



RF TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd
FCC ID XMR201808BC66
Product NB_IoT Module
Brand Quectel
Model BC66
Report No. R1809A0442-R3
Issue Date November 16, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2018)/ FCC CFR47 Part 27C (2018)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Jiang peng Lan

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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)/27.50(h)(2)	PASS
3	Occupied Bandwidth	2.1049	PASS
4	Band Edge Compliance	27.53(h) /27.53(g) /27.53(f) /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 29, 2018 ~ November 12, 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.

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.
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2 General Description of Equipment under Test

Client Information

Applicant	Quectel Wireless Solutions Co., Ltd
Applicant address	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

General information

EUT Description			
Model	BC66		
IMEI	867997030054273		
Hardware Version	R1.0		
Software Version	BC66NBR01A06		
Power Supply	External Power Supply		
Antenna Type	The EUT don't have standard Adapter and Antenna. The adapter and Antenna used for testing in this report is the after-market accessory.		
Antenna Gain	4dBi		
Test Mode(s)	NB-IOT Band 4/ NB-IOT Band 12/ NB-IOT Band 13 / NB-IOT Band 17/ NB-IOT Band 66;		
Test Modulation	BPSK, QPSK		
Category	NB1		
Deployment	stand-alone		
Sub-carrier spacing	3.75KHz, 15KHz		
Ntones	single, multi-tone		
Maximum E.I.R.P./ E.R.P.	NB-IOT Band 4:	25.11dBm	
	NB-IOT Band 12:	25.11dBm	
	NB-IOT Band 13:	27.13dBm	
	NB-IOT Band 17:	24.87dBm	
	NB-IOT Band 66:	26.01dBm	
Rated Power Supply Voltage:	3.3V		
Extreme Voltage	Minimum: 2.1V Maximum: 3.63V		
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
	NB-IOT Band 17	704 ~ 716	734 ~ 746
	NB-IOT Band 66	1710 ~ 1780	2110 ~ 2200

Note: 1. The information of the EUT is declared by the manufacturer.

Accessory equipment	
Evaluation Board	RF Cable
RS232-to-USB Cable	Antenna: Dipole Antenna
DC 5V Adaptor	/

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 (2018)

FCC CFR47 Part 27C (2018)

ANSI C63.26 (2015)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4 Test Configuration

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

All mode and data rates and positions and RB size and modulations 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 4/12/13/17/66:

Test items	Mode	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
	NB-IOT B17	O	O	O	O	O	O	O	O
	NB-IOT B66	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
	NB-IOT B17	O	O	O	O	O	O	O	O
	NB-IOT B66	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
	NB-IOT B17	O	O	O	O	O	O	O	O
	NB-IOT B66	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
	NB-IOT B17	O	O	O	O	O	O	-	O
	NB-IOT B66	O	O	O	O	O	O	-	O
Peak-to-Average Power Ratio	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
	NB-IOT B17	O	O	O	O	O	O	O	O
	NB-IOT B66	O	O	O	O	O	O	O	O



Frequency Stability	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
	NB-IOT B17	O	O	O	O	O	O	O	O
	NB-IOT B66	O	O	O	O	O	O	O	O
Conducted Spurious Emissions	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
	NB-IOT B17	O	-	O	-	O	O	O	O
	NB-IOT B66	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
	NB-IOT B17	O	-	O	-	O	O	O	O
	NB-IOT B66	O	-	O	-	O	O	O	O
Note1. 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

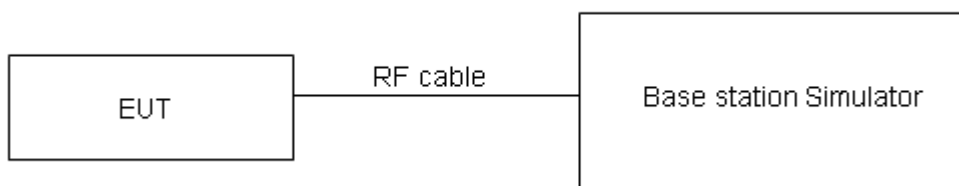
Ambient condition

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	Output Power (dBm) for low/mid/high channel		
				19951/1710.1	20175/1732.5	20399/1754.9
Band 4 Standalone	BPSK	3.75	1@0	23.28	23.32	23.64
			1@47	23.19	23.31	23.57
		15	1@0	23.21	23.23	23.40
			1@11	23.11	23.18	23.31
	QPSK	3.75	1@0	23.25	23.29	23.50
			1@47	23.26	23.30	23.51
		15	1@0	23.14	23.15	23.33
			1@11	23.08	23.09	23.27
		15	12@0	20.82	20.91	21.25

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Output Power (dBm) for low/mid/high channel		
				23011/699.1	23095/707.5	23179/715.9
Band 12 Standalone	BPSK	3.75	1@0	23.04	23.36	23.51
			1@47	22.99	23.29	23.44
		15	1@0	22.96	23.23	23.36
			1@11	22.88	23.31	23.27
	QPSK	3.75	1@0	22.97	23.32	23.49
			1@47	23.06	23.30	23.45
		15	1@0	22.86	23.21	23.31
			1@11	22.80	23.08	23.23
		15	12@0	20.63	20.78	20.87

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Output Power (dBm) for low/mid/high channel		
				23181/777.1	23230/782	23279/786.9
Band 13 Standalone	BPSK	3.75	1@0	22.81	23.15	23.10
			1@47	22.75	23.05	23.01
		15	1@0	22.50	22.96	22.95
			1@11	22.41	22.83	22.85
	QPSK	3.75	1@0	22.78	23.11	23.03
			1@47	22.76	23.07	23.02
		15	1@0	22.55	22.95	22.88
			1@11	22.37	22.86	22.80
		15	12@0	20.37	20.71	20.78

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Output Power (dBm) for low/mid/high channel		
				23731/704.1	23790/710	23849/715.9
Band 17 Standalone	BPSK	3.75	1@0	22.98	23.38	23.38
			1@47	22.91	23.31	23.34
		15	1@0	22.82	23.19	23.12
			1@11	22.77	23.21	23.10
	QPSK	3.75	1@0	22.88	23.32	23.31
			1@47	22.84	23.34	23.26
		15	1@0	22.75	23.16	23.19
			1@11	22.68	23.07	23.15
		15	12@0	20.66	20.89	20.90

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Output Power (dBm) for low/mid/high channel		
				131973/1710.1	132322/1745	132671/1779.9
Band 66 Standalone	BPSK	3.75	1@0	23.22	23.21	23.35
			1@47	23.03	23.17	23.33
		15	1@0	23.05	23.08	23.25
			1@11	22.91	23.00	23.16
	QPSK	3.75	1@0	23.16	23.15	23.39
			1@47	23.10	23.18	23.32
		15	1@0	23.09	23.02	23.20
			1@11	22.98	23.04	23.11
		15	12@0	20.87	20.76	20.92

5.2 Effective Isotropic Radiated Power

Ambient condition

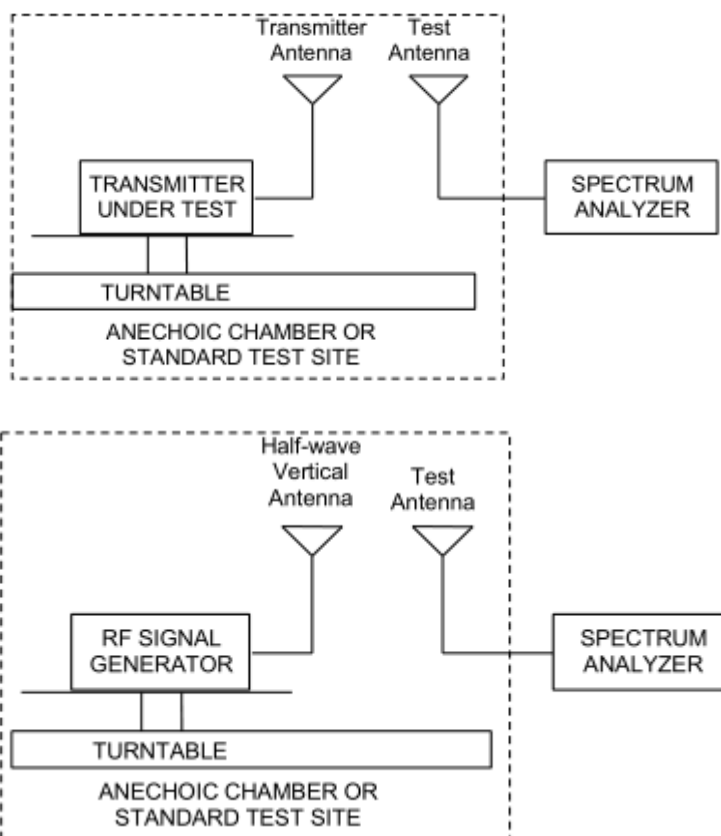
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI C63.26 (2015).
 - 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. $LOSS = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$
 - e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation: $ERP \text{ (dBm)} = LVL \text{ (dBm)} + LOSS \text{ (dB)}$
 - 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:
 $EIRP \text{ (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBd)}$
 where: dBd refers to gain relative to an ideal dipole.
 $EIRP \text{ (dBm)} = ERP \text{ (dBm)} + 2.15 \text{ (dB.)}$

The RB allocation refers to section 5.1, using the maximum output power configuration.

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”

Rule Part 27.50(h) (2) specifies that “Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.”

Part 27.50(b)(10)Limit	$\leq 3 \text{ W}$ (34.77 dBm)
Part 27.50(c)(10)Limit	$\leq 3 \text{ W}$ (34.77 dBm)
Part 27.50(d)(4)Limit	$\leq 1 \text{ W}$ (30 dBm)
Part 27.50(h)(2) Limit	$\leq 2 \text{ W}$ (33 dBm)

Measurement Uncertainty

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

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	EIRP (dBm)	Limit (dBm)	Conclusion
Band4 Standalone	19951	1710.1	BPSK	H	3.75	1@0	24.67	30	Pass
			QPSK	H	3.75	1@0	24.58	30	Pass
			BPSK	H	15	1@0	24.16	30	Pass
			QPSK	H	15	1@0	24.05	30	Pass
	20175	1732.5	BPSK	H	3.75	1@0	24.59	30	Pass
			QPSK	H	3.75	1@0	24.63	30	Pass
			BPSK	H	15	1@0	24.21	30	Pass
			QPSK	H	15	1@0	24.13	30	Pass
	20399	1754.9	BPSK	H	3.75	1@0	25.11	30	Pass
			QPSK	H	3.75	1@0	25.08	30	Pass
			BPSK	H	15	1@0	25.08	30	Pass
			QPSK	H	15	1@0	25.01	30	Pass

Mode	Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	ERP (dBm)	Limit (dBm)	Conclusion
Band12 Standalone	23011	699.1	BPSK	H	3.75	1@0	24.29	34.77	Pass
			QPSK	H	3.75	1@0	24.21	34.77	Pass
			BPSK	H	15	1@0	24.31	34.77	Pass
			QPSK	H	15	1@0	24.18	34.77	Pass
	23095	707.5	BPSK	H	3.75	1@0	24.57	34.77	Pass
			QPSK	H	3.75	1@0	24.32	34.77	Pass
			BPSK	H	15	1@0	24.46	34.77	Pass
			QPSK	H	15	1@0	24.13	34.77	Pass
	23179	715.9	BPSK	H	3.75	1@0	25.11	34.77	Pass
			QPSK	H	3.75	1@0	24.98	34.77	Pass
			BPSK	H	15	1@0	24.67	34.77	Pass
			QPSK	H	15	1@0	24.32	34.77	Pass

Mode	Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	ERP (dBm)	Limit (dBm)	Conclusion
Band13 Standalone	23181	777.1	BPSK	H	3.75	1@0	27.07	34.77	Pass
			QPSK	H	3.75	1@0	26..98	34.77	Pass
			BPSK	H	15	1@0	27.03	34.77	Pass
			QPSK	H	15	1@0	26.87	34.77	Pass
	23230	782	BPSK	H	3.75	1@0	27.05	34.77	Pass
			QPSK	H	3.75	1@0	27.01	34.77	Pass
			BPSK	H	15	1@0	26.77	34.77	Pass
			QPSK	H	15	1@0	26.89	34.77	Pass
	23279	786.9	BPSK	H	3.75	1@0	27.12	34.77	Pass
			QPSK	H	3.75	1@0	27.13	34.77	Pass
			BPSK	H	15	1@0	26.98	34.77	Pass
			QPSK	H	15	1@0	27.01	34.77	Pass

Mode	Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	ERP (dBm)	Limit (dBm)	Conclusion
Band17 Standalone	23731	704.1	BPSK	H	3.75	1@0	24.01	34.77	Pass
			QPSK	H	3.75	1@0	23.87	34.77	Pass
			BPSK	H	15	1@0	23.97	34.77	Pass
			QPSK	H	15	1@0	23.65	34.77	Pass
	23790	710	BPSK	H	3.75	1@0	24.87	34.77	Pass
			QPSK	H	3.75	1@0	24.63	34.77	Pass
			BPSK	H	15	1@0	24.58	34.77	Pass
			QPSK	H	15	1@0	24.39	34.77	Pass
	23849	715.9	BPSK	H	3.75	1@0	24.76	34.77	Pass
			QPSK	H	3.75	1@0	24.51	34.77	Pass
			BPSK	H	15	1@0	24.32	34.77	Pass
			QPSK	H	15	1@0	24.16	34.77	Pass



Mode	Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	EIRP (dBm)	Limit (dBm)	Conclusion
Band66 Standalone	131973	1710.1	BPSK	H	3.75	1@0	25.76	30	Pass
			QPSK	H	3.75	1@0	25.61	30	Pass
			BPSK	H	15	1@0	25.37	30	Pass
			QPSK	H	15	1@0	25.24	30	Pass
	132322	1745	BPSK	H	3.75	1@0	26.01	30	Pass
			QPSK	H	3.75	1@0	25.84	30	Pass
			BPSK	H	15	1@0	25.87	30	Pass
			QPSK	H	15	1@0	25.61	30	Pass
	132671	1779.9	BPSK	H	3.75	1@0	25.43	30	Pass
			QPSK	H	3.75	1@0	25.47	30	Pass
			BPSK	H	15	1@0	25.47	30	Pass
			QPSK	H	15	1@0	25.29	30	Pass

5.3 Occupied Bandwidth

Ambient condition

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

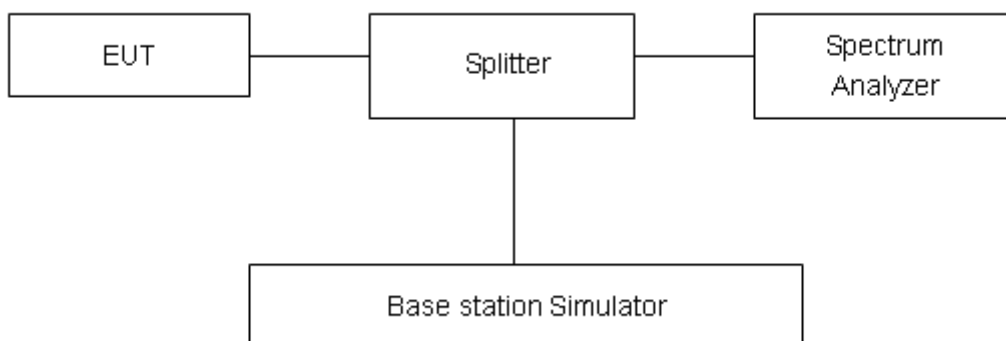
Method of Measurement

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 4/12/13/17/66.

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 $k = 2$, $U=624\text{Hz}$.

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	60.07	43.14	58.35	42.24	57.86	42.80
	QPSK	3.75	1@0	63.77	42.50	65.28	42.76	65.81	45.01
	BPSK	15	1@0	96.11	106.20	104.88	117.50	105.79	127.20
	QPSK	15	1@0	104.06	131.00	104.62	129.10	104.45	128.30
	QPSK	15	12@0	181.43	239.10	181.15	238.30	181.05	238.00

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	56.31	42.58	56.32	42.42	56.29	42.74
	QPSK	3.75	1@0	64.21	45.48	62.99	42.07	63.53	44.69
	BPSK	15	1@0	106.62	114.90	107.55	124.70	106.10	116.40
	QPSK	15	1@0	107.92	130.20	105.64	130.60	102.88	130.20
	QPSK	15	12@0	179.99	238.80	180.20	237.50	180.58	237.80

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	57.34	42.99	56.92	41.78	56.97	42.49
	QPSK	3.75	1@0	62.19	42.29	63.23	45.30	62.03	42.25
	BPSK	15	1@0	108.70	124.70	104.22	115.40	104.03	114.50
	QPSK	15	1@0	108.64	131.30	104.95	129.80	104.19	130.10
	QPSK	15	12@0	180.34	236.20	180.28	235.60	181.13	222.70

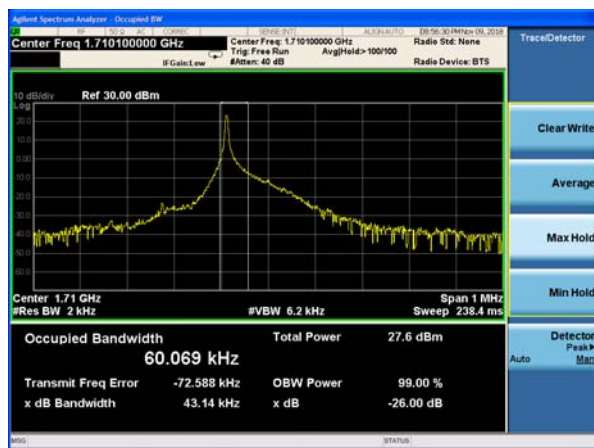


Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
				23731/704.1		23790/710		23849/715.9	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
Band 17 Standalone	BPSK	3.75	1@0	56.65	40.22	56.77	44.82	56.55	42.61
	QPSK	3.75	1@0	63.15	46.19	63.78	42.39	61.82	42.47
	BPSK	15	1@0	102.63	115.10	104.32	113.60	105.42	119.70
	QPSK	15	1@0	103.44	131.00	107.36	130.60	103.64	131.80
	QPSK	15	12@0	179.11	226.90	179.66	238.50	179.06	236.00

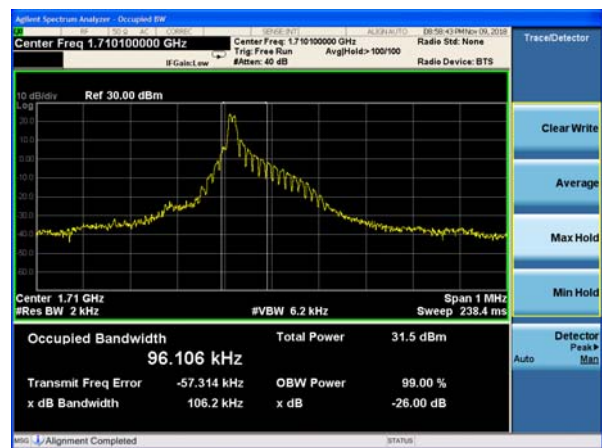
Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
				131973/1710.1		132322/1745		132671/1779.9	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
Band 66 Standalone	BPSK	3.75	1@0	58.34	42.39	58.14	42.70	58.17	42.05
	QPSK	3.75	1@0	63.75	44.58	64.16	45.09	64.22	45.08
	BPSK	15	1@0	104.94	117.90	102.67	113.40	103.83	114.00
	QPSK	15	1@0	102.70	129.80	104.55	129.80	105.87	130.40
	QPSK	15	12@0	180.41	238.20	179.33	237.30	179.97	238.10



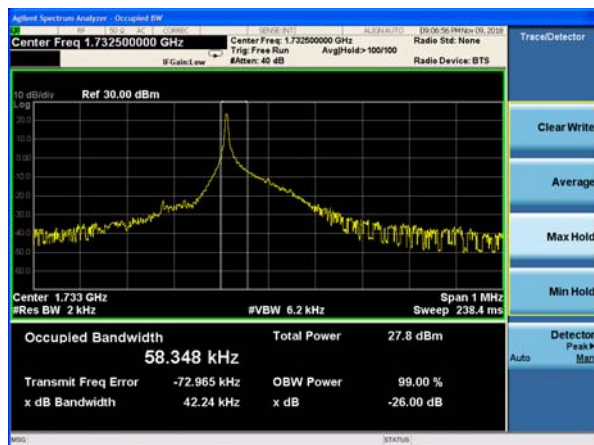
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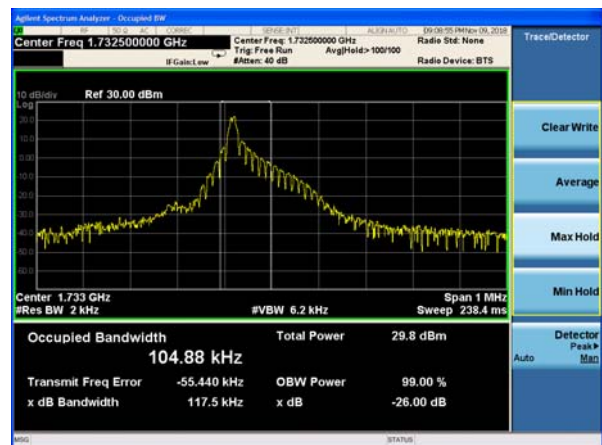
NB-IOT Band 4 BPSK 15kHz 1@0 CH-Low



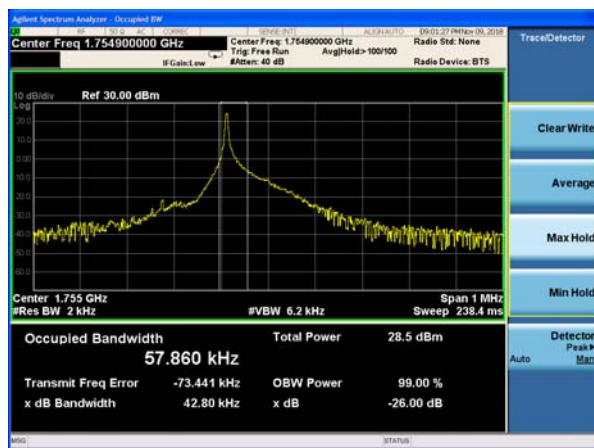
NB-IOT Band 4 BPSK 3.75kHz 1@0 CH-Middle



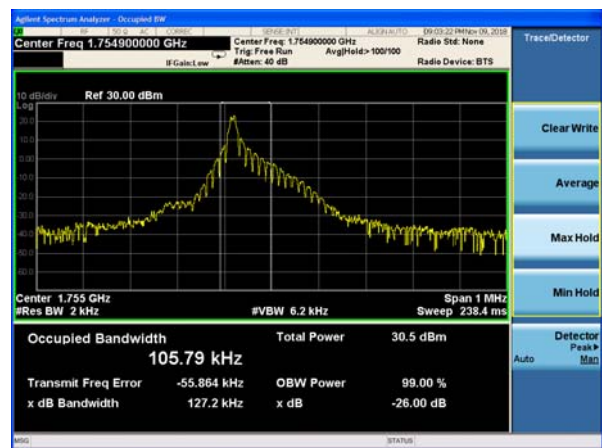
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NB-IOT Band 4 BPSK 3.75kHz 1@0 CH-High

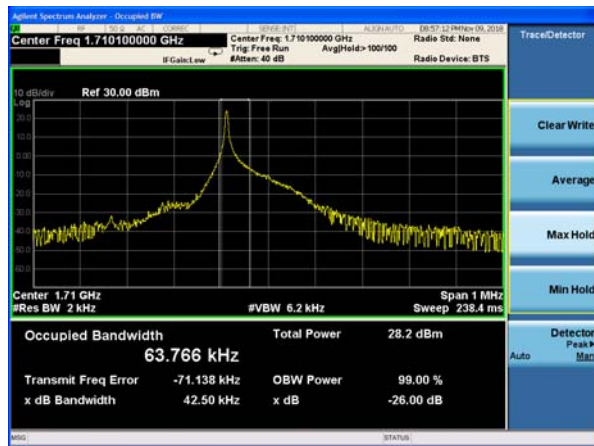


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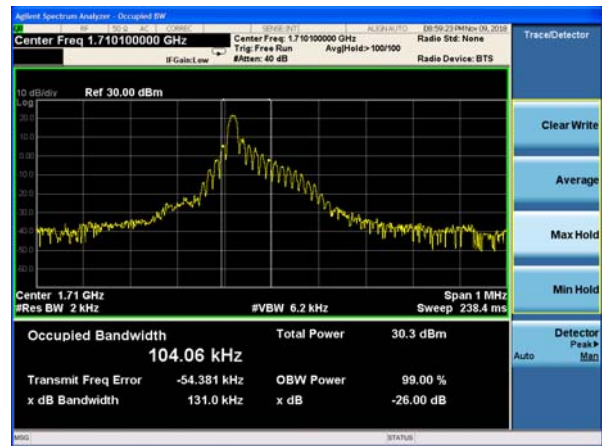




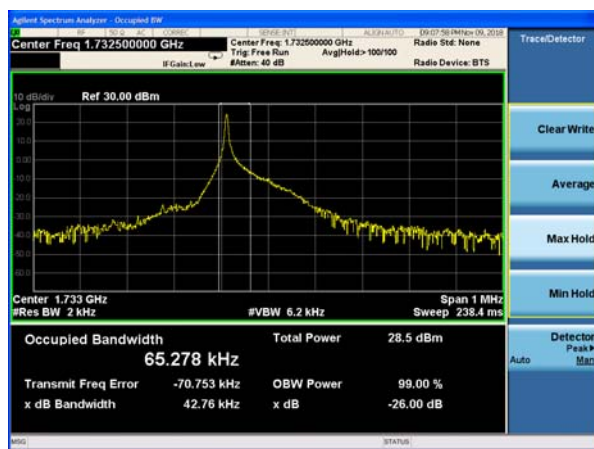
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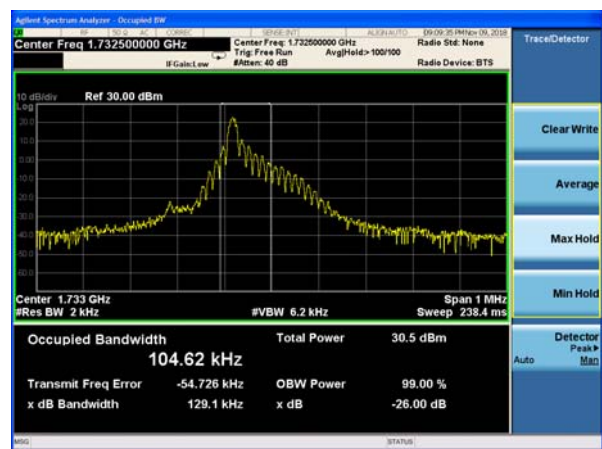
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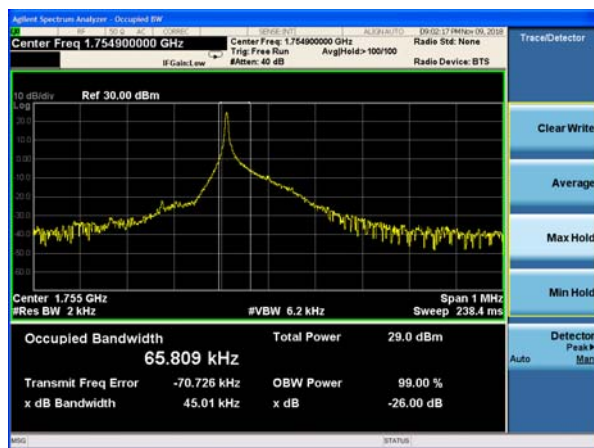
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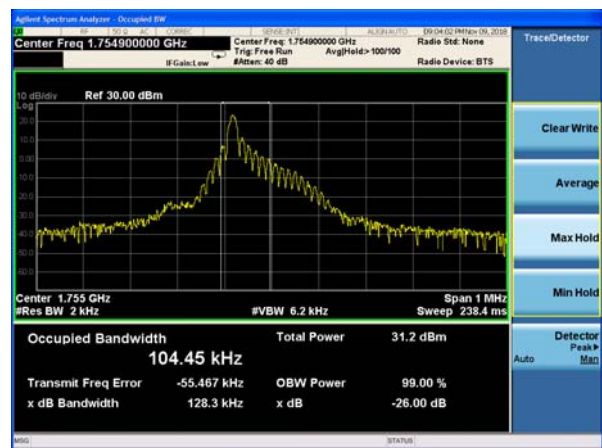
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NB-IOT Band 4 QPSK 3.75kHz 1@0 CH-High

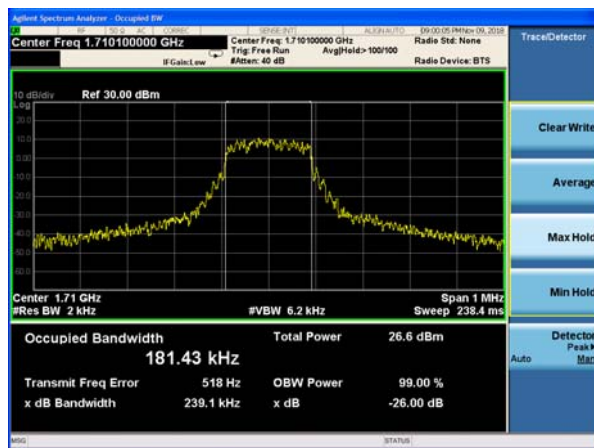


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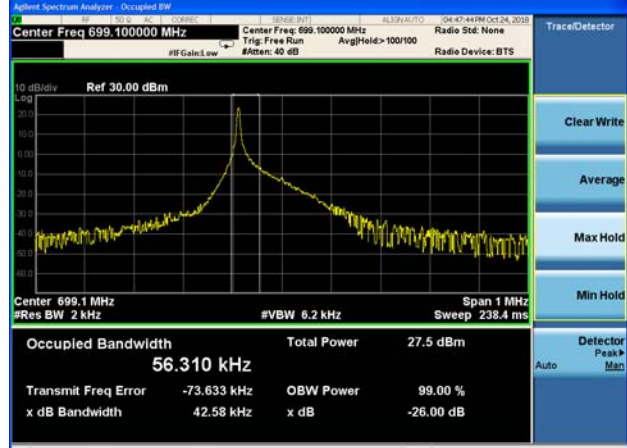




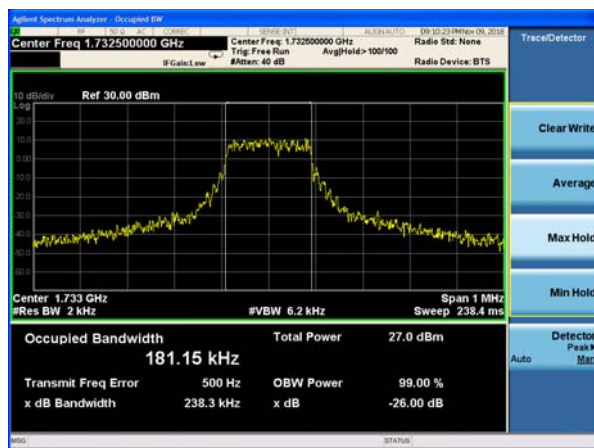
NB-IOT Band 4 QPSK 15kHz 12@0 CH-Low



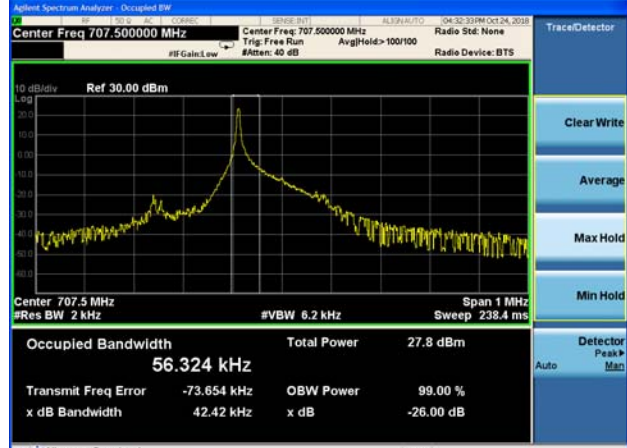
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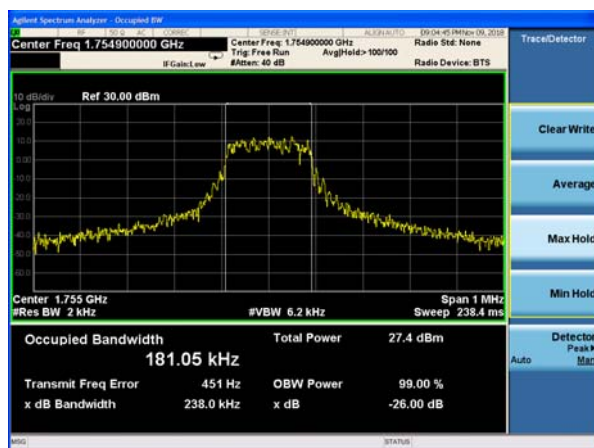
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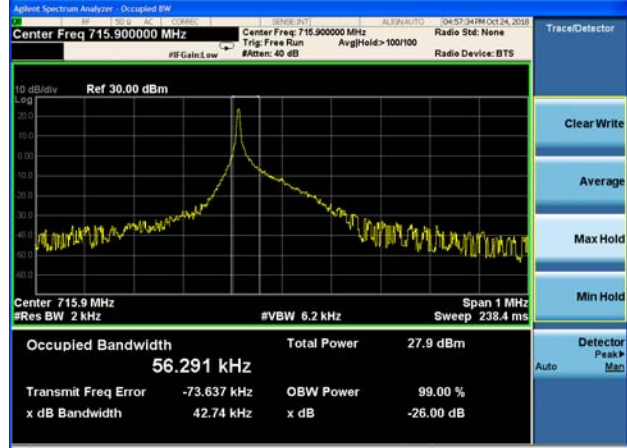
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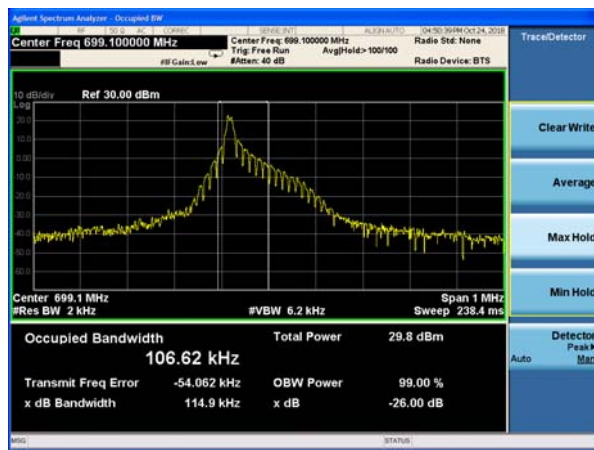


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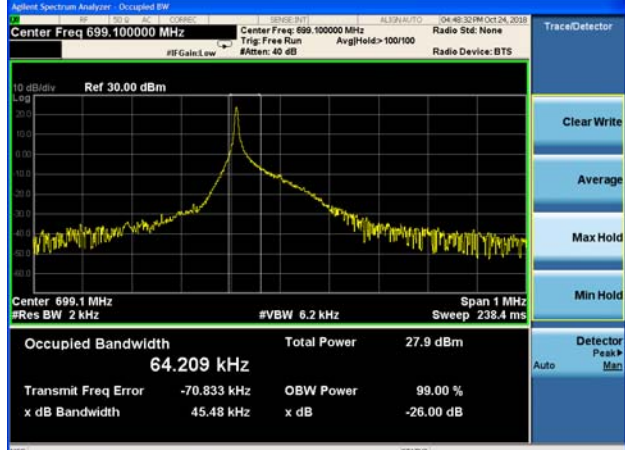




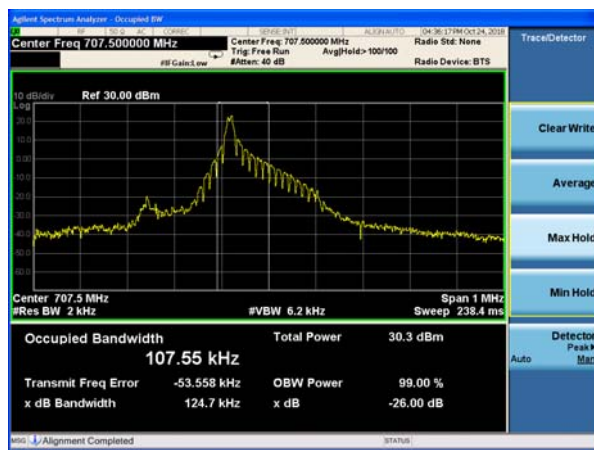
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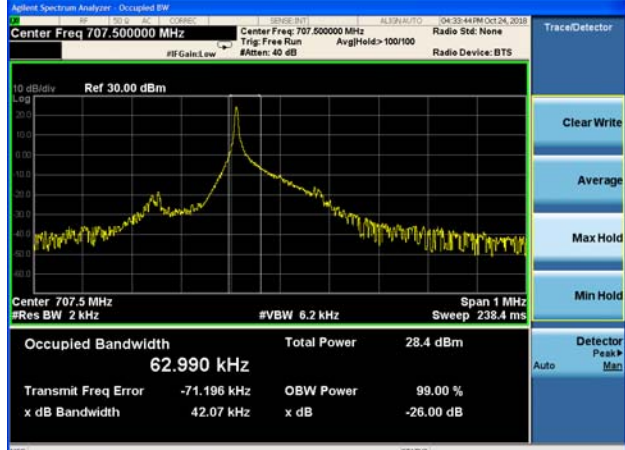
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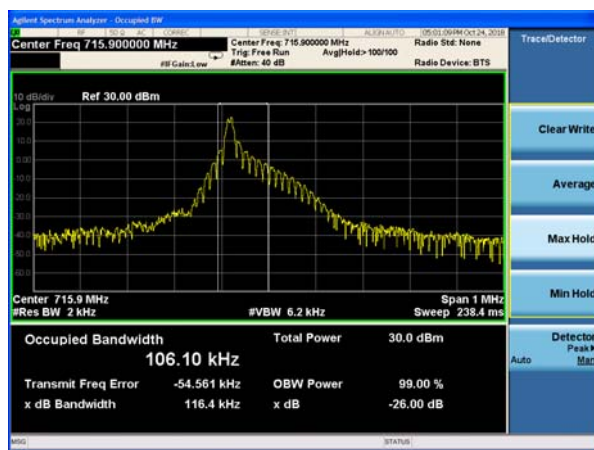
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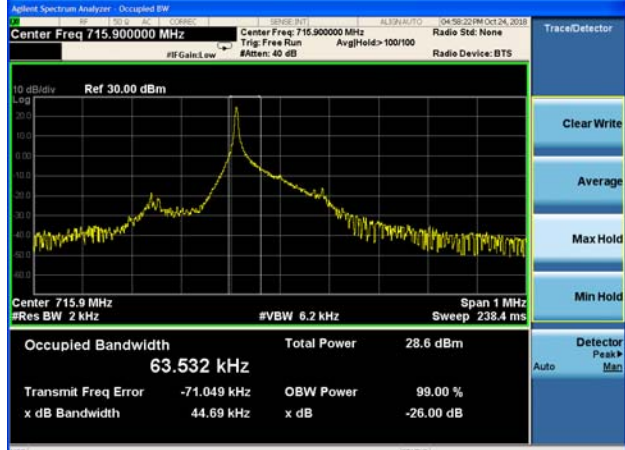
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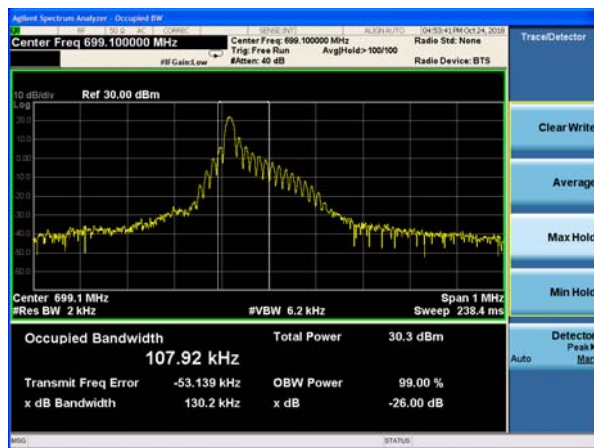


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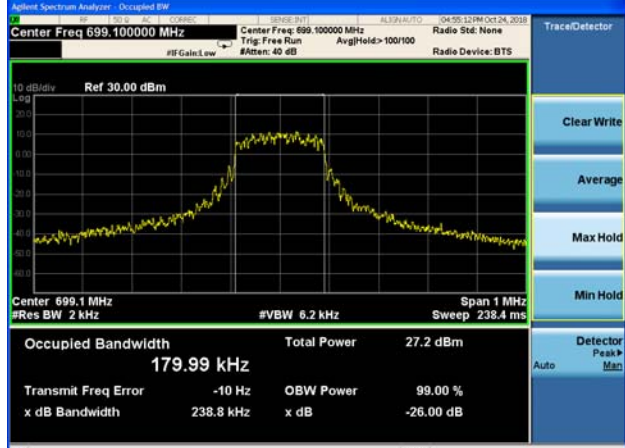




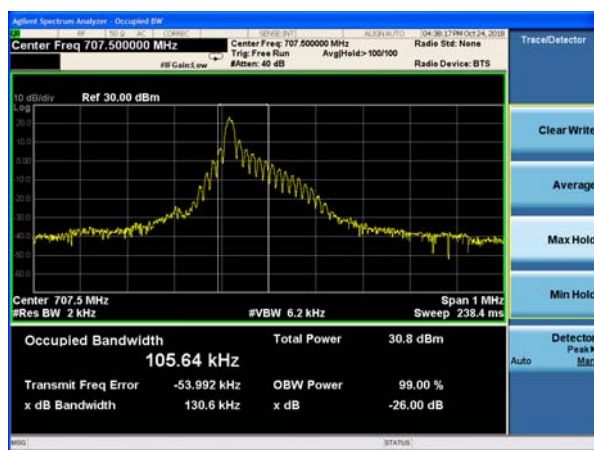
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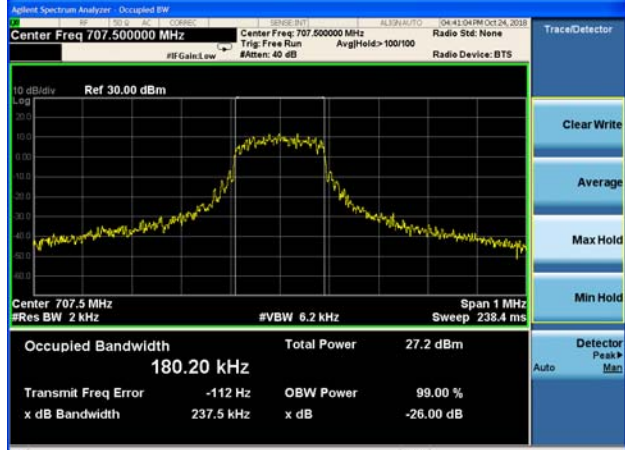
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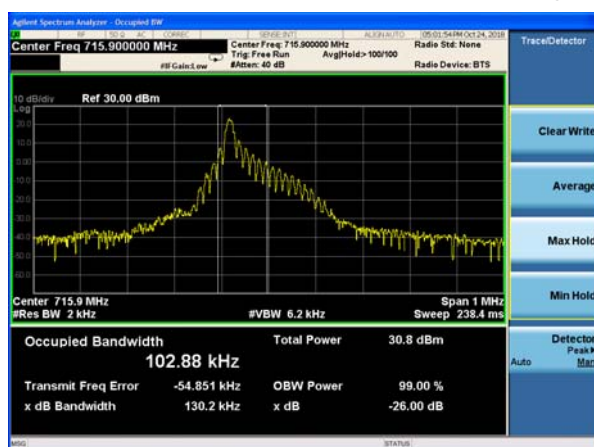
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NB-IOT Band 12 QPSK 15kHz 12@0 CH-Middle



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

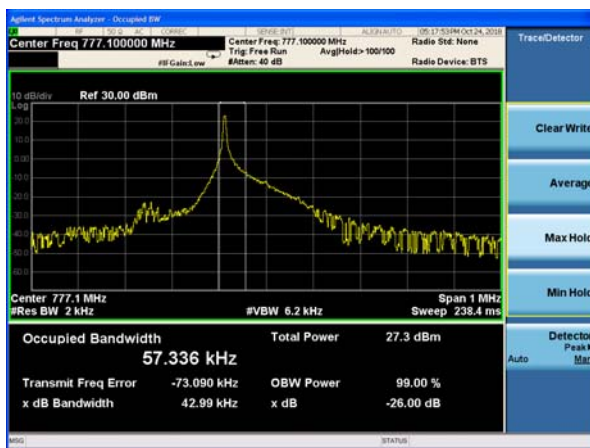


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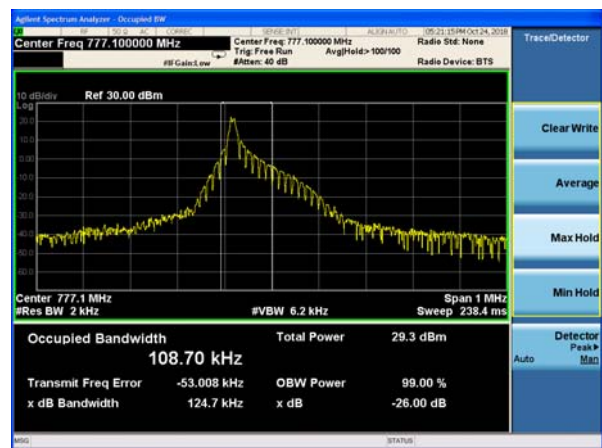
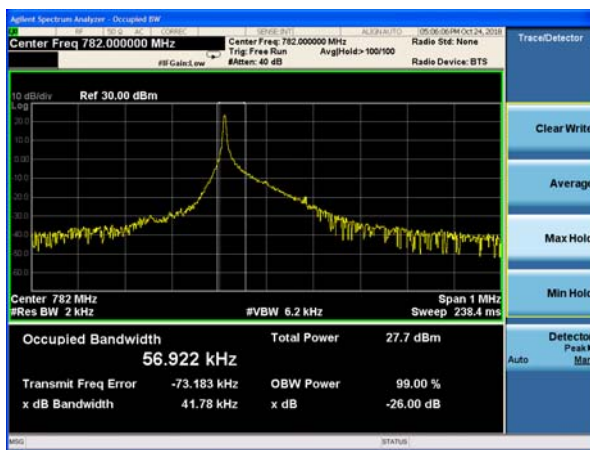




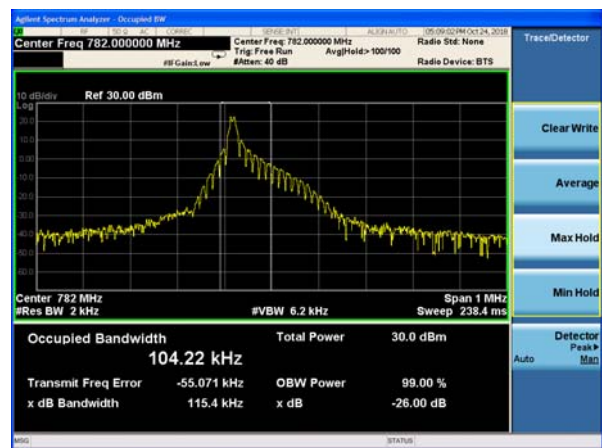
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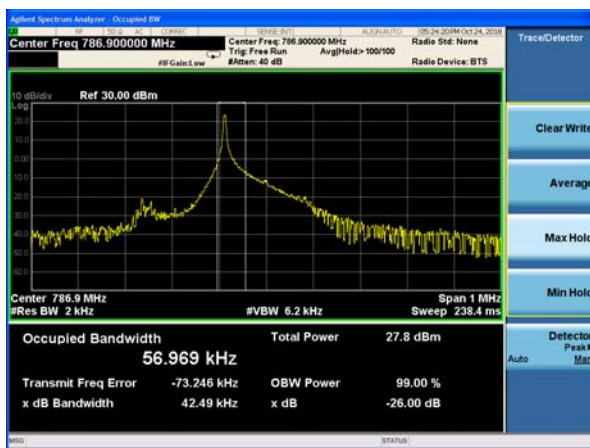
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NB-IOT Band 13 BPSK 3.75kHz 1@0
CH-Middle

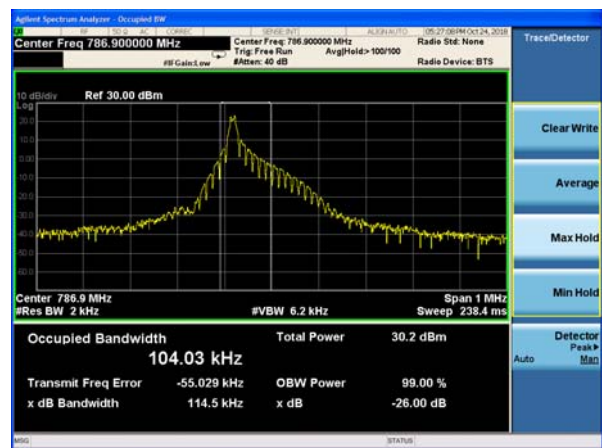
NB-IOT Band 13 BPSK 15kHz 1@0 CH-Middle



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

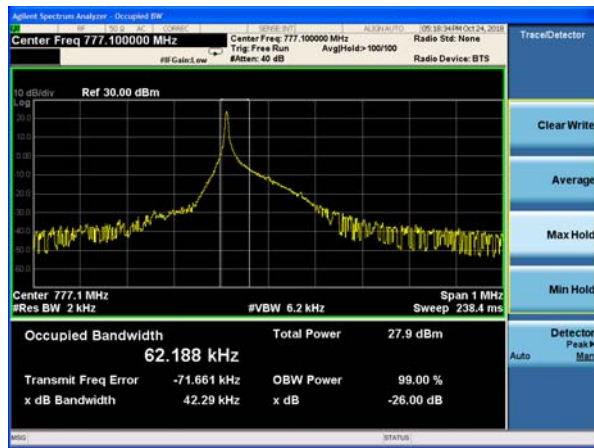


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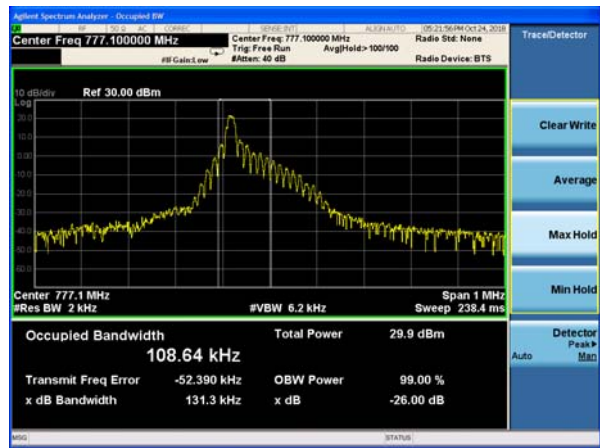




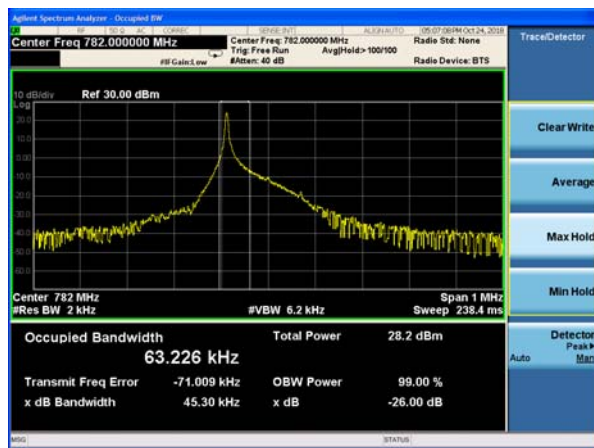
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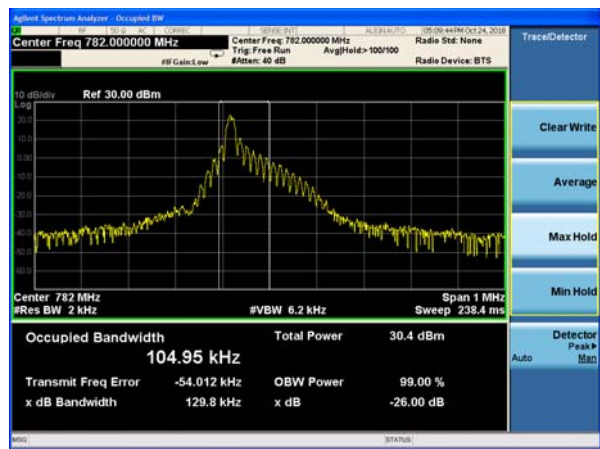
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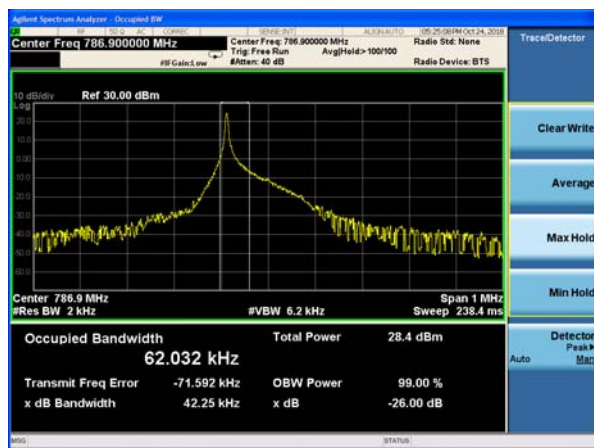
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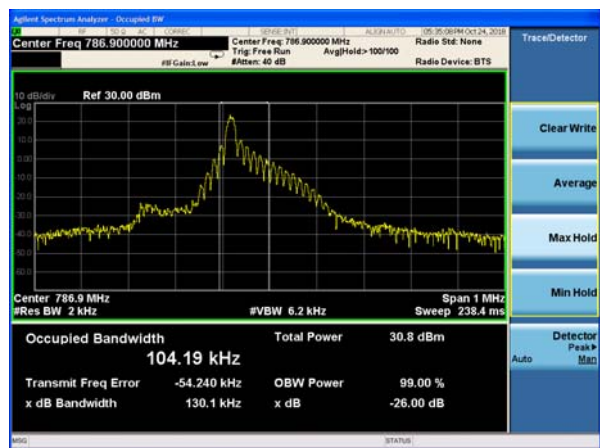
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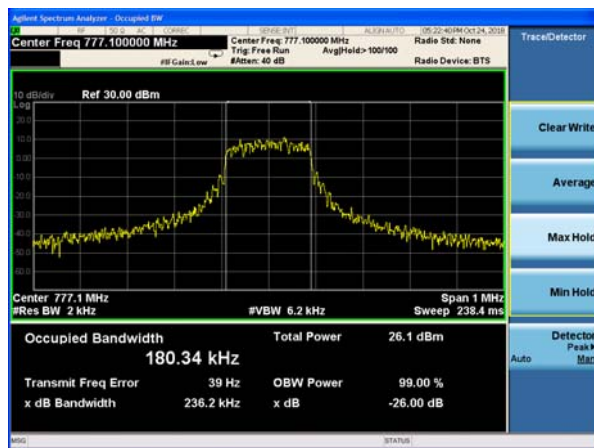


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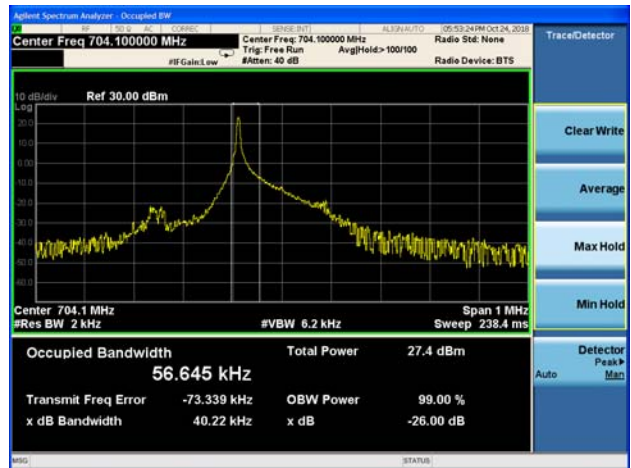




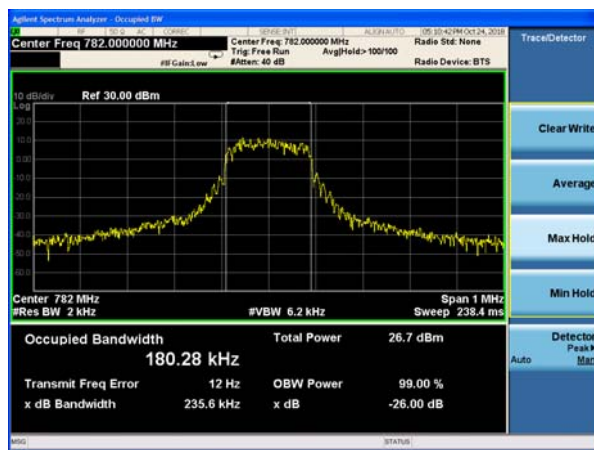
NB-IOT Band 13 QPSK 15kHz 12@0 CH-Low



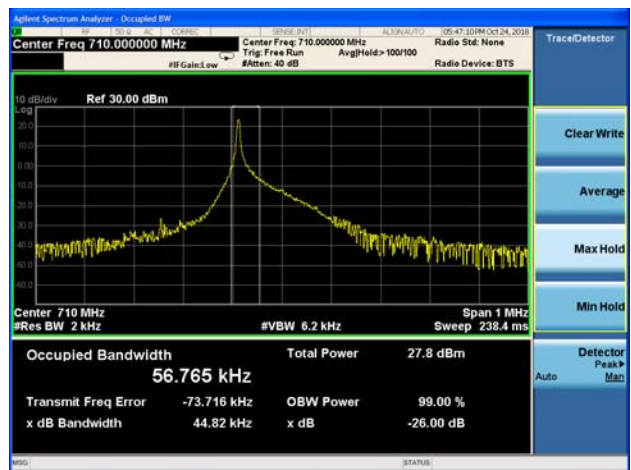
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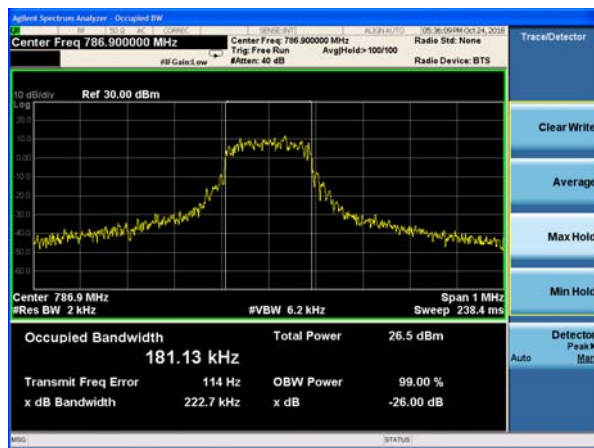
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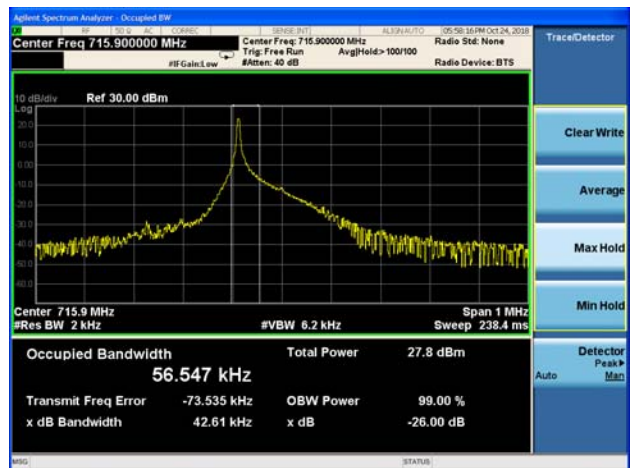
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NB-IOT Band 13 QPSK 15kHz 12@0 CH-High

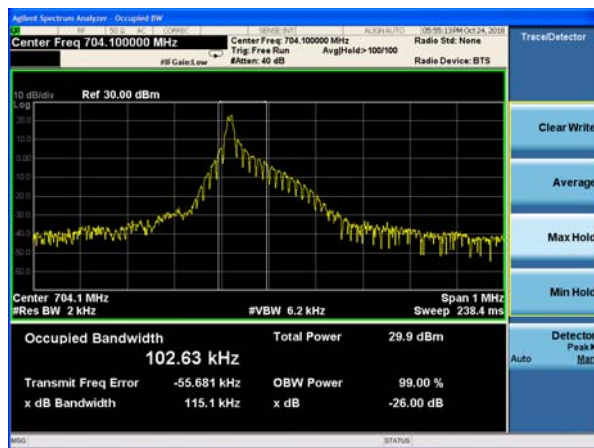


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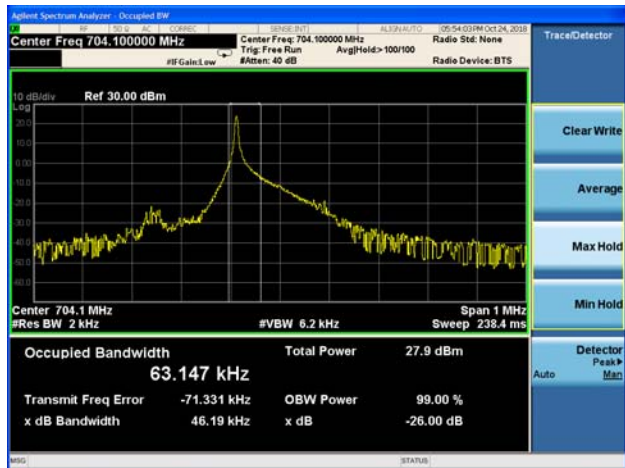




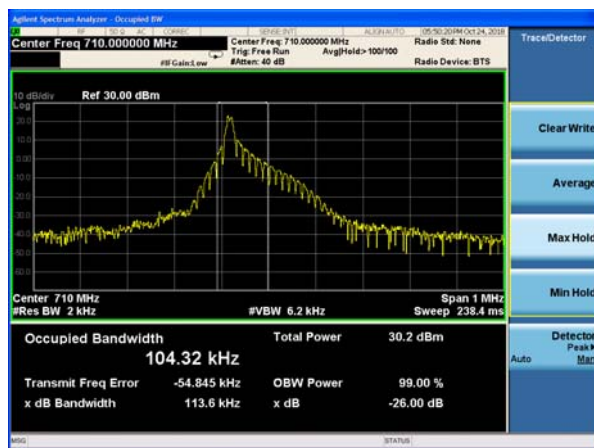
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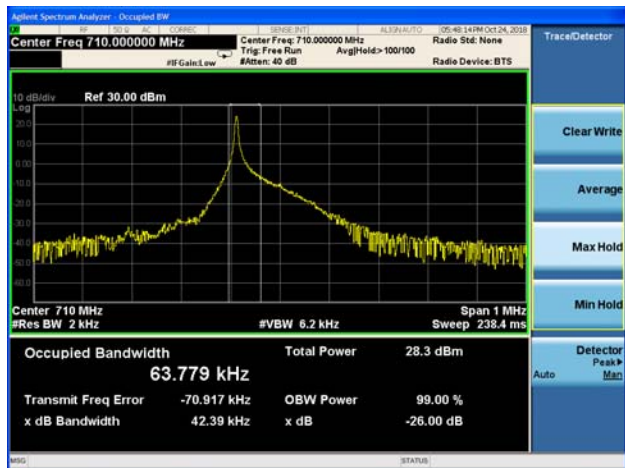
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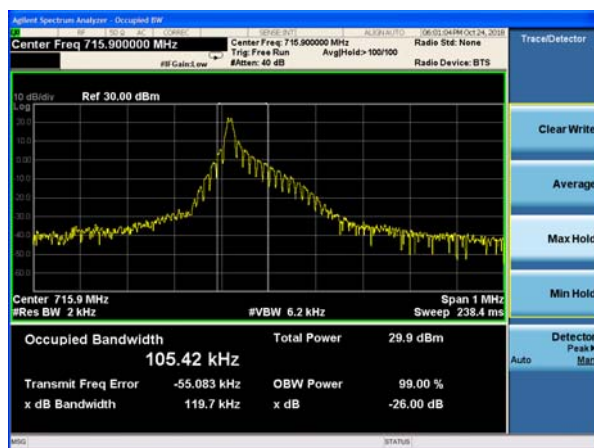
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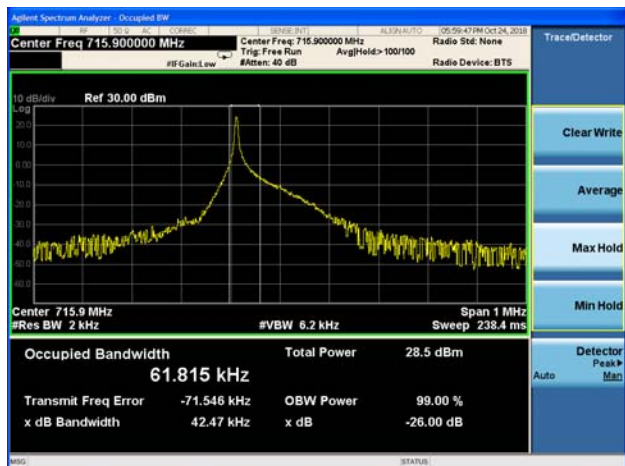
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NB-IOT Band 17 BPSK 15kHz 1@0 CH-High

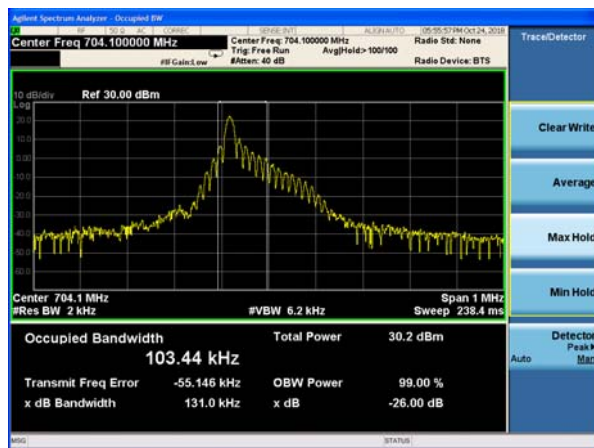


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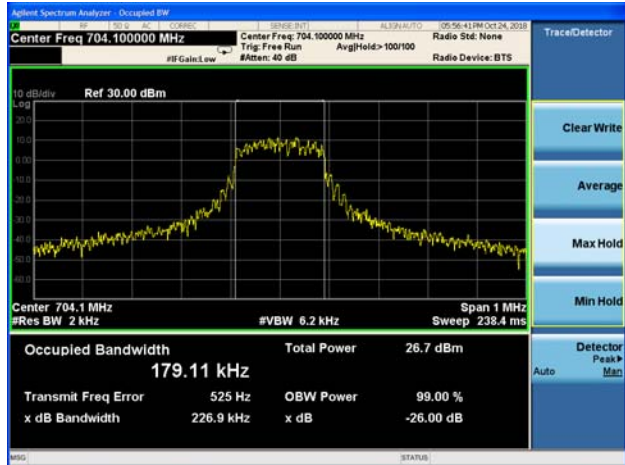




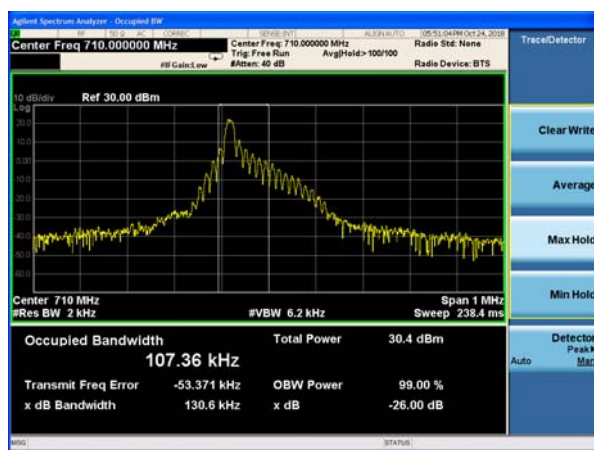
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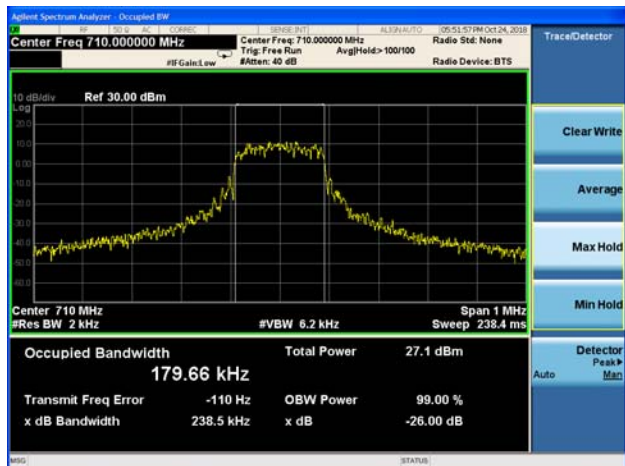
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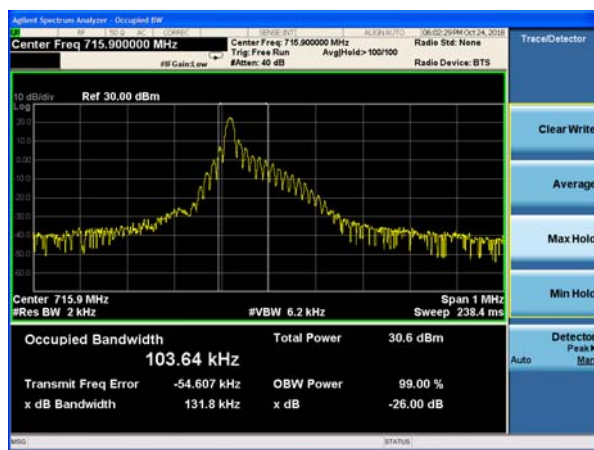
NB-IOT Band 17 QPSK 15kHz 1@0 CH-Middle



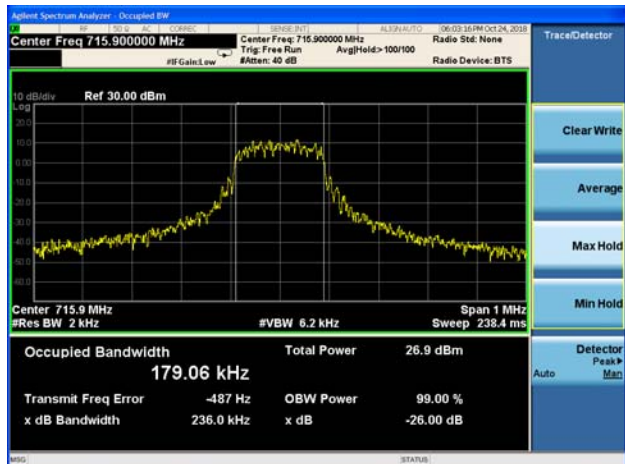
NB-IOT Band 17 QPSK 15kHz 12@0 CH-Middle



NB-IOT Band 17 QPSK 15kHz 1@0 CH-High

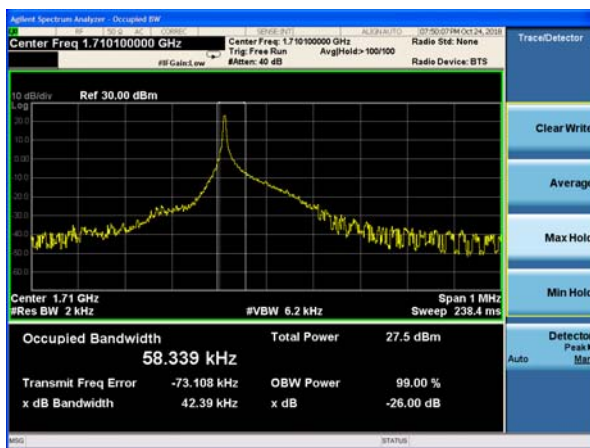


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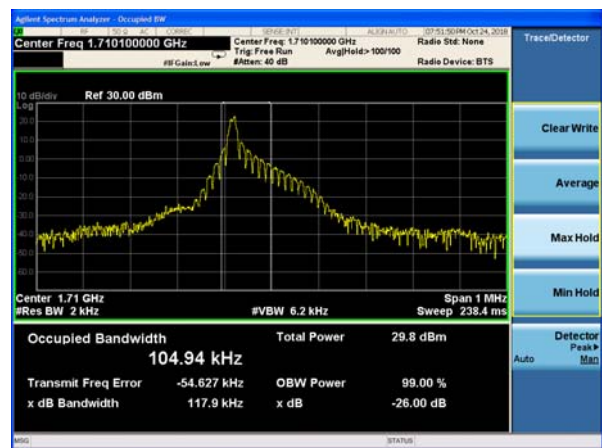
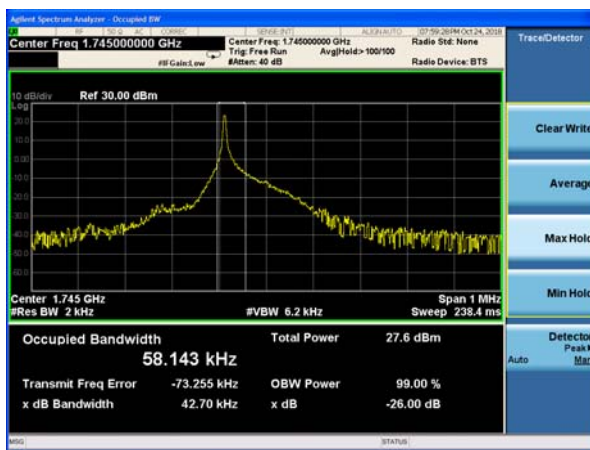




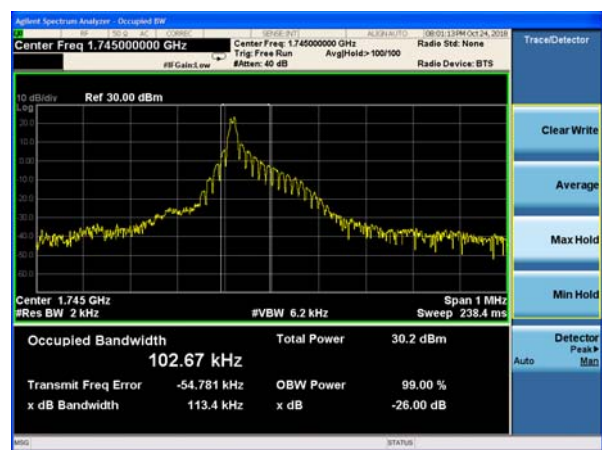
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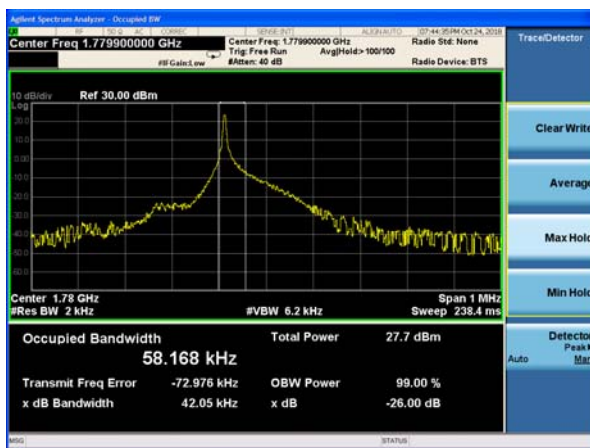
NB-IOT Band 66 BPSK 15kHz 1@0 CH-Low

NB-IOT Band 66 BPSK 3.75kHz 1@0
CH-Middle

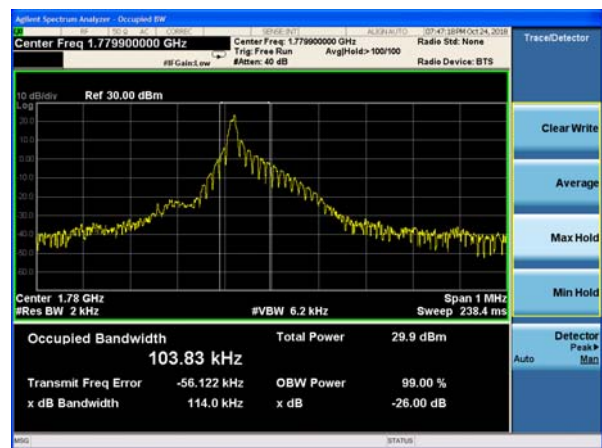
NB-IOT Band 66 BPSK 15kHz 1@0 CH-Middle



NB-IOT Band 66 BPSK 3.75kHz 1@0 CH-High

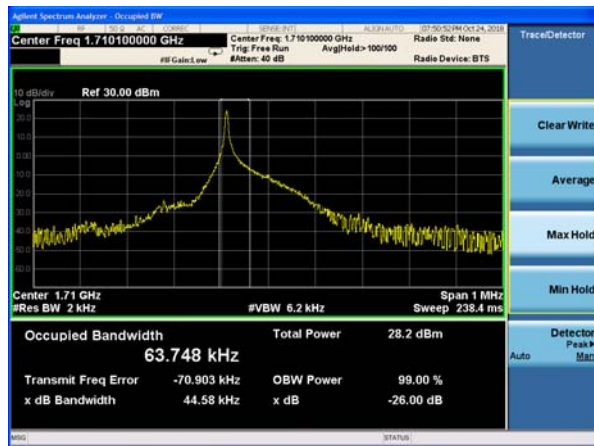


NB-IOT Band 66 BPSK 15kHz 1@0 CH-High

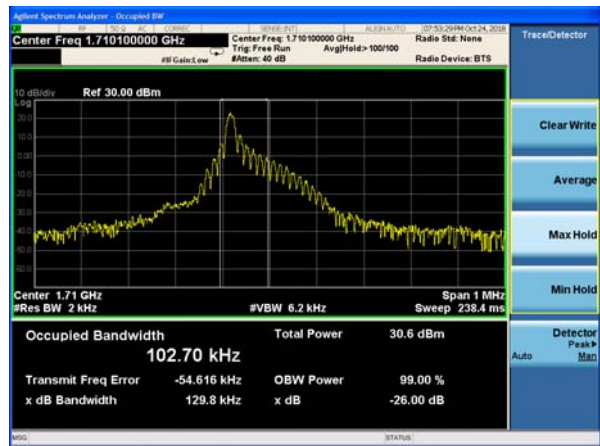




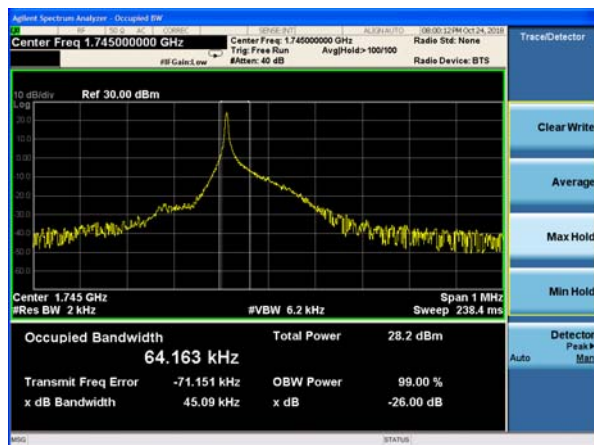
NB-IOT Band 66 QPSK 3.75kHz 1@0 CH-Low



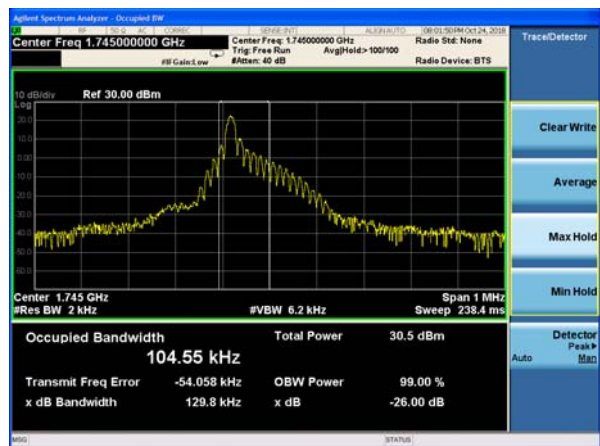
NB-IOT Band 66 QPSK 15kHz 1@0 CH-Low



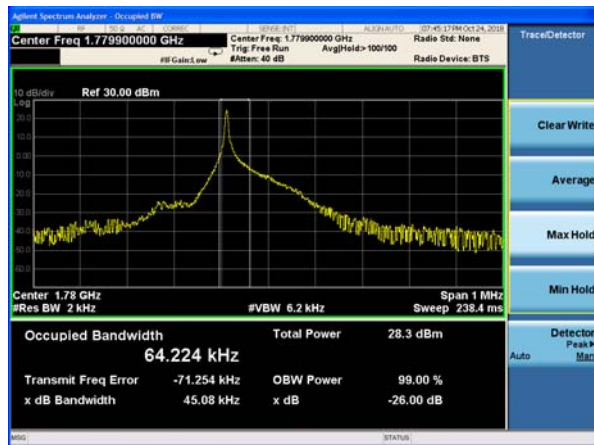
NB-IOT Band 66 QPSK 3.75kHz 1@0 CH-Middle



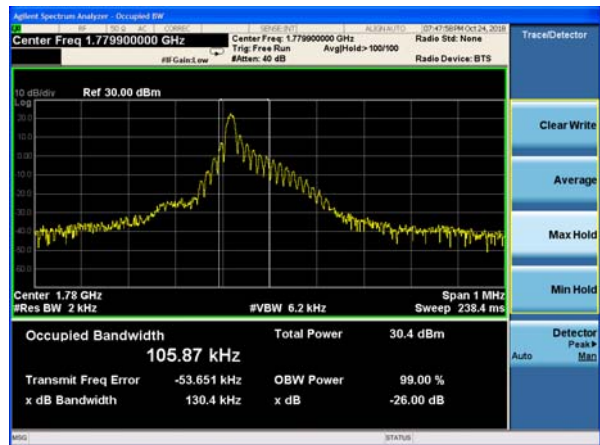
NB-IOT Band 66 QPSK 15kHz 1@0 CH-Middle



NB-IOT Band 66 QPSK 3.75kHz 1@0 CH-High

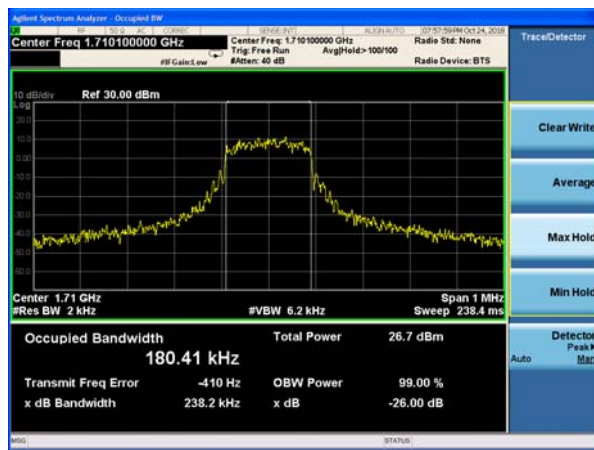


NB-IOT Band 66 QPSK 15kHz 1@0 CH-High

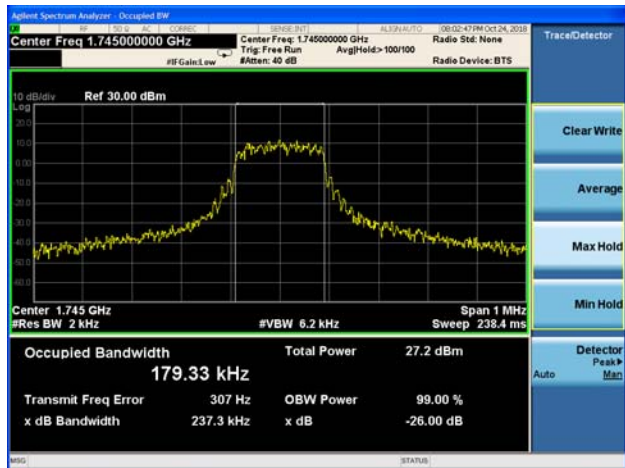




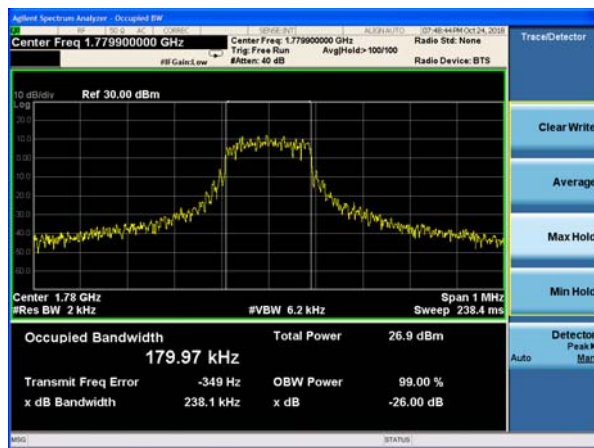
NB-IOT Band 66 QPSK 15kHz 12@0 CH-Low



NB-IOT Band 66 QPSK 15kHz 12@0 CH-Middle



NB-IOT Band 66 QPSK 15kHz 12@0 CH-High



5.4 Band Edge Compliance

Ambient condition

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

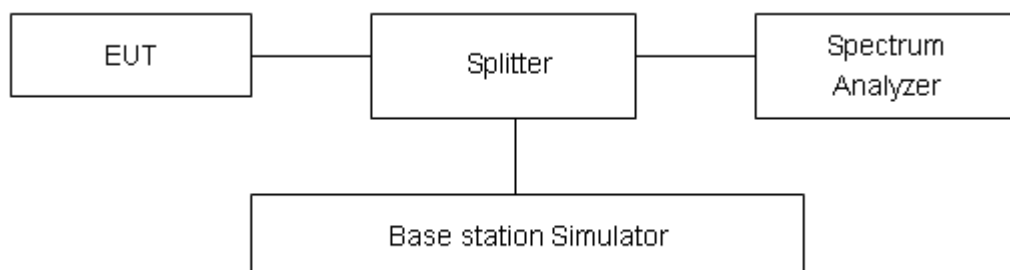
Method of Measurement

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 D01 v03r01 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) 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.

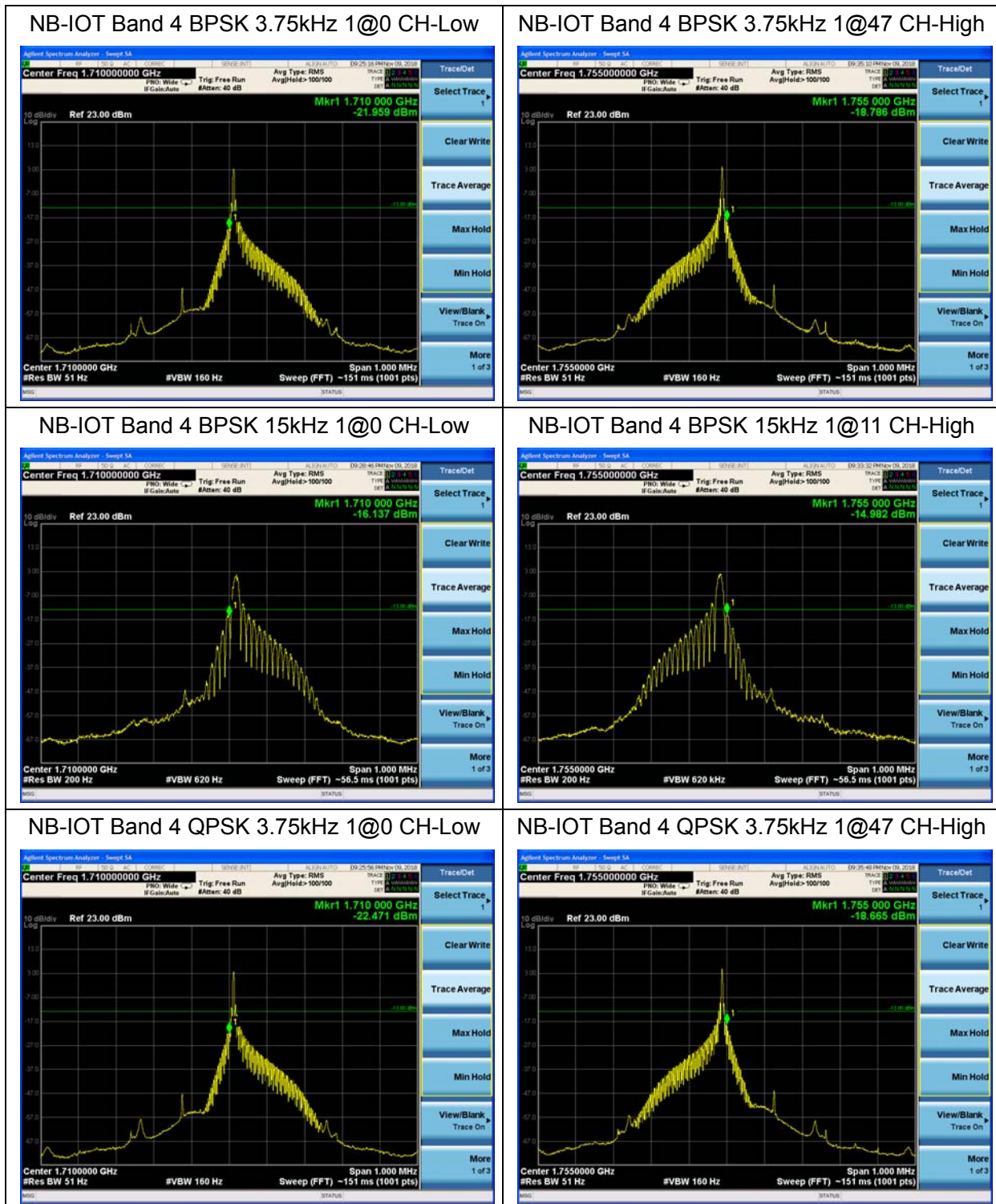
Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For 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.

Measurement Uncertainty

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

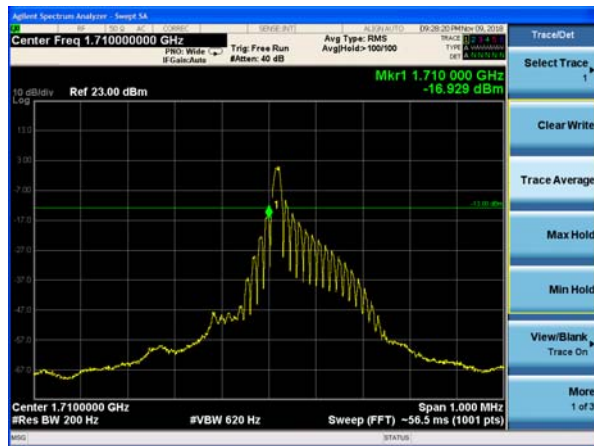
Test Result

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





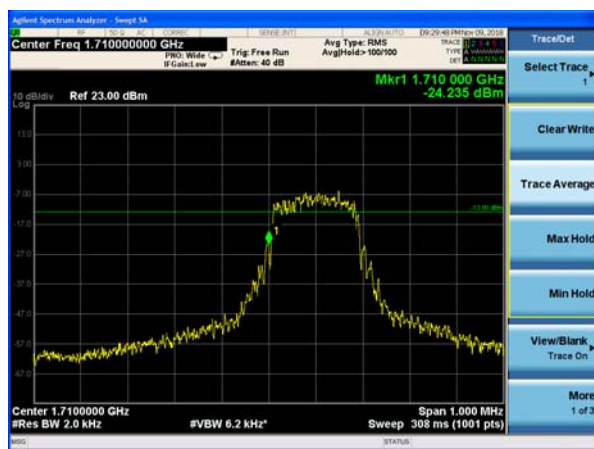
NB-IOT Band 4 QPSK 15kHz 1@0 CH-Low



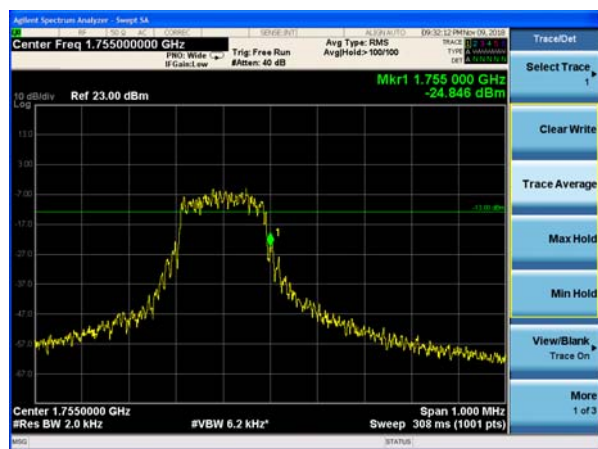
NB-IOT Band 4 QPSK 15kHz 1@11 CH-High



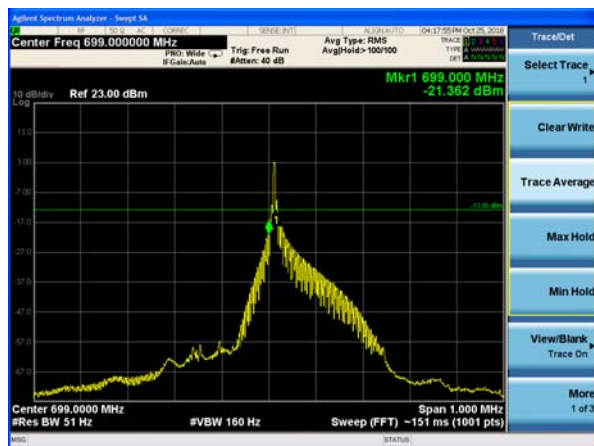
NB-IOT Band 4 QPSK 15kHz 12@0 CH-Low



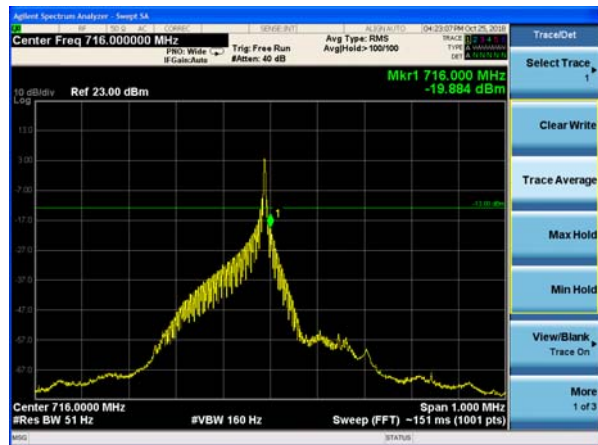
NB-IOT Band 4 QPSK 15kHz 12@0 CH-High



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

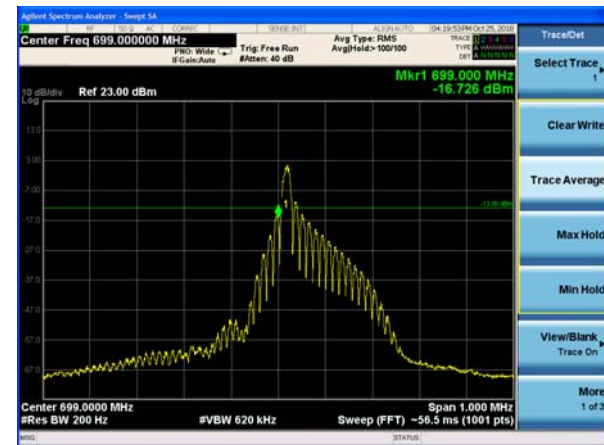


NB-IOT Band 12 BPSK 3.75kHz 1@47 CH-High

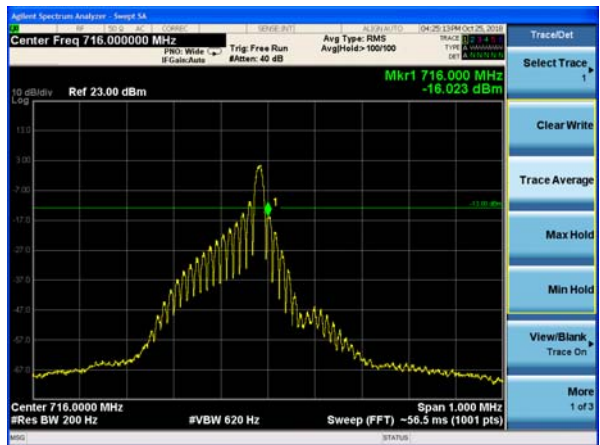




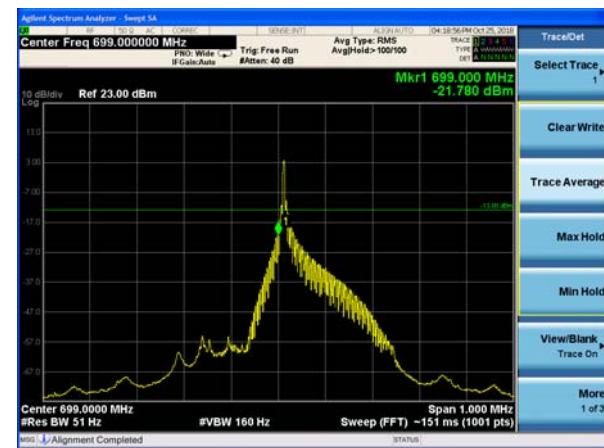
NB-IOT Band 12 BPSK 15kHz 1@0 CH-Low



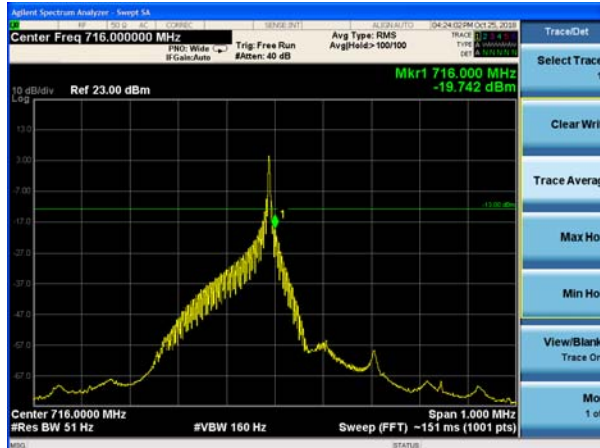
NB-IOT Band 12 BPSK 15kHz 1@11 CH-High



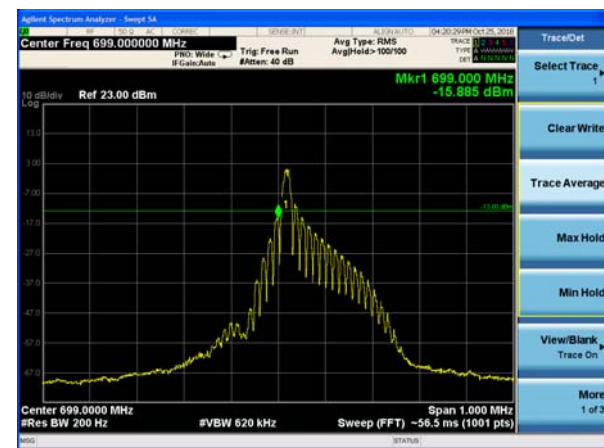
NB-IOT Band 12 QPSK 3.75kHz 1@0 CH-Low



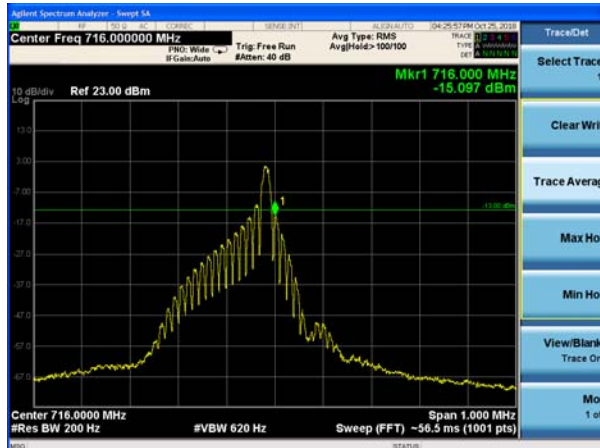
NB-IOT Band 12 QPSK 3.75kHz 1@47 CH-High



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

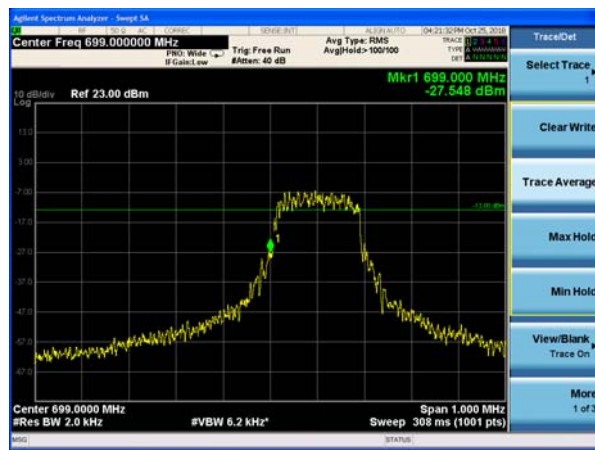


NB-IOT Band 12 QPSK 15kHz 1@11 CH-High

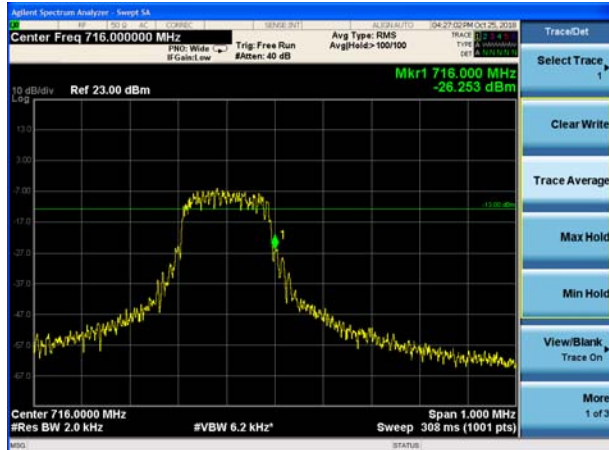




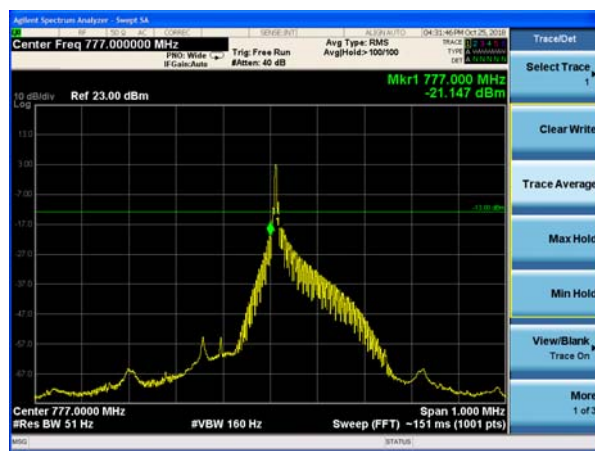
NB-IOT Band 12 QPSK 15kHz 12@0 CH-Low



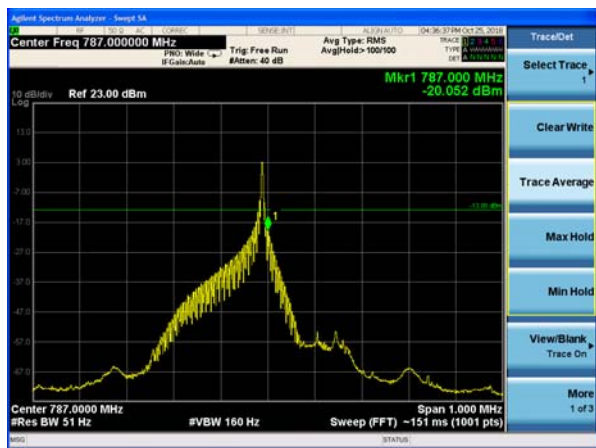
NB-IOT Band 12 QPSK 15kHz 12@0 CH-High



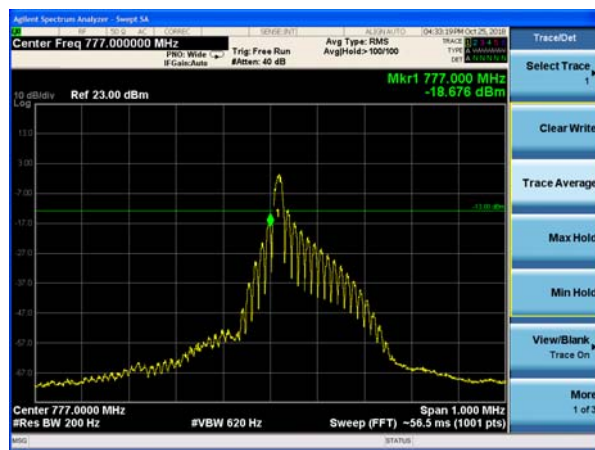
NB-IOT Band 13 BPSK 3.75kHz 1@0 CH-Low



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

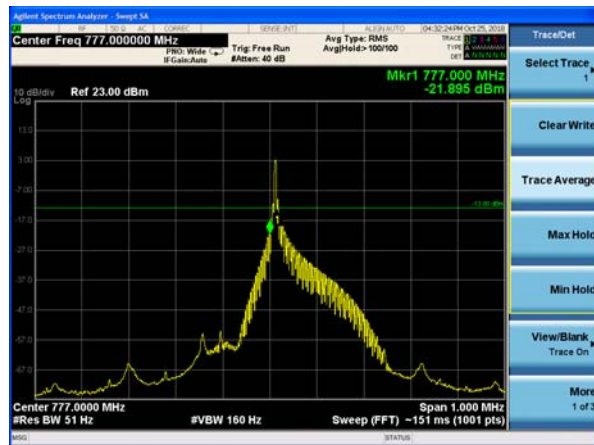
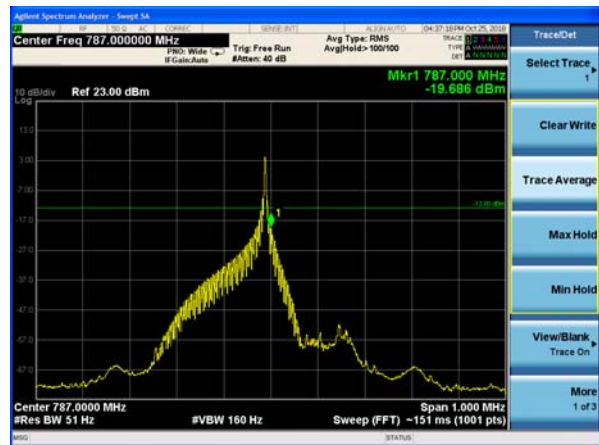


NB-IOT Band 13 BPSK 15kHz 1@0 CH-Low

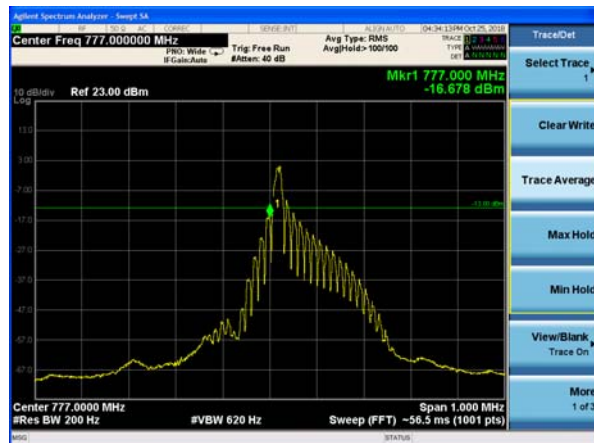


NB-IOT Band 13 BPSK 15kHz 1@11 CH-High

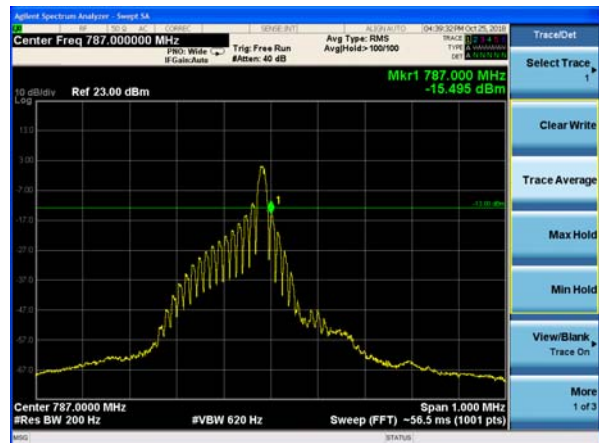


NB-IOT Band 13 QPSK 3.75kHz 1@0
CH-LowNB-IOT Band 13 QPSK 3.75kHz 1@47
CH-High

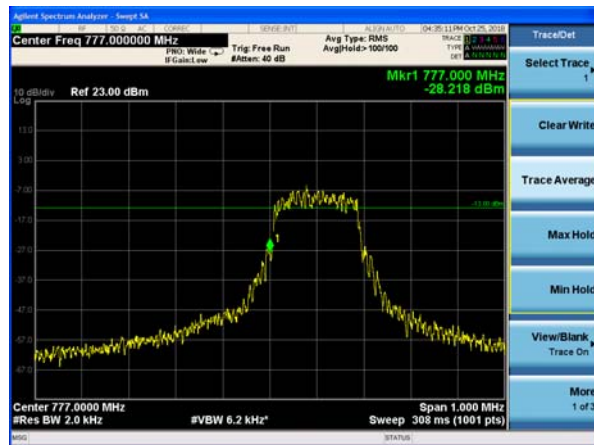
NB-IOT Band 13 QPSK 15kHz 1@0 CH-Low



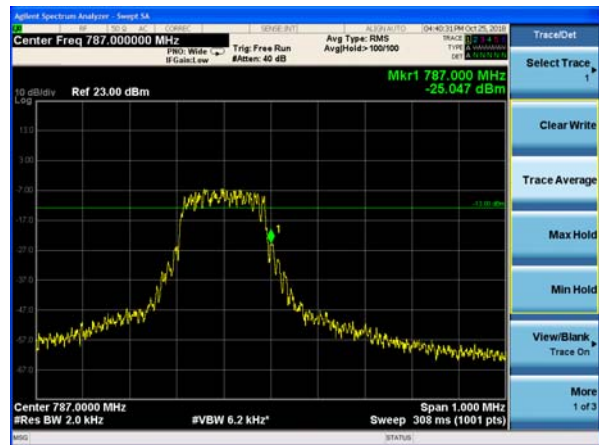
NB-IOT Band 13 QPSK 15kHz 1@11 CH-High

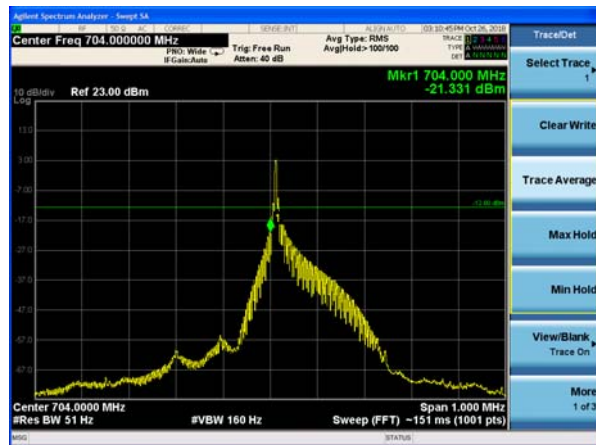
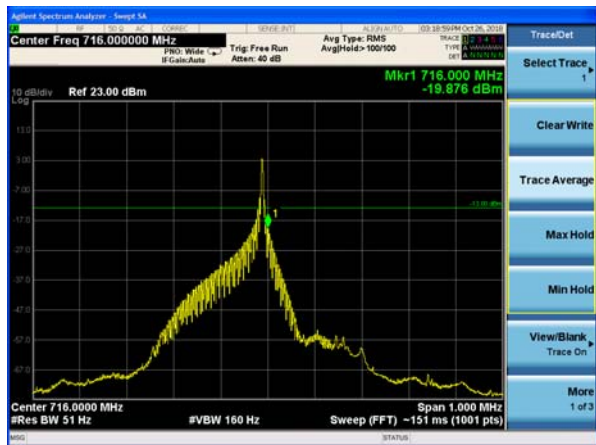


NB-IOT Band 13 QPSK 15kHz 12@0 CH-Low

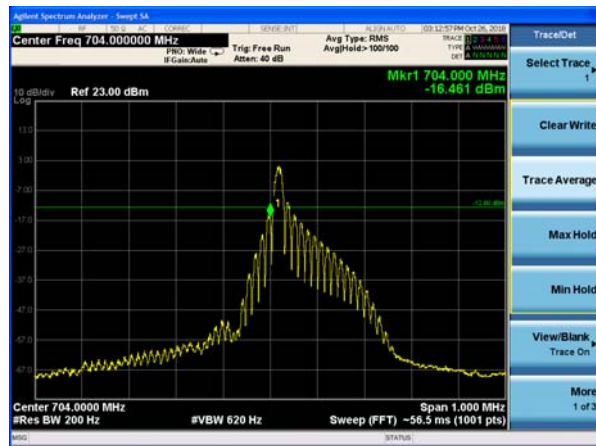


NB-IOT Band 13 QPSK 15kHz 12@0 CH-High

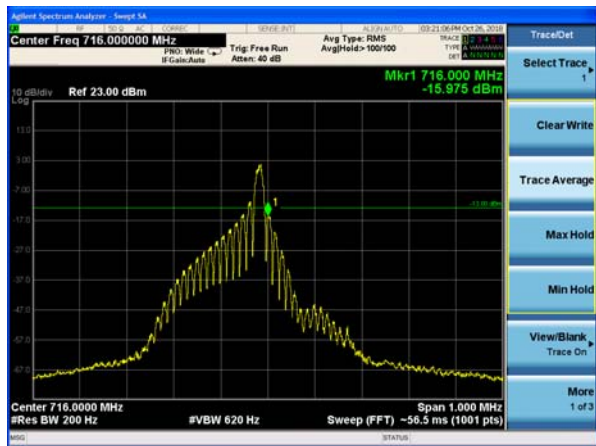


NB-IOT Band 17 BPSK 3.75kHz 1@0
CH-LowNB-IOT Band 17 BPSK 3.75kHz 1@47
CH-High

NB-IOT Band 17 BPSK 15kHz 1@0 CH-Low



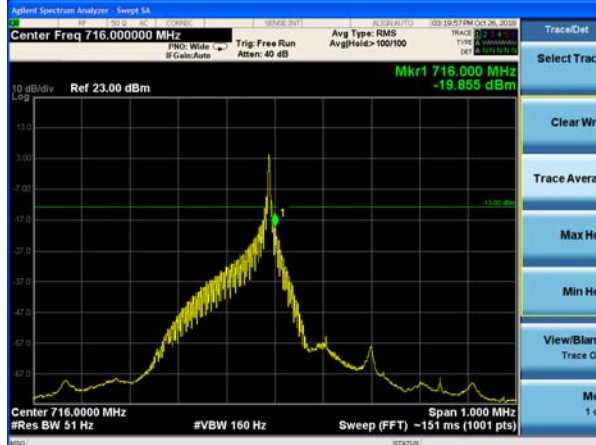
NB-IOT Band 17 BPSK 15kHz 1@11 CH-High



NB-IOT Band 17 QPSK 3.75kHz 1@0 CH-Low

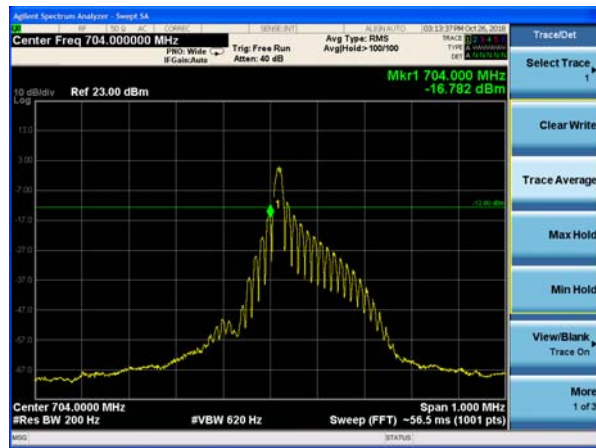


NB-IOT Band 17 QPSK 3.75kHz 1@47 CH-High

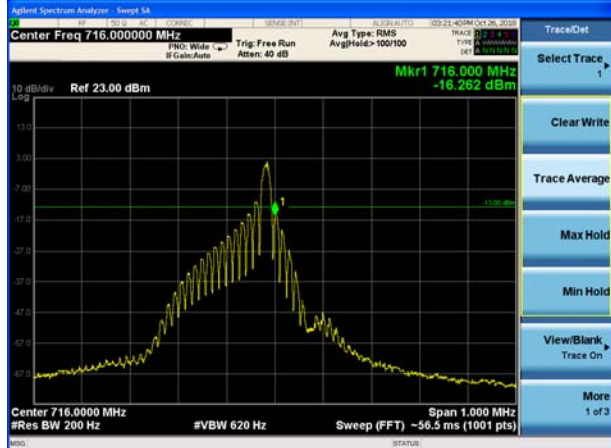




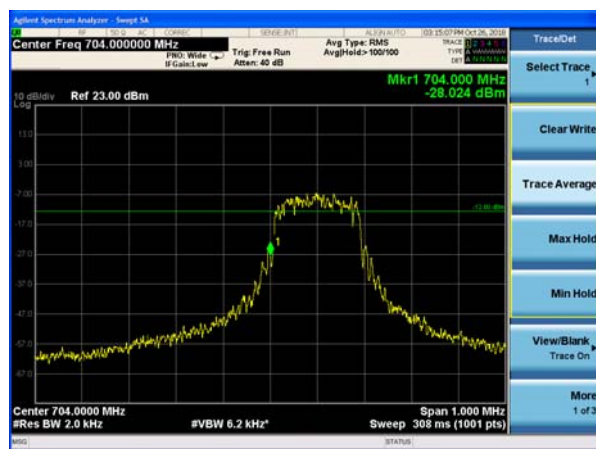
NB-IOT Band 17 QPSK 15kHz 1@0 CH-Low



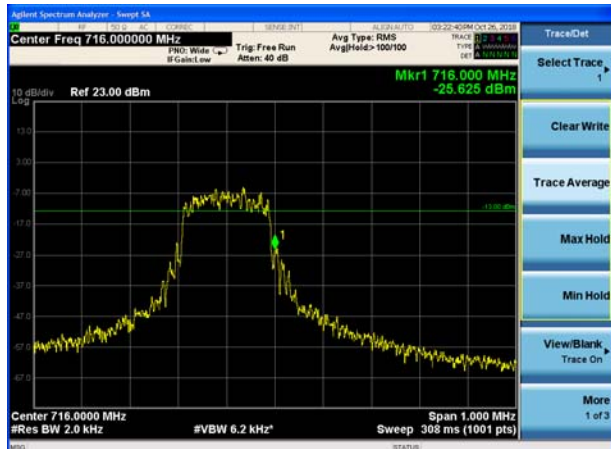
NB-IOT Band 17 QPSK 15kHz 1@11 CH-High



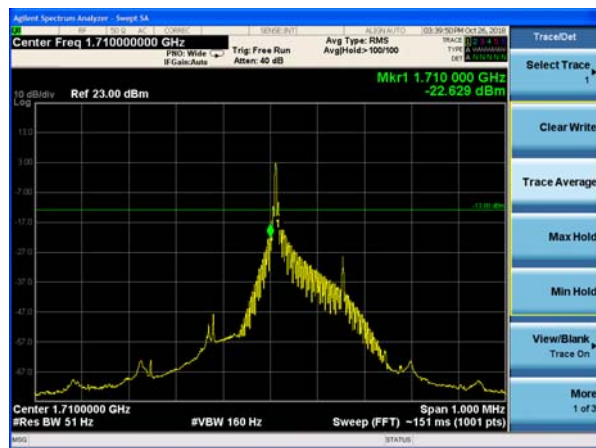
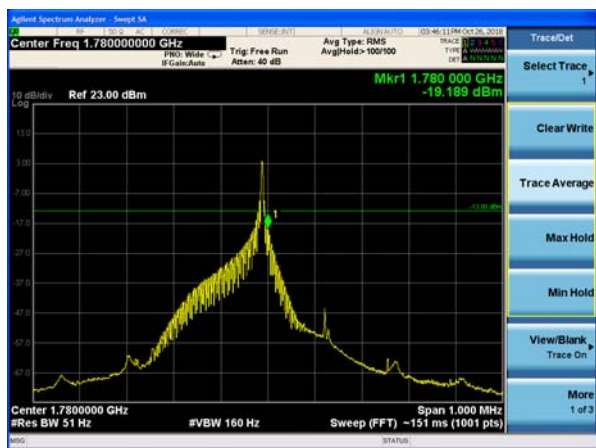
NB-IOT Band 17 QPSK 15kHz 12@0 CH-Low



NB-IOT Band 17 QPSK 15kHz 12@0 CH-High

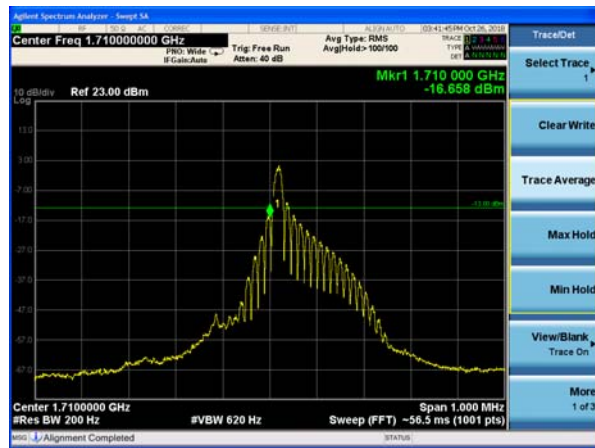


NB-IOT Band 66 BPSK 3.75kHz 1@0 CH-Low

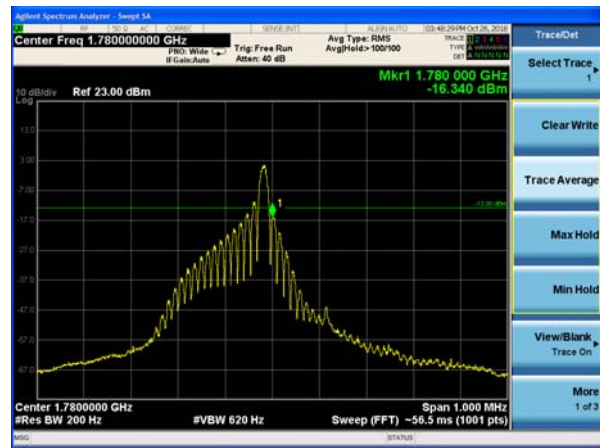
NB-IOT Band 66 BPSK 3.75kHz 1@47
CH-High



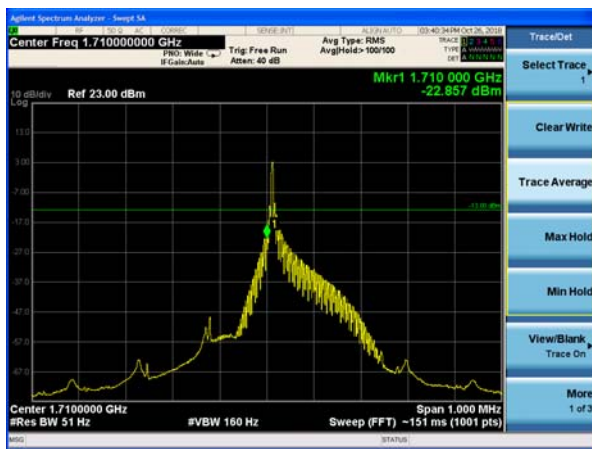
NB-IOT Band 66 BPSK 15kHz 1@0 CH-Low



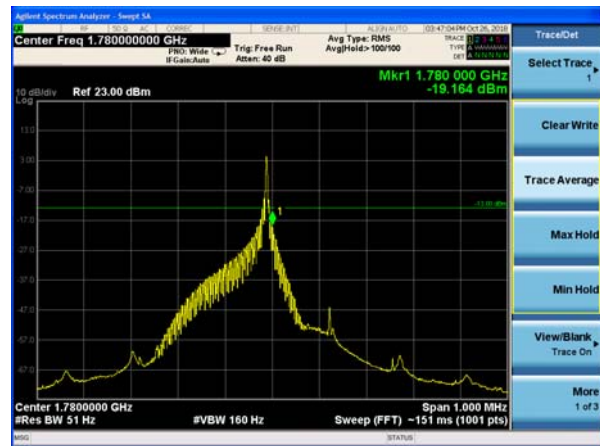
NB-IOT Band 66 BPSK 15kHz 1@11 CH-High



NB-IOT Band 66 QPSK 3.75kHz 1@0 CH-Low



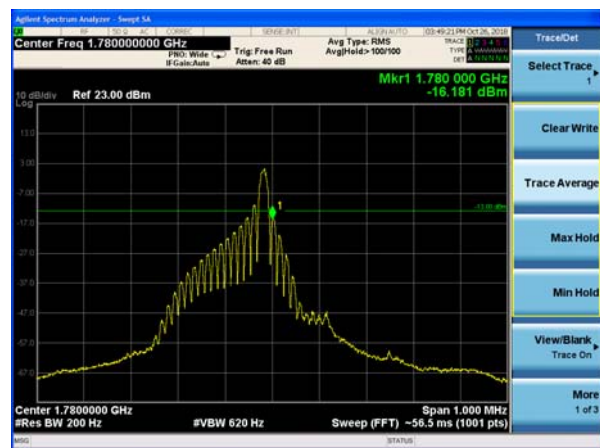
NB-IOT Band 66 QPSK 3.75kHz 1@47 CH-High



NB-IOT Band 66 QPSK 15kHz 1@0 CH-Low

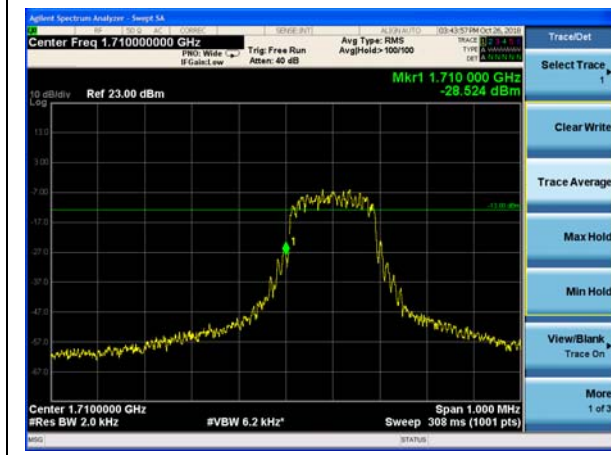


NB-IOT Band 66 QPSK 15kHz 1@11 CH-High

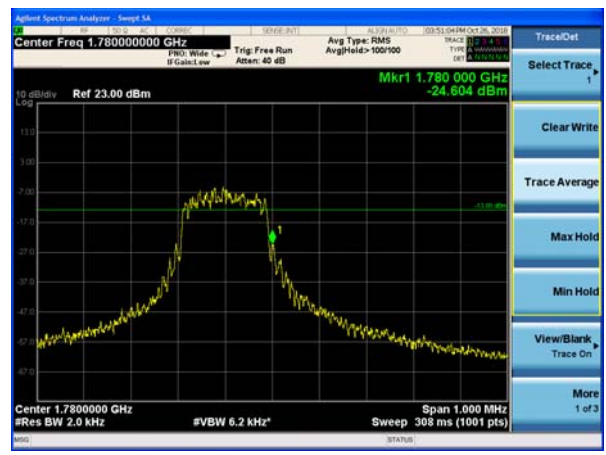




NB-IOT Band 66 QPSK 15kHz 12@0 CH-Low



NB-IOT Band 66 QPSK 15kHz 12@0 CH-High



5.5 Peak-to-Average Power Ratio (PAPR)

Ambient condition

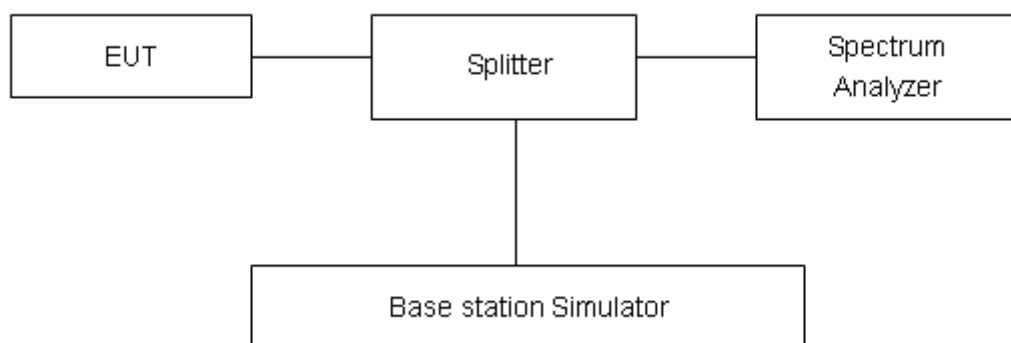
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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:

$$\text{PAPR (dB)} = \text{PPk (dBm)} - \text{PAvg (dBm)}.$$

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 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 4 Standalone	BPSK	3.75	20175/1732.5	26.39	22.21	4.18
	QPSK	3.75	20175/1732.5	25.87	22.19	3.68
	BPSK	15	20175/1732.5	26.07	19.22	6.85
	QPSK	15	20175/1732.5	25.83	19.17	6.66

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	26.44	22.14	4.30
	QPSK	3.75	23095/707.5	25.92	22.16	3.76
	BPSK	15	23095/707.5	26.18	19.21	6.97
	QPSK	15	23095/707.5	25.91	19.12	6.79

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	26.30	21.99	4.31
	QPSK	3.75	23230/782	25.75	22.02	3.73
	BPSK	15	23230/782	25.90	18.64	7.26
	QPSK	15	23230/782	25.65	18.92	6.73

Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band 17 Standalone	BPSK	3.75	23790/710	26.41	22.11	4.30
	QPSK	3.75	23790/710	25.80	22.04	3.76
	BPSK	15	23790/710	26.05	19.04	7.01
	QPSK	15	23790/710	25.77	19.00	6.77

Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band 66 Standalone	BPSK	3.75	132322/1745	26.19	21.92	4.27
	QPSK	3.75	132322/1745	25.64	21.91	3.73
	BPSK	15	132322/1745	25.89	19.01	6.88
	QPSK	15	132322/1745	25.63	18.96	6.67

5.6 Frequency Stability

Ambient condition

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

Method of Measurement

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -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.

Frequency Stability (Voltage Variation)

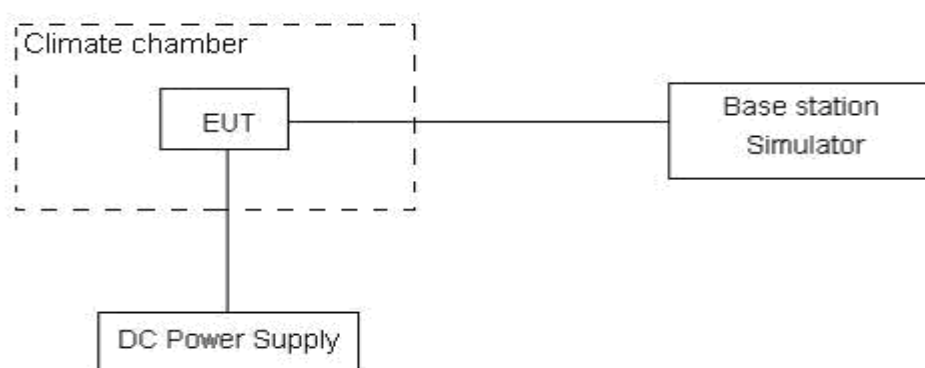
The frequency stability shall be measured with variation of primary supply voltage as follows:

(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 2.1 V and 3.63 V, with a nominal voltage of 3.3V.

Test setup



Limits

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Measurement Uncertainty

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

Test Result

NB-IOT Band 4					
BPSK,(15KHz)					
Condition		1710	1755	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	1710.0973	1754.0679	2.65	0.00317
Extreme (85°C)		1710.0948	1754.0643	14.76	0.01764
Extreme (80°C)		1710.0946	1754.0628	6.52	0.00779
Extreme (70°C)		1710.0997	1754.0664	8.95	0.01070
Extreme (60°C)		1710.0932	1754.0631	13.54	0.01619
Extreme (50°C)		1710.0961	1754.0665	25.11	0.03002
Extreme (40°C)		1710.0919	1754.0694	23.01	0.02751
Extreme (30°C)		1710.0948	1754.0676	18.41	0.02201
Extreme (20°C)		1710.0925	1754.0684	7.22	0.00863
Extreme (10C)		1710.0939	1754.0659	19.64	0.02348
Extreme (0°C)		1710.0967	1754.0662	17.43	0.02084
Extreme (-10°C)		1710.0958	1754.0671	28.65	0.03425
Extreme (-20°C)		1710.0939	1754.0652	30.42	0.03637
Extreme (-30°C)		1710.0942	1754.0684	4.65	0.00556
Extreme (-40°C)		1710.0987	1754.0696	2.84	0.00340
25°C	LV	1710.0963	1754.0637	7.95	0.00950
	HV	1710.0924	1754.0659	18.46	0.02207
QPSK,(15KHZ)					
Condition		1710	1755	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	1710.0764	1754.0223	2.84	0.00340
Extreme (85°C)		1710.0749	1754.0269	7.58	0.00906
Extreme (80°C)		1710.0763	1754.0235	18.34	0.02192
Extreme (70°C)		1710.0752	1754.0273	19.64	0.02348
Extreme (60°C)		1710.0728	1754.0258	25.03	0.02992
Extreme (50°C)		1710.0796	1754.0252	27.63	0.03303
Extreme (40°C)		1710.0774	1754.0247	21.45	0.02564
Extreme (30°C)		1710.0768	1754.0286	13.58	0.01623
Extreme (20°C)		1710.0756	1754.0253	9.64	0.01152
Extreme (10C)		1710.0743	1754.0241	3.78	0.00452
Extreme (0°C)		1710.0791	1754.0268	6.95	0.00831
Extreme (-10°C)		1710.0772	1754.0228	18.34	0.02192
Extreme (-20°C)		1710.0758	1754.0236	2.44	0.00292
Extreme (-30°C)		1710.0794	1754.0274	15.73	0.01880



Extreme (-40°C)		1710.0761	1754.0291	22.61	0.02703
25°C	LV	1710.0737	1754.0254	15.39	0.01840
	HV	1710.0749	1754.0236	29.37	0.03511

NB-IOT Band 12					
BPSK,(15KHz)					
Condition		699	716	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	699.0373	715.9789	3.97	0.00561
Extreme (85°C)		699.0403	715.9813	5.32	0.00752
Extreme (80°C)		699.0372	715.9776	4.11	0.00581
Extreme (70°C)		699.0401	715.9815	8.19	0.01158
Extreme (60°C)		699.0385	715.9804	15.24	0.02154
Extreme (50°C)		699.0512	715.9928	18.67	0.02639
Extreme (40°C)		699.0399	715.9815	11.23	0.01587
Extreme (30°C)		699.0434	715.985	9.56	0.01351
Extreme (20°C)		699.0456	715.9872	14.29	0.02020
Extreme (10C)		699.0429	715.9845	16.77	0.02370
Extreme (0°C)		699.0420	715.9836	8.84	0.01249
Extreme (-10°C)		699.0409	715.9827	2.64	0.00373
Extreme (-20°C)		699.0411	715.9827	5.08	0.00718
Extreme (-30°C)		699.0349	715.9765	14.37	0.02031
Extreme (-40°C)		699.0426	715.9842	19.54	0.02762
25°C	LV	699.0405	715.9821	7.77	0.01098
	HV	699.0398	715.9814	9.64	0.01363
QPSK,(15KHZ)					
Condition		699	716	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	699.0259	715.9675	9.64	0.01363
Extreme (85°C)		699.0235	715.9645	6.26	0.00885
Extreme (80°C)		699.0272	715.9676	9.54	0.01348
Extreme (70°C)		699.0233	715.9647	4.86	0.00687
Extreme (60°C)		699.0247	715.9663	15.84	0.02239
Extreme (50°C)		699.0120	715.9536	14.31	0.02023
Extreme (40°C)		699.0233	715.9649	4.20	0.00594
Extreme (30°C)		699.0198	715.9614	6.57	0.00929
Extreme (20°C)		699.0176	715.9592	18.92	0.02674
Extreme (10C)		699.0203	715.9684	3.22	0.00455
Extreme (0°C)		699.0212	715.9628	7.46	0.01054
Extreme (-10°C)		699.0223	715.9639	12.38	0.01750



Extreme (-20°C)		699.0221	715.9637	9.73	0.01375
Extreme (-30°C)		699.0283	715.9699	6.01	0.00849
Extreme (-40°C)		699.0206	715.9622	16.74	0.02366
25°C	LV	699.0227	715.9643	11.92	0.01685
	HV	699.0234	715.965	13.45	0.01901

NB-IOT Band 13					
BPSK,(15KHz)					
Condition		777	787	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	777.4363	786.5756	9.27	0.01310
Extreme (85°C)		777.4375	786.5744	-8.92	-0.01261
Extreme (80°C)		777.4356	786.5763	11.24	0.01589
Extreme (70°C)		777.4353	786.5766	13.21	0.01867
Extreme (60°C)		777.4368	786.5751	6.25	0.00883
Extreme (50°C)		777.4357	786.5762	-7.63	-0.01078
Extreme (40°C)		777.4354	786.5765	3.61	0.00510
Extreme (30°C)		777.4370	786.5749	1.66	0.00235
Extreme (20°C)		777.4361	786.5758	10.12	0.01430
Extreme (10°C)		777.4356	786.5751	0.17	0.00024
Extreme (0°C)		777.4362	786.5765	-0.56	-0.00079
Extreme (-10°C)		777.4356	786.5763	-7.09	-0.01002
Extreme (-20°C)		777.4356	786.5755	-1.18	-0.00167
Extreme (-30°C)		777.4362	786.5744	-4.31	-0.00609
Extreme (-40°C)		777.4368	786.5751	4.21	0.00595
25°C	LV	777.4326	786.5723	2.86	0.00404
	HV	777.4372	786.5721	4.59	0.00649
QPSK,(15KHZ)					
Condition		777	787	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	777.5179	786.5012	-4.97	-0.00702
Extreme (85°C)		777.5191	786.5131	-4.92	-0.00695
Extreme (80°C)		777.5172	786.5019	-6.47	-0.00914
Extreme (70°C)		777.5169	786.5022	0.48	0.00068
Extreme (60°C)		777.5184	786.5007	-0.68	-0.00096
Extreme (50°C)		777.5173	786.5018	-1.78	-0.00252
Extreme (40°C)		777.5170	786.5021	-0.60	-0.00085
Extreme (30°C)		777.5186	786.5005	-5.19	-0.00734
Extreme (20°C)		777.5177	786.5014	-8.51	-0.01203



Extreme (10C)		777.5176	786.5011	-1.29	-0.00182
Extreme (0°C)		777.5169	786.5131	-3.75	-0.00530
Extreme (-10°C)		777.5173	786.5018	-1.77	-0.00250
Extreme (-20°C)		777.5172	786.5019	2.39	0.00338
Extreme (-30°C)		777.5178	786.5013	-2.87	-0.00406
Extreme (-40°C)		777.5184	786.5021	3.74	0.00529
25°C	LV	777.5123	786.5028	2.19	0.00310
	HV	777.5115	786.5071	0.82	0.00116

NB-IOT Band 17					
BPSK,(15KHz)					
Condition		704	716	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	704.3566	715.7036	3.04	0.00430
Extreme (85°C)		704.3567	715.7035	4.43	0.00626
Extreme (80°C)		704.3563	715.7039	8.09	0.01143
Extreme (70°C)		704.3556	715.7046	-2.96	-0.00418
Extreme (60°C)		704.3565	715.7037	-1.53	-0.00216
Extreme (50°C)		704.3562	715.7040	5.83	0.00824
Extreme (40°C)		704.3555	715.7047	10.40	0.01470
Extreme (30°C)		704.3559	715.7043	5.12	0.00724
Extreme (20°C)		704.3554	715.7048	3.04	0.00430
Extreme (10C)		704.3561	715.7041	9.49	0.01341
Extreme (0°C)		704.3564	715.7038	8.60	0.01216
Extreme (-10°C)		704.3552	715.7050	8.99	0.01271
Extreme (-20°C)		704.3565	715.7037	8.92	0.01261
Extreme (-30°C)		704.3552	715.7050	-6.71	-0.00948
Extreme (-40°C)		704.3562	715.9842	-3.78	-0.00534
25°C	LV	704.3567	715.9821	6.28	0.00888
	HV	704.3565	715.9814	5.65	0.00799
QPSK,(15KHZ)					
Condition		704	716	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	704.4601	715.6232	2.84	0.00401
Extreme (85°C)		704.4602	715.6231	4.03	0.00570
Extreme (80°C)		704.4598	715.6235	8.11	0.01146
Extreme (70°C)		704.4591	715.6242	15.25	0.02155
Extreme (60°C)		704.4600	715.6233	11.21	0.01584
Extreme (50°C)		704.4597	715.6236	12.85	0.01816



Extreme (40°C)		704.4590	715.6243	12.74	0.01801
Extreme (30°C)		704.4594	715.6239	16.43	0.02322
Extreme (20°C)		704.4589	715.6244	8.70	0.01230
Extreme (10°C)		704.4596	715.6237	-3.20	-0.00452
Extreme (0°C)		704.4599	715.6234	-4.86	-0.00687
Extreme (-10°C)		704.4587	715.6246	0.49	0.00069
Extreme (-20°C)		704.4600	715.6233	-0.13	-0.00018
Extreme (-30°C)		704.4587	715.6246	7.96	0.01125
Extreme (-40°C)		704.4585	715.9622	9.25	0.01307
25°C	LV	704.4589	715.9643	9.26	0.01309
	HV	704.4591	715.965	6.54	0.00924

NB-IOT Band 66					
BPSK,(15KHz)					
Condition		1710	1780	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	1710.3406	1779.6709	3.51	0.00496
Extreme (85°C)		1710.3405	1779.6708	4.90	0.00693
Extreme (80°C)		1710.3403	1779.6703	-2.65	-0.00375
Extreme (70°C)		1710.3421	1779.6723	-1.64	-0.00232
Extreme (60°C)		1710.3418	1779.6721	3.59	0.00507
Extreme (50°C)		1710.3409	1779.6712	-7.62	-0.01077
Extreme (40°C)		1710.3394	1779.6697	-2.49	-0.00352
Extreme (30°C)		1710.3413	1779.6716	-1.06	-0.00150
Extreme (20°C)		1710.3416	1779.6719	6.30	0.00890
Extreme (10°C)		1710.3401	1779.6704	-9.93	-0.01404
Extreme (0°C)		1710.3412	1779.6715	5.59	0.00790
Extreme (-10°C)		1710.3415	1779.6718	3.51	0.00496
Extreme (-20°C)		1710.3399	1779.6702	-9.02	-0.01275
Extreme (-30°C)		1710.3409	1779.6712	-7.21	-0.01019
Extreme (-40°C)		1710.3408	1779.6711	-8.13	-0.01149
25°C	LV	1710.3413	1779.6716	3.89	0.00550
	HV	1710.3407	1779.6713	6.47	0.00914
QPSK,(15KHZ)					
Condition		1710	1780	Delta (Hz)	Frequency Stability(ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	1710.4049	1779.7132	2.44	0.00345
Extreme (85°C)		1710.4051	1779.7131	8.45	0.01194
Extreme (80°C)		1710.4069	1779.7131	3.10	0.00438



Extreme (70°C)		1710.4047	1779.7144	-1.43	-0.00202
Extreme (60°C)		1710.4042	1779.7145	-3.65	-0.00516
Extreme (50°C)		1710.4046	1779.7135	7.63	0.01078
Extreme (40°C)		1710.4061	1779.7123	-1.09	-0.00154
Extreme (30°C)		1710.4042	1779.7139	2.36	0.00334
Extreme (20°C)		1710.4039	1779.7142	9.71	0.01372
Extreme (10°C)		1710.4054	1779.7127	-5.44	-0.00769
Extreme (0°C)		1710.4043	1779.7138	4.28	0.00605
Extreme (-10°C)		1710.4043	1779.7141	7.56	0.01069
Extreme (-20°C)		1710.4056	1779.7125	-1.45	-0.00205
Extreme (-30°C)		1710.4046	1779.7135	4.33	0.00612
Extreme (-40°C)		1710.4047	1779.7134	8.10	0.01145
25°C	LV	1710.4042	1779.7139	2.34	0.00331
	HV	1710.4048	1779.7133	-2.59	-0.00366

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.

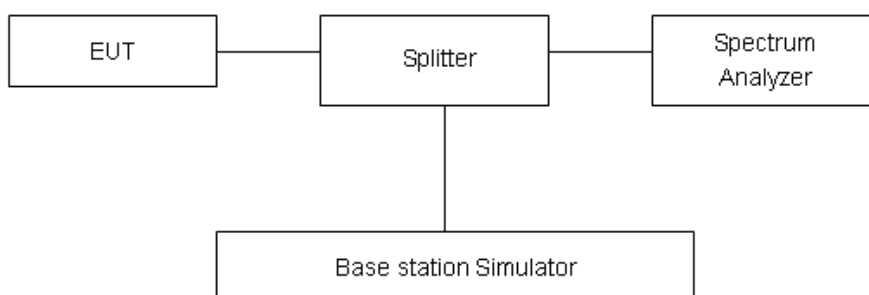
RBW is set to 100kHz, VBW is set to 300kHz for 30MHz~1GHz

RBW is set to 1MHz, VBW is set to 3MHz for above 1GHz, Sweep is set to ATUO.

Of those disturbances below (limit – 20 dB), the mark is not required for the EUT.

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

Test setup



Limits

NB-IOT -4 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..”

NB-IOT -12 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.

NB-IOT -13 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 13- 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;

Part 27.53 (h)/(g) Limit		-13 dBm
Part 27.53(f) 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 $k = 1.96$.

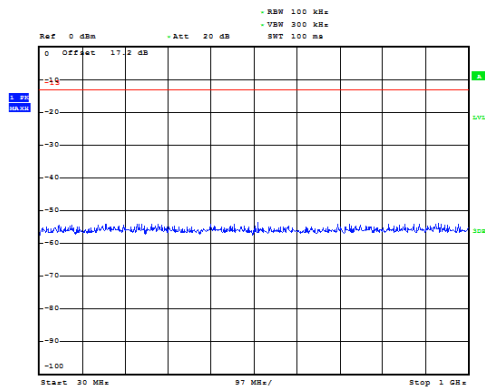
Frequency	Uncertainty
9kHz-1GHz	0.684 dB
1GHz-27GHz	1.407 dB

Test Result

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

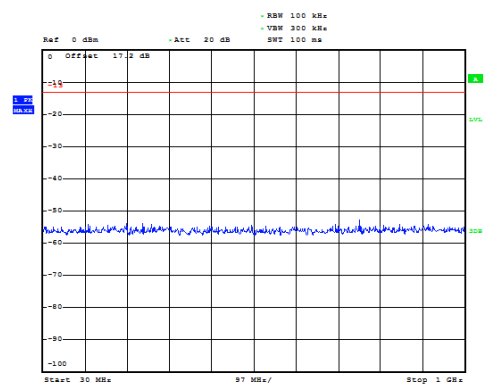
The signal beyond the limit is carrier.

NB-IOT Band 4 CH-Low 30MHz~1GHz



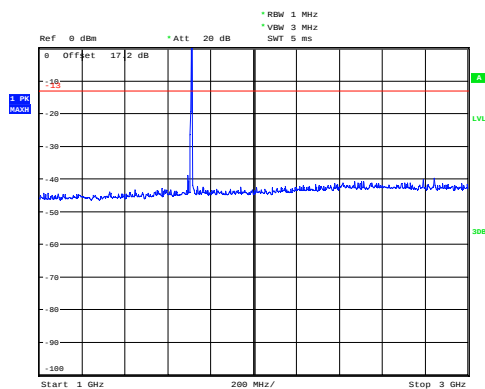
Date: 10.NOV.2018 09:58:14

NB-IOT Band 4 CH-Middle 30MHz~1GHz



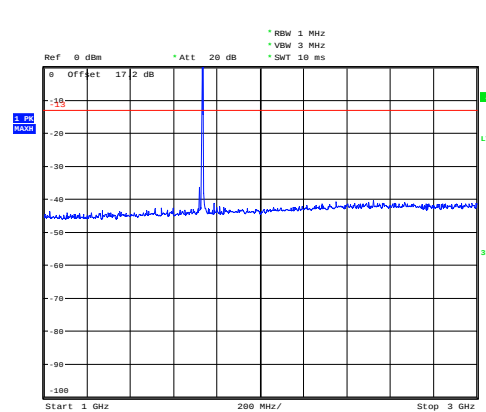
Date: 10.NOV.2018 10:02:20

NB-IOT Band 4 CH-Low 1GHz~3GHz



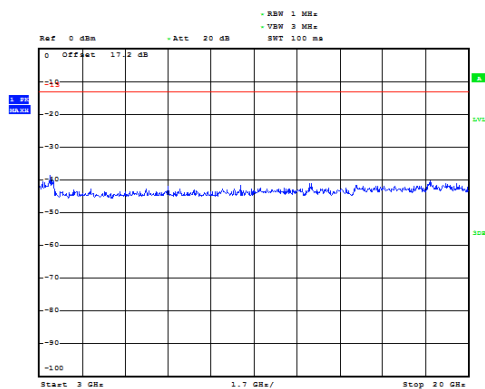
Date: 10.NOV.2018 09:57:52

NB-IOT Band 4 CH-Middle 1GHz~3GHz



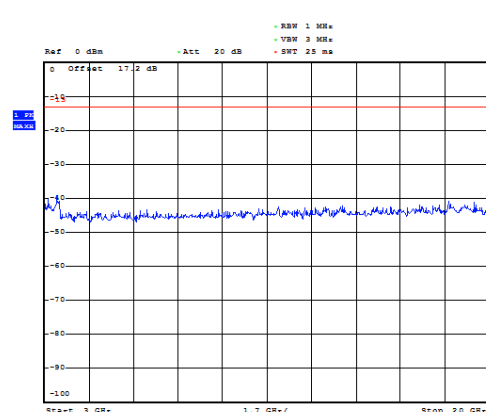
Date: 10.NOV.2018 10:03:05

NB-IOT Band 4 CH-Low 3GHz~20GHz



Date: 10.NOV.2018 09:57:22

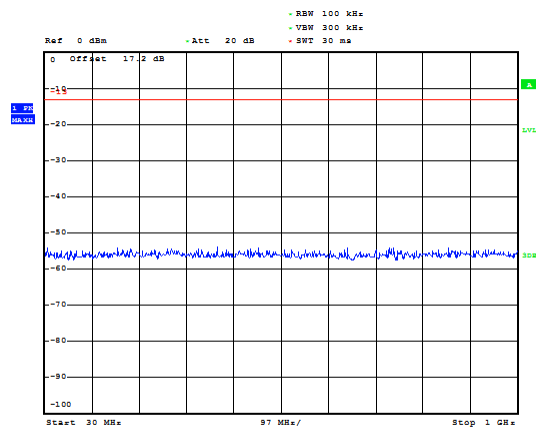
NB-IOT Band 4 CH-Middle 3GHz~20GHz



Date: 10.NOV.2018 10:09:27

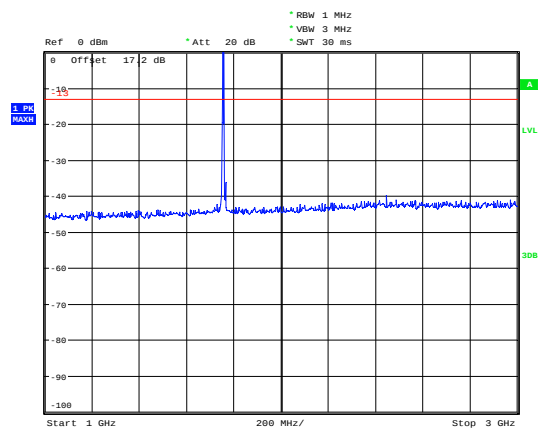


NB-IOT Band 4 CH-High 30MHz~1GHz



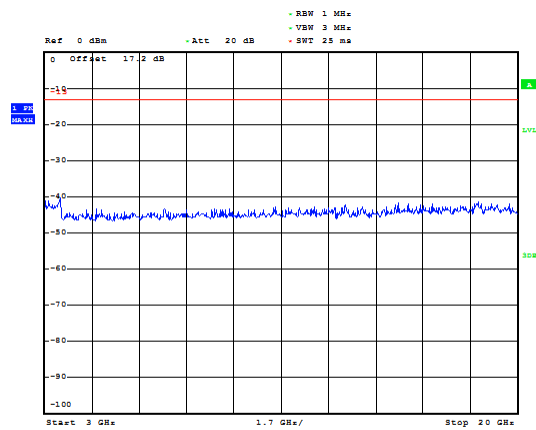
Date: 10.NOV.2018 10:38:19

NB-IOT Band 4 CH-High 1GHz~3GHz



Date: 10.NOV.2018 10:37:51

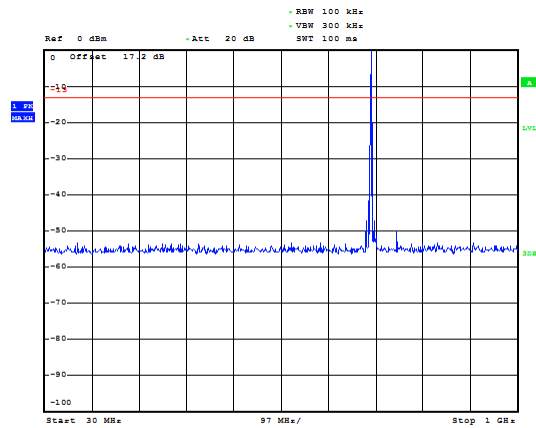
NB-IOT Band 4 CH-High 3GHz~20GHz



Date: 10.NOV.2018 10:37:36

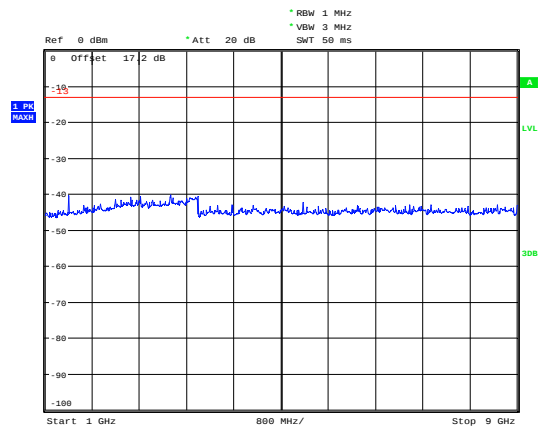


NB-IOT Band 12 CH-Low 30MHz~1GHz



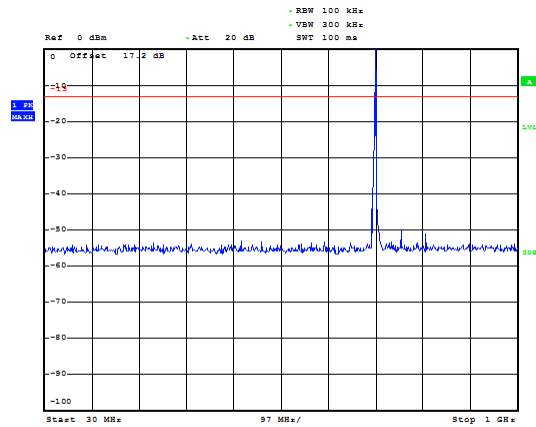
Date: 29.OCT.2018 11:32:20

NB-IOT Band 12 CH-Low 1GHz~9GHz



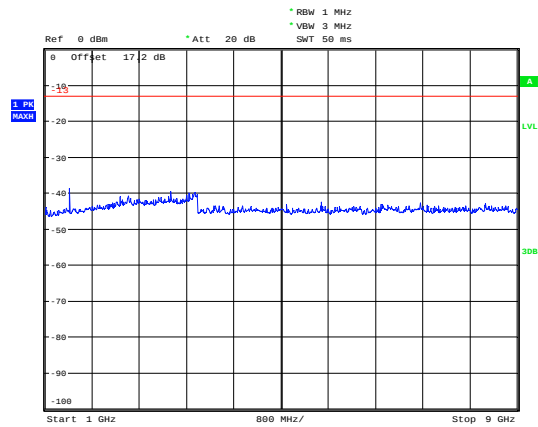
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NB-IOT Band 12 CH- Middle 30MHz~1GHz



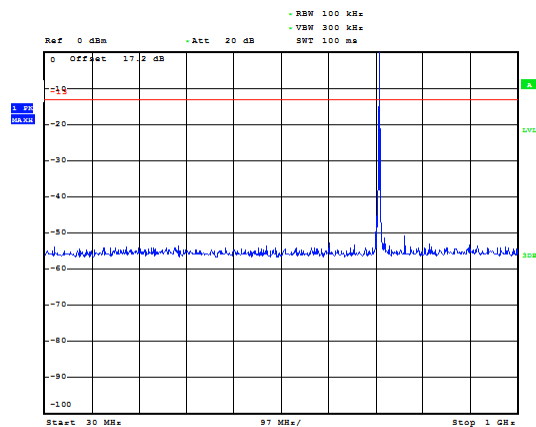
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NB-IOT Band 12 CH- Middle 1GHz~9GHz



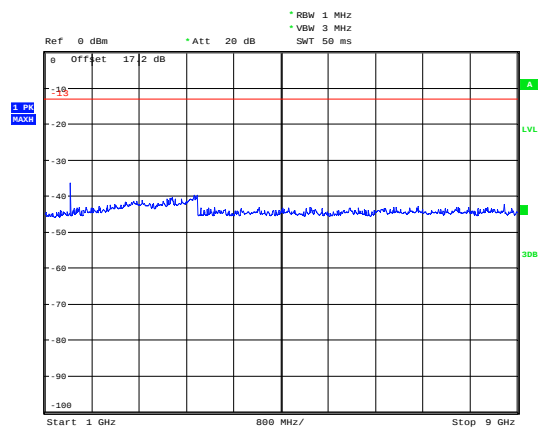
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NB-IOT Band 12 CH-High 30MHz~1GHz



Date: 29.OCT.2018 11:40:58

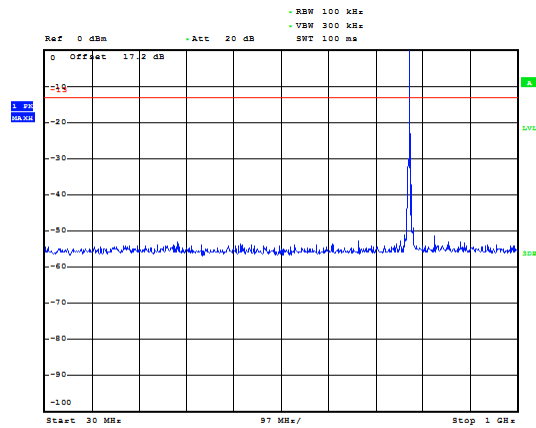
NB-IOT Band 12 CH-High 1GHz~9GHz



Date: 29.OCT.2018 11:41:42

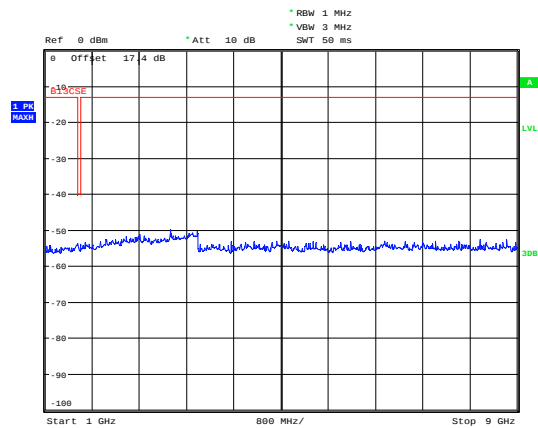


NB-IOT Band 13 CH-Low 30MHz~1GHz



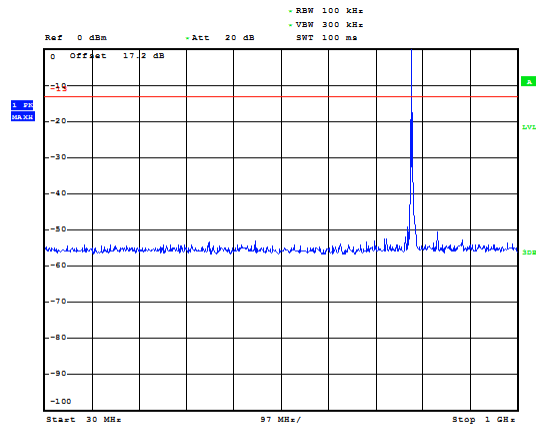
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NB-IOT Band 13 CH-Low 1GHz~9GHz



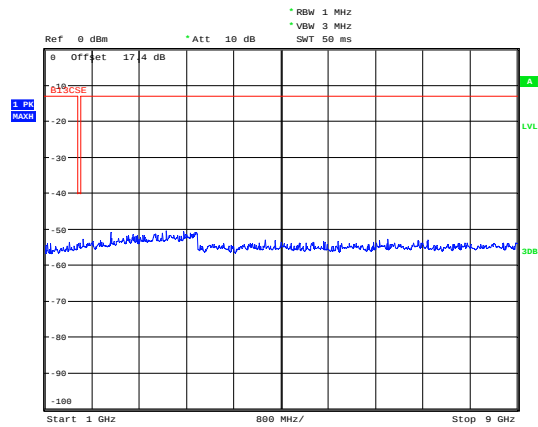
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NB-IOT Band 13 CH- Middle 30MHz~1GHz



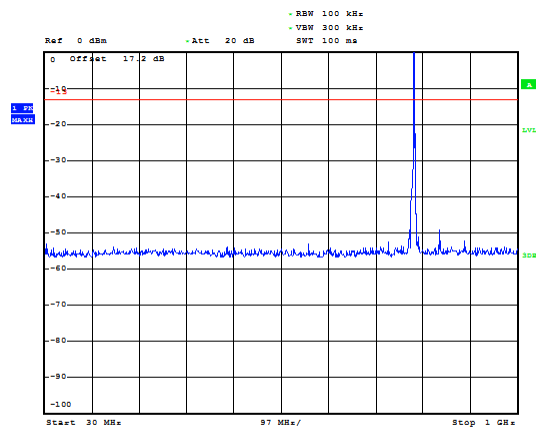
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NB-IOT Band 13 CH- Middle 1GHz~9GHz



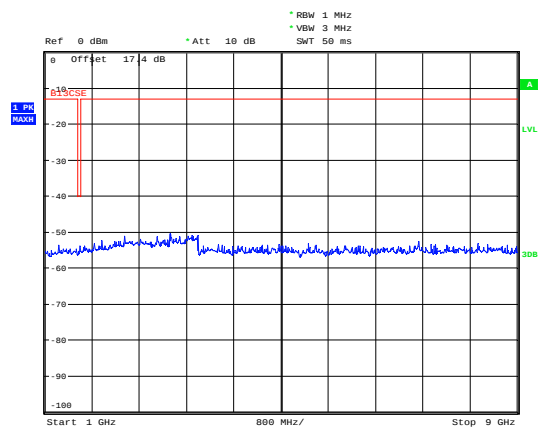
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NB-IOT Band 13 CH-High 30MHz~1GHz



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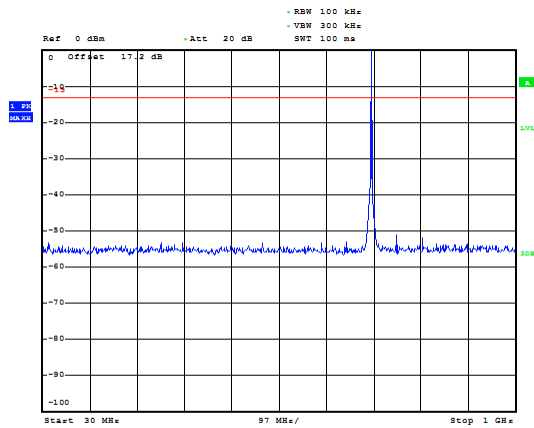
NB-IOT Band 13 CH-High 1GHz~9GHz



Date: 14.NOV.2018 16:49:47

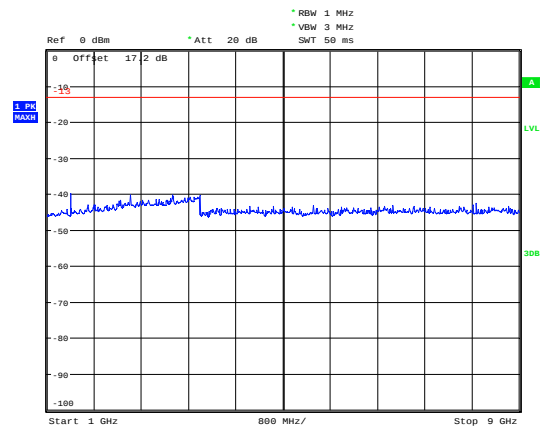


NB-IOT Band 17 CH-Low 30MHz~1GHz



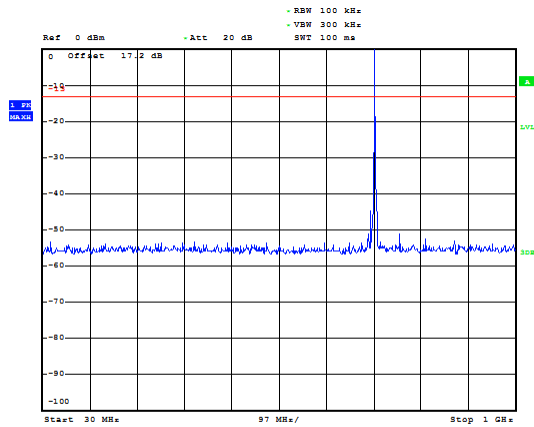
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NB-IOT Band 17 CH-Low 1GHz~9GHz



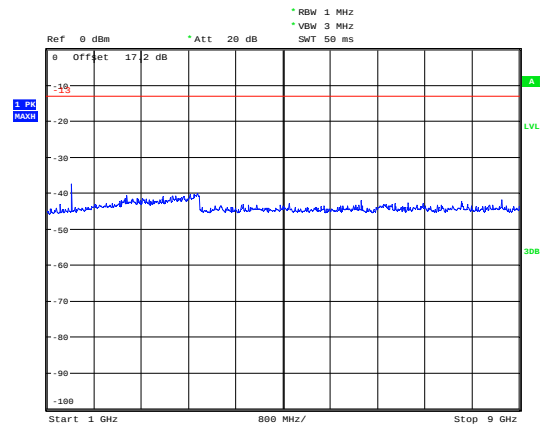
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NB-IOT Band 17 CH- Middle 30MHz~1GHz



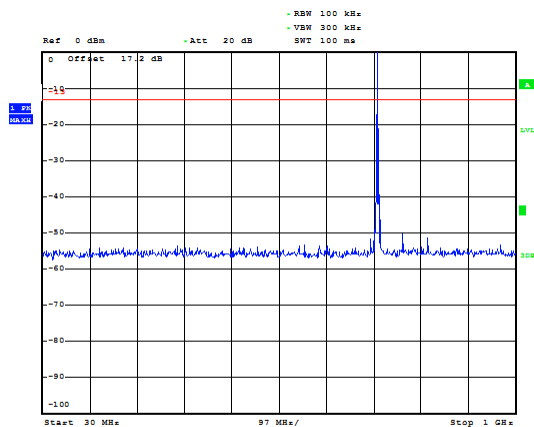
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NB-IOT Band 17 CH- Middle 1GHz~9GHz



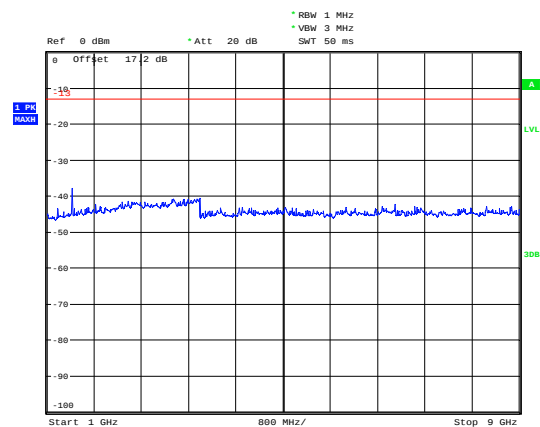
Date: 29.OCT.2018 12:00:07

NB-IOT Band 17 CH-High 30MHz~1GHz



Date: 29.OCT.2018 12:05:23

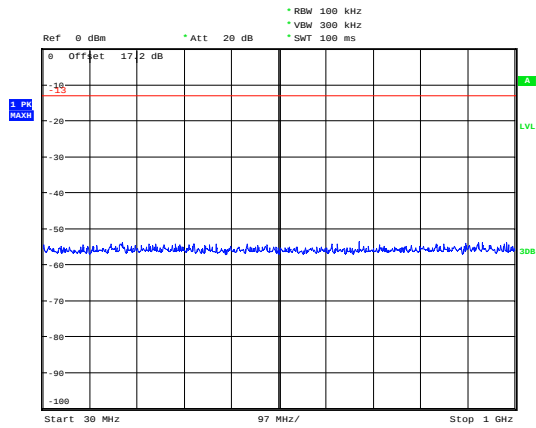
NB-IOT Band 17 CH-High 1GHz~9GHz



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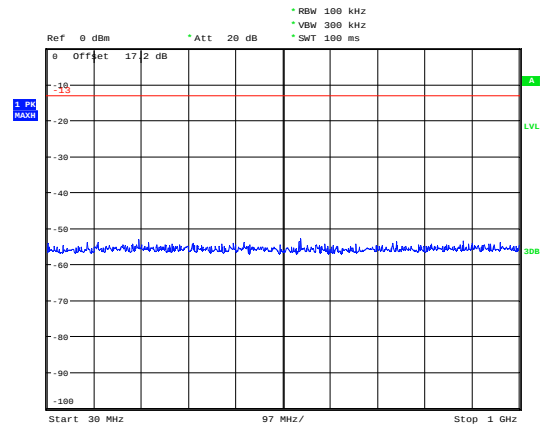


NB-IOT Band 66 CH-Low 30MHz~1GHz



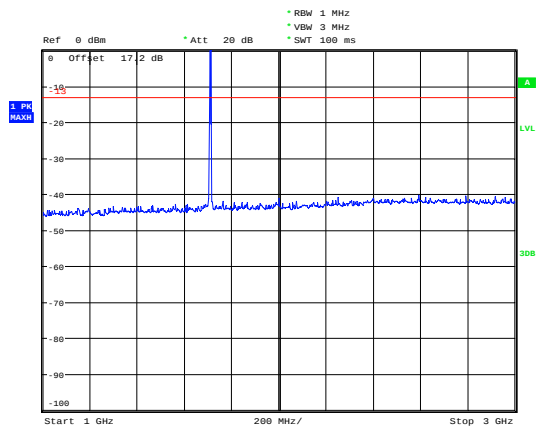
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NB-IOT Band 66 CH-Middle 30MHz~1GHz



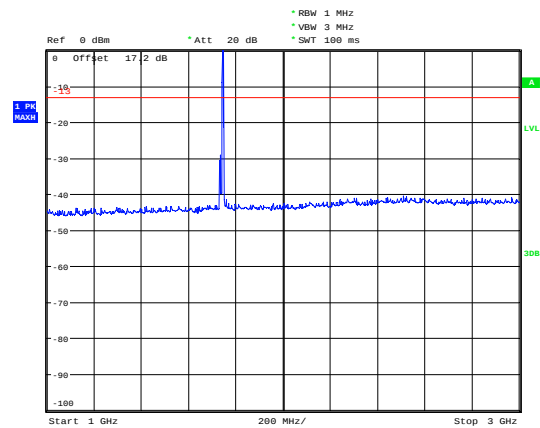
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NB-IOT Band 66 CH-Low 1GHz~3GHz



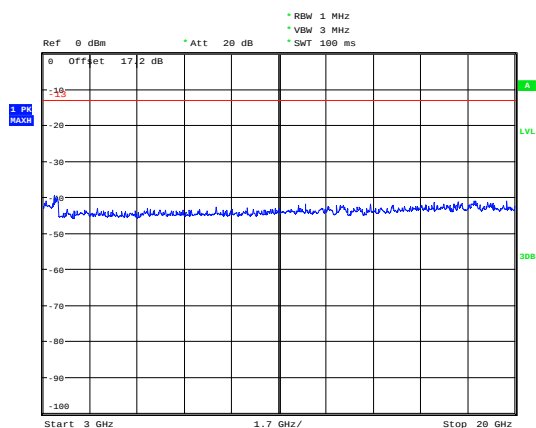
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NB-IOT Band 66 CH-Middle 1GHz~3GHz



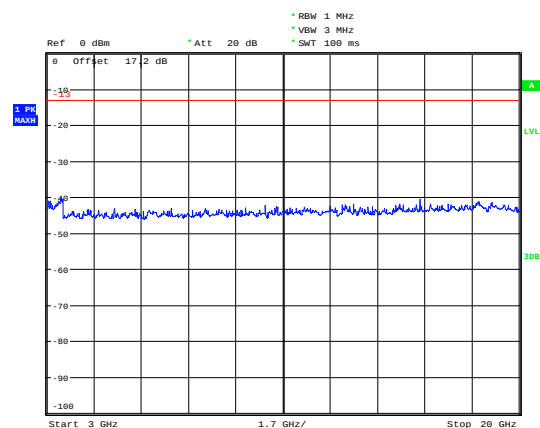
Date: 29.OCT.2018 13:58:01

NB-IOT Band 66 CH-Low 3GHz~20GHz



Date: 29.OCT.2018 13:54:51

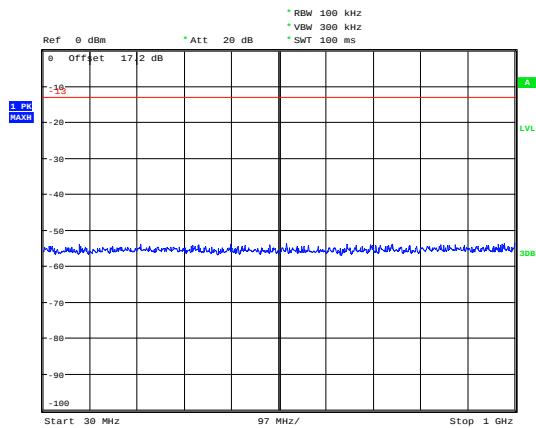
NB-IOT Band 66 CH-Middle 3GHz~20GHz



Date: 29.OCT.2018 13:58:16

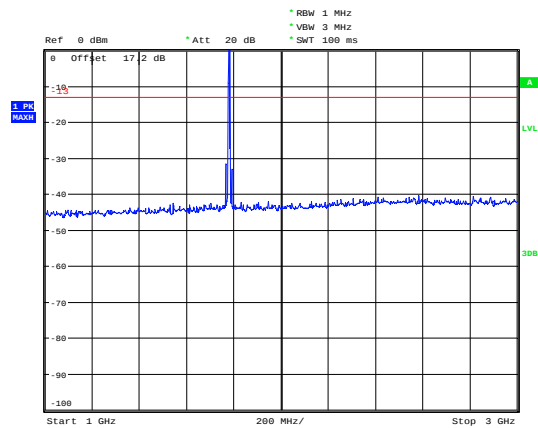


NB-IOT Band 66 CH-High 30MHz~1GHz



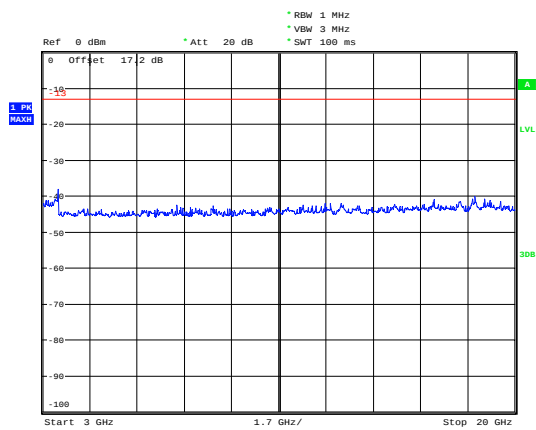
Date: 29.OCT.2018 14:01:56

NB-IOT Band 66 CH-High 1GHz~3GHz



Date: 29.OCT.2018 14:01:26

NB-IOT Band 66 CH-High 3GHz~20GHz



Date: 29.OCT.2018 14:01:09

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 D01 v03r01 Section 5.8 and ANSI C63.26 (2015).
2. Above 30MHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H). Above 1GHz: (Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).
3. A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
4. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz 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:

$$\text{Power(EIRP)} = \text{PMea} - \text{PAg} - \text{Pcl} + \text{Ga}$$
The measurement results are amend as described below:

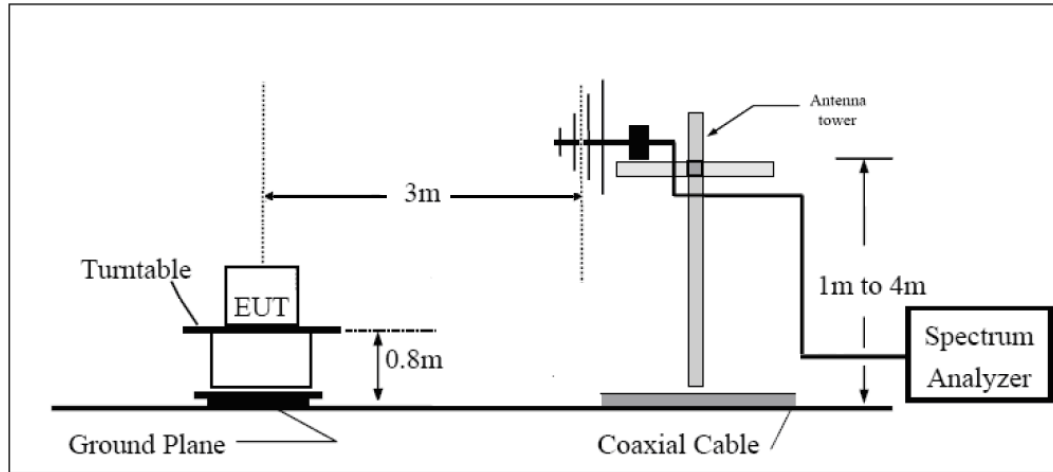
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP

= EIRP-2.15dBi.

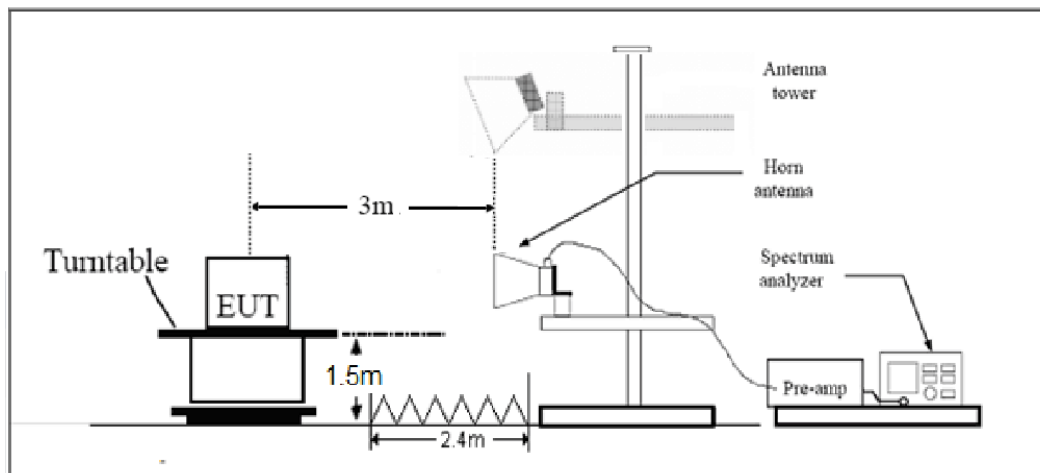
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

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..”

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.

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;

Part 27.53/(h)/(g) Limit		-13 dBm
Part 27.53(f) 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 $k = \pm 1.96$, $U = \pm 3.55$ dB.

Test Result

Sweep the whole frequency band through the range from 30MHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

NB-IOT Band 4 CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3509.8	-60.72	2.6	10.15	Horizontal	-53.17	-13.00	40.17	135
3	5264.7	-63.67	2.4	11.35	Horizontal	-54.72	-13.00	41.72	180
4	7019.6	-56.28	4.5	10.85	Horizontal	-49.93	-13.00	36.93	315
5	8774.5	-54.68	5.1	11.35	Horizontal	-48.43	-13.00	35.43	135
6	10529.4	-52.27	5.3	11.95	Horizontal	-45.62	-13.00	32.62	225
7	12284.3	-53.67	5.5	13.55	Horizontal	-45.62	-13.00	32.62	90
8	14039.2	-50.72	6.3	13.75	Horizontal	-43.27	-13.00	30.27	135
9	15794.1	-54.27	6.7	13.85	Horizontal	-47.12	-13.00	34.12	45
10	17549	-50.91	6.8	14.25	Horizontal	-43.46	-13.00	30.46	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 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3461	-62.24	2.6	10.75	Horizontal	-54.09	-13.00	41.09	135
3	5191.5	-62.33	2.4	11.05	Horizontal	-53.68	-13.00	40.68	180
4	6922	-57.20	4.5	11.15	Horizontal	-50.55	-13.00	37.55	315
5	8652.5	-54.78	5.1	11.35	Horizontal	-48.53	-13.00	35.53	135
6	10383	-50.14	5.3	11.95	Horizontal	-43.49	-13.00	30.49	225
7	12113.5	-53.25	5.5	13.55	Horizontal	-45.20	-13.00	32.20	90
8	13844	-50.64	6.3	13.75	Horizontal	-43.19	-13.00	30.19	135
9	15574.5	-54.69	6.7	13.85	Horizontal	-47.54	-13.00	34.54	45
10	17305	-51.10	6.8	14.25	Horizontal	-43.65	-13.00	30.65	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 CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3420	-65.21	2.6	10.15	Horizontal	-57.66	-13.00	44.66	135
3	5130	-61.55	2.4	11.05	Horizontal	-52.90	-13.00	39.90	180
4	6840	-57.36	4.5	11.15	Horizontal	-50.71	-13.00	37.71	315
5	8550	-55.30	5.1	11.35	Horizontal	-49.05	-13.00	36.05	135
6	10260	-53.08	5.3	11.95	Horizontal	-46.43	-13.00	33.43	225
7	11970	-52.37	5.5	13.55	Horizontal	-44.32	-13.00	31.32	90
8	13680	-50.30	6.3	13.75	Horizontal	-42.85	-13.00	29.85	135
9	15390	-53.77	6.7	13.85	Horizontal	-46.62	-13.00	33.62	45
10	17100	-50.99	6.8	14.25	Horizontal	-43.54	-13.00	30.54	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 12 CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1398.0	-48.56	2.00	10.15	Horizontal	-42.56	-13.00	29.56	315
3	2097.0	-61.58	2.50	11.35	Horizontal	-54.88	-13.00	41.88	90
4	2796.0	-59.02	4.20	10.85	Horizontal	-54.52	-13.00	41.52	45
5	3520.0	-61.80	5.20	11.35	Horizontal	-57.80	-13.00	44.80	135
6	4224.0	-60.00	5.50	11.95	Horizontal	-55.70	-13.00	42.70	180
7	4928.0	-58.60	5.70	13.55	Horizontal	-52.90	-13.00	39.90	45
8	5632.0	-59.90	6.30	13.75	Horizontal	-54.60	-13.00	41.60	225
9	6336.0	-57.60	6.80	13.85	Horizontal	-52.70	-13.00	39.70	180
10	7040.0	-54.00	6.90	14.25	Horizontal	-48.80	-13.00	35.80	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 12 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.0	-45.43	2.00	10.75	Horizontal	-38.83	-13.00	25.83	270
3	2122.5	-62.38	2.51	11.05	Horizontal	-55.99	-13.00	42.99	315
4	2830.0	-60.07	4.20	11.15	Horizontal	-55.27	-13.00	42.27	180
5	3537.5	-61.91	5.20	11.15	Horizontal	-58.11	-13.00	45.11	90
6	4245.0	-60.14	5.50	11.95	Horizontal	-55.84	-13.00	42.84	45
7	4952.5	-59.27	5.70	13.55	Horizontal	-53.57	-13.00	40.57	90
8	5660.0	-59.64	6.30	13.75	Horizontal	-54.34	-13.00	41.34	135
9	6367.5	-57.69	6.80	13.85	Horizontal	-52.79	-13.00	39.79	180
10	7075.0	-54.65	6.90	14.25	Horizontal	-49.45	-13.00	36.45	315
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 CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1431.5	-47.86	2.00	10.15	Horizontal	-41.86	-13.00	28.86	90
3	2133.0	-61.36	2.51	11.05	Horizontal	-54.97	-13.00	41.97	45
4	2844.0	-58.91	4.20	11.15	Horizontal	-54.11	-13.00	41.11	90
5	3555.0	-61.25	5.20	11.15	Horizontal	-57.45	-13.00	44.45	135
6	4266.0	-60.85	5.50	11.95	Horizontal	-56.55	-13.00	43.55	225
7	4977.0	-60.57	5.70	13.55	Horizontal	-54.87	-13.00	41.87	90
8	5688.0	-59.49	6.30	13.75	Horizontal	-54.19	-13.00	41.19	135
9	6399.0	-57.28	6.80	13.85	Horizontal	-52.38	-13.00	39.38	45
10	7110.0	-54.37	6.90	14.25	Horizontal	-49.17	-13.00	36.17	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 CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1554.0	-54.73	2.00	10.15	Horizontal	-48.73	-13.00	35.73	45
3	2313.3	-61.68	2.50	11.35	Horizontal	-54.98	-13.00	41.98	315
4	3084.4	-61.59	4.20	10.85	Horizontal	-57.09	-13.00	44.09	180
5	3855.5	-60.70	5.20	11.35	Horizontal	-56.70	-13.00	43.70	90
6	4626.6	-60.04	5.50	11.95	Horizontal	-55.74	-13.00	42.74	45
7	5397.7	-59.34	5.70	13.55	Horizontal	-53.64	-13.00	40.64	90
8	6168.8	-59.14	6.30	13.75	Horizontal	-53.84	-13.00	40.84	135
9	6939.9	-55.56	6.80	13.85	Horizontal	-50.66	-13.00	37.66	180
10	7711.0	-55.09	6.90	14.25	Horizontal	-49.89	-13.00	36.89	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 13 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1564.0	-54.14	2.00	10.75	Horizontal	-47.54	-40.00	7.54	90
3	2346.0	-62.16	2.51	11.05	Horizontal	-55.77	-13.00	42.77	45
4	3128.0	-62.35	4.20	11.15	Horizontal	-57.55	-13.00	44.55	225
5	3910.0	-60.39	5.20	11.15	Horizontal	-56.59	-13.00	43.59	180
6	4692.0	-58.93	5.50	11.95	Horizontal	-54.63	-13.00	41.63	180
7	5474.0	-59.65	5.70	13.55	Horizontal	-53.95	-13.00	40.95	90
8	6256.0	-57.93	6.30	13.75	Horizontal	-52.63	-13.00	39.63	45
9	7038.0	-54.08	6.80	13.85	Horizontal	-49.18	-13.00	36.18	90
10	7820.0	-54.48	6.90	14.25	Horizontal	-49.28	-13.00	36.28	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 CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1573.8	-54.68	2.00	10.15	Horizontal	-48.68	-40.00	8.68	270
3	2360.7	-62.08	2.51	11.05	Horizontal	-55.69	-13.00	42.69	315
4	3147.6	-61.60	4.20	11.15	Horizontal	-56.80	-13.00	43.80	180
5	3934.5	-60.32	5.20	11.15	Horizontal	-56.52	-13.00	43.52	315
6	4721.4	-58.82	5.50	11.95	Horizontal	-54.52	-13.00	41.52	135
7	5508.3	-59.65	5.70	13.55	Horizontal	-53.95	-13.00	40.95	225
8	6295.2	-57.87	6.30	13.75	Horizontal	-52.57	-13.00	39.57	90
9	7082.1	-54.05	6.80	13.85	Horizontal	-49.15	-13.00	36.15	135
10	7869.0	-54.88	6.90	14.25	Horizontal	-49.68	-13.00	36.68	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 17 CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1408.0	-46.94	2.00	10.15	Horizontal	-40.94	-13.00	27.94	45
3	2112.0	-62.79	2.50	11.35	Horizontal	-56.09	-13.00	43.09	315
4	2816.0	-59.85	4.20	10.85	Horizontal	-55.35	-13.00	42.35	90
5	3520.0	-61.95	5.20	11.35	Horizontal	-57.95	-13.00	44.95	90
6	4224.0	-59.01	5.50	11.95	Horizontal	-54.71	-13.00	41.71	135
7	4928.7	-61.09	5.70	13.55	Horizontal	-55.39	-13.00	42.39	180
8	5632.8	-59.25	6.30	13.75	Horizontal	-53.95	-13.00	40.95	45
9	6336.9	-56.60	6.80	13.85	Horizontal	-51.70	-13.00	38.70	225
10	7041.0	-54.73	6.90	14.25	Horizontal	-49.53	-13.00	36.53	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 17 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1420.0	-47.06	2.00	10.75	Horizontal	-40.46	-13.00	27.46	45
3	2130.0	-60.33	2.51	11.05	Horizontal	-53.94	-13.00	40.94	270
4	2840.0	-59.83	4.20	11.15	Horizontal	-55.03	-13.00	42.03	315
5	3550.0	-60.43	5.20	11.15	Horizontal	-56.63	-13.00	43.63	180
6	4260.0	-59.99	5.50	11.95	Horizontal	-55.69	-13.00	42.69	90
7	4970.0	-60.53	5.70	13.55	Horizontal	-54.83	-13.00	41.83	45
8	5680.0	-59.12	6.30	13.75	Horizontal	-53.82	-13.00	40.82	90
9	6390.0	-55.80	6.80	13.85	Horizontal	-50.90	-13.00	37.90	135
10	7100.0	-53.37	6.90	14.25	Horizontal	-48.17	-13.00	35.17	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 17 CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1431.5	-48.09	2.00	10.15	Horizontal	-42.09	-13.00	29.09	180
3	2154.0	-60.15	2.51	11.05	Horizontal	-53.76	-13.00	40.76	90
4	2860.0	-59.64	4.20	11.15	Horizontal	-54.84	-13.00	41.84	45
5	3555.0	-61.42	5.20	11.15	Horizontal	-57.62	-13.00	44.62	315
6	4266.0	-61.44	5.50	11.95	Horizontal	-57.14	-13.00	44.14	135
7	4977.0	-60.33	5.70	13.55	Horizontal	-54.63	-13.00	41.63	225
8	5688.0	-59.01	6.30	13.75	Horizontal	-53.71	-13.00	40.71	90
9	6399.0	-58.22	6.80	13.85	Horizontal	-53.32	-13.00	40.32	135
10	7110.0	-53.62	6.90	14.25	Horizontal	-48.42	-13.00	35.42	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 66 CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3421.4	-58.16	2.6	10.15	Horizontal	-50.61	-13.00	37.61	45
3	5131.1	-60.68	2.4	11.35	Horizontal	-51.73	-13.00	38.73	315
4	6842.8	-56.70	4.5	10.85	Horizontal	-50.35	-13.00	37.35	90
5	8553.5	-53.01	5.1	11.35	Horizontal	-46.76	-13.00	33.76	45
6	10264.2	-51.42	5.3	11.95	Horizontal	-44.77	-13.00	31.77	270
7	11974.9	-53.08	5.5	13.55	Horizontal	-45.03	-13.00	32.03	315
8	13685.6	-50.46	6.3	13.75	Horizontal	-43.01	-13.00	30.01	180
9	15396.3	-53.58	6.7	13.85	Horizontal	-46.43	-13.00	33.43	90
10	17107	-51.72	6.8	14.25	Horizontal	-44.27	-13.00	31.27	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 66 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3464.3	-63.91	2.6	10.75	Horizontal	-55.76	-13.00	42.76	135
3	5197.5	-62.90	2.4	11.05	Horizontal	-54.25	-13.00	41.25	180
4	6930	-57.16	4.5	11.15	Horizontal	-50.51	-13.00	37.51	45
5	8662.5	-55.31	5.1	11.35	Horizontal	-49.06	-13.00	36.06	225
6	10395	-53.14	5.3	11.95	Horizontal	-46.49	-13.00	33.49	180
7	12127.5	-54.13	5.5	13.55	Horizontal	-46.08	-13.00	33.08	180
8	13860	-51.88	6.3	13.75	Horizontal	-44.43	-13.00	31.43	90
9	15592.5	-54.34	6.7	13.85	Horizontal	-47.19	-13.00	34.19	45
10	17325	-51.24	6.8	14.25	Horizontal	-43.79	-13.00	30.79	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 66 CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3507.8	-61.79	2.6	10.15	Horizontal	-54.24	-13.00	41.24	135
3	5261.6	-61.90	2.4	11.05	Horizontal	-53.25	-13.00	40.25	180
4	7017.2	-55.08	4.5	11.15	Horizontal	-48.43	-13.00	35.43	315
5	8771.5	-54.48	5.1	11.35	Horizontal	-48.23	-13.00	35.23	135
6	10525.8	-52.74	5.3	11.95	Horizontal	-46.09	-13.00	33.09	225
7	12280.1	-52.65	5.5	13.55	Horizontal	-44.60	-13.00	31.60	90
8	14034.4	-50.94	6.3	13.75	Horizontal	-43.49	-13.00	30.49	135
9	15788.7	-53.22	6.7	13.85	Horizontal	-46.07	-13.00	33.07	45
10	17543	-52.24	6.8	14.25	Horizontal	-44.79	-13.00	31.79	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.

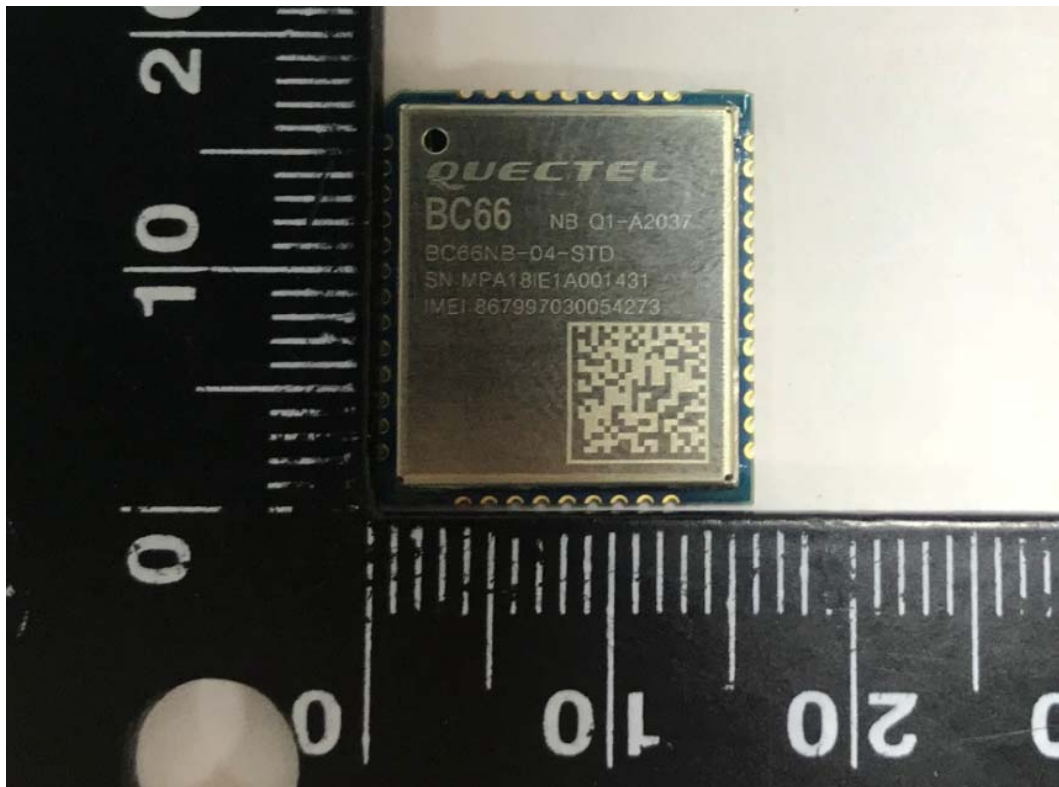
6 Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMW500	113824	2018-05-20	2019-05-19
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Spectrum Analyzer	Key sight	N9010A	MY50210259	2018-05-20	2019-05-19
Signal Analyzer	R&S	FSV30	100815	2017-12-17	2018-12-16
EMI Test Receiver	R&S	ESCI	100948	2018-05-20	2019-05-19
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-09-26	2019-09-25
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2019-11-17
Horn Antenna	R&S	HF907	100126	2018-07-07	2020-07-06
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2020-06-19
Horn Antenna	STEATITE	QSH-SL-26-40-K-15	16779	2017-07-20	2019-07-19
Signal generator	R&S	SMB 100A	102594	2018-05-20	2019-05-19
Climatic Chamber	ESPEC	SU-242	93000506	2017-12-17	2020-12-16
Preamplifier	R&S	SCU18	102327	2018-05-20	2019-05-19
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2018-05-21	2019-05-20
RF Cable	Agilent	SMA 15cm	0001	/	/
Software	R&S	EMC32	9.26.0	/	/

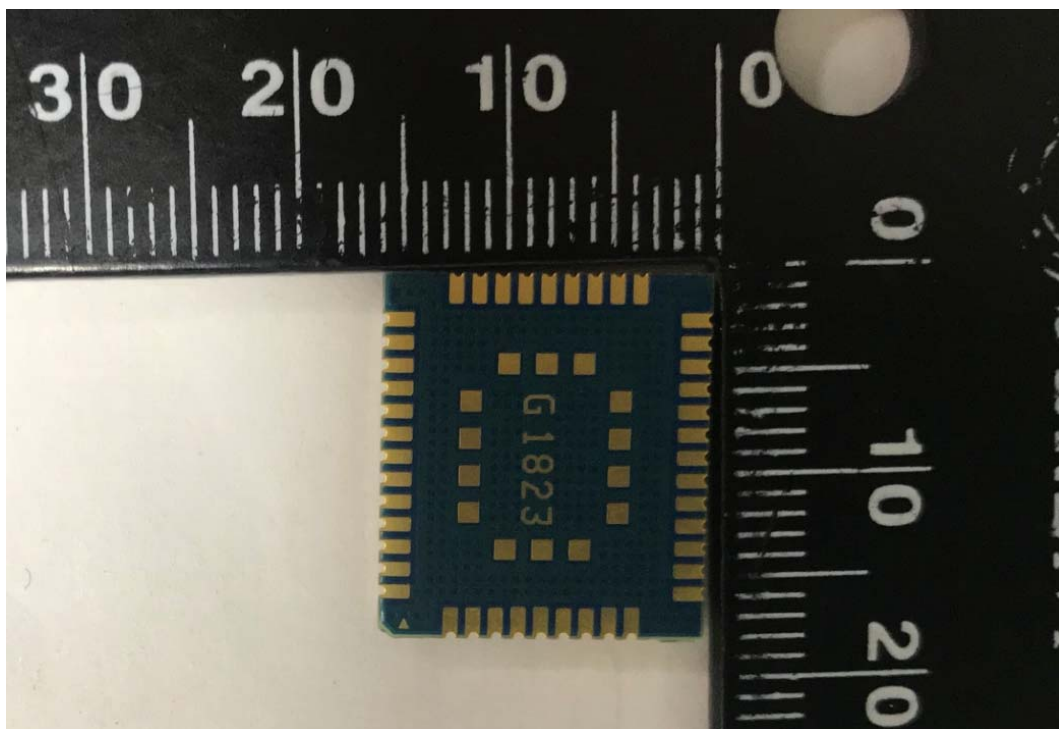
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ANNEX A: EUT Appearance and Test Setup

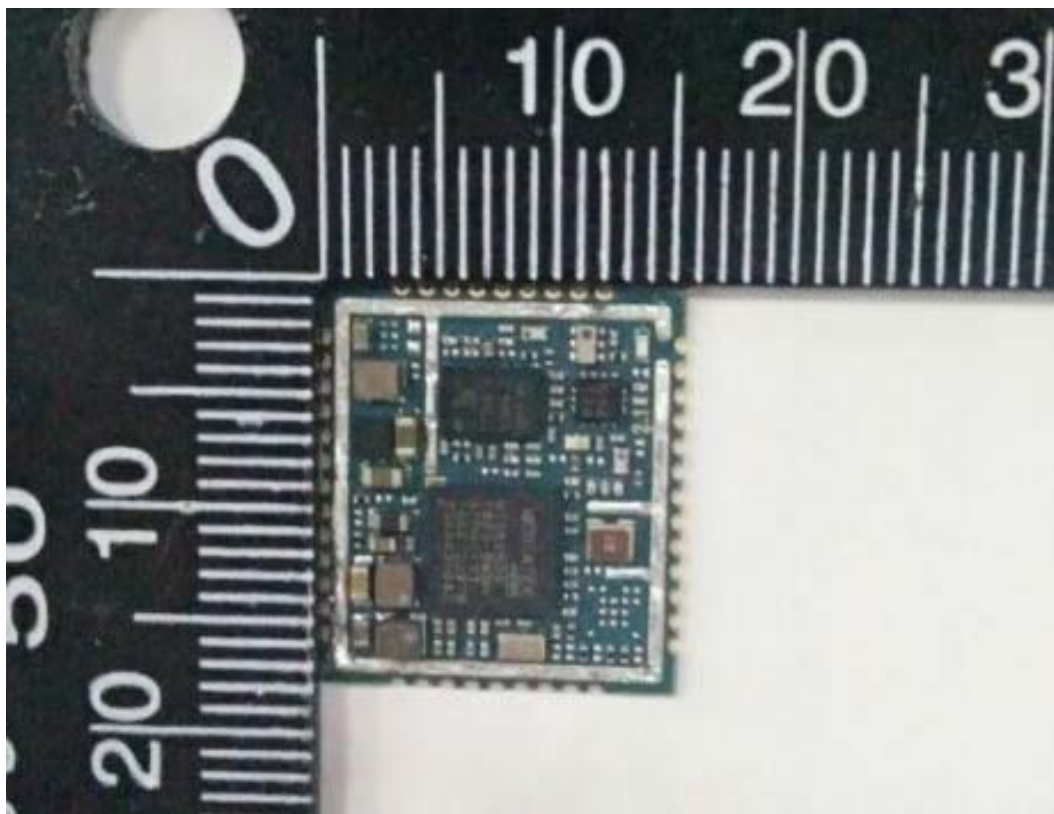
A.1 EUT Appearance



Front Side



Back Side



Unshielded

a: EUT

Picture 1 EUT and Accessory

A.2 Test Setup



Picture 2: Radiated Spurious Emissions Test setup