FCC Test Report

FCC Part 22 & 90

Report Reference No.:	HK2302270554-6E
FCC ID :	2A2FCBT4101
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Approved by (position+printed name+signature) . :	Manager Jason 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 Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Applicant's name ..... :	**PowUnity GmbH**
Address ..... :	Feldstrasse 9d Innsbruck, 6020 Austria
Test specification ..... :	
Standard ..... :	**FCC Part 22 & 90**

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Test item description ..... :	GPS Tracker
Trade Mark ..... :	BikeTrax
Manufacturer ..... :	**PowUnity GmbH**
Model/Type reference ..... :	BT41-01
Series Models ..... :	T4101-03-04
Ratings ..... :	DC 3.7V from battery
Modulation ..... :	QPSK, 16QAM
Hardware version ..... :	V2.2
Software version ..... :	V2.2
Frequency	LTE Band 18
Result ..... :	**PASS**

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TEST REPORT

Test Report No. :	HK2302270554-6E	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.
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** Modified History **

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

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1. Summary

1.1 Test Standards

The tests were performed according to following standards:
FCC Part 90 : PRIVATE LAND MOBILE RADIO SERVICES

FCC Part 22Subpart H:PRIVATE LAND MOBILE RADIO 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

KDB971168 D01 v03r01: MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS

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1.2 Test Description

Requirement	CFR 47 Section	Result
Conducted Output Power	§2.1046; §90.635;	PASS
Effective(Isotropic) Radiated Output Power	§22.913(a)(2)	PASS
Peak-to-Average Ratio	§2.1046;	PASS
Effective Radiated Power	§2.1046; §90.635;	PASS
Occupied Bandwidth	§2.1049;	PASS
Band Edge	§2.1051; §90.691	PASS
Conducted Spurious Emission	§2.1051; §90.691	PASS
Field Strength of Spurious Radiation	§2.1053; §90.691	PASS
Frequency Stability for Temperature & Voltage	§2.1055; §90.231	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

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2. EUT Description

Product Name:	GPS Tracker
Model :	BT41-01
Series Models:	T4101-03-04
Trade Mark:	BikeTrax
Tx Frequency:	LTE Band 18: 815 MHz ~ 830 MHz
Bandwidth:	LTE Band 18: 5MHz / 10MHz / 15MHz
Type of Modulation:	QPSK/16QAM
Antenna Type:	Internal Antenna
Antenna Gain:	LTE Band 18: 1dBi
Power Supply:	DC 3.7V from battery

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3. General Information

3.1. Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation
The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

Description Operation Frequency

LTE Band 18(5MHz)		LTE Band 18(10MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
23875	817.5	23900	820.0
23925	822.5	23925	822.5
23975	827.5	23950	825.0

LTE Band 18(15MHz)	
Channel	Frequency (MHz)
23925	822.5

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3.2. Test Mode

All modes and data rates and positions were investigated.
Test modes are chosen to be reported as the worst case configuration below:

Test Mode		
Band	**Radiated TCs**	**Conducted TCs**
LTE Band 18	QPSK Link (5MHz / 10MHz/ 15MHz)	16QAM Link (5MHz / 10MHz/ 15MHz)

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas License Digital Systems v03 with maximum output power. Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

3.3. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

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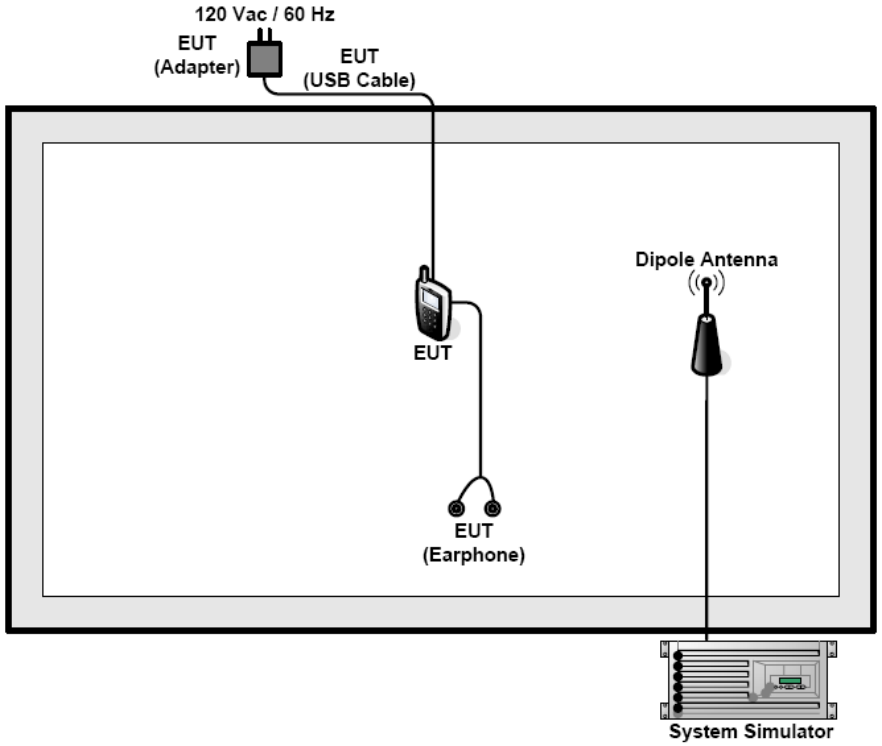
3.4. Configuration of Tested System



3.5. Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level. The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

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3.6. 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

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4. Facilities and Accreditations

4.1. 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.

4.2. Measurement Uncertainty

The reported uncertainty of measurement y ± U, 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 %.

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	Above 1GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95%
confidence level using a coverage factor of k=2.

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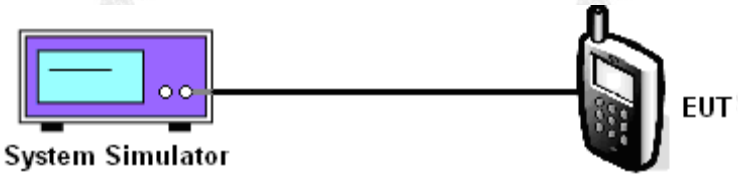
5. Test Results and Measurement Data

5.1. Conducted Output Power Measurement

5.1.1. Test Specification

Test Requirement:	FCC part 90.635
Test Method:	FCC part 2.1046
Limits:	LTE Band 18: 100W
Test Setup:	
Test Procedure:	1. The transmitter output port was connected to the system simulator. 2. Set EUT at maximum power through system simulator. 3. Select lowest, middle, highest channels for each band and different modulation. 4. Measure and record the power level from the system simulator.
Test Result:	PASS

TEST RESULTS

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Conducted Measurement:

LTE FDD Band 18				
TX Channel Bandwidth	RB Size/Offset	Frequency (MHz)	Average Power [dBm]	
			QPSK	16QAM
5 MHz	1 RB low	817.5	20.05	19.97
		822.5	20.09	18.06
		827.5	19.87	19.61
	1 RB high	817.5	19.42	19.82
		822.5	19.50	18.40
		827.5	20.71	20.39
	50% RB mid	817.5	19.87	20.29
		822.5	20.15	18.93
		827.5	19.13	20.23
	100% RB	817.5	19.36	18.22
		822.5	20.46	19.63
		827.5	20.17	18.75
10 MHz	1 RB low	820.0	21.35	21.63
		822.5	21.28	21.10
		825.0	20.36	19.35
	1 RB high	820.0	20.40	21.15
		822.5	21.11	21.24
		825.0	20.02	19.41
	50% RB mid	820.0	20.46	21.21
		822.5	20.99	21.09
		825.0	21.89	19.47
	100% RB	820.0	21.23	20.14
		822.5	20.47	19.52
		825.0	20.77	19.32
15 MHz	1 RB low	822.5	21.62	21.65
	1 RB high	822.5	22.37	21.49
	50% RB mid	822.5	21.20	20.88
	100% RB	822.5	21.42	19.32

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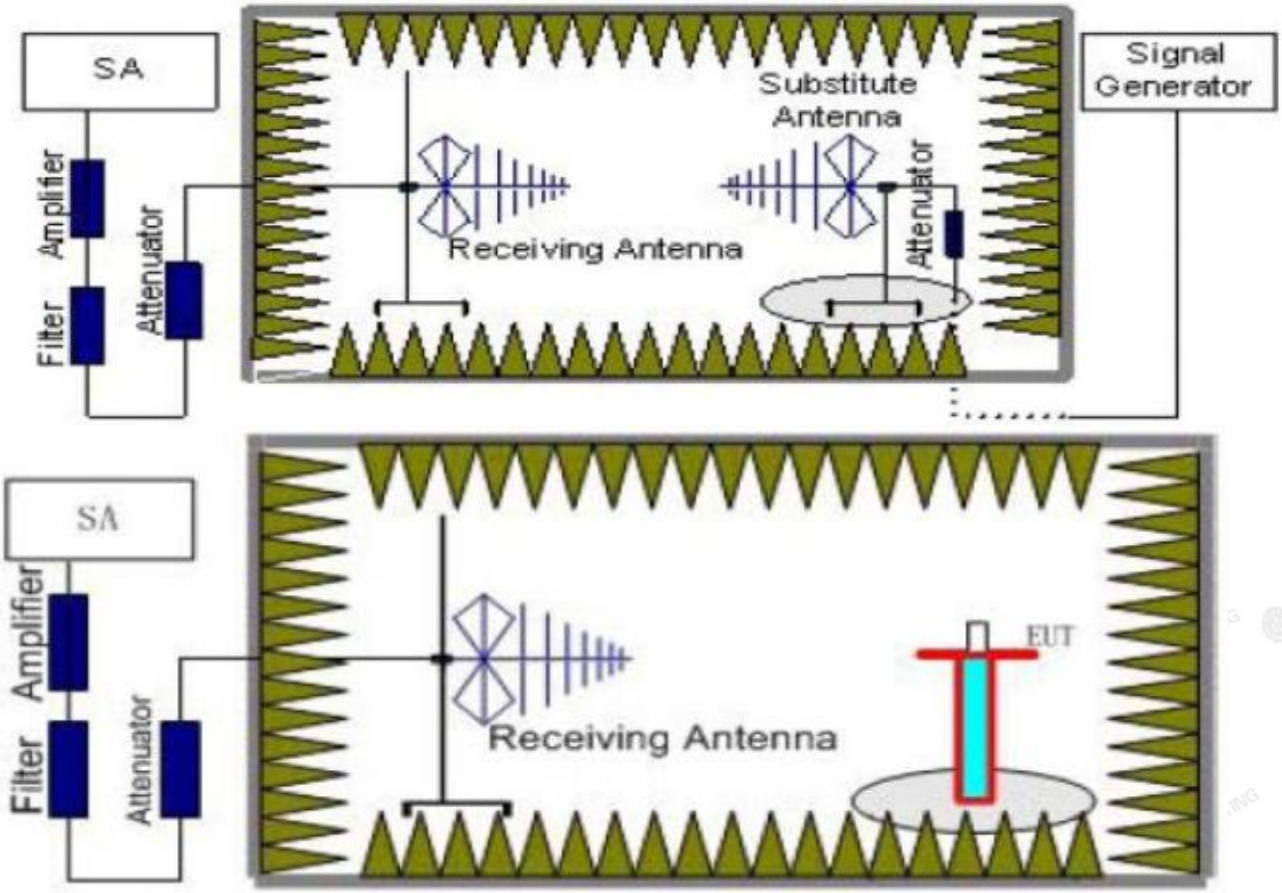
5.2. Radiated Output Power

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.

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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 is connected 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 18; recorded worst case for each Channel Bandwidth of LTE FDD Band 18.*
2. *EIRP=PMea(dBm)-Pcl(dB)+PAg(dB)+Ga(dBi)*
3. *Margin=Limit-ERP*
4. *We measured both Horizontal and Vertical direction, recorded worst case direction.*

LTE FDD Band 18_Channel Bandwidth 5MHz_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
817.5	-18.03	2.42	8.45	36.82	24.82	22.67	38.45	15.78	V
822.5	-17.3	3.46	8.45	36.82	24.51	22.36	38.45	16.09	V
827.5	-19.1	2.53	8.36	36.82	23.55	21.4	38.45	17.05	V

LTE FDD Band 18_Channel Bandwidth 10MHz_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
820.0	-19.25	2.42	8.45	36.82	23.6	21.45	38.45	17	V
822.5	-17.56	3.46	8.45	36.82	24.25	22.1	38.45	16.35	V
825.0	-18.26	2.53	8.36	36.82	24.39	22.24	38.45	16.21	V

LTE FDD Band 18_Channel Bandwidth 15MHz_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
822.5	-16.44	3.46	8.45	36.82	25.37	23.22	38.45	15.23	V

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LTE FDD Band 18_Channel Bandwidth 5MHz_16QAM

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
817.5	-17.65	2.42	8.45	36.82	25.2	23.05	38.45	15.4	V
822.5	-17.76	3.46	8.45	36.82	24.05	21.9	38.45	16.55	V
827.5	-17.36	2.53	8.36	36.82	25.29	23.14	38.45	15.31	V

LTE FDD Band 18_Channel Bandwidth 10MHz_16QAM

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
820.0	-17.51	2.42	8.45	36.82	25.34	23.19	38.45	15.26	V
822.5	-17.26	3.46	8.45	36.82	24.55	22.4	38.45	16.05	V
825.0	-18.65	2.53	8.36	36.82	24	21.85	38.45	16.6	V

LTE FDD Band 18_Channel Bandwidth 15MHz_16QAM

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
822.5	-16.24	3.46	8.45	36.82	25.57	23.42	38.45	15.03	V

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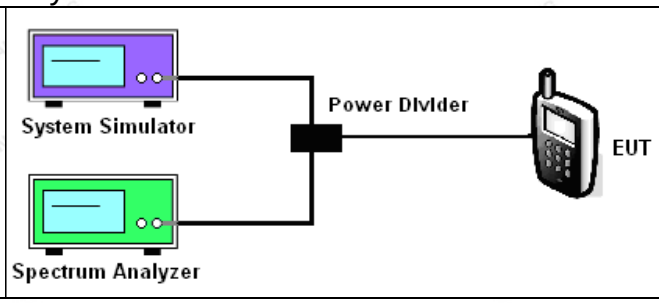
5.3. Peak to Average Ratio

5.3.1. Test Specification

Test Method:	FCC KDB 971168 D01v03
Limit:	The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.
Test Setup:	
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03 Section 5.7.1. 2. The EUT was connected to spectrum analyzer and system simulator via a power divider. 3. Set EUT to transmit at maximum output power. 4. Set the CCDF (Complementary Cumulative Distribution Function) option of the spectrum analyzer. Record the maximum PAPR level associated with a probability of 0.1%.
Test Result:	PASS

TEST RESULTS

Remark:

1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 18; recorded worst case for each Channel Bandwidth of LTE FDD Band 18.*

LTE FDD Band 18				
TX Channel Bandwidth	Frequency (MHz)	RB Size/Offset	PAPR (dB)	
			QPSK	16QAM
5 MHz	817.5	*1RB#0*	12.07	12.22
	822.5		9.99	10.11
	827.5		9.81	10.08
10 MHz	820.0	*1RB#0*	10.26	11.96
	822.5		8.50	12.64
	825.0		10.41	9.80
15 MHz	822.5	*1RB#0*	9.73	11.35

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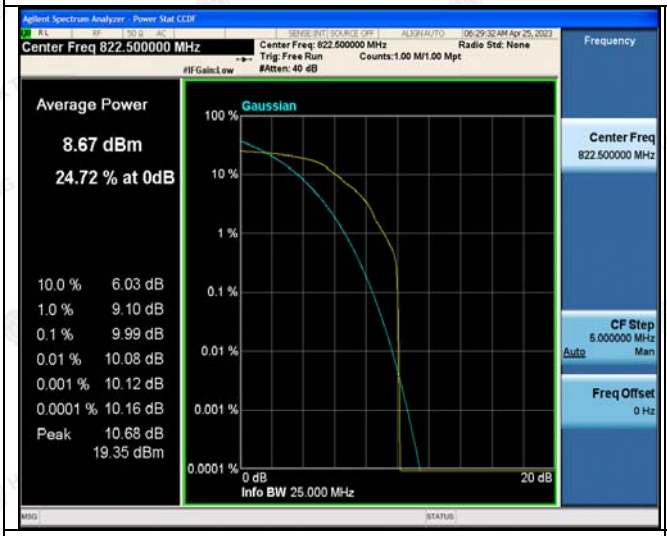
LTE FDD Band 18-5MHz Channel Bandwidth PAPR	
QPSK	16QAM
	
1RB#0	1RB#0
Low Channel	
	
1RB#0	1RB#0
Middle Channel	

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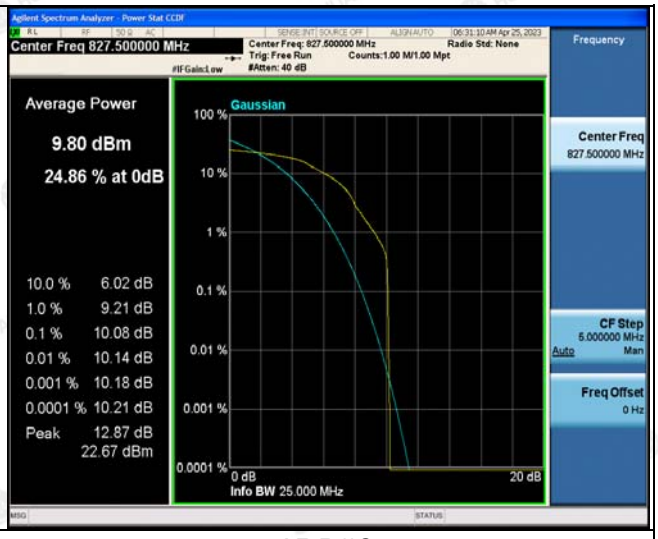
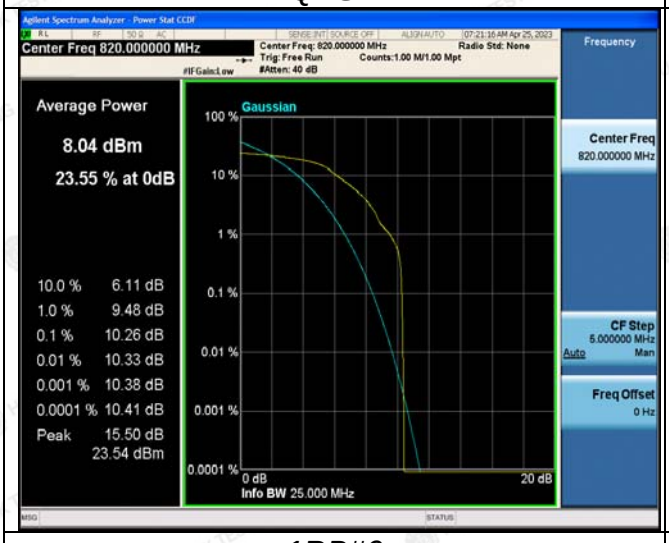
	
1RB#0	*1RB#0*
High Channel	

LTE FDD Band 18-10MHz Channel Bandwidth PAPR	
QPSK	*16QAM*
	
1RB#0	*1RB#0*
Low Channel	

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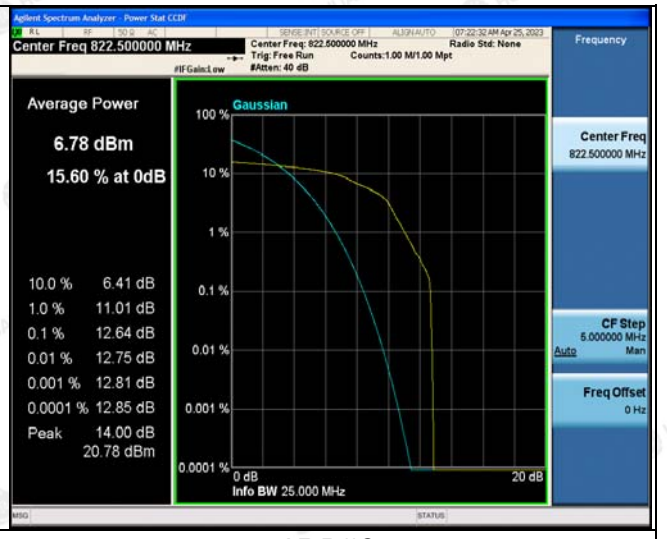
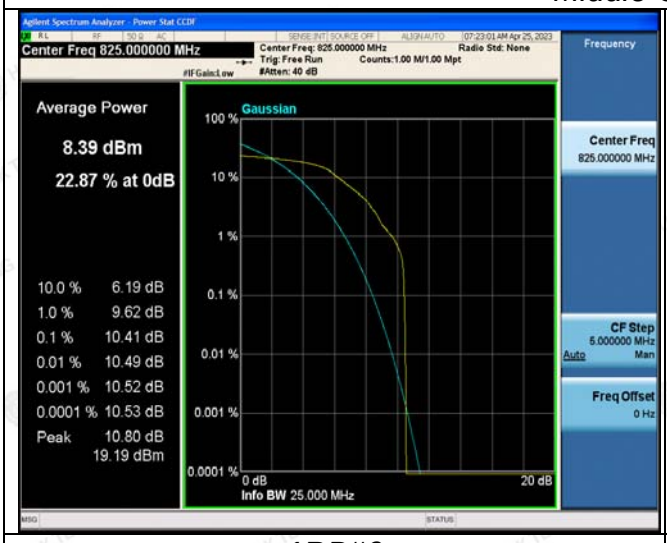
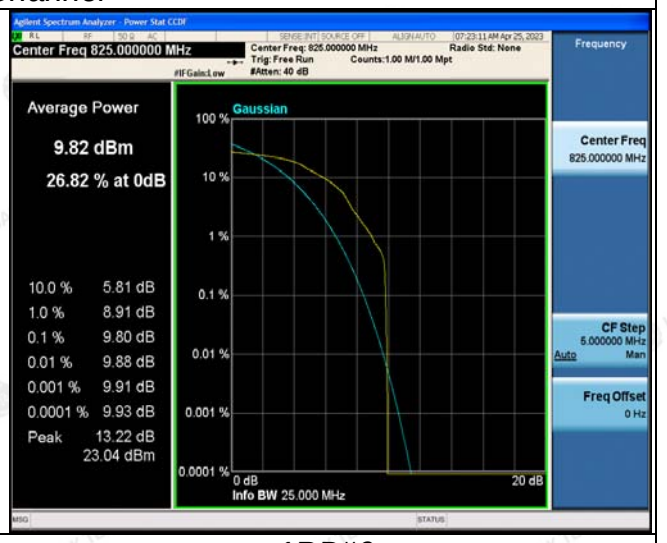
	
1RB#0	*1RB#0*
Middle Channel	
	
1RB#0	*1RB#0*
High Channel	

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LTE FDD Band 18-15MHz Channel Bandwidth PAPR	
QPSK	16QAM
	
1RB#0	1RB#0

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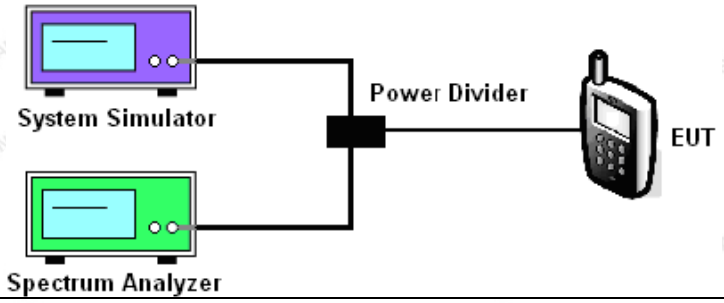
5.4. 99% Occupied Bandwidth and 26dB Bandwidth Measurement

5.4.1. Test Specification

Test Method:	FCC part 2.1049
Limit:	N/A
Test Setup:	
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03 Section 4.2. 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider. 3. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 4. The 99% occupied bandwidth were measured, set RBW= 1% of OBW, VBW= 3*RBW, sample detector, trace maximum hold. 5. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW= 3*RBW, peak detector, trace maximum hold.
Test Result:	PASS

TEST RESULTS

Remark:

1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 18; recorded worst case for each Channel Bandwidth of LTE FDD Band 18.*

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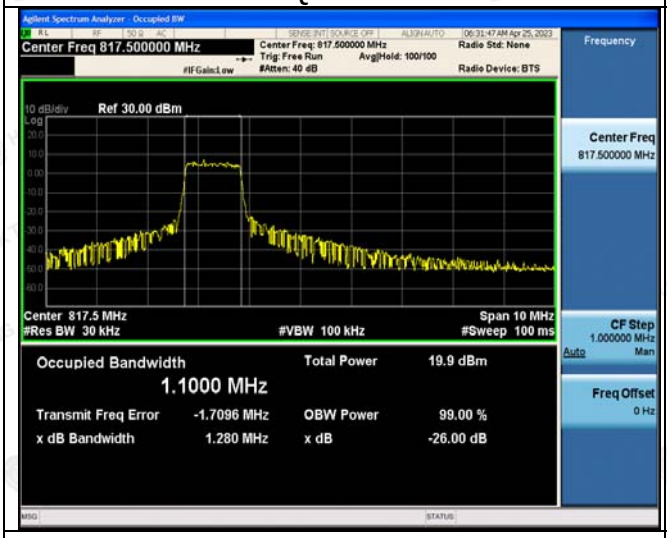
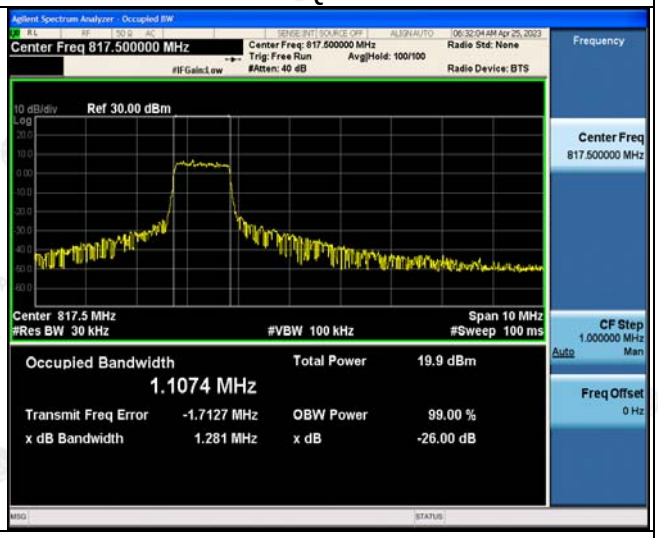
LTE FDD Band 18						
TX Channel Bandwidth	RB Size/Offset	Frequency (MHz)	-26dBc Emission bandwidth (MHz)		99% Occupied bandwidth (MHz)	
			QPSK	16QAM	QPSK	16QAM
5 MHz	*6RB#0*	817.5	1.280	1.281	1.1000	1.1074
		822.5	1.286	1.300	1.0934	1.0912
		827.5	1.309	1.287	1.1025	1.1031
10 MHz	*6RB#0*	820.0	1.339	1.305	1.0992	1.0999
		822.5	1.304	1.300	1.1009	1.1006
		825.0	1.287	1.290	1.1022	1.1087
15 MHz	*6RB#0*	822.5	1.292	1.308	1.1109	1.1116

LTE FDD Band 18-5MHz Channel Bandwidth	
QPSK	*16QAM*
	
6RB#0	*6RB#0*

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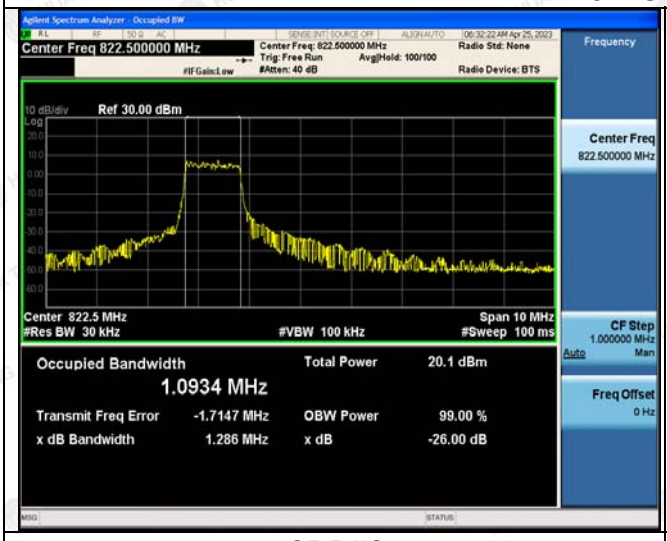
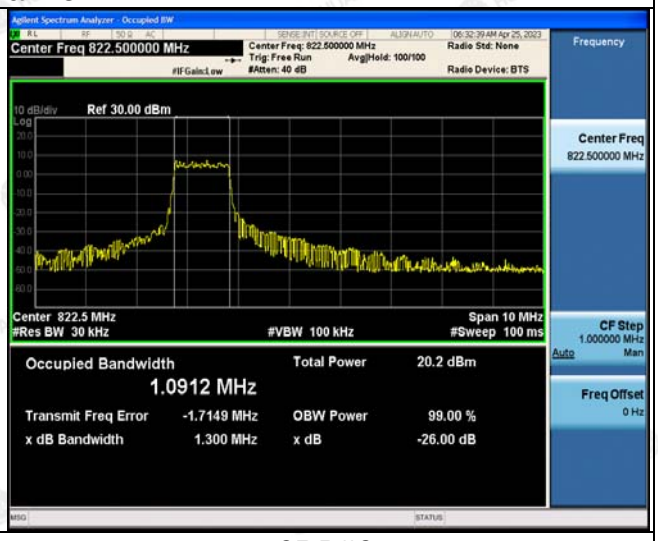
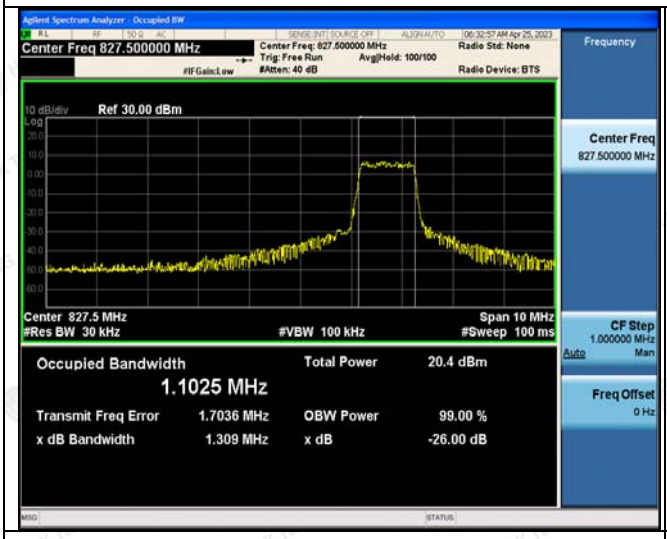
Low Channel	
	
6RB#0	6RB#0
Middle Channel	
	
6RB#0	6RB#0
High Channel	

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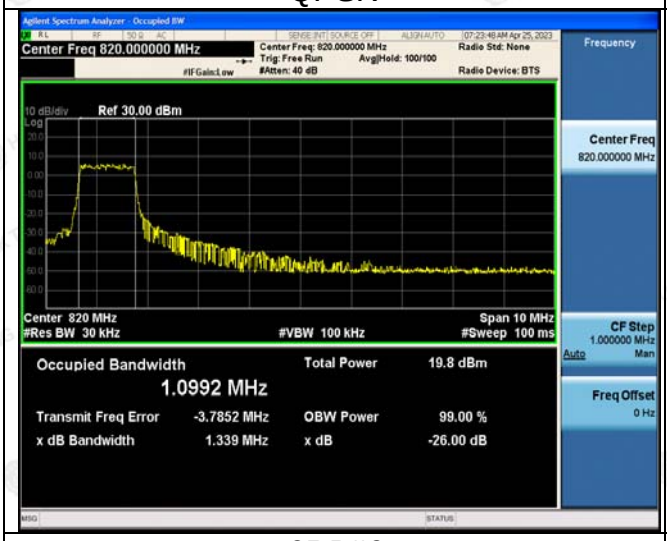
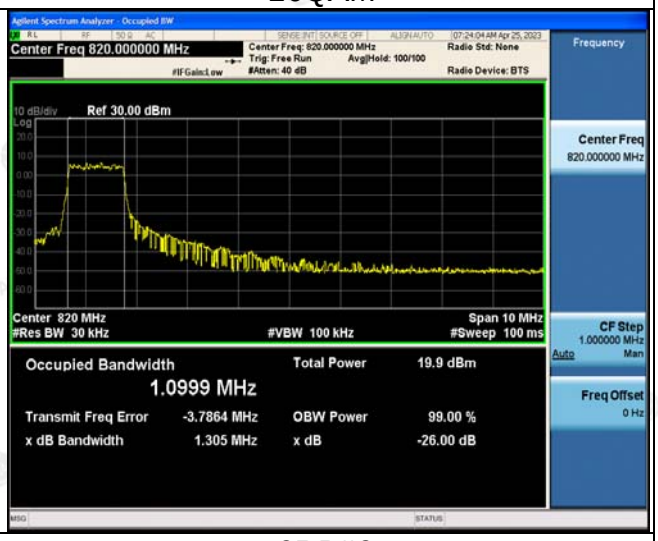
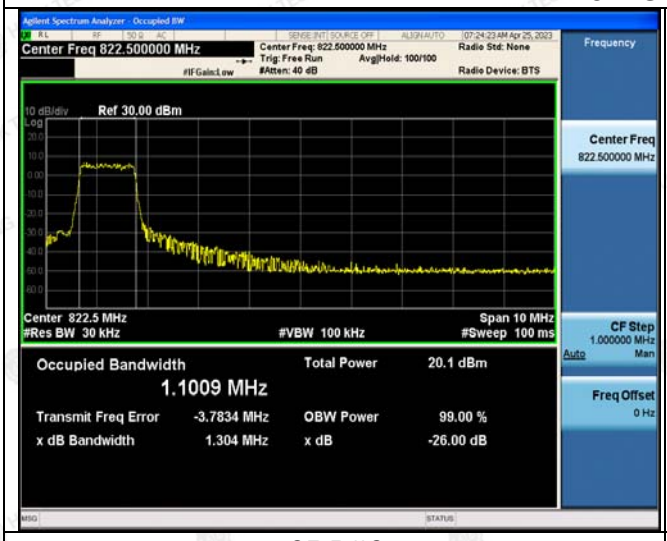
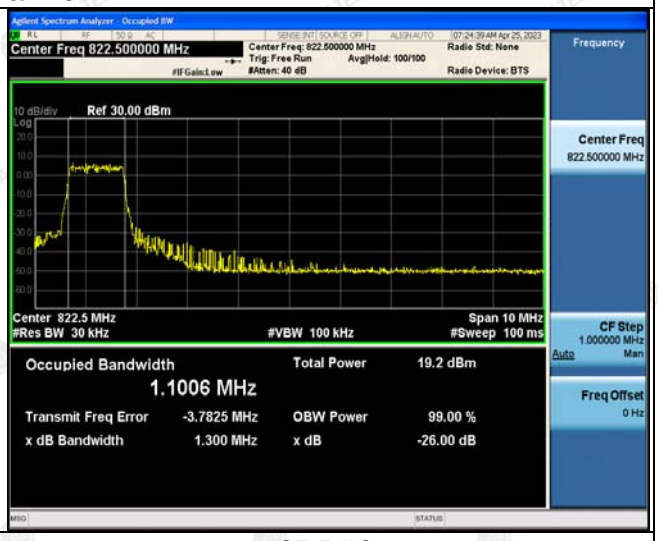
LTE FDD Band 18-10MHz Channel Bandwidth	
QPSK	16QAM
	
6RB#0	6RB#0
Low Channel	
	
6RB#0	6RB#0
Middle Channel	

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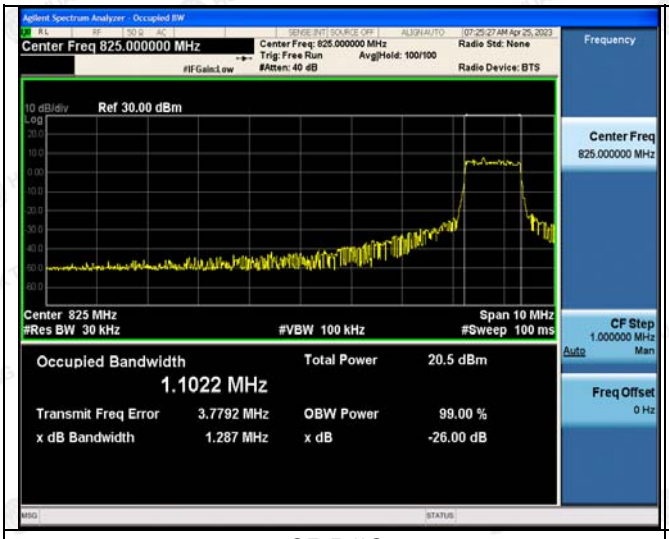
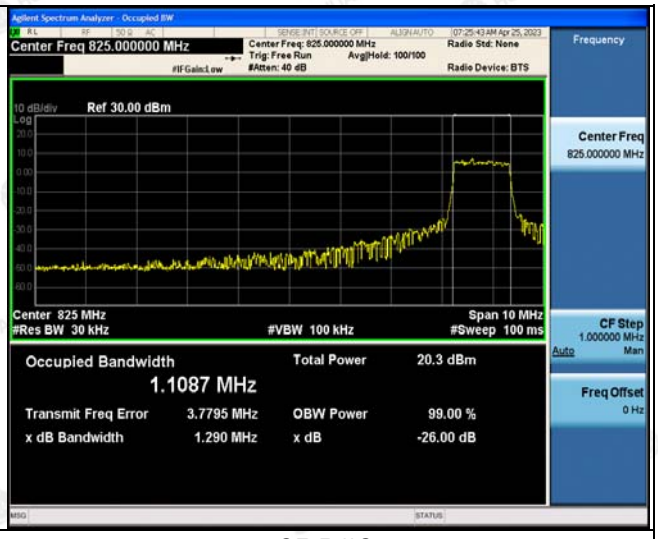
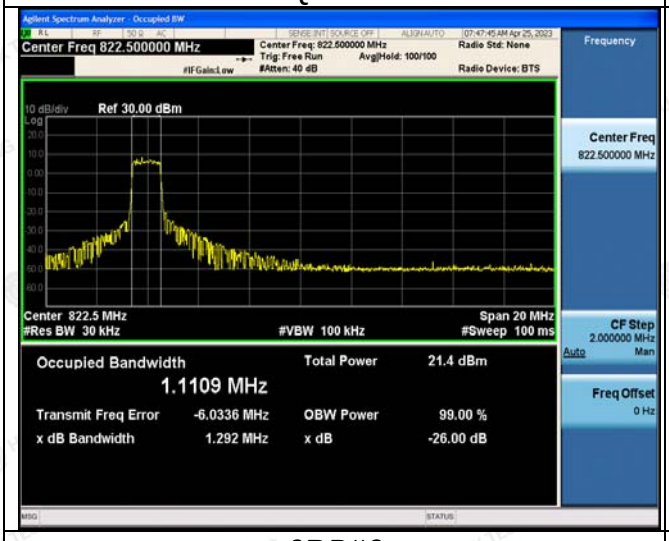
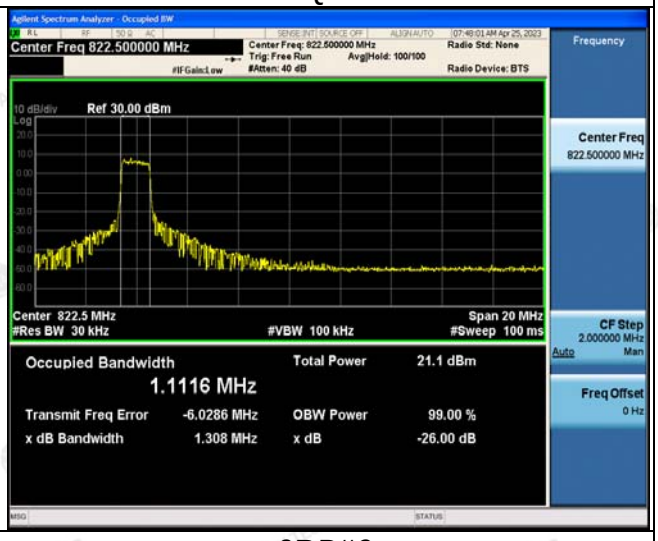
	
6RB#0	*6RB#0*
High Channel	

LTE FDD Band 18-15MHz Channel Bandwidth	
QPSK	*16QAM*
	
6RB#0	*6RB#0*
Low Channel	

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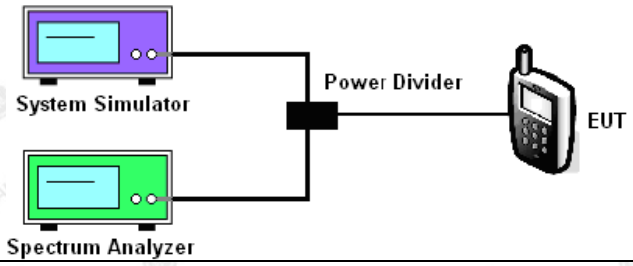
5.5. Band Edge and Conducted Spurious Emission Measurement

5.5.1. Test Specification

Test Requirement:	FCC part 90.691
Test Method:	FCC part2.1051
Limit:	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.
Test Setup:	
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03 Section 6.0. 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider. 3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement. 4. The band edges of low and high channels for the highest RF powers were measured. 5. The conducted spurious emission for the whole frequency range was taken. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

.

TEST RESULTS

Remark:

1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 18; recorded worst case for each Channel Bandwidth of LTE FDD Band 18.*

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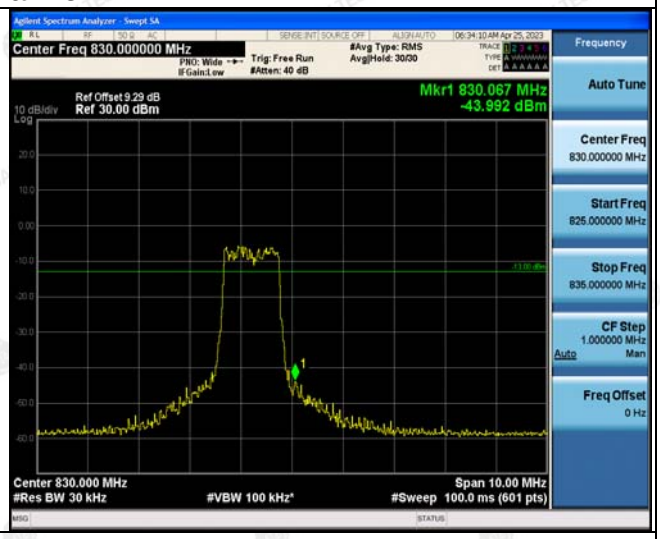
LTE FDD Band 18-5MHz Channel Bandwidth Band Edge Compliance	
QPSK	16QAM
	
6RB#0	6RB#0
Low Channel	
	
6RB#0	6RB#0
High Channel	

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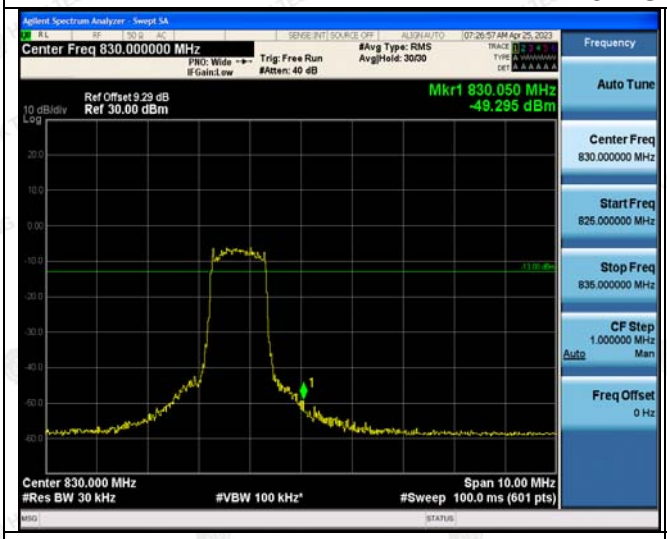
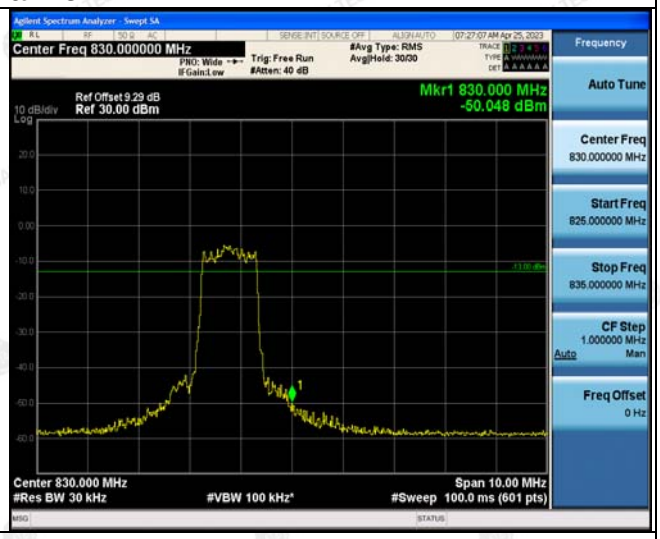
LTE FDD Band 18-10MHz Channel Bandwidth Band Edge Compliance	
QPSK	16QAM
	
6RB#0	6RB#0
Low Channel	
	
6RB#0	6RB#0
High Channel	

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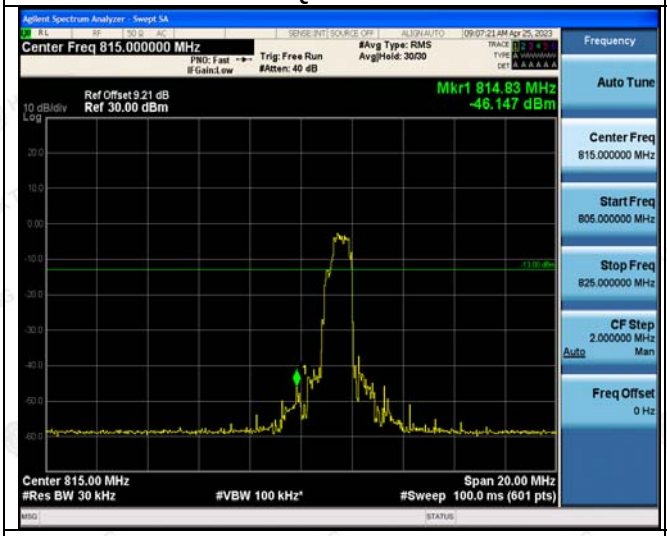
LTE FDD Band 18-15MHz Channel Bandwidth Band Edge Compliance	
QPSK	*16QAM*
	
6RB#0	*6RB#0*

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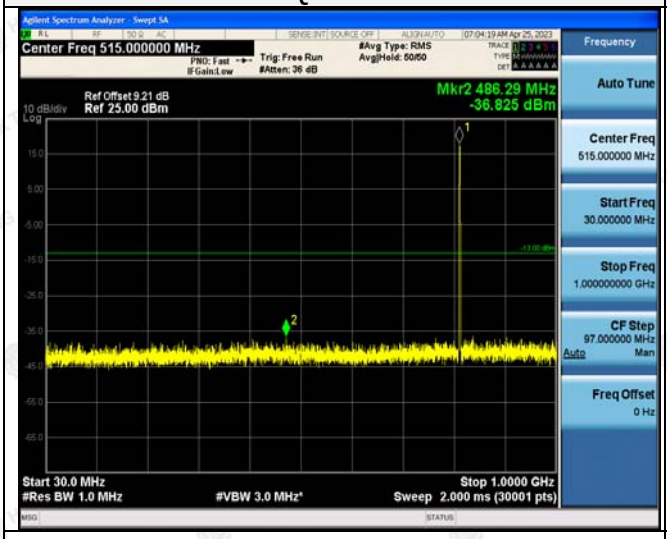
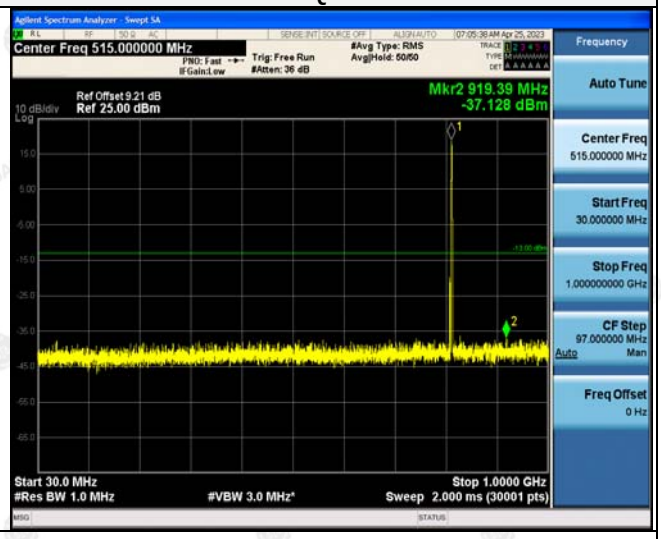
Conducted Measurement:

LTE FDD Band 18-5MHz Channel Bandwidth	
Low Channel	
QPSK	*16QAM*
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz~5GHz	*1GHz~5GHz*

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5GHz~12GHz

5GHz~12GHz

12GHz~26.5GHz

1RB#0

12GHz~26.5GHz

1RB#0

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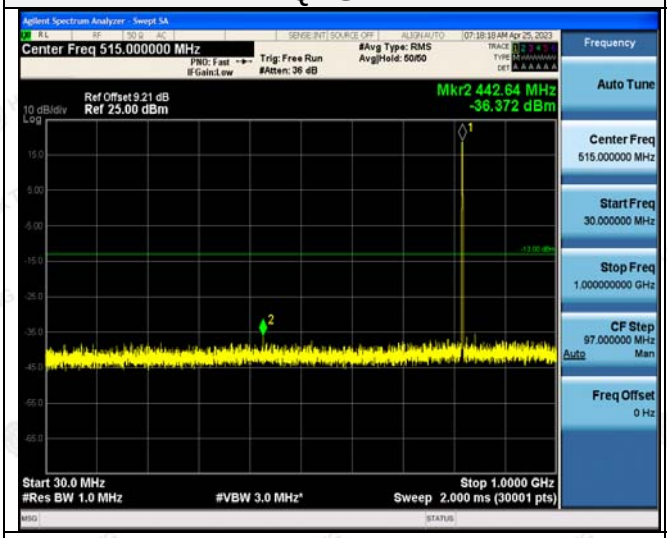
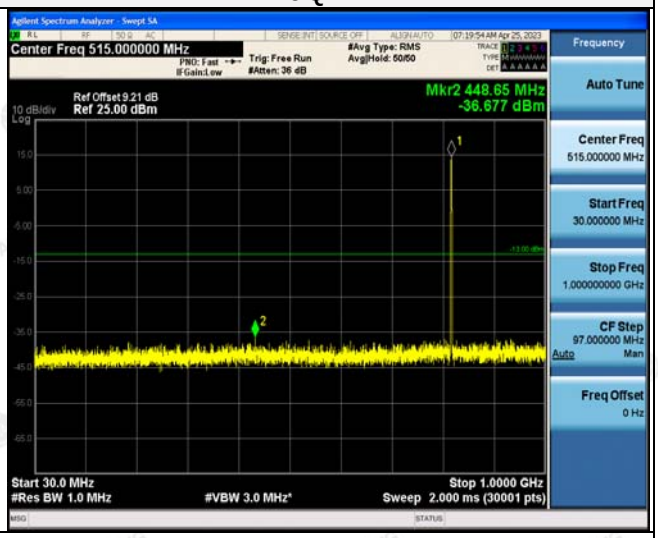
LTE FDD Band 18-5MHz Channel Bandwidth	
Middle Channel	
QPSK	*16QAM*
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz~5GHz	*1GHz~5GHz*

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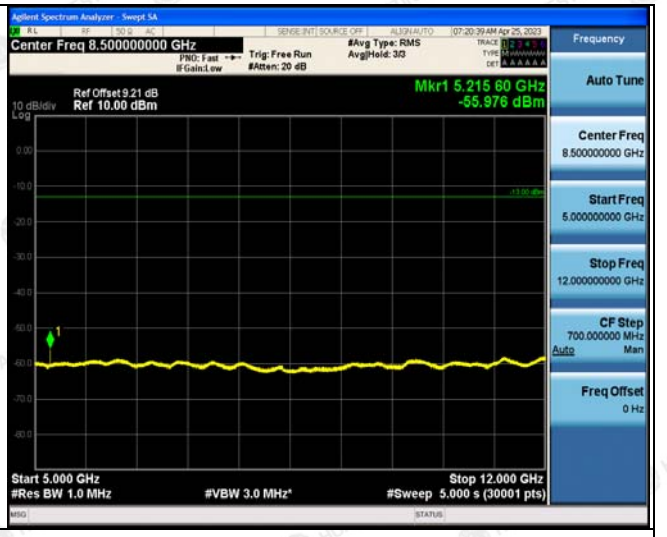
5GHz~12GHz



5GHz~12GHz

12GHz~26.5GHz

1RB#0

12GHz~26.5GHz

1RB#0

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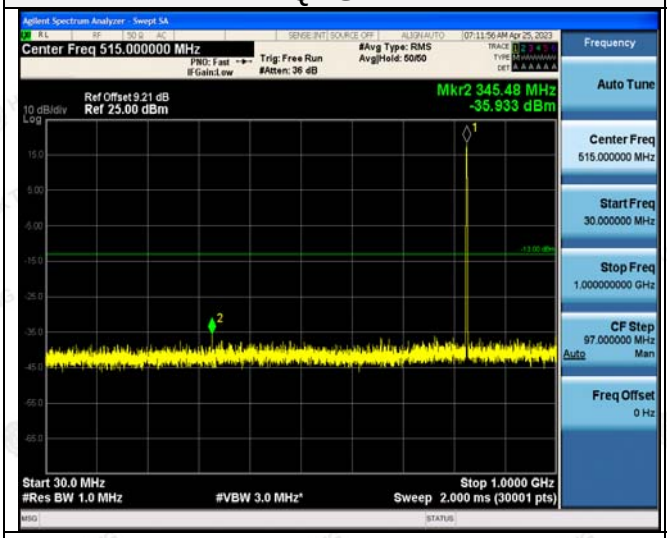
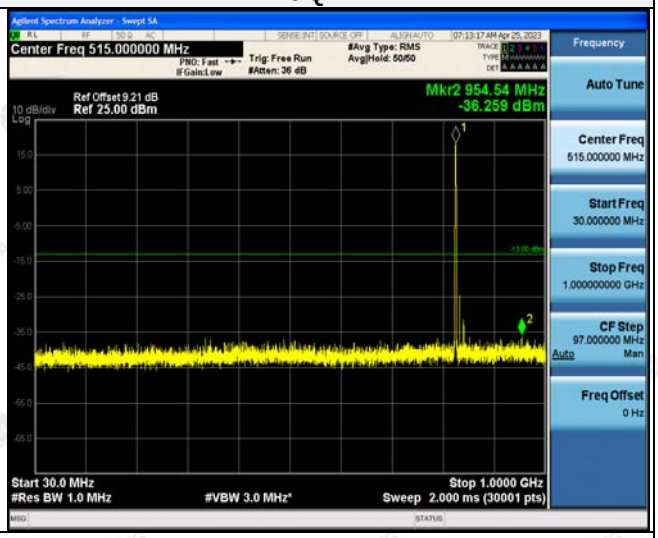
LTE FDD Band 18-5MHz Channel Bandwidth	
High Channel	
QPSK	*16QAM*
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz~5GHz	*1GHz~5GHz*

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5GHz~12GHz

5GHz~12GHz

12GHz~26.5GHz

1RB#0

12GHz~26.5GHz

1RB#0

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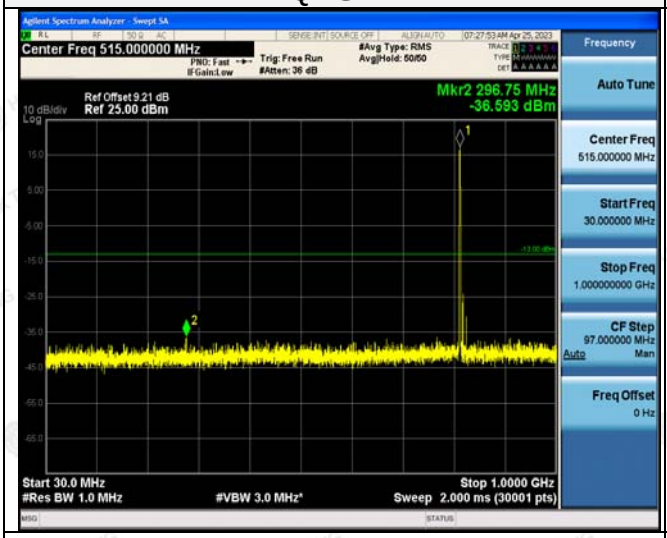
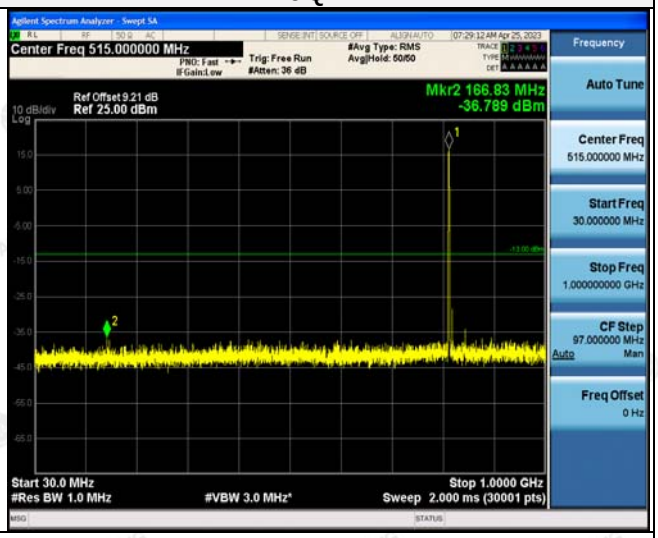
LTE FDD Band 18-10MHz Channel Bandwidth	
Low Channel	
QPSK	*16QAM*
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz~5GHz	*1GHz~5GHz*

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5GHz~12GHz

5GHz~12GHz

12GHz~26.5GHz

1RB#0

12GHz~26.5GHz

1RB#0

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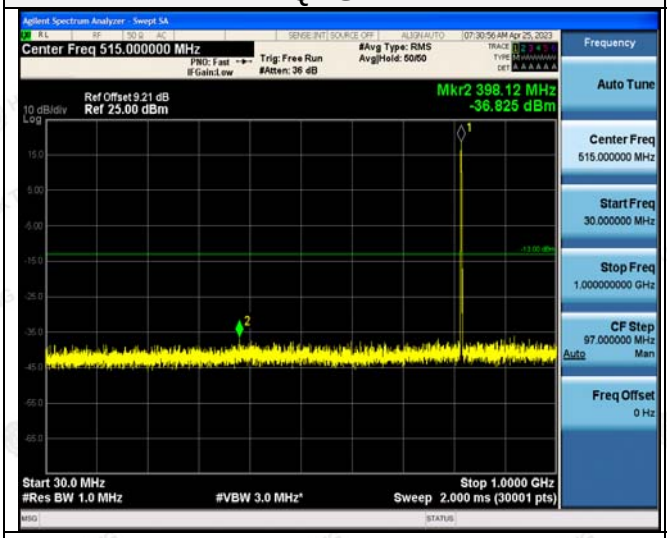
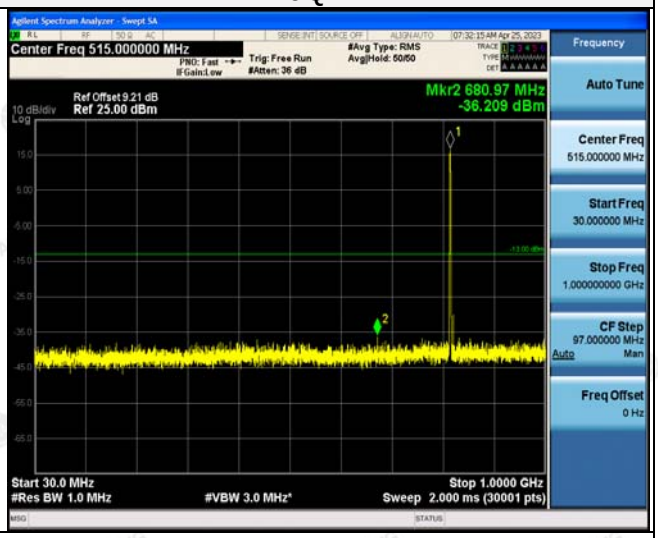
LTE FDD Band 18-10MHz Channel Bandwidth	
Middle Channel	
QPSK	*16QAM*
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz~5GHz	*1GHz~5GHz*

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5GHz~12GHz

5GHz~12GHz

12GHz~26.5GHz

1RB#0

12GHz~26.5GHz

1RB#0

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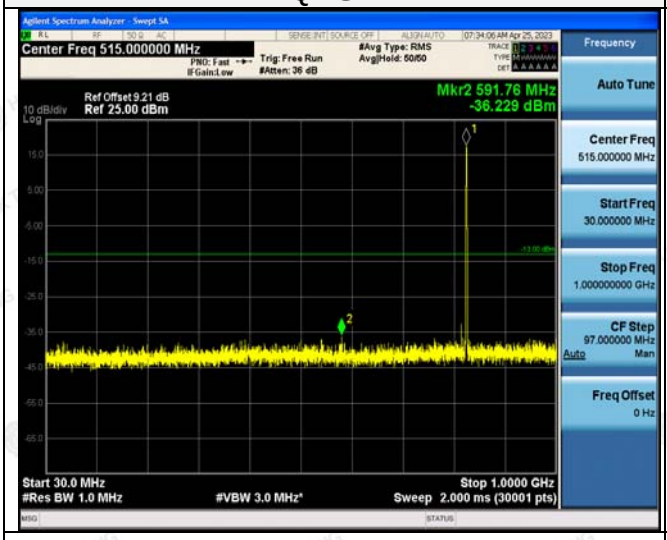
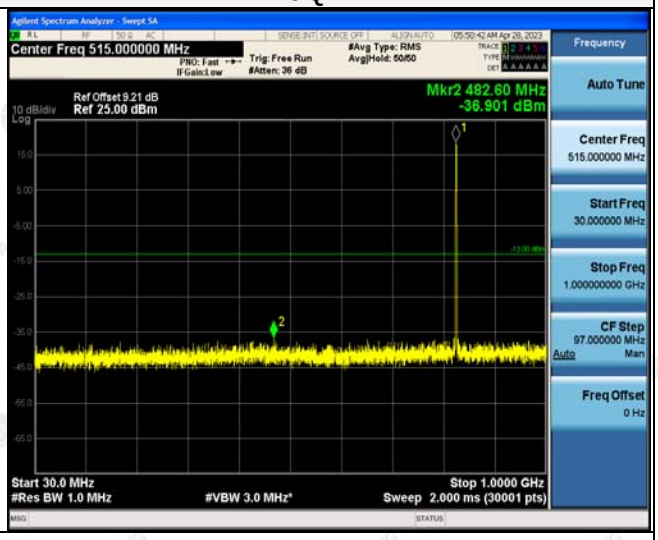
LTE FDD Band 18-10MHz Channel Bandwidth	
High Channel	
QPSK	*16QAM*
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz~5GHz	*1GHz~5GHz*

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5GHz~12GHz

5GHz~12GHz

12GHz~26.5GHz

1RB#0

12GHz~26.5GHz

1RB#0

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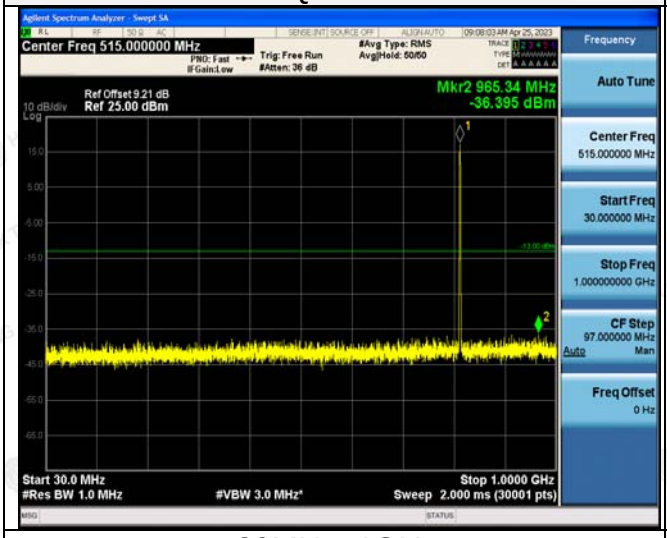
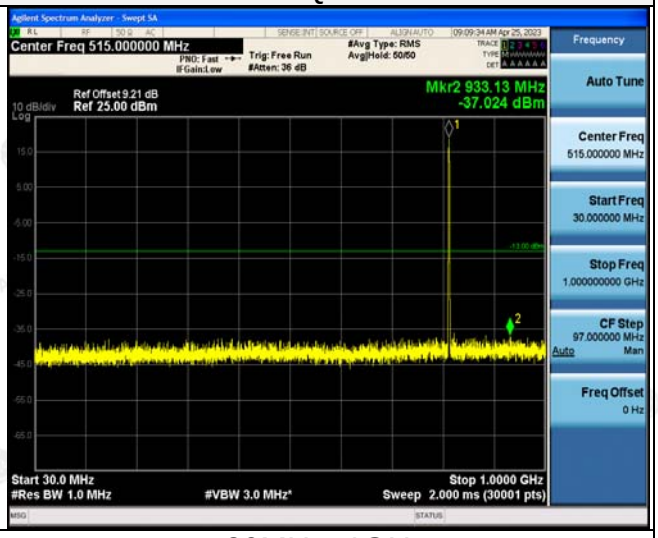
LTE FDD Band 18-15MHz Channel Bandwidth	
QPSK	*16QAM*
	
30MHz~1GHz	*30MHz~1GHz*
	
1GHz~5GHz	*1GHz~5GHz*

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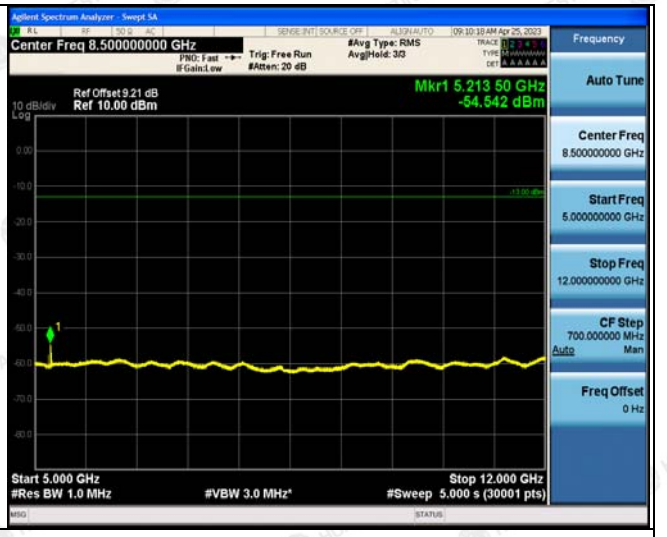
5GHz~12GHz



5GHz~12GHz

12GHz~26.5GHz

1RB#0

12GHz~26.5GHz

1RB#0

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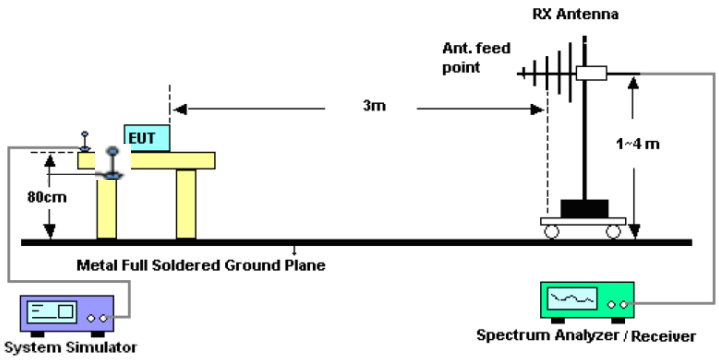
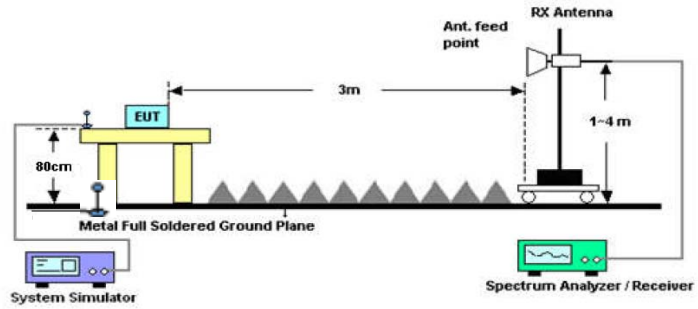
Field Strength of Spurious Radiation Measurement

5.5.2. Test Specification

Test Requirement:	FCC part90.691
Test Method:	FCC part 2.1053
Limit:	30MHz~20GHz -13dBm
Test setup:	From 30MHz to 1GHz  Above 1GHz 
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03 Section 5.8 and ANSI / TIA-603-D-2010Section 2.2.12. 2. The EUT was placed on a rotatable wooden table 0.8 meters above the ground. 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower. 4. The table was rotated 360 degrees to determine the position of the highest spurious emission. 5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.

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	6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission. 7. A horn antenna was substituted in place of the EUT and was driven by a signal generator. 8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission. 9. Taking the record of output power at antenna port. 10. Repeat step 7 to step 8 for another polarization. 11. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain 12. ERP (dBm) = EIRP - 2.15 13. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test results:	PASS

Radiated Measurement:

Remark:

1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 18; recorded worst case for each Channel Bandwidth of LTE FDD Band 18.*
2. *EIRP=P_{Mea}(dBm)-P_{cl}(dB) +G_a(dBi)*
3. *We were not recorded other points as values lower than limits.*
4. *Margin = Limit - EIRP*

LTE FDD Band 18_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
1635.0	-36.18	2.86	3.00	7.25	-33.94	-13.00	20.94	H
2452.5	-41.87	2.94	3.00	9.53	-37.43	-13.00	24.43	H
1635.0	-45.33	2.86	3.00	7.25	-43.09	-13.00	30.09	V
2452.5	-47.67	2.94	3.00	9.53	-43.23	-13.00	30.23	V

LTE FDD Band 18_Channel Bandwidth 5MHz_QPSK_ Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1645.0	-34.04	2.86	3.00	7.25	-31.8	-13.00	18.8	H
2467.5	-40.61	2.94	3.00	9.53	-36.17	-13.00	23.17	H
1645.0	-41.63	2.86	3.00	7.25	-39.39	-13.00	26.39	V
2467.5	-48.52	2.94	3.00	9.53	-44.08	-13.00	31.08	V

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LTE FDD Band 18_Channel Bandwidth 5MHz_QPSK_ High Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1655.0	-41.15	2.86	3.00	7.25	-38.91	-13.00	25.91	H
2482.5	-43.67	2.94	3.00	9.53	-39.23	-13.00	26.23	H
1655.0	-49.91	2.86	3.00	7.25	-47.67	-13.00	34.67	V
2482.5	-53.25	2.94	3.00	9.53	-48.81	-13.00	35.81	V

LTE FDD Band 18_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
1640.0	-34.64	2.86	3.00	7.25	-32.4	-13.00	19.4	H
2460.0	-43.05	2.94	3.00	9.53	-38.61	-13.00	25.61	H
1640.0	-44.56	2.86	3.00	7.25	-42.32	-13.00	29.32	V
2460.0	-47.72	2.94	3.00	9.53	-43.28	-13.00	30.28	V

LTE FDD Band 18_Channel Bandwidth 10MHz_QPSK_ Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1645.0	-39.54	2.86	3.00	7.25	-37.3	-13.00	24.3	H
2467.5	-39.39	2.94	3.00	9.53	-34.95	-13.00	21.95	H
1645.0	-41.96	2.86	3.00	7.25	-39.72	-13.00	26.72	V
2467.5	-50.1	2.94	3.00	9.53	-45.66	-13.00	32.66	V

LTE FDD Band 18_Channel Bandwidth 10MHz_QPSK_ High Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1650.0	-41.34	2.86	3.00	7.25	-39.1	-13.00	26.1	H
2475.0	-44.28	2.94	3.00	9.53	-39.84	-13.00	26.84	H
1650.0	-50.76	2.86	3.00	7.25	-48.52	-13.00	35.52	V
2475.0	-53.14	2.94	3.00	9.53	-48.7	-13.00	35.7	V

LTE FDD Band 18_Channel Bandwidth 15MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1645.0	-31.14	2.86	3.00	7.25	-28.9	-13.00	15.9	H
2467.5	-41.85	2.94	3.00	9.53	-37.41	-13.00	24.41	H
1645.0	-45.23	2.86	3.00	7.25	-42.99	-13.00	29.99	V
2467.5	-46.82	2.94	3.00	9.53	-42.38	-13.00	29.38	V

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LTE FDD Band 18_Channel Bandwidth 5MHz_16QAM _ Low Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1635.0	-35.37	2.86	3.00	7.25	-33.13	-13.00	20.13	H
2452.5	-43.82	2.94	3.00	9.53	-39.38	-13.00	26.38	H
1635.0	-44.85	2.86	3.00	7.25	-42.61	-13.00	29.61	V
2452.5	-48.73	2.94	3.00	9.53	-44.29	-13.00	31.29	V

LTE FDD Band 18_Channel Bandwidth 5MHz_16QAM _ Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1645.0	-34.68	2.86	3.00	7.25	-32.44	-13.00	19.44	H
2467.5	-40.57	2.94	3.00	9.53	-36.13	-13.00	23.13	H
1645.0	-41.31	2.86	3.00	7.25	-39.07	-13.00	26.07	V
2467.5	-49.52	2.94	3.00	9.53	-45.08	-13.00	32.08	V

LTE FDD Band 18_Channel Bandwidth 5MHz_16QAM _ High Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1655.0	-40.07	2.86	3.00	7.25	-37.83	-13.00	24.83	H
2482.5	-43.95	2.94	3.00	9.53	-39.51	-13.00	26.51	H
1655.0	-49.16	2.86	3.00	7.25	-46.92	-13.00	33.92	V
2482.5	-53.34	2.94	3.00	9.53	-48.9	-13.00	35.9	V

LTE FDD Band 18_Channel Bandwidth 10MHz_16QAM _ Low Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1640.0	-35.17	2.86	3.00	7.25	-32.93	-13.00	19.93	H
2460.0	-41.91	2.94	3.00	9.53	-37.47	-13.00	24.47	H
1640.0	-45.11	2.86	3.00	7.25	-42.87	-13.00	29.87	V
2460.0	-48.56	2.94	3.00	9.53	-44.12	-13.00	31.12	V

LTE FDD Band 18_Channel Bandwidth 10MHz_16QAM _ Middle Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1645.0	-33.98	2.86	3.00	7.25	-31.74	-13.00	18.74	H
2467.5	-39.84	2.94	3.00	9.53	-35.4	-13.00	22.4	H
1645.0	-40.57	2.86	3.00	7.25	-38.33	-13.00	25.33	V
2467.5	-49.44	2.94	3.00	9.53	-45	-13.00	32	V

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LTE FDD Band 18_Channel Bandwidth 10MHz_16QAM _ High Channel

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1650.0	-40.17	2.86	3.00	7.25	-37.93	-13.00	24.93	H
2475.0	-44.22	2.94	3.00	9.53	-39.78	-13.00	26.78	H
1650.0	-49.36	2.86	3.00	7.25	-47.12	-13.00	34.12	V
2475.0	-54.4	2.94	3.00	9.53	-49.96	-13.00	36.96	V

LTE FDD Band 18_Channel Bandwidth 15MHz_16QAM

Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Diatance	G_a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1645.0	-36.15	2.86	3.00	7.25	-33.91	-13.00	20.91	H
2467.5	-42.56	2.94	3.00	9.53	-38.12	-13.00	25.12	H
1645.0	-43.71	2.86	3.00	7.25	-41.47	-13.00	28.47	V
2467.5	-46.41	2.94	3.00	9.53	-41.97	-13.00	28.97	V

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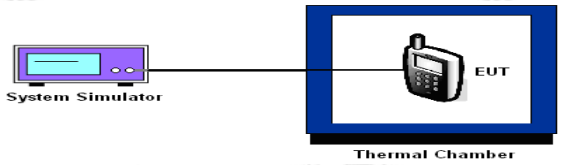
5.6. Frequency Stability Measurement

5.6.1. Test Specification

Test Requirement:	FCC part 90.213
Test Method:	FCC Part 2.1055
Limit:	±2.5 ppm
Test Setup:	
Test Procedure:	**Test Procedures for Temperature Variation** 1. The testing follows FCC KDB 971168 D01v03 Section 9.0. 2. The EUT was set up in the thermal chamber and connected with the system simulator. 3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute. 4. With power OFF, the temperature was raised in 10°C steps up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute. **Test Procedures for Voltage Variation** 1. The testing follows FCC KDB 971168 D01v03 Section 9.0. 2. The EUT was placed in a temperature chamber at 25±5° C and connected with the system simulator. 3. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT. 4. The variation in frequency was measured for the worst case.
Test Result:	PASS

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TEST RESULTS

Remark:
1. We tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 18; recorded worst case.

LTE Band 18, 5MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)		Limit (ppm)
	QPSK	16QAM	QPSK	16QAM	
3.15	4.86	4.21	0.005945	0.005150	2.50
3.70	4.50	-3.59	0.005505	-0.004391	2.50
4.26	3.71	3.15	0.004538	0.003853	2.50

Frequency Error vs Temperature

Temperature (℃)	Frequency error (Hz)		Frequency error (ppm)		Limit (ppm)
	QPSK	16QAM	QPSK	16QAM	
-30°	4.15	-4.61	0.005076	-0.005639	2.50
-20°	-5.61	4.10	-0.006862	0.005015	2.50
-10°	4.32	4.75	0.005284	0.005810	2.50
0°	-3.82	-3.99	-0.004673	-0.004881	2.50
10°	4.11	-4.44	0.005028	-0.005431	2.50
20°	4.20	-3.80	0.005138	-0.004648	2.50
30°	5.52	4.84	0.006711	0.005884	2.50
40°	6.54	5.99	0.007951	0.007283	2.50
50°	7.23	5.30	0.008790	0.006444	2.50

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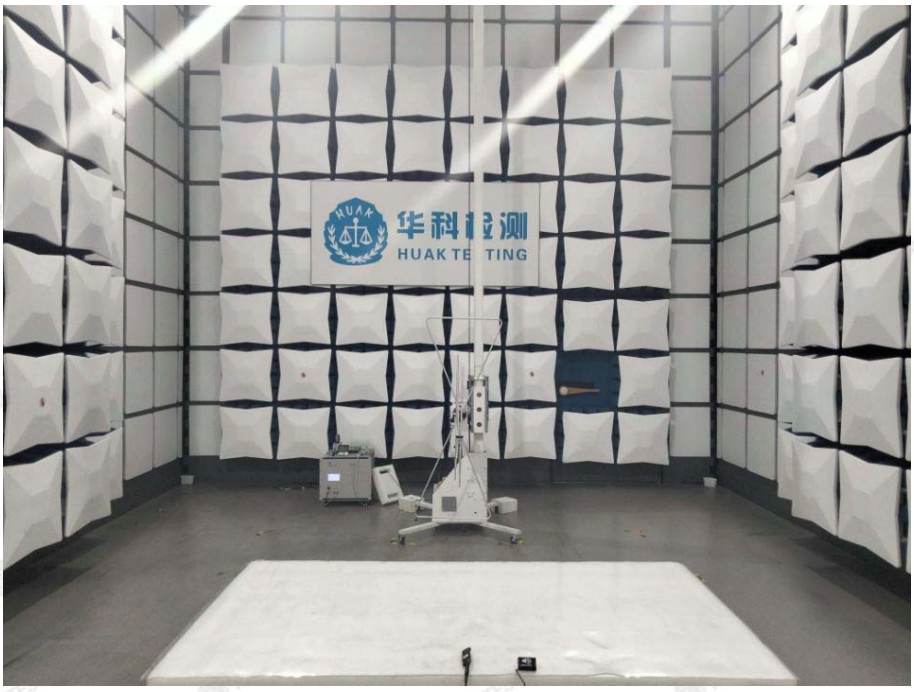
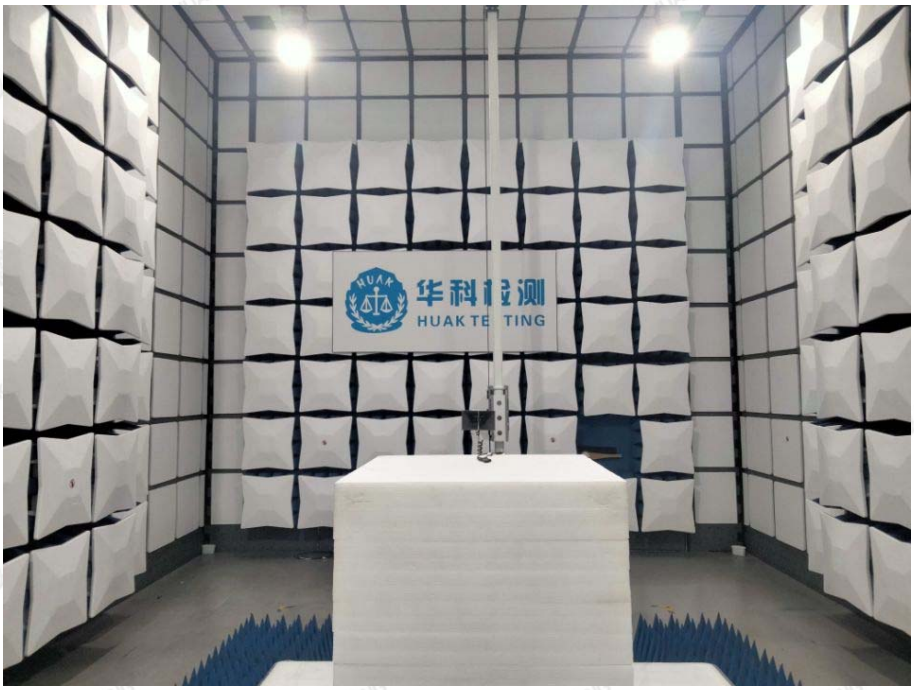
6. Photographs of Test Setup

Radiated Emission





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7. Photographs of EUT

Refer to test report ANNEX A of external photos and ANNEX B of internal photos

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

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