



FCC PART 24TEST REPORT

Part 24 Subpart E

Report Reference No.....: HK2007171893-1E

FCC ID.....: 2AHH4TL-403

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Date of issue.....: Jul. 29, 2020

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Applicant's name.....: Toplovo Industrial Co.,Ltd

Address: Building B2b, Yingzhan Industrial Park Kengzi Town, Longgang
District, Shenzhen, China

Test specification

Standard: FCC CFR Title 47 Part 2, Part 24E

TRF Originator.....: Shenzhen HUAK Testing Technology Co., Ltd.

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Test item description: Personal GPS tracker

Trade Mark: N/A

Manufacturer.....: Toplovo Industrial Co.,Ltd

Model/Type reference.....: TL-403

Listed Models: N/A

Modulation Type: QPSK, 16QAM

Rating: DC 5V from USB or DC3.7V By Battery

Hardware version: V05

Software version.....: V05

Result.....: **PASS**

**TEST REPORT**

Test Report No. :	HK2007171893-1E	Jul. 29, 2020
		Date of issue

Equipment under Test : Personal GPS tracker

Model /Type : TL-403

Listed Models : N/A

Applicant : **Toplovo Industrial Co.,Ltd**

Address : Building B2b, Yingzhan Industrial Park Kengzi Town,
Longgang District, Shenzhen, China

Manufacturer : **Toplovo Industrial Co.,Ltd**

Address : Building B2b, Yingzhan Industrial Park Kengzi Town,
Longgang District, Shenzhen, China

Test Result:	PASS
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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.



Revision History

Revision	Issue Date	Revisions	Revised By
V1.0	2020-07-29	Initial Issue	Jasou Zhou



Contents

<u>1</u>	<u>TEST STANDARDS.....</u>	<u>5</u>
<u>2</u>	<u>SUMMARY</u>	<u>6</u>
2.1	General Remarks	6
2.2	Product Description	6
2.3	Equipment under Test	6
2.4	Short description of the Equipment under Test (EUT)	6
2.5	Test frequency list	7
2.6	Normal Accessory setting	7
2.7	EUT configuration	7
2.8	Related Submittal(s) / Grant (s)	7
2.9	Modifications	7
2.10	GeneralTest Conditions/Configurations	8
<u>3</u>	<u>TEST ENVIRONMENT.....</u>	<u>9</u>
3.1	Address of the test laboratory	9
3.2	Environmental conditions	9
3.3	Test Description	9
3.4	Equipments Used during the Test	10
<u>4</u>	<u>TEST CONDITIONS AND RESULTS.....</u>	<u>11</u>
4.1	Output Power	11
4.2	Peak-to-Average Ratio (PAR)	17
4.3	Occupied Bandwidth and Emission Bandwidth	24
4.4	Band Edge compliance	32
4.5	Spurious Emssion on Antenna Port	39
4.6	Radiated Spurious Emssion	58
4.7	Frequency Stability	65
<u>5</u>	<u>TEST SETUP PHOTOS OF THE EUT</u>	<u>67</u>



1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Part 24](#) :PUBLIC MOBILE 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:v02r02](#)MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS



2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Jul. 17, 2020
Testing commenced on	:	Jul. 18, 2020
Testing concluded on	:	Jul. 29, 2020

2.2 Product Description

The **Toplovo Industrial Co.,Ltd**'s Model:MAS-501 or the "EUT" as referred to in this report; more general information as follows,for more details, refer to the user's manual of the EUT.

Name of EUT	Personal GPS tracker
Model/Type reference:	TL-403
List Model:	N/A
Power supply:	DC 5V from USB or DC3.7V By Battery
Modulation Type	QPSK,16QAM
Antenna Type	Internal Antenna
Antenna Gain	1dBi
Operation Frequency Band	LTE Band 2
Operation frequency	LTE Band 2: 1850~1910 MHz(TX), 1930~1990 MHz(TX)
LTE Release	R8
Extreme temp. Tolerance	-30°C to +70°C
Extreme vol. Limits	3.33VDC to 4.07VDC (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 5V from USB or DC3.7V By Battery

2.4 Short description of the Equipment under Test (EUT)

2.4.1 GeneralDescription

This is a Personal GPS tracker .

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



2.5 Test frequency list

TX Channel Bandwidth	Frequency (MHz)	channel
1.4 MHz	1850.7	18607
	1880.0	18900
	1909.3	19193
3 MHz	1851.5	18615
	1880.0	18900
	1908.5	19185
5 MHz	1852.5	18625
	1880.0	18900
	1907.5	19175
10 MHz	1855.0	18650
	1880.0	18900
	1905.0	19150
15 MHz	1857.5	18675
	1880.0	18900
	1902.5	19125
20 MHz	1860.0	18700
	1880.0	18900
	1900.0	19100

2.6 Normal Accessory setting

Fully charged battery was used during the test.

2.7 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. :	/

2.8 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AHH4TL-403** filing to comply with FCC Part 24, Rules.

2.9 Modifications

No modifications were implemented to meet testing criteria.



2.10 General Test Conditions/Configurations

2.10.1 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	3.33V
	VN	3.7V
	VH	4.07V

NOTE: VL=lower extreme test voltage VN=nominal voltage
VH=upper extreme test voltage TN=normal temperature



3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
1F, Building No. 13A, Zhonghaixin Science and Technology City, No.12,6 Road, Ganli Industrial Park,
Buji Street, Longgang District, Shenzhen, Guangdong

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

PCSBand (1850-1915MHz pairedwith 1930-1995MHz)

Test Item	FCCRuleNo.	Requirements	Verdict
Effective(Isotropic)RadiatedOutputPower	Part§2.1046, Part§24.232	EIRP $\leq$ 2W	Pass
Peak-AverageRatio	Part§2.1046, Part§24.232	FCC:Limit $\leq$ 13dB	Pass
Bandwidth	Part§2.1049 RSS-133	OBW: Nolimit. EBW: Nolimit.	Pass
BandEdgesCompliance	Part§2.1051, Part§24.238	$\leq$ -13dBm/1%*EBW, In1MHzbandsimmediatelyoutsideandadjacentto Thefrequency block.	Pass
SpuriousEmissionatAntennaTerminals	Part§2.1051, Part§24.238	$\leq$ -13dBm/1MHz, from9kHzto10thharmonicsbut outsideauthorized Operatingfrequency ranges.	Pass
Field Strengthof Spurious Radiation	Part§2.1053, Part§24.238	$\leq$ -13dBm/1MHz.	Pass
Frequency Stability	Part§2.1055, Part§24.235	FCC:withinauthorizedfrequency block.	Pass
NOTE 1:For the verdict,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	ENV216	R&S	HKE-059	2019/12/26	2020/12/25
LISN	R&S	ENV216	HKE-002	2019/12/26	2020/12/25
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	2019/12/26	2020/12/25
Receiver	R&S	ESCI 7	HKE-010	2019/12/26	2020/12/25
Spectrum analyzer	Agilent	N9020A	HKE-048	2019/12/26	2020/12/25
RF automatic control unit	Tonscend	JS0806-2	HKE-060	2019/12/26	2020/12/25
Horn antenna	Schwarzbeck	9120D	HKE-013	2019/12/26	2020/12/25
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	2019/12/26	2020/12/25
Preamplifier	EMCI	EMC051845SE	HKE-015	2019/12/26	2020/12/25
Preamplifier	Agilent	83051A	HKE-016	2019/12/26	2020/12/25
Temperature and humidity meter	Boyang	HTC-1	HKE-075	2019/12/26	2020/12/25
High pass filter unit	Tonscend	JS0806-F	HKE-055	2019/12/26	2020/12/25
RF cable	Times	1-40G	HKE-034	2019/12/26	2020/12/25
Power meter	Agilent	E4419B	HKE-085	2019/12/26	2020/12/25
Power Sensor	Agilent	E9300A	HKE-086	2019/12/26	2020/12/25
Wireless Communication Test Set	R&S	CMW500	HKE-026	2019/12/26	2020/12/25
Wireless Communication Test Set	R&S	CMU200	HKE-029	2019/12/26	2020/12/25
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	2019/12/26	2020/12/25



4 TEST CONDITIONS AND RESULTS

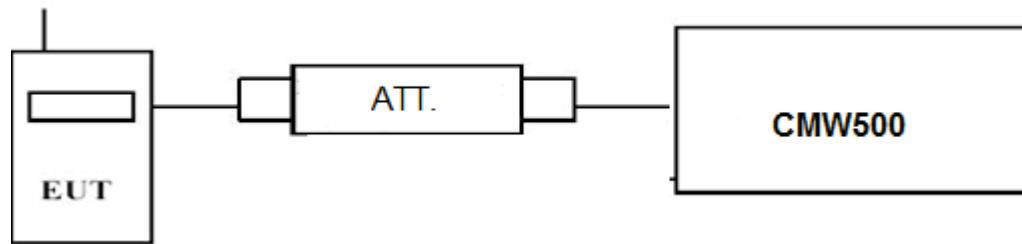
4.1 Output Power

4.1.1 Conducted 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:

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

TEST RESULTS

Remark:

- We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 2;

LTE FDD Band 2				
TX Channel Bandwidth	Frequency (MHz)	RB Size/Offset	Burst Average Power [dBm]	
			QPSK	16QAM
1.4 MHz	1850.7	1 RB low	23.42	22.51
		1 RB high	23.53	22.60
		50% RB mid	23.56	22.46
		100% RB	23.42	22.10
	1880.0	1 RB low	23.31	22.23
		1 RB high	23.19	22.11
		50% RB mid	22.38	21.41
		100% RB	23.49	22.53
	1909.3	1 RB low	23.54	21.42
		1 RB high	23.71	21.58
		50% RB mid	23.71	21.79
		100% RB	23.65	22.23
3 MHz	1851.5	1 RB low	22.88	22.31
		1 RB high	23.01	22.14
		50% RB mid	22.94	22.15
		100% RB	22.22	21.12
	1880.0	1 RB low	22.14	21.18
		1 RB high	22.07	21.20
		50% RB mid	22.12	21.18
		100% RB	23.20	22.39



	1908.5	1 RB low	23.28	22.45
		1 RB high	23.64	22.42
		50% RB mid	22.42	21.57
		100% RB	22.55	21.65
5 MHz	1852.5	1 RB low	22.98	22.18
		1 RB high	23.27	22.26
		50% RB mid	23.18	21.05
		100% RB	22.16	21.16
	1880.0	1 RB low	22.06	21.08
		1 RB high	22.10	21.17
		50% RB mid	22.08	22.35
		100% RB	23.32	22.50
	1907.5	1 RB low	23.33	22.05
		1 RB high	23.10	21.54
		50% RB mid	22.47	21.27
		100% RB	22.55	21.45
10 MHz	1855.0	1 RB low	23.98	21.69
		1 RB high	23.81	21.87
		50% RB mid	23.99	/
		100% RB	22.76	/
	1880.0	1 RB low	22.95	23.43
		1 RB high	22.73	22.87
		50% RB mid	22.76	/
		100% RB	23.63	/
	1905.0	1 RB low	21.63	22.43
		1 RB high	23.27	22.11
		50% RB mid	22.51	/
		100% RB	22.74	/
15 MHz	1857.5	1 RB low	23.82	22.94
		1 RB high	23.94	23.00
		50% RB mid	23.81	/
		100% RB	23.81	/
	1880.0	1 RB low	23.56	23.03
		1 RB high	23.78	22.57
		50% RB mid	22.86	/
		100% RB	23.97	/
	1902.5	1 RB low	24.01	22.23
		1 RB high	23.49	23.14
		50% RB mid	23.59	/
		100% RB	23.99	/
20 MHz	1860.0	1 RB low	23.82	23.76
		1 RB high	23.31	22.98
		50% RB mid	22.89	/
		100% RB	23.18	/
	1880.0	1 RB low	24.05	22.91
		1 RB high	22.98	22.91
		50% RB mid	23.77	/
		100% RB	22.91	/
	1900.0	1 RB low	23.53	22.92
		1 RB high	23.30	23.28
		50% RB mid	23.05	/
		100% RB	23.32	/

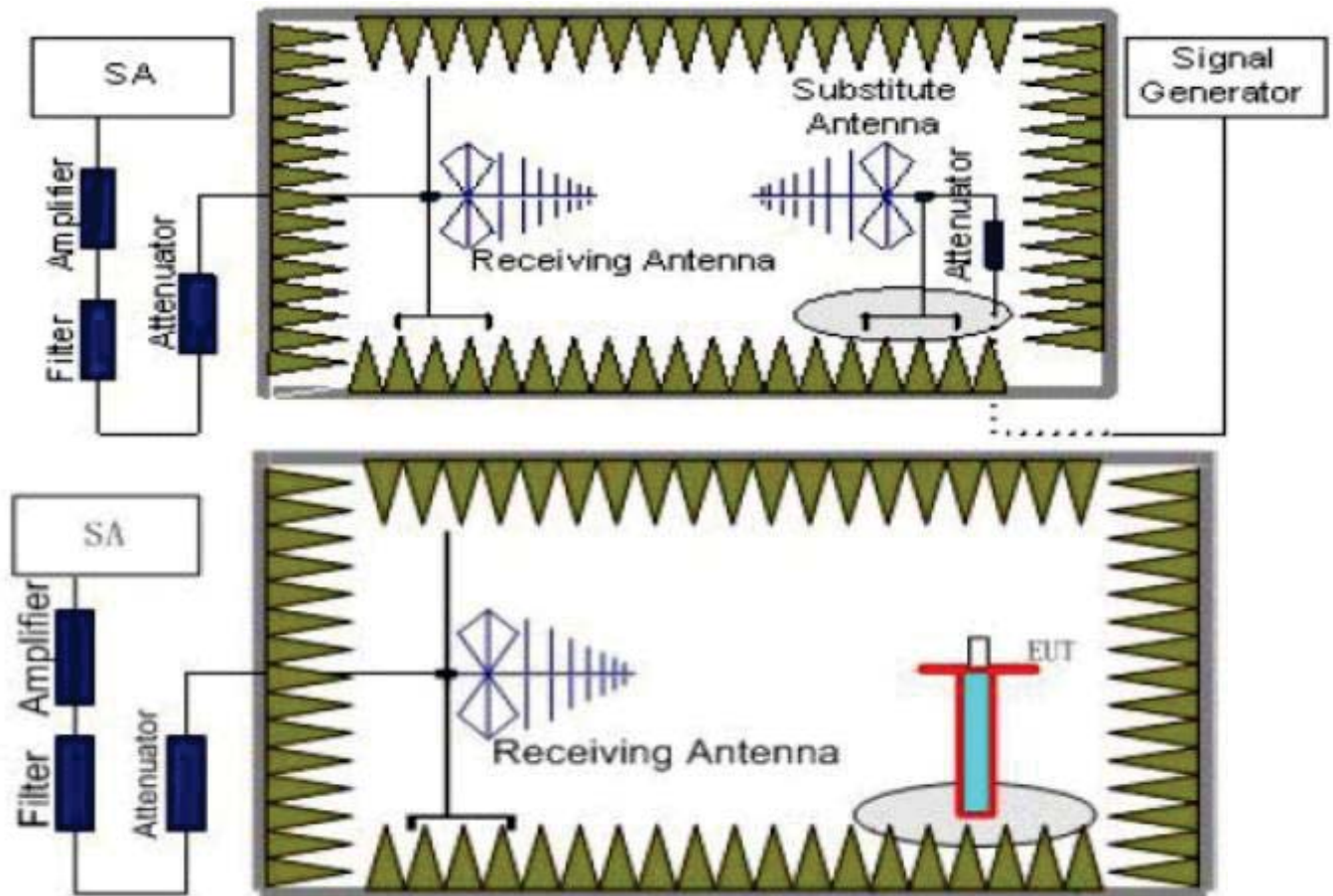
4.1.2. Radiated Output Power

LIMIT

This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(b) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p.

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 1.5 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 1.5m. 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 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 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:

$$\text{Power(EIRP)} = P_{\text{Mea}} - P_{\text{Ag}} - P_{\text{cl}} + G_a$$

We used SMF100A microwave signal generator which signal level can up to 33dBm, so we not used power Amplifier for substitution test; The measurement results are amend as described below:

$$\text{Power(EIRP)} = P_{\text{Mea}} - P_{\text{cl}} + G_a$$

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, $\text{ERP} = \text{EIRP} - 2.15\text{dBi}$.

TEST RESULTS

Radiated Measurement:

Remark:

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

LTE FDD Band 2_Channel Bandwidth 1.4MHz_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
1850.7	-14.78	3.41	10.24	33.6	25.65	33.01	7.36	V
1880.0	-15.66	3.49	10.24	33.6	24.69	33.01	8.32	V
1909.3	-15.79	3.55	10.23	33.6	24.49	33.01	8.52	V
1850.7	-14.64	3.41	10.24	33.6	25.79	33.01	7.22	H
1880.0	-15.92	3.49	10.24	33.6	24.43	33.01	8.58	H
1909.3	-15.03	3.55	10.23	33.6	25.25	33.01	7.76	H

LTE FDD Band 2_Channel Bandwidth 3MHz_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
1851.5	-15.01	3.41	10.24	33.6	25.42	33.01	7.59	V
1880.0	-15.97	3.49	10.24	33.6	24.38	33.01	8.63	V
1908.5	-15.78	3.55	10.23	33.6	24.5	33.01	8.51	V
1851.5	-14.2	3.41	10.24	33.6	26.23	33.01	6.78	H
1880.0	-15.97	3.49	10.24	33.6	24.38	33.01	8.63	H
1908.5	-15.17	3.55	10.23	33.6	25.11	33.01	7.9	H

LTE FDD Band 2_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
1852.5	-15.54	3.41	10.24	33.6	24.89	33.01	8.12	V
1880.0	-15.67	3.49	10.24	33.6	24.68	33.01	8.33	V
1907.5	-15.86	3.55	10.23	33.6	24.42	33.01	8.59	V
1852.5	-14.24	3.41	10.24	33.6	26.19	33.01	6.82	H
1880.0	-15.63	3.49	10.24	33.6	24.72	33.01	8.29	H
1907.5	-15.51	3.55	10.23	33.6	24.77	33.01	8.24	H

*LTE FDD Band 2_Channel Bandwidth 10MHz_QPSK*

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1855.0	-14.87	3.41	10.24	33.6	25.56	33.01	7.45	V
1880.0	-16.37	3.49	10.24	33.6	23.98	33.01	9.03	V
1905.0	-15.91	3.55	10.23	33.6	24.37	33.01	8.64	V
1855.0	-14.53	3.41	10.24	33.6	25.9	33.01	7.11	H
1880.0	-15.63	3.49	10.24	33.6	24.72	33.01	8.29	H
1905.0	-15.78	3.55	10.23	33.6	24.5	33.01	8.51	H

LTE FDD Band 2_Channel Bandwidth 15MHz_QPSK

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1857.5	-14.86	3.41	10.24	33.6	25.57	33.01	7.44	V
1880.0	-15.52	3.49	10.24	33.6	24.83	33.01	8.18	V
1902.5	-15.8	3.55	10.23	33.6	24.48	33.01	8.53	V
1857.5	-13.77	3.41	10.24	33.6	26.66	33.01	6.35	H
1880.0	-15.37	3.49	10.24	33.6	24.98	33.01	8.03	H
1902.5	-15.82	3.55	10.23	33.6	24.46	33.01	8.55	H

LTE FDD Band 2_Channel Bandwidth 20MHz_QPSK

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1860.0	-15.52	3.41	10.24	33.6	24.91	33.01	8.1	V
1880.0	-15.79	3.49	10.24	33.6	24.56	33.01	8.45	V
1900.0	-15.88	3.55	10.23	33.6	24.4	33.01	8.61	V
1860.0	-13.7	3.41	10.24	33.6	26.73	33.01	6.28	H
1880.0	-15.64	3.49	10.24	33.6	24.71	33.01	8.3	H
1900.0	-15.11	3.55	10.23	33.6	25.17	33.01	7.84	H

LTE FDD Band 2_Channel Bandwidth 1.4MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1850.7	-15.56	3.41	10.24	33.6	24.87	33.01	8.14	V
1880.0	-16.29	3.49	10.24	33.6	24.06	33.01	8.95	V
1909.3	-15.95	3.55	10.23	33.6	24.33	33.01	8.68	V
1850.7	-13.92	3.41	10.24	33.6	26.51	33.01	6.5	H
1880.0	-15.49	3.49	10.24	33.6	24.86	33.01	8.15	H
1909.3	-15.72	3.55	10.23	33.6	24.56	33.01	8.45	H

LTE FDD Band 2_Channel Bandwidth 3MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1851.5	-15.03	3.41	10.24	33.6	25.4	33.01	7.61	V
1880.0	-15.97	3.49	10.24	33.6	24.38	33.01	8.63	V
1908.5	-15.59	3.55	10.23	33.6	24.69	33.01	8.32	V
1851.5	-13.82	3.41	10.24	33.6	26.61	33.01	6.4	H
1880.0	-16.17	3.49	10.24	33.6	24.18	33.01	8.83	H
1908.5	-15.45	3.55	10.23	33.6	24.83	33.01	8.18	H

*LTE FDD Band 2_Channel Bandwidth 5MHz_16QAM*

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1852.5	-15.27	3.41	10.24	33.6	25.16	33.01	7.85	V
1880.0	-16.3	3.49	10.24	33.6	24.05	33.01	8.96	V
1907.5	-16.01	3.55	10.23	33.6	24.27	33.01	8.74	V
1852.5	-14.06	3.41	10.24	33.6	26.37	33.01	6.64	H
1880.0	-16.2	3.49	10.24	33.6	24.15	33.01	8.86	H
1907.5	-15.69	3.55	10.23	33.6	24.59	33.01	8.42	H

LTE FDD Band 2_Channel Bandwidth 10MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1855.0	-15.6	3.41	10.24	33.6	24.83	33.01	8.18	V
1880.0	-16.15	3.49	10.24	33.6	24.2	33.01	8.81	V
1905.0	-15.93	3.55	10.23	33.6	24.35	33.01	8.66	V
1855.0	-14.01	3.41	10.24	33.6	26.42	33.01	6.59	H
1880.0	-16.27	3.49	10.24	33.6	24.08	33.01	8.93	H
1905.0	-15.33	3.55	10.23	33.6	24.95	33.01	8.06	H

LTE FDD Band 2_Channel Bandwidth 15MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1857.5	-15.56	3.41	10.24	33.6	24.87	33.01	8.14	V
1880.0	-15.59	3.49	10.24	33.6	24.76	33.01	8.25	V
1902.5	-16.16	3.55	10.23	33.6	24.12	33.01	8.89	V
1857.5	-13.81	3.41	10.24	33.6	26.62	33.01	6.39	H
1880.0	-15.46	3.49	10.24	33.6	24.89	33.01	8.12	H
1902.5	-15.85	3.55	10.23	33.6	24.43	33.01	8.58	H

LTE FDD Band 2_Channel Bandwidth 20MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain(dB)	P _{Aq} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1860.0	-15.34	3.41	10.24	33.6	25.09	33.01	7.92	V
1880.0	-16.05	3.49	10.24	33.6	24.3	33.01	8.71	V
1900.0	-16.1	3.55	10.23	33.6	24.18	33.01	8.83	V
1860.0	-13.81	3.41	10.24	33.6	26.62	33.01	6.39	H
1880.0	-15.48	3.49	10.24	33.6	24.87	33.01	8.14	H
1900.0	-15.73	3.55	10.23	33.6	24.55	33.01	8.46	H

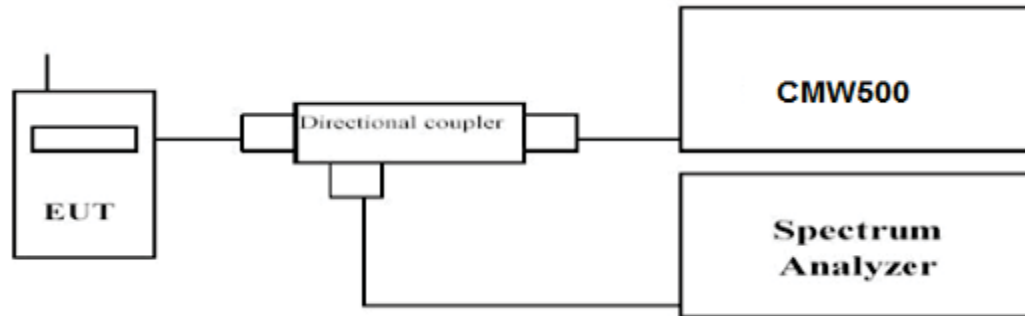


4.2 Peak-to-Average Ratio (PAR)

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 $\geq$ 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 2; recorded worst case for each Channel Bandwidth of LTE FDD Band 2.

LTE FDD Band 2				
TX Channel Bandwidth	Frequency (MHz)	RB Size/Offset	PAPR(dB)	
			QPSK	16QAM
1.4 MHz	1850.7	1RB#0	3.31	4.35
	1880.0		3.13	4.25
	1909.3		3.02	4.03
3 MHz	1851.5	1RB#0	2.48	2.92
	1880.0		2.82	3.47
	1908.5		2.81	3.40
5 MHz	1852.5	1RB#0	2.73	3.42
	1880.0		2.88	3.29
	1907.5		3.47	4.21
10 MHz	1855.0	1RB#0	4.17	3.74
	1880.0		4.16	3.59
	1905.0		3.76	3.52
15 MHz	1857.5	1RB#0	4.06	4.91
	1880.0		4.59	5.34
	1902.5		3.14	4.04
20 MHz	1860.0	1RB#0	4.10	4.88
	1880.0		4.15	5.31
	1900.0		2.94	3.86

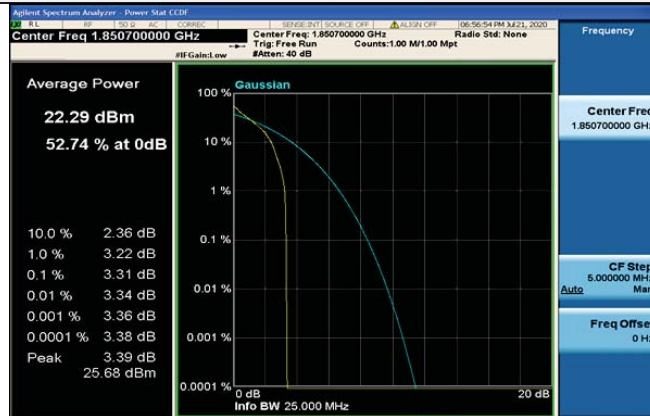


LTE FDD Band 2 – 1.4 MHz Channel Bandwidth PPR

QPSK

16QAM

Low Channel



1RB#0



1RB#0

Middle Channel



1RB#0

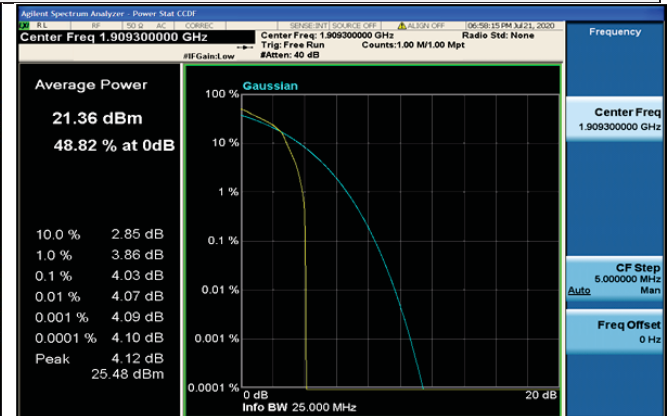


1RB#0

High Channel



1RB#0



1RB#0

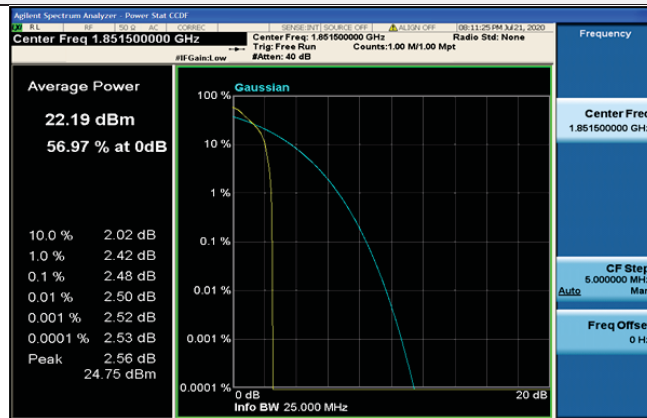


LTE FDD Band 2-3MHz Channel BandwidthPAPR

QPSK

16QAM

Low Channel



1RB#0

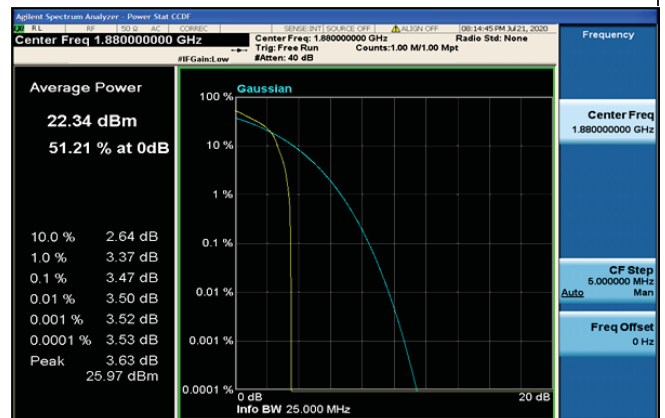


1RB#0

Middle Channel



1RB#0



1RB#0

High Channel



1RB#0



1RB#0

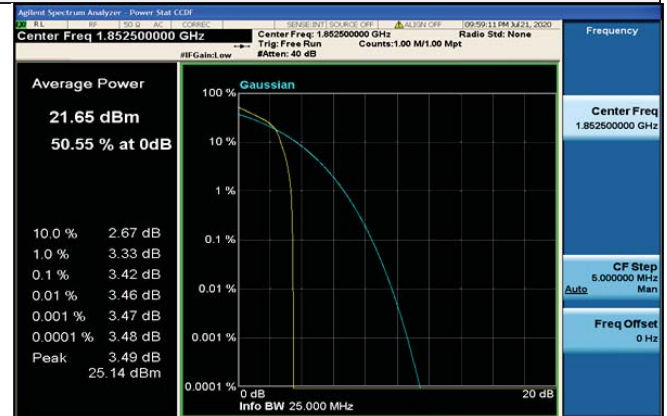
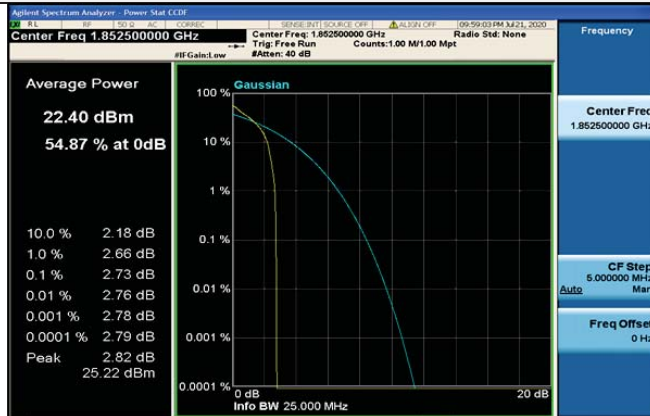


LTE FDD Band 2-5MHz Channel BandwidthPAPR

QPSK

16QAM

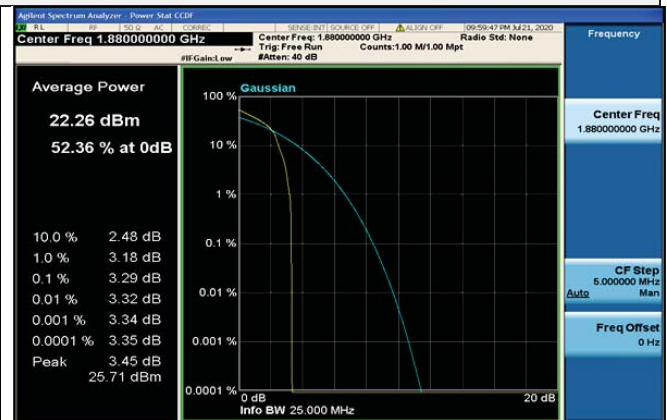
Low Channel



1RB#0

1RB#0

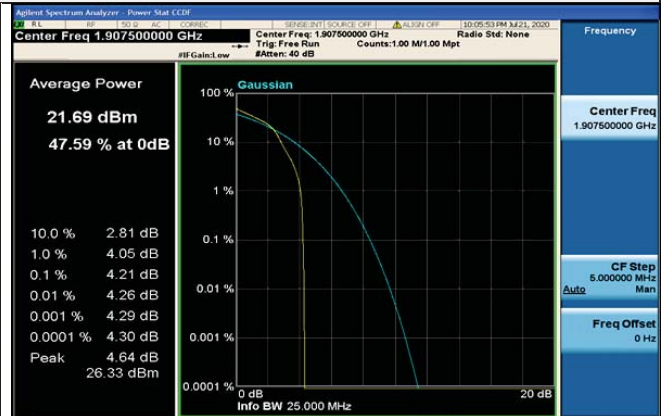
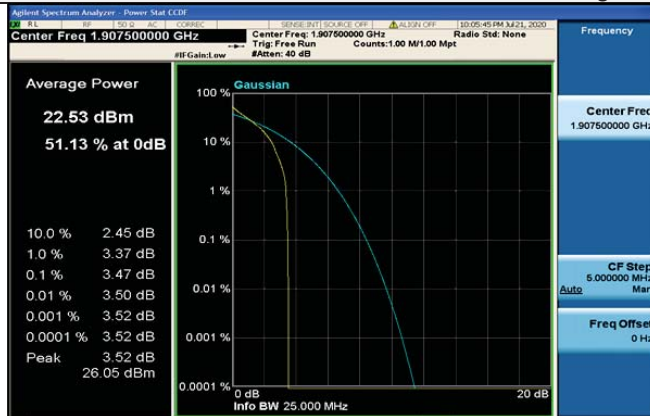
Middle Channel



1RB#0

1RB#0

High Channel



1RB#0

1RB#0

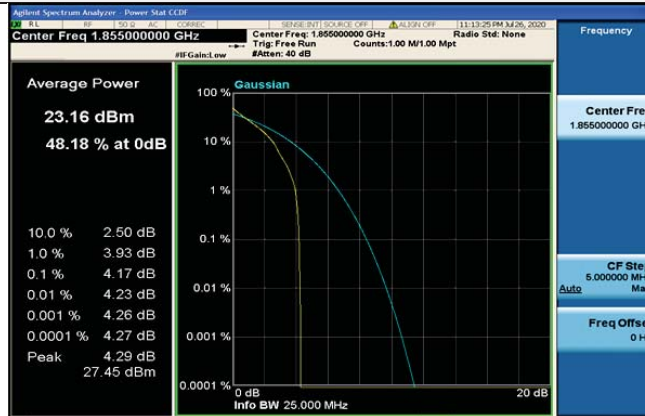


LTE FDD Band 2-10MHz Channel Bandwidth PAPR

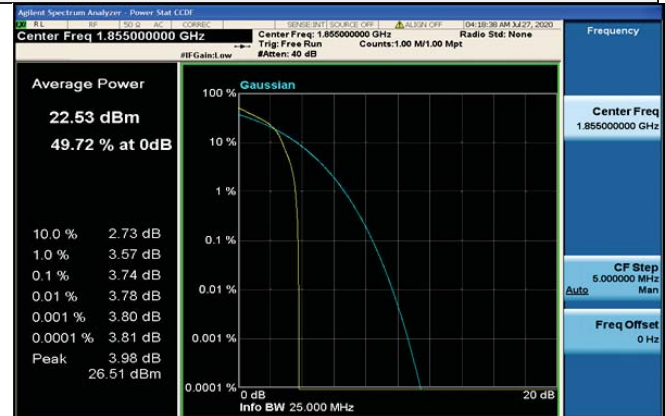
QPSK

16QAM

Low Channel



1RB#0

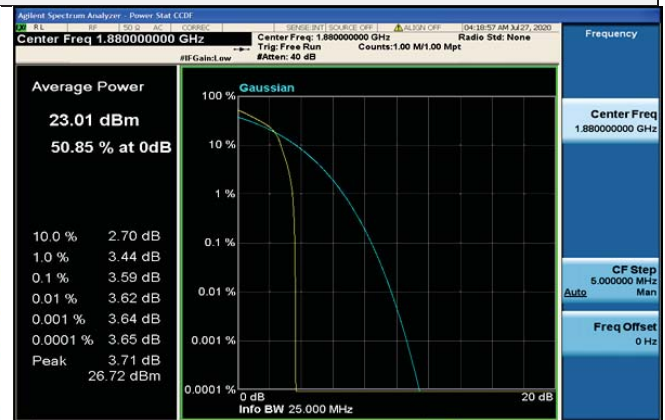


1RB#0

Middle Channel



1RB#0



1RB#0

High Channel



1RB#0



1RB#0

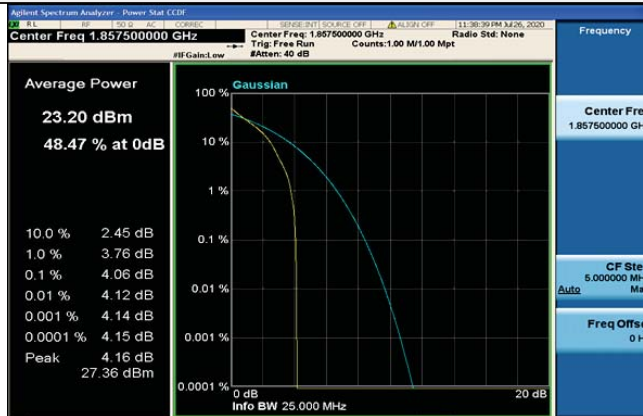


LTE FDD Band 2– 15 MHz Channel Bandwidth PAPR

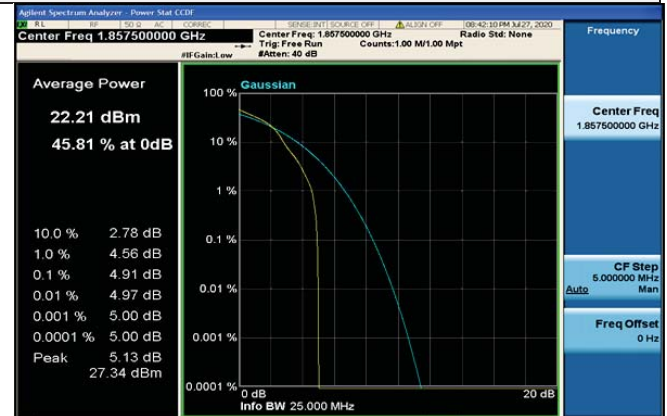
QPSK

16QAM

Low Channel



1RB#0



1RB#0

Middle Channel

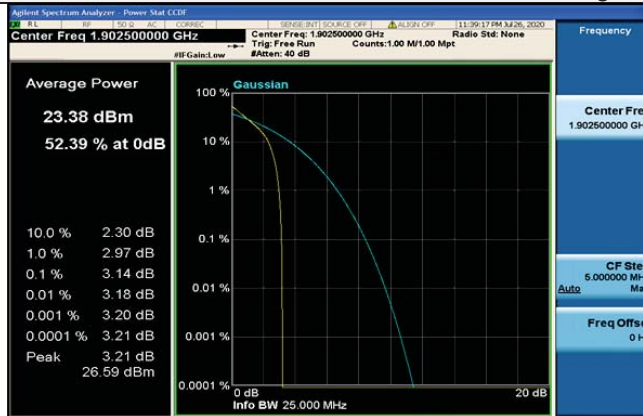


1RB#0

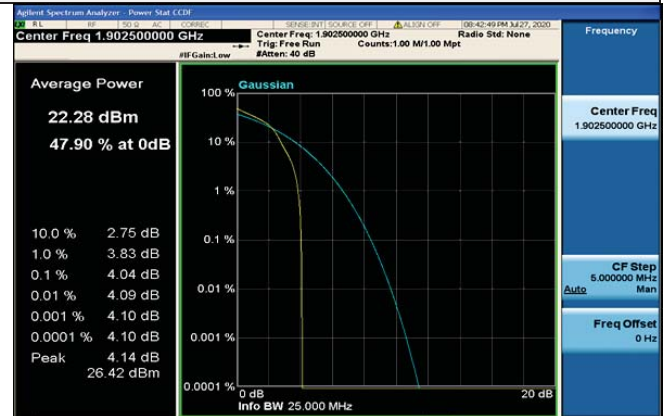


1RB#0

High Channel



1RB#0



1RB#0

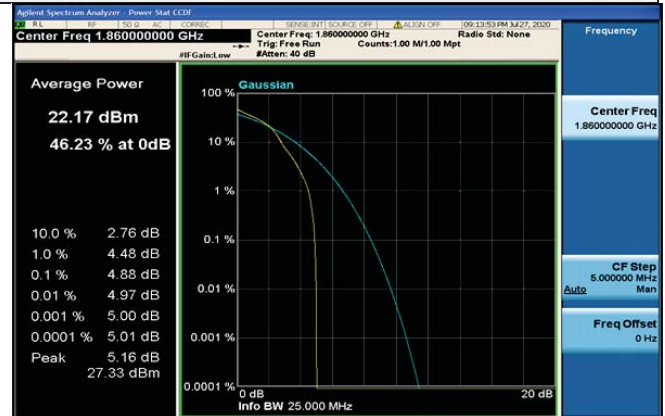


LTE FDD Band 2-20MHz Channel Bandwidth PAPR

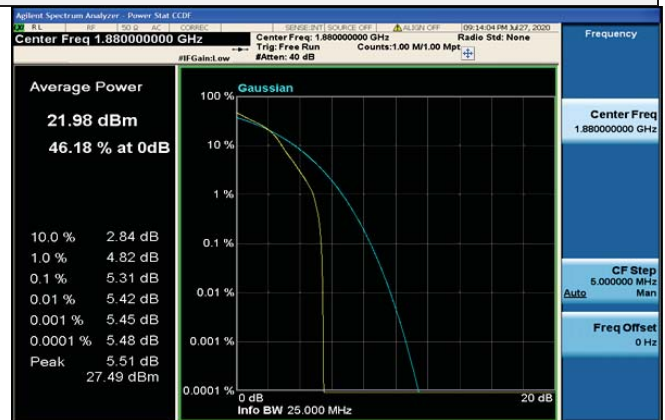
QPSK

16QAM

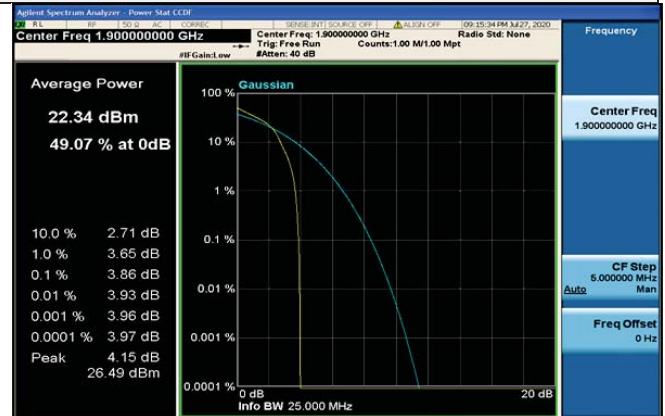
Low Channel



Middle Channel



High Channel



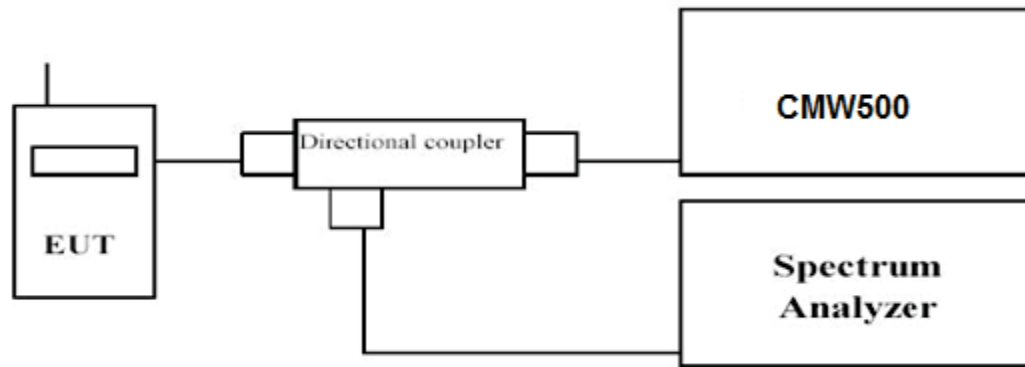


4.3 Occupied Bandwidth and Emission Bandwidth

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 RBW was set to about 1% of emission BW, VBW $\geq$ 3 times RBW.

-26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the 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 2; recorded worst case for each Channel Bandwidth of LTE FDD Band 2.

LTE FDD Band 2				
TX Channel Bandwidth	RB Size/Offset	Frequency (MHz)	99% Occupied bandwidth (MHz)	-26dBc Emission bandwidth (MHz)
			QPSK	QPSK
1.4 MHz	6RB#0	1850.7	1.0908	1.268
		1880.0	1.0928	1.254
		1909.3	1.0926	1.261
3 MHz	15RB#0	1851.5	2.6966	2.930
		1880.0	2.7037	2.950
		1908.5	2.6928	2.939
5 MHz	25RB#0	1852.5	4.5082	4.960
		1880.0	4.5587	8.966
		1907.5	4.5337	7.611
10 MHz	50RB#0	1855.0	8.9755	9.568
		1880.0	8.9530	9.578
		1905.0	8.9644	9.555
15 MHz	75RB#0	1857.5	13.448	14.33
		1880.0	13.423	14.30
		1902.5	13.456	14.40
20 MHz	100RB#0	1860.0	17.917	18.95
		1880.0	17.870	18.94
		1900.0	17.934	19.02



<i>LTE FDD Band 2</i>				
TX Channel Bandwidth	RB Size/Offset	Frequency (MHz)	99% Occupied bandwidth (MHz)	-26dBc Emission bandwidth (MHz)
			16QAM	16QAM
1.4 MHz	6RB#0	1850.7	1.0922	1.272
		1880.0	1.0900	1.276
		1909.3	1.0899	1.254
3 MHz	15RB#0	1851.5	2.6989	2.905
		1880.0	2.6975	2.912
		1908.5	2.6951	2.916
5 MHz	25RB#0	1852.5	4.5162	4.967
		1880.0	4.5164	4.941
		1907.5	4.5079	4.910
10 MHz	12RB#0	1855.0	2.3344	2.719
		1880.0	2.3287	2.721
		1905.0	2.3385	2.744
15 MHz	16RB#0	1857.5	3.1415	7.171
		1880.0	3.1431	7.160
		1902.5	3.1402	3.727
20 MHz	18RB#0	1860.0	3.5951	4.252
		1880.0	3.5988	4.248
		1900.0	3.6125	4.322

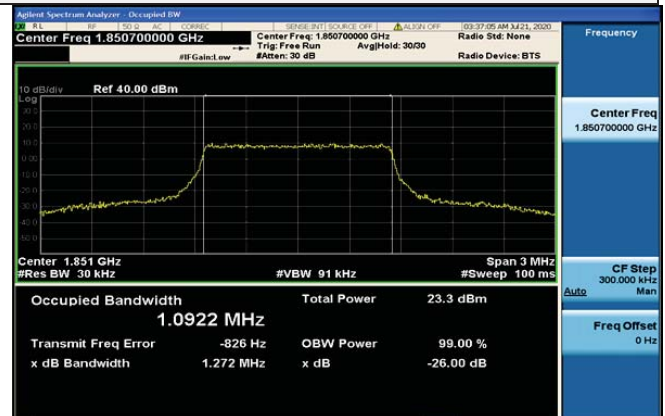
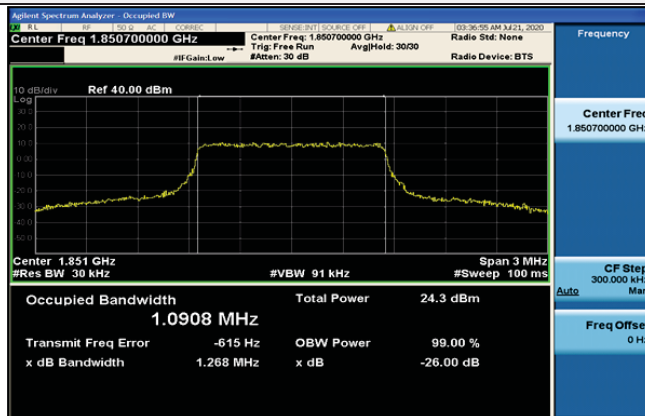


LTE FDD Band 2 – 1.4 MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth

QPSK

16QAM

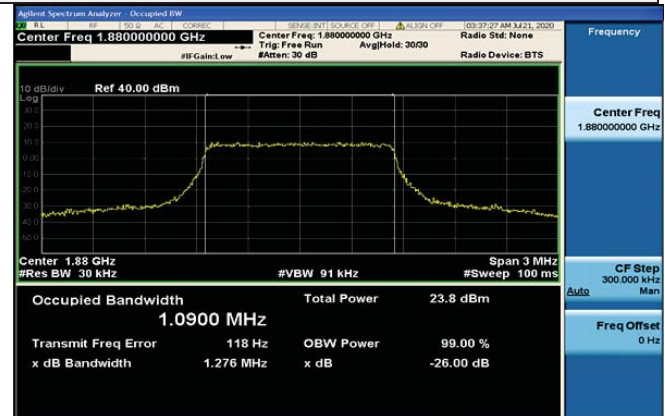
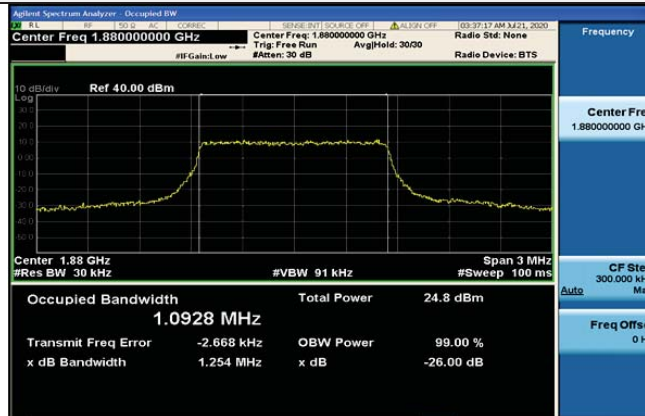
Low Channel



6RB#0

6RB#0

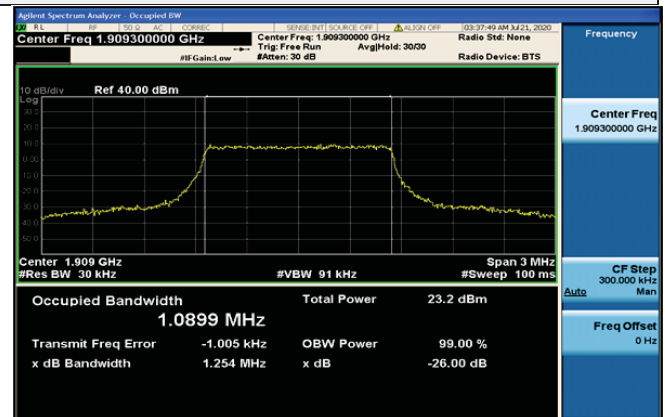
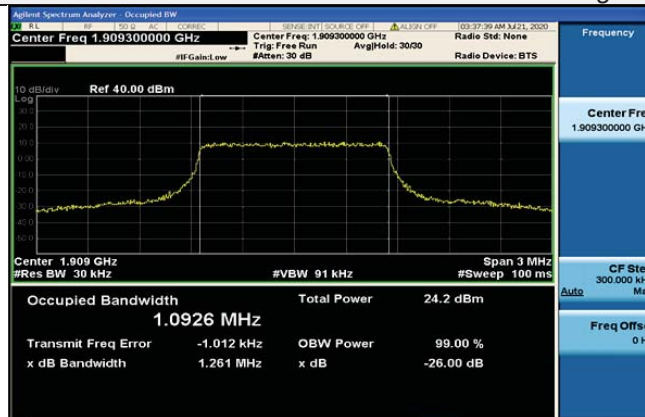
Middle Channel



6RB#0

6RB#0

High Channel



6RB#0

6RB#0

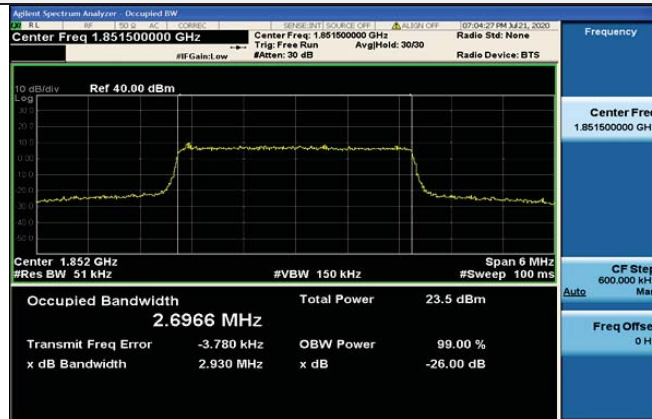


LTE FDD Band 2-3MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth

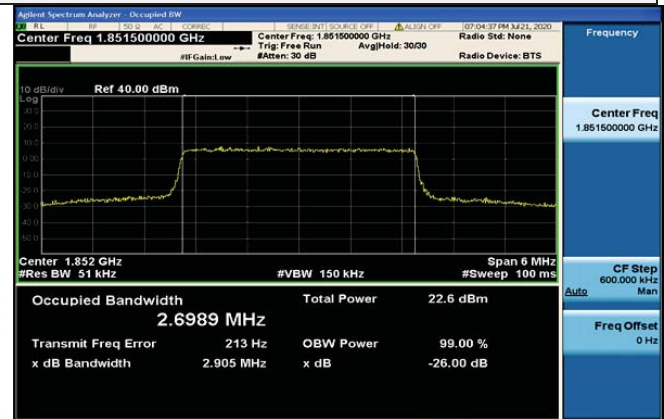
QPSK

16QAM

Low Channel

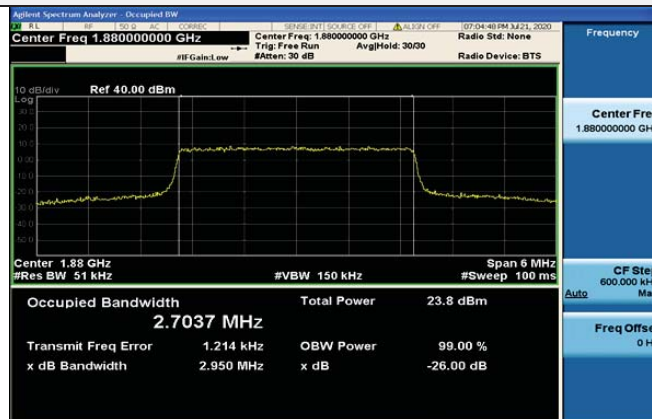


15RB#0

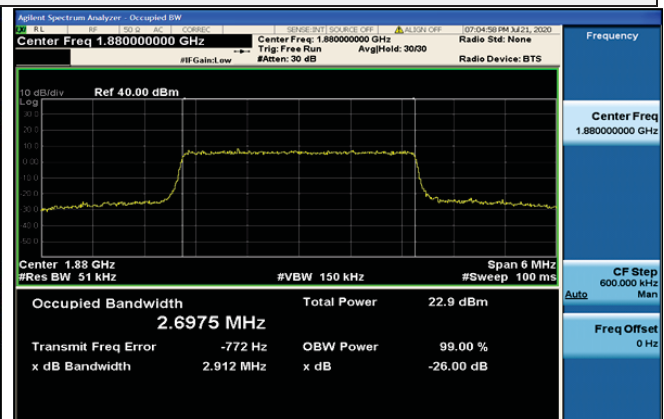


15RB#0

Middle Channel

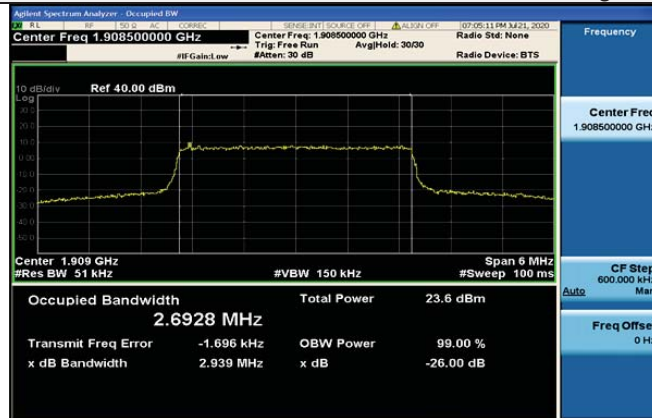


15RB#0

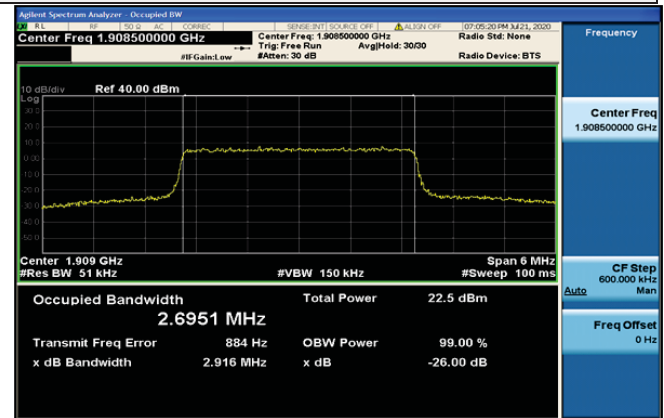


15RB#0

High Channel



15RB#0



15RB#0

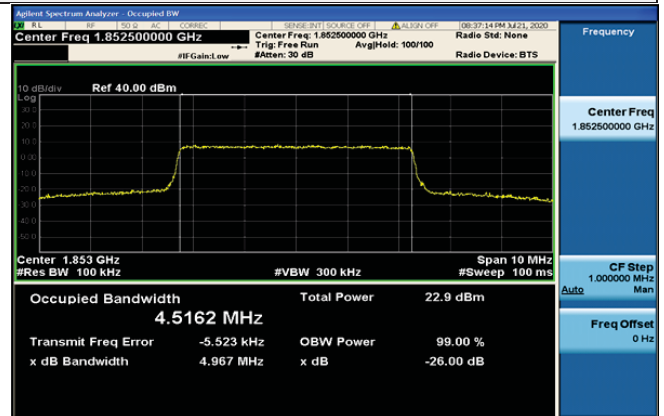
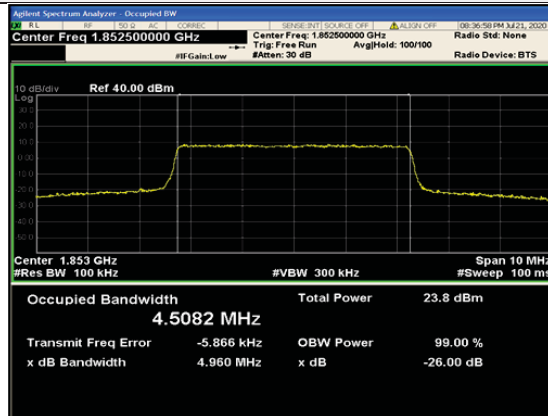


LTE FDD Band 2-5MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth

QPSK

16QAM

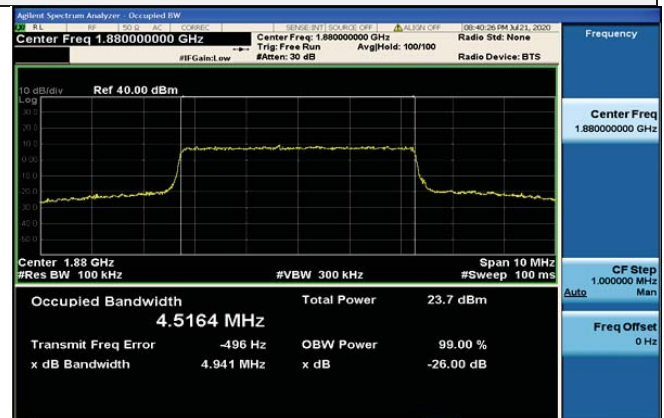
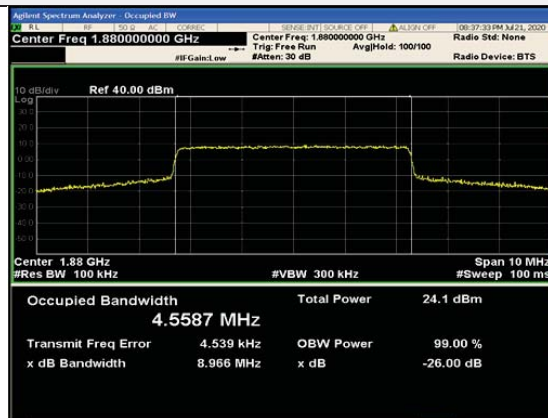
Low Channel



25RB#0

25RB#0

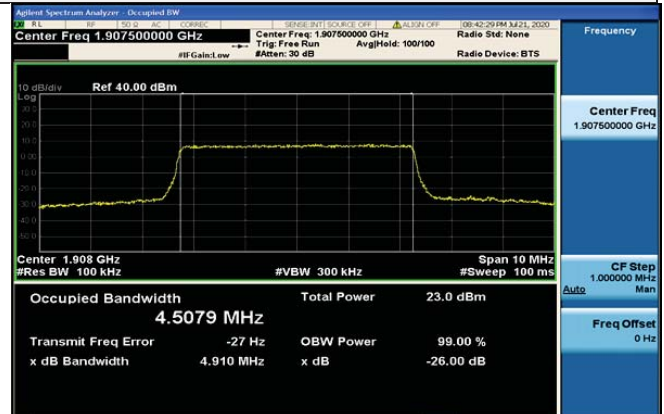
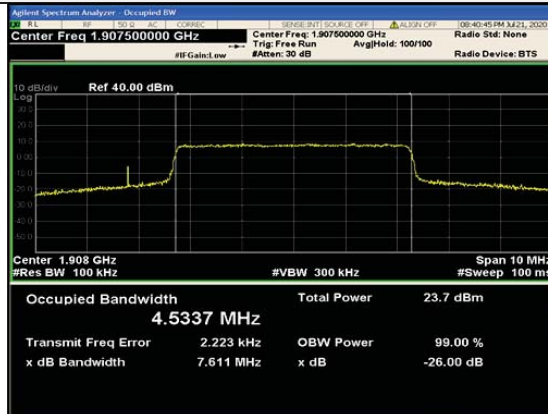
Middle Channel



25RB#0

25RB#0

High Channel



25RB#0

25RB#0

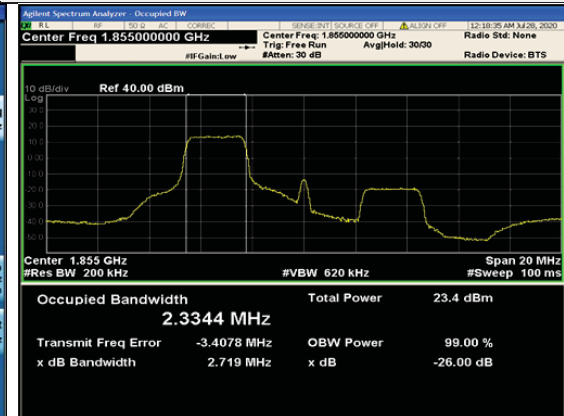
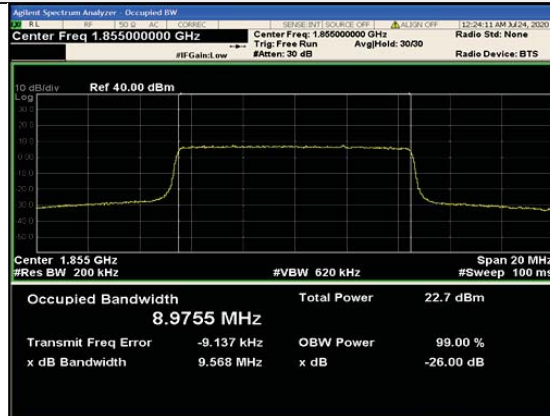


LTE FDD Band 2-10MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth

QPSK

16QAM

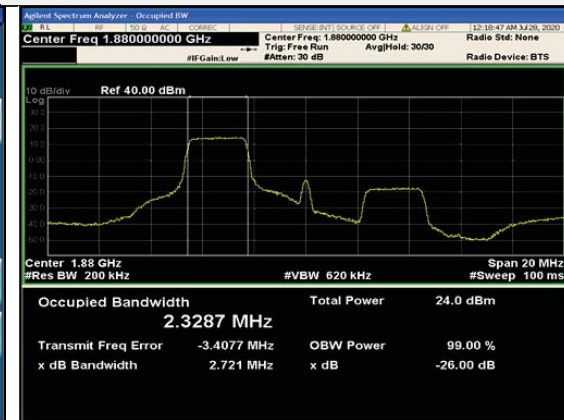
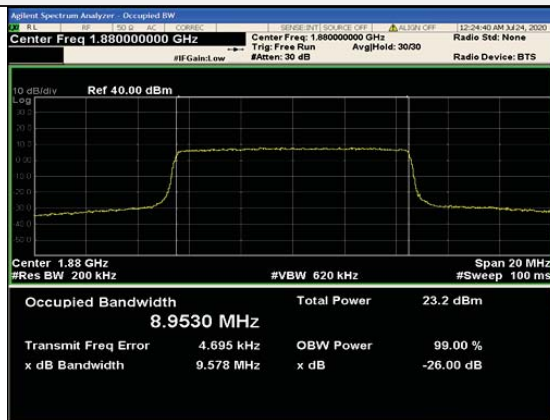
Low Channel



50RB#0

12RB#0

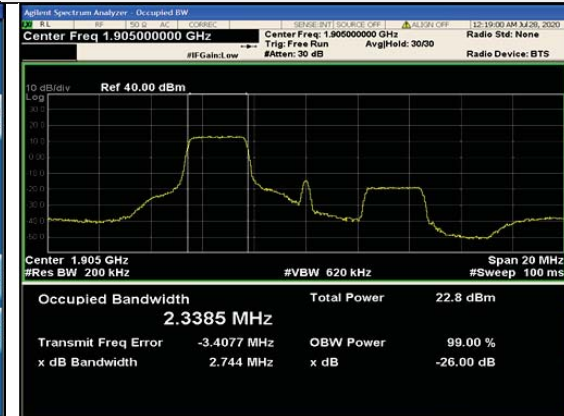
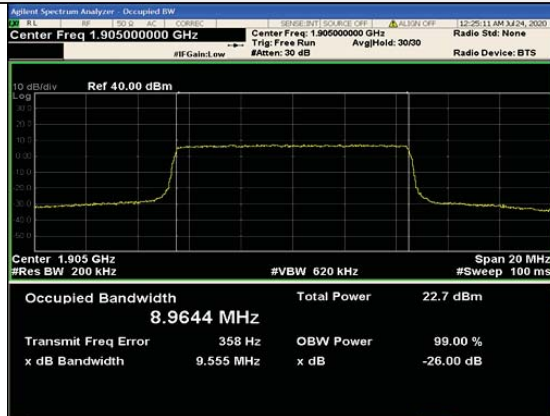
Middle Channel



50RB#0

12RB#0

High Channel



50RB#0

12RB#0

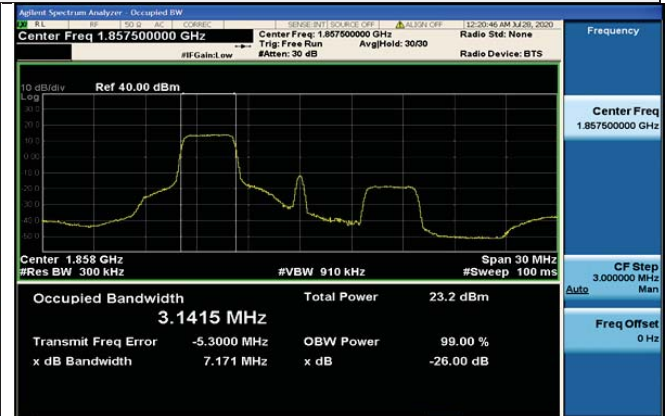
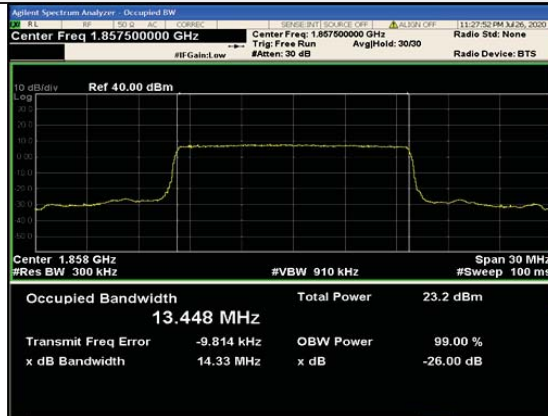


LTE FDD Band 2-15MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth

QPSK

16QAM

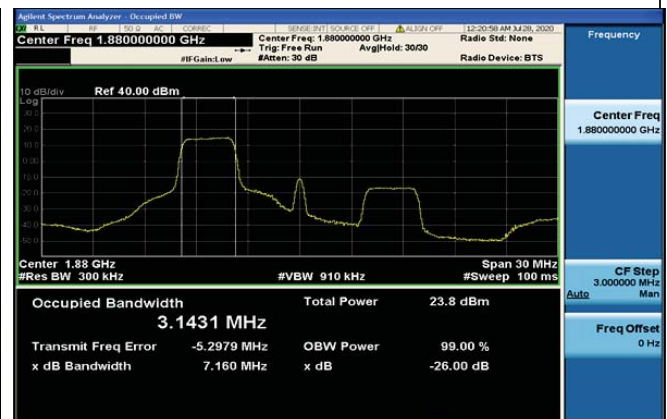
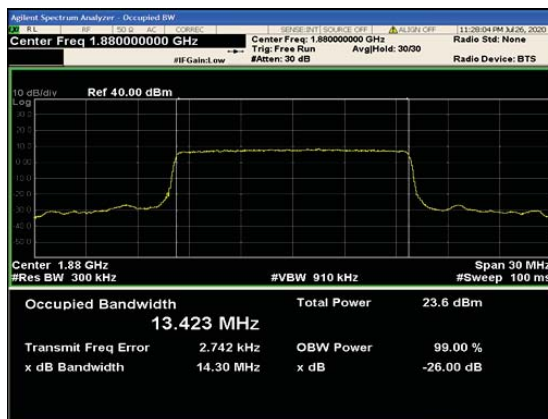
Low Channel



75RB#0

16RB#0

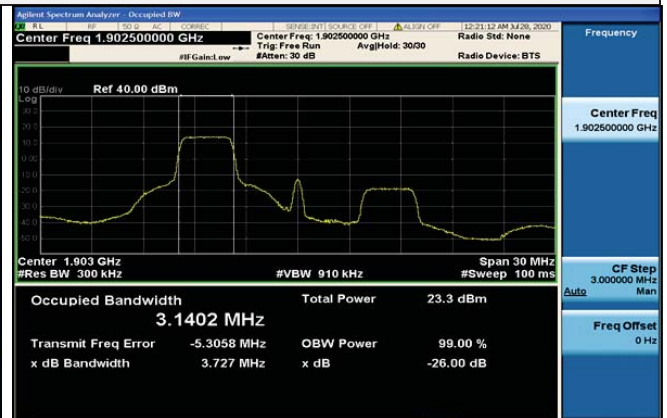
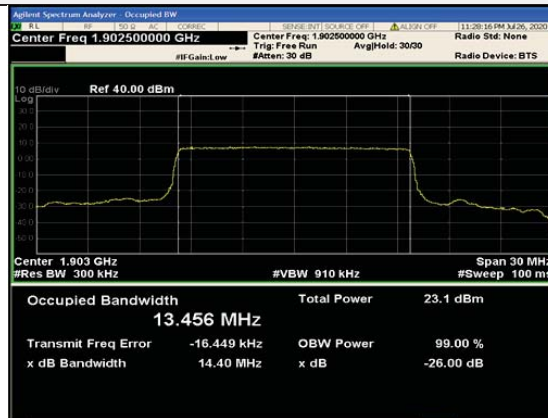
Middle Channel



75RB#0

16RB#0

High Channel



75RB#0

16RB#0

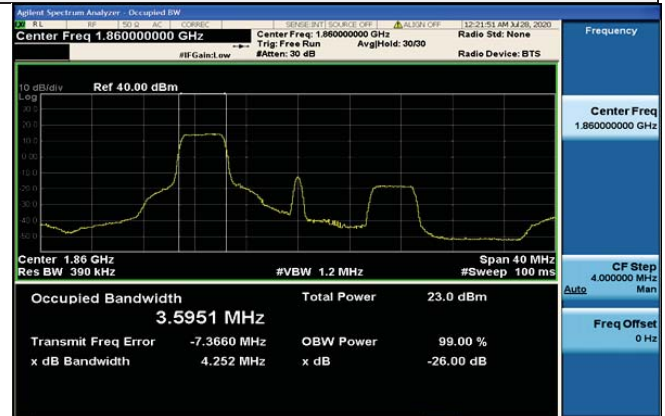
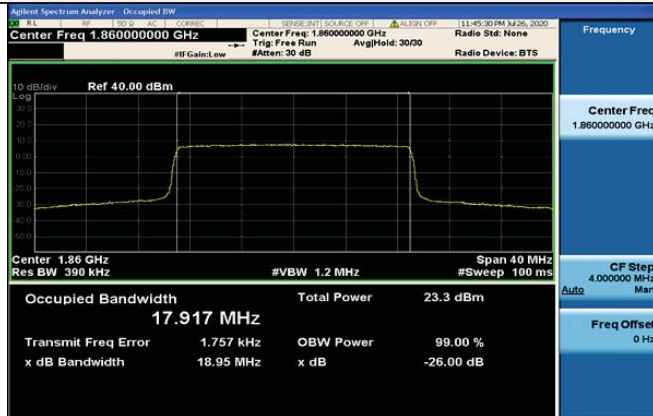


LTE FDD Band 2-20MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth

QPSK

16QAM

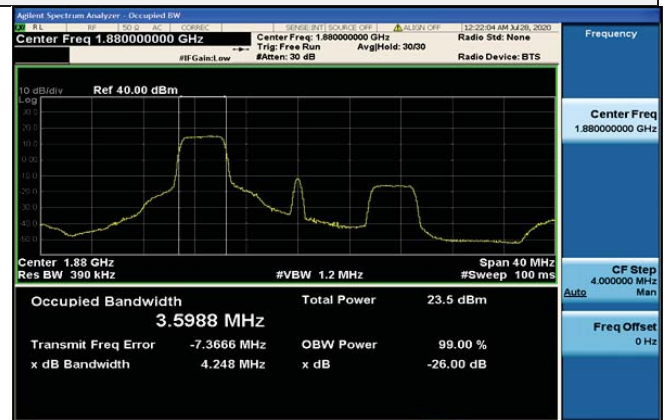
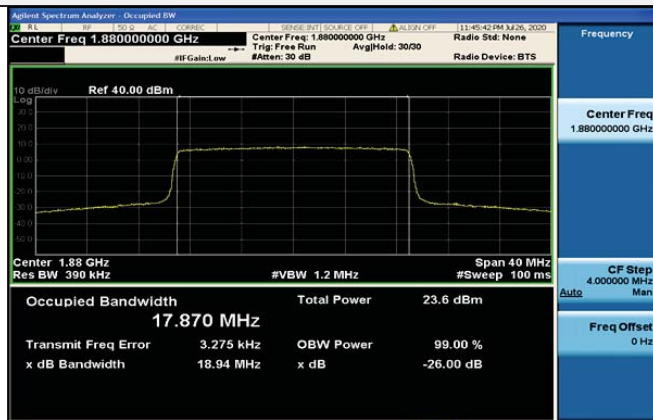
Low Channel



100RB#0

18RB#0

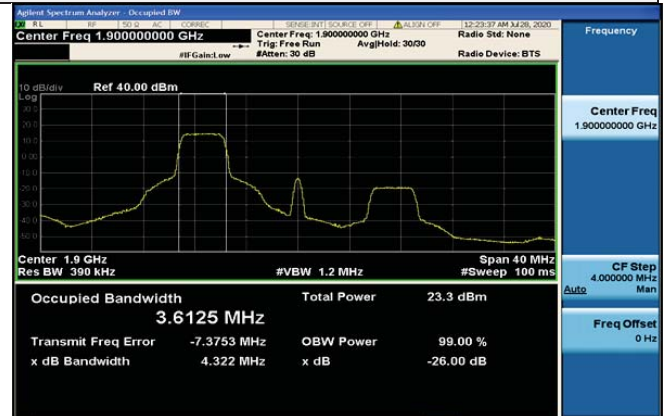
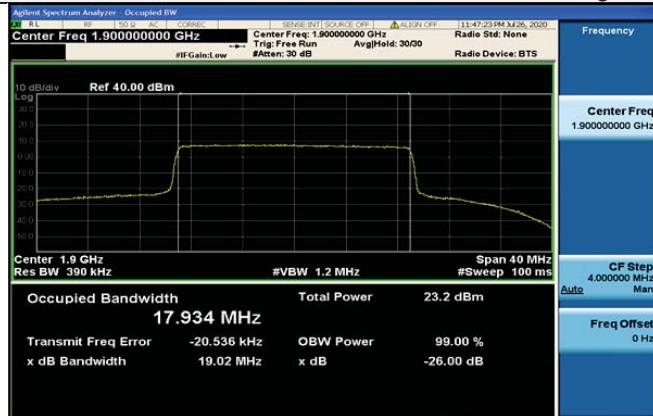
Middle Channel



100RB#0

18RB#0

High Channel



100RB#0

18RB#0

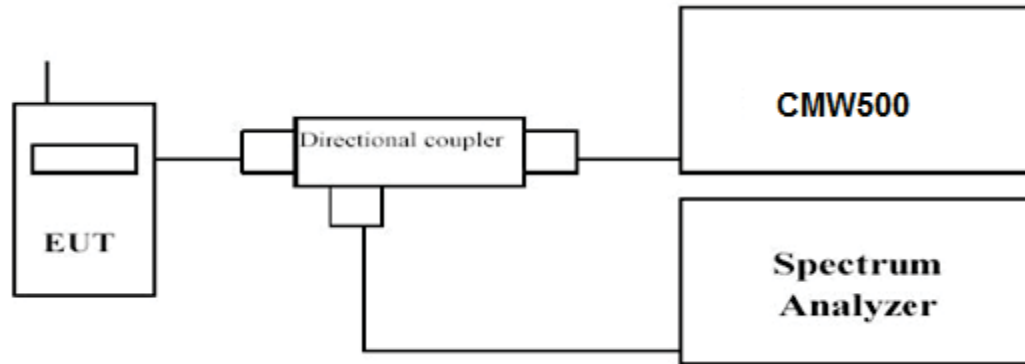


4.4 Band Edge compliance

LIMIT

Per FCC §24.238 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.

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 lowest and 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 2; recorded worst case for each Channel Bandwidth of LTE FDD Band 2.



LTE FDD Band 2 – 1.4 MHz Channel Bandwidth Band Edge Compliance

QPSK

16QAM

Low Channel



6RB#0



6RB#0

High Channel



6RB#0



6RB#0



LTE FDD Band 2-3MHz Channel BandwidthBand Edge Compliance

QPSK

16QAM

Low Channel



15RB#0



15RB#0

High Channel



15RB#0



15RB#0

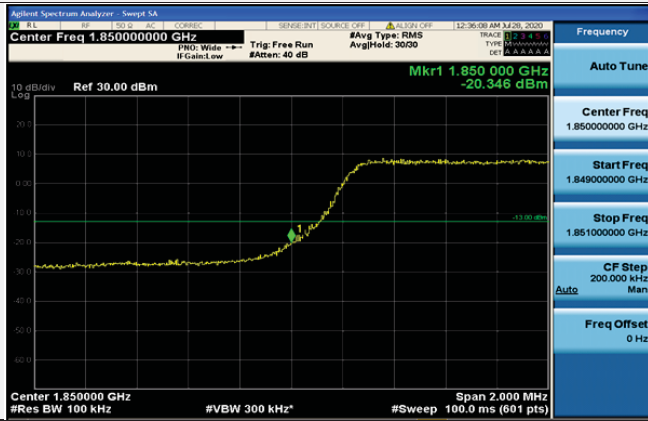


LTE FDD Band 2-5MHz Channel BandwidthBand Edge Compliance

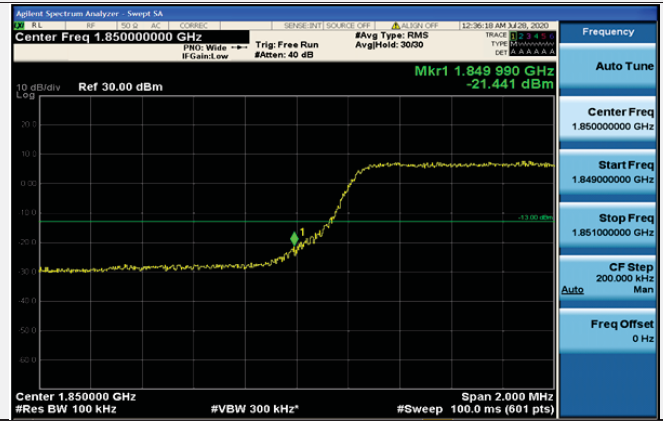
QPSK

16QAM

Low Channel



25RB#0



25RB#0

High Channel



25RB#0



25RB#0



LTE FDD Band 2 – 10 MHz Channel Bandwidth Band Edge Compliance

QPSK

16QAM

Low Channel



50RB#0



12RB#0

High Channel



50RB#0



12RB#0



LTE FDD Band 2–15MHz Channel BandwidthBand Edge Compliance

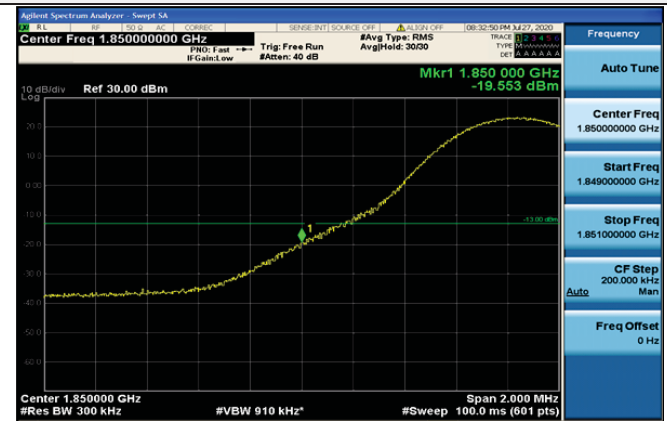
QPSK

16QAM

Low Channel



75RB#0



16RB#0

High Channel



75RB#0



16RB#0

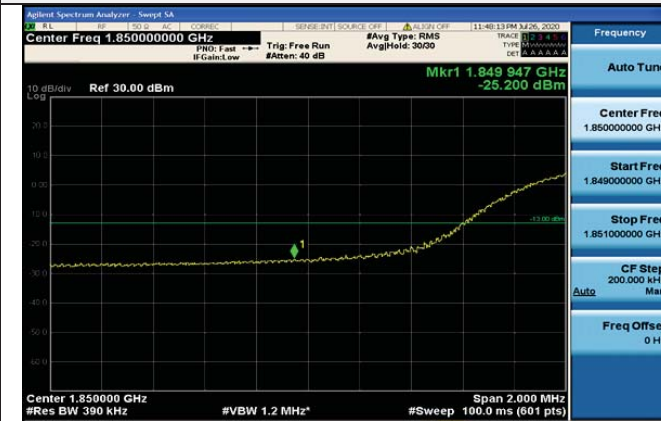


LTE FDD Band 2–20MHz Channel BandwidthBand Edge Compliance

QPSK

16QAM

Low Channel



100RB#0



100RB#0

High Channel



100RB#0



100RB#0

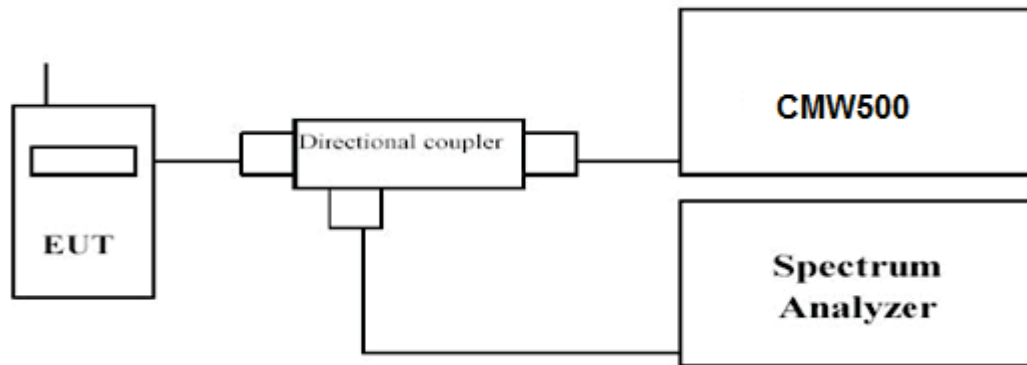


4.5 Spurious Emission on Antenna Port

LIMIT

Per FCC §24.238, 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.

TEST CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

- Place the EUT on a bench and set it in transmitting mode.
- Connect a low loss RF cable from the antenna port to a spectrum analyzer and CMW500 by a Directional Couple.
- EUT Communicate with CMW500, then select a channel for testing.
- Add a correction factor to the display of spectrum, and then test.
- The resolution bandwidth of the spectrum analyzer was set sufficient scans were taken to show the out of band Emission if any up to 10^{th} harmonic.
- Please refer to following tables for test antenna conducted emissions.

Working Frequency	Sub range (GHz)	RBW	VBW	Sweep time (s)
LTE FDD Band 2	0.01~20	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 2; recorded worst case at the QPSK Mode for each Channel Bandwidth of LTE FDD Band 2



LTE FDD Band 2-1.4MHz Channel Bandwidth

Low Channel

QPSK

