FCC RADIO TEST REPORT

FCC ID: 2AFOZF3501

IC: 20622-F3501

Product： MOB Link Safety HUB

Trade Name： Link Safety HUB

Model Name： F3501

Serial Model： N/A

Report No.： UNIA19121108FR-04

Prepared for

FELL Technology AS

Gjellebekkstubben 10 Lierskogen Buskerud 3420 Norway

Prepared by

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

TEST RESULT CERTIFICATION

Applicant's name	:	FELL Technology AS
Address	:	Gjellebekkstubben 10 Lierskogen Buskerud 3420 Norway
Manufacture's Name	:	FELL Technology AS
Address	:	Gjellebekkstubben 10 Lierskogen Buskerud 3420 Norway
Product description		
Product name	:	MOB Link Safety HUB
Trade Mark	:	Link Safety HUB
Model and/or type reference	:	F3501
Standards	:	FCC Rules and Regulations Part 15 Subpart C Section 15.225; ANSI C63.10: 2013; RSS-210 Issue 10: December 2019, RSS-Gen Issue 5 April 2018;

This device described above has been tested by Shenzhen United Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test	:	
Date (s) of performance of tests	:	Nov. 15 ~Dec. 06, 2019
Date of Issue	:	Dec. 09, 2019
Test Result	:	Pass

Prepared by: Kahn yang/Editor

Reviewer: Sherwin Qian/Supervisor

Approved & Authorized Signer: Liuze/Manager

Table of Contents Page

1. TEST SUMMARY 4
2. GENERAL INFORMATION 5
2.1 GENERAL DESCRIPTION OF EUT 5
2.2 Carrier Frequency of Channels 6
2.3 Operation of EUT during testing 6
2.4 DESCRIPTION OF TEST SETUP 6
2.5 MEASUREMENT INSTRUMENTS LIST 7
3. CONDUCTED EMISSIONS TEST 8
3.1 Conducted Power Line Emission Limit 8
3.2 Test Setup 8
3.3 Test Procedure 8
3.4 Test Result 8
4. RADIATED EMISSION TEST 9
4.1 Radiation Limit 9
4.2 Test Procedure 9
4.3 Test Steup 10
4.4 Test Result 11
5. OCCUPIED BANDWIDTH MEASUREMENT 12
5.1 Test Limit 12
5.2 Test Procedure 12
5.3 Test Setup 12
5.4 Test Result 12
6. FREQUENCY STABILITY 14
6.1 Test Limit 14
6.2 Test Procedure 14
6.2 Test Result 14
7. PHOTOGRAPH OF TEST 15
7.1 Radiated Emission 15

11. TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

DESCRIPTION OF TEST	RESULT
CONDUCTED EMISSIONS TEST	COMPLIANT
IN-BAND EMISSIONS	COMPLIANT
OCCUPIED BANDWIDTH MEASUREMENT	COMPLIANT
OUT-OF-BAND EMISSIONS	COMPLIANT
FREQUENCY STABILITY TOLERANCE	COMPLIANT

1.2 1.1 TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.

Address : 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

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

CNAS-LAB Code: L6494

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1227

Test Firm Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

1.3 1.2 MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	MOB Link Safety HUB
Trade Mark	Link Safety HUB
Model Name	F3501
Serial No.	N/A
Model Difference	N/A
FCC ID	2AFOZF3501
Antenna Type	Loop Antenna
Antenna Gain	2dBi
Frequency Range	13.56MHz
Number of Channels	1CH
Modulation Type	ASK
Power Source	DC 12V from battery
Product HW/SW version	1.0.0/1.0.0
Radio HW/SW version	1.0.0/1.0.0

Table for auxiliary equipment:

Equipment Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	Lenovo G475	GB14477457

2.2 Carrier Frequency of Channels

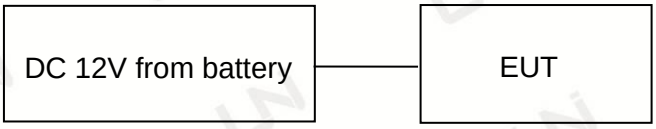
Channel List for ASK	
Channel	Frequency (MHz)
01	13.56

2.3 Operation of EUT during testing

Operating Mode
The mode is used: Transmitting mode for ASK
Channel: 13.56MHz
Test SW Version: SmartRF_Studio_7

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:



2.5 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
CONDUCTED EMISSIONS TEST					
1	AMN	Schwarzbeck	NNLK8121	8121370	2020.9.6
2	AMN	ETS	3810/2	00020199	2020.9.6
3	EMI TEST RECEIVER	Rohde&Schwarz	ESCI	101210	2020.9.6
4	AAN	TESEQ	T8-Cat6	38888	2020.9.6
RADIATED EMISSION TEST					
1	Horn Antenna	Sunol	DRH-118	A101415	2020.9.6
2	BicoNILog Antenna	Sunol	JB1 Antenna	A090215	2020.9.6
3	PREAMP	HP	8449B	3008A00160	2020.9.6
4	PREAMP	HP	8447D	2944A07999	2020.9.6
5	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2020.9.6
6	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2020.9.6
7	Signal Generator	Agilent	E4421B	MY4335105	2020.9.6
8	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020.9.6
9	MXA Signal Analyzer	Agilent	N9020A	MY51110104	2020.9.6
10	ANT Tower&Turn table Controller	Champro	EM 1000	60764	2020.9.6
11	Anechoic Chamber	Taihe Maorui	9m*6m*6m	966A0001	2020.9.6
12	Shielding Room	Taihe Maorui	6.4m*4m*3m	643A0001	2020.9.6
13	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2020.9.6
14	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2020.9.6
15	RF power divider	Anritsu	K241B	992289	2020.9.6
16	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2020.9.6
17	Biconical antenna	Schwarzbeck	VHA 9103	91032360	2020.9.6
18	Biconical antenna	Schwarzbeck	VHA 9103	91032361	2020.9.6
19	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2020.9.6
20	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2020.9.6
21	Active Receive Loop Antenna	Schwarzbeck	FMZB 1919B	00023	2020.9.6
22	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170651	2020.9.6
23	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2020.9.6
24	Active Loop Antenna	Com-Power	AL-130R	10160009	2020.9.6
25	Power Meter	KEYSIGHT	N1911A	MY50520168	2020.9.6
26	Frequency Meter	VICTOR	VC2000	997406086	2020.9.6
27	DC Power Source	HYELEC	HY5020E	055161818	2020.9.6
Test software					
1	E3	XINHUA	6.101223a	N/A	N/A

3. CONDUCTED EMISSIONS TEST

3.1 Conducted Power Line Emission Limit

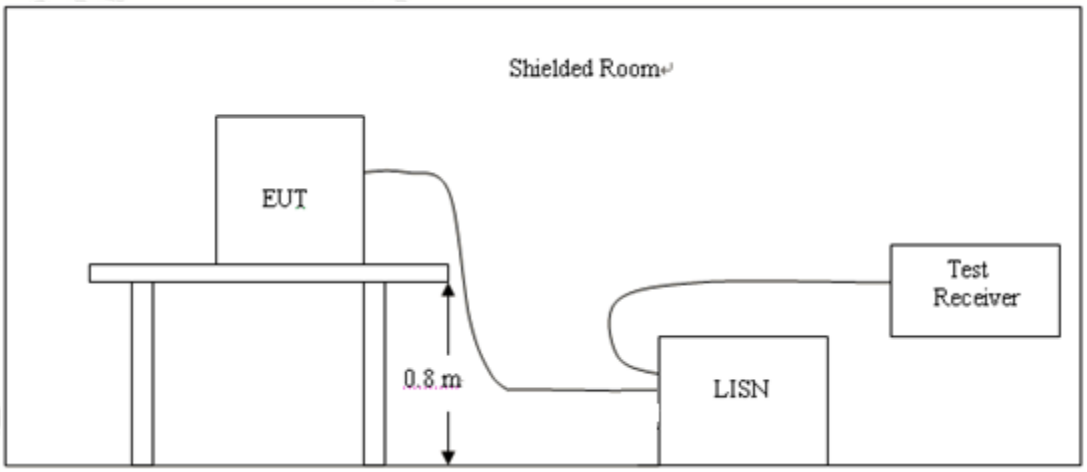
For unintentional device, according to § 15.107(a) & RSS-Gen [8.8] Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage(dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56*	56~46*
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

3.2 Test Setup



3.3 Test Procedure

1, The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. A wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
2, Support equipment, if needed, was placed as per ANSI C63.10.
3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4, If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5, All support equipments received AC power from a second LISN, if any.
6, The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

3.4 Test Result

This device is pure battery powered and does not require charging.

4. RADIATED EMISSION TEST

4.1 Radiation Limit

The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

Within the bands 13.410 – 13.553 MHz and 13.567 – 13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110– 14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Frequency (MHz)	Distance (Meters)	Radiated (dBuV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-13.110	3	69.54	30
13.110-13.410	3	80.50	106
13.410-13.553	3	90.47	334
13.553-13.567	3	124.00	15848
13.567-13.710	3	90.47	334
13.710-14.010	3	80.50	106
14.010-30.0	3	69.54	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

4.2 Test Procedure

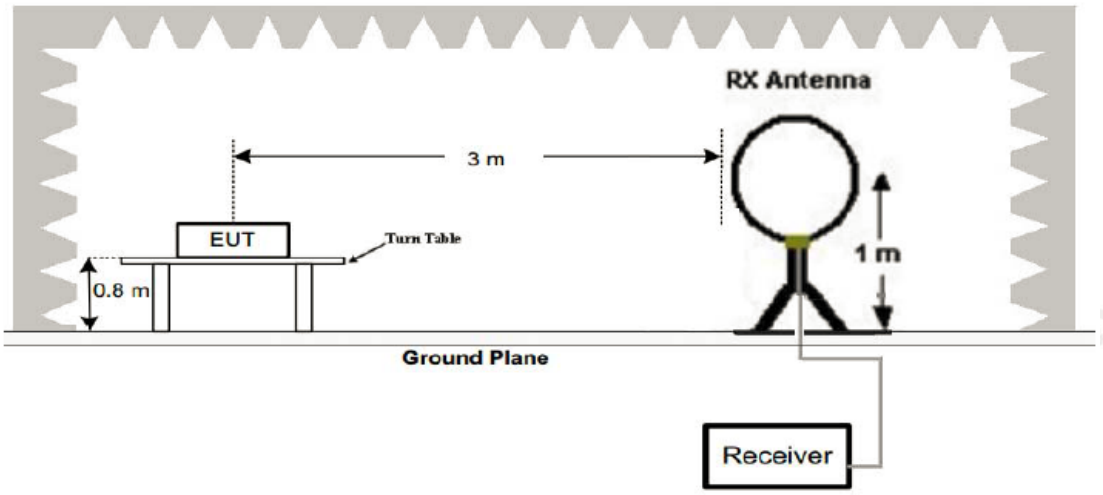
1. The EUT was placed on 10cm wooden desk above ground plane which on a turn table.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.

Field Strength Calculation

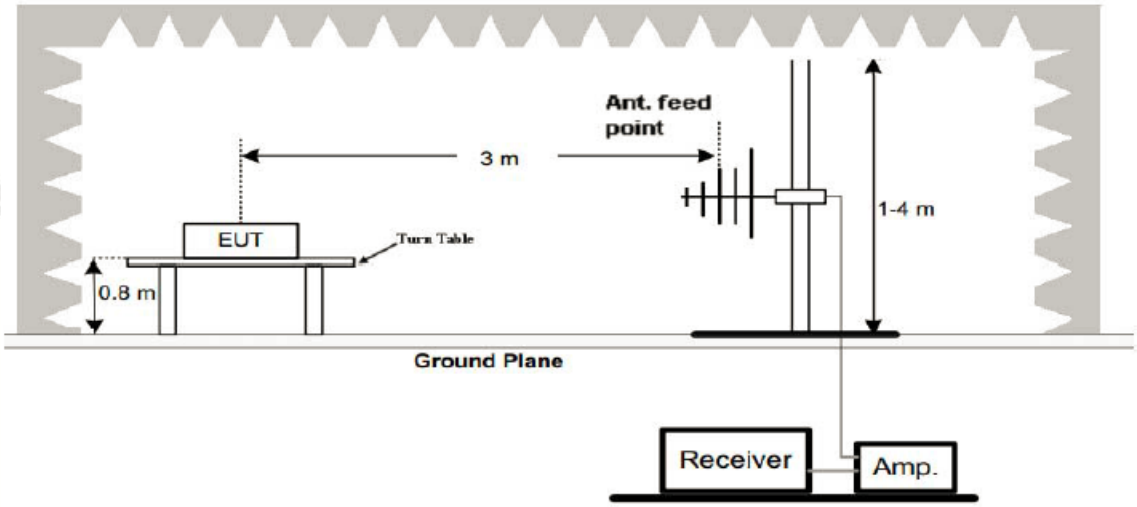
The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

4.3 Test Steup

1. Radiated Emission Test-Up Frequency Below 30MHz



2. Radiated Emission Test-Up Frequency 30MHz~1GHz



4.4 Test Result

In-band Emissions

Horizontal

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
13.15	41.28	-0.67	40.61	80.50	-39.89	PK
13.55	49.17	-0.68	48.49	90.47	-41.98	PK
13.56	86.25	-0.69	85.56	124.00	-38.44	PK
13.57	48.51	-0.55	47.96	90.47	-42.51	PK
13.75	41.15	-0.53	40.62	80.50	-39.88	PK
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
13.15	41.63	-0.67	40.96	80.50	-39.54	PK
13.55	49.58	-0.68	48.9	90.47	-41.57	PK
13.56	86.29	-0.69	85.6	124.00	-38.40	PK
13.57	48.53	-0.55	47.98	90.47	-42.49	PK
13.75	41.47	-0.53	40.94	80.50	-39.56	PK
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Out-of-band Emissions

Horizontal

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
27.12	39.57	-4.32	35.25	69.54	-34.29	PK
40.68	35.14	-4.38	30.76	40.00	-9.24	PK
54.24	32.58	-4.59	27.99	40.00	-12.01	PK
67.80	33.18	-4.87	28.31	40.00	-11.69	PK
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
27.12	39.62	-4.32	35.3	69.54	-34.24	PK
40.68	35.21	-4.38	30.83	40.00	-9.17	PK
54.24	32.39	-4.59	27.8	40.00	-12.20	PK
67.80	33.22	-4.87	28.35	40.00	-11.65	PK
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

5. OCCUPIED BANDWIDTH MEASUREMENT

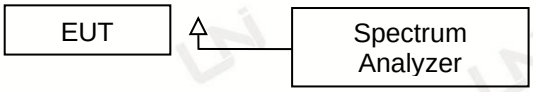
5.1 Test Limit

No limit for 20dB bandwidth.

5.2 Test Procedure

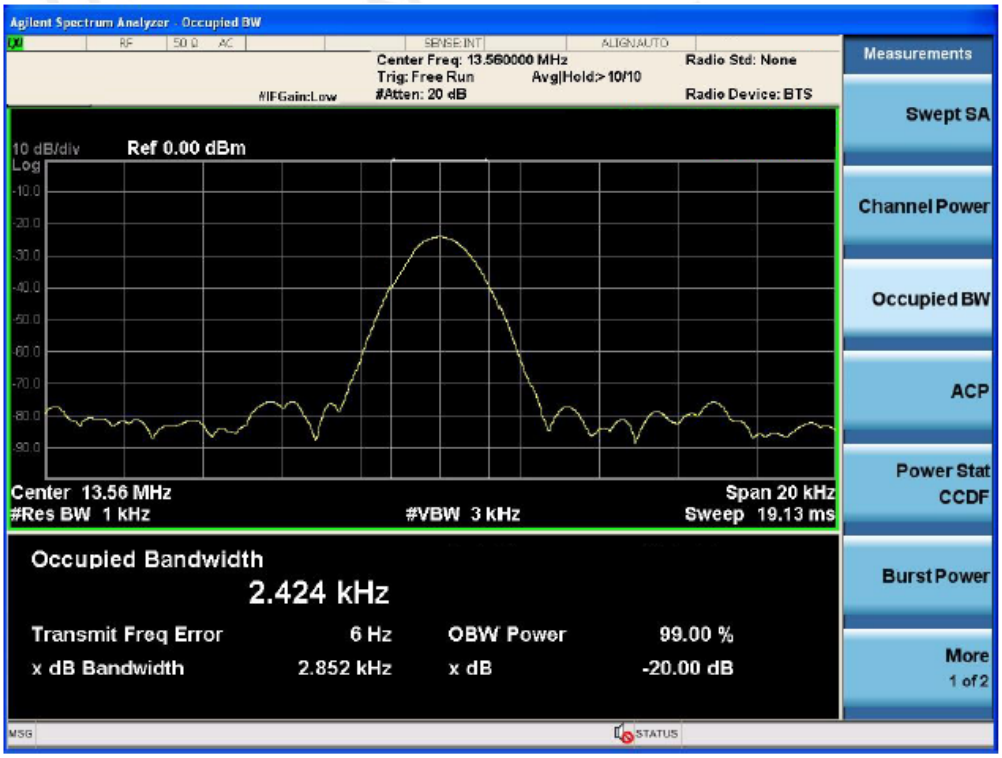
1. The 20dB bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.
2. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power Minus 20dB.

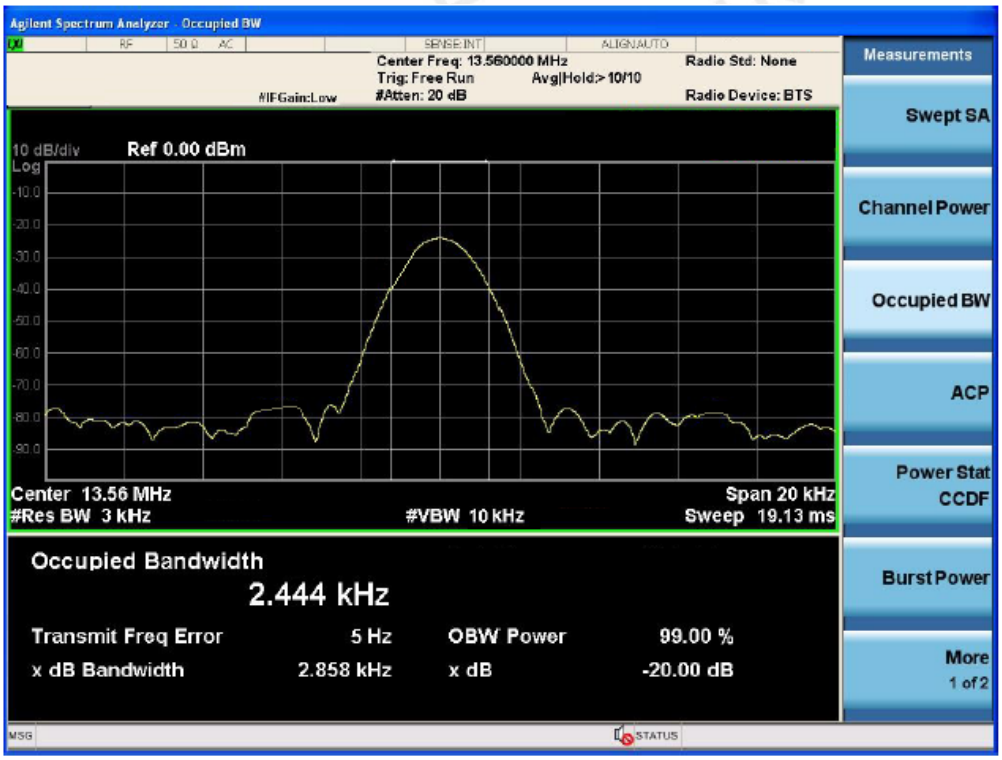
5.3 Test Setup



5.4 Test Result

Modulation	Frequency (MHz)	20dB bandwidth (KHz)	99%dB bandwidth (KHz)	Result
ASK	13.56	2.852	2.444	Pass




Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Center Freq: 13.560000 MHz
Trig: Free Run Avg|Hold:>10/10
#IFGain:Low #Atten: 20 dB
Radio Std: None
Radio Device: BTS
10 dB/div Ref 0.00 dBm
Log
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
Center 13.56 MHz
#Res BW 3 kHz
#VBW 10 kHz
Span 20 kHz
Sweep 19.13 ms
Occupied Bandwidth
2.444 kHz
Transmit Freq Error 5 Hz
OBW Power 99.00 %
x dB Bandwidth 2.858 kHz
x dB -20.00 dB
MSG
STATUS
Measurements
Swept SA
Channel Power
Occupied BW
ACP
Power Stat CCDF
Burst Power
More 1 of 2

6. FREQUENCY STABILITY

6.1 Test Limit

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

6.2 Test Procedure

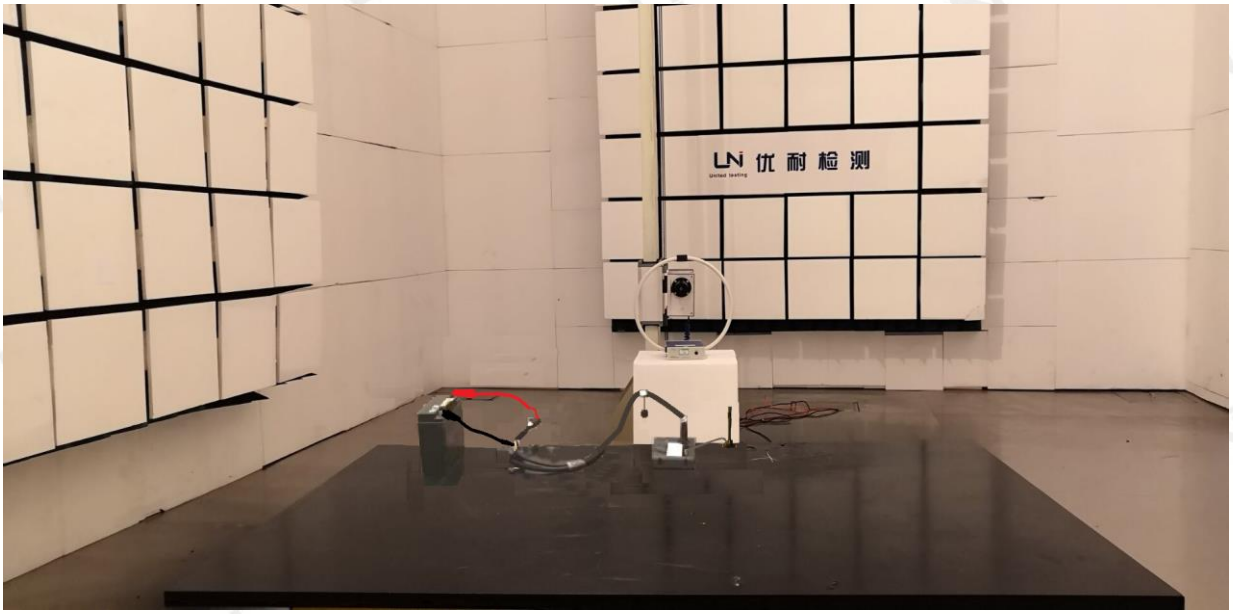
1. The equipment under test was connected to an external DC power supply and input rated voltage.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20℃ operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to －20℃. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.
7. Reduce the input voltage to specified extreme voltage variation (+/- 15%) or endpoint, record the maximum frequency change.

6.2 Test Result

Reference Frequency: 13.56MHz				
Voltage (V)	Temperature (℃)	Frequency (Hz)	Frequency Deviation (Hz)	Deviation (%)
12	+20(Ref)	13.560103	103	0.000760
	-20	13.560063	63	0.000465
	-10	13.560187	187	0.001379
	0	13.560130	130	0.000959
	+10	13.560108	108	0.000796
	+20	13.560090	90	0.000664
	+25	13.560140	140	0.001032
	+30	13.560151	151	0.001114
	+40	13.560177	177	0.001305
	+50	13.560062	62	0.000457
13.8	+20	13.560030	30	0.000221
10.2	+20	13.560101	101	0.000745

7. PHOTOGRAPH OF TEST

7.1 Radiated Emission



End of Report