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-G4502E, RT-G4512E, RT-G1388E, RT-G8278E
Trade Mark:	N/A
FCC ID:	2AOKM-G1AAC
Applicable Standards:	FCC CFR Title 47 Part 15C (§15.231)
Date of Sample Receipt:	30 Sep., 2022
Date of Test:	01 Oct., to 24 Oct., 2022
Date of Report Issue:	18 Nov., 2022
Test Result:	PASS

Tested by:	Mike ou ***Test Engineer***	***Date:***	*18 Nov., 2022*
Reviewed by:	Winner Zhang ***Project Engineer***	***Date:***	*18 Nov., 2022*
Approved by:	Manager ***Manager***	***Date:***	*18 Nov., 2022*

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	*27 Oct., 2022*	*Original*
01	*18 Nov., 2022*	*Update pages 14 and 18 to 20*

2 Contents

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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-G4502E, RT-G4512E, RT-G1388E, RT-G8278E
Operation Frequency:	315 MHz
Channel Numbers:	1
Modulation Type:	ASK
Antenna Type:	PCB Antenna
Antenna Gain:	-5 dBi
Power Supply:	DC 3V (CR2032 battery)
Test Sample Condition:	The test samples were provided in good working order with no visible defects.
Remark:	Model No.: RT-G4502E, RT-G4512E, RT-G1388E, RT-G8278E All models are identical inside, including the electrical circuit design, layout, components used and internal wiring. Models RT-G4502E, RT-G4512E, RT-G1388E, RT-G8278E represent appearance of the key with 3, 4, 5, and 6 buttons on the shell. The PCB function is the same for all these models.

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℃ ~ 35℃
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)))
Conducted Emission for LISN (9kHz ~ 150kHz)	±3.11 dB
Conducted Emission for LISN (150kHz ~ 30MHz)	±2.62 dB
Radiated Emission (9kHz ~ 30MHz) (3m SAC)	±3.13 dB
Radiated Emission (30MHz ~ 1GHz) (3m SAC)	±4.45 dB
Radiated Emission (1GHz ~ 18GHz) (3m SAC)	±5.34 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

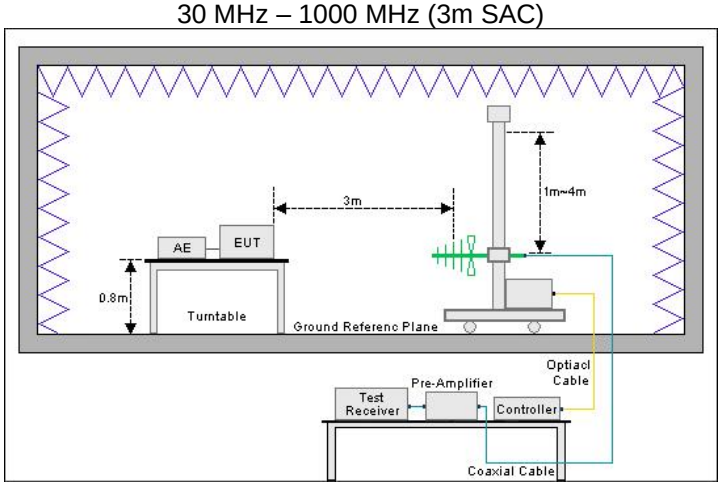
Radiated Emission(3m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	03-08-2022	03-07-2023
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	03-08-2022	03-07-2023
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	01-20-2022	01-19-2023
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	01-20-2022	01-19-2023
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	03-05-2022	03-04-2023
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-20-2022	01-19-2023
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-20-2022	01-19-2023
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	01-20-2022	01-19-2023
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

4 Measurement Setup and Procedure

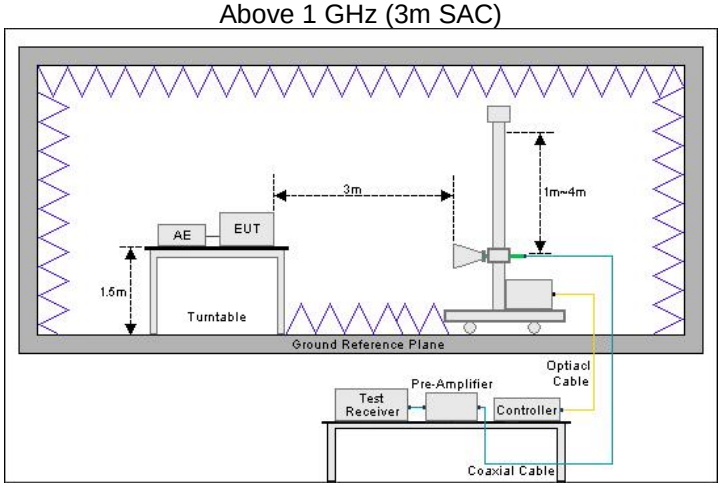
4.1 Test Setup

Radiated emission measurement:

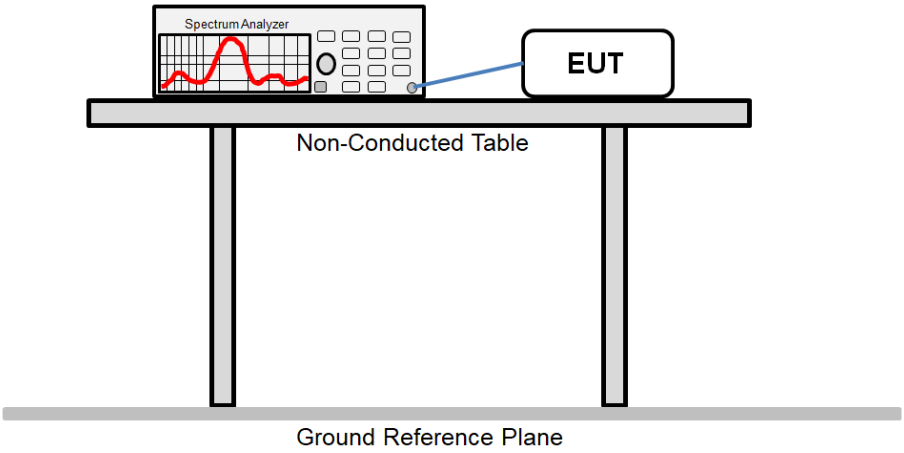
30 MHz – 1000 MHz (3m SAC)



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

<table>
<tr><th>Test items</th><th>Limit</th></tr>
<tr><td>AC Power Line Conducted Emission</td><td>
<table>
<tr><th rowspan="2">Frequency (MHz)</th><th colspan="2">Limit (dBμV)</th></tr>
<tr><th>Quasi-Peak</th><th>Average</th></tr>
<tr><td>0.15 – 0.5</td><td>66 to 56 Note 1</td><td>56 to 46 Note 1</td></tr>
<tr><td>0.5 – 5</td><td>56</td><td>46</td></tr>
<tr><td>5 – 30</td><td>60</td><td>50</td></tr>
<tr><td colspan="3">Note 1: The limit level in dBμV decreases linearly with the logarithm of frequency.
Note 2: The more stringent limit applies at transition frequencies.</td></tr>
</table>
</td></tr>
<tr><td>20dB Bandwidth</td><td>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.</td></tr>
<tr><td>Field Strength of Fundamental

Field Strength of Spurious Emissions</td><td>
<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>[1]1250 to 3750</td><td>[1]125 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>[1]3750 to 12500</td><td>[1]375 to 1250</td></tr>
<tr><td>Above 470.00</td><td>12500</td><td>1250</td></tr>
<tr><td colspan="3">[1]Linear interpolations.</td></tr>
</table>
(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>
<tr><td colspan="3">Note: The more stringent limit applies at transition frequencies.</td></tr>
<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>
<tr><td colspan="3">Note: The measurement bandwidth shall be 1 MHz or greater.</td></tr>
</table>
</td></tr>
<tr><td>Duration Time</td><td>A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.</td></tr>
</table>

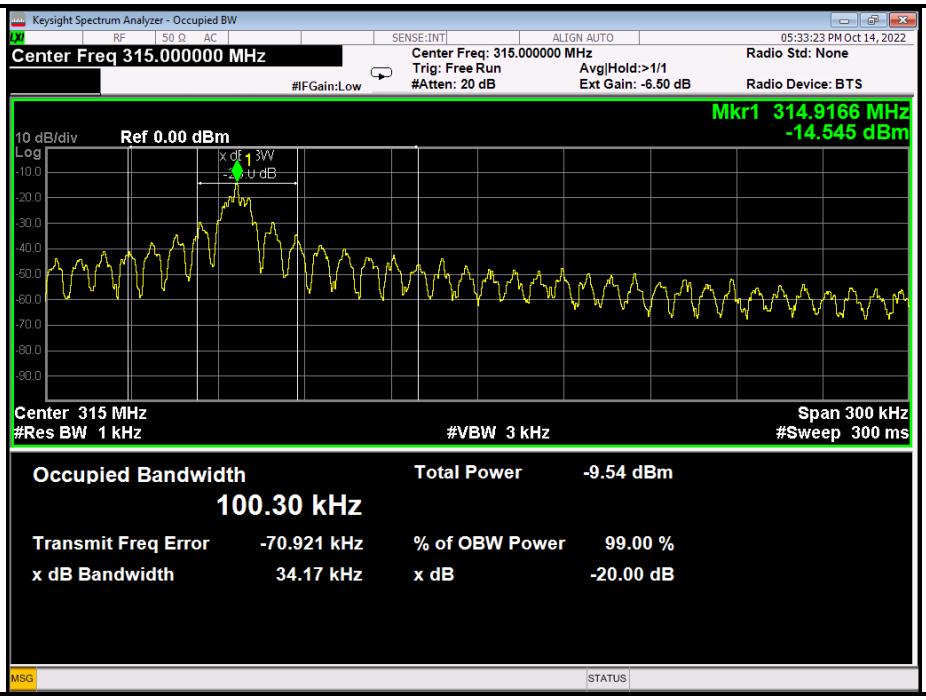
5.2 Antenna Requirement

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 (MHz)	Limit (MHz)	Results
0.03417	0.7875	Passed
Note: *Limit = Fundamental frequency×0.25%=315×0.25%=0.7875MHz.*		

Test plot as follows:



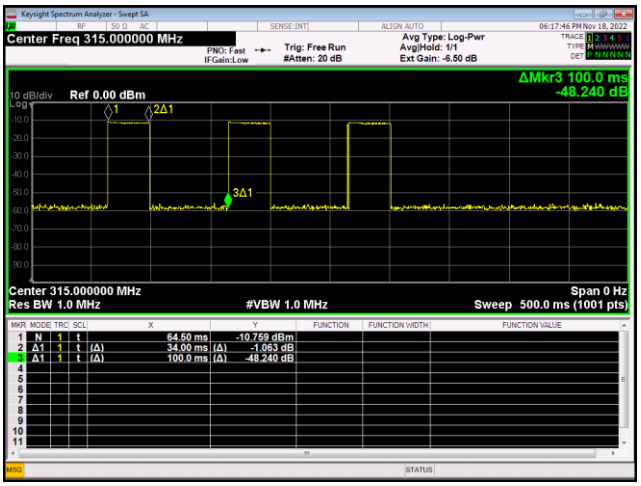
5.4 Field Strength of Fundamental

Peak value						
Frequency (MHz)	Read level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
314.9375	74.38	-12.63	61.75	95.62	33.87	Vertical
314.9375	96.01	-12.63	83.38	95.62	12.24	Horizontal
629.848	43.13	-6.27	36.86	75.62	38.76	Vertical
629.848	43.83	-6.27	37.56	75.62	38.06	Horizontal
944.807	42.87	-2.36	40.51	75.62	35.11	Vertical
944.807	52.86	-2.36	50.50	75.62	25.12	Horizontal

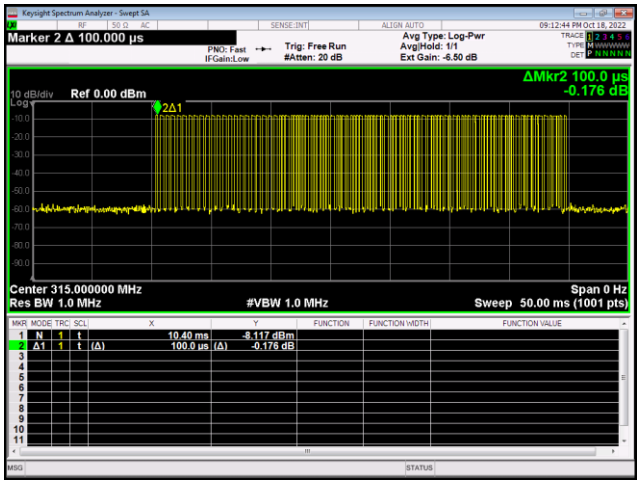
Average value						
Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
314.9375	61.75	-9.37	52.38	75.62	23.24	Vertical
314.9375	83.38	-9.37	74.01	75.62	1.61	Horizontal
629.848	36.86	-9.37	27.49	55.62	28.13	Vertical
629.848	37.56	-9.37	28.19	55.62	27.43	Horizontal
944.807	40.51	-9.37	31.14	55.62	24.48	Vertical
944.807	50.50	-9.37	41.13	55.62	14.49	Horizontal

Duty Cycle Factor Calculate Formula:	Average value = Peak value + Duty Cycle Factor
	Duty cycle factor = 20log(Duty cycle)
	Duty cycle = on time/100 milliseconds or period, whichever is less
	T on time = 34(ms)
	T period = 100(ms)
	Duty cycle = 34%
	Duty cycle factor = 20log(Duty cycle) = -9.37

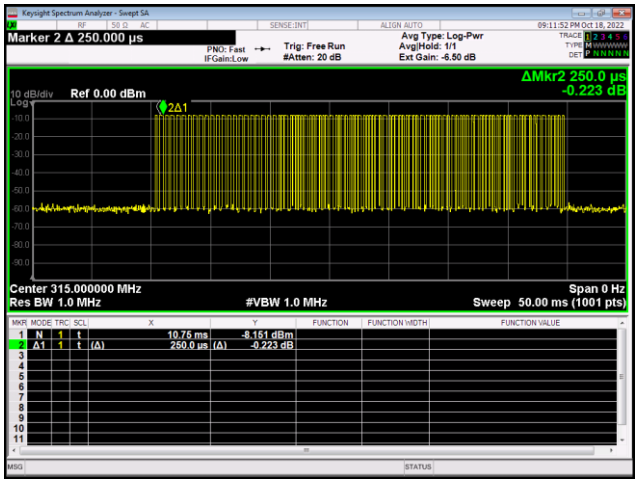
T period:



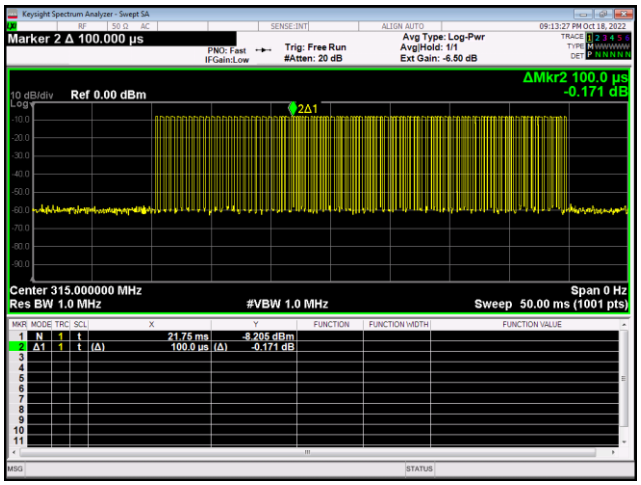
T 100ms:



T 62ms:



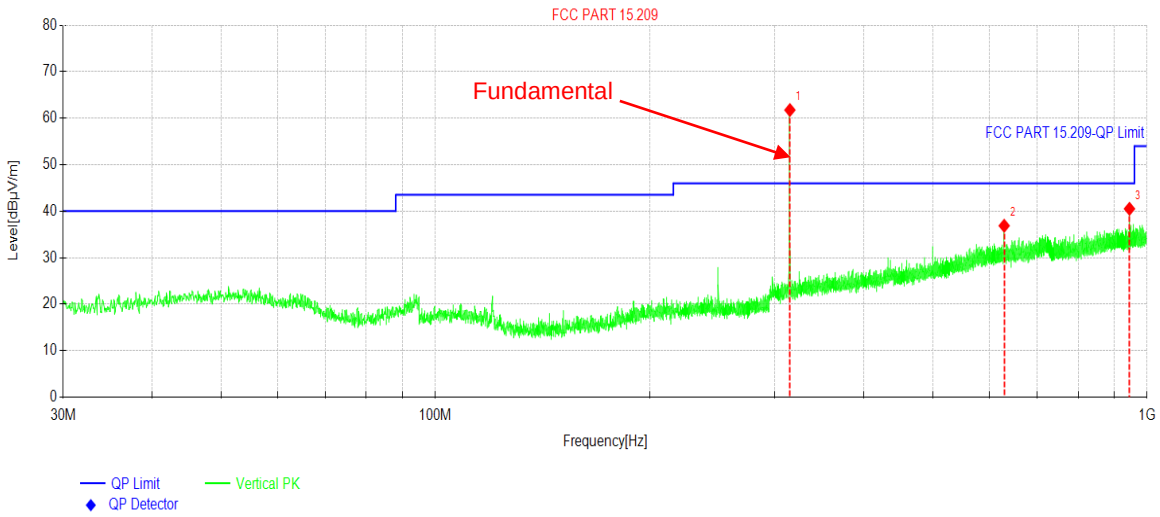
T on time slot-1:



5.5 Field Strength of Spurious Emissions

Below 1GHz (30MHz-1000MHz)

Product Name:	Smart Key	**Product Model:**	RT-G4502E
Test By:	Mike	**Test mode:**	Tx mode
Test Frequency:	30 MHz – 1000 MHz	**Polarization:**	Vertical
Test Voltage:	DC 3V		



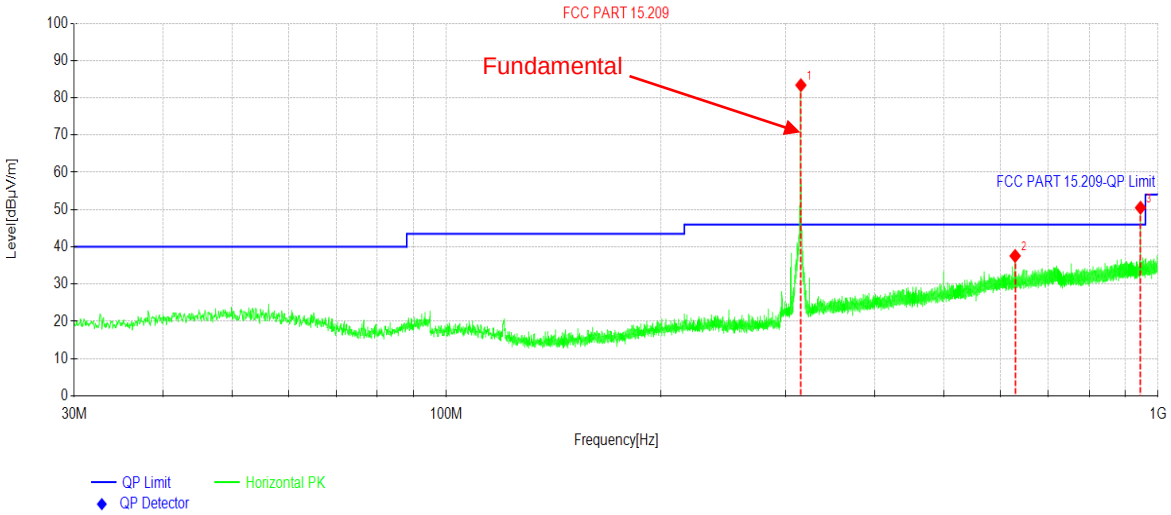
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	314.9375	74.38	61.75	-12.63	95.62	33.87	PK	Vertical
2	629.8480	43.13	36.86	-6.27	75.62	38.76	PK	Vertical
3	944.8070	42.87	40.51	-2.36	75.62	35.11	PK	Vertical

Suspected Data List								
NO.	Freq. [MHz]	Peak Level (dBuV/m)	Duty cycle factor[dB]	Average value (dBuV/m)	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	314.9375	61.75	-9.37	52.38	75.62	23.24	AV	Vertical
2	629.8480	36.86	-9.37	27.49	55.62	28.13	AV	Vertical
3	944.8070	40.51	-9.37	31.14	55.62	24.48	AV	Vertical

Remark:

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

Product Name:	Smart Key	Product Model:	RT-G4502E
Test By:	Mike	Test mode:	Tx mode
Test Frequency:	30 MHz – 1000 MHz	Polarization:	Horizontal
Test Voltage:	DC 3V		



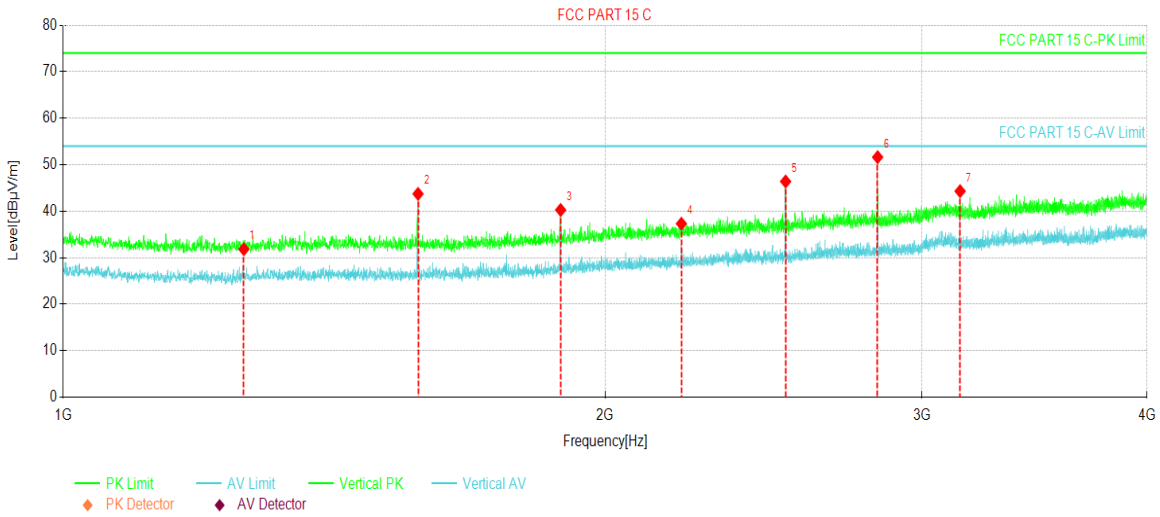
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	314.9375	96.01	83.38	-12.63	95.62	12.24	PK	Horizontal
2	629.8480	43.83	37.56	-6.27	75.62	38.06	PK	Horizontal
3	944.8070	52.86	50.50	-2.36	75.62	25.12	PK	Horizontal

Suspected Data List								
NO.	Freq. [MHz]	Peak Level (dBuV/m)	Duty cycle factor[dB]	Average value (dBuV/m)	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	314.9375	83.38	-9.37	74.01	75.62	1.61	AV	Horizontal
2	629.8480	37.56	-9.37	28.19	55.62	27.43	AV	Horizontal
3	944.8070	50.50	-9.37	41.13	55.62	14.49	AV	Horizontal

Remark:

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

Product Name:	Smart Key	Product Model:	RT-G4502E
Test By:	Mike	Test mode:	Tx mode
Test Frequency:	1000 MHz – 4000 MHz	Polarization:	Vertical
Test Voltage:	DC 3V		



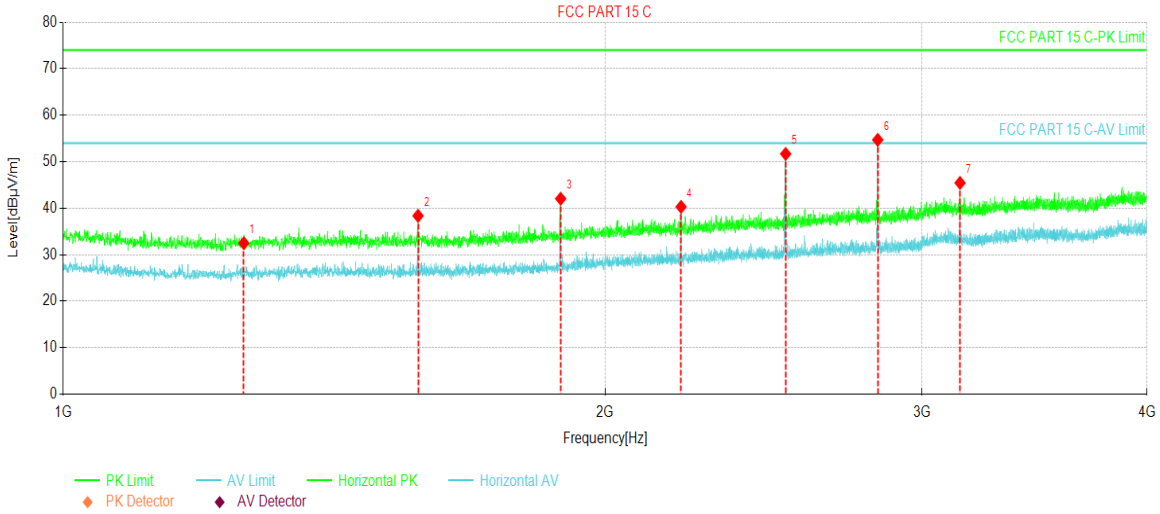
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1260.00	54.59	-22.76	31.83	75.62	43.79	PK	Vertical
2	1574.50	66.16	-22.44	43.72	74.00	30.28	PK	Vertical
3	1889.50	61.66	-21.41	40.25	75.62	35.37	PK	Vertical
4	2205.00	57.18	-19.88	37.3	74.00	36.7	PK	Vertical
5	2519.50	65.08	-18.69	46.39	75.62	29.23	PK	Vertical
6	2834.12	69.04	-17.42	51.62	74.00	22.38	PK	Vertical
7	3149.50	60.04	-15.74	44.3	75.62	31.32	PK	Vertical

Suspected Data List								
NO.	Freq. [MHz]	Peak Level (dBuV/m)	Duty cycle factor [dB]	Average value (dBuV/m)	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1260.250	31.83	-9.37	22.46	55.62	33.16	AV	Vertical
2	1574.500	43.72	-9.37	34.35	54.00	19.65	AV	Vertical
3	1889.500	40.25	-9.37	30.88	55.62	24.74	AV	Vertical
4	2204.500	37.3	-9.37	27.93	54.00	26.07	AV	Vertical
5	2519.500	46.39	-9.37	37.02	55.62	18.6	AV	Vertical
6	2834.500	51.62	-9.37	42.25	54.00	11.75	AV	Vertical
7	3149.125	44.3	-9.37	34.93	55.62	20.69	AV	Vertical

Remark:

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

Product Name:	Smart Key	Product Model:	RT-G4502E
Test By:	Mike	Test mode:	Tx mode
Test Frequency:	1000 MHz – 4000 MHz	Polarization:	Horizontal
Test Voltage:	DC 3V		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1260.000	55.23	-22.76	32.47	75.62	43.15	PK	Horizontal
2	1574.500	60.79	-22.44	38.35	74.00	35.65	PK	Horizontal
3	1889.500	63.44	-21.41	42.03	75.62	33.59	PK	Horizontal
4	2204.125	60.16	-19.88	40.28	74.00	33.72	PK	Horizontal
5	2519.500	70.36	-18.69	51.67	75.62	23.95	PK	Horizontal
6	2834.500	72.12	-17.42	54.70	74.00	19.3	PK	Horizontal
7	3149.125	61.17	-15.74	45.43	75.62	30.19	PK	Horizontal

Suspected Data List								
NO.	Freq. [MHz]	Peak Level (dBuV/m)	Duty cycle factor [dB]	Average value (dBuV/m)	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1260.250	32.47	-9.37	23.1	55.62	32.52	AV	Horizontal
2	1574.500	38.35	-9.37	28.98	54.00	25.02	AV	Horizontal
3	1889.500	42.03	-9.37	32.66	55.62	22.96	AV	Horizontal
4	2204.500	40.28	-9.37	30.91	54.00	23.09	AV	Horizontal
5	2519.500	51.67	-9.37	42.3	55.62	13.32	AV	Horizontal
6	2834.500	54.7	-9.37	45.33	54.00	8.67	AV	Horizontal
7	3149.125	45.43	-9.37	36.06	55.62	19.56	AV	Horizontal

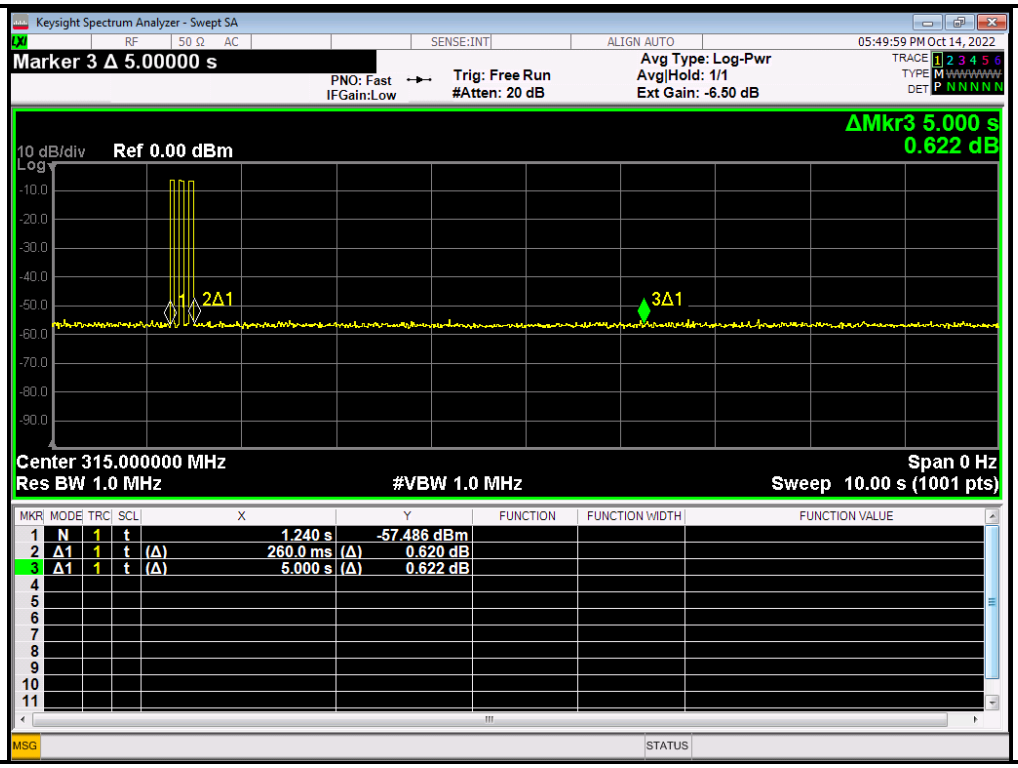
Remark:

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

5.6 Duration Time

Measurement monitoring	Result
The EUT automatically deactivate the transmitter within 0.034 seconds of switch being released.	Pass

Test plot as follows:



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