FCC Test Report
(Part 22 – GSM, LTE B5/B26, NB-IoT B5)

Report No.:	RFBCKS-WTW-P22090987-1
FCC ID:	2A82RMARK3
Test Model:	Mark 3
Received Date:	Oct. 17, 2022
Test Date:	Oct. 20, 2022 ~ Jan. 13, 2023
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

Testing Laboratory
2021

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBCKS-WTW-P22090987-1	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 ~ Jan. 13, 2023
Standards:	FCC Part 22, Subpart H

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 22 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 22.913 (a)	Effective radiated power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement of limit.
22.913 (d)	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1055 22.355	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
22.917	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 22.917	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 22.917	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -30.43 dB at 48.43 MHz.

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) (±)
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. 02, 2022
			Dec. 09, 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. 27, 2022
			Oct. 21, 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	GSM/GPRS: GMSK EDGE: GMSK, 8PSK LTE: QPSK, 16QAM NB-IoT: BPSK, QPSK (Subcarrier Spacing: 3.75kHz,15kHz)	
Operating Frequency	GSM850	824.2MHz ~ 848.8MHz
	eMTC	
	LTE Band 5 (Channel Bandwidth 1.4MHz)	824.7MHz ~ 848.3MHz
	LTE Band 5 (Channel Bandwidth 3MHz)	825.5MHz ~ 847.5MHz
	LTE Band 5 (Channel Bandwidth 5MHz)	826.5MHz ~ 846.5MHz
	LTE Band 5 (Channel Bandwidth 10MHz)	829.0MHz ~ 844.0MHz
	LTE 26 (Channel Bandwidth: 1.4 MHz)	824.7 ~ 848.3 MHz
	LTE 26 (Channel Bandwidth: 3 MHz)	825.5 ~ 847.5 MHz
	LTE 26 (Channel Bandwidth: 5 MHz)	826.5 ~ 846.5 MHz
	LTE 26 (Channel Bandwidth: 10 MHz)	829 ~ 844 MHz
	LTE 26 (Channel Bandwidth: 15 MHz)	831.5 ~ 841.5 MHz
	NB-IoT Standalone	
	NB-IoT Band 5	824.2MHz ~ 848.8MHz

Max. ERP Power	GPRS	1309.182 mW (31.17dBm)	
	EDGE	321.366 mW (25.07dBm)	
	eMTC		
		QPSK	16QAM
	LTE Band 5 (Channel Bandwidth 1.4MHz)	155.955mW (21.93dBm)	151.356mW (21.80dBm)
	LTE Band 5 (Channel Bandwidth 3MHz)	159.956mW (22.04dBm)	156.675W (21.95dBm)
	LTE Band 5 (Channel Bandwidth 5MHz)	159.588mW (22.03dBm)	150.314mW (21.77dBm)
	LTE Band 5 (Channel Bandwidth 10MHz)	163.305mW (22.13dBm)	159.588mW (22.03dBm)
	LTE 26 (Channel Bandwidth: 1.4 MHz)	163.305mW (22.13dBm)	159.588mW (22.03dBm)
	LTE 26 (Channel Bandwidth: 3 MHz)	169.044mW (22.28dBm)	161.436mW (22.08dBm)
	LTE 26 (Channel Bandwidth: 5 MHz)	164.059mW (22.15dBm)	161.808mW (22.09dBm)
	LTE 26 (Channel Bandwidth: 10 MHz)	162.181mW (22.10dBm)	152.757mW (21.84dBm)
	LTE 26 (Channel Bandwidth: 15 MHz)	173.380mW (22.39dBm)	161.065mW (22.07dBm)
	NB-IoT Standalone		
		BPSK	QPSK
	NB-IoT Band 5	168.655mW (22.27dBm)	174.181mW (22.41dBm)
Emission Designator	GPRS	249KGXW	
	EDGE	246KG7W	
	eMTC		
		QPSK	16QAM
	LTE Band 5 (Channel Bandwidth 1.4MHz)	1M09G7D	911KD7W
	LTE Band 5 (Channel Bandwidth 3MHz)	1M08G7D	914KD7W
	LTE Band 5 (Channel Bandwidth 5MHz)	1M09G7D	912KD7W
	LTE Band 5 (Channel Bandwidth 10MHz)	1M09G7D	910KD7W
	LTE 26 (Channel Bandwidth: 1.4 MHz)	1M08G7D	902KD7W
	LTE 26 (Channel Bandwidth: 3 MHz)	1M08G7D	902KD7W
	LTE 26 (Channel Bandwidth: 5 MHz)	1M08G7D	900KD7W
	LTE 26 (Channel Bandwidth: 10 MHz)	1M08G7D	899KD7W
	LTE 26 (Channel Bandwidth: 15 MHz)	1M08G7D	899KD7W
	NB-IoT Standalone		
		BPSK	QPSK
	NB-IoT Band 5	85K3G7D	191KG7D

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.

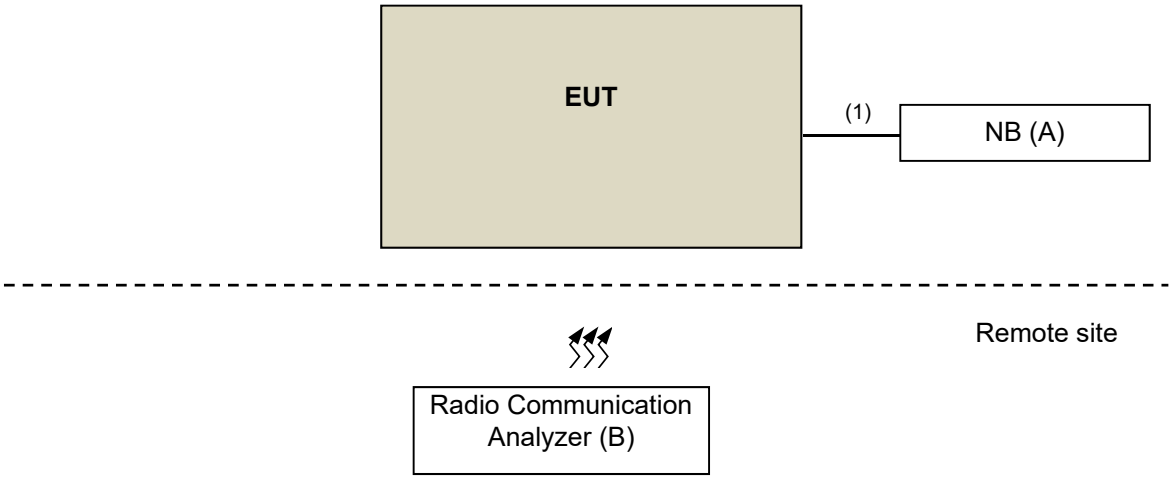
Type	Dipole
Connector	N Plug

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.
4. NB-IoT test method refers to 3GPP TS 36.521-1 V17.4.0 (2022-09) section 6.1. For NB-IoT tests in all operating frequency bands, standalone is used as the default operating mode unless otherwise specified by the test case.

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

GSM850

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Mode
-	ERP	128 to 251	128 (824.2MHz), 189 (836.4MHz), 251 (848.8MHz)	GPRS, EDGE
-	Modulation Characteristics	128 to 251	189 (836.4MHz)	GPRS, EDGE
-	Frequency Stability	128 to 251	128 (824.2MHz), 251 (848.8MHz)	GPRS, EDGE
-	Occupied Bandwidth	128 to 251	128 (824.2MHz), 189 (836.4MHz), 251 (848.8MHz)	GPRS, EDGE
-	Band Edge	128 to 251	128(824.2MHz), 251(848.8MHz)	GPRS, EDGE
-	Peak To Average Ratio	128 to 251	128 (824.2MHz), 189 (836.4MHz), 251 (848.8MHz)	GPRS, EDGE
-	Conducted Emission	128 to 251	128 (824.2MHz), 189 (836.4MHz), 251 (848.8MHz)	GPRS, EDGE
-	Radiated Emission Below 1GHz	128 to 251	189 (836.4MHz)	GPRS
			251 (848.8MHz)	EDGE
-	Radiated Emission Above 1GHz	128 to 251	128 (824.2MHz), 189 (836.4MHz), 251 (848.8MHz)	GPRS, EDGE

Note: For radiated emission below 1GHz, select the worst radiated emission channel (above 1GHz) for final testing.

eMTC
LTE Band 5

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	RB #
-	ERP	20407 to 20643	20407 (824.7MHz), 20525 (836.5MHz), 20643 (848.3MHz)	1.4MHz	QPSK / 16QAM	1 Half Full
		20415 to 20635	20415 (825.5MHz), 20525 (836.5MHz), 20635 (847.5MHz)	3MHz	QPSK / 16QAM	1 Half Full
		20425 to 20625	20425 (826.5MHz), 20525 (836.5MHz), 20625 (846.5MHz)	5MHz	QPSK / 16QAM	1 Half Full
		20450 to 20600	20450 (829.0MHz), 20525 (836.5MHz), 20600 (844.0MHz)	10MHz	QPSK / 16QAM	1 Half Full
-	Modulation Characteristics	20450 to 20600	20525 (836.5MHz)	10MHz	QPSK / 16QAM	Full
-	Frequency Stability	20407 to 20643	20407 (824.7MHz), 20643 (848.3MHz)	1.4MHz	QPSK	Full
		20415 to 20635	20415 (825.5MHz), 20635 (847.5MHz)	3MHz	QPSK	Full
		20425 to 20625	20425 (826.5MHz), 20625 (846.5MHz)	5MHz	QPSK	Full
		20450 to 20600	20450 (829.0MHz), 20600 (844.0MHz)	10MHz	QPSK	Full
-	Occupied Bandwidth	20407 to 20643	20407 (824.7MHz), 20525 (836.5MHz), 20643 (848.3MHz)	1.4MHz	QPSK / 16QAM	Full
		20415 to 20635	20415 (825.5MHz), 20525 (836.5MHz), 20635 (847.5MHz)	3MHz	QPSK / 16QAM	Full
		20425 to 20625	20425 (826.5MHz), 20525 (836.5MHz), 20625 (846.5MHz)	5MHz	QPSK / 16QAM	Full
		20450 to 20600	20450 (829.0MHz), 20525 (836.5MHz), 20600 (844.0MHz)	10MHz	QPSK / 16QAM	Full
-	Band Edge	20407 to 20643	20407 (824.7MHz), 20643 (848.3MHz)	1.4MHz	QPSK	1 Half Full
		20415 to 20635	20415 (825.5MHz), 20635 (847.5MHz)	3MHz	QPSK	1 Half Full
		20425 to 20625	20425 (826.5MHz), 20625 (846.5MHz)	5MHz	QPSK	1 Half Full
		20450 to 20600	20450 (829.0MHz), 20600 (844.0MHz)	10MHz	QPSK	1 Half Full

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	RB #
-	Peak to Average Ratio	20407 to 20643	20407 (824.7MHz), 20525 (836.5MHz), 20643 (848.3MHz)	1.4MHz	QPSK / 16QAM	1
		20415 to 20635	20415 (825.5MHz), 20525 (836.5MHz), 20635 (847.5MHz)	3MHz	QPSK / 16QAM	1
		20425 to 20625	20425 (826.5MHz), 20525 (836.5MHz), 20625 (846.5MHz)	5MHz	QPSK / 16QAM	1
		20450 to 20600	20450 (829.0MHz), 20525 (836.5MHz), 20600 (844.0MHz)	10MHz	QPSK / 16QAM	1
-	Conducted Emission	20407 to 20643	20407 (824.7MHz), 20525 (836.5MHz), 20643 (848.3MHz)	1.4MHz	QPSK	1
		20415 to 20635	20415 (825.5MHz), 20525 (836.5MHz), 20635 (847.5MHz)	3MHz	QPSK	1
		20425 to 20625	20425 (826.5MHz), 20525 (836.5MHz), 20625 (846.5MHz)	5MHz	QPSK	1
		20450 to 20600	20450 (829.0MHz), 20525 (836.5MHz), 20600 (844.0MHz)	10MHz	QPSK	1
-	Radiated Emission Below 1GHz	20407 to 20643	20407 (824.7MHz)	1.4MHz	QPSK	1
-	Radiated Emission Above 1GHz	20407 to 20643	20407 (824.7MHz), 20525 (836.5MHz), 20643 (848.3MHz)	1.4MHz	QPSK	1
		20425 to 20625	20425 (826.5MHz), 20525 (836.5MHz), 20625 (846.5MHz)	5MHz	QPSK	1
		20450 to 20600	20450 (829.0MHz), 20525 (836.5MHz), 20600 (844.0MHz)	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.

LTE Band 26

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	RB #
-	ERP	26797 to 27033	26797 (824.7MHz), 26915 (836.5MHz), 27033 (848.3MHz)	1.4MHz	QPSK / 16QAM	1 Half Full
		26805 to 27025	26805 (825.5MHz), 26915 (836.5MHz), 27025 (847.5MHz)	3MHz	QPSK / 16QAM	1 Half Full
		26815 to 27015	26815 (826.5MHz), 26915 (836.5MHz), 27015 (846.5MHz)	5MHz	QPSK / 16QAM	1 Half Full
		26840 to 26990	26840 (829.0MHz), 26915 (836.5MHz), 26990 (844.0MHz)	10MHz	QPSK / 16QAM	1 Half Full
		26865 to 26965	26865 (831.5MHz), 26915 (836.5MHz), 26965 (841.5MHz)	15MHz	QPSK / 16QAM	1 Half Full
-	Modulation Characteristics	26865 to 26965	26915 (836.5MHz)	15 MHz	QPSK / 16QAM	Full
-	Frequency Stability	26797 to 27033	26797 (824.7MHz), 27033 (848.3MHz)	1.4MHz	QPSK	Full
		26805 to 27025	26805 (825.5MHz), 27025 (847.5MHz)	3MHz	QPSK	Full
		26815 to 27015	26815 (826.5MHz), 27015 (846.5MHz)	5MHz	QPSK	Full
		26840 to 26990	26840 (829.0MHz), 26990 (844.0MHz)	10MHz	QPSK	Full
		26865 to 26965	26865 (831.5MHz), 26965 (841.5MHz)	15MHz	QPSK	Full
-	Occupied Bandwidth	26797 to 27033	26797 (824.7MHz), 26915 (836.5MHz), 27033 (848.3MHz)	1.4MHz	QPSK / 16QAM	Full
		26805 to 27025	26805 (825.5MHz), 26915 (836.5MHz), 27025 (847.5MHz)	3MHz	QPSK / 16QAM	Full
		26815 to 27015	26815 (826.5MHz), 26915 (836.5MHz), 27015 (846.5MHz)	5MHz	QPSK / 16QAM	Full
		26840 to 26990	26840 (829.0MHz), 26915 (836.5MHz), 26990 (844.0MHz)	10MHz	QPSK / 16QAM	Full
		26865 to 26965	26865 (831.5MHz), 26915 (836.5MHz), 26965 (841.5MHz)	15MHz	QPSK / 16QAM	Full

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	RB #
-	Band Edge	26797 to 27033	26797 (824.7MHz), 27033 (848.3MHz)	1.4MHz	QPSK	1 Half Full
		26805 to 27025	26805 (825.5MHz), 27025 (847.5MHz)	3MHz	QPSK	1 Half Full
		26815 to 27015	26815 (826.5MHz), 27015 (846.5MHz)	5MHz	QPSK	1 Half Full
		26840 to 26990	26840 (829.0MHz), 26990 (844.0MHz)	10MHz	QPSK	1 Half Full
		26865 to 26965	26865 (831.5MHz), 26965 (841.5MHz)	15MHz	QPSK	1 Half Full
-	Peak to Average Ratio	26797 to 27033	26797 (824.7MHz), 26915 (836.5MHz), 27033 (848.3MHz)	1.4MHz	QPSK / 16QAM	1
		26805 to 27025	26805 (825.5MHz), 26915 (836.5MHz), 27025 (847.5MHz)	3MHz	QPSK / 16QAM	1
		26815 to 27015	26815 (826.5MHz), 26915 (836.5MHz), 27015 (846.5MHz)	5MHz	QPSK / 16QAM	1
		26840 to 26990	26840 (829.0MHz), 26915 (836.5MHz), 26990 (844.0MHz)	10MHz	QPSK / 16QAM	1
		26865 to 26965	26865 (831.5MHz), 26915 (836.5MHz), 26965 (841.5MHz)	15MHz	QPSK / 16QAM	1
-	Conducted Emission	26797 to 27033	26797 (824.7MHz), 26915 (836.5MHz), 27033 (848.3MHz)	1.4MHz	QPSK	1
		26805 to 27025	26805 (825.5MHz), 26915 (836.5MHz), 27025 (847.5MHz)	3MHz	QPSK	1
		26815 to 27015	26815 (826.5MHz), 26915 (836.5MHz), 27015 (846.5MHz)	5MHz	QPSK	1
		26840 to 26990	26840 (829.0MHz), 26915 (836.5MHz), 26990 (844.0MHz)	10MHz	QPSK	1
		26865 to 26965	26865 (831.5MHz), 26915 (836.5MHz), 26965 (841.5MHz)	15MHz	QPSK	1

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	RB #
-	Radiated Emission Below 1GHz	26797 to 27033	26915 (836.5MHz),	1.4MHz	QPSK	1
-	Radiated Emission Above 1GHz	26797 to 27033	26797 (824.7MHz), 26915 (836.5MHz), 27033 (848.3MHz)	1.4MHz	QPSK	1
		26815 to 27015	26815 (826.5MHz), 26915 (836.5MHz), 27015 (846.5MHz)	5MHz	QPSK	1
		26865 to 26965	26865 (831.5MHz), 26915 (836.5MHz), 26965 (841.5MHz)	15MHz	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.

NB-IoT Band 5

EUT Configure Mode	Test item	Available channel		Tested Channel	Channel Bandwidth	Subcarrier Spacing	Modulation	Number of Subcarrier / Starting Subcarrier
-	ERP	Standalone	20402 to 20648	20402 (824.2MHz), 20525 (836.5MHz), 20648 (848.8MHz)	-	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
					-	15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 12@0
-	Modulation Characteristics	Standalone	20402 to 20648	20525 (836.5MHz)	-	3.75kHz	BPSK	1@0
					-	15kHz	QPSK	1@0
-	Frequency Stability	Standalone	20402 to 20648	20402 (824.2MHz), 20648 (848.8MHz)	-	3.75kHz	BPSK	1@0
					-	15kHz	QPSK	1@0
-	Occupied Bandwidth	Standalone	20402 to 20648	20402 (824.2MHz), 20525 (836.5MHz), 20648 (848.8MHz)	-	3.75kHz	BPSK	1@0 1@47
					-	15kHz	QPSK	12@0
-	Band Edge	Standalone	20402 to 20648	20402 (824.2MHz), 20648 (848.8MHz)	-	3.75kHz	BPSK	1@0 1@47
					-	15kHz	QPSK	1@0 12@0
-	Peak To Average Ratio	Standalone	20402 to 20648	20402 (824.2MHz), 20525 (836.5MHz), 20648 (848.8MHz)	-	3.75kHz	BPSK	1@0 1@47
					-	15kHz	QPSK	12@0
-	Conducted Emission	Standalone	20402 to 20648	20402 (824.2MHz), 20525 (836.5MHz), 20648 (848.8MHz)	-	3.75kHz	BPSK	1@0
					-	15kHz	QPSK	12@0
-	Radiated Emission Below 1GHz	Standalone	20402 to 20648	20525 (836.5MHz)	-	15kHz	QPSK	1@0
-	Radiated Emission Above 1GHz	Standalone	20402 to 20648	20402 (824.2MHz), 20525 (836.5MHz), 20648 (848.8MHz)	-	15kHz	QPSK	1@0

Note: For radiated emission below 1GHz, select the worst radiated emission channel (above 1GHz) for final testing.

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	120Vac, 60Hz	Willy Cheng
Frequency Stability	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Occupied Bandwidth	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Band Edge	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Peak To Average Ratio	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Conducted Emission	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Radiated Emission Below 1GHz	23deg. C, 71%RH	120 Vac, 60 Hz	Thomas Cheng
Radiated Emission Above 1GHz	22deg. C, 71%RH	120 Vac, 60 Hz	Thomas Cheng Vincent Chen

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 22

ANSI/TIA/EIA-603-E 2016

ANSI 63.26-2015

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

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

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

Mobile / Portable station are limited to 7 watts e.r.p.

4.1.2 Test Procedures

Conducted Power Measurement:

The EUT was set up for the maximum power with GPRS, EDGE, NB-IoT and 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:

$EIRP = P_{Meas} + G_T$

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

where

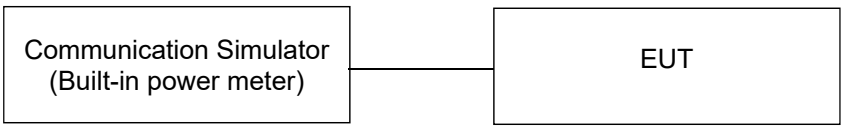
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

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)

Band	GSM850		
Channel	128	189	251
Frequency (MHz)	824.2	836.4	848.8
GPRS	31.38	31.52	31.46
EDGE	25.33	25.42	25.39

eMTC

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20407	20525	20643
		Frequency (MHz)		824.7	836.5	848.3
1.4M	QPSK	1	0	22.07	22.28	22.12
		1	6	22.06	22.25	22.09
		6	0	22.03	22.20	22.03
	16QAM	1	0	22.02	22.15	22.00
		1	6	21.99	22.11	21.96
		6	0	21.97	22.03	21.91

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20415	20525	20635
		Frequency (MHz)		825.5	836.5	847.5
3M	QPSK	1	0	21.90	22.21	22.19
		1	6	21.76	22.34	22.39
		6	0	21.85	21.98	22.03
	16QAM	1	0	21.85	21.99	22.17
		1	6	21.75	22.30	22.21
		6	0	21.83	21.95	21.99

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20425	20525	20625
		Frequency (MHz)		826.5	836.5	846.5
5M	QPSK	1	0	22.06	22.20	22.05
		1	6	22.04	22.38	22.08
		6	0	22.19	22.23	21.82
	16QAM	1	0	21.87	22.12	21.75
		1	6	21.75	21.91	21.94
		6	0	21.97	22.00	21.67

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20450	20525	20600
		Frequency (MHz)		829	836.5	844
10M	QPSK	1	0	22.16	22.48	22.11
		1	6	22.30	22.30	21.84
		6	0	22.29	22.08	22.15
	16QAM	1	0	21.95	21.97	22.09
		1	6	21.85	22.38	21.83
		6	0	21.87	22.06	21.62

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26797	26915	27033
		Frequency (MHz)		824.7	836.5	848.3
1.4M	QPSK	1	0	22.23	22.48	22.34
		1	6	22.22	22.46	22.29
		6	0	21.17	21.31	21.22
	16QAM	1	0	22.14	22.38	22.21
		1	6	22.09	22.35	22.18
		6	0	21.02	21.28	21.14

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26805	26915	27025
		Frequency (MHz)		825.5	836.5	847.5
3M	QPSK	1	0	22.32	22.63	22.53
		1	6	22.44	22.54	22.02
		6	0	21.22	21.12	21.33
	16QAM	1	0	22.05	22.43	22.13
		1	6	21.83	22.05	21.90
		6	0	21.57	21.90	22.13

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26815	26915	27015
		Frequency (MHz)		826.5	836.5	846.5
5M	QPSK	1	0	22.38	22.32	22.46
		1	6	22.19	22.28	22.22
		6	0	21.94	22.29	22.50
	16QAM	1	0	21.97	22.28	22.44
		1	6	21.84	22.24	22.19
		6	0	21.74	21.25	22.14

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26840	26915	26990
		Frequency (MHz)		829	836.5	844
10M	QPSK	1	0	22.20	22.22	22.13
		1	6	21.92	22.53	21.99
		6	0	22.39	22.15	22.45
	16QAM	1	0	22.18	22.19	22.11
		1	6	21.87	22.41	22.36
		6	0	22.17	22.01	22.03

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26865	26915	26965
		Frequency (MHz)		831.5	836.5	841.5
15M	QPSK	1	0	21.94	22.74	22.05
		1	6	22.43	22.24	22.09
		6	0	22.17	22.45	22.06
	16QAM	1	0	22.04	22.10	21.96
		1	6	22.30	22.14	22.07
		6	0	21.74	22.42	22.04

NB-IoT Band 5

BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20402	20525	20648
		Frequency (MHz)		824.2	836.5	848.8
Stand-alone	3.75k BPSK	1	0	22.29	22.10	22.36
		1	47	22.02	22.23	22.29
	3.75k QPSK	1	0	22.48	22.53	22.43
		1	47	22.52	22.49	22.53
	15k BPSK	1	0	22.62	22.48	22.32
		1	11	22.18	22.41	22.19
	15k QPSK	1	0	22.67	22.76	22.39
		1	11	22.68	22.56	22.72
		12	0	20.98	20.85	21.07

ERP Power (dBm)

Band	GSM850		
Channel	128	189	251
Frequency (MHz)	824.2	836.4	848.8
GPRS	31.03	**31.17**	31.11
EDGE	24.98	**25.07**	25.04

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

eMTC

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20407	20525	20643
		Frequency (MHz)		824.7	836.5	848.3
1.4M	QPSK	1	0	21.72	**21.93**	21.77
		1	6	21.71	21.90	21.74
		6	0	21.68	21.85	21.68
	16QAM	1	0	21.67	**21.80**	21.65
		1	6	21.64	21.76	21.61
		6	0	21.62	21.68	21.56

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

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20415	20525	20635
		Frequency (MHz)		825.5	836.5	847.5
3M	QPSK	1	0	21.55	21.86	21.84
		1	6	21.41	21.99	**22.04**
		6	0	21.50	21.63	21.68
	16QAM	1	0	21.50	21.64	21.82
		1	6	21.40	**21.95**	21.86
		6	0	21.48	21.60	21.64

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

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20425	20525	20625
		Frequency (MHz)		826.5	836.5	846.5
5M	QPSK	1	0	21.71	21.85	21.70
		1	6	21.69	**22.03**	21.73
		6	0	21.84	21.88	21.47
	16QAM	1	0	21.52	**21.77**	21.40
		1	6	21.40	21.56	21.59
		6	0	21.62	21.65	21.32

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

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20450	20525	20600
		Frequency (MHz)		829	836.5	844
10M	QPSK	1	0	21.81	**22.13**	21.76
		1	6	21.95	21.95	21.49
		6	0	21.94	21.73	21.80
	16QAM	1	0	21.60	21.62	21.74
		1	6	21.50	**22.03**	21.48
		6	0	21.52	21.71	21.27

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

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26797	26915	27033
		Frequency (MHz)		824.7	836.5	848.3
1.4M	QPSK	1	0	21.88	**22.13**	21.99
		1	6	21.87	22.11	21.94
		6	0	20.82	20.96	20.87
	16QAM	1	0	21.79	**22.03**	21.86
		1	6	21.74	22.00	21.83
		6	0	20.67	20.93	20.79

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

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26805	26915	27025
		Frequency (MHz)		825.5	836.5	847.5
3M	QPSK	1	0	21.97	**22.28**	22.18
		1	6	22.09	22.19	21.67
		6	0	20.87	20.77	20.98
	16QAM	1	0	21.70	**22.08**	21.78
		1	6	21.48	21.70	21.55
		6	0	21.22	21.55	21.78

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

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26815	26915	27015
		Frequency (MHz)		826.5	836.5	846.5
5M	QPSK	1	0	22.03	21.97	22.11
		1	6	21.84	21.93	21.87
		6	0	21.59	21.94	**22.15**
	16QAM	1	0	21.62	21.93	**22.09**
		1	6	21.49	21.89	21.84
		6	0	21.39	20.90	21.79

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

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26840	26915	26990
		Frequency (MHz)		829	836.5	844
10M	QPSK	1	0	21.85	21.87	21.78
		1	6	21.57	22.18	21.64
		6	0	22.04	21.80	**22.10**
	16QAM	1	0	21.83	**21.84**	21.76
		1	6	21.52	22.06	22.01
		6	0	21.82	21.66	21.68

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

LTE Band 26						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26865	26915	26965
		Frequency (MHz)		831.5	836.5	841.5
15M	QPSK	1	0	21.59	**22.39**	21.70
		1	6	22.08	21.89	21.74
		6	0	21.82	22.10	21.71
	16QAM	1	0	21.69	21.75	21.61
		1	6	21.95	21.79	21.72
		6	0	21.39	**22.07**	21.69

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

NB-IoT Band 5

BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20402	20525	20648
		Frequency (MHz)		824.2	836.5	848.8
Stand-alone	3.75k BPSK	1	0	21.94	21.75	22.01
		1	47	21.67	21.88	21.94
	3.75k QPSK	1	0	22.13	22.18	22.08
		1	47	22.17	22.14	22.18
	15k BPSK	1	0	**22.27**	22.13	21.97
		1	11	21.83	22.06	21.84
	15k QPSK	1	0	22.32	**22.41**	22.04
		1	11	22.33	22.21	22.37
		12	0	20.63	20.50	20.72

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

4.2 Modulation Characteristics Measurement

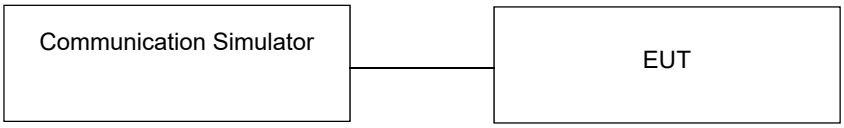
4.2.1 Limits of Modulation Characteristics

N/A

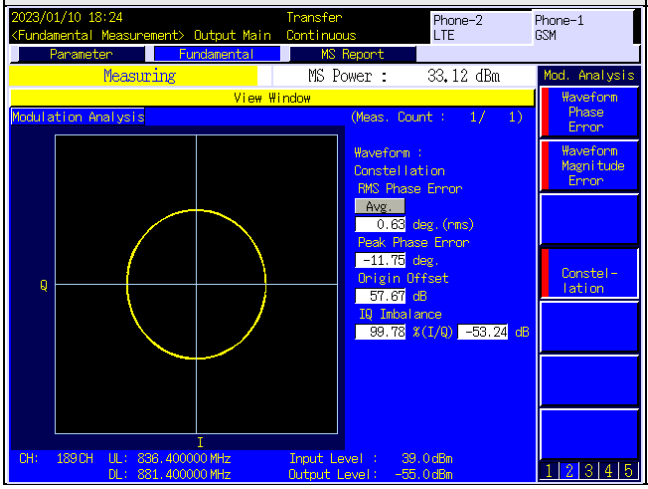
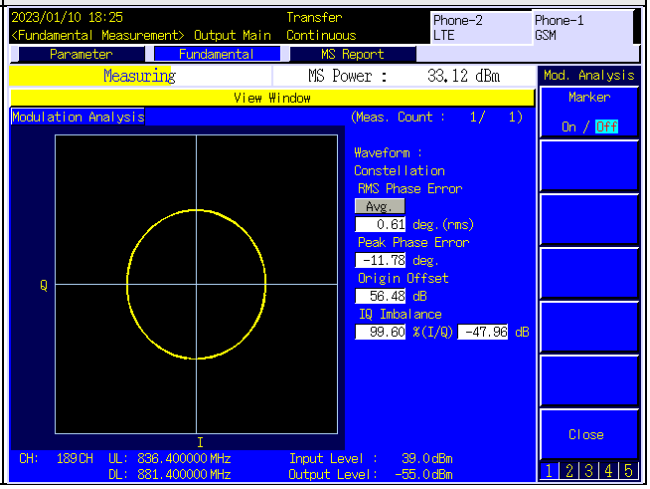
4.2.2 Test Procedure

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.

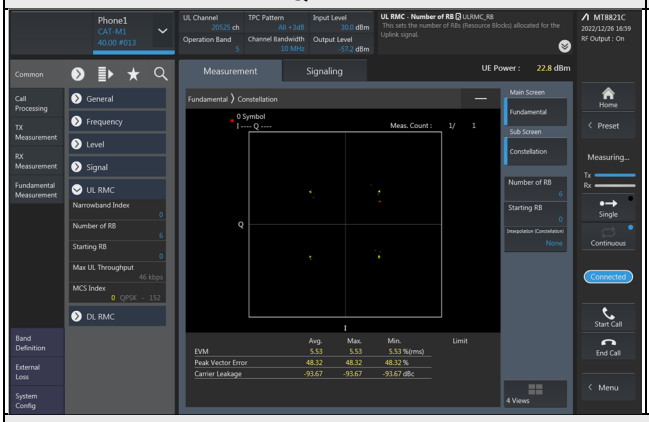
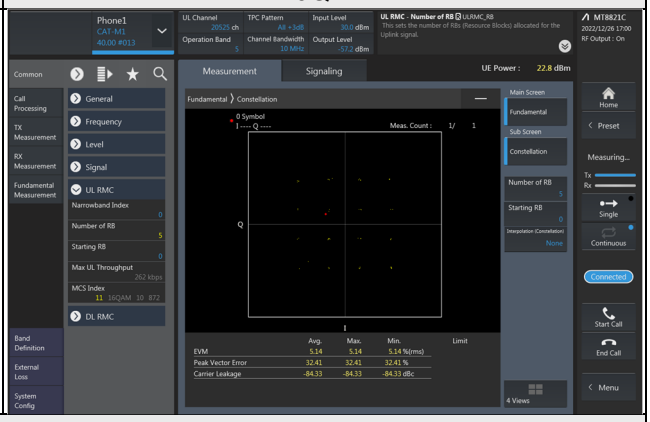
4.2.3 Test Setup

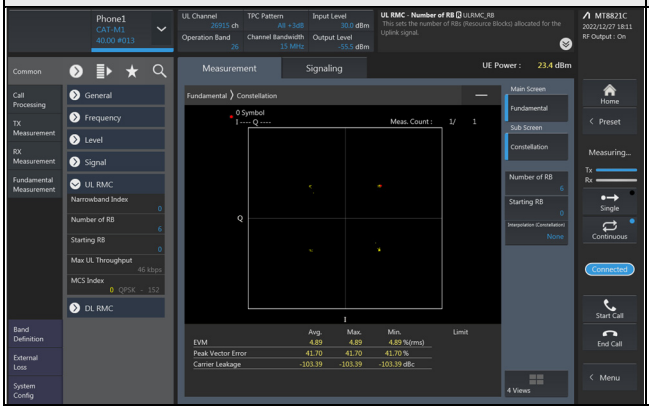
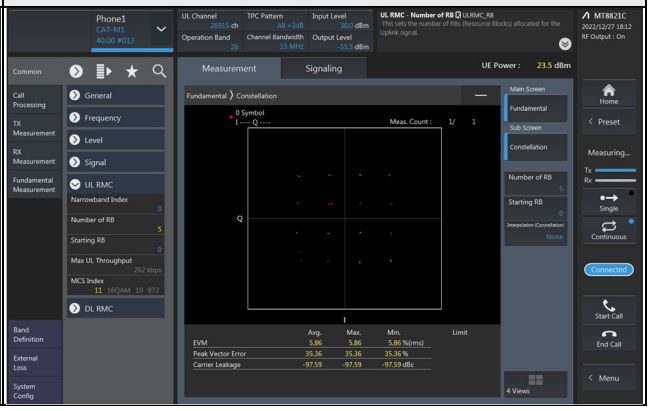


4.2.4 Test Results

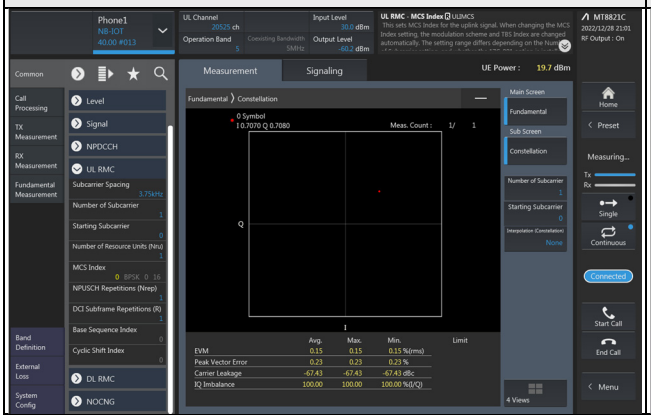
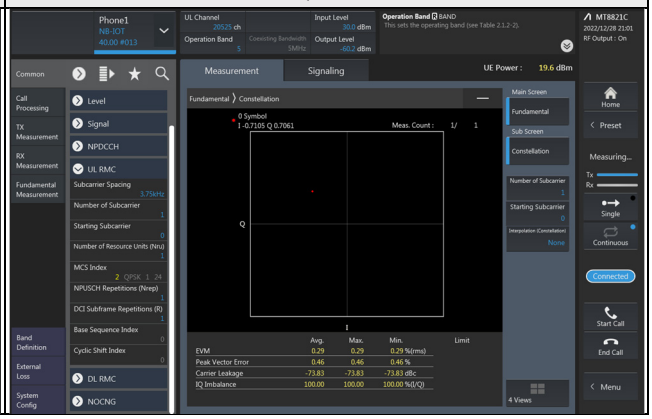
GSM	
Spectrum Plot of Measurement Value	
Channel: 189 / Frequency (MHz): 836.4MHz	
GPRS	EDGE
	

eMTC

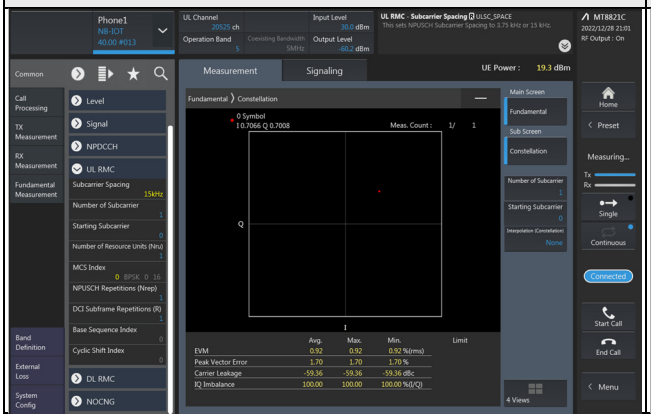
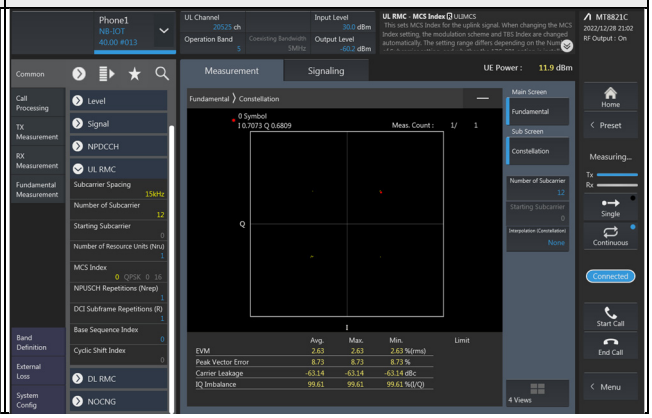
LTE Band 5	
Spectrum Plot of Measurement Value	
Channel: 20525 / Frequency (MHz): 836.5MHz	
QPSK	16QAM
	

LTE Band 26	
Spectrum Plot of Measurement Value	
Channel: 26915 / Frequency (MHz): 836.5MHz	
QPSK	16QAM
	

NB-IoT Band 5
Subcarrier Spacing 3.75kHz

Spectrum Plot of Measurement Value	
Channel: 20525 / Frequency (MHz): 836.5MHz	
BPSK	QPSK
	

Subcarrier Spacing 15kHz

Spectrum Plot of Measurement Value	
Channel: 20525 / Frequency (MHz): 836.5MHz	
BPSK	QPSK
	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

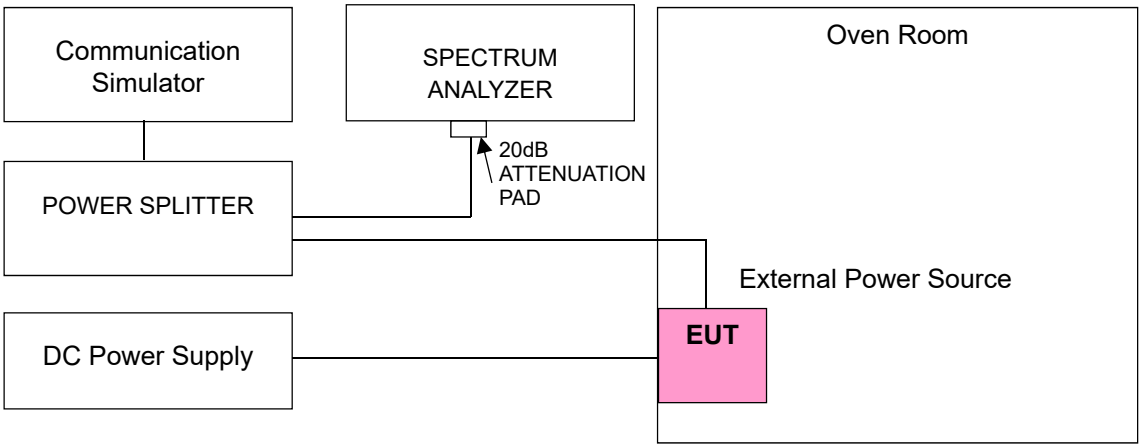
1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

4.3.2 Test Procedure

a. 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.
b. 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.
c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ±0.5 ℃ 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

Frequency Error vs. Voltage

Voltage (Vdc)	GPRS			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	824.199996	-0.005	848.800002	0.002
3.7	824.199998	-0.002	848.799997	-0.004
4.26	824.200004	0.005	848.799997	-0.004

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

Frequency Error vs. Temperature

Temp. (℃)	GPRS			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	824.200001	0.001	848.799996	-0.005
-20	824.200003	0.004	848.800003	0.004
-10	824.200003	0.004	848.799997	-0.004
0	824.200003	0.004	848.799996	-0.005
10	824.200002	0.002	848.799998	-0.002
20	824.200003	0.004	848.800003	0.004
30	824.199999	-0.001	848.800003	0.004
40	824.199998	-0.002	848.799996	-0.005
50	824.199996	-0.005	848.800002	0.002
60	824.200003	0.004	848.799998	-0.002

Frequency Error vs. Voltage

Voltage (Vdc)	EDGE			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	824.200003	0.004	848.799998	-0.002
3.7	824.200002	0.002	848.799999	-0.001
4.26	824.200003	0.004	848.800002	0.002

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

Frequency Error vs. Temperature

Temp. (℃)	EDGE			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	824.199998	-0.002	848.800003	0.004
-20	824.199998	-0.002	848.800002	0.002
-10	824.200001	0.001	848.799999	-0.001
0	824.199996	-0.005	848.800002	0.002
10	824.200003	0.004	848.799998	-0.002
20	824.199998	-0.002	848.799998	-0.002
30	824.199997	-0.004	848.799998	-0.002
40	824.200002	0.002	848.799996	-0.005
50	824.200001	0.001	848.800004	0.005
60	824.200003	0.004	848.800004	0.005

eMTC
Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 5			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	824.7000020	0.002	848.3000020	0.002
3.7	824.6999970	-0.004	848.2999970	-0.004
4.26	824.6999980	-0.002	848.3000010	0.001

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 5			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	824.6999970	-0.004	848.3000010	0.001
-20	824.7000020	0.002	848.3000020	0.002
-10	824.6999980	-0.002	848.2999980	-0.002
0	824.6999970	-0.004	848.2999960	-0.005
10	824.7000030	0.004	848.3000010	0.001
20	824.7000040	0.005	848.3000040	0.005
30	824.7000030	0.004	848.2999970	-0.004
40	824.6999960	-0.005	848.3000020	0.002
50	824.6999980	-0.002	848.3000030	0.004
60	824.7000030	0.004	848.2999990	-0.001

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 5			
	Channel Bandwidth 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	825.4999960	-0.005	847.4999980	-0.002
3.7	825.5000030	0.004	847.5000010	0.001
4.26	825.4999990	-0.001	847.5000040	0.005

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 5			
	Channel Bandwidth 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	825.5000030	0.004	847.5000010	0.001
-20	825.4999980	-0.002	847.4999990	-0.001
-10	825.4999990	-0.001	847.5000040	0.005
0	825.4999970	-0.004	847.5000040	0.005
10	825.4999970	-0.004	847.4999960	-0.005
20	825.5000030	0.004	847.4999970	-0.004
30	825.4999980	-0.002	847.4999970	-0.004
40	825.4999990	-0.001	847.4999960	-0.005
50	825.4999970	-0.004	847.4999990	-0.001
60	825.5000020	0.002	847.4999960	-0.005

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 5			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	826.5000040	0.005	846.4999960	-0.005
3.7	826.4999970	-0.004	846.4999960	-0.005
4.26	826.5000010	0.001	846.4999970	-0.004

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 5			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	826.5000030	0.004	846.5000020	0.002
-20	826.4999970	-0.004	846.5000010	0.001
-10	826.4999980	-0.002	846.5000040	0.005
0	826.4999990	-0.001	846.5000020	0.002
10	826.5000030	0.004	846.5000020	0.002
20	826.5000010	0.001	846.4999990	-0.001
30	826.5000020	0.002	846.5000020	0.002
40	826.4999960	-0.005	846.4999970	-0.004
50	826.5000040	0.005	846.5000020	0.002
60	826.4999970	-0.004	846.5000030	0.004

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 5			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	828.9999980	-0.002	843.9999990	-0.001
3.7	829.0000040	0.005	843.9999960	-0.005
4.26	828.9999980	-0.002	844.0000020	0.002

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 5			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	828.9999970	-0.004	844.0000030	0.004
-20	828.9999980	-0.002	843.9999960	-0.005
-10	828.9999960	-0.005	844.0000040	0.005
0	828.9999980	-0.002	843.9999980	-0.002
10	828.9999990	-0.001	843.9999980	-0.002
20	829.0000020	0.002	843.9999970	-0.004
30	829.0000010	0.001	844.0000010	0.001
40	829.0000020	0.002	844.0000020	0.002
50	829.0000010	0.001	843.9999990	-0.001
60	829.0000020	0.002	843.9999970	-0.004

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	824.6999960	-0.005	848.2999980	-0.002
3.7	824.7000020	0.002	848.3000030	0.004
4.26	824.7000040	0.005	848.3000040	0.005

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 26			
	Channel Bandwidth: 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	824.7000020	0.002	848.3000010	0.001
-20	824.6999980	-0.002	848.2999970	-0.004
-10	824.6999970	-0.004	848.3000030	0.004
0	824.7000010	0.001	848.3000020	0.002
10	824.7000010	0.001	848.2999990	-0.001
20	824.6999970	-0.004	848.2999990	-0.001
30	824.7000010	0.001	848.2999960	-0.005
40	824.7000030	0.004	848.2999990	-0.001
50	824.7000010	0.001	848.3000040	0.005
60	824.6999980	-0.002	848.3000030	0.004

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 26			
	Channel Bandwidth: 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	825.4999970	-0.004	847.4999980	-0.002
3.7	825.4999990	-0.001	847.4999970	-0.004
4.26	825.5000040	0.005	847.5000030	0.004

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 26			
	Channel Bandwidth: 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	825.4999990	-0.001	847.4999960	-0.005
-20	825.5000010	0.001	847.5000030	0.004
-10	825.5000040	0.005	847.4999960	-0.005
0	825.5000040	0.005	847.5000030	0.004
10	825.5000030	0.004	847.4999970	-0.004
20	825.4999990	-0.001	847.4999990	-0.001
30	825.4999990	-0.001	847.4999990	-0.001
40	825.4999970	-0.004	847.5000020	0.002
50	825.5000020	0.002	847.5000020	0.002
60	825.4999970	-0.004	847.5000040	0.005

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 26			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	826.5000020	0.002	846.4999990	-0.001
3.7	826.4999960	-0.005	846.5000040	0.005
4.26	826.5000030	0.004	846.5000010	0.001

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 26			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	826.4999960	-0.005	846.5000010	0.001
-20	826.5000040	0.005	846.4999990	-0.001
-10	826.4999990	-0.001	846.4999980	-0.002
0	826.5000020	0.002	846.4999990	-0.001
10	826.4999970	-0.004	846.5000040	0.005
20	826.5000010	0.001	846.4999990	-0.001
30	826.5000040	0.005	846.5000020	0.002
40	826.4999980	-0.002	846.4999970	-0.004
50	826.5000040	0.005	846.4999980	-0.002
60	826.4999980	-0.002	846.5000020	0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 26			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	829.0000010	0.001	843.9999960	-0.005
3.7	829.0000030	0.004	843.9999990	-0.001
4.26	829.0000030	0.004	843.9999990	-0.001

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 26			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	828.9999980	-0.002	843.9999980	-0.002
-20	828.9999960	-0.005	843.9999960	-0.005
-10	829.0000030	0.004	843.9999960	-0.005
0	829.0000040	0.005	843.9999980	-0.002
10	829.0000030	0.004	843.9999970	-0.004
20	829.0000040	0.005	843.9999960	-0.005
30	828.9999980	-0.002	843.9999980	-0.002
40	828.9999960	-0.005	844.0000020	0.002
50	829.0000040	0.005	843.9999960	-0.005
60	828.9999970	-0.004	844.0000010	0.001

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 26			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	831.4999980	-0.002	841.4999960	-0.005
3.7	831.4999970	-0.004	841.4999970	-0.004
4.26	831.4999960	-0.005	841.5000020	0.002

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

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 26			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	831.4999990	-0.001	841.5000040	0.005
-20	831.5000040	0.005	841.5000040	0.005
-10	831.4999990	-0.001	841.4999960	-0.005
0	831.4999980	-0.002	841.4999960	-0.005
10	831.4999980	-0.002	841.5000020	0.002
20	831.4999970	-0.004	841.5000010	0.001
30	831.4999980	-0.002	841.4999970	-0.004
40	831.4999960	-0.005	841.5000010	0.001
50	831.5000040	0.005	841.4999970	-0.004
60	831.4999980	-0.002	841.4999960	-0.005

NB-IoT Band 5
Frequency Error vs. Voltage

Voltage (Vdc)	NB-IoT Band 5			
	Standalone			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	824.199998	-0.002	848.800004	0.005
3.7	824.200004	0.005	848.800003	0.004
4.26	824.200004	0.005	848.799998	-0.002

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

Frequency Error vs. Temperature

Temp. (℃)	NB-IoT Band 5			
	Standalone			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	824.200004	0.005	848.799997	-0.004
-20	824.199997	-0.004	848.799997	-0.004
-10	824.199997	-0.004	848.799997	-0.004
0	824.200001	0.001	848.799997	-0.004
10	824.200001	0.001	848.800004	0.005
20	824.199998	-0.002	848.800001	0.001
30	824.199998	-0.002	848.799999	-0.001
40	824.200002	0.002	848.800002	0.002
50	824.200002	0.002	848.800004	0.005
60	824.200003	0.004	848.800002	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.

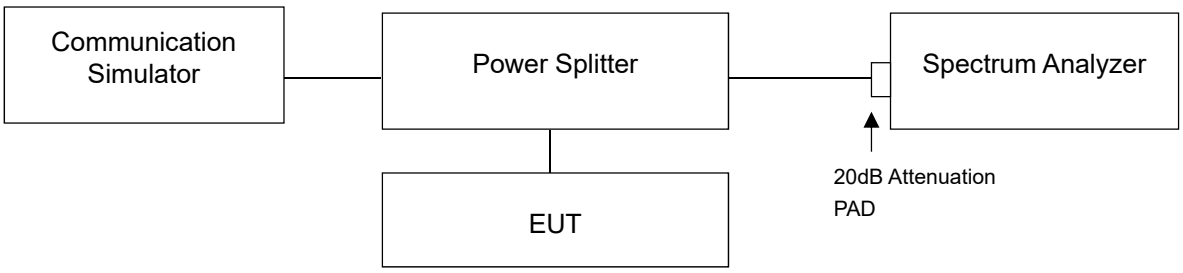
4.4.2 Test Procedure

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

a) 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.
b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) 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.
d) 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.
e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
f) 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).
g) 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.
h) 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.
i) 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.

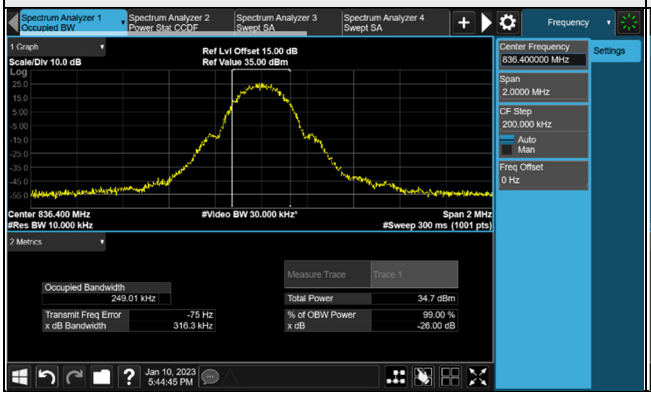
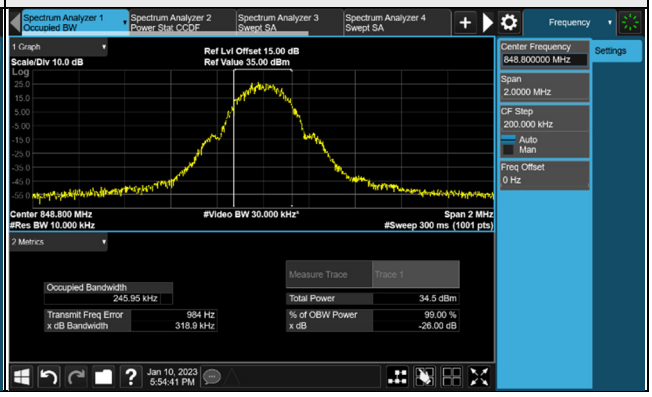
4.4.3 Test Setup



4.4.4 Test Result

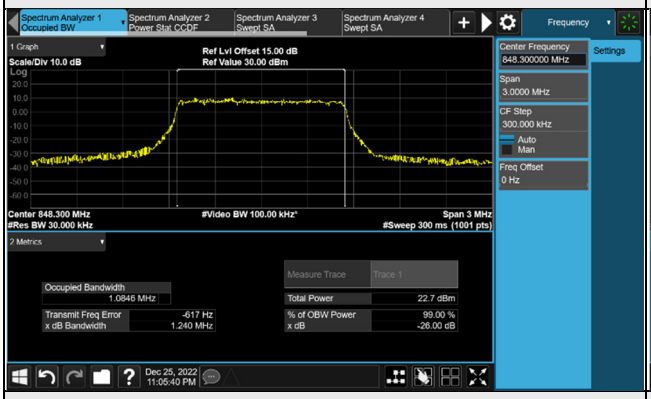
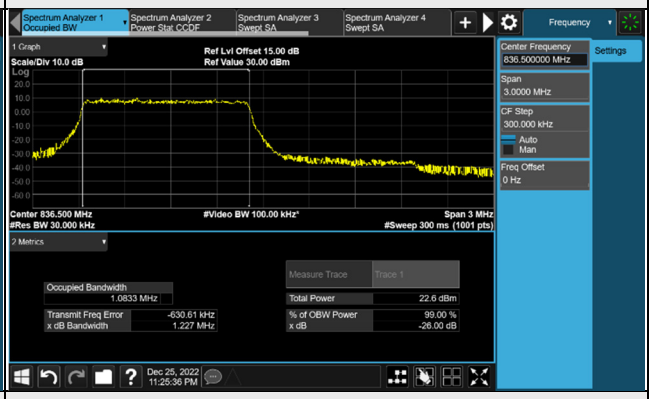
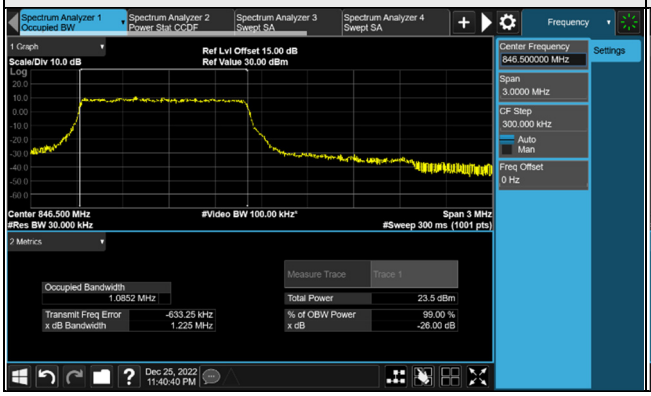
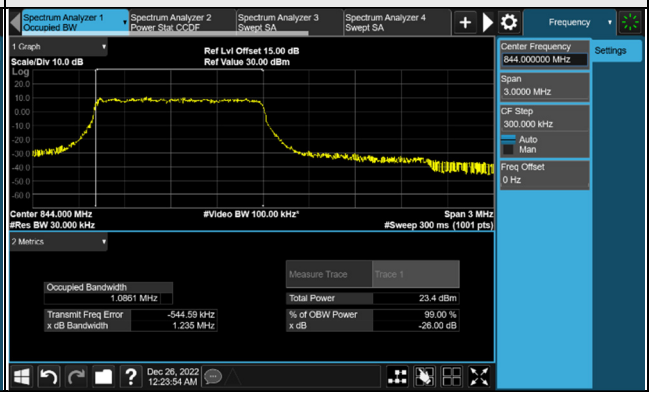
Occupied Bandwidth

Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	
		GPRS	EDGE
128	824.2	246.10	244.91
189	836.4	249.01	245.56
251	848.8	244.66	245.95

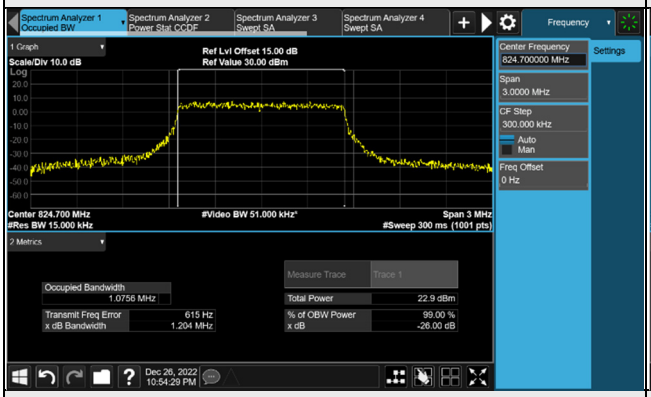
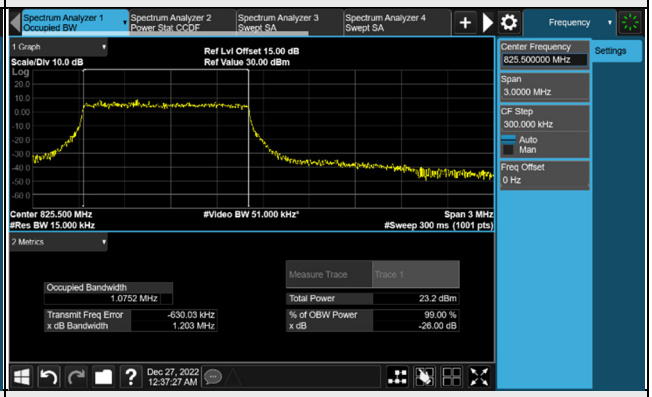
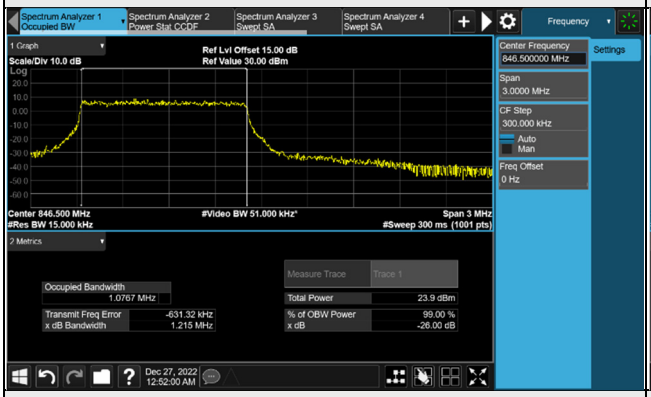
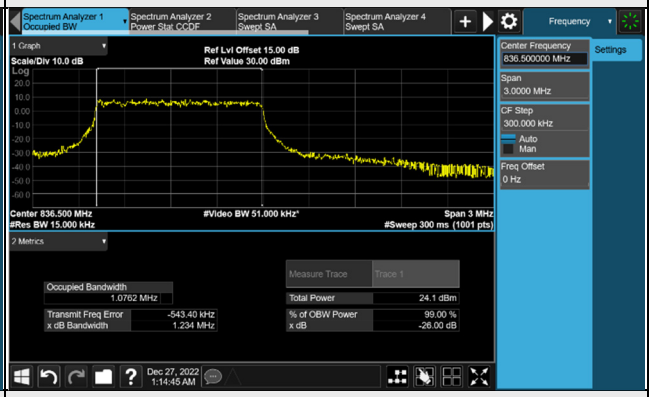
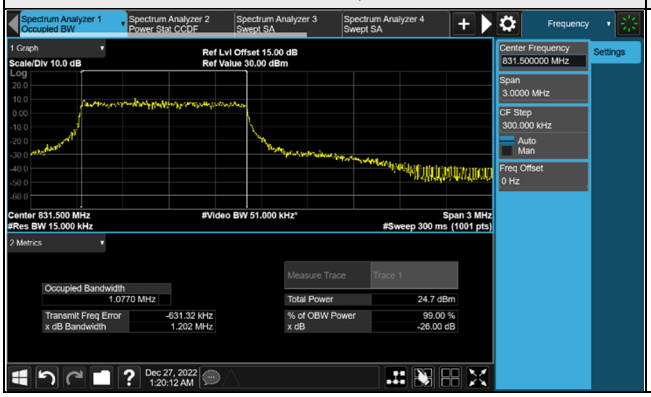
Spectrum Plot of Worst Value	
GPRS	EDGE
	

eMTC

LTE Band 5, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
20407	824.7	1.085	0.910
20525	836.5	1.084	0.910
20643	848.3	1.085	0.911
LTE Band 5, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
20415	825.5	1.083	0.913
20525	836.5	1.083	0.914
20635	847.5	1.083	0.911
LTE Band 5, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
20425	826.5	1.084	0.910
20525	836.5	1.084	0.912
20625	846.5	1.085	0.910
LTE Band 5, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
20450	829.0	1.084	0.908
20525	836.5	1.085	0.910
20600	844.0	1.086	0.910

Spectrum Plot of Worst Value	
1.4MHz / QPSK	3MHz / QPSK
	
5MHz / QPSK	10MHz / QPSK
	

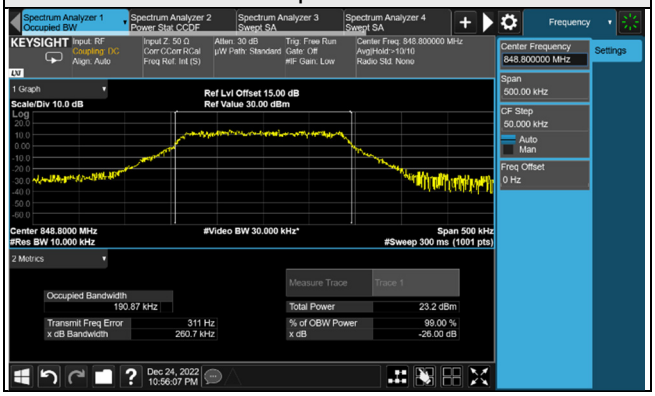
LTE Band 26, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26797	824.7	1.076	0.902
26915	836.5	1.074	0.902
27033	848.3	1.075	0.900
LTE Band 26, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26805	825.5	1.075	0.902
26915	836.5	1.074	0.901
27025	847.5	1.074	0.899
LTE Band 26, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26815	826.5	1.075	0.899
26915	836.5	1.076	0.900
27015	846.5	1.077	0.899
LTE Band 26, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26840	829.0	1.075	0.899
26915	836.5	1.076	0.898
26990	844.0	1.076	0.896
LTE Band 26, Channel Bandwidth 15MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26865	831.5	1.077	0.899
26915	836.5	1.075	0.899
26965	841.5	1.076	0.899

Spectrum Plot of Worst Value	
1.4MHz / QPSK	3MHz / QPSK
	
5MHz / QPSK	10MHz / QPSK
	
15MHz / QPSK	
	

NB-IoT Band 5

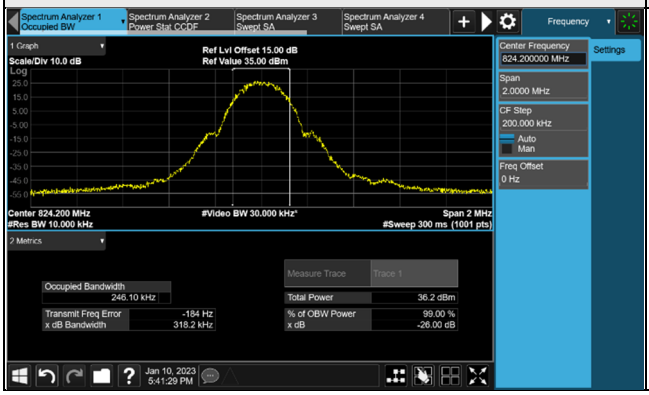
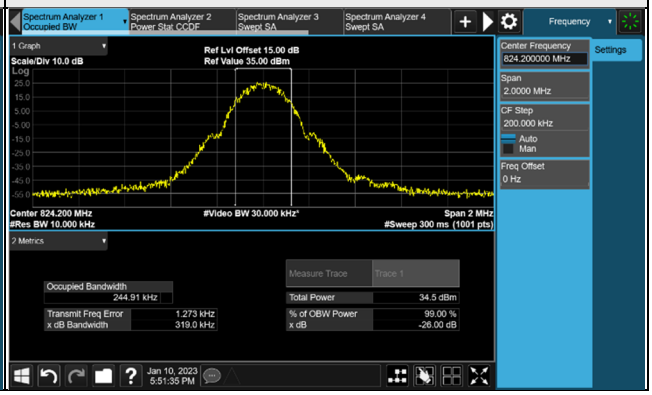
NB-IoT Band 5					
Channel	Frequency (MHz)	Subcarrier Spacing (kHz)	Number of Subcarrier / Starting Subcarrier	Modulation	99% Occupied Bandwidth (kHz)
20402	824.2	3.75	1@0	BPSK	83.37
		15	12@0	QPSK	190.50
20525	836.5	3.75	1@0	BPSK	82.02
		15	12@0	QPSK	189.99
20648	848.8	3.75	1@47	BPSK	85.32
		15	12@0	QPSK	190.87

Spectrum Plot of Worst Value
99% Occupied Bandwidth



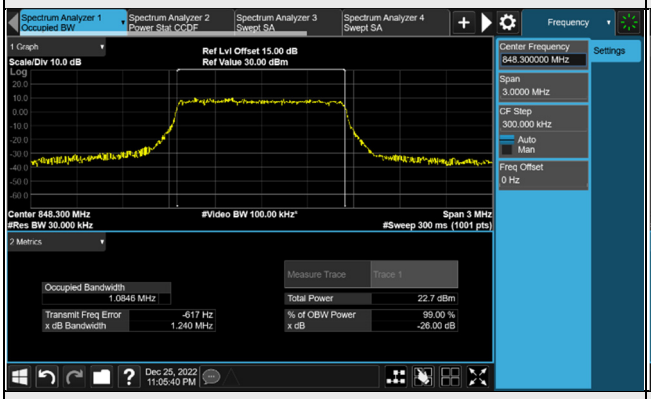
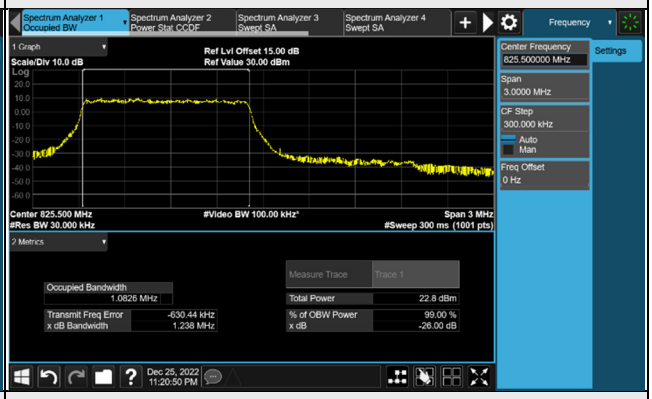
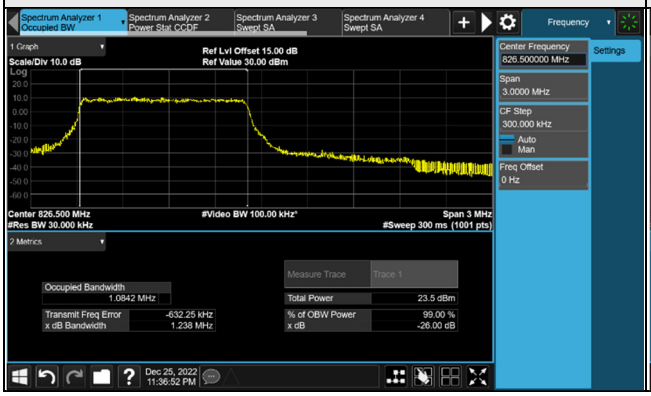
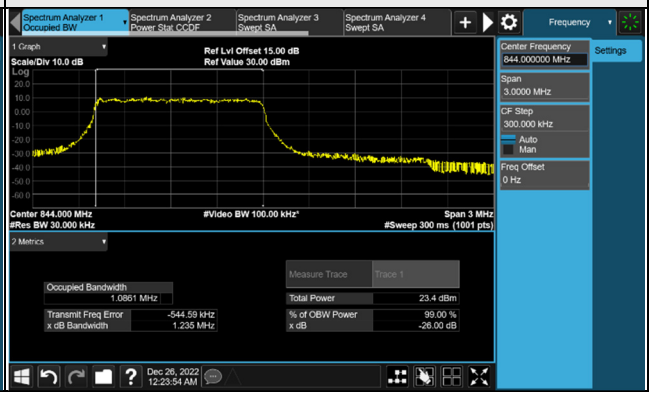
26dB Bandwidth

Channel	Frequency (MHz)	26dB Bandwidth (kHz)	
		GPRS	EDGE
128	824.2	318.20	319.00
189	836.4	316.30	310.50
251	848.8	312.90	318.90

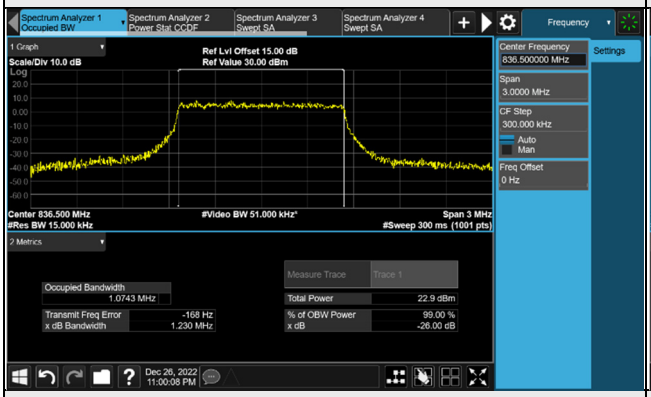
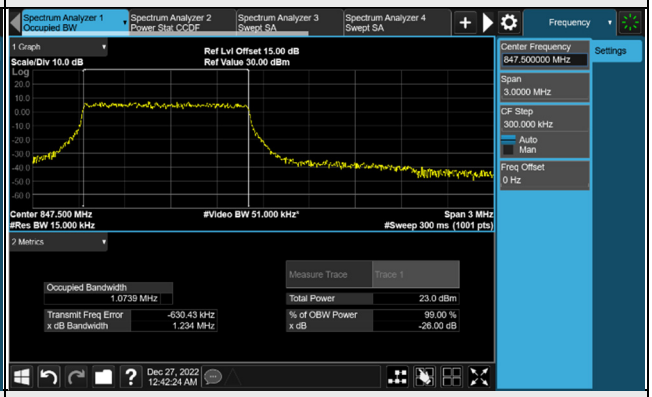
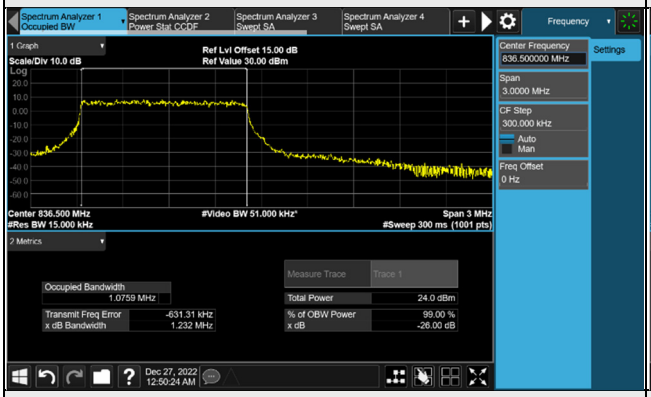
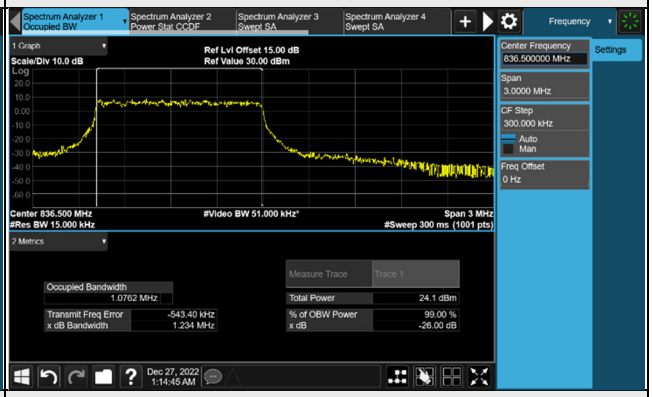
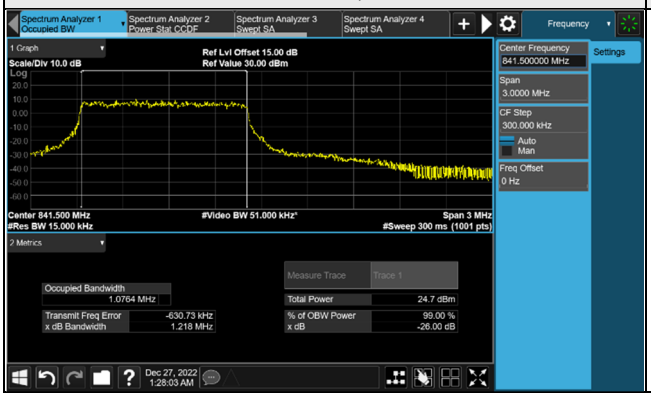
Spectrum Plot of Worst Value	
GPRS	EDGE
	

eMTC

LTE Band 5, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
20407	824.7	1.230	1.081
20525	836.5	1.238	1.067
20643	848.3	1.240	1.068
LTE Band 5, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
20415	825.5	1.238	1.078
20525	836.5	1.227	1.072
20635	847.5	1.235	1.066
LTE Band 5, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
20425	826.5	1.238	1.073
20525	836.5	1.233	1.065
20625	846.5	1.225	1.072
LTE Band 5, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
20450	829.0	1.229	1.097
20525	836.5	1.233	1.070
20600	844.0	1.235	1.098

Spectrum Plot of Worst Value	
1.4MHz / QPSK	3MHz / QPSK
	
5MHz / QPSK	10MHz / QPSK
	

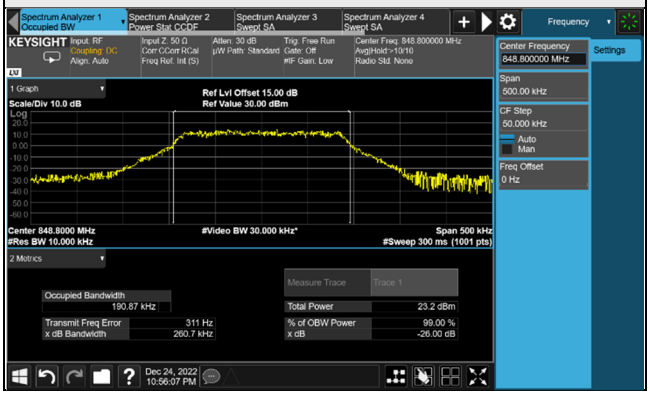
LTE Band 26, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26797	824.7	1.204	1.068
26915	836.5	1.230	1.044
27033	848.3	1.214	1.058
LTE Band 26, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26805	825.5	1.203	1.081
26915	836.5	1.199	1.069
27025	847.5	1.234	1.064
LTE Band 26, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26815	826.5	1.220	1.055
26915	836.5	1.232	1.055
27015	846.5	1.215	1.045
LTE Band 26, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26840	829.0	1.230	1.073
26915	836.5	1.234	1.072
26990	844.0	1.233	1.050
LTE Band 26, Channel Bandwidth 15MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
26865	831.5	1.202	1.053
26915	836.5	1.212	1.059
26965	841.5	1.218	1.058

Spectrum Plot of Worst Value	
1.4MHz / QPSK	3MHz / QPSK
	
5MHz / QPSK	10MHz / QPSK
	
15MHz / QPSK	
	

NB-IoT Band 5

NB-IoT Band 5					
Channel	Frequency (MHz)	Subcarrier Spacing (kHz)	Number of Subcarrier / Starting Subcarrier	Modulation	26dB Bandwidth (kHz)
20402	824.2	3.75	1@0	BPSK	81.20
		15	12@0	QPSK	254.00
20525	836.5	3.75	1@0	BPSK	80.78
		15	12@0	QPSK	257.60
20648	848.8	3.75	1@47	BPSK	83.52
		15	12@0	QPSK	260.70

Spectrum Plot of Worst Value
26dB Bandwidth

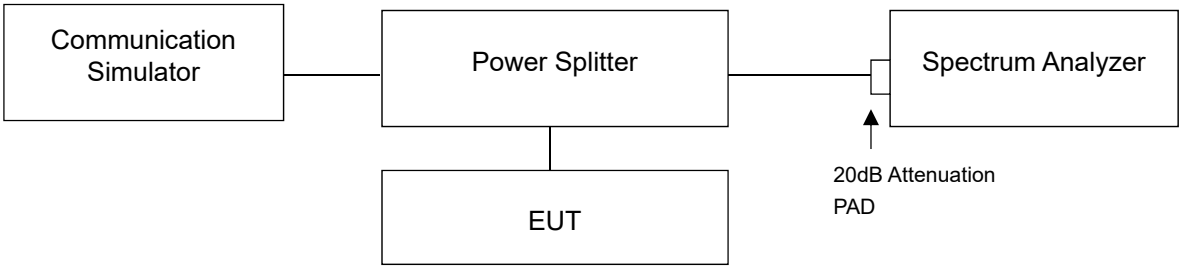


4.5 Band Edge Measurement

4.5.1 Limits of Band Edge Measurement

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. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

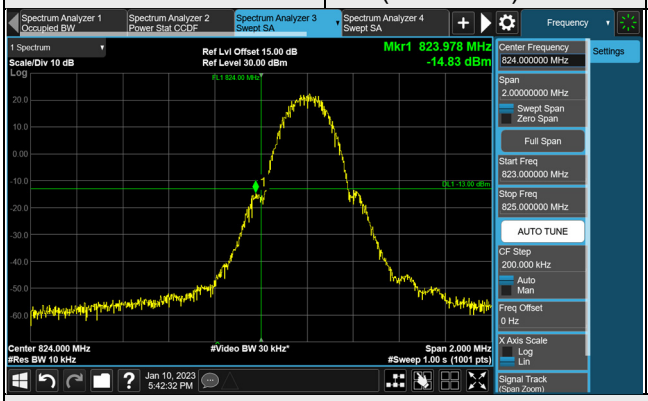
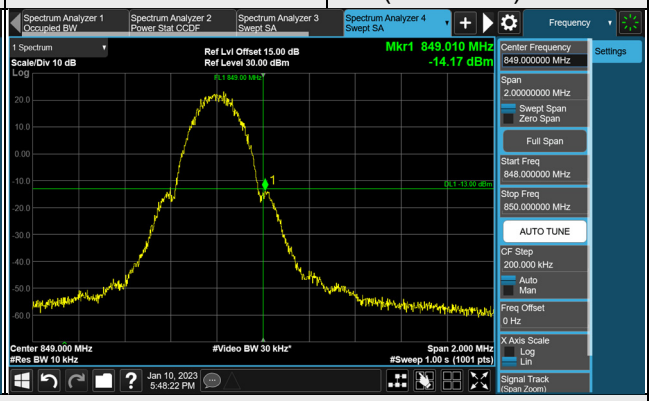
4.5.2 Test Setup



4.5.3 Test Procedures

a. All measurements were done at low and high operational frequency range.
b. Measurement refer to ANSI C63.26 section 5.7.
c. Measuring frequency band edge, narrow RBW (no less than 1% of the OBW) is used for conducted emission measurement. VBW ≥ 3 x RBW, Detector = Average.
d. The center frequency of spectrum is the band edge frequency and span is 2MHz. RB of the spectrum is 10kHz and VB of the spectrum is 30kHz (GPRS / EDGE).
e. The center frequency of spectrum is the band edge frequency and span is 2MHz. RB of the spectrum is 30kHz and VB of the spectrum is 100kHz (NB-IoT).
f. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 15kHz and VB of the spectrum is 51kHz (LTE Channel Bandwidth 1.4MHz).
g. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 15kHz and VB of the spectrum is 51kHz (LTE Channel Bandwidth 3MHz).
h. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 15kHz and VB of the spectrum is 51kHz (LTE Channel Bandwidth 5MHz).
i. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 15kHz and VB of the spectrum is 51kHz (LTE Channel Bandwidth 10MHz).
j. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 15kHz and VB of the spectrum is 51kHz (LTE Channel Bandwidth 15MHz).
k. Record the max trace plot into the test report.

4.5.4 Test Results

GPRS			
Channel	128 (824.2MHz)	Channel	251 (848.8MHz)
			
EDGE			
Channel	128 (824.2MHz)	Channel	251 (848.8MHz)