FCC Test Report
(Part 24 – NB-IoT B2)

Report No.:	RFBCYD-WTW-P21090659-1
FCC ID:	2AQYP-TRACK1100
Test Model:	SNT3.5 ULTRA
Received Date:	Oct. 08, 2021
Test Date:	Dec. 09, 2021 ~ May 26, 2022
Issued Date:	May 30, 2022
Applicant:	Sensolus NV
Address:	Rijsenbergstraat 148D, 9000 Gent, Belgium
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 (1):	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN
FCC Registration / Designation Number:	788550 / TW0003
Test Location (2):	No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
FCC Registration / Designation Number:	281270 / TW0032

This report is 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. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, 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. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBCYD-WTW-P21090659-1	Original release	May 30, 2022

1 Certificate of Conformity

Product:	TRACK1100
Brand:	sensolus
Test Model:	SNT3.5 ULTRA
Sample Status:	Mass Production
Applicant:	Sensolus NV
Test Date:	Dec. 09, 2021 ~ May 26, 2022
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 : Celine Chou , **Date:** May 30, 2022

Celine Chou / Senior Specialist

Approved by : Jeremy Lin , **Date:** May 30, 2022

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	Effective 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
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 -28.23dB at 3760.00MHz.

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	3.00 dB
	30MHz ~ 200MHz	2.91 dB
	200MHz ~1000MHz	2.92 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	1.76 dB
	18GHz ~ 40GHz	1.77 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Rohde & Schwarz	ESR3	102579	Jul. 05, 2021	Jul. 04, 2022
Spectrum Analyzer KEYSIGHT	N9020B	MY60110462	Dec. 18, 2020	Dec. 17, 2021
			Dec. 21, 2021	Dec. 20, 2022
BILOG Antenna SCHWARZBECK	VULB9168	995	Oct. 28, 2021	Oct. 27, 2022
HORN Antenna RF SPIN	DRH18-E	210104A18E	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	9170-1049	Nov. 14, 2021	Nov. 13, 2022
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier EMCI	EMC330N	980783	Jan. 19, 2021	Jan. 18, 2022
			Jan. 17, 2022	Jan. 16, 2023
Preamplifier EMCI	EMC118A45SE	980810	Jan. 06, 2021	Jan. 05, 2022
			Dec. 30, 2021	Dec. 29, 2022
Preamplifier EMCI	EMC184045SE	980787	Jan. 18, 2021	Jan. 17, 2022
			Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC104-SM-SM-(9000+2000+1000)	201230+ 201242+ 210101	Jan. 18, 2021	Jan. 17, 2022
			Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMCCFD400-NM-NM-(9000+300+500)	201252+ 201250+ 201245	Jan. 18, 2021	Jan. 17, 2022
			Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201259+201256+201253	Jan. 18, 2021	Jan. 17, 2022
			Jan. 17, 2022	Jan. 16, 2023
Software BV CPS	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Turn Table Max-Full	MFT-151SS-0.5T	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208675	NA	NA
Antenna Tower KaiTuo	NA	NA	NA	NA
Antenna Tower Controller KaiTuo	KT-2000	NA	NA	NA
Temperature & Humidity Chamber Giant Force	GTH-120-40-CP-AR	MAA1306-019	Sep. 10, 2021	Sep. 09, 2022
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
True RMS Clamp Meter Fluke	325	31130711WS	Jun. 02, 2021	Jun. 01, 2022
DC power supply Keysight	U8002A	MY56330015	NA	NA
Radio Communication Analyzer Anritsu	MT8821C	6272278310	Jun. 23, 2021	Jun. 22, 2022

Note: 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 WM Chamber 7.

3 General Information

3.1 General Description of EUT

Product	TRACK1100		
Brand	sensolus		
Test Model	SNT3.5 ULTRA		
Sample Status	Mass Production		
Power Supply Rating	3.6Vdc from battery		
Subcarrier Spacing	3.75kHz,15kHz		
Modulation Type	BPSK, QPSK		
Operating Frequency	NB-IoT Standalone		
	NB-IoT Band 2	1850.2MHz ~ 1909.8MHz	
	NB-IoT In band		
	NB-IoT Band 2 (Channel Bandwidth 3MHz)	1851.5MHz ~ 1908.5MHz	
	NB-IoT Band 2 (Channel Bandwidth 5MHz)	1852.5MHz ~ 1907.5MHz	
	NB-IoT Band 2 (Channel Bandwidth 10MHz)	1855.0MHz ~ 1905.0MHz	
	NB-IoT Band 2 (Channel Bandwidth 15MHz)	1857.5MHz ~ 1902.5MHz	
	NB-IoT Band 2 (Channel Bandwidth 20MHz)	1860.0MHz ~ 1900.0MHz	
	NB-IoT Guard band		
	NB-IoT Band 2 (Channel Bandwidth 5MHz)	1852.5MHz ~ 1907.5MHz	
	NB-IoT Band 2 (Channel Bandwidth 10MHz)	1855.0MHz ~ 1905.0MHz	
	NB-IoT Band 2 (Channel Bandwidth 15MHz)	1857.5MHz ~ 1902.5MHz	
	NB-IoT Band 2 (Channel Bandwidth 20MHz)	1860.0MHz ~ 1900.0MHz	
Max. EIRP Power		BPSK	QPSK
	NB-IoT Standalone		
	NB-IoT Band 2	410.204mW (26.13dBm)	428.549mW (26.32dBm)
	NB-IoT In band		
	NB-IoT Band 2 (Channel Bandwidth 3MHz)	399.025mW (26.01dBm)	395.367mW (25.97dBm)
	NB-IoT Band 2 (Channel Bandwidth 5MHz)	397.192mW (25.99dBm)	392.645mW (25.94dBm)
	NB-IoT Band 2 (Channel Bandwidth 10MHz)	398.107mW (26.00dBm)	395.367mW (25.97dBm)
	NB-IoT Band 2 (Channel Bandwidth 15MHz)	399.025mW (26.01dBm)	395.367mW (25.97dBm)
	NB-IoT Band 2 (Channel Bandwidth 20MHz)	399.945mW (26.02dBm)	395.367mW (25.97dBm)

Max. EIRP Power		BPSK	QPSK
	NB-IoT Guard band		
	NB-IoT Band 2 (Channel Bandwidth 5MHz)	388.150mW (25.89dBm)	385.478mW (25.86dBm)
	NB-IoT Band 2 (Channel Bandwidth 10MHz)	389.942mW (25.91dBm)	385.478mW (25.86dBm)
	NB-IoT Band 2 (Channel Bandwidth 15MHz)	389.942mW (25.91dBm)	388.150mW (25.89dBm)
	NB-IoT Band 2 (Channel Bandwidth 20MHz)	391.742mW (25.93dBm)	389.942mW (25.91dBm)
Emission Designator		BPSK	QPSK
	NB-IoT Standalone		
	NB-IoT Band 2	52K3G7D	181KG7D
Antenna Type	SMD antenna with 2.5dBi gain		
Antenna Connector	NA		
Accessory Device	Battery		
Cable Supplied	NA		

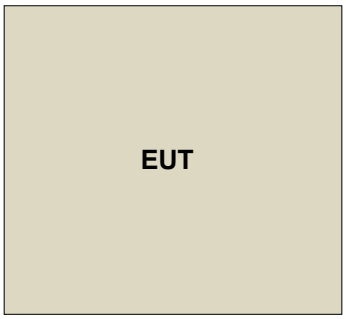
Note:

1. The EUT consumes power from the Battery.

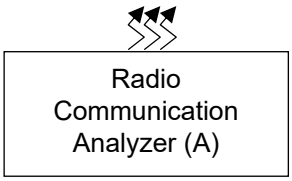
Battery	
Brand	RAMWAY
Model	ER17505-3
Rating	3.6Vdc, 10500mAh

2. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Configuration of System under Test



Remote site



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.	Radio Communication Analyzer	Anritsu	MT8821C	6201010284	NA	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X-plane. Following channel(s) was (were) selected for the final test as listed below:

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 3@3 12@0

EUT Configure Mode	Test item	Available channel		Tested Channel	Channel Bandwidth	Subcarrier Spacing	Modulation	Number of Subcarrier / Starting Subcarrier
-	EIRP	In-Band	18615 to 19185	18615 (1851.5MHz), 18900 (1880.0MHz), 19185 (1908.5MHz)	3MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 12@0
			18625 to 19175	18625 (1852.5MHz), 18900 (1880.0MHz), 19175 (1907.5MHz)	5MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 12@0
			18650 to 19150	18650 (1855.0MHz), 18900 (1880.0MHz), 19150 (1905.0MHz)	10MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 12@0
			18675 to 19125	18675 (1857.5MHz), 18900 (1880.0MHz), 19125 (1902.5MHz)	15MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 12@0
			18700 to 19100	18700 (1860.0MHz), 18900 (1880.0MHz), 19100 (1900.0MHz)	20MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 12@0

EUT Configure Mode	Test item	Available channel		Tested Channel	Channel Bandwidth	Subcarrier Spacing	Modulation	Number of Subcarrier / Starting Subcarrier
-	EIRP	Guard-Band	18625 to 19175	18625 (1852.5MHz), 18900 (1880.0MHz), 19175 (1907.5MHz)	5MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 12@0
			18650 to 19150	18650 (1855.0MHz), 18900 (1880.0MHz), 19150 (1905.0MHz)	10MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 12@0
			18675 to 19125	18675 (1857.5MHz), 18900 (1880.0MHz), 19125 (1902.5MHz)	15MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 12@0
			18700 to 19100	18700 (1860.0MHz), 18900 (1880.0MHz), 19100 (1900.0MHz)	20MHz	3.75kHz	BPSK	1@0 1@47
							QPSK	1@0 1@47
						15kHz	BPSK	1@0 1@11
							QPSK	1@0 1@11 3@3 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

EUT Configure Mode	Test item	Available channel		Tested Channel	Channel Bandwidth	Subcarrier Spacing	Modulation	Number of Subcarrier / Starting Subcarrier
-	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)	-	3.75kHz	BPSK	1@0
-	Radiated Emission Above 1GHz	Standalone	18602 to 19198	18602 (1850.2MHz), 18900 (1880.0MHz), 19198 (1909.8MHz)	-	3.75kHz	BPSK	1@0

Note:

1. The output power for Stand-alone, In-band and Guard-band, measured value of Stand-alone is higher than In-band and Guard-band. The other test items were performed under Stand-alone mode only.
2. The Conducted Emission and Radiated Emission measurement were based on the worst maximum conducted power.
3. 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	3.6Vdc	James Yang
Modulation Characteristics	25deg. C, 60%RH	3.6Vdc	James Yang
Frequency Stability	25deg. C, 60%RH	3.6Vdc	James Yang
Occupied Bandwidth	25deg. C, 60%RH	3.6Vdc	James Yang
Band Edge	25deg. C, 60%RH	3.6Vdc	James Yang
Peak To Average Ratio	25deg. C, 60%RH	3.6Vdc	James Yang
Conducted Emission	25deg. C, 60%RH	3.6Vdc	James Yang
Radiated Emission	17deg. C, 62%RH	3.6Vdc	Wade Huang

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 NB-IoT 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)

NB-IoT Band 2 Standalone						
Subcarrier Spacing	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
		Channel		18602	18900	19198
		Frequency (MHz)		1850.2	1880	1909.8
3.75kHz	QPSK	1	0	23.44	23.43	23.27
		1	47	23.46	23.45	23.22
	BPSK	1	0	23.61	23.48	23.29
		1	47	23.55	23.50	23.31
BW	MCS Index	Channel		18602	18900	19198
		Frequency (MHz)		1850.2	1880	1909.8
15kHz	QPSK	1	0	23.42	23.52	23.21
		1	11	23.38	23.53	23.19
		3	3	23.80	22.92	23.66
		12	0	23.82	21.87	23.68
	BPSK	1	0	23.55	23.55	23.25
		1	11	23.63	23.56	23.24

NB-IoT Band 2 In-Band							
Subcarrier Spacing	BW	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
			Channel		18700	18900	19100
			Frequency (MHz)		1860	1880	1900
3.75kHz	20M	QPSK	1	0	23.42	23.38	23.24
			1	47	23.44	23.39	23.23
		BPSK	1	0	23.52	23.43	23.28
			1	47	23.49	23.41	23.29
	BW	MCS Index	Channel		18675	18900	19125
			Frequency (MHz)		1857.5	1880	1902.5
	15M	QPSK	1	0	23.44	23.46	23.19
			1	47	23.45	23.47	23.17
		BPSK	1	0	23.51	23.51	23.23
			1	47	23.49	23.50	23.24
	BW	MCS Index	Channel		18650	18900	19150
			Frequency (MHz)		1855	1880	1905
	10M	QPSK	1	0	23.44	23.41	23.03
			1	47	23.47	23.43	23.04
		BPSK	1	0	23.49	23.48	23.08
			1	47	23.50	23.49	23.09
	BW	MCS Index	Channel		18625	18900	19175
			Frequency (MHz)		1852.5	1880	1907.5
	5M	QPSK	1	0	23.43	23.35	23.08
			1	47	23.44	23.34	23.10
		BPSK	1	0	23.48	23.38	23.15
			1	47	23.49	23.39	23.14
	BW	MCS Index	Channel		18615	18900	19185
			Frequency (MHz)		1851.5	1880	1908.5
	3M	QPSK	1	0	23.44	23.31	23.07
			1	47	23.45	23.32	23.08
		BPSK	1	0	23.51	23.37	23.12
			1	47	23.48	23.35	23.14

NB-IoT Band 2 In-Band							
Subcarrier Spacing	BW	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
			Channel		18700	18900	19100
			Frequency (MHz)		1860	1880	1900
15kHz	20M	QPSK	1	0	23.36	23.47	23.34
			1	11	23.39	23.46	23.33
			3	3	22.75	22.81	22.65
			12	0	21.85	21.85	21.67
		BPSK	1	0	23.43	23.44	23.31
			1	11	23.42	23.45	23.32
	BW	MCS Index	Channel		18675	18900	19125
			Frequency (MHz)		1857.5	1880	1902.5
	15M	QPSK	1	0	23.37	23.34	23.16
			1	11	23.40	23.33	23.17
			3	3	22.69	22.73	22.49
			12	0	21.85	21.73	21.62
		BPSK	1	0	23.44	23.32	23.26
			1	11	23.43	23.31	23.27
	BW	MCS Index	Channel		18650	18900	19150
			Frequency (MHz)		1855	1880	1905
	10M	QPSK	1	0	23.39	23.31	23.05
			1	11	23.36	23.30	23.06
			3	3	22.69	22.76	22.51
			12	0	21.84	21.79	21.48
		BPSK	1	0	23.42	23.33	23.10
			1	11	23.43	23.30	23.13
	BW	MCS Index	Channel		18625	18900	19175
			Frequency (MHz)		1852.5	1880	1907.5
	5M	QPSK	1	0	23.36	23.26	23.17
			1	11	23.39	23.24	23.18
			3	3	22.72	22.78	22.59
			12	0	21.77	21.80	21.60
		BPSK	1	0	23.42	23.32	23.24
			1	11	23.43	23.33	23.22
	BW	MCS Index	Channel		18615	18900	19185
			Frequency (MHz)		1851.5	1880	1908.5
	3M	QPSK	1	0	23.45	23.33	23.17
			1	11	23.47	23.28	23.16
			3	3	22.75	22.78	22.59
			12	0	21.79	21.78	21.60
		BPSK	1	0	23.43	23.36	23.14
			1	11	23.44	23.37	23.15

NB-IoT Band 2 Guard-Band							
Subcarrier Spacing	BW	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
			Channel		18700	18900	19100
			Frequency (MHz)		1860	1880	1900
3.75kHz	20M	QPSK	1	0	23.40	23.29	23.22
			1	47	23.41	23.32	23.20
		BPSK	1	0	23.43	23.34	23.23
			1	47	23.42	23.35	23.24
	BW	MCS Index	Channel		18675	18900	19125
			Frequency (MHz)		1857.5	1880	1902.5
	15M	QPSK	1	0	23.39	23.30	23.09
			1	47	23.38	23.32	23.08
		BPSK	1	0	23.41	23.36	23.16
			1	47	23.40	23.35	23.15
	BW	MCS Index	Channel		18650	18900	19150
			Frequency (MHz)		1855	1880	1905
	10M	QPSK	1	0	23.35	23.27	23.06
			1	47	23.36	23.29	23.07
		BPSK	1	0	23.39	23.31	23.09
			1	47	23.41	23.32	23.10
	BW	MCS Index	Channel		18625	18900	19175
			Frequency (MHz)		1852.5	1880	1907.5
	5M	QPSK	1	0	23.43	23.35	23.08
			1	47	23.44	23.34	23.10
		BPSK	1	0	23.48	23.38	23.15
			1	47	23.49	23.39	23.14

NB-IoT Band 2 Guard-Band							
Subcarrier Spacing	BW	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
			Channel		18700	18900	19100
			Frequency (MHz)		1860	1880	1900
15kHz	20M	QPSK	1	0	23.11	23.08	23.07
			1	11	23.10	23.04	23.05
			3	3	22.43	22.52	22.38
			12	0	21.58	21.52	21.47
		BPSK	1	0	23.08	23.12	23.05
			1	11	23.07	23.11	23.04
	BW	MCS Index	Channel		18675	18900	19125
			Frequency (MHz)		1857.5	1880	1902.5
	15M	QPSK	1	0	23.09	23.16	22.95
			1	11	23.07	23.14	22.93
			3	3	22.42	22.55	22.38
			12	0	21.49	21.55	21.29
		BPSK	1	0	23.07	23.14	22.93
			1	11	23.05	23.12	22.91
	BW	MCS Index	Channel		18650	18900	19150
			Frequency (MHz)		1855	1880	1905
	10M	QPSK	1	0	23.01	23.09	22.96
			1	11	23.02	23.05	22.94
			3	3	22.42	22.51	22.35
			12	0	21.56	21.60	21.33
		BPSK	1	0	23.07	23.13	22.92
			1	11	23.06	23.11	22.91
	BW	MCS Index	Channel		18625	18900	19175
			Frequency (MHz)		1852.5	1880	1907.5
	5M	QPSK	1	0	22.89	23.00	22.81
			1	11	22.88	22.93	22.78
			3	3	22.31	22.44	22.23
			12	0	21.43	21.50	21.24
		BPSK	1	0	22.94	23.03	22.85
			1	11	22.94	23.07	22.75

EIRP Power (dBm)

NB-IoT Band 2 Standalone						
Subcarrier Spacing	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
		Channel		18602	18900	19198
		Frequency (MHz)		1850.2	1880	1909.8
3.75kHz	QPSK	1	0	25.94	25.93	25.77
		1	47	25.96	25.95	25.72
	BPSK	1	0	26.11	25.98	25.79
		1	47	26.05	26.00	25.81
BW	MCS Index	Channel		18602	18900	19198
		Frequency (MHz)		1850.2	1880	1909.8
15kHz	QPSK	1	0	25.92	26.02	25.71
		1	11	25.88	26.03	25.69
		3	3	26.30	25.42	26.16
		12	0	26.32	24.37	26.18
	BPSK	1	0	26.05	26.05	25.75
		1	11	26.13	26.06	25.74

NB-IoT Band 2 In-Band							
Subcarrier Spacing	BW	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
			Channel		18700	18900	19100
			Frequency (MHz)		1860	1880	1900
3.75kHz	20M	QPSK	1	0	25.92	25.88	25.74
			1	47	25.94	25.89	25.73
		BPSK	1	0	26.02	25.93	25.78
			1	47	25.99	25.91	25.79
	BW	MCS Index	Channel		18675	18900	19125
			Frequency (MHz)		1857.5	1880	1902.5
	15M	QPSK	1	0	25.94	25.96	25.69
			1	47	25.95	25.97	25.67
		BPSK	1	0	26.01	26.01	25.73
			1	47	25.99	26.00	25.74
	BW	MCS Index	Channel		18650	18900	19150
			Frequency (MHz)		1855	1880	1905
	10M	QPSK	1	0	25.94	25.91	25.53
			1	47	25.97	25.93	25.54
		BPSK	1	0	25.99	25.98	25.58
			1	47	26.00	25.99	25.59
	BW	MCS Index	Channel		18625	18900	19175
			Frequency (MHz)		1852.5	1880	1907.5
	5M	QPSK	1	0	25.93	25.85	25.58
			1	47	25.94	25.84	25.60
		BPSK	1	0	25.98	25.88	25.65
			1	47	25.99	25.89	25.64
	BW	MCS Index	Channel		18615	18900	19185
			Frequency (MHz)		1851.5	1880	1908.5
	3M	QPSK	1	0	25.94	25.81	25.57
			1	47	25.95	25.82	25.58
		BPSK	1	0	26.01	25.87	25.62
			1	47	25.98	25.85	25.64

NB-IoT Band 2 In-Band							
Subcarrier Spacing	BW	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
			Channel		18700	18900	19100
			Frequency (MHz)		1860	1880	1900
15kHz	20M	QPSK	1	0	25.86	25.97	25.84
			1	11	25.89	25.96	25.83
			3	3	25.25	25.31	25.15
			12	0	24.35	24.35	24.17
		BPSK	1	0	25.93	25.94	25.81
			1	11	25.92	25.95	25.82
	BW	MCS Index	Channel		18675	18900	19125
			Frequency (MHz)		1857.5	1880	1902.5
	15M	QPSK	1	0	25.87	25.84	25.66
			1	11	25.90	25.83	25.67
			3	3	25.19	25.23	24.99
			12	0	24.35	24.23	24.12
		BPSK	1	0	25.94	25.82	25.76
			1	11	25.93	25.81	25.77
	BW	MCS Index	Channel		18650	18900	19150
			Frequency (MHz)		1855	1880	1905
	10M	QPSK	1	0	25.89	25.81	25.55
			1	11	25.86	25.80	25.56
			3	3	25.19	25.26	25.01
			12	0	24.34	24.29	23.98
		BPSK	1	0	25.92	25.83	25.60
			1	11	25.93	25.80	25.63
	BW	MCS Index	Channel		18625	18900	19175
			Frequency (MHz)		1852.5	1880	1907.5
	5M	QPSK	1	0	25.86	25.76	25.67
			1	11	25.89	25.74	25.68
			3	3	25.22	25.28	25.09
			12	0	24.27	24.30	24.10
		BPSK	1	0	25.92	25.82	25.74
			1	11	25.93	25.83	25.72
	BW	MCS Index	Channel		18615	18900	19185
			Frequency (MHz)		1851.5	1880	1908.5
	3M	QPSK	1	0	25.95	25.83	25.67
			1	11	25.97	25.78	25.66
			3	3	25.25	25.28	25.09
			12	0	24.29	24.28	24.10
		BPSK	1	0	25.93	25.86	25.64
			1	11	25.94	25.87	25.65

NB-IoT Band 2 Guard-Band							
Subcarrier Spacing	BW	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
			Channel		18700	18900	19100
			Frequency (MHz)		1860	1880	1900
3.75kHz	20M	QPSK	1	0	25.90	25.79	25.72
			1	47	25.91	25.82	25.70
		BPSK	1	0	25.93	25.84	25.73
			1	47	25.92	25.85	25.74
	BW	MCS Index	Channel		18675	18900	19125
			Frequency (MHz)		1857.5	1880	1902.5
	15M	QPSK	1	0	25.89	25.80	25.59
			1	47	25.88	25.82	25.58
		BPSK	1	0	25.91	25.86	25.66
			1	47	25.90	25.85	25.65
	BW	MCS Index	Channel		18650	18900	19150
			Frequency (MHz)		1855	1880	1905
	10M	QPSK	1	0	25.85	25.77	25.56
			1	47	25.86	25.79	25.57
		BPSK	1	0	25.89	25.81	25.59
			1	47	25.91	25.82	25.60
	BW	MCS Index	Channel		18625	18900	19175
			Frequency (MHz)		1852.5	1880	1907.5
	5M	QPSK	1	0	25.86	25.72	25.55
			1	47	25.85	25.74	25.54
		BPSK	1	0	25.89	25.80	25.62
			1	47	25.88	25.79	25.64

NB-IoT Band 2 Guard-Band							
Subcarrier Spacing	BW	MCS Index	Number of Subcarrier	Starting Subcarrier	Low	Mid	High
			Channel		18700	18900	19100
			Frequency (MHz)		1860	1880	1900
15kHz	20M	QPSK	1	0	25.61	25.58	25.57
			1	11	25.60	25.54	25.55
			3	3	24.93	25.02	24.88
			12	0	24.08	24.02	23.97
		BPSK	1	0	25.58	25.62	25.55
			1	11	25.57	25.61	25.54
	BW	MCS Index	Channel		18675	18900	19125
			Frequency (MHz)		1857.5	1880	1902.5
	15M	QPSK	1	0	25.59	25.66	25.45
			1	11	25.57	25.64	25.43
			3	3	24.92	25.05	24.88
			12	0	23.99	24.05	23.79
		BPSK	1	0	25.57	25.64	25.43
			1	11	25.55	25.62	25.41
	BW	MCS Index	Channel		18650	18900	19150
			Frequency (MHz)		1855	1880	1905
	10M	QPSK	1	0	25.51	25.59	25.46
			1	11	25.52	25.55	25.44
			3	3	24.92	25.01	24.85
			12	0	24.06	24.10	23.83
		BPSK	1	0	25.57	25.63	25.42
			1	11	25.56	25.61	25.41
	BW	MCS Index	Channel		18625	18900	19175
			Frequency (MHz)		1852.5	1880	1907.5
	5M	QPSK	1	0	25.39	25.50	25.31
			1	11	25.38	25.43	25.28
			3	3	24.81	24.94	24.73
			12	0	23.93	24.00	23.74
		BPSK	1	0	25.44	25.53	25.35
			1	11	25.44	25.57	25.25

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

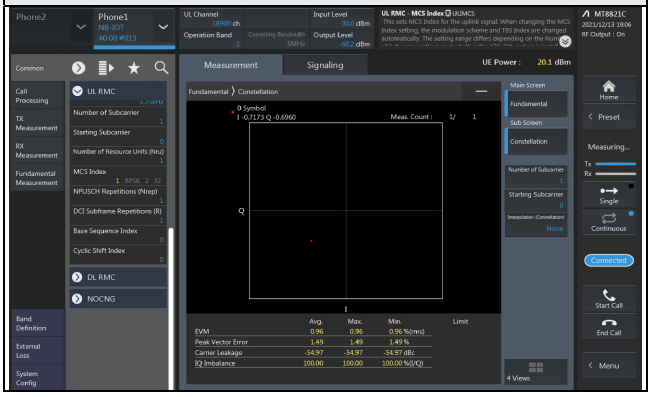
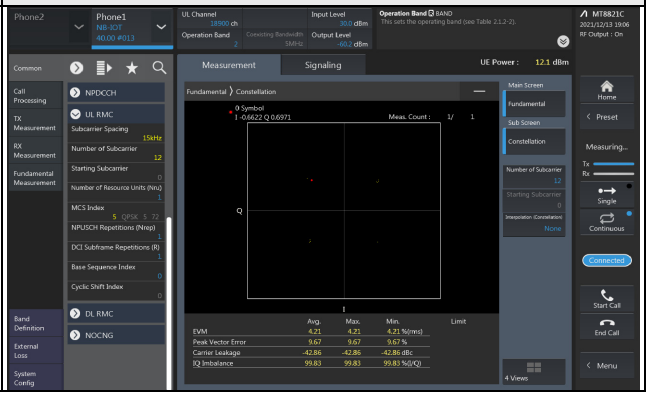
N/A

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

NB-IoT Band 2	
Spectrum Plot of Measurement Value	
Channel: 18900 / Frequency (MHz): 1880.0MHz	
BPSK	QPSK
	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stabiliity Measurement

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

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.

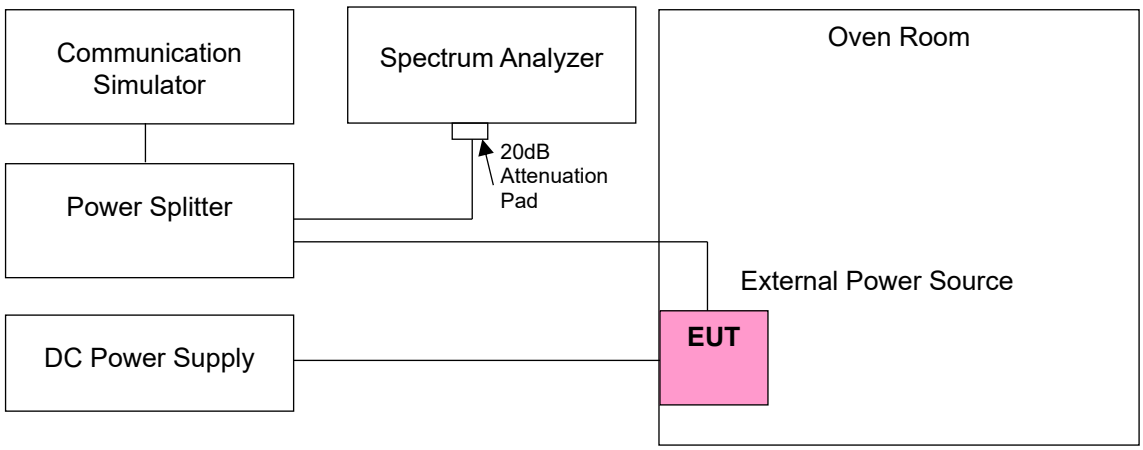
Note: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Radio Communication Analyzer Anritsu	MT8821C	6272278310	Jun. 23, 2021	Jun. 22, 2022
Temperature & Humidity Chamber Giant Force	GTH-120-40-CP-AR	MAA1306-019	Sep. 10, 2021	Sep. 09, 2022
Digital Multimeter Fluke	87-III	70360742	Jun. 24, 2021	Jun. 23, 2022
DC Power Supply Topward	6306A	727263	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.3.4 Test Setup



4.3.5 Test Results

Frequency Error vs. Voltage

Voltage (Vdc)	NB-IoT Band 2			
	SubcarrierSpacing 3.75kHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.06	1850.200003	0.002	1909.800000	0.002
3.60	1850.200002	0.001	1909.800002	0.001
4.14	1850.200003	0.001	1909.800001	0.001

Note: The applicant defined the normal working voltage is from 3.06Vdc to 4.14Vdc.

Frequency Error vs. Temperature

Temp. (℃)	NB-IoT Band 2			
	SubcarrierSpacing 3.75kHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-20	1850.200001	0.001	1909.800004	0.002
-10	1850.200004	0.002	1909.800002	0.001
0	1850.200002	0.001	1909.800002	0.001
10	1850.200003	0.002	1909.800003	0.001
20	1850.199997	-0.002	1909.799997	-0.002
30	1850.199996	-0.002	1909.799998	-0.001
40	1850.199996	-0.002	1909.799997	-0.002
50	1850.199999	-0.001	1909.799997	-0.002
60	1850.199998	-0.001	1909.799998	-0.001

Note: When the EUT temperature is below -20°C, it will shut down and will not work.

Frequency Error vs. Voltage

Voltage (Vdc)	NB-IoT Band 2			
	SubcarrierSpacing 15kHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.06	1850.200002	0.001	1909.800003	0.002
3.60	1850.200002	0.001	1909.800003	0.001
4.14	1850.200001	0.001	1909.800002	0.001

Note: The applicant defined the normal working voltage is from 3.06Vdc to 4.14Vdc.

Frequency Error vs. Temperature

Temp. (℃)	NB-IoT Band 2			
	SubcarrierSpacing 15kHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-20	1850.200002	0.001	1909.800004	0.002
-10	1850.200003	0.001	1909.800003	0.001
0	1850.200002	0.001	1909.800001	0.001
10	1850.200004	0.002	1909.800001	0.001
20	1850.199998	-0.001	1909.799997	-0.001
30	1850.199997	-0.002	1909.799997	-0.002
40	1850.199997	-0.002	1909.799998	-0.001
50	1850.199997	-0.002	1909.799998	-0.001
60	1850.199997	-0.002	1909.799997	-0.002

Note: When the EUT temperature is below -20°C, it will shut down and will not work.

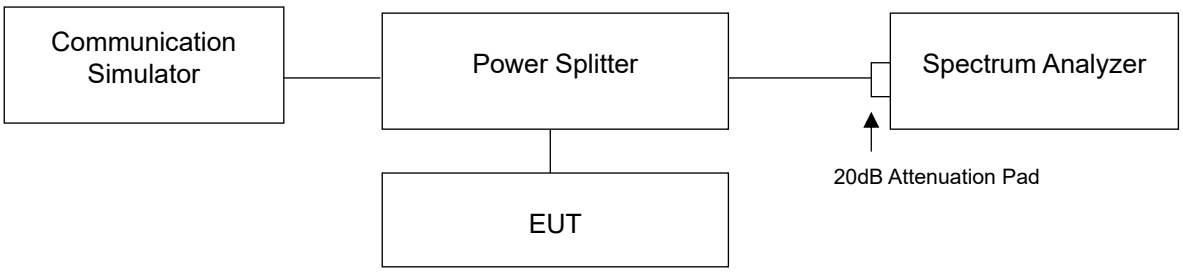
4.4 Occupied Bandwidth Measurement

4.4.1 Test Procedure

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Measurement method, please refer to section 5.4.4 of ANSI C63.26. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

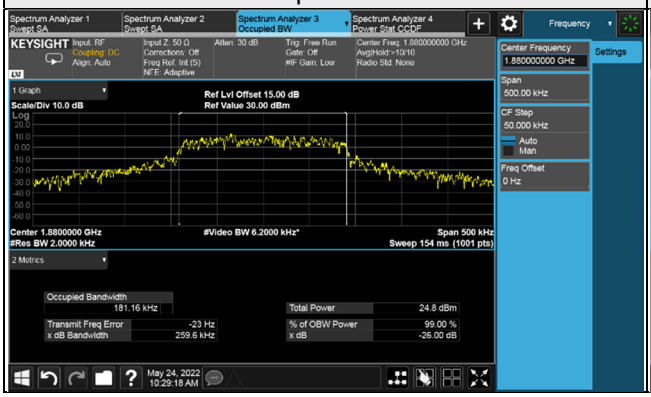
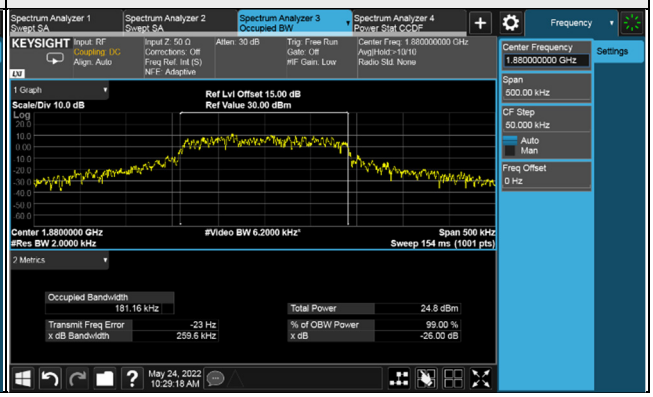
For the 26dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

4.4.2 Test Setup



4.4.3 Test Result

NB-IoT Band 2						
Channel	Frequency (MHz)	Subcarrier Spacing (kHz)	Number of Subcarrier / Starting Subcarrier	Modulation	99% Occupied Bandwidth (kHz)	26dB Bandwidth (kHz)
18602	1850.2	3.75	1@0	BPSK	51.22	36.77
		15	12@0	QPSK	179.98	248.30
18900	1880.0	3.75	1@0	BPSK	52.28	37.18
		15	12@0	QPSK	181.16	259.60
19198	1909.8	3.75	1@47	BPSK	49.86	37.07
		15	12@0	QPSK	179.75	238.40

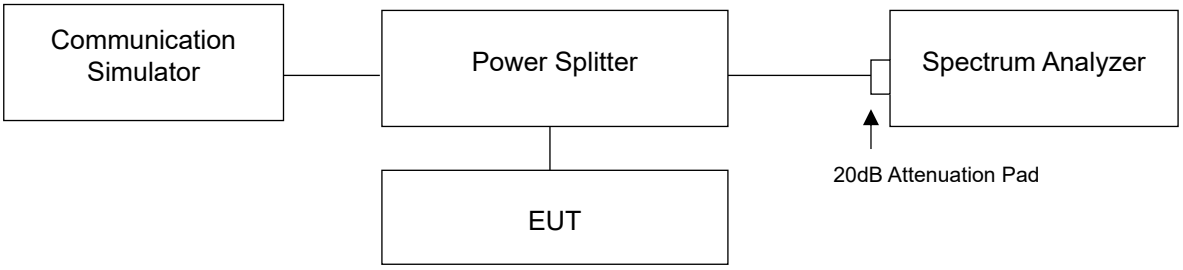
Spectrum Plot of Worst Value	
99% Occupied Bandwidth	26dB Bandwidth
	

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

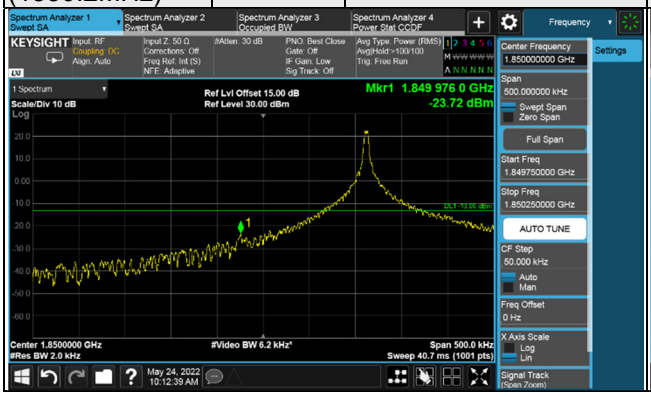


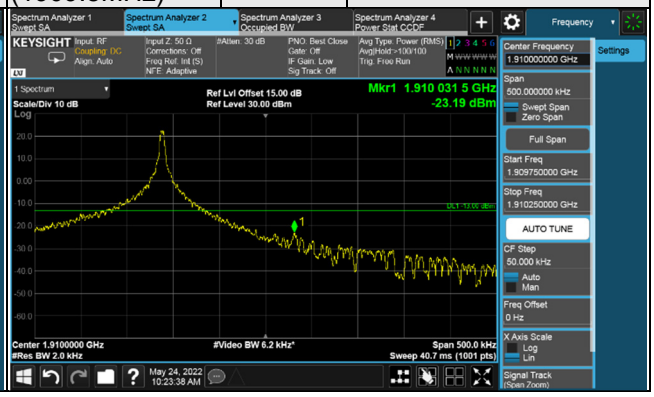
4.5.3 Test Procedures

a. All measurements were done at low and high operational frequency range.
b. The center frequency of spectrum is the band edge frequency and span is 500kHz. RB of the spectrum is 2kHz and VB of the spectrum is 6.2kHz.
c. Record the max trace plot into the test report.

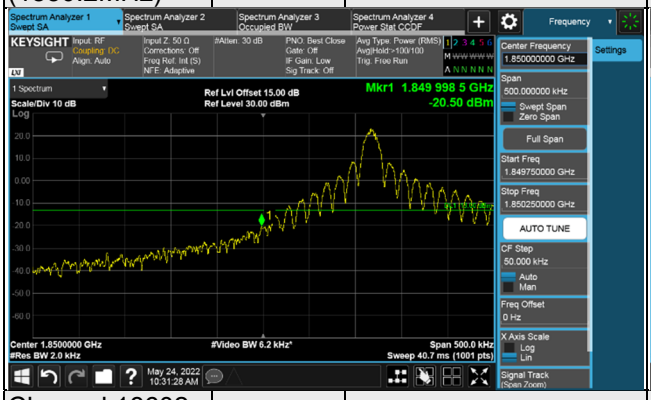
4.5.4 Test Results

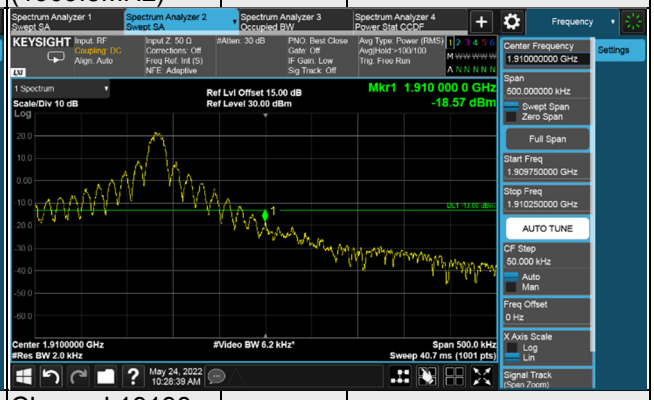
NB-IoT Band 2, Subcarrier Spacing 3.75kHz					
Channel 18602 (1850.2MHz)	BPSK	1@0	Channel 19198 (1909.8MHz)	BPSK	1@0



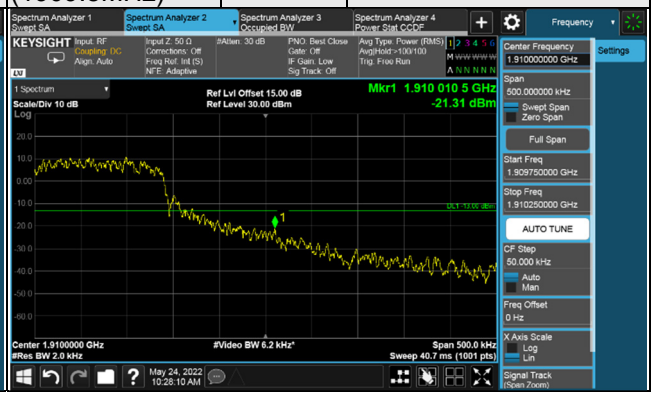


NB-IoT Band 2, Subcarrier Spacing 15kHz					
Channel 18602 (1850.2MHz)	QPSK	1@0	Channel 19198 (1909.8MHz)	QPSK	1@0





Channel 18602 (1850.2MHz)	QPSK	12@0	Channel 19198 (1909.8MHz)	QPSK	12@0

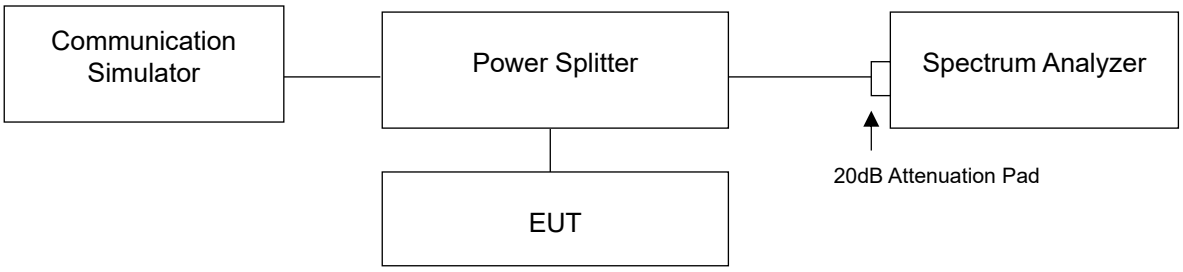


4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

4.6.2 Test Setup



4.6.3 Test Procedures

a. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
b. Set the number of counts to a value that stabilizes the measured CCDF curve;
c. Record the maximum PAPR level associated with a probability of 0.1%.

4.6.4 Test Results

NB-IoT Band 2					
Channel	Frequency (MHz)	Subcarrier Spacing (kHz)	Number of Subcarrier / Starting Subcarrier	Modulation	Peak To Average Ratio (dB)
18602	1850.2	3.75	1@0	BPSK	0.65
		15	12@0	QPSK	3.32
18900	1880.0	3.75	1@0	BPSK	0.60
		15	12@0	QPSK	3.31
19198	1909.8	3.75	1@47	BPSK	0.61
		15	12@0	QPSK	3.32

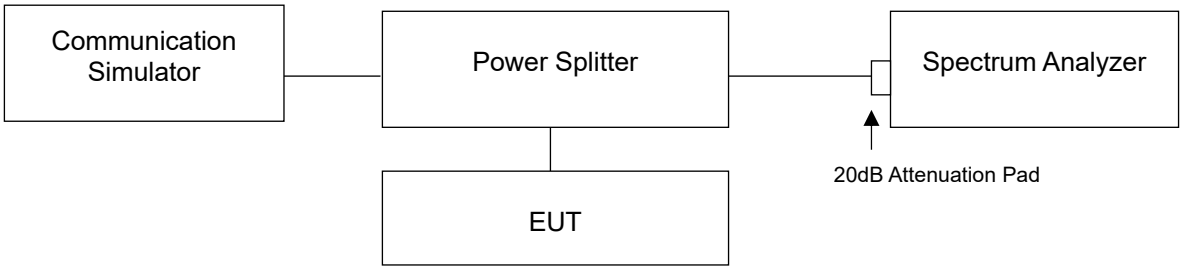
Spectrum Plot of Worst Value

4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. The emission limit equal to –13dBm.

4.7.2 Test Setup

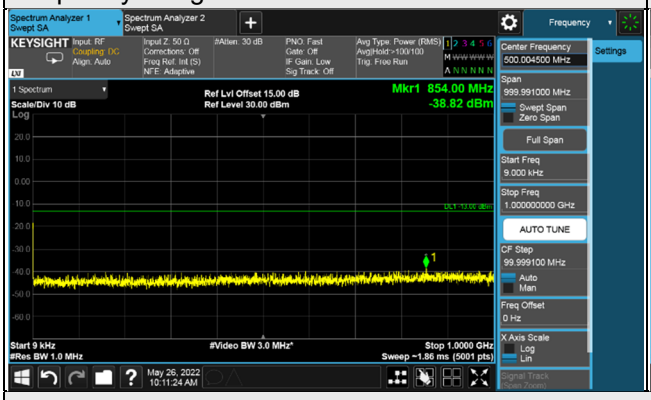
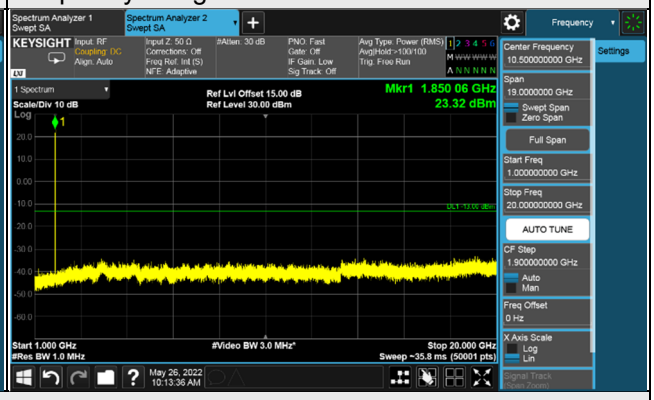
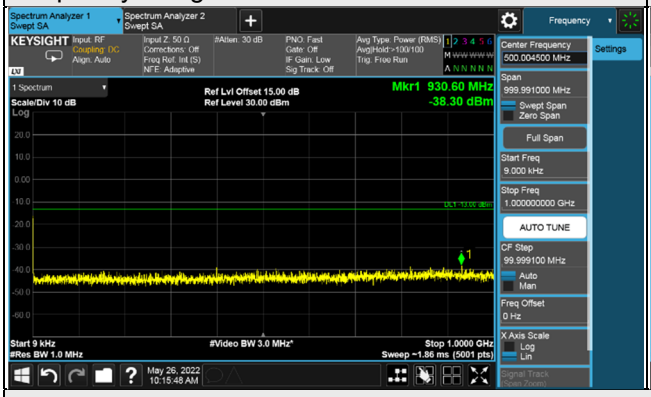
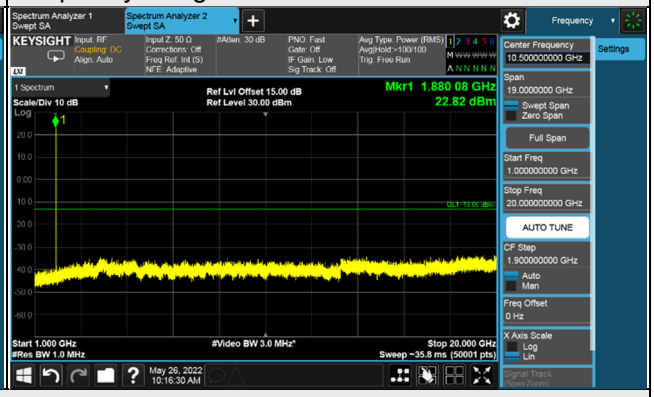
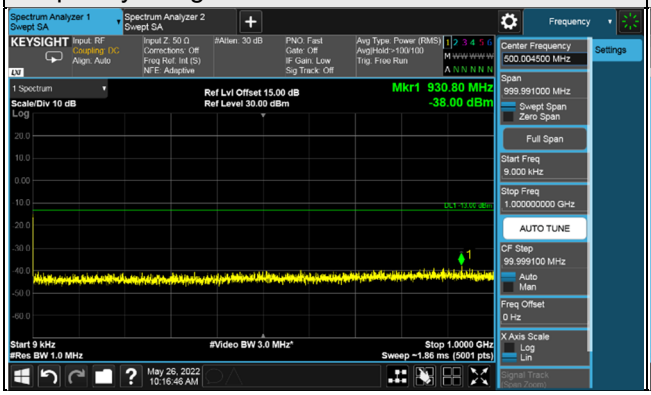
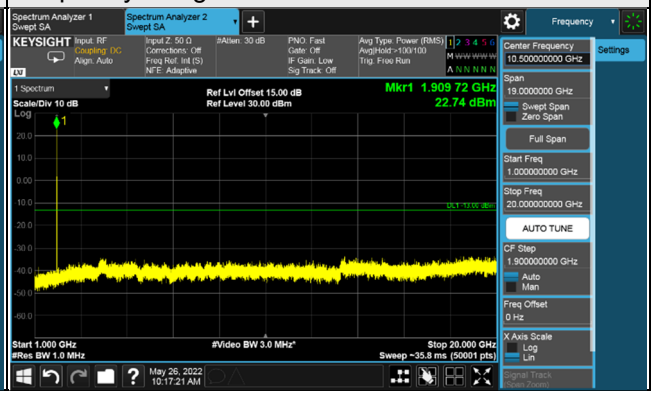


4.7.3 Test Procedure

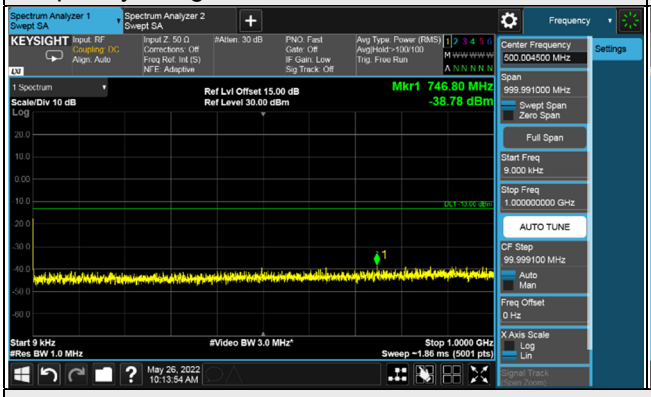
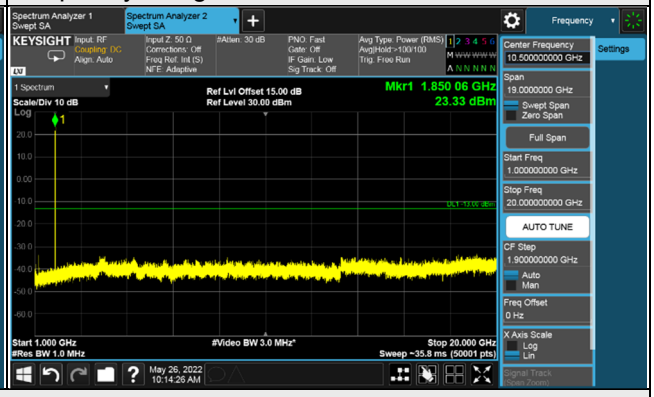
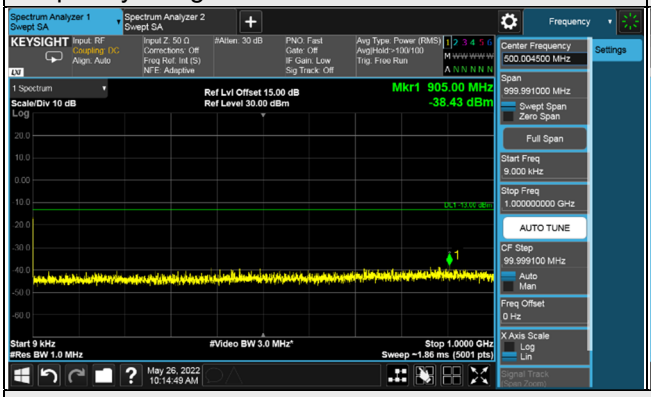
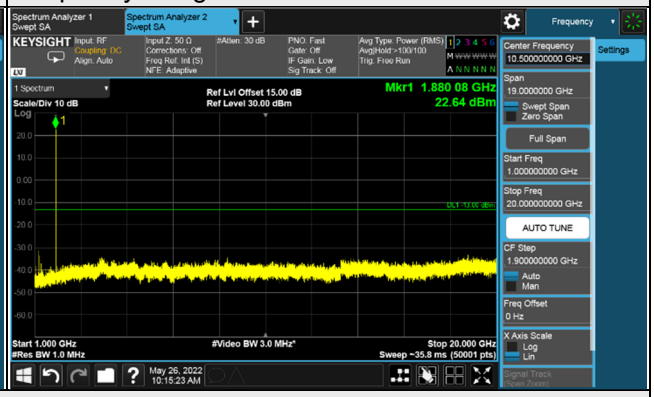
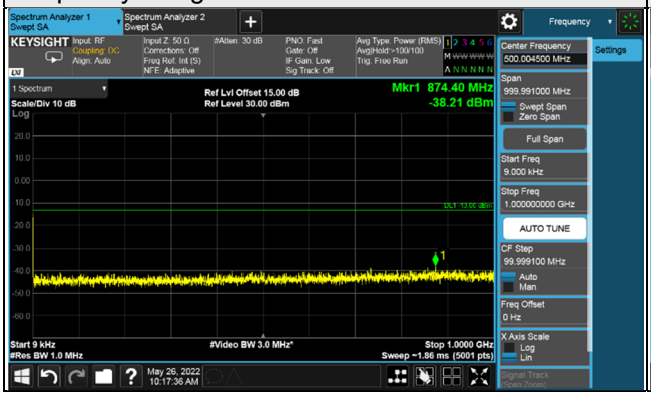
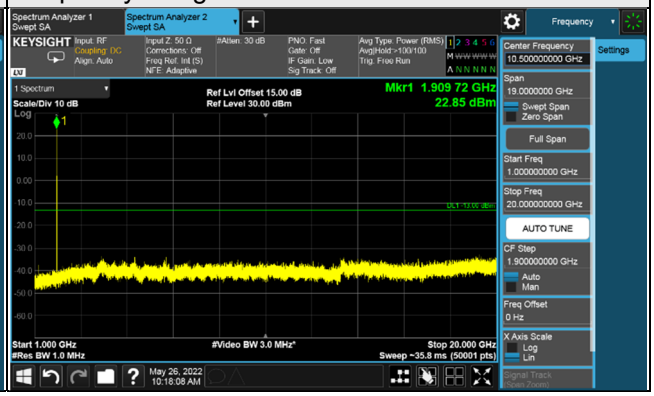
a. All measurements were done at low, middle and high channels operational frequency range.

a. Measuring frequency range is from 9kHz to 20GHz. 20dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz are used for conducted emission measurement.

4.7.4 Test Results

NB-IoT Band 2, Subcarrier Spacing 3.5kHz	
Channel 18602 (1850.2MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	
Channel 18900 (1880.0MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	
Channel 19198 (1909.8MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	

*The 9kHz signal over the limit is from Spectrum.

NB-IoT Band 2, Subcarrier Spacing 15kHz	
Channel 18602 (1850.2MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	
Channel 18900 (1880.0MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	
Channel 19198 (1909.8MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	

*The 9kHz signal over the limit is from Spectrum.

4.8 Radiated Emission Measurement

4.8.1 Limits of Radiated Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. The emission limit equal to –13dBm.

4.8.2 Test Procedure

a. In the semi-anechoic chamber, EUT placed on the 0.8m(below or equal 1GHz) and/or 1.5m(above 1GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.

b. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

c. Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.

d. Following C63.26 section 5.5 and 5.2.7
   - EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m.
   - ERP (dBm) = E (dBμV/m) + 20log(D) - 104.8 - 2.15; where D is the measurement distance (in the far field region) in m.

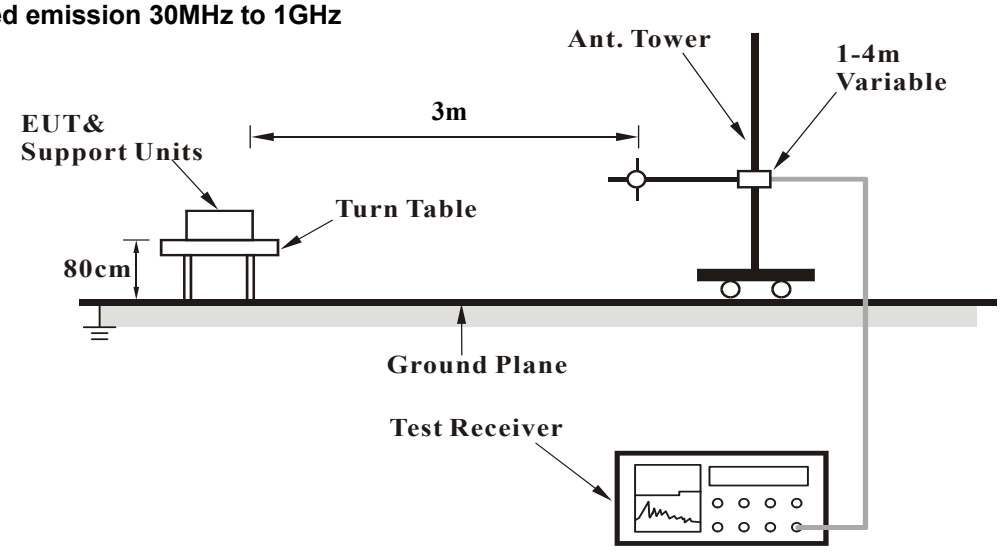
Note:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.
2. The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:
   The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

4.8.3 Deviation from Test Standard

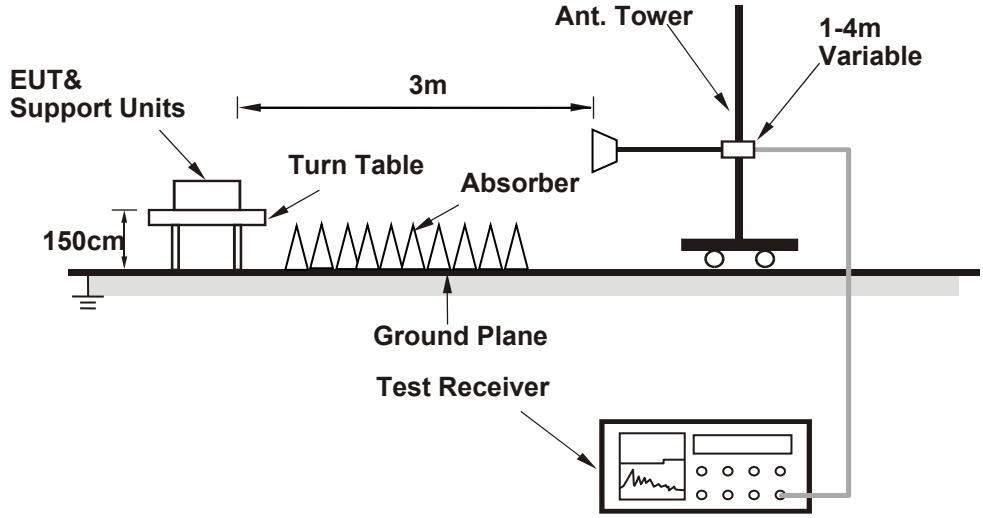
No deviation.

4.8.4 Test Setup

For radiated emission 30MHz to 1GHz



For radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.8.5 Test Results

Below 1GHz

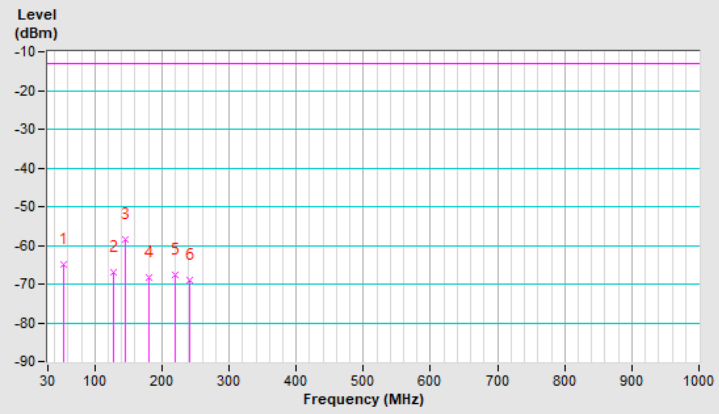
NB-IoT Band 2, Subcarrier Spacing 3.5kHz

Mode	TX channel 18900 (1880.0MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	17deg. C, 62%RH	Input Power	3.6Vdc
Tested By	Wade Huang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	54.25	-64.98	-13.00	-51.98	1.01 H	69	49.20	-114.18
2	127.97	-66.84	-13.00	-53.84	1.49 H	81	48.24	-115.08
3	145.43	-58.38	-13.00	-45.38	1.49 H	282	55.25	-113.63
4	180.35	-68.40	-13.00	-55.40	2.00 H	132	46.85	-115.25
5	219.15	-67.53	-13.00	-54.53	1.49 H	210	49.75	-117.28
6	241.46	-68.92	-13.00	-55.92	1.01 H	151	46.41	-115.33

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

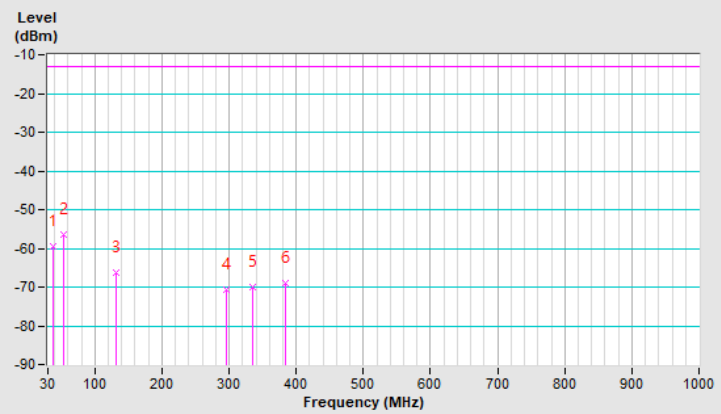


Mode	TX channel 18900 (1880.0MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	17deg. C, 62%RH	Input Power	3.6Vdc
Tested By	Wade Huang		

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	38.73	-59.63	-13.00	-46.63	1.01 V	142	54.90	-114.53
2	53.28	-56.52	-13.00	-43.52	1.01 V	131	57.54	-114.06
3	131.85	-66.24	-13.00	-53.24	1.01 V	196	48.53	-114.77
4	296.75	-70.64	-13.00	-57.64	1.49 V	21	42.89	-113.53
5	334.58	-70.15	-13.00	-57.15	2.00 V	357	42.24	-112.39
6	384.05	-69.03	-13.00	-56.03	1.49 V	209	42.20	-111.23

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.



Above 1GHz

NB-IoT Band 2, Subcarrier Spacing 3.5kHz

Mode	TX channel 18602 (1850.2MHz)	Frequency Range	1GHz ~ 20GHz
Environmental Conditions	17deg. C, 62%RH	Input Power	3.6Vdc
Tested By	Wade Huang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3700.40	-43.65	-13.00	-30.65	2.50 H	49	52.36	-96.01
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3700.40	-45.77	-13.00	-32.77	2.22 V	351	50.24	-96.01

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

Mode	TX channel 18900 (1880.0MHz)	Frequency Range	1GHz ~ 20GHz
Environmental Conditions	17deg. C, 62%RH	Input Power	3.6Vdc
Tested By	Wade Huang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	**3760.00**	**-41.23**	**-13.00**	**-28.23**	**1.52 H**	**59**	**54.50**	**-95.73**
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3760.00	-44.71	-13.00	-31.71	3.02 V	359	51.02	-95.73

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

Mode	TX channel 19198 (1909.8MHz)	Frequency Range	1GHz ~ 20GHz
Environmental Conditions	17deg. C, 62%RH	Input Power	3.6Vdc
Tested By	Wade Huang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3819.60	-41.72	-13.00	-28.72	1.49 H	54	53.74	-95.46
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3819.60	-44.09	-13.00	-31.09	2.99 V	324	51.37	-95.46

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

--- END ---