



TEST REPORT
FCC CFR Title 47 Part 2, Part 27

Report Reference No.....: HK1902130277-4E

FCC ID.....: 2APRD-CATM

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Date of issue.....: Feb. 21, 2019

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Address 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation
Park,Heping Community, Fuhai Street, Bao 'an District, Shenzhen,
China

Applicant's name..... **CHEP**

Address 2901 Tasman Drive Suite 107 Santa Clara, CA 95054

Test specification

Standard **FCC CFR Title 47 Part 2, Part 27**

TRF Originator..... Shenzhen HUAKE Testing Technology Co., Ltd.

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Test item description Container tracker

Trade Mark N/A

Manufacturer..... **iTraq Inc**

Model/Type reference..... ULTRA M CATM

Listed Models N/A

Modulation Type QPSK, BPSK

Rating DC 10.5V From Battery

Hardware version V2.0

Software version V2.0

Result..... **PASS**

**TEST REPORT**

Test Report No. :	HK1902130277-4E	Feb. 21, 2019
		Date of issue

Equipment under Test : Container tracker

Model /Type : ULTRA M CATM

Listed Models : /

Applicant : **CHEP**

Address : 2901 Tasman Drive Suite 107 Santa Clara, CA 95054

Manufacturer : **iTraq Inc**

Address : 7554 185th Ave NE STE 200 Redmond Washington
98052

Test result	Pass *
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* In the configuration tested, the EUT complied with the standards specified page 4.

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.



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1 SUMMARY

1.1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Part 27](#) : MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

47 CFR FCC Part 15 Subpart B: - Unintentional Radiators

[FCC Part 2](#): FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

[TIA/EIA 603 D June 2010](#): Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

47 CFR FCC Part 15 Subpart B: - Unintentional Radiators

[KDB971168 D01 v02r02](#): MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS

[ANSI C63.4:2014](#): Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

1.2 Test Description

Test Item	Section in CFR 47	Result
RF Output Power	Part 2.1046 27.50 (b)(10) and (d)(4)	Pass
Peak-to-Average Ratio	27.50 (d)(5)	compliance *
99% & -26 dB Occupied Bandwidth	Part 2.1049 Part 27.53(h)	compliance *
Spurious Emissions at Antenna Terminal	Part 2.1051 Part 27.53(h)	compliance *
Field Strength of Spurious Radiation	Clause 7 of KDB971168 D01 v02r02	Pass
Out of band emission, Band Edge	2.1051 27.53 (c)(2) and (5), (h)(1) and (3)(i)	compliance *
Frequency stability	2.1055 27.54	compliance *

NOTE 1: For the verdict, the “compliance *” Test data refers to FCC ID:XPY2AGQN4NNN, and report number is:MDE_UBLOX_1708_FCCb_rev1.



1.3 Test Facility

1.3.1 Address of the test laboratory

Shenzhen HUAKE Testing Technology Co., Ltd.

Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

1.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen HUAKE Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen HUAKE Testing Technology Co., Ltd. is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	Above 1GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.



2 GENERAL INFORMATION

2.1 General Remarks

Date of receipt of test sample	:	Feb. 13, 2019
Testing commenced on	:	Feb. 13, 2019
Testing concluded on	:	Feb. 21, 2019

2.2 Product Description

Name of EUT	Container tracker
Model/Type reference:	ULTRA M CATM
List Model:	/
Power supply:	DC 10.5V From Battery
Adapter Information	N/A
Modulation Type	QPSK,BPSK
Antenna Type	Internal
Operation Frequency Band	NB-IoT eFDD 13
Operation frequency	NB-IoT eFDD 13: 777~787 MHz
LTE Release	R8
Extreme temp. Tolerance	-30°C to +50°C
Extreme vol. Limits	9.45VDC to 11.55VDC (nominal: 10.50VDC)

2.3 Equipment under Test

Power supply system utilised

Power supply voltage	:	☐ 120V/ 60 Hz	☐ 115V/60Hz
		☐ 12 V DC	☐ 24 V DC
		☒ Other (specified in blank below)	

DC 10.5V From Battery

2.4 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.5 Description of Test Modes

The EUT has been tested under typical operating condition. The CMW500 used to control the EUT staying in continuous transmitting and receiving mode for testing. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.



2.6 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	ENV216	R&S	HKE-059	2018/12/28	2019/12/27
LISN	R&S	ENV216	HKE-002	2018/12/28	2019/12/27
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	2017/12/27	2019/12/26
Receiver	R&S	ESCI 7	HKE-010	2018/12/28	2019/12/27
Spectrum analyzer	Agilent	N9020A	HKE-048	2018/12/28	2019/12/27
RF automatic control unit	Tonscend	JS0806-2	HKE-060	2018/12/28	2019/12/27
Horn antenna	Schwarzbeck	9120D	HKE-013	2017/12/27	2019/12/26
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	2017/12/27	2019/12/26
Preamplifier	EMCI	EMC051845SE	HKE-015	2018/12/28	2019/12/27
Preamplifier	Agilent	83051A	HKE-016	2018/12/28	2019/12/27
Temperature and humidity meter	Boyang	HTC-1	HKE-075	2018/12/28	2019/12/27
High pass filter unit	Tonscend	JS0806-F	HKE-055	2018/12/28	2019/12/27
RF cable	Times	1-40G	HKE-034	2018/12/28	2019/12/27
Power meter	Agilent	E4419B	HKE-085	2018/12/28	2019/12/27
Power Sensor	Agilent	E9300A	HKE-086	2018/12/28	2019/12/27
Wireless Communication Test Set	R&S	CMW500	HKE-026	2018/12/28	2019/12/27

2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2APRD-CATM** filing to comply with of the FCC Part 27 Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

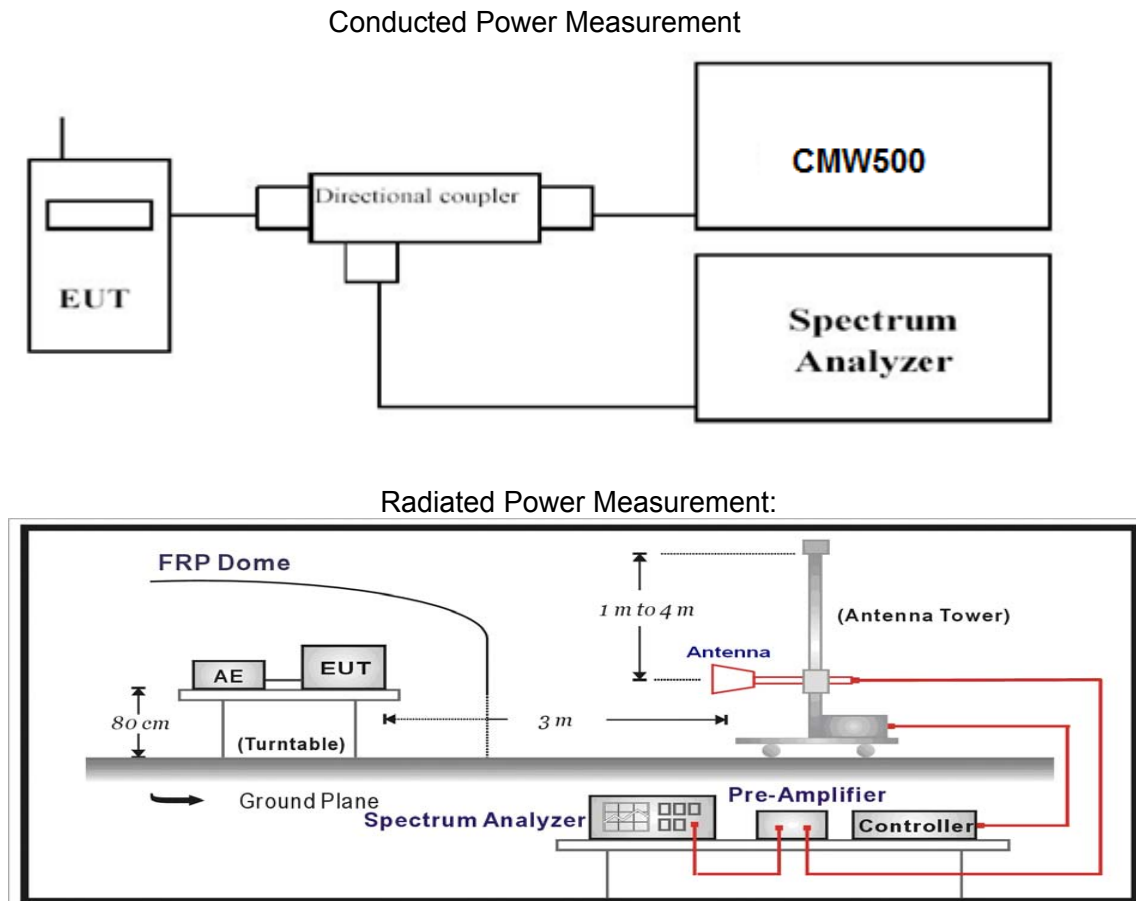
3 TEST CONDITIONS AND RESULTS

3.1 Output Power

LIMIT

During the process of testing, the EUT was controlled via R&S Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation. This result contains output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

TEST CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

Conducted Power Measurement:

- Place the EUT on a bench and set it in transmitting mode.
- Connect a low loss RF cable from the antenna port to a spectrum analyzer and CMW500 by a Directional Couple.
- EUT Communicate with CMW500, then select a channel for testing.
- Add a correction factor to the display of spectrum, and then test.

Radiated Power Measurement:

- The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
- The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter
- The output of the test antenna shall be connected to the measuring receiver.
- The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.



- f. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- g. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- h. The maximum signal level detected by the measuring receiver shall be noted.
- i. The transmitter shall be replaced by a substitution antenna.
- j. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- k. The substitution antenna shall be connected to a calibrated signal generator.
- l. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- m. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
- n. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
- o. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
- p. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
- q. Test site anechoic chamber refer to ANSI C63.4.

TEST RESULTS

Conducted Measurement:

compliance *

Note: Test data refers to FCC ID:XPY2AGQN4NNN, and report number is:MDE_UBLOX_1708_FCCb_rev1.

Radiated Measurement:

Radio Technology	Modulation Type	Reference Test Frequencies	Channel	Sub-carrier	RMS Conducted (dBm)	FCC EIRP Limit(W)
NB-IoT eFDD 13	QPSK	Standalone	23181	12	20.94	3
NB-IoT eFDD 13	QPSK	Standalone	23230	12	20.90	3
NB-IoT eFDD 13	QPSK	Standalone	23279	12	20.82	3
NB-IoT eFDD 13	QPSK	In-land	23187	12	20.70	3
NB-IoT eFDD 13	QPSK	In-land	23221	12	20.86	3
NB-IoT eFDD 13	QPSK	In-land	23240	12	21.06	3
NB-IoT eFDD 13	QPSK	In-land	23249	12	21.00	3
NB-IoT eFDD 13	QPSK	In-land	23273	12	20.75	3
NB-IoT eFDD 13	QPSK	guard-band	23181	12	21.01	3
NB-IoT eFDD 13	QPSK	guard-band	23206	12	20.84	3
NB-IoT eFDD 13	QPSK	guard-band	23279	12	21.00	3
NB-IoT eFDD 13	QPSK	Standalone	23181	6	20.81	3
NB-IoT eFDD 13	QPSK	Standalone	23230	6	21.14	3
NB-IoT eFDD 13	QPSK	Standalone	23279	6	20.97	3
NB-IoT eFDD 13	QPSK	In-land	23187	6	21.07	3
NB-IoT eFDD 13	QPSK	In-land	23221	6	20.72	3
NB-IoT eFDD 13	QPSK	In-land	23240	6	20.74	3
NB-IoT eFDD 13	QPSK	In-land	23249	6	20.74	3
NB-IoT eFDD 13	QPSK	In-land	23273	6	20.82	3
NB-IoT eFDD 13	QPSK	guard-band	23181	6	20.79	3
NB-IoT eFDD 13	QPSK	guard-band	23206	6	21.06	3
NB-IoT eFDD 13	QPSK	guard-band	23279	6	20.96	3
NB-IoT eFDD 13	QPSK	Standalone	23181	3	21.13	3
NB-IoT eFDD 13	QPSK	Standalone	23230	3	21.25	3
NB-IoT eFDD 13	QPSK	Standalone	23279	3	21.45	3



NB-IoT eFDD 13	QPSK	In-land	23187	3	21.54	3
NB-IoT eFDD 13	QPSK	In-land	23221	3	21.47	3
NB-IoT eFDD 13	QPSK	In-land	23240	3	21.20	3
NB-IoT eFDD 13	QPSK	In-land	23249	3	21.57	3
NB-IoT eFDD 13	QPSK	In-land	23273	3	21.28	3
NB-IoT eFDD 13	QPSK	guard-band	23181	3	21.43	3
NB-IoT eFDD 13	QPSK	guard-band	23206	3	21.10	3
NB-IoT eFDD 13	QPSK	guard-band	23279	3	21.40	3
NB-IoT eFDD 13	QPSK	Standalone	23181	1	21.18	3
NB-IoT eFDD 13	QPSK	Standalone	23230	1	21.40	3
NB-IoT eFDD 13	QPSK	Standalone	23279	1	21.15	3
NB-IoT eFDD 13	QPSK	In-land	23187	1	21.33	3
NB-IoT eFDD 13	QPSK	In-land	23221	1	21.56	3
NB-IoT eFDD 13	QPSK	In-land	23240	1	21.44	3
NB-IoT eFDD 13	QPSK	In-land	23249	1	21.41	3
NB-IoT eFDD 13	QPSK	In-land	23273	1	21.13	3
NB-IoT eFDD 13	QPSK	In-land	23181	1	21.42	3
NB-IoT eFDD 13	QPSK	guard-band	23206	1	21.33	3
NB-IoT eFDD 13	QPSK	guard-band	23279	1	21.44	3
NB-IoT eFDD 13	QPSK	guard-band	23181	1	21.24	3
NB-IoT eFDD 13	BPSK	Standalone	23181	1	21.33	3
NB-IoT eFDD 13	BPSK	Standalone	23230	1	21.35	3
NB-IoT eFDD 13	BPSK	Standalone	23279	1	21.17	3
NB-IoT eFDD 13	BPSK	In-land	23187	1	21.42	3
NB-IoT eFDD 13	BPSK	In-land	23221	1	21.53	3
NB-IoT eFDD 13	BPSK	In-land	23240	1	21.24	3
NB-IoT eFDD 13	BPSK	In-land	23249	1	21.25	3
NB-IoT eFDD 13	BPSK	In-land	23273	1	21.50	3
NB-IoT eFDD 13	BPSK	guard-band	23181	1	21.33	3
NB-IoT eFDD 13	BPSK	guard-band	23206	1	21.44	3
NB-IoT eFDD 13	BPSK	guard-band	23279	1	21.24	3

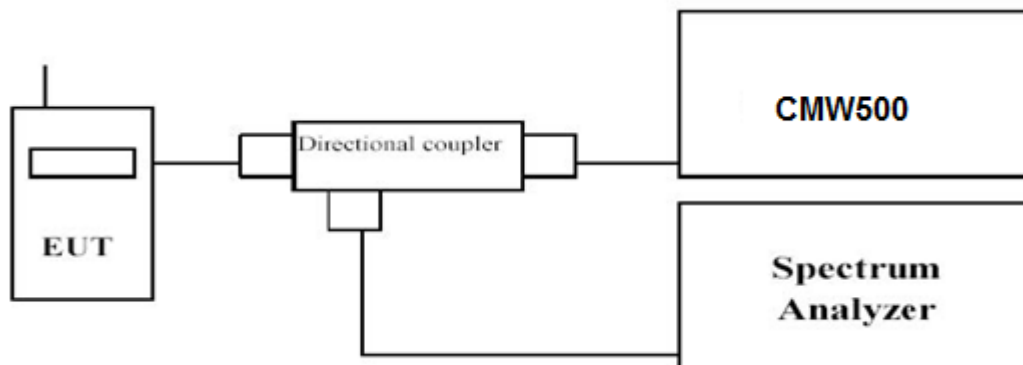


3.3 Peak-to-Average Ratio (PAR)

LIMIT

The Peak-to-Average Ratio (PAR) of the transmission may not exceed 13 dB.

TEST CONFIGURATION



TEST PROCEDURE

1. Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
2. Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
3. Set the number of counts to a value that stabilizes the measured CCDF curve;
4. Set the measurement interval as follows:
 - 1). for continuous transmissions, set to 1 ms,
 - 2). for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
5. Record the maximum PAPR level associated with a probability of 0.1%.

TEST RESULTS

compliance *

Note: Test data refers to FCC ID:XPY2AGQN4NNN, and report number is:MDE_UBLOX_1708_FCCb_rev1.

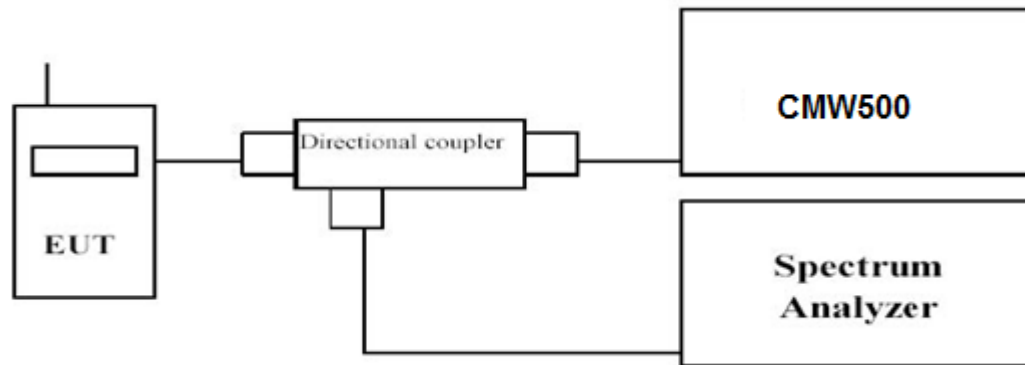


3.4 Occupied Bandwidth and Emission Bandwidth

LIMIT

N/A

TEST CONFIGURATION



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 low, middle and high channel in each band. The -26dBc Emission bandwidth was also measured and recorded.

Set RBW was set to about 1% of emission BW, VBW $\geq$ 3 times RBW.

-26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

TEST RESULTS

compliance *

Note: Test data refers to FCC ID:XPY2AGQN4NNN, and report number is:MDE_UBLOX_1708_FCCb_rev1.

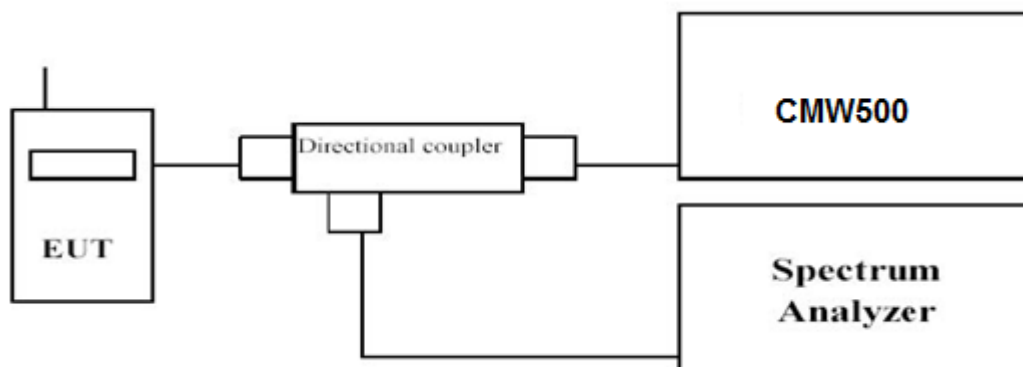


3.5 Band Edge compliance

LIMIT

According to §27.53 (h): the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

TEST CONFIGURATION



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 and highest channels for each band and different modulation.
5. Measure Band edge using RMS (Average) detector by spectrum

TEST RESULTS

compliance *

Note: Test data refers to FCC ID:XPY2AGQN4NNN, and report number is:MDE_UBLOX_1708_FCCb_rev1.



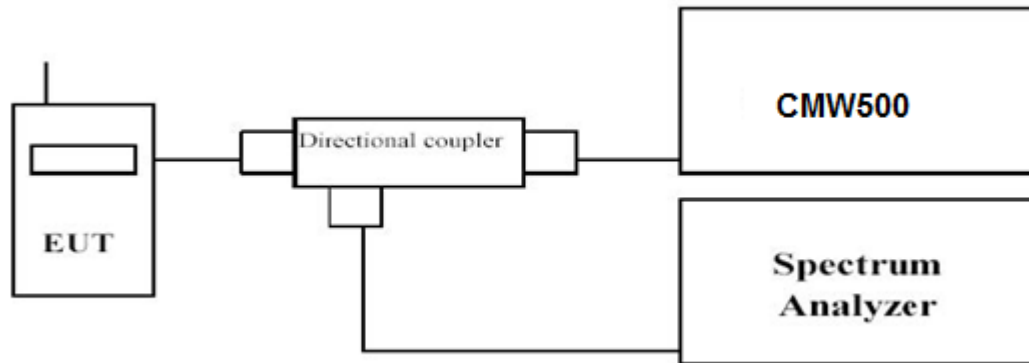
3.6 Spurious Emission

LIMIT

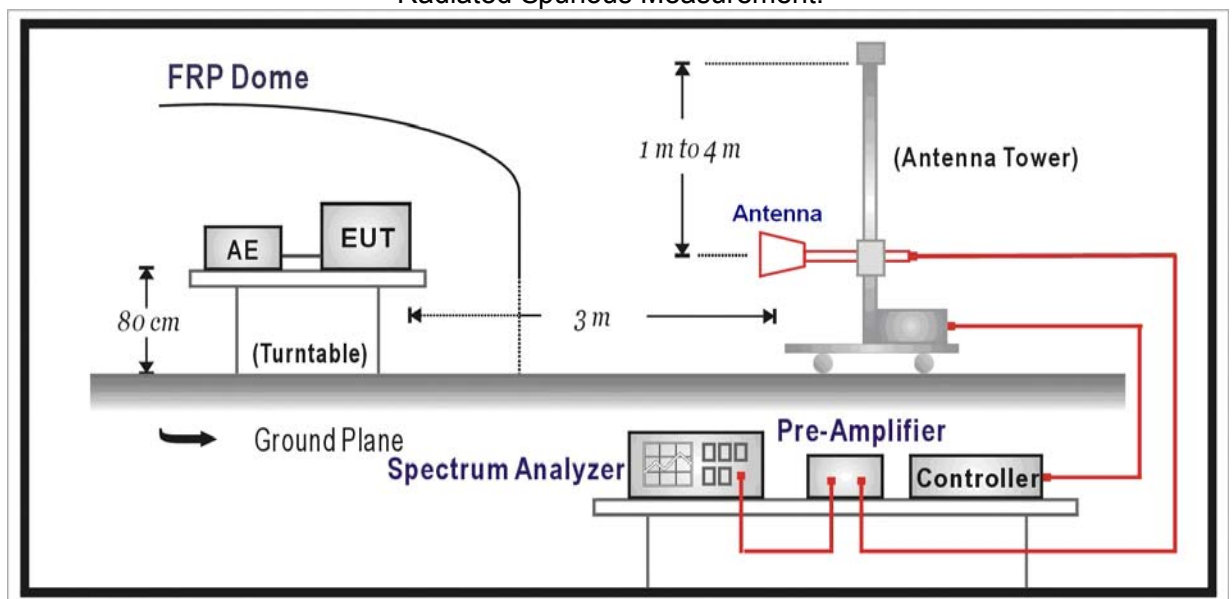
Per FCC §24.238, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

TEST CONFIGURATION

Conducted Spurious Measurement:



Radiated Spurious Measurement:



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

Conducted Spurious Measurement:

- Place the EUT on a bench and set it in transmitting mode.
- Connect a low loss RF cable from the antenna port to a spectrum analyzer and CMW500 by a Directional Couple.
- EUT Communicate with CMW500, then select a channel for testing.
- Add a correction factor to the display of spectrum, and then test.
- The resolution bandwidth of the spectrum analyzer was set sufficient scans were taken to show the out of band Emission if any up to 10^{th} harmonic.
- Please refer to following tables for test antenna conducted emissions.

Working Frequency	Sub range (GHz)	RBW	VBW	Sweep time (s)
NB-IoT eFDD 13	0.000009~0.000015	1KHz	3KHz	Auto
	0.000015~0.03	10KHz	30KHz	Auto
	0.03~26.5	1 MHz	3 MHz	Auto

Radiated Spurious Measurement:



- a. The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
- b. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter
- c. The output of the test antenna shall be connected to the measuring receiver.
- d. The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- e. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- f. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- g. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- h. The maximum signal level detected by the measuring receiver shall be noted.
- i. The transmitter shall be replaced by a substitution antenna.
- j. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- k. The substitution antenna shall be connected to a calibrated signal generator.
- l. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- m. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
- n. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
- o. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
- p. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
- q. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for Part 22 and 1MHz for Part 24. The frequency range was checked up to 10th harmonic.
- r. Test site anechoic chamber refer to ANSI C63.

TEST RESULTS

Conducted Measurement:

compliance *

Note: Test data refers to FCC ID:XPY2AGQN4NNN, and report number is:MDE_UBLOX_1708_FCCb_rev1.

Radiated Measurement:

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Max Value /dBm	Limit /dBm	Margin to Limit /dB
eFDD 12 QPSK NB IoT	low	peak	maxhold	20	777	-20.62	-13	7.62
eFDD 12 QPSK NB IoT	mid	peak	maxhold	-	-	-	-13	>20
eFDD 12 QPSK NB IoT	high	peak	maxhold	20	787.5	-25.68	-13	12.68

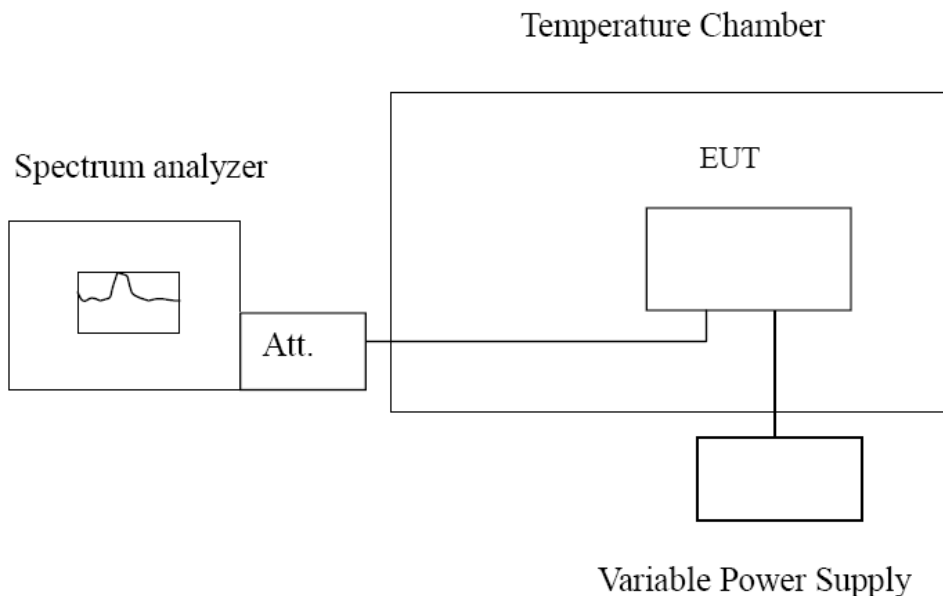


3.7 Frequency Stability under Temperature & Voltage Variations

LIMIT

According to §27.54, §2.1055 requirement, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation and should not exceed 2.5ppm.

TEST CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

Frequency Stability Under Temperature Variations:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for NB-IoT eFDD 13, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 °C increments from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change.



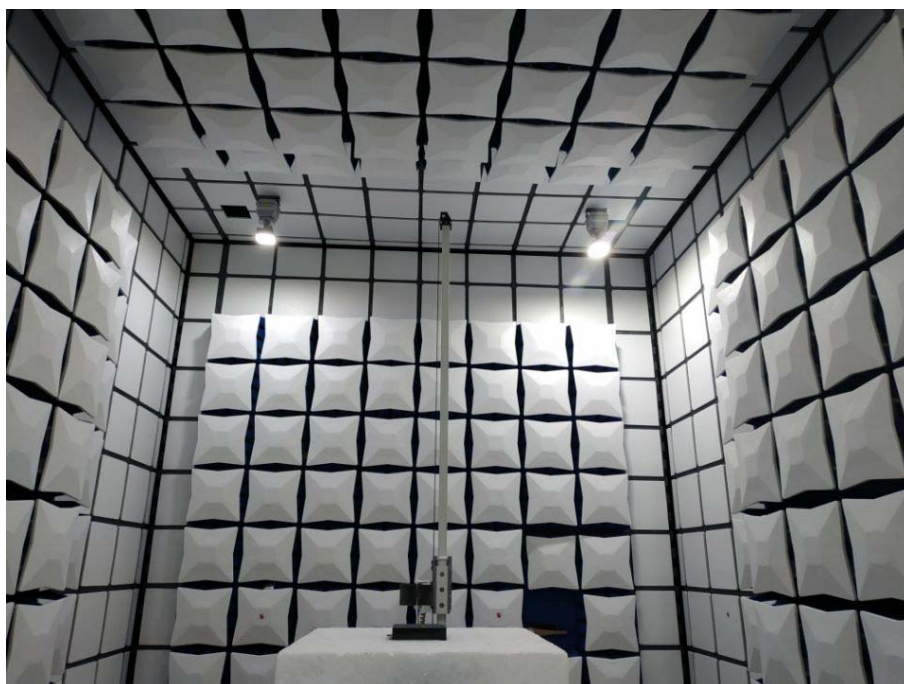
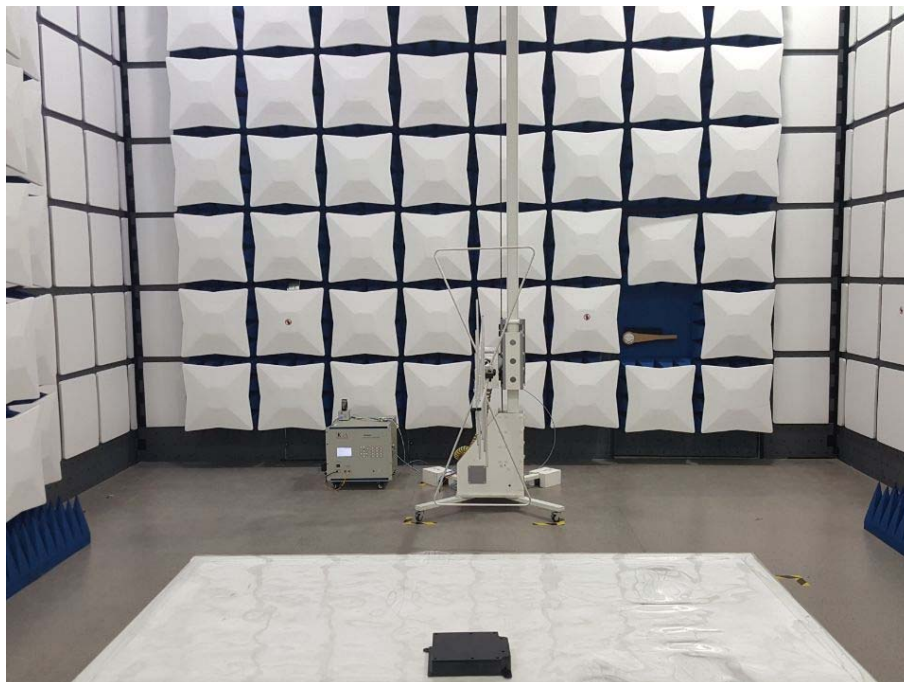
TEST RESULTS

compliance *

Note: Test data refers to FCC ID:XPY2AGQN4NNN, and report number is:MDE_UBLOX_1708_FCCb_rev1.



4 Test Setup Photos of the EUT



***** End of Report *****