

FCC RF Test Report

Applicant: Remote Tech LLC
Address of Applicant: 310 ALDER RD, DOVER DE 19904 USA
Equipment Under Test (EUT)
Product Name: Smart Key
Model No.: RT-HK4F11
FCC ID: 2AOKM-HK14
Applicable Standards: FCC CFR Title 47 Part 15C (§15.231)
Date of Sample Receipt: 24 Jul., 2023
Date of Test: 25 Jul., to 01 Aug., 2023
Date of Report Issue: 04 Aug., 2023
Test Result: PASS

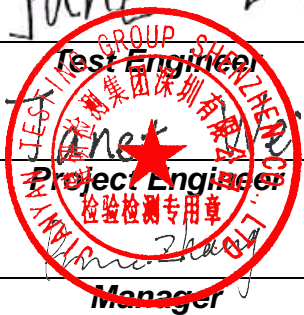
Tested by: _____

June Li

Date: _____

04 Aug., 2023

Reviewed by: _____



Date: _____

04 Aug., 2023

Approved by: _____

Manager

Date: _____

04 Aug., 2023

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in above the application standard version. Test results reported herein relate only to the item(s) tested.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

1 Version

Version No.	Date	Description
00	02 Aug., 2023	Original

2 Contents

Page

Cover Page	1
1 Version	2
2 Contents	3
3 General Information	4
3.1 Client Information	4
3.2 General Description of E.U.T.	4
3.3 Test Mode and Environment	5
3.4 Description of Test Auxiliary Equipment	5
3.5 Measurement Uncertainty	5
3.6 Additions to, Deviations, or Exclusions From the Method.....	5
3.7 Laboratory Facility	5
3.8 Laboratory Location.....	5
3.9 Test Instruments List	6
4 Measurement Setup and Procedure	7
4.1 Test Setup	7
4.2 Test Procedure	8
5 Test Results	9
5.1 Summary	9
5.1.1 Clause and Data Summary.....	9
5.1.2 Test Limit.....	10
5.2 Antenna Requirement	11
5.3 20dB Bandwidth	12
5.4 Field Strength of Fundamental	13
5.5 Field Strength of Spurious Emissions	15
5.6 Duration Time	19

3 General Information

3.1 Client Information

Applicant:	Remote Tech LLC
Address:	310 ALDER RD, DOVER DE 19904 USA
Manufacturer:	Remote Tech LLC
Address:	310 ALDER RD, DOVER DE 19904 USA

3.2 General Description of E.U.T.

Product Name:	Smart Key
Model No.:	RT-HK4F11
Operation Frequency:	433.92 MHz
Channel Numbers:	1
Modulation Type:	ASK
Antenna Type:	PCB Antenna
Antenna Gain:	-12.88 dBi
Power Supply:	DC 3 V (CR2032 Battery)
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

3.3 Test Mode and Environment

Test Mode:	
Transmitting mode:	Keep the EUT in transmitting mode with modulation
<i>Remark: The EUT was placed on three different polar directions tested: i.e. X axis, Y axis, Z axis, and found the test results are both the "worst case" and "worst setup": Y axis, so the report only reflects the test data of worst mode.</i>	
Operating Environment:	
Temperature:	15°C ~ 35°C
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1008 mbar

3.4 Description of Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number	FCC ID/DoC
N/A	N/A	N/A	N/A	N/A

3.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Radiated Emission (9kHz ~ 30MHz) (3m SAC)	3.2 dB
Radiated Emission (30MHz ~ 1GHz) (3m SAC)	3.8 dB
Radiated Emission (1GHz ~ 18GHz) (3m SAC)	3.6 dB

Remark: All the measurement uncertainty value were shown with a coverage k=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

3.6 Additions to, Deviations, or Exclusions From the Method

No

3.7 Laboratory Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> ● FCC - Designation No.: CN1211 JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551. ● ISED – CAB identifier.: CN0021 The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1. ● CNAS - Registration No.: CNAS L15527 JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527. ● A2LA - Registration No.: 4346.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf
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3.8 Laboratory Location

<p>JianYan Testing Group Shenzhen Co., Ltd. Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China. Tel: +86-755-23118282, Fax: +86-755-23116366 Email: info-JYTee@lets.com, Website: http://jyt.lets.com</p>

3.9 Test Instruments List

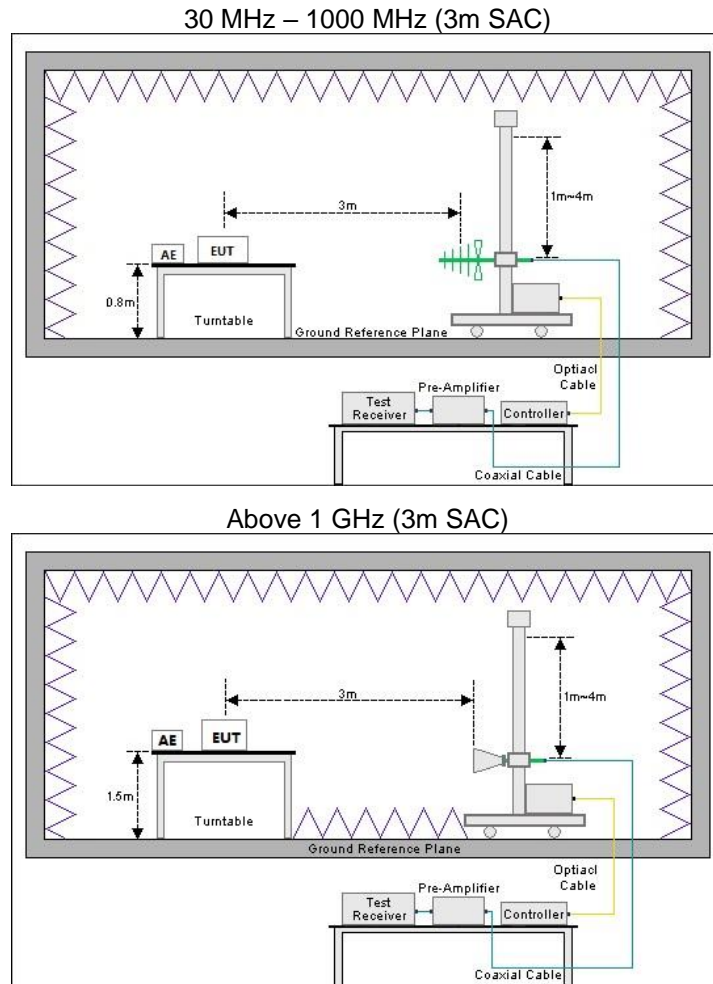
Radiated Emission(3m SAC):					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	02-09-2023	02-08-2024
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	02-09-2023	02-08-2024
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	01-10-2023	01-09-2024
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	01-10-2023	01-09-2024
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	01-11-2023	01-10-2024
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-10-2023	01-09-2024
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-18-2023	01-17-2024
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	01-18-2023	01-17-2024
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

Conducted Method:					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-10-2023	01-09-2024
EMI Test Receiver	Rohde & Schwarz	ESCI3	WXJ003	01-10-2023	01-09-2024
Spectrum Analyzer	Keysight	N9010B	WXJ004-3	10-17-2022	10-16-2023
DC Power Supply	Keysight	E3642A	WXJ025-2	10-17-2022	10-16-2023

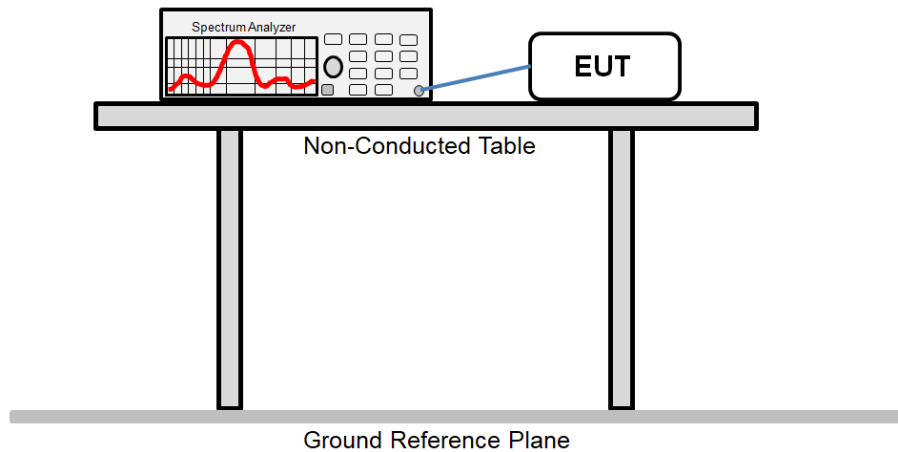
4 Measurement Setup and Procedure

4.1 Test Setup

Radiated emission measurement:



Conducted test method:



4.2 Test Procedure

Test method	Test step
Radiated emission	<ol style="list-style-type: none"> 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
Conducted test method	<ol style="list-style-type: none"> 1. The antenna port of EUT was connected to the RF port of the spectrum analyzer through an RF cable. 2. The EUT is keeping in continuous transmission mode and tested in all modulation modes. 3. The test data is saved by the screenshot function of the spectrum analyzer.

5 Test Results

5.1 Summary

5.1.1 Clause and Data Summary

Test items	Standard clause	Test data	Result
Antenna Requirement	15.203	See Section 5.2	Pass
AC Power Line Conducted Emission	15.207	N/A	N/A
20dB Bandwidth	15.231 (c)	See Section 5.3	Pass
Field Strength of Fundamental	15.231 (b)	See Section 5.4	Pass
Field Strength of Spurious Emissions	15.209 15.231 (b)	See Section 5.5	Pass
Duration Time	15.231 (a)(1)	See Section 5.6	Pass
Remark: 1. Pass: The EUT complies with the essential requirements in the standard. 2. N/A: Not Applicable.			
Test Method:	ANSI C63.4-2014 ANSI C63.10-2013		

5.1.2 Test Limit

Test items	Limit																																												
20dB Bandwidth	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.																																												
<p>Field Strength of Fundamental</p> <p>Field Strength of Spurious Emissions</p>	<table border="1" data-bbox="518 450 1450 723"> <thead> <tr> <th>Fundamental Frequency (MHz)</th> <th>Field strength of fundamental (microvolts/meter)</th> <th>Field strength of spurious emissions (microvolts/meter)</th> </tr> </thead> <tbody> <tr> <td>40.66 – 40.70</td> <td>2250</td> <td>225</td> </tr> <tr> <td>70.00 – 130.00</td> <td>1250</td> <td>125</td> </tr> <tr> <td>130.00 – 174.00</td> <td>¹1250 to 3750</td> <td>¹125 to 375</td> </tr> <tr> <td>174.00 – 260.00</td> <td>3750</td> <td>375</td> </tr> <tr> <td>260.00 – 470.00</td> <td>¹3750 to 12500</td> <td>¹375 to 1250</td> </tr> <tr> <td>Above 470.00</td> <td>12500</td> <td>1250</td> </tr> </tbody> </table> <p>¹Linear interpolations.</p> <p>(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.</p> <p>(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in § 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of § 15.205 shall be demonstrated using the measurement instrumentation specified in that section.</p> <p>(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength:</p> <table border="1" data-bbox="582 1330 1385 1666"> <thead> <tr> <th>Frequency (MHz)</th> <th>Limit (dBµV/m) @ 3m</th> <th>Detector</th> </tr> </thead> <tbody> <tr> <td>30 – 88</td> <td>40.0</td> <td>Quasi-peak</td> </tr> <tr> <td>88 – 216</td> <td>43.5</td> <td>Quasi-peak</td> </tr> <tr> <td>216 – 960</td> <td>46.0</td> <td>Quasi-peak</td> </tr> <tr> <td>960 – 1000</td> <td>54.0</td> <td>Quasi-peak</td> </tr> </tbody> </table> <p>Note: The more stringent limit applies at transition frequencies.</p> <table border="1" data-bbox="582 1541 1385 1637"> <thead> <tr> <th rowspan="2">Frequency</th> <th colspan="2">Limit (dBµV/m) @ 3m</th> </tr> <tr> <th>Average</th> <th>Peake</th> </tr> </thead> <tbody> <tr> <td>Above 1 GHz</td> <td>54.0</td> <td>74.0</td> </tr> </tbody> </table> <p>Note: The measurement bandwidth shall be 1 MHz or greater.</p>	Fundamental Frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)	40.66 – 40.70	2250	225	70.00 – 130.00	1250	125	130.00 – 174.00	¹ 1250 to 3750	¹ 125 to 375	174.00 – 260.00	3750	375	260.00 – 470.00	¹ 3750 to 12500	¹ 375 to 1250	Above 470.00	12500	1250	Frequency (MHz)	Limit (dBµV/m) @ 3m	Detector	30 – 88	40.0	Quasi-peak	88 – 216	43.5	Quasi-peak	216 – 960	46.0	Quasi-peak	960 – 1000	54.0	Quasi-peak	Frequency	Limit (dBµV/m) @ 3m		Average	Peake	Above 1 GHz	54.0	74.0
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Duration Time	A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.																																												

5.2 Antenna Requirement

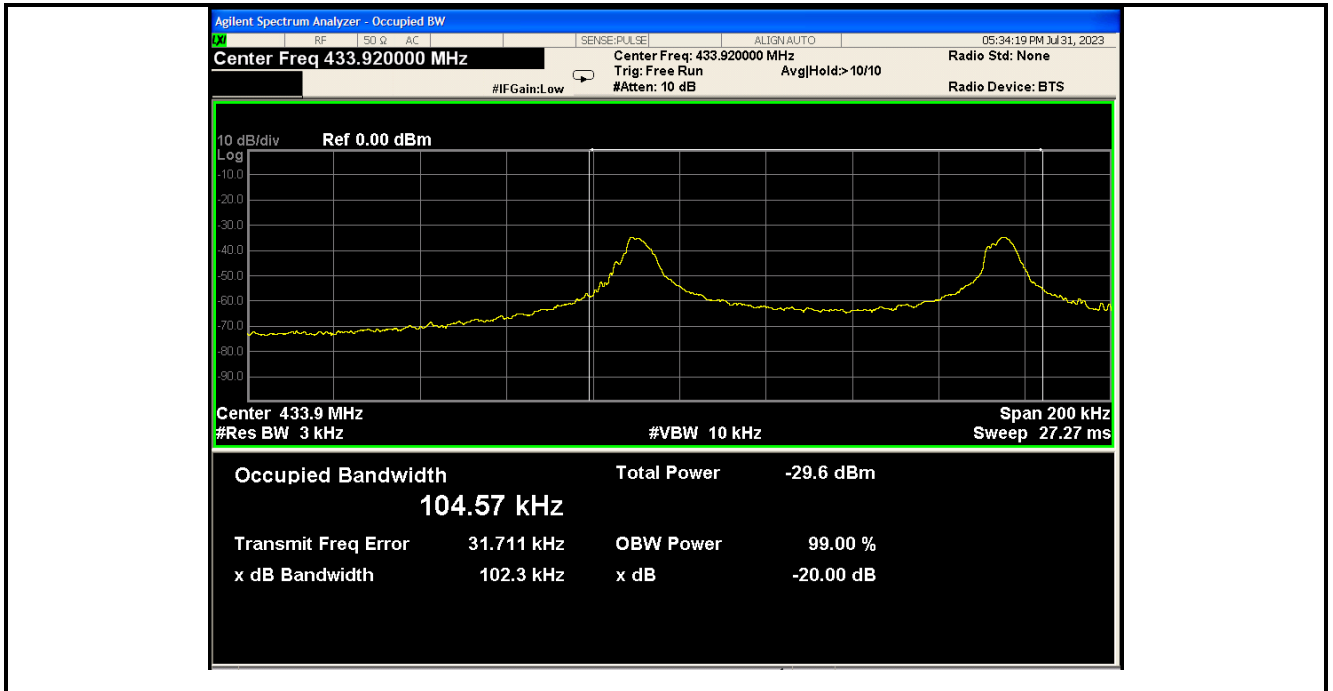
Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
E.U.T Antenna:	The antenna of EUT is an PCB Antenna which cannot replace by end-user. See product internal photos for details.

5.3 20dB Bandwidth

20dB bandwidth (kHz)	Limit (MHz)	Results
102.3	1.0848	Passed

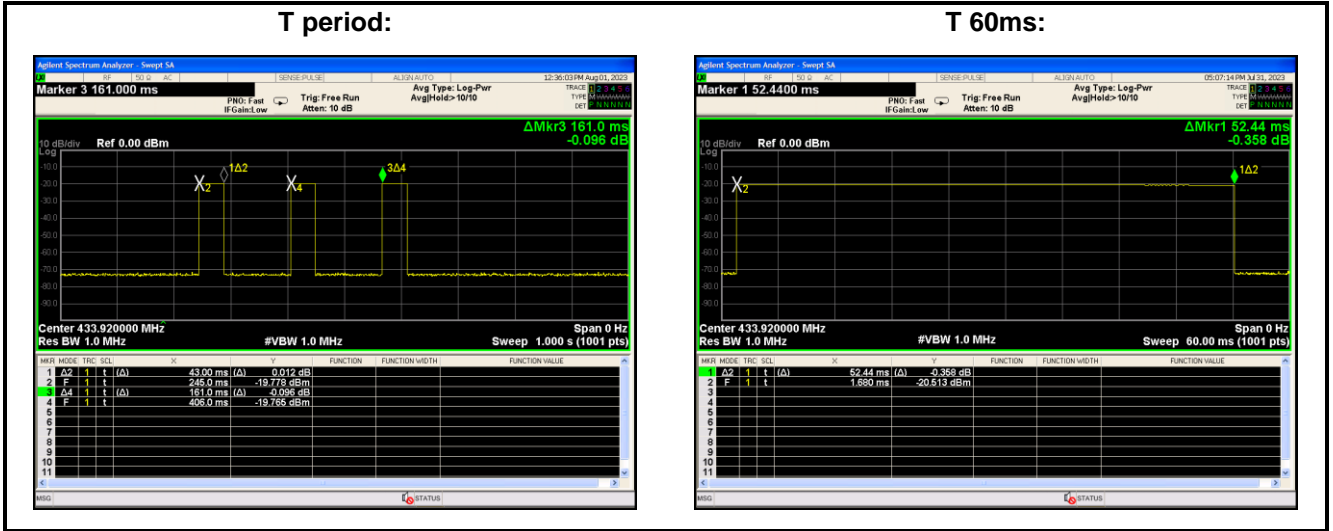
Note: Limit = Fundamental frequency x 0.25% = 433.92 x 0.25% = 1.0848 MHz.

Test plot as follows:



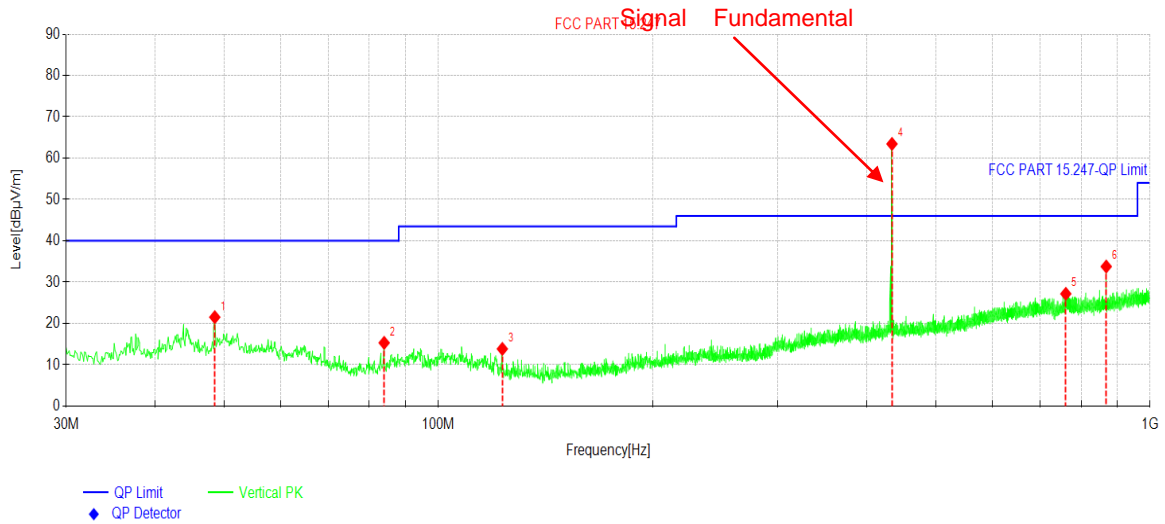
5.4 Field Strength of Fundamental

Peak value						
Frequency (MHz)	Read level (dBuV)	Ant. factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Over limit (dB)	Polarization
433.948	73.25	-9.81	63.44	100.83	37.39	Vertical
433.948	82.36	-9.81	72.55	100.83	28.28	Horizontal
Average value						
Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit (dBuV/m)	Over limit (dB)	Polarization
433.948	63.44	-5.61	57.83	80.83	23.0	Vertical
433.948	72.55	-5.61	66.94	80.83	13.89	Horizontal
Duty Cycle Factor Calculate Formula:	Average value = Peak value + Duty Cycle Factor					
	Duty cycle factor = $20\log(\text{Duty cycle})$					
	Duty cycle = on time/100 milliseconds or period, whichever is less					
	T on time =52.44(ms)					
	T period = 100(ms)					
	Duty cycle = 52.44%					
	Duty cycle factor = $20\log(\text{Duty cycle}) = -5.61$					



5.5 Field Strength of Spurious Emissions

Product Name:	Smart Key	Product Model:	RT-HK4F11
Test By:	June	Test mode:	Tx mode
Test Frequency:	30 MHz – 1000 MHz	Polarization:	Vertical
Test Voltage:	DC 3V		



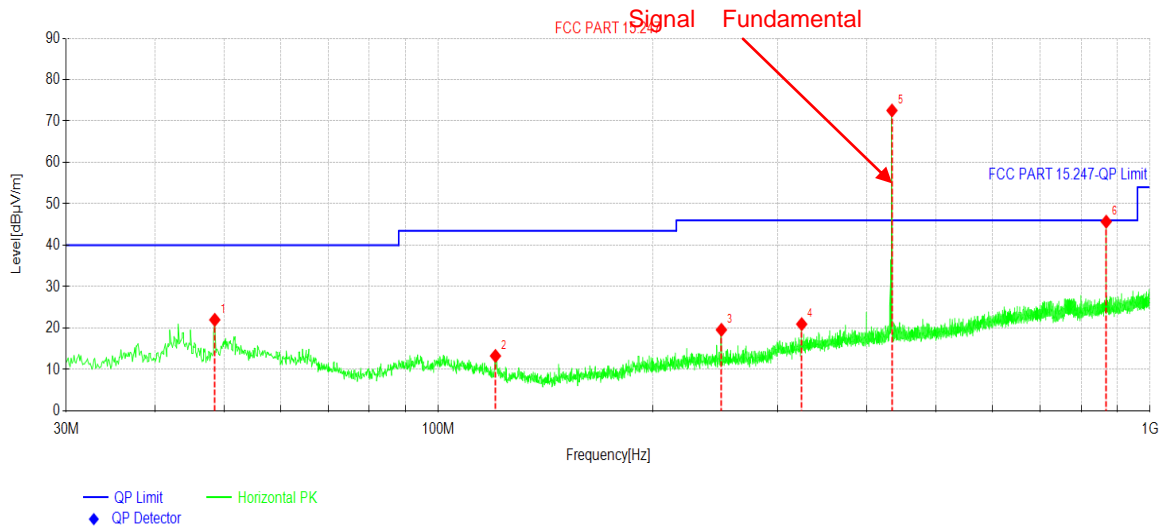
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	48.5289	34.20	21.52	-12.68	40.00	18.48	PK	Vertical
2	83.9374	33.16	15.31	-17.85	40.00	24.69	PK	Vertical
3	123.032	31.07	13.84	-17.23	43.50	29.66	PK	Vertical
4	433.948	73.25	63.44	-9.81	100.83	37.39	PK	Vertical
5	761.453	31.18	27.18	-4.00	46.00	18.82	PK	Vertical
6	867.872	36.78	33.78	-3.00	80.83	47.05	PK	Vertical

Suspected Data List								
NO.	Freq. [MHz]	Level (dBµV/m)	Duty cycle factor	Average value (dBµV/m)	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	433.948	63.44	-5.61	57.83	80.83	23.00	Av	Vertical
2	867.872	33.78	-5.61	28.17	60.83	32.66	Av	Vertical

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Smart Key	Product Model:	RT-HK4F11
Test By:	June	Test mode:	Tx mode
Test Frequency:	30 MHz – 1000 MHz	Polarization:	Horizontal
Test Voltage:	DC 3V		



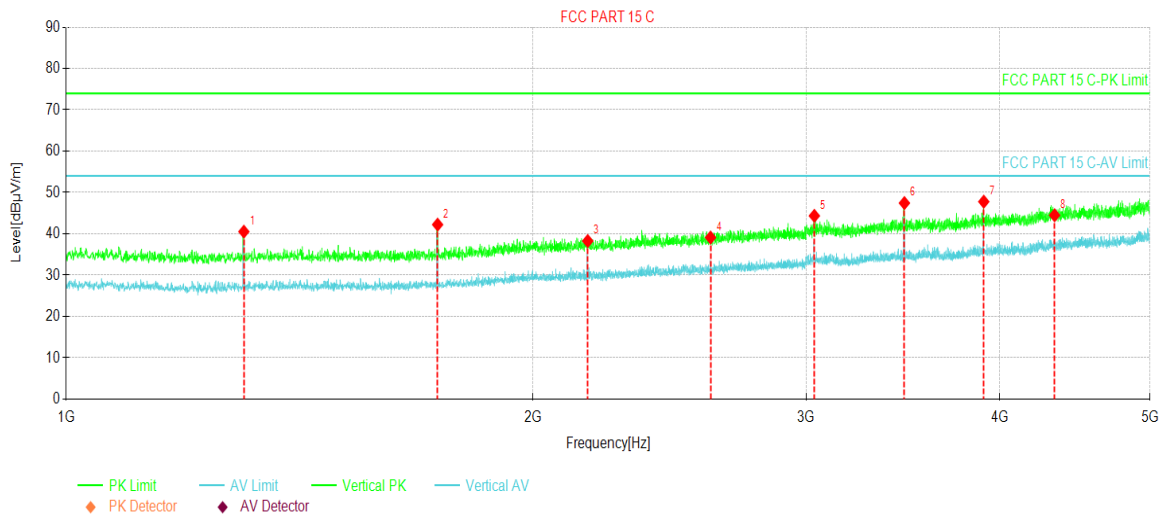
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	48.5289	34.67	21.99	-12.68	40.00	18.01	PK	Horizontal
2	120.316	30.04	13.27	-16.77	43.50	30.23	PK	Horizontal
3	249.921	33.07	19.58	-13.49	46.00	26.42	PK	Horizontal
4	324.036	33.03	20.95	-12.08	46.00	25.05	PK	Horizontal
5	433.948	82.36	72.55	-9.81	100.83	28.28	PK	Horizontal
6	867.872	48.70	45.70	-3.00	80.83	35.13	PK	Horizontal

Suspected Data List								
NO.	Freq. [MHz]	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	433.948	72.55	-5.61	66.94	80.83	13.89	Av	Horizontal
2	867.872	45.70	-5.61	40.09	80.83	40.74	Av	Horizontal

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Pre-amplifier Factor).

Product Name:	Smart Key	Product Model:	RT-HK4F11
Test By:	June	Test mode:	Tx mode
Test Frequency:	1000 MHz – 5000 MHz	Polarization:	Vertical
Test Voltage:	DC 3V		



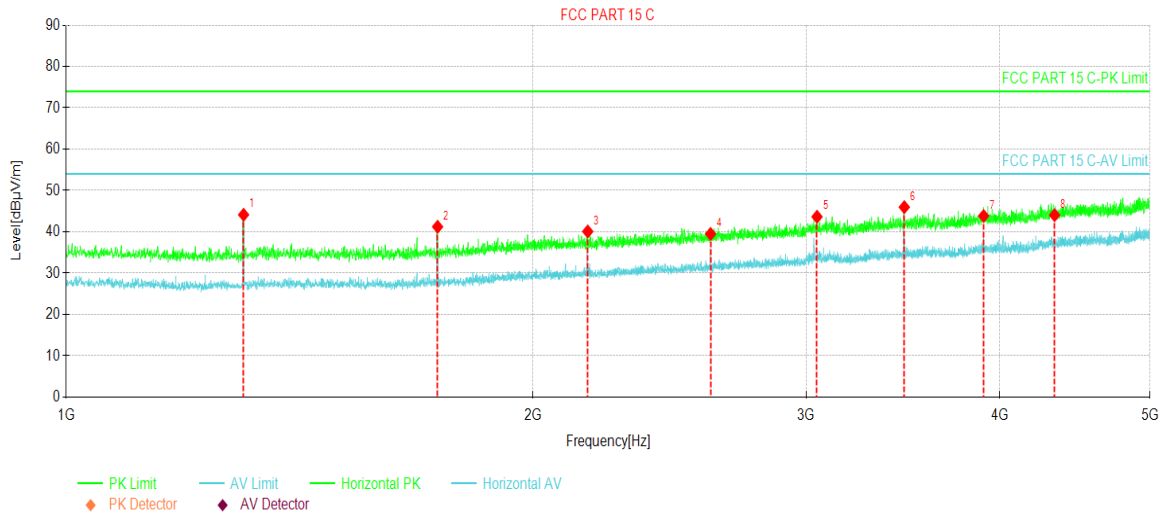
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1302.00	63.47	40.52	-22.95	74.00	33.48	PK	Vertical
2	1736.00	64.63	42.23	-22.40	80.83	38.60	PK	Vertical
3	2169.60	58.71	38.26	-20.45	80.83	42.57	PK	Vertical
4	2603.52	57.89	39.10	-18.79	80.83	41.73	PK	Vertical
5	3037.50	61.57	44.35	-17.22	80.83	36.48	PK	Vertical
6	3472.00	63.34	47.44	-15.90	80.83	33.39	PK	Vertical
7	3906.00	62.03	47.78	-14.25	74.00	26.22	PK	Vertical
8	4339.20	56.73	44.50	-12.23	74.00	29.50	PK	Vertical

Suspected Data List(Average)								
NO.	Freq. [MHz]	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1736	42.23	-5.61	36.62	60.83	24.21	Av	Vertical
2	2169.6	38.26	-5.61	32.65	60.83	28.18	Av	Vertical
3	2603.52	39.10	-5.61	33.49	60.83	27.34	Av	Vertical
4	3037.5	44.35	-5.61	38.74	60.83	22.09	Av	Vertical
5	3472	47.44	-5.61	41.83	60.83	19.00	Av	Vertical

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Smart Key	Product Model:	RT-HK4F11
Test By:	June	Test mode:	Tx mode
Test Frequency:	1000 MHz – 5000 MHz	Polarization:	Horizontal
Test Voltage:	DC 3V		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1301.50	67.09	44.13	-22.96	74.00	29.87	PK	Horizontal
2	1736.00	63.62	41.22	-22.40	80.83	39.61	PK	Horizontal
3	2169.50	60.53	40.08	-20.45	80.83	40.75	PK	Horizontal
4	2603.52	58.28	39.49	-18.79	80.83	41.34	PK	Horizontal
5	3049.50	60.83	43.65	-17.18	80.83	37.18	PK	Horizontal
6	3471.50	61.87	45.97	-15.90	80.83	34.86	PK	Horizontal
7	3905.28	58.09	43.83	-14.26	74.00	30.17	PK	Horizontal
8	4339.20	56.27	44.04	-12.23	74.00	29.96	PK	Horizontal

Suspected Data List(Average)								
NO.	Freq. [MHz]	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1736	41.22	-5.61	35.61	60.83	25.22	Av	Horizontal
2	2169.5	40.08	-5.61	34.47	60.83	26.36	Av	Horizontal
3	2603.52	39.49	-5.61	33.88	60.83	26.95	Av	Horizontal
4	3049.5	43.65	-5.61	38.04	60.83	22.79	Av	Horizontal
5	3471.5	45.97	-5.61	40.36	60.83	20.47	Av	Horizontal

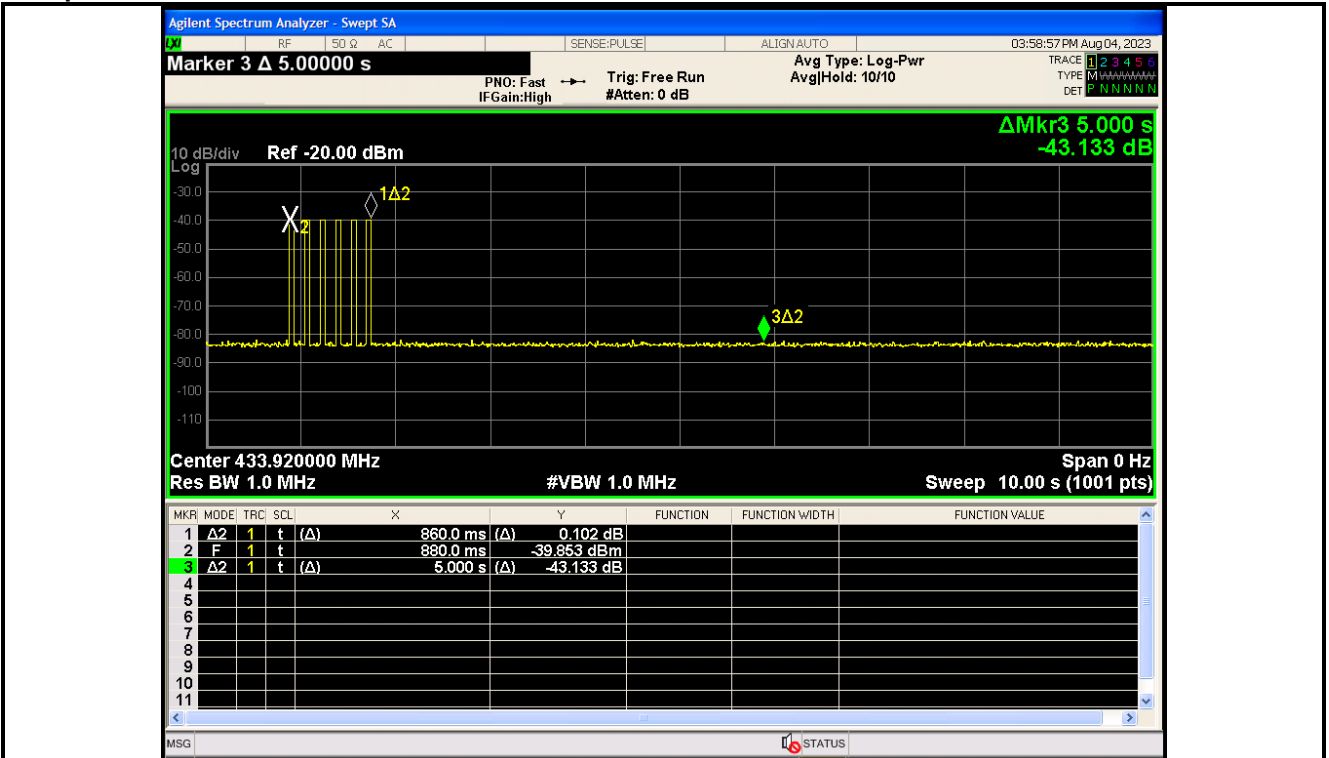
Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

5.6 Duration Time

Measurement monitoring	Result
The EUT automatically deactivate the transmitter within 5 seconds of switch being released.	Pass

Test plot as follows:



-----End of report-----