



RF TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd
FCC ID XMR202005BG95M5
Product LTE Cat M1 & Cat NB2 & EGPRS Module
Brand Quectel
Model BG95-M5
Marketing Quectel BG95-M5
Report No. R2005A0283-R7
Issue Date June 30, 2020

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2019)/ FCC CFR47 Part 27C (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of Measurement Results

| Number | Test Case | Clause in FCC rules | Verdict |
|--------|--|---|---------|
| 1 | RF Power Output and Effective Isotropic Radiated Power | 2.1046 27.50(d)(4) /27.50(b)(10) /27.50(c)(10) | PASS |
| 2 | Occupied Bandwidth | 2.1049 | PASS |
| 3 | Band Edge Compliance | 27.53(h) /27.53(g) /27.53(f) /27.53(c) | PASS |
| 4 | Peak-to-Average Power Ratio | 27.50(d)/KDB971168 D01(5.7) | PASS |
| 5 | Frequency Stability | 2.1055 / 27.54 | PASS |
| 6 | Spurious Emissions at Antenna Terminals | 2.1051 /27.53(h) /27.53(g) /27.53(f) /27.53(c) | PASS |
| 7 | Radiates Spurious Emission | 2.1053 /27.53(h) /27.53(g) /27.53(f) /27.53(c) | PASS |

Date of Testing: May 24, 2020~ June 16, 2020

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

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

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



1 Test Laboratory

1.1 Notes of the Test Report

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

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.

A2LA (Certificate Number: 3857.01)

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

1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
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2 General Description of Equipment under Test

2.1 Applicant and Manufacturer Information

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

2.2 General information

| EUT Description | | |
|---------------------|---|-----------|
| Model | BG95-M5 | |
| IMEI | 866833040004456 | |
| Hardware Version | R1.1 | |
| Software Version | BG95M5LAR02A02 | |
| Power Supply | External power supply | |
| Antenna Type | The EUT don't have standard Antenna, The Antenna used for testing in this report is the after-market accessory (Dipole Antenna) | |
| Antenna Gain | Frequency(MHz) | Gain(dBi) |
| | 700 | 1.66 |
| | 710 | 3.26 |
| | 780 | 4.45 |
| | 1720 | 1.94 |
| | 1740 | 2.00 |
| | 1780 | 0.97 |
| Test Mode(s) | NB-IOT Band 4/12/13/66/71/85 | |
| Test Modulation | BPSK, QPSK | |
| Category | NB2 | |
| Deployment | stand-alone | |
| Sub-carrier spacing | 3.75KHz, 15KHz | |
| Ntones | single-tone, multi-tone | |
| Maximum E.I.R.P | NB-IOT Band 4 | 25.68dBm |
| | NB-IOT Band 66 | 25.54dBm |
| Maximum E.R.P. | NB-IOT Band 12 | 25.12dBm |
| | NB-IOT Band 13 | 26.01dBm |
| | NB-IOT Band 71 | 23.20dBm |
| | NB-IOT Band 85 | 25.27dBm |



| | | | |
|--|---------------------------------|-------------|-------------|
| Rated Power Supply Voltage: | 3.8V | | |
| Extreme Voltage | Minimum: 3.3V Maximum: 4.3V | | |
| Extreme Temperature | Lowest: -40°C Highest: +85°C | | |
| 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 66 | 1710 ~ 1780 | 2110 ~ 2180 |
| | NB-IOT Band 71 | 663 ~ 698 | 617 ~ 652 |
| | NB-IOT Band 85 | 698 ~ 716 | 728 ~ 746 |
| Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant. | | | |



3 Applied Standards

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

Test standards:

FCC CFR47 Part 27C (2019)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2019)

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 modes as Subcarrier Spacing, modulations, Channel were investigated.

Subsequently, only the worst case emissions are reported.

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

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

Test modes are chosen to be reported as the worst case configuration below for NB-IOT Band 4/12/13/66/71/85:

| Test items | Mode | Deployment mode | Subcarrier Spacing (kHz) | | Modulation | | Test Channel | | |
|--|------------|-----------------|--------------------------|----|------------|------|--------------|---|---|
| | | Stand-alone | 3.75 | 15 | BPSK | QPSK | L | M | H |
| RF Power Output and 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 B66 | O | O | O | O | O | O | O | O |
| | NB-IOT B71 | O | O | O | O | O | O | O | O |
| | NB-IOT B85 | 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 B66 | O | O | O | O | O | O | O | O |
| | NB-IOT B71 | O | O | O | O | O | O | O | O |
| | NB-IOT B85 | 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 B66 | O | O | O | O | O | O | - | O |
| | NB-IOT B71 | O | O | O | O | O | O | - | O |
| | NB-IOT B85 | O | O | O | O | O | O | - | O |
| Peak-to-Average Power Ratio | NB-IOT B4 | O | O | O | O | O | - | O | - |
| | NB-IOT B12 | O | O | O | O | O | - | O | - |
| | NB-IOT B13 | O | O | O | O | O | - | O | - |
| | NB-IOT B66 | O | O | O | O | O | - | O | - |
| | NB-IOT B71 | O | O | O | O | O | - | O | - |
| | NB-IOT B85 | 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 B66 | O | O | O | O | O | O | O | O |
| | NB-IOT B71 | O | O | O | O | O | O | O | O |
| | NB-IOT B85 | 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 B66 | O | - | O | - | O | O | O | O |
| | NB-IOT B71 | O | - | O | - | O | O | O | O |
| | NB-IOT B85 | 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 B66 | O | - | O | - | O | O | O | O |
| | NB-IOT B71 | O | - | O | - | O | O | O | O |
| | NB-IOT B85 | O | - | O | - | O | O | O | O |
| <p>Note</p> <p>1. The mark "O" means that this configuration is chosen for testing.</p> <p>2. The mark "-" means that this configuration is not testing.</p> | | | | | | | | | |

5 Test Case Results

5.1 RF Power Output and Effective Isotropic Radiated Power

Ambient condition

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

Methods of Measurement

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

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: $ERP \text{ (dBm)} = \text{LVL (dBm)} + \text{LOSS (dB)}$
- f) The maximum ERP is the maximum value determined in the preceding step.
- g) When calculating ERP, in addition to knowing the antenna radiation and matching characteristics, it is necessary to know the loss values of all elements (e.g. transmission line attenuation, mismatches, filters, combiners) interposed between the point where transmitter output power is measured, and the point where power is applied to the antenna. ERP can then be calculated as follows:

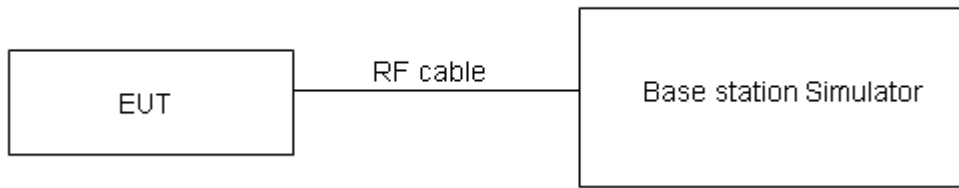
$$EIRP \text{ (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBi)}$$

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

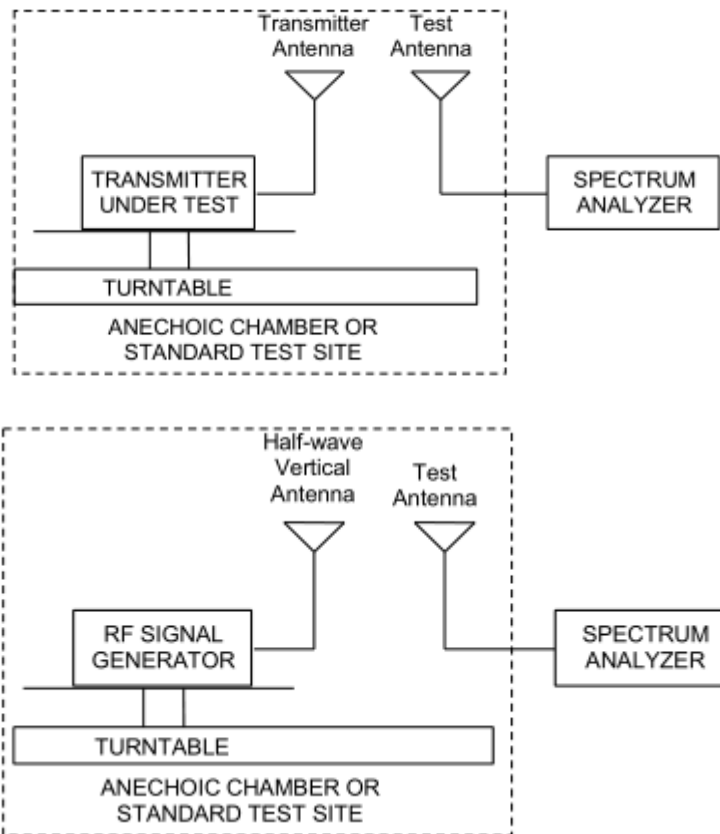
$$EIRP \text{ (dBm)} = ERP \text{ (dBm)} + 2.15 \text{ (dB.)}$$

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

Test Setup



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



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

No specific RF power output requirements in part 2.1046.

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

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



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

| | |
|------------------------|--------------------------------|
| Part 27.50(b)(10)Limit | $\leq 3 \text{ W}$ (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) |

Measurement Uncertainty

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



Test Results

| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Conducted Power (dBm) for low/middle/high channel | | | EIRP(dBm) | | |
|---------------------------|------------|---------------------------|--------|---|---------------|---------------|---------------|---------------|---------------|
| | | | | 19952 /1710.2 | 20175 /1732.5 | 20398 /1754.8 | 19952 /1710.2 | 20175 /1732.5 | 20398 /1754.8 |
| NB-IOT Band 4 Standalone | BPSK | 3.75 | 1@0 | 23.74 | 23.62 | 23.67 | 25.68 | 25.62 | 25.24 |
| | | | 1@47 | 23.58 | 23.52 | 23.59 | 25.52 | 25.52 | 25.16 |
| | | 15 | 1@0 | 23.59 | 23.45 | 23.66 | 25.53 | 25.45 | 25.23 |
| | | | 1@11 | 23.57 | 23.44 | 23.64 | 25.51 | 25.44 | 25.21 |
| | QPSK | 3.75 | 1@0 | 23.59 | 23.47 | 23.60 | 25.53 | 25.47 | 25.17 |
| | | | 1@47 | 23.65 | 23.45 | 23.58 | 25.59 | 25.45 | 25.15 |
| | | 15 | 1@0 | 23.52 | 23.45 | 23.74 | 25.46 | 25.45 | 25.31 |
| | | | 1@11 | 23.55 | 23.48 | 23.69 | 25.49 | 25.48 | 25.26 |
| | | 15 | 12@0 | 21.60 | 21.47 | 21.63 | 23.54 | 23.47 | 23.20 |
| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Conducted Power (dBm) for low/middle/high channel | | | ERP(dBm) | | |
| | | | | 23012 /699.2 | 23095 /707.5 | 23178 /715.8 | 23012 /699.2 | 23095 /707.5 | 23178 /715.8 |
| NB-IOT Band 12 Standalone | BPSK | 3.75 | 1@0 | 23.30 | 23.29 | 23.21 | 22.81 | 24.40 | 25.01 |
| | | | 1@47 | 23.24 | 23.22 | 23.23 | 22.75 | 24.33 | 25.03 |
| | | 15 | 1@0 | 23.44 | 23.30 | 23.28 | 22.95 | 24.41 | 25.08 |
| | | | 1@11 | 23.38 | 23.25 | 23.25 | 22.89 | 24.36 | 25.05 |
| | QPSK | 3.75 | 1@0 | 23.30 | 23.30 | 23.16 | 22.81 | 24.41 | 24.96 |
| | | | 1@47 | 23.37 | 23.24 | 23.26 | 22.88 | 24.35 | 25.06 |
| | | 15 | 1@0 | 23.41 | 23.37 | 23.31 | 22.92 | 24.48 | 25.11 |
| | | | 1@11 | 23.34 | 23.32 | 23.32 | 22.85 | 24.43 | 25.12 |
| | | 15 | 12@0 | 21.34 | 21.26 | 21.27 | 20.85 | 22.37 | 23.07 |
| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Conducted Power (dBm) for low/middle/high channel | | | ERP(dBm) | | |
| | | | | 23182 /777.2 | 23230 /782 | 23278 /786.8 | 23182 /777.2 | 23230 /782 | 23278 /786.8 |
| NB-IOT Band 13 Standalone | BPSK | 3.75 | 1@0 | 23.40 | 23.40 | 23.37 | 25.70 | 25.70 | 24.85 |
| | | | 1@47 | 23.30 | 23.33 | 23.31 | 25.60 | 25.63 | 24.79 |
| | | 15 | 1@0 | 23.62 | 23.65 | 23.48 | 25.92 | 25.95 | 24.96 |
| | | | 1@11 | 23.56 | 23.61 | 23.42 | 25.86 | 25.91 | 24.90 |
| | QPSK | 3.75 | 1@0 | 23.39 | 23.39 | 23.37 | 25.69 | 25.69 | 24.85 |
| | | | 1@47 | 23.32 | 23.40 | 23.35 | 25.62 | 25.70 | 24.83 |
| | | 15 | 1@0 | 23.51 | 23.62 | 23.40 | 25.81 | 25.92 | 24.88 |
| | | | 1@11 | 23.56 | 23.71 | 23.46 | 25.86 | 26.01 | 24.94 |
| | | 15 | 12@0 | 21.32 | 21.39 | 21.27 | 23.62 | 23.69 | 22.75 |
| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Conducted Power (dBm) for low/middle/high channel | | | EIRP(dBm) | | |
| | | | | 131974 | 132322 | 132670 | 131974 | 132322 | 132670 |



| | | | | /1710.2 | /1745 | /1779.8 | /1710.2 | /1745 | /1779.8 | |
|---------------------------------|---------------------------------|------|------------|---------------------------|--------|---|---------------|---------------|---------------|---------------|
| NB-IOT Band 66 Standalone | BPSK | 3.75 | 1@0 | 23.57 | 23.47 | 23.67 | 25.51 | 25.47 | 24.64 | |
| | | | 1@47 | 23.54 | 23.41 | 23.61 | 25.48 | 25.41 | 24.58 | |
| | | 15 | 1@0 | 23.57 | 23.42 | 23.63 | 25.51 | 25.42 | 24.60 | |
| | | | 1@11 | 23.48 | 23.36 | 23.58 | 25.42 | 25.36 | 24.55 | |
| | QPSK | 3.75 | 1@0 | 23.49 | 23.47 | 23.66 | 25.43 | 25.47 | 24.63 | |
| | | | 1@47 | 23.44 | 23.54 | 23.67 | 25.38 | 25.54 | 24.64 | |
| | | 15 | 1@0 | 23.58 | 23.31 | 23.56 | 25.52 | 25.31 | 24.53 | |
| | | | 1@11 | 23.56 | 23.37 | 23.54 | 25.50 | 25.37 | 24.51 | |
| | | 15 | 12@0 | 21.55 | 21.37 | 21.66 | 23.49 | 23.37 | 22.63 | |
| | | Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Conducted Power (dBm) for low/middle/high channel | | | ERP(dBm) | |
| | 133124 /663.2 | | | | | 133297 /680.5 | 133470 /697.8 | 133124 /663.2 | 133297 /680.5 | 133470 /697.8 |
| | NB-IOT Band 71 Standalone | BPSK | 3.75 | 1@0 | 23.67 | 23.57 | 23.52 | 23.18 | 23.08 | 23.03 |
| 1@47 | | | | 23.66 | 23.45 | 23.42 | 23.17 | 22.96 | 22.93 | |
| 15 | | | 1@0 | 23.47 | 23.47 | 23.43 | 22.98 | 22.98 | 22.94 | |
| | | | 1@11 | 23.50 | 23.38 | 23.40 | 23.01 | 22.89 | 22.91 | |
| QPSK | | 3.75 | 1@0 | 23.60 | 23.48 | 23.44 | 23.11 | 22.99 | 22.95 | |
| | | | 1@47 | 23.69 | 23.48 | 23.37 | 23.20 | 22.99 | 22.88 | |
| | | 15 | 1@0 | 23.52 | 23.37 | 23.42 | 23.03 | 22.88 | 22.93 | |
| | | | 1@11 | 23.45 | 23.52 | 23.40 | 22.96 | 23.03 | 22.91 | |
| | | 15 | 12@0 | 21.42 | 21.38 | 21.44 | 20.93 | 20.89 | 20.95 | |
| | | Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Conducted Power (dBm) for low/middle/high channel | | | ERP(dBm) | |
| 134004 /698.2 | 134092 /707 | | | | | 134180 /715.8 | 134004 /698.2 | 134092 /707 | 134180 /715.8 | |
| NB-IOT Band 85 Standalone | BPSK | 3.75 | 1@0 | 23.54 | 23.23 | 23.47 | 23.05 | 24.34 | 25.27 | |
| | | | 1@47 | 23.41 | 23.22 | 23.32 | 22.92 | 24.33 | 25.12 | |
| | | 15 | 1@0 | 23.48 | 23.31 | 23.43 | 22.99 | 24.42 | 25.23 | |
| | | | 1@11 | 23.42 | 23.29 | 23.40 | 22.93 | 24.40 | 25.20 | |
| | QPSK | 3.75 | 1@0 | 23.46 | 23.26 | 23.33 | 22.97 | 24.37 | 25.13 | |
| | | | 1@47 | 23.44 | 23.13 | 23.25 | 22.95 | 24.24 | 25.05 | |
| | | 15 | 1@0 | 23.37 | 23.26 | 23.38 | 22.88 | 24.37 | 25.18 | |
| | | | 1@11 | 23.51 | 23.25 | 23.46 | 23.02 | 24.36 | 25.26 | |
| | | 15 | 12@0 | 21.35 | 21.12 | 21.32 | 20.86 | 22.23 | 23.12 | |

5.2 Occupied Bandwidth

Ambient condition

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

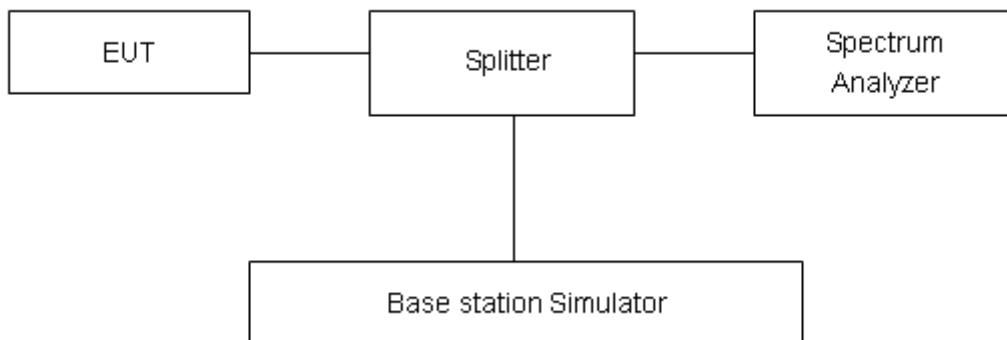
Method of Measurement

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 4/12/13/66/71/85.

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

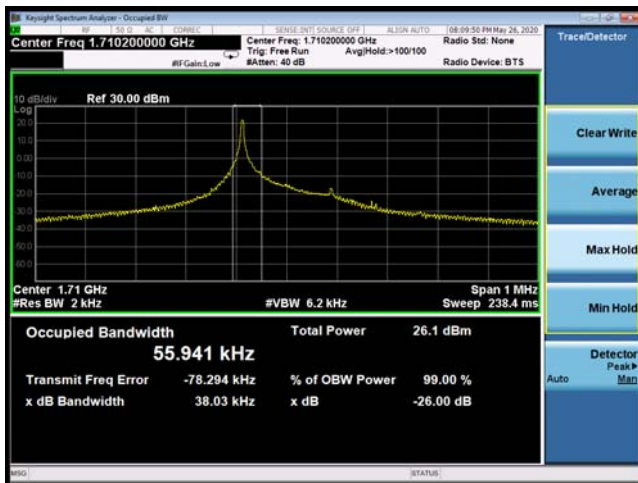
| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Bandwidth(KHz) for low/middle/high channel | | | | | |
|---------------------------------|------------|---------------------------|--------|---|--------|--------------|--------|---------------|--------|
| | | | | 19952/1710.2 | | 20175/1732.5 | | 20398/1754.8 | |
| | | | | 99% Power | -26dBc | 99% Power | -26dBc | 99% Power | -26dBc |
| NB-IOT Band 4 Standalone | BPSK | 3.75 | 1@0 | 55.94 | 38.03 | 55.70 | 36.12 | 53.15 | 37.57 |
| | QPSK | 3.75 | 1@0 | 61.03 | 41.84 | 59.66 | 39.05 | 62.34 | 39.95 |
| | BPSK | 15 | 1@0 | 131.66 | 113.60 | 128.32 | 114.60 | 133.81 | 132.30 |
| | QPSK | 15 | 1@0 | 117.21 | 103.00 | 116.09 | 117.00 | 118.06 | 117.50 |
| | QPSK | 15 | 12@0 | 183.53 | 239.60 | 183.50 | 239.50 | 184.45 | 252.30 |
| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Bandwidth(KHz) for low/ middle/high channel | | | | | |
| | | | | 23012/699.2 | | 23095/707.5 | | 23178/715.8 | |
| | | | | 99% Power | -26dBc | 99% Power | -26dBc | 99% Power | -26dBc |
| NB-IOT Band 12 Standalone | BPSK | 3.75 | 1@0 | 53.48 | 37.77 | 55.82 | 38.81 | 57.30 | 38.58 |
| | QPSK | 3.75 | 1@0 | 59.52 | 39.67 | 60.05 | 39.46 | 59.93 | 39.53 |
| | BPSK | 15 | 1@0 | 134.16 | 119.20 | 132.64 | 116.70 | 127.53 | 118.00 |
| | QPSK | 15 | 1@0 | 118.53 | 116.00 | 116.47 | 118.00 | 118.29 | 130.30 |
| | QPSK | 15 | 12@0 | 184.50 | 257.30 | 183.12 | 248.70 | 183.30 | 248.50 |
| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Bandwidth(KHz) for low/ middle/high channel | | | | | |
| | | | | 23182/777.2 | | 23230/782 | | 23278/786.8 | |
| | | | | 99% Power | -26dBc | 99% Power | -26dBc | 99% Power | -26dBc |
| Band 13 Standalone | BPSK | 3.75 | 1@0 | 53.78 | 37.83 | 55.18 | 37.68 | 54.26 | 37.80 |
| | QPSK | 3.75 | 1@0 | 61.68 | 41.11 | 60.37 | 39.72 | 59.82 | 39.31 |
| | BPSK | 15 | 1@0 | 128.09 | 117.20 | 119.21 | 112.80 | 118.09 | 100.90 |
| | QPSK | 15 | 1@0 | 119.19 | 130.90 | 116.89 | 102.20 | 116.30 | 117.90 |
| | QPSK | 15 | 12@0 | 182.40 | 240.10 | 185.96 | 249.20 | 183.66 | 238.10 |
| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Bandwidth(KHz) for low/ middle/high channel | | | | | |
| | | | | 131974/1710.2 | | 132322/1745 | | 132670/1779.8 | |
| | | | | 99% Power | -26dBc | 99% Power | -26dBc | 99% Power | -26dBc |
| NB-IOT Band 66 Standalone | BPSK | 3.75 | 1@0 | 53.35 | 37.75 | 54.09 | 37.90 | 54.19 | 37.82 |
| | QPSK | 3.75 | 1@0 | 60.68 | 39.66 | 61.43 | 42.56 | 61.10 | 39.41 |
| | BPSK | 15 | 1@0 | 125.40 | 104.40 | 121.05 | 102.20 | 126.67 | 104.70 |
| | QPSK | 15 | 1@0 | 123.25 | 118.00 | 117.73 | 129.70 | 113.46 | 102.40 |
| | QPSK | 15 | 12@0 | 184.61 | 239.00 | 185.86 | 259.60 | 184.61 | 234.00 |
| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Bandwidth(KHz) for low/ middle/high channel | | | | | |
| | | | | 133124/663.2 | | 133297/680.5 | | 133470/697.8 | |
| | | | | 99% Power | -26dBc | 99% Power | -26dBc | 99% Power | -26dBc |
| Band 71 Standalone | BPSK | 3.75 | 1@0 | 53.87 | 37.56 | 54.51 | 37.84 | 54.54 | 37.60 |
| | QPSK | 3.75 | 1@0 | 59.48 | 39.47 | 61.04 | 39.64 | 59.79 | 39.53 |
| | BPSK | 15 | 1@0 | 124.84 | 112.90 | 128.80 | 103.00 | 128.56 | 101.10 |
| | QPSK | 15 | 1@0 | 117.72 | 104.00 | 119.13 | 130.10 | 117.27 | 116.10 |
| | QPSK | 15 | 12@0 | 184.09 | 249.70 | 184.05 | 240.90 | 184.15 | 249.10 |



| Mode | Modulation | Sub-carrier spacing (KHz) | Ntones | Bandwidth(KHz) for low/ middle/high channel | | | | | |
|---------------------------------|------------|---------------------------|--------|---|--------|------------|--------|--------------|--------|
| | | | | 134004/698.2 | | 134092/707 | | 134180/715.8 | |
| | | | | 99% Power | -26dBc | 99% Power | -26dBc | 99% Power | -26dBc |
| NB-IOT Band 85 Standalone | BPSK | 3.75 | 1@0 | 54.26 | 37.64 | 53.84 | 37.83 | 58.46 | 38.80 |
| | QPSK | 3.75 | 1@0 | 60.52 | 39.45 | 59.78 | 39.47 | 60.36 | 39.55 |
| | BPSK | 15 | 1@0 | 129.76 | 105.60 | 127.11 | 117.90 | 120.64 | 117.30 |
| | QPSK | 15 | 1@0 | 119.44 | 115.90 | 115.68 | 103.00 | 120.77 | 116.00 |
| | QPSK | 15 | 12@0 | 183.20 | 247.20 | 180.95 | 235.00 | 184.35 | 239.60 |



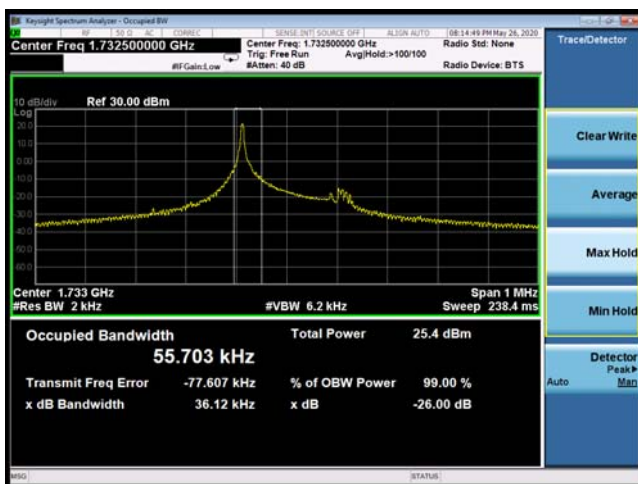
NB-IOT Band 4 BPSK 3.75KHz 1@0 CH-Low



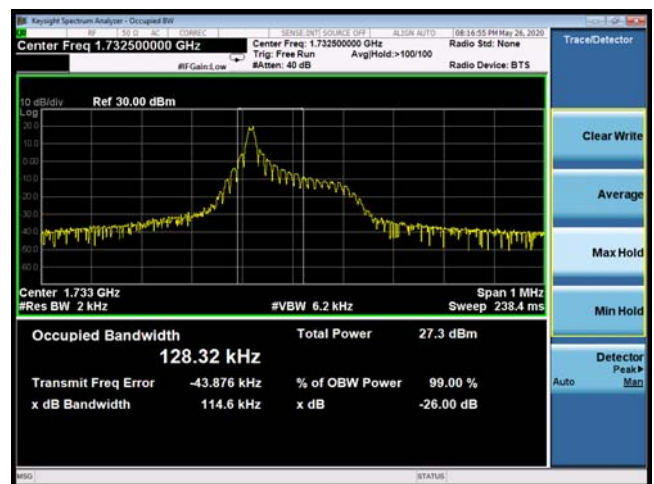
NB-IOT Band 4 BPSK 15KHz 1@0 CH-Low



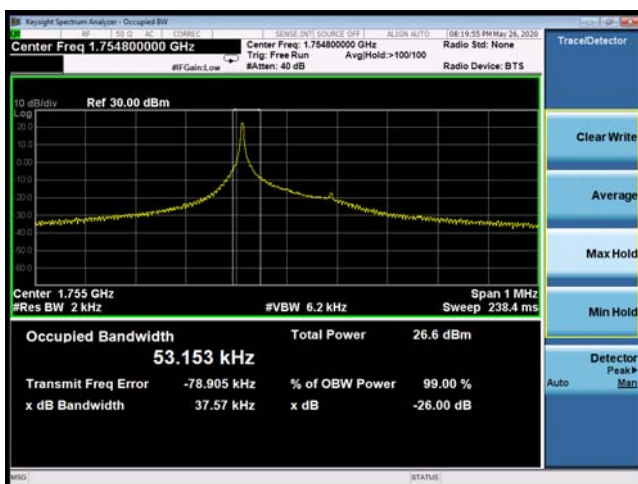
NB-IOT Band 4 BPSK 3.75KHz 1@0 CH-Middle



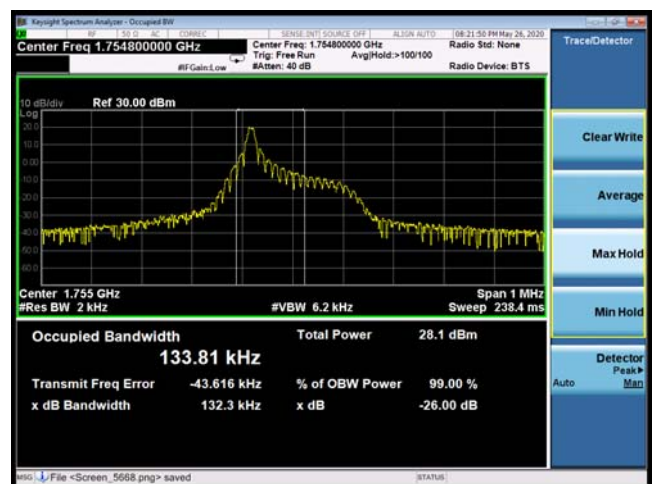
NB-IOT Band 4 BPSK 15KHz 1@0 CH-Middle



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

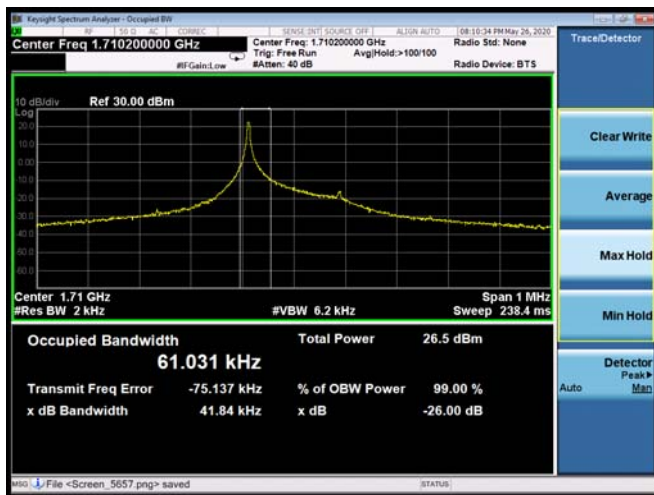


NB-IOT Band 4 BPSK 15KHz 1@0 CH-High





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



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



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



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



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



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



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



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

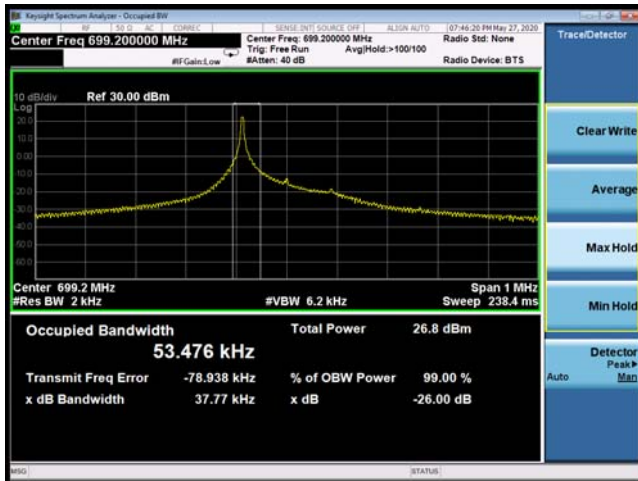


NB-IOT Band 4 QPSK 15KHz 12@0 CH-High





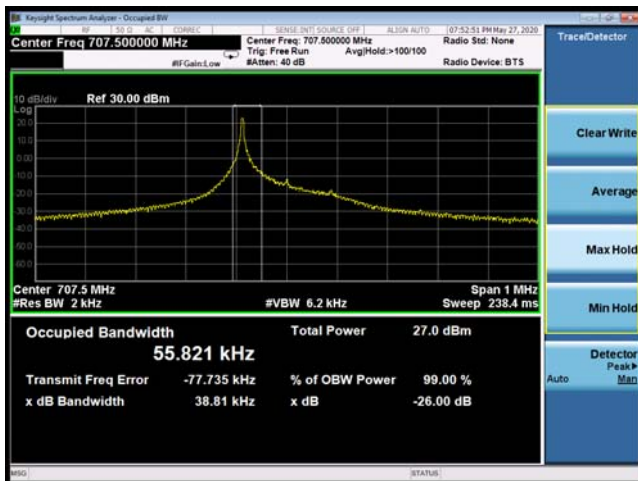
NB-IOT Band 12 BPSK 3.75KHz 1@0 CH-Low



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



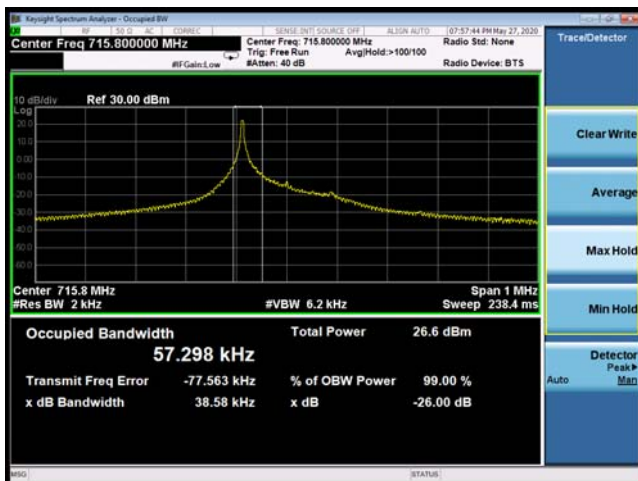
NB-IOT Band 12 BPSK 3.75KHz 1@0 CH-Middle



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



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



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





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



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



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



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



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



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



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



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

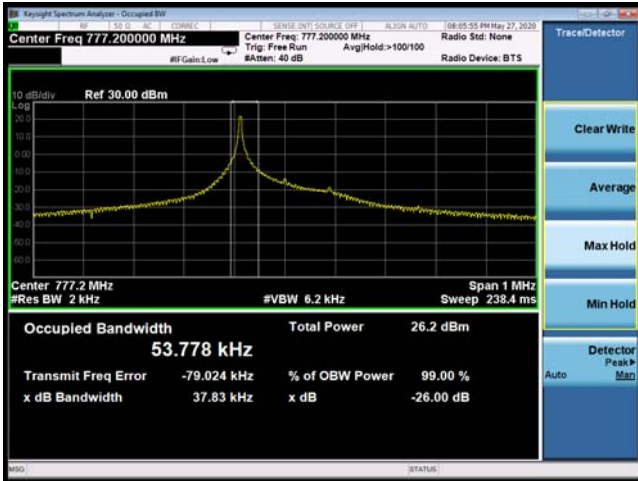


NB-IOT Band 12 QPSK 15KHz 12@0 CH-High





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



NB-IOT Band 13 BPSK15KHz 1@0 CH-Low



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



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



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



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





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



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



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



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



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



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



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



NB-IOT Band 13 QPSK 15KHz 12@0 CH-Middle



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





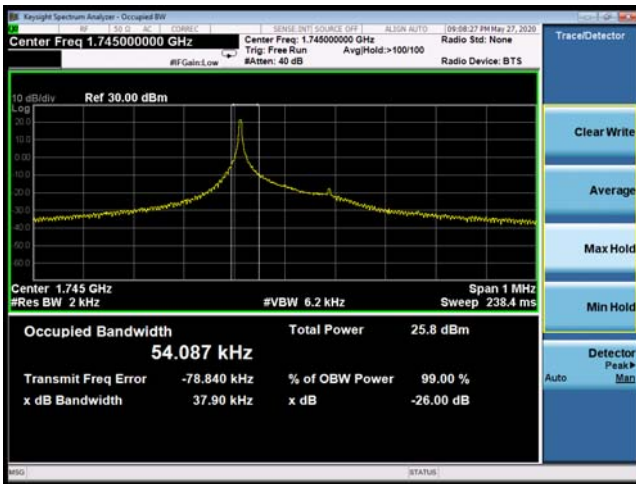
NB-IOT Band 66 BPSK 3.75KHz 1@0 CH-Low



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



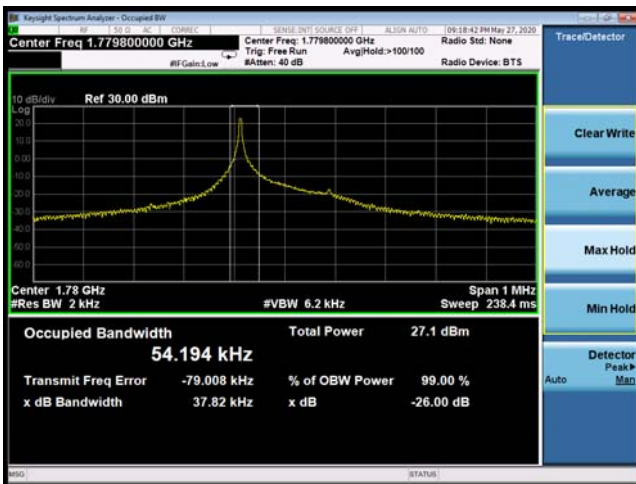
NB-IOT Band 66 BPSK 3.75KHz 1@0 CH-Middle



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





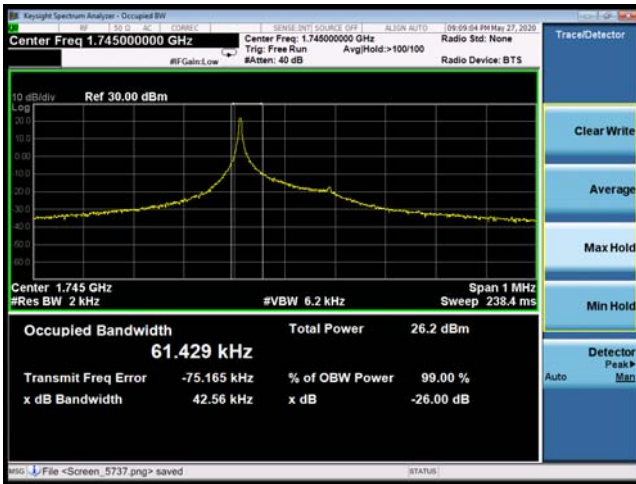
NB-IOT Band 66 QPSK 3.75KHz 1@0 CH-Low



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



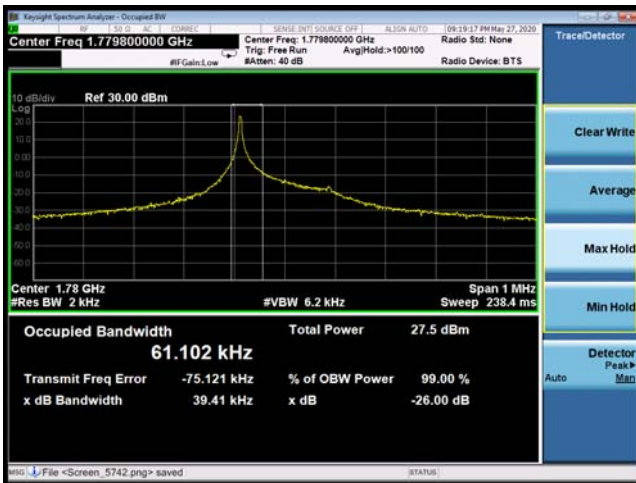
NB-IOT Band 66 QPSK 3.75KHz 1@0 CH-Middle



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





NB-IOT Band 71 BPSK 3.75KHz 1@0 CH-Low



NB-IOT Band 71 BPSK 15KHz 1@0 CH-Low



NB-IOT Band 71 BPSK 3.75KHz 1@0 CH-Middle



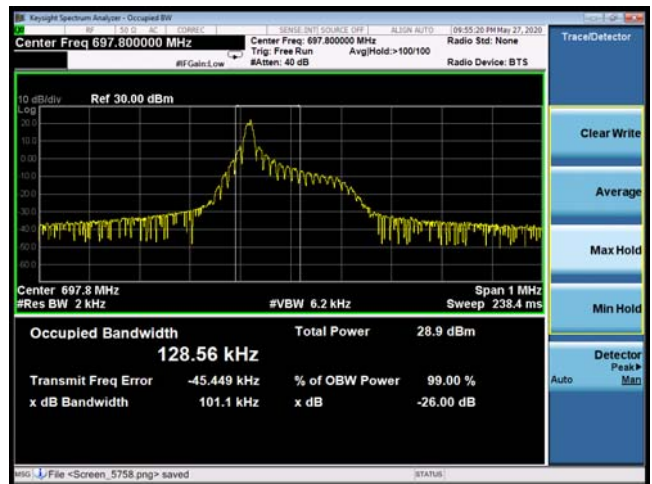
NB-IOT Band 71 BPSK 15KHz 1@0 CH-Middle



NB-IOT Band 71 BPSK 3.75KHz 1@0 CH-High

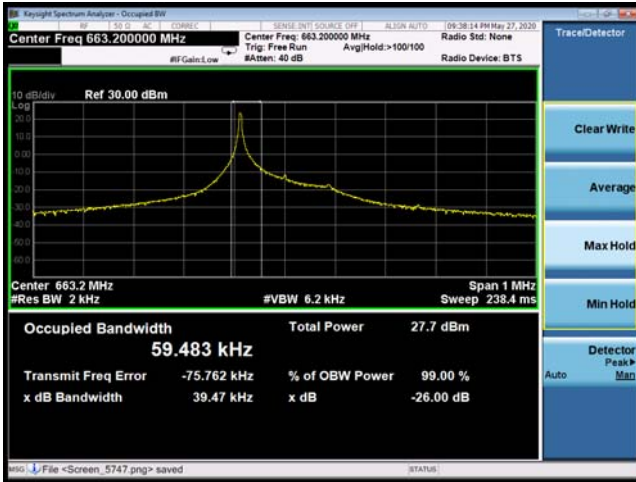


NB-IOT Band 71 BPSK 15KHz 1@0 CH-High





NB-IOT Band 71 QPSK 3.75KHz 1@0 CH-Low



NB-IOT Band 71 QPSK 15KHz 1@0 CH-Low



NB-IOT Band 71 QPSK 3.75KHz 1@0 CH-Middle



NB-IOT Band 71 QPSK 15KHz 1@0 CH-Middle



NB-IOT Band 71 QPSK 3.75KHz 1@0 CH-High



NB-IOT Band 71 QPSK 15KHz 1@0 CH-High



NB-IOT Band 71 QPSK 15KHz 12@0 CH-Low



NB-IOT Band 71 QPSK 15KHz 12@0 CH-Middle



NB-IOT Band 71 QPSK 15KHz 12@0 CH-High





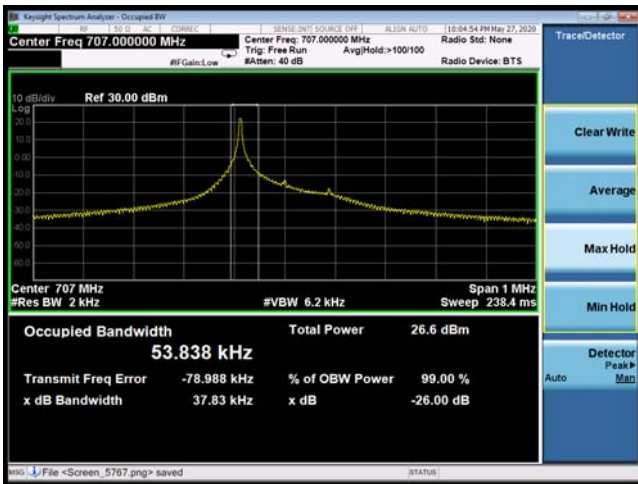
NB-IOT Band 85 BPSK 3.75KHz 1@0 CH-Low



NB-IOT Band 85 BPSK 15KHz 1@0 CH-Low



NB-IOT Band 85 BPSK 3.75KHz 1@0 CH-Middle



NB-IOT Band 85 BPSK 15KHz 1@0 CH-Middle



NB-IOT Band 85 BPSK 3.75KHz 1@0 CH-High

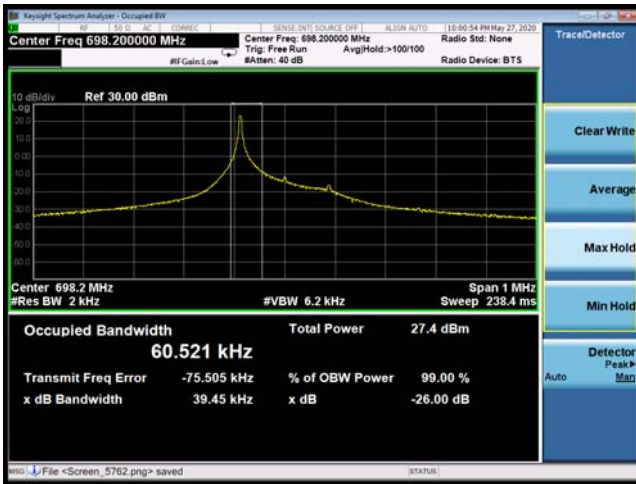


NB-IOT Band 85 BPSK 15KHz 1@0 CH-High





NB-IOT Band 85 QPSK 3.75KHz 1@0 CH-Low



NB-IOT Band 85 QPSK 15KHz 1@0 CH-Low



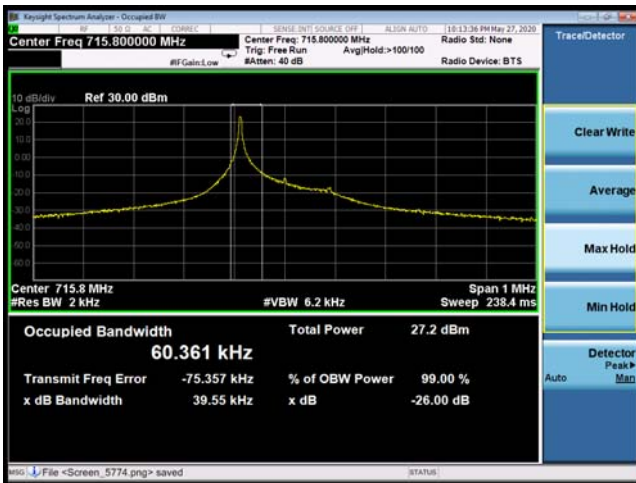
NB-IOT Band 85 QPSK 3.75KHz 1@0 CH-Middle



NB-IOT Band 85 QPSK 15KHz 1@0 CH-Middle



NB-IOT Band 85 QPSK 3.75KHz 1@0 CH-High



NB-IOT Band 85 QPSK 15KHz 1@0 CH-High



NB-IOT Band 85 QPSK 15KHz 12@0 CH-Low



NB-IOT Band 85 QPSK 15KHz 12@0 CH-Middle



NB-IOT Band 85 QPSK 15KHz 12@0 CH-High



5.3 Band Edge Compliance

Ambient condition

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

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured.

The testing follows KDB 971168 D01 v03r01 Section 6.0

The EUT was connected to spectrum analyzer and system simulator via a power divider.

The band edges of low and high channels for the highest RF powers were measured.

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

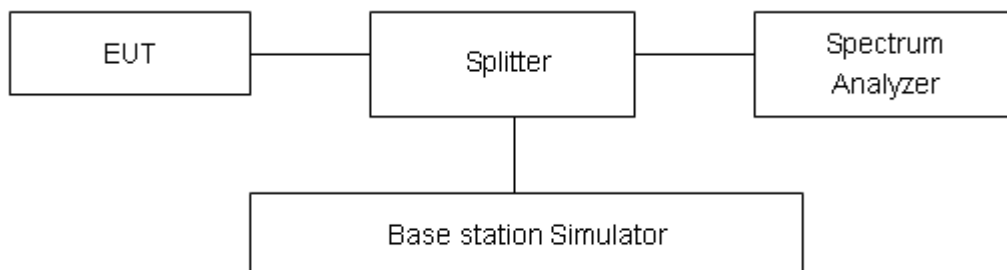
on spectrum analyzer.

Set spectrum analyzer with RMS detector.

The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

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”

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.

Rule Part 27.53 (c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

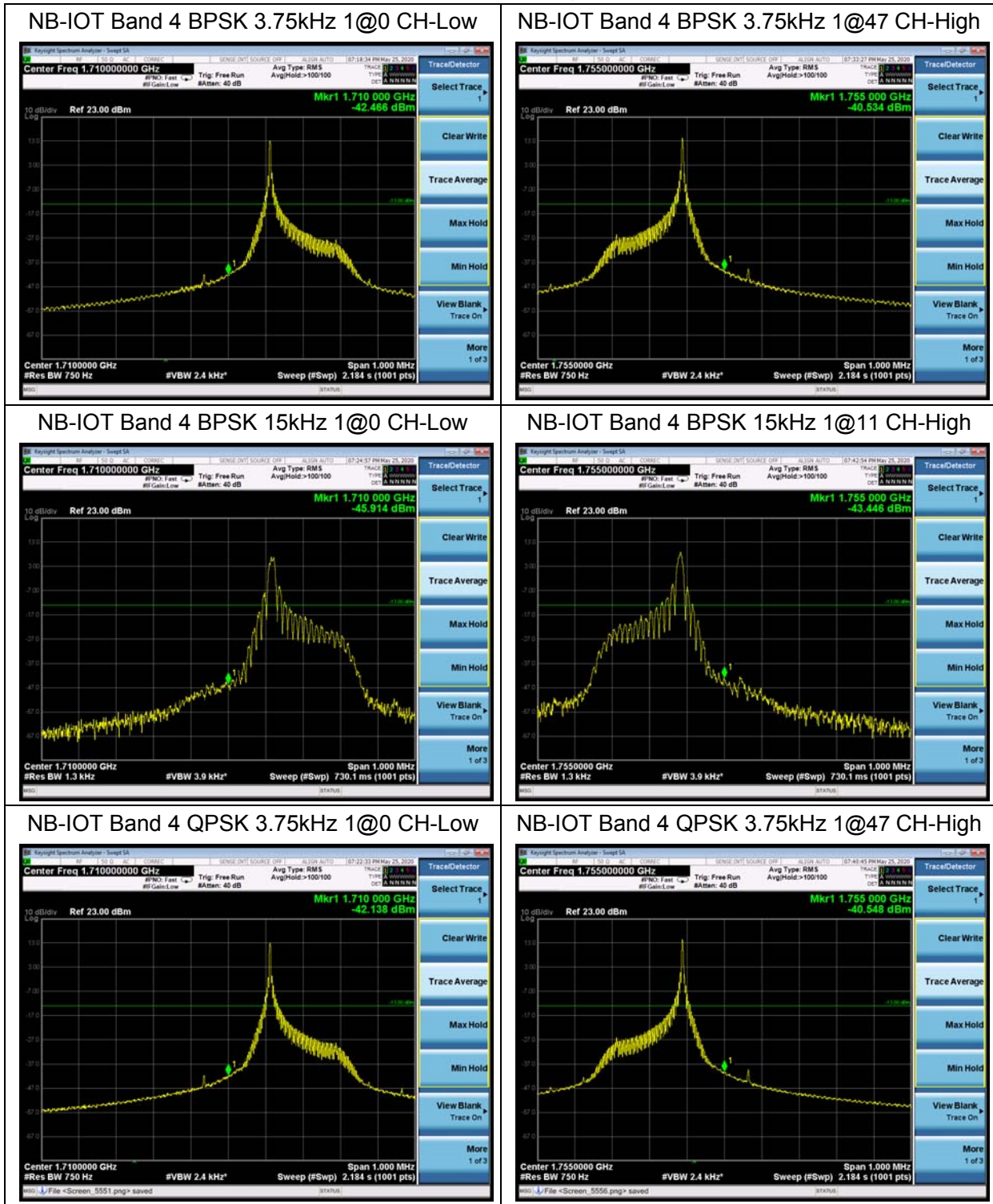
- (1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;
- (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below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

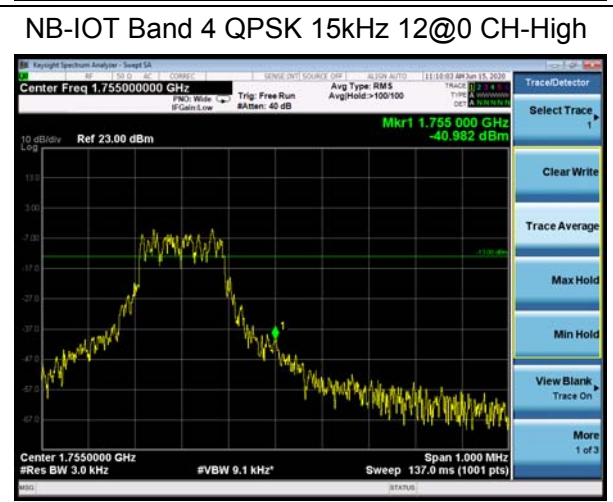
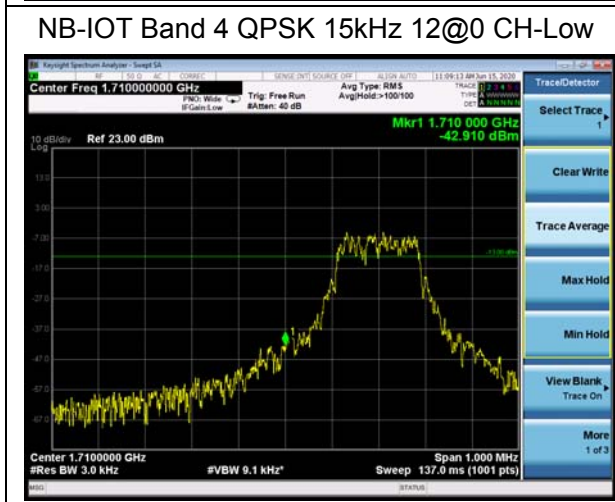
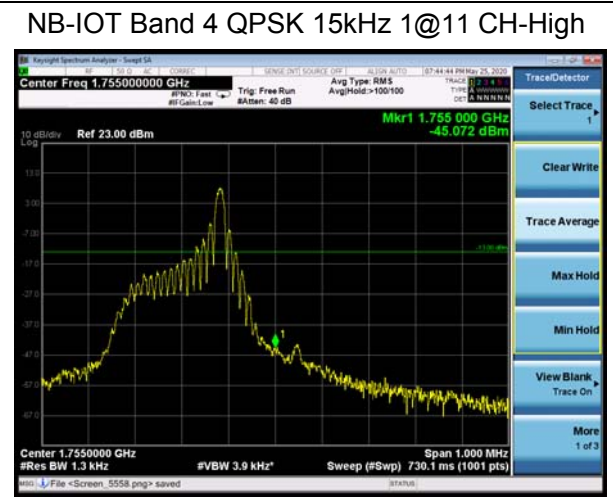
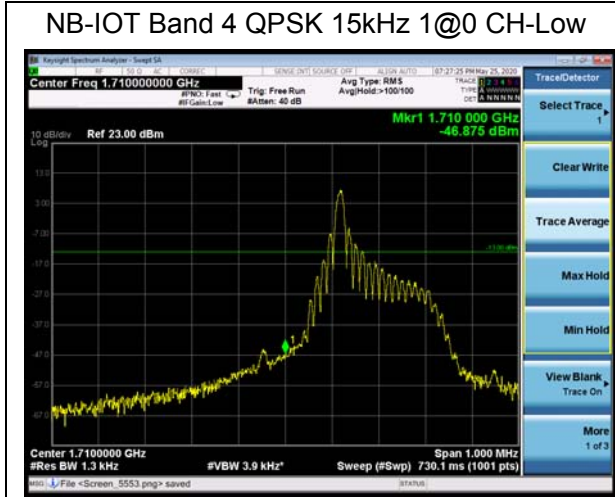
Measurement Uncertainty

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

Test Result

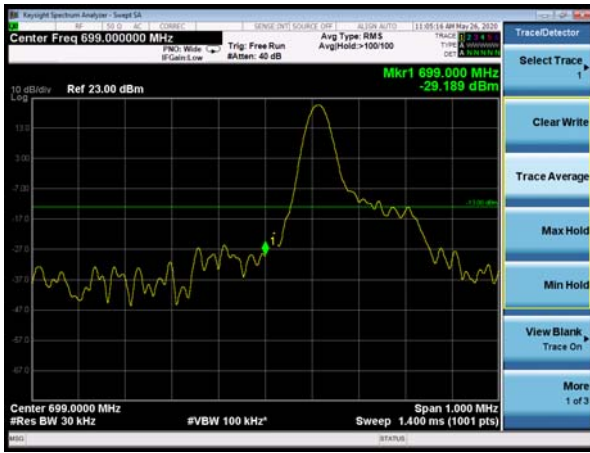
All the test traces in the plots shows the test results clearly.







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

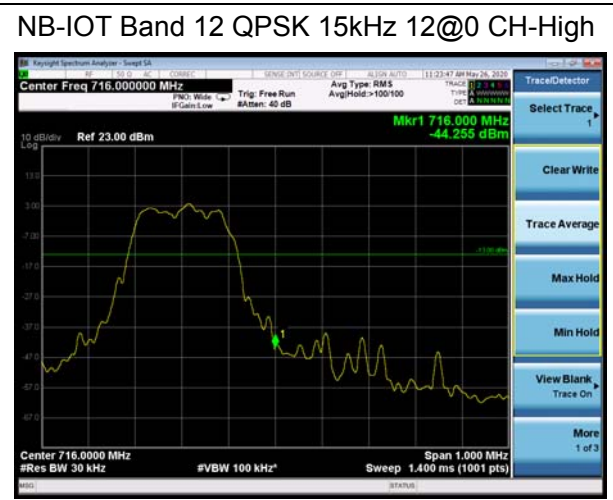
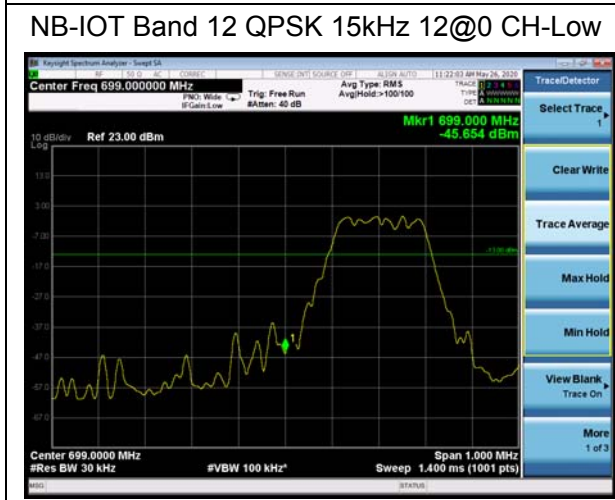
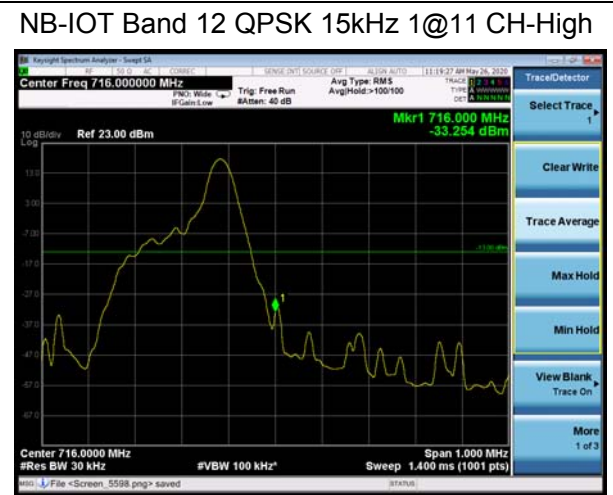
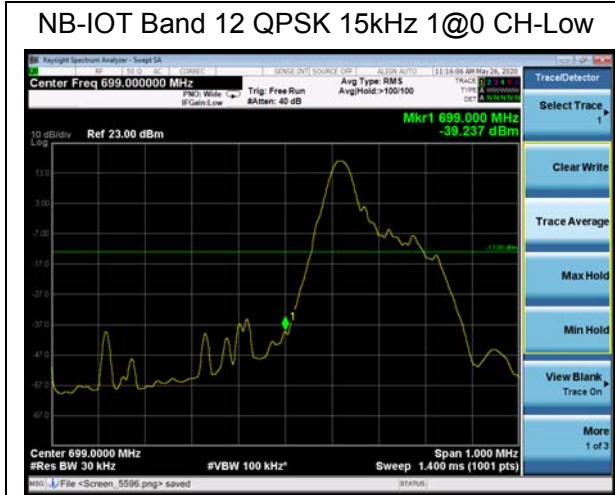


NB-IOT Band 12 QPSK 3.75kHz 1@0 CH-Low



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







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



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



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



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

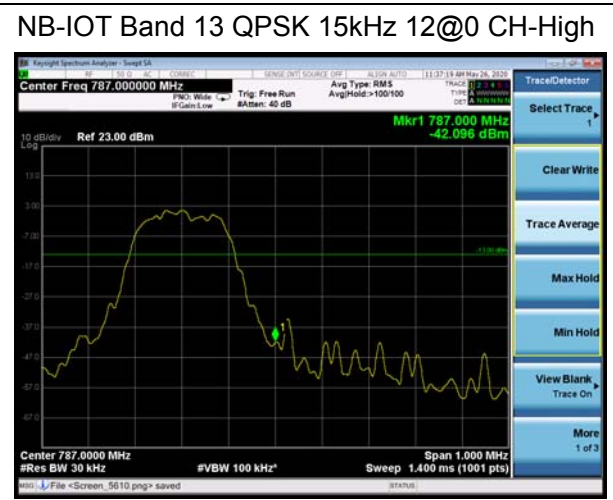
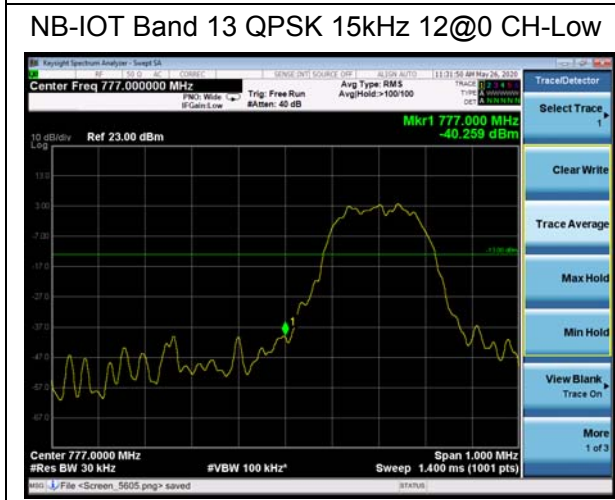
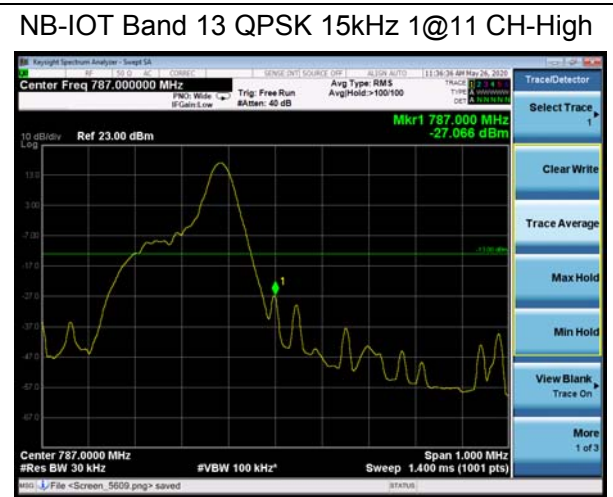
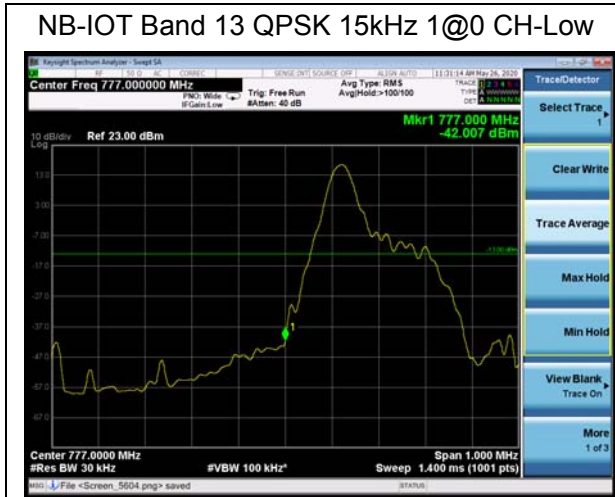


NB-IOT Band 13 QPSK 3.75kHz 1@0 CH-Low



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







NB-IOT Band 13 BPSK 3.75kHz 1@0 763MHz-775MHz



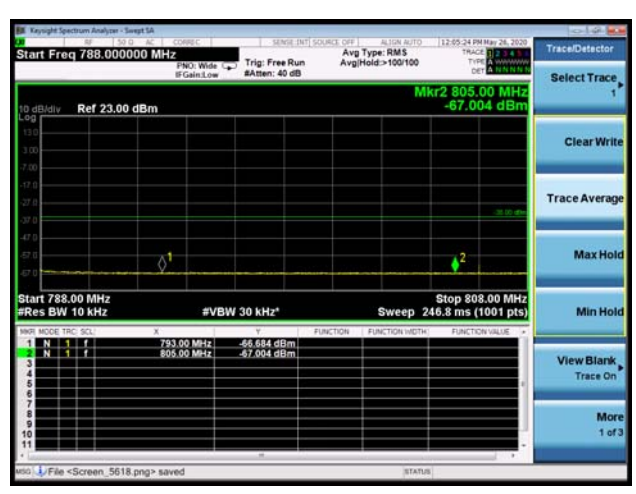
NB-IOT Band 13 BPSK 3.75kHz 1@47 793MHz -805MHz



NB-IOT Band 13 BPSK 15kHz 1@0 763MHz-775MHz



NB-IOT Band 13 BPSK 15kHz 1@11 793MHz -805MHz



NB-IOT Band 13 QPSK 3.75kHz 1@0 763MHz-775MHz

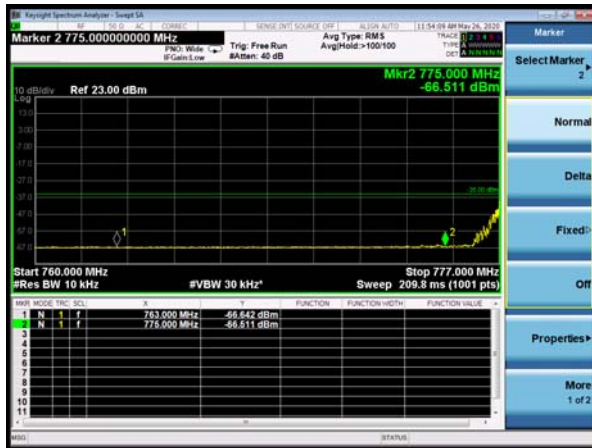


NB-IOT Band 13 QPSK 3.75kHz 1@47 793MHz -805MHz

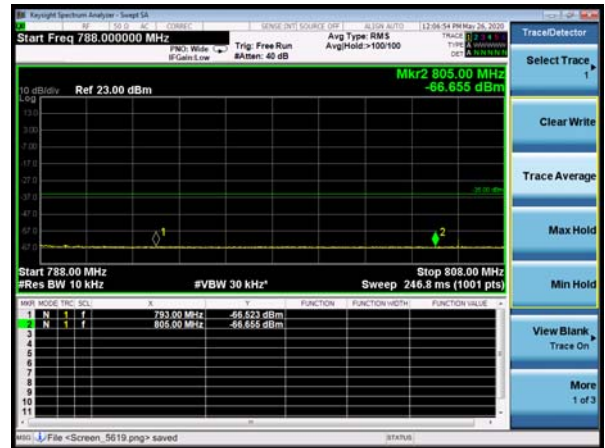




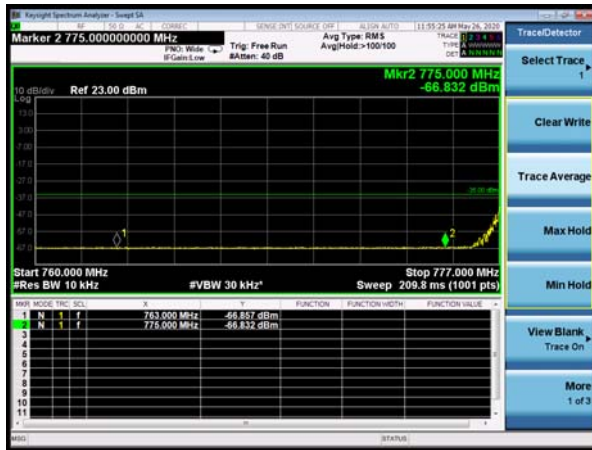
NB-IOT Band 13 QPSK 15kHz 1@0
763MHz-775MHz



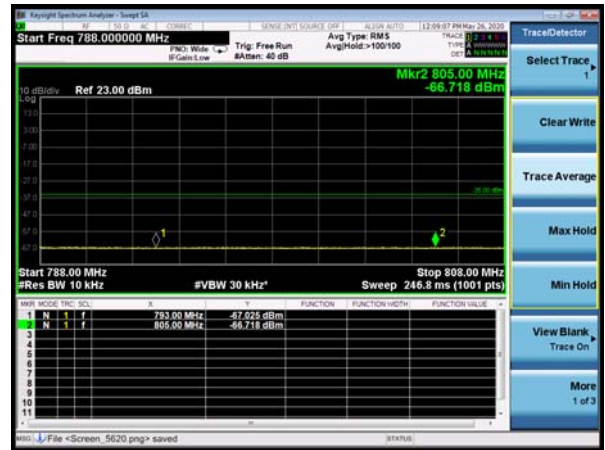
NB-IOT Band 13 QPSK 15kHz 1@11
793MHz -805MHz



NB-IOT Band 13 QPSK 15kHz 12@0
763MHz-775MHz

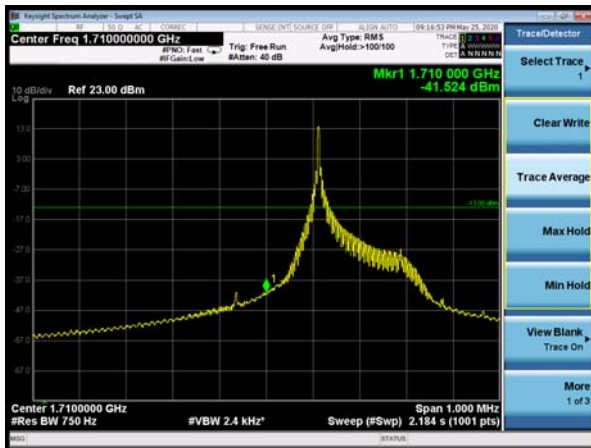


NB-IOT Band 13 QPSK 15kHz 12@0
793MHz -805MHz

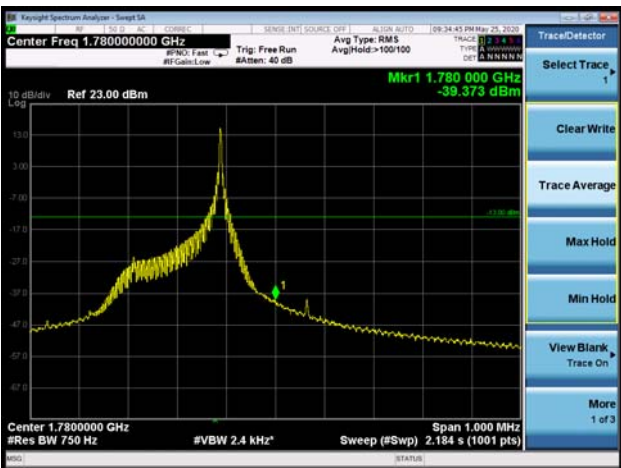




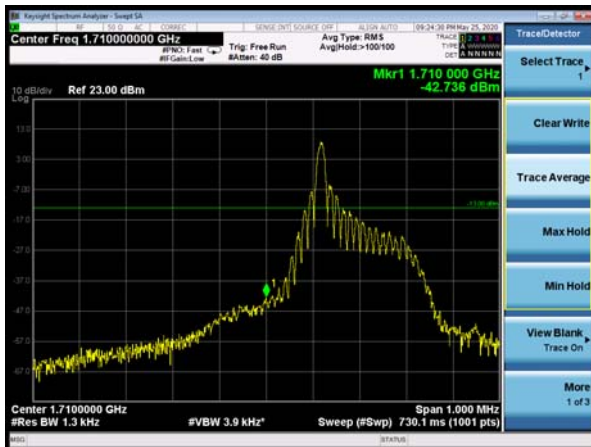
NB-IOT Band 66 BPSK 3.75kHz 1@0 CH-Low



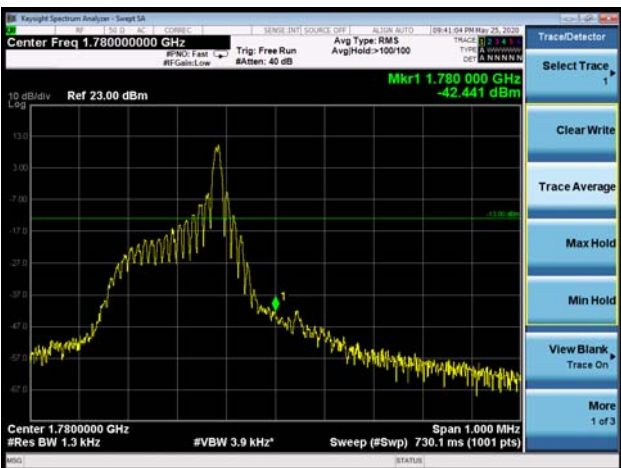
NB-IOT Band 66 BPSK 3.75kHz 1@47 CH-High



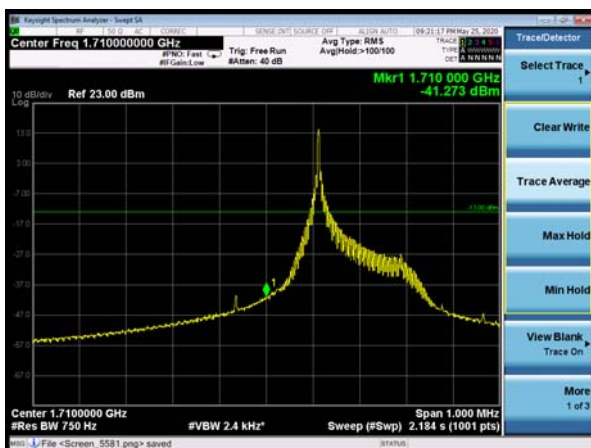
NB-IOT Band 66 BPSK 15kHz 1@0 CH-Low



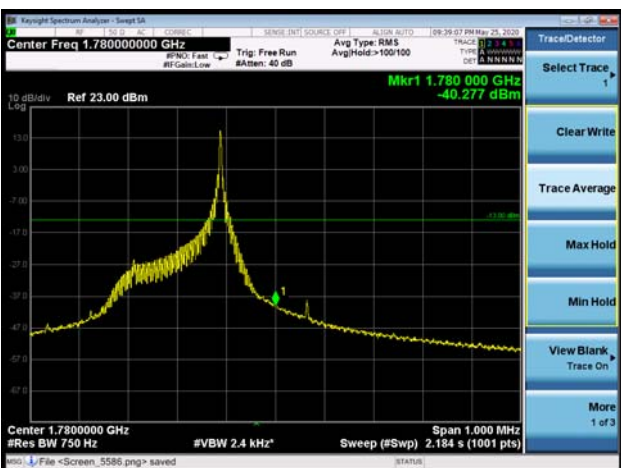
NB-IOT Band 66 BPSK 15kHz 1@11 CH-High

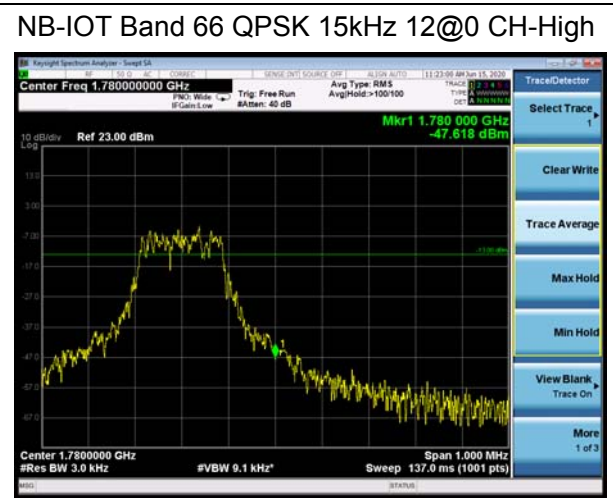
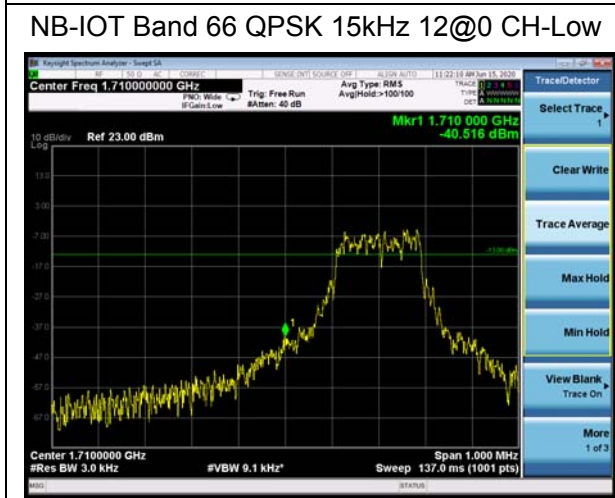
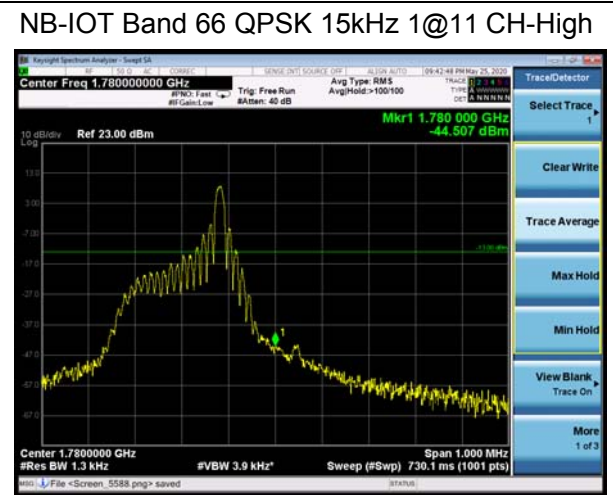
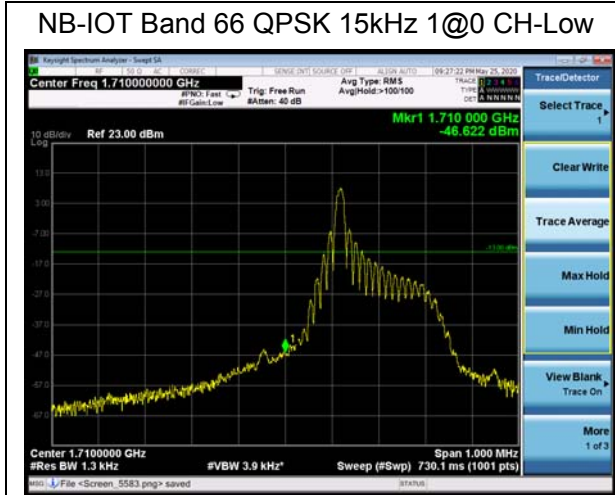


NB-IOT Band 66 QPSK 3.75kHz 1@0 CH-Low



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







NB-IOT Band 71 BPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 71 BPSK 3.75kHz 1@47 CH-High



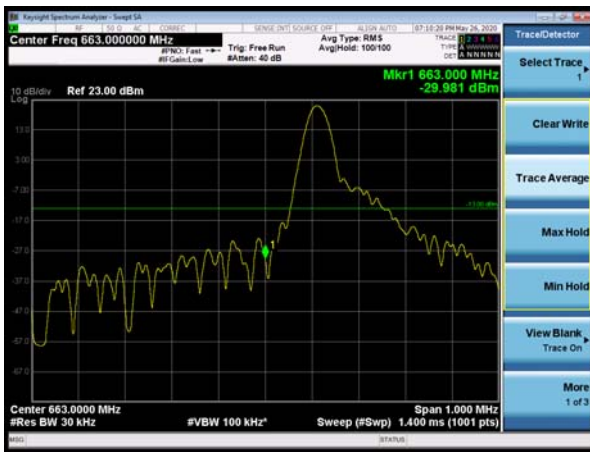
NB-IOT Band 71 BPSK 15kHz 1@0 CH-Low



NB-IOT Band 71 BPSK 15kHz 1@11 CH-High

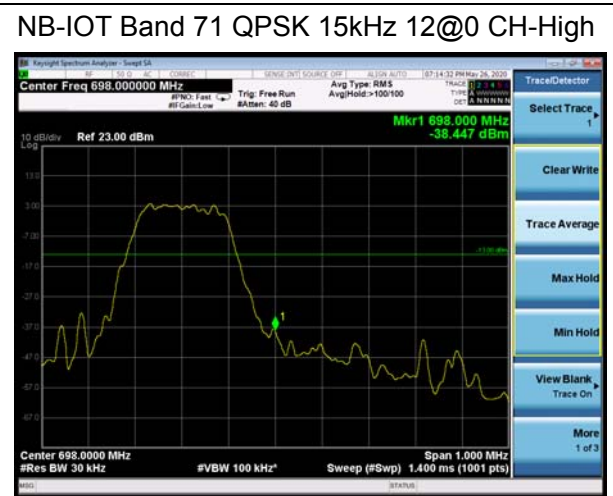
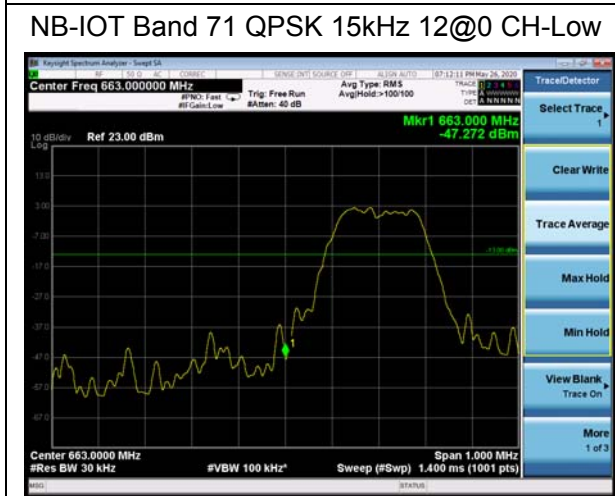
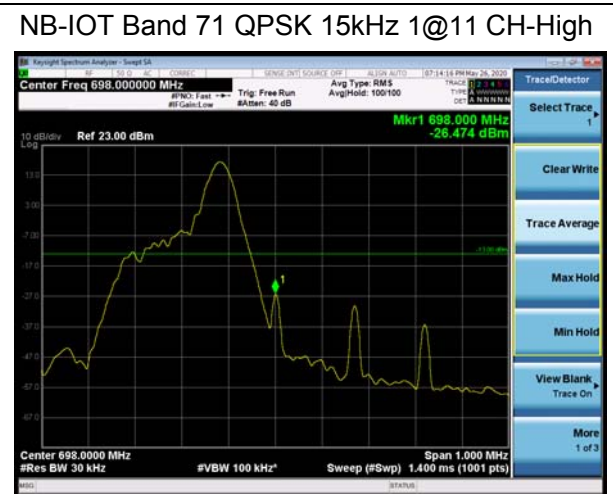
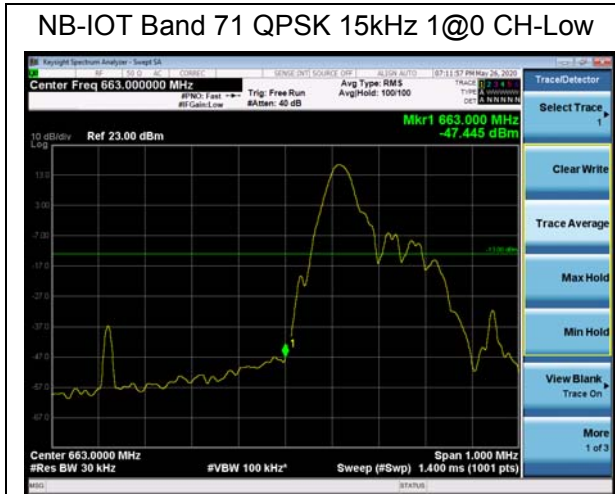


NB-IOT Band 71 QPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 71 QPSK 3.75kHz 1@47 CH-High







NB-IOT Band 85 BPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 85 BPSK 3.75kHz 1@47 CH-High



NB-IOT Band 85 BPSK 15kHz 1@0 CH-Low



NB-IOT Band 85 BPSK 15kHz 1@11 CH-High



NB-IOT Band 85 QPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 85 QPSK 3.75kHz 1@47 CH-High

