



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-HK4F28
FCC ID: 2AOKM-HK18
Applicable Standards: FCC CFR Title 47 Part 15C (§15.231)
Date of Sample Receipt: 24 Jul., 2023
Date of Test: 25 Jul., to 18 Aug., 2023
Date of Report Issue: 18 Aug., 2023
Test Result: PASS

Tested by:

June Li

Date:

18 Aug., 2023

Reviewed by:

Project Engineer

Date:

18 Aug., 2023

Approved by:

Manager

Date:

18 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.

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1 Version

Version No.	Date	Description
00	18 Aug., 2023	Original

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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-HK4F28
Operation Frequency:	433.92 MHz
Channel Numbers:	1
Modulation Type:	ASK
Antenna Type:	PCB Antenna
Antenna Gain:	-12.88 dBi
Power Supply:	DC 3V (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
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.	
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				

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

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

● **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>

3.8 Laboratory Location

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>

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		

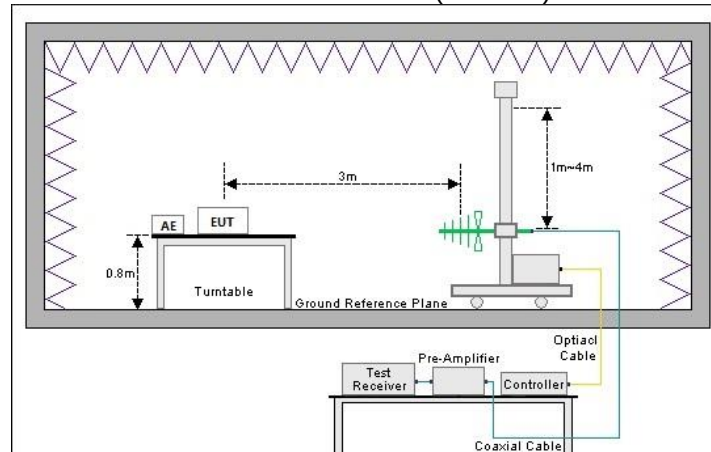
Conducted Method:					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Spectrum Analyzer	Keysight	N9020B	WXJ081-1	06-13-2023	06-12-2024

4 Measurement Setup and Procedure

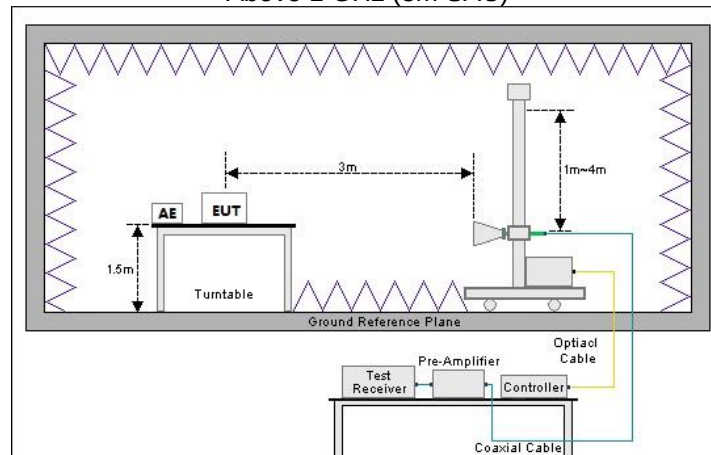
4.1 Test Setup

Radiated emission measurement:

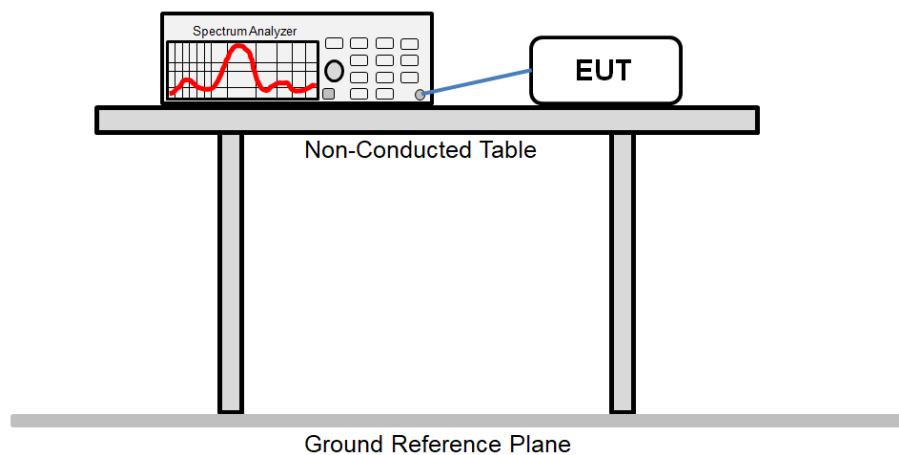
30 MHz – 1000 MHz (3m SAC)



Above 1 GHz (3m SAC)



Conducted test method:



4.2 Test Procedure

Test method	Test step
Radiated emission	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	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.																																												
Field Strength of Fundamental Field Strength of Spurious Emissions	<table><tr><th>Fundamental Frequency (MHz)</th><th>Field strength of fundamental (microvolts/meter)</th><th>Field strength of spurious emissions (microvolts/meter)</th></tr><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></table> ¹Linear interpolations. (1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges. (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. (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: <table><tr><th>Frequency (MHz)</th><th>Limit (dBµV/m) @ 3m</th><th>Detector</th></tr><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></table> Note: The more stringent limit applies at transition frequencies. <table><tr><th rowspan="2">Frequency</th><th colspan="2">Limit (dBµV/m) @ 3m</th></tr><tr><th>Average</th><th>Peake</th></tr><tr><td>Above 1 GHz</td><td>54.0</td><td>74.0</td></tr></table> Note: The measurement bandwidth shall be 1 MHz or greater.	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
Fundamental Frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)																																											
40.66 – 40.70	2250	225																																											
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174.00 – 260.00	3750	375																																											
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	Average	Peake																																											
Above 1 GHz	54.0	74.0																																											
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.																																												

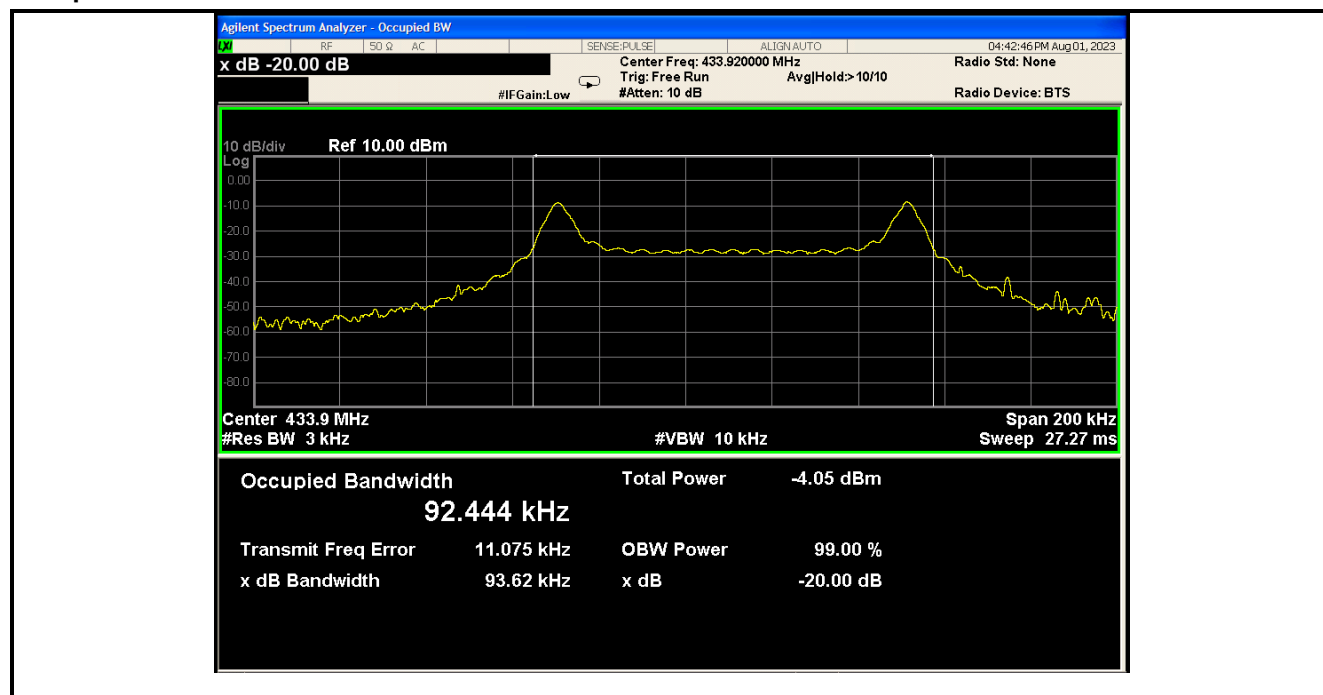
5.2 Antenna Requirement

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 a PCB Antenna which cannot replace by end-user. See product internal photos for details.	

5.3 20dB Bandwidth

20dB bandwidth (MHz)	Limit (MHz)	Results
0.09362	1.0848	Passed
Note: Limit = Fundamental frequency×0.25%=433.92×0.25%=1.0848MHz.		

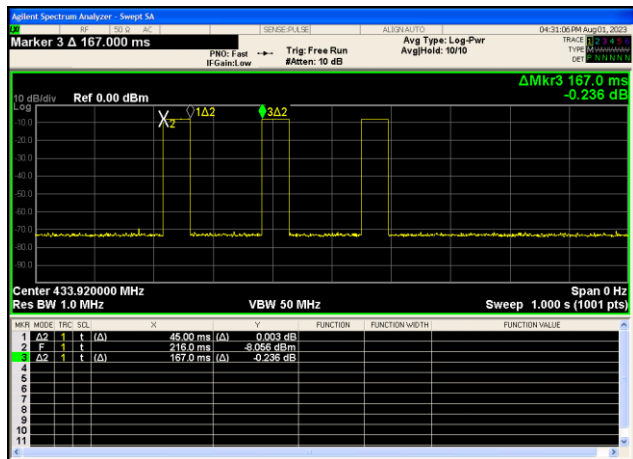
Test plot as follows:



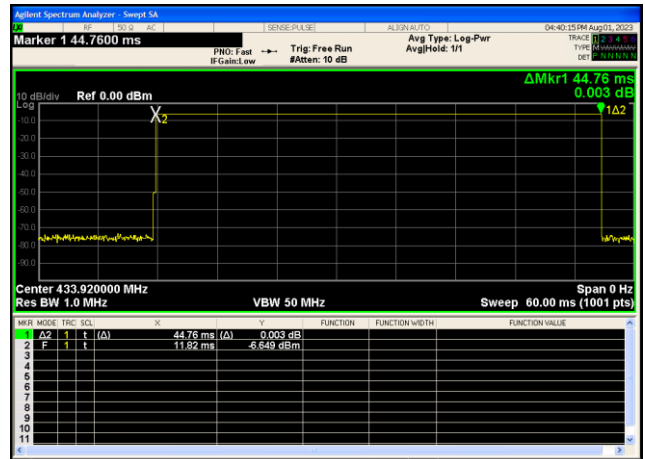
5.4 Field Strength of Fundamental

Peak value						
Frequency (MHz)	Read level (dBuV)	Ant. factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Over limit (dB)	Polarization
433.948	88.26	-9.81	78.45	100.83	22.38	Vertical
433.948	92.68	-9.81	82.87	100.83	17.96	Horizontal
Average value						
Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit (dBuV/m)	Over limit (dB)	Polarization
433.948	78.45	-6.98	71.47	80.83	9.36	Vertical
433.948	82.87	-6.98	75.89	80.83	4.94	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 =44.76(ms)					
	T period = 100(ms)					
	Duty cycle =44.76%					
	Duty cycle factor = $20\log(\text{Duty cycle}) = -6.98$					

T period:

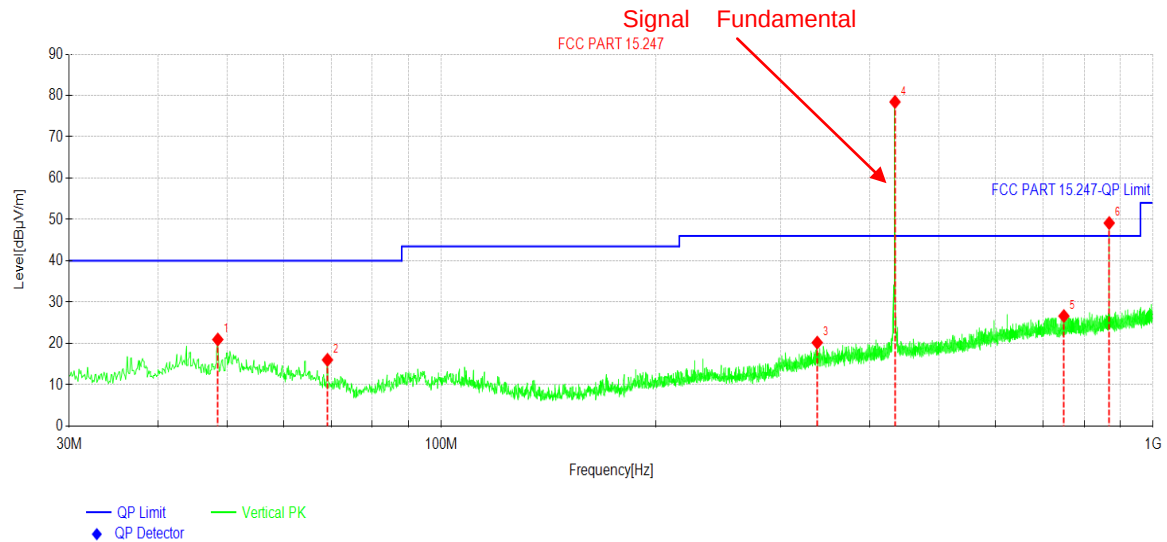


T 100ms:



5.5 Field Strength of Spurious Emissions

Product Name:	Smart Key	Product Model:	RT-HK4F28
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	33.63	20.95	-12.68	40.00	19.05	PK	Vertical
2	69.1919	32.79	16.04	-16.75	40.00	23.96	PK	Vertical
3	337.423	31.71	20.20	-11.51	46.00	25.80	PK	Vertical
4	433.948	88.26	78.45	-9.81	100.83	22.38	PK	Vertical
5	749.521	30.60	26.64	-3.96	46.00	19.36	PK	Vertical
6	867.775	52.13	49.14	-2.99	80.83	31.69	PK	Vertical

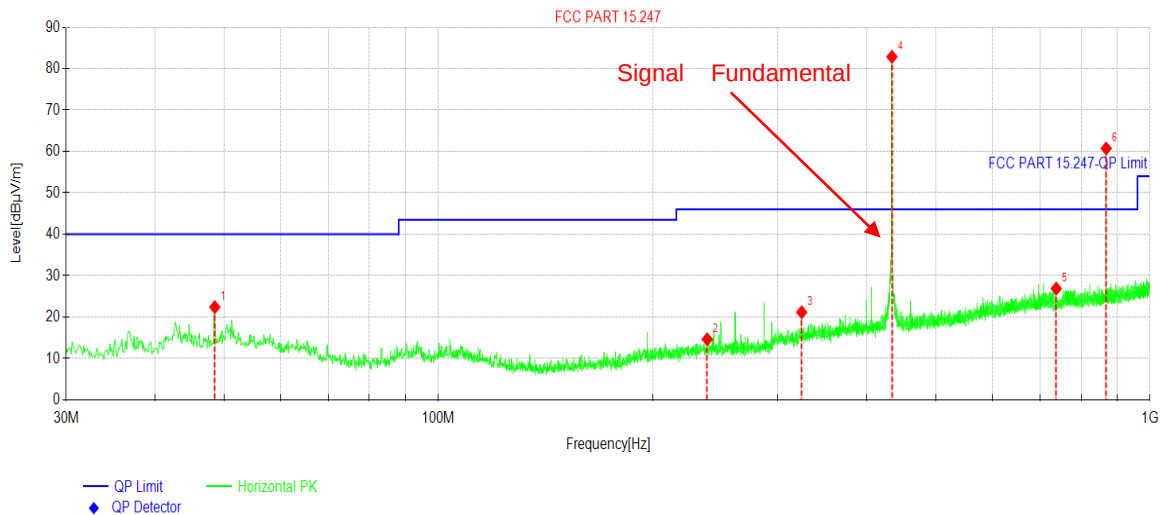
Suspected Data List

NO.	Freq. [MHz]	Level (dBμV/m)	Duty cycle factor	Average value (dBμV/m)	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	433.948	78.45	-6.98	71.47	80.83	9.36	Av	Vertical
2	867.775	49.14	-6.98	42.16	60.83	18.67	Av	Vertical

Remark:

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

Product Name:	Smart Key	Product Model:	RT-HK4F28
Test By:	June	Test mode:	Tx mode
Test Frequency:	30 MHz – 1000 MHz	Polarization:	Horizontal
Test Voltage:	DC 3V		



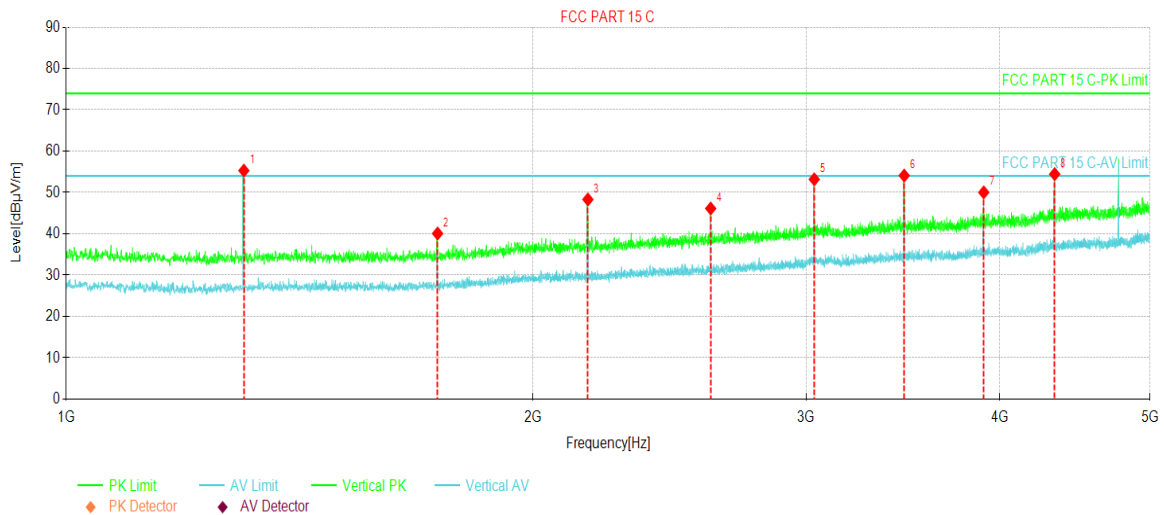
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	48.5289	35.09	22.41	-12.68	40.00	17.59	PK	Horizontal
2	238.667	28.54	14.63	-13.91	46.00	31.37	PK	Horizontal
3	324.036	33.24	21.16	-12.08	46.00	24.84	PK	Horizontal
4	433.948	92.68	82.87	-9.81	100.83	17.96	PK	Horizontal
5	738.267	31.27	26.89	-4.38	46.00	19.11	PK	Horizontal
6	867.775	63.72	60.73	-2.99	80.83	20.10	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	82.87	-6.98	71.47	80.83	9.36	Av	Horizontal
2	867.775	60.73	-6.98	53.75	60.83	7.08	Av	Horizontal

Remark:

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

Product Name:	Smart Key	Product Model:	RT-HK4F28
Test By:	June	Test mode:	Tx mode
Test Frequency:	1000 MHz – 5000 MHz	Polarization:	Vertical
Test Voltage:	DC 3V		

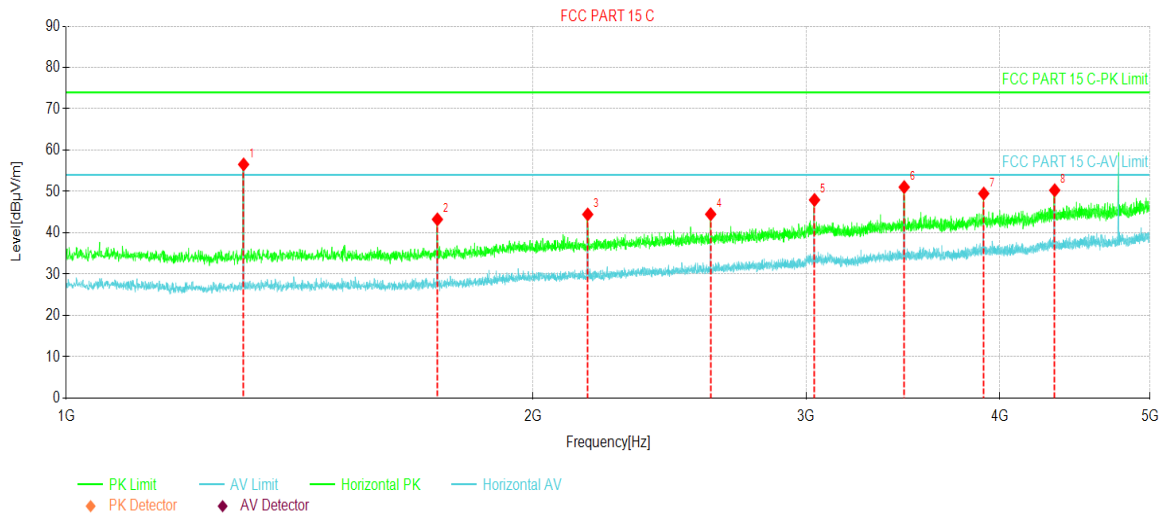


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	1302.00	78.25	55.30	-22.95	74.00	18.70	PK	Vertical
2	1736.00	62.47	40.07	-22.40	80.83	40.76	PK	Vertical
3	2170.00	68.77	48.32	-20.45	80.83	32.51	PK	Vertical
4	2604.00	64.92	46.13	-18.79	80.83	34.70	PK	Vertical
5	3037.00	70.40	53.18	-17.22	80.83	27.65	PK	Vertical
6	3471.00	70.00	54.10	-15.90	80.83	26.73	PK	Vertical
7	3906.00	64.27	50.02	-14.25	74.00	23.98	PK	Vertical
8	4340.00	66.67	54.44	-12.23	74.00	19.56	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	1736.00	40.07	-6.98	33.09	60.83	40.07	Av	Vertical
2	2170.00	48.32	-6.98	41.34	60.83	48.32	Av	Vertical
3	2604.00	46.13	-6.98	39.15	60.83	46.13	Av	Vertical
4	3037.00	53.18	-6.98	46.20	60.83	53.18	Av	Vertical
5	3471.00	54.10	-6.98	47.12	60.83	54.10	Av	Vertical

Remark:

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

Product Name:	Smart Key	Product Model:	RT-HK4F28
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	79.51	56.55	-22.96	74.00	17.45	PK	Horizontal
2	1735.50	65.66	43.26	-22.40	80.83	37.57	PK	Horizontal
3	2169.50	64.90	44.45	-20.45	80.83	36.38	PK	Horizontal
4	2604.00	63.29	44.50	-18.79	80.83	36.33	PK	Horizontal
5	3038.00	65.16	47.95	-17.21	80.83	32.88	PK	Horizontal
6	3471.00	66.96	51.06	-15.90	80.83	29.77	PK	Horizontal
7	3906.00	63.74	49.49	-14.25	74.00	24.51	PK	Horizontal
8	4340.00	62.53	50.30	-12.23	74.00	23.70	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	1735.50	43.26	-6.98	36.28	60.83	24.55	Av	Horizontal
2	2169.50	44.45	-6.98	37.47	60.83	23.36	Av	Horizontal
3	2604.00	44.50	-6.98	37.52	60.83	23.31	Av	Horizontal
4	3038.00	47.95	-6.98	40.97	60.83	19.86	Av	Horizontal
5	3471.00	51.06	-6.98	44.08	60.83	16.75	Av	Horizontal

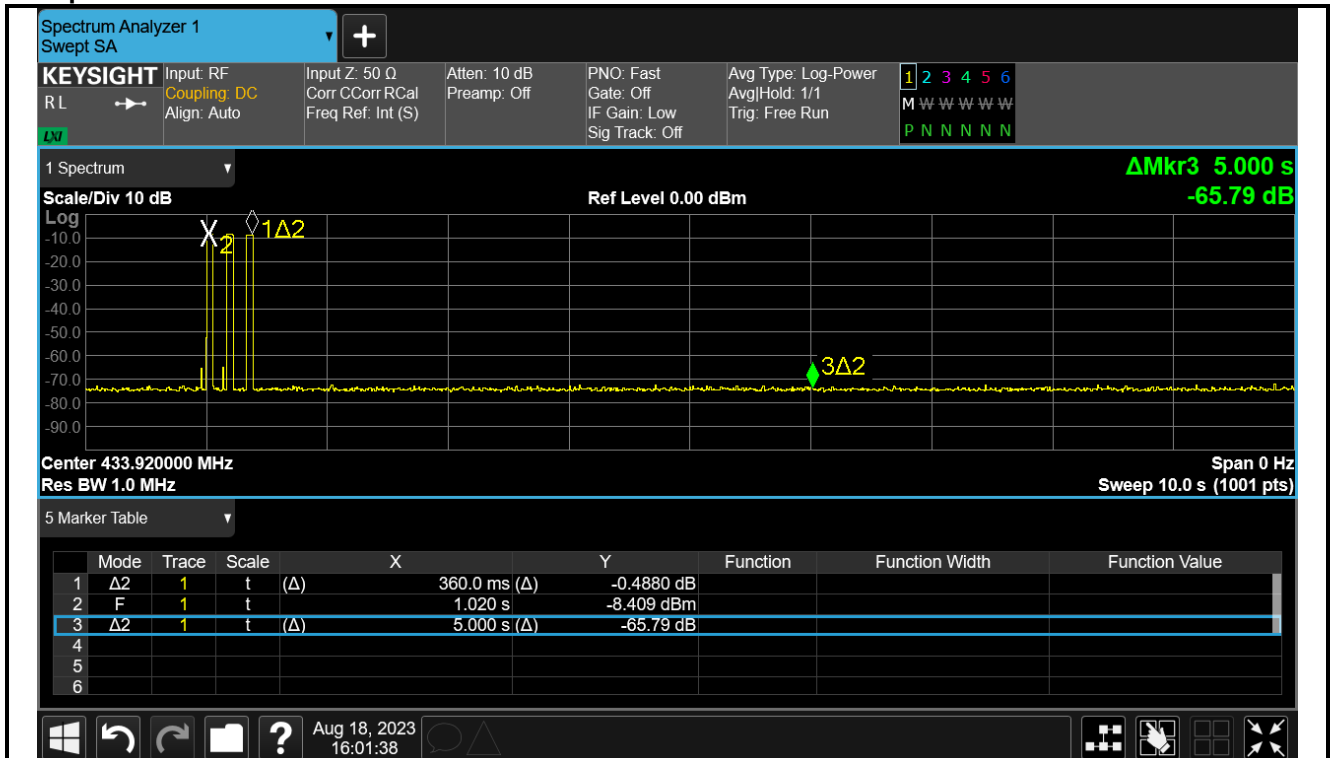
Remark:

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-----