



FCC TEST REPORT

FCC ID: 2ARN2-EM200

On Behalf of

Bizringer Inc

Smart Tail Light Tracker

Model No.: EM200

Prepared for : Bizringer Inc

Address : 1221 E. Dyer Road Suite 250 Sant Ana. CA92705,
USA

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.

Address : Building i, No.2, Lixin Road, Fuyong Street, Bao'an
District, 518103, Shenzhen, Guangdong, China

Report Number : A2103153-C01-R03

Date of Receipt : March 18, 2021

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Date of Report : April 14, 2021

Version Number : V0

Contents

Page

1	TEST SUMMARY	5
2	GENERAL INFORMATION	6
2.1	GENERAL DESCRIPTION OF EUT	6
2.2	RELATED SUBMITTAL(S) / GRANT (S)	7
2.3	TEST FACILITY	7
2.4	ACCESSORIES OF DEVICE (EUT)	7
2.5	TESTED SUPPORTING SYSTEM DETAILS	7
2.6	TEST CONDITIONS	7
2.7	MEASUREMENT UNCERTAINTY	8
3	TEST INSTRUMENTS LIST	9
4	SYSTEM TEST CONFIGURATION	10
4.1	TEST MODE	10
4.2	CONFIGURATION OF TESTED SYSTEM	10
4.3	CONDUCTED OUTPUT POWER	11
4.4	PEAK-TO-AVERAGE RATIO	15
4.5	OCCUPY BANDWIDTH	22
4.6	MODULATION CHARACTERISTIC	27
4.7	OUT OF BAND EMISSION AT ANTENNA TERMINALS	27
4.8	ERP, EIRP MEASUREMENT	43
4.9	FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT	49
4.10	FREQUENCY STABILITY V.S. TEMPERATURE MEASUREMENT	56
4.11	FREQUENCY STABILITY V.S. VOLTAGE MEASUREMENT	59
4.12	TEST SETUP PHOTO	61

TEST REPORT DECLARATION

Applicant : Bizringer Inc

Address : 1221 E. Dyer Road Suite 250 Sant Ana. CA92705, USA

Manufacturer : HuiZhou Cantrack Technology Co., Ltd
2nd floor, Building 3, Changguang Maosen Industrial Park,

Address : Chayuan, Qiuchang Town, Huiyang District, Huizhou, Guangdong, China

EUT Description : Smart Tail Light Tracker

(A) Model No. : EM200

(B) Trademark : N/A

Measurement Standard Used:

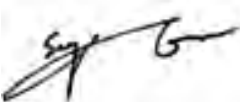
FCC CFR47 Part 2
FCC CFR47 Part 27C
ANSI/TIA-603-E
KDB 971168 D01 Power Meas License Digital Systems v03

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....: Lucas Pang
Project Engineer 

Approved by (name + signature).....: Simple Guan
Project Manager 

Date of issue.....: April 14, 2021

Revision History

Revision	Issue Date	Revisions	Revised By
V0	April 14, 2021	Initial released Issue	Lucas Pang

1 Test Summary

Test Item	Section in CFR 47	Result
RF Exposure (SAR)	Part 1.1307 Part 2.1093	Pass* (Please refer to MPE assessment)
RF Output Power	Part 2.1046	Pass
Peak-To-Average Ratio	Part 27.50(d)	Pass
Effective Isotropic Radiated power	Part 27.50 (b)(10) Part 27.50 (c)(10) Part 27.50 (d)(4) Part 24.232 (c) Part 22.913(a)	Pass
Modulation Characteristics	Part 2.1047	N/A
99% & -26 dB Occupied Bandwidth	Part 2.1049	Pass
Spurious Emissions at Antenna Terminal	Part 27.53 (h) Part 27.53 (g) Part 27.53 (f)	Pass
Field Strength of Spurious Radiation	Part 27.53(h) Part 27.53(g) Part 27.53(f)	Pass
Out of band emission, Band Edge	Part 27.53(h) Part 27.53(g) Part 27.53(c)	Pass
Frequency stability vs. temperature	Part 27.54	Pass
Frequency stability vs. voltage	Part 27.54	Pass

Pass: The EUT complies with the essential requirements in the standard.

2 General Information

2.1 General Description of EUT

Description of Device (EUT)

Description	: Smart Tail Light Tracker
Trademark	: N/A
Model Number	: EM200
DIFF.	: N/A
Test Voltage	: DC 3.7V by battery(Built in battery), DC 12V by battery(External battery)
Power supply	: DC 9-24V
Support Networks	: LTE (NB-IOT)
Support Bands	Band 2/4/5/12/13
Sub-carrier spacing	3.75KHz, 15KHz
TX Frequency	Band 2: 1850 ~ 1910 MHz Band 4: 1710 ~ 1755 MHz Band 5: 824 ~ 849 MHz Band 12: 699MHz ~ 716MHz Band 13: 777MHz ~ 787MHz.
Modulation type	QPSK, BPSK
Antenna Type	: Internal antenna, Maximum Gain is 0dBi
Software version	: V1.0
Hardware version	: V1.0

Remark 1: The worst-case simultaneous transmission configuration was evaluated with no non-compliance found. Results in this report are only for 4G function, and there is no other transmitter involved.

2.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is filing to comply with Section Part 22 subpart H and Part 24 subpart E of the FCC CFR 47 Rules.

2.3 Test Facility

Shenzhen Alpha Product Testing Co., Ltd

Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103, Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission

Registration Number: 293961

July 15, 2019 Certificated by IC

Registration Number: CN0085

2.4 Accessories of Device (EUT)

Accessories1 : /

Manufacturer : /

Model : /

Input : /

Output : /

2.5 Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDOC
1.	Power bank	--	--	--	--

2.6 Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	24℃
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	98kPa

2.7 Measurement Uncertainty

Item	Uncertainty
Uncertainty for Power point Conducted Emissions Test	2.74dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB(Polarize: V)
	2.57dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.16dB(Polarize: H)
	4.13dB(Polarize: V)
Uncertainty for radio frequency	5.4×10^{-8}
Uncertainty for conducted RF Power	0.37dB
Uncertainty for temperature	0.2°C
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

3 Test Instruments list

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	N/A	2019.09.06	3Year
Spectrum analyzer	R&S	FSV40-N	102137	2020.09.02	1Year
Spectrum analyzer	Agilent	N9020A	MY499100060	2020.09.02	1Year
Receiver	R&S	ESR	1316.3003K03-102082-Wa	2020.09.02	1Year
Receiver	R&S	ESCI	101165	2020.09.02	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2020.04.12	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D(1201)	2020.04.12	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00059	2019.09.07	2Year
Cable	Resenberger	N/A	No.1	2020.09.02	1Year
Cable	Resenberger	N/A	No.2	2020.09.02	1Year
Cable	Resenberger	N/A	No.3	2020.09.02	1Year
Pre-amplifier	HP	HP8347A	2834A00455	2020.09.02	1Year
Pre-amplifier	Agilent	8449B	3008A02664	2020.09.02	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2020.09.02	1Year
L.I.S.N.#2	R&S	ENV216	101043	2020.09.02	1 Year
20db Attenuator	ICPROBING	IATS1	82347	2020.09.02	1 Year
Horn Antenna	SCHWARZBECK	BBHA9170	00946	2019.09.07	2 Year
Preamplifier	SKET	LNPA_1840-50	SK2018101801	2020.09.02	1 Year
Power Meter	Agilent	E9300A	MY41496625	2020.09.02	1 Year
Temp. &Humid. Chamber	Weihuang	WHTH-1000-40-880	100631	2020.09.02	1 Year
Switching Mode Power Supply	JUNKE	JK12010S	20140927-6	2020.09.02	1 Year
CMW500	R&S	CMW500	1201.0002K50-117239-sM	2020.09.02	2021.09.01
Antenna	SCHWARZBECK	STLP9128E-special	STLP9128E s#139	N/A	NCR

4 System test configuration

4.1 Test mode

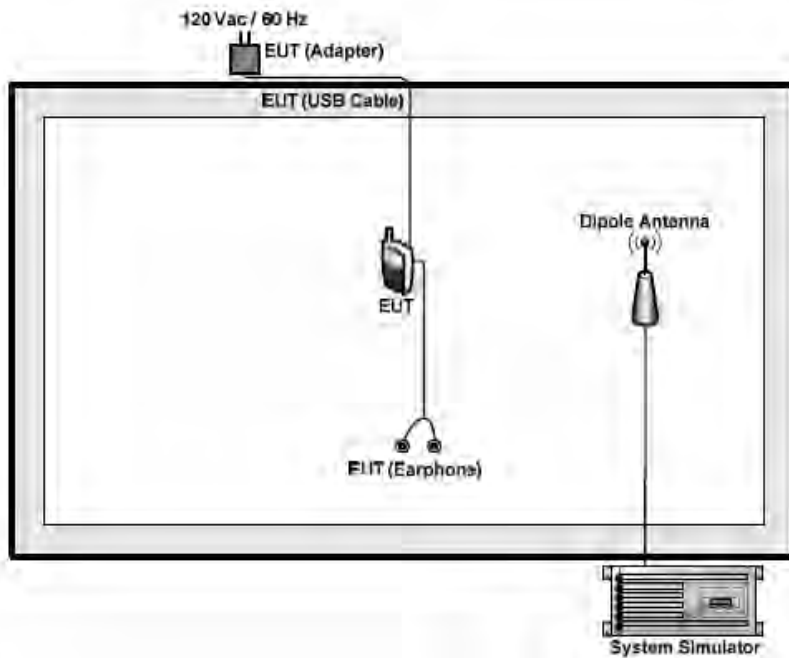
During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

Test modes		
Band	Radiated	Conducted
NB-IOT Band 2	■ QPSK link, BPSK link	■ QPSK link, BPSK link
NB-IOT Band 4	■ QPSK link, BPSK link	■ QPSK link, BPSK link
NB-IOT Band 5	■ QPSK link, BPSK link	■ QPSK link, BPSK link
NB-IOT Band 12	■ QPSK link, BPSK link	■ QPSK link, BPSK link
NB-IOT Band 13	■ QPSK link, BPSK link	■ QPSK link, BPSK link

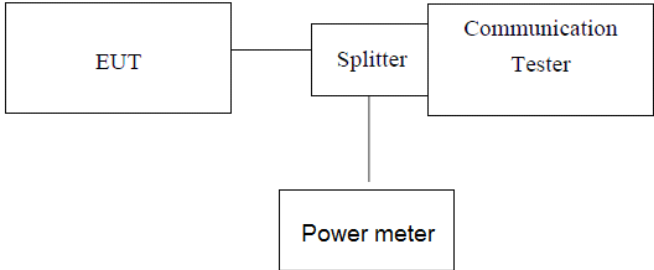
Note: Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas License Digital Systems v03r1 with maximum output power.

Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

4.2 Configuration of Tested System



4.3 Conducted Output Power

Test Requirement:	FCC part22.913(a) , FCC part24.232(b) and FCC Part 27.50
Test Method:	ANSI C63.26:2015
Limit:	No specific RF power output requirements
Test setup:	 <i>Note: Measurement setup for testing on Antenna connector</i>
Test Procedure:	1. The transmitter output port was connected to base station. 2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement. 3. Set EUT at maximum power through base station. 4. Select lowest, middle, and highest channels for each band and different modulation. 5. Measure the maximum burst average power.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

NB-IOT Band2

Mode	Modulation	Sub-carrier spacing(KHz)	Ntones	Conducted Power (dBm)/Chanel L/M/H		
				1850.2	1880	1909.8
Standalone	BPSK	3.75	1@0	23.37	23.43	23.26
			1@47	22.81	22.28	22.30
		15	1@0	22.56	22.14	22.70
			1@11	22.24	22.79	22.20
	QPSK	3.75	1@0	23.15	21.79	22.81
			1@47	22.55	22.37	23.26
		15	1@0	23.07	20.89	22.53
			1@11	21.32	22.09	21.28
		15	12@0	20.64	20.16	20.06

NB-IOT Band4

Mode	Modulation	Sub-carrier spacing(KHz)	Ntones	Conducted Power (dBm)/Chanel L/M/H		
				1710.2	1732.5	1754.8
Standalone	BPSK	3.75	1@0	22.76	23.49	22.63
			1@47	22.63	22.26	21.58
		15	1@0	22.55	22.76	23.18
			1@11	22.48	22.09	21.65
	QPSK	3.75	1@0	23.18	21.57	22.65
			1@47	22.25	21.81	23.56
		15	1@0	22.47	21.13	22.22
			1@11	20.78	21.77	21.09
		15	12@0	20.24	20.06	20.01

NB-IOT Band5

Mode	Modulation	Sub-carrier spacing(KHz)	Ntones	Conducted Power (dBm)/Chanel L/M/H		
				824.2	836.5	848.8
Standalone	BPSK	3.75	1@0	23.29	23.30	22.29
			1@47	22.20	23.02	22.31
		15	1@0	22.82	21.91	22.60
			1@11	22.62	22.71	21.59
	QPSK	3.75	1@0	23.59	22.07	22.32
			1@47	22.48	22.11	23.41
		15	1@0	22.65	20.68	22.70
			1@11	20.86	21.52	21.13
		15	12@0	20.00	20.01	20.08

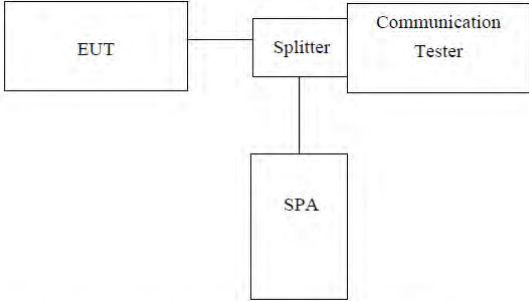
NB-IOT Band12

Mode	Modulation	Sub-carrier spacing(KHz)	Ntones	Conducted Power (dBm)/Chanel L/M/H		
				669.2	707.5	715.8
Standalone	BPSK	3.75	1@0	23.57	23.75	22.75
			1@47	22.87	22.32	22.19
		15	1@0	22.61	22.29	23.17
			1@11	21.81	22.25	21.50
	QPSK	3.75	1@0	23.04	21.95	23.01
			1@47	22.56	21.78	22.82
		15	1@0	23.15	21.25	22.50
			1@11	21.59	22.13	20.77
		15	12@0	20.00	20.10	20.01

NB-IOT Band13

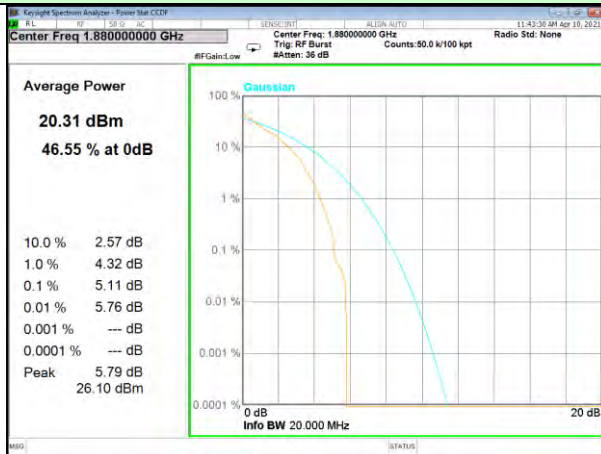
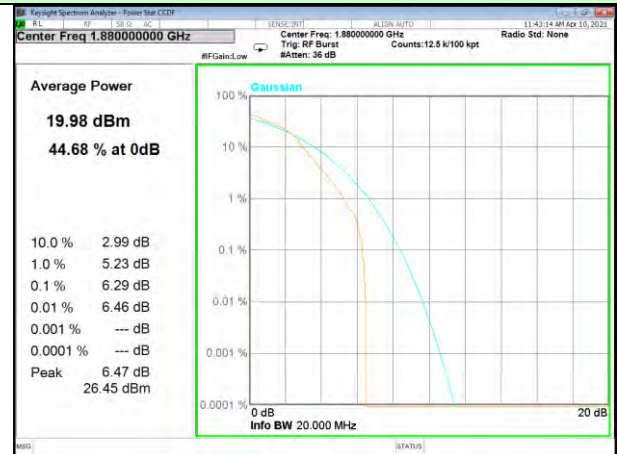
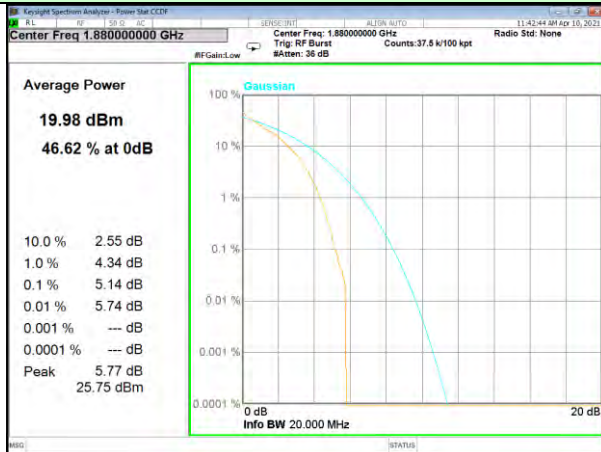
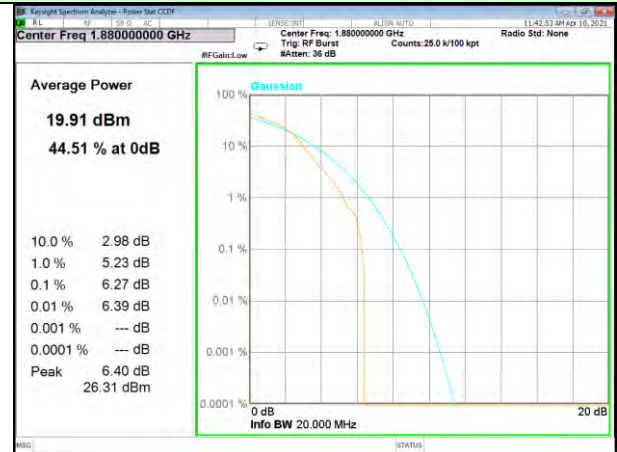
Mode	Modulation	Sub-carrier spacing(KHz)	Ntones	Conducted Power (dBm)/Chanel L/M/H		
				777.2	782	786.8
Standalone	BPSK	3.75	1@0	22.75	23.19	22.81
			1@47	22.19	23.01	22.40
		15	1@0	22.07	22.10	22.83
			1@11	22.55	22.30	22.19
	QPSK	3.75	1@0	23.52	22.08	22.70
			1@47	21.95	22.54	23.34
		15	1@0	22.39	21.14	22.13
			1@11	21.47	21.81	21.27
		15	12@0	20.08	20.04	20.06

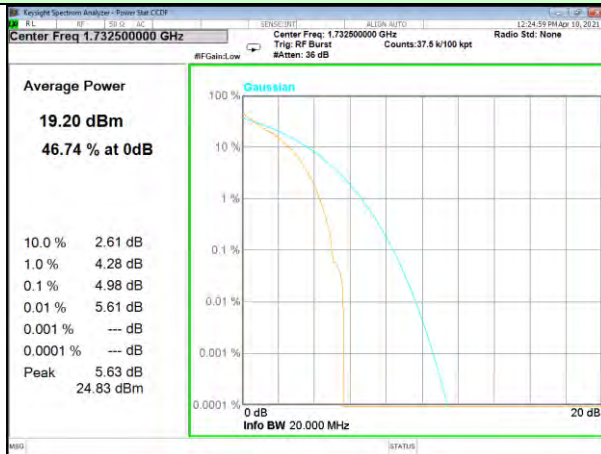
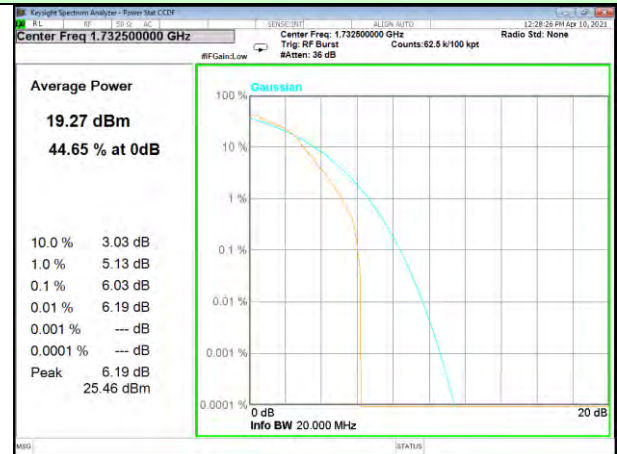
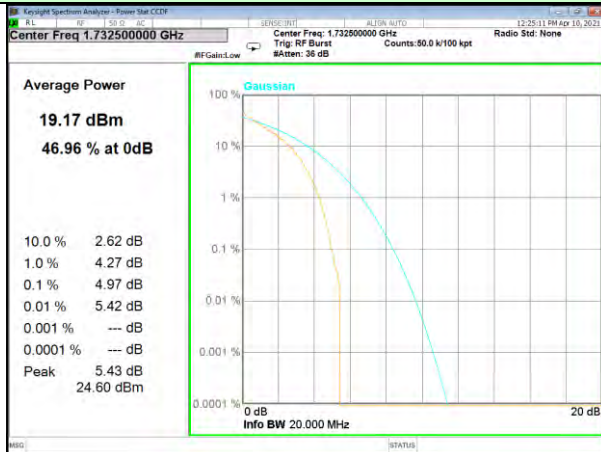
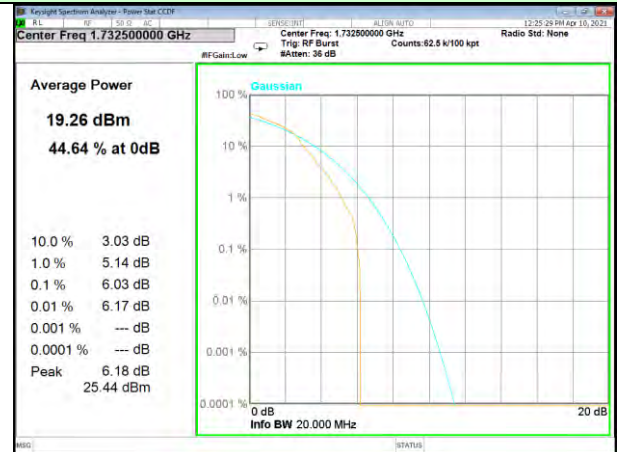
4.4 Peak-to-Average Ratio

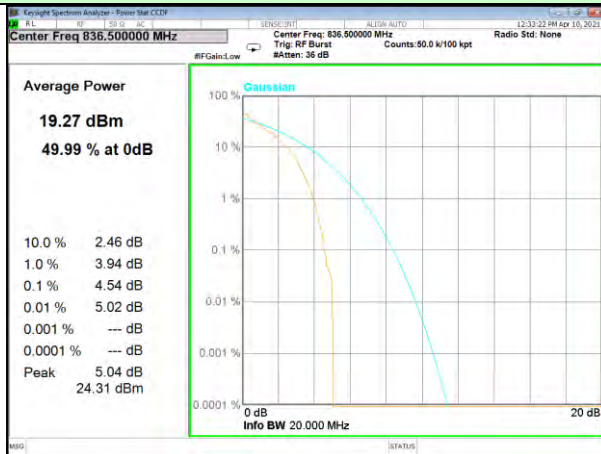
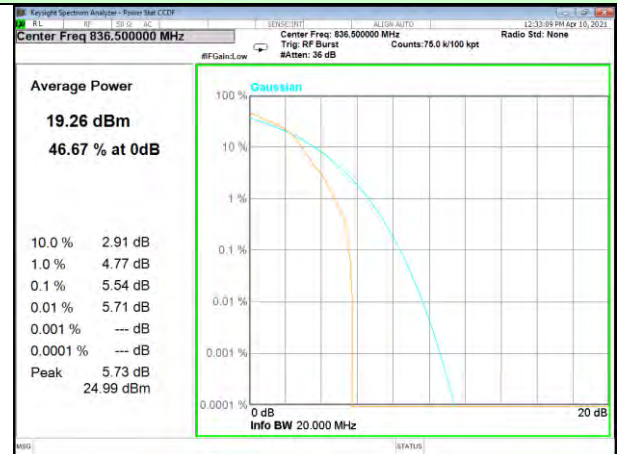
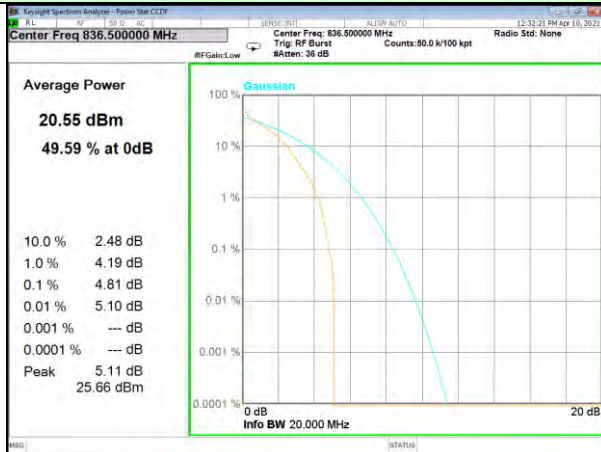
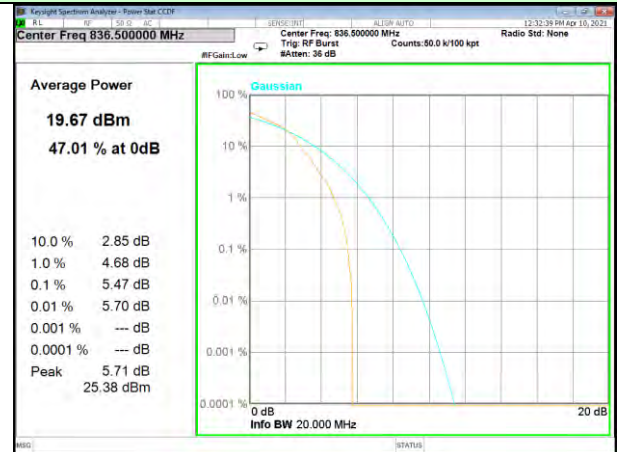
Test Requirement:	Part 22.913(d), FCC part24.232(d) and FCC part 27.50(d)(5), (d)(6)
Test Method:	ANSI C63.26:2015
Test Limit:	Used complementary cumulative distribution function (CCDF) of analyzer to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time
Test setup:	 <i>Note: Measurement setup for testing on Antenna connector</i>
Test Procedure:	1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.7.. 2. The EUT was connected to spectrum and system simulator via a power divider 3. Using the CCDF measurement of spectrum analyzer; 4. Set $RBW \geq OBW$ or specified reference bandwidth; 5. Set the number of counts to a value that stabilizes the measured CCDF curve; 6. Set the measurement interval as 1ms 7. Record the maximum PAPR level associated with a probability of 0.1%.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

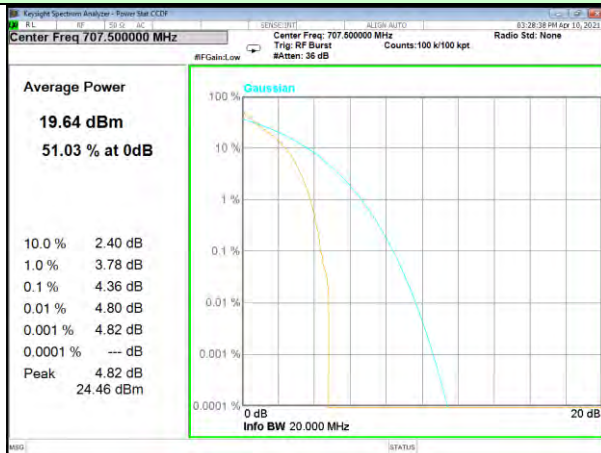
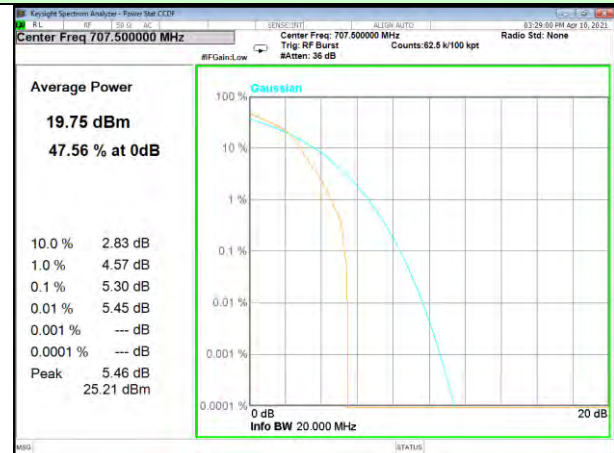
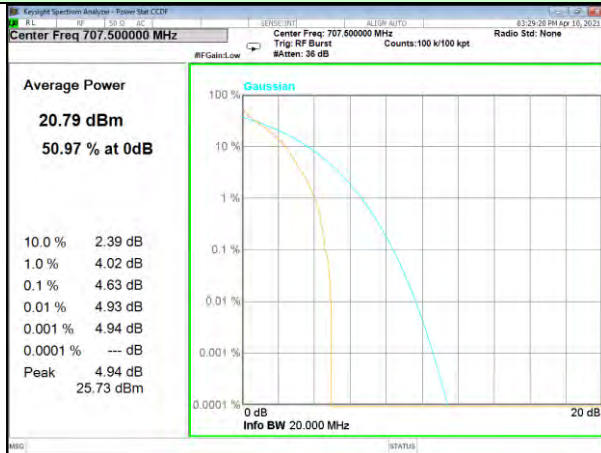
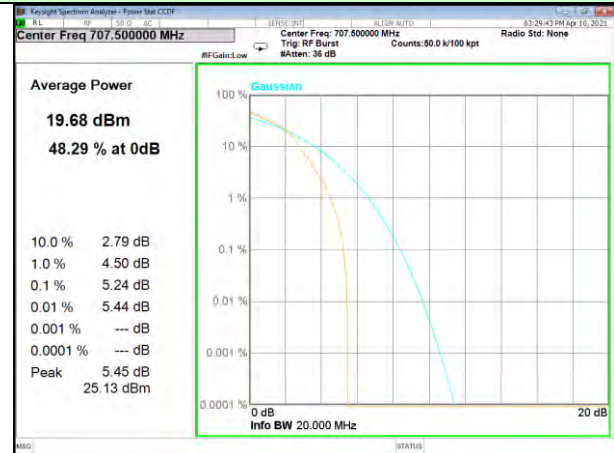
Test plots are listed as below:

Test mode	Peak to Average Ratio (dB)	Limit (dB)	Result
NB-IOT Band 2 Middle channel/3.75KHz/QPSK	5.11	13	Pass
NB-IOT Band 2 Middle channel/3.75KHz /BPSK	6.29	13	Pass
NB-IOT Band 2 Middle channel/15KHz/QPSK	5.14	13	Pass
NB-IOT Band 2 Middle channel/15KHz /BPSK	6.27	13	Pass
NB-IOT Band 4 Middle channel/3.75KHz/QPSK	4.98	13	Pass
NB-IOT Band 4 Middle channel/3.75KHz /BPSK	6.03	13	Pass
NB-IOT Band 4 Middle channel/15KHz/QPSK	4.97	13	Pass
NB-IOT Band 4 Middle channel/15KHz /BPSK	6.03	13	Pass
NB-IOT Band 5 Middle channel/3.75KHz/QPSK	4.54	13	Pass
NB-IOT Band 5 Middle channel/3.75KHz /BPSK	5.54	13	Pass
NB-IOT Band 5 Middle channel/15KHz/QPSK	4.81	13	Pass
NB-IOT Band 5 Middle channel/15KHz /BPSK	5.47	13	Pass
NB-IOT Band 12 Middle channel/3.75KHz/QPSK	4.36	13	Pass
NB-IOT Band 12 Middle channel/3.75KHz /BPSK	5.30	13	Pass
NB-IOT Band 12 Middle channel/15KHz/QPSK	4.63	13	Pass
NB-IOT Band 12 Middle channel/15KHz /BPSK	5.24	13	Pass
NB-IOT Band 13 Middle channel/3.75KHz/QPSK	4.75	13	Pass
NB-IOT Band 13 Middle channel/3.75KHz /BPSK	5.65	13	Pass
NB-IOT Band 13 Middle channel/15KHz/QPSK	4.84	13	Pass
NB-IOT Band 13 Middle channel/15KHz /BPSK	5.48	13	Pass

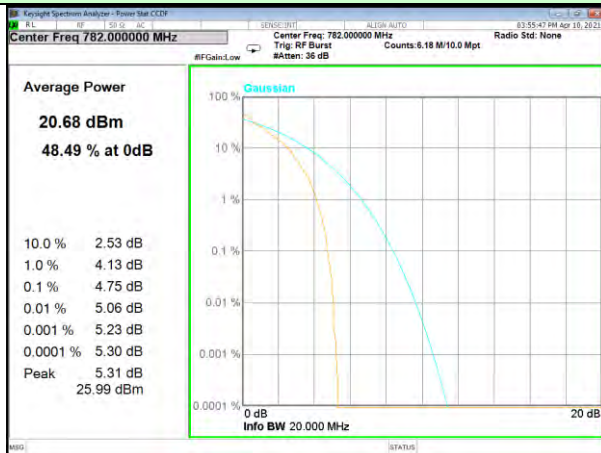
Test Mode: NB-IOT Band 2
Middle channel/3.75kHz/QPSK**Test Mode: NB-IOT Band 2**
Middle channel/3.75kHz/BPSK**Test Mode: NB-IOT Band 2**
Middle channel/15kHz/QPSK**Test Mode: NB-IOT Band 2**
Middle channel/15kHz/BPSK

Test Mode: NB-IOT Band 4
Middle channel/3.75kHz/QPSK**Test Mode: NB-IOT Band 4**
Middle channel/3.75kHz/BPSK**Test Mode: NB-IOT Band 4**
Middle channel/15kHz/QPSK**Test Mode: NB-IOT Band 4**
Middle channel/15kHz/BPSK

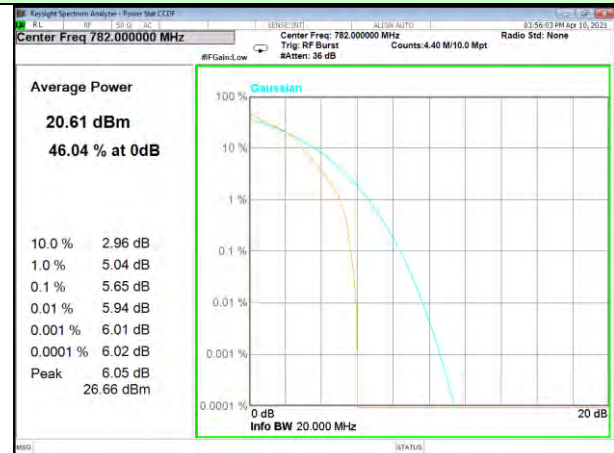
Test Mode: NB-IOT Band 5
Middle channel/3.75kHz/QPSK**Test Mode: NB-IOT Band 5**
Middle channel/3.75kHz/BPSK**Test Mode: NB-IOT Band 5**
Middle channel/15kHz/QPSK**Test Mode: NB-IOT Band 5**
Middle channel/15kHz/BPSK

Test Mode: NB-IOT Band 12
Middle channel/3.75kHz/QPSK**Test Mode: NB-IOT Band 12**
Middle channel/3.75kHz/BPSK**Test Mode: NB-IOT Band 12**
Middle channel/15kHz/QPSK**Test Mode: NB-IOT Band 12**
Middle channel/15kHz/BPSK

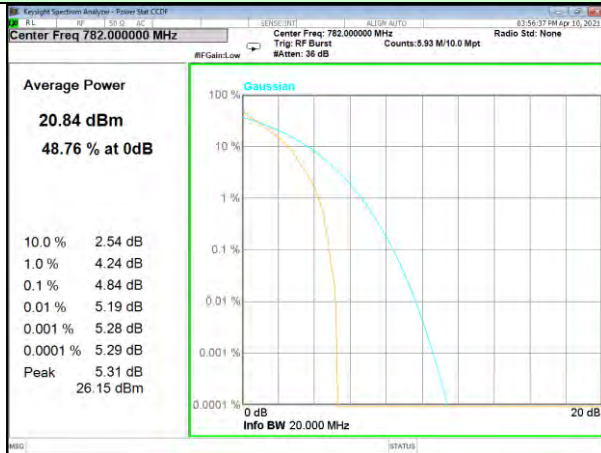
Test Mode: NB-IOT Band 13
Middle channel/3.75kHz/QPSK



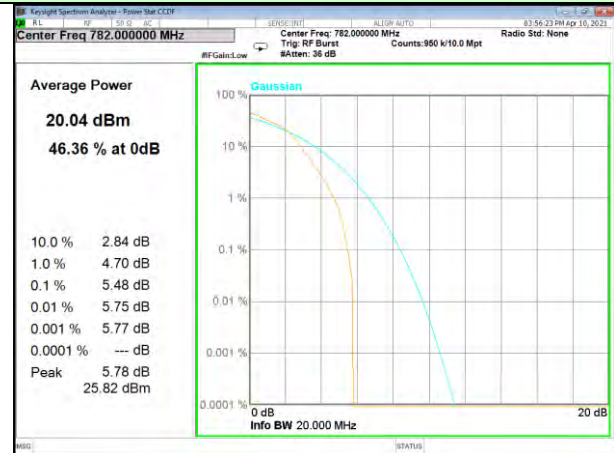
Test Mode: NB-IOT Band 12
Middle channel/3.75kHz/BPSK



Test Mode: NB-IOT Band 13
Middle channel/15kHz/QPSK

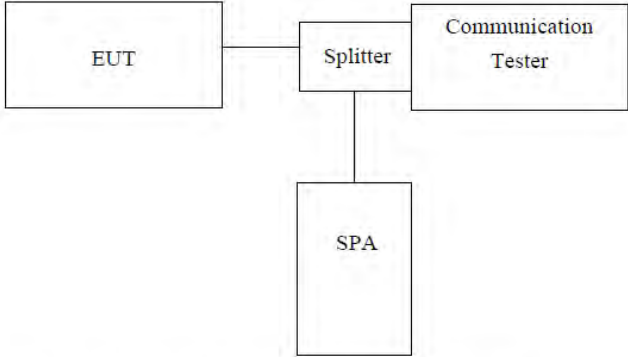


Test Mode: NB-IOT Band 13
Middle channel/15kHz/BPSK



Note: All Channel and modulation are tested, only the worst results are reported.

4.5 Occupy Bandwidth

Test Requirement:	FCC part22.913(a), FCC part24.232(b) and FCC part27.53(a)
Test Method:	ANSI C63.26:2015
Test Limits	No specific occupied bandwidth requirements in part2.1049.
Test setup:	 <i>Note: Measurement setup for testing on Antenna connector</i>
Test Procedure:	1. The EUT's output RF connector was connected with a short cable to the spectrum analyzer, set center frequency to channel center frequency. 2. RBW is set to 2kHz, VBW is set to 6.2kHz for NB-IOT band. 3. Set spectrum analyzer detection mode to peak, and the trace mode to max hold. 4. Use the 99% OBW function, The 99% power OBW can be found on the plot, determine the "-26dB amplitude" as equal to reference value -26dB.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

EUT Mode	Modulation	Sub-carrier spacing (kHz)	Ntones	Bandwidth (kHz) for Low/Mid/High channel					
				1850.1MHz		1880.0MHz		1909.9MHz	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 2	QPSK	15	12@0	190.92	245.4	187.33	246.7	184.84	248.9

EUT Mode	Modulation	Sub-carrier spacing (kHz)	Ntones	Bandwidth (kHz) for Low/Mid/High channel					
				1710.1MHz		1732.5MHz		1754.9MHz	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 4	QPSK	15	12@0	188.62	245.8	190.68	250.7	186.24	254.6

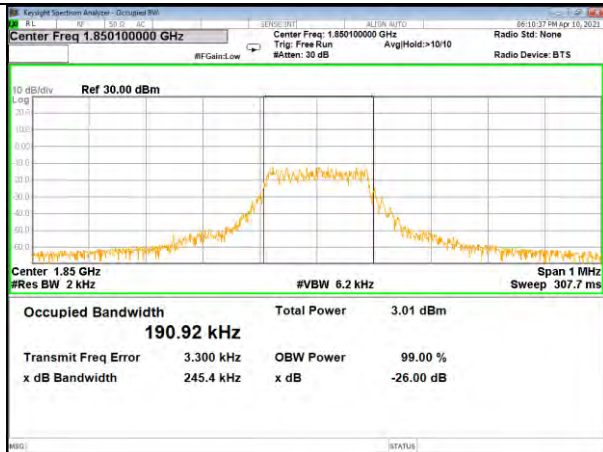
EUT Mode	Modulation	Sub-carrier spacing (kHz)	Ntones	Bandwidth (kHz) for Low/Mid/High channel					
				824.1MHz		836.5MHz		848.9MHz	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 5	QPSK	15	12@0	187.27	248.3	186.27	247.1	189.59	259.1

EUT Mode	Modulation	Sub-carrier spacing (kHz)	Ntones	Bandwidth (kHz) for Low/Mid/High channel					
				699.1MHz		707.5MHz		715.9MHz	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 12	QPSK	15	12@0	184.22	250.8	184.22	250.8	184.22	250.8

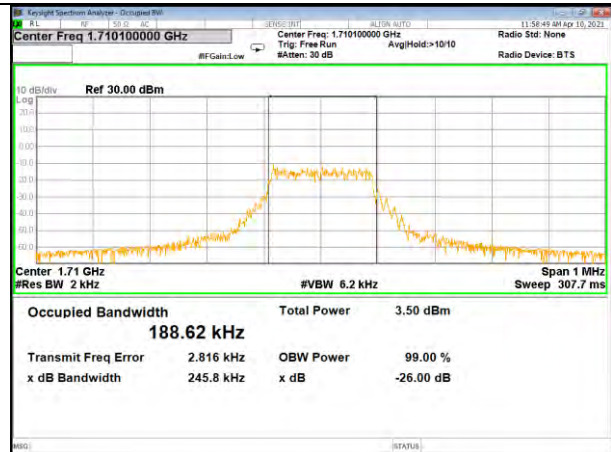
EUT Mode	Modulation	Sub-carrier spacing (kHz)	Ntones	Bandwidth (kHz) for Low/Mid/High channel					
				777.1MHz		782.0MHz		786.9MHz	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 13	QPSK	15	12@0	184.22	250.4	184.22	250.4	184.22	250.4

Test plot as follows:

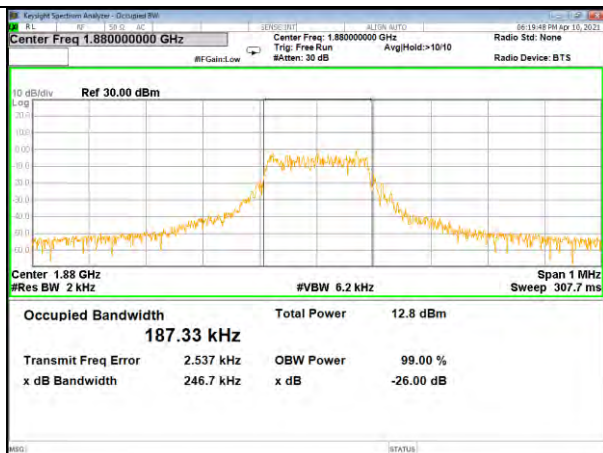
NB-IOT Band 2 QPSK 15kHz 12@0 CH-Low



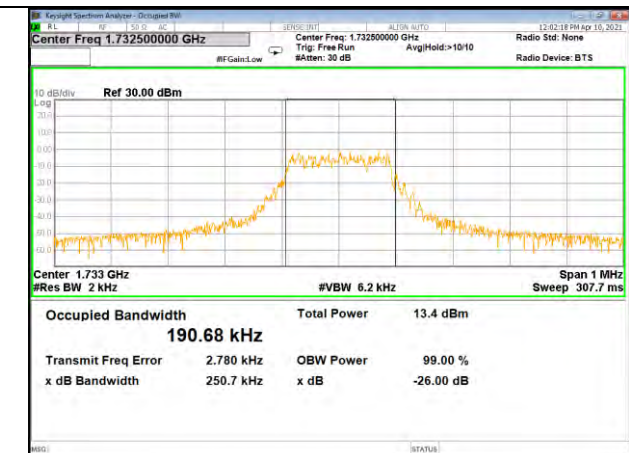
NB-IOT Band 4 QPSK 15kHz 12@0 CH-Low



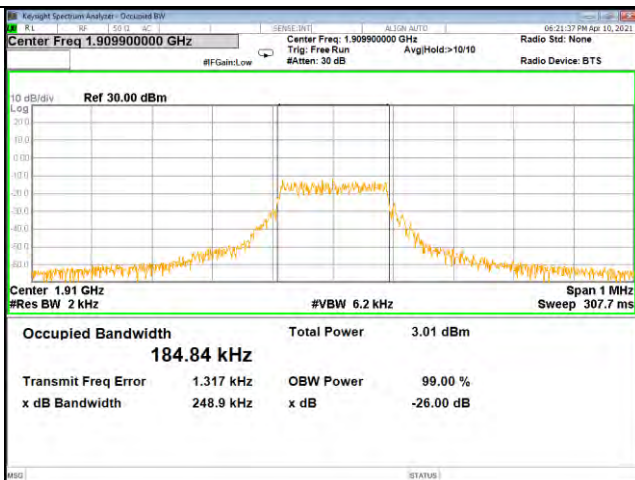
NB-IOT Band 2 QPSK 15kHz 12@0 CH-Mid



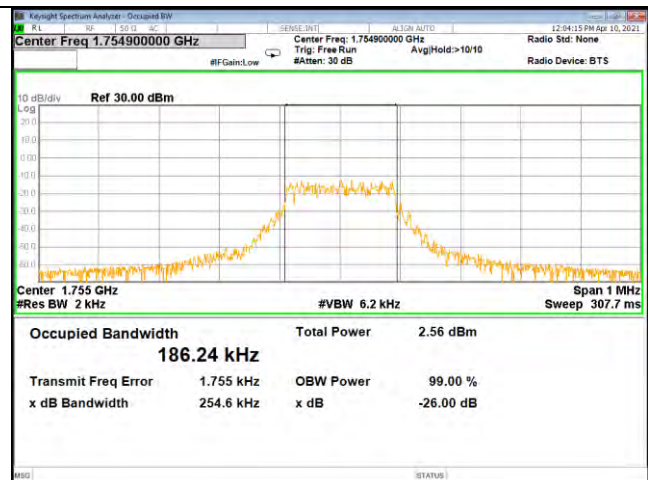
NB-IOT Band 4 QPSK 15kHz 12@0 CH-Mid



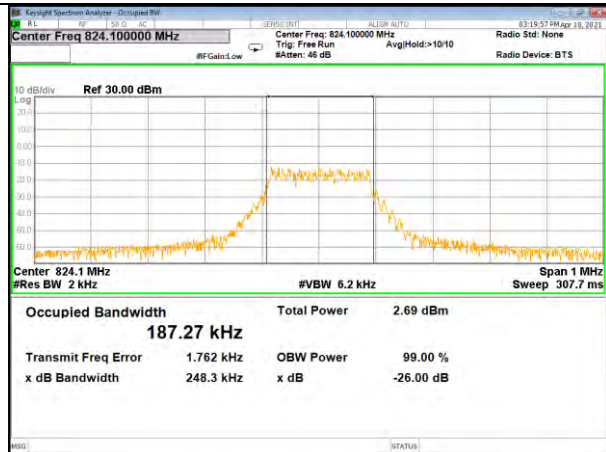
NB-IOT Band 2 QPSK 15kHz 12@0 CH-High



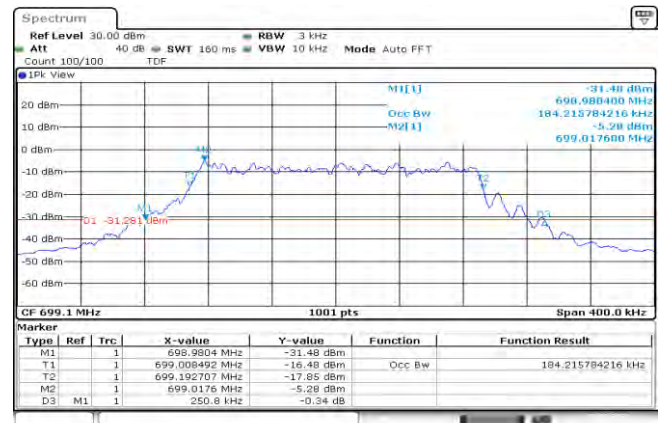
NB-IOT Band 4 QPSK 15kHz 12@0 CH-High



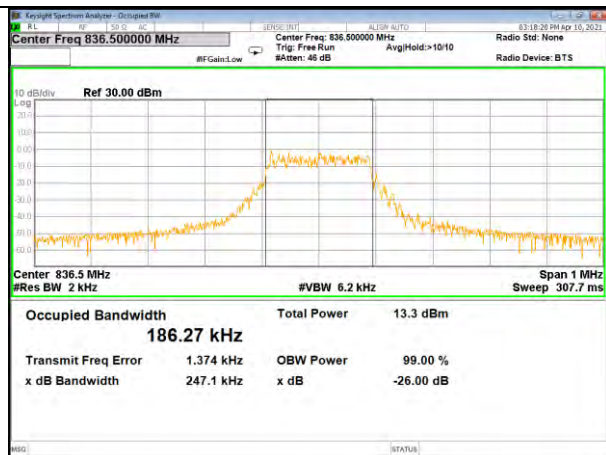
NB-IOT Band 5 QPSK 15kHz 12@0 CH-Low



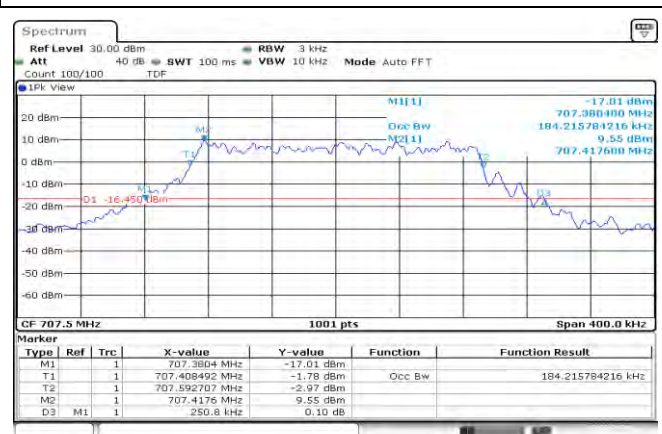
NB-IOT Band 12 QPSK 15kHz 12@0 CH-Low



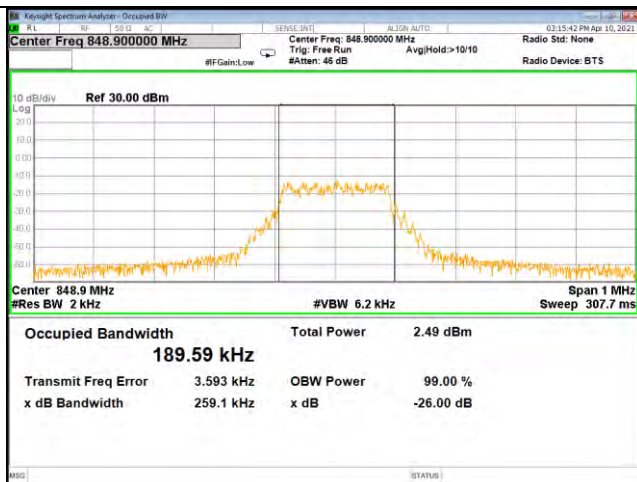
NB-IOT Band 5 QPSK 15kHz 12@0 CH-Mid



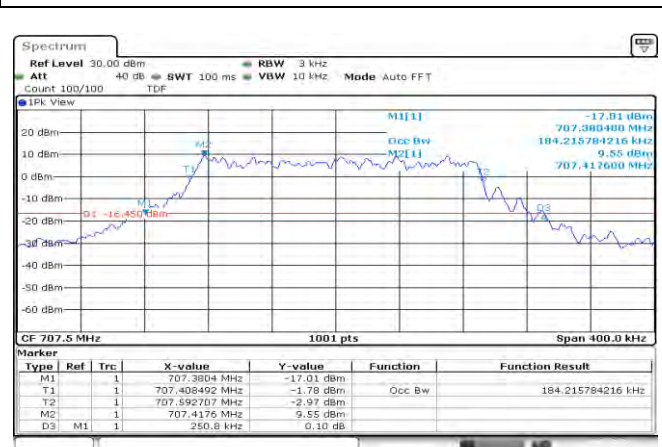
NB-IOT Band 12 QPSK 15kHz 12@0 CH-Mid



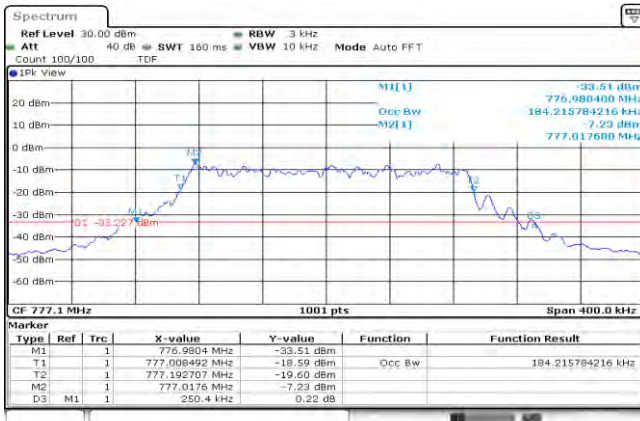
NB-IOT Band 5 QPSK 15kHz 12@0 CH-High



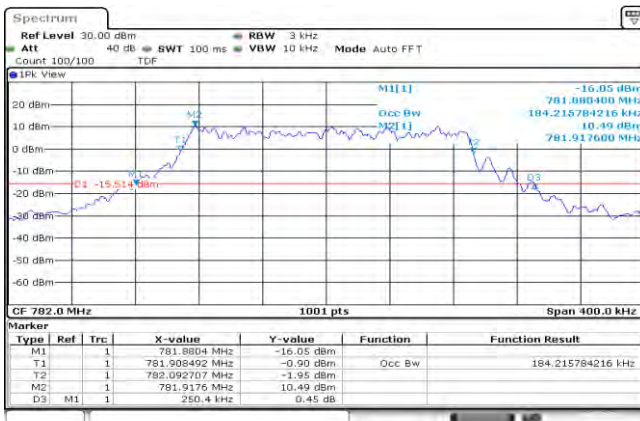
NB-IOT Band 12 QPSK 15kHz 12@0 CH-High



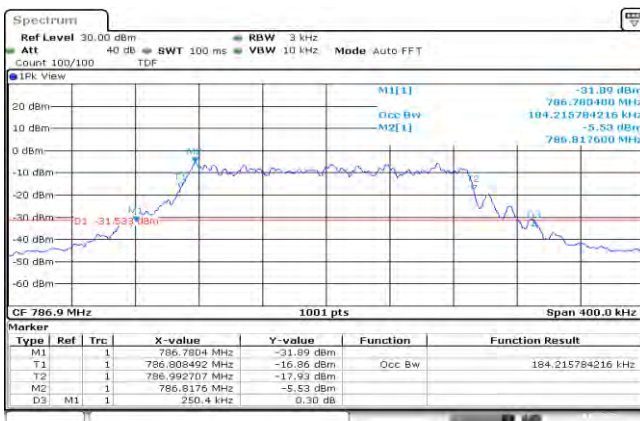
NB-IOT Band 13 QPSK 15kHz 12@0 CH-Low



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



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

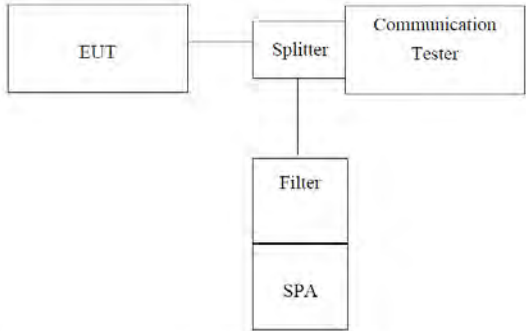


Note: All channel and modulation are tested, only the worst results are reported.

4.6 MODULATION CHARACTERISTIC

According to FCC § 2.1047(d), Part 24E & Part 27 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

4.7 Out of band emission at antenna terminals

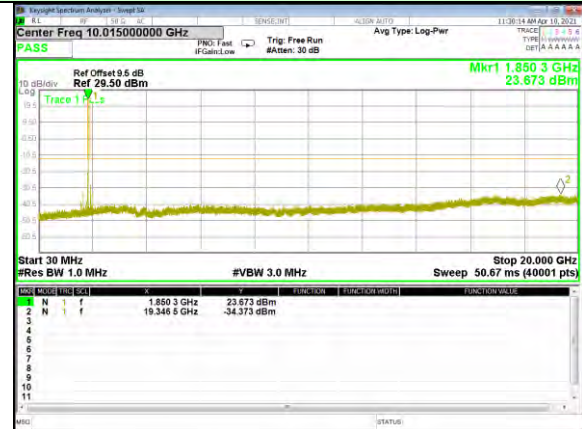
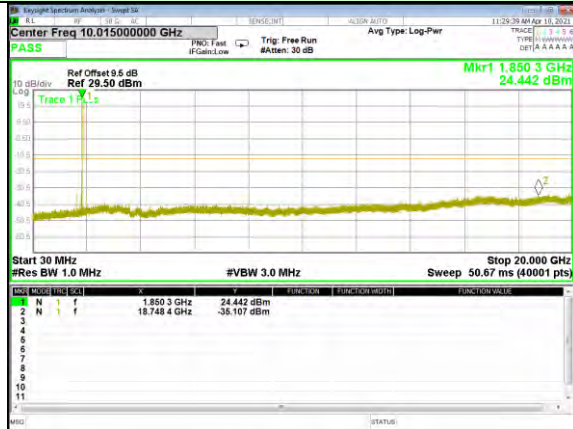
Test Requirement:	FCC part22.913(a), FCC part24.238(a) and FCC part27.53(h)
Test Method:	ANSI C63.26:2015
Limit:	-13dBm Band 7: -26dBm
Test setup:	 <i>Note: Measurement setup for testing on Antenna connector</i>
Test Procedure:	1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. 2 The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic. 3 For the out of band: Set the RBW=1MHz, VBW = 3MHz, Start=30MHz, Stop= 10th harmonic. 4 Band Edge Requirements: In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Test plot as follows:

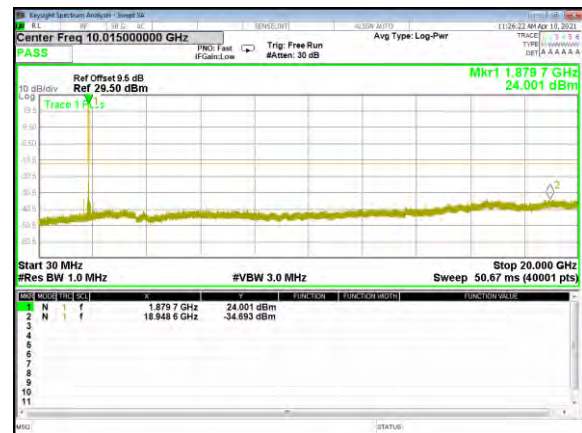
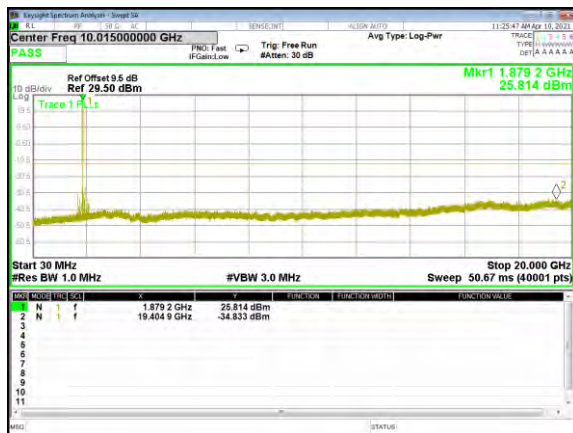
Conducted Spurious Emission:

Test Mode: NB-IOT Band 2 3.75kHz QPSK

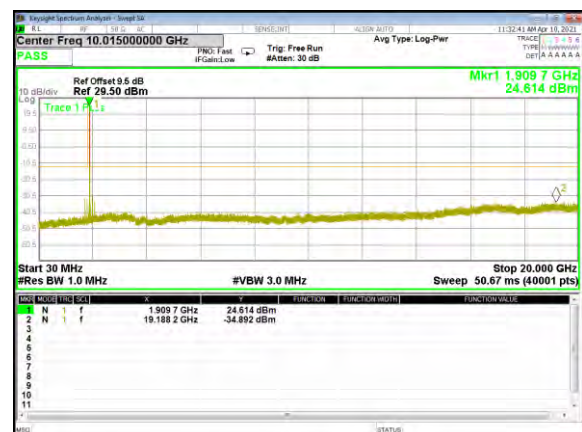
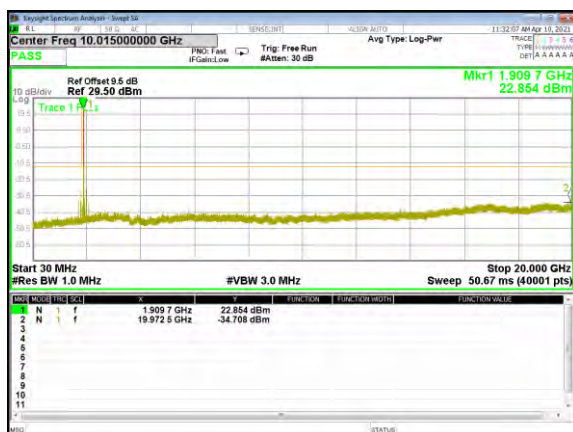
Test Mode: NB-IOT Band 2 15kHz QPSK



Lowest channel

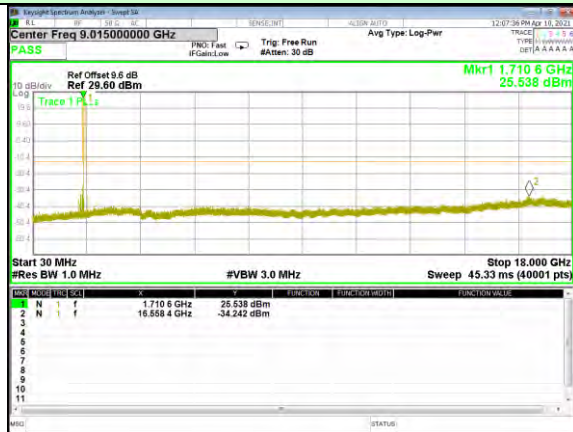


Middle channel



Highest channel

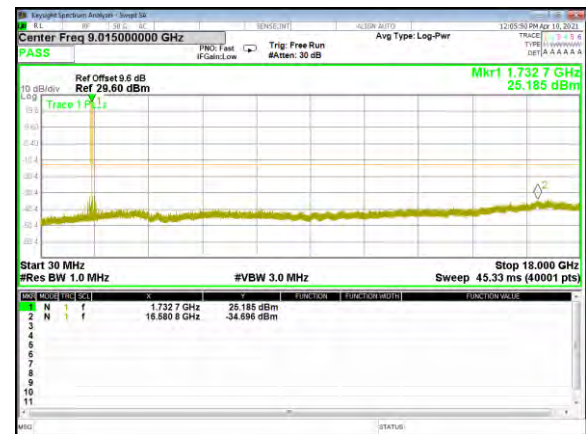
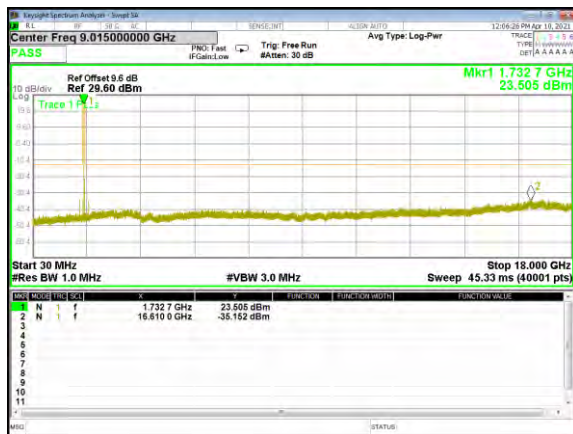
Test Mode: NB-IOT Band 4 3.75kHz QPSK



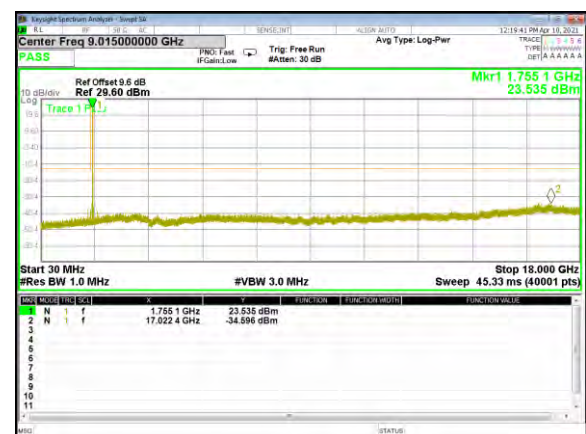
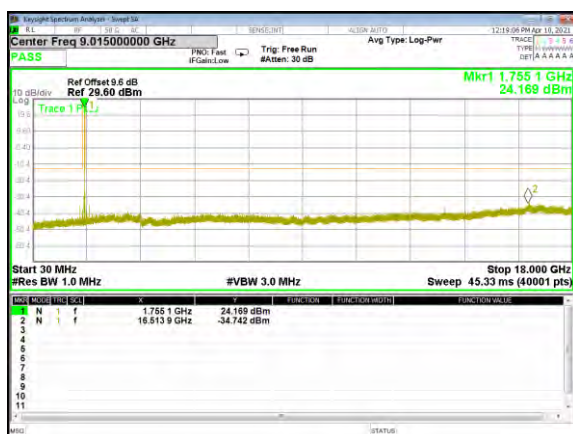
Test Mode: NB-IOT Band 4 15kHz QPSK



Lowest channel

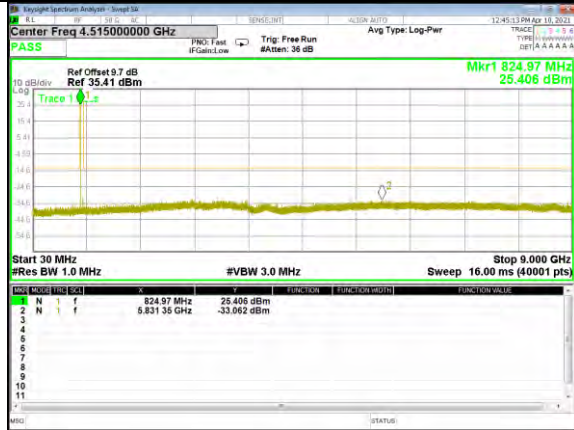


Middle channel



Highest channel

Test Mode: NB-IOT Band 5 3.75kHz QPSK



Test Mode: NB-IOT Band 5 15kHz QPSK



Lowest channel

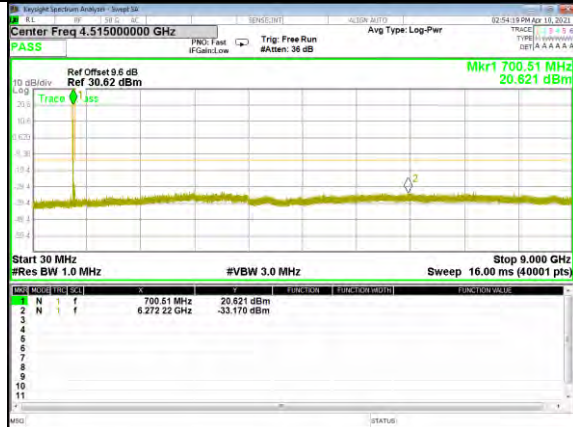


Middle channel

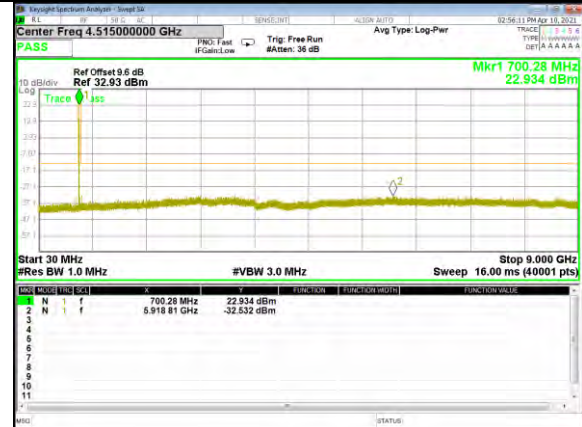


Highest channel

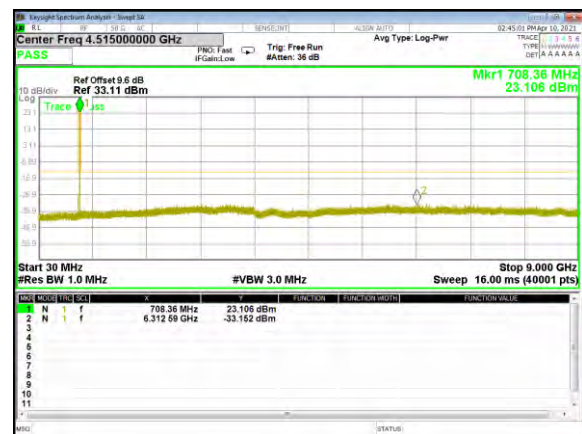
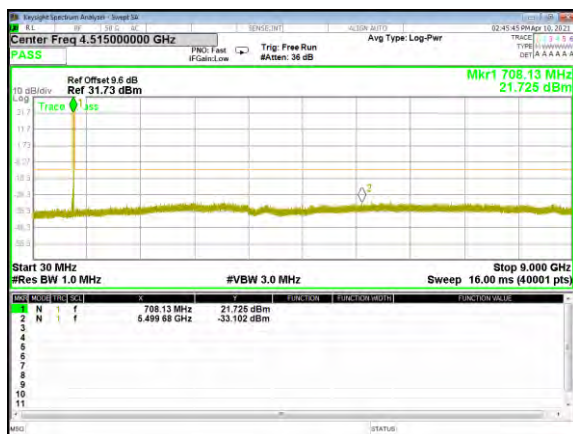
Test Mode: NB-IOT Band 12 3.75kHz QPSK



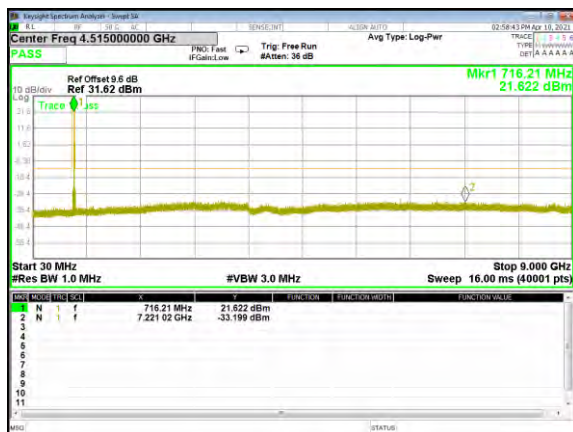
Test Mode: NB-IOT Band 12 15kHz QPSK



Lowest channel



Middle channel

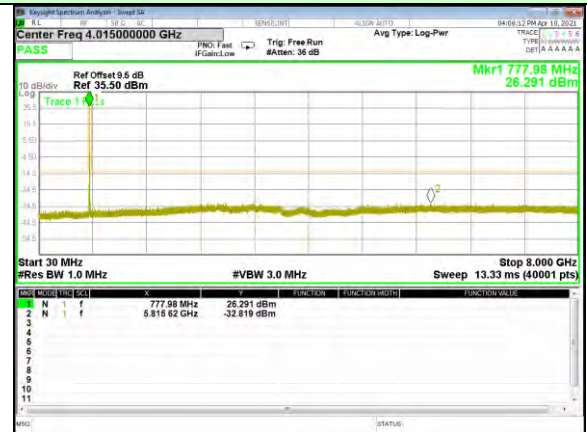


Highest channel

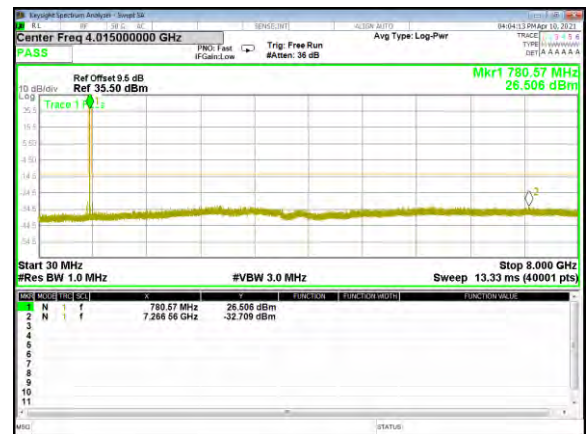
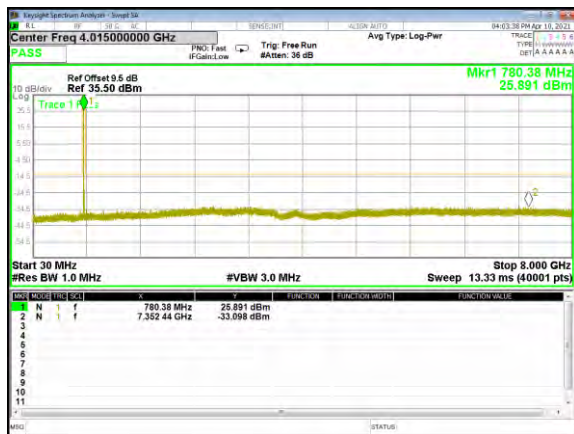
Test Mode: NB-IOT Band 13 3.75kHz QPSK



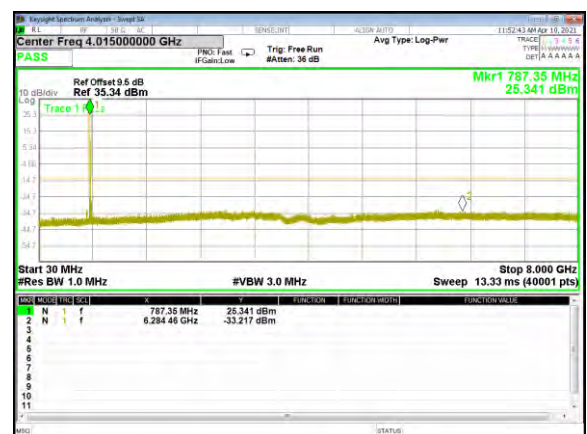
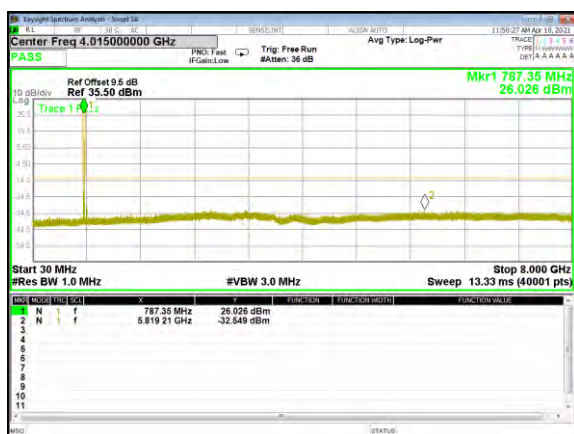
Test Mode: NB-IOT Band 13 15kHz QPSK



Lowest channel



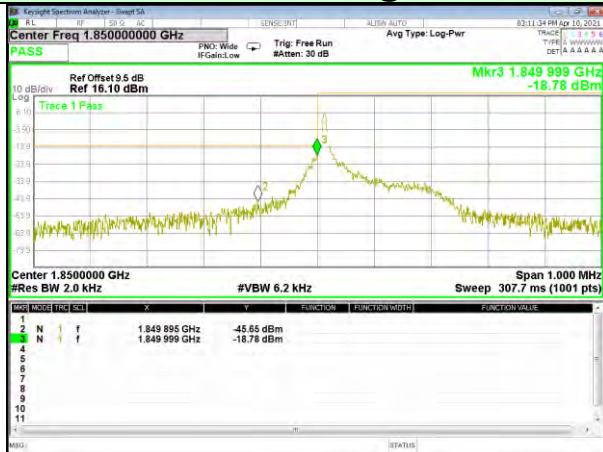
Middle channel



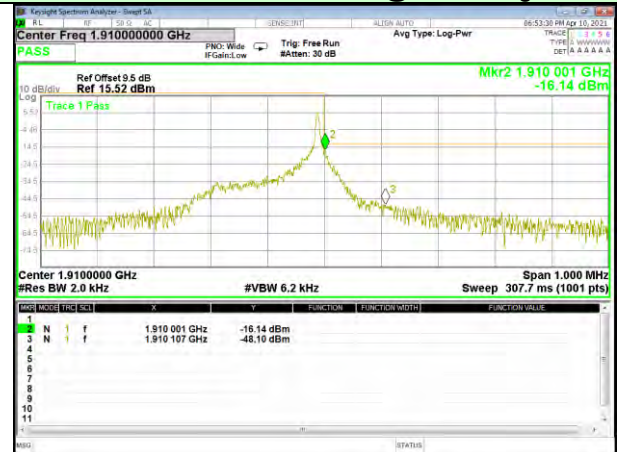
Highest channel

Band Edge

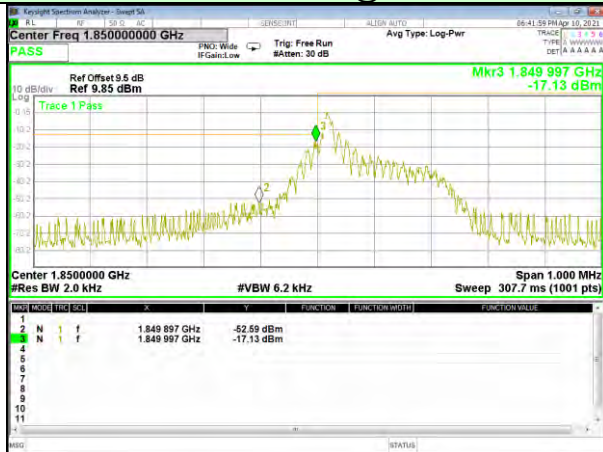
NB-IOT Band 2 BPSK 3.75kHz 1@0 CH-Low



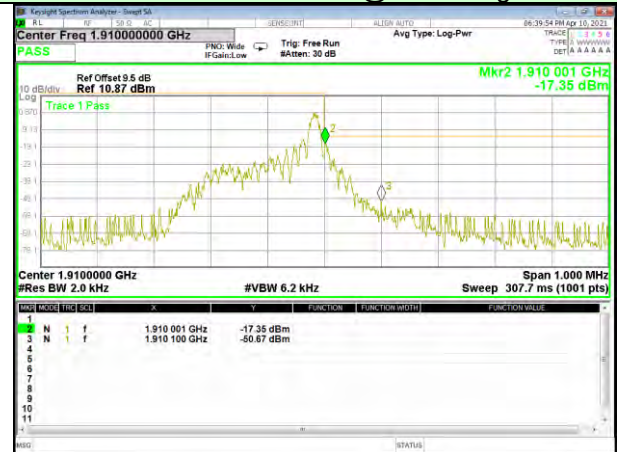
NB-IOT Band 2 BPSK 3.75kHz 1@47 CH-High



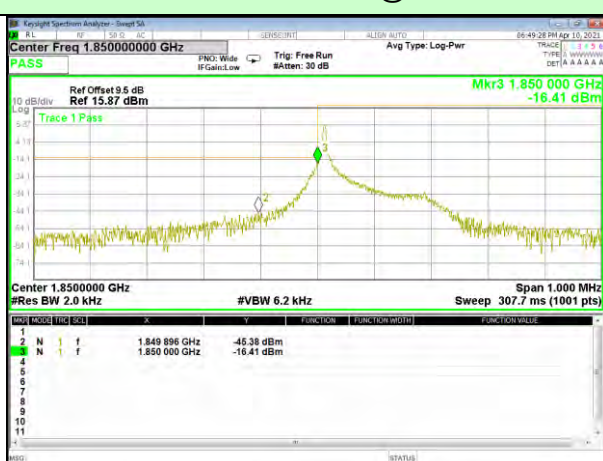
NB-IOT Band 2 BPSK 15kHz 1@0 CH-Low



NB-IOT Band 2 BPSK 15kHz 1@11 CH-High



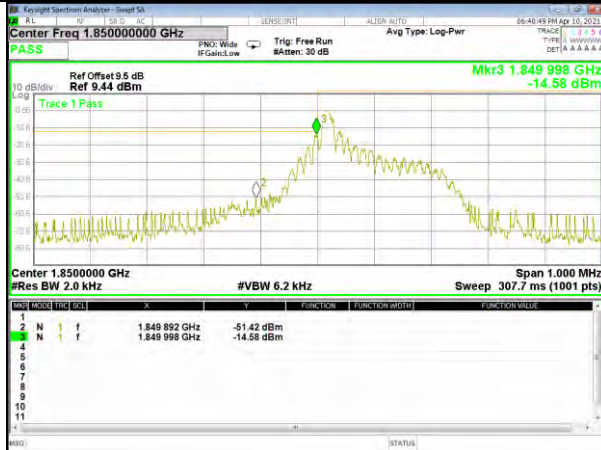
NB-IOT Band 2 QPSK 3.75kHz 1@0 CH-Low



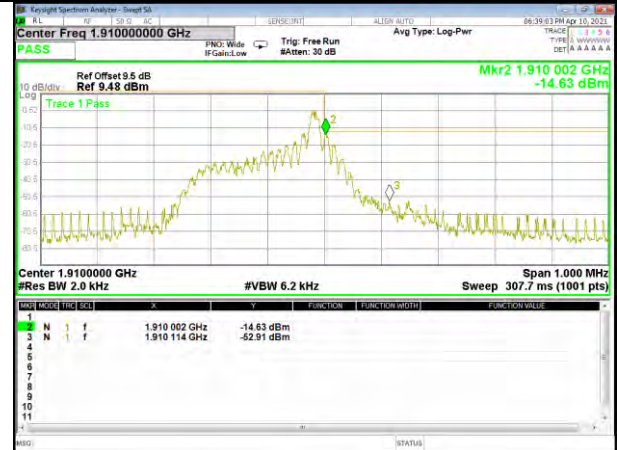
NB-IOT Band 2 QPSK 3.75kHz 1@47 CH-High



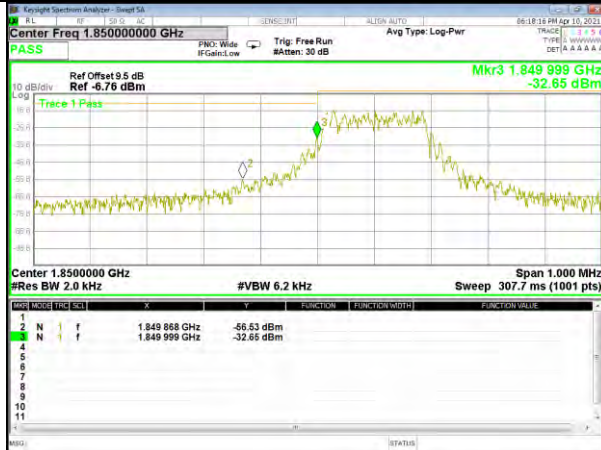
NB-IOT Band 2 QPSK 15kHz 1@0 CH-Low



NB-IOT Band 2 QPSK 15kHz 1@11 CH-High



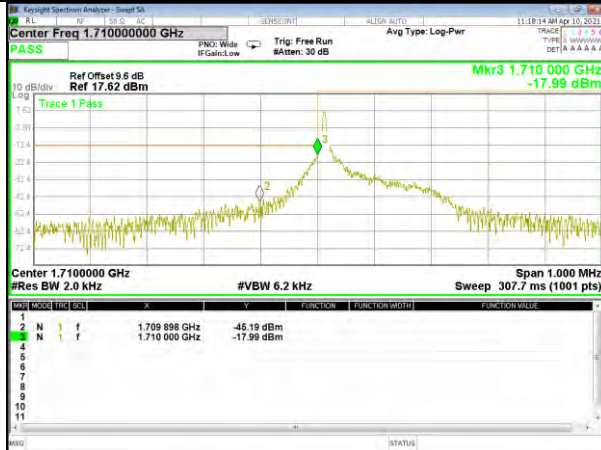
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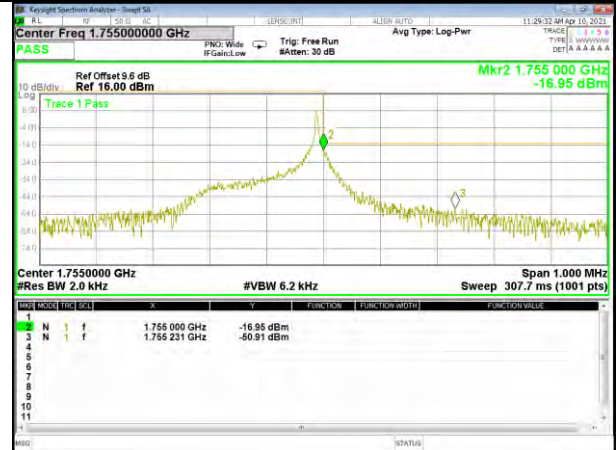
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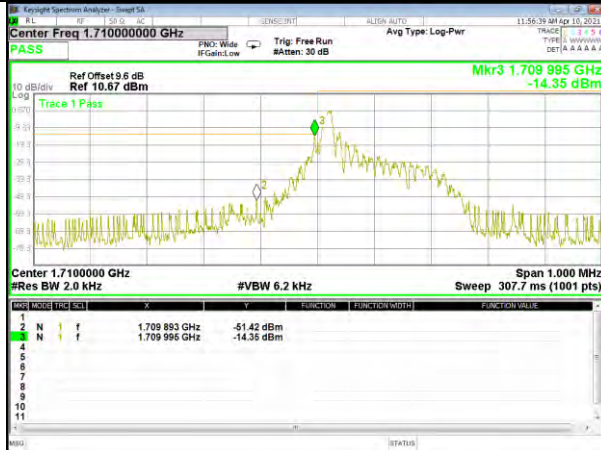
NB-IOT Band 4 BPSK 3.75kHz 1@0 CH-Low



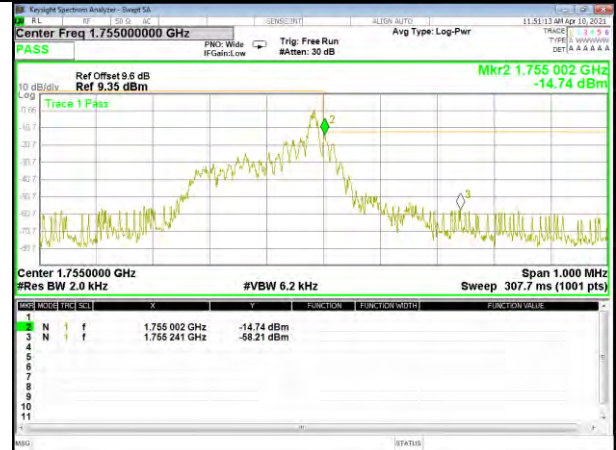
NB-IOT Band 4 BPSK 3.75kHz 1@47 CH-High



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



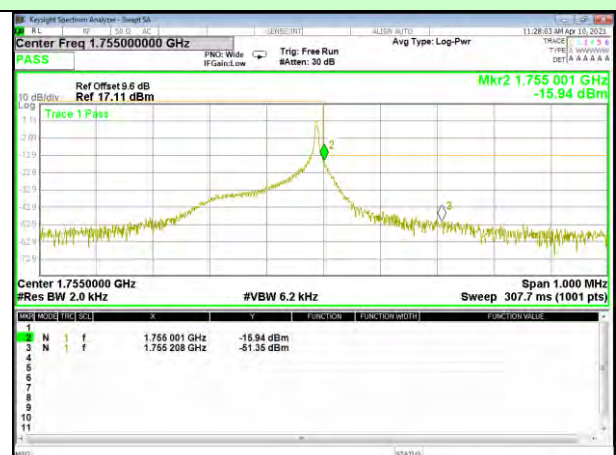
NB-IOT Band 4 BPSK 15kHz 1@11 CH-High



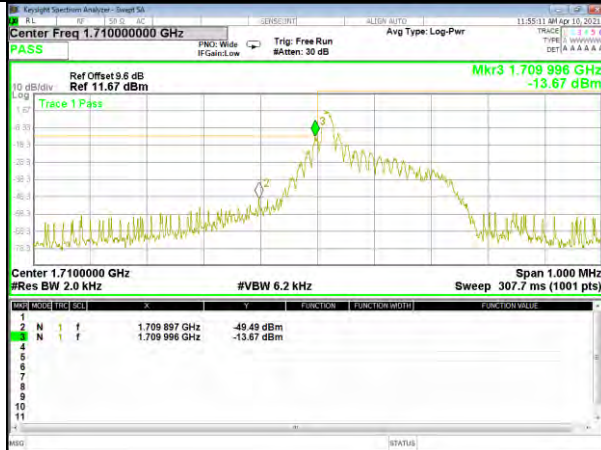
NB-IOT Band 4 QPSK 3.75kHz 1@0 CH-Low



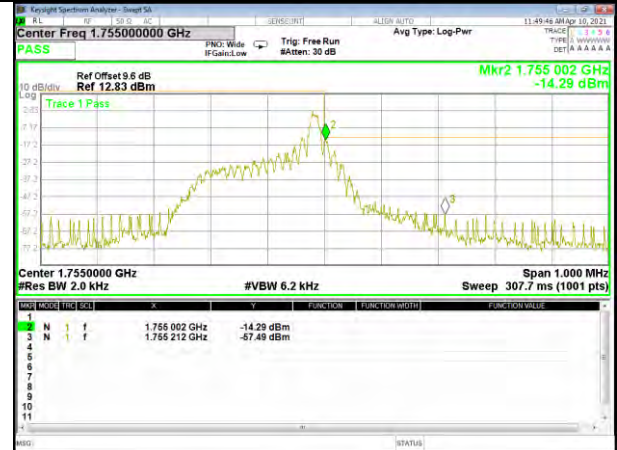
NB-IOT Band 4 QPSK 3.75kHz 1@47 CH-High



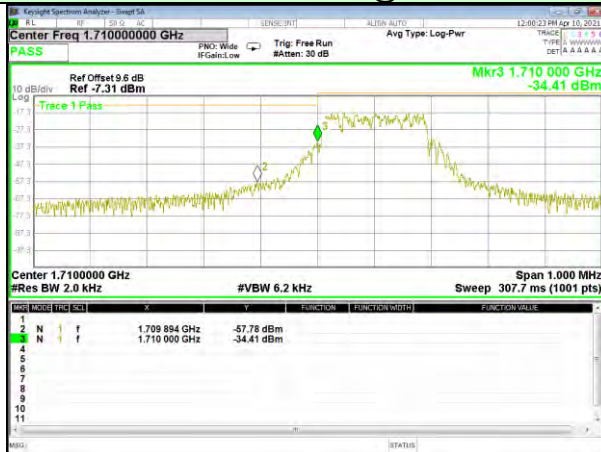
NB-IOT Band 4 QPSK 15kHz 1@0 CH-Low



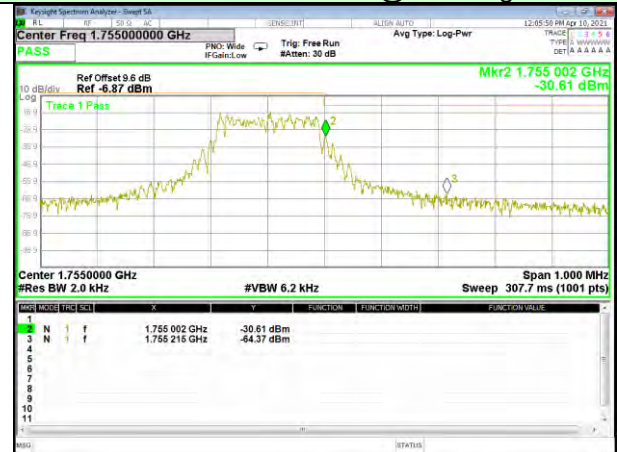
NB-IOT Band 4 QPSK 15kHz 1@11 CH-High



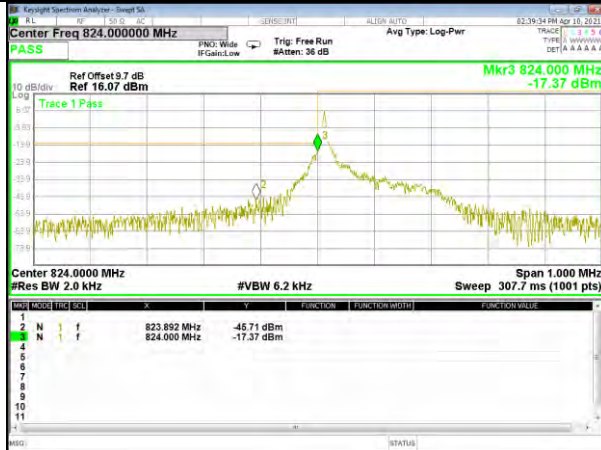
NB-IOT Band 4 QPSK 15kHz 12@0 CH-Low



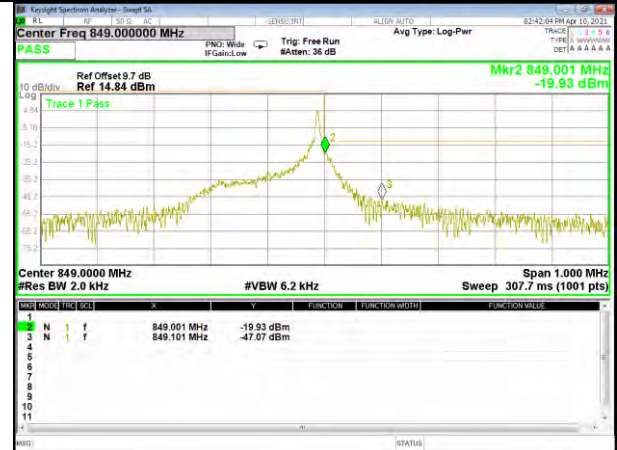
NB-IOT Band 4 QPSK 15kHz 12@0 CH-High



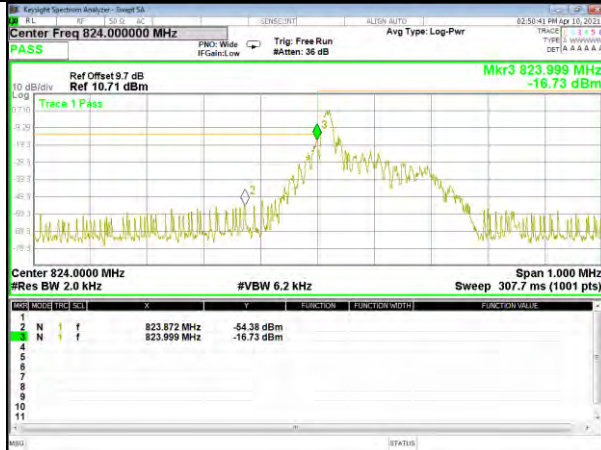
NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 5 BPSK 3.75kHz 1@47 CH-High



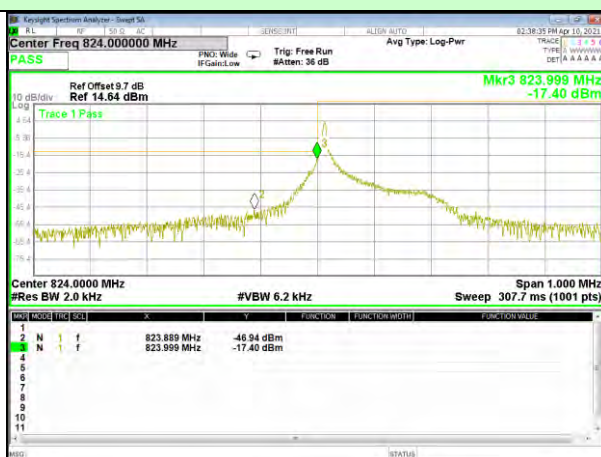
NB-IOT Band 5 BPSK 15kHz 1@0 CH-Low



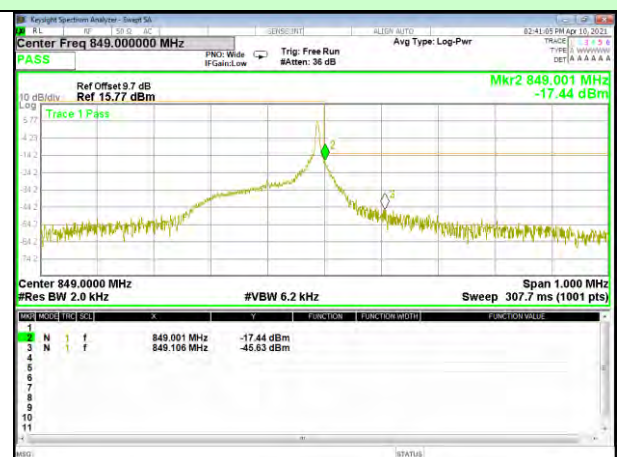
NB-IOT Band 5 BPSK 15kHz 1@11 CH-High



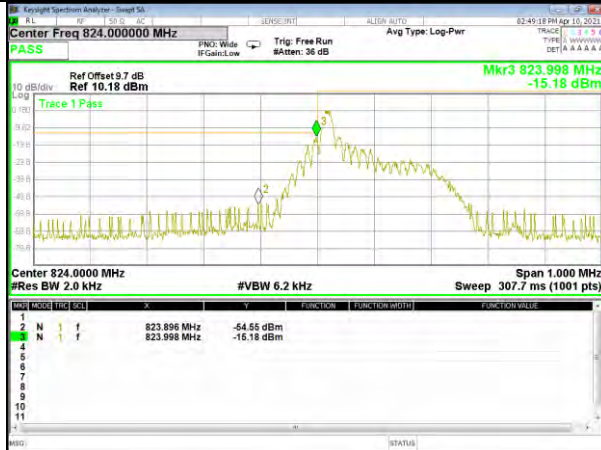
NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-Low



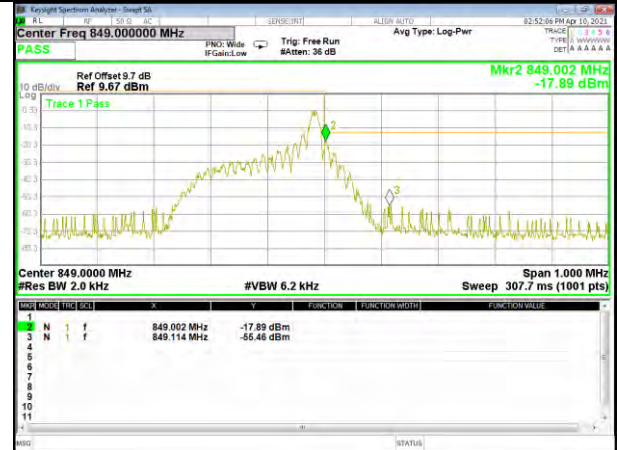
NB-IOT Band 5 QPSK 3.75kHz 1@47 CH-High



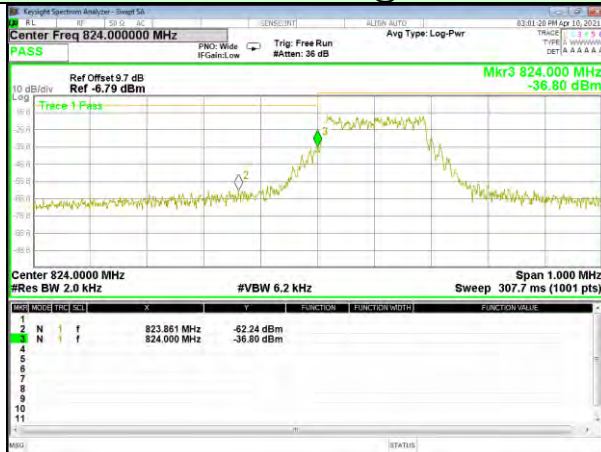
NB-IOT Band 5 QPSK 15kHz 1@0 CH-Low



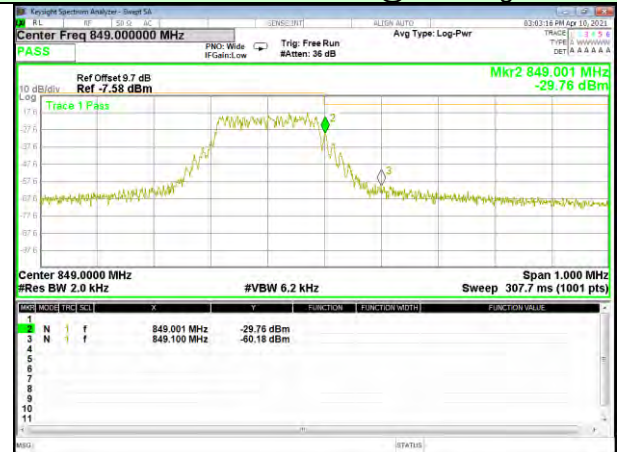
NB-IOT Band 5 QPSK 15kHz 1@11 CH-High



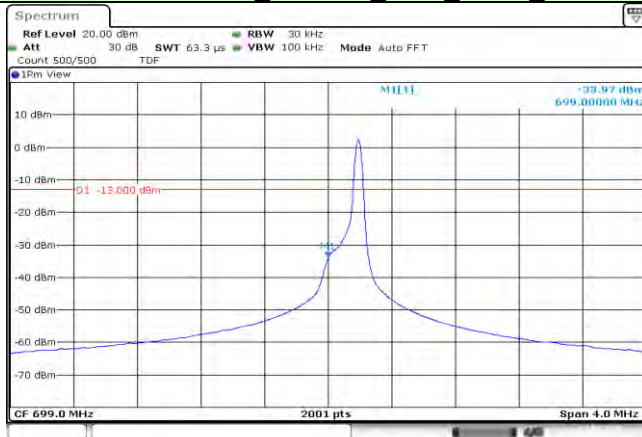
NB-IOT Band 5 QPSK 15kHz 12@0 CH-Low



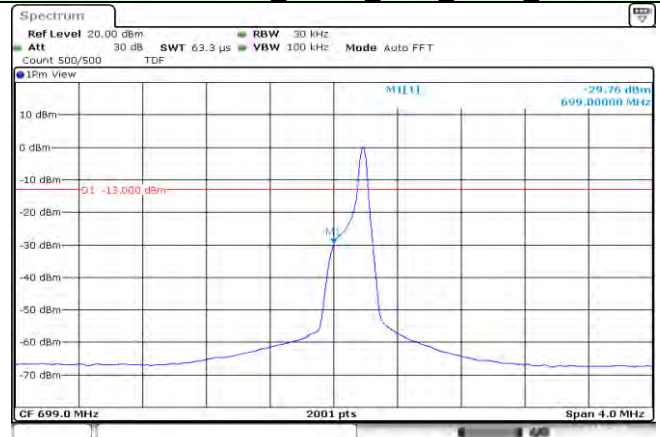
NB-IOT Band 5 QPSK 15kHz 12@0 CH-High



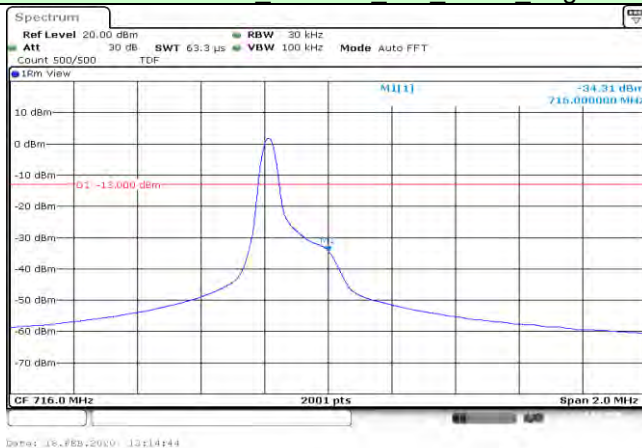
NB-IOT Band 12 3.75KHz 1#47 BPSK Low



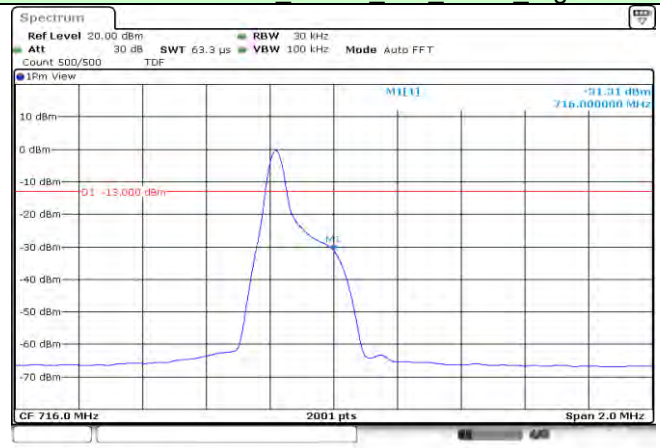
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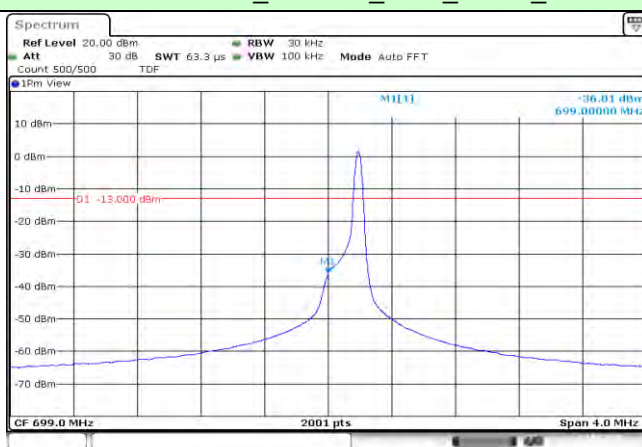
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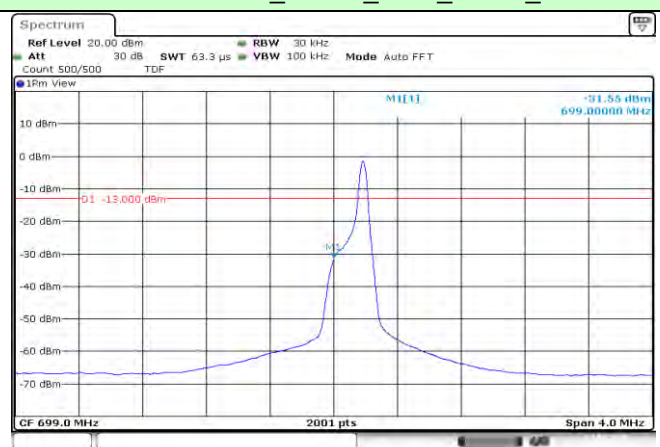
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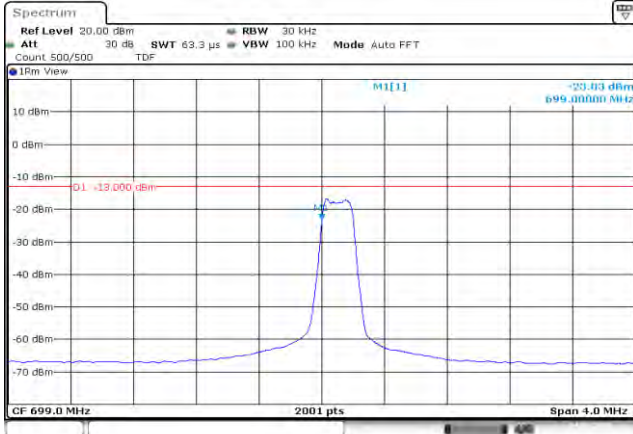
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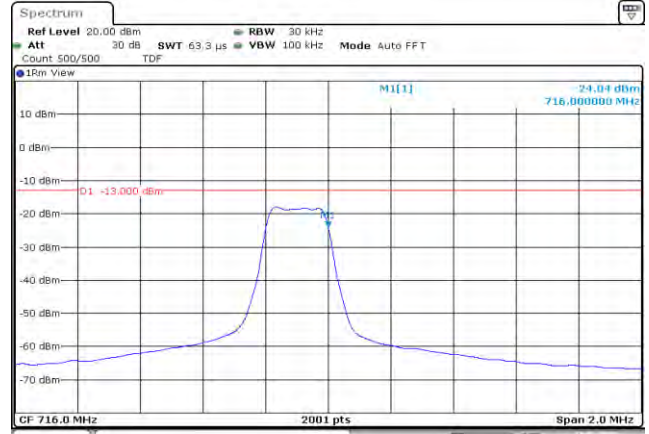
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NB-IOT Band 12 15KHz 12#0 QPSK Low



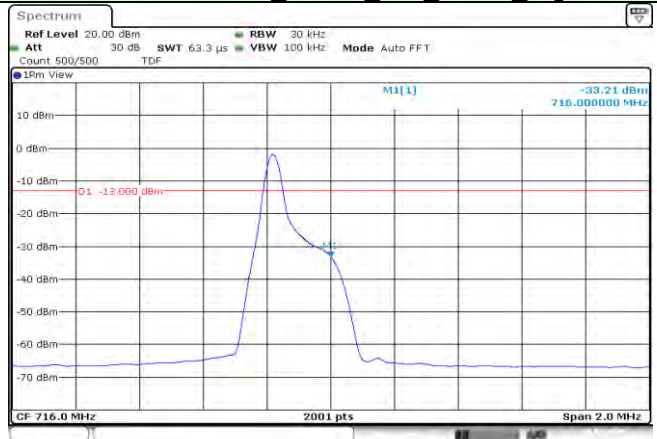
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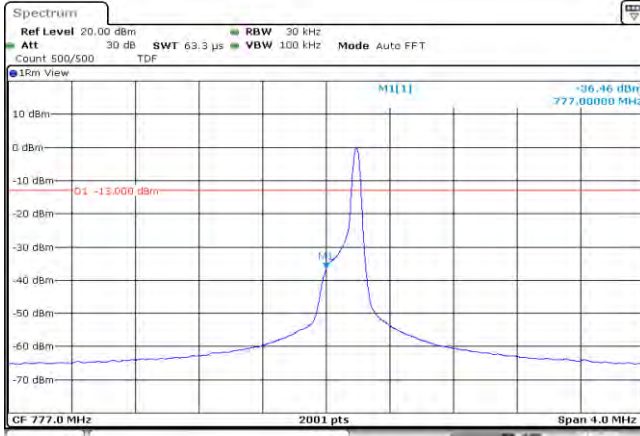
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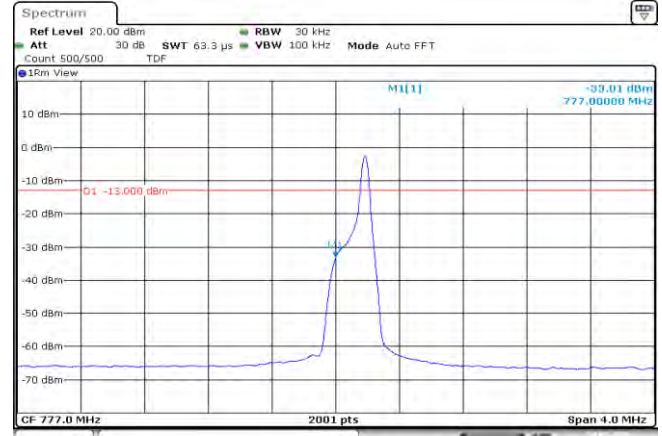
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NB-IOT Band 13 3.75KHz 1#47 BPSK Low



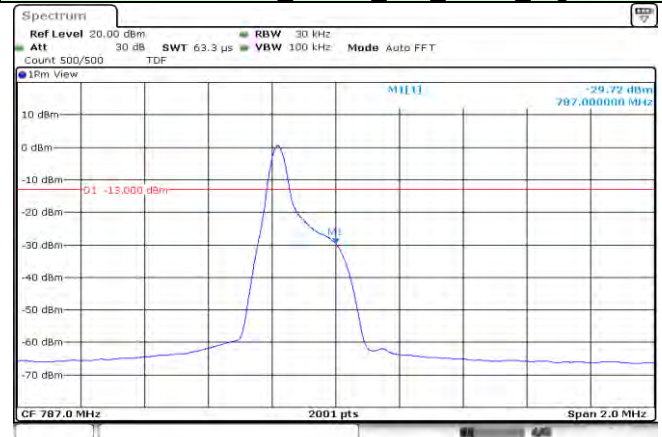
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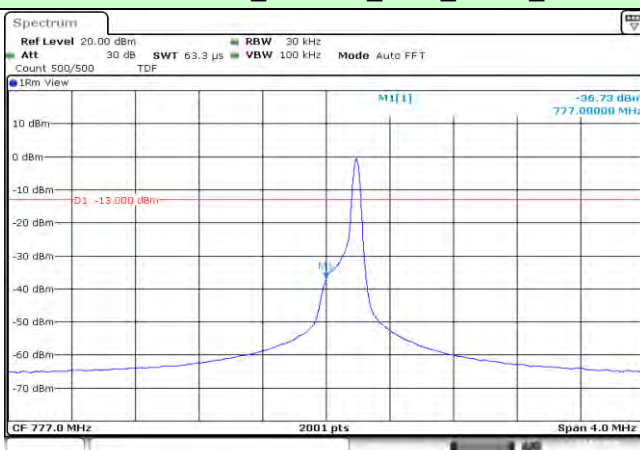
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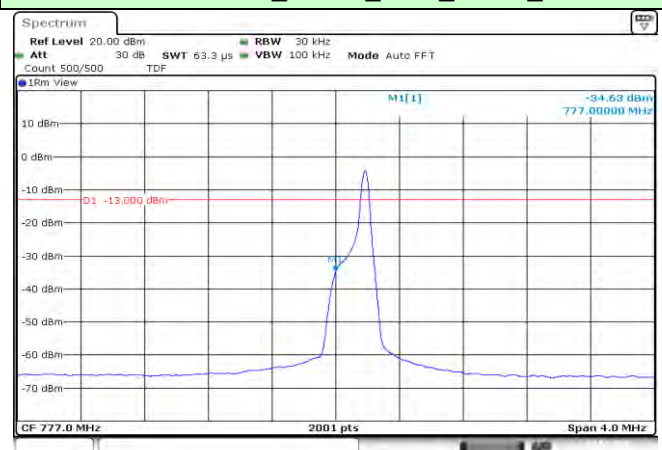
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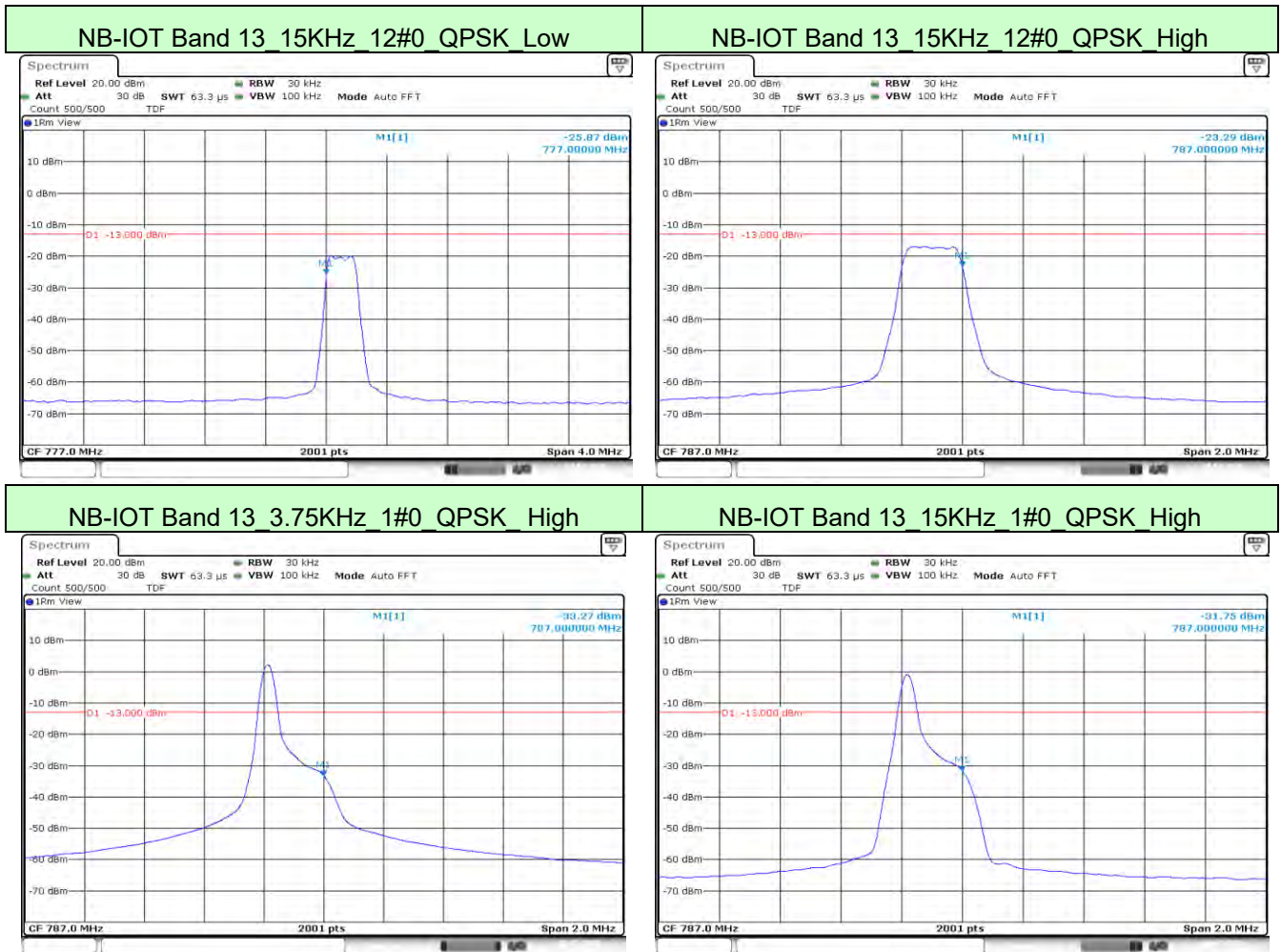


NB-IOT Band 13_3.75KHz_1#47_QPSK_Low



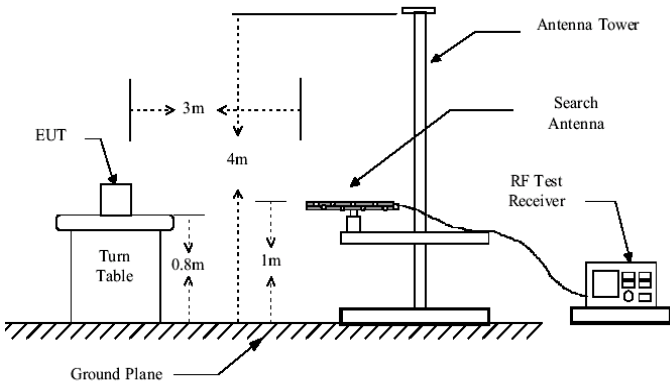
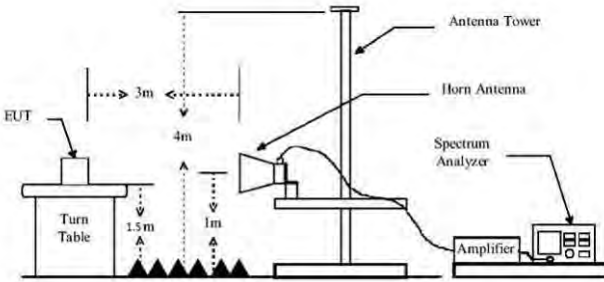
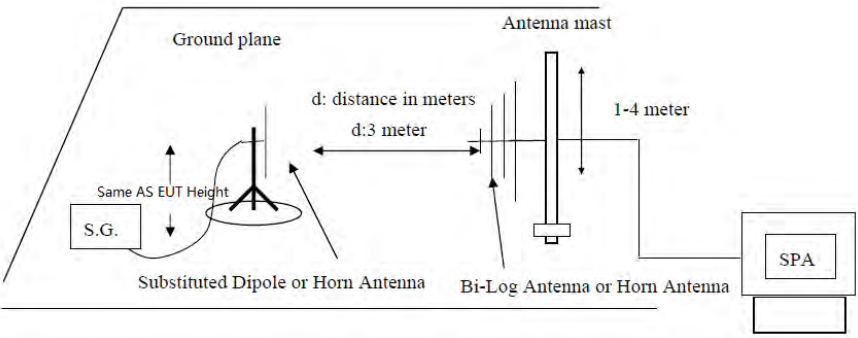
NB-IOT Band 13_15KHz_1#11_QPSK_Low





Note: All channel and modulation are tested, only the worst result is reported.

4.8 ERP, EIRP Measurement

Test Requirement:	FCC part22.913(a), FCC part24.232(b) and Part27.50
Test Method:	ANSI C63.26:2015
Limit:	Part27.50 (b)(10) Limit ($ERP \leq 3 \text{ W}$ (34.77dbm)) Part27.50 (c)(10) Limit ($ERP \leq 3 \text{ W}$ (34.77dbm)) Part27.50 (d)(4) Limit ($EIRP \leq 1 \text{ W}$ (30dbm)) Part24.232 (c) Limit ($EIRP \leq 2 \text{ W}$ (33dbm)) part22.913(a) Limit ($EIRP \leq 7 \text{ W}$ (38.45dbm))
Test setup:	Below 1GHz  Above 1GHz  Substituted method: 

Test Procedure:	1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer. 2. During the measurement, the EUT was communication with the station. The highest emission was recorded with the rotation of the turntable and the lowering of the test antenna from 4m to 1m. The reading was recorded and the field strength (E in dBuV/m) was calculated. 3. ERP were measured using a substitution method. The EUT was replaced by dipole antenna connected, the S.G. output was recorded and ERP was calculated asfollows: $\text{ERP} = \text{S.G. output (dBm)} + \text{Antenna Gain (dBd)} - \text{Cable Loss (dB)}$ 4. EIRP were measured using a substitution method. The EUT was replaced by or horn antenna connected, the S.G. output was recorded and EIRP was calculated as follows: $\text{EIRP} = \text{S.G. output (dBm)} + \text{Antenna Gain (dBi)} - \text{Cable Loss (dB)}$
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

LTE BAND 2	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	EIRP	Limit	Polarity	Margin
QPSK-3.75KHz	(MHz)	(dBm)	)	(dBi)	(dBm)	(dBm)		(dB)
	1850.2	-15.46	-29.3 -	9.8	23.64	33	H	-9.36
	1880	-15.96	-29.4 -	9.8	23.24	33	H	-9.76
	1909.8	-15.84	-29.3 -	9.8	23.26	33	H	-9.74
LTE BAND 2	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	EIRP	Limit	Polarity	Margin
QPSK-15KHz	(MHz)	(dBm)	)	Gain(dBi)	(dBm)	(dBm)		(dB)
	1850.2	-15.32	-29.3 -	9.8	23.78	33	H	-9.22
	1880	-15.45	-29.4 -	9.8	23.75	33	H	-9.25
	1909.8	-15.85	-29.3 -	9.8	23.25	33	H	-9.75
LTE BAND 2	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	EIRP	Limit	Polarity	Margin
BPSK-3.75KHz	(MHz)	(dBm)	)	(dBi)	(dBm)	(dBm)		(dB)
	1850.2	-15.95	-29.3 -	9.8	23.15	33	H	-9.85
	1880	-15.26	-29.4 -	9.8	23.94	33	H	-9.06
	1909.8	-15.72	-29.3 -	9.8	23.38	33	H	-9.62
LTE BAND 2	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	EIRP	Limit	Polarity	Margin
BPSK-15KHz	(MHz)	(dBm)	)	Gain(dBi)	(dBm)	(dBm)		(dB)
	1850.2	-15.80	-29.3 -	9.8	23.30	33	H	-9.70
	1880	-15.67	-29.4 -	9.8	23.53	33	H	-9.47
	1909.8	-15.88	-29.3 -	9.8	23.22	33	H	-9.78

LTE BAND 4	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	EIRP	Limit	Polarity	Margin
QPSK-3.75KHz	(MHz)	(dBm)	)	(dBi)	(dBm)	(dBm)		(dB)
	1710.2	-13.88	-29.6 -	8.1	23.82	30	H	-6.18
	1732.5	-14.13	-29.6 -	8.1	23.57	30	H	-6.43
	1754.8	-13.86	-29.5 -	8.1	23.74	30	H	-6.26
LTE BAND 4	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	EIRP	Limit	Polarity	Margin
QPSK-15KHz	(MHz)	(dBm)	)	Gain(dBi)	(dBm)	(dBm)		(dB)
	1710.2	-13.79	-29.6 -	8.1	23.91	30	H	-6.09
	1732.5	-14.58	-29.6 -	8.1	23.12	30	H	-6.88
	1754.8	-13.82	-29.5 -	8.1	23.78	30	H	-6.22
LTE BAND 4	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	EIRP	Limit	Polarity	Margin
BPSK-3.75KHz	(MHz)	(dBm)	)	(dBi)	(dBm)	(dBm)		(dB)
	1710.2	-14.12	-29.6 -	8.1	23.58	30	H	-6.42
	1732.5	-14.26	-29.6 -	8.1	23.44	30	H	-6.56
	1754.8	-14.15	-29.5 -	8.1	23.45	30	H	-6.55
LTE BAND 4	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	EIRP	Limit	Polarity	Margin
BPSK-15KHz	(MHz)	(dBm)	)	Gain(dBi)	(dBm)	(dBm)		(dB)
	1710.2	-14.63	-29.6 -	8.1	23.07	30	H	-6.93
	1732.5	-14.44	-29.6 -	8.1	23.26	30	H	-6.74
	1754.8	-14.20	-29.5 -	8.1	23.40	30	H	-6.60

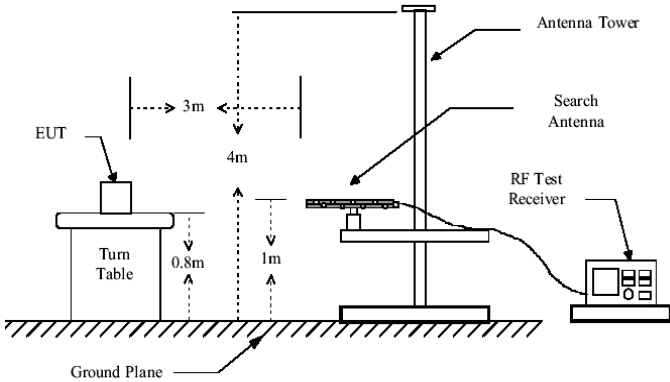
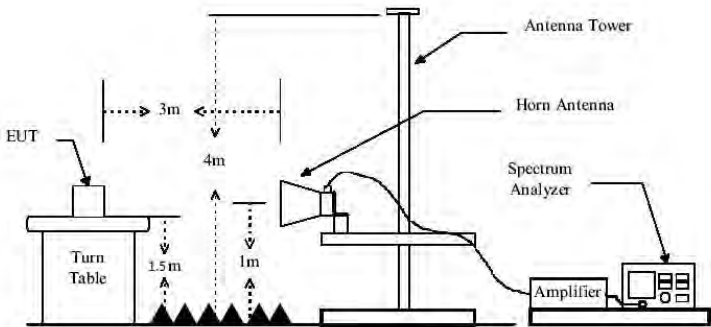
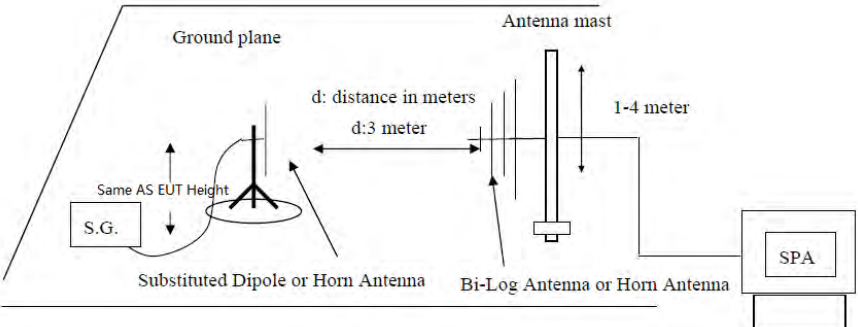
LTE BAND 5	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain (dBi)	Correction (dB)	ERP (dBm)	Limit (dBm)	Polarity	Margin (dB)
QPSK- 3.75KHz	(MHz)	(dBm)							
	824.2	-8.86	-33.6 -	-0.84	2.15	21.75	38.45	H	-16.70
	836.5	-8.99	-33.5 -	-0.74	2.15	21.62	38.45	H	-16.83
	848.8	-9.25	-33.5 -	-0.73	2.15	21.37	38.45	H	-17.08
LTE BAND 5	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP (dBm)	Limit (dBm)	Polarity	Margin (dB)
QPSK- 15KHz	(MHz)	(dBm)							
	824.2	-9.10	-33.6 -	-0.84	2.15	21.51	38.45	H	-16.94
	836.5	-9.04	-33.5 -	-0.74	2.15	21.57	38.45	H	-16.88
	848.8	-9.01	-33.5 -	-0.78	2.15	21.56	38.45	H	-16.89
LTE BAND 5	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP (dBm)	Limit (dBm)	Polarity	Margin (dB)
BPSK- 3.75KHz	(MHz)	(dBm)							
	824.2	-8.83	-33.6 -	-0.84	2.15	21.78	38.45	H	-16.67
	836.5	-8.76	-33.5 -	-0.74	2.15	21.85	38.45	H	-16.60
	848.8	-9.44	-33.5 -	-0.73	2.15	21.18	38.45	H	-17.27
LTE BAND 5	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP (dBm)	Limit (dBm)	Polarity	Margin (dB)
BPSK- 15KHz	(MHz)	(dBm)							
	824.2	-8.66	-33.6 -	-0.84	2.15	21.95	38.45	H	-16.50
	836.5	-8.98	-33.5 -	-0.74	2.15	21.63	38.45	H	-16.82
	848.8	-9.01	-33.5 -	-0.78	2.15	21.56	38.45	H	-16.89

LTE BAND 12	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	Correction	ERP	Limit	Polarity	Margin
QPSK-3.75KHz	(MHz)	(dBm)		(dBi)	(dB)	(dBm)	(dBm)		(dB)
	699.2	-6.35	-33.6 -	-0.84	2.15	24.26	38.45	H	-14.19
	707.5	-6.52	-33.5 -	-0.74	2.15	24.09	38.45	H	-14.36
	715.8	-6.15	-33.5 -	-0.73	2.15	24.47	38.45	H	-13.98
LTE BAND 12	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	Correction	ERP	Limit	Polarity	Margin
QPSK-15KHz	(MHz)	(dBm)		(dBi)	(dB)	(dBm)	(dBm)		(dB)
	699.2	-5.90	-33.6 -	-0.84	2.15	24.71	38.45	H	-13.74
	707.5	-5.69	-33.5 -	-0.74	2.15	24.92	38.45	H	-13.53
	715.8	-6.35	-33.5 -	-0.78	2.15	24.22	38.45	H	-14.23
LTE BAND 12	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	Correction	ERP	Limit	Polarity	Margin
BPSK-3.75KHz	(MHz)	(dBm)		(dBi)	(dB)	(dBm)	(dBm)		(dB)
	699.2	-6.08	-33.6 -	-0.84	2.15	24.53	38.45	H	-13.92
	707.5	-5.96	-33.5 -	-0.74	2.15	24.65	38.45	H	-13.80
	715.8	-6.42	-33.5 -	-0.73	2.15	24.20	38.45	H	-14.25
LTE BAND 12	Frequency	PMea	Pcl(dB)+PAg(dB)	Ga Antenna Gain	Correction	ERP	Limit	Polarity	Margin
BPSK-15KHz	(MHz)	(dBm)		(dBi)	(dB)	(dBm)	(dBm)		(dB)
	699.2	-5.70	-33.6 -	-0.84	2.15	24.91	38.45	H	-13.54
	707.5	-5.79	-33.5 -	-0.74	2.15	24.82	38.45	H	-13.63
	715.8	-5.69	-33.5 -	-0.78	2.15	24.88	38.45	H	-13.57

LTE BAND 13	Frequency	PMea	Pcl(dB)+PAg(dB)		Ga Antenna Gain (dBi)	Correction (dB)	ERP (dBm)	Limit (dBm)	Polarity	Margin (dB)
QPSK-3.75KHz	(MHz)	(dBm)								
	777.2	-6.28	-33.6	-	-0.84	2.15	24.33	38.45	H	-14.12
	782	-5.62	-33.5	-	-0.74	2.15	24.99	38.45	H	-13.46
	786.8	-6.37	-33.5	-	-0.73	2.15	24.25	38.45	H	-14.20
LTE BAND 13	Frequency	PMea	Pcl(dB)+PAg(dB)		Ga Antenna Gain(dBi)	Correction (dB)	ERP (dBm)	Limit (dBm)	Polarity	Margin (dB)
QPSK-15KHz	(MHz)	(dBm)								
	777.2	-6.38	-33.6	-	-0.84	2.15	24.23	38.45	H	-14.22
	782	-6.50	-33.5	-	-0.74	2.15	24.11	38.45	H	-14.34
	786.8	-6.04	-33.5	-	-0.78	2.15	24.53	38.45	H	-13.92
LTE BAND 13	Frequency	PMea	Pcl(dB)+PAg(dB)		Ga Antenna Gain(dBi)	Correction (dB)	ERP (dBm)	Limit (dBm)	Polarity	Margin (dB)
BPSK-3.75KHz	(MHz)	(dBm)								
	777.2	-6.52	-33.6	-	-0.84	2.15	24.09	38.45	H	-14.36
	782	-6.35	-33.5	-	-0.74	2.15	24.26	38.45	H	-14.19
	786.8	-5.85	-33.5	-	-0.73	2.15	24.77	38.45	H	-13.68
LTE BAND 13	Frequency	PMea	Pcl(dB)+PAg(dB)		Ga Antenna Gain(dBi)	Correction (dB)	ERP (dBm)	Limit (dBm)	Polarity	Margin (dB)
BPSK-15KHz	(MHz)	(dBm)								
	777.2	-6.35	-33.6	-	-0.84	2.15	24.26	38.45	H	-14.19
	782	-6.34	-33.5	-	-0.74	2.15	24.27	38.45	H	-14.18
	786.8	-6.11	-33.5	-	-0.78	2.15	24.46	38.45	H	-13.99

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

4.9 Field strength of spurious radiation measurement

Test Requirement:	FCC part22.913(a), FCC part24.238(a) and FCC part27.53
Test Method:	ANSI C63.26:2015
Limit:	Band 2/4/5/12:-13dBm Band 13: Limit out of the band 1559-1610MHz(-13dBm) Limit in the band 1559-1610MHz(-40dBm)
Test setup:	Below 1GHz  Above 1GHz  Substituted method: 

Test Procedure:	1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer. 2. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations. 3. The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method. 4. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency. $\text{ERP / EIRP} = \text{S.G. output (dBm)} + \text{Antenna Gain(dB/dBi)} - \text{Cable Loss (dB)}$
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

NB-IOT Band 2 15KHz QPSK CH-Low

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3700.2	V	-36.51	-13.00	Pass
5550.3	V	-39.12		
11100.6	V	-38.02		
16650.9	V	-43.27		
33301.8	V	---		
3700.2	H	-38.77	-13.00	Pass
5550.3	H	-42.96		
11100.6	H	-44.40		
16650.9	H	-45.60		
33301.8	H	---		

NB-IOT Band 2 15KHz QPSK CH-Mid

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3760	V	-36.45	-13.00	Pass
5640	V	-38.95		
11280	V	-37.94		
16920	V	-43.22		
33840	V	---		
3760	H	-38.92	-13.00	Pass
5640	H	-42.77		
11280	H	-44.51		
16920	H	-45.39		
33840	H	---		

NB-IOT Band 2 15KHz QPSK CH-High

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3819.8	V	-36.39	-13.00	Pass
5729.7	V	-38.73		
11459.4	V	-37.93		
17189.1	V	-42.78		
34378.2	V	---		
3819.8	H	-39.54	-13.00	Pass
5729.7	H	-43.42		
11459.4	H	-44.63		
17189.1	H	-45.40		
34378.2	H	---		

Remark :

1. The emission behaviour belongs to narrowband spurious emission, all modes investigated and only worst case is reported.
2. Remark"---" means that the emission level is too low (20dB lower than the limit) to be measured
3. The emission levels of below 1 GHz are very lower (20dB lower than the limit) than the limit and not show in test report.

NB-IOT Band 4 15KHz QPSK CH-Low

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3420.2	V	-36.67	-13.00	Pass
5130.3	V	-39.16		
10260.6	V	-38.19		
15390.9	V	-43.74		
30781.8	V	---		
3420.2	H	-39.42	-13.00	Pass
5130.3	H	-43.49		
10260.6	H	-44.34		
15390.9	H	-45.51		
30781.8	H	---		

NB-IOT Band 4 15KHz QPSK CH-Mid

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465	V	-36.17	-13.00	Pass
5197.5	V	-37.69		
10395	V	-39.50		
15592.5	V	-41.92		
31185	V	---		
3465	H	-38.34	-13.00	Pass
5197.5	H	-43.13		
10395	H	-43.32		
15592.5	H	-49.51		
31185	H	---		

NB-IOT Band 4 15KHz QPSK CH-High

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3509.8	V	-36.61	-13.00	Pass
5264.7	V	-38.38		
10529.4	V	-37.54		
15794.1	V	-43.62		
31588.2	V	---		
3509.8	H	-40.87	-13.00	Pass
5264.7	H	-40.20		
10529.4	H	-42.33		
15794.1	H	-45.64		
31588.2	H	---		

Remark :

1. The emission behaviour belongs to narrowband spurious emission, all modes investigated and only worst case is reported.
2. Remark"---" means that the emission level is too low (20dB lower than the limit) to be measured
3. The emission levels of below 1 GHz are very lower (20dB lower than the limit) than the limit and not show in test report.

NB-IOT Band 5 15KHz QPSK CH-Low

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1648.2	V	-36.59	-13.00	Pass
2472.3	V	-39.34		
4944.6	V	-37.99		
7416.9	V	-43.03		
14833.8	V	---		
1648.2	H	-38.82	-13.00	Pass
2472.3	H	-42.59		
4944.6	H	-44.84		
7416.9	H	-45.83		
14833.8	H	---		

NB-IOT Band 5 15KHz QPSK CH-Mid

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1673	V	-36.64	-13.00	Pass
2509.5	V	-38.80		
5019	V	-38.61		
7528.5	V	-42.81		
15057	V	---		
1673	H	-39.23	-13.00	Pass
2509.5	H	-43.11		
5019	H	-44.35		
7528.5	H	-45.87		
15057	H	---		

NB-IOT Band 5 15KHz QPSK CH-High

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1697.8	V	-36.12	-13.00	Pass
2546.7	V	-39.54		
5093.4	V	-38.30		
7640.1	V	-43.09		
15280.2	V	---		
1697.8	H	-39.63	-13.00	Pass
2546.7	H	-43.21		
5093.4	H	-44.28		
7640.1	H	-45.40		
15280.2	H	---		

Remark :

1. The emission behaviour belongs to narrowband spurious emission, all modes investigated and only worst case is reported.
2. Remark"---" means that the emission level is too low (20dB lower than the limit) to be measured
3. The emission levels of below 1 GHz are very lower (20dB lower than the limit) than the limit and not show in test report.

NB-IOT Band 12 15KHz QPSK CH-Low

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1398.2	V	-36.54	-13.00	Pass
2097.3	V	-38.90		
4194.6	V	-38.58		
6291.9	V	-43.30		
12583.8	V	---		
1398.2	H	-39.72	-13.00	Pass
2097.3	H	-43.22		
4194.6	H	-44.86		
6291.9	H	-45.91		
12583.8	H	---		

NB-IOT Band 12 15KHz QPSK CH-Mid

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1415	V	-36.58	-13.00	Pass
2122.5	V	-39.32		
4245	V	-38.38		
6367.5	V	-42.83		
12735	V	---		
1415	H	-38.82	-13.00	Pass
2122.5	H	-42.78		
4245	H	-44.64		
6367.5	H	-45.62		
12735	H	---		

NB-IOT Band 12 15KHz QPSK CH-High

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1431.8	V	-36.98	-13.00	Pass
2147.7	V	-39.06		
4295.4	V	-38.52		
6443.1	V	-43.03		
12886.2	V	---		
1431.8	H	-38.75	-13.00	Pass
2147.7	H	-42.71		
4295.4	H	-44.08		
6443.1	H	-45.55		
12886.2	H	---		

Remark :

1. The emission behaviour belongs to narrowband spurious emission, all modes investigated and only worst case is reported.
2. Remark"---" means that the emission level is too low (20dB lower than the limit) to be measured
3. The emission levels of below 1 GHz are very lower (20dB lower than the limit) than the limit and not show in test report.

NB-IOT Band 13 15KHz QPSK CH-Low

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1554.2	V	-40.54	-13.00	Pass
2331.3	V	-41.14		
4662.6	V	-42.27		
6993.9	V	-43.26		
13987.8	V	---		
1554.2	H	-40.25	-13.00	Pass
2331.3	H	-41.00		
4662.6	H	-42.46		
6993.9	H	-42.76		
13987.8	H	---		

NB-IOT Band 13 15KHz QPSK CH-Mid

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1564	V	-41.63	-40.00	Pass
2346	V	-42.74	-13.00	
4692	V	-43.37	-13.00	
7038	V	-43.60	-13.00	
14076	V	---	-13.00	
1564	H	-41.46	-40.00	Pass
2346	H	-43.16	-13.00	
4692	H	-43.37	-13.00	
7038	H	-49.04	-13.00	
14076	H	---	-13.00	

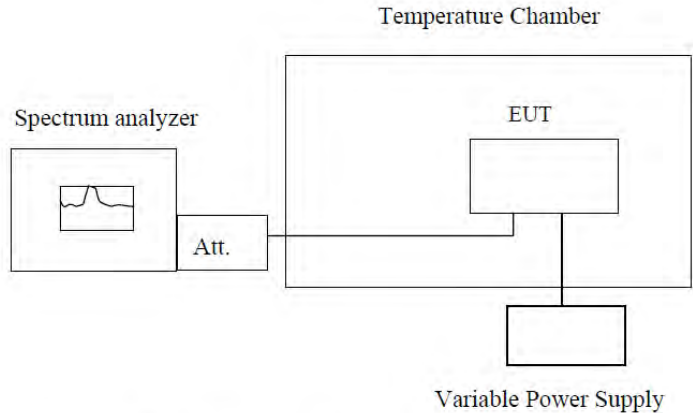
NB-IOT Band 13 15KHz QPSK CH-High

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1573.8	V	-41.61	-40.00	Pass
2360.7	V	-41.94	-13.00	
4721.4	V	-42.97	-13.00	
7082.1	V	-42.18	-13.00	
14164.2	V	---	-13.00	
1573.8	H	-40.99	-40.00	Pass
2360.7	H	-40.59	-13.00	
4721.4	H	-42.56	-13.00	
7082.1	H	-46.03	-13.00	
14164.2	H	---	-13.00	

Remark :

1. The emission behaviour belongs to narrowband spurious emission, all modes investigated and only worst case is reported.
2. Remark"---" means that the emission level is too low (20dB lower than the limit) to be measured
3. The emission levels of below 1 GHz are very lower (20dB lower than the limit) than the limit and not show in test report.

4.10 Frequency stability V.S. Temperature measurement

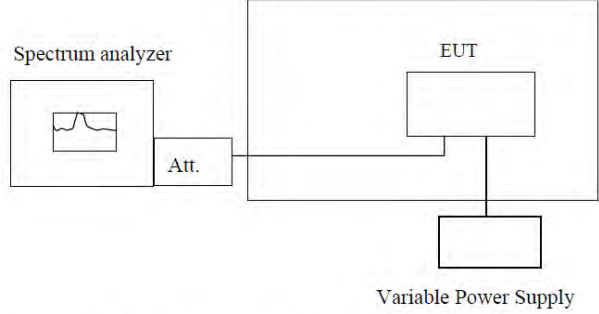
Test Requirement:	FCC Part2.1055(a)(1)(b)
Test Method:	ANSI C63.26:2015
Limit:	2.5ppm(Part 22) Within the authorized bands of operation(Part 24, Part 27)
Test setup:	 Note : Measurement setup for testing on Antenna connector
Test procedure:	1. The equipment under test was connected to an external DC power supply and input rated voltage. 2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. 3. The EUT was placed inside the temperature chamber. 4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency. 5. Turn EUT off and set the chamber temperature to –20°C . After the temperature stabilized for approximately 30 minutes recorded the frequency. 6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass
Remark:	If all frequencies stability are comply with the lower limit, then all results can be considered qualified

Measurement Data

Reference Frequency: NB-IOT Band 2 Middle channel =1880MHz					
Power supplied (Vdc)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.7	-20	16	0.0086	Within the authorized bands	Pass
	-10	23	0.0122		
	0	20	0.0108		
	10	-28	-0.0151		
	20	19	0.0099		
	30	16	0.0085		
	40	-5	-0.0029		
	50	11	0.0059		
	55	16	0.0084		
Reference Frequency: NB-IOT Band 4 Middle channel =1732.5MHz					
Power supplied (Vdc)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.7	-20	17	0.0096	2.5	Pass
	-10	23	0.0133		
	0	27	0.0153		
	10	-24	-0.0136		
	20	15	0.0087		
	30	18	0.0106		
	40	-5	-0.0028		
	50	15	0.0085		
	55	8	0.0048		
Reference Frequency: NB-IOT Band 5 Middle channel =836.5MHz					
Power supplied (Vdc)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.7	-20	16	0.0195	2.5	Pass
	-10	23	0.0275		
	0	23	0.0272		
	10	-24	-0.0282		
	20	17	0.0200		
	30	16	0.0189		
	40	-9	-0.0106		
	50	11	0.0135		
	55	5	0.0063		

Reference Frequency: NB-IOT Band 12 Middle channel =707.5MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.7	-20	18	-0.0303	2.5	Pass
	-10	-22	-0.0089		
	0	25	0.0773		
	10	-23	0.0009		
	20	15	-0.0294		
	30	17	0.0682		
	40	-7	-0.0219		
	50	13	0.0600		
	55	8	0.0891		
Reference Frequency: NB-IOT Band 13 Middle channel =782.5MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.7	-20	29	0.0267	2.5	Pass
	-10	-16	-0.0739		
	0	10	0.0915		
	10	-27	-0.0236		
	20	19	0.1104		
	30	17	0.0643		
	40	17	0.0943		
	50	-22	-0.0649		
	55	17	0.0435		

4.11 Frequency stability V.S. Voltage measurement

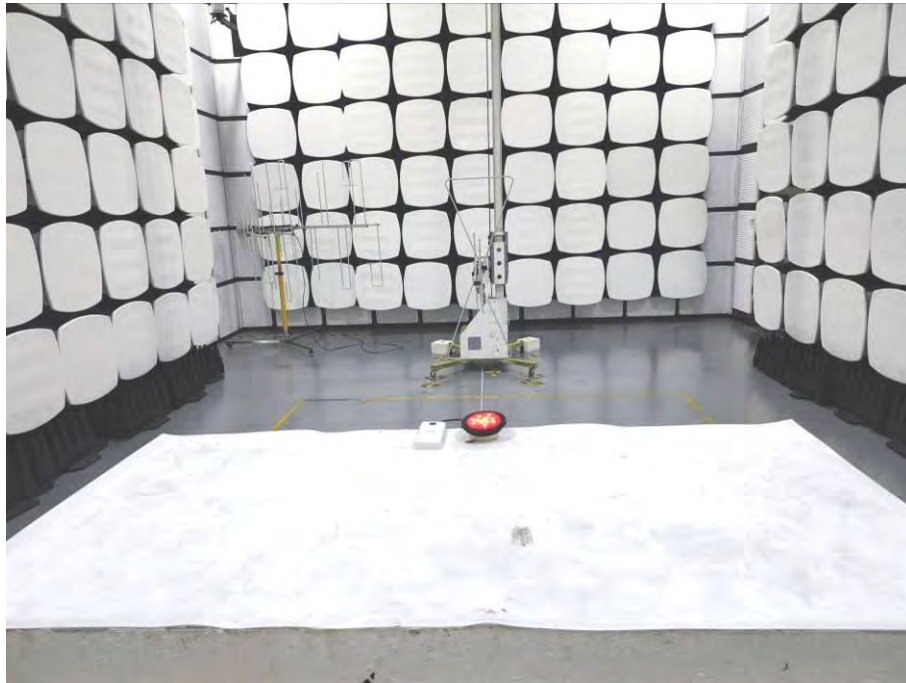
Test Requirement:	FCC Part2.1055(d)(1)(2)
Test Method:	ANSI C63.26:2015
Limit:	2.5ppm Band II & Band VII should be within authorized band.
Test setup:	Temperature Chamber  Variable Power Supply Note : Measurement setup for testing on Antenna connector
Test procedure:	1. Set chamber temperature to 20°C . Use a variable DC power source to power the EUT and set the voltage to rated voltage. 2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency. 3. Reduce the input voltage to specified extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass
Remark:	1. Manufacturer specified the battery operating end point voltage is 3.32VDC, max voltage is 4.37VDC. 2. If all frequencies stability are comply with the lower limit, then all results can be considered qualified

Measurement Data

Reference Frequency: NB-IOT Band 2 Middle channel =1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.37	23	-0.0096	within authorized band	Pass
	3.70	15	0.0252		
	3.23	-6	-0.0624		
Reference Frequency: NB-IOT Band 4 Middle channel =1732.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.37	18	0.0804	2.5	Pass
	3.70	-3	0.0669		
	3.23	10	0.0042		
Reference Frequency: NB-IOT Band 5 Middle channel =836.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.37	16	0.0191	2.5	Pass
	3.70	23	0.0275		
	3.23	23	0.0281		
Reference Frequency: NB-IOT Band 12 Middle channel =707.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.37	23	-0.0043	within authorized band	Pass
	3.70	15	0.0303		
	3.23	-6	0.0731		
Reference Frequency: NB-IOT Band 13 Middle channe =782.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.37	18	0.0231	2.5	Pass
	3.80	23	0.0294		
	3.70	25	0.0320		
	3.50	-23	-0.0293		
	3.23	12	0.0159		

4.12 Test Setup Photo

Radiated Emission



-----THE END OF REPORT-----