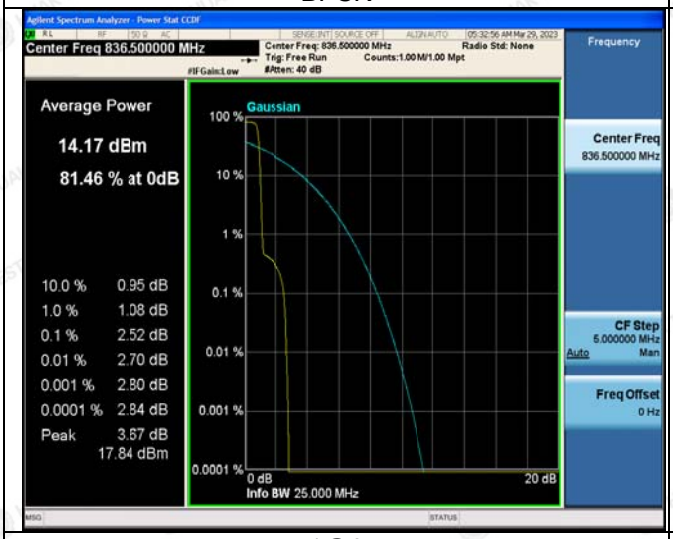
1. Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
2. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
3. Set the number of counts to a value that stabilizes the measured CCDF curve;
4. Set the measurement interval as 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:

1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*

LTE FDD Band 5				
Frequency (MHz)	Sub-carrier spacing (KHz)	Tones	Modulation PAPR (dB)	
			BPSK	QPSK
836.5	3.75	1@0	2.52	3.33
		1@47	2.92	3.28
836.5	15	1@0	4.14	5.85
		1@11	4.59	6.41

LTE FDD Band 5-3.75KHz	
BPSK	*QPSK*
	
1@0	1@0
	
1@47	1@47

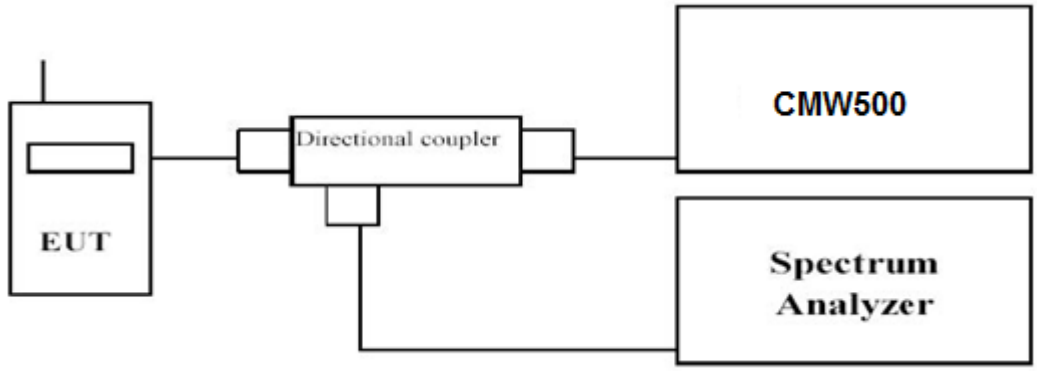
LTE FDD Band 5-15KHz	
BPSK	*QPSK*
	
1@0	1@0
	
1@11	1@11

4.3 Occupied Bandwidth and Emission Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

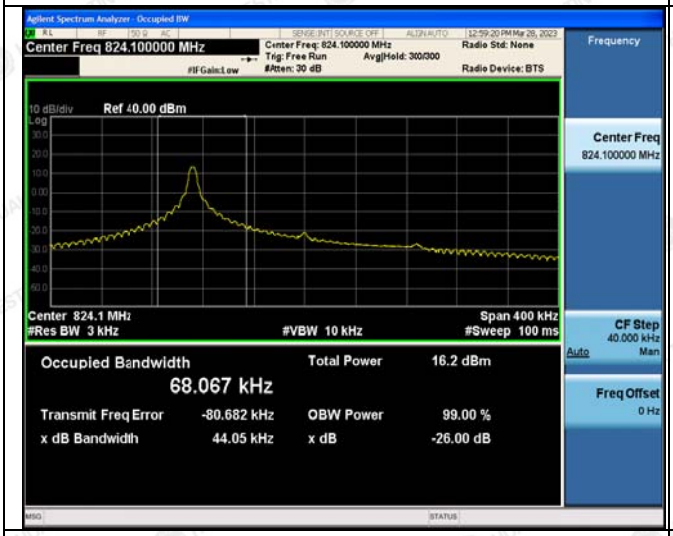
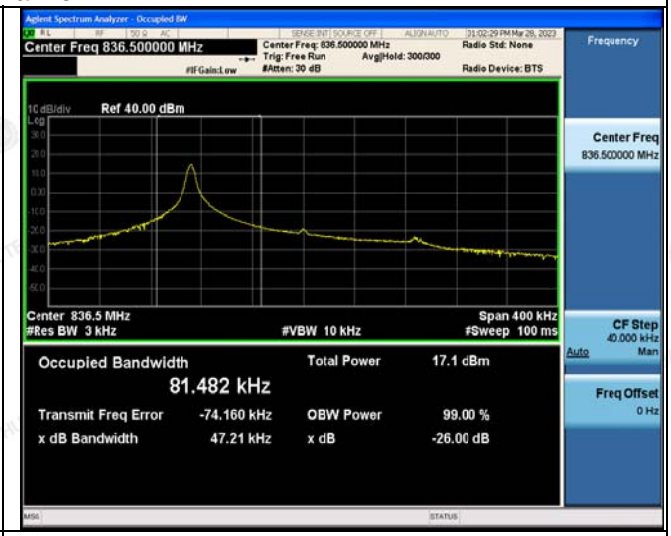
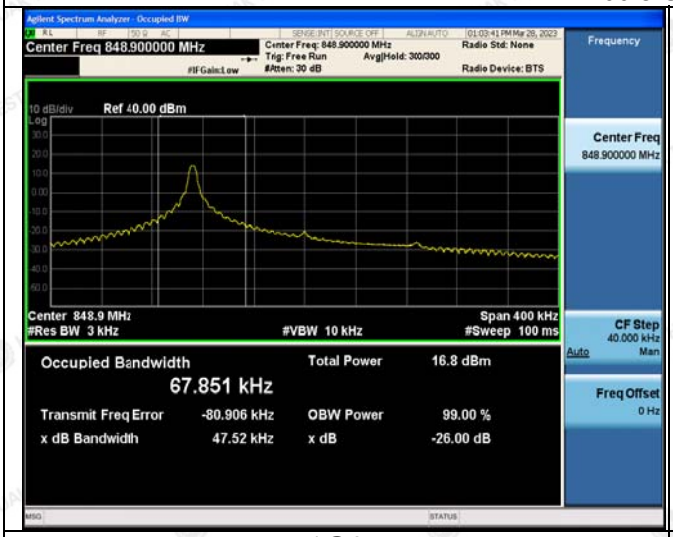
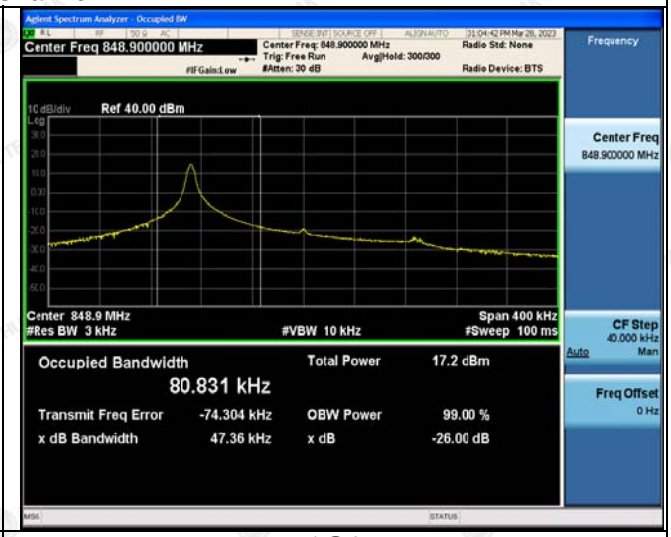
The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at low, middle and high channel in each band. The -26dBc Emission bandwidth was also measured and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

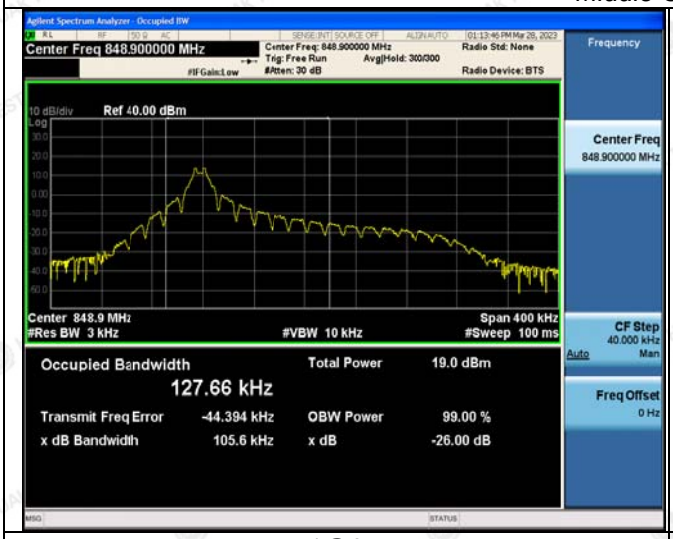
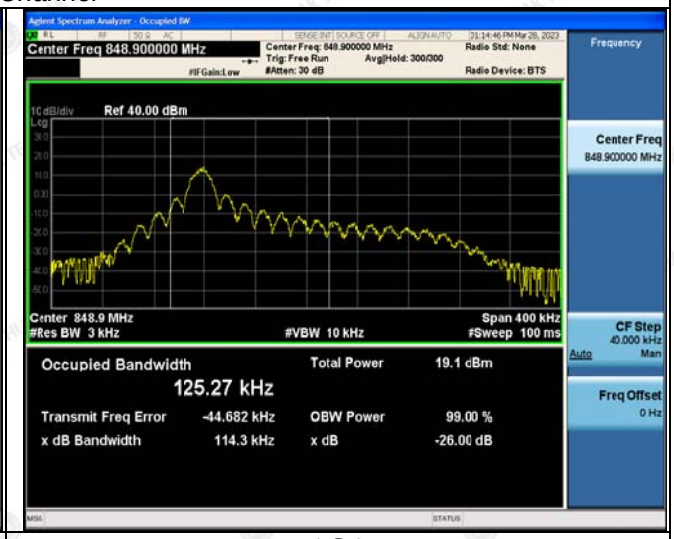
TEST RESULTS

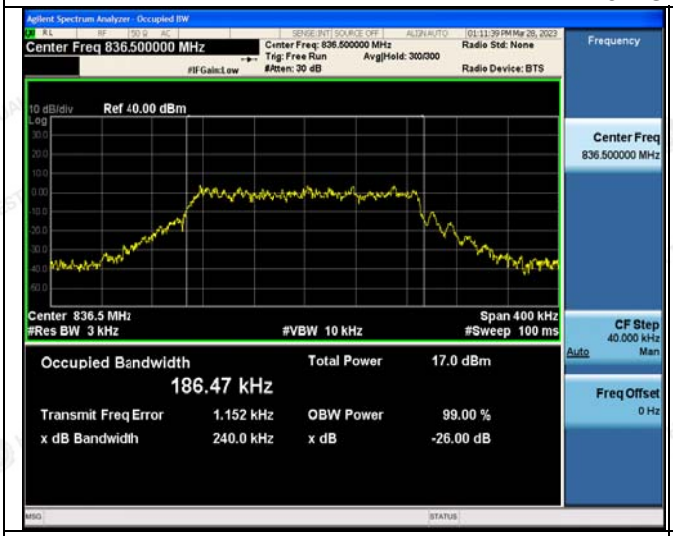
Remark:

1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*

LTE FDD Band 5						
Sub-carrier spacing (KHz)	Tones	Frequency (MHz)	-26dBc Emission bandwidth (KHz)		99% Occupied bandwidth (KHz)	
			BPSK	QPSK	BPSK	QPSK
3.75	1@0	824.1	44.05	47.10	68.067	80.899
	1@0	836.5	49.10	47.21	70.240	81.482
	1@0	848.9	47.52	47.36	67.851	80.831
15	1@0	824.1	106.0	117.4	127.58	118.52
	1@0	836.5	114.4	116.6	122.93	118.47
	1@0	848.9	105.6	114.3	127.66	125.27
	12@0	824.1	239.3	247.6	184.60	186.07
	12@0	836.5	240.0	247.6	186.47	185.85
	12@0	848.9	248.2	248.5	187.60	186.90

LTE FDD Band 5-3.75KHz	
BPSK	QPSK
	
1@0	1@0
Low Channel	
	
1@0	1@0
Middle Channel	
	
1@0	1@0
High Channel	

LTE FDD Band 5-15KHz	
BPSK	*QPSK*
	
1@0	1@0
Low Channel	
	
1@0	1@0
Middle Channel	
	
1@0	1@0
High Channel	

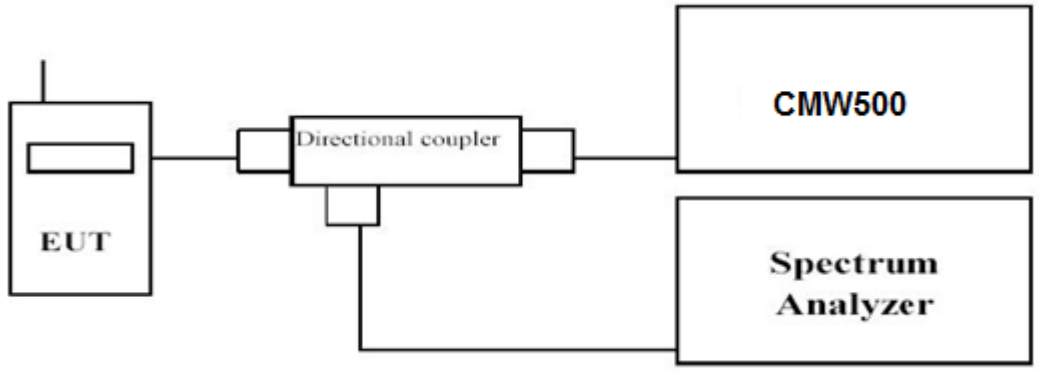
LTE FDD Band 5-15KHz	
BPSK	*QPSK*
	
12@0	12@0
Low Channel	
	
12@0	12@0
Middle Channel	
	
12@0	12@0
High Channel	

4.4 Band Edge Compliance

LIMIT

Per FCC §22.917 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 + 10log(P) dB.

TEST CONFIGURATION



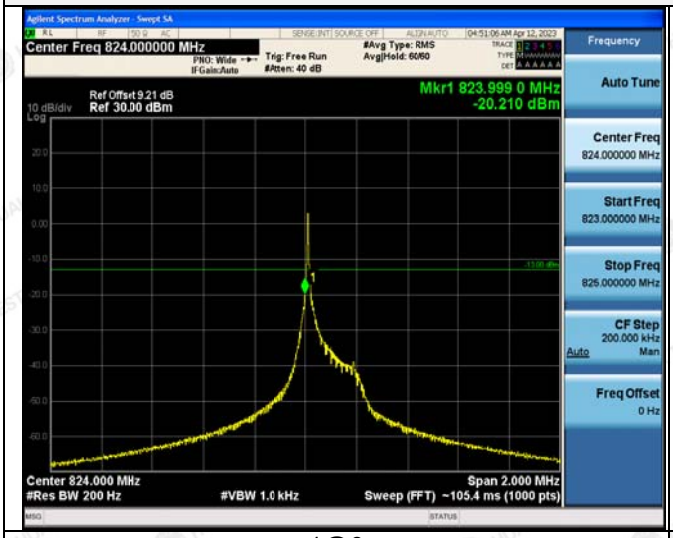
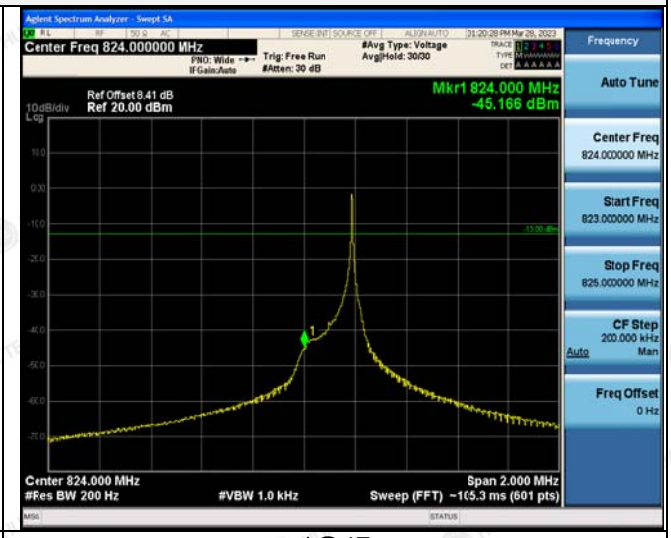
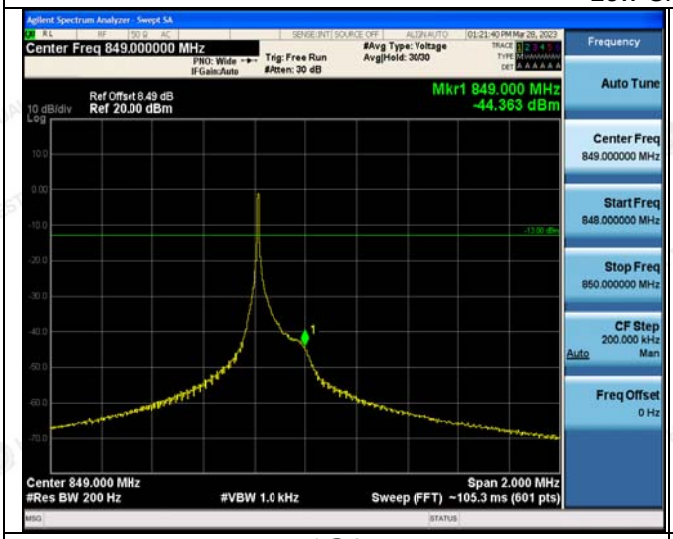
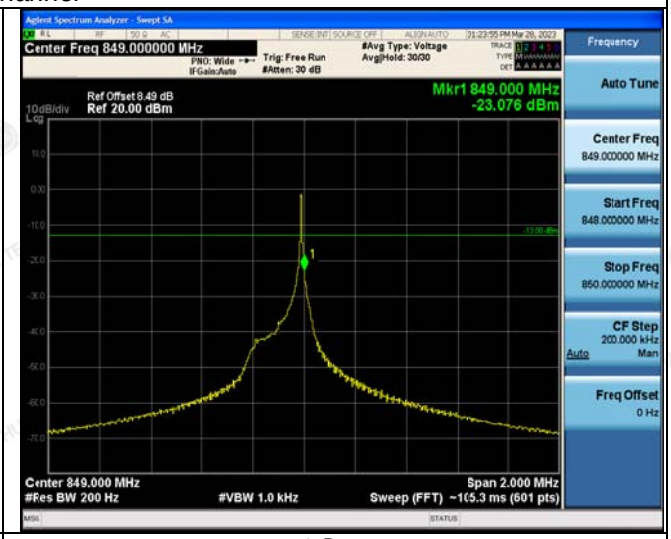
TEST PROCEDURE

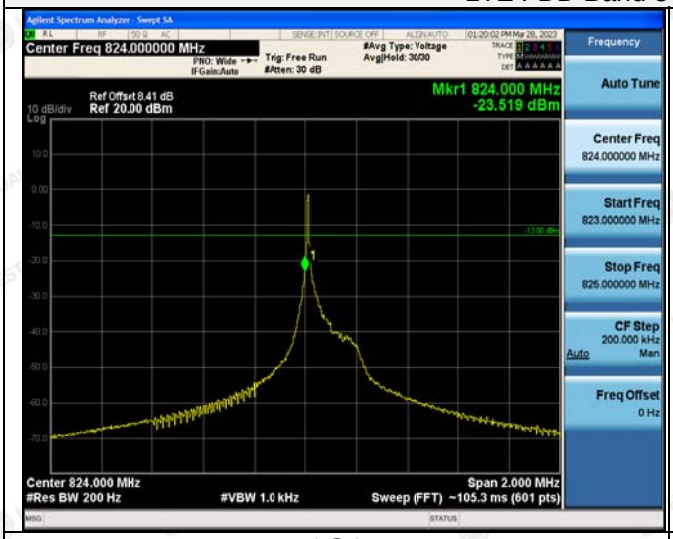
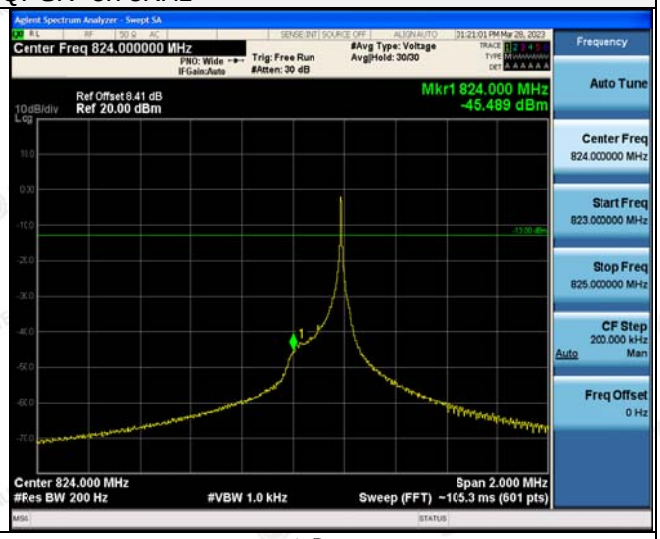
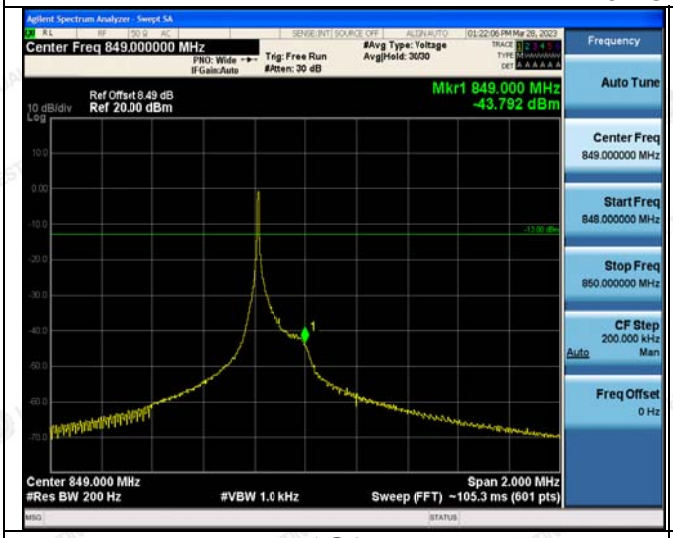
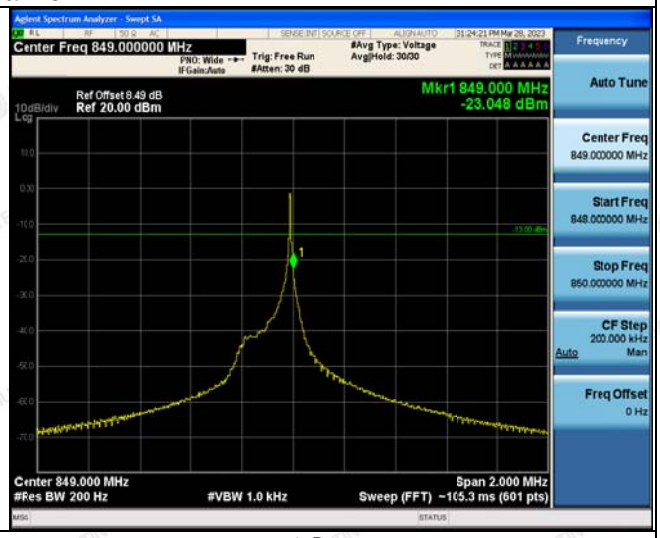
1. The transmitter output port was connected to base station.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowestand highest channels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

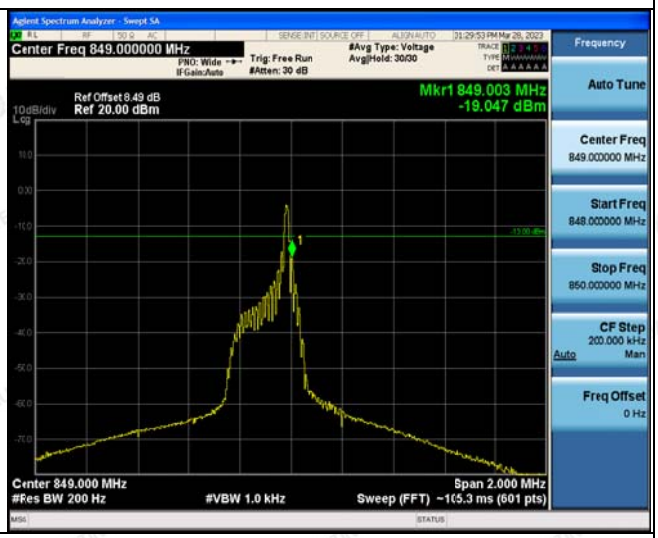
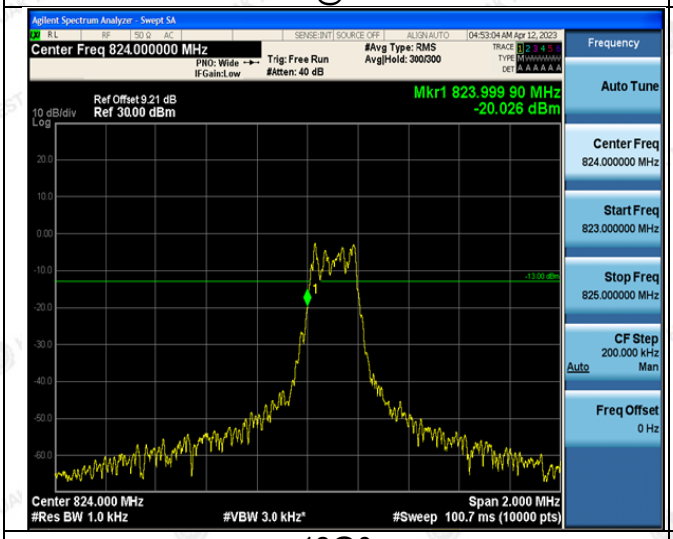
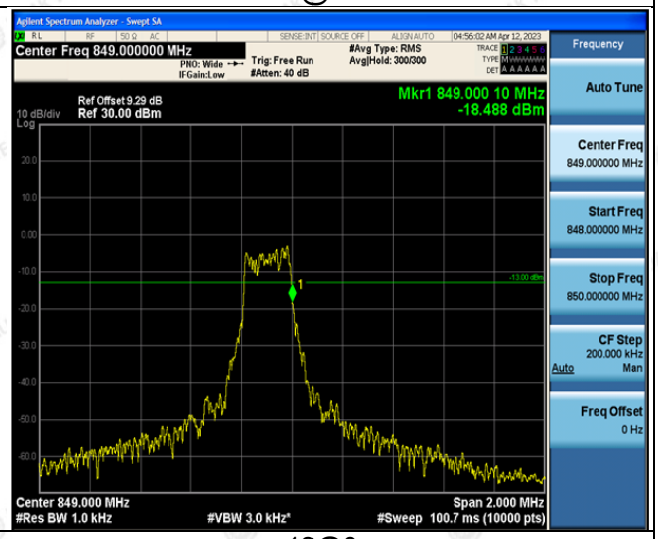
TEST RESULTS

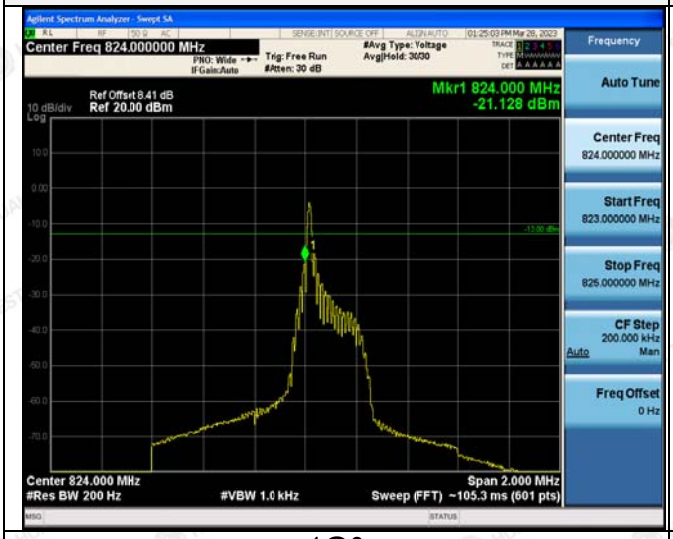
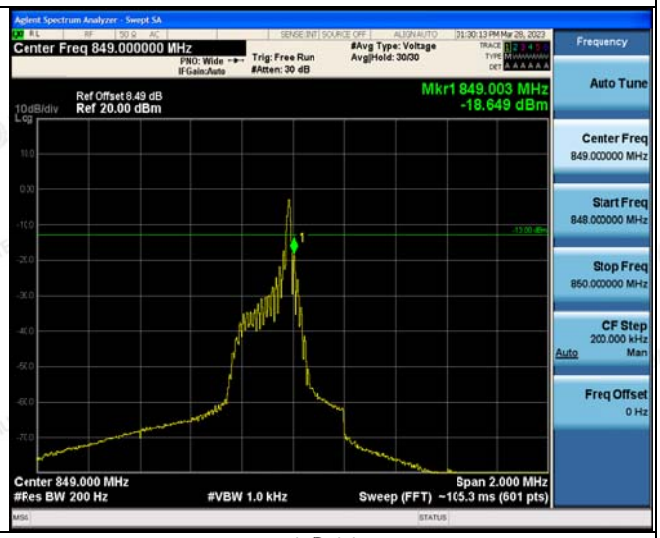
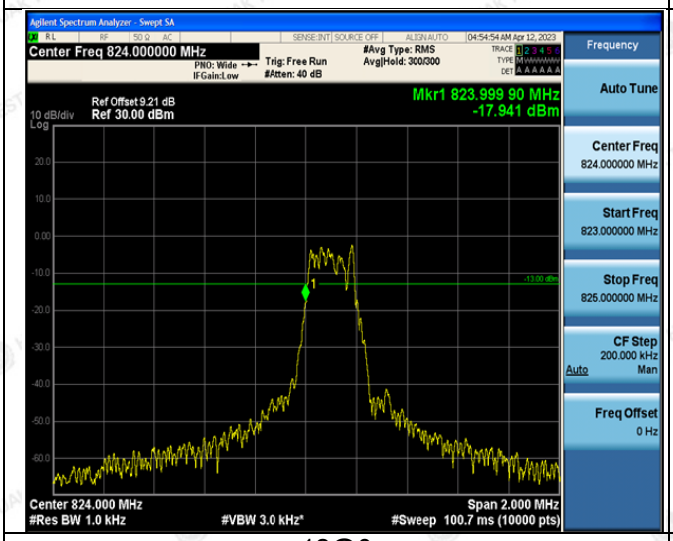
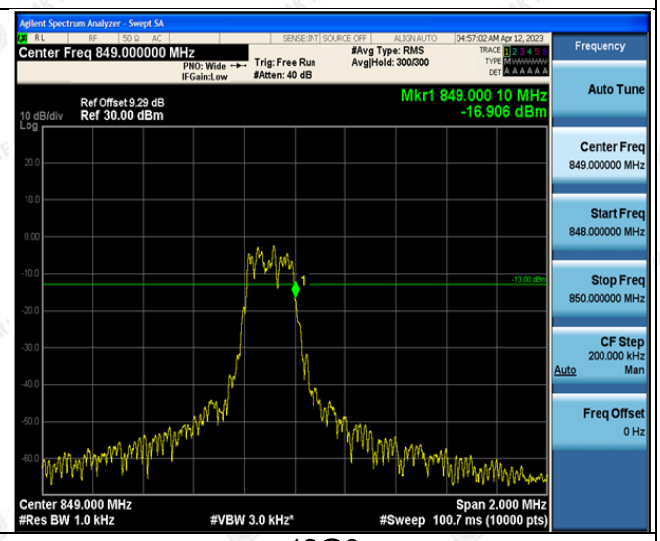
Remark:

1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*

LTE FDD Band 5-BPSK- 3.75KHz	
	
1@0	1@47
Low Channel	
	
1@0	1@47
High Channel	

LTE FDD Band 5-QPSK- 3.75KHz	
	
1@0	1@47
Low Channel	
	
1@0	1@47
High Channel	

LTE FDD Band 5-BPSK- 15KHz	
Low Channel	*High Channel*
	
1@0	1@0
	
1@11	1@11
	
12@0	12@0

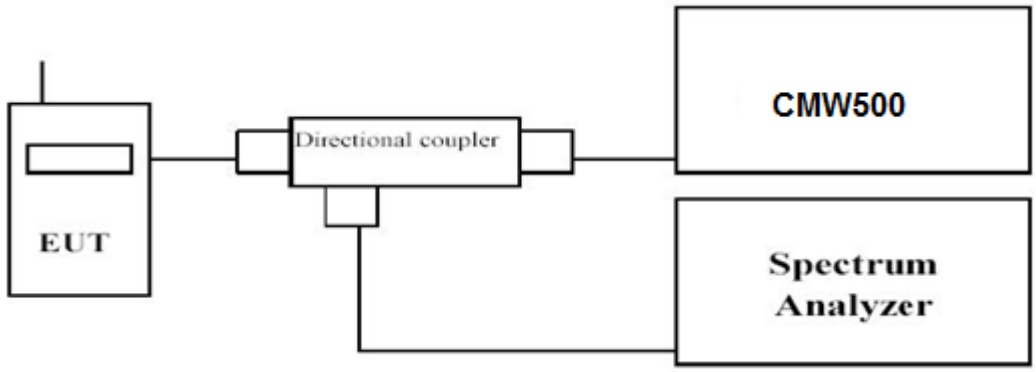
LTE FDD Band 5-QPSK- 15KHz	
Low Channel	*High Channel*
	
1@0	1@0
	
1@11	1@11
	
12@0	12@0

4.5 Spurious Emssionon Antenna Port

LIMIT

Per FCC §22.917, 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 + 10log(P) dB.

TEST CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D.

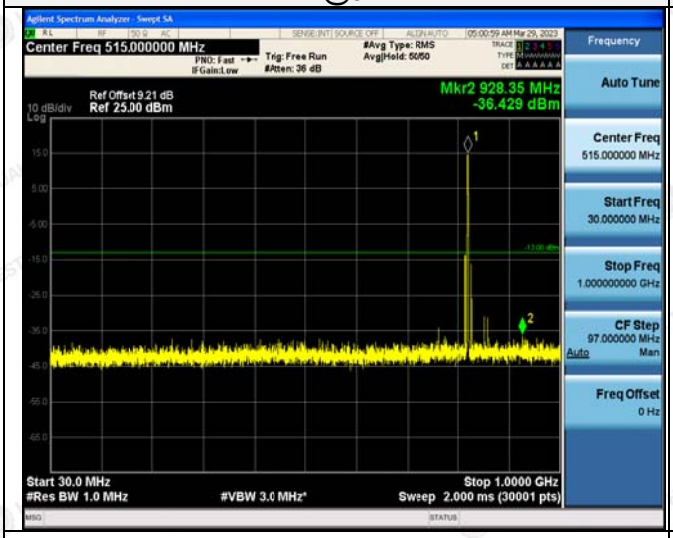
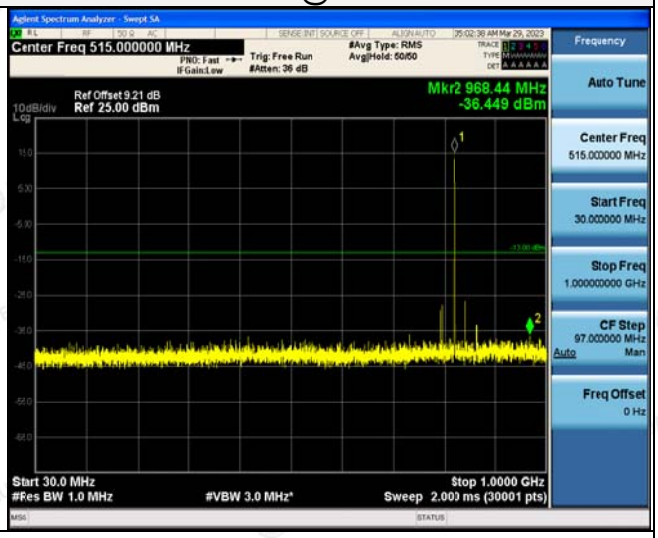
a. Place the EUT on a bench and set it in transmitting mode.
b. Connect a low loss RF cable from the antenna port to a spectrum analyzer andCMW500 by a Directional Couple.
c. EUT Communicate with CMW500, then select a channel for testing.
d. Add a correction factor to the display of spectrum, and then test.
e. The resolution bandwidth of the spectrum analyzer was setsufficient scans were taken to show the out of band Emission if any up to10th 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 5	0.01~20	1 MHz	3 MHz	Auto

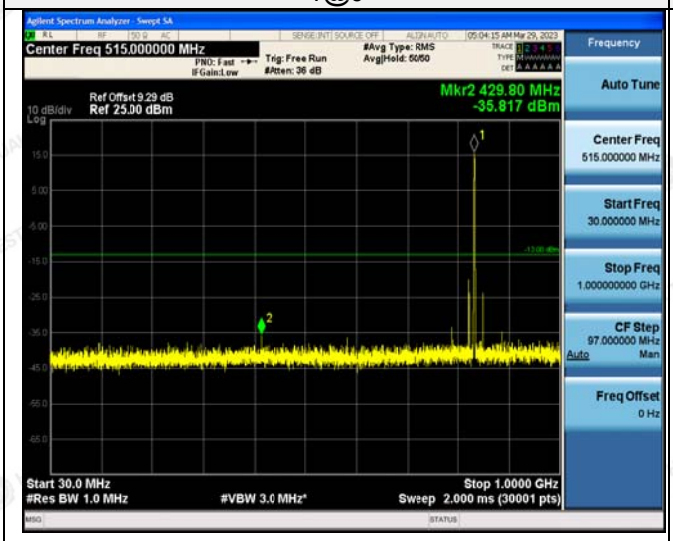
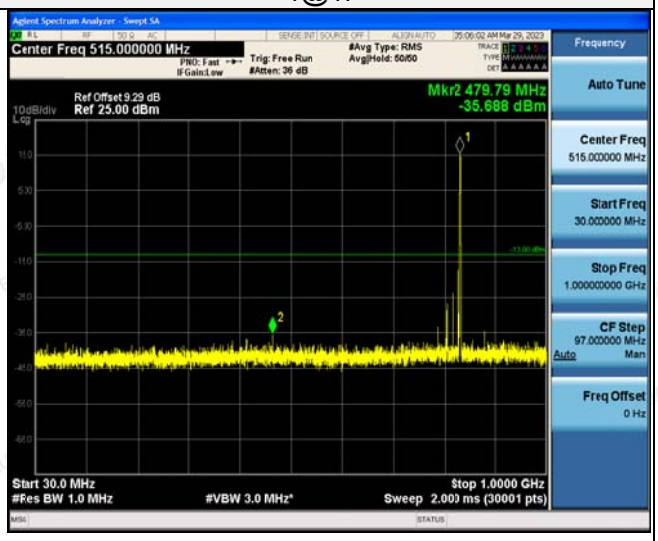
TEST RESULTS

Remark:

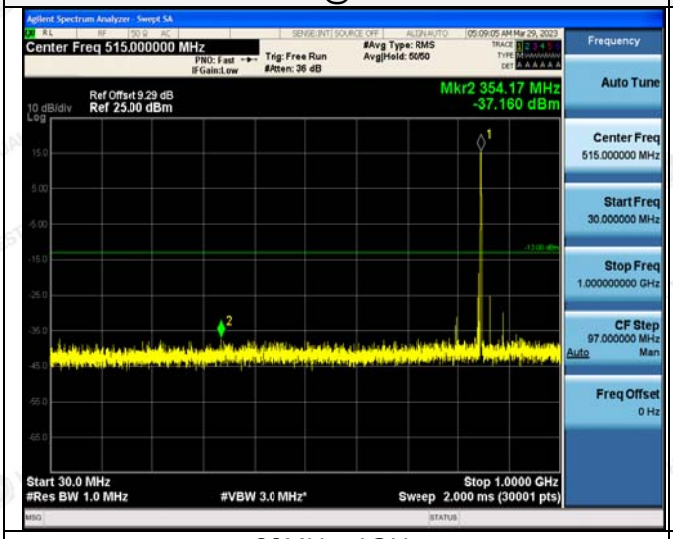
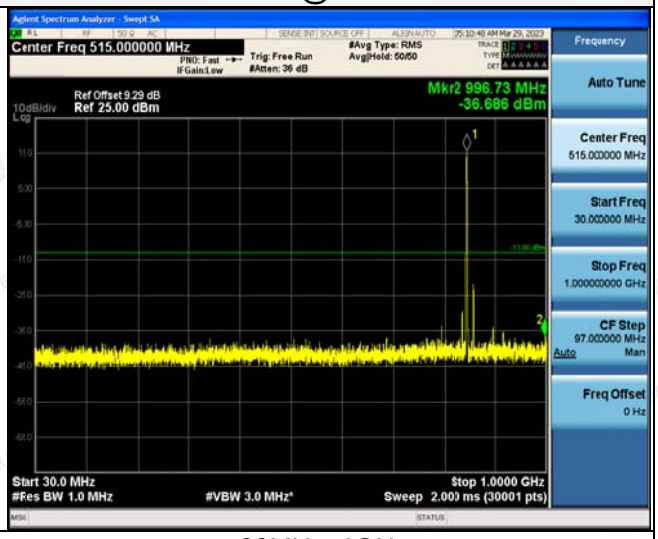
1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case at the QPSK Mode for each Channel Bandwidth of LTE FDD Band 5.*

LTE FDD Band 5-QPSK-3.75KHz	
Low Channel	
1@0	1@47
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz ~5GHz	*1GHz ~5GHz*
	
5GHz ~12GHz	*5GHz ~12GHz*

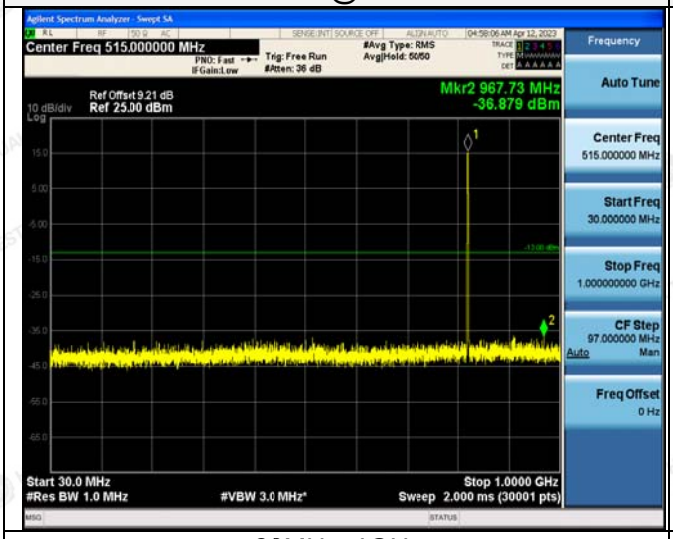
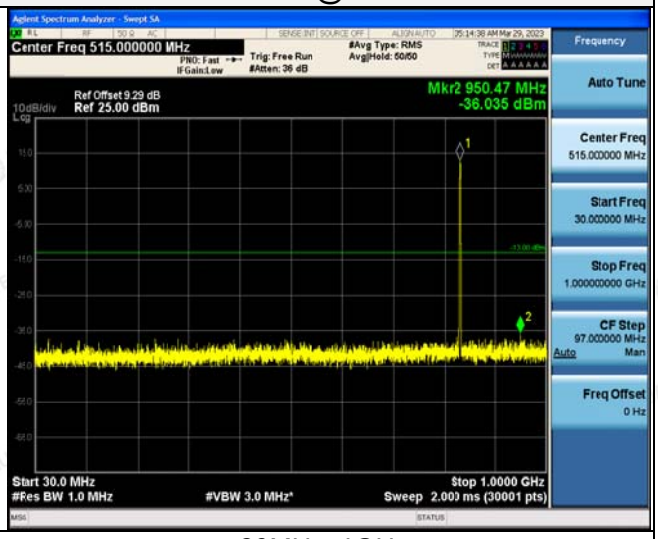
	
12GHz ~26.5GHz	*12GHz ~26.5GHz*

LTE FDD Band 5-QPSK-3.75KHz	
Middle Channel	
1@0	1@47
	
30MHz~1GHz	30MHz~1GHz
	
1GHz ~5GHz	1GHz ~5GHz
	
5GHz ~12GHz	5GHz ~12GHz

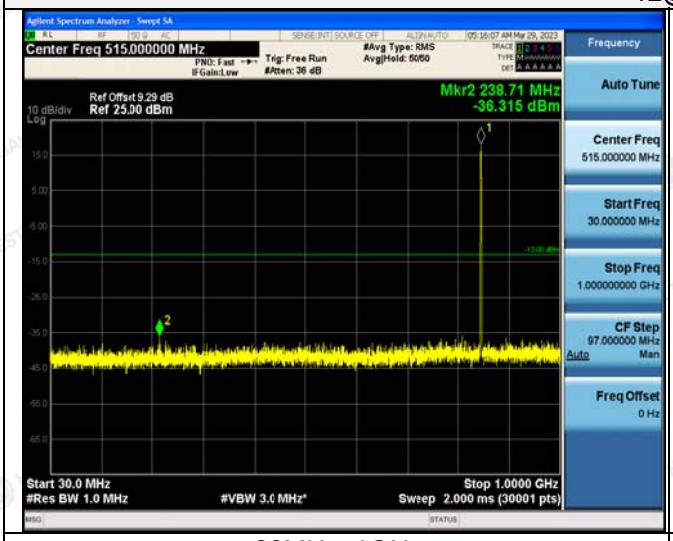
	
12GHz ~26.5GHz	*12GHz ~26.5GHz*

LTE FDD Band 5-QPSK-3.75KHz	
High Channel	
1@0	1@47
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz ~5GHz	*1GHz ~5GHz*
	
5GHz ~12GHz	*5GHz ~12GHz*

	
12GHz ~26.5GHz	*12GHz ~26.5GHz*

LTE FDD Band 5-QPSK-15KHz	
Low Channel	Middle Channel
12@0	12@0
	
30MHz~1GHz	30MHz~1GHz
	
1GHz ~5GHz	1GHz ~5GHz
	
5GHz ~12GHz	5GHz ~12GHz

	
12GHz ~26.5GHz	*12GHz ~26.5GHz*

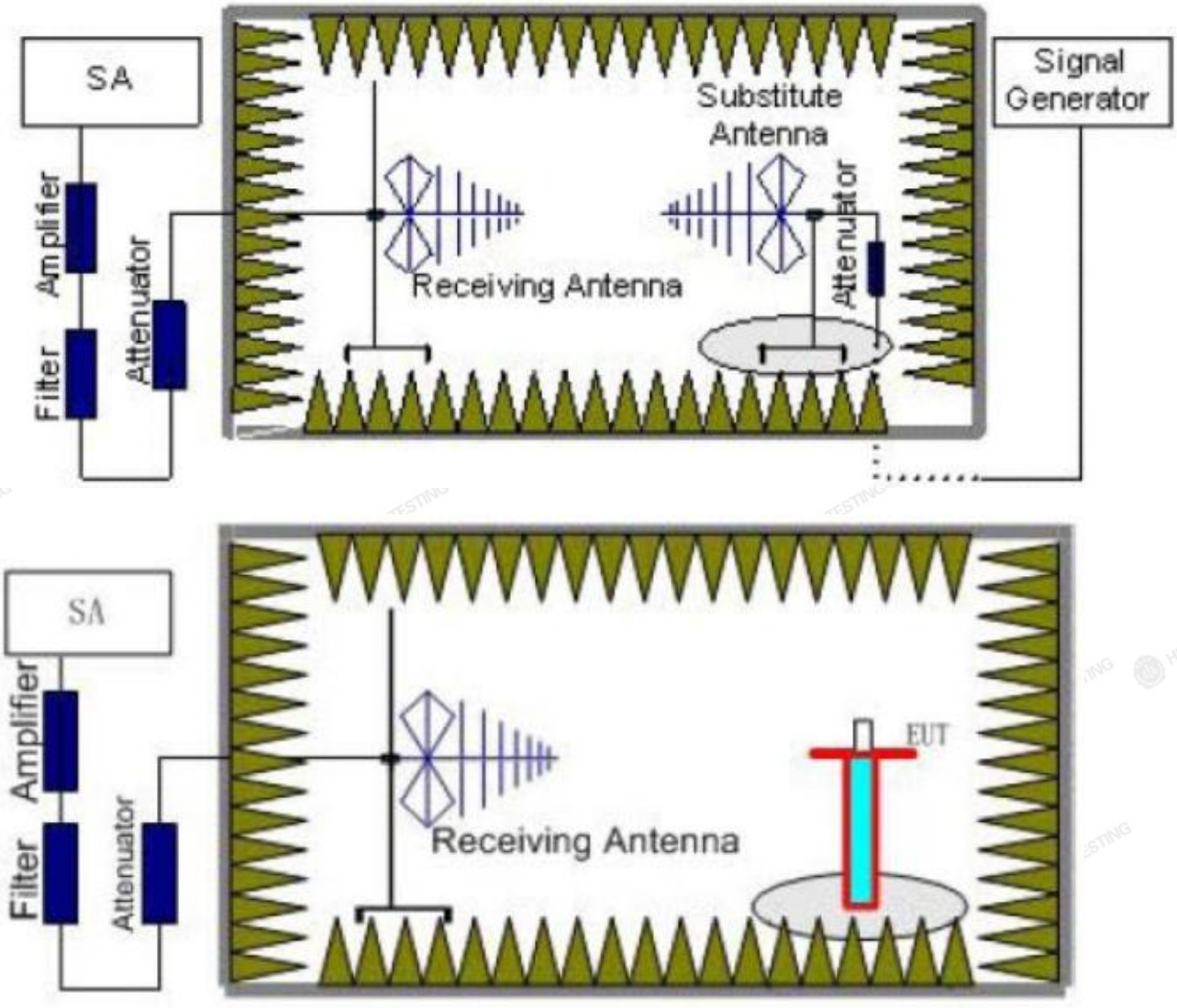
LTE FDD Band 5-QPSK-15KHz	
High Channel	
12@0	
	
30MHz~1GHz	*1GHz ~5GHz*
	
5GHz ~12GHz	*12GHz ~26.5GHz*

4.6 Radiated Spurious Emssion

TEST APPLICABLE

Per FCC §22.917, 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 + 10log(P) dB.

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 0.1 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 0.1m. 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 BAND 5	0.03~1	100KHz	300KHz	10
	1~20	1 MHz	3 MHz	2

TEST LIMITS

According to 24.238 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 BAND 5	Low	30MHz -20GHz	PASS
	Middle	30MHz -20GHz	PASS
	High	30MHz -20GHz	PASS

Radiated Measurement:

Remark:
1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE BAND 5; recorded worst case for each Channel Bandwidth of LTE BAND 5.*
2. EIRP=P_{Mea}(dBm)-P_{cl}(dB) +G_a(dBi)
3. Not recorded other points as values lower than limits.
4. Margin = Limit – EIRP

LTE FDDBand 5-15KHz-BPSK-Low Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1648.2	-42.22	3.00	3.00	9.58	-35.64	-13.00	22.64	H
2472.3	-43.77	3.03	3.00	10.72	-36.08	-13.00	23.08	H
1648.2	-42.22	3.00	3.00	9.68	-35.54	-13.00	22.54	V
2472.3	-40.58	3.03	3.00	10.72	-32.89	-13.00	19.89	V

LTE FDDBand 5-15KHz-BPSK-Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1673.0	-42.65	3.00	3.00	9.58	-36.07	-13.00	23.07	H
2509.5	-41.66	3.03	3.00	10.72	-33.97	-13.00	20.97	H
1673.0	-42.73	3.00	3.00	9.68	-36.05	-13.00	23.05	V
2509.5	-42.83	3.03	3.00	10.72	-35.14	-13.00	22.14	V

LTE FDDBand 5-15KHz-BPSK-High Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1697.8	-43.12	3.00	3.00	9.58	-36.54	-13.00	23.54	H
2546.7	-41.74	3.03	3.00	10.72	-34.05	-13.00	21.05	H
1697.8	-42.69	3.00	3.00	9.68	-36.01	-13.00	23.01	V
2546.7	-42.17	3.03	3.00	10.72	-34.48	-13.00	21.48	V

LTE FDDBand 5-15KHz-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
1648.2	-42.78	3.00	3.00	9.58	-36.2	-13.00	23.2	H
2472.3	-43.44	3.03	3.00	10.72	-35.75	-13.00	22.75	H
1648.2	-42.74	3.00	3.00	9.68	-36.06	-13.00	23.06	V
2472.3	-40.81	3.03	3.00	10.72	-33.12	-13.00	20.12	V

LTE FDDBand 5-15KHz-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
1673.0	-43.42	3.00	3.00	9.58	-36.84	-13.00	23.84	H
2509.5	-42.47	3.03	3.00	10.72	-34.78	-13.00	21.78	H
1673.0	-43.68	3.00	3.00	9.68	-37	-13.00	24	V
2509.5	-40.61	3.03	3.00	10.72	-32.92	-13.00	19.92	V

LTE FDDBand 5-15KHz-QPSK-High Channel

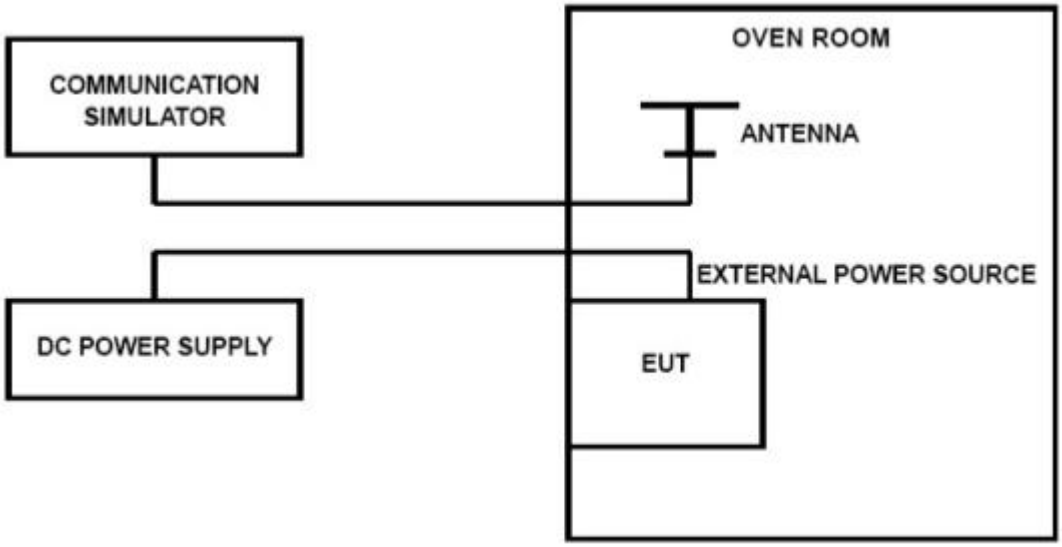
Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1697.8	-43.46	3.00	3.00	9.58	-36.88	-13.00	23.88	H
2546.7	-43.73	3.03	3.00	10.72	-36.04	-13.00	23.04	H
1697.8	-42.86	3.00	3.00	9.68	-36.18	-13.00	23.18	V
2546.7	-41.66	3.03	3.00	10.72	-33.97	-13.00	20.97	V

4.7 Frequency Stability

LIMIT

According to §22.355, §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 5, 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:
1. We testedall RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case.

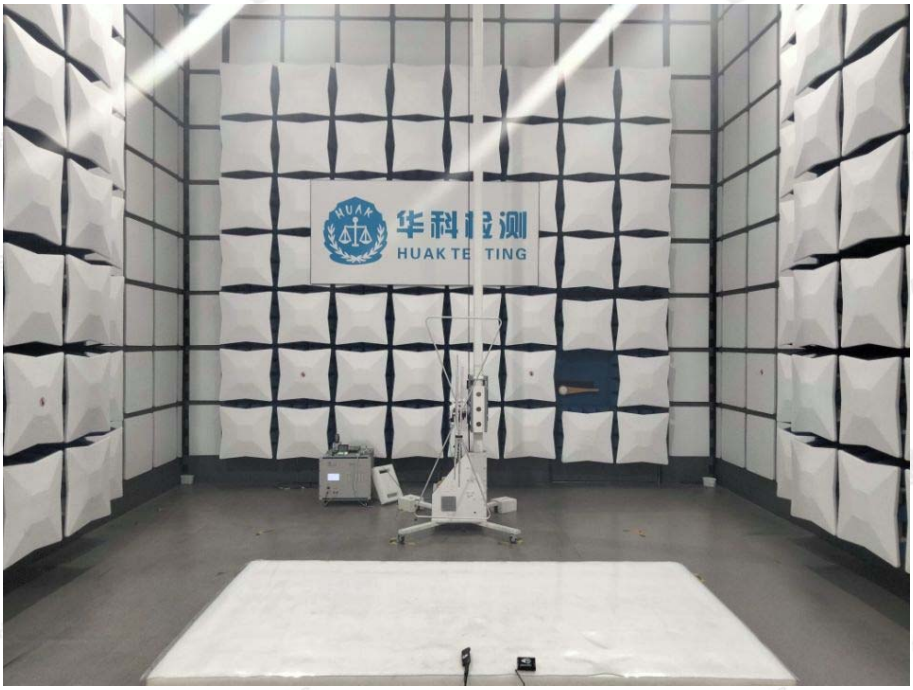
LTE Band 5, 15KHz , BPSK (worst case of all bandwidths)

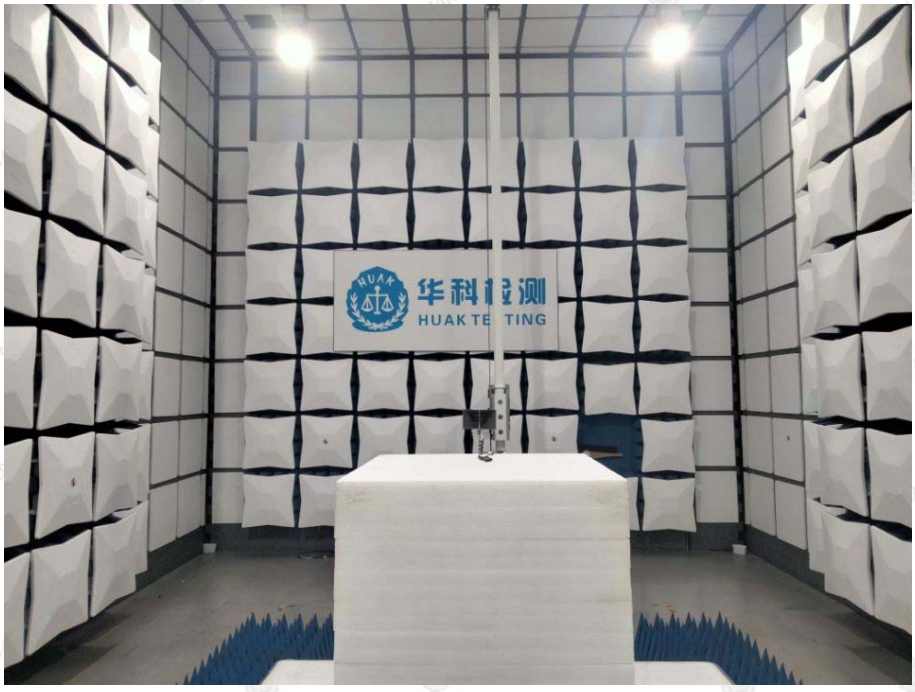
LTE FDD Band 5					
DC Power(V)	**Temperature (℃)**	**Frequency error(Hz)**	**Frequency error(ppm)**	**Limit (ppm)**	**Verdict**
3.15	20	-23.05	-0.027970	±2.50	PASS
3.70	20	-24.70	-0.029972	±2.50	PASS
4.26	20	-25.46	-0.030894	±2.50	PASS
3.70	-30	-26.10	-0.031671	±2.50	PASS
3.70	-20	-25.94	-0.031477	±2.50	PASS
3.70	-10	-24.91	-0.030227	±2.50	PASS
3.70	0	-24.63	-0.029444	±2.50	PASS
3.70	10	-24.14	-0.028858	±2.50	PASS
3.70	20	-25.46	-0.030436	±2.50	PASS
3.70	30	-24.40	-0.029169	±2.50	PASS
3.70	40	-23.63	-0.028249	±2.50	PASS
3.70	50	-23.23	-0.027770	±2.50	PASS

LTE Band 5, 15KHz , QPSK (worst case of all bandwidths)

LTE FDD Band 5					
DC Power(V)	**Temperature (℃)**	**Frequency error(Hz)**	**Frequency error(ppm)**	**Limit (ppm)**	**Verdict**
3.15	20	-22.40	-0.027181	±2.50	PASS
3.70	20	-22.83	-0.027703	±2.50	PASS
4.26	20	-22.88	-0.027764	±2.50	PASS
3.70	-30	-19.42	-0.023565	±2.50	PASS
3.70	-20	-22.65	-0.027485	±2.50	PASS
3.70	-10	-21.89	-0.026562	±2.50	PASS
3.70	0	-17.74	-0.021207	±2.50	PASS
3.70	10	-19.69	-0.023539	±2.50	PASS
3.70	20	-19.13	-0.022869	±2.50	PASS
3.70	30	-19.18	-0.022929	±2.50	PASS
3.70	40	-17.68	-0.021136	±2.50	PASS
3.70	50	-20.01	-0.023921	±2.50	PASS

5 Test Setup Photos of the EUT





6 External and Internalphotos of the EUT

Reference to the report :ANNEX A of external photos and ANNEX B ofinternal photos.

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

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