

FCC - TEST REPORT

Report Number : **60.790.17.023.03** Date of Issue : September 8, 2017

Model : **SF-BTHFRD**

Product Type : **RFID Reader with BLE**

Applicant : Hong Kong RFID Ltd.

Address : Unit 11, 9/F, Wah Wai Centre, 38-40 Au Pui Wan Street, Fotan, Shatin, N.T., Hong Kong

Production Facility : Hong Kong RFID Ltd.

Address : Unit 11, 9/F, Wah Wai Centre, 38-40 Au Pui Wan Street, Fotan, Shatin, N.T., Hong Kong

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including Appendices : 47

TÜV SÜD HONG KONG LTD. is a subcontractor to TÜV SÜD Product Service GmbH according to the principles outlined in ISO 17025. TÜV SÜD HONG KONG LTD. reports apply only to the specific samples tested under stated test conditions. Construction of the actual test samples has been documented. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. The manufacturer/importer is responsible to the Competent Authorities in Europe for any modifications made to the production units which result in non-compliance to the relevant regulations TÜV SÜD HONG KONG LTD. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD HONG KONG LTD. issued reports. This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval.

1 Table of Contents

1 Table of Contents.....	2
2 Description of Equipment Under Test	3
3 Summary of Test Standards	4
4 Details about the Test Laboratory	5
4.1 Test Equipment Site List	6
4.2 Measurement System Uncertainty	7
5 Summary of Test Results.....	8
6 General Remarks.....	9
7 Emission Test Results	10
7.1 Radiated Emission.....	10
7.2 Frequency Tolerance	12
7.3 Spurious Radiated Emission	13
7.4 Conducted Emission.....	19
7.5 6dB & 99% Bandwidth	21
7.6 Peak Output Power.....	24
7.7 Spurious Emissions at Antenna Terminals.....	27
7.6 100kHz Bandwidth of band edges.....	30
7.9 Power Spectral Density	34
7.8 Antenna Requirement.....	37
8 Appendix A - Photographs of EUT	38
9 Appendix B - Setup Photographs of EUT.....	43
10 Appendix C - General Product Information	46

2 Description of Equipment Under Test

Description of the Equipment Under Test

Product:	RFID Reader with BLE
Model no.:	SF-BTHFRD
FCC ID:	XNO-SF-BTHFRD
Rating:	5.0VDC (USB port)
Frequency:	13.56MHz, 2402MHz-2480MHz
Antenna gain:	0 dBi
Number of operated channel:	40
Modulation:	GFSK

3 Summary of Test Standards

Test Standards
FCC Part 15 Subpart C 10-1-16 Edition Federal Communications Commission, PART 15 — Radio Frequency Devices, Subpart C — Unintentional Radiators

4 Details about the Test Laboratory

Site 1

Company name: TÜV SÜD Hong Kong Ltd.
3/F, West Wing, Lakeside 2,
10 Science Park West Avenue,
Science Park, Shatin, Hong Kong

Site 2

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13 Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2,
Shenzhen 518052, P.R.China
FCC Registration Number: 502708

Emission Tests	
Test Item	Test Site
FCC Part 15 Subpart C	
FCC Title 47 Part 15.205, 15.209 & 15.225 (c) (d) Radiated Emission	Site 2
FCC Title 47 Part 15.225 (e) Frequency Tolerance	Site 2
FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission	Site 2
FCC Title 47 Part 15.207 Conducted Emission	Site 2
FCC Title 47 Part 15.247(a)(1) 6dB & 99% Bandwidth	Site 2
FCC Title 47 Part 15.247(b) Peak Output Power	Site 2
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	Site 2
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	Site 2
FCC Title 47 Part 15.247(e) Power Spectral Density	Site 2
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	Site 2

4.1 Test Equipment Site List

Radiated emission Test – Site 2

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2018-7-14
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2018-7-14
Horn Antenna	Rohde & Schwarz	HF907	102294	2018-7-14
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100398	2018-7-14
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2018-7-14
Signal Generator	Rohde & Schwarz	SMY01	839369/005	2018-7-7
Attenuator	Agilent	8491A	MY39264334	2018-7-7
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

Conducted Emission Test – Site 2

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2018-7-14
LISN	Rohde & Schwarz	ENV4200	100249	2018-7-14
LISN	Rohde & Schwarz	ENV432	101318	2018-7-14
LISN	Rohde & Schwarz	ENV216	100326	2018-7-14
ISN	Rohde & Schwarz	ENY81	100177	2018-7-14
ISN	Rohde & Schwarz	ENY81-CA6	101664	2018-7-14
High Voltage Probe	Rohde & Schwarz	TK9420(VT9420)	9420-584	2018-7-14
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2018-7-14
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2018-7-7
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

20dB & 99% Bandwidth, Peak Output Power, Spurious Emissions at Antenna Terminals, 100kHz Bandwidth of band edges, Power Spectral Density – Site 2

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Generator	Rohde & Schwarz	SMB100A	108272	2018-7-7
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2018-7-7
Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2018-7-7
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2018-7-7

4.2 Measurement System Uncertainty

Measurement System Uncertainty Emissions

System Measurement Uncertainty	
Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.54dB
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.83dB; Vertical: 4.91dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-25000MHz	Horizontal: 4.89dB; Vertical: 4.88dB;
Uncertainty for Conducted RF test	2.04dB

5 Summary of Test Results

Emission Tests				
FCC Part 15 Subpart C				
Test Condition	Pages	Test Result		
		Pass	Fail	N/A
FCC Title 47 Part 15.205, 15.209 & 15.225 (c) (d) Radiated Emission	10-11	☒	☐	☐
FCC Title 47 Part 15.225 (e) Frequency Tolerance	12	☒	☐	☐
FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission	13-18	☒	☐	☐
FCC Title 47 Part 15.207 Conduct Emission	19-20	☒	☐	☐
FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth	21-23	☒	☐	☐
FCC Title 47 Part 15.247(b) Peak Output Power	24-26	☒	☐	☐
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	27-29	☒	☐	☐
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	30-33	☒	☐	☐
FCC Title 47 Part 15.247(e) Power Spectral Density	34-36	☒	☐	☐
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	37	☒	☐	☐

6 General Remarks

Remarks

NIL.

SUMMARY:

- All tests according to the regulations cited on page 5 were

☒ - Performed

☐ - **Not** Performed

- The Equipment Under Test

☒ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date: June 19, 2017

Testing Start Date: June 20, 2017

Testing End Date: July 31, 2017

- TÜV SÜD HONG KONG LTD. -

Reviewed by:



CHAN Kwong Ngai
EMC Test Engineer



Prepared by:



Alex CHAN
EMC Project Engineer

7 Emission Test Results

7.1 Radiated Emission

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (13.56MHz)
 Test Specification: FCC15.225(a), (d) Antenna: Horizontal
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: 9kHz to 1GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
13.562	54.61	124.0	-69.39	Quasi Peak
27.124	36.06	69.5	-33.48	Quasi Peak
30.210	22.58	40.0	-17.42	Quasi Peak
54.252	27.50	40.0	-12.50	Quasi Peak
67.815	26.70	40.0	-13.30	Quasi Peak
81.378	27.70	40.0	-12.30	Quasi Peak
108.504	28.90	43.5	-14.60	Quasi Peak
122.068	29.50	43.5	-14.00	Quasi Peak
135.620	30.20	43.5	-13.30	Quasi Peak

Spurious Radiated Emission

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (13.56MHz)
 Test Specification: FCC15.225(a), (d) Antenna: Vertical
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: 9kHz to 1GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
13.562	46.83	124.0	-77.17	Quasi Peak
27.124	35.37	69.5	-34.17	Quasi Peak
30.120	20.21	40.0	-19.79	Quasi Peak
40.689	23.36	43.5	-20.14	Quasi Peak
67.814	24.80	43.5	-18.70	Quasi Peak
81.375	24.23	43.5	-19.27	Quasi Peak
108.510	27.54	43.5	-15.96	Quasi Peak
122.065	29.58	46.0	-16.42	Quasi Peak
135.620	30.40	46.0	-15.60	Quasi Peak

7.2 Frequency Tolerance

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (13.56MHz)
 Test Specification: FCC15.225(e)
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: NIL

Test Result
☒ Passed
☐ Not Passed

Operating Frequency (MHz):		13.562386		
Test Condition				
Temperature (°C)	Power (VAC / Hz)	Measured Frequency (MHz)	Frequency Error (%)	Limit (%)
+50	120 / 60	13.562374	-0.000088	± 0.01
+40		13.562384	-0.000015	
+30		13.562308	-0.000575	
+20		13.562386	0	
+10		13.562381	-0.000037	
0		13.562376	-0.000074	
-10		13.562372	-0.000103	
-20		13.562368	-0.000133	

Operating Frequency (MHz):		13.562386		
Test Condition				
Temperature (°C)	Power (VAC / Hz)	Measured Frequency (MHz)	Frequency Error (%)	Limit (%)
+20	102 / 60	13.562384	-0.000015	± 0.01
	120 / 60	13.562386	0	
	138 / 60	13.562387	+0.000007	

7.3 Spurious Radiated Emission

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
58.507	23.91	40.0	-16.09	Quasi Peak
274.116	25.21	46.0	-20.79	Quasi Peak
863.392	30.19	46.0	-15.81	Quasi Peak
1351.931	30.31	74.0	-43.69	Peak
1351.931	24.63	54.0	-29.37	Average
1833.437	29.55	74.0	-44.45	Peak
1833.437	26.28	54.0	-27.72	Average
4803.281	41.99	74.0	-32.01	Peak
4803.281	34.10	54.0	-19.90	Average
6000.000	41.82	74.0	-32.18	Peak
6000.000	35.91	54.0	-18.09	Average
7508.437	40.50	74.0	-33.50	Peak
7508.437	34.78	54.0	-13.83	Average
11165.625	42.52	74.0	-13.83	Peak
11165.625	38.09	54.0	-13.83	Average

Spurious Radiated Emission

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
59.100	20.03	40.0	-19.97	Quasi Peak
277.134	23.55	43.5	-19.95	Quasi Peak
876.648	28.99	46.0	-17.01	Quasi Peak
1240.125	29.00	74.0	-45.00	Peak
1240.125	22.97	54.0	-31.03	Average
1592.937	30.83	74.0	-43.17	Peak
1592.937	23.48	54.0	-30.52	Average
4803.282	36.79	74.0	-37.21	Peak
4803.282	31.21	54.0	-22.79	Average
7043.437	38.97	74.0	-35.03	Peak
7043.437	33.47	54.0	-20.53	Average
9392.812	40.49	74.0	-33.51	Peak
9392.812	35.18	54.0	-18.82	Average
11742.656	43.47	74.0	-30.53	Peak
11742.656	38.92	54.0	-15.08	Average

Spurious Radiated Emission

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
95.151	18.53	43.5	-24.97	Quasi Peak
392.295	23.56	46.0	-22.44	Quasi Peak
868.442	31.28	46.0	-14.72	Quasi Peak
1266.562	30.16	74.0	-43.84	Peak
1266.562	25.33	54.0	-28.67	Average
1647.625	27.87	74.0	-46.13	Peak
1647.625	20.18	54.0	-33.82	Average
4880.156	36.86	74.0	-37.14	Peak
4880.156	30.78	54.0	-23.22	Average
6000.000	41.58	74.0	-32.42	Peak
6000.000	37.81	54.0	-16.19	Average
8263.594	39.52	74.0	-34.48	Peak
8263.594	33.71	54.0	-20.29	Average
10667.812	42.56	74.0	-31.44	Peak
10667.812	37.84	54.0	-16.16	Average

Spurious Radiated Emission

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
95.205	17.08	43.5	-26.42	Quasi Peak
625.472	22.13	46.0	-23.87	Quasi Peak
863.470	30.01	46.0	-15.99	Quasi Peak
1270.250	32.87	74.0	-41.13	Peak
1270.250	27.94	54.0	-26.06	Average
1594.812	30.81	74.0	-43.19	Peak
1594.812	27.44	54.0	-26.56	Average
4880.156	40.01	74.0	-33.99	Peak
4880.156	34.73	54.0	-19.27	Average
7357.500	39.39	74.0	-34.61	Peak
7357.500	32.86	54.0	-21.14	Average
9547.500	40.78	74.0	-33.22	Peak
9547.500	35.09	54.0	-18.91	Average
12440.625	43.42	74.0	-30.58	Peak
12440.625	37.92	54.0	-16.08	Average

Spurious Radiated Emission

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
142.789	17.19	43.5	-26.31	Quasi Peak
564.955	25.54	46.0	-20.46	Quasi Peak
870.125	30.19	46.0	-15.81	Quasi Peak
1248.937	30.29	74.0	-43.71	Peak
1248.937	24.75	54.0	-29.25	Average
1594.313	28.33	74.0	-45.67	Peak
1594.313	22.48	54.0	-31.52	Average
4959.375	37.31	74.0	-36.69	Peak
4959.375	30.59	54.0	-23.41	Average
6000.000	38.05	74.0	-35.95	Peak
6000.000	32.49	54.0	-21.51	Average
8231.250	39.91	74.0	-34.09	Peak
8231.250	33.42	54.0	-20.58	Average
12502.031	43.62	74.0	-30.38	Peak
12502.031	38.53	54.0	-15.47	Average

Spurious Radiated Emission

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 120VAC, 60Hz (For external adaptor)
 Remark: 9kHz to 25GHz

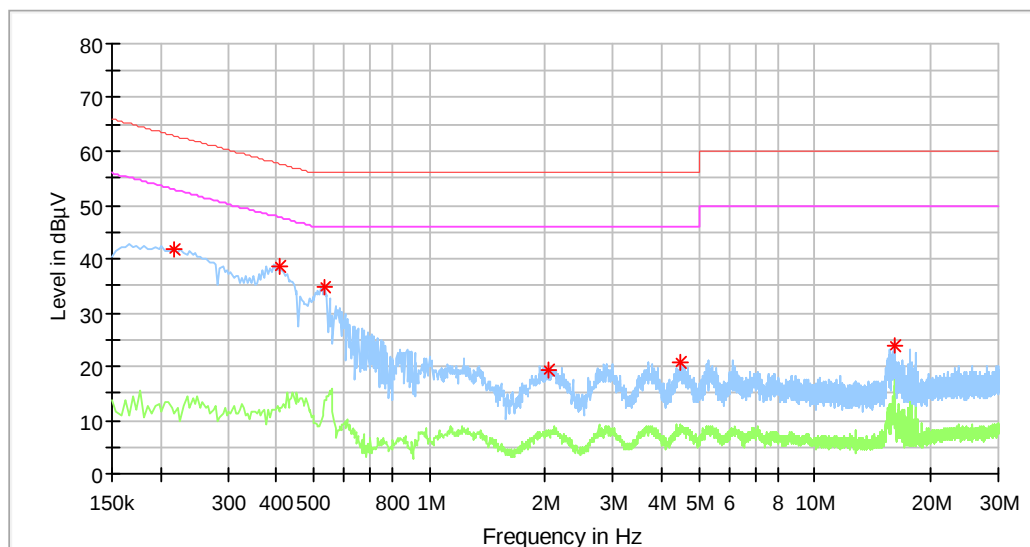
Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
142.789	14.59	43.5	-28.91	Quasi Peak
528.776	25.73	46.0	-20.27	Quasi Peak
876.648	28.95	46.0	-17.05	Quasi Peak
1250.375	28.74	74.0	-45.26	Peak
1250.375	22.46	54.0	-31.54	Average
1797.375	28.71	74.0	-45.29	Peak
1797.375	21.98	54.0	-32.02	Average
4959.375	35.24	74.0	-38.76	Peak
4959.375	30.07	54.0	-23.93	Average
6000.125	38.64	74.0	-35.36	Peak
6000.125	32.48	54.0	-21.52	Average
7591.406	39.41	74.0	-34.59	Peak
7591.406	33.84	54.0	-20.16	Average
11701.875	41.51	74.0	-32.49	Peak
11701.875	38.64	54.0	-15.36	Average

7.4 Conducted Emission

EUT: SF-BTHFRD
 Op Condition: Operated, Normal Link
 Test Specification: FCC 15.207 Conduct Emission, N Line
 Comment: 120VAC, 60Hz (For external adaptor)

Test Result	
☒	Passed
☐	Not Passed

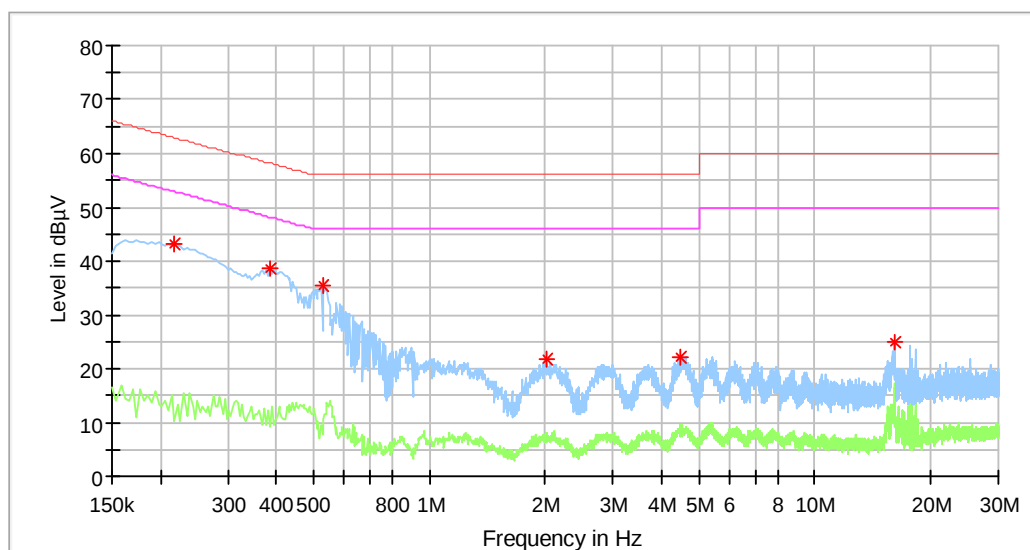


Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)
0.218000	41.90	---	62.89	-21.00
0.406000	38.56	---	57.73	-19.17
0.534000	34.75	---	56.00	-21.25
2.038000	19.42	---	56.00	-36.58
4.478000	20.83	---	56.00	-35.17
16.230000	23.96	---	60.00	-36.04

Conducted Emission

EUT: SF-BTHFRD
 Op Condition: Operated, Normal Link
 Test Specification: FCC 15.207 Conduct Emission, L Line
 Comment: 120VAC, 60Hz (For external adaptor)

Test Result	
☒	Passed
☐	Not Passed



Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)
0.218000	43.00	---	62.89	-19.89
0.386000	38.63	---	58.15	-19.52
0.530000	35.35	---	56.00	-20.65
2.006000	21.74	---	56.00	-34.26
4.462000	21.98	---	56.00	-34.02
16.226000	24.86	---	60.00	-35.14

7.5 6dB & 99% Bandwidth

EUT:SF-BTHFRD

Op Condition:Operated, TX Mode (2402MHz)

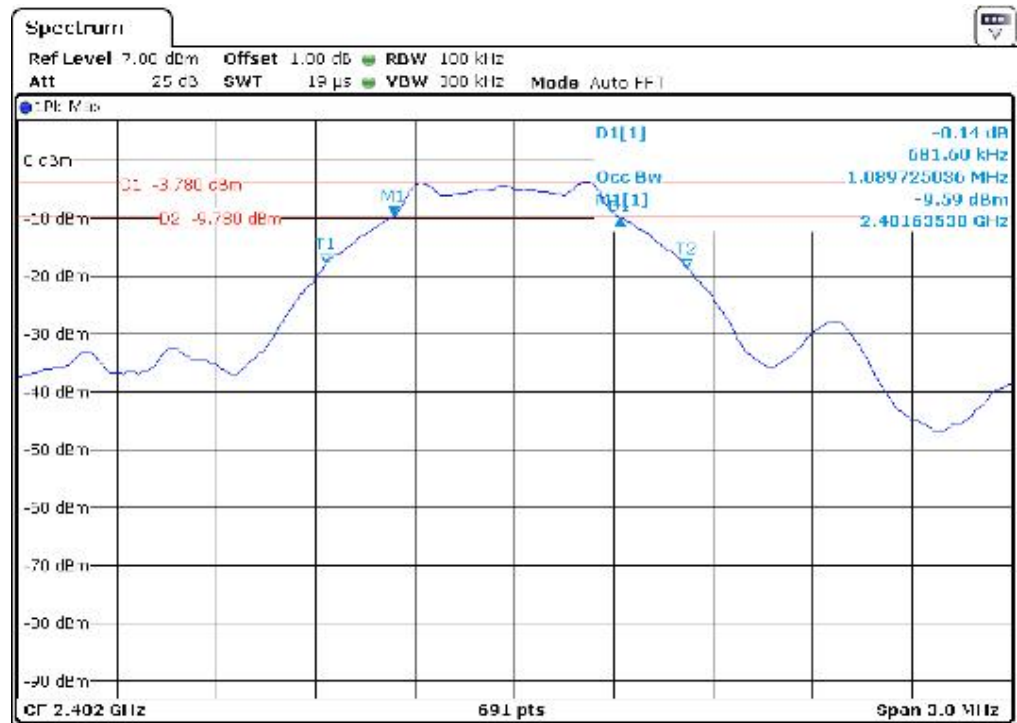
Test Specification:FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth

Comment:120VAC, 60Hz (For external adaptor)

Test Result

☒ Passed

☐ Not Passed



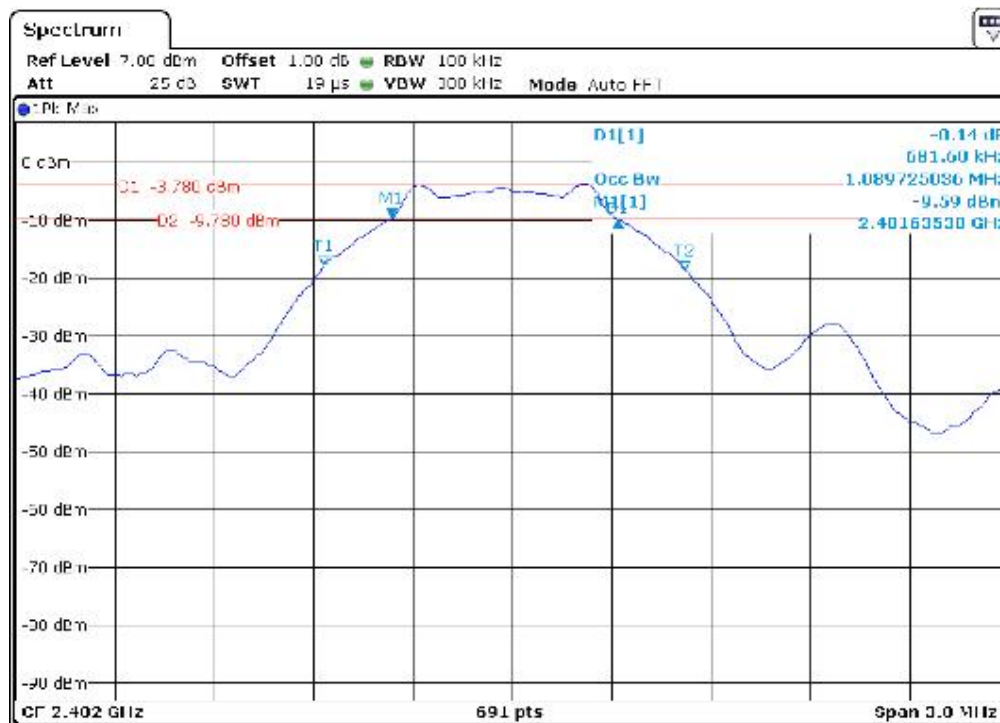
6dB bandwidth	Limit
681.600 kHz	> 500 kHz

99% bandwidth
1089.725 kHz

6dB & 99% Bandwidth

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 120VAC, 60Hz (For external adaptor)

Test Result
☒ Passed
☐ Not Passed



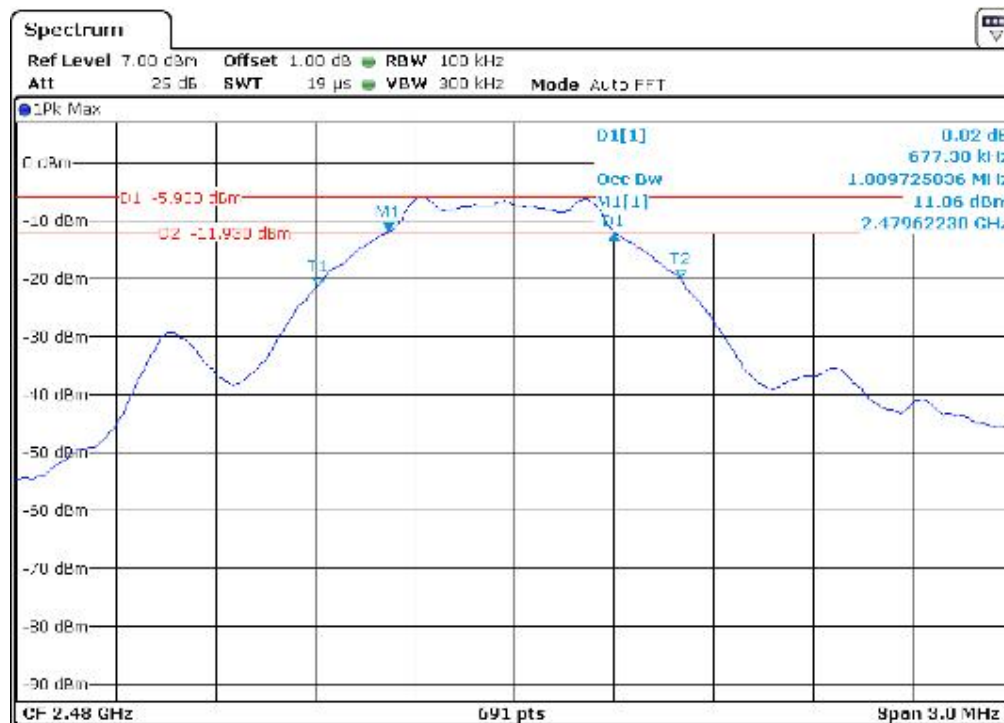
6dB bandwidth	Limit
681.600 kHz	> 500 kHz

99% bandwidth
1089.725 kHz

6dB & 99% Bandwidth

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 120VAC, 60Hz (For external adaptor)

Test Result
☒ Passed
☐ Not Passed



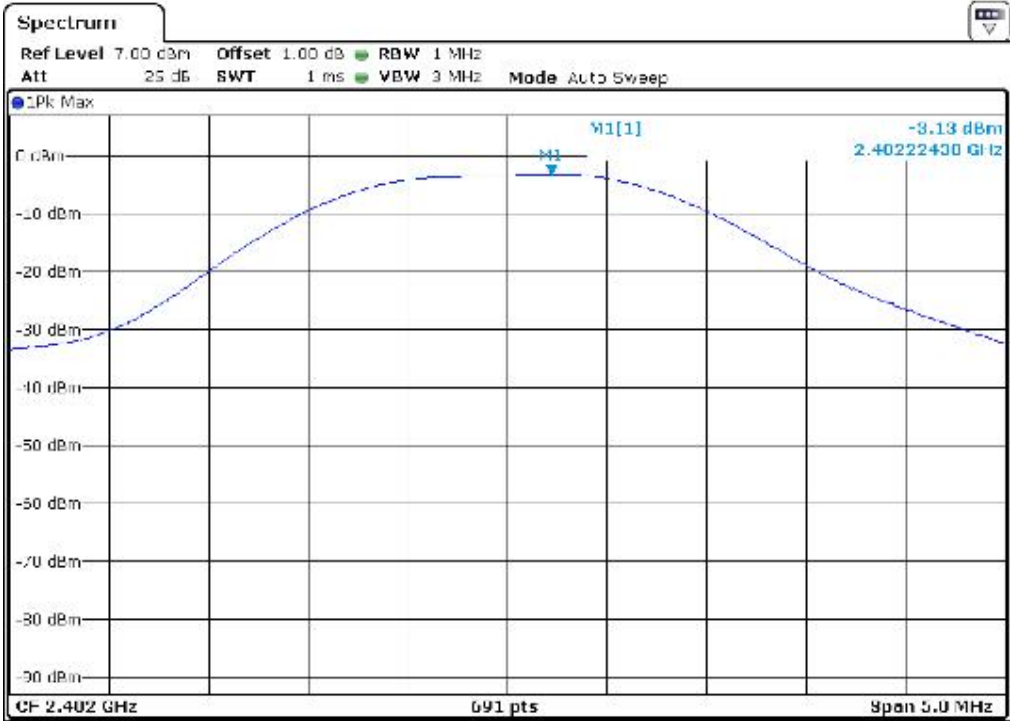
6dB bandwidth	Limit
677.300 kHz	>500 kHz

99% bandwidth
1089.725 kHz

7.6 Peak Output Power

EUT: SF-BTHFRD
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(b)
Comment: 120VAC, 60Hz (For external adaptor)
Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result	
☒	Passed
☐	Not Passed



Conducted Output Power	Limit
-3.13 dBm	< 30dBm

Peak Output Power

EUT: SF-BTHFRD
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC15.247(b)
Comment: 120VAC, 60Hz (For external adaptor)
Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed

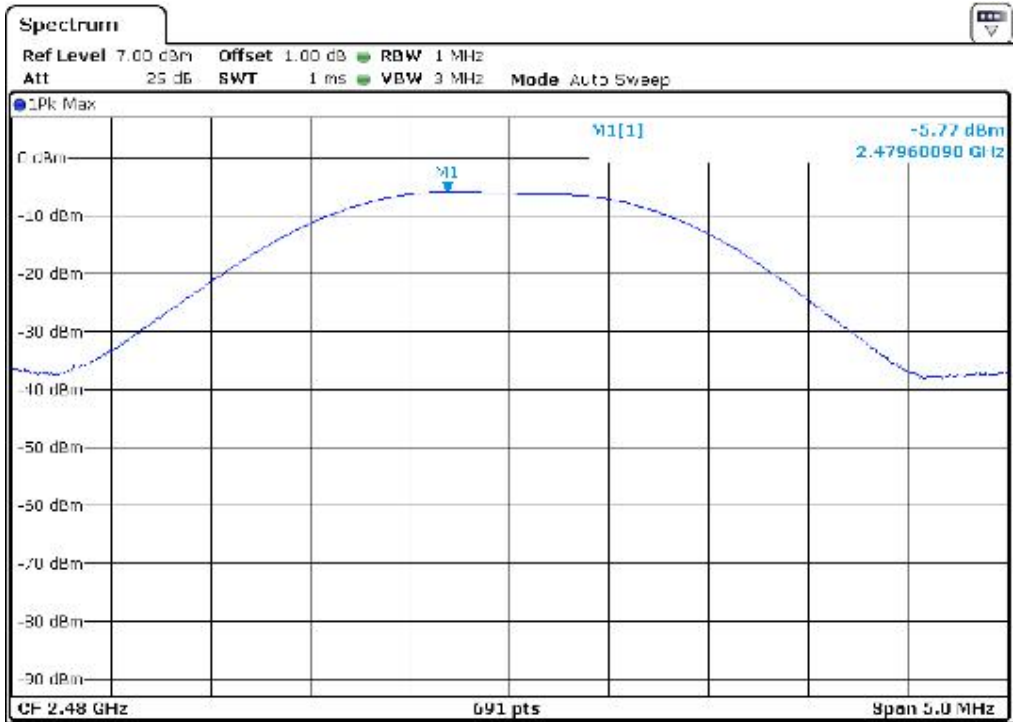


Conducted Output Power	Limit
-4.62 dBm	< 30dBm

Peak Output Power

EUT: SF-BTHFRD
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(b)
Comment: 120VAC, 60Hz (For external adaptor)
Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed

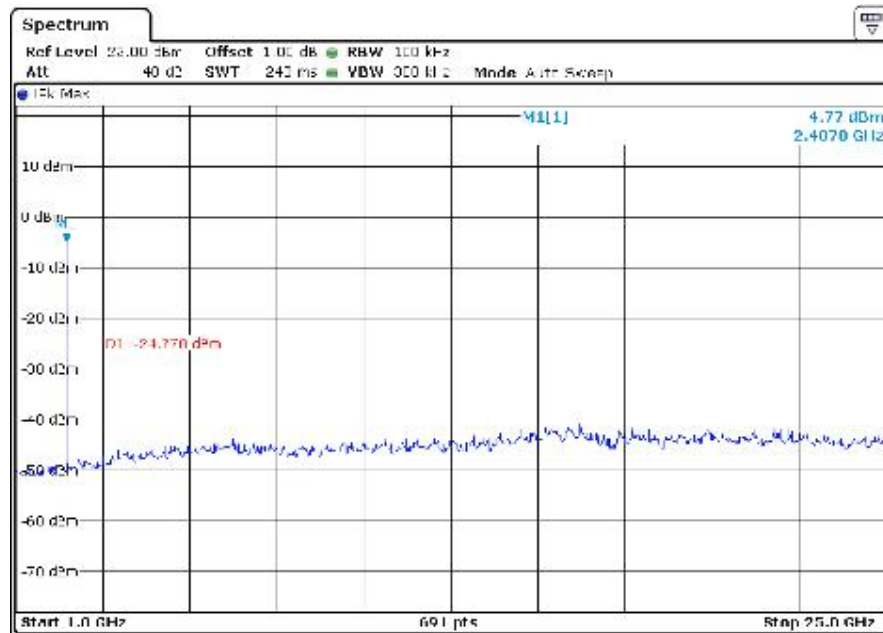
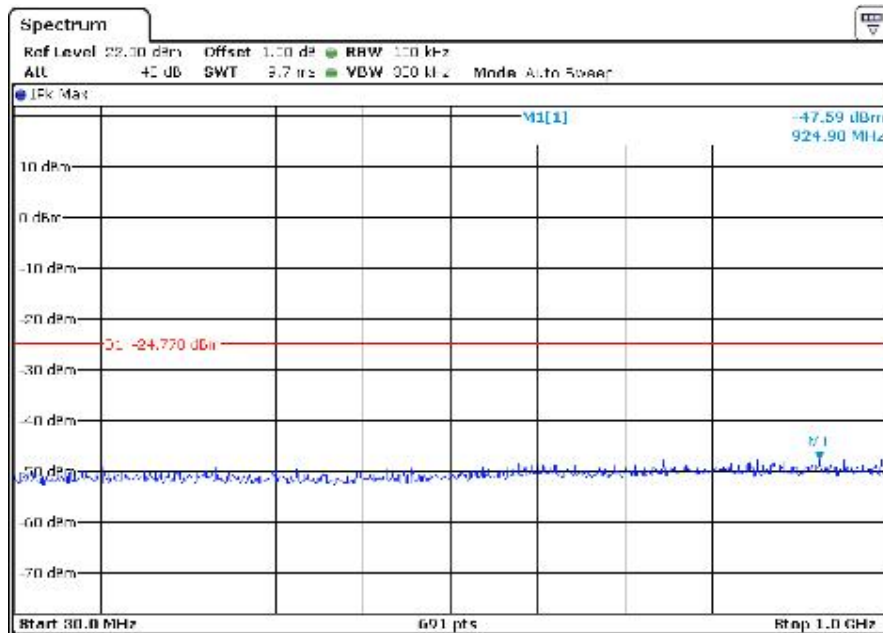


Conducted Output Power	Limit
-5.77 dBm	< 30dBm

7.7 Spurious Emissions at Antenna Terminals

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 120VAC, 60Hz (For external adaptor)

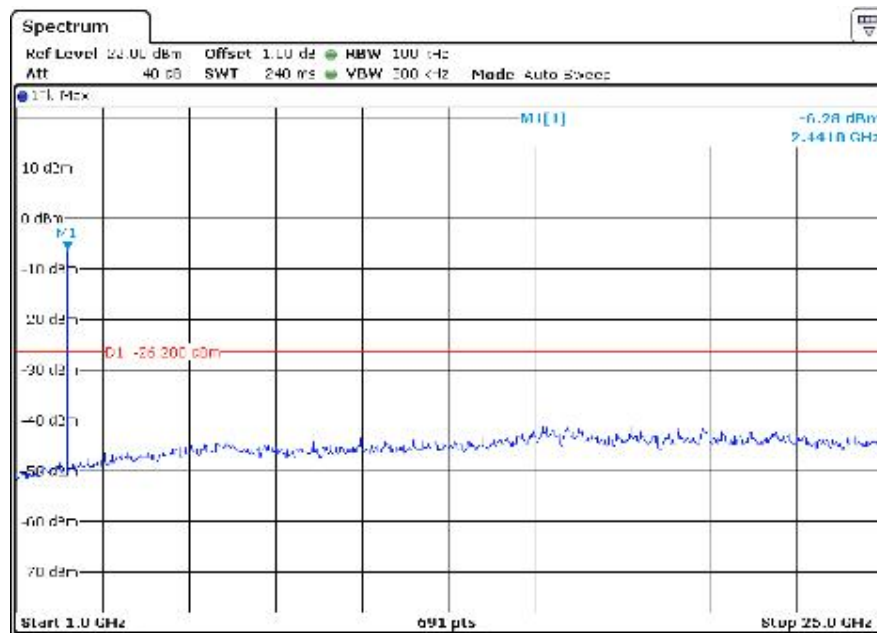
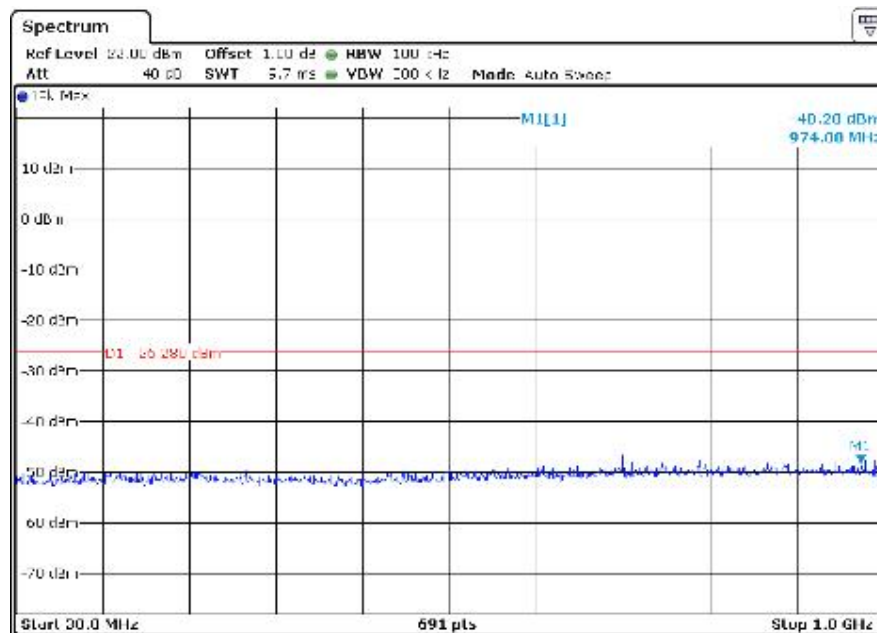
Test Result
☒ Passed
☐ Not Passed



Spurious Emissions at Antenna Terminals

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 120VAC, 60Hz (For external adaptor)

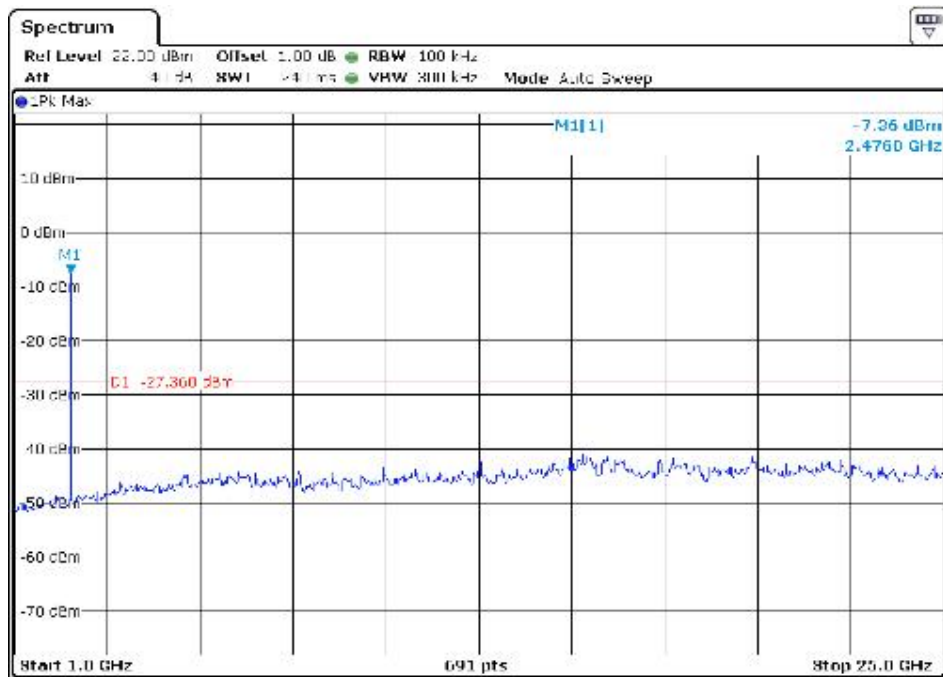
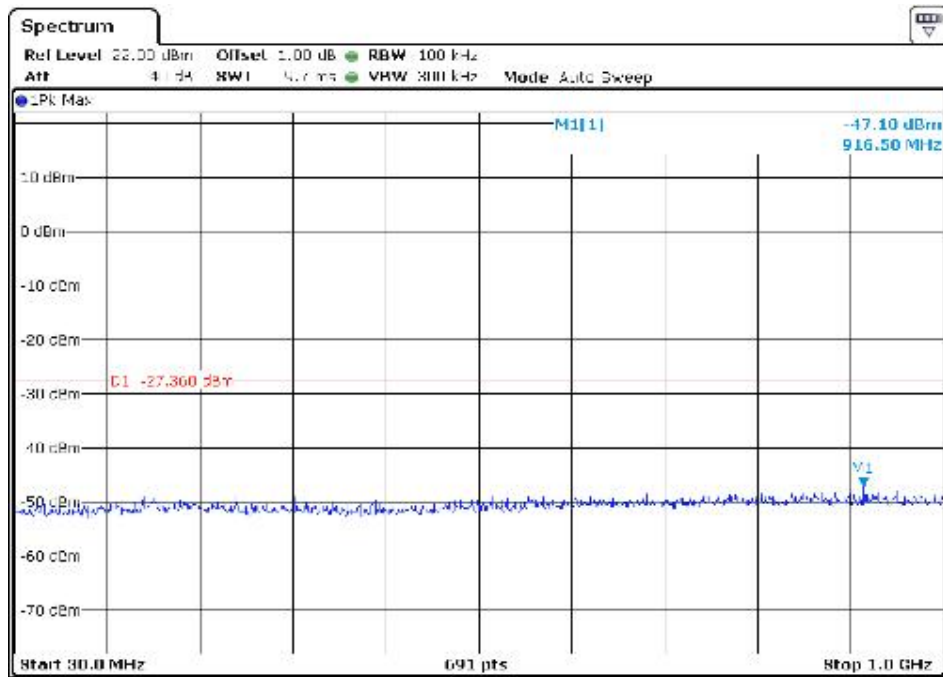
Test Result	
☒	Passed
☐	Not Passed



Spurious Emissions at Antenna Terminals

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 120VAC, 60Hz (For external adaptor)

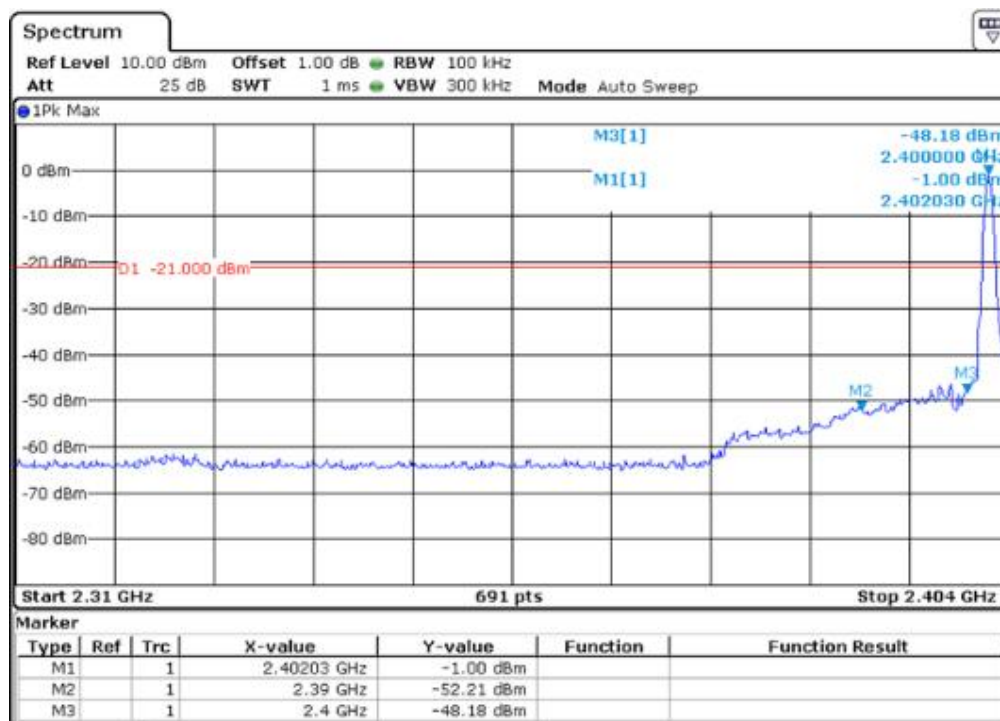
Test Result	
☒	Passed
☐	Not Passed



7.6 100kHz Bandwidth of band edges

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.247(d), Conducted
 Comment: 120VAC, 60Hz (For external adaptor)

Test Result
☒ Passed
☐ Not Passed



Band edges	Limit
47.18 dB	> 20dB

100kHz Bandwidth of band edges

EUT: SF-BTHFRD
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 120VAC, 60Hz (For external adaptor)

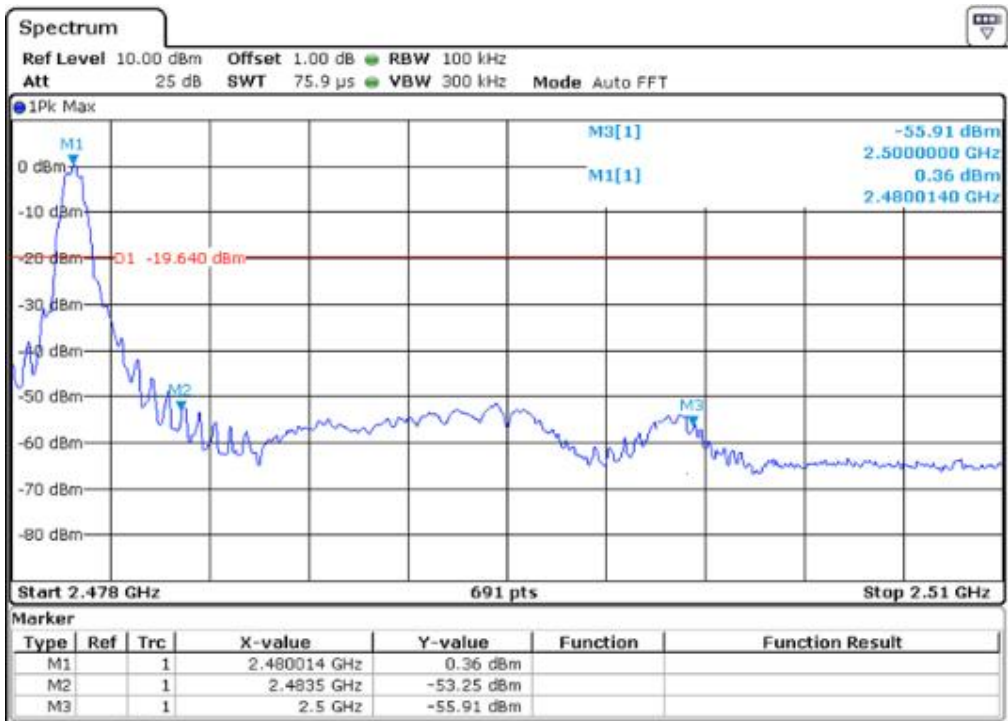
Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
2390.000	43.02	74	-30.98	Peak
2390.000	32.72	54	-21.28	Average

100kHz Bandwidth of band edges

EUT: SF-BTHFRD
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(d), Conducted
Comment: 120VAC, 60Hz (For external adaptor)

Test Result
☒ Passed
☐ Not Passed



Band edges	Limit
52.89 dB	> 20dB

100kHz Bandwidth of band edges

EUT: SF-BTHFRD
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 120VAC, 60Hz (For external adaptor)

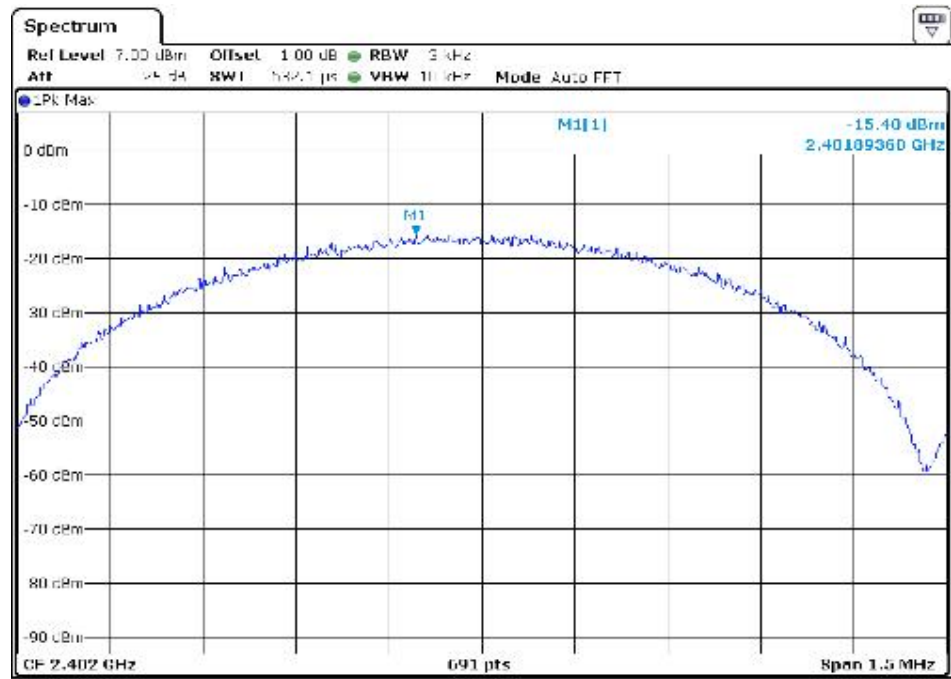
Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
2483.500	41.98	74	-32.02	Peak
2483.500	30.25	54	-23.75	Average

7.9 Power Special Density

EUT: SF-BTHFRD
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(e)
Comment: 120VAC, 60Hz (For external adaptor)

Test Result
☒ Passed
☐ Not Passed



PSD	Limit
-15.40 dBm	< 8 dBm

Power Special Density

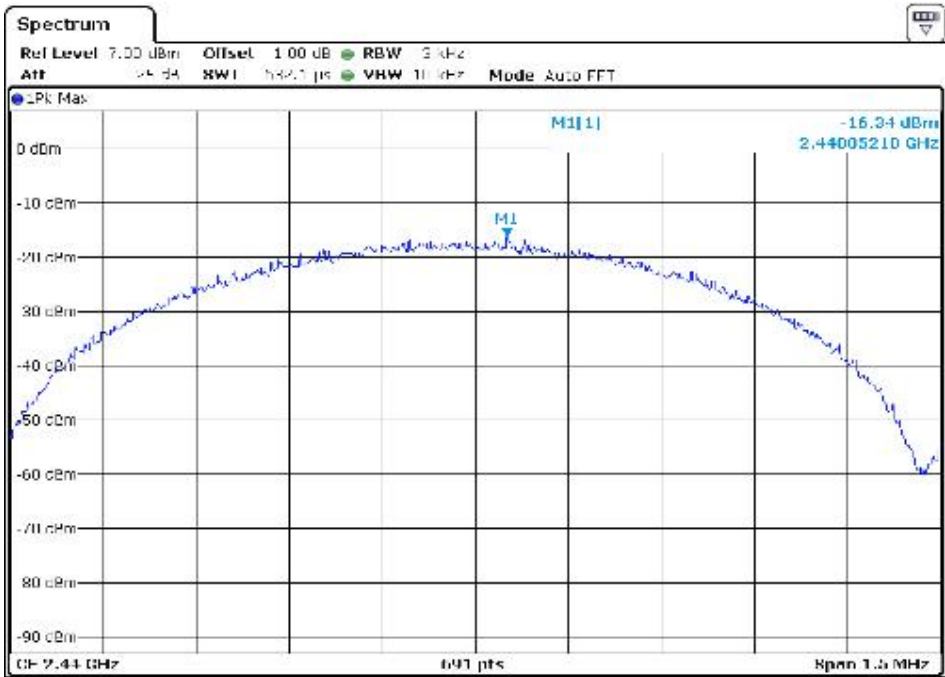
EUT:
Op Condition:
Test Specification:
Comment:

SF-BTHFRD
Operated, TX Mode (2440MHz)
FCC15.247(e)
120VAC, 60Hz (For external adaptor)

Test Result

☒ Passed

☐ Not Passed

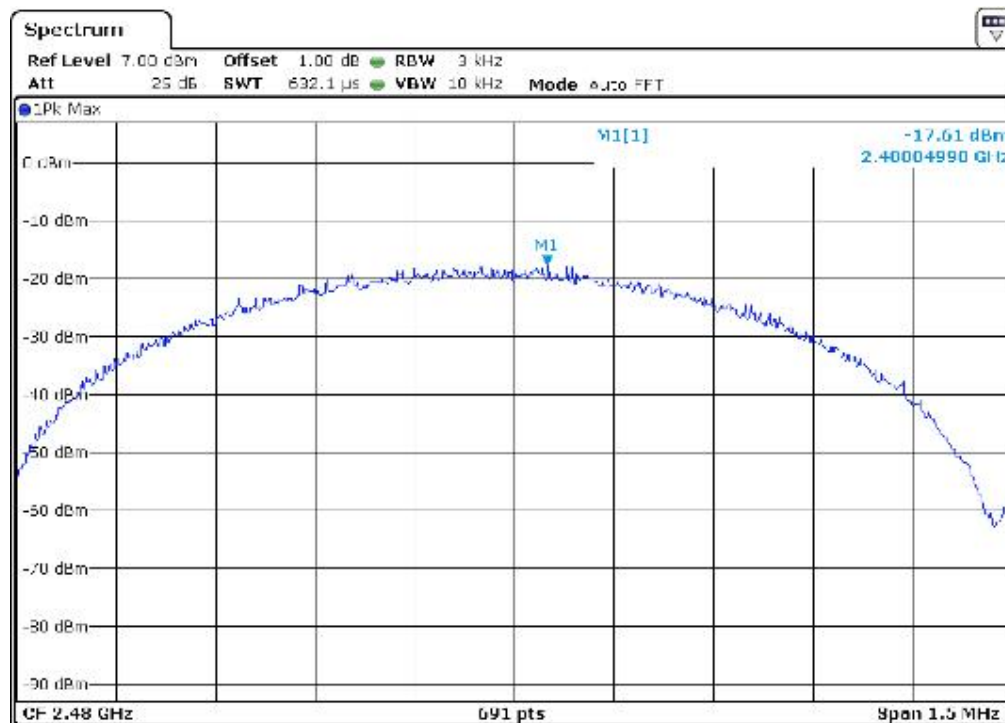


PSD	Limit
-16.34 dBm	< 8 dBm

Power Special Density

EUT: SF-BTHFRD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(e)
 Comment: 120VAC, 60Hz (For external adaptor)

Test Result	
☒	Passed
☐	Not Passed



PSD	Limit
-17.61 dBm	< 8 dBm

7.8 Antenna Requirement

EUT: SF-BTHFRD
Op Condition: Operated, TX Mode
Test Specification: FCC15.203 & 15.247(b)
Comment: 120VAC, 60Hz (For external adaptor)

Test Result	
☒	Passed
☐	Not Passed

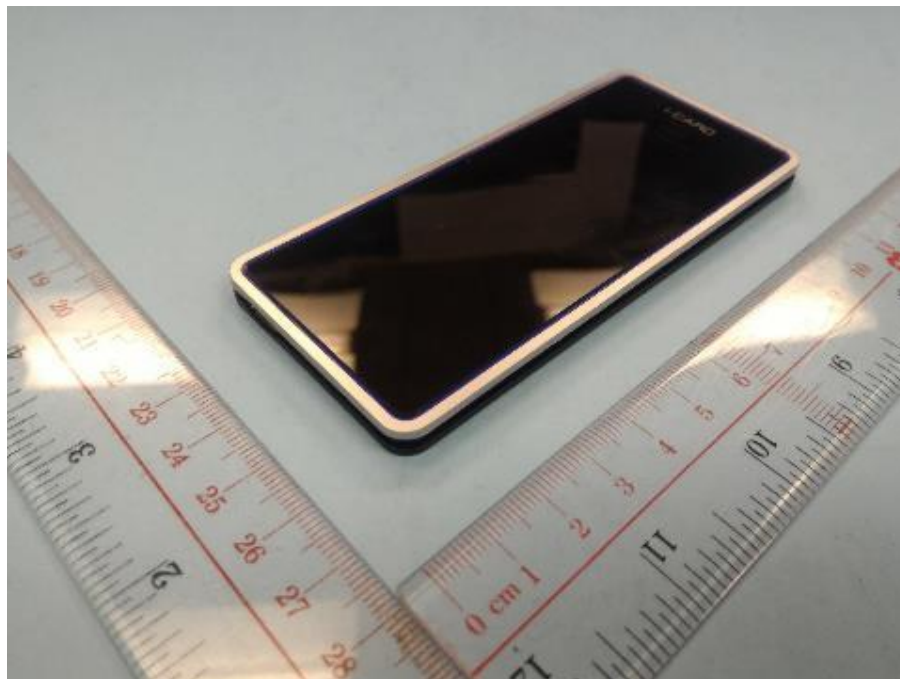
Limit

For intentional device, according to FCC Title 47 Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC Title 47 Part 15.247(b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

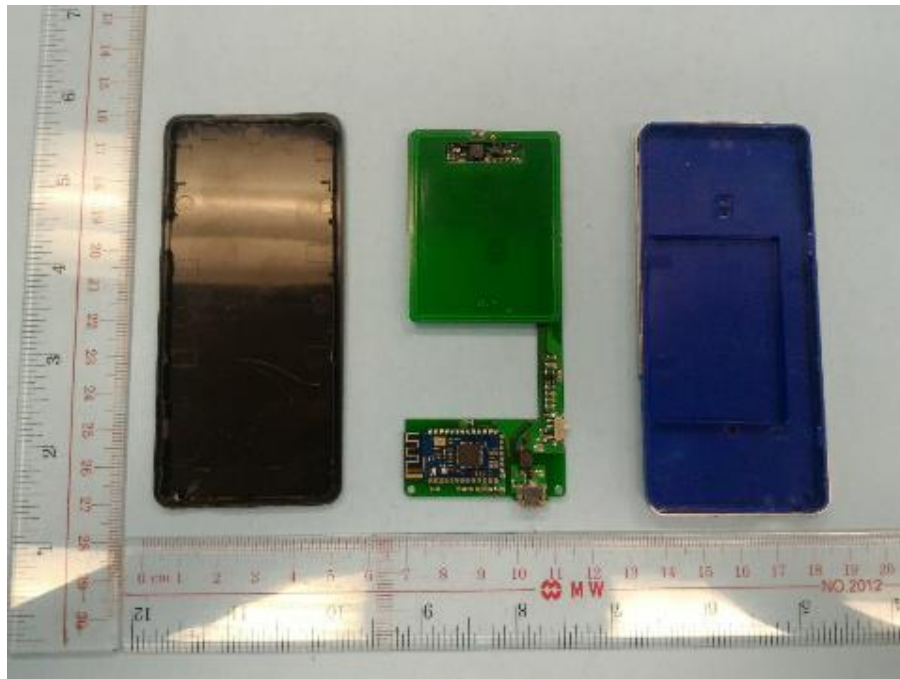
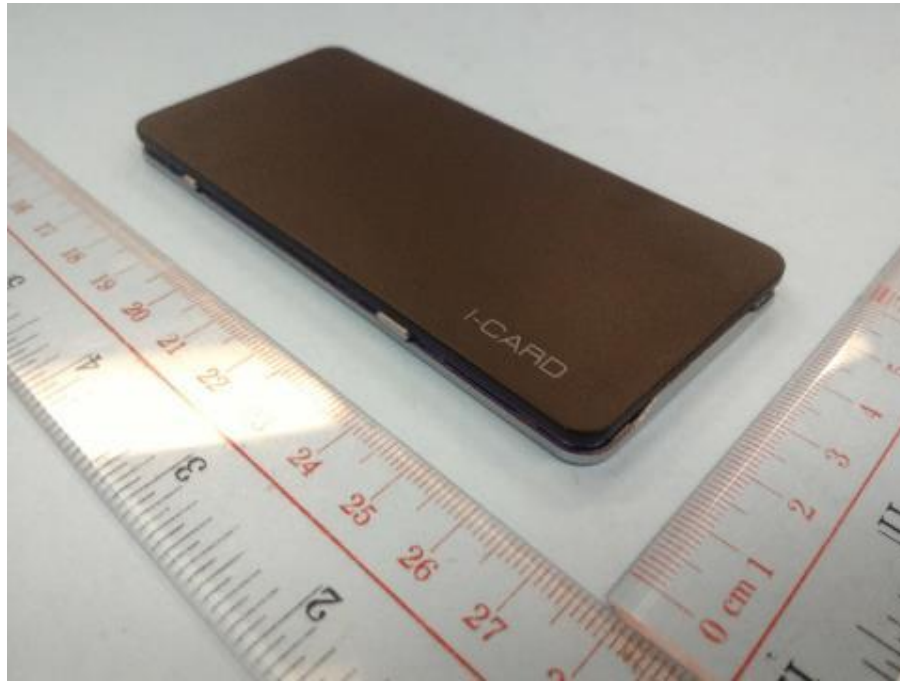
Antenna Connector Construction

The antenna used in this product is PCB antenna, and the maximum gain of this antenna is 0.0 dBi.

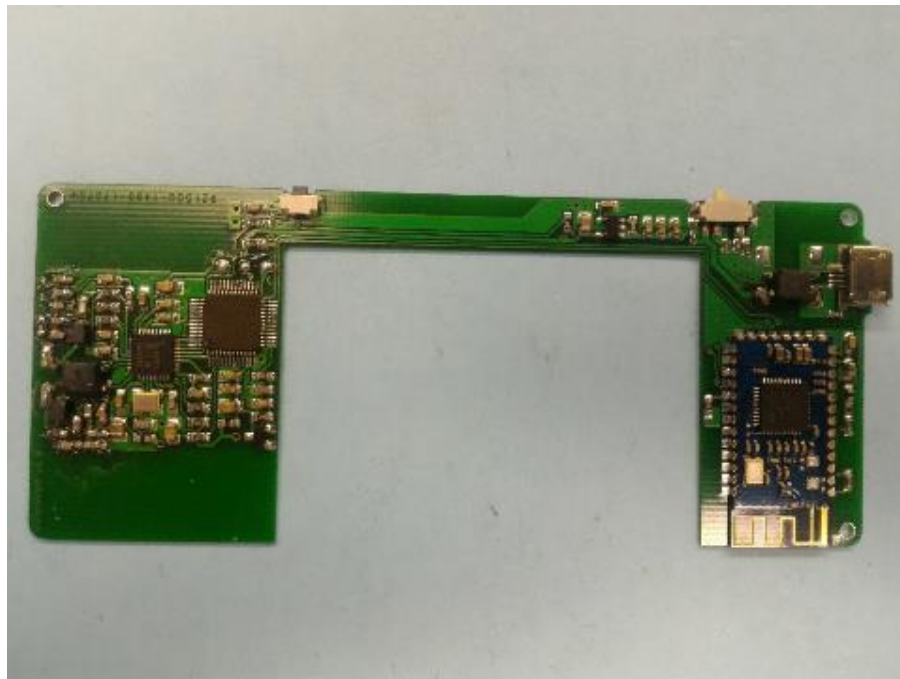
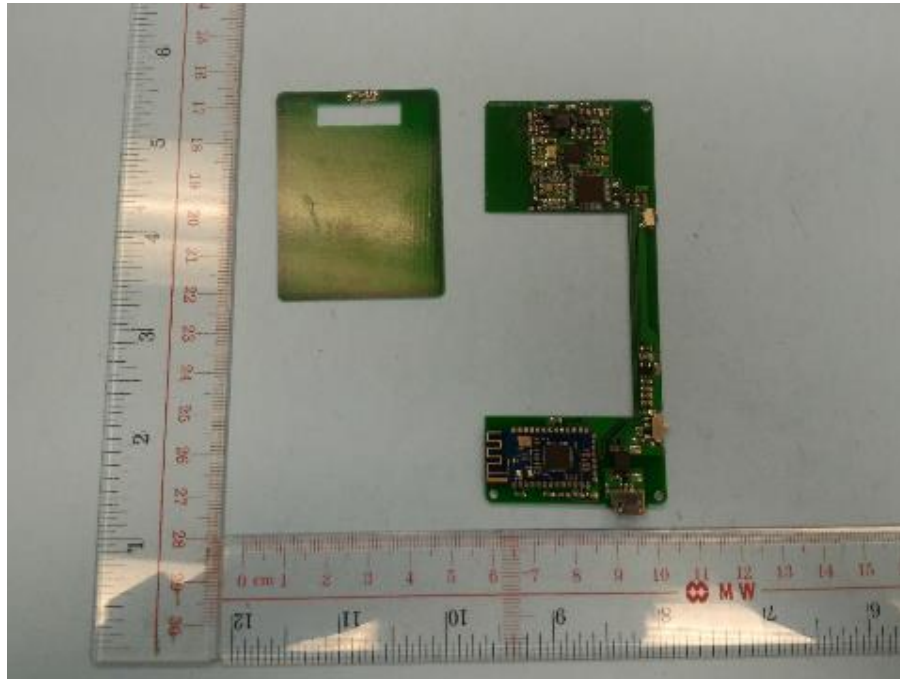
8 Appendix A - Photographs of EUT



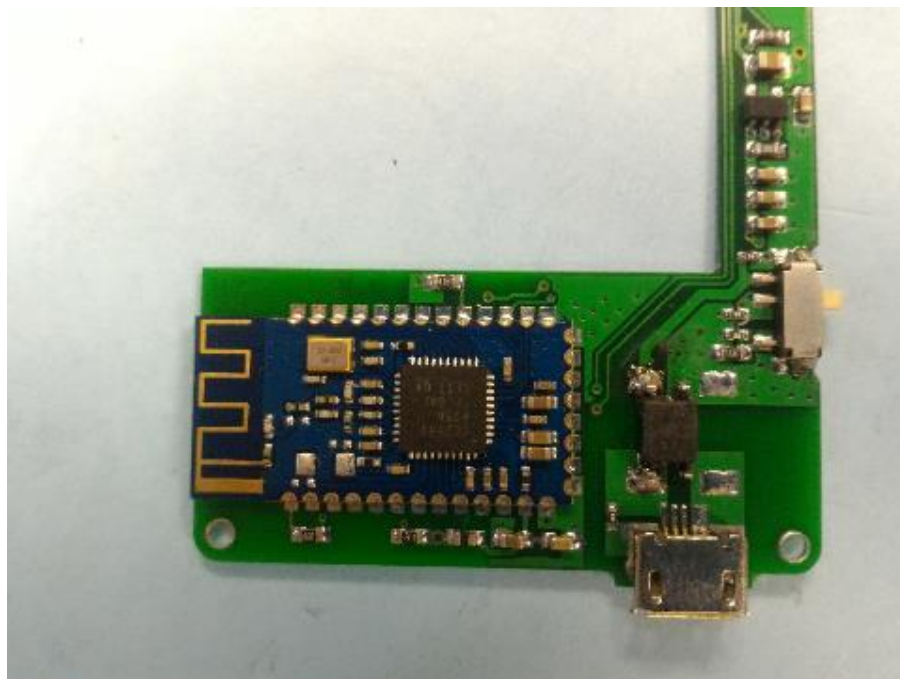
Appendix A



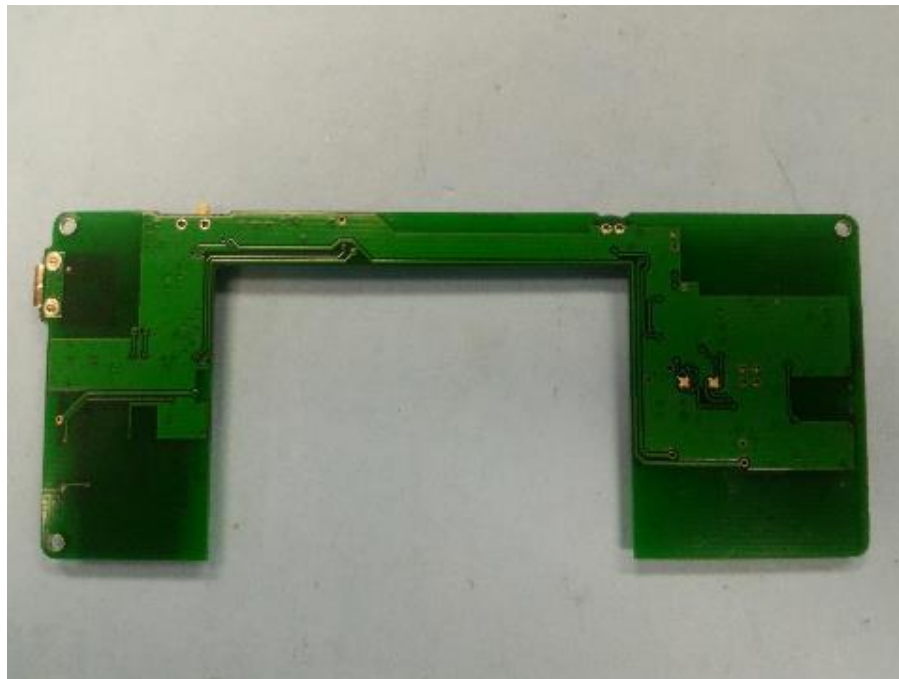
Appendix A



Appendix A



Appendix A



9 Appendix B - Setup Photographs of EUT

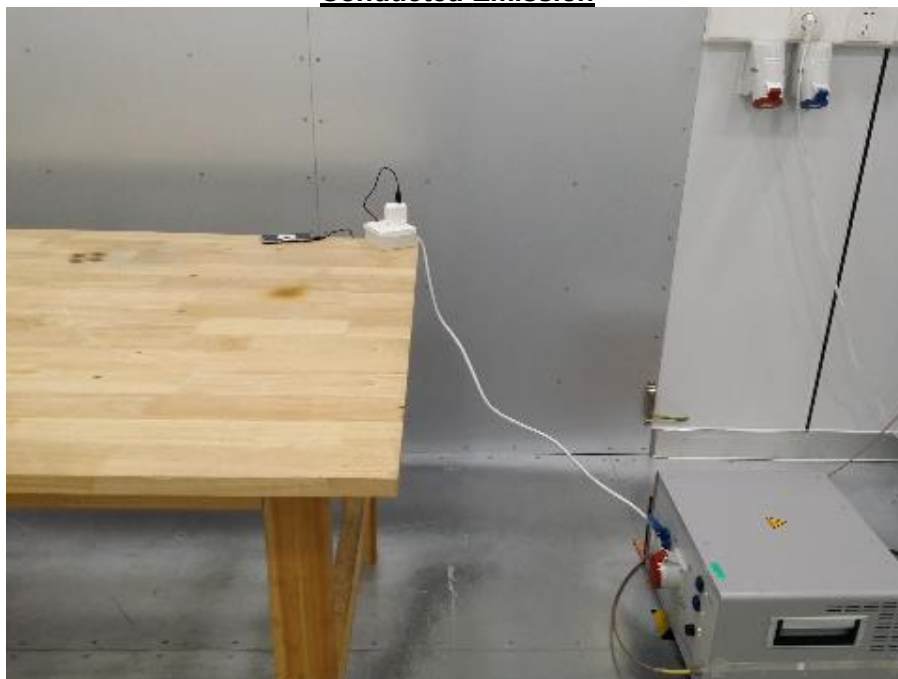
Spurious Radiated Emission, Radiated Emission



Appendix B

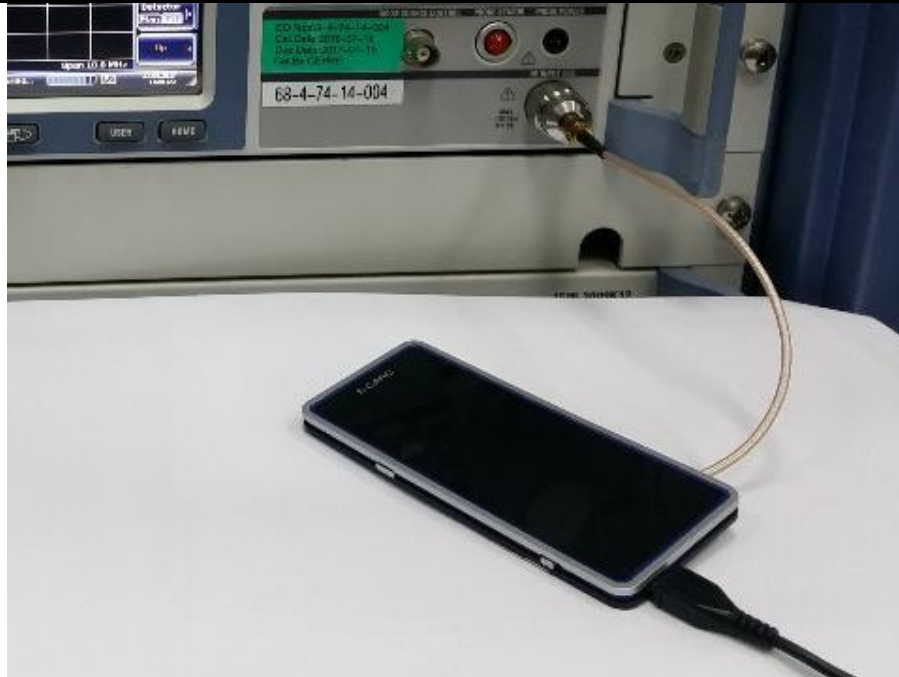


Conducted Emission



Appendix B

20dB & 99% Bandwidth, Peak Output Power,
Spurious Emissions at Antenna Terminals,
100kHz Bandwidth of band edges, Min. No. of Hopping Frequencies,
Min. Hopping Channel Carrier Frequency Separation, Average Time of Occupancy



10 Appendix C - General Product Information

Radiofrequency radiation exposure evaluation

According to KDB 447498 D01v06 section 4.3.1, For frequencies between 100 MHz to 6GHz and test separation distances ≤ 50 mm, the Numeric threshold is determined as:

Step a)

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]
 $\cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR

>> The fundamental frequency of the EUT are 15.56MHz, 2402-2480MHz,
 the test separation distance is ≤ 50 mm.
 (Manufacturer specified the separation distance is: 20mm)

Step a)

>> Numeric threshold (2402MHz), $\text{mW} / 20\text{mm} \cdot \sqrt{2.402\text{GHz}} \leq 3.0$
 Numeric threshold (2402MHz) $\leq 38.713\text{mW}$

>> Numeric threshold (2440MHz), $\text{mW} / 20\text{mm} \cdot \sqrt{2.440\text{GHz}} \leq 3.0$
 Numeric threshold (2440MHz) $\leq 38.411\text{mW}$

>> Numeric threshold (2480MHz), $\text{mW} / 20\text{mm} \cdot \sqrt{2.480\text{GHz}} \leq 3.0$
 Numeric threshold (2480MHz) $\leq 38.100\text{mW}$

>> The power of EUT measured (2402MHz) is: $-3.13\text{dBm} = 0.486\text{mW}$
 The power of EUT measured (2440MHz) is: $-4.62\text{dBm} = 0.345\text{mW}$
 The power of EUT measured (2480MHz) is: $-5.77\text{dBm} = 0.265\text{mW}$

Which is smaller than the Numeric threshold.

Therefore, the device is exempt from stand-alone SAR test requirements.

Appendix C

Radiofrequency radiation exposure evaluation

According to KDB 447498 D01v06 section 4.3.1, For frequencies below 100 MHz and test separation distances ≤ 50 mm, the Numeric threshold is determined as:

Step a)

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR

Step b)

$\{[\text{Power allowed at numeric threshold for 50mm in step a)}] + [(\text{test separation distance} - 50\text{mm}) \cdot (f(\text{MHz})/150)]\}$ mW

Step c) 1)

For test separation distances $> 50\text{mm}$ and $< 200\text{mm}$, the power threshold at the corresponding test separation distance at 100MHz in step b) is multiplied by $[1 + \log(100/f(\text{MHz}))]$

Step c) 2)

For test separation distances $\leq 50\text{mm}$, the power threshold determined by the equation in c) 1) for 50mm and 100MHz is multiplied by $\frac{1}{2}$.

>> The fundamental frequency of the EUT is 13.56MHz, the test separation distance is $\leq 50\text{mm}$.
(Manufacturer specified the separation distance is: 20mm)

Step a)

>> Numeric threshold, mW / 50mm $\cdot \sqrt{0.1\text{GHz}} \leq 3.0$ *
Numeric threshold $\leq 474.3\text{mW}$

Step b)

>> Numeric threshold $\leq 474.3\text{mW} + (50\text{mm} - 50\text{mm} \cdot 100\text{MHz}/150)$
Numeric threshold $\leq 474.3\text{mW}$

Step c) 1) & c) 2)

>> Numeric threshold $\leq 474.3\text{mW} \cdot [1 + \log 100/100\text{MHz}] \cdot \frac{1}{2}$
Numeric threshold $\leq 237.15\text{mW}$

>> The power of EUT measured is: $-42.77\text{dBm} = 0.000053\text{mW}$
Which is smaller than the Numeric threshold.

Therefore, the device is exempt from stand-alone SAR test requirements.