

TEST REPORT

Applicant Name : Safe360 LLC
Address : 8148 lefferts blvd, Kew Gardens, NY 11415, United States
Report Number : XMTN1220906-40328E-RF
FCC ID: 2A8AB153D

Test Standard (s)

FCC PART 27; FCC PART 24E

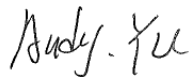
Sample Description

Product: Cellular 4G/LTE water and freeze sensor
Model No.: 153D
Trademark: Safe360
Date Received: 2022-09-06
Date of Test: 2022-10-09 to 2022-11-05
Report Date: 2022-11-07

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:



Audy.Yu
EMC Engineer

Approved By:



Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	XMTN1220906-40328E-RF	Original Report	2022-11-07

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Cellular 4G/LTE water and freeze sensor
Tested Model	153D
Radio	LTE Cat M1
Frequency Range	LTE Band 2: 1850-1910MHz(TX); 1930-1990MHz(RX) LTE Band 4: 1710-1755MHz(TX); 2110-2155MHz(RX)
Maximum Output Power (Conducted power)	LTE Band 2: 19.67dBm; LTE Band 4: 20.33dBm;
Modulation Technique	LTE: QPSK, 16QAM
Antenna Specification*	Internal Antenna: 5 dBi (provided by the applicant):
Voltage Range	DC 1.5V*2 AA battery
Sample serial number	XMTN1220906-40328E-RF-S1(RF Radiated Test) XMTN1220906-40328E-RF-S2(RF Conducted Test) (Assigned by ATC, Shenzhen)
Sample/EUT Status	Good condition
Normal/Extreme Condition	L.V.: Low Voltage 2.6 V _{DC} N.V.: Normal Voltage 3 V _{DC} (provided by applicant)

Objective

This test report is in accordance with Part 2-Subpart J, Part 24-Subpart E, and Subpart 27 of the Federal Communication Commission's rules.

The objective is to determine the compliance of the EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability and band edge.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2-Subpart J as well as the following parts:

Part 24 Subpart E - Personal Communication Services
Part 27 - Miscellaneous Wireless Communications Services

ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
RF Frequency		0.082×10^{-7}
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
Temperature		1°C
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISED), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The final qualification test was performed with the EUT operating at normal mode.

The test items were performed with the EUT operating at testing mode. Test was performed with channels as below table:

Frequency band	Bandwidth (MHz)	Test Frequency(MHz)		
		Low	Middle	High
LTE B2	1.4	1850.7	1880	1909.3
	3	1851.5	1880	1908.5
	5	1852.5	1880	1907.5
	10	1855	1880	1905
	15	1857.5	1880	1902.5
	20	1860	1880	1900
LTE B4	1.4	1710.7	1732.5	1754.3
	3	1711.5	1732.5	1753.5
	5	1712.5	1732.5	1752.5
	10	1715	1732.5	1750
	15	1717.5	1732.5	1747.5
	20	1720	1732.5	1745

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

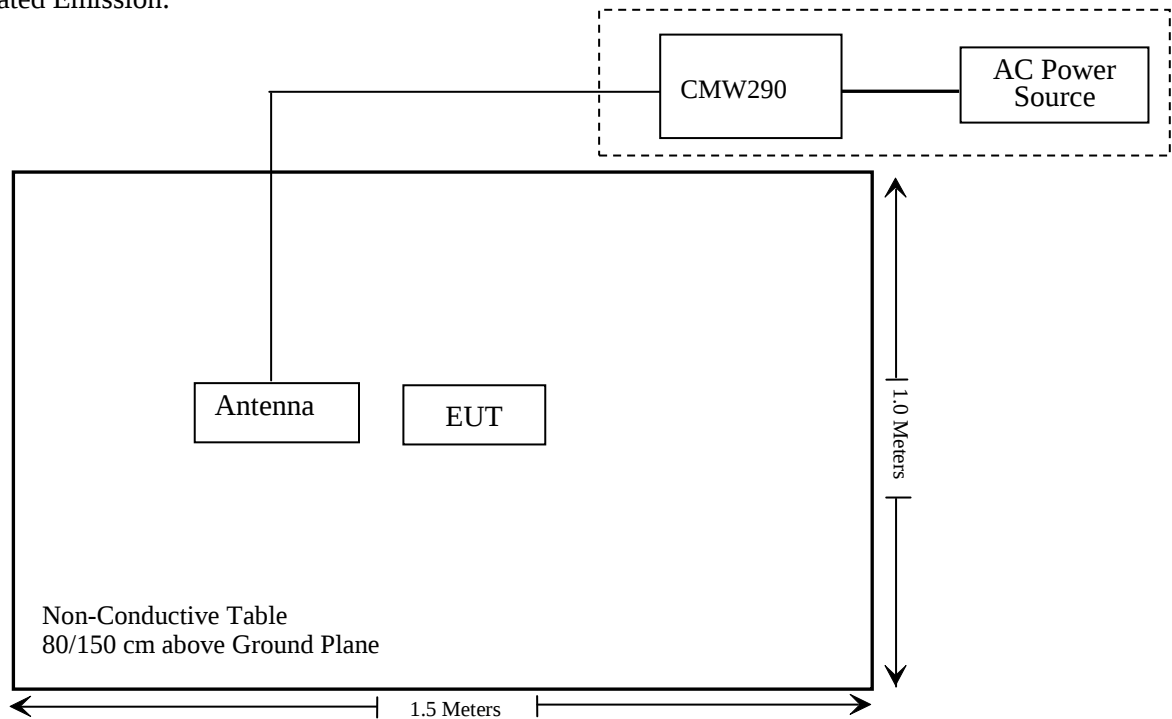
Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Functional Radio Communication Tester	CMW290	154606

Support Cable Description

Cable Description	Length (m)	From / Port	To
Unshielded Un-detachable AC cable	1.2	AC Power	CMW290

Block Diagram of Test Setup

For Radiated Emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§ 1.1310 & §2.1091	RF Exposure Evaluation	Compliant
§2.1046;§ 24.232 (c)(d); §27.50 (d)	RF Output Power	Compliant
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049;§ 24.238; §27.53	Occupied Bandwidth	Compliant
§ 2.1051;§ 24.238 (a); §27.53;	Spurious Emissions at Antenna Terminal	Compliant
§ 2.1053; § 24.238 (a); §27.53	Field Strength of Spurious Radiation	Compliant
§ 24.238 (a); §27.53 (h)	Band Edge	Compliant
§ 2.1055; § 24.235; §27.54;	Frequency stability	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Quinstar	Amplifier	QLW-184055 36-J0	15964001002	2021/11/11	2022/11/10
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Bilog Antenna	VULB9163	9163-194	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-655	2020/01/05	2023/01/04
PASTERNAK	Horn Antenna	PE9852/2F-20	1120 (ATC-BA-024-1)	2020/01/05	2023/01/04
PASTERNAK	Horn Antenna	PE9852/2F-20	1120 (ATC-BA-025-1)	2020/01/05	2023/01/04
Agilent	Signal Generator	N5183A	MY51040755	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.15	N600	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.16	N650	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.16	N200	2021/12/14	2022/12/13

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101948	2021/12/13	2022/12/12
Rohde & Schwarz	Functional Radio Communication Tester	CMW290	154606	2021/12/13	2022/12/12
HP	6dB Attenuator	8493B 6dB Attenuator	2708A 04769	2021/12/14	2022/12/13
Unknown	Band Reject Filter	MSF1850-191 OMS-1148	ATCE-142	2021/12/14	2022/12/13
Unknown	Band Reject Filter	MSF1710-178 5MS-1150	ATCE-144	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	/
Mini-Circuits	Power Splitter	DC-18000MH z	SF10944151S	2021/12/14	2022/12/13
UNI-T	DC Power Supply	UTP8305B	10584	NCR	NCR
Fluke	Desktop Multi Meter	45	7664009	2021/12/14	2022/12/13
REALE	Temp. & Humid. Chamber	RHP-800BT	R20170318310	2021/12/14	2022/12/13

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091 –RF EXPOSURE EVALUATION

Applicable Standard

According to KDB 447498 D04 Interim General RF Exposure Guidance v01, clause 2.1.4 –MPE-Based Exemption:

An alternative to the SAR-based exemption is provided in § 1.1307(b)(3)(i)(C), for a much wider frequency range, from 300 kHz to 100 GHz, applicable for separation distances greater or equal to $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power. For this case, a RF source is an RF exempt device if its ERP (watts) is no more than a frequency-dependent value, as detailed tabular form in Appendix B. These limits have been derived based on the basic specifications on Maximum Permissible Exposure (MPE) considered for the FCC rules in § 1.1310(e)(1).

Table to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.

f = frequency in MHz;

R = minimum separation distance from the body of a nearby person (appropriate units, e.g., m);

Test Result:

For worst case:

Mode	Frequency Range (MHz)	Tune-up Output Power		Antenna Gain		ERP		Evaluation Distance (cm)	ERP Limit (W)
		(dBm)	(W)	(dBi)	(dBd)	(dBm)	(W)		
Band 2	1850-1910	20	0.10	5	2.85	22.85	0.193	20	0.768
Band 4	1710-1755	20.5	0.11	5	2.85	23.35	0.216	20	0.768

Note 1: The tune-up power was declared by the applicant.

Note 2: 0dBd=2.15dBi.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

FCC §2.1047 - MODULATION CHARACTERISTIC

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

FCC § 2.1046, § 24.232 (c)(d); §27.50 (d) - RF OUTPUT POWER

Applicable Standard

According to FCC §2.1046 and §24.232 (c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to FCC §2.1046 and §24.232 (d), Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of § 24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

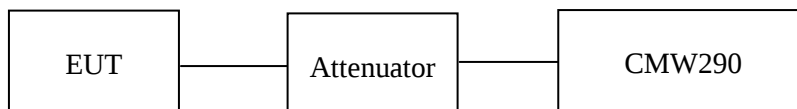
According to §27.50(d), Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

Test Procedure

Conducted method:

ANSI C63.26-2015 Section 5.2.

The RF output of the transmitter was connected to the CMW290 through sufficient attenuation.



Note: the path loss (cable loss and attenuator) has included in the result.

Radiated method:

ANSI C63.26-2015 Section 5.5.

Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Jesse Chen on 2022-10-14.

LTE Band 2

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
1.4	QPSK	RB1#0	19.32	19.01	18.93	24.32	24.01	23.93
		RB1#3	19.13	18.89	18.70	24.13	23.89	23.70
		RB1#5	19.06	18.80	18.59	24.06	23.80	23.59
		RB3#0	18.22	17.83	17.72	23.22	22.83	22.72
		RB3#3	18.05	17.72	17.59	23.05	22.72	22.59
		RB6#0	16.90	16.71	16.69	21.90	21.71	21.69
	16QAM	RB1#0	18.24	17.85	17.75	23.24	22.85	22.75
		RB1#3	18.09	17.77	17.92	23.09	22.77	22.92
		RB1#5	17.96	17.60	18.05	22.96	22.60	23.05
		RB3#0	16.74	16.50	16.62	21.74	21.50	21.62
		RB3#3	16.73	16.45	16.40	21.73	21.45	21.40
		RB5#0	16.88	16.64	16.68	21.88	21.64	21.68
3.0	QPSK	RB1#1	19.19	19.03	19.22	24.19	24.03	24.22
		RB1#4	19.01	18.90	18.98	24.01	23.90	23.98
		RB1#6	19.09	18.82	18.94	24.09	23.82	23.94
		RB3#1	18.14	17.84	17.94	23.14	22.84	22.94
		RB3#4	18.01	17.74	17.76	23.01	22.74	22.76
		RB6#1	16.91	16.72	16.75	21.91	21.72	21.75
	16QAM	RB1#1	18.06	17.85	17.78	23.06	22.85	22.78
		RB1#4	17.96	17.80	17.80	22.96	22.80	22.80
		RB1#6	17.80	17.54	17.50	22.80	22.54	22.50
		RB3#1	16.70	16.57	16.63	21.70	21.57	21.63
		RB3#4	16.58	16.55	16.51	21.58	21.55	21.51
		RB5#1	16.83	16.57	16.68	21.83	21.57	21.68

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
5.0	QPSK	RB1#0	19.48	19.07	19.35	24.48	24.07	24.35
		RB1#3	19.26	18.87	18.98	24.26	23.87	23.98
		RB1#5	19.22	18.86	19.01	24.22	23.86	24.01
		RB3#0	19.21	19.24	19.13	24.21	24.24	24.13
		RB3#3	19.25	19.12	19.08	24.25	24.12	24.08
		RB6#0	18.15	17.94	17.90	23.15	22.94	22.90
	16QAM	RB1#0	19.19	19.04	19.52	24.19	24.04	24.52
		RB1#3	19.05	18.97	19.36	24.05	23.97	24.36
		RB1#5	18.75	18.81	19.28	23.75	23.81	24.28
		RB3#0	18.46	18.69	18.10	23.46	23.69	23.10
		RB3#3	18.32	18.44	17.91	23.32	23.44	22.91
		RB5#0	18.19	17.91	17.80	23.19	22.91	22.80
10.0	QPSK	RB1#1	19.30	19.03	19.00	24.30	24.03	24.00
		RB1#4	19.11	19.05	18.96	24.11	24.05	23.96
		RB1#6	19.04	18.88	18.77	24.04	23.88	23.77
		RB3#1	19.29	19.18	19.16	24.29	24.18	24.16
		RB3#4	19.15	19.13	19.02	24.15	24.13	24.02
		RB6#1	18.04	17.89	17.87	23.04	22.89	22.87
	16QAM	RB1#1	19.50	19.03	19.01	24.50	24.03	24.01
		RB1#4	19.34	18.91	18.80	24.34	23.91	23.80
		RB1#6	19.26	18.90	18.83	24.26	23.90	23.83
		RB3#1	18.24	18.50	18.47	23.24	23.50	23.47
		RB3#4	18.14	18.50	18.35	23.14	23.50	23.35
		RB5#1	17.99	18.04	17.85	22.99	23.04	22.85

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
15.0	QPSK	RB1#1	19.25	19.19	19.29	24.25	24.19	24.29
		RB1#4	19.26	19.06	18.95	24.26	24.06	23.95
		RB1#6	19.15	19.02	19.13	24.15	24.02	24.13
		RB3#1	19.49	19.38	19.33	24.49	24.38	24.33
		RB3#4	19.38	19.26	19.19	24.38	24.26	24.19
		RB6#1	19.23	19.15	19.06	24.23	24.15	24.06
	16QAM	RB1#1	19.43	19.61	19.67	24.43	24.61	24.67
		RB1#4	19.43	19.51	19.41	24.43	24.51	24.41
		RB1#6	19.51	19.41	19.49	24.51	24.41	24.49
		RB3#1	18.43	18.30	18.13	23.43	23.30	23.13
		RB3#4	18.32	18.20	17.99	23.32	23.20	22.99
		RB5#1	18.29	18.19	18.06	23.29	23.19	23.06
20.0	QPSK	RB1#2	19.22	19.29	19.18	24.22	24.29	24.18
		RB1#5	19.17	19.34	19.07	24.17	24.34	24.07
		RB1#7	19.05	19.25	18.88	24.05	24.25	23.88
		RB3#2	19.51	19.48	19.34	24.51	24.48	24.34
		RB3#5	19.39	19.26	19.20	24.39	24.26	24.20
		RB6#2	18.15	18.22	18.12	23.15	23.22	23.12
	16QAM	RB1#2	18.99	19.29	18.63	23.99	24.29	23.63
		RB1#5	18.99	19.09	18.57	23.99	24.09	23.57
		RB1#7	18.81	19.12	18.58	23.81	24.12	23.58
		RB3#2	18.43	18.49	18.67	23.43	23.49	23.67
		RB3#5	18.28	18.37	18.53	23.28	23.37	23.53
		RB5#2	18.25	18.17	18.23	23.25	23.17	23.23

Note: EIRP(dBm) = Conducted Power(dBm) + Antenna Gain(dBi)

For Band2: Antenna Gain = 5dBi

Limit: EIRP ≤ 33dBm

LTE Band 4

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
1.4	QPSK	RB1#0	19.46	19.26	19.36	24.46	24.26	24.36
		RB1#3	19.59	19.05	19.23	24.59	24.05	24.23
		RB1#5	19.37	18.89	18.94	24.37	23.89	23.94
		RB3#0	18.86	18.46	18.35	23.86	23.46	23.35
		RB3#3	18.17	18.46	17.90	23.17	23.46	22.90
		RB6#0	17.49	16.79	17.29	22.49	21.79	22.29
	16QAM	RB1#0	18.68	17.98	18.18	23.68	22.98	23.18
		RB1#3	18.54	18.57	18.26	23.54	23.57	23.26
		RB1#5	18.09	18.08	18.73	23.09	23.08	23.73
		RB3#0	17.49	17.07	17.30	22.49	22.07	22.30
		RB3#3	16.74	17.17	17.11	21.74	22.17	22.11
		RB5#0	17.03	17.37	17.21	22.03	22.37	22.21
3.0	QPSK	RB1#1	19.68	19.53	20.00	24.68	24.53	25.00
		RB1#4	19.45	19.53	19.44	24.45	24.53	24.44
		RB1#6	19.79	19.13	19.36	24.79	24.13	24.36
		RB3#1	18.56	18.58	18.05	23.56	23.58	23.05
		RB3#4	18.41	18.07	17.91	23.41	23.07	22.91
		RB6#1	16.95	16.87	17.28	21.95	21.87	22.28
	16QAM	RB1#1	18.72	18.56	18.08	23.72	23.56	23.08
		RB1#4	18.72	18.56	18.27	23.72	23.56	23.27
		RB1#6	18.27	18.04	17.54	23.27	23.04	22.54
		RB3#1	17.25	17.16	16.87	22.25	22.16	21.87
		RB3#4	17.04	16.87	16.56	22.04	21.87	21.56
		RB5#1	17.20	17.06	17.40	22.20	22.06	22.40

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
5.0	QPSK	RB1#0	19.95	19.70	19.50	24.95	24.70	24.50
		RB1#3	19.34	19.28	19.75	24.34	24.28	24.75
		RB1#5	19.59	19.63	19.67	24.59	24.63	24.67
		RB3#0	19.83	19.98	19.76	24.83	24.98	24.76
		RB3#3	19.36	19.87	19.23	24.36	24.87	24.23
		RB6#0	18.57	18.15	18.32	23.57	23.15	23.32
	16QAM	RB1#0	19.97	19.15	20.07	24.97	24.15	25.07
		RB1#3	19.85	19.06	20.03	24.85	24.06	25.03
		RB1#5	19.38	19.23	19.73	24.38	24.23	24.73
		RB3#0	18.66	19.49	18.37	23.66	24.49	23.37
		RB3#3	18.74	19.03	18.58	23.74	24.03	23.58
		RB5#0	18.48	18.70	18.32	23.48	23.70	23.32
10.0	QPSK	RB1#1	19.94	19.75	19.02	24.94	24.75	24.02
		RB1#4	19.17	19.24	19.13	24.17	24.24	24.13
		RB1#6	19.76	19.42	18.84	24.76	24.42	23.84
		RB3#1	19.34	19.70	19.78	24.34	24.70	24.78
		RB3#4	19.75	19.52	19.42	24.75	24.52	24.42
		RB6#1	18.05	18.57	18.21	23.05	23.57	23.21
	16QAM	RB1#1	20.22	19.38	19.57	25.22	24.38	24.57
		RB1#4	19.38	19.22	18.96	24.38	24.22	23.96
		RB1#6	19.51	19.13	19.04	24.51	24.13	24.04
		RB3#1	18.50	18.59	18.83	23.50	23.59	23.83
		RB3#4	18.53	18.78	18.75	23.53	23.78	23.75
		RB5#1	18.14	18.15	18.23	23.14	23.15	23.23

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
15.0	QPSK	RB1#1	19.59	19.83	19.71	24.59	24.83	24.71
		RB1#4	19.51	19.65	19.04	24.51	24.65	24.04
		RB1#6	19.40	19.35	19.41	24.40	24.35	24.41
		RB3#1	19.86	19.81	19.38	24.86	24.81	24.38
		RB3#4	19.53	20.01	19.35	24.53	25.01	24.35
		RB6#1	19.48	19.23	19.41	24.48	24.23	24.41
	16QAM	RB1#1	19.57	19.64	20.33	24.57	24.64	25.33
		RB1#4	19.55	19.55	19.46	24.55	24.55	24.46
		RB1#6	20.27	19.86	19.84	25.27	24.86	24.84
		RB3#1	18.83	18.75	18.24	23.83	23.75	23.24
		RB3#4	19.12	18.81	18.15	24.12	23.81	23.15
		RB5#1	18.51	18.35	18.48	23.51	23.35	23.48
20.0	QPSK	RB1#2	19.41	19.64	19.91	24.41	24.64	24.91
		RB1#5	19.74	20.12	19.32	24.74	25.12	24.32
		RB1#7	19.53	19.65	19.58	24.53	24.65	24.58
		RB3#2	20.06	20.18	19.98	25.06	25.18	24.98
		RB3#5	20.06	19.37	19.36	25.06	24.37	24.36
		RB6#2	18.40	18.76	18.86	23.40	23.76	23.86
	16QAM	RB1#2	19.65	20.06	18.97	24.65	25.06	23.97
		RB1#5	19.20	19.85	18.78	24.20	24.85	23.78
		RB1#7	19.17	19.91	18.69	24.17	24.91	23.69
		RB3#2	18.63	19.26	19.41	23.63	24.26	24.41
		RB3#5	18.34	19.00	18.84	23.34	24.00	23.84
		RB5#2	19.01	18.78	18.40	24.01	23.78	23.40

Note: EIRP(dBm) = Conducted Power(dBm) + Antenna Gain(dBi)
 For Band4: Antenna Gain =5dBi
 Limit: EIRP≤30dBm

Peak-to-average ratio (PAR)**Part 24E_Band 2 (1850-1910 MHz) 20M bandwidth**

Modulation	RB	Low channel (dB)	Middle channel (dB)	High channel (dB)	Limit (dB)
QPSK	RB1#2	9.51	9.86	9.62	13
	RB6#2	10.00	10.06	10.12	
16QAM	RB1#2	10.32	10.61	10.26	
	RB5#2	9.86	10.00	10.03	

Part 27_Band 4 (1710-1755 MHz) 20M bandwidth

Modulation	RB	Low channel (dB)	Middle channel (dB)	High channel (dB)	Limit (dB)
QPSK	RB1#2	9.51	9.74	9.80	13
	RB6#2	10.06	10.12	10.09	
16QAM	RB1#2	10.32	10.70	10.55	
	RB5#2	9.83	10.03	10.14	

FCC §2.1049, §24.238 & §27.53 - OCCUPIED BANDWIDTH

Applicable Standard

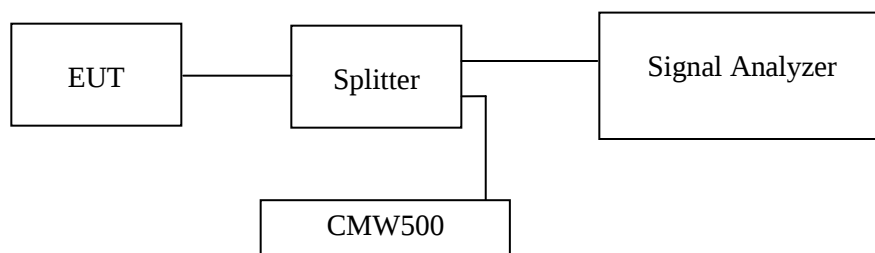
FCC 47 §2.1049, §24.238, and §27.53.

Test Procedure

ANSI C63.26-2015 Section 5.4.

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1% to 5% of the anticipated emission bandwidth and the 26 dB & 99% bandwidth was recorded.



Note: the worst path loss (cable loss and splitter inset loss) among the test frequency range has included in the plot.

Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	56-60 %
ATM Pressure:	101.0 kPa

The testing was performed by Jesse Chen from 2022-11-05.

EUT operation mode: Transmitting

Test Result: Pass

LTE Band 2:

Bandwidth	Modulation	Low channel		Middle channel		High channel	
		OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)
1.4 MHz	QPSK	1.096	1.284	1.096	1.278	1.096	1.284
	16QAM	0.928	1.140	0.928	1.140	0.928	1.122
3 MHz	QPSK	1.102	1.284	1.102	1.284	1.090	1.296
	16QAM	0.934	1.188	0.934	1.188	0.934	1.224
5 MHz	QPSK	1.118	1.300	1.118	1.300	1.098	1.320
	16QAM	0.958	1.140	0.958	1.180	0.938	1.160
10 MHz	QPSK	1.118	1.320	1.118	1.320	1.118	1.320
	16QAM	0.958	1.160	0.958	1.120	0.958	1.120
15 MHz	QPSK	1.138	1.380	1.138	1.440	1.138	1.380
	16QAM	0.958	1.200	0.958	1.200	0.958	1.200
20 MHz	QPSK	1.118	1.360	1.198	1.360	1.198	1.360
	16QAM	0.958	1.200	0.958	1.200	0.958	1.280

LTE Band 4:

Bandwidth	Modulation	Low channel		Middle channel		High channel	
		OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)
1.4 MHz	QPSK	1.096	1.266	1.096	1.272	1.102	1.308
	16QAM	0.934	1.194	0.934	1.194	0.928	1.134
3 MHz	QPSK	1.102	1.284	1.102	1.284	1.090	1.296
	16QAM	0.934	1.200	0.934	1.200	0.934	1.224
5 MHz	QPSK	1.098	1.320	1.098	1.320	1.098	1.300
	16QAM	0.938	1.160	0.938	1.160	0.938	1.160
10 MHz	QPSK	1.118	1.320	1.118	1.320	1.118	1.320
	16QAM	0.958	1.120	0.958	1.120	0.958	1.120
15 MHz	QPSK	1.138	1.320	1.138	1.320	1.138	1.380
	16QAM	0.958	1.200	0.958	1.200	0.958	1.200
20 MHz	QPSK	1.198	1.360	1.198	1.360	1.118	1.360
	16QAM	0.958	1.200	1.038	1.200	1.038	1.200

Test plots refer to the Appendix A.

FCC §2.1051, §24.238(a) & §27.53 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

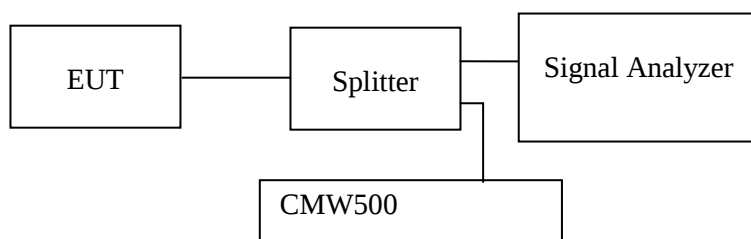
FCC §2.1051, §24.238(a) & §27.53.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Procedure

ANSI C63.26-2015 Section 5.7.

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Note: the worst path loss (cable loss and splitter inset loss) among the test frequency range has included in the plot.

Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	57%
ATM Pressure:	101.0 kPa

The testing was performed by Jesse Chen on 2022-10-19.

EUT operation mode: Transmitting

Test result: Pass. Test plots refer to the Appendix B.

FCC § 2.1053; § 24.238 (a); §27.53 - SPURIOUS RADIATED EMISSIONS

Applicable Standard

FCC § 2.1053, § 24.238(a) & § 27.53.

Test Procedure

ANSI C63.26-2015 Section 5.5.

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Test Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	54 %
ATM Pressure:	101.1 kPa

The testing was performed by Level Li on 2022-10-09.

EUT operation mode: Transmitting

Pre-scan all bandwidth and modulation, the worst case as below:

Frequency (MHz)	Receiver	Turntable Angle Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)		Height (m)	Polar (H/V)				
4G BAND2								
Test frequency range: 30MHz-20GHz								
QPSK, 1.4MHz bandwidth, Low Channel								
125.61	-47.08	204	1.3	H	-6.17	-53.25	-13	-40.25
375.11	-55.97	158	1.3	V	5.33	-50.64	-13	-37.64
3701.4	-61.90	304	1.2	H	4.72	-57.18	-13	-44.18
3701.4	-57.72	232	1.2	V	4.61	-53.11	-13	-40.11
QPSK, 1.4MHz bandwidth, Middle Channel								
125.61	-48.08	91	1.7	H	-6.17	-54.25	-13	-41.25
375.11	-56.87	118	1.8	V	5.33	-51.54	-13	-38.54
3760	-61.19	126	1.4	H	4.94	-56.25	-13	-43.25
3760	-59.10	269	1.2	V	4.85	-54.25	-13	-41.25
QPSK, 1.4MHz bandwidth, High Channel								
125.61	-48.18	79	1.3	H	-6.17	-54.35	-13	-41.35
375.11	-55.31	272	1.8	V	5.33	-49.98	-13	-36.98
3818.6	-61.40	29	1.2	H	5.25	-56.15	-13	-43.15
3818.6	-60.35	343	1.6	V	5.08	-55.27	-13	-42.27
4G BAND4								
Test frequency range: 30MHz-20GHz								
QPSK, 1.4MHz bandwidth, Low Channel								
125.61	-47.38	12	1.5	H	-6.17	-53.55	-13	-40.55
375.11	-54.98	341	2.1	V	5.33	-49.65	-13	-36.65
3421.4	-57.85	113	1.5	H	2.72	-55.13	-13	-42.13
3421.4	-57.27	133	1.7	V	2.59	-54.68	-13	-41.68
QPSK, 1.4MHz bandwidth, Middle Channel								
125.61	-48.39	225	1.4	H	-6.17	-54.56	-13	-41.56
375.11	-55.98	289	2.1	V	5.33	-50.65	-13	-37.65
3465	-54.63	30	1.5	H	3.09	-51.54	-13	-38.54
3465	-56.79	87	1.5	V	2.97	-53.82	-13	-40.82
QPSK, 1.4MHz bandwidth, High Channel								
125.61	-49.08	310	2.0	H	-6.17	-55.25	-13	-42.25
375.11	-56.80	225	1.6	V	5.33	-51.47	-13	-38.47
3508.6	-57.77	272	1.5	H	3.44	-54.33	-13	-41.33
3508.6	-58.65	320	1.2	V	3.31	-55.34	-13	-42.34

Note:

Absolute Level = Reading Level + Substituted Factor

Substituted Factor contains: SG Level - Cable loss+ Antenna Gain

Margin = Absolute Level – Limit

FCC§ 24.238 (a); §27.53 (h) - BAND EDGES

Applicable Standard

According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

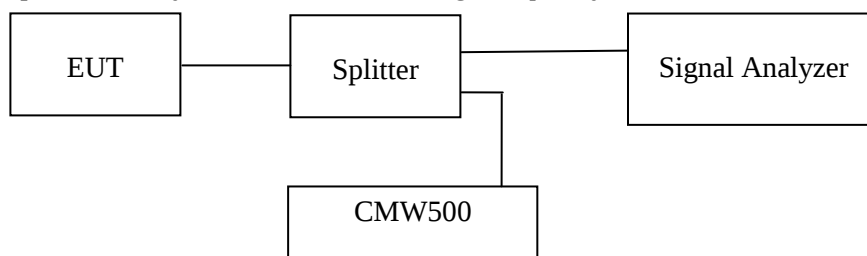
According to FCC §27.53 (h), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Test Procedure

ANSI C63.10-2013 Section 6.10.

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency



Note: the worst path loss (cable loss and splitter inset loss) among the test frequency range has included in the plot.

Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	56-40 %
ATM Pressure:	101.0 kPa

The testing was performed by Jesse Chen from 2022-11-05.

EUT operation mode: Transmitting

Test Result: Pass. Test plots refer to the Appendix C.

FCC § 2.1055; § 24.235; §27.54 - FREQUENCY STABILITY

Applicable Standard

FCC § 2.1055, §24.235 & §27.54.

According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

According to §24.235 & §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

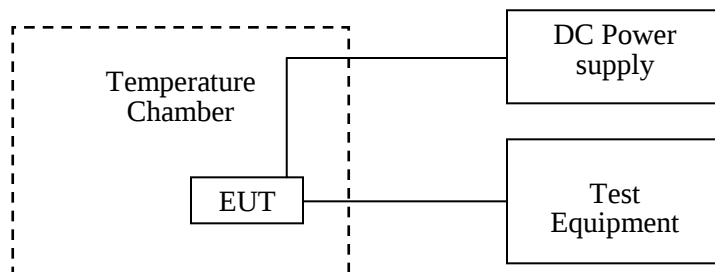
Test Procedure

ANSI C63.26-2015 Section 5.1.

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Jesse Chen on 2022-10-18.

EUT operation mode: Transmitting

Test Result: Pass. Please refer to the following tables.

LTE:

Pre-scan all bandwidths, the worst case as below:

QPSK:**Band 2:**

5MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	1850.0433	1909.9533	1850	1910
-20		1850.0404	1909.9519	1850	1910
-10		1850.0400	1909.9470	1850	1910
0		1850.0377	1909.9480	1850	1910
10		1850.0400	1909.9525	1850	1910
20		1850.0411	1909.9520	1850	1910
30		1850.0381	1909.9496	1850	1910
40		1850.0393	1909.9467	1850	1910
50		1850.0394	1909.9508	1850	1910
20	L.V.	1850.0386	1909.9491	1850	1910

Band 4:

5MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	1710.0613	1754.9391	1710	1755
-20		1710.0594	1754.9468	1710	1755
-10		1710.0557	1754.9441	1710	1755
0		1710.0570	1754.9392	1710	1755
10		1710.0580	1754.9420	1710	1755
20		1710.0566	1754.9417	1710	1755
30		1710.0558	1754.9461	1710	1755
40		1710.0593	1754.9437	1710	1755
50		1710.0628	1754.9461	1710	1755
20	L.V.	1710.0604	1754.9422	1710	1755

16QAM:**Band 2:**

5MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	1850.0416	1909.9512	1850	1910
-20		1850.0376	1909.9495	1850	1910
-10		1850.0416	1909.9511	1850	1910
0		1850.0416	1909.9535	1850	1910
10		1850.0404	1909.9526	1850	1910
20		1850.0403	1909.9521	1850	1910
30		1850.0388	1909.9506	1850	1910
40		1850.0378	1909.9504	1850	1910
50		1850.0424	1909.9502	1850	1910
20	L.V.	1850.0370	1909.9507	1850	1910

Band 4:

5MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	1710.0485	1754.8108	1710	1755
-20		1710.0439	1754.8121	1710	1755
-10		1710.0438	1754.8089	1710	1755
0		1710.0463	1754.8140	1710	1755
10		1710.0460	1754.8100	1710	1755
20		1710.0442	1754.8072	1710	1755
30		1710.0443	1754.8110	1710	1755
40		1710.0466	1754.8113	1710	1755
50		1710.0463	1754.8088	1710	1755
20	L.V.	1710.0432	1754.8130	1710	1755

***** END OF REPORT *****