FCC TEST REPORT

Product Name:	Global LTE Cat.M1/lte Cat.nb2 Data-only Module
Trade Mark:	CINTERION
Model No.:	TX62-W-B
Report Number:	210804012RFM-1
Test Standards:	FCC 47 CFR Part 27 P
FCC ID:	QIPTX62-W-B
Test Result:	PASS
Date of Issue:	September 17, 2021

Prepared for:

THALES DIS AIS Deutschland GmbH
Siemensdamm 50, 13629 Berlin, Germany

Prepared by:

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Approved by: Kevin Liang — Assistant Manager

Date: September 17, 2021

Version

Version No.	Date	Description
V1.0	September 17, 2021	Original

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	THALES DIS AIS Deutschland GmbH
Address of Applicant:	Siemensdamm 50, 13629 Berlin, Germany
Manufacturer:	Thales DIS AIS Deutschland GmbH
Address of Manufacturer:	Werinherstr. 81, 81541 Munich, Germany

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Global LTE Cat.M1/lte Cat.nb2 Data-only Module	
Model No.:	TX62-W-B	
Trade Mark:	CINTERION	
DUT Stage:	Production Unit	
EUT Supports Function:	E-UTRA Bands:	FDD Band 2/ Band 4/ Band 5/ Band8 / Band 12/ Band 13/ Band 25/ Band 26/ Band 66/ Band 71
Sample Received Date:	August 19, 2021	
Sample Tested Date:	August 19, 2021 to August 30, 2021	

1.2.2 Description of Accessories

None.

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Support Networks:	LTE		
Type of Modulation:	LTE Band 8:	CAT-M1	QPSK, 16QAM
		NB-IoT	BPSK, QPSK
Antenna Type:	External Antenna		
Antenna Gain:	LTE Band 8:		50 ohm terminal (0dBi)
Normal Test Voltage:	3.8 Vdc		
Extreme Test Voltage:	2.5 to 4.5Vdc		
Extreme Test Temperature:	-40 ℃ to +70 ℃		

Summary of Results:

Bands	BW (MHz)	Modulation	Frequency Range (MHz)	Max RF Output Power (dBm) Conducted (Average)	Max RF Output Power (dBm) ERP (Average)	ERP (W)	99% BW (MHz)	Emission Designator
8	1.4	QPSK	897.5-900.5	22.93	22.93	0.19634	1.0966	1M10G7D
		16QAM		21.73	21.73	0.14894	0.93965	940KW7D
	3	QPSK	897.5-900.5	22.94	22.94	0.19679	1.1354	1M14G7W
		16QAM		21.77	21.77	0.15031	0.97005	970KW7D

Summary of Results:								
Bands	Sub-carrier spacing	Modulation	Frequency Range	Max RF Output Power (dBm)		EIRP/ERP	99% BW	Emission Designator
	(KHz)		(MHz)	Conducted (Average)	ERP/EIRP (Average)	(W)	(kHz)	
8	3.75	BPSK	897.5-900.5	23.37	23.37	0.21727	53.087	53K1G7D
		QPSK		23.34	23.34	0.21577	60.096	60K1G7D
	15	BPSK	897.5-900.5	22.13	22.13	0.16331	120.41	120KG7D
		QPSK		22.15	22.15	0.16406	187.14	187KG7D

1.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Adaptor	N/A	CD139	20359	Applicant
PCB board	N/A	DSB75	--	Applicant
PCB board	N/A	AH8	--	Applicant
50 ohm terminal	N/A	N/A	N/A	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.1 Meter	UnionTrust
2	RF Cable	SMA	0.8 Meter	UnionTrust
3	RF Cable	SMA	0.8 Meter	UnionTrust

1.5 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.6 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the

identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.7 DEVIATION FROM STANDARDS

None.

1.8 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.10 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated spurious emissions 30MHz-1GHz	± 4.9 dB
4	Radiated spurious emissions 1GHz-18GHz	± 4.8 dB
5	Radiated spurious emissions 18GHz-40GHz	± 5.1 dB
6	Occupied Bandwidth	± 1.86 %
7	DC Supply Voltages	± 0.68 %
8	Temperature	± 0.62 °C
9	Humidity	± 3.9 %
10	Conducted spurious emissions	± 2.7 dB
11	DC Supply Voltages	± 0.68 %
12	AC Supply Voltages	± 1.2 %
13	Radio Frequency	± 6.5 x 10^{-8}
14	RF Power, Conducted	± 0.9 dB

2. TEST SUMMARY

FCC 47 CFR Part 27 Test Cases (LTE Band 8)			
Test Item	**Test Requirement**	**Test Method**	**Result**
Equivalent Radiated Power (ERP)	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 27.1507(a)(3)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Conducted Output Power	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 27.1507(a)(3)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Peak-to-average ratio	FCC 47 CFR Part 27.1507(d)	KDB 971168 D01v03r01	PASS
99%&26dB Bandwidth	FCC 47 CFR Part 2.1049(h) FCC 47 CFR Part 27.1506	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Band Edge at antenna terminals	FCC 47 CFR Part 27.1509(a)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Spurious emissions at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 27.1509(a)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Field strength of spurious radiation	FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 27.1509(a)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Frequency stability	FCC 47 CFR Part 2.1055	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	3m SAC	ETS-LINDGREN	3M	N/A	Jan. 22, 2021	Jan. 21, 2024
☐	Loop Antenna	ETS-Lindgren	6502	00202525	Nov. 14, 2020	Nov. 13, 2021
☒	Receiver	R&S	ESIB26	100114	Nov. 18, 2020	Nov. 17, 2021
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 14, 2020	Nov. 13, 2021
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 14, 2020	Nov.13, 2021
☒	Preamplifier	HP	8447F	2805A02960	Nov. 10, 2020	Nov. 9, 2021
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	Apr. 30, 2021	Apr. 29, 2022
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	Nov. 10, 2020	Nov. 9, 2021
☐	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 14, 2020	Nov. 13, 2021
☐	Pre-amplifier	ETS-Lindgren	00118384	00202652	Nov. 14, 2020	Nov. 13, 2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

RF Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	Spectrum Analyzer	R&S	FSV40-N	101653	Apr. 22, 2021	Apr. 21, 2022
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Nov. 10, 2020	Nov. 9, 2021
☒	Wideband Radio Communication Tester	R&S	CMW500	120932	Apr. 22, 2021	Apr. 21, 2022
☐	Wideband Radio Communication Tester	R&S	CMW500	119583	Apr. 22, 2021	Apr. 21, 2022
☒	DC Source	KIKUSUI	PWR400L	LK003024	N/A	N/A
☒	Digital multimeter	FLUKE	15B+	30701460WS 15	Nov. 12, 2020	Nov. 11, 2021
☒	Temp & Humidity chamber	Votisch	VT4002	58566133290 020	Apr. 22, 2021	Apr. 21, 2022

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

Test Environment	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
TN/VN	+15 to +35	3.8	20 to 75
TL/VL	-40	2.5	20 to 75
TH/VL	+70	2.5	20 to 75
TL/VH	-40	4.5	20 to 75
TH/VH	+70	4.5	20 to 75

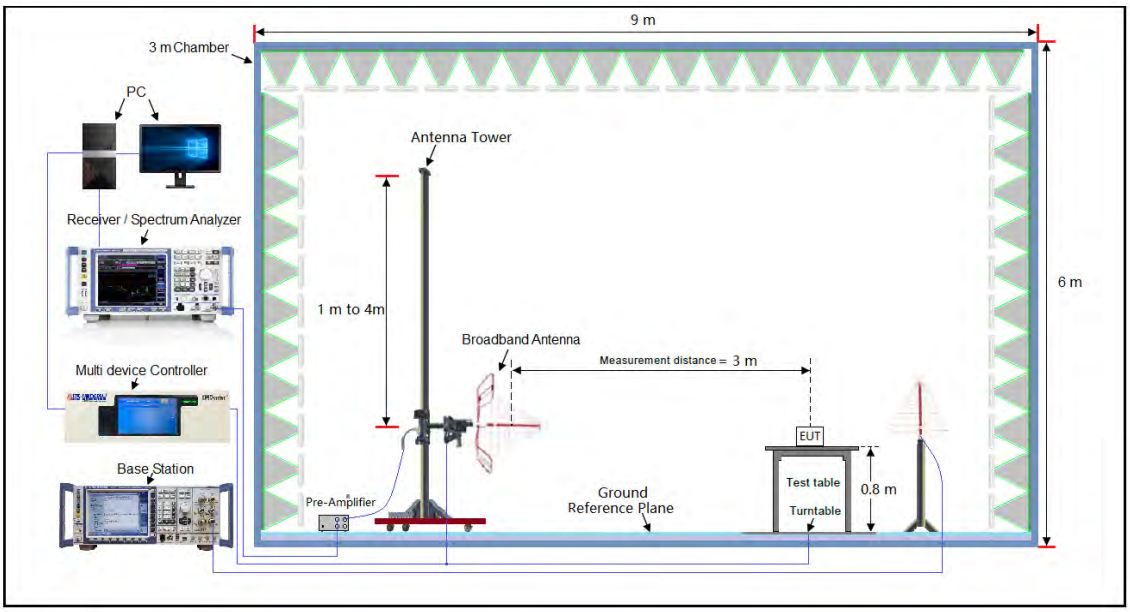
Remark:

1) The EUT just work in such extreme temperature of -40 ℃ to +70 °C and the extreme voltage of 2.5 V to 4.5 V, so here the EUT is tested in the temperature of -40 ℃ to +70 °C and the voltage of 2.5 V to 4.5 V.
2) VN: Normal Voltage; TN: Normal Temperature;
TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;
VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

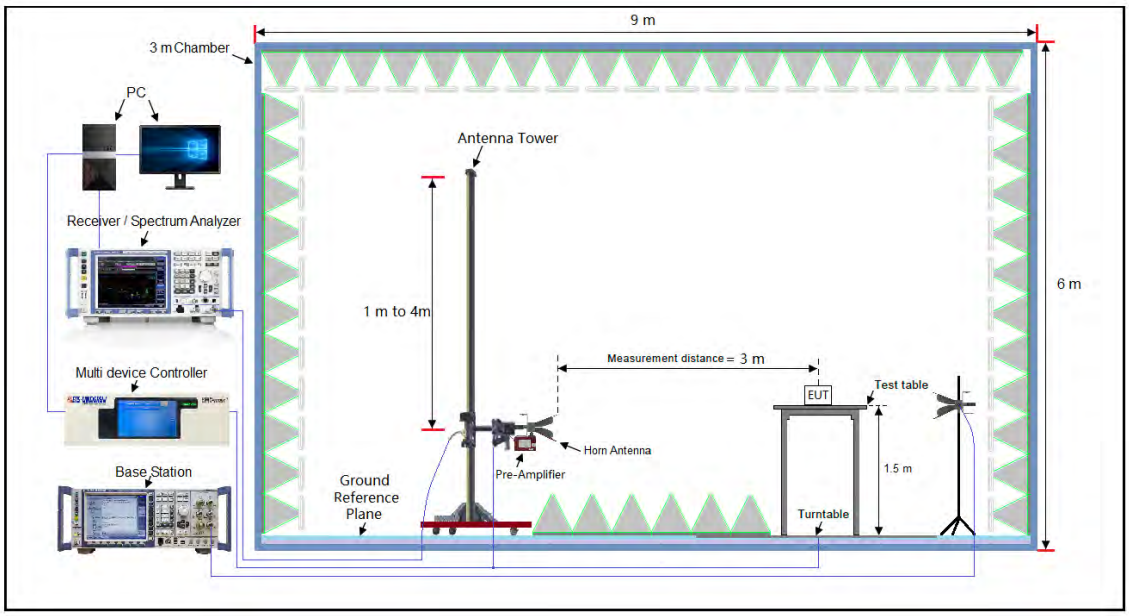
4.2 TEST SETUP

4.2.1 For Radiated Emissions test setup

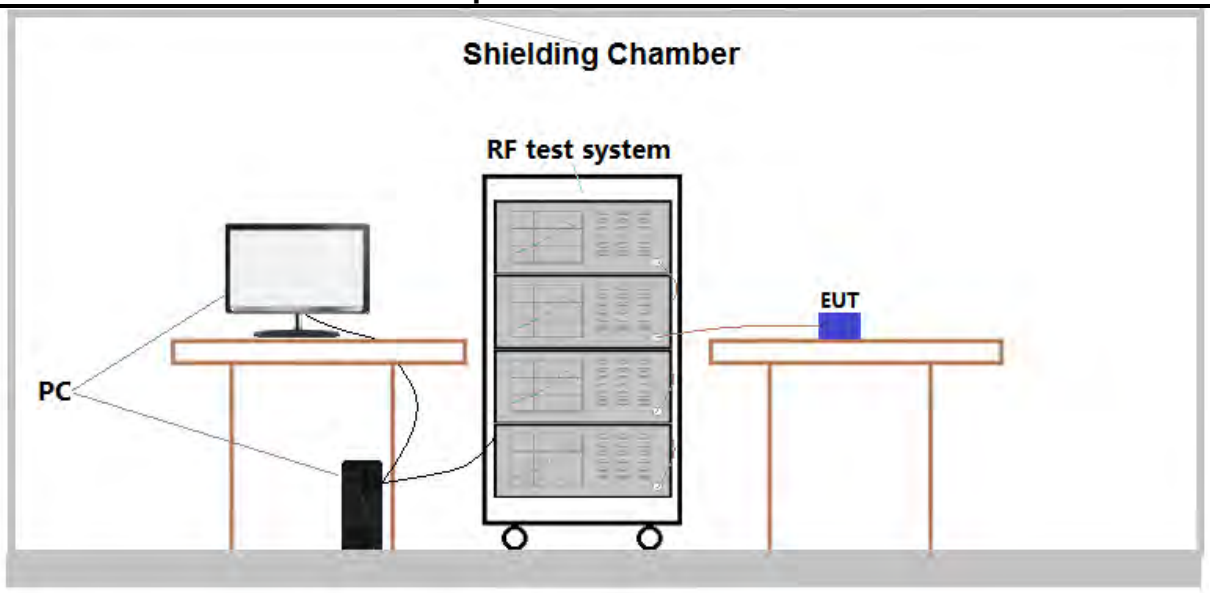
Radiated Emissions 30MHz to 1GHz Test setup



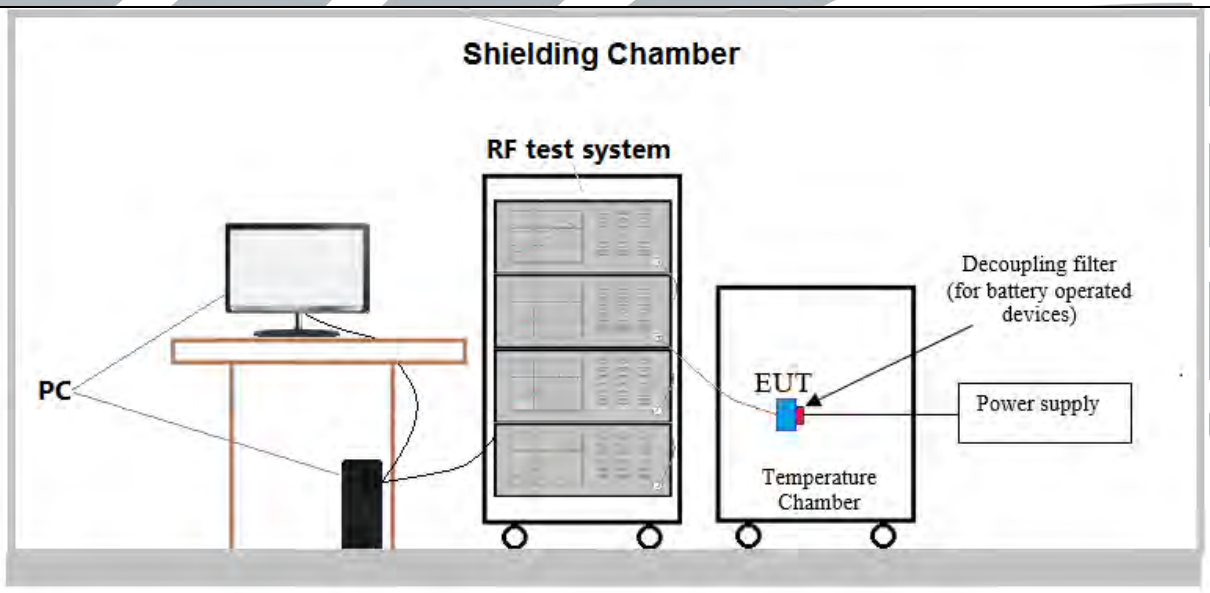
Radiated Emissions Above 1GHz Test setup



4.2.2 For Conducted RF test setup



Normal Environment



Extreme Environment

4.3 TEST CHANNELS

Band	Test Frequency ID	Bandwidth (MHz)	Number [UL]	Frequency of Uplink (MHz)
CAT-M1 LTE Band 8 TX: 897.5-900.5MHz	Low Range	1.4	21632	898.2
	Middle Range	1.4/3	21640	899
	High Range	1.4	21648	899.8

Band	Test Frequency ID	Sub-carrier spacing (KHz)	Number [UL]	Frequency of Uplink (MHz)
NB-IoT LTE Band 8 TX: 897.5-900.5MHz	Low Range	3.75 or 15	21626	897.6
	Middle Range	3.75 or 15	21640	899
	High Range	3.75 or 15	21654	900.4

4.4 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Only the worst case data were recorded in this test report.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X/Y/Z axis, and antenna ports.
The worst case was found when positioned as the table below.

Band	Mode	Antenna Port	Worst-case axis positioning
LTE Band 8	1TX	Chain 0	Z axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.5 PRE-SCAN

Pre-scan under all rate at lowest middle and highest channel, find the transmitter power as below.

LTE Band 8

CAT-M1 Maximum Average Power(dBm)					
Bandwidth	Channel/ Frequency(MHz)	Index	RB# RBstart	Conducted Power (dBm)	
				QPSK	16QAM
1.4MHz	21632/898.2	0	1#0	22.93	21.73
		0	6#0	20.53	20.59
	21640/899	0	1#0	22.88	21.70
		0	6#0	20.54	20.59
	21648/899.8	0	1#5	22.91	21.70
		0	6#0	20.55	20.37
3MHz	21640/899	0	1#0	22.94	21.77
		0	6#0	20.58	20.59

NB-IoT Maximum Average Power (dBm)					
Modulation	Sub-carrier spacing (KHz)	Ntones	Conducted Power (dBm) for low/mid/high channel		
			21626/897.6	21640/899	21654/900.4
BPSK	3.75	1@0	23.32	23.37	23.33
		1@47	23.22	23.32	23.24
	15	1@0	22.06	22.04	22.13
		1@11	21.96	21.93	21.98
QPSK	3.75	1@0	23.31	23.34	23.32
		1@47	23.27	23.27	23.29
	15	1@0	22.05	22.13	22.15
		1@11	21.95	22.03	22.05
	15	12@0	21.16	21.13	21.20

Pre-scan all bandwidth and RB, find worse case mode are chosen to the report, the LTE worse case mode applicability and tested channel detail as below:

CAT-M1 Item	Band	Bandwidth(MHz)		Modulation			RB			Test Channel		
		1.4	3	QPSK	16QAM	64QAM	1	Half	Full	L	M	H
ERP/EIRP	8	☒	☒	☒	☒	☐	☒	☐	☐	☒	☒	☒
Conducted output power	8	☒	☒	☒	☒	☐	☒	☒	☒	☒	☒	☒
99%&26dB Bandwidth	8	☒	☒	☒	☒	☐	☐	☐	☒	☒	☒	☒
peak-to-average ratio	8	☒	☒	☒	☒	☐	☒	☐	☒	☒	☒	☒
Band Edge at antenna terminals	8	☒	☒	☒	☒	☐	☒	☐	☒	☒	☒	☒
Spurious emissions at antenna terminals	8	☒	☒	☒	☒	☐	☒	☐	☐	☒	☒	☒
Field strength of spurious radiation	8	☒	☒	☒	☐	☐	☒	☐	☐	☒	☒	☒
Frequency stability	8	☐	☒	☒	☐	☐	☐	☐	☒	☐	☒	☐

Remark:
The mark "☒" means is chosen for testing; The mark "☐" means is not chosen for testing;
The mark "-" means is not supported bandwidth

NB-IoT Item	Band	Sub-carrier spacing (KHz)		Modulation		Channel		
		3.75	15	BPSK	QPSK	L	M	H
ERP/EIRP	2	☒	☒	☒	☒	☒	☒	☒
Conducted output power	2	☒	☒	☒	☒	☒	☒	☒
99%&26dB Bandwidth	2	☒	☒	☒	☒	☒	☒	☒
peak-to-average ratio	2	☒	☒	☒	☒	☐	☒	☐
Band Edge at antenna terminals	2	☒	☒	☒	☒	☒	☐	☒
Spurious emissions at antenna terminals	2	☐	☒	☐	☒	☒	☒	☒
Field strength of spurious radiation	2	☐	☒	☐	☒	☒	☒	☒
Frequency stability	2	☐	☒	☐	☒	☐	☒	☐

Remark:
The mark "☒" means is chosen for testing; The mark "☐" means is not chosen for testing;
The mark "-" means is not supported bandwidth

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 27	Miscellaneous Wireless Communications Services

5.2 ERP

Test Requirement: FCC 47 CFR Part 2.1046(a)
LTE Band 8 : FCC 47 CFR Part 27.1507(a)(3)

Test Method: KDB 971168 D01v03r01 Section 5.6 & ANSI C63.26-2015

Limit:

FCC 47 CFR Part 27.1507(a)(3):
Mobile, control and auxiliary test stations. Mobile, control and auxiliary test stations must not exceed 10 watts ERP.

Test Procedure:

$$\textbf{ERP or EIRP} = P_{Meas} + G_T - L_C$$

where:
ERP or EIRP = effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;
G_T = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
1) L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

Test Setup: Refer to section 4.2.1 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: See table below

LTE Band 8

CAT-M1 Maximum ERP (dBm)						
Bandwidth	Modulation	Channel/ Frequency(MHz)	RB	Index	EIRP(dBm)	Limit(dBm)
1.4MHz	QPSK	21632/898.2	1#0	0	22.93	40
		21640/899	1#0	0	22.88	40
		21648/899.8	1#5	0	22.91	40
	16QAM	21632/898.2	1#0	0	21.73	40
		21640/899	1#0	0	21.70	40
		21648/899.8	1#5	0	21.70	40
3MHz	QPSK	21640/899	1#0	0	22.94	40
	16QAM	21640/899	1#0	0	21.77	40

NB-IoT Maximum ERP (dBm) Standalone							
Channel	Frequency(MHz)	Modulation	Sub-carrier spacing (KHz)	Ntones	ERP(dBm)	Limit(dBm)	Result
21626	897.6	BPSK	3.75	1@0	23.32	40	Pass
		QPSK	3.75	1@0	23.31	40	Pass
		BPSK	15	1@0	22.06	40	Pass
		QPSK	15	1@0	22.05	40	Pass
21640	899	BPSK	3.75	1@0	23.37	40	Pass
		QPSK	3.75	1@0	23.34	40	Pass
		BPSK	15	1@0	22.04	40	Pass
		QPSK	15	1@0	22.13	40	Pass
21654	900.4	BPSK	3.75	1@0	23.33	40	Pass
		QPSK	3.75	1@0	23.32	40	Pass
		BPSK	15	1@0	22.13	40	Pass
		QPSK	15	1@0	22.15	40	Pass

5.3 CONDUCTED OUTPUT POWER

Test Requirement: FCC 47 CFR Part 2.1046(a)
LTE Band 8: FCC 47 CFR Part 27.1507(a)(3)

Test Method: KDB 971168 D01v03r01 & ANSI C63.26-2015

Limit:

FCC 47 CFR Part 27.1507(a)(3):
Mobile, control and auxiliary test stations. Mobile, control and auxiliary test stations must not exceed 10 watts ERP.

Test Procedure:
The EUT was set up for the maximum power with LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: The full result refer to section 4.5 for details.

5.4 PEAK-TO-AVERAGE RATIO

Test Requirement: **LTE Band 8:** FCC 47 CFR Part 27.1507(d)

Test Method: KDB 971168 D01v03r01 Section 5.7

Limit: PAR limit. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.

a) Set resolution/measurement bandwidth ≥ signal's occupied bandwidth
b) Set the number of counts to a value that stabilizes the measured CCDF curve
c) Record the maximum PAPR level associated with a probability of 0.1 %

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

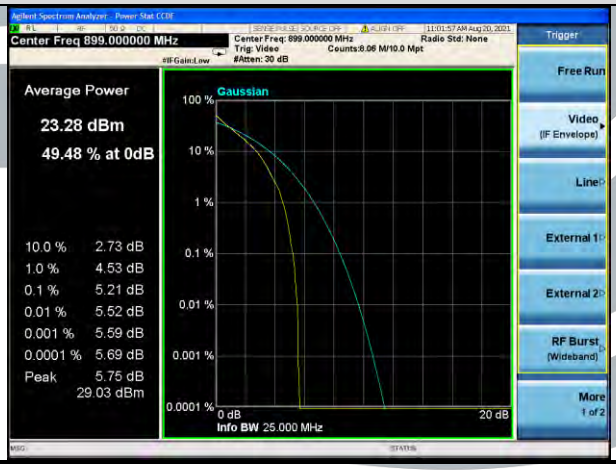
Test Data: See table below

LTE Band 8

CAT-M1 Peak-to-average ratio (dB)					
Bandwidth	**Modulation**	**Channel/ Frequency(MHz)**	**Peak-to-Average Power Ratio (PAPR)**	**Limit (dB)**	**Result**
3MHz	QPSK	21640/899	5.52	13	Pass
	16QAM	21640/899	5.71	13	Pass

LTE Band 8_Middle channel

QPSK



16QAM

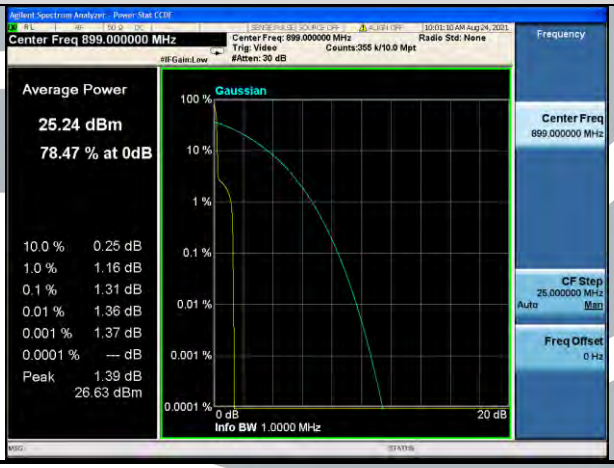
NB-IoT Peak-to-average ratio (dB)					
Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	PAPR(dB)	Limit (dB)	Result
BPSK	3.75	21640/899	1.46	13	Pass
QPSK	3.75	21640/899	1.41	13	Pass
BPSK	15	21640/899	1.31	13	Pass
QPSK	15	21640/899	1.45	13	Pass

LTE Band 8_Middle channel

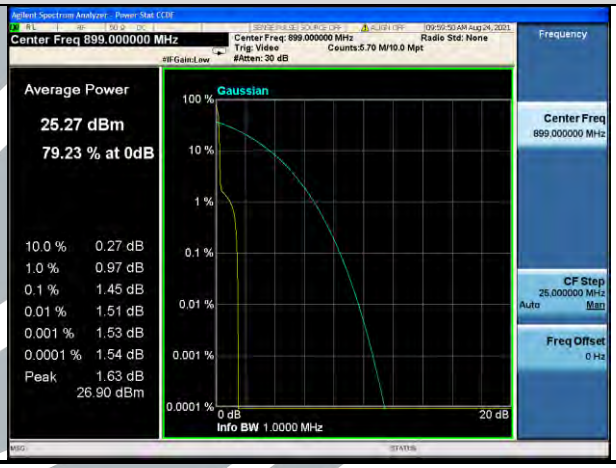
3.75KHz Sub-carrier spacing, BPSK

3.75KHz Sub-carrier spacing, QPSK

15KHz Sub-carrier spacing, BPSK



15KHz Sub-carrier spacing, QPSK



5.5 99%&26DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 2.1049(h)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01 Section 4

Limit: No Limit, for reporting purposes only.

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

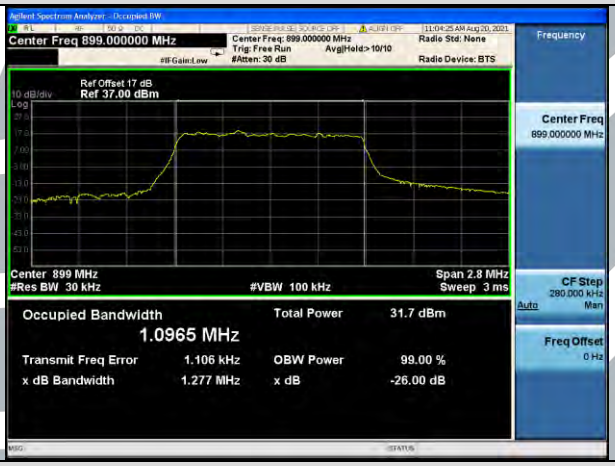
Test Mode: Link mode

Test Results: Pass

Test Data: See table below

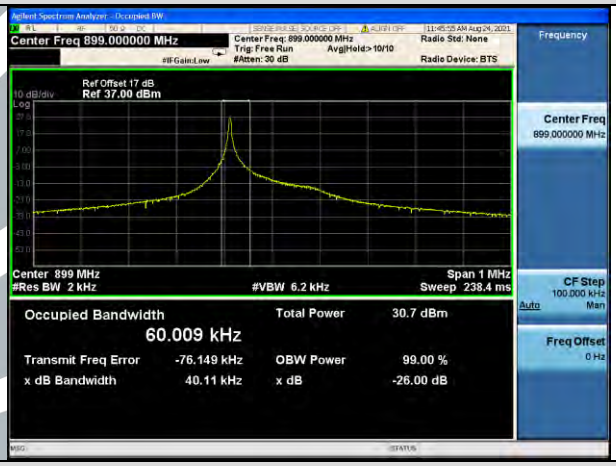
LTE Band 8

CAT-M1 99%&26DB BANDWIDTH				
Bandwidth	Modulation	Channel	Bandwidth(MHz)	
			99% Power	-26dBc
1.4MHz	QPSK	Low	1.0966	1.277
		Mid	1.0965	1.277
		High	1.0955	1.276
	16QAM	Low	0.93634	1.141
		Mid	0.93965	1.289
		High	0.93525	1.271
3MHz	QPSK	Mid	1.1354	1.391
	16QAM	Mid	0.97005	1.191

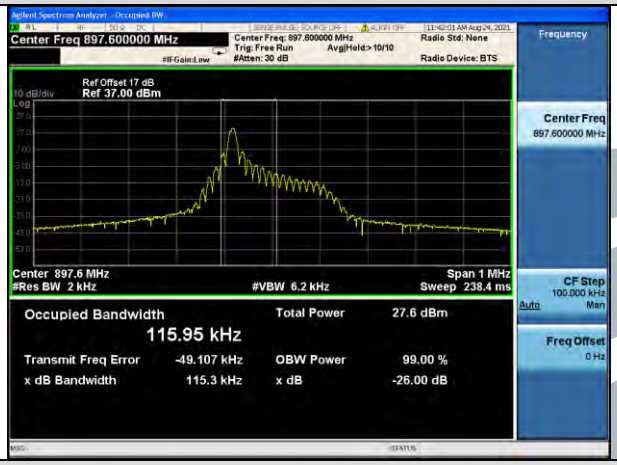
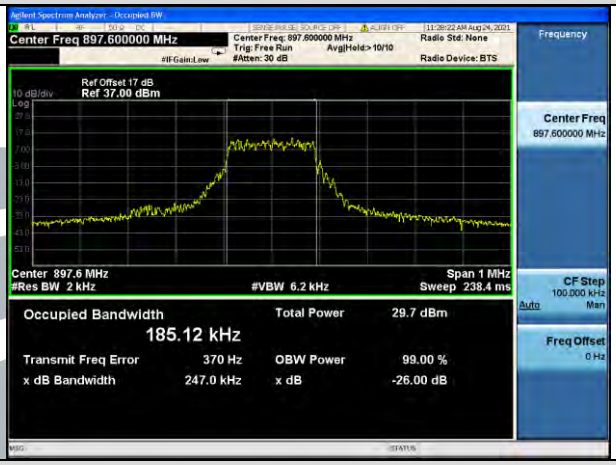
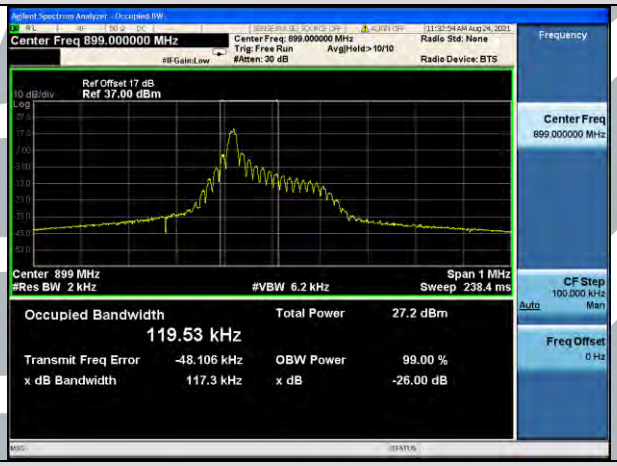
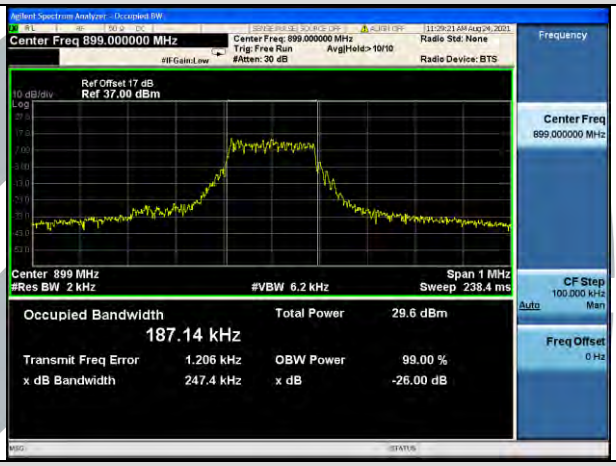
LTE Band 8_ Channel Bandwidth: 1.4 MHz	
QPSK	16QAM
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

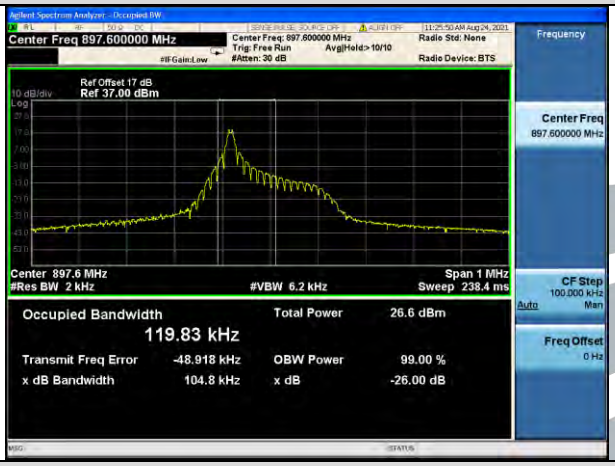
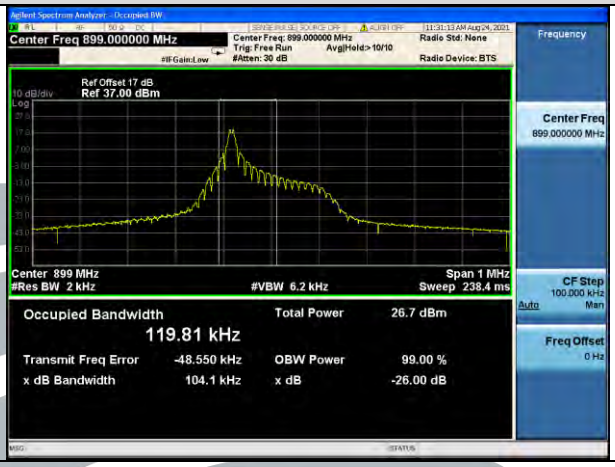
LTE Band 8_ Channel Bandwidth: 3 MHz	
QPSK	16QAM
Middle Channel	
	

NB-IoT 99%&26DB BANDWIDTH								
Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
			Low		Mid		High	
			99% (KHz)	-26dBc (KHz)	99% (KHz)	-26dBc (KHz)	99% (KHz)	-26dBc (KHz)
BPSK	3.75	1@0	51.668	37.70	53.087	37.49	51.925	37.16
QPSK	3.75	1@0	60.096	39.97	60.009	40.11	59.218	39.97
BPSK	15	1@0	119.83	104.8	119.81	104.1	120.41	116.5
QPSK	15	1@0	115.95	115.3	119.53	117.3	121.88	118.3
QPSK	15	12@0	185.12	247.0	187.14	247.4	185.70	246.6

LTE Band 8	
3.75KHz Sub-carrier spacing, Ntones1@0_BPSK	3.75KHz Sub-carrier spacing, Ntones1@0_QPSK
Lowest Channel	
	
Middle Channel	
	
Highest Channel	


Agilent Spectrum Analyzer - Occupied BW
Center Freq 900.400000 MHz
Center Freq: 900.400000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 17 dB
10 dB/div
Ref 37.00 dBm
Center Freq
900.400000 MHz
Center 900.4 MHz
#Res BW 2 kHz
#VBW 6.2 kHz
Span 1 MHz
Sweep 238.4 ms
CF Step
100.000 kHz
Auto
Man
Occupied Bandwidth
51.925 kHz
Total Power
30.0 dBm
Transmit Freq Error
-79.922 kHz
OBW Power
99.00 %
x dB Bandwidth
37.16 kHz
x dB
-26.00 dB
Freq Offset
0 Hz
MSG
STATUS
Agilent Spectrum Analyzer - Occupied BW
Center Freq 900.400000 MHz
Center Freq: 900.400000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 17 dB
10 dB/div
Ref 37.00 dBm
Center Freq
900.400000 MHz
Center 900.4 MHz
#Res BW 2 kHz
#VBW 6.2 kHz
Span 1 MHz
Sweep 238.4 ms
CF Step
100.000 kHz
Auto
Man
Occupied Bandwidth
59.218 kHz
Total Power
30.7 dBm
Transmit Freq Error
-76.301 kHz
OBW Power
99.00 %
x dB Bandwidth
39.97 kHz
x dB
-26.00 dB
Freq Offset
0 Hz
MSG
STATUS

LTE Band 8	
15KHz Sub-carrier spacing, Ntones1@0_QPSK	15KHz Sub-carrier spacing, Ntones12@0_QPSK
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

LTE Band 8	
15KHz Sub-carrier spacing, Ntones1@0_BPSK	
Lowest Channel	**Middle Channel**
	
Highest Channel	
	N/A

5.6 BAND EDGE AT ANTENNA TERMINALS

Test Requirement: **LTE Band 8:** FCC 47 CFR Part 27.1509(a)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit:

FCC 47 CFR Part 27.1509(a):

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:
(a) For 900 MHz broadband operations in 897.5-900.5 MHz band by at least 43 + 10 log (P) dB.

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.
For each band edge measurement:

1) Set the spectrum analyzer span to include the block edge frequency.
2) Set a marker to point the corresponding band edge frequency in each test case.
3) Set display line at -13 dBm
4) Set resolution bandwidth to at least 1% of emission bandwidth.
5) Set spectrum analyzer with RMS detector.
6) Record the max trace plot into the test report

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

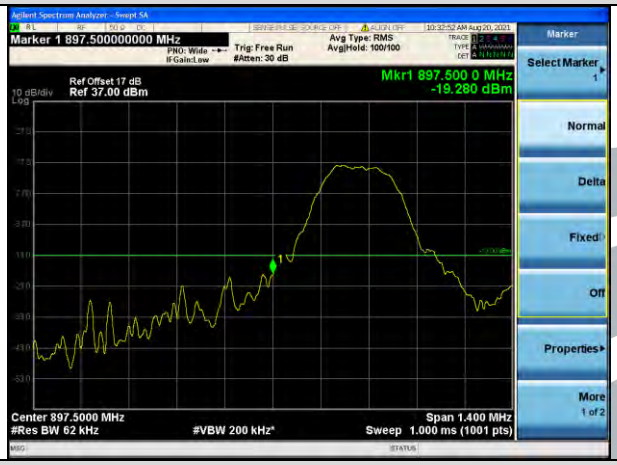
Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

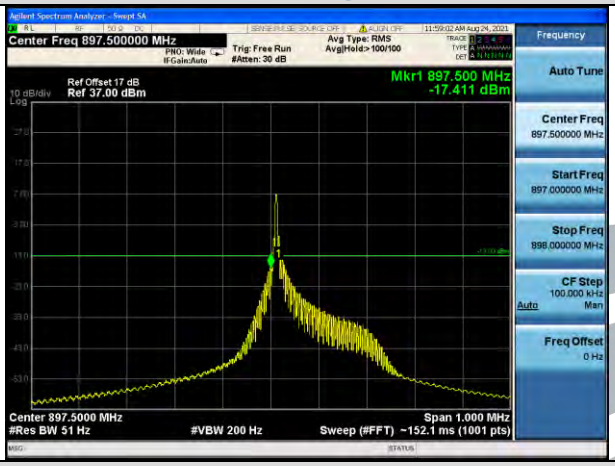
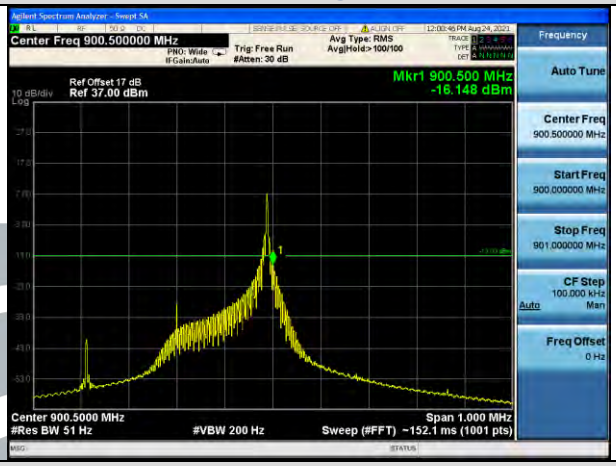
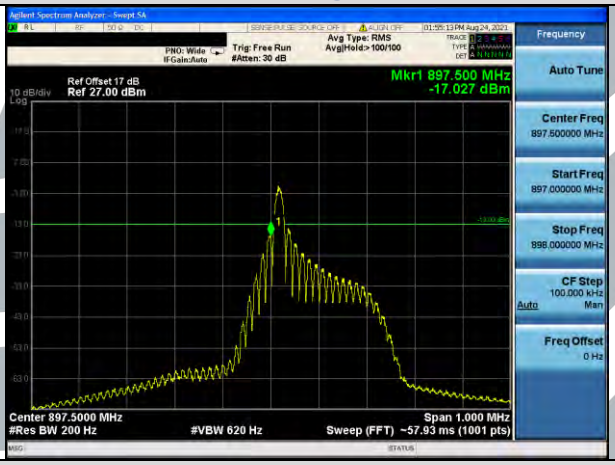
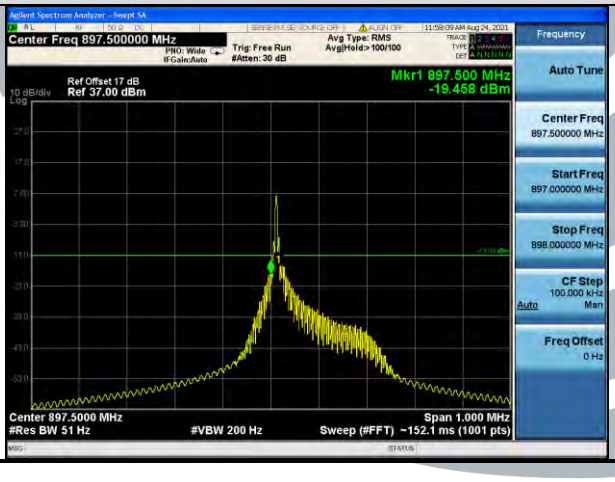
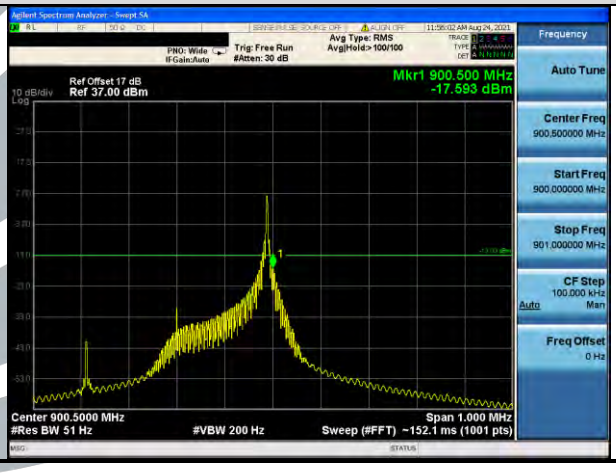
LTE Band 8

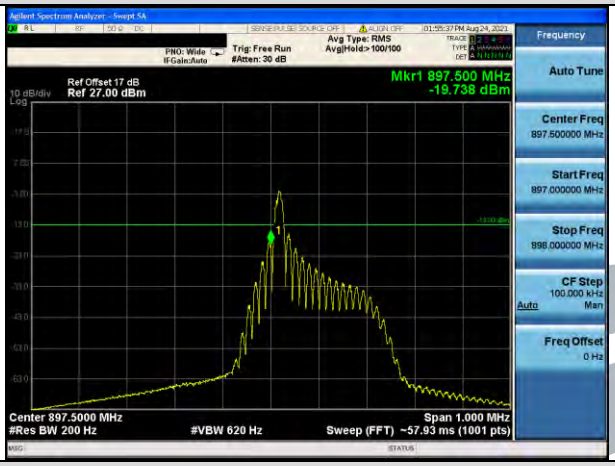
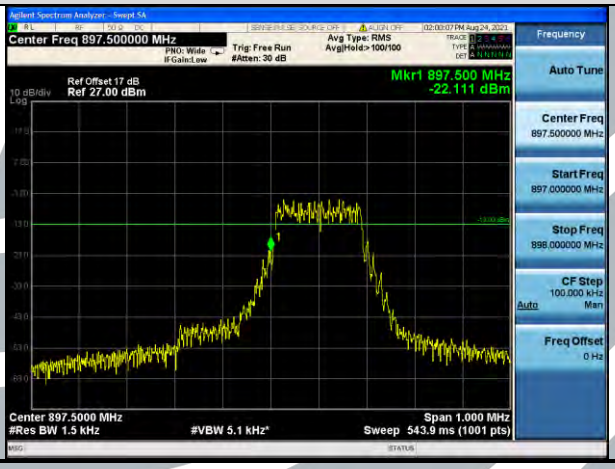
CAT-M1 / 1.4 MHz / QPSK	
1 RB	Full RB
Lowest Channel	
	
Highest Channel	
	

CAT-M1 / 3 MHz / QPSK	
1 RB	Full RB
Middle Channel	
	
	

CAT-M1 / 1.4 MHz / 16QAM	
1 RB	Full RB
Lowest Channel	
	
Highest Channel	
	

CAT-M1 / 3 MHz / 16QAM	
1 RB	Full RB
Middle Channel	
	
	

NB-IoT	
BPSK 3.75kHz 1@0 CH-Low	BPSK 3.75kHz 1@47 CH-High
	
BPSK 15kHz 1@0 CH-Low	BPSK 15kHz 1@11 CH-High
	
QPSK 3.75kHz 1@0 CH-Low	QPSK 3.75kHz 1@47 CH-High
	

QPSK 15kHz 1@0 CH-Low	QPSK 15kHz 1@11 CH-High
	
QPSK 15kHz 12@0 CH-Low	**QPSK 15kHz 12@0 CH-High**
	

5.7 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Requirement: **LTE Band 8:** FCC 47 CFR Part 27.1509(a)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit:

FCC 47 CFR Part 27.1509(a):

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:
(a) For 900 MHz broadband operations in 897.5-900.5 MHz band by at least 43 + 10 log (P) dB.

Test Procedure:

The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range. b. Measuring frequency range is from 30 MHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

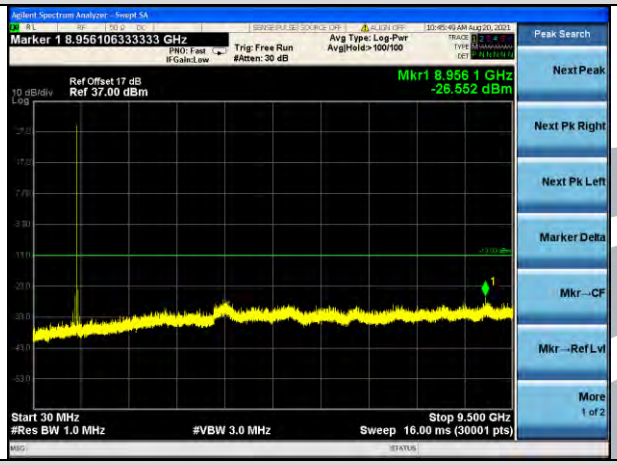
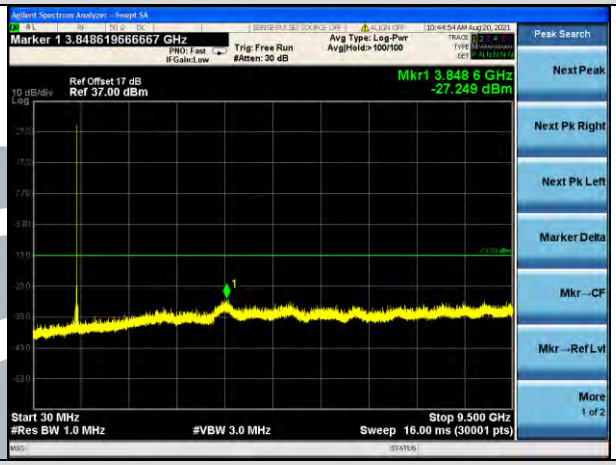
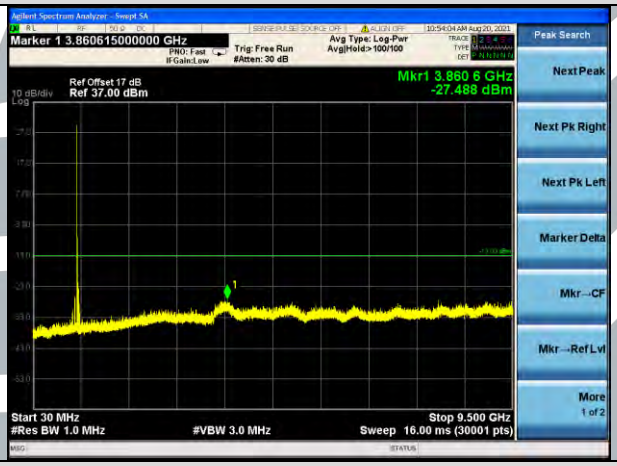
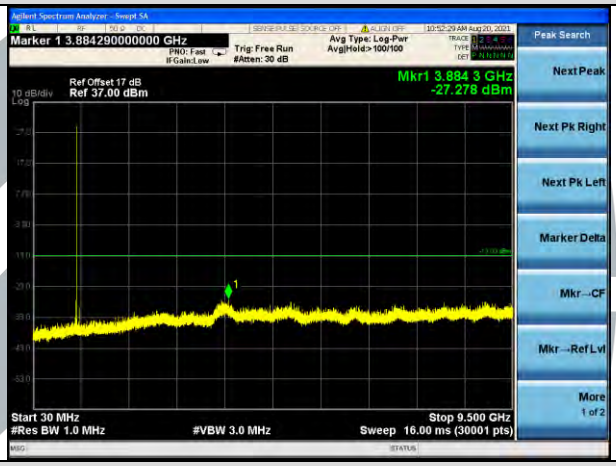
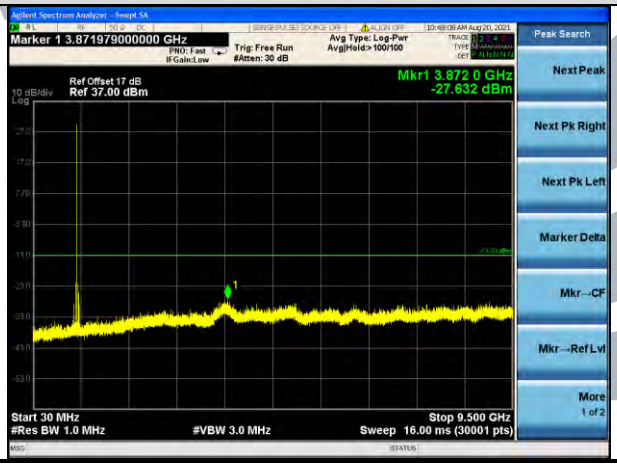
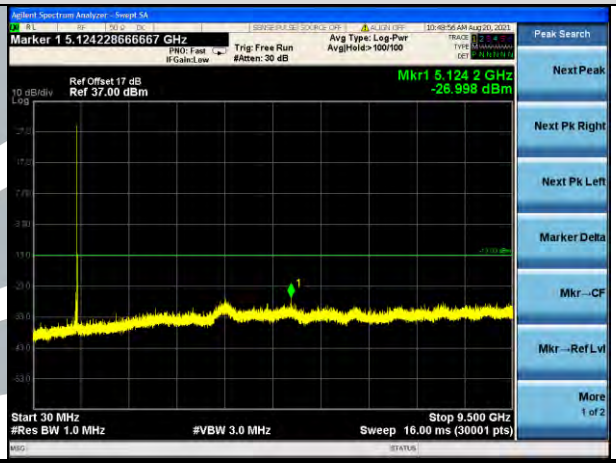
Test Setup: Refer to section 4.2.2 for details.

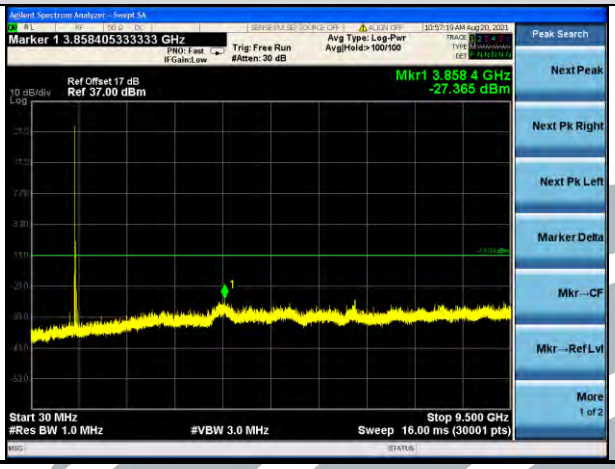
Instruments Used: Refer to section 3 for details

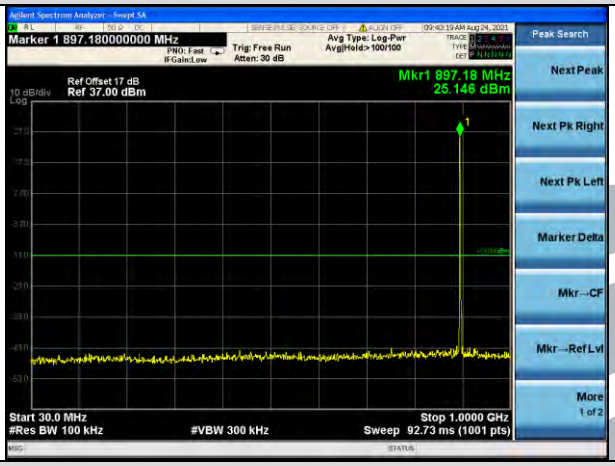
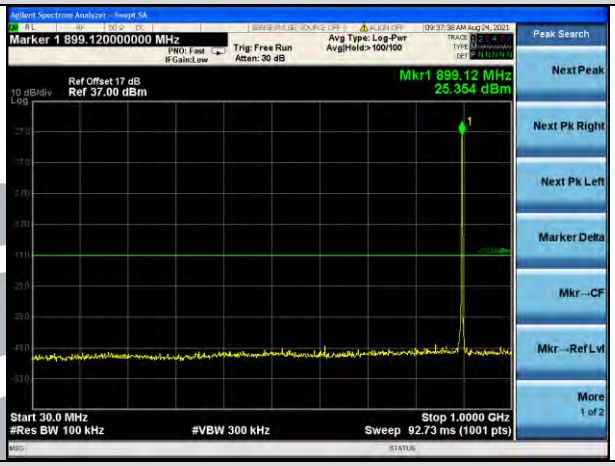
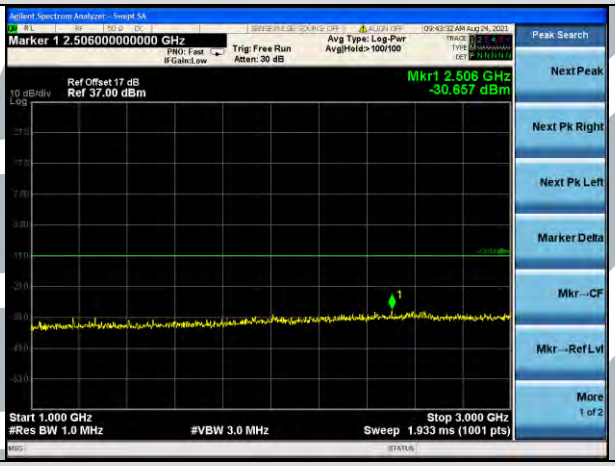
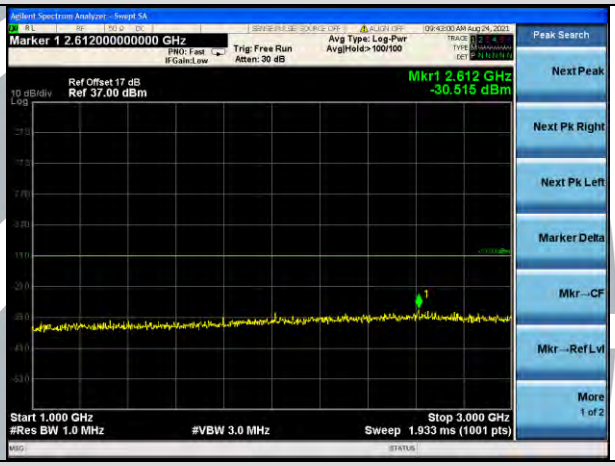
Test Mode: Link mode

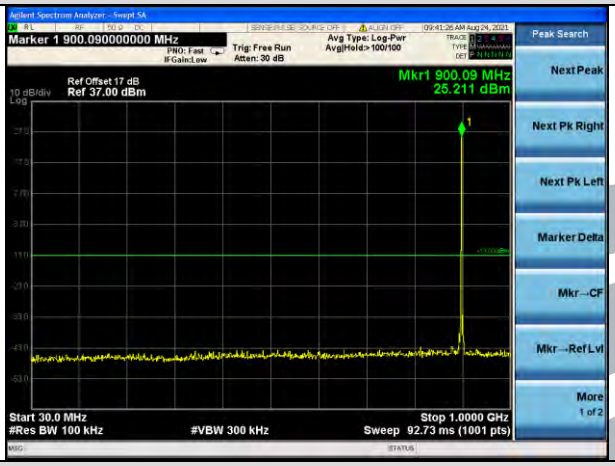
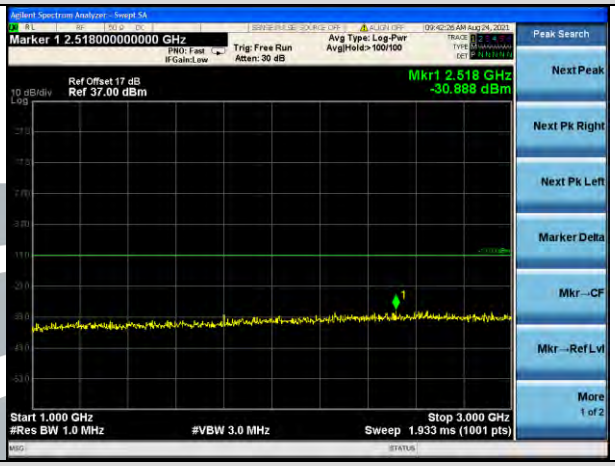
Test Results: Pass

LTE Band 8

CAT-M1_ Channel Bandwidth: 1.4 MHz	
QPSK	16QAM
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

CAT-M1_ Channel Bandwidth: 3 MHz	
QPSK	16QAM
Middle Channel	
	

NB-IoT	
Lowest Channel	**Middle Channel**
30MHz-1GHz	
	
1GHz-3GHz	
	
3GHz-20GHz	
	

NB-IoT	
Highest Channel	
30MHz-1GHz	1GHz-3GHz
	
3GHz-20GHz	
	N/A

Remark:

1) All the above radiation data, the fundamental frequency is not marked, it may exceed the limit, please ignore it.

5.8 FIELD STRENGTH OF SPURIOUS RADIATION

Test Requirement: **LTE Band 8:** FCC 47 CFR Part 27.1509(a)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009 MHz-30 MHz	Peak	10 kHz	30 KHz	Peak
30 MHz-1 GHz	Quasi-peak	100 kHz	300 KHz	Peak
Above 1 GHz	Peak	1 MHz	3 MHz	Peak

Limits:

FCC 47 CFR Part 27.1509(a):

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:

(a) For 900 MHz broadband operations in 897.5-900.5 MHz band by at least 43 + 10 log (P) dB.

Test Setup: Refer to section 4.2.1 for details.

Test Procedures: KDB 971168 D01v03r01 Section 7

Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

LTE Band 8

CAT-M1_ 1.4 MHz_ QPSK							
No.	Frequency	SA Reading	Correction factor	EIRP Result	Limit	Margin	Ant. Pol.
	(MHz)	(dBm)	(dB/m)	(dBm)	(dBm)	(dB)	
Lowest Channel							
1	586.217	-88.85	38.05	-50.80	-13.00	-37.80	Horizontal
2	693.910	-89.45	40.62	-48.83	-13.00	-35.83	Horizontal
3	781.961	-88.90	41.05	-47.85	-13.00	-34.85	Horizontal
4	1796.400	-60.69	0.94	-59.75	-13.00	-46.75	Horizontal
5	2694.600	-64.44	3.38	-61.06	-13.00	-48.06	Horizontal
6	578.036	-88.70	38.30	-50.40	-13.00	-37.40	Vertical
7	703.731	-88.08	39.62	-48.46	-13.00	-35.46	Vertical
8	798.620	-88.00	40.59	-47.41	-13.00	-34.41	Vertical
9	1796.400	-61.05	0.27	-60.78	-13.00	-47.78	Vertical
10	2694.600	-64.46	2.82	-61.64	-13.00	-48.64	Vertical
Middle Channel							
1	535.038	-89.65	37.47	-52.18	-13.00	-39.18	Horizontal
2	611.462	-89.32	39.04	-50.28	-13.00	-37.28	Horizontal
3	713.692	-88.92	40.45	-48.47	-13.00	-35.47	Horizontal
4	1798.000	-60.82	0.95	-59.87	-13.00	-46.87	Horizontal
5	2697.000	-63.94	3.38	-60.56	-13.00	-47.56	Horizontal
6	558.079	-88.88	38.02	-50.86	-13.00	-37.86	Vertical
7	703.731	-88.69	39.62	-49.07	-13.00	-36.07	Vertical
8	821.387	-87.64	41.12	-46.52	-13.00	-33.52	Vertical
9	1798.000	-59.66	0.29	-59.37	-13.00	-46.37	Vertical
10	2697.000	-64.61	2.83	-61.78	-13.00	-48.78	Vertical
Highest Channel							
1	523.876	-88.10	37.44	-50.66	-13.00	-37.66	Horizontal
2	689.051	-89.77	40.52	-49.25	-13.00	-36.25	Horizontal
3	862.802	-88.14	41.30	-46.84	-13.00	-33.84	Horizontal
4	1799.600	-61.20	0.96	-60.24	-13.00	-47.24	Horizontal
5	2699.400	-61.67	3.40	-58.27	-13.00	-45.27	Horizontal
6	427.292	-90.34	35.47	-54.87	-13.00	-41.87	Vertical
7	538.811	-88.32	37.64	-50.68	-13.00	-37.68	Vertical
8	754.963	-88.56	38.98	-49.58	-13.00	-36.58	Vertical
9	1799.600	-61.92	0.30	-61.62	-13.00	-48.62	Vertical
10	2699.400	-64.85	2.84	-62.01	-13.00	-49.01	Vertical

CAT-M1_ 3 MHz_ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Middle Channel							
1	418.378	-89.44	34.96	-54.48	-13.00	-41.48	Horizontal
2	527.571	-89.40	37.49	-51.91	-13.00	-38.91	Horizontal
3	698.804	-88.87	40.73	-48.14	-13.00	-35.14	Horizontal
4	1798.000	-61.03	0.95	-60.08	-13.00	-47.08	Horizontal
5	2697.000	-65.16	3.38	-61.78	-13.00	-48.78	Horizontal
6	546.437	-89.44	37.78	-51.66	-13.00	-38.66	Vertical
7	698.804	-88.35	39.59	-48.76	-13.00	-35.76	Vertical
8	868.886	-88.43	41.30	-47.13	-13.00	-34.13	Vertical
9	1798.000	-62.41	0.29	-62.12	-13.00	-49.12	Vertical
10	2697.000	-64.44	2.83	-61.61	-13.00	-48.61	Vertical

NB-IoT _ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Lowest Channel							
1	602.929	-89.02	38.90	-50.12	-13.00	-37.12	Horizontal
2	693.910	-89.59	40.62	-48.97	-13.00	-35.97	Horizontal
3	798.620	-88.91	41.42	-47.49	-13.00	-34.49	Horizontal
4	1795.200	-62.63	0.93	-61.70	-13.00	-48.70	Horizontal
5	2692.800	-64.38	3.38	-61.00	-13.00	-48.00	Horizontal
6	495.238	-88.78	36.72	-52.06	-13.00	-39.06	Vertical
7	703.731	-89.58	39.62	-49.96	-13.00	-36.96	Vertical
8	821.387	-88.24	41.12	-47.12	-13.00	-34.12	Vertical
9	1795.200	-60.78	0.27	-60.51	-13.00	-47.51	Vertical
10	2692.800	-64.10	2.82	-61.28	-13.00	-48.28	Vertical
Middle Channel							
1	562.014	-88.85	37.42	-51.43	-13.00	-38.43	Horizontal
2	708.694	-88.81	40.56	-48.25	-13.00	-35.25	Horizontal
3	793.028	-87.65	41.30	-46.35	-13.00	-33.35	Horizontal
4	1798.000	-62.40	0.95	-61.45	-13.00	-48.45	Horizontal
5	2697.000	-65.03	3.38	-61.65	-13.00	-48.65	Horizontal
6	554.171	-89.98	37.93	-52.05	-13.00	-39.05	Vertical
7	628.894	-89.36	37.85	-51.51	-13.00	-38.51	Vertical
8	827.179	-88.60	41.18	-47.42	-13.00	-34.42	Vertical
9	1798.000	-62.46	0.29	-62.17	-13.00	-49.17	Vertical
10	2697.000	-63.67	2.83	-60.84	-13.00	-47.84	Vertical
Highest Channel							
1	484.907	-88.95	36.16	-52.79	-13.00	-39.79	Horizontal
2	642.292	-89.03	39.29	-49.74	-13.00	-36.74	Horizontal
3	765.648	-87.81	40.69	-47.12	-13.00	-34.12	Horizontal
4	1800.800	-62.68	0.97	-61.71	-13.00	-48.71	Horizontal
5	2701.200	-61.82	3.40	-58.42	-13.00	-45.42	Horizontal
6	554.171	-89.65	37.93	-51.72	-13.00	-38.72	Vertical
7	693.910	-89.42	39.32	-50.10	-13.00	-37.10	Vertical
8	809.924	-88.79	40.87	-47.92	-13.00	-34.92	Vertical
9	1800.800	-61.46	0.31	-61.15	-13.00	-48.15	Vertical
10	2701.200	-64.32	2.84	-61.48	-13.00	-48.48	Vertical

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit

5.9 FREQUENCY STABILITY

Test Requirement: FCC 47 CFR Part 2.1055 &

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limits:

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Setup: Refer to section 4.2.2 for details.

Test Procedures:

1) Use CMW 500 or CMU 200 with Frequency Error measurement capability.
   a) Temp. = −30° to + 50°C
   b) Voltage =low voltage, 2.5 Vdc, Normal, 3.8 Vdc and High voltage, 4.5 Vdc.
2) Frequency Stability vs Temperature:

The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

3) Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

Equipment Used: Refer to section 3 for details.

Test Result: Pass

LTE Band 8

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
CAT-M1 / 3MHz / Full RB							
QPSK	21640 / 899.0	VL	TN	-5.46	-0.0029	N/A	Pass
		VN		-4.09	-0.0022		Pass
		VH		-5.39	-0.0029		Pass
		VN	50	-6.45	-0.0034		Pass
			40	-4.48	-0.0024		Pass
			30	-5.51	-0.0029		Pass
			20	-5.78	-0.0031		Pass
			10	-6.51	-0.0035		Pass
			0	-4.75	-0.0025		Pass
			-10	-4.89	-0.0026		Pass
			-20	-6.15	-0.0033		Pass
			-30	-4.33	-0.0023		Pass

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
NB-IoT LTE Band 8							
QPSK	21640 / 899.0	VL	TN	-4.78	-0.0028	N/A	Pass
		VN		-6.46	-0.0037		Pass
		VH		-6.30	-0.0036		Pass
		VN	50	-7.52	-0.0043		Pass
			40	-8.75	-0.0051		Pass
			30	-4.87	-0.0028		Pass
			20	-9.05	-0.0052		Pass
			10	-7.27	-0.0042		Pass
			0	-5.07	-0.0029		Pass
			-10	-5.11	-0.0029		Pass
			-20	-6.33	-0.0037		Pass
			-30	-5.79	-0.0033		Pass

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.
