RF TEST REPORT

Applicant	ZTE Corporation
FCC ID	SRQ-ZM8300G
Product	NB-IoT/eMTC Module
Model	ZM8300G
Report No.	R1801A0028-R1
Issue Date	January 19, 2017

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2017)/ FCC CFR47 Part 27C (2017)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Jiangpeng Lan	*Approved by: Kai Xu*

TA Technology (Shanghai) Co., Ltd.

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

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

Table of Contents

Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	RF power output	2.1046	PASS
2	Effective Isotropic Radiated power	27.50(d)(4)/27.50(b)(10) /27.50(c)(10)	PASS
3	Occupied Bandwidth	2.1049	PASS
4	Band Edge Compliance	27.53(h)/27.53(g)/ 27.53 (c)	PASS
5	Peak-to-Average Power Ratio	27.50(d)/KDB971168 D01(5.7)	PASS
6	Frequency Stability	2.1055 /27.54	PASS
7	Spurious Emissions at Antenna Terminals	2.1051 /27.53(h)/ 27.53(g) /27.53(f)	PASS
8	Radiates Spurious Emission	2.1053 /27.53(h)/ 27.53(g) /27.53(f)	PASS
Date of Testing: October 13, 2017~ October 30, 2017 and January 14, 2018~ January 18, 2018			
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. This report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

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 Shanghai, China
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Xu Kai
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	ZTE Corporation
Applicant address	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P.R.China
Manufacturer	ZTE Corporation
Manufacturer address	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P.R.China

General information

EUT Description			
Model:	ZM8300G		
IMEI:	865199030108496		
Hardware Version:	ek8A		
Software Version:	EN_ZTE_ZM8300GV1.0.0B01		
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 4, NB-IOT Band 12, NB-IOT Band 13;		
Test Modulation:	BPSK, QPSK		
Category	NB1		
Deployment:	Standalone, in-band, guard-band		
Sub-carrier spacing:	3.75KHz, 15KHz		
Ntones:	single, multi-tone		
Maximum E.R.P./ E.I.R.P.	NB-IOT Band 4:	22.69dBm	
	NB-IOT Band 12:	23.51dBm	
	NB-IOT Band 13:	23.54dBm	
Rated Power Supply Voltage:	3.6V		
Extreme Voltage:	Minimum: 3.0V Maximum: 4.2V		
Extreme Temperature:	Lowest: -40°C Highest: +85°C		
Operating Frequency Range(s)	Mode	Tx (MHz)	Rx (MHz)
	NB-IOT Band 4	1710 ~ 1755	2110 ~ 2155
	NB-IOT Band 12	699 ~ 716	729 ~ 746
	NB-IOT Band 13	777 ~ 787	746 ~ 756
Note：1. The information of the EUT is declared by the manufacturer.			

ZM8300G (R1801A0028-R1) is a variant model of ZM8300G (RXA1709-0333RF03R1). This report only increases NB-IOT Band 4. The detailed product change description please refers to the ANNEX B.

3 Applied Standards

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

Test standards

FCC CFR47 Part 2 (2017)

FCC CFR47 Part 27C (2017)

ANSI/TIA-603-E (2016)

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 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.

Test modes are chosen to be reported as the worst case configuration below for NB-IOT Band 4/12/13:

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 B4	O	O	O	O	O	O	O	O
	NB-IOT B12	O	O	O	O	O	O	O	O
	NB-IOT B13	O	O	O	O	O	O	O	O
Effective Isotropic Radiated power	NB-IOT B4	O	O	O	O	O	O	O	O
	NB-IOT B12	O	O	O	O	O	O	O	O
	NB-IOT B13	O	O	O	O	O	O	O	O
Occupied Bandwidth	NB-IOT B4	O	O	O	O	O	O	O	O
	NB-IOT B12	O	O	O	O	O	O	O	O
	NB-IOT B13	O	O	O	O	O	O	O	O
Band Edge Compliance	NB-IOT B4	O	O	O	O	O	O	-	O
	NB-IOT B12	O	O	O	O	O	O	-	O
	NB-IOT B13	O	O	O	O	O	O	-	O
Peak-to-Average Power Ratio	NB-IOT B4	O	O	O	O	O	-	O	-
	NB-IOT B12	O	O	O	O	O	-	O	-
	NB-IOT B13	O	O	O	O	O	-	O	-
Frequency Stability	NB-IOT B4	O	O	O	O	O	-	O	-
	NB-IOT B12	O	O	O	O	O	-	O	-
	NB-IOT B13	O	O	O	O	O	-	O	-
Spurious Emissions at Antenna Terminals	NB-IOT B4	O	-	O	-	O	O	O	O
	NB-IOT B12	O	-	O	-	O	O	O	O
	NB-IOT B13	O	-	O	-	O	O	O	O
Radiates Spurious Emission	NB-IOT B4	O	-	O	-	O	O	O	O
	NB-IOT B12	O	-	O	-	O	O	O	O
	NB-IOT B13	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 Information

5.1 RF Power Output

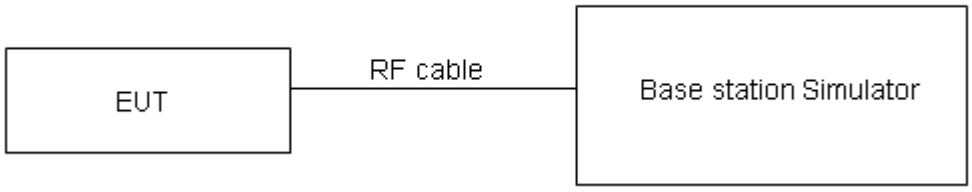
Ambient condition

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		
				19951/1710.1	20175/1732.5	20399/1754.9
Band 4 Standalone	BPSK	3.75	1@0	22.65	22.68	22.86
			1@47	22.62	22.64	22.88
		15	1@0	22.59	22.70	22.80
			1@11	22.67	22.74	22.82
	QPSK	3.75	1@0	22.63	22.73	22.84
			1@47	22.66	22.71	22.81
		15	1@0	22.61	22.78	22.88
			1@11	22.65	22.75	22.85
		15	12@0	20.84	21.06	21.19

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Conducted Power (dBm) for Low/mid/high channel		
				23011/699.1	23095/707.5	23179/715.9
Band 12 Standalone	BPSK	3.75	1@0	23.80	23.60	23.66
			1@47	23.65	23.55	23.62
		15	1@0	23.94	23.85	23.92
			1@11	23.91	23.81	23.95
	QPSK	3.75	1@0	23.75	23.58	23.71
			1@47	23.68	23.59	23.70
		15	1@0	23.94	23.84	23.93
			1@11	23.97	23.88	23.97
		15	12@0	22.10	22.09	22.19

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Conducted Power (dBm) for low/mid/high channel		
				23181/777.1	23230/782	23279/786.9
Band 13 Standalone	BPSK	3.75	1@0	23.54	23.53	23.55
			1@47	23.50	23.49	23.48
		15	1@0	23.98	23.99	23.87
			1@11	23.96	23.95	23.82
	QPSK	3.75	1@0	23.55	23.53	23.50
			1@47	23.53	23.52	23.46
		15	1@0	23.96	23.98	23.89
			1@11	23.95	23.94	23.88
		15	12@0	22.31	22.30	22.16

5.2 Effective Isotropic Radiated Power

Ambient condition

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

Methods of Measurement

1. The testing follows FCC KDB 971168 v03 Section 5.8 and ANSI/TIA-603-E (2016).

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.

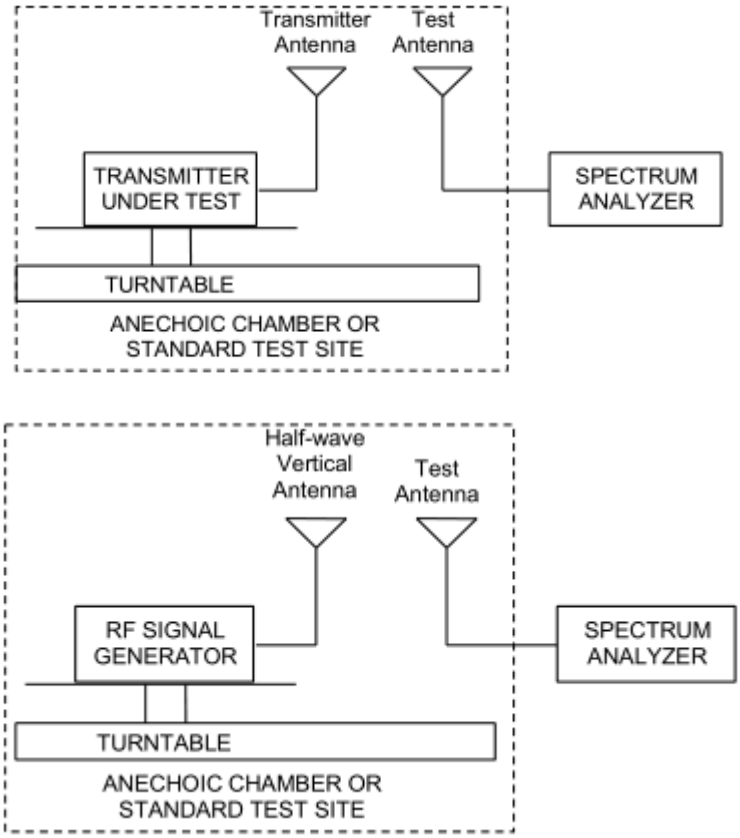
g) When calculating ERP, in addition to knowing the antenna radiation and matching characteristics, it is necessary to know the loss values of all elements (e.g.transmission line attenuation, mismatches, filters, combiners) interposed between the point where transmitter output power is measured, and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



Note: Area side:2.4mX3.6m

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

Limits

Rule Part 27.50(b) (10) specifies that “Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP”

Rule Part 27.50(c) (10) specifies that “Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP”

Rule Part 27.50(d) (4) specifies that “Fixed, mobile and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP”

Part 27.50(b)(10)Limit (ERP)	≤ 3 W (34.77 dBm)
Part 27.50(c)(10)Limit (ERP)	≤ 3 W (34.77 dBm)
Part 27.50(d)(4)Limit (EIRP)	≤ 1 W (30 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.

NB-IOT Band 4									
Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	Output power (dBm)	Losses (dBm)	Ant gain (dBi)	EIRP (dBm)
19951	1710.1	BPSK	H	3.75	1@0	-34.82	-55.37	1.92	22.48
		QPSK	H	3.75	1@0	-35.14	-55.37	1.92	22.15
		BPSK	H	15	1@0	-35.15	-55.37	1.92	22.15
		QPSK	H	15	1@0	-35.12	-55.37	1.92	22.17
20175	1732.5	BPSK	H	3.75	1@0	-36.33	-57.08	1.94	22.69
		QPSK	H	3.75	1@0	-36.87	-57.08	1.94	22.15
		BPSK	H	15	1@0	-36.54	-57.08	1.94	22.48
		QPSK	H	15	1@0	-36.33	-57.08	1.94	22.69
20399	1754.9	BPSK	H	3.75	1@0	-38.29	-58.87	1.90	22.48
		QPSK	H	3.75	1@0	-38.09	-58.87	1.90	22.68
		BPSK	H	15	1@0	-38.29	-58.87	1.90	22.48
		QPSK	H	15	1@0	-38.45	-58.87	1.90	22.31

NB-IOT Band 12									
Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	Output power (dBm)	Losses (dBm)	Ant gain (dBi)	ERP (dBm)
23011	699.1	BPSK	H	3.75	1@0	-27.41	-47.92	2.06	22.57
		QPSK	H	3.75	1@0	-27.37	-47.92	2.06	22.61
		BPSK	H	15	1@0	-26.40	-47.85	2.06	23.51
		QPSK	H	15	1@0	-26.56	-47.85	2.06	23.35
23095	707.5	BPSK	H	3.75	1@0	-28.14	-48.27	2.03	22.16
		QPSK	H	3.75	1@0	-28.04	-48.27	2.03	22.25
		BPSK	H	15	1@0	-27.23	-48.26	2.03	23.06
		QPSK	H	15	1@0	-27.13	-48.26	2.03	23.16
23179	715.9	BPSK	H	3.75	1@0	-28.35	-48.68	1.96	22.28
		QPSK	H	3.75	1@0	-28.26	-48.68	1.96	22.38
		BPSK	H	15	1@0	-27.44	-48.66	1.96	23.18
		QPSK	H	15	1@0	-27.34	-48.66	1.96	23.29

NB-IOT Band 13									
Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	Output power (dBm)	Losses (dBm)	Ant gain (dBi)	ERP (dBm)
23181	777.1	BPSK	H	3.75	1@0	-29.65	-50.88	1.37	22.60
		QPSK	H	3.75	1@0	-29.61	-50.88	1.37	22.64
		BPSK	H	15	1@0	-29.05	-51.22	1.37	23.54
		QPSK	H	15	1@0	-29.22	-51.22	1.37	23.38
23230	782	BPSK	H	3.75	1@0	-29.82	-50.66	1.34	22.18
		QPSK	H	3.75	1@0	-29.73	-50.66	1.34	22.28
		BPSK	H	15	1@0	-29.15	-50.89	1.34	23.08
		QPSK	H	15	1@0	-29.05	-50.89	1.34	23.19
23279	786.9	BPSK	H	3.75	1@0	-29.27	-50.27	1.31	22.31
		QPSK	H	3.75	1@0	-29.17	-50.27	1.31	22.41
		BPSK	H	15	1@0	-28.55	-50.45	1.31	23.21
		QPSK	H	15	1@0	-28.45	-50.45	1.31	23.32

Note: 1. EIRP= E.R.P+2.15

5.3 Occupied Bandwidth

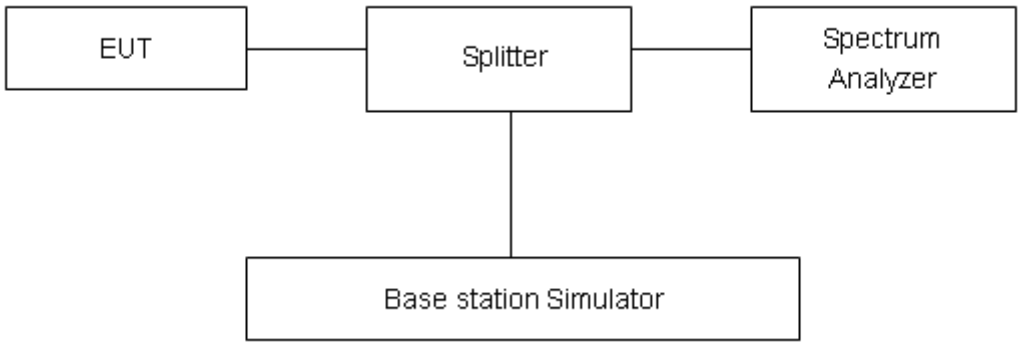
Ambient condition

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 4/12/13.
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.

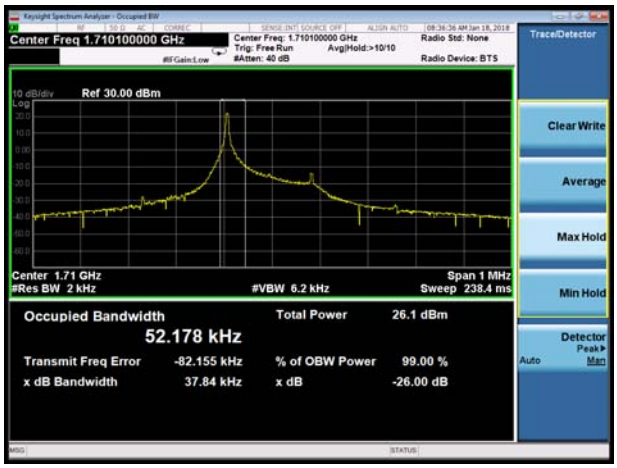
Test Result

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
				19951/1710.1		20175/1732.5		20399/1754.9	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
Band 4 Standalone	BPSK	3.75	1@0	52.178	37.84	51.389	37.84	50.951	37.72
	QPSK	3.75	1@0	58.195	39.04	59.512	39.14	57.878	39.39
	BPSK	15	1@0	129.00	112.2	129.48	101.9	123.63	110.6
	QPSK	15	1@0	120.24	128.5	118.64	118.5	119.91	131.2
	QPSK	15	12@0	183.61	238.2	183.15	238.9	182.42	230.5

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
				23011/699.1		23095/707.5		23179/715.9	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
Band 12 Standalone	BPSK	3.75	1@0	50.088	38.13	46.454	36.33	47.092	37.14
	QPSK	3.75	1@0	57.542	38.97	55.123	39.82	56.826	38.59
	BPSK	15	1@0	128.04	119.4	130.25	105	126.67	104.4
	QPSK	15	1@0	115.93	115.9	119.41	128.2	117.87	118
	QPSK	15	12@0	183.31	238.3	183.79	238	182.91	239.5

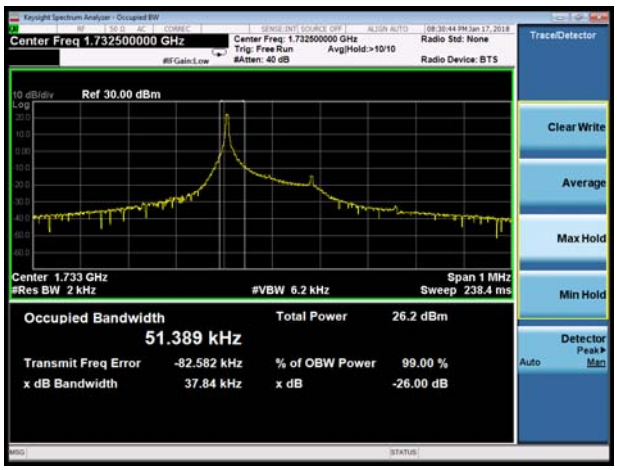
Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
				23181/777.1		23230/782		23279/786.9	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
Band 13 Standalone	BPSK	3.75	1@0	46.734	37.5	48.824	37.75	49.498	38.01
	QPSK	3.75	1@0	58.95	39.63	58.048	42.21	57.558	39.72
	BPSK	15	1@0	130.01	116.9	126.22	112.2	123.14	105.4
	QPSK	15	1@0	117.94	116.9	119.13	117.5	118.91	131.6
	QPSK	15	12@0	183.27	238.7	183.28	239.4	182.66	237.9

NB-IOT Band 4 BPSK 3.75KHz 1@0 CH-Low



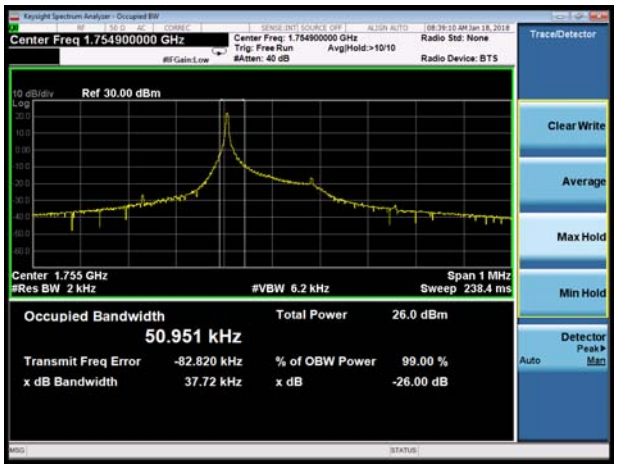
NB-IOT Band 4 BPSK 15KHz 1@0 CH-Low

NB-IOT Band 4 BPSK 3.75KHz 1@0 CH-Middle



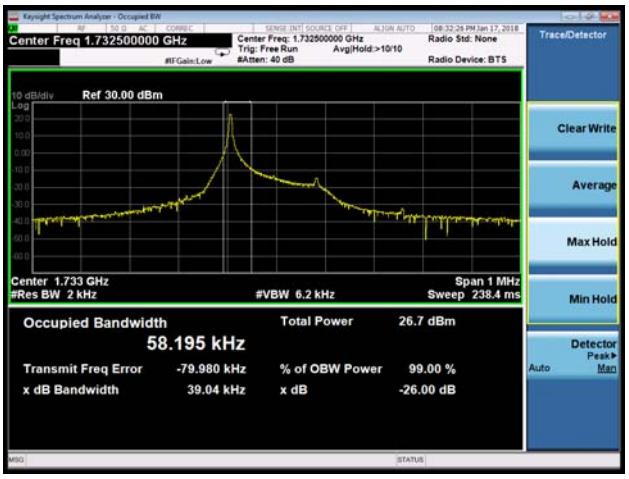
NB-IOT Band 4 BPSK 15KHz 1@0 CH-Middle

NB-IOT Band 4 BPSK 3.75KHz 1@0 CH-High



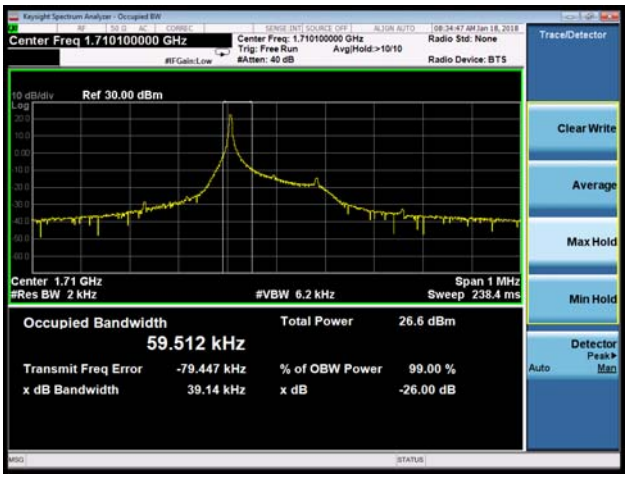
NB-IOT Band 4 BPSK 15KHz 1@0 CH-High

NB-IOT Band 4 QPSK 3.75KMHz 1@0 CH-Low



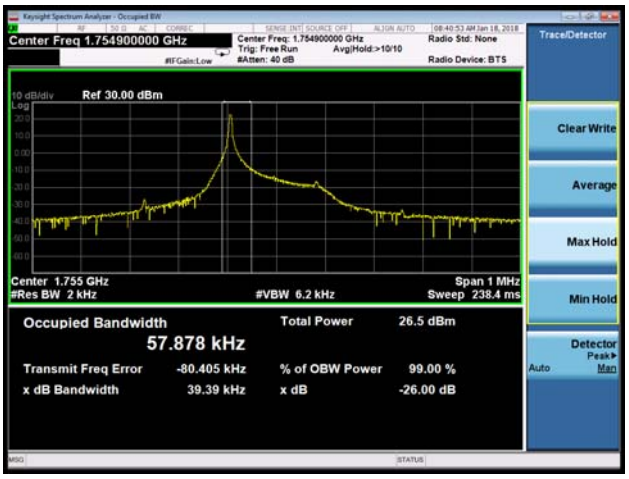
NB-IOT Band 4 QPSK 15KHz 1@0 CH-Low

NB-IOT Band 4 QPSK 3.75KHz 1@0 CH-Middle



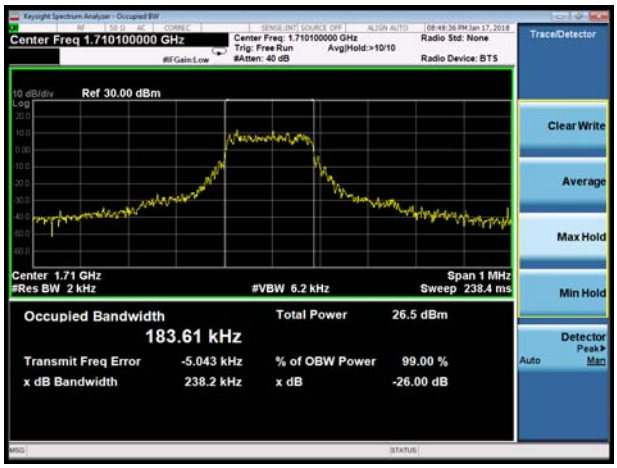
NB-IOT Band 4 QPSK 15KHz 1@0 CH-Middle

NB-IOT Band 4 QPSK 3.75KMHz 1@0 CH-High



NB-IOT Band 4 QPSK 15KHz 1@0 CH-High

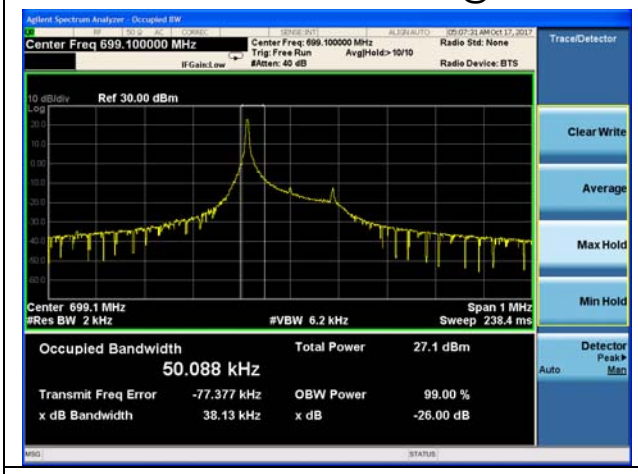
NB-IOT Band 4 QPSK 15KHz 12@0 CH-Low



NB-IOT Band 4 QPSK 15KHz 12@0 CH-Middle

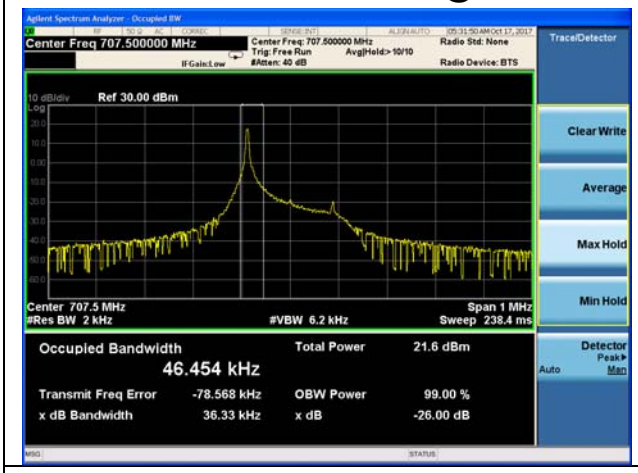
NB-IOT Band 4 QPSK 15KHz 12@0 CH-High

NB-IOT Band 12 BPSK 3.75KHz 1@0 CH-Low



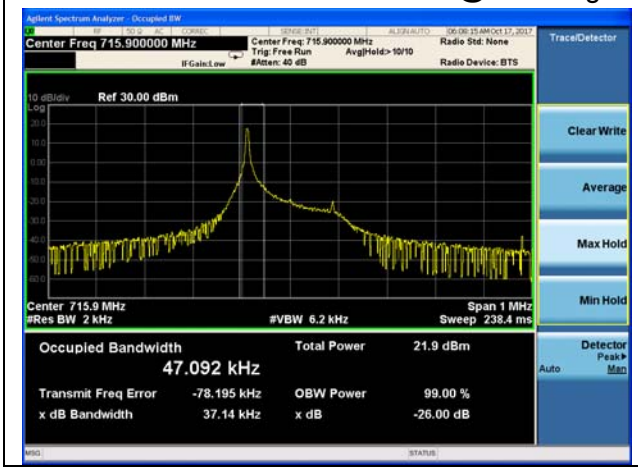
NB-IOT Band 12 BPSK 15KHz 1@0 CH-Low

NB-IOT Band 12 BPSK 3.75KHz 1@0 CH-Middle



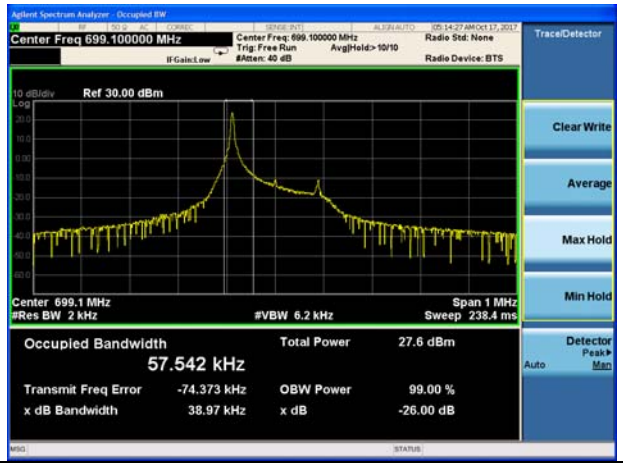
NB-IOT Band 12 BPSK 15KHz 1@0 CH-Middle

NB-IOT Band 12 BPSK 3.75KHz 1@0 CH-High



NB-IOT Band 12 BPSK 15KHz 1@0 CH-High

NB-IOT Band 12 QPSK 3.75KMHz 1@0 CH-Low

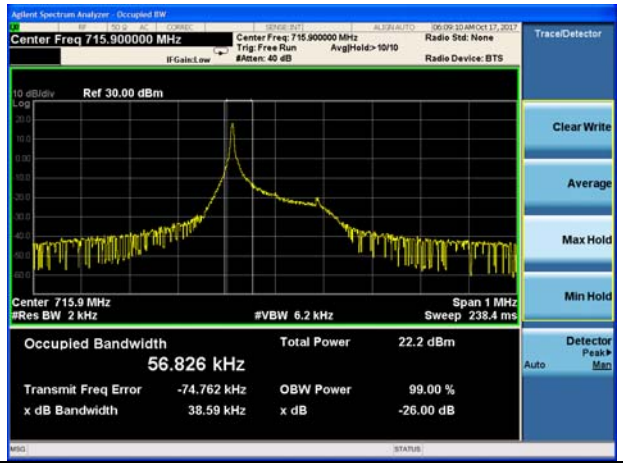


NB-IOT Band 12 QPSK 15KHz 1@0 CH-Low

NB-IOT Band 12 QPSK 3.75KHz 1@0 CH-Middle

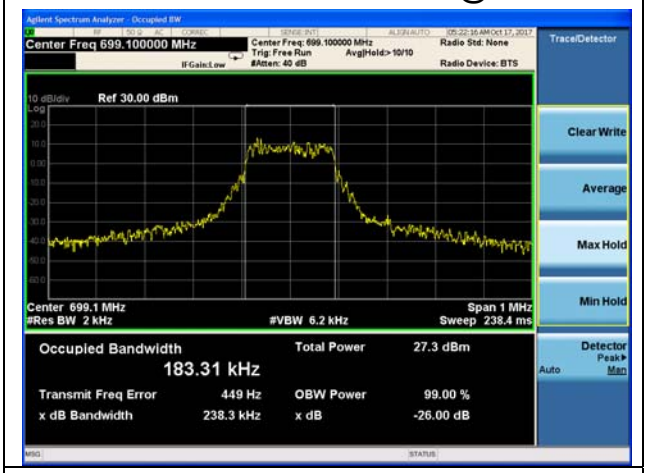
NB-IOT Band 12 QPSK 15KHz 1@0 CH-Middle

NB-IOT Band 12 QPSK 3.75KMHz 1@0 CH-High

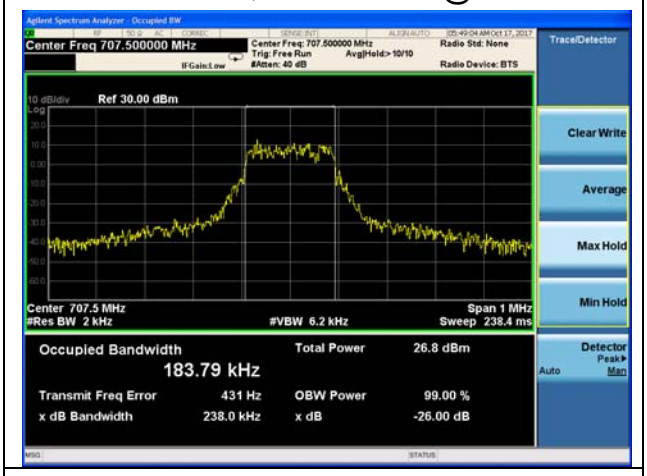


NB-IOT Band 12 QPSK 15KHz 1@0 CH-High

NB-IOT Band 12 QPSK 15KHz 12@0 CH-Low

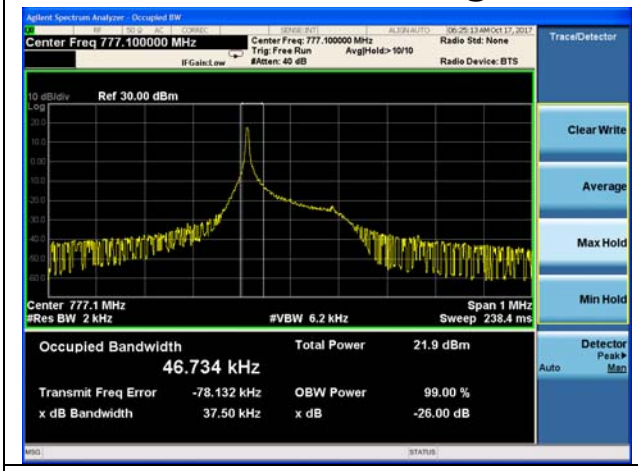


NB-IOT Band 12 QPSK 15KHz 12@0 CH-Middle

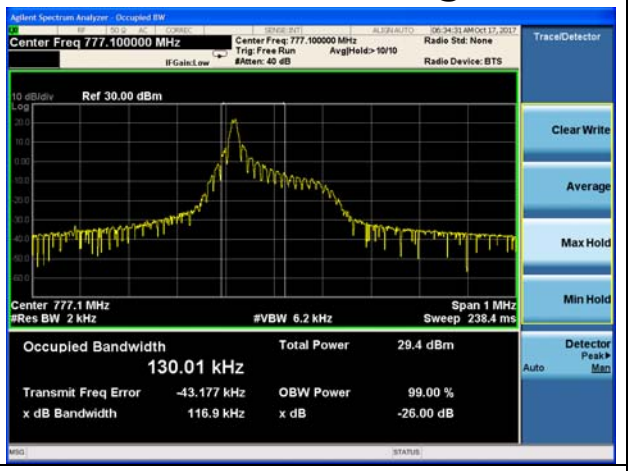


NB-IOT Band 12 QPSK 15KHz 12@0 CH-High

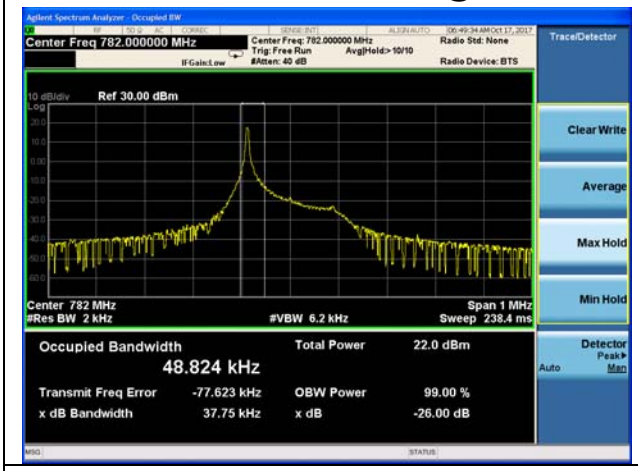
NB-IOT Band 13 BPSK 3.75KHz 1@0 CH-Low



NB-IOT Band 13 BPSK 15KHz 1@0 CH-Low

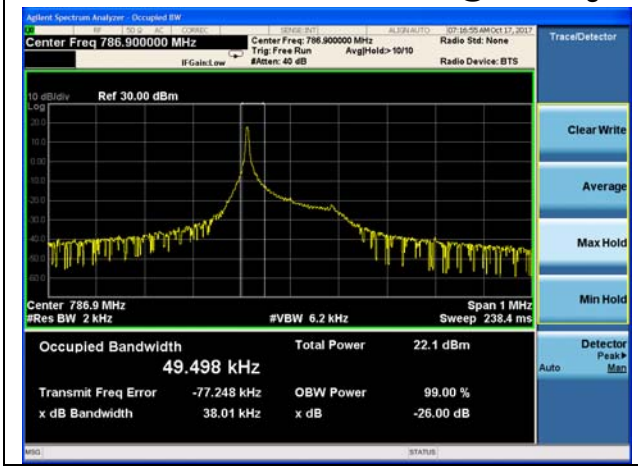


NB-IOT Band 13 BPSK 3.75KHz 1@0 CH-Middle



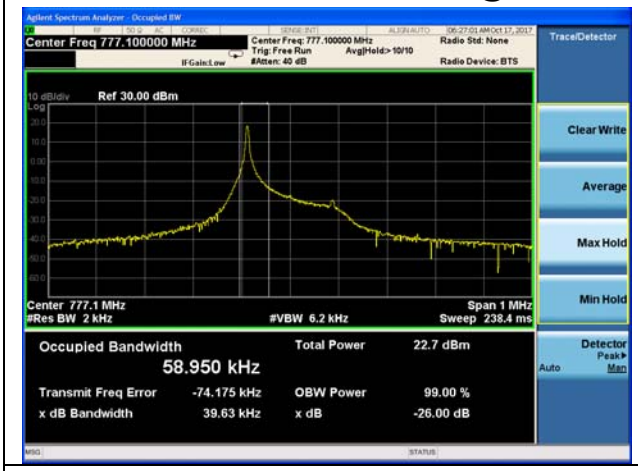
NB-IOT Band 13 BPSK 15KHz 1@0 CH-Middle

NB-IOT Band 13 BPSK 3.75KHz 1@0 CH-High



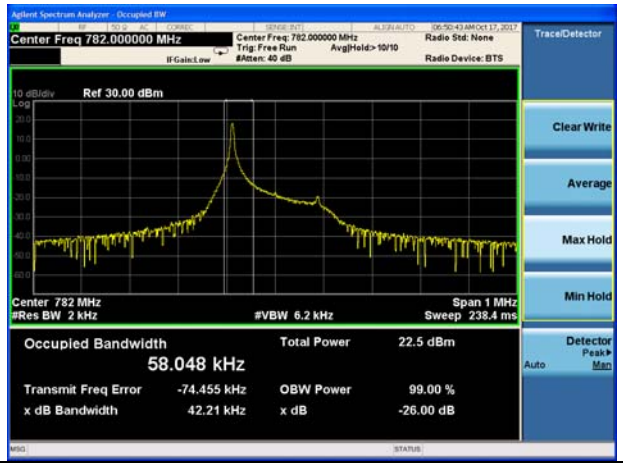
NB-IOT Band 13 BPSK 15KHz 1@0 CH-High

NB-IOT Band 13 QPSK 3.75KHz 1@0 CH-Low



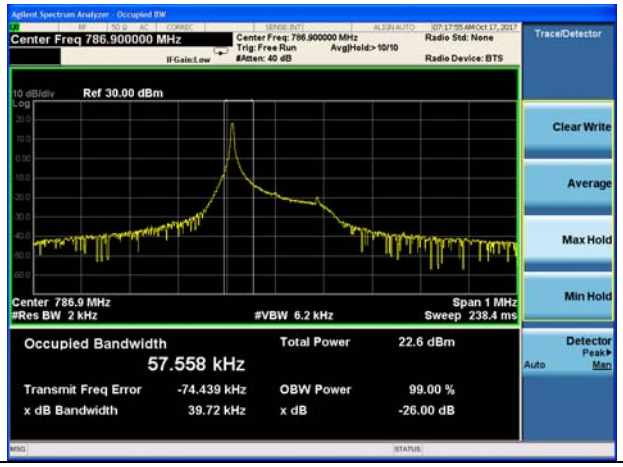
NB-IOT Band 13 QPSK 5MHz 1@0 CH-Low

NB-IOT Band 13 QPSK 3.75KHz 1@0 CH-Middle



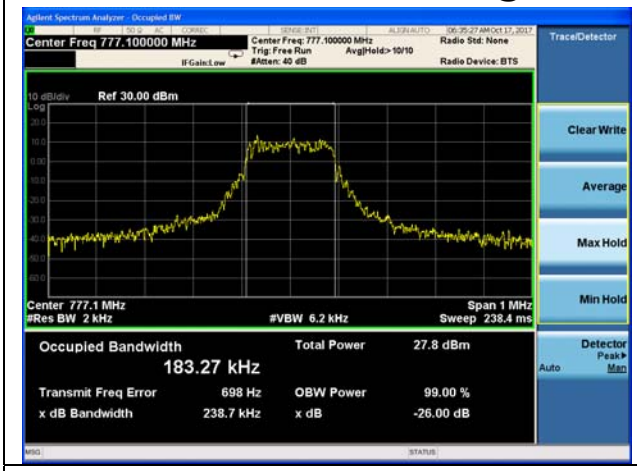
NB-IOT Band 13 QPSK 5MHz 1@0 CH-Middle

NB-IOT Band 13 QPSK 3.75Hz 1@0 CH-High

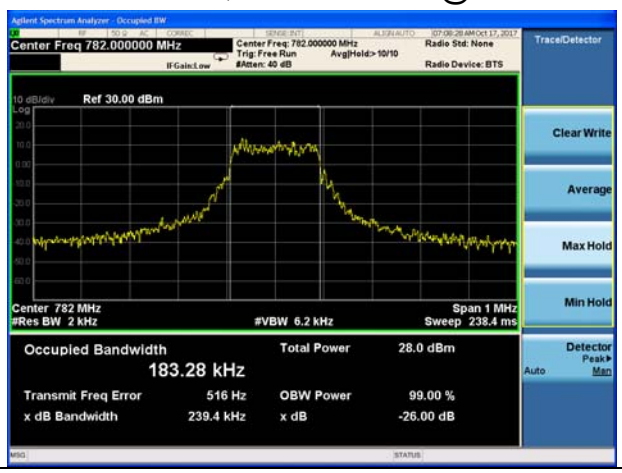


NB-IOT Band 13 QPSK 5MHz 1@0 CH-High

NB-IOT Band 13 QPSK 3.75KHz 12@0 CH-Low



NB-IOT Band 13 QPSK 3.75KHz 12@0 CH-Middle



NB-IOT Band 13 QPSK 3.75KHz 12@0 CH-High

5.4 Band Edge Compliance

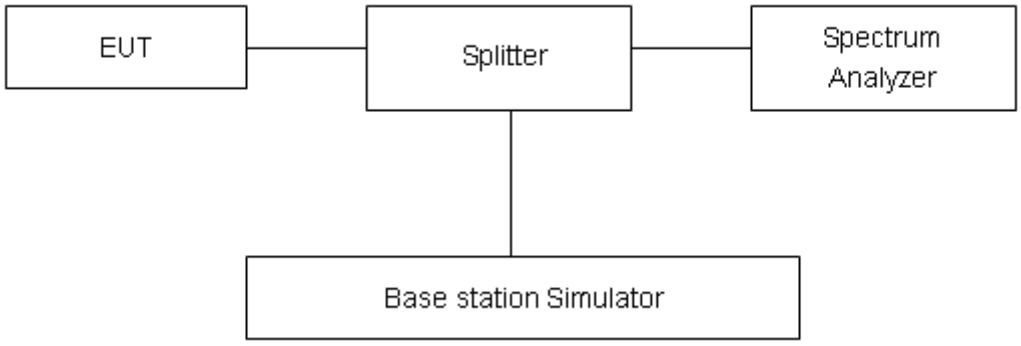
Ambient condition

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 testing follows KDB 971168 v03 Section 6.0
1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The band edges of low and high channels for the highest RF powers were measured.
3. 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,
RBW is set to 2kHz, VBW is set to 6.2KHz for 15KHz full carrier on spectrum analyzer
4. Set spectrum analyzer with RMS detector.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
6. Checked that all the results comply with the emission limit line.

Test Setup



Limits

Rule Part 27.53(h) specifies that " for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) dB"

Part 27.53(g) specifies that " For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log10 (P) dB."

Part 27.53 (c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;
(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;
(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

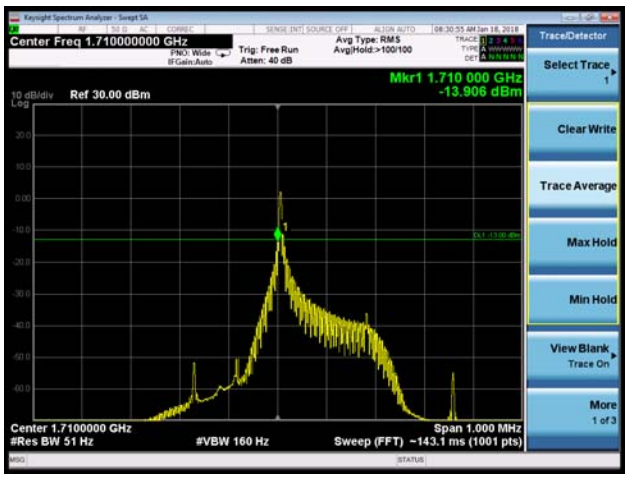
Measurement Uncertainty

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

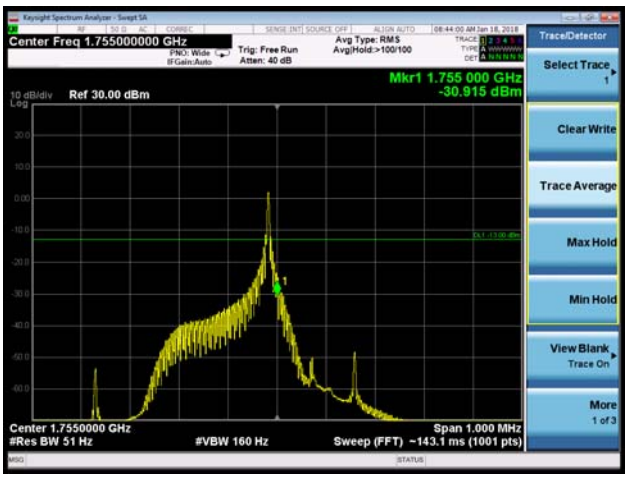
Test Result

All the test traces in the plots shows the test results clearly.

NB-IOT Band 4 BPSK 3.75kHz 1@0 CH-Low



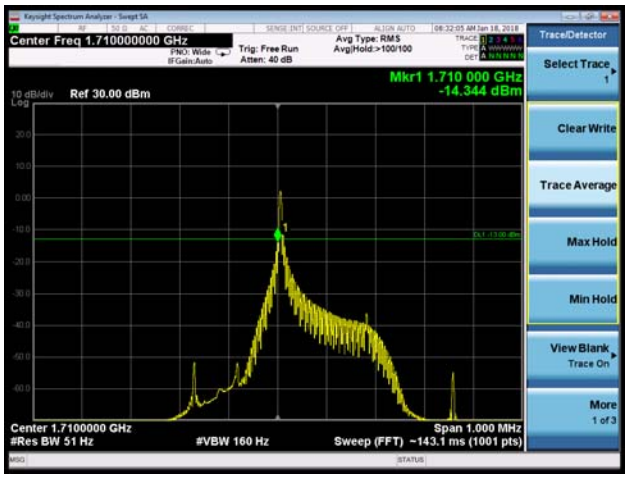
NB-IOT Band 4 BPSK 3.75kHz 1@47 CH-High



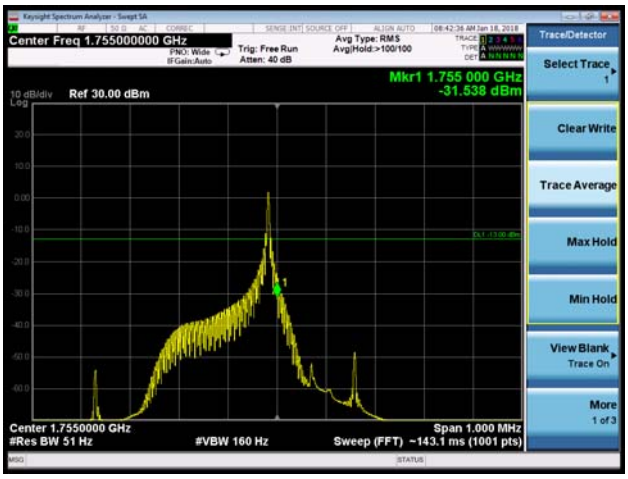
NB-IOT Band 4 BPSK 15kHz 1@0 CH-Low

NB-IOT Band 4 BPSK 15kHz 1@11 CH-High

NB-IOT Band 4 QPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 4 QPSK 3.75K 1@47 CH-High



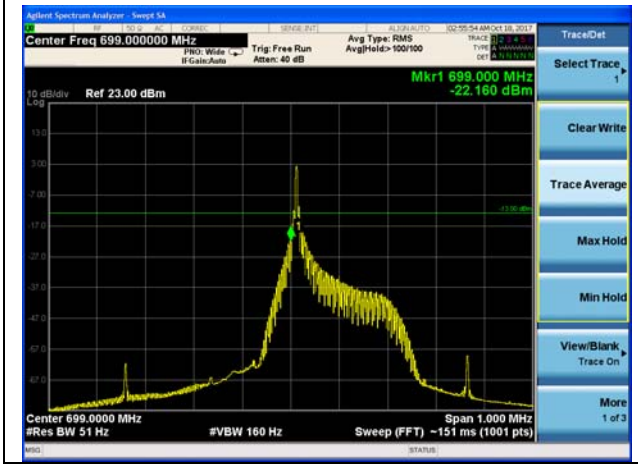
NB-IOT Band 4 QPSK 15kHz 1@0 CH-Low

NB-IOT Band 4 QPSK 15kHz 1@11 CH-High

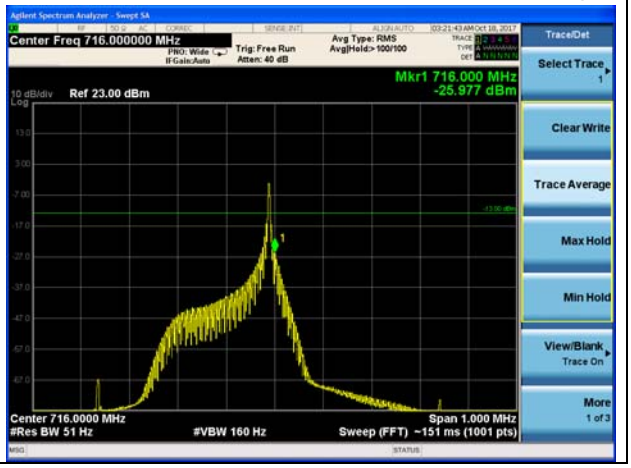
NB-IOT Band 4 QPSK 15kHz 12@0 CH-Low

NB-IOT Band 4 QPSK 15kHz 12@0 CH-High

NB-IOT Band 12 BPSK 3.75kHz 1@0 CH-Low

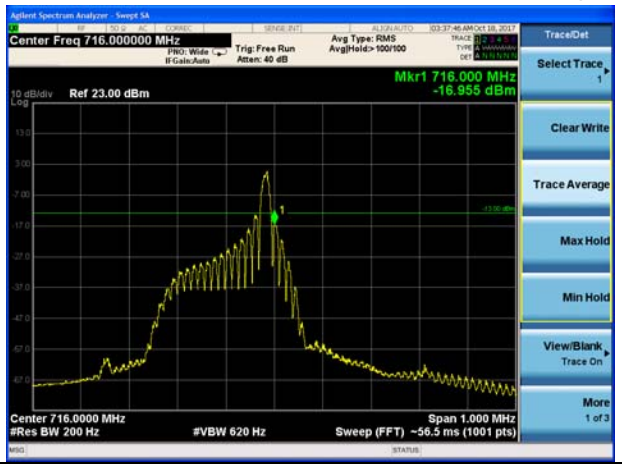


NB-IOT Band 12 BPSK 3.75kHz 1@47 CH-High

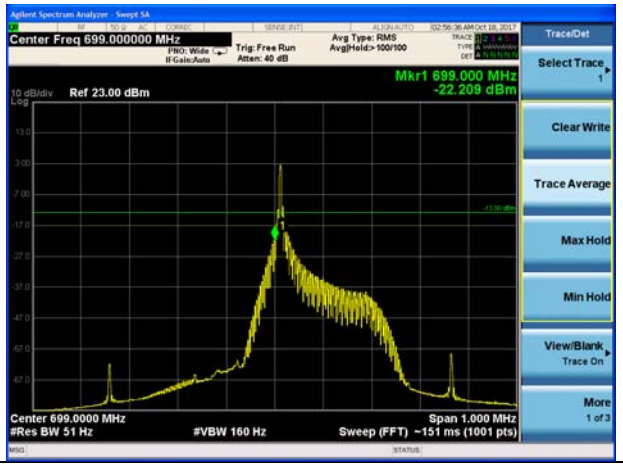


NB-IOT Band 12 BPSK 15kHz 1@0 CH-Low

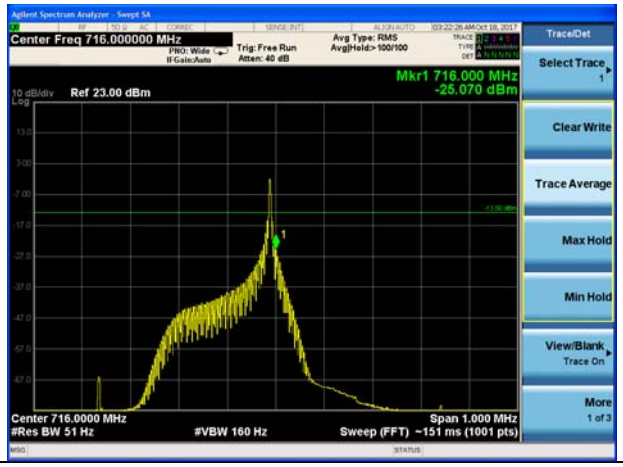
NB-IOT Band 12 BPSK 15kHz 1@11 CH-High



NB-IOT Band 12 QPSK 3.75kHz 1@0 CH-Low

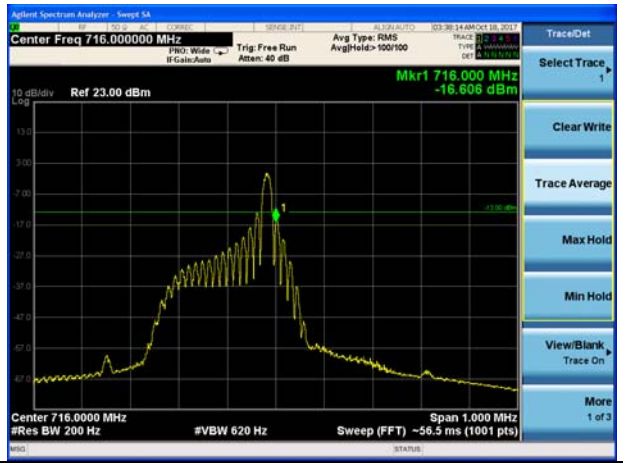


NB-IOT Band 12 QPSK 3.75K 1@47 CH-High



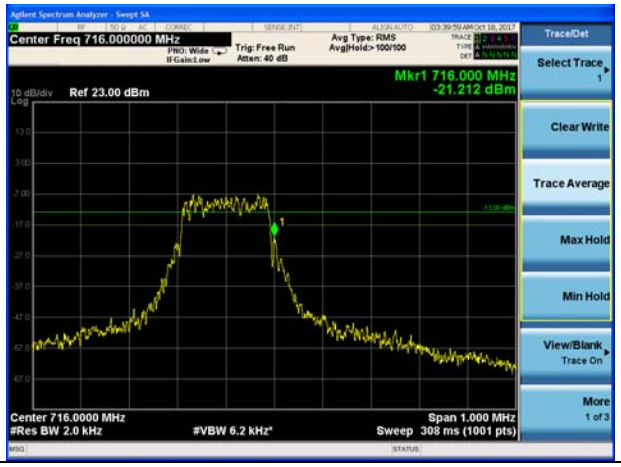
NB-IOT Band 12 QPSK 15kHz 1@0 CH-Low

NB-IOT Band 12 QPSK 15kHz 1@11 CH-High

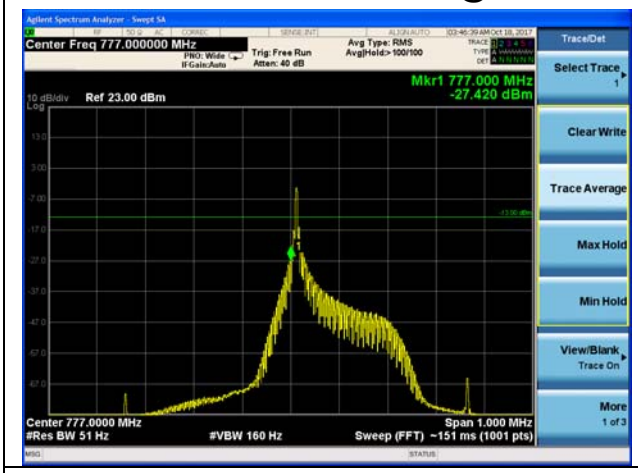


NB-IOT Band 12 QPSK 15kHz 12@0 CH-Low

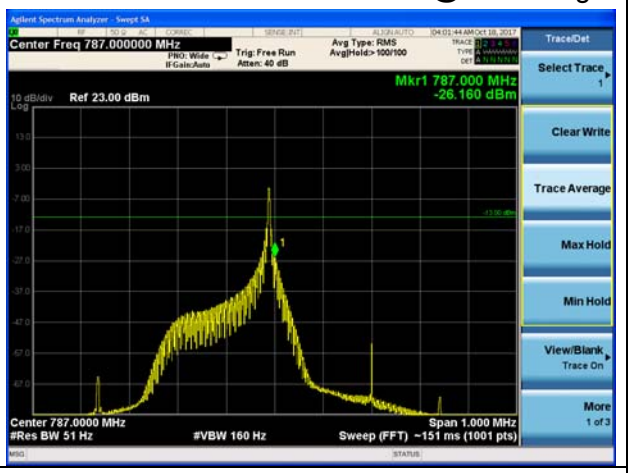
NB-IOT Band 12 QPSK 15kHz 12@0 CH-High



NB-IOT Band 13 BPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 13 BPSK 3.75kHz 1@47 CH-High

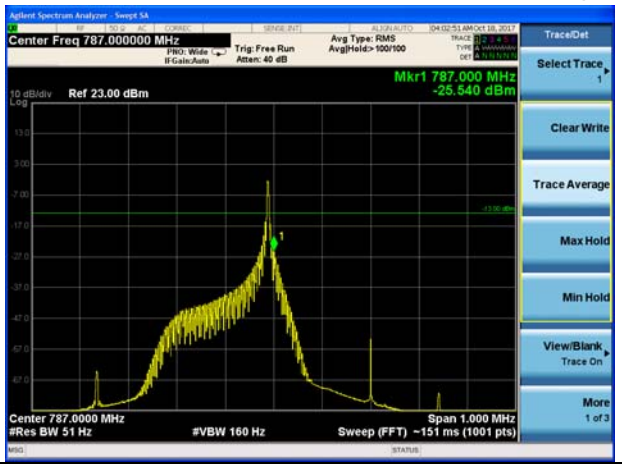


NB-IOT Band 13 BPSK 15kHz 1@0 CH-Low

NB-IOT Band 13 BPSK 15kHz 1@11 CH-High

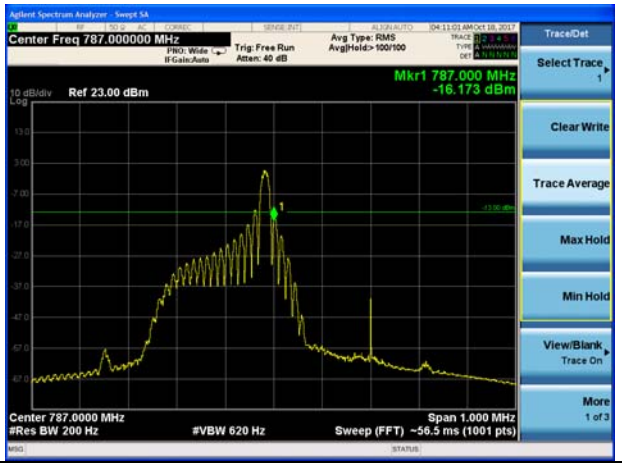
NB-IOT Band 13 QPSK 3.75kHz 1@0 CH-Low

NB-IOT Band 13 QPSK 3.75kHz 1@47 CH-High



NB-IOT Band 13 QPSK 15kHz 1@0 CH-Low

NB-IOT Band 13 QPSK 15kHz 1@11 CH-High



NB-IOT Band 13 QPSK 15kHz 12@0 CH-Low

NB-IOT Band 13 QPSK 15kHz 12@0 CH-High

5.5 Peak-to-Average Power Ratio (PAPR)

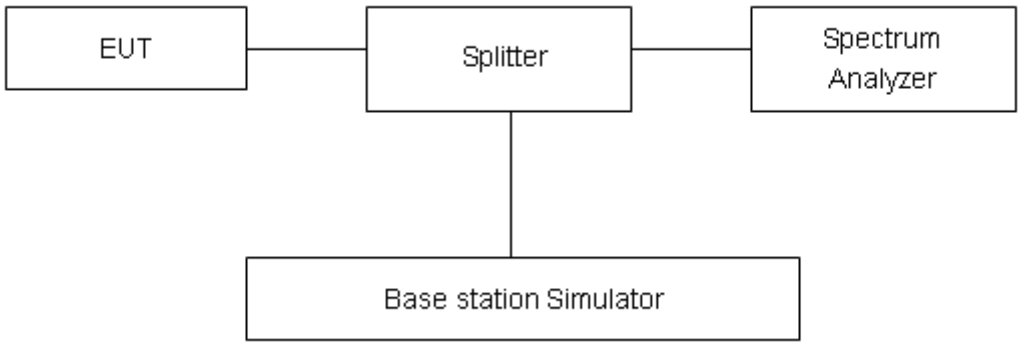
Ambient condition

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

Methods of Measurement

Measure the total peak power and record as 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

Rule Part 27.50(d)(5) Equipment employed must be authorized in accordance with the provisions of 24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. 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.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for thenormal 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 4 Standalone	BPSK	3.75	20175/1732.5	28.71	22.68	6.03
	QPSK	3.75	20175/1732.5	28.21	22.73	5.48
	BPSK	15	20175/1732.5	30.71	22.70	8.01
	QPSK	15	20175/1732.5	30.26	22.78	7.48

Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band 12 Standalone	BPSK	3.75	23095/707.5	27.42	23.60	3.82
	QPSK	3.75	23095/707.5	27.08	23.58	3.50
	BPSK	15	23095/707.5	30.41	23.85	6.56
	QPSK	15	23095/707.5	30.35	23.84	6.51

Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band 13 Standalone	BPSK	3.75	23230/782	27.36	23.53	3.83
	QPSK	3.75	23230/782	27.01	23.53	3.48
	BPSK	15	23230/782	30.45	23.99	6.46
	QPSK	15	23230/782	30.43	23.98	6.45

5.6 Frequency Stability

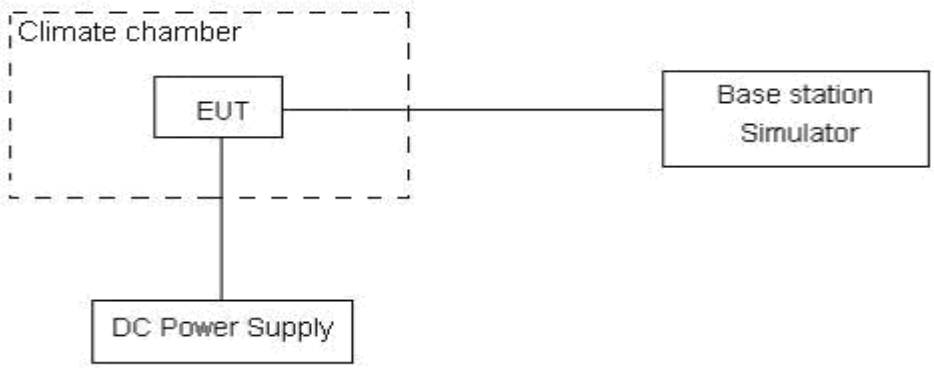
Ambient condition

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 -40°C to +85°C in 10°C step size.
   (1)With all power removed, the temperature was decreased to -10°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 -40°C to +85°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.
2. 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 3.0 V and 4.2 V, with a nominal voltage of 3.6V.

Test setup



Limits

No specific frequency stability requirements in part 27.54

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 4 Standalone	3.75	20175/1732.5	-40°C/Normal Voltage	0.00083	-0.00051
		20175/1732.5	-30°C/Normal Voltage	-0.00109	-0.00175
		20175/1732.5	-20°C/Normal Voltage	-0.00113	0.00020
		20175/1732.5	-10°C/Normal Voltage	-0.00139	-0.00101
		20175/1732.5	0°C/Normal Voltage	0.00025	-0.00265
		20175/1732.5	10°C/Normal Voltage	-0.00020	-0.00043
		20175/1732.5	20°C/Normal Voltage	-0.00044	0.00012
		20175/1732.5	30°C/Normal Voltage	-0.00201	-0.00185
		20175/1732.5	40°C/Normal Voltage	-0.00034	-0.00181
		20175/1732.5	50°C/Normal Voltage	-0.00223	-0.00208
		20175/1732.5	60°C/Normal Voltage	0.00116	0.00186
		20175/1732.5	70°C/Normal Voltage	0.00051	0.00147
		20175/1732.5	80°C/Normal Voltage	-0.00077	0.00103
		20175/1732.5	85°C/Normal Voltage	-0.00223	-0.00208
		20175/1732.5	20°C/Minimum Voltage	-0.00110	-0.00012
		20175/1732.5	20°C/Maximum Voltage	-0.00112	0.00014
	15	20175/1732.5	-40°C/Normal Voltage	-0.00013	-0.00174
		20175/1732.5	-30°C/Normal Voltage	-0.00191	0.00023
		20175/1732.5	-20°C/Normal Voltage	-0.00058	0.00037
		20175/1732.5	-10°C/Normal Voltage	-0.00083	0.00014
		20175/1732.5	0°C/Normal Voltage	-0.00026	-0.00034
		20175/1732.5	10°C/Normal Voltage	-0.00091	0.00018
		20175/1732.5	20°C/Normal Voltage	-0.00055	-0.00044
		20175/1732.5	30°C/Normal Voltage	0.00022	-0.00051
		20175/1732.5	40°C/Normal Voltage	-0.00078	-0.00024
		20175/1732.5	50°C/Normal Voltage	-0.00027	-0.00096
		20175/1732.5	60°C/Normal Voltage	0.00204	0.00144
		20175/1732.5	70°C/Normal Voltage	0.00117	0.00148
		20175/1732.5	80°C/Normal Voltage	0.00115	-0.00057
		20175/1732.5	85°C/Normal Voltage	-0.00027	-0.00096
		20175/1732.5	20°C/Minimum Voltage	-0.00038	0.00062
		20175/1732.5	20°C/Maximum Voltage	0.00149	0.00151

Mode	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Test status	Frequency Stability (ppm)	
				BPSK	QPSK
Band 12 Standalone	3.75	23095/707.5	-40°C/Normal Voltage	-0.00414	-0.00220
		23095/707.5	-30°C/Normal Voltage	-0.00222	-0.00316
		23095/707.5	-20°C/Normal Voltage	-0.00153	0.00090
		23095/707.5	-10°C/Normal Voltage	-0.00166	0.00072
		23095/707.5	0°C/Normal Voltage	-0.00084	-0.00092
		23095/707.5	10°C/Normal Voltage	-0.00393	-0.00410
		23095/707.5	20°C/Normal Voltage	-0.00160	-0.00311
		23095/707.5	30°C/Normal Voltage	0.00052	-0.00348
		23095/707.5	40°C/Normal Voltage	-0.00177	-0.00207
		23095/707.5	50°C/Normal Voltage	-0.00297	-0.00040
		23095/707.5	60°C/Normal Voltage	0.00042	0.00087
		23095/707.5	70°C/Normal Voltage	-0.00206	-0.00292
		23095/707.5	80°C/Normal Voltage	-0.00099	0.00091
		23095/707.5	85°C/Normal Voltage	0.00164	0.00121
		23095/707.5	20°C/Minimum Voltage	-0.00173	-0.00193
		23095/707.5	20°C/Maximum Voltage	-0.00116	-0.00162
	15	23095/707.5	-40°C/Normal Voltage	0.00193	0.00237
		23095/707.5	-30°C/Normal Voltage	0.00078	0.00099
		23095/707.5	-20°C/Normal Voltage	0.00210	0.00101
		23095/707.5	-10°C/Normal Voltage	0.00146	0.00199
		23095/707.5	0°C/Normal Voltage	0.00071	0.00194
		23095/707.5	10°C/Normal Voltage	-0.00149	0.00102
		23095/707.5	20°C/Normal Voltage	0.00106	0.00459
		23095/707.5	30°C/Normal Voltage	0.00132	0.00098
		23095/707.5	40°C/Normal Voltage	0.00218	0.00104
		23095/707.5	50°C/Normal Voltage	0.00025	0.00080
		23095/707.5	60°C/Normal Voltage	-0.00097	0.00039
		23095/707.5	70°C/Normal Voltage	-0.00155	0.00335
		23095/707.5	80°C/Normal Voltage	0.00131	0.00032
		23095/707.5	85°C/Normal Voltage	0.00183	0.00170
		23095/707.5	20°C/Minimum Voltage	0.00213	0.00205
		23095/707.5	20°C/Maximum Voltage	0.00166	0.00101

Mode	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Test status	Frequency Stability (ppm)	
				BPSK	QPSK
Band 13 Standalone	3.75	23230/782	-40°C/Normal Voltage	-0.00221	-0.00189
		23230/782	-30°C/Normal Voltage	-0.00407	0.00072
		23230/782	-20°C/Normal Voltage	-0.00399	0.00137
		23230/782	-10°C/Normal Voltage	-0.00335	0.00060
		23230/782	0°C/Normal Voltage	-0.00356	-0.00123
		23230/782	10°C/Normal Voltage	-0.00349	-0.00575
		23230/782	20°C/Normal Voltage	-0.00349	-0.00265
		23230/782	30°C/Normal Voltage	-0.00299	-0.00232
		23230/782	40°C/Normal Voltage	-0.00377	-0.00360
		23230/782	50°C/Normal Voltage	-0.00166	-0.00136
		23230/782	60°C/Normal Voltage	-0.00306	0.00038
		23230/782	70°C/Normal Voltage	-0.00258	0.00124
		23230/782	80°C/Normal Voltage	-0.00268	0.00104
		23230/782	85°C/Normal Voltage	-0.00139	-0.00037
		23230/782	20°C/Minimum Voltage	-0.00029	-0.00041
		23230/782	20°C/Maximum Voltage	-0.00490	0.00133
	15	23230/782	-40°C/Normal Voltage	0.00030	0.00196
		23230/782	-30°C/Normal Voltage	0.00059	0.00171
		23230/782	-20°C/Normal Voltage	0.00413	-0.00002
		23230/782	-10°C/Normal Voltage	0.00170	0.00219
		23230/782	0°C/Normal Voltage	0.00010	-0.00214
		23230/782	10°C/Normal Voltage	0.00156	-0.00074
		23230/782	20°C/Normal Voltage	-0.00077	-0.00398
		23230/782	30°C/Normal Voltage	0.00045	0.00275
		23230/782	40°C/Normal Voltage	-0.00242	-0.00063
		23230/782	50°C/Normal Voltage	-0.00136	-0.00034
		23230/782	60°C/Normal Voltage	0.00011	0.00028
		23230/782	70°C/Normal Voltage	0.00104	-0.00296
		23230/782	80°C/Normal Voltage	-0.00106	-0.00140
		23230/782	85°C/Normal Voltage	-0.00195	-0.00135
		23230/782	20°C/Minimum Voltage	0.00284	-0.00095
		23230/782	20°C/Maximum Voltage	-0.00143	0.00099

5.7 Spurious Emissions at Antenna Terminals

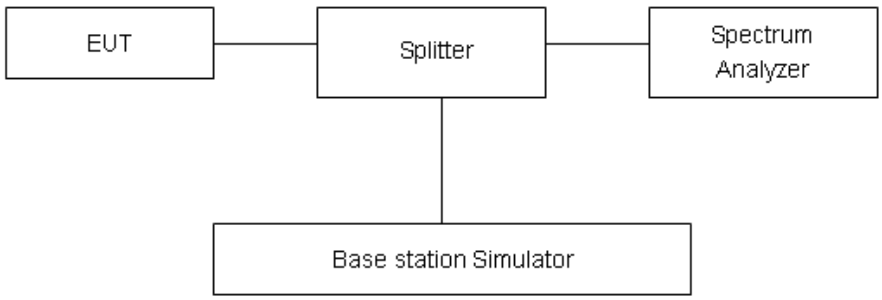
Ambient condition

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 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW 1MHz and VBW3MHz， Sweep is set to ATUO.
Of those disturbances below (limit – 20 dB), the mark is not required for the EUT.

Test setup



Limits

Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB..”

Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

NB-IOT B12/B4 Limit

Limit	-13 dBm

NB-IOT B13 Limit

Limit out of the band 1559-1610 MHz	-13 dBm
Limit in the band 1559-1610 MHz	-40 dBm

Measurement Uncertainty

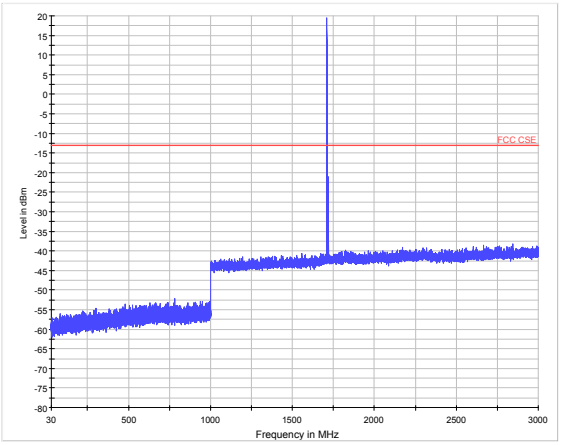
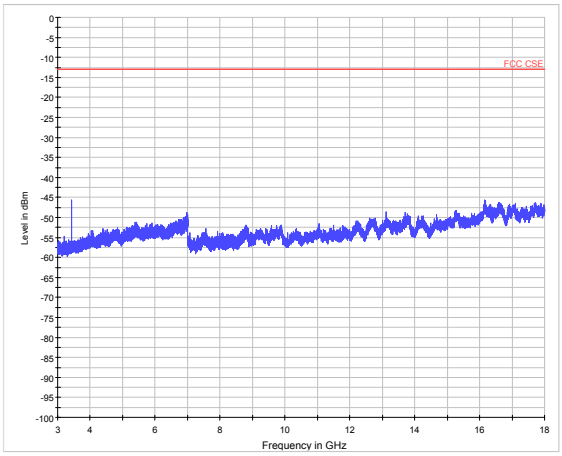
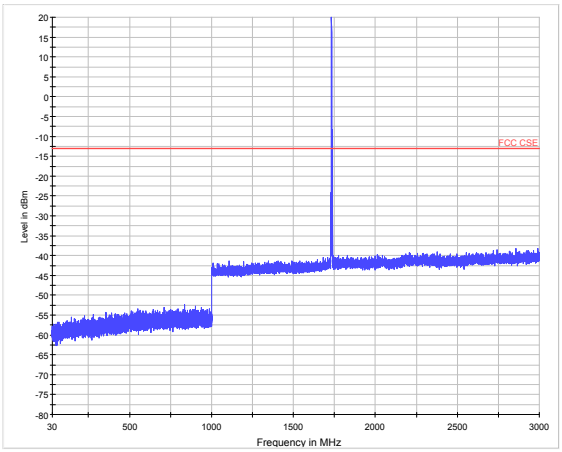
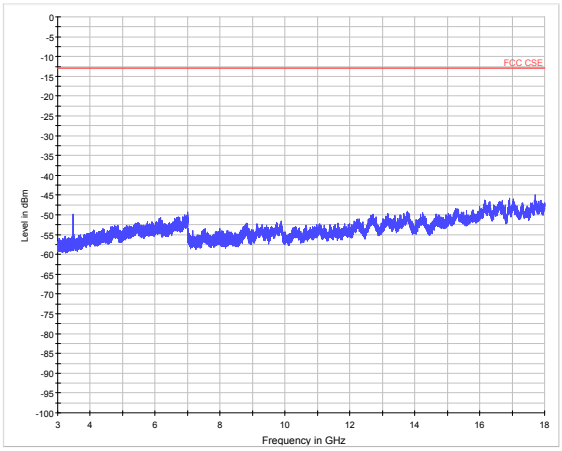
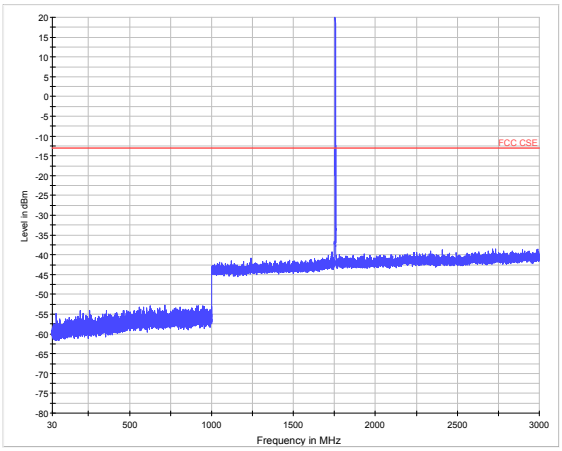
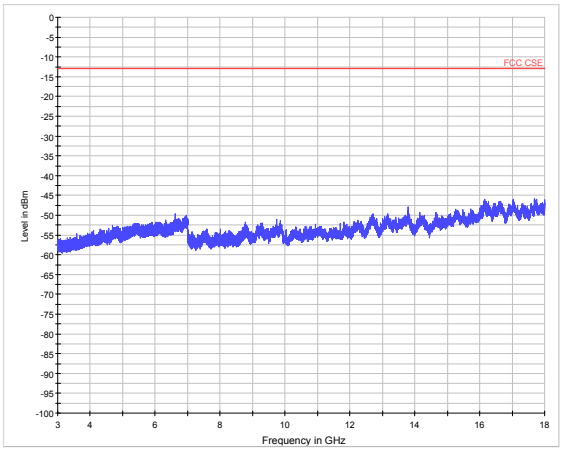
The assessed measurement uncertainty to ensure 99.75％ confidence level for the normal distribution is with the coverage factor *k* = 1.96.

Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-12.75GHz	1.407 dB

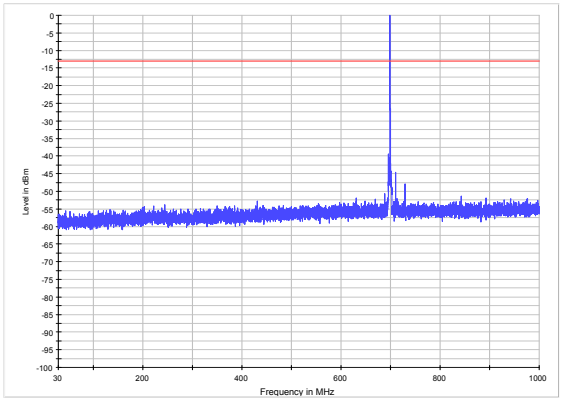
Test Result: PASS

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

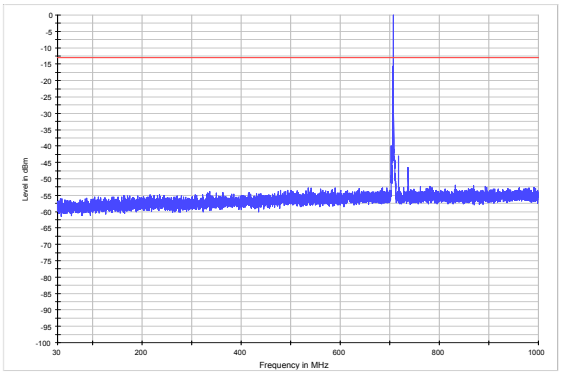
Standalone deployment with 15 KHz subcarrier spacing and QPSK mode for CAT NB1:

NB-IOT Band 4 15KHz CH-Low 30MHz~3GHz	NB-IOT Band 4 15KHz CH-Low 3GHz~18GHz
	
NB-IOT Band 4 15KHz CH-Middle 30MHz~3GHz	NB-IOT Band 4 15KHz CH-Middle 3GHz~18GHz
	
NB-IOT Band 4 15KHz CH-High 30MHz~3GHz	NB-IOT Band 4 15KHz CH-High 3GHz~18GHz
	

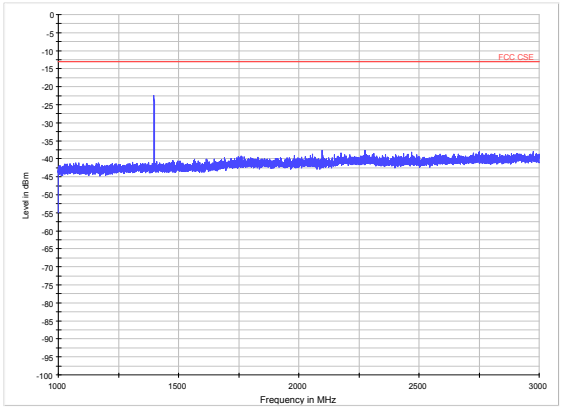
NB-IOT Band 12 15KHz CH-Low 30MHz~1GHz



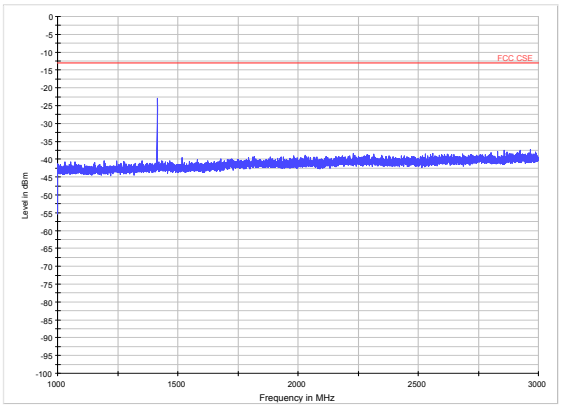
NB-IOT Band 12 15KHz CH-Middle 30MHz~1GHz



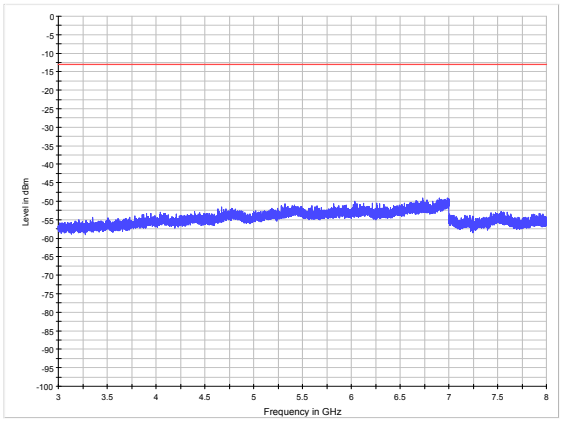
NB-IOT Band 12 15KHz CH-Low 1GHz~3GHz



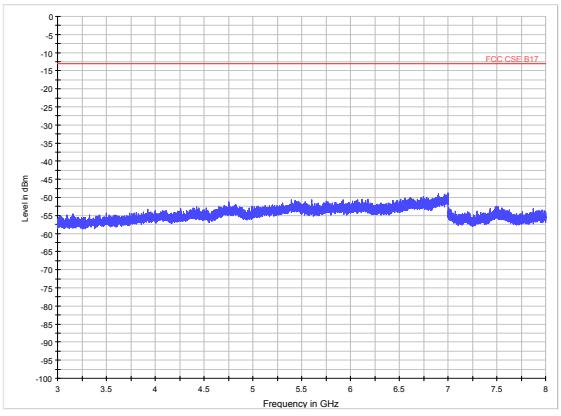
NB-IOT Band 12 15KHz CH-Middle 1GHz~3GHz



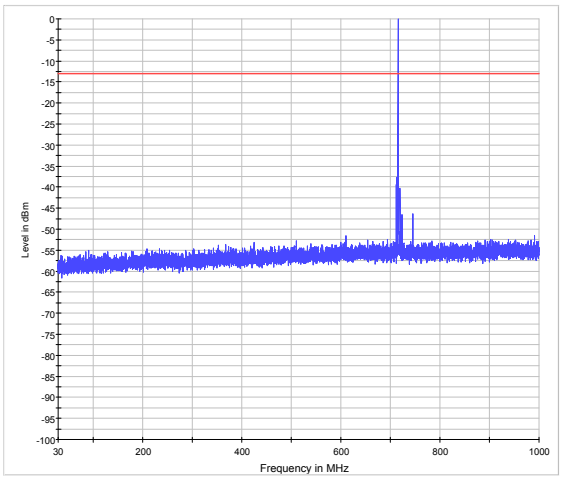
NB-IOT Band 12 15KHz CH-Low 3GHz~8GHz



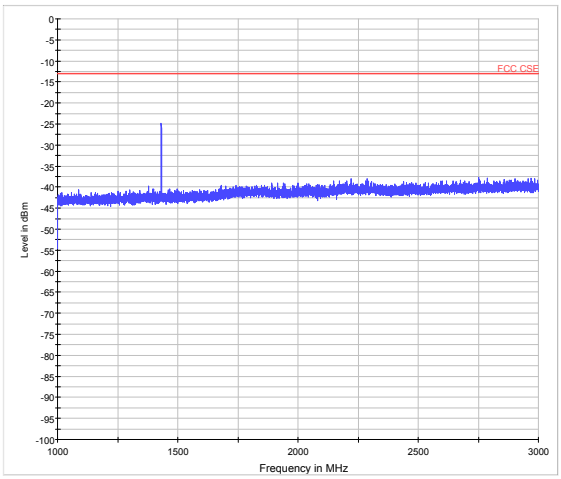
NB-IOT Band 12 15KHz CH-Middle 3GHz~8GHz



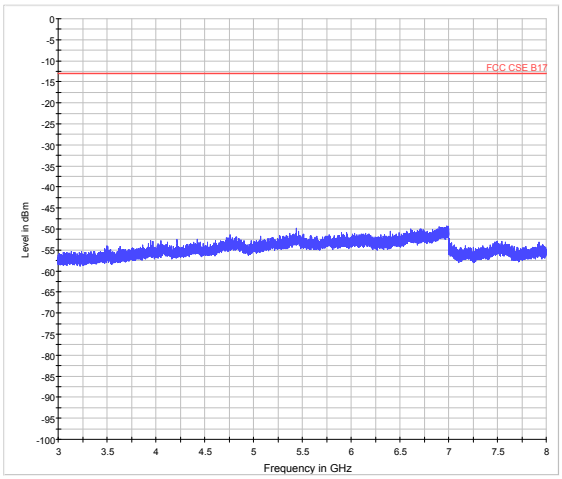
NB-IOT Band 12 15KHz CH-High 30MHz~1GHz



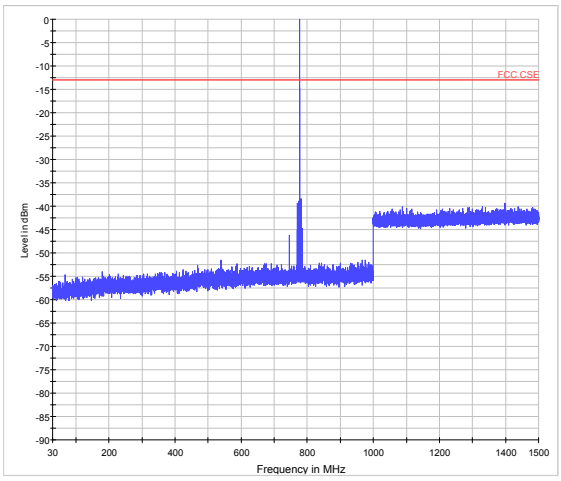
NB-IOT Band 12 15KHz CH-High 1GHz~3GHz



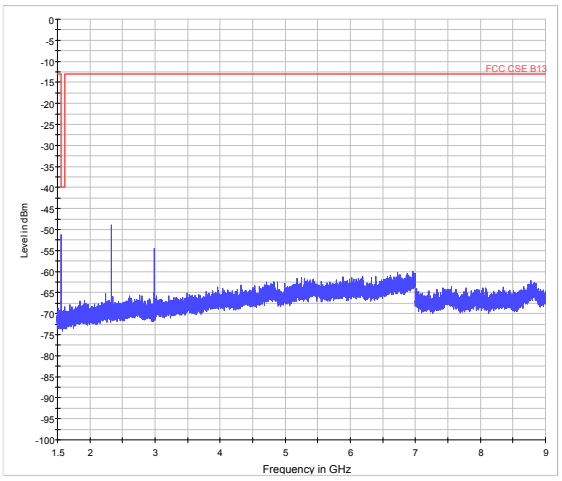
NB-IOT Band 12 15KHz CH-High 3GHz~8GHz



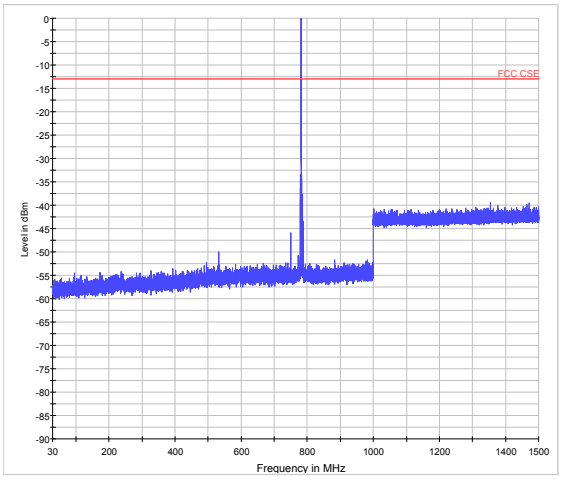
NB-IOTBand 13 15KHz CH-Low 30MHz~1.5GHz



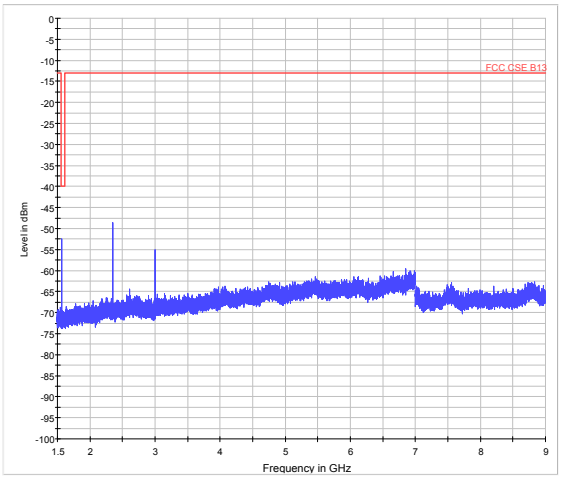
NB-IOT Band 13 15KHz CH-Low 1.5GHz~8GHz



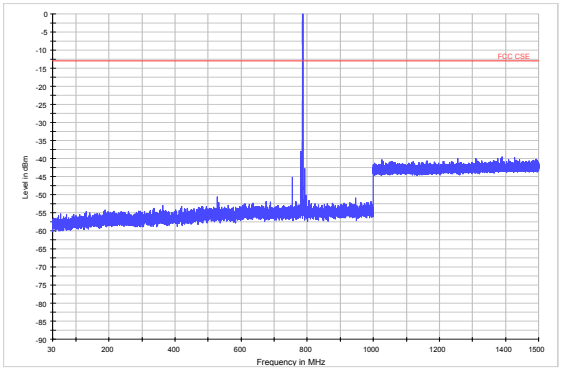
NB-IOT Band 13 15KHz CH-Middle 30MHz~1.5GHz



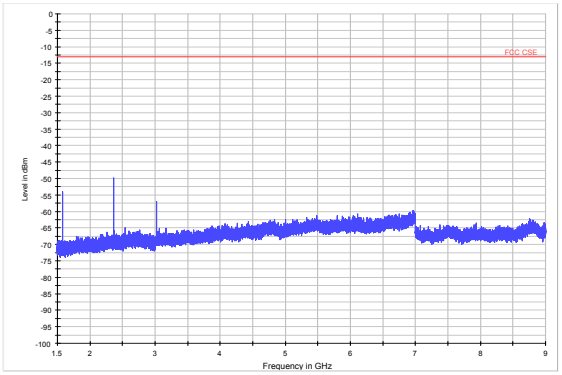
NB-IOT Band 13 15KHz CH-Middle 1.5GHz~8GHz



NB-IOTBand13 15KHz CH-High 30MHz~1.5GHz



NB-IOT Band 13 15KHz CH-High 1.5GHz~8GHz



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 in the following plots.

Test Data File Name	Frequency (MHz)	Peak (dBm)	Limit (dBm)	Margin (dB)
CSE_NB-IOT B12_CHLOW_1-3GHz	1398.0	-22.39	-13.00	9.39
CSE _ NB-IOT B12_CHMID_1-3GHz	1415.3	-24.33	-13.00	11.33
CSE _ NB-IOT B12_CHHIGH_1-3GHz	1431.8	-24.89	-13.00	11.89

5.8 Radiates Spurious Emission

Ambient condition

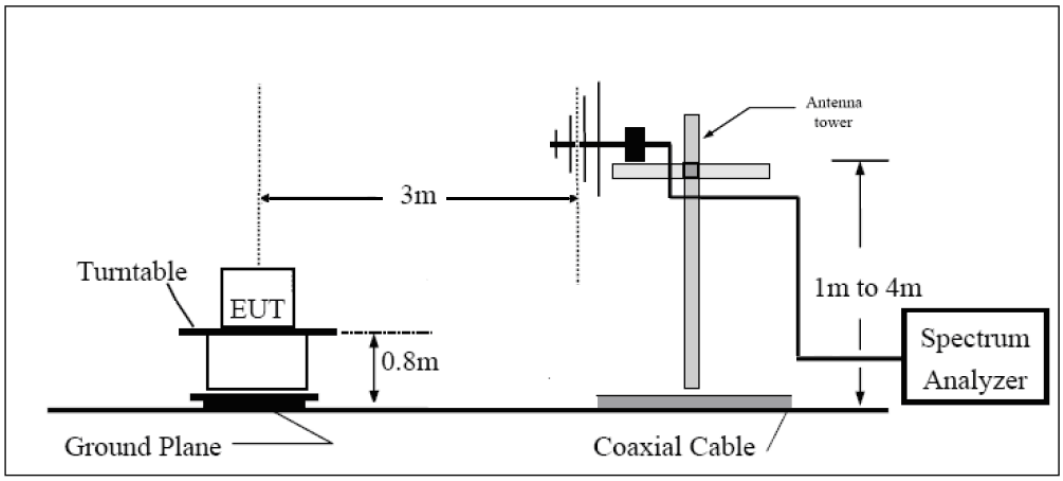
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

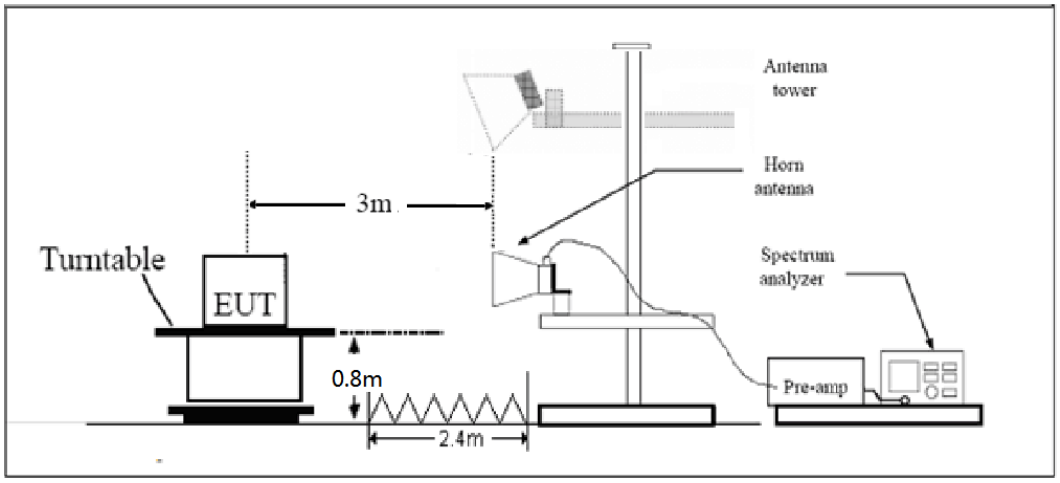
1. The testing follows FCC KDB 971168 v03 Section 5.8 and ANSI/TIA-603-E (2016).
2. The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, 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, 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

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

Limits

Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB..”

Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands

immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

Rule Part 27.53(f)For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

NB-IOT Band 4/ Band 12 Limit

Limit	-13 dBm

NB-IOT Band 13 Limit

Limit out of the band 1559-1610 MHz	-13 dBm
Limit in the band 1559-1610 MHz	-40 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

Standalone deployment with 15 KHz subcarrier spacing and QPSK mode for CAT NB1:

NB-IOT Band 4 15KHz 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	3420.2	-57.06	2.6	10.15	Horizontal	-49.51	-13.00	36.51	270
3	5130.3	-55.13	2.4	11.35	Horizontal	-46.18	-13.00	33.18	180
4	6840.4	-49.63	4.5	10.85	Horizontal	-43.28	-13.00	30.28	135
5	8550.5	-48.97	5.1	11.35	Horizontal	-42.72	-13.00	29.72	270
6	10260.6	-46.82	5.3	11.95	Horizontal	-40.17	-13.00	27.17	180
7	11970.7	-46.73	5.5	13.55	Horizontal	-38.68	-13.00	25.68	225
8	13680.8	-43.03	6.3	13.75	Horizontal	-35.58	-13.00	22.58	45
9	15390.9	-45.83	6.7	13.85	Horizontal	-38.68	-13.00	25.68	270
10	17101.0	-44.52	6.8	14.25	Horizontal	-37.07	-13.00	24.07	180
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 4 15KHz 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	3465.0	-54.92	2.6	10.75	Horizontal	-46.77	-13.00	33.77	180
3	5197.5	-55.37	2.4	11.05	Horizontal	-46.72	-13.00	33.72	135
4	6930.0	-50.75	4.5	11.15	Horizontal	-44.10	-13.00	31.10	270
5	8662.5	-47.61	5.1	11.35	Horizontal	-41.36	-13.00	28.36	180
6	10395.0	-46.58	5.3	11.95	Horizontal	-39.93	-13.00	26.93	225
7	12127.5	-45.54	5.5	13.55	Horizontal	-37.49	-13.00	24.49	45
8	13860.0	-43.39	6.3	13.75	Horizontal	-35.94	-13.00	22.94	90
9	15592.5	-46.50	6.7	13.85	Horizontal	-39.35	-13.00	26.35	270
10	17325.0	-43.77	6.8	14.25	Horizontal	-36.32	-13.00	23.32	180
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 4 15KHz 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	3509.8	-58.21	2.6	10.15	Horizontal	-50.66	-13.00	37.66	225
3	5264.7	-57.02	2.4	11.05	Horizontal	-48.37	-13.00	35.37	45
4	7019.6	-50.02	4.5	11.15	Horizontal	-43.37	-13.00	30.37	270
5	8774.5	-47.22	5.1	11.35	Horizontal	-40.97	-13.00	27.97	180
6	10529.4	-45.18	5.3	11.95	Horizontal	-38.53	-13.00	25.53	135
7	12284.3	-47.32	5.5	13.55	Horizontal	-39.27	-13.00	26.27	270
8	14039.2	-44.41	6.3	13.75	Horizontal	-36.96	-13.00	23.96	180
9	15794.1	-46.65	6.7	13.85	Horizontal	-39.50	-13.00	26.50	225
10	17549.0	-43.82	6.8	14.25	Horizontal	-36.37	-13.00	23.37	45
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 12 15KHz QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1399.40	-32.45	2.00	10.15	Horizontal	-26.45	-13.00	13.45	90
3	2099.10	-55.53	2.50	11.35	Horizontal	-48.83	-13.00	35.83	135
4	2798.80	-54.42	4.20	10.85	Horizontal	-49.92	-13.00	36.92	45
5	3498.50	-55.31	5.20	11.35	Horizontal	-51.31	-13.00	38.31	270
6	4198.20	-54.53	5.50	11.95	Horizontal	-50.23	-13.00	37.23	225
7	4897.90	-52.55	5.70	13.55	Horizontal	-46.85	-13.00	33.85	135
8	5597.60	-51.87	6.30	13.75	Horizontal	-46.57	-13.00	33.57	135
9	6297.30	-50.35	6.80	13.85	Horizontal	-45.45	-13.00	32.45	315
10	6997.00	-47.58	6.90	14.25	Horizontal	-42.38	-13.00	29.38	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 12 15KHz QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.00	-32.81	2.00	10.75	Horizontal	-26.21	-13.00	13.21	90
3	2122.50	-53.03	2.51	11.05	Horizontal	-46.64	-13.00	33.64	135
4	2830.00	-54.62	4.20	11.15	Horizontal	-49.82	-13.00	36.82	45
5	3537.50	-52.59	5.20	11.15	Horizontal	-48.79	-13.00	35.79	270
6	4245.00	-53.07	5.50	11.95	Horizontal	-48.77	-13.00	35.77	225
7	4952.50	-52.91	5.70	13.55	Horizontal	-47.21	-13.00	34.21	90
8	5660.00	-51.25	6.30	13.75	Horizontal	-45.95	-13.00	32.95	135
9	6367.50	-49.96	6.80	13.85	Horizontal	-45.06	-13.00	32.06	315
10	7075.00	-46.81	6.90	14.25	Horizontal	-41.61	-13.00	28.61	45
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 12 15KHz QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1430.60	-35.14	2.00	10.15	Horizontal	-29.14	-13.00	16.14	90
3	2145.90	-51.48	2.51	11.05	Horizontal	-45.09	-13.00	32.09	225
4	2861.20	-54.94	4.20	11.15	Horizontal	-50.14	-13.00	37.14	135
5	3576.50	-52.99	5.20	11.15	Horizontal	-49.19	-13.00	36.19	315
6	4291.80	-52.62	5.50	11.95	Horizontal	-48.32	-13.00	35.32	0
7	5007.10	-51.42	5.70	13.55	Horizontal	-45.72	-13.00	32.72	90
8	5722.40	-50.88	6.30	13.75	Horizontal	-45.58	-13.00	32.58	135
9	6437.70	-49.18	6.80	13.85	Horizontal	-44.28	-13.00	31.28	45
10	7153.00	-46.48	6.90	14.25	Horizontal	-41.28	-13.00	28.28	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 13 15KHZ QPSK CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1497.0	-54.26	2.00	10.15	Horizontal	-48.26	-13.00	35.26	135
3	2245.5	-51.22	2.50	11.35	Horizontal	-44.52	-13.00	31.52	45
4	2994.0	-53.94	4.20	10.85	Horizontal	-49.44	-13.00	36.44	135
5	3742.5	-52.51	5.20	11.35	Horizontal	-48.51	-13.00	35.51	90
6	4491.0	-51.95	5.50	11.95	Horizontal	-47.65	-13.00	34.65	225
7	5239.5	-51.03	5.70	13.55	Horizontal	-45.33	-13.00	32.33	135
8	5988.0	-49.69	6.30	13.75	Horizontal	-44.39	-13.00	31.39	45
9	6736.5	-48.71	6.80	13.85	Horizontal	-43.81	-13.00	30.81	270
10	7485.0	-46.29	6.90	14.25	Horizontal	-41.09	-13.00	28.09	225
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 13 15KHZ+QPSK CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1502.0	-55.61	2.00	10.75	Horizontal	-49.01	-13.00	36.01	90
3	2253.0	-51.23	2.51	11.05	Horizontal	-44.84	-13.00	31.84	135
4	3004.0	-54.03	4.20	11.15	Horizontal	-49.23	-13.00	36.23	45
5	3755.0	-50.68	5.20	11.15	Horizontal	-46.88	-13.00	33.88	135
6	4506.0	-50.97	5.50	11.95	Horizontal	-46.67	-13.00	33.67	225
7	5257.0	-51.01	5.70	13.55	Horizontal	-45.31	-13.00	32.31	135
8	6008.0	-50.21	6.30	13.75	Horizontal	-44.91	-13.00	31.91	135
9	6759.0	-48.06	6.80	13.85	Horizontal	-43.16	-13.00	30.16	315
10	7510.0	-46.56	6.90	14.25	Horizontal	-41.36	-13.00	28.36	90
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 13 15KHZ+QPSK CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1507.0	-56.89	2.00	10.15	Horizontal	-50.89	-13.00	37.89	90
3	2260.5	-52.21	2.51	11.05	Horizontal	-45.82	-13.00	32.82	135
4	3014.0	-53.81	4.20	11.15	Horizontal	-49.01	-13.00	36.01	270
5	3767.5	-52.63	5.20	11.15	Horizontal	-48.83	-13.00	35.83	225
6	4521.0	-51.63	5.50	11.95	Horizontal	-47.33	-13.00	34.33	90
7	5274.5	-50.48	5.70	13.55	Horizontal	-44.78	-13.00	31.78	135
8	6028.0	-50.31	6.30	13.75	Horizontal	-45.01	-13.00	32.01	135
9	6781.5	-47.44	6.80	13.85	Horizontal	-42.54	-13.00	29.54	315
10	7535.0	-46.31	6.90	14.25	Horizontal	-41.11	-13.00	28.11	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.									

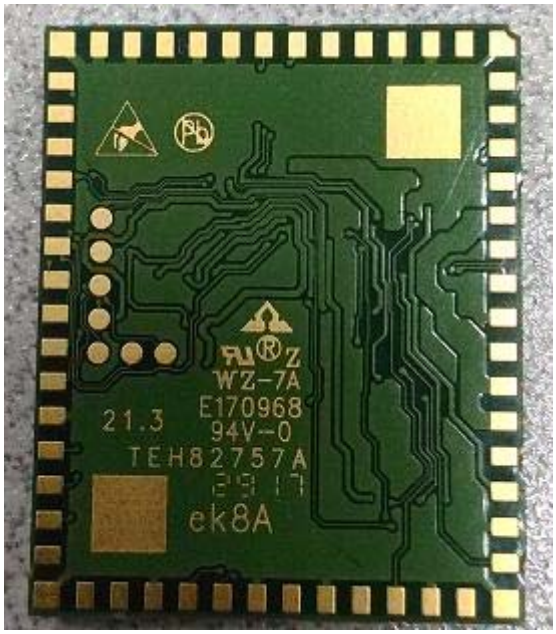
6 Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Time
Base Station Simulator	R&S	CMW500	113645	2017-05-14	2018-05-13
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	2017-05-14	2018-05-13
Universal Radio Communication Tester	Agilent	E5515C	MY48367192	2017-05-14	2018-05-13
Spectrum Analyzer	Agilent	N9010A	MY47191109	2017-05-14	2018-05-13
Signal Analyzer	R&S	FSV30	100815	2016-12-16	2017-12-15
Signal Analyzer	R&S	FSV30	100815	2017-12-17	2018-12-16
Signal generator	R&S	SMB 100A	102594	2017-05-14	2018-05-13
EMI Test Receiver	R&S	ESCI	100948	2017-05-20	2018-05-19
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	2017-12-05
Horn Antenna	R&S	HF907	100126	2017-12-06	2019-12-05
Horn Antenna	ETS-Lindgren	3160-09	00102643	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

ANNEX A: EUT Appearance and Test Setup

A.1 EUT Appearance

Front Side



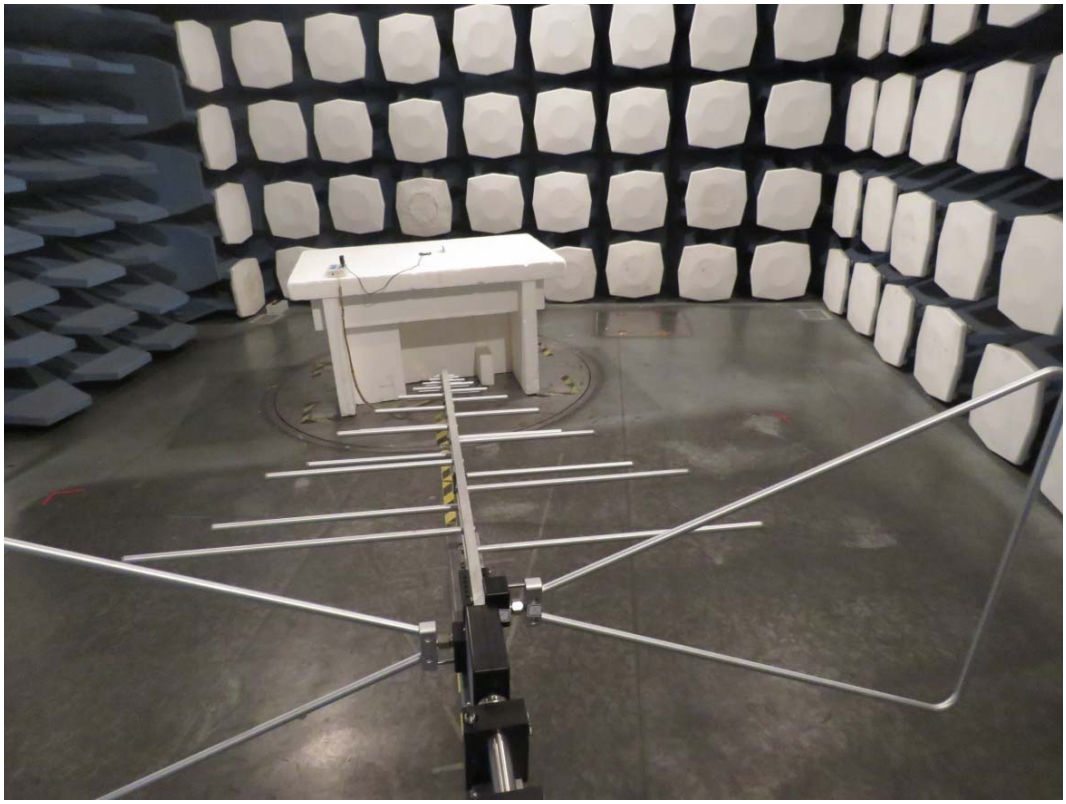
Back Side

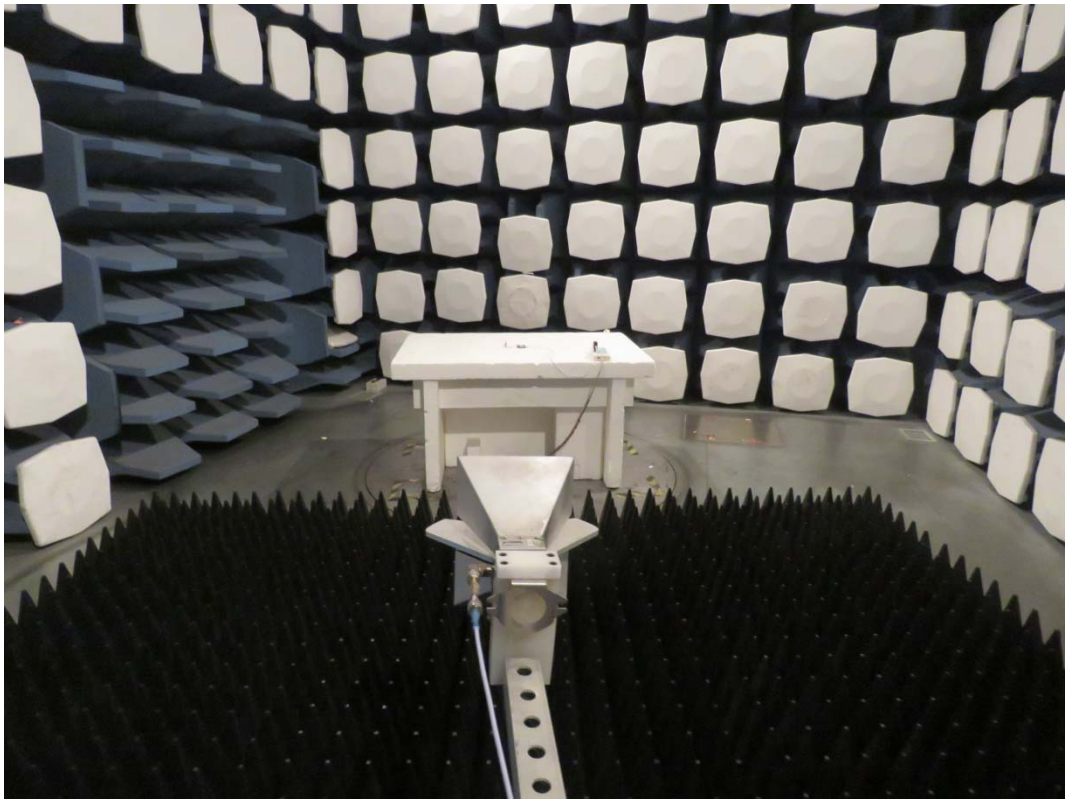
Shield

a: EUT

Picture 1 EUT and Accessory

A.2 Test Setup





Picture 2: Radiated Spurious Emissions Test setup

ANNEX B: Product Change Description

Date: January 18, 2018
Federal Communications Commission
Authorization and Evaluation Devision
7435 Oakland Mills Road
Columbia, MD 21046

Attn: OET Dept.

Ref: FCC Class II Permissive change for FCC ID: SRQ-ZM8300G
Original Grant Date: 11/22/2017
Applicant: ZTE Corporation

Dear Examiner,

This is to request a Class II permissive change for FCC ID: SRQ-ZM8300G, originally granted on 11/22/2017.

SOFTWARE Change:
Band change: Add NB-IoT band 4

Sincerely,

Print name: Min Zhang

Company: ZTE Corporation