



RF TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd
FCC ID XMR202004BG600LM3
Product LTE Cat M1 & Cat NB2 & EGPRS Module
Brand Quectel
Model BG600L-M3
Report No. R2003A0168-R6
Issue Date June 18, 2020

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2019)/ FCC CFR 47 Part 24E (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

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

Date of Testing: April 20, 2020~ May 21, 2020 and June 8, 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.
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2. General Description of Equipment under Test

2.3. 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

2.4. General information

EUT Description			
Model	BG600L-M3		
IMEI	860873040012816		
Hardware Version	R1.2		
Software Version	BG600LM3LAR02A03		
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	GSM1900	Low channel	1.25dBi
		Middle channel	1.38dBi
		High channel	1.59dBi
	NB-IOT Band 2	Low channel	1.25dBi
		Middle channel	1.38dBi
		High channel	1.59dBi
	NB-IOT Band 25	Low channel	1.25dBi
		Middle channel	1.38dBi
		High channel	1.36dBi
Test Mode(s)	GSM1900; NB-IOT Band 2/25;		
Test Modulation:	(GSM/ GPRS)GMSK, (EGPRS) GMSK/8PSK; (NB-IOT)BPSK, QPSK		
GPRS Multislot Class	33		
EGPRS Multislot Class	33		
Category	NB2		
Deployment:	stand-alone		
Sub-carrier spacing:	3.75KHz, 15KHz		
Ntones:	single-tone, multi-tone		
Maximum E.I.R.P	GSM 1900:		31.19dBm
	NB-IOT Band 2:		23.66dBm
	NB-IOT Band 25:		23.36dBm



Rated Power Supply Voltage	3.8V		
Extreme Voltage	Minimum: 3.3V Maximum: 4.3V		
Extreme Temperature	Lowest: -40°C Highest: +85°C		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM1900	1850 ~ 1910	1930 ~ 1990
	NB-IOT Band 2	1850 ~ 1910	1930 ~ 1990
	NB-IOT Band 25	1850 ~ 1915	1930 ~ 1995
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.			

3. Applied Standards

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

Test standards:

FCC CFR 47 Part 24E (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 (X axis, horizontal polarization) and the worst case was recorded.

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

Subsequently, only the worst case emissions are reported.

The following testing in GSM/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:

Test items	Modes/Modulation
	GSM 1900
RF Power Output and Effective Isotropic Radiated Power	GSM GPRS EGPRS
Occupied Bandwidth	GSM GPRS(1Tx slot) EGPRS(1Tx slot)
Band Edge Compliance	GSM GPRS(1Tx slot) EGPRS(1Tx slot)
Peak-to-Average Power Ratio	GSM GPRS(1Tx slot) EGPRS(1Tx slot)
Frequency Stability	GSM GPRS(1Tx slot) EGPRS(1Tx slot)
Spurious Emissions at Antenna Terminals	GSM
Radiates Spurious Emission	GSM



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

Test items		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 Band 2	O	O	O	O	O	O	O	O
	NB-IOT Band 25	O	O	O	O	O	O	O	O
Occupied Bandwidth	NB-IOT Band 2	O	O	O	O	O	O	O	O
	NB-IOT Band 25	O	O	O	O	O	O	O	O
Band Edge Compliance	NB-IOT Band 2	O	O	O	O	O	O	-	O
	NB-IOT Band 25	O	O	O	O	O	O	-	O
Peak-to-Average Power Ratio	NB-IOT Band 2	O	O	O	O	O	-	O	-
	NB-IOT Band 25	O	O	O	O	O	-	O	-
Frequency Stability	NB-IOT Band 2	O	O	O	O	O	O	O	O
	NB-IOT Band 25	O	O	O	O	O	O	O	O
Conducted Spurious Emissions	NB-IOT Band 2	O	-	O	-	O	O	O	O
	NB-IOT Band 25	O	-	O	-	O	O	O	O
Radiates Spurious Emission	NB-IOT Band 2	O	-	O	-	O	O	O	O
	NB-IOT Band 25	O	-	O	-	O	O	O	O

Note

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

5. Test Case Results

5.1.RF Power Output and Effective Isotropic Radiated Power

Ambient condition

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

Methods of Measurement

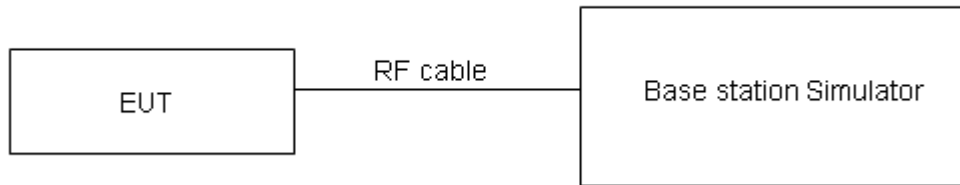
During the process of the testing, The EUT is controlled by the Base Station Simulator to ensure max power transmission and proper modulation.

The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).

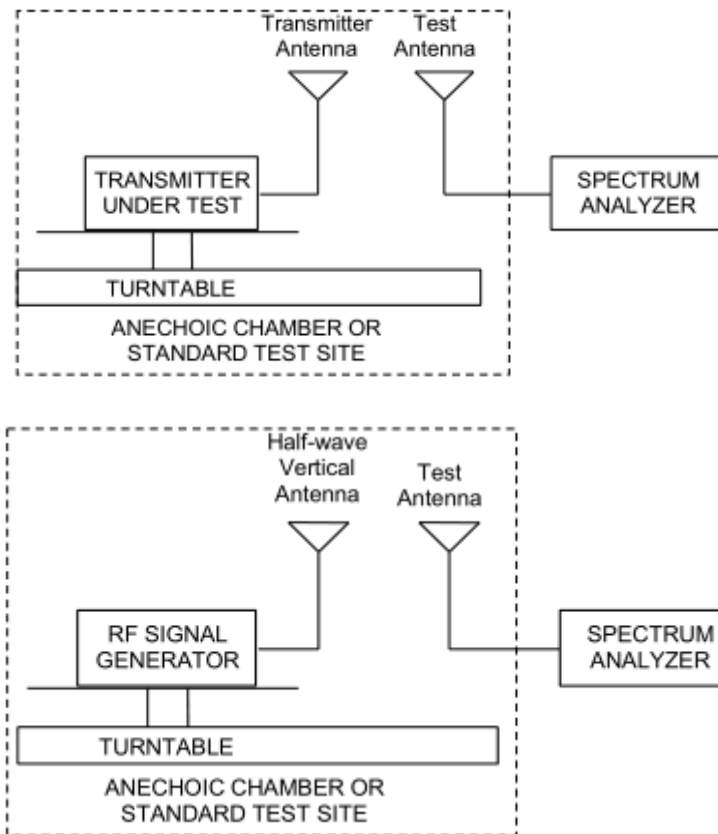
- a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.
- b) Key the transmitter,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



Limits

No specific RF power output requirements in part 2.1046.

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

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

Limit	$\leq 2\text{ W}$ (33 dBm)
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**Measurement Uncertainty**

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



Test Results

GSM 1900		Conducted Power (dBm)			EIRP (dBm)		
		Channel 512	Channel 661	Channel 810	Channel 512	Channel 661	Channel 810
		1850.2 (MHz)	1880 (MHz)	1909.8 (MHz)	1850.2 (MHz)	1880 (MHz)	1909.8 (MHz)
GSM(GMSK)	Results	29.13	29.32	29.05	30.38	30.70	30.64
GPRS (GMSK)	1TXslot	29.42	29.52	29.60	30.67	30.90	31.19
	2TXslots	28.76	28.55	28.65	30.01	29.93	30.24
	3TXslots	27.23	26.96	27.41	28.48	28.34	29.00
	4TXslots	26.70	26.71	26.45	27.95	28.09	28.04
EGPRS (8PSK)	1TXslot	26.31	26.21	26.04	27.56	27.59	27.63
	2TXslots	24.40	24.34	24.20	25.65	25.72	25.79
	3TXslots	22.53	22.51	22.42	23.78	23.89	24.01
	4TXslots	21.46	21.32	21.17	22.71	22.70	22.76

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Conducted Power (dBm) for low/middle/high channel			EIRP(dBm)		
				18602 /1850.2	18900 /1880.0	19198 /1909.8	18602 /1850.2	18900 /1880.0	19198 /1909.8
NB-IOT Band 2 Standalone	BPSK	3.75	1@0	21.66	21.52	22.07	22.91	22.90	23.66
			1@47	21.68	21.44	21.96	22.93	22.82	23.55
		15	1@0	21.64	2.52	22.00	22.89	3.90	23.59
			1@11	21.65	21.51	21.89	22.90	22.89	23.48
	QPSK	3.75	1@0	21.67	21.58	22.06	22.92	22.96	23.65
			1@47	21.62	21.51	21.95	22.87	22.89	23.54
		15	1@0	21.67	21.56	21.93	22.92	22.94	23.52
			1@11	21.69	21.44	21.84	22.94	22.82	23.43
		15	12@0	19.79	19.61	19.89	21.04	20.99	21.48
Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Conducted Power (dBm) for low/middle/high channel			EIRP(dBm)		
				26042 /1850.2	26365 /1882.5	26688 /1914.8	26042 /1850.2	26365 /1882.5	26688 /1914.8
NB-IOT Band 25 Standalone	BPSK	3.75	1@0	21.47	21.41	21.87	22.72	22.79	23.23
			1@47	21.39	21.36	21.88	22.64	22.74	23.24
		15	1@0	21.59	21.63	21.93	22.84	23.01	23.29
			1@11	21.57	21.43	22.00	22.82	22.81	23.36
	QPSK	3.75	1@0	21.48	21.35	21.94	22.73	22.73	23.30
			1@47	21.51	21.42	21.84	22.76	22.80	23.20
		15	1@0	21.53	21.47	21.97	22.78	22.85	23.33
			1@11	21.67	21.36	21.89	22.92	22.74	23.25
		15	12@0	19.57	19.47	19.87	20.82	20.85	21.23

5.2. Occupied Bandwidth

Ambient condition

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

Method of Measurement

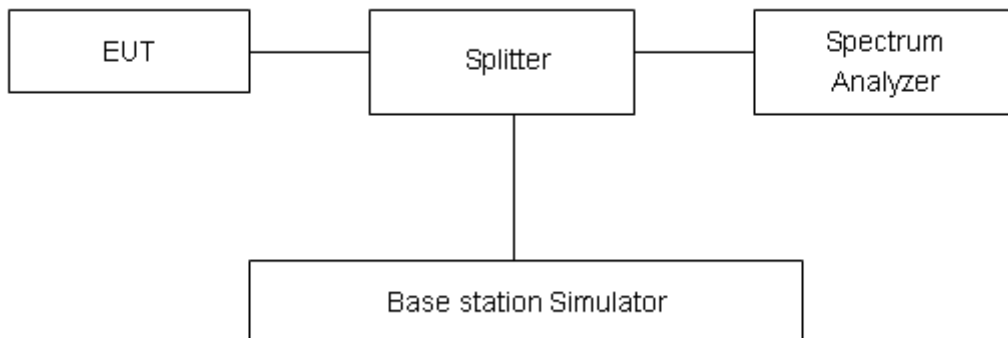
The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.

RBW is set to 3kHz, VBW is set to 10kHz for GSM

RBW is set to 2kHz, VBW is set to 6.2kHz for NB-IOT Band 2/25

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.

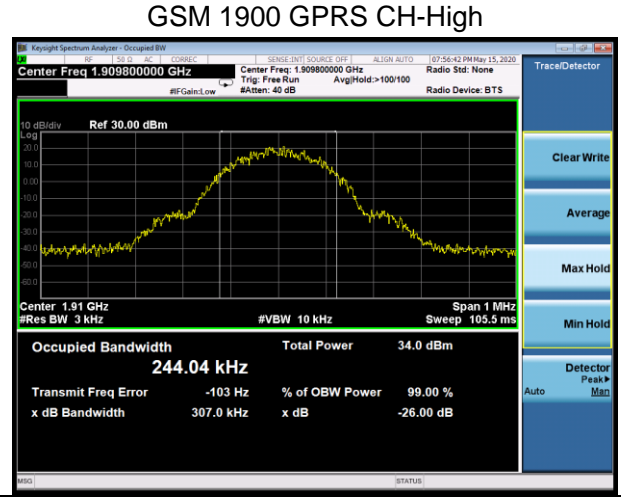
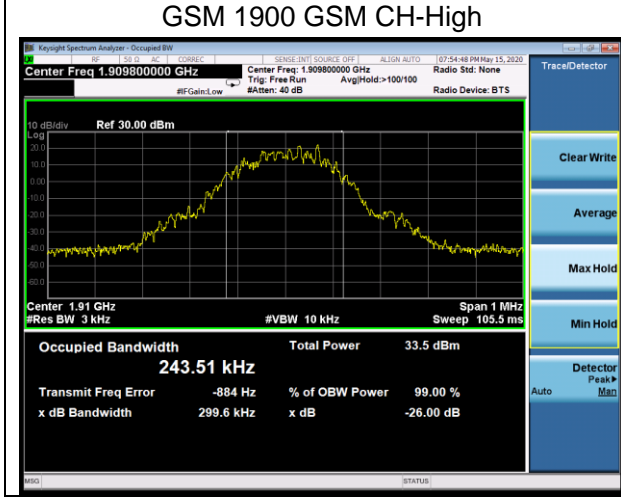
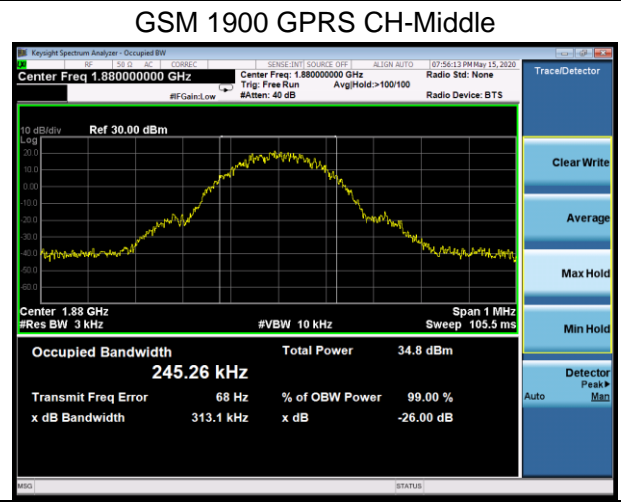
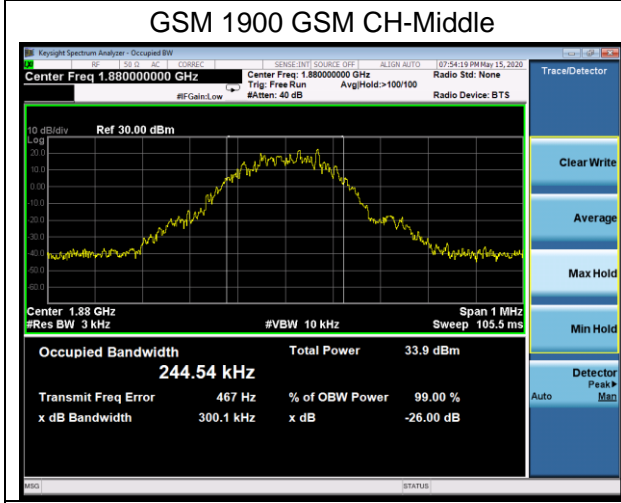
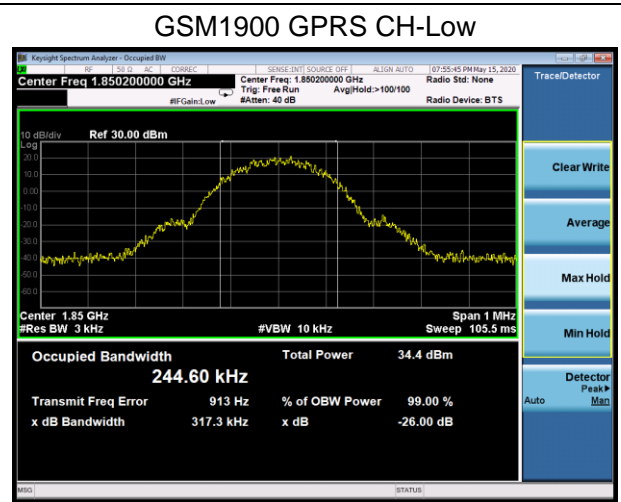
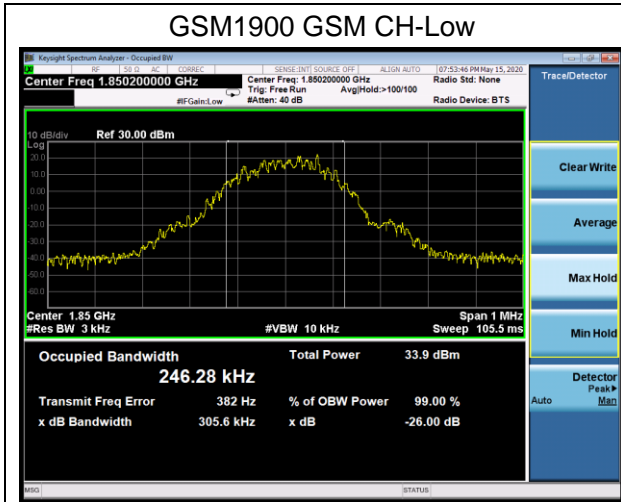
Measurement Uncertainty

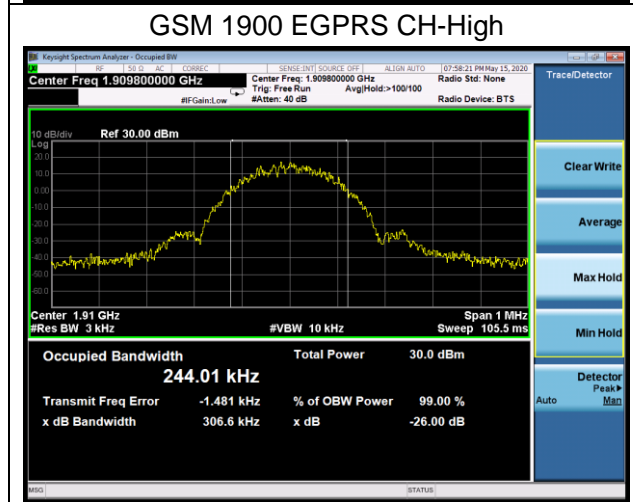
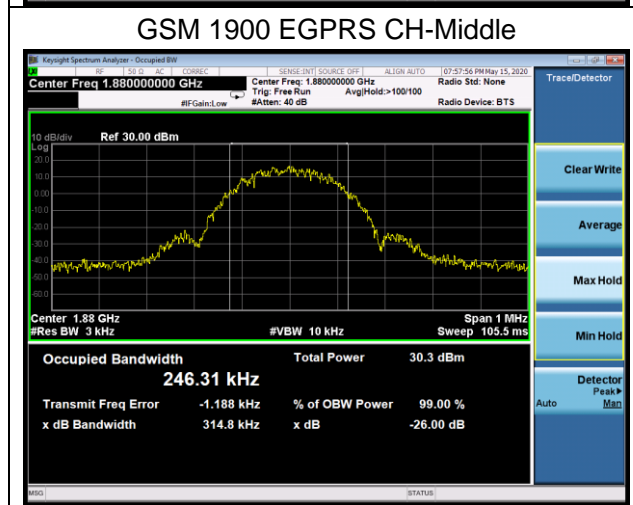
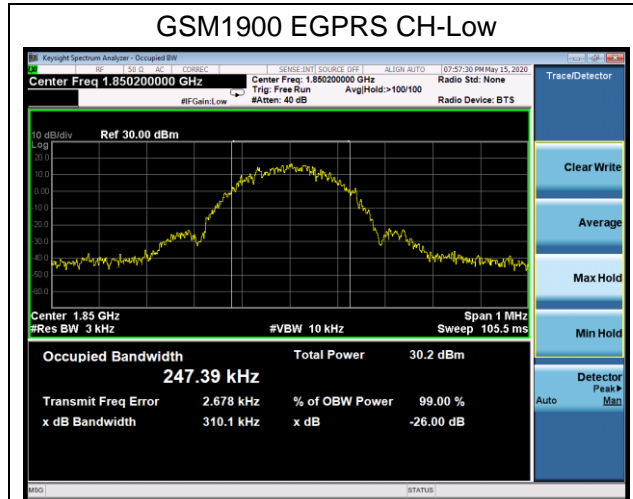
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 624\text{Hz}$.

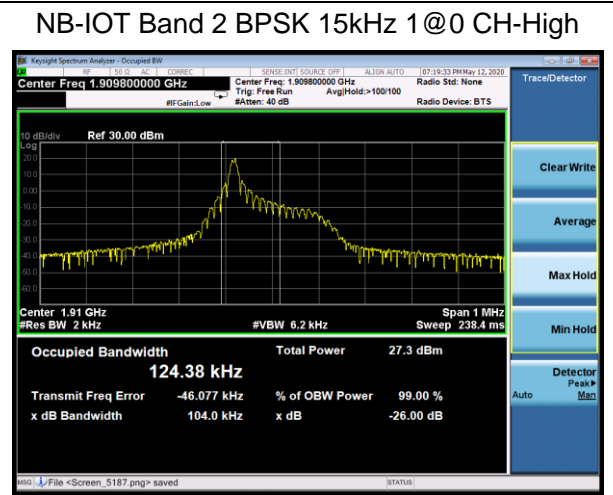
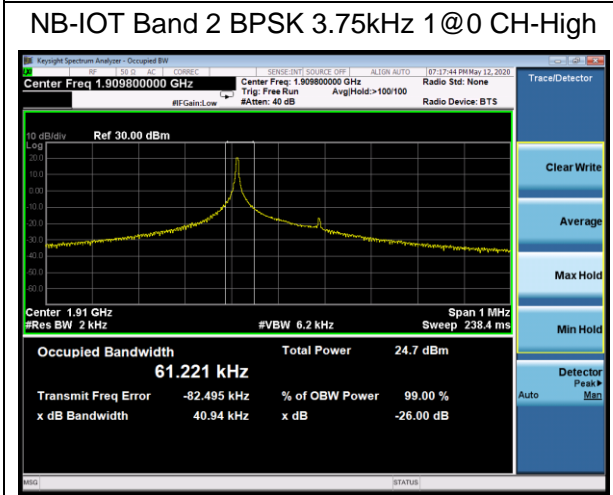
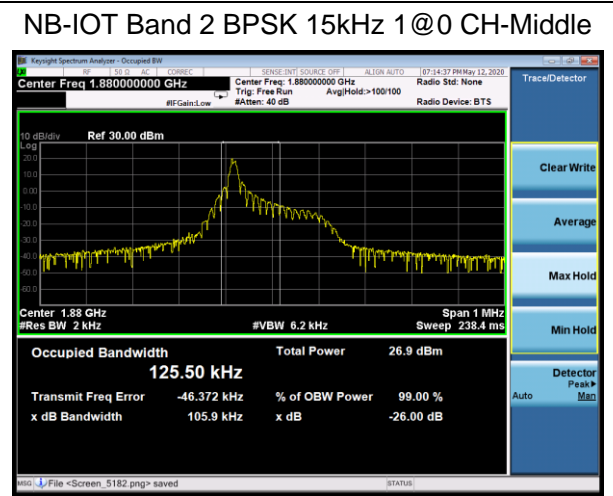
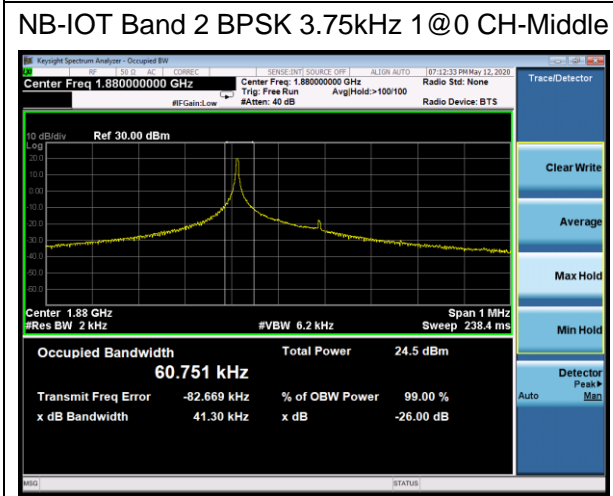
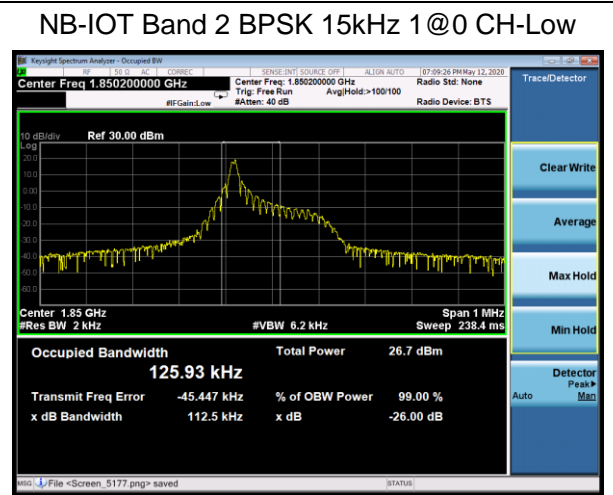
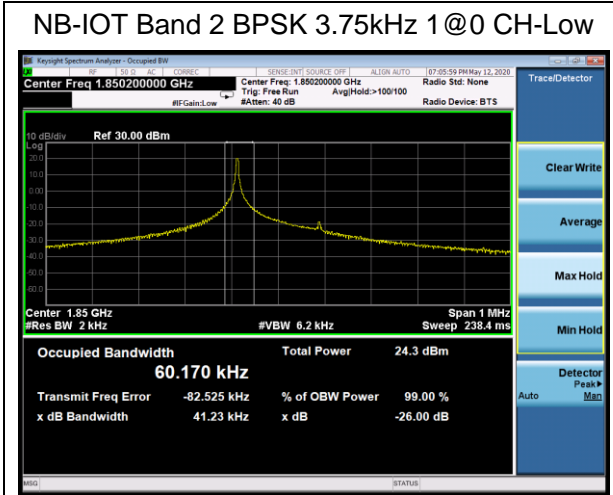
Test Result

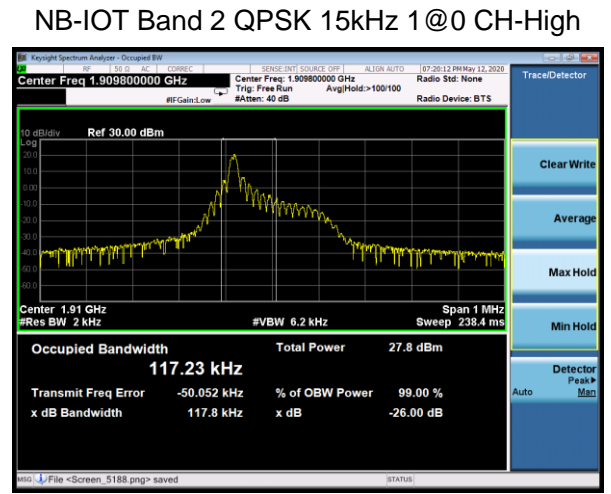
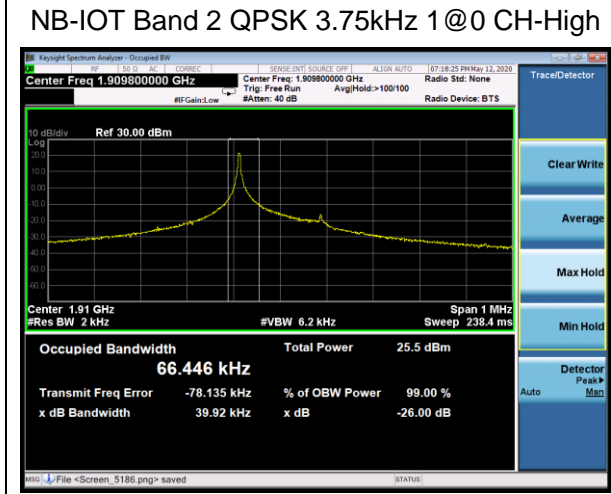
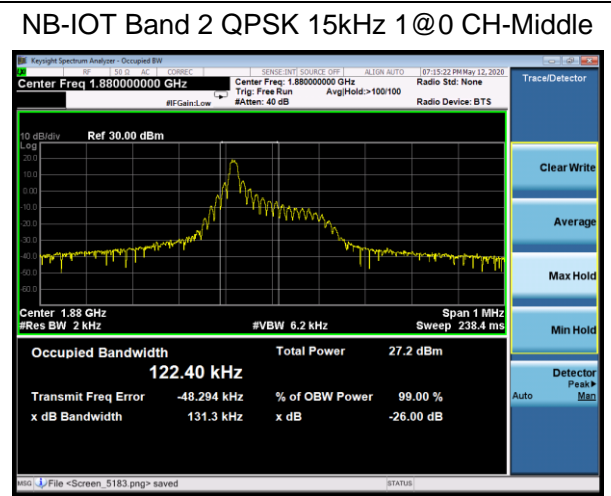
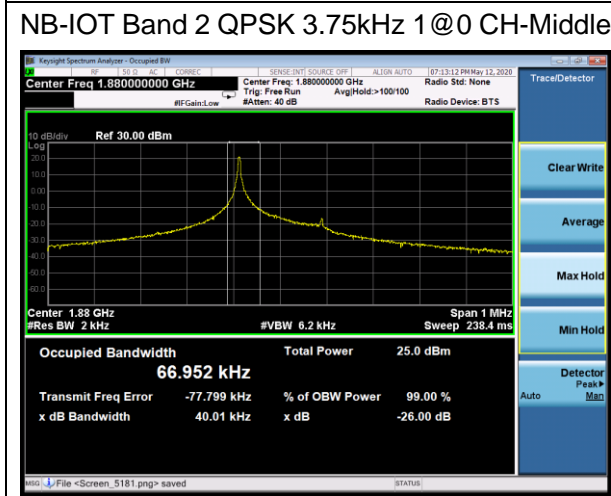
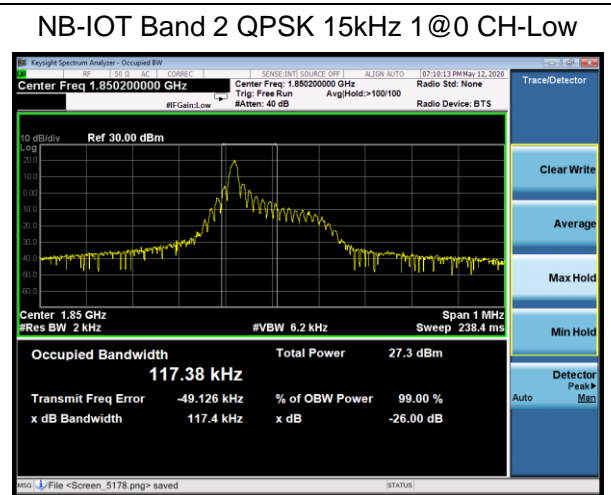
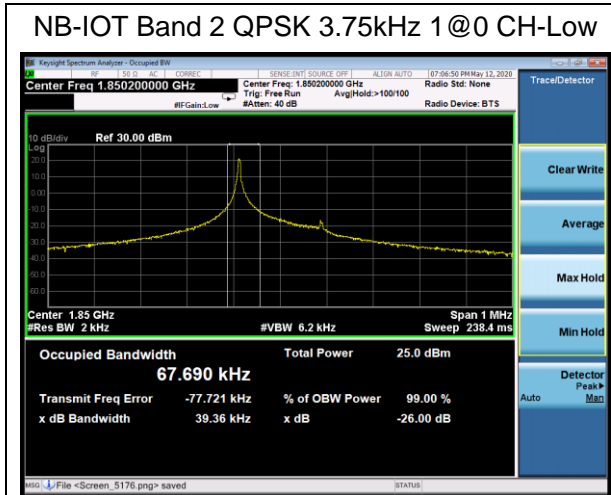
Mode	Channel	Frequency (MHz)	99% Power Bandwidth (MHz)	-26dBc Bandwidth(MHz)
GSM 1900 (GMSK)	512	1850.2	0.2463	0.306
	661	1880.0	0.2445	0.300
	810	1909.8	0.2435	0.300
GPRS 1900 (GMSK)	512	1850.2	0.2446	0.317
	661	1880.0	0.2453	0.313
	810	1909.8	0.2440	0.307
EGPRS 1900 (8PSK)	512	1850.2	0.2474	0.310
	661	1880.0	0.2463	0.315
	810	1909.8	0.2440	0.307

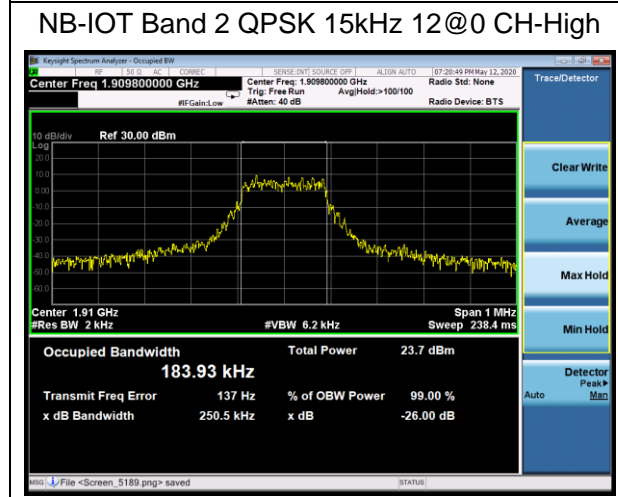
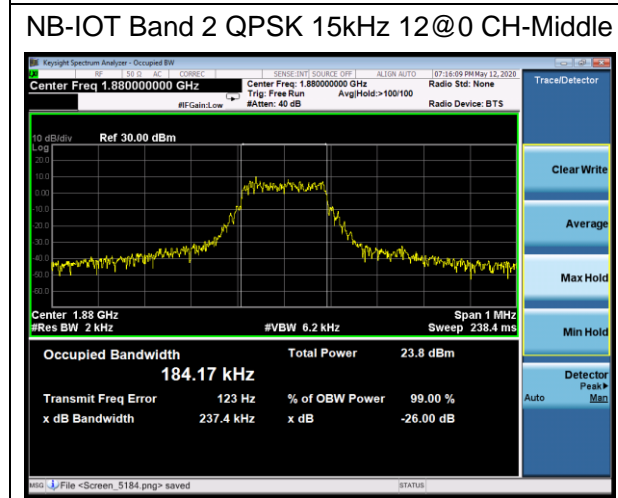
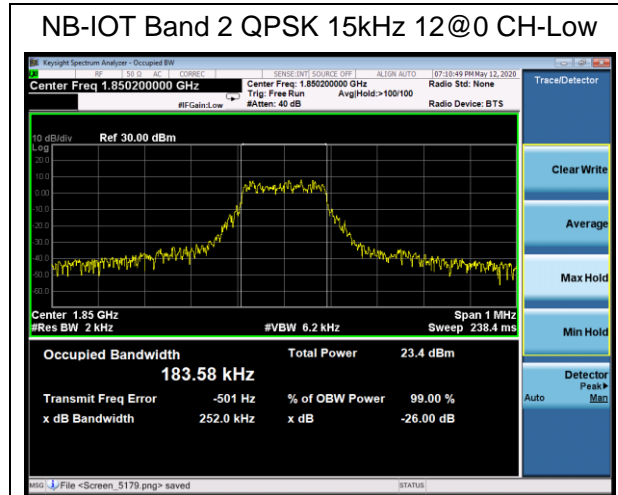
Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/middle/high channel					
				18602/1850.2		18900/1880.0		19198/1909.8	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 2 Standalone	BPSK	3.75	1@0	60.17	41.23	60.75	41.30	61.22	40.94
	QPSK	3.75	1@0	67.69	39.36	66.95	40.01	66.45	39.92
	BPSK	15	1@0	125.93	112.50	125.50	105.90	124.38	104.00
	QPSK	15	1@0	117.38	117.40	122.40	131.30	117.23	117.80
	QPSK	15	12@0	183.58	252.00	184.17	237.40	183.93	250.50
Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/middle/high channel					
				26042/1850.2		26365/1882.5		26688/1914.8	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 25 Standalone	BPSK	3.75	1@0	61.82	40.93	60.32	41.10	61.16	41.14
	QPSK	3.75	1@0	68.91	40.12	69.13	39.22	67.87	39.76
	BPSK	15	1@0	127.63	104.60	119.91	103.10	126.37	111.80
	QPSK	15	1@0	117.34	104.10	114.80	104.10	116.11	104.30
	QPSK	15	12@0	184.92	250.40	184.04	239.60	183.56	251.90



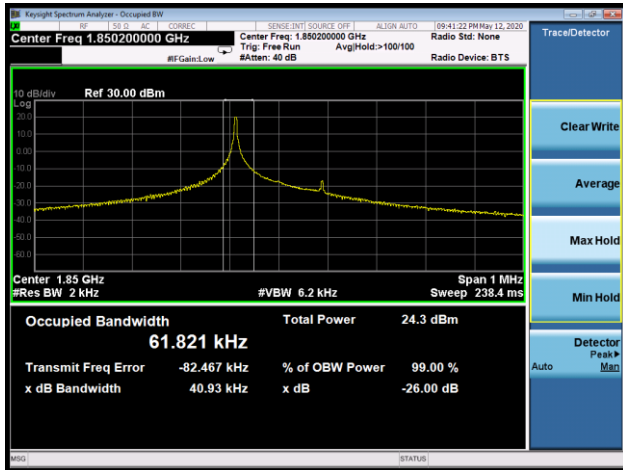








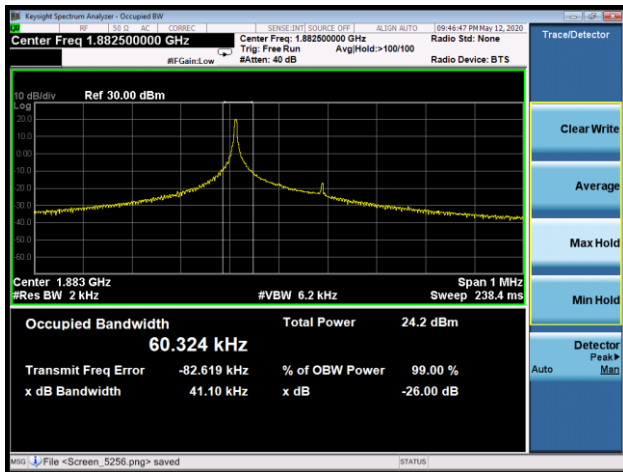
NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-Low



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



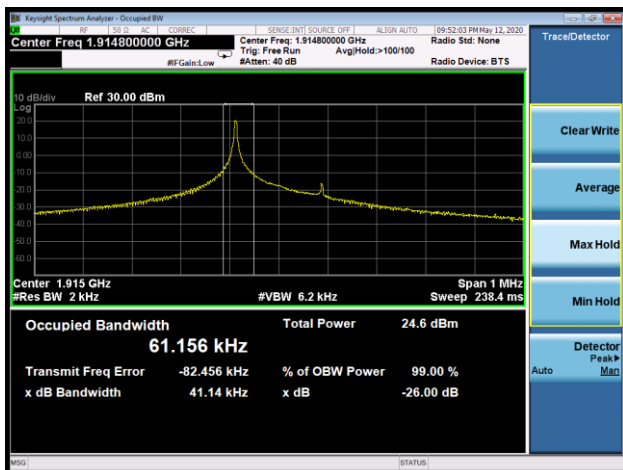
NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-Middle



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



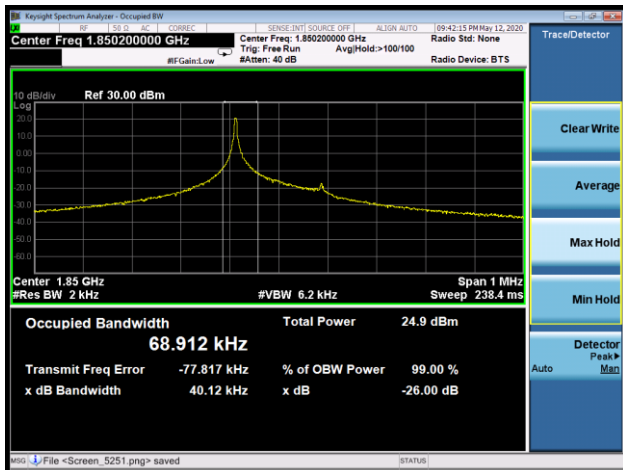
NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-High



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



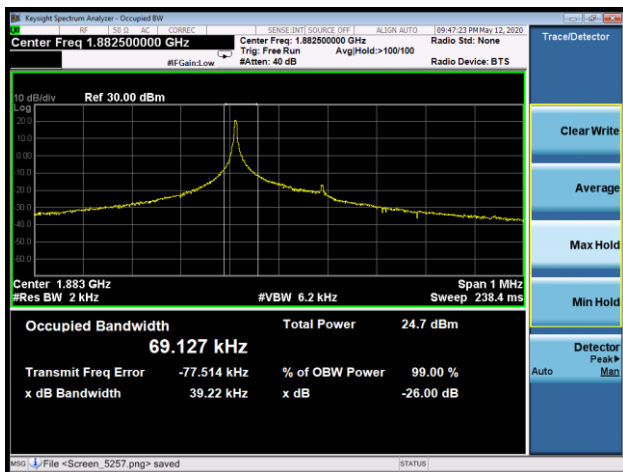
NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-Low



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



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



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



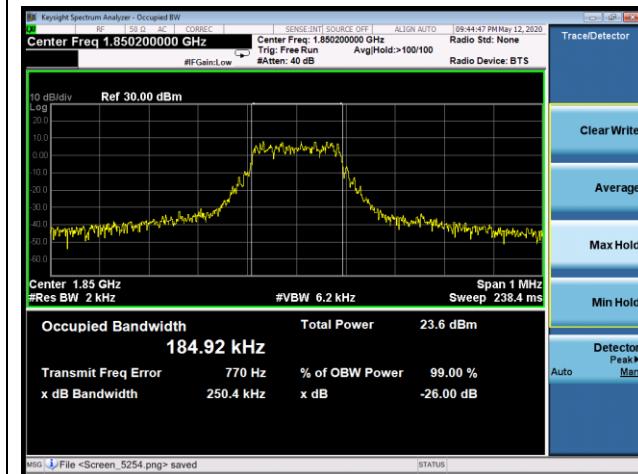
NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-High



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



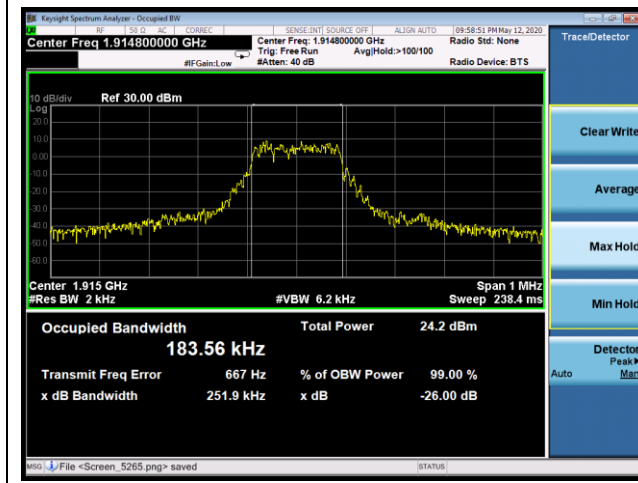
NB-IOT Band 25 QPSK 15kHz 12@0 CH-Low



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



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



5.3. Band Edge Compliance

Ambient condition

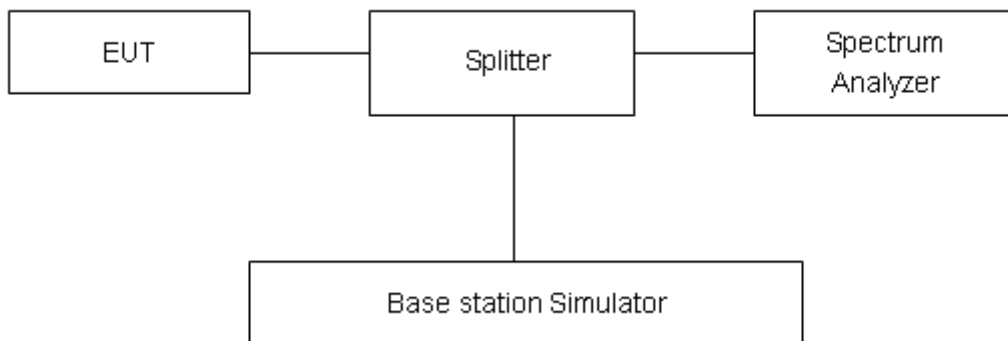
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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 Average detector is used and RBW is set to 3kHz, VBW is set to 10kHz for GSM 1900
 RBW is set to $\geq 1\%EBW$, VBW is set to 3x RBW.

Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit	-13 dBm
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Measurement Uncertainty

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

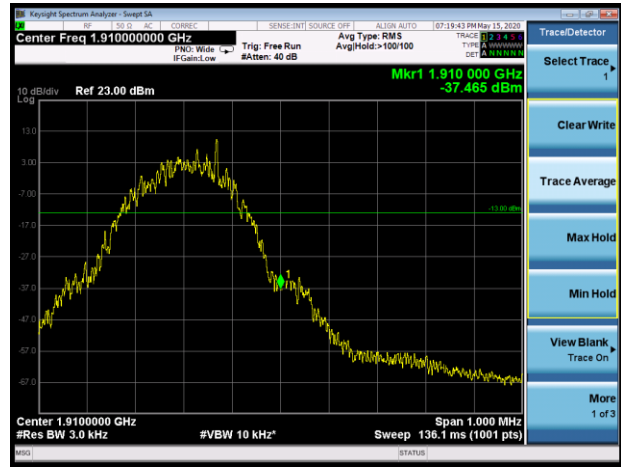


Test Result:

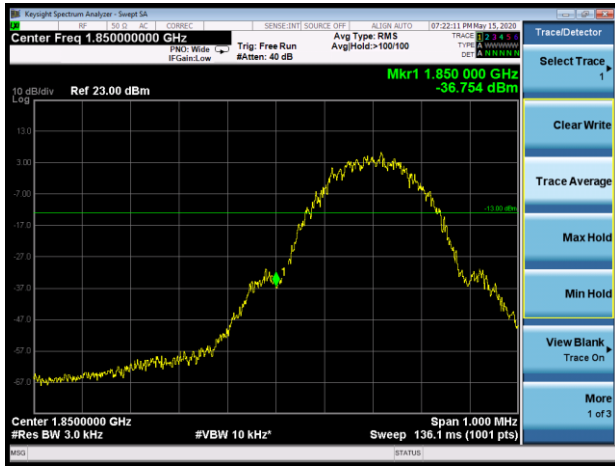
GSM 1900 GSM CH-Low



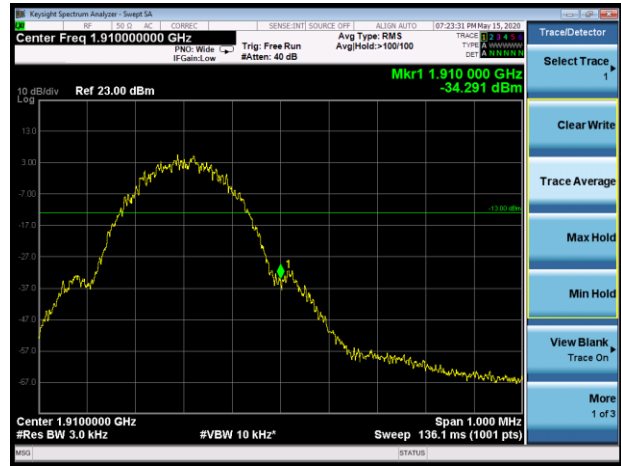
GSM 1900 GSM CH-High



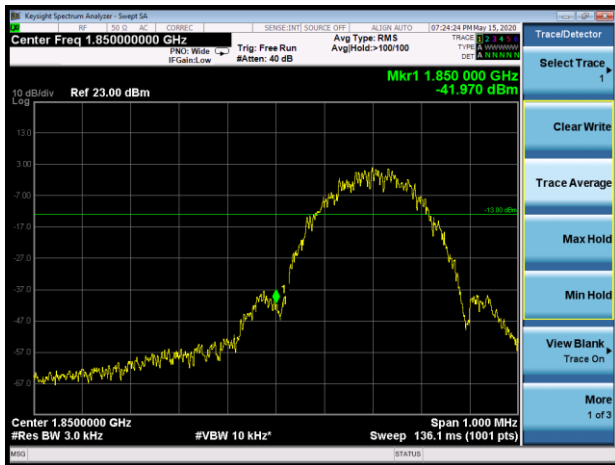
GSM 1900 GPRS CH-Low



GSM 1900 GPRS CH-High



GSM 1900 EGPRS CH-Low



GSM 1900 EGPRS CH-High

