RF TEST REPORT

Applicant	Zhejiang Lierda Internet of Things technology Co.,Ltd
FCC ID	2AOFDNB05-01
Product	NB-IoT Module(LTE)
Brand	Lierda
Model	NB05-01
Report No.	RXA1711-0359RF01R2
Issue Date	January 29, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2017)/ FCC CFR 47 Part 22H (2017)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Jiangpeng Lan

Performed by: Jiangpeng Lan

Kai Xu

Approved by: Kai Xu

TA Technology (Shanghai) Co., Ltd.

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TABLE OF CONTENT

Summary of measurement results

No.	Test Type	Clause in FCC rules	Verdict
1	RF power output	2.1046	PASS
2	Effective Radiated Power	22.913(a)(2)	PASS
3	Occupied Bandwidth	2.1049	PASS
4	Band Edge Compliance	2.1051 / 22.917(a)	PASS
5	Peak-to-Average Power Ratio	22.913(d)/ KDB 971168 D01(5.7)	PASS
6	Frequency Stability	2.1055 / 22.355	PASS
7	Spurious Emissions at Antenna Terminals	2.1051 / 22.917(a)	PASS
8	Radiates Spurious Emission	2.1053 / 22.917 (a)	PASS
Date of Testing: November 3, 2017~ November 28, 2017			
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.			

1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (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

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

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 electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3. Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City:	Shanghai
Post code:	201201
Country:	P. R. China
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Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	http://www.ta-shanghai.com
E-mail:	xukai@ta-shanghai.com

2. General Description of Equipment under Test

Client Information

Applicant	Zhejiang Lierda Internet of Things technology Co.,Ltd
Applicant address	Lierda IOT park, No.1326 Wenyi Xi Road, Hangzhou, China
Manufacturer	Zhejiang Lierda Internet of Things technology Co.,Ltd
Manufacturer address	Lierda IOT park, No.1326 Wenyi Xi Road, Hangzhou, China

General Information

EUT Description			
Model	NB05-01		
IMEI	865352030093602		
Hardware Version	01		
Software Version	01		
Power Supply	External power supply		
Antenna Type	The EUT don't have standard Antenna, The Antenna used for testing in this report is the after-market accessory (Dipole Antenna)		
Test Mode(s)	NB-IOT Band 5		
Test Modulation	BPSK, QPSK		
Category	NB1		
Deployment	stand-alone		
Sub-carrier spacing	3.75KHz, 15KHz		
Ntones	single		
Maximum E.R.P.	NB-IOT Band 5:	25.88 dBm	
Rated Power Supply Voltage	3.6V		
Extreme Voltage	Minimum: 3.1V Maximum: 4.2V		
Extreme Temperature	Lowest: -30°C Highest: +85°C		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	NB-IOT Band 5	824 ~ 849	869 ~ 894
Note: The information of the EUT is declared by the manufacturer.			

3. Applied Standards

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

FCC CFR47 Part 2 (2017)

FCC CFR 47 Part 22H (2017)

ANSI/TIA-603-D (2010)

KDB 971168 D01 Power Meas License Digital Systems v03

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 (X axis, horizontal polarization) and the worst case was recorded.

All mode and data rates and positions 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.
Test modes are chosen to be reported as the worst case configuration below:

Test modes are chosen as the worst case configuration below for NB-IOT Band 5.

Test items	Modes	Deployment mode	Subcarrier Spacing (kHz)		Modulation		Test Channel		
		Stand-alone	3.75	15	BPSK	QPSK	L	M	H
RF power output	NB-IOT B5	O	O	O	O	O	O	O	O
Effective Isotropic Radiated power	NB-IOT B5	O	O	O	O	O	O	O	O
Occupied Bandwidth	NB-IOT B5	O	O	O	O	O	O	O	O
Band Edge Compliance	NB-IOT B5	O	O	O	O	O	O	-	O
Peak-to-Average Power Ratio	NB-IOT B5	O	O	O	O	O	-	O	-
Frequency Stability	NB-IOT B5	O	O	O	O	O	-	O	-
Spurious Emissions at Antenna Terminals	NB-IOT B5	O	-	O	-	O	O	O	O
Radiates Spurious Emission	NB-IOT B5	O	-	O	-	O	O	O	O
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 Results

5.1. RF Power Output

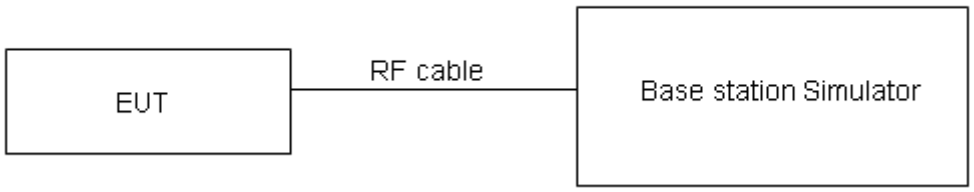
Ambient condition

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

Methods of Measurement

During the process of the testing, The EUT is controlled by the Base Station Simulator to ensure max power transmission and proper modulation.

Test Setup



The loss between RF output port of the EUT and the input port of the tester has been taken into consideration.

Limits

No specific RF power output requirements in part 2.1046.

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

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Conducted Power (dBm) for low/mid/high channel		
				20401/824.1	20525/836.5	20649/848.9
Band 5 Standalone	BPSK	3.75	1@0	22.49	22.65	22.68
			1@47	22.47	22.61	22.66
		15.00	1@0	22.43	22.62	22.65
			1@11	22.48	22.60	22.67
	QPSK	3.75	1@0	22.48	22.62	22.66
			1@47	22.52	22.56	22.68
		15.00	1@0	22.45	22.59	22.68
			1@11	22.50	22.64	22.70

5.2. Effective Radiated Power

Ambient condition

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

Methods of Measurement

The testing follows FCC KDB 971168 v03 Section 5.8 and ANSI/TIA-603-D-2010.

a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.

b) Key the transmitter, then rotate the EUT 360° azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).

c) Replace the transmitter under test with a vertically polarized half-wave dipole (or an antenna whose gain is known relative to an ideal half-wave dipole). The center of the antenna should be at the same location as the center of the antenna under test.

d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading.LOSS = Generator Output Power (dBm) – Analyzer reading (dBm)

e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation:ERP (dBm) = LVL (dBm) + LOSS (dB)

f) The maximum ERP is the maximum value determined in the preceding step.

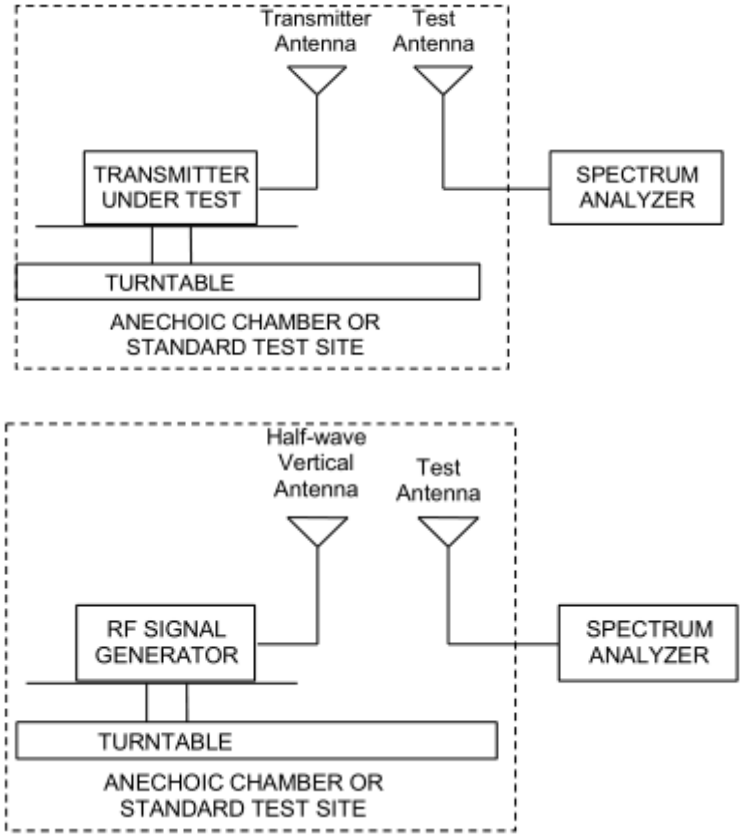
g) When calculating ERP, in addition to knowing the antenna radiation and matching characteristics, it is necessary to know the loss values of all elements (e.g.transmission line attenuation, mismatches, filters, combiners) interposed between the point where transmitter output power is measured, and the point where power is applied to the antenna. ERP can then be calculated as follows:

ERP (dBm) = Output Power (dBm) - Losses (dB) + Antenna Gain (dBd)

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

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

Test setup



Limits

Rule Part 22.913(a) specifies that "Mobile/portable stations are limited to 7 watts ERP".

Limit	≤ 7 W (38.45 dBm)

Measurement Uncertainty

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

Test Results:

The measurement is performed for both of horizontal and vertical antenna Polarization, and only the data of worst mode is recorded in this report.

Mode	Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	Output power (dBm)	Losses (dBm)	Ant gain (dBi)	ERP (dBm)
Band5	20401	824.1	BPSK	H	3.75	1@0	-23.48	-47.13	1.06	24.71
			QPSK	H	3.75	1@0	-23.43	-47.13	1.06	24.77
			BPSK	H	15.00	1@0	-23.29	-47.13	1.06	24.91
			QPSK	H	15.00	1@0	-23.09	-47.13	1.06	25.10
	20525	836.5	BPSK	H	3.75	1@0	-23.74	-47.20	1.24	24.70
			QPSK	H	3.75	1@0	-23.74	-47.20	1.24	24.69
			BPSK	H	15.00	1@0	-23.26	-47.20	1.24	25.18
			QPSK	H	15.00	1@0	-23.33	-47.20	1.24	25.11
	20649	848.9	BPSK	H	3.75	1@0	-23.09	-47.59	1.38	25.88
			QPSK	H	3.75	1@0	-23.73	-47.59	1.38	25.25
			BPSK	H	15.00	1@0	-23.35	-47.59	1.38	25.62
			QPSK	H	15.00	1@0	-23.34	-47.59	1.38	25.63

5.3. Occupied Bandwidth

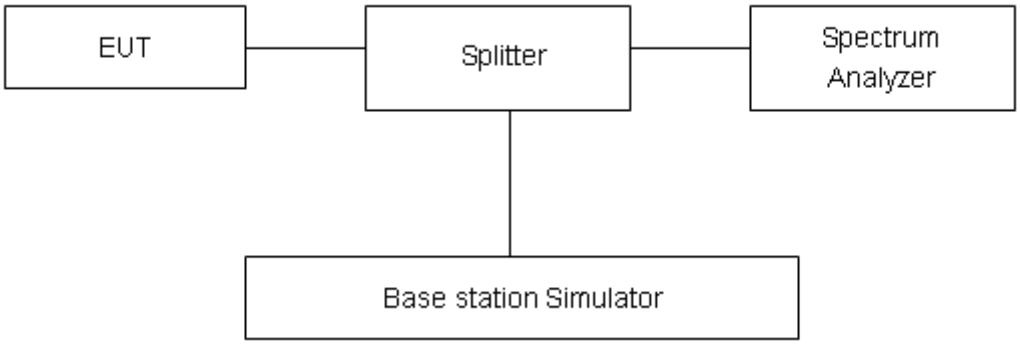
Ambient condition

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 occupied bandwidth is measured using spectrum analyzer.
RBW is set to 2kHz, VBW is set to 6.2kHz for NB-IOT Band 5
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.

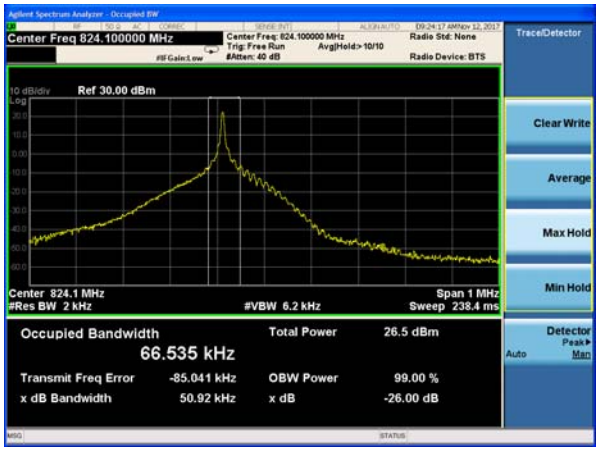
Measurement Uncertainty

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

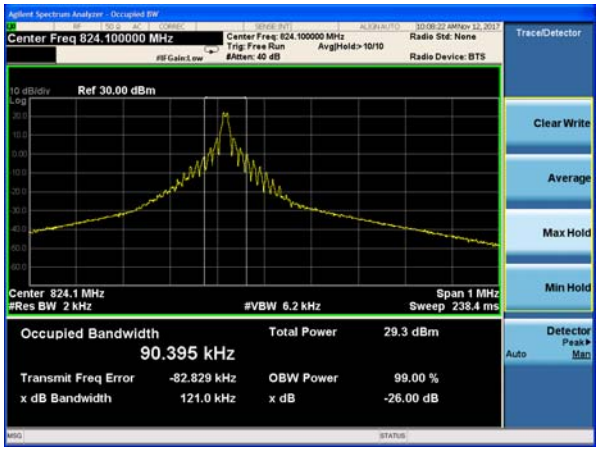
Test Result

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
				20401/824.1		20525/836.5		20649/848.9	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
Band 5 Standalone	BPSK	3.75	1@0	66.535	50.92	66.113	50.81	64.169	50.72
	QPSK	3.75	1@0	79.311	54.46	78.514	54.99	78.060	54.45
	BPSK	15	1@0	90.395	121.00	90.795	121.30	90.990	120.90
	QPSK	15	1@0	109.150	138.80	103.510	139.80	98.319	127.40

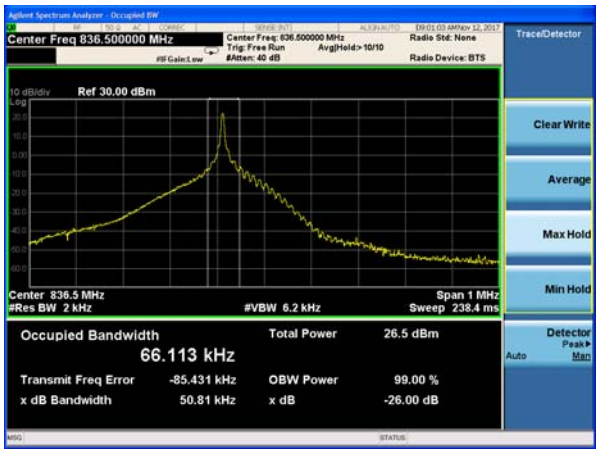
NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-Low



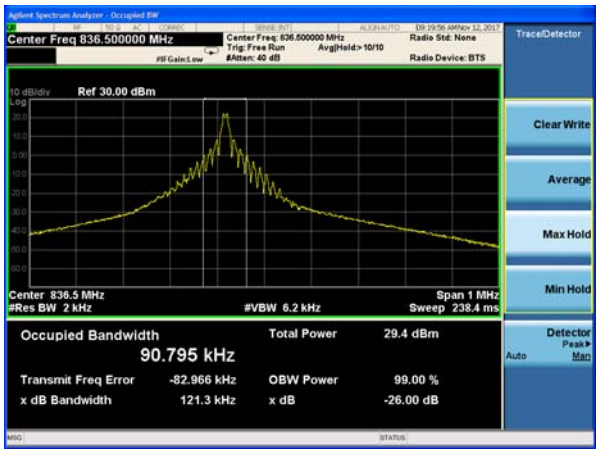
NB-IOT Band 5 BPSK 15kHz 1@0 CH-Low



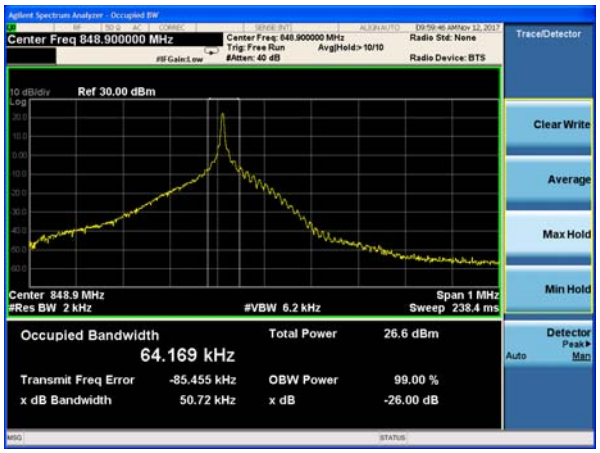
NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-Middle



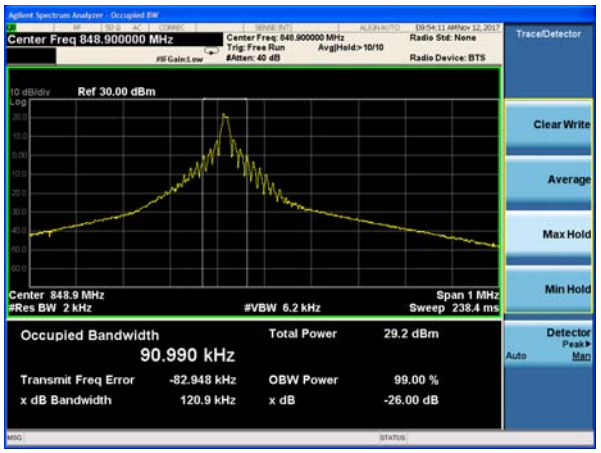
NB-IOT Band 5 BPSK 15kHz 1@0 CH-Middle



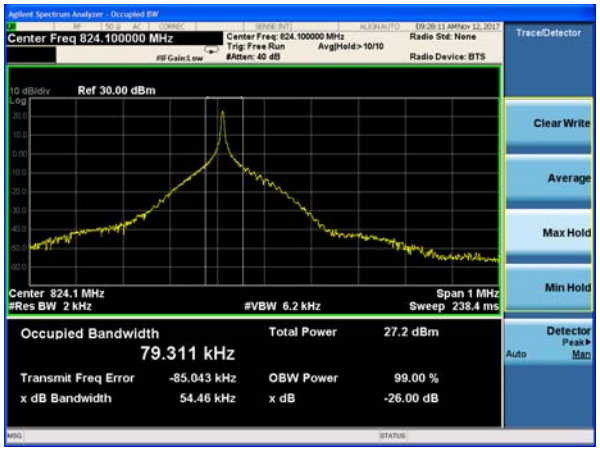
NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-High



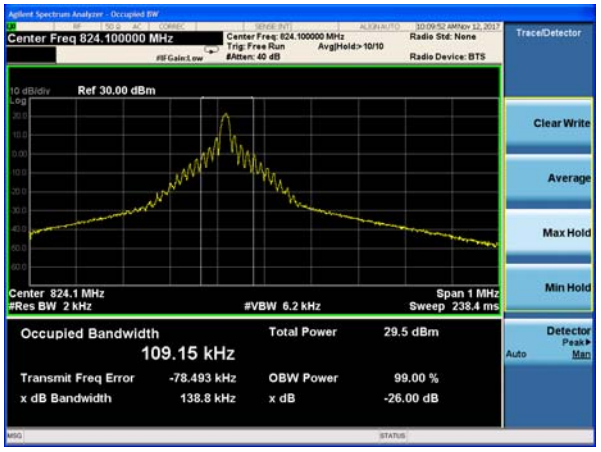
NB-IOT Band 5 BPSK 15kHz 1@0 CH-High



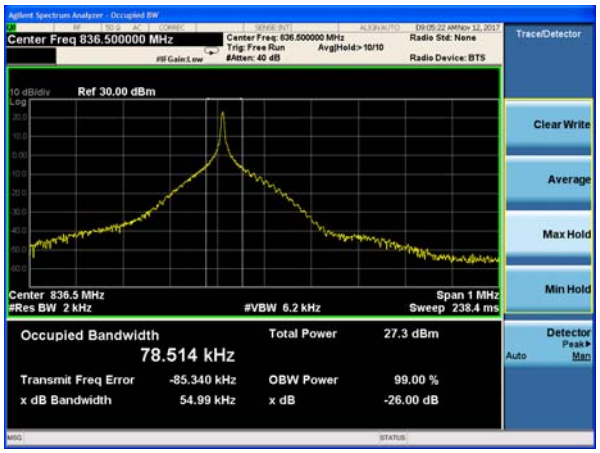
NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-Low



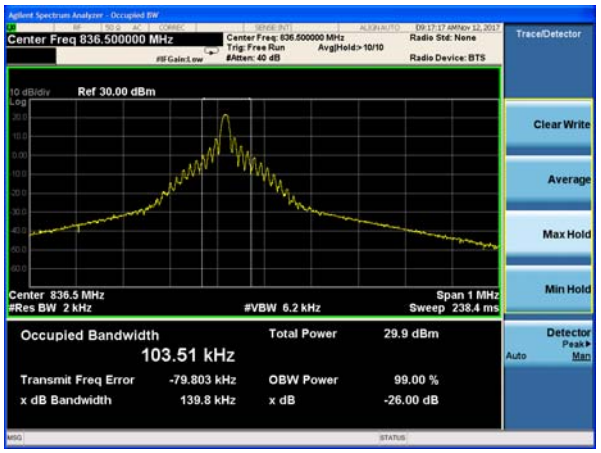
NB-IOT Band 5 QPSK 15kHz 1@0 CH-Low



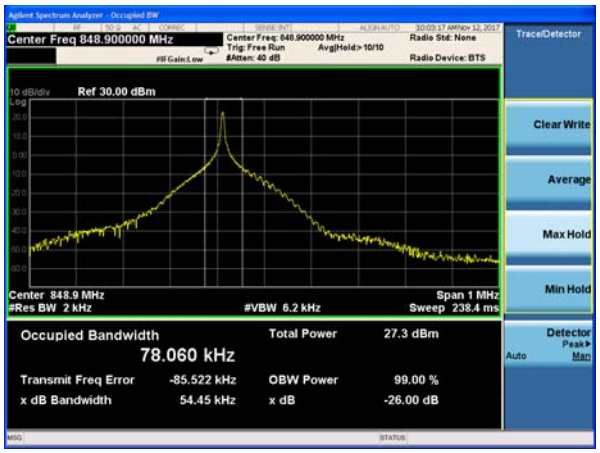
NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-Middle



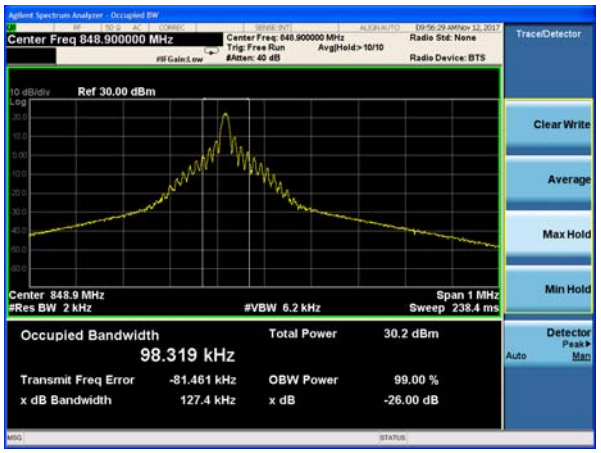
NB-IOT Band 5 QPSK 15kHz 1@0 CH-Middle



NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-High



NB-IOT Band 5 QPSK 15kHz 1@0 CH-High



5.4. Band Edge Compliance

Ambient condition

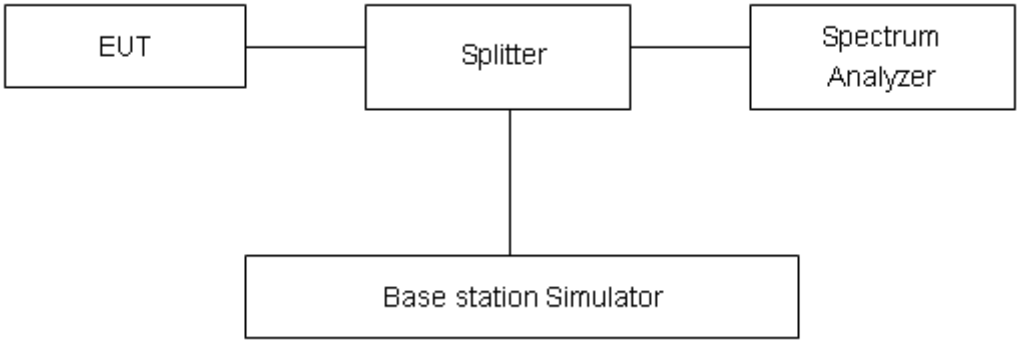
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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.
RBW is set to 51Hz, VBW is set to 160Hz for 3.75KHz single carrier,
RBW is set to 200Hz, VBW is set to 620Hz for 15KHz single carrier,

Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

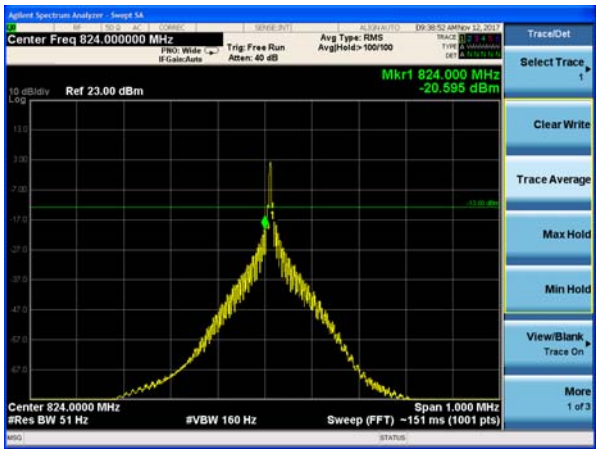
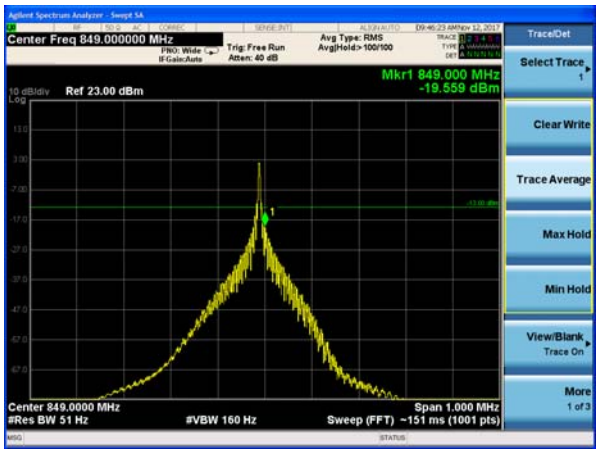
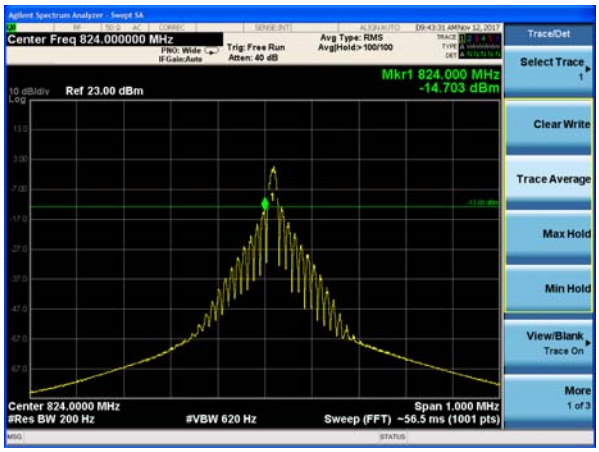
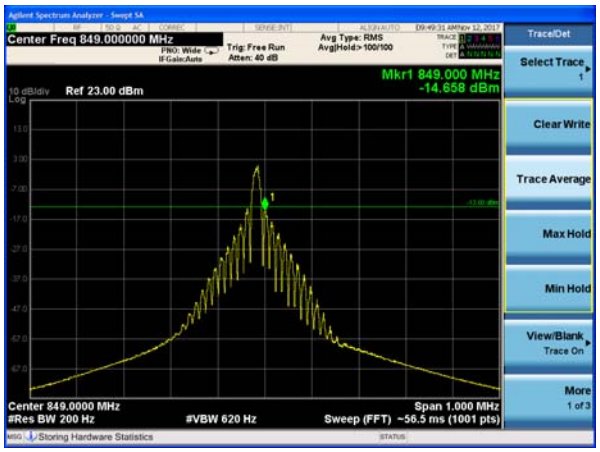
Rule Part 22.917(a) specifies that “The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.”

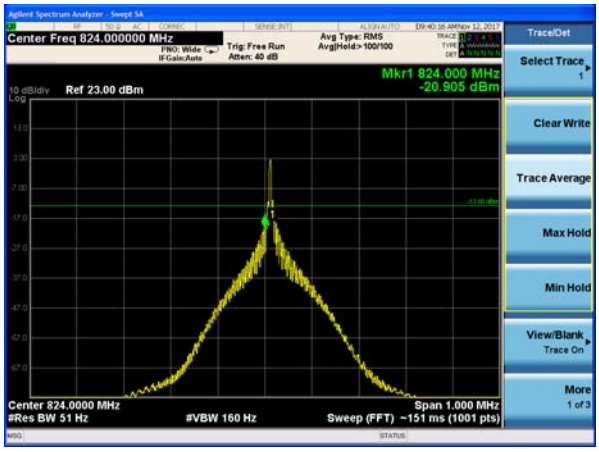
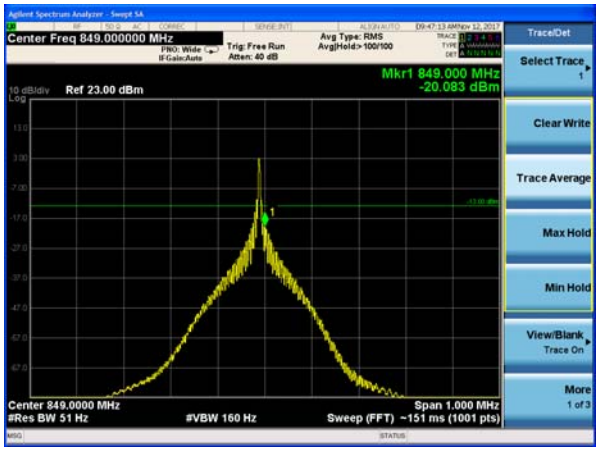
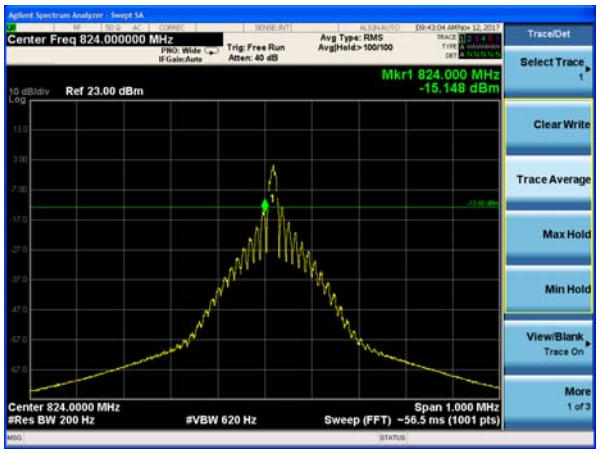
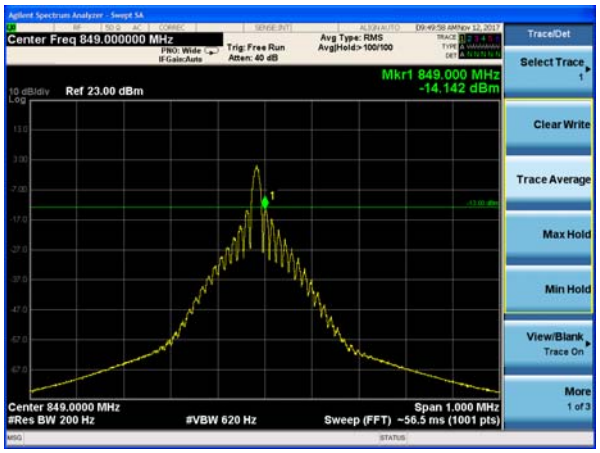
Limit	-13 dBm

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 Result:

NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-Low	NB-IOT Band 5 BPSK 3.75kHz 1@47 CH-High
	
NB-IOT Band 5 BPSK 15kHz 1@0 CH-Low	NB-IOT Band 5 BPSK 15kHz 1@11 CH-High
	

NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-Low	NB-IOT Band 5 QPSK 3.75kHz 1@47 CH-High
	
NB-IOT Band 5 QPSK 15kHz 1@0 CH-Low	NB-IOT Band 5 QPSK 15kHz 1@11 CH-High
	

5.5. Peak-to-Average Power Ratio (PAPR)

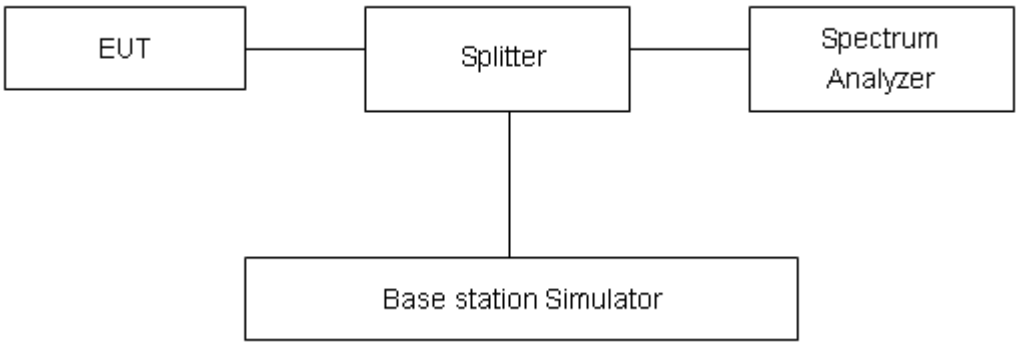
Ambient condition

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

Methods of Measurement

Measure the total peak power and record as P_{Pk}. And measure the total average power and record as P_{Avg}. Both the peak and average power levels must be expressed in the same logarithmic units (*e.g.*, dBm). Determine the PAPR from:
PAPR (dB) = P_{Pk} (dBm) - P_{Avg} (dBm).

Test Setup



Limits

According to the Sec. 22.913(d), The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

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

Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band 5 Standalone	BPSK	3.75	20525/836.5	25.08	22.65	2.43
	QPSK	3.75	20525/836.5	28.12	22.62	5.50
	BPSK	15	20525/836.5	25.28	22.62	2.66
	QPSK	15	20525/836.5	28.22	22.59	5.63

5.6. Frequency Stability

Ambient condition

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

Method of Measurement

1. Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -30°C to +85°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 +85°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements. Frequency Stability (Voltage Variation)

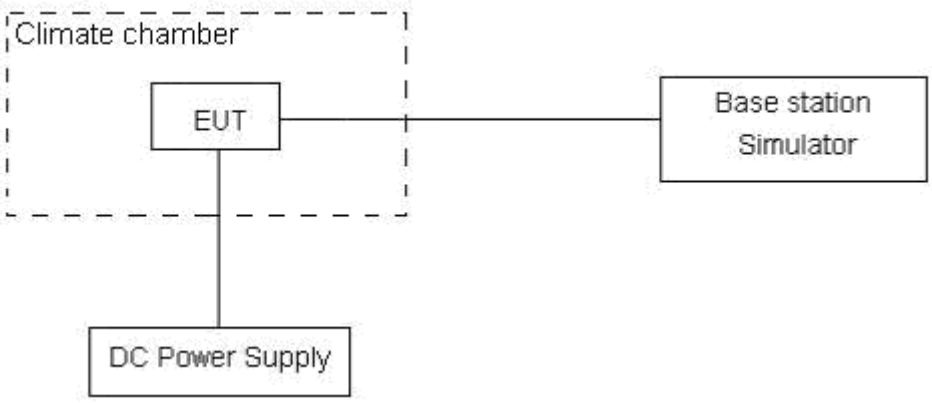
The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage 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 3.1 V and 4.2 V, with a nominal voltage of 3.6V.

Test setup



Limits

According to the Sec. 22.355, the frequency stability of the carrier shall be accurate to within 2.5 ppm of the received frequency for mobile stations.

Limits	≤ 2.5 ppm

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 Result

Mode	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Test status	Frequency Stability (ppm)	
				BPSK	QPSK
Band 5 Standalone	3.75	20525/836.5	-30°C/Normal Voltage	0.04562	0.04138
		20525/836.5	-20°C/Normal Voltage	0.04569	0.04101
		20525/836.5	-10°C/Normal Voltage	0.04531	0.04162
		20525/836.5	0°C/Normal Voltage	0.04695	0.04457
		20525/836.5	10°C/Normal Voltage	0.04301	0.04533
		20525/836.5	20°C/Normal Voltage	0.04493	0.04182
		20525/836.5	30°C/Normal Voltage	0.04415	0.04059
		20525/836.5	40°C/Normal Voltage	0.04392	0.04134
		20525/836.5	50°C/Normal Voltage	0.04656	0.04367
		20525/836.5	60°C/Normal Voltage	0.04488	0.04273
		20525/836.5	70°C/Normal Voltage	0.04385	0.04087
		20525/836.5	80°C/Normal Voltage	0.04342	0.04186
		20525/836.5	85°C/Normal Voltage	0.04482	0.04146
		20525/836.5	20°C/Minimum Voltage	0.04236	0.04034
		20525/836.5	20°C/Maximum Voltage	0.04333	0.04115
	15	20525/836.5	-30°C/Normal Voltage	0.02686	0.02945
		20525/836.5	-20°C/Normal Voltage	0.02709	0.01990
		20525/836.5	-10°C/Normal Voltage	0.03037	0.02995
		20525/836.5	0°C/Normal Voltage	0.03255	0.02056
		20525/836.5	10°C/Normal Voltage	0.02978	0.02010
		20525/836.5	20°C/Normal Voltage	0.03002	0.02850
		20525/836.5	30°C/Normal Voltage	0.03051	0.02098
		20525/836.5	40°C/Normal Voltage	0.03113	0.02711
		20525/836.5	50°C/Normal Voltage	0.03359	0.02613
		20525/836.5	60°C/Normal Voltage	0.02962	0.02770

		20525/836.5	70°C/Normal Voltage	0.03065	0.03048
		20525/836.5	80°C/Normal Voltage	0.02938	0.02862
		20525/836.5	85°C/Normal Voltage	0.03145	0.02634
		20525/836.5	20°C/Minimum Voltage	0.03297	0.02117
		20525/836.5	20°C/Maximum Voltage	0.02927	0.03339

5.7. Spurious Emissions at Antenna Terminals

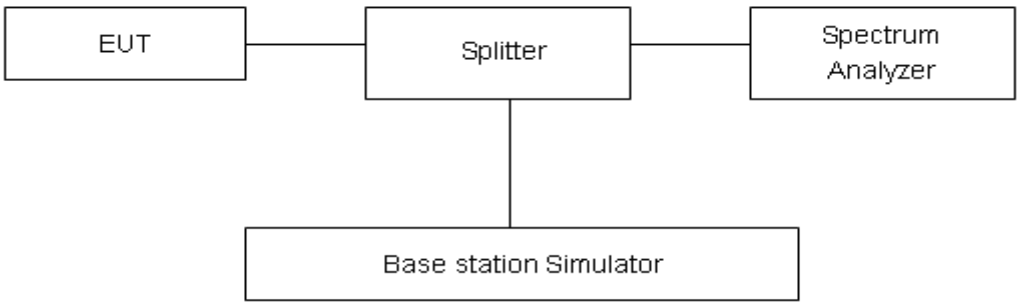
Ambient condition

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 are set to 100 kHz and VBW are set to 300 kHz for below 1G, RBW are set to 1MHz and VBW are set to 3MHz for above 1G, Sweep is set to ATUO.

Test setup



Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm

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
100kHz-2GHz	0.684 dB
2GHz-18GHz	1.407 dB

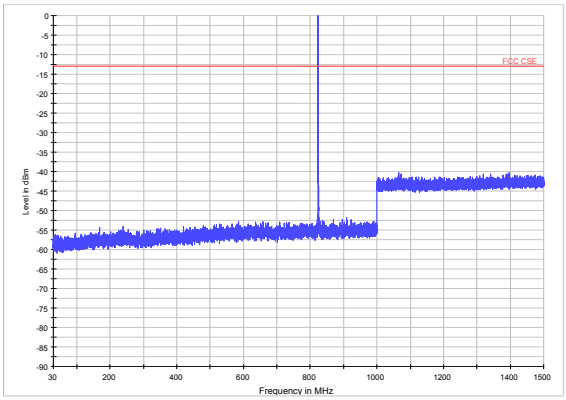
Test Result

Sweep from 9 kHz to 30MHz, and the emissions more than 20 dB below the permissible value are not reported.

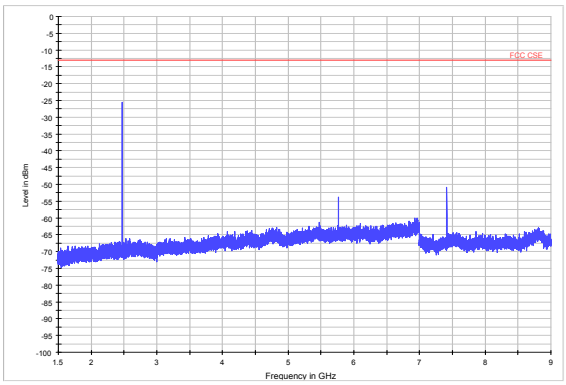
If disturbances were found more than 20dB below limit line, the mark is not required for the EUT.

The signal beyond the limit is carrier.

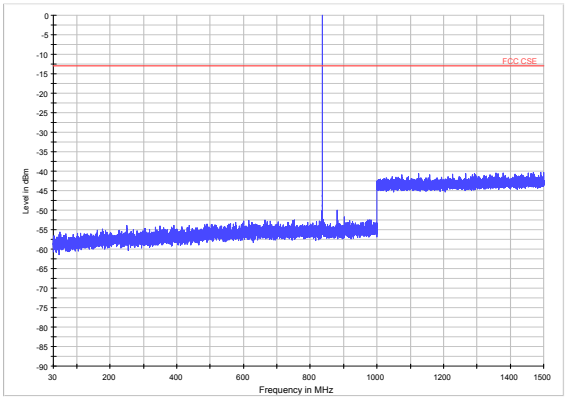
NB-IOT Band 5 CH-Low 30MHz-1.5GHz



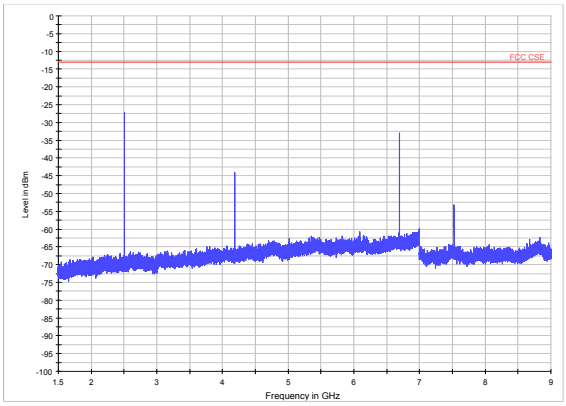
NB-IOT Band 5 CH-Low 1.5GHz-9GHz



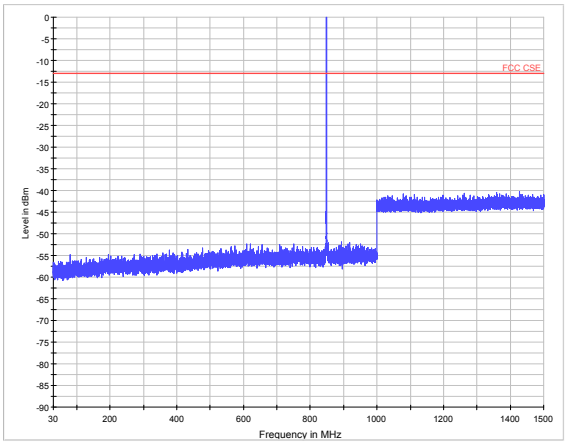
NB-IOT Band 5 CH-Middle 30MHz-1.5GHz



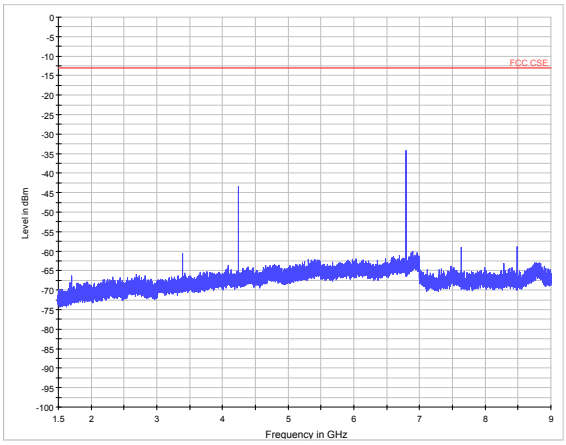
NB-IOT Band 5 CH-Middle 1.5GHz-9GHz



NB-IOT Band 5 CH-High 30MHz-1.5GHz



NB-IOT Band 5 CH-High 1.5GHz-9GHz



If disturbances were found more than 20dB below limit line, the mark is not required for the EUT.

Mode	Frequency	Peak (dBm)	Limit (dBm)	Margin (dB)
CSE_3.75KHZ+BPSK_NB-IOT B5_CHLOW_1.5-9GHz	2472.0	-25.58	-13.00	12.58
CSE_3.75KHZ+BPSK_NB-IOTB5_CHMID_1.5-9GHz	2509.3	-27.33	-13.00	14.33

5.8. Radiates Spurious Emission

Ambient condition

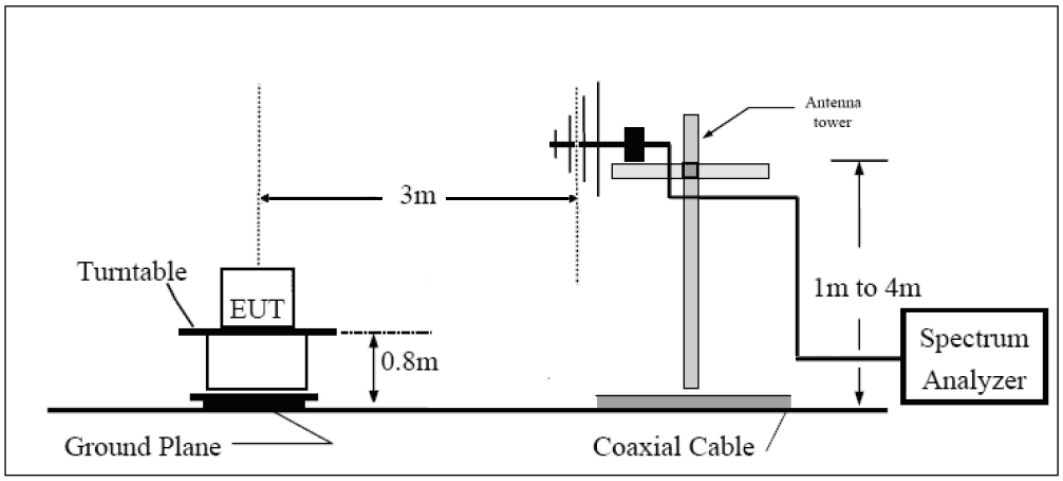
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

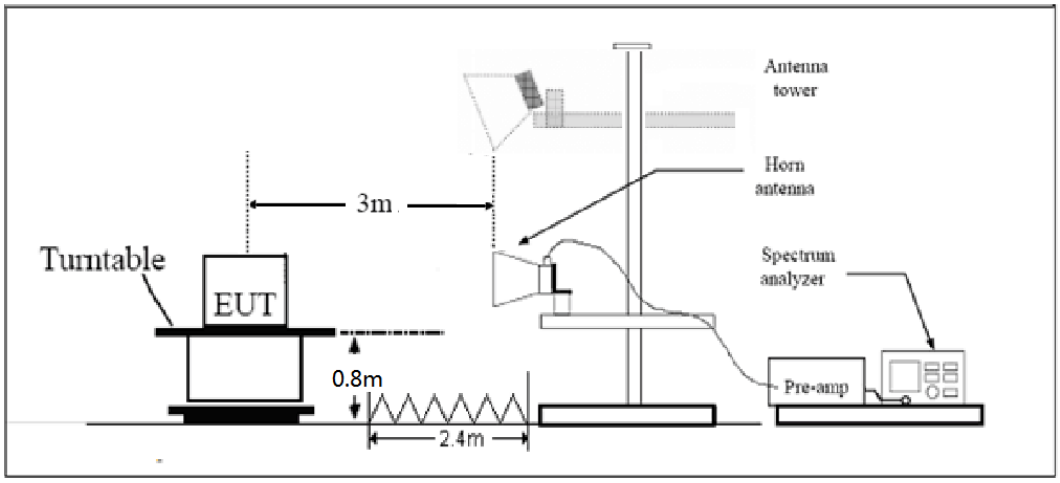
1. The testing follows FCC KDB 971168 v03 Section 5.8 and ANSI/TIA-603-D-2010.
2. The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, 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).
3. A log-periodic antenna or double-ridged waveguide 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 for above 1GHz and RBW=100kHz,VBW=300kHz for 30MHz to 1GHz,, 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 (Pcl) ,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 dBi) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

Test setup

30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm

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 Result

NB-IOT Band 5 3.75KHZ+BPSK _CH_LOW

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1992.00	-53.57	2.00	10.75	Horizontal	-46.97	-13.00	33.97	90
3	2472.4	-30.68	2.51	11.05	Horizontal	-24.29	-13.00	11.29	135
4	3296.4	-55.23	4.20	11.15	Horizontal	-50.43	-13.00	37.43	45
5	4120.5	-49.45	5.20	11.15	Horizontal	-45.65	-13.00	32.65	270
6	4944.6	-50.61	5.50	11.95	Horizontal	-46.31	-13.00	33.31	225
7	5768.7	-50.69	5.70	13.55	Horizontal	-44.99	-13.00	31.99	135
8	6592.8	-49.10	6.30	13.75	Horizontal	-43.80	-13.00	30.80	45
9	7416.9	-44.34	6.80	13.85	Horizontal	-39.44	-13.00	26.44	315
10	8241.0	-45.83	6.90	14.25	Horizontal	-40.63	-13.00	27.63	135
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 Horizontal position.									

NB-IOT Band 5 3.75KHZ+BPSK _ CH_MID

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1672.7	-54.19	2.00	10.75	Horizontal	-47.59	-13.00	34.59	90
3	2509.3	-32.56	2.51	11.05	Horizontal	-26.17	-13.00	13.17	135
4	3346.0	-55.31	4.20	11.15	Horizontal	-50.51	-13.00	37.51	45
5	4182.5	-49.64	5.20	11.15	Horizontal	-45.84	-13.00	32.84	270
6	5019.0	-50.22	5.50	11.95	Horizontal	-45.92	-13.00	32.92	225
7	5855.5	-50.48	5.70	13.55	Horizontal	-44.78	-13.00	31.78	135
8	6692.0	-48.81	6.30	13.75	Horizontal	-43.51	-13.00	30.51	135
9	7528.5	-45.91	6.80	13.85	Horizontal	-41.01	-13.00	28.01	315
10	8365.0	-47.51	6.90	14.25	Horizontal	-42.31	-13.00	29.31	0
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 Horizontal position.									

NB-IOT Band 5 3.75KHZ+BPSK _ CH_HIGH

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1697.4	-51.61	2.00	10.75	Horizontal	-45.01	-13.00	32.01	90
3	2546.5	-33.58	2.51	11.05	Horizontal	-27.19	-13.00	14.19	135
4	3395.6	-55.69	4.20	11.15	Horizontal	-50.89	-13.00	37.89	45
5	4244.5	-52.62	5.20	11.15	Horizontal	-48.82	-13.00	35.82	270
6	5093.4	-49.10	5.50	11.95	Horizontal	-44.80	-13.00	31.80	225
7	5942.3	-51.16	5.70	13.55	Horizontal	-45.46	-13.00	32.46	135
8	6791.2	-49.07	6.30	13.75	Horizontal	-43.77	-13.00	30.77	225
9	7640.1	-46.51	6.80	13.85	Horizontal	-41.61	-13.00	28.61	315
10	8489.0	-47.06	6.90	14.25	Horizontal	-41.86	-13.00	28.86	270
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 Horizontal position.									

6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Wireless Test Set	StarPoint	SP8315	SP8315-1202	2017-05-08	2018-05-07
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	2017-05-14	2018-05-13
Spectrum Analyzer	Agilent	N9010A	MY47191109	2017-05-20	2018-05-19
Signal Analyzer	R&S	FSV30	100815	2016-12-16	2017-12-15
EMI Test Receiver	R&S	ESCI	100948	2017-05-20	2018-05-19
Signal generator	R&S	SMB 100A	102594	2017-05-14	2018-05-13
Signal generator	R&S	SMR27	100365	2017-05-14	2018-05-13
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2014-12-06	2017-12-05
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2020-11-17
Horn Antenna	R&S	HF907	100126	2014-12-06	2019-12-05
Horn Antenna	ETS-Lindgren	3160-09	00102644	2015-01-30	2018-01-29
Climatic Chamber	Re Ce	PT-30B	20101891	2015-07-18	2018-07-17
RF Cable	Agilent	SMA 15cm	0001	2017-08-04	2018-02-03
Preampflier	R&S	SCU18	102327	2017-06-18	2018-06-17
Software	R&S	EMC32	V 8.52.0	NA	NA

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