TESTING (OR CALIBRATION)
NVLAP LAB CODE 600141-0

Registration
No.788871

.

TEST REPORT FOR RF TESTING

Report No: SRTC2019-9004(F)-19080201(C)

Product Name: Fi Smart Collar

Product Model: FC1

Applicant: Barking Labs Corp.

Manufacturer: Barking Labs Corp.

Specification: FCC CFR47 PART 2, 22H, 24E, 27L (2019)

FCC ID: 2ARXN-FC1

The State Radio_monitoring_center Testing Center (SRTC)

15th Building, No.30, Shixing Street, Shijingshan District,

Beijing, P.R.China

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1. GENERAL INFORMATION

1.1 Notes of the test report

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The test results relate only to individual items of the samples which have been tested.
The certification and accreditation identifiers used in this report shall not be applicable to the tested or calibrated samples thereof. The manufacturer shall not mark the tested samples or items (or a separate part of the item) with the identifiers of certification and accreditation to mislead relevant parties about the tested samples or items.

1.2 Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
Address:	15th Building, No.30 Shixing Street, Shijingshan District, P.R.China
City:	Beijing
Country or Region:	P.R.China
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1.3 Applicant's details

Company:	Barking Labs Corp.
Address:	53 Bridge St., Suite 103
City:	Brooklyn, NY
Country or Region:	USA
Contacted person:	Bob Blake
Tel:	+1-914-249-9347
Fax:	---
Email:	bob@tryfi.com

1.4 Manufacturer's details

Company:	Barking Labs Corp.
Address:	53 Bridge St., Suite 103
City:	Brooklyn, NY
Country or Region:	USA
Contacted person:	Bob Blake
Tel:	+1-914-249-9347
Fax:	---
Email:	bob@tryfi.com

1.5 Test Environment

Date of Receipt of test sample at SRTC:	2019-01-29
Testing Start Date:	2019-01-29
Testing End Date:	2019-08-19

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient	25	30
Maximum Extreme	60	---
Minimum Extreme	-20	---

Normal Supply Voltage (V d.c.):	3.85
Maximum Extreme Supply Voltage (V d.c.):	4.35
Minimum Extreme Supply Voltage (V d.c.):	3.00

2 DESCRIPTION OF THE EQUIPMENT UNDER TEST

2.1 Final Equipment Build Status

Frequency Range	LTE_CAT-M1 Band 2: Tx:1850~1910MHz Rx:1930~1990MHz LTE_CAT-M1 Band 4: Tx:1710~1755MHz Rx:2110~2155MHz LTE_CAT-M1 Band 12: Tx:699~716 MHz Rx:729~746 MHz
Modulation Type	QPSK 16QAM
Antenna Type	IFA Antenna
Power Supply	Battery/Charge
HW Version	Rev.B
SW Version	1.0
SN	Sample 1#

Note: The conducted test results of variant product derive from original product Report No.: SRTC2019-9004(F)-19012902(A).

2.2 Summary table

FCC Rule Part	Frequency Range(MHz)	EIRP/ERP (W)	Frequency Tolerance (ppm)	Emission Designator	Emission Bandwidth (MHz)	Measured 26dBC Bandwidth (MHz)	Communication Type
BAND2							
24E	1850.7-1909.3	0.189	0.020	1M13G7D	1.4M	1.279	QPSK
	1850.7-1909.3	0.149	0.020	939KD7W	1.4M	1.076	16QAM
	1851.5-1908.5	0.188	0.016	1M29G7D	3M	1.421	QPSK
	1851.5-1908.5	0.149	0.016	1M28D7W	3M	1.410	16QAM
	1852.5-1907.5	0.188	0.017	1M10G7D	5M	1.488	QPSK
	1852.5-1907.5	0.150	0.017	928KD7W	5M	1.856	16QAM
	1855-1905	0.190	0.020	1M13G7D	10M	1.705	QPSK
	1855-1905	0.150	0.020	967KD7W	10M	1.526	16QAM
	1857.5-1902.5	0.190	0.019	1M11G7D	15M	1.705	QPSK
	1857.5-1902.5	0.149	0.019	970KD7W	15M	1.601	16QAM
	1860-1900	0.192	0.020	1M14G7D	20M	1.755	QPSK
	1860-1900	0.150	0.020	959KD7W	20M	1.451	16QAM

BAND4							
27L	1710.7-1754.3	0.134	0.020	1M12G7D	1.4M	1.277	QPSK
	1710.7-1754.3	0.101	0.020	1M11D7W	1.4M	1.238	16QAM
	1711.5-1753.5	0.138	0.017	1M28G7D	3M	1.431	QPSK
	1711.5-1753.5	0.103	0.017	1M27D7W	3M	1.421	16QAM
	1712.5-1752.5	0.138	0.018	1M10G7D	5M	1.383	QPSK
	1712.5-1752.5	0.104	0.018	932KD7W	5M	1.427	16QAM
	1715-1750	0.142	0.020	1M13G7D	10M	1.513	QPSK
	1715-1750	0.111	0.020	960KD7W	10M	1.555	16QAM
	1717.5-1747.5	0.145	0.019	1M12G7D	15M	1.597	QPSK
	1717.5-1747.5	0.113	0.019	959KD7W	15M	1.486	16QAM
	1720-1745	0.148	0.020	1M12G7D	20M	1.658	QPSK
	1720-1745	0.116	0.020	942KD7W	20M	1.416	16QAM
BAND12							
27H	699.7-715.3	0.090	0.016	1M11G7D	1.4M	1.261	QPSK
	699.7-715.3	0.068	0.016	1M12D7W	1.4M	1.229	16QAM
	700.5-714.5	0.090	0.017	1M28G7D	3M	1.447	QPSK
	700.5-714.5	0.069	0.017	1M28D7W	3M	1.420	16QAM
	701.5-713.5	0.090	0.018	1M10G7D	5M	1.370	QPSK
	701.5-713.5	0.069	0.018	937KD7W	5M	1.488	16QAM
	704-711	0.091	0.019	1M12G7D	10M	1.611	QPSK
	704-711	0.070	0.019	954KD7W	10M	1.649	16QAM

2.3 Support Equipment

The following support equipment was used to exercise the EUT during testing:

Equipment	Notebook
Manufacturer	LENOVO
Model Number	E420
SN	---

Equipment	Charger
Manufacturer	DEE VAN ENTERPRISE CO., LTD.
Model Number	DSA-5PF03-05 FUS 050100
SN	---

Equipment	USB cable
Manufacturer	SuZhou KELI TECHNOLOGY DEVELOPMENT CO., LTD.
Model Number	KLC-3103
SN	---

3 REFERENCE SPECIFICATION

The tests documented in this report were performed in accordance with ANSI C63.26:2015, FCC CFR 47 Part 2, FCC KDB 971168 D01 v02r02, KDB 971168 D02 v01, Part 22, Part 24, Part 27.

Specification	Version	Title
ANSI C63.26:2015	11 December 2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
FCC CFR 47 Part 2	2019	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
FCC CFR 47 Part 22	2019	PUBLIC MOBILE SERVICES
FCC CFR 47 Part 24	2019	PERSONAL COMMUNICATIONS SERVICES
FCC CFR 47 Part 27	2019	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
KDB 971168 D01	v03r01	MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS
KDB 971168 D02	v02r01	MISCELLANEOUS AND BASIC REVIEW AND APPROVAL ITEMS FOR TRANSMITTING EQUIPMENT USED IN LICENSED RADIO SERVICES
ANSI C63.26	2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
KDB 971168 D01	April 9, 2018	MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS

4 KEY TO NOTES AND RESULT CODES

The following are the definition of the test result.

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
N/T	Test case is not tested.
NTNV	Nominal voltage, Normal Temperature
HV	High voltage, Normal Temperature
LV	Low voltage, Normal Temperature
HTHV	high voltage, High Temperature
LTHV	High voltage, Low Temperature
HTLV	Low voltage, High Temperature
LTLV	Low voltage, Low Temperature

5 RESULT SUMMARY

The following table summarizes the test results obtained.

No.	Test case	FCC reference	Verdict
1	RF Power Output	2.1046	Pass
2	Effective Radiated Power and Effective Isotropic Radiated Power	22.913, 24.232, 27.50	Pass
3	Occupied Bandwidth	2.1049	Pass
4	Peak-Average Ratio	22.913, 24.232, 27.50	Pass
5	Emission Bandwidth	2.1049	Pass
6	Spurious Emissions at antenna terminals	2.1051, 22.901, 22.917, 24.238, 27.53	Pass
7	Band Edges Compliance	2.1051, 22.359, 22.917, 24.238, 27.53	Pass
8	Frequency Stability	2.1055, 22.355, 24.235, 27.54	Pass
9	Radiated Spurious Emissions	2.1053, 22.917, 24.238, 27.53	Pass

This Test Report Is Issued by: Mr. Peng Zhen	Checked by: Mr. Li Bin
Tested by: Mr. He Dengshun	Issued date: 20190820

6 TEST RESULT

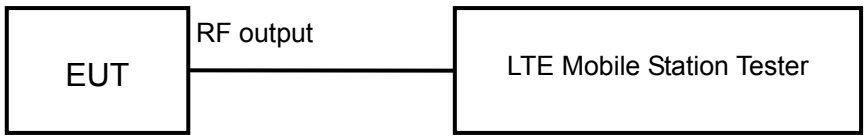
6.1 RF Power Output

Rule Part(s)
FCC: 2.1046

Ambient condition:

Temperature	Relative humidity	Pressure
23°C	42%	101.9kPa

Test Setup:



Test procedure:

After a radio link has been established between EUT and Tester, the output power of the cell signal of the testing equipment will be decreased until the output power of the EUT reach a maximum value. Then the test data can be read at the tester screen. The loss between RF output port of the EUT and the input port of the tester will be taken into consideration.

Limits	≤30dBm

Test result:
The test results are shown in Appendix A.

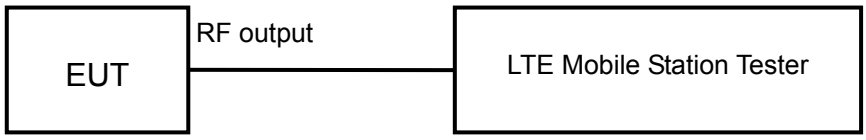
6.2 Effective Radiated Power

Rule Part(s)
FCC: 22.913, 24.232, 27.50

Ambient condition:

Temperature	Relative humidity	Pressure
20.8°C	36.5%	100.9kPa

Test setup:



ERP/EIRP LIMIT
This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15dB) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP – 2.15 (dB).
22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7Watts.
24.232(c) - Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.
27.50 (c) (10) the following power and antenna height requirements apply to stations transmitting in the 698–746 MHz band, the portable stations (hand-held devices) are limited to 3 watts ERP.
27.50 (b)(10) Portable stations (hand-held devices) transmitting in the 746–757 MHz, 758–763 MHz, 776–793 MHz, and 805–806 MHz bands are limited to 3 watts ERP.
27.50 (d)(4) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands: Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP
27.50 (h) The following power limits shall apply in the BRS and EBS: (2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

Test result:
The test results are shown in Appendix A.

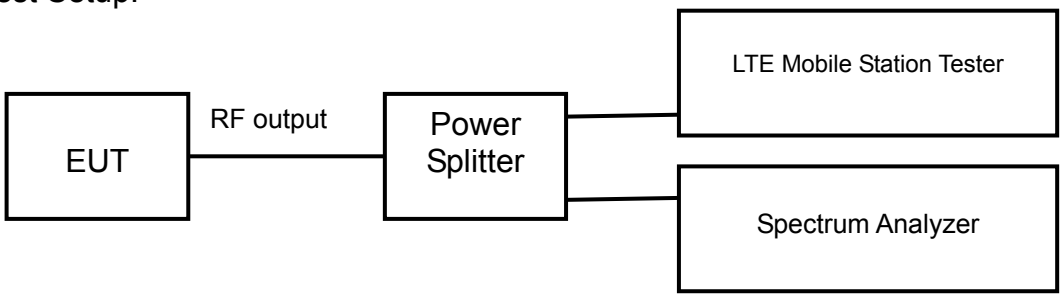
6.3 Occupied Bandwidth

Rule Part(s)
FCC: 2.1049

Ambient condition:

Temperature	Relative humidity	Pressure
23°C	42%	101.9kPa

Test Setup:



Test procedure:

After a radio link has been established between EUT and Tester, the output power of the cell signal of the testing equipment will be decreased until the output power of the EUT reach a maximum value. The occupied bandwidth is measured using spectrum analyzer. RBW is set to 30kHz on spectrum analyzer. The bandwidth of 99% power can be read on spectrum analyzer.

The measurement will be conducted at three channels (Bottom, middle and top channels of LTE band)

Limits: No specific occupied bandwidth requirements in part 2.1049

Test result:
The test results are shown in Appendix A.

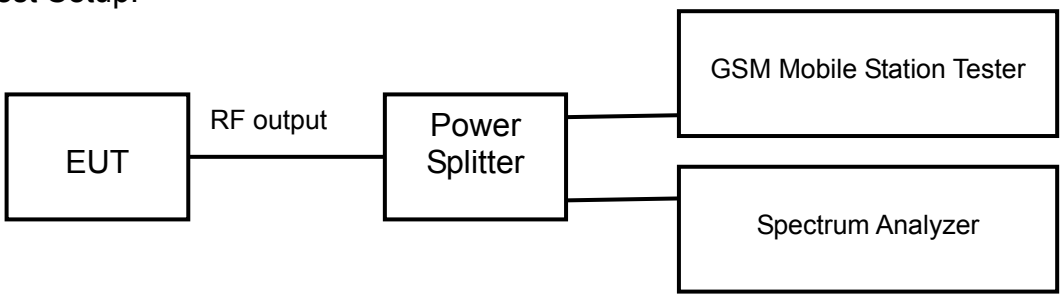
6.4 Emission Bandwidth

Rule Part(s)
FCC: 2.1049

Ambient condition:

Temperature	Relative humidity	Pressure
23℃	42%	101.9kPa

Test Setup:



Test procedure:

After a radio link has been established between EUT and Tester, the output power of the cell signal of the testing equipment will be decreased until the output power of the EUT reach a maximum value. The emission bandwidth is measured using spectrum analyzer. RBW is set to 3 kHz on spectrum analyzer. The bandwidth of -26dB transmitter power can be read on spectrum analyzer.

Limits: No specific emission bandwidth requirements in part 22.917(b)

Test result:
The test results are shown in Appendix A.

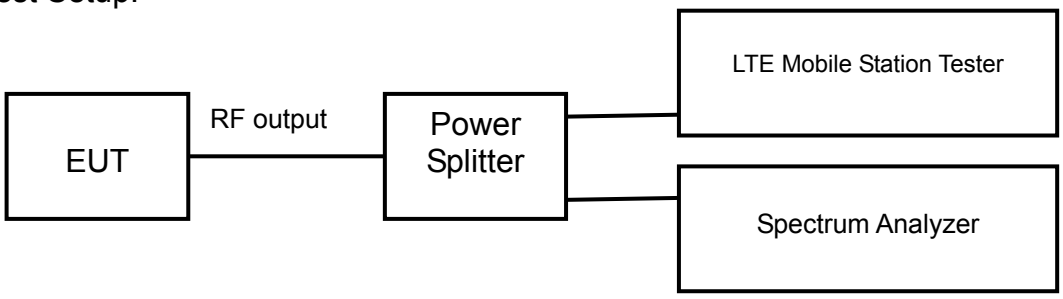
6.5 Peak-Average Ratio

Rule Part(s)
FCC: 22.913, 24.232, 27.50

Ambient condition:

Temperature	Relative humidity	Pressure
23°C	42%	101.9kPa

Test Setup:



Test procedure:
After a radio link has been established between EUT and Tester, the output power of the cell signal of the testing equipment will be decreased until the output power of the EUT reach a maximum value. The Peak-Average Ratio is measured using spectrum analyzer. RBW is set to 30 kHz on spectrum analyzer. The Peak-Average Ratio can be read on spectrum analyzer.

Limits	≤13dB

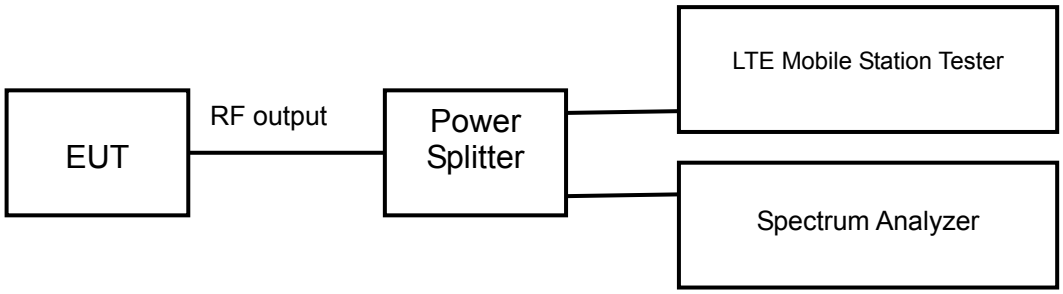
Test result:
The test results are shown in Appendix A.

6.6 Spurious Emissions at antenna terminal

Ambient condition:

Temperature	Relative humidity	Pressure
23°C	42%	101.9kPa

Test Setup:



Test procedure:

After a radio link has been established between EUT and Tester, the output power of the cell signal of the testing equipment will be decreased until the output power of the EUT reach a maximum value. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 30MHz to 20GHz (higher than the 10th harmonic of the carrier). The peak detector is used and RBW is set to 1MHz on spectrum analyzer.

Limits	≤-13dBm

Test result:
The test results are shown in Appendix A.

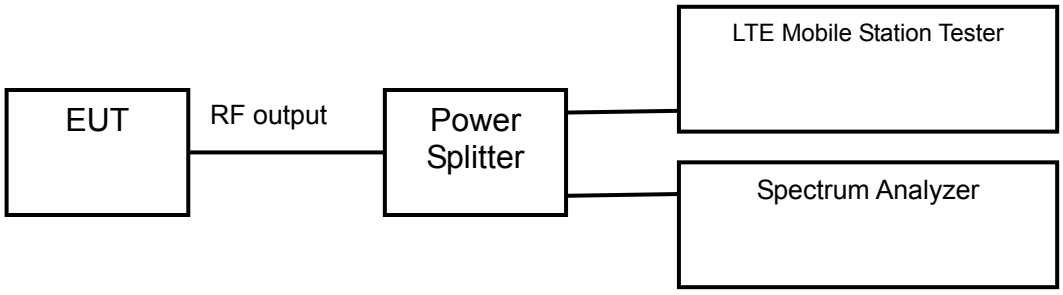
6.7 Band Edges Compliance

Rule Part(s)
FCC: 2.1051, 22.359, 22.917, 24.238, 27.53

Ambient condition:

Temperature	Relative humidity	Pressure
23°C	42%	101.9kPa

Test Setup:



Test procedure:

After a radio link has been established between EUT and Tester, the output power of the cell signal of the testing equipment will be decreased until the output power of the EUT reach a maximum value. The measurement is carried out using a spectrum analyzer. The peak detector is used and RBW is set to at least 1% of the emission bandwidth on spectrum analyzer.

Limits	≤-13dBm

Test result:
The test results are shown in Appendix A.

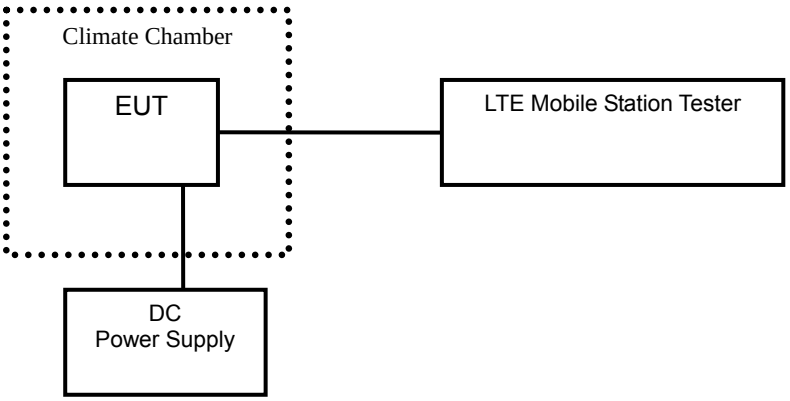
6.8 Frequency Stability

Rule Part(s)
FCC: 2.1055, 22.355, 24.235, 27.54

Ambient condition:

Temperature	Relative humidity	Pressure
23°C	42%	101.9kPa

Test setup:



Test Procedure:
A radio link shall be established between EUT and Tester. The tester will sample the transmitter RF output signal and measure its frequency. The temperature inside the climate chamber is varied from -30 to +50°C in 10°C step size, and also the DC power supply voltage to the EUT is varied from LV to HV. The measurement will be conducted at three channels No18100, No18300 and No18500 (Bottom, middle and top channels of LTE band I).

Limits: No specific frequency stability requirements in part 2.1055 and part 22.355.

Test result:
The test results are shown in Appendix A.

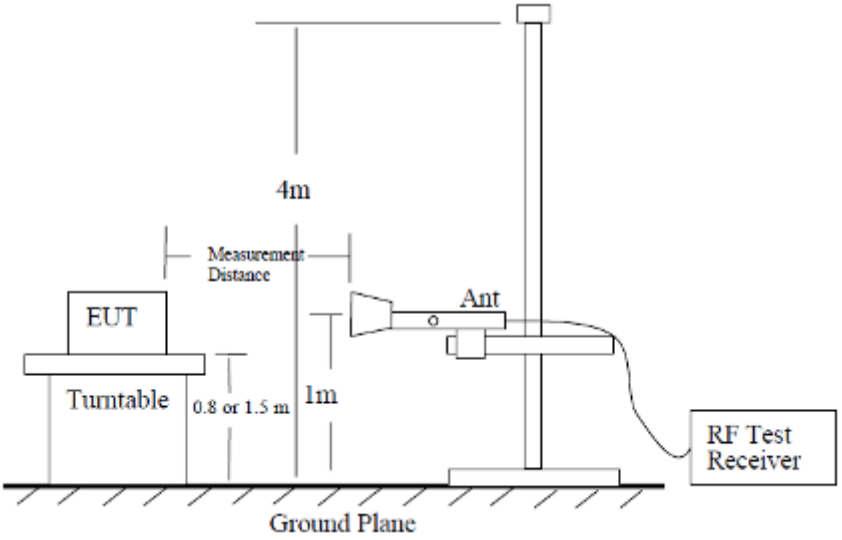
6.9 Radiated Spurious Emissions

Rule Part(s)
FCC: 2.1053, 22.917, 24.238, 27.53

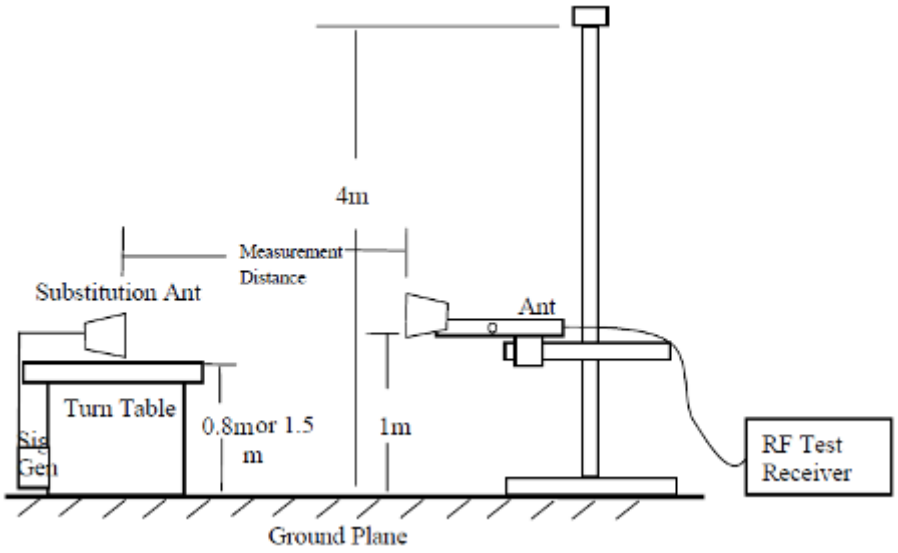
Ambient condition:

Temperature	Relative humidity	Pressure
20.8°C	36.5%	100.9kPa

Test Setup:



Step 1



Step 2

Test procedure:
The measurements procedures in TIA-603E-2016 are used.
The spectrum was scanned from 30MHz to the 10th harmonic of the highest frequency generated within the equipment.

Step 1:
The measurement is carried out in the fully anechoic chamber. EUT was placed on a 2.4 meter high non-conductive table at a 3 meter test distance from the test receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT. The height of receiving antenna is 2.4m and varies in certain range to find the maximum power value. A radio link shall be established between EUT and Tester. The output power of the cell signal of the tester will be decreased until the output power of the EUT reach a maximum value. The measurement is carried out using a spectrum analyzer or receiver. The spectrum analyzer scans from 30MHz to 20GHz (higher than the 10th harmonic of the carrier). The peak detector is used and RBW is set to 1MHz on spectrum analyzer. Then the antenna height and turn table rotation is adjusted till the maximum power value is founded on spectrum analyzer or receiver. A notch filter is necessary in the band near to the carrier frequency. A high pass filter is needed to avoid the distortion of the testing equipment in the band above the carrier frequency.
Step 2:
A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
A power (Pmea) is applied to the input of the substitution antenna, and adjusts the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (Pmea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
A “reference path loss” should be calculated after test. The attenuation of “reference path loss” is the cable loss between the Signal Source with the Substitution Antenna (Pca) and the Substitution Antenna Gain (Ga).
Calculation procedure:
The data of cable loss and antenna gain has been calibrated in full testing frequency range before the testing.
The power of the Radiated Spurious Emissions is calculated by adding the cable loss and antenna gain. The basic equation with a sample calculation is as followed:
Power(EIRP) = Pmea+ Pca + Ga
This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15dB) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP – 2.15 (dB).
Assumed the power of signal source record is -20dBm. A cable loss of -30dB, and an antenna gain of 11dB are added.
P=Pmea+Pca+Ga=(-20dBm)+(-30dB)+(11dB)= -39dBm

Test result:
The test results are shown in Appendix B.

7 MEASUREMENT UNCERTAINTIES

Items	Uncertainty	
RF Power Output	0.6 dB	
Occupied Bandwidth	3 kHz	
Spurious Emissions	30MHz～1GHz	2.83 dB
	1GHz～12.75GHz	2.50 dB
	12.75GHz～25GHz	2.75 dB
Band Edges Compliance	1.2dB	
Frequency Stability	4 Hz	

8 TEST EQUIPMENTS

No.	Name/Model	Manufacturer	S/N	Calibration Date	Calibration Due Date
1	CMW500 Mobile Station Tester	R&S	134669	2018.8.20	2019.8.19
2	FSV40 Spectrum Analyzer	R&S	101065	2018.8.20	2019.8.19
2	N9020A Spectrum Analyzer	Agilent	MY48010771	2018.08.20	2019.08.19
3	6007 Power Divider	Weinschel	6007-GJ-1	2018.08.20	2019.08.19
4	DC Power Supply E3645A	Agilent	MY40000741	2019.3.01	2020.2.28
5	Temperature chamber SH241	ESPEC	92013758	2018.8.20	2019.8.19
6	12.65m×8.03m×7.50m Fully-Anechoic Chamber	FRANKONIA	-----	-----	-----
7	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA	---	-----	-----
8	Turn table Diameter:1m	FRANKONIA	-----	-----	-----
9	Turn table Diameter:5m	FRANKONIA	-----	-----	-----
10	Antenna master FAC(MA4.0)	MATURO	-----	-----	-----
11	Antenna master SAC(MA4.0)	MATURO	-----	-----	-----
12	9.080m×5.255m×3.525m Shielding room	FRANKONIA	-----	-----	-----
13	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100512	2018.08.20	2019.08.19
14	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100513	2018.08.20	2019.08.19
15	HL562 Ultra log antenna	R&S	100016	2018.08.20	2019.08.19
16	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2018.08.20	2019.08.19
17	ESI 40 EMI test receiver	R&S	100015	2018.08.20	2019.08.19
18	ESCS30 EMI test receiver	R&S	100029	2018.08.20	2019.08.19
19	HL562 Receive antenna	R&S	100167	2018.08.20	2019.08.19
20	ENV216 AMN	R&S	3560.6550.12	2018.08.20	2019.08.19