

FCC Test Report (Part 24 – GSM, LTE B2/B25, NB-IoT B2/B25)

Report No.: RFBCKS-WTW-P22090987-2

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



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	4
1 Certificate of Conformity	5
2 Summary of Test Results	6
2.1 Measurement Uncertainty	6
2.2 Test Site and Instruments	7
3 General Information	8
3.1 General Description of EUT	8
3.2 Configuration of System under Test	12
3.2.1 Description of Support Units	12
3.3 Test Mode Applicability and Tested Channel Detail	13
3.4 EUT Operating Conditions	22
3.5 General Description of Applied Standards and References	22
4 Test Types and Results	23
4.1 Output Power Measurement	23
4.1.1 Limits of Output Power Measurement	23
4.1.2 Test Procedures	23
4.1.3 Test Setup	23
4.1.4 Test Results	23
4.2 Modulation Characteristics Measurement	35
4.2.1 Limits of Modulation Characteristics	35
4.2.2 Test Procedure	35
4.2.3 Test Setup	35
4.2.4 Test Results	35
4.3 Frequency Stability Measurement	39
4.3.1 Limits of Frequency Stability Measurement	39
4.3.2 Test Procedure	39
4.3.3 Conducted Setup	39
4.3.4 Test Results	40
4.4 Occupied Bandwidth Measurement	56
4.4.1 Limits of Occupied Bandwidth Measurement	56
4.4.2 Test Procedure	56
4.4.3 Test Setup	56
4.4.4 Test Result	57
4.5 Band Edge Measurement	75
4.5.1 Limits of Band Edge Measurement	75
4.5.2 Test Setup	75
4.5.3 Test Procedures	75
4.5.4 Test Results	76
4.6 Peak to Average Ratio	91
4.6.1 Limits of Peak to Average Ratio Measurement	91
4.6.2 Test Setup	91
4.6.3 Test Procedures	91
4.6.4 Test Results	91
4.7 Conducted Spurious Emissions	100
4.7.1 Limits of Conducted Spurious Emissions Measurement	100
4.7.2 Test Setup	100
4.7.3 Test Procedure	100
4.7.4 Test Results	101
4.8 Radiated Emission Measurement	119
4.8.1 Limits of Radiated Emission Measurement	119
4.8.2 Test Procedure	119
4.8.3 Deviation from Test Standard	119
4.8.4 Test Setup	120

4.8.5 Test Results	121
Appendix – Information of the Testing Laboratories	153

Release Control Record

Issue No.	Description	Date Issued
RFBCKS-WTW-P22090987-2	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 24, Subpart E

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 24 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 24.232	Equivalent Isotropically Radiated Power	Pass	Meet the requirement of limit.
2.1046 24.232 (d)	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement of limit.
2.1055 24.235	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
24.238	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 24.238	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 24.238	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -20.23 dB at 3760.00 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. 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	GSM/GPRS: GMSK EDGE: GMSK, 8PSK LTE: QPSK, 16QAM NB-IoT: BPSK, QPSK (Subcarrier Spacing: 3.75kHz,15kHz)	
Operating Frequency	GSM1900	1850.2MHz ~1909.8MHz
	eMTC	
	LTE Band 2 (Channel Bandwidth: 1.4 MHz)	1850.7MHz ~ 1909.3MHz
	LTE Band 2 (Channel Bandwidth: 3 MHz)	1851.5MHz ~ 1908.5MHz
	LTE Band 2 (Channel Bandwidth: 5 MHz)	1852.5MHz ~ 1907.5MHz
	LTE Band 2 (Channel Bandwidth: 10 MHz)	1855.0MHz ~ 1905.0MHz
	LTE Band 2 (Channel Bandwidth: 15 MHz)	1857.5MHz ~ 1902.5MHz
	LTE Band 2 (Channel Bandwidth: 20 MHz)	1860.0MHz ~ 1900.0MHz
	LTE Band 25 (Channel Bandwidth: 1.4 MHz)	1850.7MHz ~ 1914.3MHz
	LTE Band 25 (Channel Bandwidth: 3 MHz)	1851.5MHz ~ 1913.5MHz
	LTE Band 25 (Channel Bandwidth: 5 MHz)	1852.5MHz ~ 1912.5MHz
	LTE Band 25 (Channel Bandwidth: 10 MHz)	1855.0MHz ~ 1910.0MHz
	LTE Band 25 (Channel Bandwidth: 15 MHz)	1857.5MHz ~ 1907.5MHz
	LTE Band 25 (Channel Bandwidth: 20 MHz)	1860.0MHz ~ 1905.0MHz
	NB-IoT Standalone	
	NB-IoT Band 2	1850.2MHz ~1909.8MHz
	NB-IoT Band 25	1850.2MHz ~1914.8MHz

Max. EIRP Power	GPRS	1629.296mW (32.12dBm)	
	EDGE	642.688mW (28.08dBm)	
	eMTC		
		QPSK	16QAM
	LTE Band 2 (Channel Bandwidth: 1.4 MHz)	433.511mW (26.37dBm)	364.754mW (25.62dBm)
	LTE Band 2 (Channel Bandwidth: 3 MHz)	438.531mW (26.42dBm)	333.426mW (25.23dBm)
	LTE Band 2 (Channel Bandwidth: 5 MHz)	431.519mW (26.35dBm)	358.922mW (25.55dBm)
	LTE Band 2 (Channel Bandwidth: 10 MHz)	438.531mW (26.42dBm)	361.410mW (25.58dBm)
	LTE Band 2 (Channel Bandwidth: 15 MHz)	420.727mW (26.24dBm)	362.243mW (25.59dBm)
	LTE Band 2 (Channel Bandwidth: 20 MHz)	421.697mW (26.25dBm)	377.572mW (25.77dBm)
	LTE Band 25 (Channel Bandwidth: 1.4 MHz)	373.250mW (25.72dBm)	365.595mW (25.63dBm)
	LTE Band 25 (Channel Bandwidth: 3 MHz)	391.742mW (25.93 dBm)	388.150mW (25.89dBm)
	LTE Band 25 (Channel Bandwidth: 5 MHz)	388.150mW (25.89dBm)	359.749mW (25.56dBm)
	LTE Band 25 (Channel Bandwidth: 10 MHz)	392.645mW (25.94dBm)	389.942mW (25.91dBm)
	LTE Band 25 (Channel Bandwidth: 15 MHz)	382.825mW (25.83dBm)	377.572mW (25.77dBm)
	LTE Band 25 (Channel Bandwidth: 20 MHz)	395.367mW (25.97dBm)	371.535mW (25.70dBm)
	NB-IoT Standalone		
		BPSK	QPSK
	NB-IoT Band 2	465.586mW (26.68dBm)	466.659mW (26.69dBm)
	NB-IoT Band 25	486.407mW (26.87dBm)	495.450mW (26.95dBm)

Emission Designator	GPRS	247KGXW	
	EDGE	248KG7W	
		QPSK	16QAM
	LTE Band 2 (Channel Bandwidth 1.4MHz)	1M09G7D	910KD7W
	LTE Band 2 (Channel Bandwidth 3MHz)	1M09G7D	915KD7W
	LTE Band 2 (Channel Bandwidth 5MHz)	1M09G7D	912KD7W
	LTE Band 2 (Channel Bandwidth 10MHz)	1M09G7D	914KD7W
	LTE Band 2 (Channel Bandwidth 15MHz)	1M09G7D	921KD7W
	LTE Band 2 (Channel Bandwidth 20MHz)	1M09G7D	917KD7W
	LTE Band 25 (Channel Bandwidth 1.4MHz)	1M09G7D	914KD7W
	LTE Band 25 (Channel Bandwidth 3MHz)	1M08G7D	913KD7W
	LTE Band 25 (Channel Bandwidth 5MHz)	1M09G7D	913KD7W
	LTE Band 25 (Channel Bandwidth 10MHz)	1M09G7D	913KD7W
	LTE Band 25 (Channel Bandwidth 15MHz)	1M09G7D	915KD7W
	LTE Band 25 (Channel Bandwidth 20MHz)	1M09G7D	917KD7W
	NB-IoT Standalone		
		BPSK	QPSK
	NB-IoT Band 2	89K8G7D	192KG7D
	NB-IoT Band 25	85K9G7D	193KG7D
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.

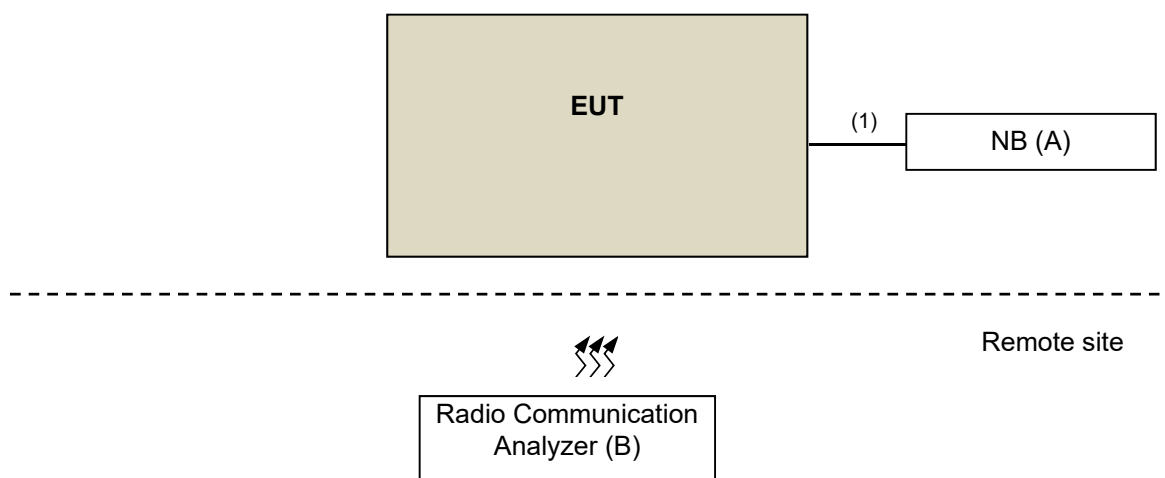
Type		Dipole									
Connector		N Plug									
Antenna gain (dBi)											
GSM 850	GSM 1900	eMTC Band 26	NB-IoT Band 71	eMTC / NB-IoT Band							
				2	4	5	12	13	25	66	85
1.8	3.2	1.8	1.8	3.2	3.2	1.8	1.8	1.8	3.2	3.2	1.8

* 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

GSM1900

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Mode
-	EIRP	512 to 810	512 (1850.2MHz), 661 (1880.0MHz), 810 (1909.8MHz)	GPRS, EDGE
-	Modulation Characteristics	512 to 810	661 (1880.0MHz)	GPRS, EDGE
-	Frequency Stability	512 to 810	512 (1850.2MHz), 810 (1909.8MHz)	GPRS, EDGE
-	Occupied Bandwidth	512 to 810	512 (1850.2MHz), 661 (1880.0MHz), 810 (1909.8MHz)	GPRS, EDGE
-	Band Edge	512 to 810	512(1850.2MHz), 810(1909.8MHz)	GPRS, EDGE
-	Peak To Average Ratio	512 to 810	512 (1850.2MHz), 661 (1880.0MHz), 810 (1909.8MHz)	GPRS, EDGE
-	Conducted Emission	512 to 810	512 (1850.2MHz), 661 (1880.0MHz), 810 (1909.8MHz)	GPRS, EDGE
-	Radiated Emission Below 1GHz	512 to 810	661 (1880.0MHz)	GPRS, EDGE
-	Radiated Emission Above 1GHz	512 to 810	512 (1850.2MHz), 661 (1880.0MHz), 810 (1909.8MHz)	GPRS, EDGE

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

eMTC
LTE Band 2

EUT Configure Mode	Test item	Available channel	Tested Channel	Channel Bandwidth	Modulation	RB #
-	EIRP	18607 to 19193	18607 (1850.7MHz), 18900 (1880.0MHz), 19193 (1909.3MHz)	1.4MHz	QPSK / 16QAM	1 Half Full
		18615 to 19185	18615 (1851.5MHz), 18900 (1880.0MHz), 19185 (1908.5MHz)	3MHz	QPSK / 16QAM	1 Half Full
		18625 to 19175	18625 (1852.5MHz), 18900 (1880.0MHz), 19175 (1907.5MHz)	5MHz	QPSK / 16QAM	1 Half Full
		18650 to 19150	18650 (1855.0MHz), 18900 (1880.0MHz), 19150 (1905.0MHz)	10MHz	QPSK / 16QAM	1 Half Full
		18675 to 19125	18675 (1857.5MHz), 18900 (1880.0MHz), 19125 (1902.5MHz)	15MHz	QPSK / 16QAM	1 Half Full
		18700 to 19100	18700 (1860.0MHz), 18900 (1880.0MHz), 19100 (1900.0MHz)	20MHz	QPSK / 16QAM	1 Half Full
-	Modulation Characteristics	18700 to 19100	18900 (1880.0MHz)	20MHz	QPSK / 16QAM	Full
-	Frequency Stability	18607 to 19193	18607 (1850.7MHz), 19193 (1909.3MHz)	1.4MHz	QPSK	Full
		18615 to 19185	18615 (1851.5MHz), 19185 (1908.5MHz)	3MHz	QPSK	Full
		18625 to 19175	18625 (1852.5MHz), 19175 (1907.5MHz)	5MHz	QPSK	Full
		18650 to 19150	18650 (1855.0MHz), 19150 (1905.0MHz)	10MHz	QPSK	Full
		18675 to 19125	18675 (1857.5MHz), 19125 (1902.5MHz)	15MHz	QPSK	Full
		18700 to 19100	18700 (1860.0MHz), 19100 (1900.0MHz)	20MHz	QPSK	Full
-	Occupied Bandwidth	18607 to 19193	18607 (1850.7MHz), 18900 (1880.0MHz), 19193 (1909.3MHz)	1.4MHz	QPSK / 16QAM	Full
		18615 to 19185	18615 (1851.5MHz), 18900 (1880.0MHz), 19185 (1908.5MHz)	3MHz	QPSK / 16QAM	Full
		18625 to 19175	18625 (1852.5MHz), 18900 (1880.0MHz), 19175 (1907.5MHz)	5MHz	QPSK / 16QAM	Full
		18650 to 19150	18650 (1855.0MHz), 18900 (1880.0MHz), 19150 (1905.0MHz)	10MHz	QPSK / 16QAM	Full
		18675 to 19125	18675 (1857.5MHz), 18900 (1880.0MHz), 19125 (1902.5MHz)	15MHz	QPSK / 16QAM	Full
		18700 to 19100	18700 (1860.0MHz), 18900 (1880.0MHz), 19100 (1900.0MHz)	20MHz	QPSK / 16QAM	Full

EUT Configure Mode	Test item	Available channel	Tested Channel	Channel Bandwidth	Modulation	RB #
-	Band Edge	18607 to 19193	18607 (1850.7MHz), 19193 (1909.3MHz)	1.4MHz	QPSK	1 Half Full
		18615 to 19185	18615 (1851.5MHz), 19185 (1908.5MHz)	3MHz	QPSK	1 Half Full
		18625 to 19175	18625 (1852.5MHz), 19175 (1907.5MHz)	5MHz	QPSK	1 Half Full
		18650 to 19150	18650 (1855.0MHz), 19150 (1905.0MHz)	10MHz	QPSK	1 Half Full
		18675 to 19125	18675 (1857.5MHz), 19125 (1902.5MHz)	15MHz	QPSK	1 Half Full
		18700 to 19100	18700 (1860.0MHz), 19100 (1900.0MHz)	20MHz	QPSK	1 Half Full
-	Peak to Average Ratio	18607 to 19193	18607 (1850.7MHz), 18900 (1880.0MHz), 19193 (1909.3MHz)	1.4MHz	QPSK / 16QAM	1
		18615 to 19185	18615 (1851.5MHz), 18900 (1880.0MHz), 19185 (1908.5MHz)	3MHz	QPSK / 16QAM	1
		18625 to 19175	18625 (1852.5MHz), 18900 (1880.0MHz), 19175 (1907.5MHz)	5MHz	QPSK / 16QAM	1
		18650 to 19150	18650 (1855.0MHz), 18900 (1880.0MHz), 19150 (1905.0MHz)	10MHz	QPSK / 16QAM	1
		18675 to 19125	18675 (1857.5MHz), 18900 (1880.0MHz), 19125 (1902.5MHz)	15MHz	QPSK / 16QAM	1
		18700 to 19100	18700 (1860.0MHz), 18900 (1880.0MHz), 19100 (1900.0MHz)	20MHz	QPSK / 16QAM	1

EUT Configure Mode	Test item	Available channel	Tested Channel	Channel Bandwidth	Modulation	RB #
-	Conducted Emission	18607 to 19193	18607 (1850.7MHz), 18900 (1880.0MHz), 19193 (1909.3MHz)	1.4MHz	QPSK	1
		18615 to 19185	18615 (1851.5MHz), 18900 (1880.0MHz), 19185 (1908.5MHz)	3MHz	QPSK	1
		18625 to 19175	18625 (1852.5MHz), 18900 (1880.0MHz), 19175 (1907.5MHz)	5MHz	QPSK	1
		18650 to 19150	18650 (1855.0MHz), 18900 (1880.0MHz), 19150 (1905.0MHz)	10MHz	QPSK	1
		18675 to 19125	18675 (1857.5MHz), 18900 (1880.0MHz), 19125 (1902.5MHz)	15MHz	QPSK	1
		18700 to 19100	18700 (1860.0MHz), 18900 (1880.0MHz), 19100 (1900.0MHz)	20MHz	QPSK	1
-	Radiated Emission Below 1GHz	18625 to 19175	18900 (1880.0MHz)	5MHz	QPSK	1
-	Radiated Emission Above 1GHz	18607 to 19193	18607 (1850.7MHz), 18900 (1880.0MHz), 19193 (1909.3MHz)	1.4MHz	QPSK	1
		18625 to 19175	18625 (1852.5MHz), 18900 (1880.0MHz), 19175 (1907.5MHz)	5MHz	QPSK	1
		18700 to 19100	18700 (1860.0MHz), 18900 (1880.0MHz), 19100 (1900.0MHz)	20MHz	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 EIRP, 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 25

EUT Configure Mode	Test item	Available channel	Tested Channel	Channel Bandwidth	Modulation	RB #
-	EIRP	26047 to 26683	26047 (1850.7MHz), 26365 (1882.5MHz), 26683 (1914.3MHz)	1.4MHz	QPSK / 16QAM	1 Half Full
		26055 to 26675	26055 (1851.5MHz), 26365 (1882.5MHz), 26675 (1913.5MHz)	3MHz	QPSK / 16QAM	1 Half Full
		26065 to 26665	26065 (1852.5MHz), 26365 (1882.5MHz), 26665 (1912.5MHz)	5MHz	QPSK / 16QAM	1 Half Full
		26090 to 26640	26090 (1855.0MHz), 26365 (1882.5MHz), 26640 (1910.0MHz)	10MHz	QPSK / 16QAM	1 Half Full
		26115 to 26615	26115 (1857.5MHz), 26365 (1882.5MHz), 26615 (1907.5MHz)	15MHz	QPSK / 16QAM	1 Half Full
		26140 to 26590	26140 (1860.0MHz), 26365 (1882.5MHz), 26590 (1905.0MHz)	20MHz	QPSK / 16QAM	1 Half Full
-	Modulation Characteristics	26140 to 26590	26365 (1882.5MHz)	20MHz	QPSK / 16QAM	Full
-	Frequency Stability	26047 to 26683	26047 (1850.7MHz), 26683 (1914.3MHz)	1.4MHz	QPSK	Full
		26055 to 26675	26055 (1851.5MHz), 26675 (1913.5MHz)	3MHz	QPSK	Full
		26065 to 26665	26065 (1852.5MHz), 26665 (1912.5MHz)	5MHz	QPSK	Full
		26090 to 26640	26090 (1855.0MHz), 26640 (1910.0MHz)	10MHz	QPSK	Full
		26115 to 26615	26115 (1857.5MHz), 26615 (1907.5MHz)	15MHz	QPSK	Full
		26140 to 26590	26140 (1860.0MHz), 26590 (1905.0MHz)	20MHz	QPSK	Full
-	Occupied Bandwidth	26047 to 26683	26047 (1850.7MHz), 26365 (1882.5MHz), 26683 (1914.3MHz)	1.4MHz	QPSK / 16QAM	Full
		26055 to 26675	26055 (1851.5MHz), 26365 (1882.5MHz), 26675 (1913.5MHz)	3MHz	QPSK / 16QAM	Full
		26065 to 26665	26065 (1852.5MHz), 26365 (1882.5MHz), 26665 (1912.5MHz)	5MHz	QPSK / 16QAM	Full
		26090 to 26640	26090 (1855.0MHz), 26365 (1882.5MHz), 26640 (1910.0MHz)	10MHz	QPSK / 16QAM	Full
		26115 to 26615	26115 (1857.5MHz), 26365 (1882.5MHz), 26615 (1907.5MHz)	15MHz	QPSK / 16QAM	Full
		26140 to 26590	26140 (1860.0MHz), 26365 (1882.5MHz), 26590 (1905.0MHz)	20MHz	QPSK / 16QAM	Full

EUT Configure Mode	Test item	Available channel	Tested Channel	Channel Bandwidth	Modulation	RB #
-	Band Edge	26047 to 26683	26047 (1850.7MHz), 26683 (1914.3MHz)	1.4MHz	QPSK	1 Half Full
		26055 to 26675	26055 (1851.5MHz), 26675 (1913.5MHz)	3MHz	QPSK	1 Half Full
		26065 to 26665	26065 (1852.5MHz), 26665 (1912.5MHz)	5MHz	QPSK	1 Half Full
		26090 to 26640	26090 (1855.0MHz), 26640 (1910.0MHz)	10MHz	QPSK	1 Half Full
		26115 to 26615	26115 (1857.5MHz), 26615 (1907.5MHz)	15MHz	QPSK	1 Half Full
		26140 to 26590	26140 (1860.0MHz), 26590 (1905.0MHz)	20MHz	QPSK	1 Half Full
-	Peak to Average Ratio	26047 to 26683	26047 (1850.7MHz), 26365 (1882.5MHz), 26683 (1914.3MHz)	1.4MHz	QPSK / 16QAM	1
		26055 to 26675	26055 (1851.5MHz), 26365 (1882.5MHz), 26675 (1913.5MHz)	3MHz	QPSK / 16QAM	1
		26065 to 26665	26065 (1852.5MHz), 26365 (1882.5MHz), 26665 (1912.5MHz)	5MHz	QPSK / 16QAM	1
		26090 to 26640	26090 (1855.0MHz), 26365 (1882.5MHz), 26640 (1910.0MHz)	10MHz	QPSK / 16QAM	1
		26115 to 26615	26115 (1857.5MHz), 26365 (1882.5MHz), 26615 (1907.5MHz)	15MHz	QPSK / 16QAM	1
		26140 to 26590	26140 (1860.0MHz), 26365 (1882.5MHz), 26590 (1905.0MHz)	20MHz	QPSK / 16QAM	1

EUT Configure Mode	Test item	Available channel	Tested Channel	Channel Bandwidth	Modulation	RB #
-	Conducted Emission	26047 to 26683	26047 (1850.7MHz), 26365 (1882.5MHz), 26683 (1914.3MHz)	1.4MHz	QPSK	1
		26055 to 26675	26055 (1851.5MHz), 26365 (1882.5MHz), 26675 (1913.5MHz)	3MHz	QPSK	1
		26065 to 26665	26065 (1852.5MHz), 26365 (1882.5MHz), 26665 (1912.5MHz)	5MHz	QPSK	1
		26090 to 26640	26090 (1855.0MHz), 26365 (1882.5MHz), 26640 (1910.0MHz)	10MHz	QPSK	1
		26115 to 26615	26115 (1857.5MHz), 26365 (1882.5MHz), 26615 (1907.5MHz)	15MHz	QPSK	1
		26140 to 26590	26140 (1860.0MHz), 26365 (1882.5MHz), 26590 (1905.0MHz)	20MHz	QPSK	1
-	Radiated Emission Below 1GHz	26140 to 26590	26590 (1905.0MHz)	20MHz	QPSK	1
-	Radiated Emission Above 1GHz	26047 to 26683	26047 (1850.7MHz), 26365 (1882.5MHz), 26683 (1914.3MHz)	1.4MHz	QPSK	1
		26065 to 26665	26065 (1852.5MHz), 26365 (1882.5MHz), 26665 (1912.5MHz)	5MHz	QPSK	1
		26140 to 26590	26140 (1860.0MHz), 26365 (1882.5MHz), 26590 (1905.0MHz)	20MHz	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 EIRP, 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 2

EUT Configure Mode	Test item	Available channel		Tested Channel	Channel Bandwidth	Subcarrier Spacing	Modulation	Number of Subcarrier / Starting Subcarrier
-	EIRP	Standalone	18602 to 19198	18602 (1850.2MHz), 18900 (1880.0MHz), 19198 (1909.8MHz)	-	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	18602 to 19198	18900 (1880.0MHz)	-	3.75kHz	BPSK	1@0
						15kHz	QPSK	1@0
-	Frequency Stability	Standalone	18602 to 19198	18602 (1850.2MHz), 19198 (1909.8MHz)	-	3.75kHz	BPSK	1@0
						15kHz	QPSK	1@0
-	Occupied Bandwidth	Standalone	18602 to 19198	18602 (1850.2MHz), 18900 (1880.0MHz), 19198 (1909.8MHz)	-	3.75kHz	BPSK	1@0 1@47
						15kHz	QPSK	12@0
-	Band Edge	Standalone	18602 to 19198	18602 (1850.2MHz), 19198 (1909.8MHz)	-	3.75kHz	BPSK	1@0 1@47
						15kHz	QPSK	1@0 12@0
-	Peak To Average Ratio	Standalone	18602 to 19198	18602 (1850.2MHz), 18900 (1880.0MHz), 19198 (1909.8MHz)	-	3.75kHz	BPSK	1@0 1@47
						15kHz	QPSK	12@0
-	Conducted Emission	Standalone	18602 to 19198	18602 (1850.2MHz), 18900 (1880.0MHz), 19198 (1909.8MHz)	-	3.75kHz	BPSK	1@0
						15kHz	QPSK	12@0
-	Radiated Emission Below 1GHz	Standalone	18602 to 19198	18900 (1880.0MHz)	-	15kHz	QPSK	1@0
-	Radiated Emission Above 1GHz	Standalone	18602 to 19198	18602 (1850.2MHz), 18900 (1880.0MHz), 19198 (1909.8MHz)	-	15kHz	QPSK	1@0

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

NB-IoT Band 25

EUT Configure Mode	Test item	Available channel		Tested Channel	Channel Bandwidth	Subcarrier Spacing	Modulation	Number of Subcarrier / Starting Subcarrier
-	EIRP	Standalone	26042 to 26688	26042 (1850.2MHz), 26365 (1882.5MHz), 26688 (1914.8MHz)	-	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	26042 to 26688	26365 (1882.5MHz)	-	3.75kHz	BPSK	1@0
						15kHz	QPSK	1@0
-	Frequency Stability	Standalone	26042 to 26688	26042 (1850.2MHz), 26688 (1914.8MHz)	-	3.75kHz	BPSK	1@0
						15kHz	QPSK	1@0
-	Occupied Bandwidth	Standalone	26042 to 26688	26042 (1850.2MHz), 26365 (1882.5MHz), 26688 (1914.8MHz)	-	3.75kHz	BPSK	1@0 1@47
						15kHz	QPSK	12@0
-	Band Edge	Standalone	26042 to 26688	26042 (1850.2MHz), 26688 (1914.8MHz)	-	3.75kHz	BPSK	1@0 1@47
						15kHz	QPSK	1@0 12@0
-	Peak To Average Ratio	Standalone	26042 to 26688	26042 (1850.2MHz), 26365 (1882.5MHz), 26688 (1914.8MHz)	-	3.75kHz	BPSK	1@0 1@47
						15kHz	QPSK	12@0
-	Conducted Emission	Standalone	26042 to 26688	26042 (1850.2MHz), 26365 (1882.5MHz), 26688 (1914.8MHz)	-	3.75kHz	BPSK	1@0
						15kHz	QPSK	12@0
-	Radiated Emission Below 1GHz	Standalone	26042 to 26688	26365 (1882.5MHz)	-	15kHz	QPSK	1@0
-	Radiated Emission Above 1GHz	Standalone	26042 to 26688	26042 (1850.2MHz), 26365 (1882.5MHz), 26688 (1914.8MHz)	-	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
EIRP	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
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 24

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 2 watts e.i.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:

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

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

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)

Band	GSM1900		
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
GPRS	28.79	28.92	28.88
EDGE	24.70	24.88	24.85

eMTC

LTE Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18607	18900	19193
		Frequency (MHz)		1850.7	1880	1909.3
1.4M	QPSK	1	0	22.68	23.17	22.80
		1	6	22.65	22.94	22.62
		6	0	20.81	20.89	20.66
	16QAM	1	0	21.87	21.86	22.42
		1	6	21.71	21.87	22.14
		6	0	20.80	20.87	20.62

LTE Band 2						
BW	MCS Index	Channel		18615	18900	19185
		Frequency (MHz)		1851.5	1880	1908.5
3M	QPSK	1	0	22.73	23.22	23.00
		1	6	22.38	22.95	22.87
		6	0	20.90	20.84	20.57
	16QAM	1	0	21.74	22.00	21.95
		1	6	21.77	21.85	22.03
		6	0	20.79	20.83	20.45

LTE Band 2						
BW	MCS Index	Channel		18625	18900	19175
		Frequency (MHz)		1852.5	1880	1907.5
5M	QPSK	1	0	22.75	23.15	22.96
		1	6	22.74	22.84	22.48
		6	0	21.05	21.00	20.72
	16QAM	1	0	21.94	21.75	22.12
		1	6	22.00	21.75	22.35
		6	0	20.69	20.67	20.71

LTE Band 2						
BW	MCS Index	Channel		18650	18900	19150
		Frequency (MHz)		1855	1880	1905
10M	QPSK	1	0	22.85	23.22	22.81
		1	6	22.49	23.01	22.50
		6	0	21.18	20.64	20.78
	16QAM	1	0	21.76	22.04	22.38
		1	6	21.86	22.02	22.37
		6	0	21.17	20.63	20.37

LTE Band 2						
BW	MCS Index	Channel		18675	18900	19125
		Frequency (MHz)		1857.5	1880	1902.5
15M	QPSK	1	0	22.74	23.04	22.55
		1	6	22.44	22.72	22.34
		6	0	20.98	20.84	20.91
	16QAM	1	0	22.07	21.88	22.39
		1	6	21.54	21.64	22.18
		6	0	20.57	20.79	20.76

LTE Band 2						
BW	MCS Index	Channel		18700	18900	19100
		Frequency (MHz)		1860	1880	1900
20M	QPSK	1	0	22.76	23.05	22.64
		1	6	22.75	22.94	22.59
		6	0	20.97	21.07	20.76
	16QAM	1	0	22.16	21.56	22.57
		1	6	21.51	21.66	22.37
		6	0	20.93	20.85	20.66

LTE Band 25						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26047	26365	26683
		Frequency (MHz)		1850.7	1882.5	1914.3
1.4M	QPSK	1	0	22.38	22.52	22.46
		1	6	22.36	22.48	22.42
		6	0	22.29	22.46	22.36
	16QAM	1	0	22.26	22.43	22.35
		1	6	22.23	22.40	22.33
		6	0	22.19	22.30	22.28

LTE Band 25						
BW	MCS Index	Channel		26055	26365	26675
		Frequency (MHz)		1851.5	1882.5	1913.5
3M	QPSK	1	0	22.55	22.67	22.68
		1	6	22.22	22.28	22.53
		6	0	22.18	22.73	22.56
	16QAM	1	0	22.24	22.14	22.42
		1	6	22.19	22.24	22.34
		6	0	22.15	22.69	22.10

LTE Band 25						
BW	MCS Index	Channel		26065	26365	26665
		Frequency (MHz)		1852.5	1882.5	1912.5
5M	QPSK	1	0	22.13	22.69	22.48
		1	6	22.56	22.22	22.39
		6	0	22.16	22.65	22.51
	16QAM	1	0	22.18	22.33	22.05
		1	6	22.36	22.21	22.11
		6	0	22.12	22.18	22.13

LTE Band 25						
BW	MCS Index	Channel		26090	26365	26640
		Frequency (MHz)		1855	1882.5	1910
10M	QPSK	1	0	22.22	22.59	22.36
		1	6	22.38	22.74	22.13
		6	0	22.10	22.27	22.08
	16QAM	1	0	22.18	22.49	22.24
		1	6	22.35	22.71	22.10
		6	0	21.99	22.11	21.99

LTE Band 25						
BW	MCS Index	Channel		26115	26365	26615
		Frequency (MHz)		1857.5	1882.5	1907.5
15M	QPSK	1	0	22.27	22.61	22.58
		1	6	22.52	22.73	22.62
		6	0	22.33	22.63	22.23
	16QAM	1	0	22.01	22.57	22.12
		1	6	22.44	22.33	22.51
		6	0	21.93	22.19	22.13

LTE Band 25						
BW	MCS Index	Channel		26140	26365	26590
		Frequency (MHz)		1860	1882.5	1905
20M	QPSK	1	0	22.65	22.77	22.75
		1	6	22.55	22.42	22.42
		6	0	22.22	22.50	22.25
	16QAM	1	0	22.50	22.45	22.31
		1	6	22.44	22.37	22.41
		6	0	22.19	22.08	22.06

NB-IoT Band 2

BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18602	18900	19198
		Frequency (MHz)		1850.2	1880	1909.8
Stand-alone	3.75k BPSK	1	0	22.26	22.22	22.29
		1	47	22.22	22.39	22.50
	3.75k QPSK	1	0	22.29	22.34	22.37
		1	47	22.25	22.96	22.78
	15k BPSK	1	0	23.24	23.48	23.32
		1	11	23.20	22.95	23.45
	15k QPSK	1	0	23.38	23.49	23.42
		1	11	23.42	23.04	23.48
		12	0	20.99	21.03	21.15

NB-IoT Band 25

BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26042	26365	26688
		Frequency (MHz)		1850.2	1882.5	1914.8
Stand-alone	3.75k BPSK	1	0	23.16	22.70	22.83
		1	47	22.56	22.84	22.57
	3.75k QPSK	1	0	23.24	22.95	22.96
		1	47	22.93	22.96	22.73
	15k BPSK	1	0	23.67	23.62	23.55
		1	11	23.30	23.49	23.45
	15k QPSK	1	0	23.33	23.75	23.67
		1	11	23.69	23.60	23.53
		12	0	21.18	21.11	21.24

EIRP Power (dBm)

Band	GSM1900		
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
GPRS	31.99	32.12	32.08
EDGE	27.90	28.08	28.05

*EIRP = Conducted + antenna gain (3.2dBi)

eMTC

LTE Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18607	18900	19193
		Frequency (MHz)		1850.7	1880	1909.3
1.4M	QPSK	1	0	25.88	26.37	26.00
		1	6	25.85	26.14	25.82
		6	0	24.01	24.09	23.86
	16QAM	1	0	25.07	25.06	25.62
		1	6	24.91	25.07	25.34
		6	0	24.00	24.07	23.82

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 2						
BW	MCS Index	Channel		18615	18900	19185
		Frequency (MHz)		1851.5	1880	1908.5
3M	QPSK	1	0	25.93	26.42	26.20
		1	6	25.58	26.15	26.07
		6	0	24.10	24.04	23.77
	16QAM	1	0	24.94	25.20	25.15
		1	6	24.97	25.05	25.23
		6	0	23.99	24.03	23.65

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 2						
BW	MCS Index	Channel		18625	18900	19175
		Frequency (MHz)		1852.5	1880	1907.5
5M	QPSK	1	0	25.95	26.35	26.16
		1	6	25.94	26.04	25.68
		6	0	24.25	24.20	23.92
	16QAM	1	0	25.14	24.95	25.32
		1	6	25.20	24.95	25.55
		6	0	23.89	23.87	23.91

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 2						
BW	MCS Index	Channel		18650	18900	19150
		Frequency (MHz)		1855	1880	1905
10M	QPSK	1	0	26.05	26.42	26.01
		1	6	25.69	26.21	25.70
		6	0	24.38	23.84	23.98
	16QAM	1	0	24.96	25.24	25.58
		1	6	25.06	25.22	25.57
		6	0	24.37	23.83	23.57

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 2						
BW	MCS Index	Channel		18675	18900	19125
		Frequency (MHz)		1857.5	1880	1902.5
15M	QPSK	1	0	25.94	26.24	25.75
		1	6	25.64	25.92	25.54
		6	0	24.18	24.04	24.11
	16QAM	1	0	25.27	25.08	25.59
		1	6	24.74	24.84	25.38
		6	0	23.77	23.99	23.96

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 2						
BW	MCS Index	Channel		18700	18900	19100
		Frequency (MHz)		1860	1880	1900
20M	QPSK	1	0	25.96	26.25	25.84
		1	6	25.95	26.14	25.79
		6	0	24.17	24.27	23.96
	16QAM	1	0	25.36	24.76	25.77
		1	6	24.71	24.86	25.57
		6	0	24.13	24.05	23.86

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 25						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26047	26365	26683
		Frequency (MHz)		1850.7	1882.5	1914.3
1.4M	QPSK	1	0	25.58	25.72	25.66
		1	6	25.56	25.68	25.62
		6	0	25.49	25.66	25.56
	16QAM	1	0	25.46	25.63	25.55
		1	6	25.43	25.60	25.53
		6	0	25.39	25.50	25.48

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 25						
BW	MCS Index	Channel		26055	26365	26675
		Frequency (MHz)		1851.5	1882.5	1913.5
3M	QPSK	1	0	25.75	25.87	25.88
		1	6	25.42	25.48	25.73
		6	0	25.38	25.93	25.76
	16QAM	1	0	25.44	25.34	25.62
		1	6	25.39	25.44	25.54
		6	0	25.35	25.89	25.30

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 25						
BW	MCS Index	Channel		26065	26365	26665
		Frequency (MHz)		1852.5	1882.5	1912.5
5M	QPSK	1	0	25.33	25.89	25.68
		1	6	25.76	25.42	25.59
		6	0	25.36	25.85	25.71
	16QAM	1	0	25.38	25.53	25.25
		1	6	25.56	25.41	25.31
		6	0	25.32	25.38	25.33

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 25						
BW	MCS Index	Channel		26090	26365	26640
		Frequency (MHz)		1855	1882.5	1910
10M	QPSK	1	0	25.42	25.79	25.56
		1	6	25.58	25.94	25.33
		6	0	25.30	25.47	25.28
	16QAM	1	0	25.38	25.69	25.44
		1	6	25.55	25.91	25.30
		6	0	25.19	25.31	25.19

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 25						
BW	MCS Index	Channel		26115	26365	26615
		Frequency (MHz)		1857.5	1882.5	1907.5
15M	QPSK	1	0	25.47	25.81	25.78
		1	6	25.72	25.93	25.82
		6	0	25.53	25.83	25.43
	16QAM	1	0	25.21	25.77	25.32
		1	6	25.64	25.53	25.71
		6	0	25.13	25.39	25.33

*EIRP = Conducted + antenna gain (3.2dBi)

LTE Band 25						
BW	MCS Index	Channel		26140	26365	26590
		Frequency (MHz)		1860	1882.5	1905
20M	QPSK	1	0	25.85	25.97	25.95
		1	6	25.75	25.62	25.62
		6	0	25.42	25.70	25.45
	16QAM	1	0	25.70	25.65	25.51
		1	6	25.64	25.57	25.61
		6	0	25.39	25.28	25.26

*EIRP = Conducted + antenna gain (3.2dBi)

NB-IoT Band 2

BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18602	18900	19198
		Frequency (MHz)		1850.2	1880	1909.8
Stand-alone	3.75k BPSK	1	0	25.46	25.42	25.49
		1	47	25.42	25.59	25.70
	3.75k QPSK	1	0	25.49	25.54	25.57
		1	47	25.45	26.16	25.98
	15k BPSK	1	0	26.44	26.68	26.52
		1	11	26.40	26.15	26.65
	15k QPSK	1	0	26.58	26.69	26.62
		1	11	26.62	26.24	26.68
		12	0	24.19	24.23	24.35

*EIRP = Conducted + antenna gain (3.2dBi)

NB-IoT Band 25

BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		26042	26365	26688
		Frequency (MHz)		1850.2	1882.5	1914.8
Stand-alone	3.75k BPSK	1	0	26.36	25.90	26.03
		1	47	25.76	26.04	25.77
	3.75k QPSK	1	0	26.44	26.15	26.16
		1	47	26.13	26.16	25.93
	15k BPSK	1	0	26.87	26.82	26.75
		1	11	26.50	26.69	26.65
	15k QPSK	1	0	26.53	26.95	26.87
		1	11	26.89	26.80	26.73
		12	0	24.38	24.31	24.44

*EIRP = Conducted + antenna gain (3.2dBi)

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

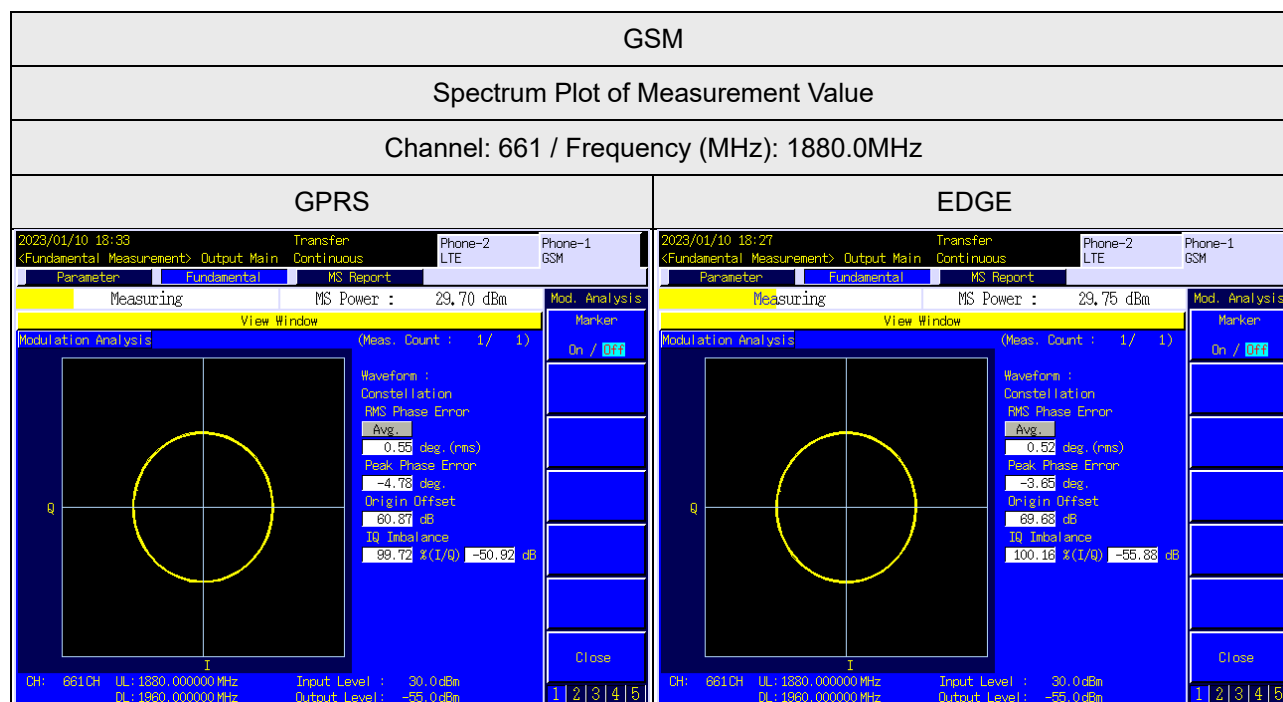
4.2.2 Test Procedure

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



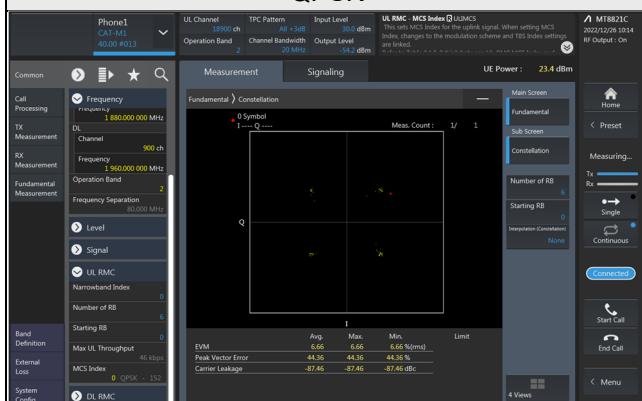
eMTC

LTE Band 2

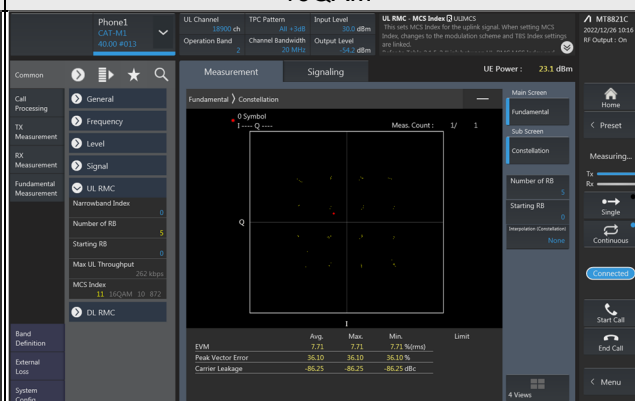
Spectrum Plot of Measurement Value

Channel: 18900 / Frequency (MHz): 1880.0MHz

QPSK



16QAM

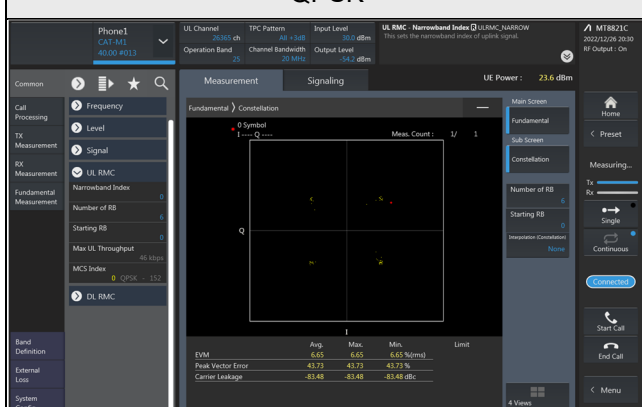


LTE Band 25

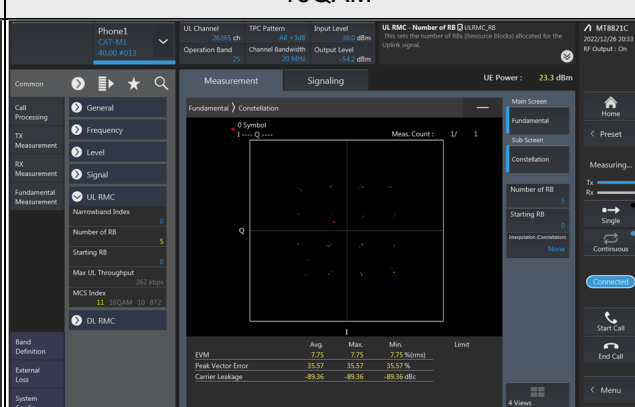
Spectrum Plot of Measurement Value

Channel: 26365 / Frequency (MHz): 1882.5MHz

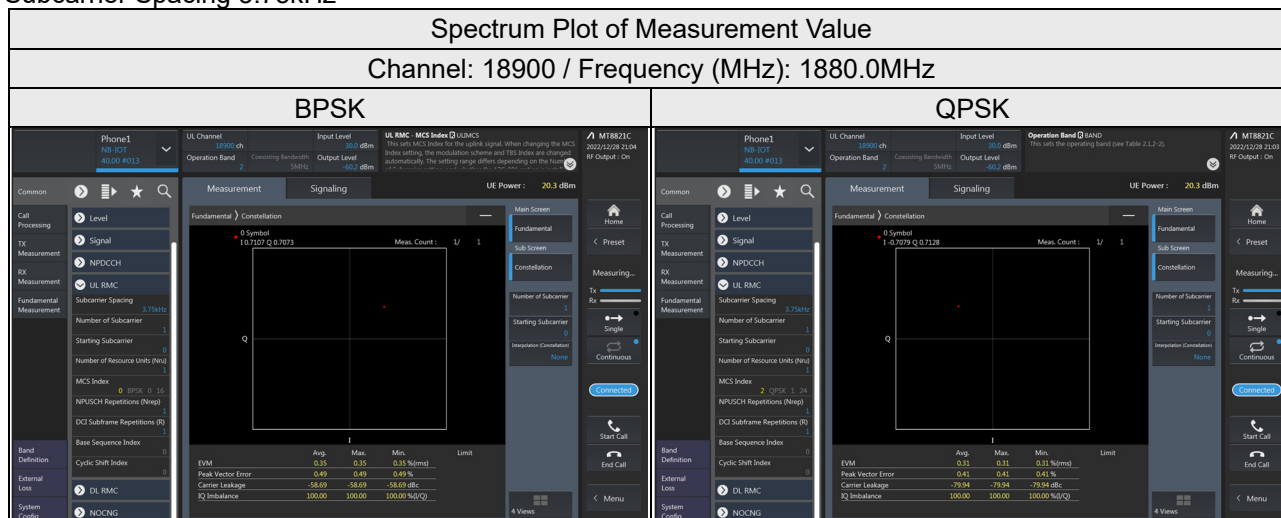
QPSK



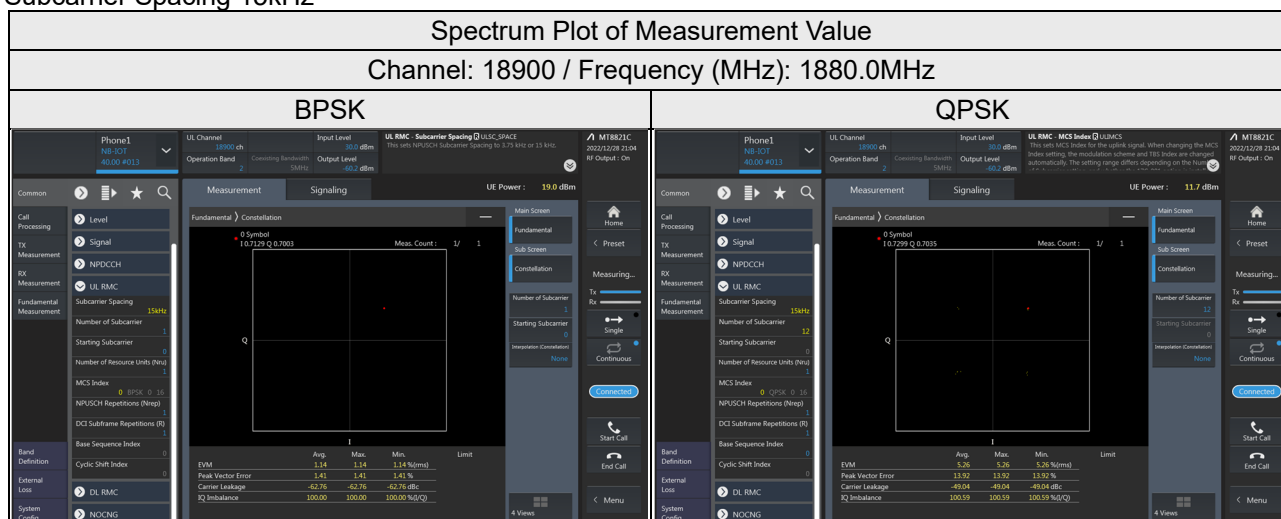
16QAM



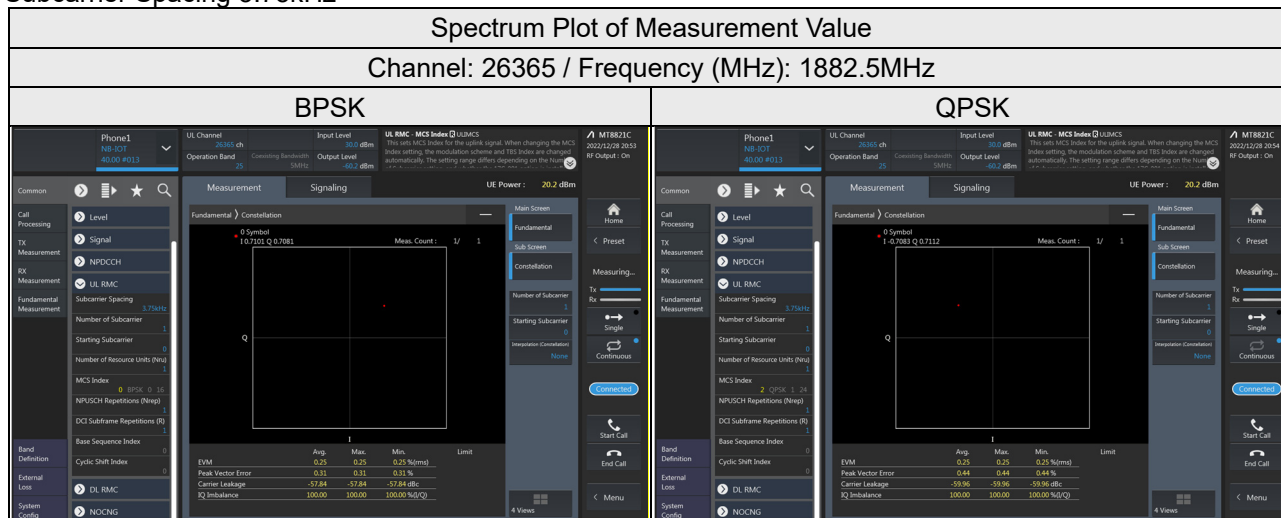
NB-IoT Band 2 Subcarrier Spacing 3.75kHz



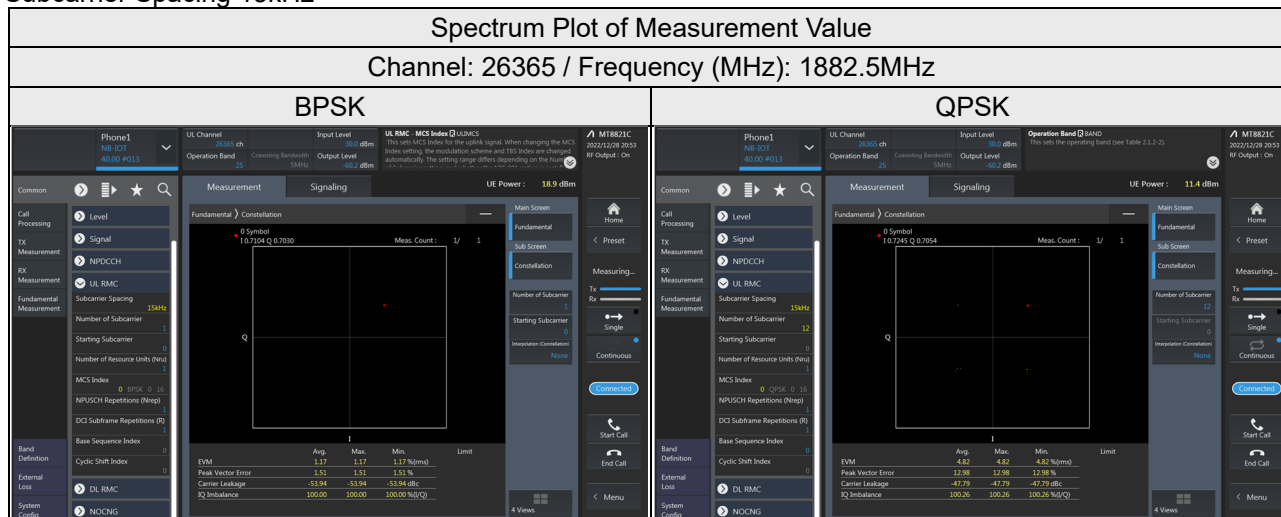
Subcarrier Spacing 15kHz



NB-IoT Band 25 Subcarrier Spacing 3.75kHz



Subcarrier Spacing 15kHz



4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

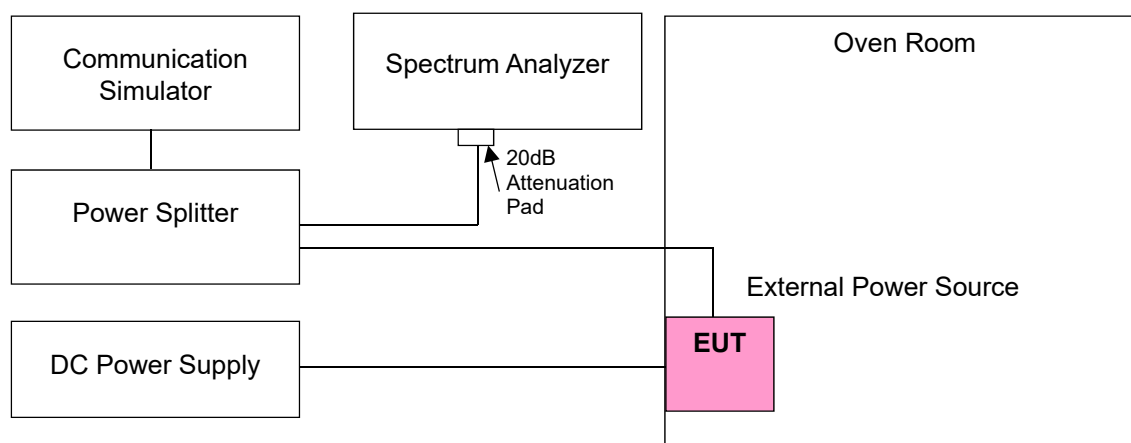
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

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 Conducted 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	1850.199997	-0.002	1909.799997	-0.002
3.7	1850.199998	-0.001	1909.799998	-0.001
4.26	1850.199998	-0.001	1909.799997	-0.002

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

Frequency Error vs. Temperature

Temp. (°C)	GPRS			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1850.200002	0.001	1909.800002	0.001
-20	1850.199997	-0.002	1909.800001	0.001
-10	1850.199999	-0.001	1909.799998	-0.001
0	1850.200002	0.001	1909.800004	0.002
10	1850.200001	0.001	1909.799997	-0.002
20	1850.200001	0.001	1909.800004	0.002
30	1850.199997	-0.002	1909.800002	0.001
40	1850.199996	-0.002	1909.800004	0.002
50	1850.200001	0.001	1909.800002	0.001
60	1850.199998	-0.001	1909.799998	-0.001

Frequency Error vs. Voltage

Voltage (Vdc)	EDGE			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1850.199999	-0.001	1909.800002	0.001
3.7	1850.199997	-0.002	1909.799998	-0.001
4.26	1850.199999	-0.001	1909.799996	-0.002

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

Frequency Error vs. Temperature

Temp. (°C)	EDGE			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1850.200002	0.001	1909.800003	0.002
-20	1850.199997	-0.002	1909.799996	-0.002
-10	1850.199999	-0.001	1909.799996	-0.002
0	1850.199996	-0.002	1909.799996	-0.002
10	1850.200004	0.002	1909.800003	0.002
20	1850.199998	-0.001	1909.800002	0.001
30	1850.200003	0.002	1909.800002	0.001
40	1850.200001	0.001	1909.799996	-0.002
50	1850.200004	0.002	1909.800003	0.002
60	1850.200004	0.002	1909.799997	-0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 2			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1850.700003	0.002	1909.300000	-0.002
3.7	1850.700001	0.001	1909.300002	0.001
4.26	1850.700002	0.001	1909.299997	-0.002

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1850.7000030	0.002	1909.2999980	-0.001
-20	1850.6999990	-0.001	1909.2999980	-0.001
-10	1850.7000010	0.001	1909.2999960	-0.002
0	1850.7000030	0.002	1909.3000010	0.001
10	1850.6999980	-0.001	1909.3000040	0.002
20	1850.6999970	-0.002	1909.3000010	0.001
30	1850.6999990	-0.001	1909.2999990	-0.001
40	1850.6999990	-0.001	1909.3000020	0.001
50	1850.6999990	-0.001	1909.2999980	-0.001
60	1850.7000020	0.001	1909.3000030	0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 2			
	Channel Bandwidth 3MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1851.500002	0.001	1908.499997	-0.002
3.7	1851.499997	-0.002	1908.500002	0.001
4.26	1851.500003	0.002	1908.500002	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 2			
	Channel Bandwidth 3MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1851.5000040	0.002	1908.5000020	0.001
-20	1851.5000020	0.001	1908.5000020	0.001
-10	1851.5000010	0.001	1908.4999980	-0.001
0	1851.4999990	-0.001	1908.5000010	0.001
10	1851.4999960	-0.002	1908.5000030	0.002
20	1851.5000040	0.002	1908.4999980	-0.001
30	1851.4999980	-0.001	1908.4999960	-0.002
40	1851.4999980	-0.001	1908.4999980	-0.001
50	1851.4999990	-0.001	1908.4999990	-0.001
60	1851.4999970	-0.002	1908.5000040	0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 2			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1852.499999	-0.001	1907.500001	0.001
3.7	1852.499996	-0.002	1907.499996	-0.002
4.26	1852.499999	-0.001	1907.500004	0.002

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1852.4999960	-0.002	1907.4999980	-0.001
-20	1852.5000010	0.001	1907.5000020	0.001
-10	1852.4999980	-0.001	1907.4999970	-0.002
0	1852.4999960	-0.002	1907.4999970	-0.002
10	1852.4999970	-0.002	1907.4999960	-0.002
20	1852.4999990	-0.001	1907.4999990	-0.001
30	1852.5000020	0.001	1907.4999960	-0.002
40	1852.4999990	-0.001	1907.4999960	-0.002
50	1852.5000010	0.001	1907.4999980	-0.001
60	1852.4999980	-0.001	1907.5000030	0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 2			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1855.000001	0.001	1904.999999	-0.001
3.7	1854.999997	-0.002	1904.999999	-0.001
4.26	1855.000001	0.001	1904.999999	-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 2			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1854.9999990	-0.001	1904.9999990	-0.001
-20	1855.0000030	0.002	1905.0000040	0.002
-10	1855.0000040	0.002	1904.9999970	-0.002
0	1855.0000020	0.001	1905.0000030	0.002
10	1855.0000020	0.001	1905.0000010	0.001
20	1854.9999990	-0.001	1904.9999990	-0.001
30	1855.0000020	0.001	1904.9999960	-0.002
40	1855.0000040	0.002	1904.9999980	-0.001
50	1855.0000010	0.001	1904.9999980	-0.001
60	1854.9999990	-0.001	1905.0000030	0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 2			
	Channel Bandwidth 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1857.500003	0.002	1902.499997	-0.002
3.7	1857.499999	-0.001	1902.499998	-0.001
4.26	1857.499999	-0.001	1902.499997	-0.002

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1857.4999980	-0.001	1902.4999980	-0.001
-20	1857.4999960	-0.002	1902.5000030	0.002
-10	1857.4999980	-0.001	1902.4999990	-0.001
0	1857.4999960	-0.002	1902.5000030	0.002
10	1857.5000020	0.001	1902.5000030	0.002
20	1857.5000020	0.001	1902.5000030	0.002
30	1857.4999970	-0.002	1902.4999980	-0.001
40	1857.5000020	0.001	1902.5000040	0.002
50	1857.5000040	0.002	1902.4999960	-0.002
60	1857.4999980	-0.001	1902.5000030	0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 2			
	Channel Bandwidth 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1860.000003	0.002	1899.999996	-0.002
3.7	1860.000004	0.002	1900.000001	0.001
4.26	1860.000001	0.001	1899.999999	-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 2			
	Channel Bandwidth 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1860.0000020	0.001	1899.9999980	-0.001
-20	1859.9999990	-0.001	1899.9999970	-0.002
-10	1859.9999990	-0.001	1900.0000040	0.002
0	1860.0000040	0.002	1899.9999990	-0.001
10	1860.0000010	0.001	1899.9999960	-0.002
20	1859.9999970	-0.002	1899.9999990	-0.001
30	1860.0000040	0.002	1899.9999960	-0.002
40	1860.0000020	0.001	1900.0000010	0.001
50	1860.0000040	0.002	1899.9999990	-0.001
60	1859.9999990	-0.001	1900.0000020	0.001

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 25			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1850.6999990	-0.001	1914.2999980	-0.001
3.7	1850.7000040	0.002	1914.3000020	0.001
4.26	1850.7000040	0.002	1914.3000010	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 25			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1850.6999960	-0.002	1914.3000030	0.002
-20	1850.6999970	-0.002	1914.2999970	-0.002
-10	1850.6999970	-0.002	1914.2999980	-0.001
0	1850.6999970	-0.002	1914.3000010	0.001
10	1850.6999990	-0.001	1914.2999980	-0.001
20	1850.6999980	-0.001	1914.2999970	-0.002
30	1850.6999990	-0.001	1914.2999990	-0.001
40	1850.7000010	0.001	1914.2999960	-0.002
50	1850.6999990	-0.001	1914.2999970	-0.002
60	1850.7000030	0.002	1914.2999960	-0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 25			
	Channel Bandwidth 3MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1851.4999980	-0.001	1913.4999980	-0.001
3.7	1851.5000040	0.002	1913.5000040	0.002
4.26	1851.4999970	-0.002	1913.5000030	0.002

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 25			
	Channel Bandwidth 3MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1851.5000020	0.001	1913.5000020	0.001
-20	1851.5000040	0.002	1913.4999960	-0.002
-10	1851.5000030	0.002	1913.5000030	0.002
0	1851.5000030	0.002	1913.4999960	-0.002
10	1851.4999990	-0.001	1913.4999990	-0.001
20	1851.4999980	-0.001	1913.5000040	0.002
30	1851.4999960	-0.002	1913.5000040	0.002
40	1851.4999960	-0.002	1913.5000030	0.002
50	1851.4999990	-0.001	1913.5000030	0.002
60	1851.5000020	0.001	1913.5000010	0.001

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 25			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1852.5000040	0.002	1912.5000020	0.001
3.7	1852.4999970	-0.002	1912.4999980	-0.001
4.26	1852.5000020	0.001	1912.5000020	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 25			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1852.5000020	0.001	1912.4999970	-0.002
-20	1852.4999980	-0.001	1912.4999980	-0.001
-10	1852.4999990	-0.001	1912.5000030	0.002
0	1852.5000010	0.001	1912.5000010	0.001
10	1852.5000020	0.001	1912.4999960	-0.002
20	1852.4999990	-0.001	1912.4999970	-0.002
30	1852.5000020	0.001	1912.4999970	-0.002
40	1852.4999970	-0.002	1912.5000020	0.001
50	1852.5000040	0.002	1912.4999960	-0.002
60	1852.4999980	-0.001	1912.5000030	0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 25			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1854.9999990	-0.001	1909.9999990	-0.001
3.7	1855.0000020	0.001	1910.0000040	0.002
4.26	1855.0000040	0.002	1909.9999960	-0.002

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 25			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1854.9999960	-0.002	1910.0000030	0.002
-20	1854.9999980	-0.001	1910.0000030	0.002
-10	1854.9999990	-0.001	1909.9999990	-0.001
0	1854.9999980	-0.001	1910.0000020	0.001
10	1854.9999970	-0.002	1910.0000020	0.001
20	1854.9999960	-0.002	1909.9999960	-0.002
30	1854.9999990	-0.001	1910.0000020	0.001
40	1855.0000010	0.001	1909.9999970	-0.002
50	1854.9999990	-0.001	1910.0000010	0.001
60	1855.0000040	0.002	1910.0000030	0.002

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 25			
	Channel Bandwidth 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1857.4999980	-0.001	1907.4999970	-0.002
3.7	1857.5000020	0.001	1907.4999960	-0.002
4.26	1857.5000010	0.001	1907.4999990	-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 25			
	Channel Bandwidth 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1857.5000020	0.001	1907.5000040	0.002
-20	1857.5000030	0.002	1907.5000010	0.001
-10	1857.4999960	-0.002	1907.5000030	0.002
0	1857.4999990	-0.001	1907.4999960	-0.002
10	1857.4999970	-0.002	1907.4999960	-0.002
20	1857.5000010	0.001	1907.5000010	0.001
30	1857.5000020	0.001	1907.4999980	-0.001
40	1857.5000030	0.002	1907.5000020	0.001
50	1857.4999990	-0.001	1907.4999960	-0.002
60	1857.5000030	0.002	1907.5000020	0.001

Frequency Error vs. Voltage

Voltage (Vdc)	LTE Band 25			
	Channel Bandwidth 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1860.0000010	0.001	1905.0000030	0.002
3.7	1859.9999990	-0.001	1905.0000030	0.002
4.26	1859.9999990	-0.001	1904.9999970	-0.002

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 25			
	Channel Bandwidth 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1860.0000040	0.002	1905.0000010	0.001
-20	1860.0000040	0.002	1905.0000020	0.001
-10	1859.9999970	-0.002	1905.0000020	0.001
0	1860.0000040	0.002	1904.9999990	-0.001
10	1860.0000020	0.001	1905.0000040	0.002
20	1859.9999960	-0.002	1904.9999990	-0.001
30	1859.9999980	-0.001	1904.9999990	-0.001
40	1859.9999960	-0.002	1904.9999960	-0.002
50	1859.9999960	-0.002	1904.9999960	-0.002
60	1859.9999980	-0.001	1905.0000010	0.001

Frequency Error vs. Voltage

Voltage (Vdc)	NB-IoT Band 2			
	Standalone			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1850.199999	-0.001	1909.800002	0.001
3.7	1850.199997	-0.002	1909.799999	-0.001
4.26	1850.200002	0.001	1909.800004	0.002

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

Frequency Error vs. Temperature

Temp. (°C)	NB-IoT Band 2			
	Standalone			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1850.199996	-0.002	1909.800002	0.001
-20	1850.199996	-0.002	1909.799999	-0.001
-10	1850.200003	0.002	1909.799996	-0.002
0	1850.200001	0.001	1909.800001	0.001
10	1850.200002	0.001	1909.799999	-0.001
20	1850.200002	0.001	1909.800001	0.001
30	1850.200001	0.001	1909.799996	-0.002
40	1850.199997	-0.002	1909.800004	0.002
50	1850.199996	-0.002	1909.799998	-0.001
60	1850.200001	0.001	1909.799997	-0.002

Voltage (Vdc)	NB-IoT Band 25			
	Standalone			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.15	1850.200003	0.002	1914.800002	0.001
3.7	1850.199998	-0.001	1914.800004	0.002
4.26	1850.199996	-0.002	1914.800003	0.002

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

Frequency Error vs. Temperature

Temp. (°C)	NB-IoT Band 25			
	Standalone			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1850.200002	0.001	1914.799998	-0.001
-20	1850.200002	0.001	1914.800002	0.001
-10	1850.200003	0.002	1914.800003	0.002
0	1850.199996	-0.002	1914.800001	0.001
10	1850.199999	-0.001	1914.800003	0.002
20	1850.199997	-0.002	1914.799998	-0.001
30	1850.199999	-0.001	1914.799996	-0.002
40	1850.200004	0.002	1914.799996	-0.002
50	1850.200001	0.001	1914.799996	-0.002
60	1850.200003	0.002	1914.799998	-0.001

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.

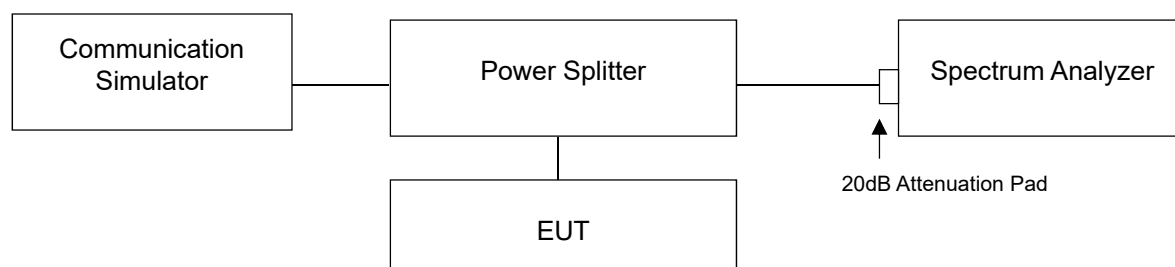
4.4.2 Test Procedure

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.

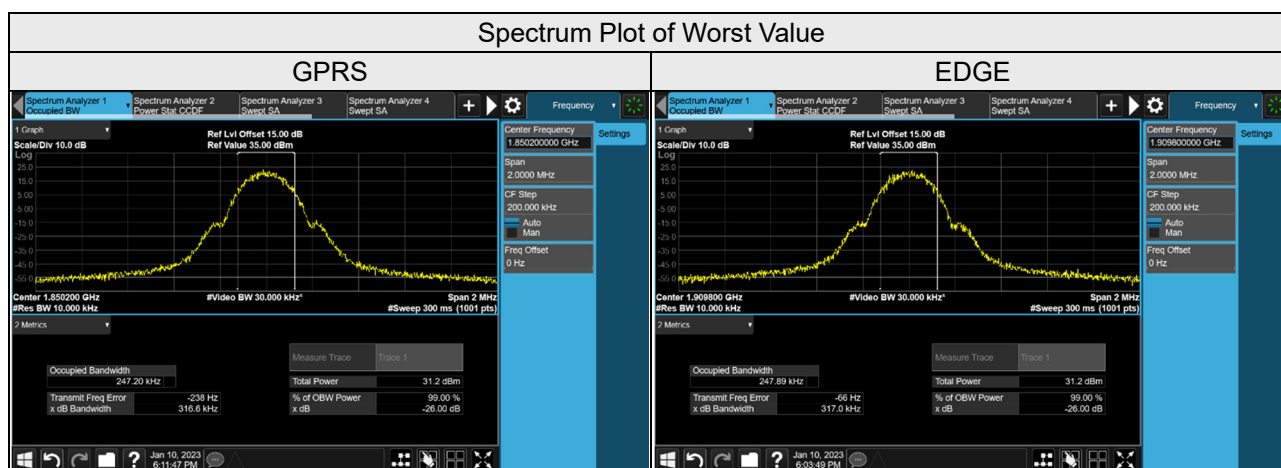
4.4.3 Test Setup



4.4.4 Test Result

Occupied Bandwidth

Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	
		GPRS	EDGE
512	1850.2	247.20	246.11
661	1880.0	246.95	246.30
810	1909.8	245.86	247.89



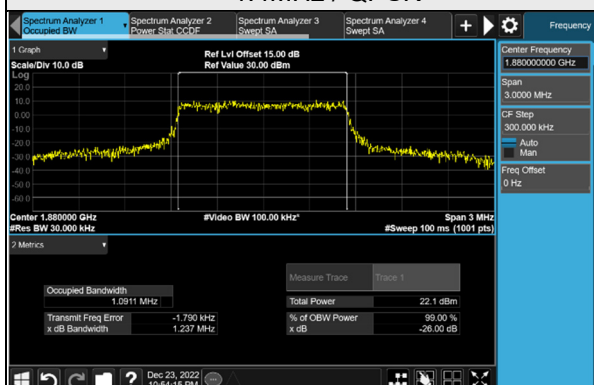
eMTC

LTE Band 2, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
18607	1850.7	1.086	0.910
18900	1880.0	1.091	0.909
19193	1909.3	1.088	0.908
LTE Band 2, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
18615	1851.5	1.085	0.910
18900	1880.0	1.082	0.912
19185	1908.5	1.086	0.915
LTE Band 2, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
18625	1852.5	1.084	0.912
18900	1880.0	1.091	0.912
19175	1907.5	1.087	0.905
LTE Band 2, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
18650	1855.0	1.088	0.914
18900	1880.0	1.087	0.908
19150	1905.0	1.083	0.913
LTE Band 2, Channel Bandwidth 15MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
18675	1857.5	1.085	0.919
18900	1880.0	1.089	0.921
19125	1902.5	1.091	0.913

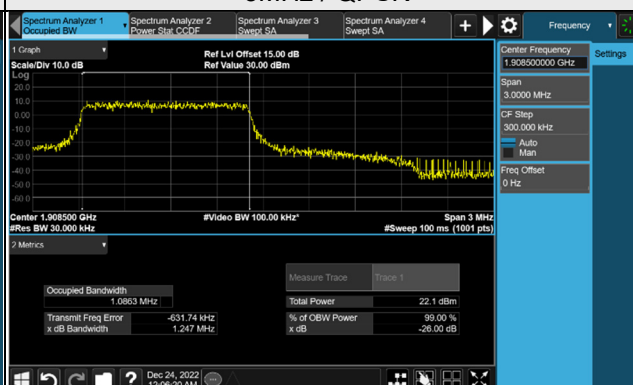
LTE Band 2, Channel Bandwidth 20MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
18700	1860.0	1.086	0.915
18900	1880.0	1.086	0.915
19100	1900.0	1.086	0.917

Spectrum Plot of Worst Value

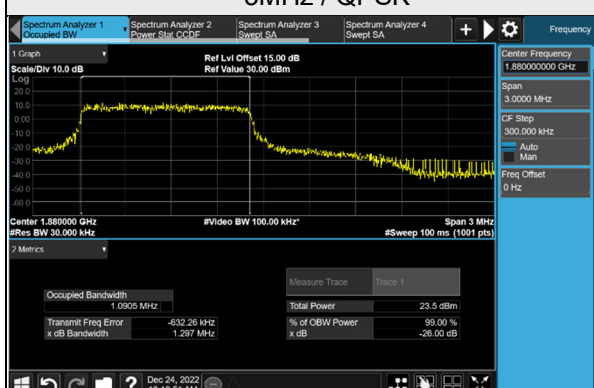
1.4MHz / QPSK



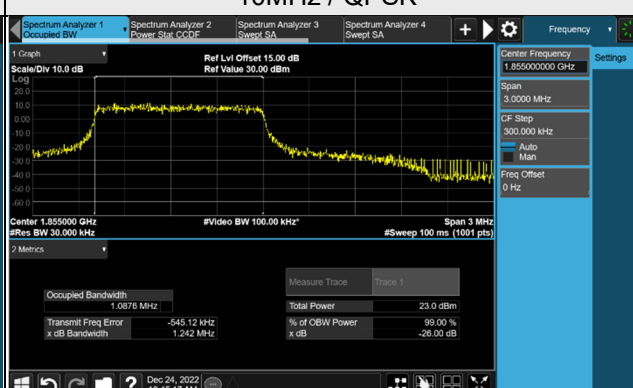
3MHz / QPSK



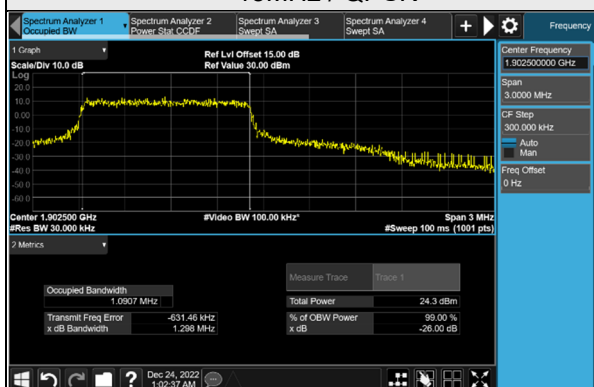
5MHz / QPSK



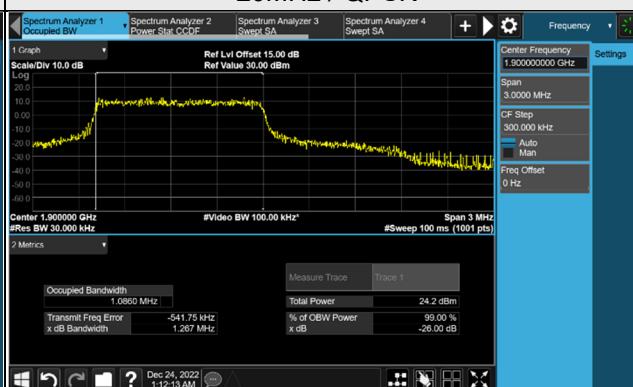
10MHz / QPSK



15MHz / QPSK



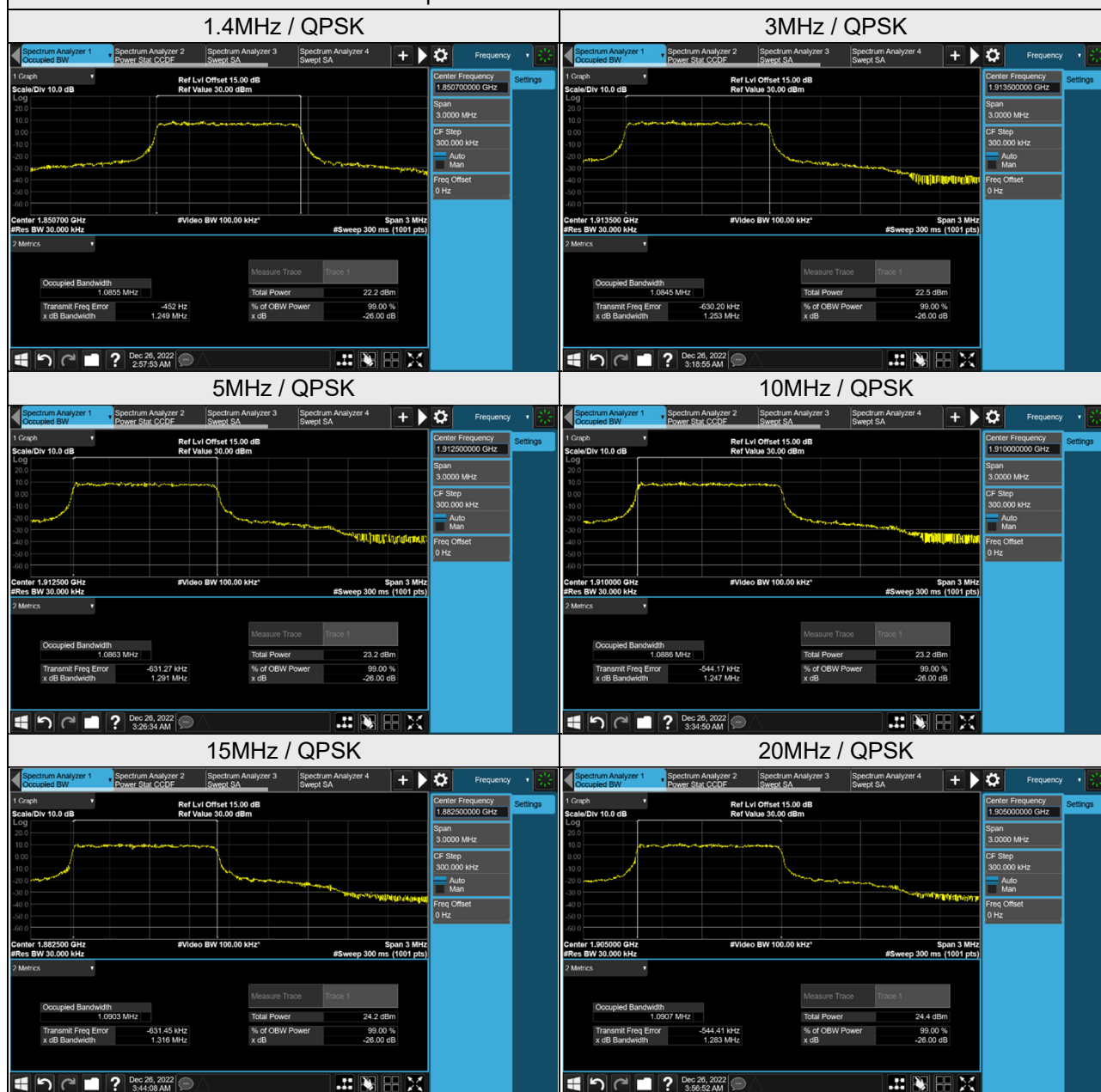
20MHz / QPSK



LTE Band 25, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26047	1850.7	1.086	0.913
26365	1882.5	1.085	0.912
26683	1914.3	1.085	0.914
LTE Band 25, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26055	1851.5	1.083	0.913
26365	1882.5	1.084	0.913
26675	1913.5	1.085	0.912
LTE Band 25, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26065	1852.5	1.086	0.913
26365	1882.5	1.085	0.911
26665	1912.5	1.086	0.913
LTE Band 25, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26090	1855.0	1.087	0.913
26365	1882.5	1.088	0.912
26640	1910.0	1.089	0.913
LTE Band 25, Channel Bandwidth 15MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26115	1857.5	1.089	0.915
26365	1882.5	1.090	0.912
26615	1907.5	1.089	0.912

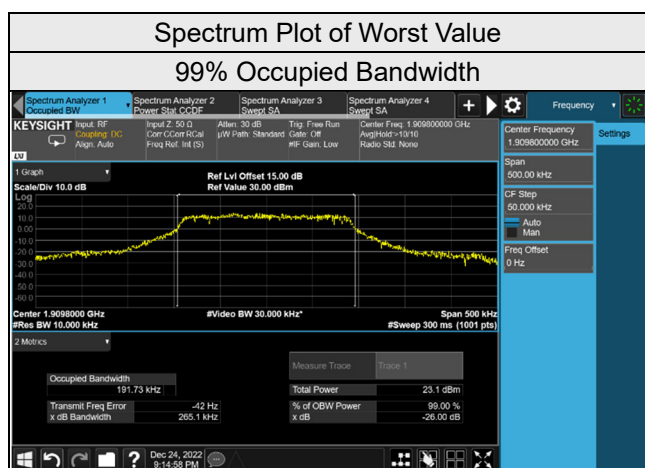
LTE Band 25, Channel Bandwidth 20MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
26140	1860.0	1.089	0.915
26365	1882.5	1.091	0.916
26590	1905.0	1.091	0.917

Spectrum Plot of Worst Value



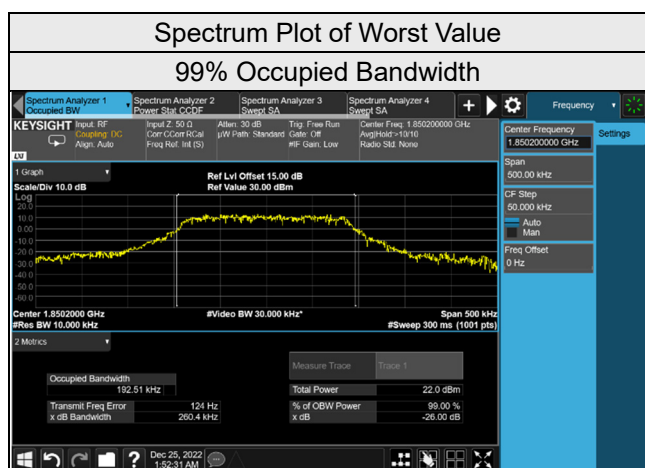
NB-IoT Band 2

NB-IoT Band 2					
Channel	Frequency (MHz)	Subcarrier Spacing (kHz)	Number of Subcarrier / Starting Subcarrier	Modulation	99% Occupied Bandwidth (kHz)
18602	1850.2	3.75	1@0	BPSK	82.61
		15	12@0	QPSK	190.95
18900	1880.0	3.75	1@0	BPSK	89.78
		15	12@0	QPSK	191.29
19198	1909.8	3.75	1@47	BPSK	86.88
		15	12@0	QPSK	191.73



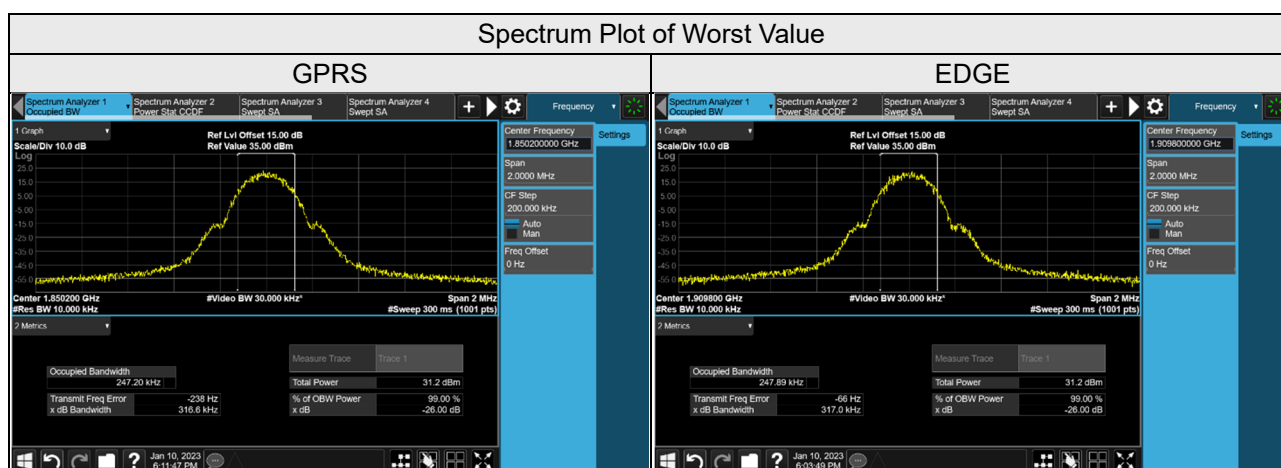
NB-IoT Band 25

NB-IoT Band 25					
Channel	Frequency (MHz)	Subcarrier Spacing (kHz)	Number of Subcarrier / Starting Subcarrier	Modulation	99% Occupied Bandwidth (kHz)
26042	1850.2	3.75	1@0	BPSK	82.96
		15	12@0	QPSK	192.51
26365	1882.5	3.75	1@0	BPSK	85.86
		15	12@0	QPSK	190.97
26688	1914.8	3.75	1@47	BPSK	79.70
		15	12@0	QPSK	191.83



26dB Bandwidth

Channel	Frequency (MHz)	26dB Bandwidth (kHz)	
		GPRS	EDGE
512	1850.2	316.60	313.50
661	1880.0	315.90	311.60
810	1909.8	312.30	317.00



eMTC

LTE Band 2, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
18607	1850.7	1.226	1.089
18900	1880.0	1.237	1.063
19193	1909.3	1.227	1.064
LTE Band 2, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
18615	1851.5	1.238	1.090
18900	1880.0	1.236	1.045
19185	1908.5	1.247	1.069
LTE Band 2, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
18625	1852.5	1.256	1.091
18900	1880.0	1.297	1.118
19175	1907.5	1.259	1.105
LTE Band 2, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
18650	1855.0	1.242	1.091
18900	1880.0	1.251	1.109
19150	1905.0	1.240	1.064
LTE Band 2, Channel Bandwidth 15MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
18675	1857.5	1.253	1.239
18900	1880.0	1.318	1.306
19125	1902.5	1.298	1.293

LTE Band 2, Channel Bandwidth 20MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
18700	1860.0	1.256	1.150
18900	1880.0	1.270	1.284
19100	1900.0	1.267	1.264