



TEST REPORT

FCC Part 90

Report Reference No.: **HK2205182092-11E**

FCC ID : **2AU4T-TM22-LCC**

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Date of issue : Jun. 16, 2022

Testing Laboratory Name..... : Shenzhen HUAKE Testing Technology Co., Ltd.

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Applicant's name : Shanghai TUGE Data Technologies Co., Ltd.

Address : Room 316, Lane 302, Lane 838, Shuyuan Town, Pudong New Area,
Shanghai, China

Test specification..... :

Standard..... : FCC Part 90

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Test item description : 4G module

Trade Mark : N/A

Manufacturer : Shanghai Stoneoim Intelligent Technology Co., Ltd.

Model/Type reference : TM22-LCC

Series Models : TM22, TM22G, TM22G-LCC, TM22C, TM22C-LCC

Ratings : DC 5V

Modulation : QPSK, 16QAM

Hardware version : V1.1

Software version : V1.1

Frequency : LTE Band 26

Result : **PASS**

**TEST REPORT****Test Report No. :****HK2205182092-11E**

Jun. 16, 2022

Date of issue

Equipment under Test : 4G module

Model /Type : TM22-LCC

Series Models : TM22, TM22G, TM22G-LCC, TM22C,
TM22C-LCC**Applicant** : **Shanghai TUGE Data Technologies Co., Ltd.**Address : Room 316, Lane 302, Lane 838, Shuyuan Town,
Pudong New Area, Shanghai, China**Manufacturer** : **Shanghai Stoneoim Intelligent Technology
Co., Ltd.**Address : Floors 11, building 7, Innovation and Intelligence
Center, No.410, Yunzhen Road, Songjiang
District, Shanghai, China**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.



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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

[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 ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

[KDB971168 D01 v03r01](#): MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS



1.2 Test Description

Requirement	CFR 47 Section	Result
Conducted Output Power	§2.1046; §90.635;	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.



2. EUT DESCRIPTION

Product Name:	4G module
Model :	TM22-LCC
Series Models:	TM22, TM22G, TM22G-LCC, TM22C, TM22C-LCC
Trade Mark:	N/A
Tx Frequency:	LTE Band 26: 814 MHz ~ 824 MHz
Rx Frequency:	LTE Band 26: 859MHz ~ 869 MHz
Bandwidth:	LTE Band 26: 1.4MHz /3MHz /5MHz /10MHz
Type of Modulation:	QPSK/16QAM
Antenna Type:	FPC Antenna
Antenna Gain:	LTE Band 26: 1dBi
Power Supply:	DC 5V



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 26(1.4MHz)		LTE Band 26(3MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
26697	814.7	26705	815.5
26740	819.0	26740	819.0
26783	823.3	26775	822.5
LTE Band 26(5MHz)		LTE Band 26(10MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
26715	816.5	26740	819.0
26740	819.0	-	-
26765	821.5	-	-



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 26	QPSK Link (1.4MHz / 3MHz / 5MHz / 10MHz)	16QAM Link (1.4MHz / 3MHz / 5MHz / 10MHz)

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.

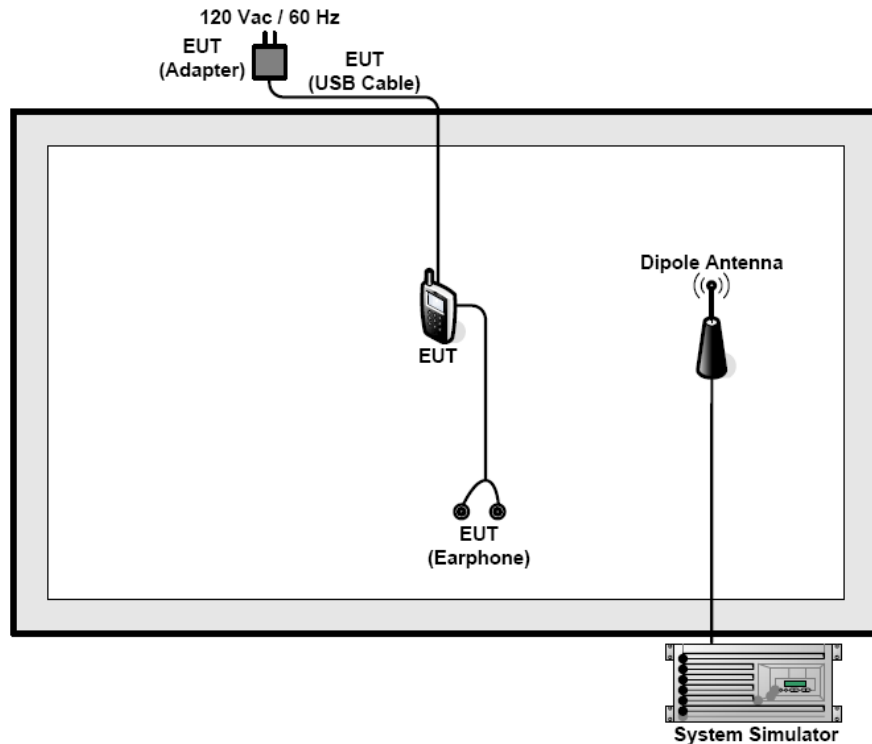
Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

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.



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.



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	2022/02/18	2023/02/17
LISN	R&S	ENV216	HKE-002	2022/02/18	2023/02/17
Receiver	R&S	ESCI 7	HKE-010	2022/02/18	2023/02/17
Spectrum analyzer	R&S	FSP40	HKE-025	2022/02/18	2023/02/17
Spectrum analyzer	Agilent	N9020A	HKE-048	2022/02/18	2023/02/17
RF automatic control unit	Tonscend	JS0806-1	HKE-060	2022/02/18	2023/02/17
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	2022/02/18	2023/02/17
Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	2022/02/18	2023/02/17
Horn antenna	Schwarzbeck	9120D	HKE-013	2022/02/18	2023/02/17
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	2022/02/18	2023/02/17
Preamplifier	EMCI	EMC051845SE	HKE-015	2022/02/18	2023/02/17
Preamplifier	Agilent	83051A	HKE-016	2022/02/18	2023/02/17
Preamplifier	Schwarzbeck	BBV 9743	HKE-006	2022/02/18	2023/02/17
Temperature and humidity meter	Boyang	HTC-1	HKE-075	2022/02/18	2023/02/17
High-low temperature chamber	Guangke	HT-80L	HKE-118	2022/02/18	2023/02/17
High pass filter unit	Tonscend	JS0806-F	HKE-055	2022/02/18	2023/02/17
RF Cable(below1GHz)	Times	9kHz-1GHz	HKE-117	2022/02/18	2023/02/17
RF Cable(above 1GHz)	Times	1-40G	HKE-034	2022/02/18	2023/02/17
Power meter	Agilent	E4419B	HKE-085	2022/02/18	2023/02/17
Power Sensor	Agilent	E9300A	HKE-086	2022/02/18	2023/02/17
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	2022/02/18	2023/02/17
Wireless Communication Test Set	R&S	CMU200	HKE-029	2022/02/18	2023/02/17



4. FACILITIES AND ACCREDITATIONS

4.1. Information of The Test Laboratory

Shenzhen HUAKE 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 $y \pm U$, where expanded 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)

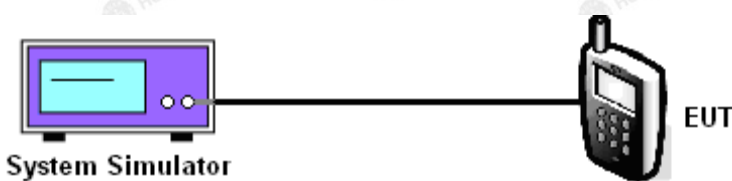
- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.



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 26: 100W
Test Setup:	 The diagram illustrates the test setup. On the left is a purple rectangular box labeled 'System Simulator' with a blue screen and two small circles. A black line connects this box to a black mobile phone on the right labeled 'EUT'.
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

**Conducted Measurement:**

LTE FDD Band 26				
TX Channel Bandwidth	RB Size/Offset	Frequency (MHz)	Average Power [dBm]	
			QPSK	16QAM
1.4 MHz	1 RB low	814.7	23.36	22.26
		819.0	23.40	22.44
		823.3	23.48	22.52
	1 RB high	814.7	23.46	21.89
		819.0	23.52	21.72
		823.3	23.51	21.85
	50% RB mid	814.7	22.30	21.34
		819.0	23.49	22.45
		823.3	23.52	22.43
	100% RB	814.7	23.44	22.39
		819.0	23.36	21.76
		823.3	23.40	21.69
3 MHz	1 RB low	815.5	23.71	22.53
		819.0	23.67	22.50
		822.5	23.66	22.41
	1 RB high	815.5	22.59	21.76
		819.0	22.47	21.63
		822.5	22.52	21.69
	50% RB mid	815.5	22.43	21.40
		819.0	23.69	21.97
		822.5	23.65	21.89
	100% RB	815.5	23.60	21.89
		819.0	22.30	21.45
		822.5	22.31	21.47
5 MHz	1 RB low	816.5	23.70	22.09
		819.0	23.82	21.97
		821.5	23.56	22.02
	1 RB high	816.5	22.56	21.51
		819.0	22.58	21.52
		821.5	22.58	21.52
	50% RB mid	816.5	22.48	21.64
		819.0	23.59	22.62
		821.5	23.68	22.22
	100% RB	816.5	23.64	22.09
		819.0	22.43	21.45
		821.5	22.45	21.45
10 MHz	1 RB low	819.0	23.66	22.37
	1 RB high	819.0	23.95	22.09
	50% RB mid	819.0	23.46	22.13
	100% RB	819.0	22.55	21.48

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by HUAKE, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.cer-mark.com>.

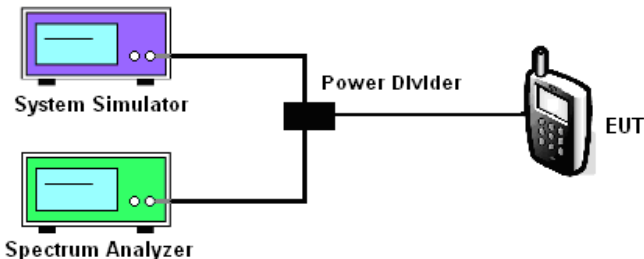
TEL : +86-755 2302 9901 FAX : +86-755 2302 9901 E-mail : service@cer-mark.com

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5.2. Peak to Average Ratio

5.2.1. 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:	 The diagram shows a System Simulator (top) and a Spectrum Analyzer (bottom) connected to a central Power Divider. The Power Divider is then connected to the EUT (Equipment Under Test) on the right.
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 26; recorded worst case for each Channel Bandwidth of LTE FDD Band 26.

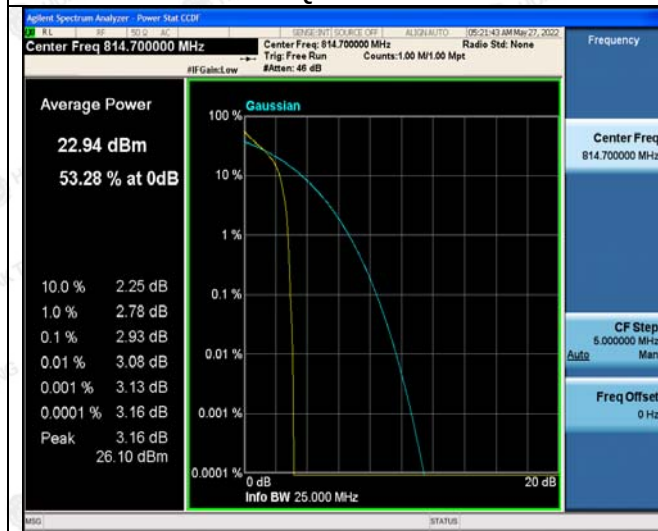
LTE FDD Band 26				
TX Channel Bandwidth	Frequency (MHz)	RB Size/Offset	PAPR (dB)	
			QPSK	16QAM
1.4 MHz	814.7	1RB#0	2.93	3.85
	819.0		3.75	4.85
	823.3		3.36	4.95
3 MHz	815.5	1RB#0	3.09	4.32
	819.0		3.68	5.18
	822.5		3.83	4.86
5 MHz	816.5	1RB#0	3.25	4.52
	819.0		3.87	4.62
	821.5		3.96	5.07
10 MHz	819.0	1RB#0	3.27	4.36



LTE FDD Band 26-1.4MHz Channel Bandwidth PAPR

QPSK

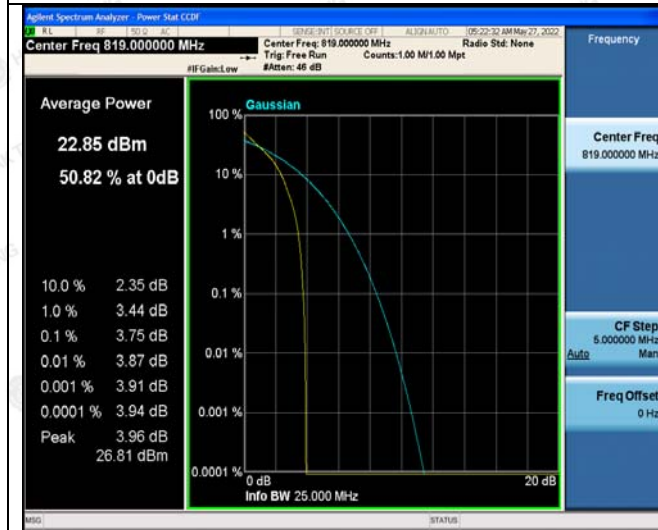
16QAM



1RB#0

1RB#0

Low Channel

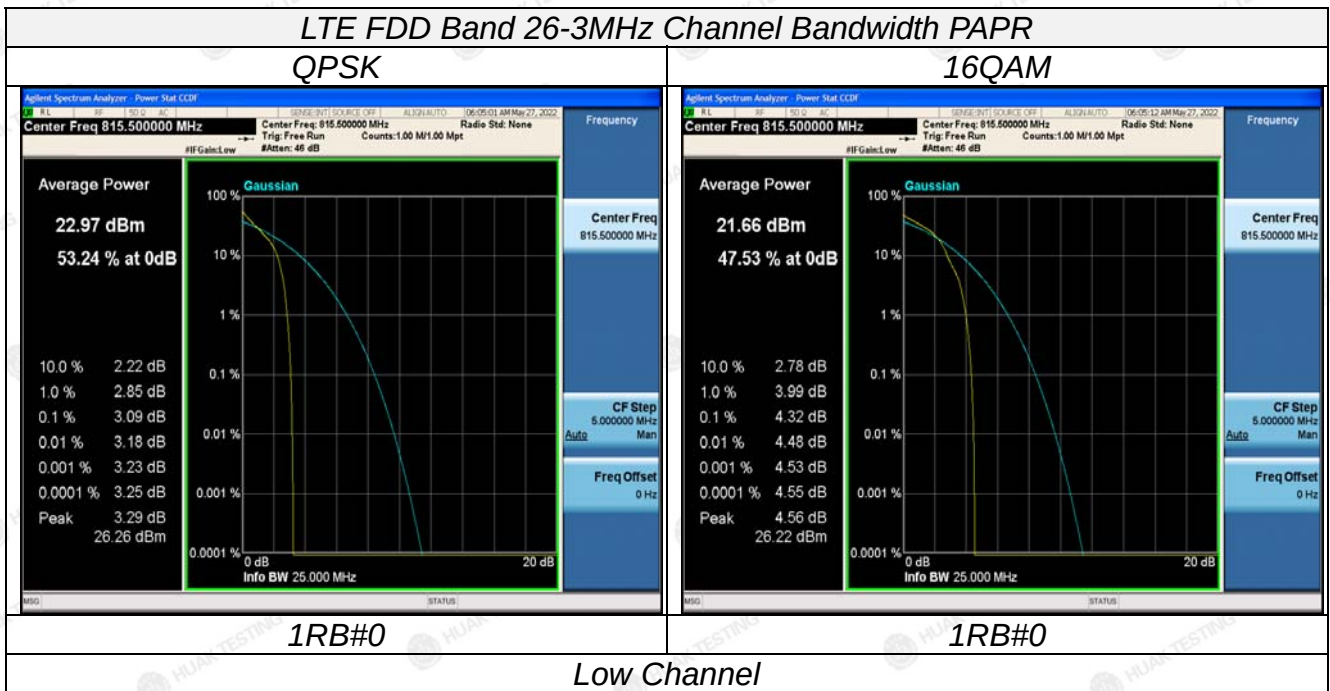
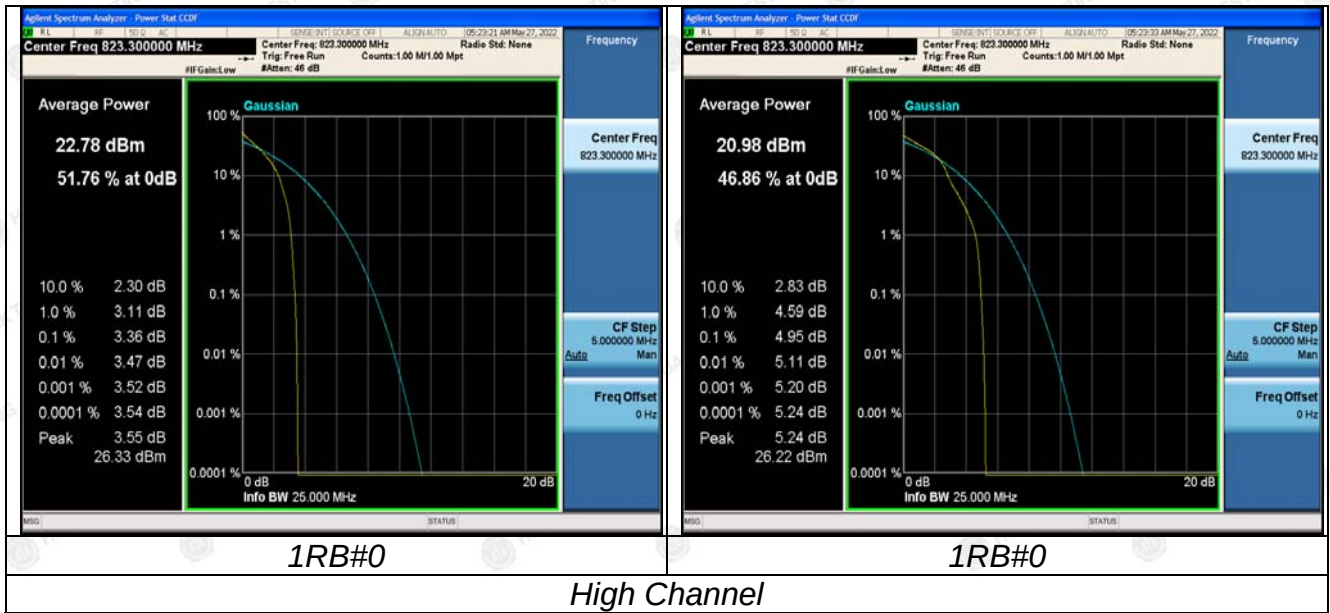


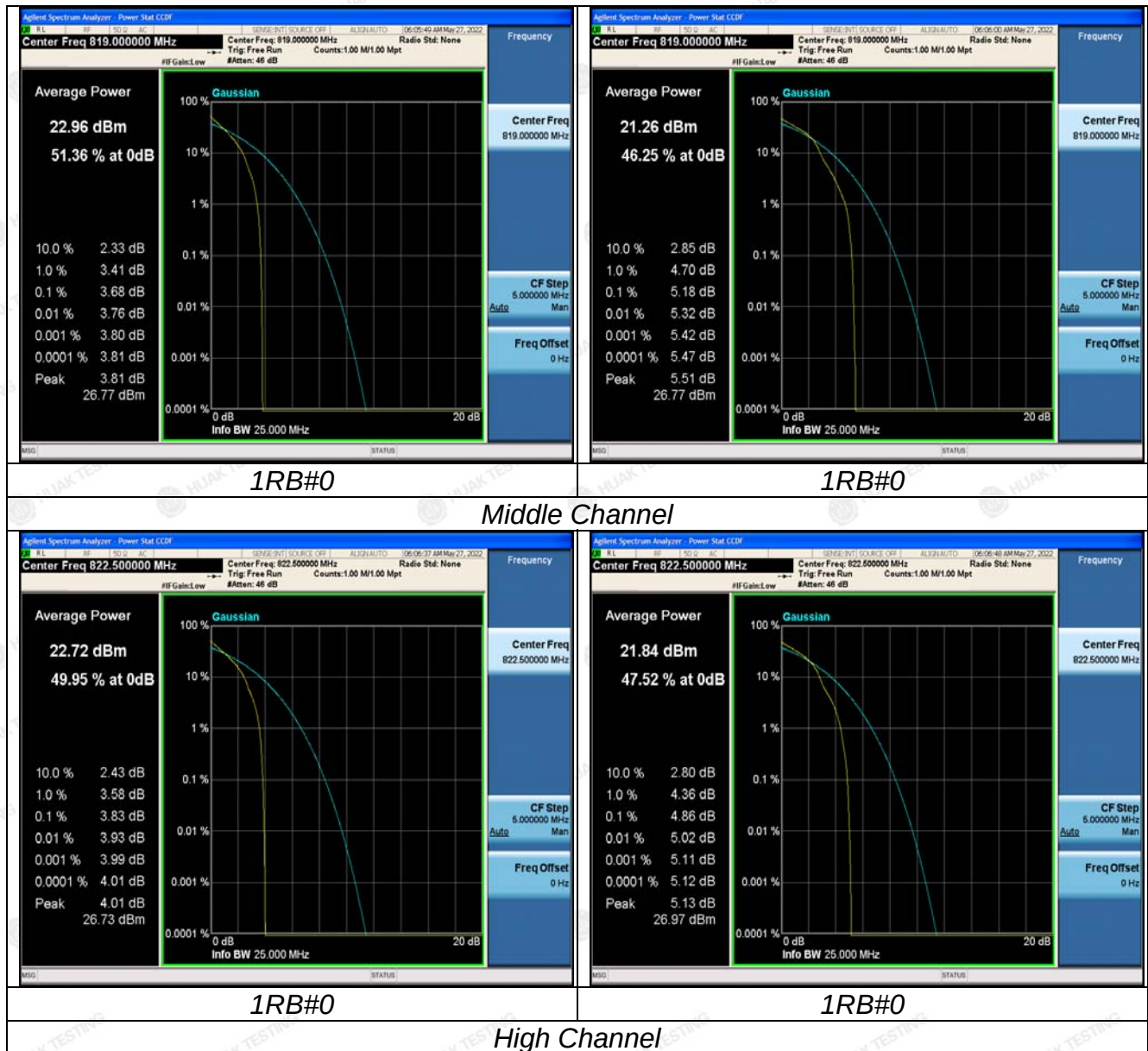
1RB#0



1RB#0

Middle Channel

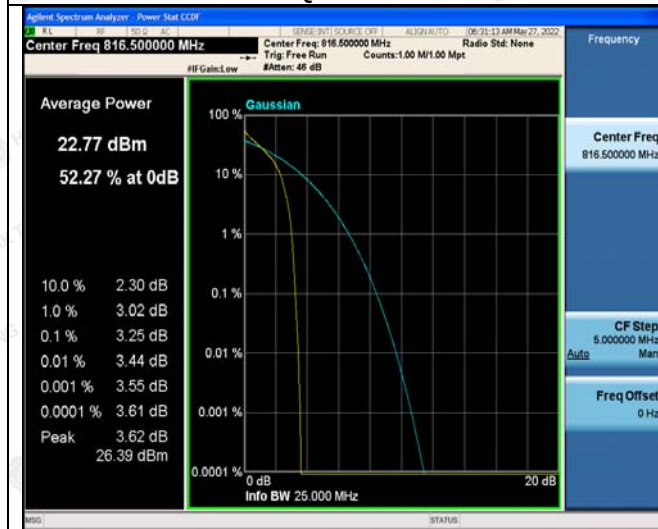






LTE FDD Band 26-5MHz Channel Bandwidth PAPR

QPSK



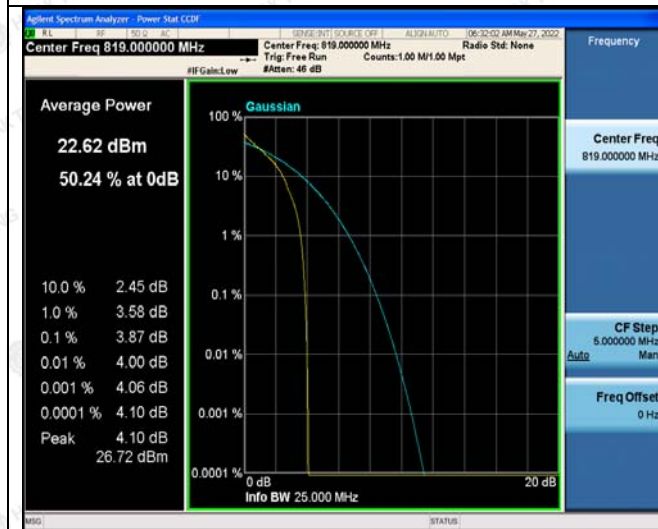
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16QAM



1RB#0

Low Channel

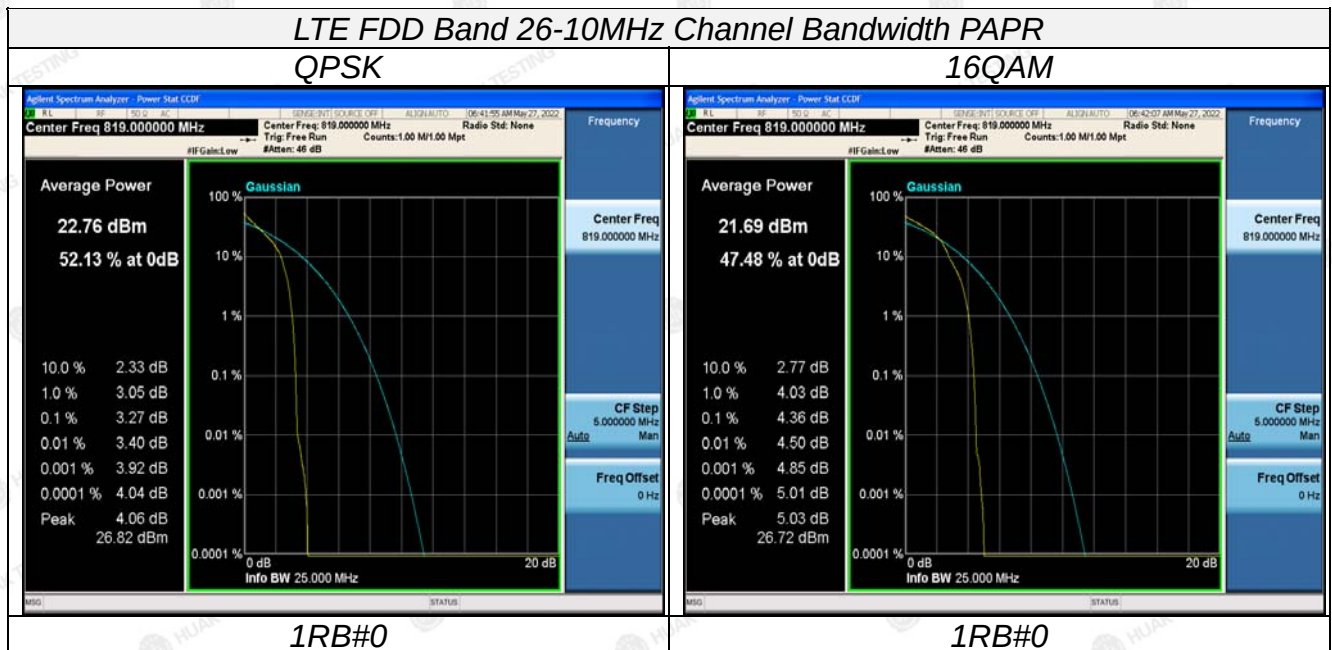
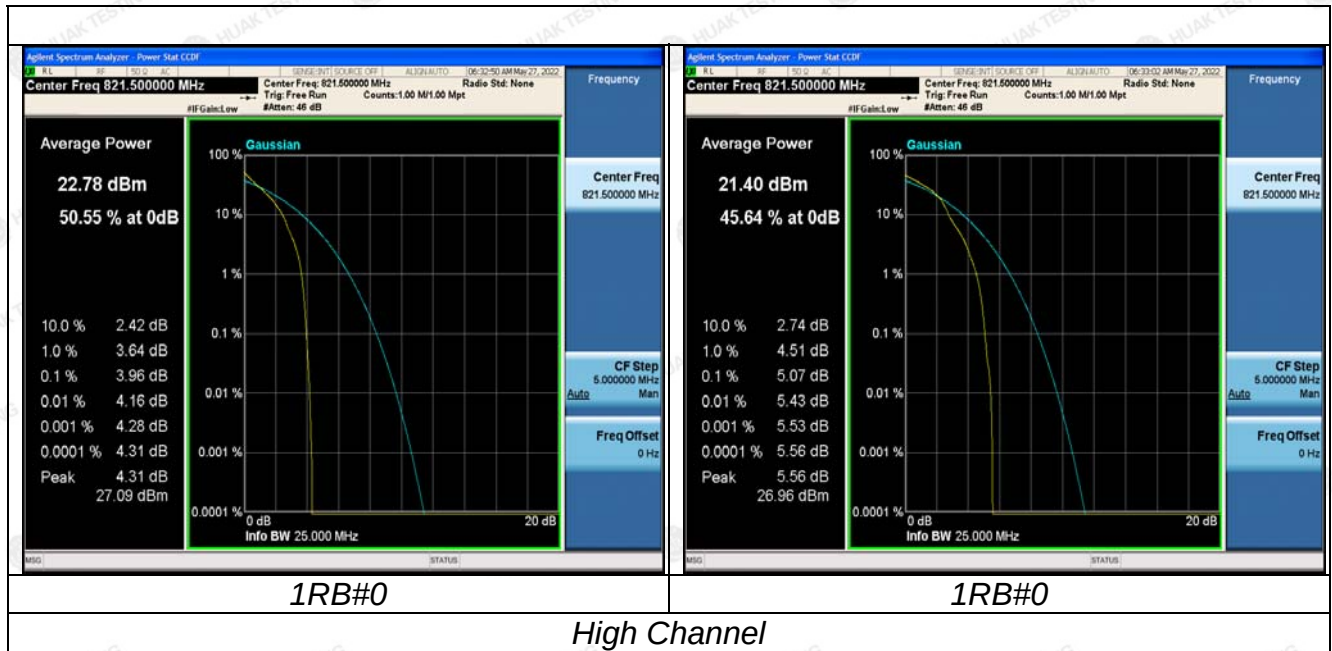


1RB#0



1RB#0

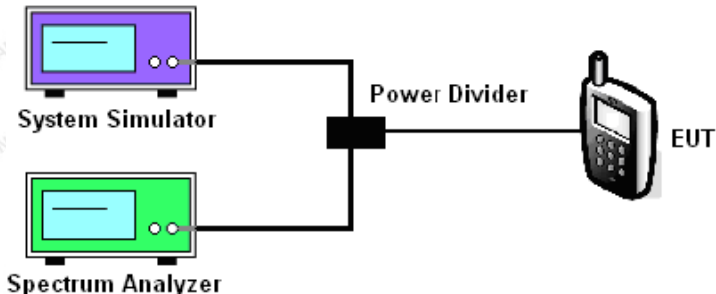
Middle Channel





5.3. 99% Occupied Bandwidth and 26dB Bandwidth Measurement

5.3.1. Test Specification

Test Method:	FCC part 2.1049
Limit:	N/A
Test Setup:	 The diagram shows a System Simulator (top) and a Spectrum Analyzer (bottom) connected to a central Power Divider. The Power Divider is then connected to the EUT (Equipment Under Test) on the right.
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

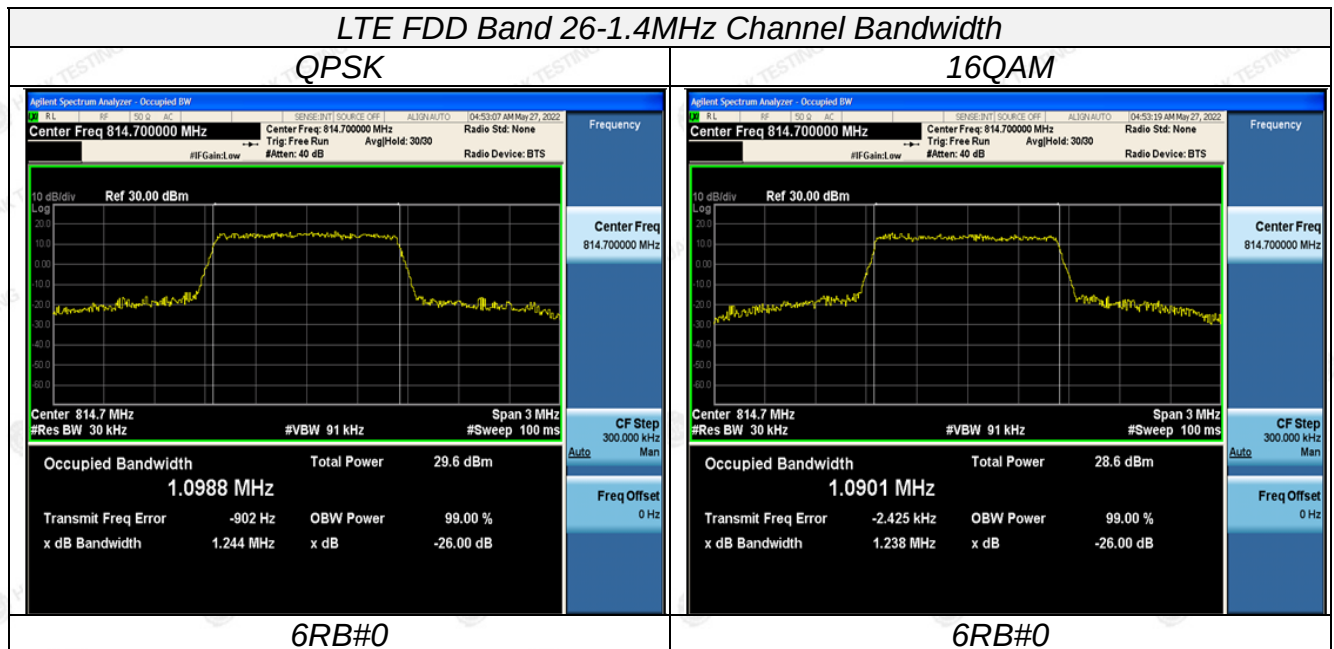
TEST RESULTS

Remark:

1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 26; recorded worst case for each Channel Bandwidth of LTE FDD Band 26.

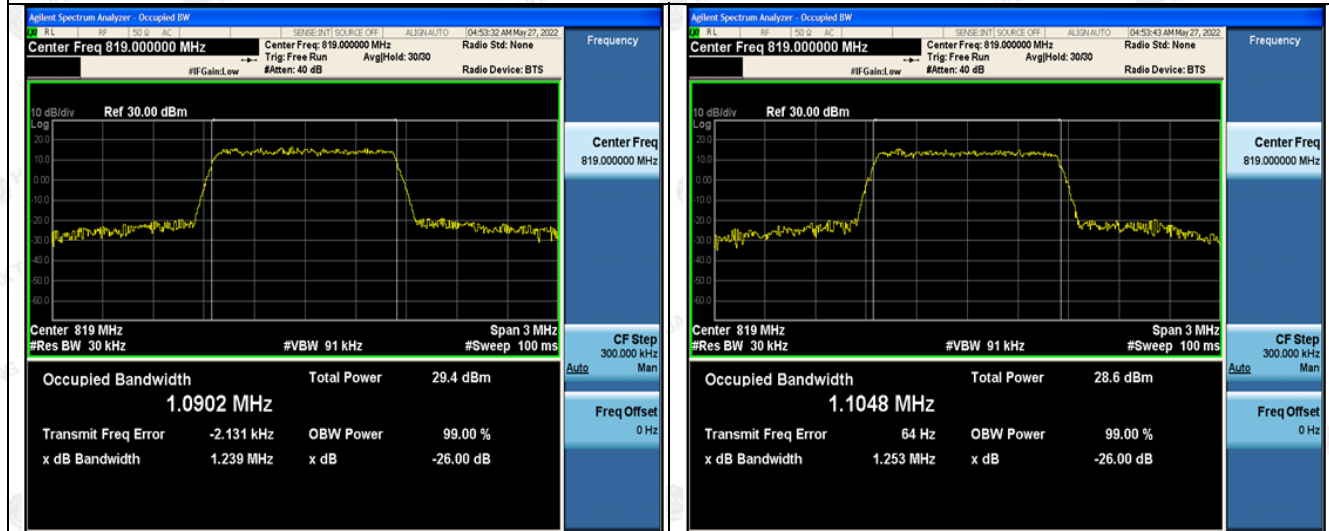


LTE FDD Band 26						
TX Channel Bandwidth	RB Size/Offset	Frequency (MHz)	-26dBc Emission bandwidth (MHz)		99% Occupied bandwidth (MHz)	
			QPSK	16QAM	QPSK	16QAM
1.4 MHz	6RB#0	814.7	1.244	1.238	1.0988	1.0901
		819.0	1.239	1.253	1.0902	1.1048
		823.3	1.247	1.245	1.0961	1.0981
3 MHz	15RB#0	815.5	3.004	3.036	2.7129	2.7048
		819.0	3.024	3.056	2.7000	2.7078
		822.5	3.022	3.016	2.7172	2.7067
5 MHz	25RB#0	816.5	4.989	4.982	4.5138	4.5088
		819.0	4.980	4.983	4.5002	4.5098
		821.5	4.983	4.997	4.5097	4.5276
10 MHz	50RB#0	819.0	9.908	9.942	9.0098	8.9988





Low Channel



Middle Channel

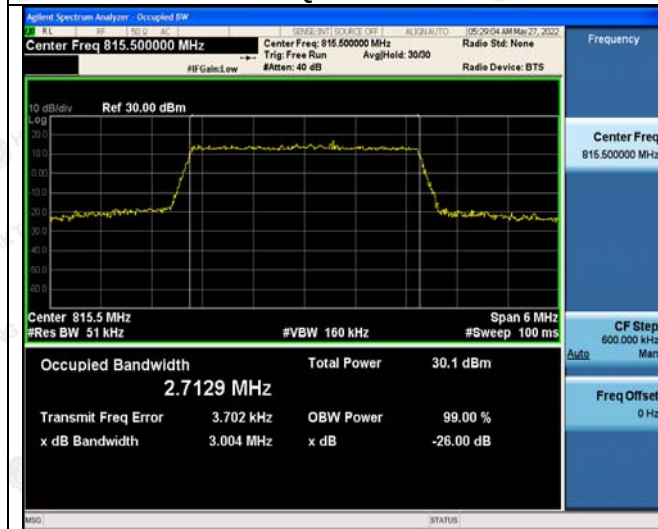


High Channel



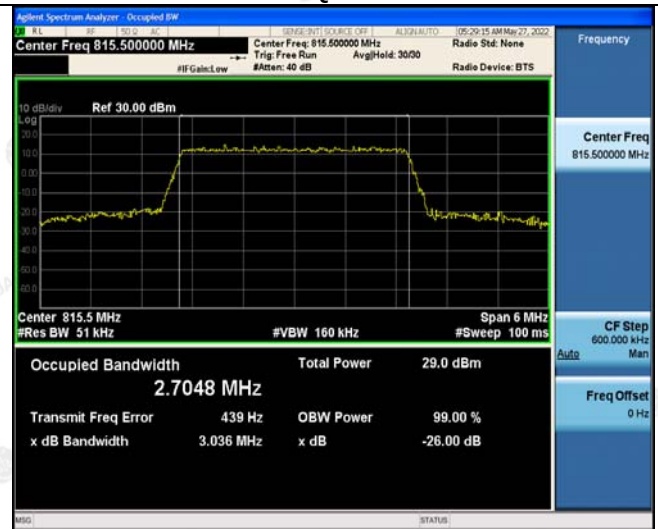
LTE FDD Band 26-3MHz Channel Bandwidth

QPSK



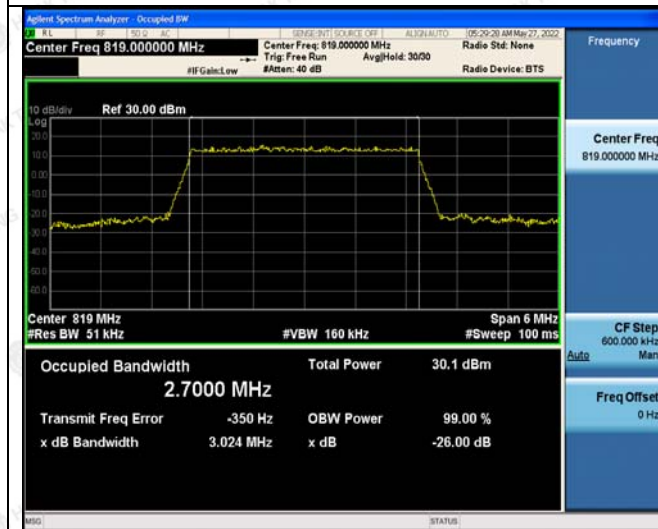
15RB#0

16QAM

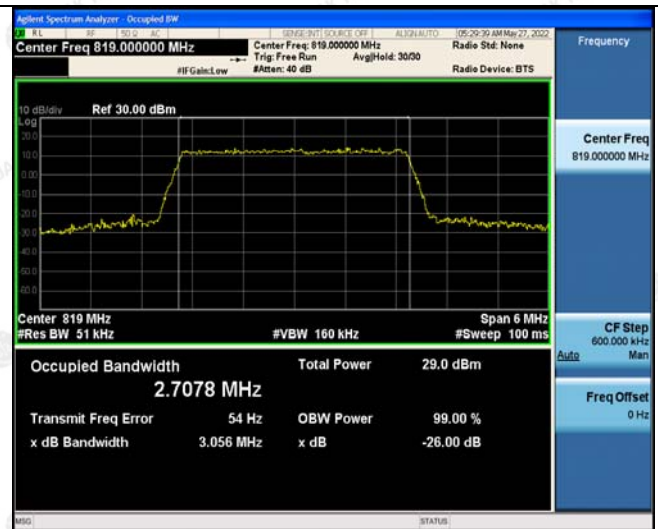


15RB#0

Low Channel



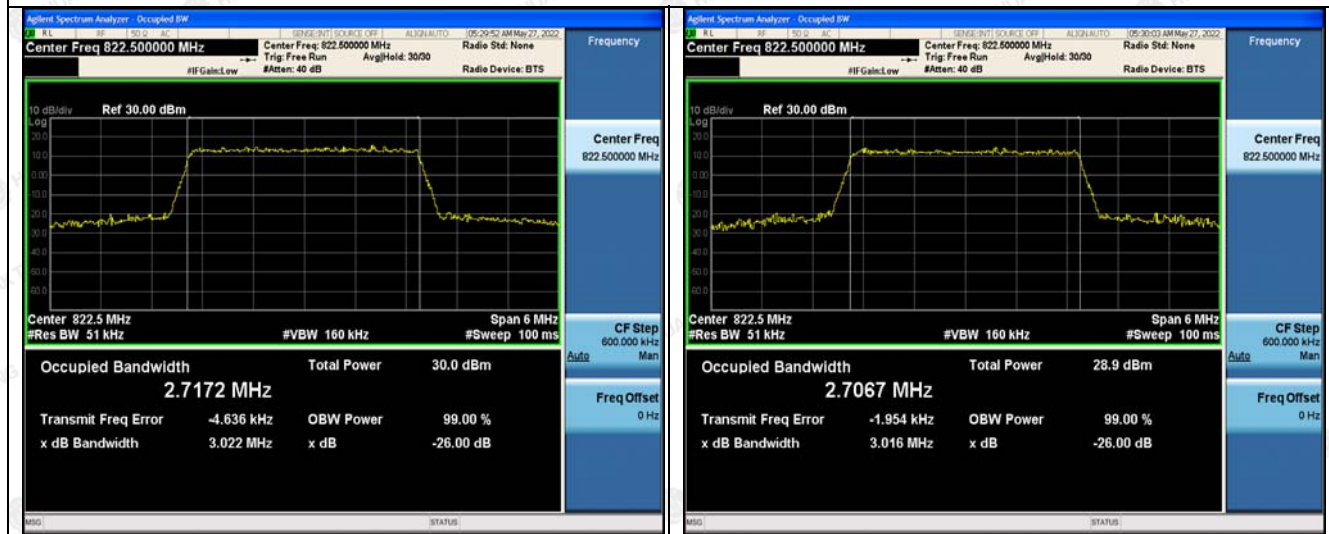
15RB#0



15RB#0



Middle Channel



15RB#0

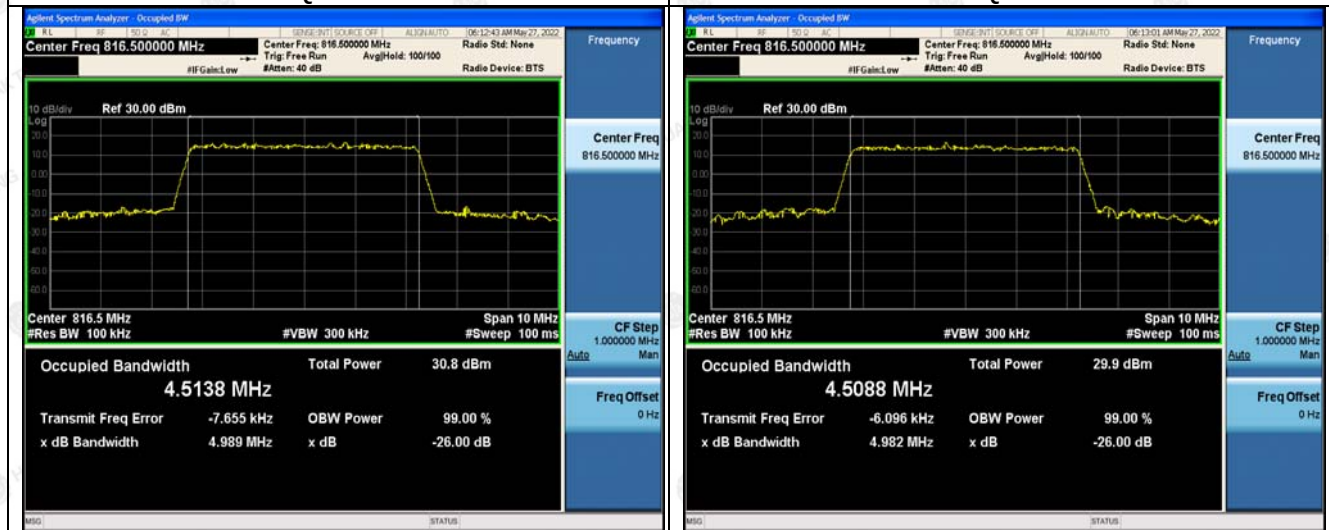
15RB#0

High Channel

LTE FDD Band 26-5MHz Channel Bandwidth

QPSK

16QAM

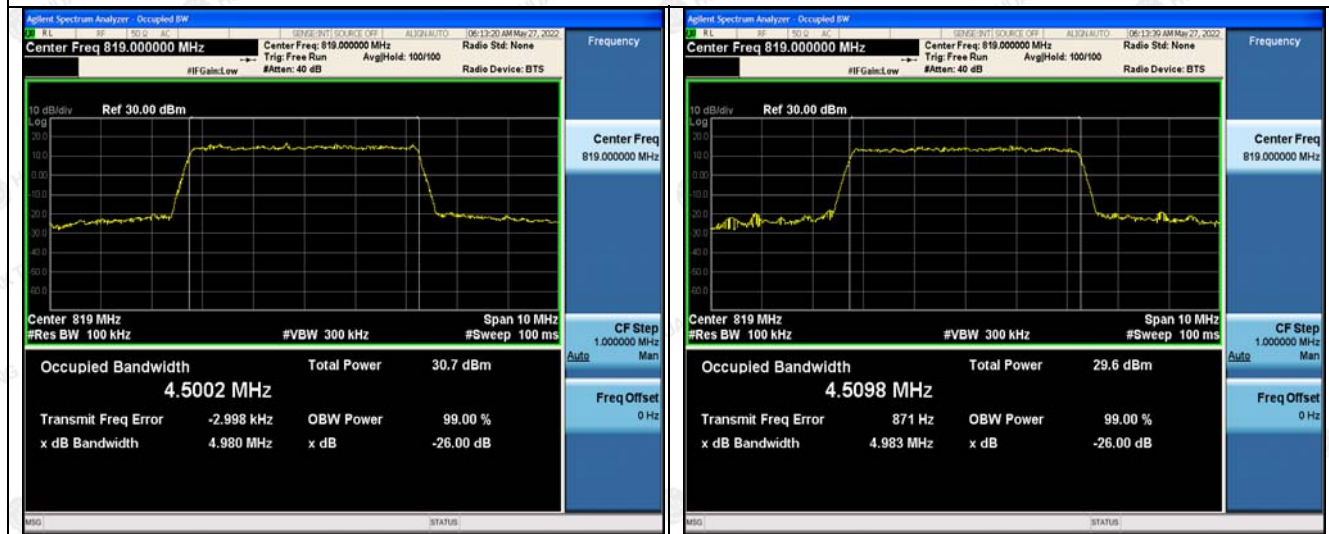


25RB#0

25RB#0

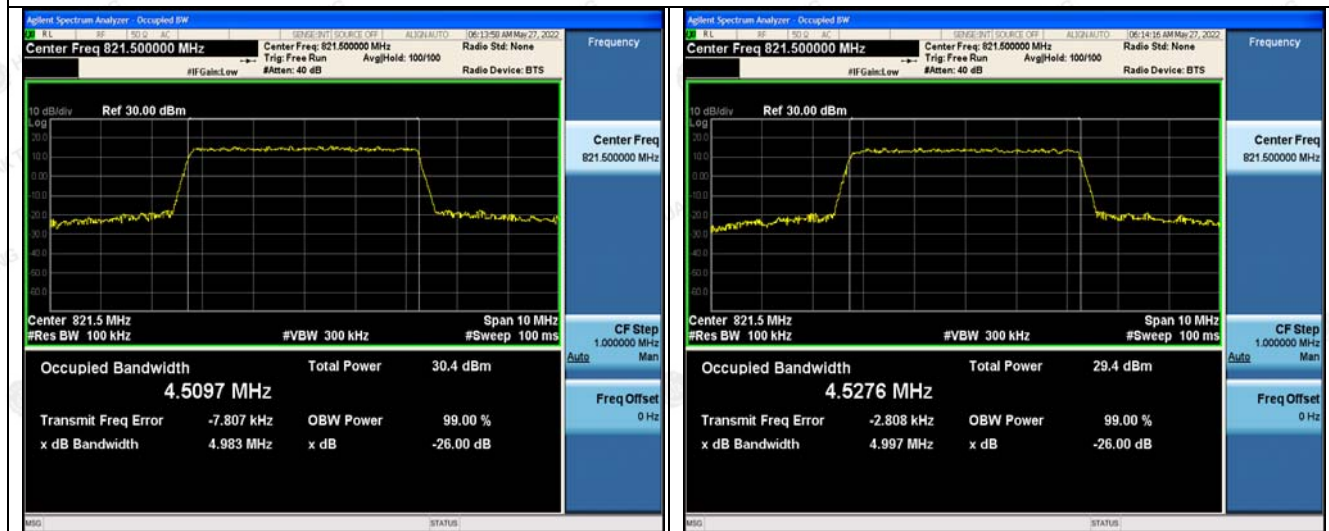


Low Channel



25RB#0

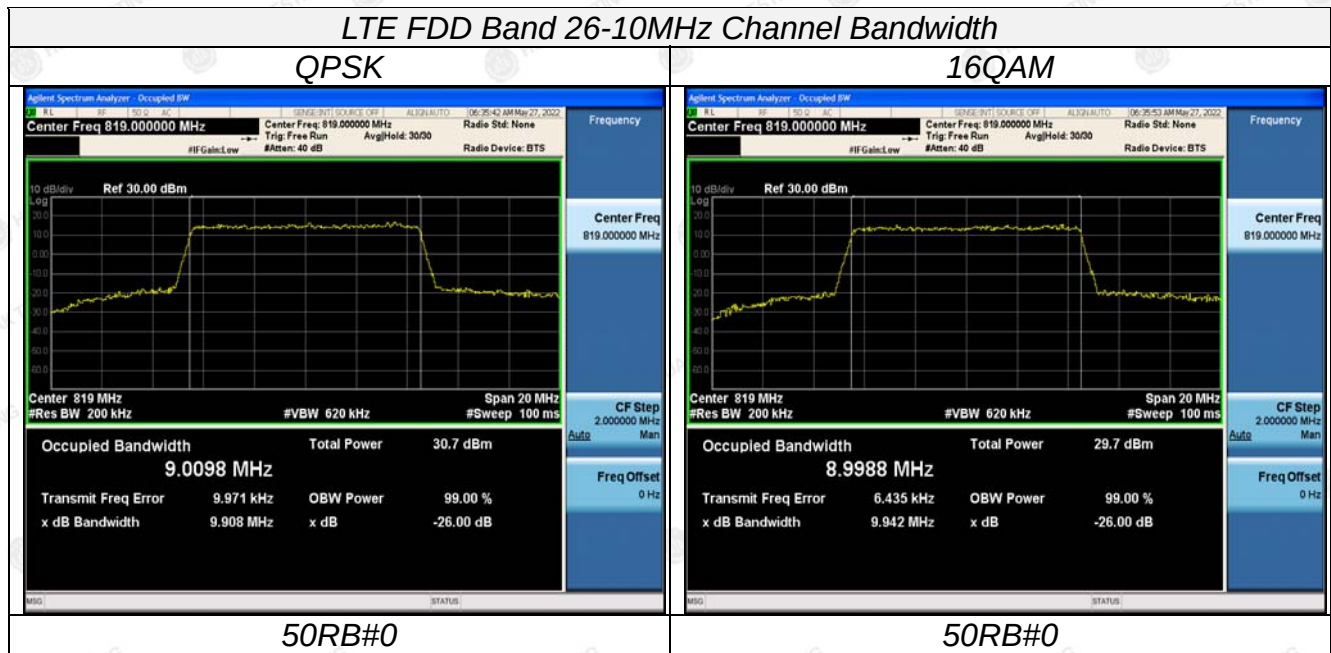
Middle Channel



25RB#0

25RB#0

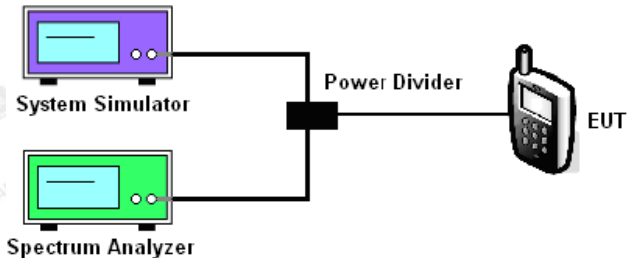
High Channel





5.4. Band Edge and Conducted Spurious Emission Measurement

5.4.1. Test Specification

Test Requirement:	FCC part 90.691
Test Method:	FCC part 2.1051
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:	 The diagram shows a System Simulator (purple box) and a Spectrum Analyzer (green box) connected to a Power Divider (black box). The Power Divider is also connected to the EUT (Equipment Under Test, represented by a mobile phone icon).
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 26; recorded worst case for each Channel Bandwidth of LTE FDD Band 26.



LTE FDD Band 26-1.4MHz Channel Bandwidth Band Edge Compliance

QPSK

16QAM



6RB#0

6RB#0

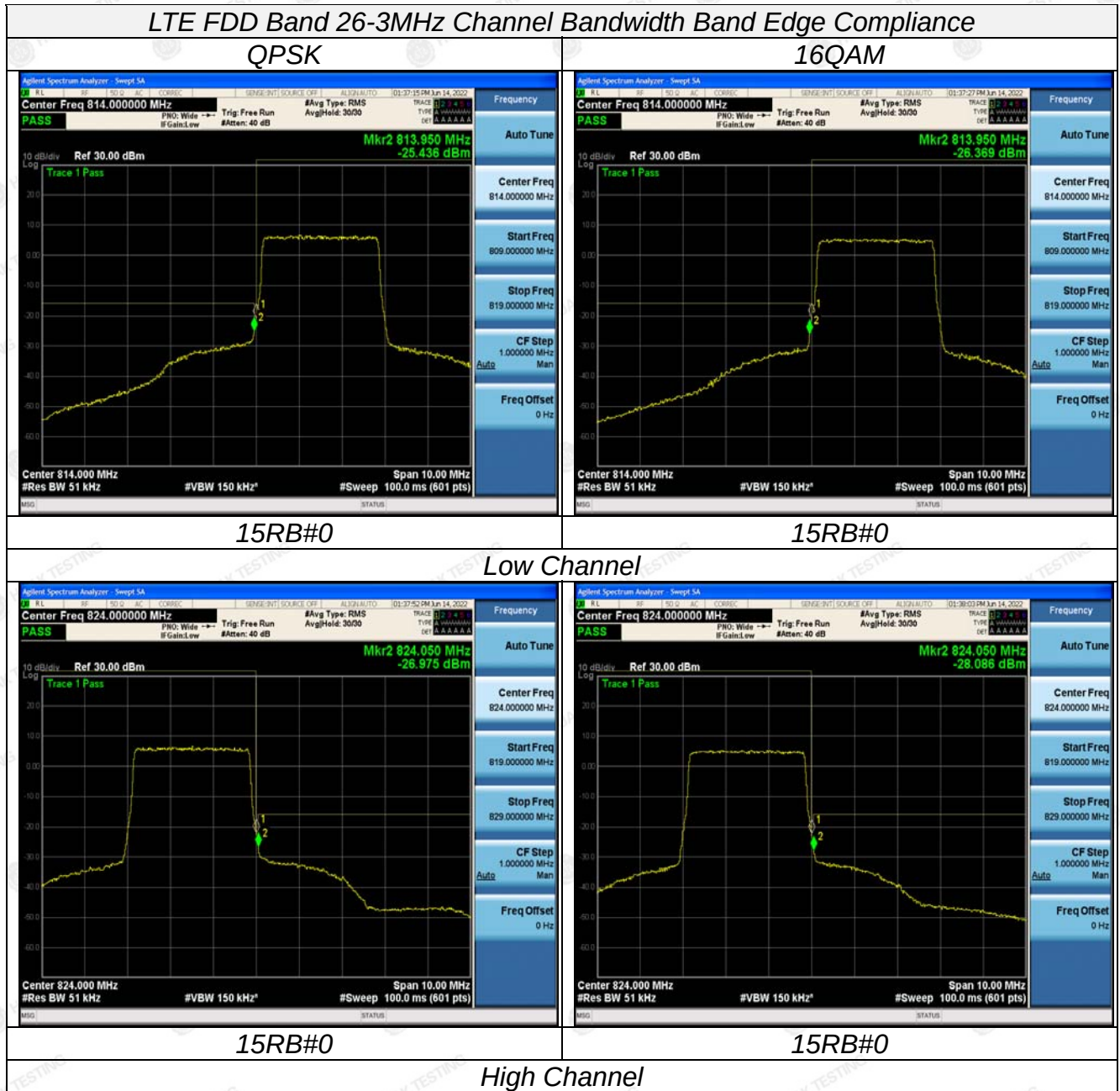
Low Channel

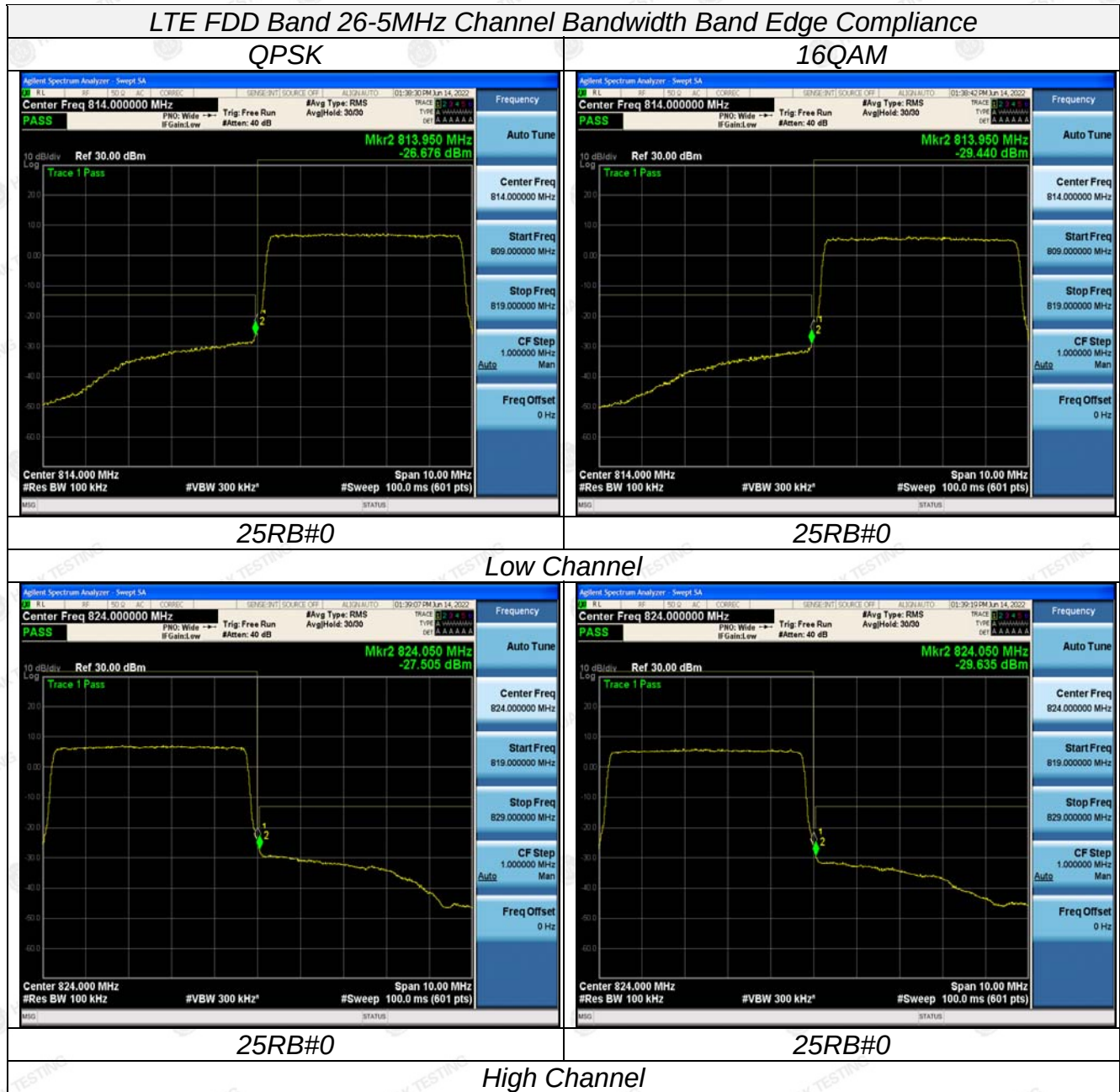


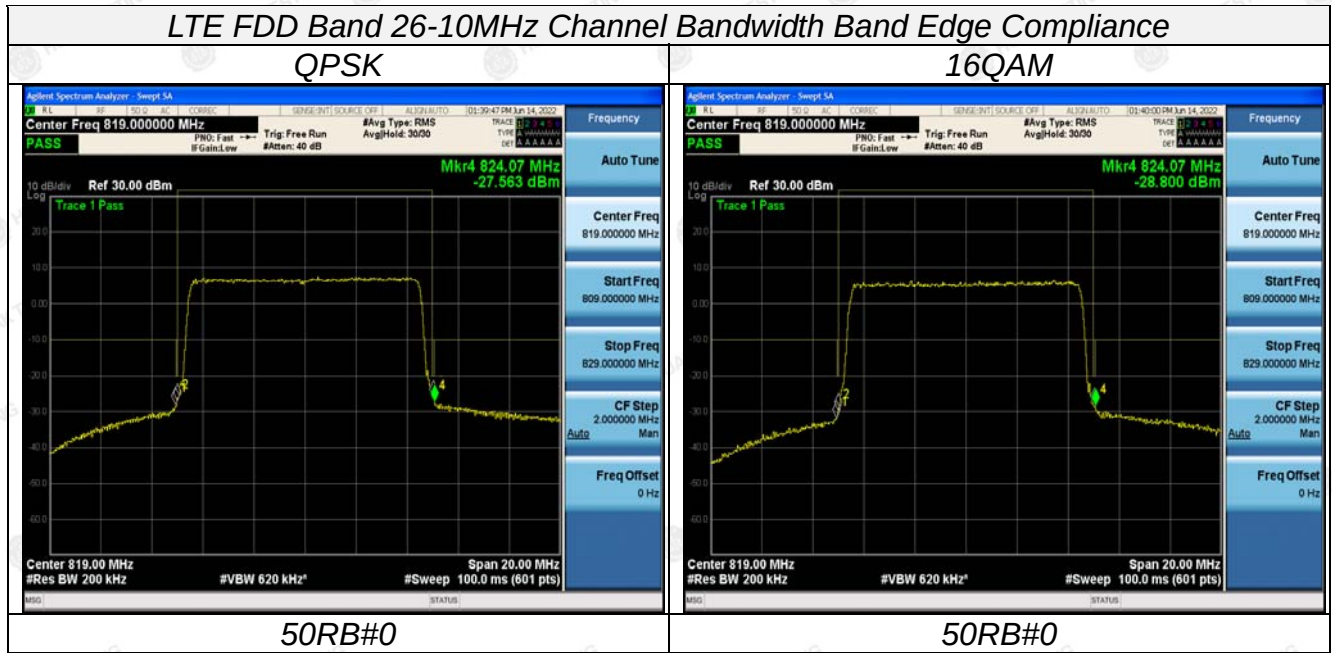
6RB#0

6RB#0

High Channel









Conducted Measurement:

