

FCC Test Report (Part 90 – LTE B26)

Report No.: RFBCKS-WTW-P22090987-4

FCC ID: 2A82RMARK3

Test Model: Mark 3

Received Date: Oct. 17, 2022

Test Date: Oct. 20, 2022 ~ Dec. 28, 2022

Issued Date: Jan. 16, 2023

Applicant: Arable Labs Inc.

Address: 51 Federal St., San Francisco, CA 94107, USA

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

Test Location: No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City
33383, TAIWAN

**FCC Registration /
Designation Number:** 788550 / TW0003



This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

Table of Contents

Release Control Record	3
1 Certificate of Conformity.....	4
2 Summary of Test Results	5
2.1 Measurement Uncertainty	5
2.2 Test Site and Instruments.....	6
3 General Information.....	7
3.1 General Description of EUT	7
3.2 Configuration of System under Test.....	9
3.2.1 Description of Support Units.....	9
3.3 Test Mode Applicability and Tested Channel Detail	10
3.4 EUT Operating Conditions	12
3.5 General Description of Applied Standards and References	12
4 Test Types and Results	13
4.1 Output Power Measurement	13
4.1.1 Limits of Output Power Measurement.....	13
4.1.2 Test Procedures.....	13
4.1.3 Test Setup.....	13
4.1.4 Test Results	14
4.2 Modulation Characteristics Measurement.....	17
4.2.1 Limits of Modulation Characteristics.....	17
4.2.2 Test Procedure	17
4.2.3 Test Setup.....	17
4.2.4 Test Results	17
4.3 Frequency Stability Measurement	18
4.3.1 Limits of Frequency Stability Measurement	18
4.3.2 Test Procedure	18
4.3.3 Test Setup.....	18
4.3.4 Test Results	19
4.4 Occupied Bandwidth Measurement	23
4.4.1 Limits of Occupied Bandwidth Measurement.....	23
4.4.2 Test Procedure	23
4.4.3 Test Setup.....	23
4.4.4 Test Result.....	24
4.5 Emission Mask Measurement.....	28
4.5.1 Limits of Emission Mask Measurement.....	28
4.5.2 Test Setup.....	28
4.5.3 Test Procedures.....	28
4.5.4 Test Results	29
4.6 Conducted Spurious Emissions	39
4.6.1 Limits of Conducted Spurious Emissions Measurement.....	39
4.6.2 Test Setup.....	39
4.6.3 Test Procedure	39
4.6.4 Test Results	40
4.7 Radiated Emission Measurement	44
4.7.1 Limits of Radiated Emission Measurement.....	44
4.7.2 Test Procedure	44
4.7.3 Deviation from Test Standard	44
4.7.4 Test Setup.....	45
4.7.5 Test Results	46
5 Pictures of Test Arrangements.....	53
Appendix – Information of the Testing Laboratories	54

Release Control Record

Issue No.	Description	Date Issued
RFBCKS-WTW-P22090987-4	Original Release	Jan. 16, 2023

1 Certificate of Conformity

Product: Arable Mark 3

Brand: Arable Labs

Test Model: Mark 3

Sample Status: Engineering Sample

Applicant: Arable Labs Inc.

Test Date: Oct. 20, 2022 ~ Dec. 28, 2022

Standards: FCC Part 90, Subpart I, S

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by :

Vera Huang

Date: Jan. 16, 2023

Vera Huang / Specialist

Approved by :

Jeremy Lin

Date: Jan. 16, 2023

Jeremy Lin / Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 90 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 90.635 (b)	Effective Radiated Power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement of limit.
2.1055 90.213	Frequency Stability	Pass	Meet the requirement of limit.
2.1049 90.209	Occupied Bandwidth	Pass	Meet the requirement of limit.
2.1051 90.691	Emission Masks	Pass	Meet the requirement of limit.
-	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 90.691	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 90.691	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -30.23dB at 47.46MHz.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.44 dB
	30MHz ~ 200MHz	2.93 dB
	200MHz ~ 1000MHz	2.95 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

2.2 Test Site and Instruments

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver Agilent	N9038A	MY51210129	Apr. 08, 2022	Apr. 07, 2023
Signal Analyzer Agilent	N9010A	MY52220314	Dec. 03, 2021 Dec. 09, 2022	Dec. 02, 2022 Dec. 08, 2023
Loop Antenna TESEQ	HLA 6121	45745	Jul. 27, 2022	Jul. 26, 2023
Pre-amplifier EMCI	EMC001340	980201	Sep. 23, 2022	Sep. 22, 2023
RF Coaxial Cable EMCI	5D-NM-BM	140903+140902	Jan. 15, 2022	Jan. 14, 2023
Preamplifier EMCI	EMC 330H	980112	Oct. 01, 2022	Sep. 30, 2023
BILOG Antenna SCHWARZBECK	VULB 9168	9168-472	Oct. 28, 2021 Oct. 21, 2022	Oct. 27, 2022 Oct. 20, 2023
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 01, 2022	Sep. 30, 2023
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 14, 2021 Nov. 13, 2022	Nov. 13, 2022 Nov. 12, 2023
Preamplifier EMCI	EMC 012645	980115	Oct. 01, 2022	Sep. 30, 2023
RF Coaxial Cable EMCI	EMC104-SM-SM-8000	171005	Oct. 01, 2022	Sep. 30, 2023
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1000(140807)	Oct. 01, 2022	Sep. 30, 2023
RF FLITER MICRO-TRONICS	BRM50716	058	Jun. 14, 2022	Jun. 13, 2023
RF FLITER MICRO-TRONICS	BRM17690	005	Jun. 14, 2022	Jun. 13, 2023
Pre-Amplifier EMCI	EMC 184045	980116	Oct. 01, 2022	Sep. 30, 2023
Broadband Horn Antenna SCHWARZBECK	BBHA 9170	148	Nov. 14, 2021 Nov. 13, 2022	Nov. 13, 2022 Nov. 12, 2023
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFA-440H	AT93021705	NA	NA
Turn Table Max-Full	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller Max-Full	MF-7802	NA	NA	NA
Boresight antenna tower fixture BV	BAF-02	7	NA	NA
Radio Communication Analyzer Anritsu	MT8821C	6201462755	Mar. 03, 2022	Mar. 02, 2023

Notes:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HY - 966 chamber 5.

3 General Information

3.1 General Description of EUT

Product	Arable Mark 3		
Brand	Arable Labs		
Test Model	Mark 3		
Sample Status	Engineering Sample		
Power Supply Rating	3.7Vdc (Battery*2pcs) 5.0Vdc (Solar panels or host)		
Modulation Type	QPSK, 16QAM		
Operating Frequency	LTE 26 (Channel Bandwidth: 1.4 MHz)	814.7MHz ~ 823.3MHz	
	LTE 26 (Channel Bandwidth: 3 MHz)	815.5MHz ~ 822.5MHz	
	LTE 26 (Channel Bandwidth: 5 MHz)	816.5MHz ~ 821.5MHz	
	LTE 26 (Channel Bandwidth: 10 MHz)	819.0MHz	
Max. ERP Power	eMTC		
		QPSK	16QAM
	LTE 26 (Channel Bandwidth: 1.4 MHz)	169.824mW (22.30dBm)	145.211mW (21.62dBm)
	LTE 26 (Channel Bandwidth: 3 MHz)	162.555mW (22.11dBm)	161.065mW (22.07dBm)
	LTE 26 (Channel Bandwidth: 5 MHz)	169.044mW (22.28dBm)	162.181mW (22.10dBm)
	LTE 26 (Channel Bandwidth: 10 MHz)	170.216mW (22.31dBm)	161.436mW (22.08dBm)
Emission Designator	eMTC		
		QPSK	16QAM
	LTE 26 (Channel Bandwidth: 1.4 MHz)	1M08G7D	901KD7W
	LTE 26 (Channel Bandwidth: 3 MHz)	1M08G7D	899KD7W
	LTE 26 (Channel Bandwidth: 5 MHz)	1M08G7D	900KD7W
	LTE 26 (Channel Bandwidth: 10 MHz)	1M08G7D	898KD7W
Antenna Type	Refer to Note		
Antenna Connector	Refer to Note		
Accessory Device	Refer to Note		
Cable Supplied	Refer to Note		

Note:

1. The EUT uses following accessories.

Solar panels		
Brand	Model	
Voltaic Systems	P293	
M8 to USB Cable		
Specification		
2.5m non-shielded without core		
Battery		
Brand	Model	Specification
K2 Energy	K2B3V7EB	Power Rating : 3.7Vdc, 7.5Ah (2pcs)

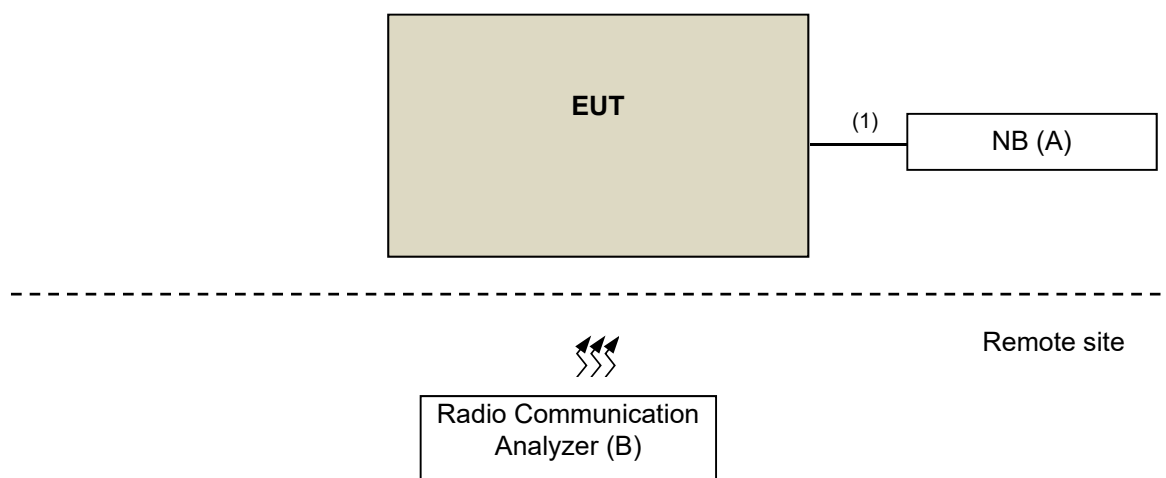
2. The antenna information for host is listed as below.

Type		Dipole									
Connector		N Plug									
Antenna gain (dBi)											
GSM 850	GSM 1900	eMTC Band 26	NB-IoT Band 71	eMTC / NB-IoT Band							
				2	4	5	12	13	25	66	85
1.8	3.2	1.8	1.8	3.2	3.2	1.8	1.8	1.8	3.2	3.2	1.8

* Detail antenna specification please refer to antenna datasheet or an antenna gain measurement report.

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 Configuration of System under Test



3.2.1 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.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	NB	Lenovo	80Q7	PF0KUGU6	N/A	Provided by Lab
B	Radio Communication Analyzer	Anritsu	MT8821C	6201462755	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	M8 to USB Cable	1	2.5	N	0	Accessory of EUT

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	The Power Supply have the following modes: Battery/Solar panels/host. Pre-scan these modes of Power Supply and find the worst case as a representative test condition.
Worst Case:	Power Supply Worst Condition: host

eMTC

LTE Band 26

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
-	ERP	26697 to 26783	26697 (814.7MHz), 26740 (819.0MHz), 26783 (823.3MHz)	1.4MHz	QPSK / 16QAM	1 Half Full
		26705 to 26775	26705 (815.5MHz), 26740 (819.0MHz), 26775 (822.5MHz)	3MHz	QPSK / 16QAM	1 Half Full
		26715 to 26765	26715 (816.5MHz), 26740 (819.0MHz), 26765 (821.5MHz)	5MHz	QPSK / 16QAM	1 Half Full
		26740	26740 (819.0MHz)	10MHz	QPSK / 16QAM	1 Half Full
-	Modulation Characteristics	26740	26740 (819.0MHz)	10MHz	QPSK / 16QAM	Full
-	Frequency Stability	26697 to 26783	26697 (814.7MHz), 26783 (823.3MHz)	1.4MHz	QPSK	Full
		26705 to 26775	26705 (815.5MHz), 26775 (822.5MHz)	3MHz	QPSK	Full
		26715 to 26765	26715 (816.5MHz), 26765 (821.5MHz)	5MHz	QPSK	Full
		26740	26740 (819.0MHz)	10MHz	QPSK	Full

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
-	Occupied Bandwidth	26697 to 26783	26697 (814.7MHz), 26740 (819.0MHz), 26783 (823.3MHz)	1.4MHz	QPSK / 16QAM	Full
		26705 to 26775	26705 (815.5MHz), 26740 (819.0MHz), 26775 (822.5MHz)	3MHz	QPSK / 16QAM	Full
		26715 to 26765	26715 (816.5MHz), 26740 (819.0MHz), 26765 (821.5MHz)	5MHz	QPSK / 16QAM	Full
		26740	26740 (819.0MHz)	10MHz	QPSK / 16QAM	Full
-	Emission Masks	26697 to 26783	26697 (814.7MHz), 26783 (823.3MHz)	1.4MHz	QPSK	1 Half Full
		26705 to 26775	26705 (815.5MHz), 26775 (822.5MHz)	3MHz	QPSK	1 Half Full
		26715 to 26765	26715 (816.5MHz), 26765 (821.5MHz)	5MHz	QPSK	1 Half Full
		26740	26740 (819.0MHz)	10MHz	QPSK	1 Half Full
-	Conducted Emission	26697 to 26783	26697 (814.7MHz), 26740 (819.0MHz), 26783 (823.3MHz)	1.4MHz	QPSK	1
		26705 to 26775	26705 (815.5MHz), 26740 (819.0MHz), 26775 (822.5MHz)	3MHz	QPSK	1
		26715 to 26765	26715 (816.5MHz), 26740 (819.0MHz), 26765 (821.5MHz)	5MHz	QPSK	1
		26740	26740 (819.0MHz)	10MHz	QPSK	1
-	Radiated Emission Below 1GHz	26715 to 26765	26740 (819.0MHz)	5MHz	QPSK	1
-	Radiated Emission Above 1GHz	26697 to 26783	26697 (814.7MHz), 26740 (819.0MHz), 26783 (823.3MHz)	1.4MHz	QPSK	1
		26715 to 26765	26715 (816.5MHz), 26740 (819.0MHz), 26765 (821.5MHz)	5MHz	QPSK	1
		26740	26740 (819.0MHz)	10MHz	QPSK	1

Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation. Therefore, only ERP, modulation characteristics, occupied bandwidth and peak to average ratio items had been tested under QPSK, 16QAM mode, the other items were performed under QPSK mode only.
2. For radiated emission below 1GHz, select the worst radiated emission channel (above 1GHz) for final testing.
3. For radiated emission above 1GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5MHz & highest channel bandwidth for final test.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
ERP	25deg. C, 60%RH	120 Vac, 60 Hz	James Yang
Modulation characteristics	25deg. C, 60%RH	120 Vac, 60 Hz	Willy Cheng
Frequency Stability	25deg. C, 60%RH	120 Vac, 60 Hz	Willy Cheng
Occupied Bandwidth	25deg. C, 60%RH	120 Vac, 60 Hz	Willy Cheng
Emission Mask	25deg. C, 60%RH	120 Vac, 60 Hz	Willy Cheng
Conducted Emission	25deg. C, 60%RH	120 Vac, 60 Hz	Willy Cheng
Radiated Emission Below 1GHz	23deg. C, 71%RH	120 Vac, 60 Hz	Thomas Cheng
Radiated Emission Above 1GHz	22deg. C, 66%RH	120 Vac, 60 Hz	Thomas Cheng

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

3.5 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test Standard:

FCC 47 CFR Part 2

FCC 47 CFR Part 90

ANSI/TIA/EIA-603-E 2016

ANSI 63.26-2015

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 971168 D02 Misc Rev Approv License Devices v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

The output power shall be according to the specific rule Part 90.635 that “Mobile station are limited to 100 watts e.r.p”.

4.1.2 Test Procedures

Conducted Power Measurement:

The EUT was set up for the maximum power with eMTC link data modulation and link up with simulator (Built-in power meter). Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Maximum EIRP / ERP

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is

given in Equation as follows:

$$\text{EIRP} = P_{\text{Meas}} + G_T$$

$$\text{ERP} = P_{\text{Meas}} + G_T - 2.15$$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively
(expressed in the same units as P_{Meas} , e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

4.1.3 Test Setup

Conducted Power Measurement:



4.1.4 Test Results

Conducted Output Power (dBm)

eMTC

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26697	26740	26783
		Frequency (MHz)		814.7	819	823.3
1.4M	QPSK	1	0	22.29	22.35	22.59
		1	6	22.39	22.65	22.28
		6	0	21.02	21.03	21.10
1.4M	16QAM	1	0	21.70	21.82	21.97
		1	6	21.66	21.73	21.96
		6	0	21.69	21.71	21.80

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26705	26740	26775
		Frequency (MHz)		815.5	819	822.5
3M	QPSK	1	0	22.45	22.19	22.46
		1	6	22.36	22.46	22.13
		6	0	21.03	21.03	21.12
3M	16QAM	1	0	21.86	22.17	21.92
		1	6	22.24	22.42	22.10
		6	0	21.05	21.37	21.46

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26715	26740	26765
		Frequency (MHz)		816.5	819	821.5
5M	QPSK	1	0	22.19	22.63	22.41
		1	6	22.40	22.40	22.05
		6	0	22.14	22.13	22.25
5M	16QAM	1	0	22.27	22.45	22.25
		1	6	22.22	22.24	21.99
		6	0	21.40	21.22	21.50

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Mid		
		Channel		26740		
		Frequency (MHz)		819		
10M	QPSK	1	0	22.66		
		1	6	22.62		
		6	0	22.55		
10M	16QAM	1	0	22.43		
		1	6	22.28		
		6	0	22.21		

ERP Power (dBm)

eMTC

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26697	26740	26783
		Frequency (MHz)		814.7	819	823.3
1.4M	QPSK	1	0	21.94	22.00	22.24
		1	6	22.04	22.30	21.93
		6	0	20.67	20.68	20.75
1.4M	16QAM	1	0	21.35	21.47	21.62
		1	6	21.31	21.38	21.61
		6	0	21.34	21.36	21.45

*ERP = Conducted + antenna gain (1.8dBi) - 2.15

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26705	26740	26775
		Frequency (MHz)		815.5	819	822.5
3M	QPSK	1	0	22.10	21.84	22.11
		1	6	22.01	22.11	21.78
		6	0	20.68	20.68	20.77
3M	16QAM	1	0	21.51	21.82	21.57
		1	6	21.89	22.07	21.75
		6	0	20.70	21.02	21.11

*ERP = Conducted + antenna gain (1.8dBi) - 2.15

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26715	26740	26765
		Frequency (MHz)		816.5	819	821.5
5M	QPSK	1	0	21.84	22.28	22.06
		1	6	22.05	22.05	21.70
		6	0	21.79	21.78	21.90
5M	16QAM	1	0	21.92	22.10	21.90
		1	6	21.87	21.89	21.64
		6	0	21.05	20.87	21.15

*ERP = Conducted + antenna gain (1.8dBi) - 2.15

LTE Band 26				
BW	MCS Index	RB Size	RB Offset	Mid
		Channel		26740
		Frequency (MHz)		819
10M	QPSK	1	0	22.31
		1	6	22.27
		6	0	22.20
10M	16QAM	1	0	22.08
		1	6	21.93
		6	0	21.86

*ERP = Conducted + antenna gain (1.8dBi) - 2.15

4.2 Modulation Characteristics Measurement

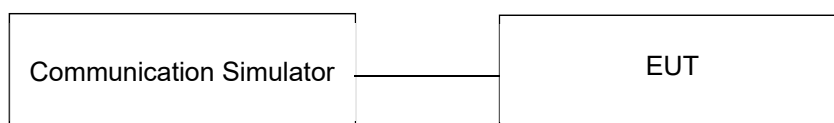
4.2.1 Limits of Modulation Characteristics

N/A

4.2.2 Test Procedure

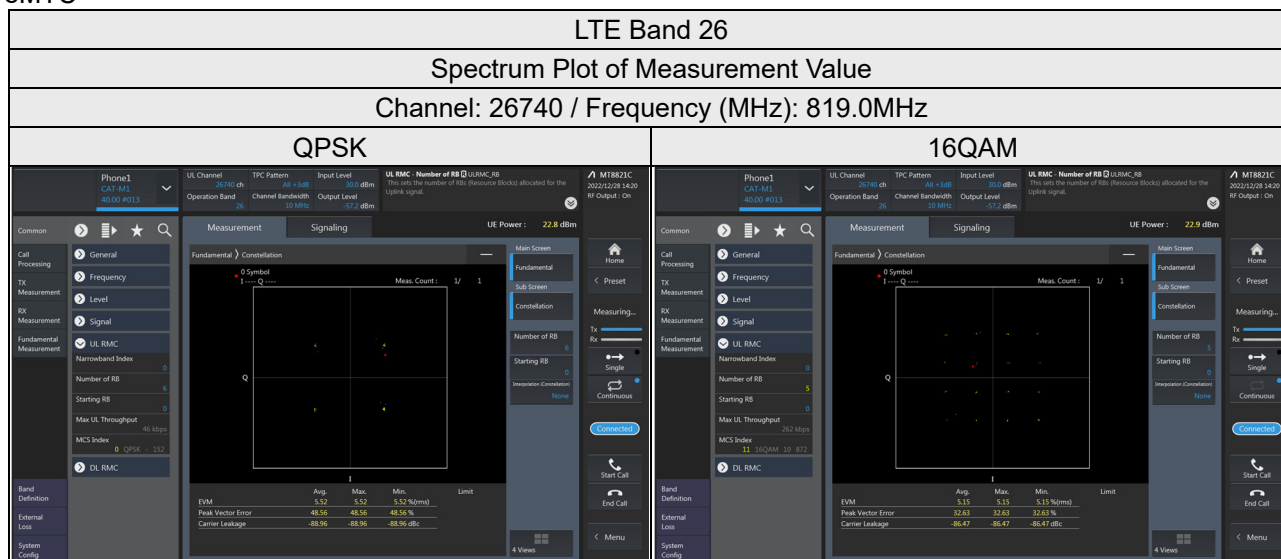
Connect the EUT to Communication Simulator via the antenna connector, The frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

4.2.3 Test Setup



4.2.4 Test Results

eMTC



4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

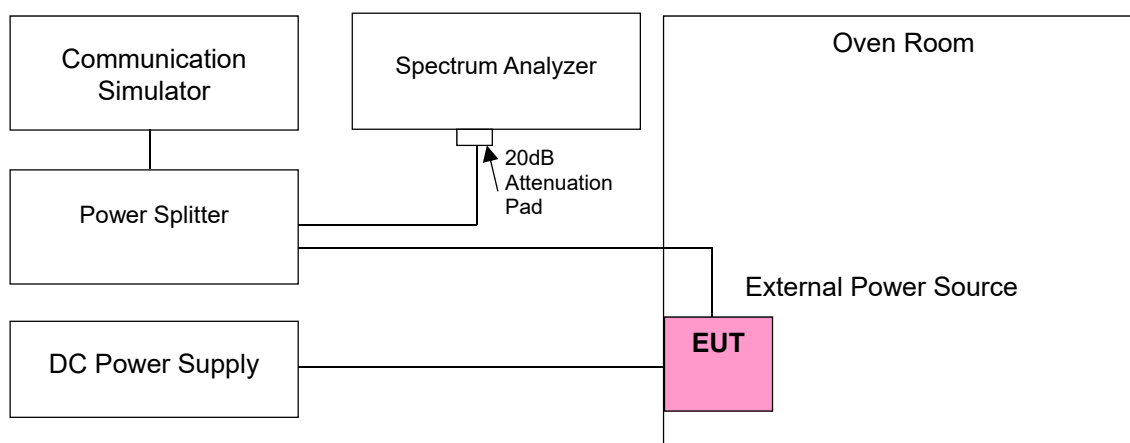
1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

4.3.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Note: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Setup



4.3.4 Test Results

eMTC

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 26			
	Channel Bandwidth: 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	814.6999960	-0.005	823.3000020	0.002
3.7	814.6999960	-0.005	823.3000040	0.005
4.26	814.6999980	-0.002	823.2999990	-0.001

Note: The applicant defined the normal working voltage is from 3.15Vdc to 4.26Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 26			
	Channel Bandwidth: 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	814.6999990	-0.001	823.3000020	0.002
-20	814.6999960	-0.005	823.3000020	0.002
-10	814.6999960	-0.005	823.3000040	0.005
0	814.6999980	-0.002	823.2999960	-0.005
10	814.7000040	0.005	823.3000030	0.004
20	814.6999970	-0.004	823.3000030	0.004
30	814.6999960	-0.005	823.3000040	0.005
40	814.6999960	-0.005	823.2999970	-0.004
50	814.7000040	0.005	823.2999990	-0.001
60	814.7000010	0.001	823.2999980	-0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 26			
	Channel Bandwidth: 3MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	815.5000010	0.001	822.4999960	-0.005
3.7	815.5000010	0.001	822.4999960	-0.005
4.26	815.5000010	0.001	822.4999990	-0.001

Note: The applicant defined the normal working voltage is from 3.15Vdc to 4.26Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 26			
	Channel Bandwidth: 3MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	815.5000010	0.001	822.4999970	-0.004
-20	815.4999980	-0.002	822.5000030	0.004
-10	815.4999980	-0.002	822.5000030	0.004
0	815.5000040	0.005	822.5000030	0.004
10	815.4999980	-0.002	822.4999960	-0.005
20	815.4999960	-0.005	822.5000020	0.002
30	815.4999980	-0.002	822.4999970	-0.004
40	815.5000010	0.001	822.5000010	0.001
50	815.5000010	0.001	822.5000010	0.001
60	815.5000020	0.002	822.5000040	0.005

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 26			
	Channel Bandwidth: 5MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	816.5000010	0.001	821.5000010	0.001
3.7	816.4999990	-0.001	821.4999970	-0.004
4.26	816.4999970	-0.004	821.5000010	0.001

Note: The applicant defined the normal working voltage is from 3.15Vdc to 4.26Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 26			
	Channel Bandwidth: 5MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	816.5000040	0.005	821.5000010	0.001
-20	816.4999990	-0.001	821.4999990	-0.001
-10	816.5000030	0.004	821.4999990	-0.001
0	816.5000030	0.004	821.4999980	-0.002
10	816.5000010	0.001	821.4999970	-0.004
20	816.4999960	-0.005	821.5000010	0.001
30	816.5000040	0.005	821.5000040	0.005
40	816.4999980	-0.002	821.4999970	-0.004
50	816.5000040	0.005	821.4999960	-0.005
60	816.4999990	-0.001	821.5000030	0.004

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 26	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
3.15	818.9999970	-0.004
3.7	819.0000040	0.005
4.26	819.0000010	0.001

Note: The applicant defined the normal working voltage is from 3.15Vdc to 4.26Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 26	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
-30	818.9999960	-0.005
-20	818.9999960	-0.005
-10	819.0000020	0.002
0	818.9999990	-0.001
10	819.0000020	0.002
20	818.9999970	-0.004
30	818.9999980	-0.002
40	818.9999970	-0.004
50	818.9999990	-0.001
60	819.0000020	0.002

4.4 Occupied Bandwidth Measurement

4.4.1 Limits of Occupied Bandwidth Measurement

The occupied bandwidth (OBW), that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 % of the total mean power radiated by a given emission.

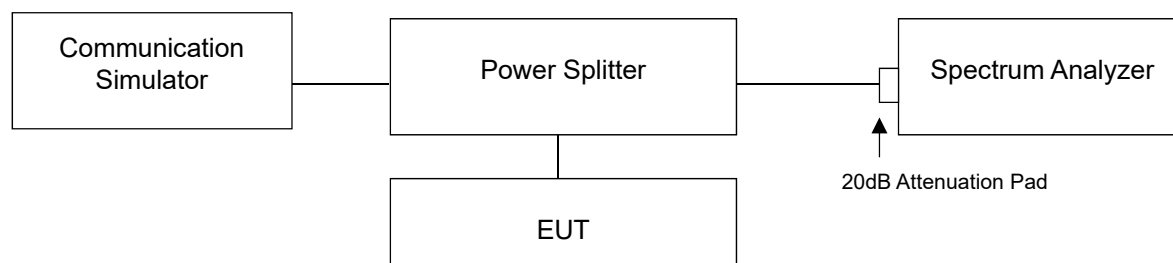
4.4.2 Test Procedure

For the 26dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times \text{RBW}$.
- Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- Determine the following reference values: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.
- The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.

4.4.3 Test Setup



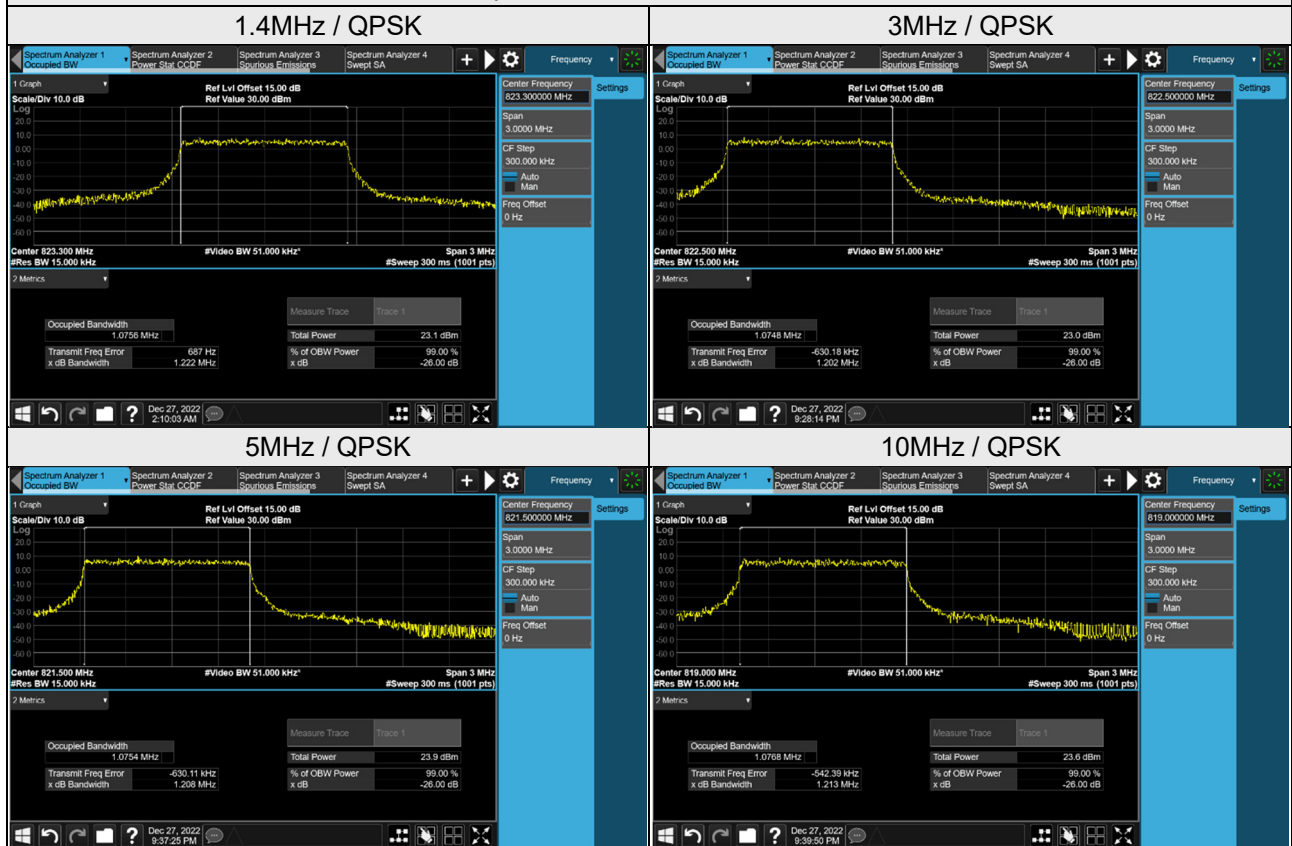
4.4.4 Test Result

Occupied Bandwidth

eMTC

LTE Band 26, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26697	814.7	1.075	0.899
26740	819.0	1.075	0.900
26783	823.3	1.076	0.901
LTE Band 26, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26705	815.5	1.073	0.895
26740	819.0	1.074	0.899
26775	822.5	1.075	0.899
LTE Band 26, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26715	816.5	1.075	0.900
26740	819.0	1.073	0.898
26765	821.5	1.075	0.898
LTE Band 26, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26740	819.0	1.077	0.898

Spectrum Plot of Worst Value

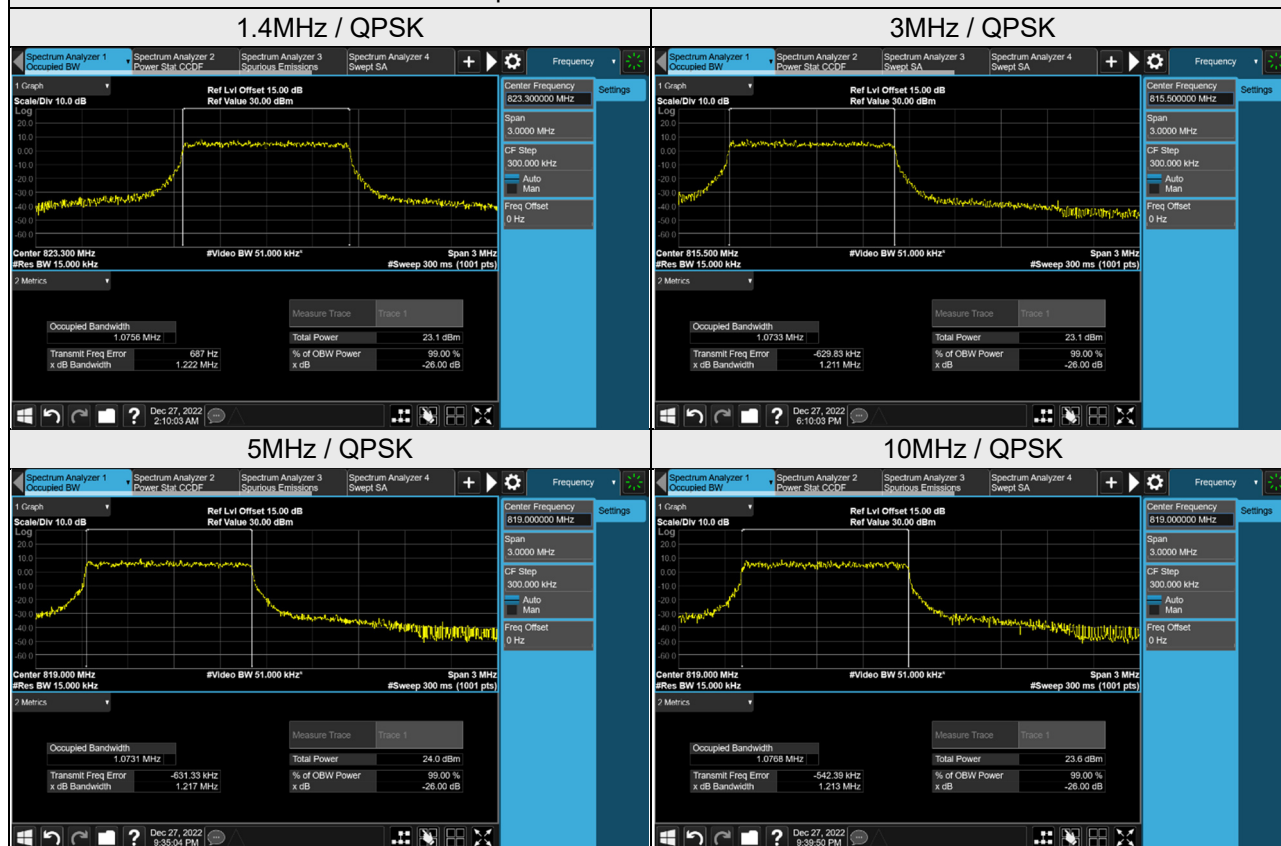


26dB Bandwidth

eMTC

LTE Band 26, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26697	814.7	1.205	1.065
26740	819.0	1.202	1.056
26783	823.3	1.222	1.075
LTE Band 26, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26705	815.5	1.211	1.059
26740	819.0	1.198	1.053
26775	822.5	1.202	1.053
LTE Band 26, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26715	816.5	1.215	1.058
26740	819.0	1.217	1.052
26765	821.5	1.208	1.049
LTE Band 26, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26740	819.0	1.213	1.048

Spectrum Plot of Worst Value



4.5 Emission Mask Measurement

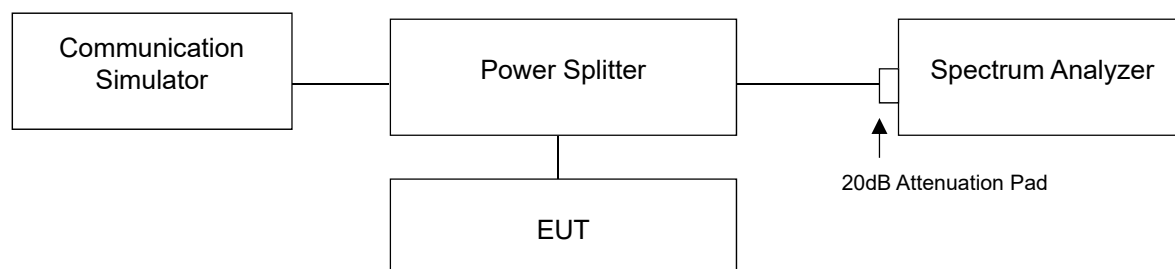
4.5.1 Limits of Emission Mask Measurement

According to FCC part 90.691 shall be tested the emission mask. 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.

For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log_{10}(P)$ 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 37.5 kHz.

For § 90.691(a), RBW=300 Hz for offset less than 37.5 kHz from channel edge and RBW=100 kHz for offsets greater than 37.5 kHz is allowed, tested in accordance with FCC KDB 971168 D02 section VIII.

4.5.2 Test Setup



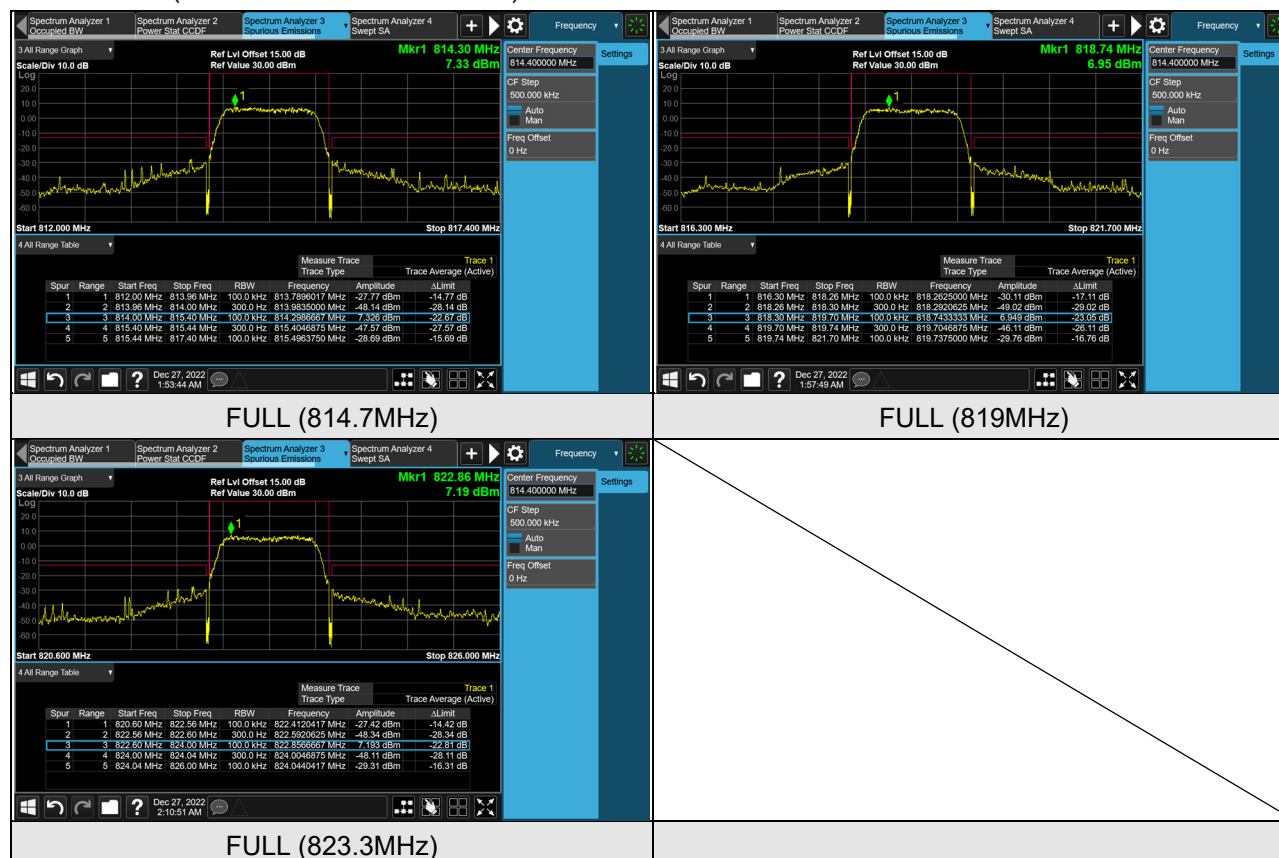
4.5.3 Test Procedures

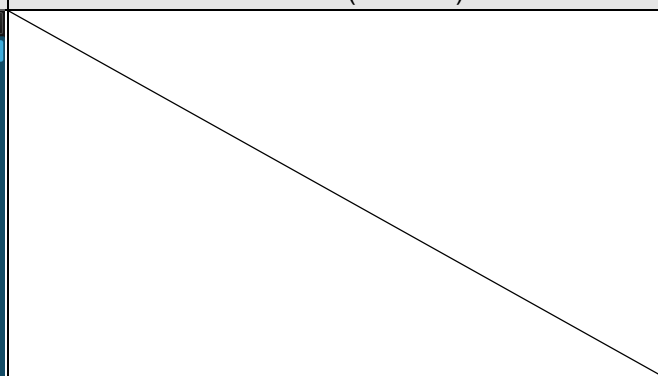
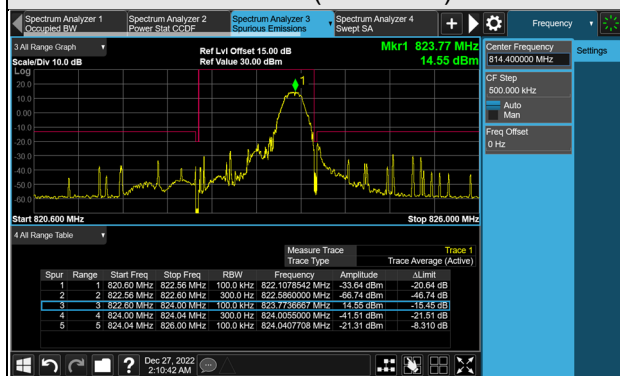
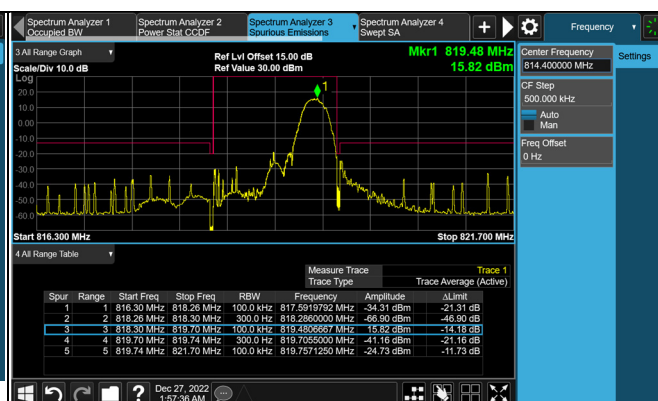
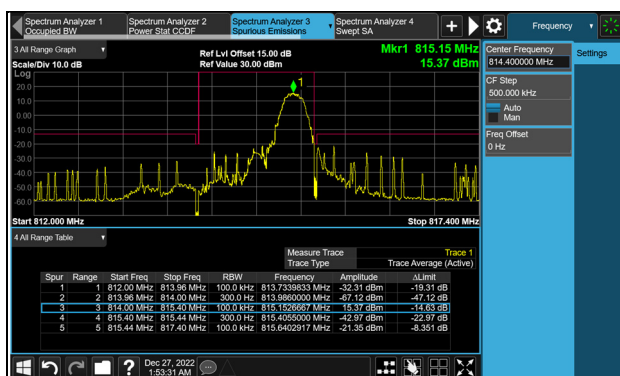
- The measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- Measurement refer to FCC part 90.691 and KDB 971168 D02 Misc Rev Approv License Devices v02r01 section VIII c).
- Record the test plot. 971168 D02 Misc Rev Approv License Devices v02r01

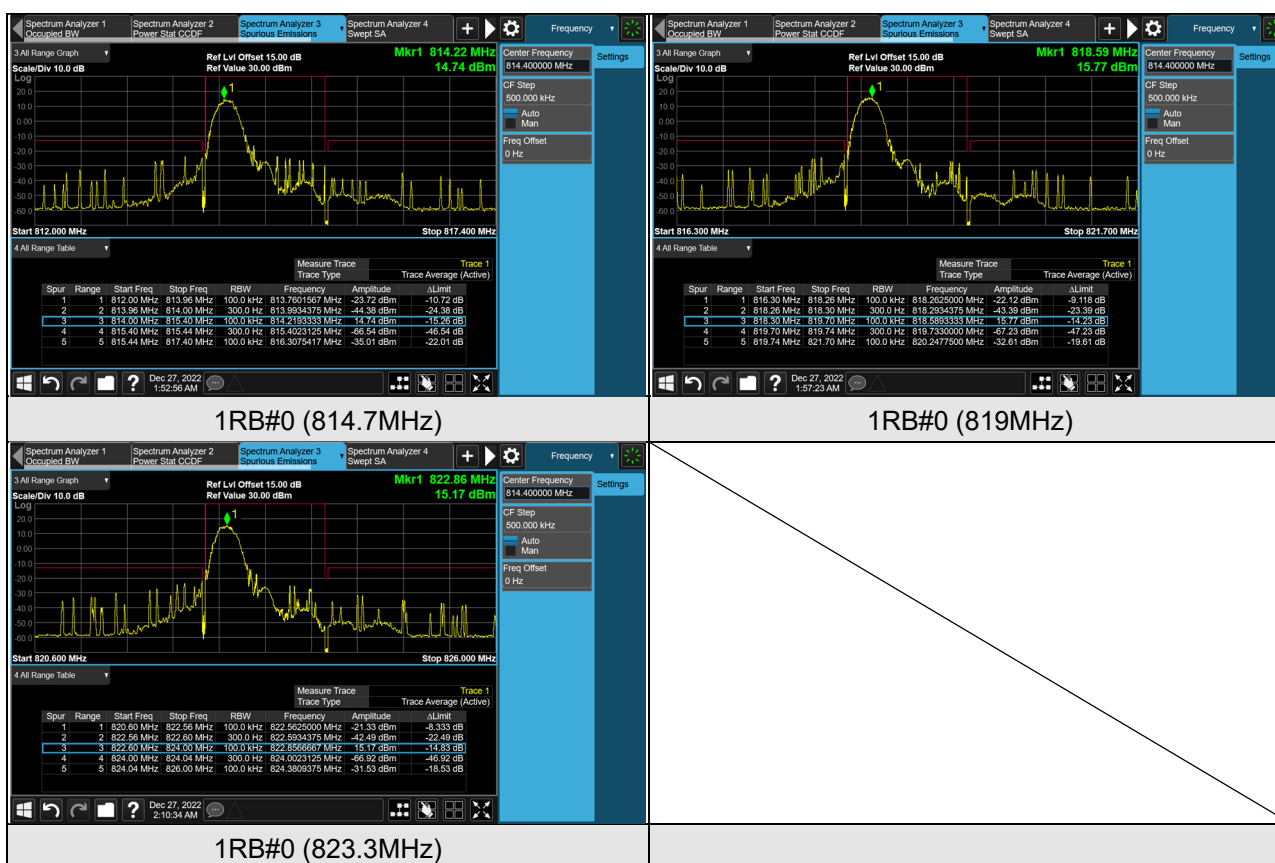
4.5.4 Test Results

eMTC

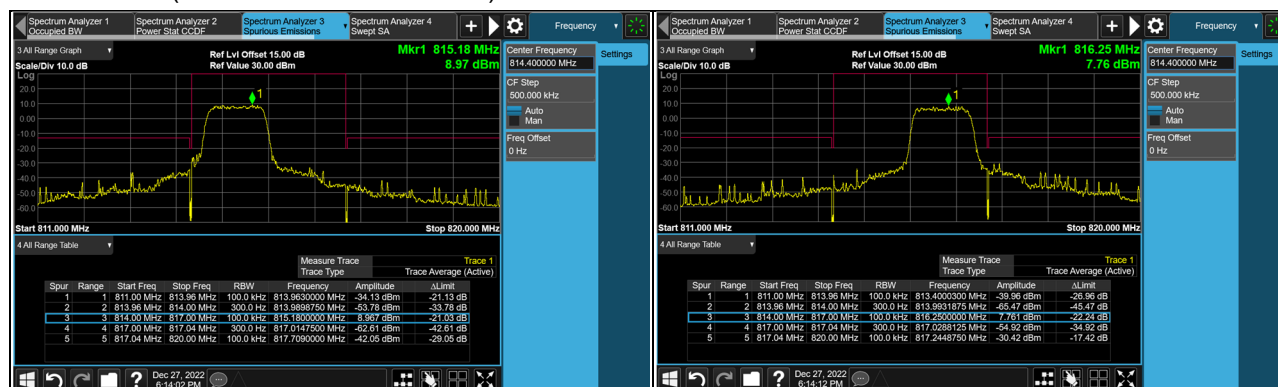
LTE Band 26 (Channel Bandwidth 1.4MHz)



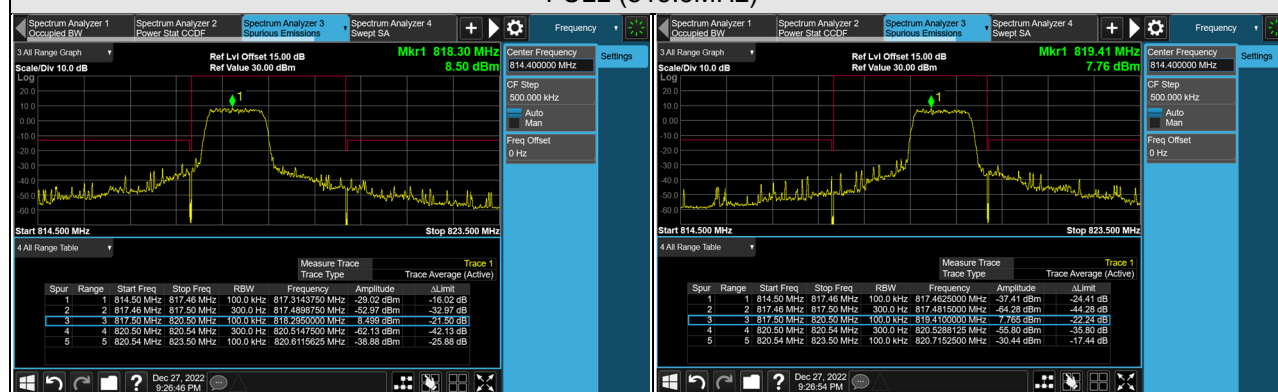




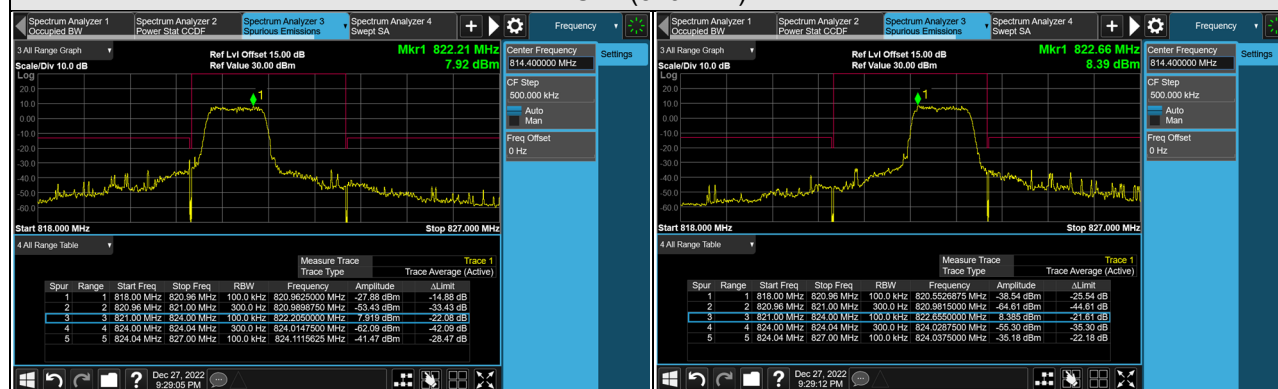
LTE Band 26 (Channel Bandwidth 3MHz)



FULL (815.5MHz)



FULL (819MHz)



FULL (822.5MHz)

