





# RF TEST REPORT

**Applicant** Quectel Wireless Solutions Co., Ltd.

FCC ID XMR2022BG955AGL

**Product** LTE Cat M1/NB1/GPRS/GNSS Module

**Brand** Quectel

Model BG955A-GL

**Report No.** R2208A0765-R2V1

Issue Date November 18, 2022

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in FCC CFR47 Part 2 (2021)/ FCC CFR 47 Part 24E (2021). The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	October 21, 2022
Rev.1	Update information.	November 18, 2022

Note: This revised report (Report No. R2208A0765-R2V1) supersedes and replaces the previously issued report (Report No. R2208A0765-R2). Please discard or destroy the previously issued report and dispose of it accordingly.



## **Summary of measurement results**

No.	Test Case	Clause in FCC rules	Verdict
1	RF Power Output and Effective Isotropic Radiated Power	2.1046 24.232(c)	PASS
2	Occupied Bandwidth	2.1049	PASS
3	Band Edge Compliance	2.1051 /24.238(a)	PASS
4	Peak-to-Average Power Ratio	24.232/KDB 971168 D01(5.7)	PASS
5	Frequency Stability	2.1055 / 24.235	PASS
6	Spurious Emissions at Antenna Terminals	2.1051 / 24.238(a)	PASS
7	Radiated Spurious Emission	2.1053 / 24.238(a)	PASS

Date of Testing: September 8, 2022~September 29, 2022 and October 18, 2022

Date of Sample Received: September 6, 2022

Note: PASS: The EUT complies with the essential requirements in the standard.

FAIL: The EUT does not comply with the essential requirements in the standard.

All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.

1. Test Laboratory

1.1. Notes of the test report

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(shanghai) co., Ltd. The results documented in this report apply only to the tested sample, under the

conditions and modes of operation as described herein . Measurement Uncertainties were not taken

into account and are published for informational purposes only. This report is written to support

regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission

list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory

Accreditation to perform measurement.

1.3. Testing Location

Company:

TA Technology (Shanghai) Co., Ltd.

Address:

Building 3, No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China

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# 2. General Description of Equipment under Test

# 2.1. Applicant and Manufacturer Information

Applicant	Quectel Wireless Solutions Co., Ltd.		
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016		
Applicant address	Tianlin Road, Minhang District, Shanghai, China, 200233		
Manufacturer	Quectel Wireless Solutions Co., Ltd.		
Manufacturar address	Building 5, Shanghai Business Park Phase III (Area B), No.1016		
Manufacturer address	Tianlin Road, Minhang District, Shanghai, China, 200233		

## 2.2. General information

EUT Description					
Model	BG955A-GL				
IMEI	868348060003740				
Hardware Version	R1.2				
Software Version	BG955AGLAAR02A	.01			
Power Supply	External power supp	oly			
Antenna Type	External Antenna				
	Mode	Frequency (MHz)	Gain (dBi)		
		1840	1.36		
Antenna Gain		1860	1.25		
Antenna Gam	NB-IoT Band 2/25	1880	1.38		
		1900	1.59		
		1920	1.36		
Test Mode(s)	NB-IoT Band 2/25				
Test Modulation:	BPSK, QPSK				
Category	NB 2				
Deployment:	Stand-alone; In-Ban	d; Guard-Band			
Sub-carrier spacing:	3.75KHz, 15KHz				
Ntones:	single-tone, multi-tone				
Maximum ELDD	NB-IoT Band 2:	25.12 dBm			
Maximum E.I.R.P	NB-IoT Band 25:	24.84 dBm			
Rated Power Supply Voltage	DC 3.8V				
Operating Voltage	Minimum: 3.3V Maximum: 4.3V				
Operating Temperature	Lowest:-35 °C Highest: +75°C				
Testing Temperature	Lowest: -30°C Highest: +50°C				
	Band	Tx (MHz)	Rx (MHz)		
Frequency Range(s)	NB-IoT Band 2	1850 ~ 1910	1930 ~ 1990		
	NB-IoT Band 25	1850 ~ 1915	1930 ~ 1995		

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Note:

1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.



# 3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:

FCC CFR 47 Part 24E (2021)

FCC CFR47 Part 2 (2021)

Reference standard:

ANSI C63.26-2015

KDB 971168 D01 Power Meas License Digital Systems v03r01





4. Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (Z axis, vertical polarization) and the worst case was recorded.

All modes as Subcarrier Spacing, modulations, Channel were investigated.

Subsequently, only the worst case emissions are reported.

The following testing in NB-IoT is set based on the maximum RF Output Power.

The following testing in different mode is set to detail in the following table:

Test modes are chosen to be reported as the worst case configuration below for NB-IoT Band 2/25

Test items	Deployment mode	Spa	arrier cing Iz)	Modu	lation	Tes	t Chai	nnel
	Stand-alone	3.75	15	BPSK	QPSK	L	M	н
RF Power Output and Effective Isotropic Radiated Power	0	0	0	0	0	0	0	0
Occupied Bandwidth	0	0	0	0	0	0	0	0
Band Edge Compliance	0	0	0	0	0	0	-	0
Peak-to-Average Power Ratio	0	0	0	0	0	-	0	-
Frequency Stability	0	0	0	0	0	-	0	-
Spurious Emissions at Antenna Terminals	0	-	0	-	0	0	0	0
Radiated Spurious Emission	0	0	-	-	0	0	0	0

#### Note

- 1. The mark "O" means that this configuration is chosen for testing.
- 2. The mark "-" means that this configuration is not testing.





5. Test Case

## 5.1.RF Power Output and Effective Isotropic Radiated Power

#### **Ambient condition**

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

#### **Methods of Measurement**

During the process of the testing, The EUT was connected to the Base Station Simulator with a known loss. The EUT is controlled by the Base Station Simulator test set to ensure max power transmission with proper modulation.

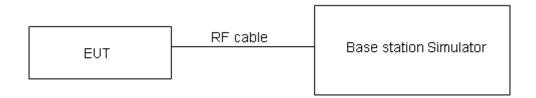
ERP can then be calculated as follows:

EIRP (dBm) = Output Power (dBm) + Antenna Gain (dBi)

where:dBd refers to gain relative to an ideal dipole.

EIRP (dBm) = ERP (dBm) + 2.15 (dB.)

#### **Test Setup**



#### Limits

No specific RF power output requirements in part 2.1046.

Rule Part 24.232(c) Mobile and portable stations are limited to 2 watts EIRP.

Rule Part 24.232(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

Limit	≤ 2 W (33 dBm)
LIIIIIL	

#### **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U = 0.4 dB for RF power output, k = 2, U = 1.19 dB for EIRP.

#### **Test Results**

Refer to the section 6.1 of this report for test data.



## 5.2. Occupied Bandwidth

#### **Ambient condition**

Temperature	Relative humidity	Pressure	
23°C ~25°C	45%~50%	101.5kPa	

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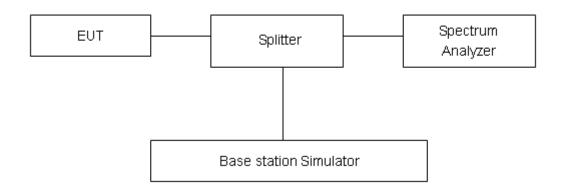
#### **Method of Measurement**

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.

RBW is set to  $\geq$ 1%EBW, VBW is set to 3x RBW.

99% power and -26dBc occupied bandwidths are recorded. Spectrum analyzer plots are included on the following pages.

#### **Test Setup**



#### Limits

No specific occupied bandwidth requirements in part 2.1049.

## **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U = 624Hz.

#### **Test Results**

Refer to the section 6.2 of this report for test data.

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## 5.3. Band Edge Compliance

#### **Ambient condition**

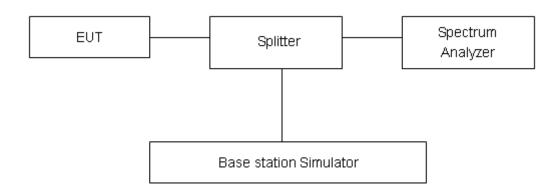
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

#### **Method of Measurement**

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured. The Average detector is used and RBW is set to ≥1%EBW, VBW is set to 3x RBW.

Spectrum analyzer plots are included on the following pages.

#### **Test Setup**



#### Limits

Rule Part 24.238(a) specifies that "on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB."

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#### **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U=0.684dB.

#### **Test Results**

Refer to the section 6.3 of this report for test data.

## 5.4. Peak-to-Average Power Ratio (PAPR)

#### **Ambient condition**

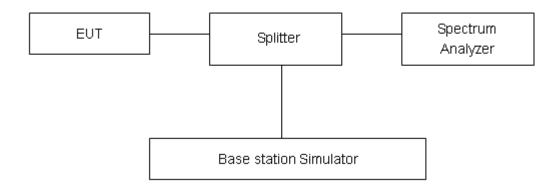
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

#### **Methods of Measurement**

Measure the total peak power and record as PPk. And measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (*e.g.*, dBm). Determine the PAPR from:

PAPR (dB) = PPk (dBm) - PAvg (dBm).

#### **Test Setup**



#### Limits

In measuring transmissions in this band using an average power technique, the peakto-average ratio (PAR) of the transmission may not exceed 13 dB in 24.232(d).

#### **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U = 0.4 dB.

#### **Test Results**

Refer to the section 6.4 of this report for test data.





#### 5.5. Frequency Stability

#### **Ambient condition**

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

#### **Method of Measurement**

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -30°C to +50°C in 10°C step size,

- (1) With all power removed, the temperature was decreased to 0°C and permitted to stabilize for three hours.
- (2) Measure the carrier frequency with the test equipment in a "call mode". These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.
- (3) Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

Frequency Stability (Voltage Variation)

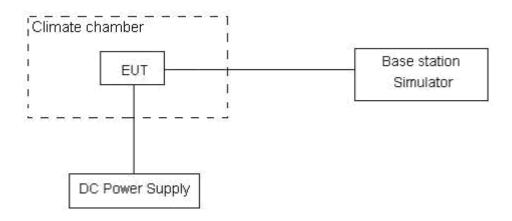
The frequency stability shall be measured with variation of primary supply voltage as follows:

Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried,

battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

This transceiver is specified to operate with an input voltage of between 3.3 V and 4.3V, with a nominal voltage of 3.8V.

### **Test setup**





#### Limits

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

## **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor k = 3, U= 0.01ppm.

#### **Test Results**

Refer to the section 6.5 of this report for test data.

## 5.6. Spurious Emissions at Antenna Terminals

#### **Ambient condition**

Temperature	Relative humidity	Pressure		
23°C ~25°C	45%~50%	101.5kPa		

#### **Method of Measurement**

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 9kHz to the 10th harmonic of the carrier. The peak detector is used.

RBW is set to 1 kHz (0.009MHz~ 0.15 MHz),

RBW is set to 10 kHz (0.15 MHz~ 30 MHz)

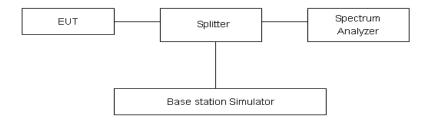
RBW is set to 100 kHz (30MHz~1000 MHz)

RBW is set to 1000 kHz (above 1000MHz)

Sweep is set to ATUO.

The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

## **Test setup**



#### Limits

Rule Part 24.238(a) specifies that "on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB."

Limit	-13 dBm
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#### **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor k = 1.96.

Frequency	Uncertainty
9kHz-1GHz	0.684 dB
9kHz~20GHz	1.407 dB

#### **Test Results**

Refer to the section 6.6 of this report for test data.



#### 5.7. Radiated Spurious Emission

#### **Ambient condition**

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

#### **Method of Measurement**

- 1. The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26-2015.
- 2. Below 1GHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H). Above 1GHz: (Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).
- 3. A loop antenna, A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
- 4. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz, and the maximum value of the receiver should be recorded as (Pr).
- 5. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
- 6. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (PcI) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
- 7. The measurement results are obtained as described below:

Power(EIRP)=PMea- PAg - Pcl + Ga

The measurement results are amend as described below:

Power(EIRP)=PMea- Pcl + Ga

8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dB) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP

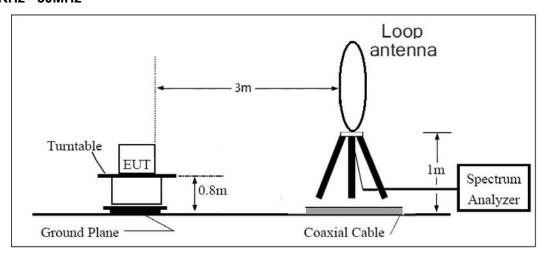


= EIRP-2.15dB.

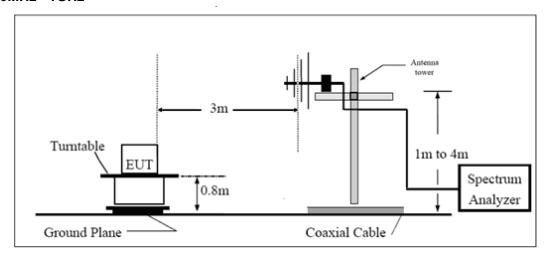
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

## **Test setup**

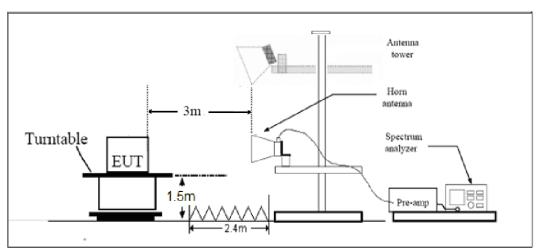
#### 9KHz~30MHz



30MHz~1GHz



#### **Above 1GHz**



Note: Area side: 2.4mX3.6m



#### Limits

Rule Part 24.238(a) specifies that "on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB."

Limit	-13 dBm
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#### **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U = 3.55 dB.

#### **Test Results**

Refer to the section 6.7 of this report for test data.



## 6. Test Results

## 6.1.RF Power Output and Effective Isotropic Radiated Power

Made M	Modulation	Sub-carrier	Ntones		ucted Power (d v/mid/high cha	•	EIRP (dBm)		
Mode	Modulation	spacing	INIONES	18602/	18900/	19198/	18602/	18900/	19198/
		(KHz)		1850.2	1880.0	1909.8	1850.2	1880.0	1909.8
		3.75	1@0	23.40	23.29	23.48	24.65	24.67	25.07
	DDOK	3.75	1@47	23.38	23.27	23.45	24.63	24.65	25.04
	BPSK	15	1@0	23.29	23.25	23.44	24.54	24.63	25.03
ND IsT			1@11	23.26	23.28	23.43	24.51	24.66	25.02
NB-loT Band 2		2.75	1@0	23.41	23.30	23.53	24.66	24.68	25.12
Danu Z		3.75	1@47	23.36	23.24	23.46	24.61	24.62	25.05
	QPSK	QPSK 15	1@0	23.21	23.20	23.45	24.46	24.58	25.04
			1@11	23.25	23.30	23.46	24.50	24.68	25.05
		15	12@0	21.06	20.97	21.11	22.31	22.35	22.70

Mada M	Modulation	Sub-carrier	Ntongo		Conducted Power (dBm) for low/mid/high channel			EIRP (dBm)		
Mode	Modulation	spacing (KHz)	Ntones	26042/	26365/	26688/	26042/	26365/	26688/	
		(KHZ)		1850.2	1882.5	1914.8	1850.2	1882.5	1914.8	
		3.75	1@0	23.30	23.16	23.37	24.55	24.54	24.73	
	BPSK		1@47	23.28	23.15	23.35	24.53	24.53	24.71	
	DESK	15	1@0	23.22	23.32	23.48	24.47	24.70	24.84	
NB-IoT			1@11	23.24	23.34	23.34	24.49	24.72	24.70	
Band 25		0.75	1@0	23.37	23.11	23.40	24.62	24.49	24.76	
Danu 23		3.75	1@47	23.35	23.13	23.34	24.60	24.51	24.70	
	QPSK	PSK 15	1@0	23.21	23.41	23.35	24.46	24.79	24.71	
			1@11	23.25	23.37	23.40	24.50	24.75	24.76	
		15	12@0	21.08	21.12	21.18	22.33	22.50	22.54	

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6.2. Occupied Bandwidth

Mode Modulation		Cub comica		Bandwidth(KHz) for low/mid/high channel						
	Modulation	Sub-carrier	Ntones	18602/	18602/1850.2		18900/1880.0		1909.8	
	spacing (KHz)	Mones	99%	-26dBc	99%	-26dBc	99%	-26dBc		
		(NHZ)		Power	-200BC	Power	-20ubc	Power	-20ubc	
	BPSK	3.75	1@0	39.47	38.53	38.90	36.91	38.10	35.97	
ND IsT	QPSK	3.75	1@0	42.99	41.64	43.51	41.62	45.25	42.35	
NB-IoT Band 2	BPSK	15	1@0	74.05	91.94	81.76	102.20	75.70	98.03	
Dariu Z	QPSK	15	1@0	73.85	101.80	77.46	102.60	75.73	103.00	
	QPSK	15	12@0	186.63	252.90	187.58	261.70	186.81	267.00	

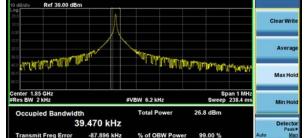
		Sub-carrier		Bandwidth(KHz) for low/mid/high channel						
Mada	Modulation		Ntones	26042/1850.2		26365/1882.5		26688/1914.8		
Mode	Mode Modulation	spacing (KHz)	Niones	99%		99%		99%		
				Power	-26dBc	Power	-26dBc	Power	-26dBc	
	BPSK	3.75	1@0	38.81	37.49	40.14	37.66	40.28	37.23	
NB-loT	QPSK	3.75	1@0	43.04	40.54	44.36	41.56	43.20	40.27	
Band	BPSK	15	1@0	74.28	90.30	75.64	89.40	77.09	96.70	
25	QPSK	15	1@0	72.46	99.60	75.26	100.60	79.77	90.64	
	QPSK	15	12@0	185.59	261.10	184.49	266.80	185.41	267.00	





# Ref 30.00 dB

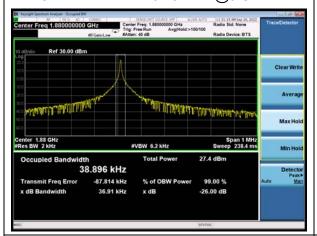
NB-IOT Band 2 BPSK 3.75kHz 1@0 CH-Low



## NB-IOT Band 2 BPSK 15kHz 1@0 CH-Low



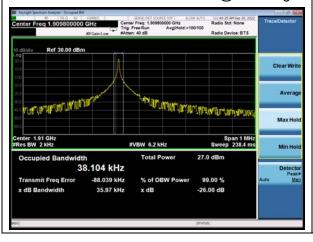
NB-IOT Band 2 BPSK 3.75kHz 1@0 CH-Middle



NB-IOT Band 2 BPSK 15kHz 1@0 CH-Middle



NB-IOT Band 2 BPSK 3.75kHz 1@0 CH-High



NB-IOT Band 2 BPSK 15kHz 1@0 CH-High







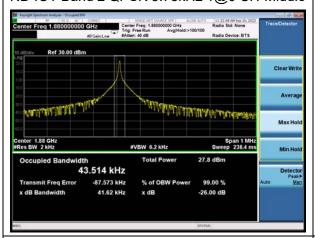
# NB-IOT Band 2 QPSK 3.75kHz 1@0 CH-Low



#### NB-IOT Band 2 QPSK 15kHz 1@0 CH-Low



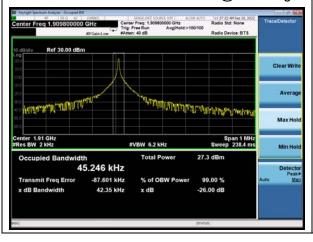
NB-IOT Band 2 QPSK 3.75kHz 1@0 CH-Middle



NB-IOT Band 2 QPSK 15kHz 1@0 CH-Middle

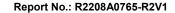


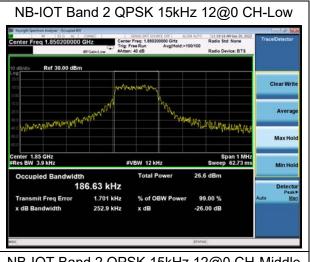
NB-IOT Band 2 QPSK 3.75kHz 1@0 CH-High

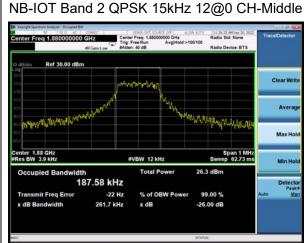


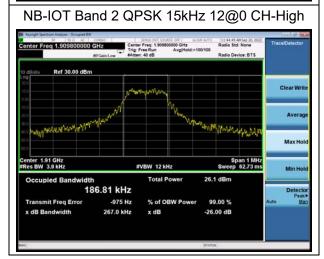
NB-IOT Band 2 QPSK 15kHz 1@0 CH-High





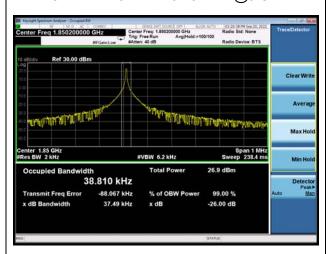








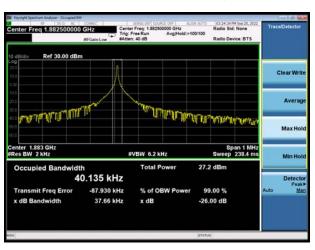
## NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-Low



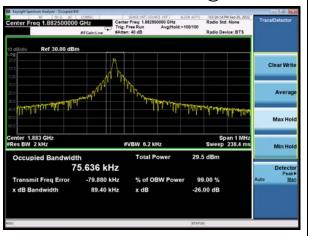
## NB-IOT Band 25 BPSK 15kHz 1@0 CH-Low



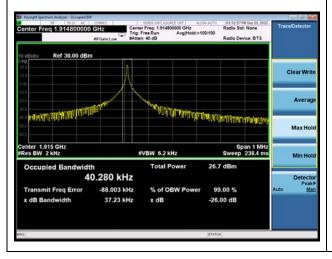
## NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-Middle



NB-IOT Band 25 BPSK 15kHz 1@0 CH-Middle



NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-High

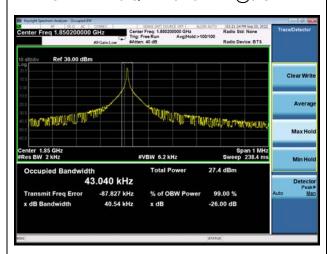


NB-IOT Band 25 BPSK 15kHz 1@0 CH-High





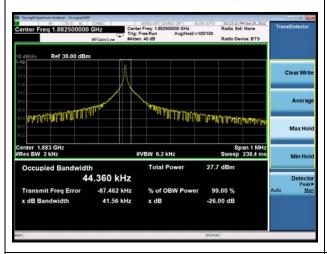
#### NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-Low



## NB-IOT Band 25 QPSK 15kHz 1@0 CH-Low



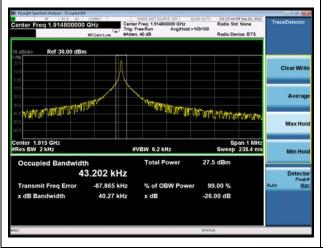
## NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-Middle



NB-IOT Band 25 QPSK 15kHz 1@0 CH-Middle

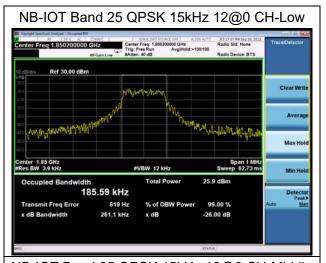


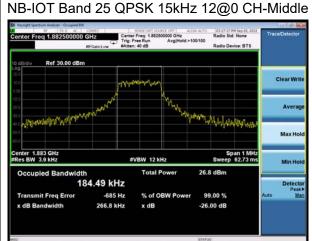
NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-High

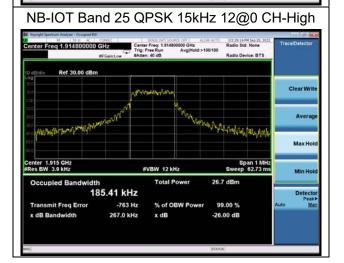


NB-IOT Band 25 QPSK 15kHz 1@0 CH-High





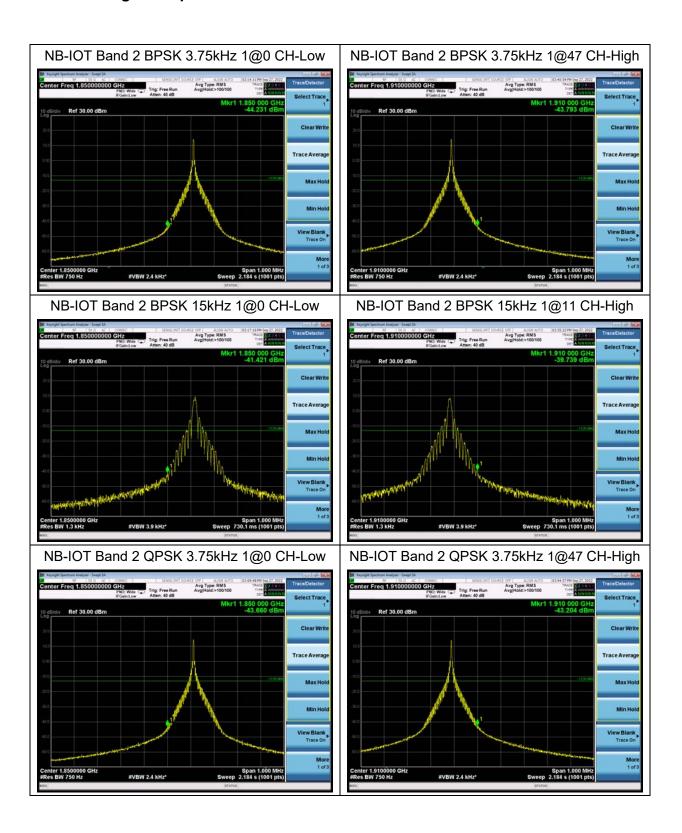








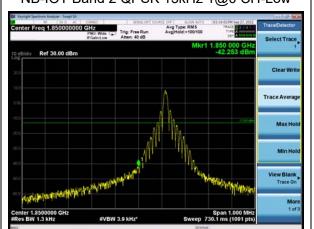
## 6.3. Band Edge Compliance



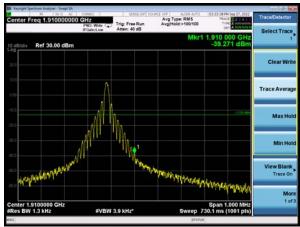




NB-IOT Band 2 QPSK 15kHz 1@0 CH-Low



NB-IOT Band 2 QPSK 15kHz 1@11 CH-High



NB-IOT Band 2 QPSK 15kHz 12@0 CH-Low



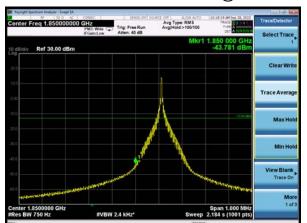
NB-IOT Band 2 QPSK 15kHz 12@0 CH-High



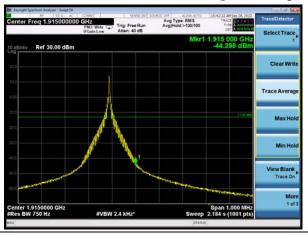




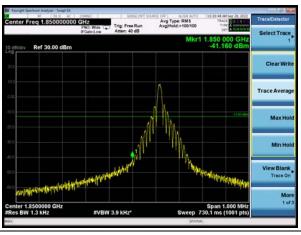
## NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-Low



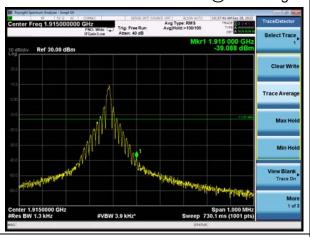
NB-IOT Band 25 BPSK 3.75kHz 1@47 CH-High



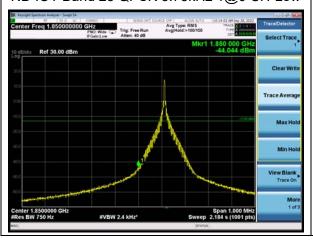
NB-IOT Band 25 BPSK 15kHz 1@0 CH-Low



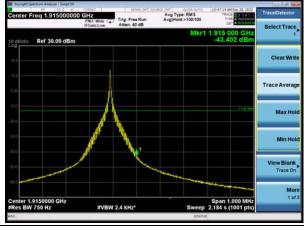
NB-IOT Band 25 BPSK 15kHz 1@11 CH-High



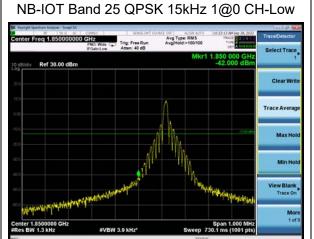
NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-Low

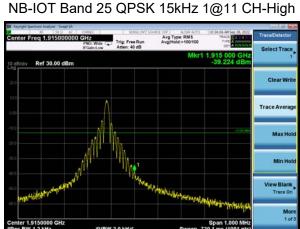


NB-IOT Band 25 QPSK 3.75kHz 1@47 CH-High









NB-IOT Band 25 QPSK 15kHz 12@0 CH-Low



NB-IOT Band 25 QPSK 15kHz 12@0 CH-High







# 6.4. Peak-to-Average Power Ratio (PAPR)

Mode	Modulation	Sub-carrier spacing	Channel/	Peak-to-Average Power Ratio (PAPR)			
		(KHz)	Frequency(MHz)	Peak(dBm)	Avg(dBm)	PAPR(dB)	
	BPSK	3.75	18900/1880.0	22.51	19.56	2.95	
NB-loT	QPSK	3.75	18900/1880.0	22.72	19.70	3.02	
Band 2	BPSK	15	18900/1880.0	23.81	17.57	6.24	
	QPSK	15	18900/1880.0	23.65	17.35	6.30	

		Sub-carrier	Channel/	Peak-to-Average Power Ratio			
Mode	Modulation	spacing		(PAPR)			
	(KHz)	Frequency(MHz)	Peak(dBm)	Avg(dBm)	PAPR(dB)		
ND IsT	BPSK	3.75	26365/1882.5	22.90	19.94	2.96	
NB-IoT Band	QPSK	3.75	26365/1882.5	22.85	19.88	2.97	
25	BPSK	15	26365/1882.5	23.88	17.68	6.20	
25	QPSK	15	26365/1882.5	23.91	17.63	6.28	

# 6.5. Frequency Stability

	Condition	Freq.Error	Freq.Error	Frequency Stability	Frequency Stability		
	Sub-carrier spacing(KHz)	3.75	(Hz)	(Hz)	(ppm)	(ppm)	Verdict
	Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
	Normal (25℃)		17.98	8.55	0.00957	0.00455	PASS
	Extreme (50°C)		10.92	10.73	0.00581	0.00571	PASS
ND I-T	Extreme (40°C)		1.51	16.44	0.00080	0.00874	PASS
NB-IoT	Extreme (30°C)	NI 1	9.24	6.75	0.00491	0.00359	PASS
Band 2	Extreme (20℃)		6.79	3.24	0.00361	0.00172	PASS
	Extreme (10°C)	Normal	14.08	15.18	0.00749	0.00808	PASS
	Extreme (0°C)		13.54	2.50	0.00720	0.00133	PASS
	Extreme (-10°C)		7.02	12.81	0.00373	0.00682	PASS
	Extreme (-20℃)		11.64	2.68	0.00619	0.00142	PASS
	Extreme (-30°C)		8.24	14.76	0.00438	0.00785	PASS
	25℃	LV	6.60	6.45	0.00351	0.00343	PASS
	25℃	HV	1.14	1.10	0.00061	0.00059	PASS

	Condition Sub-carrier	3.75	Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
	spacing(KHz) Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
	Normal (25°C)	voltago	5.32	11.22	0.00283	0.00597	PASS
	Extreme (50°C)	-	4.97	2.92	0.00264	0.00155	PASS
	Extreme (40°C)	Nama	5.50	16.14	0.00292	0.00858	PASS
NB-loT	Extreme (30°C)		13.02	17.77	0.00693	0.00945	PASS
Band 25	Extreme (20°C)		1.05	16.44	0.00056	0.00874	PASS
	Extreme (10°C)	Normal	4.25	11.28	0.00226	0.00600	PASS
	Extreme (0°C)		13.79	14.25	0.00734	0.00758	PASS
	Extreme (-10℃)		14.86	7.41	0.00791	0.00394	PASS
	Extreme (-20℃)		16.20	1.29	0.00862	0.00068	PASS
	Extreme (-30℃)		17.55	8.90	0.00934	0.00474	PASS
	25℃	LV	1.51	16.54	0.00080	0.00880	PASS
	200	HV	17.03	13.41	0.00906	0.00713	PASS



	Condition	Condition			Frequency Stability	Frequency Stability	
	Sub-carrier spacing(KHz)	15	(Hz)	(Hz)	(ppm)	(ppm)	Verdict
	Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
	Normal (25℃)		10.24	3.36	0.00545	0.00179	PASS
	Extreme (50°C)	-	10.33	3.41	0.00550	0.00181	PASS
ND IsT	Extreme (40°C)		13.64	14.86	0.00725	0.00790	PASS
NB-IoT Band 2	Extreme (30°C)	N 1	17.70	6.74	0.00941	0.00358	PASS
Danu Z	Extreme (20°C)		10.63	9.21	0.00566	0.00490	PASS
	Extreme (10°C)	Normal	2.47	4.75	0.00132	0.00253	PASS
	Extreme (0°C)		5.55	15.39	0.00295	0.00819	PASS
	Extreme (-10℃)		9.74	8.12	0.00518	0.00432	PASS
	Extreme (-20℃)		1.76	16.37	0.00094	0.00871	PASS
	Extreme (-30°C)		6.25	5.02	0.00332	0.00267	PASS
	25℃	LV	14.19	7.36	0.00755	0.00392	PASS
	25 (	HV	5.72	1.04	0.00304	0.00055	PASS

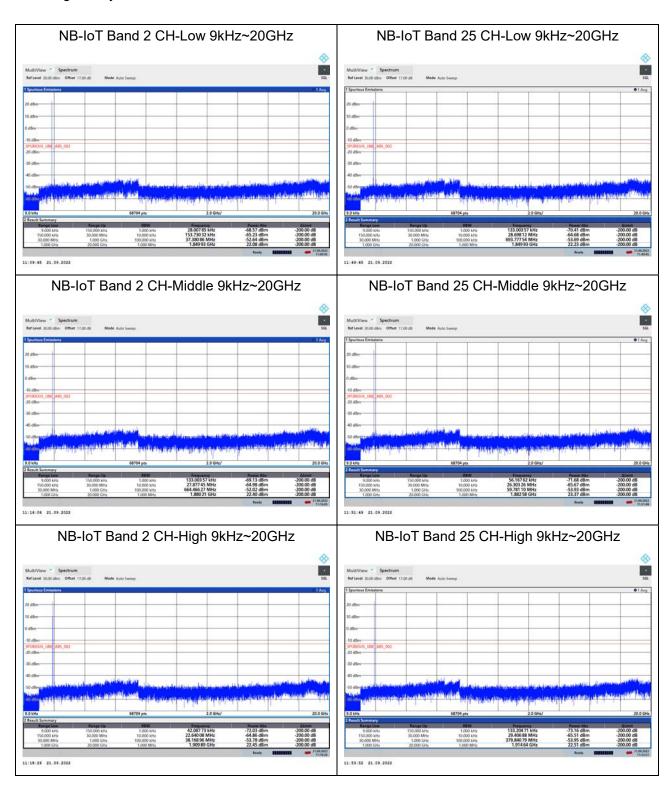
	Condition		Freq.Error	Freq.Error	Frequency Stability	Frequency Stability	
	Sub-carrier spacing(KHz)	15	(Hz)	(Hz)	(ppm)	(ppm)	Verdict
	Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
	Normal (25℃)		9.87	17.33	0.00525	0.00922	PASS
	Extreme (50°C)		4.97	1.82	0.00264	0.00097	PASS
ND IsT	Extreme (40°C)	Nama	6.48	3.25	0.00344	0.00173	PASS
NB-loT Band 25	Extreme (30°C)		10.38	12.31	0.00552	0.00655	PASS
Danu 25	Extreme (20°C)		16.04	10.60	0.00853	0.00564	PASS
	Extreme (10°C)	Normal	12.92	3.41	0.00687	0.00181	PASS
	Extreme (0°C)		8.78	15.17	0.00467	0.00807	PASS
	Extreme (-10℃)		11.82	13.29	0.00629	0.00707	PASS
	Extreme (-20℃)		16.33	1.16	0.00868	0.00062	PASS
	Extreme (-30℃)		13.52	17.57	0.00719	0.00935	PASS
	25℃	LV	9.43	6.10	0.00502	0.00325	PASS
	25 C	HV	3.50	13.83	0.00186	0.00736	PASS



## 6.6. Spurious Emissions at Antenna Terminals

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions more than 20 dB below the limit are not reported.

The signal beyond the limit is carrier.





6.7. Radiated Spurious Emission

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

Report No.: R2208A0765-R2V1

NB-IoT Band 2 3.75KHz+QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3700.20	-48.92	5.10	11.05	Vertical	-42.97	-13.00	29.97	90
3	5550.30	-56.58	5.42	12.65	Vertical	-49.35	-13.00	36.35	0
4	7400.40	-56.00	6.70	13.85	Vertical	-48.85	-13.00	35.85	0
5	9250.50	-52.40	7.01	14.75	Vertical	-44.66	-13.00	31.66	45
6	11100.60	-53.50	7.48	15.95	Vertical	-45.03	-13.00	32.03	225
7	12950.70	-53.06	7.51	16.55	Vertical	-44.02	-13.00	31.02	90
8	14800.80	-49.35	8.24	15.35	Vertical	-42.24	-13.00	29.24	45
9	16650.90	-48.87	8.41	14.95	Vertical	-42.33	-13.00	29.33	135
10	18501.00		-						

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Vertical position.

NB-IoT Band 2 3.75KHz+QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3759.75	-48.63	5.10	11.05	Vertical	-42.68	-13.00	29.68	225
3	5640.00	-57.02	5.42	12.65	Vertical	-49.79	-13.00	36.79	315
4	7520.00	-54.69	6.70	13.85	Vertical	-47.54	-13.00	34.54	180
5	9400.00	-52.31	7.01	14.75	Vertical	-44.57	-13.00	31.57	0
6	11280.00	-52.38	7.48	15.95	Vertical	-43.91	-13.00	30.91	0
7	13160.00	-53.89	7.51	16.55	Vertical	-44.85	-13.00	31.85	45
8	15040.00	-51.41	8.24	15.35	Vertical	-44.30	-13.00	31.30	315
9	16920.00	-49.00	8.41	14.95	Vertical	-42.46	-13.00	29.46	90
10	18800.00		-	1	Vertical			-	-

Note: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Vertical position.

TA Technology (Shanghai) Co., Ltd.

TA-MB-05-002R

RF Test Report Report Report No.: R2208A0765-R2V1

## NB-IoT Band 2 3.75KHz+QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3819.80	-52.04	2.60	12.50	Vertical	-42.14	-13.00	29.14	90
3	5729.70	-59.49	3.30	12.50	Vertical	-50.29	-13.00	37.29	0
4	7639.60	-56.55	4.20	12.20	Vertical	-48.55	-13.00	35.55	0
5	9549.50	-55.14	4.30	11.10	Vertical	-48.34	-13.00	35.34	45
6	11459.40	-48.82	5.90	11.90	Vertical	-42.82	-13.00	29.82	315
7	13369.30	-51.79	5.70	14.00	Vertical	-43.49	-13.00	30.49	90
8	15279.20	-51.96	5.80	13.10	Vertical	-44.66	-13.00	31.66	45
9	17189.10	-49.31	6.10	14.60	Vertical	-40.81	-13.00	27.81	135
10	19099.00								

Note: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Vertical position.

#### NB-IoT Band 25 3.75KHz+QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3700.20	-48.60	5.10	11.05	Vertical	-42.65	-13.00	29.65	180
3	5550.30	-57.83	5.42	12.65	Vertical	-50.60	-13.00	37.60	0
4	7400.40	-57.29	6.70	13.85	Vertical	-50.14	-13.00	37.14	315
5	9250.50	-54.06	7.01	14.75	Vertical	-46.32	-13.00	33.32	45
6	11100.60	-52.89	7.48	15.95	Vertical	-44.42	-13.00	31.42	270
7	12950.70	-53.33	7.51	16.55	Vertical	-44.29	-13.00	31.29	90
8	14800.80	-51.61	8.24	15.35	Vertical	-44.50	-13.00	31.50	180
9	16650.90	-49.96	8.41	14.95	Vertical	-43.42	-13.00	30.42	90
10	18501.00						-		

Note: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Vertical position.

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#### NB-IoT Band 25 3.75KHz+QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3765.00	-47.55	5.10	11.05	Vertical	-41.60	-13.00	28.60	315
3	5647.50	-56.13	5.42	12.65	Vertical	-48.90	-13.00	35.90	90
4	7530.00	-53.28	6.70	13.85	Vertical	-46.13	-13.00	33.13	180
5	9412.50	-55.33	7.01	14.75	Vertical	-47.59	-13.00	34.59	45
6	11295.00	-53.20	7.48	15.95	Vertical	-44.73	-13.00	31.73	315
7	13177.50	-52.58	7.51	16.55	Vertical	-43.54	-13.00	30.54	0
8	15060.00	-51.84	8.24	15.35	Vertical	-44.73	-13.00	31.73	180
9	16942.50	-48.32	8.41	14.95	Vertical	-41.78	-13.00	28.78	90
10	18825.00		1				1	- 1	

Note: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Vertical position.

NB-IoT Band 25 3.75KHz+QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3829.80	-49.91	5.10	11.05	Vertical	-43.96	-13.00	30.96	90
3	5744.70	-56.80	5.42	12.65	Vertical	-49.57	-13.00	36.57	315
4	7659.60	-54.72	6.70	13.85	Vertical	-47.57	-13.00	34.57	180
5	9574.50	-56.37	7.01	14.75	Vertical	-48.63	-13.00	35.63	90
6	11489.40	-52.65	7.48	15.95	Vertical	-44.18	-13.00	31.18	180
7	13404.30	-51.90	7.51	16.55	Vertical	-42.86	-13.00	29.86	0
8	15319.20	-51.52	8.24	15.35	Vertical	-44.41	-13.00	31.41	270
9	17234.10	-48.99	8.41	14.95	Vertical	-42.45	-13.00	29.45	90
10	19149.00								

Note: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst emission was found in the antenna is Vertical position.

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## 7. Main Test Instruments

Name	Manufacturer	Туре	Serial Number	Calibration Date	Expiration Date
Climatic Chamber	ESPEC	SU-242	93000506	2021-12-12	2022-12-11
Comprehensive measuring instrument	R&S	CMW500	150415	2022-05-14	2023-05-13
Spectrum Analyzer	Keysight	N9020A	MY50510203	2021-12-12	2022-12-11
Universal Radio Communication Tester	Agilent	E5515C	GB44400275	2021-12-12	2022-12-11
Universal Radio Communication Tester	StarPoint	SP8315	SP8315-1225	2022-05-14	2023-05-13
Spectrum Analyzer	R&S	FSV3030	101411	2021-12-12	2022-12-11
	Radiat	ed Spurious Emi	ssions		
Signal Analyzer	R&S	FSV30	100815	2021-12-12	2022-12-11
Loop antenna	SCHWARZBECK	FMZB1519	1519-047	2020-04-02	2023-04-01
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	01439	2021-06-30	2024-06-29
Horn Antenna	Schwarzbeck	BBHA 9120D	1594	2020-12-17	2023-12-16
Horn Antenna	ETS-Lindgren	3160-09	00102643	2021-10-10	2024-10-09
Software	R&S	EMC32	10.35.10	1	1

\*\*\*\*\*\*END OF REPORT \*\*\*\*\*\*



# **ANNEX A: The EUT Appearance**

The EUT Appearance is submitted separately.



# **ANNEX B: Test Setup Photos**

The Test Setup Photos is submitted separately.