

FCC Part 15C

Measurement and Test Report


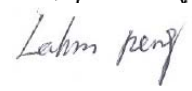

For

Smart Technologies & Investment Ltd.

Units C & D, 18/F Spectrum Tower, No, 53 Hung To ROAD, Kwun Tong,

Kowloon, Hong Kong

FCC ID: N9KSMARTWS104

FCC Rule(s):	<u>FCC Part 15.231</u>
Product Description:	<u>Key Pad Control</u>
Tested Model:	<u>WS104</u>
Report No.:	<u>STR13108285I</u>
Tested Date:	<u>2013-10-29 to 2013-11-06</u>
Issued Date:	<u>2013-11-07</u>
Tested By:	<u>Daniel LIU / Engineer</u> 
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Prepared By:	
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM. Test Technology Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Smart Technologies & Investmen Ltd.
 Address of applicant: Units C& D, 18/F Spectrum Twer, No, 53 Hung To Road, Kwun Tong, Kowloon,Fong Kong
 Manufacturer: Smart Electronicdj Indusrrialn (Dong Guan) Co., Ltd,
 Address of manufacturer: Qing Long Road, Long Jian Tian-Cun, Huang Jiang-Zhen, Dong Guan, Guang Dong,China

General Description of EUT	
Product Name:	Key Pad Control
Trade Name:	/
Model No.:	WS104
Rated Voltage:	Battery DC6V
<i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	433.92 MHz
Max. Field Strength:	82.41 dBuV/m (at 3m distance)
Modulation:	ASK
Antenna Type:	PCB Antenna
Antenna Gain:	0 dBi
Lowest Internal Frequency of EUT:	4MHz
Device Category:	Portable Device

1.2 Test Standards

The following report is prepared on behalf of the Smart Technologies & Investment Ltd. in accordance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.4 Test Facility

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Test Mode

The EUT was operated at continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	With modulation

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	N/A
§ 15.209	Radiated Supirous Emissions	Compliant
§15.231(a)	Deactivation Testing	Compliant
§15.231(b)	Radiated Emissions	Compliant
§15.231(c)	20dB Bandwidth Testing	Compliant

3. Antenna Requirement

3.1 Standard Applicable

According to FCC 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.2 Test Result

This product has a PCB antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ± 5.10 dB.

4.2 Standard Applicable

According to §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

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.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

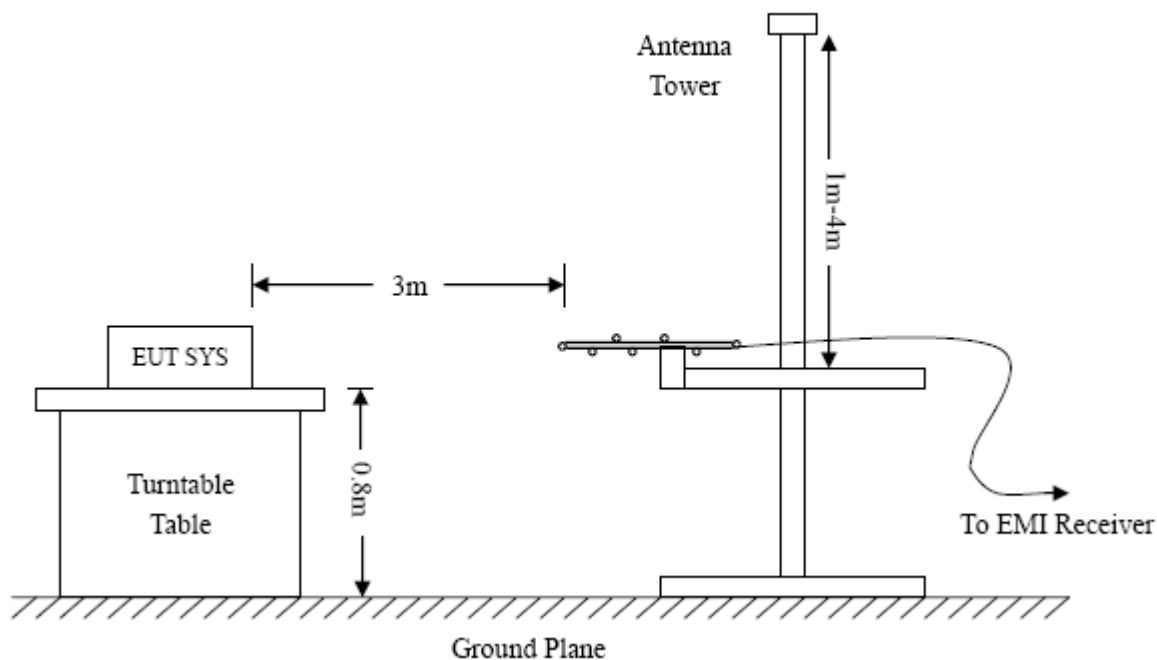
Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

4.3 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2013-05-07	2014-05-06
EMI Test Receiver	R&S	ESVB	825471/005	2013-05-07	2014-05-06
Pre-amplifier	Agilent	8447F	3113A06717	2013-05-07	2014-05-06
Pre-amplifier	Compliance Direction	PAP-0118	24002	2013-05-07	2014-05-06
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2013-04-20	2014-04-19
Horn Antenna	ETS	3117	00086197	2013-04-20	2014-04-19
Loop Antenna	SCHWARZECK	HFRA 5165	9365	2013-04-20	2014-04-19

4.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.205 15.231(b) and FCC Part 15.209 Limit.



4.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Loss} + \text{Cab. Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

4.6 Environmental Conditions

Temperature:	21° C
Relative Humidity:	50%
ATM Pressure:	1011 mbar

4.7 Summary of Test Results/Plots

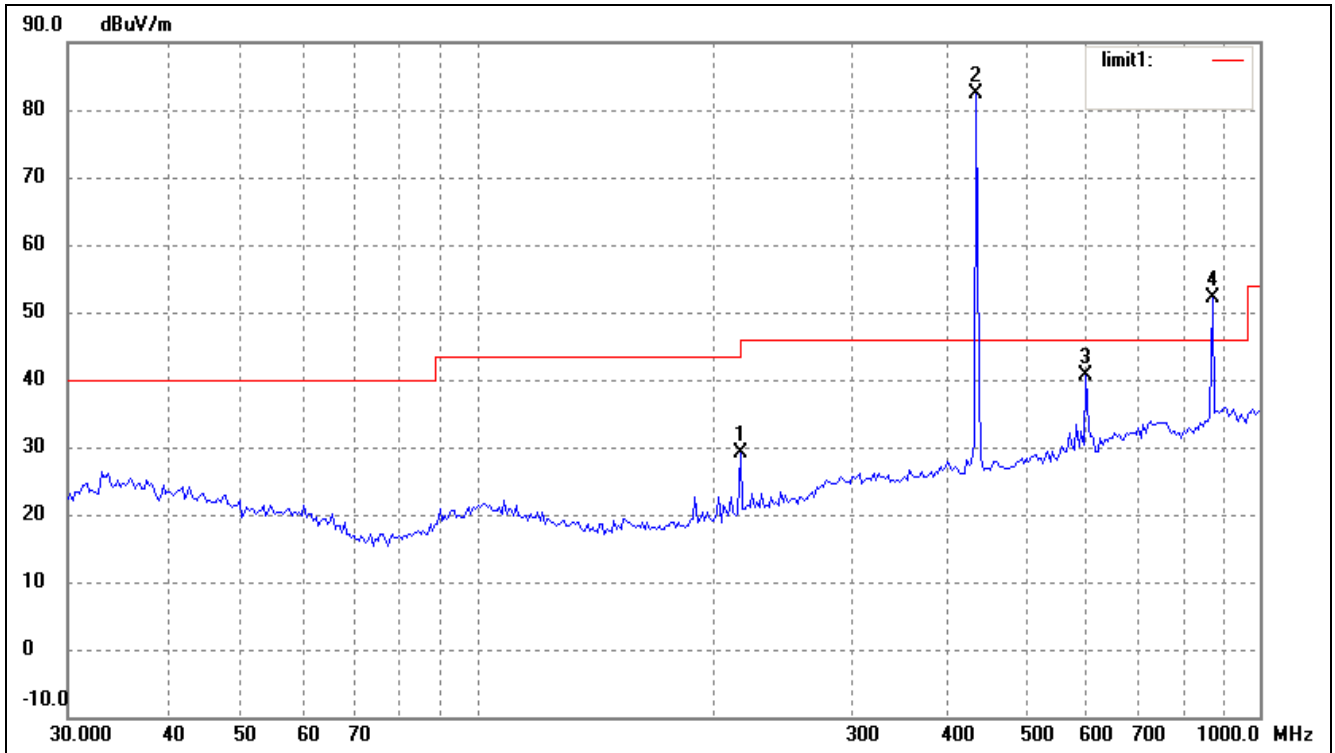
According to the data below, the FCC Part 15.205, 15.209 and 15.231 standards, and had the worst margin of:

-4.54 dB at 434.06511 MHz in the Horizontal polarization, Ave Detector, 9 kHz to 5 GHz, 3 Meters

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Plot of Radiated Emissions Test Data

EUT: *Key Pad Control*
 Tested Model: *WS104*
 Operating Condition: *Transmitting*
 Comment: *DC6V*
 Test Specification: *Horizontal*

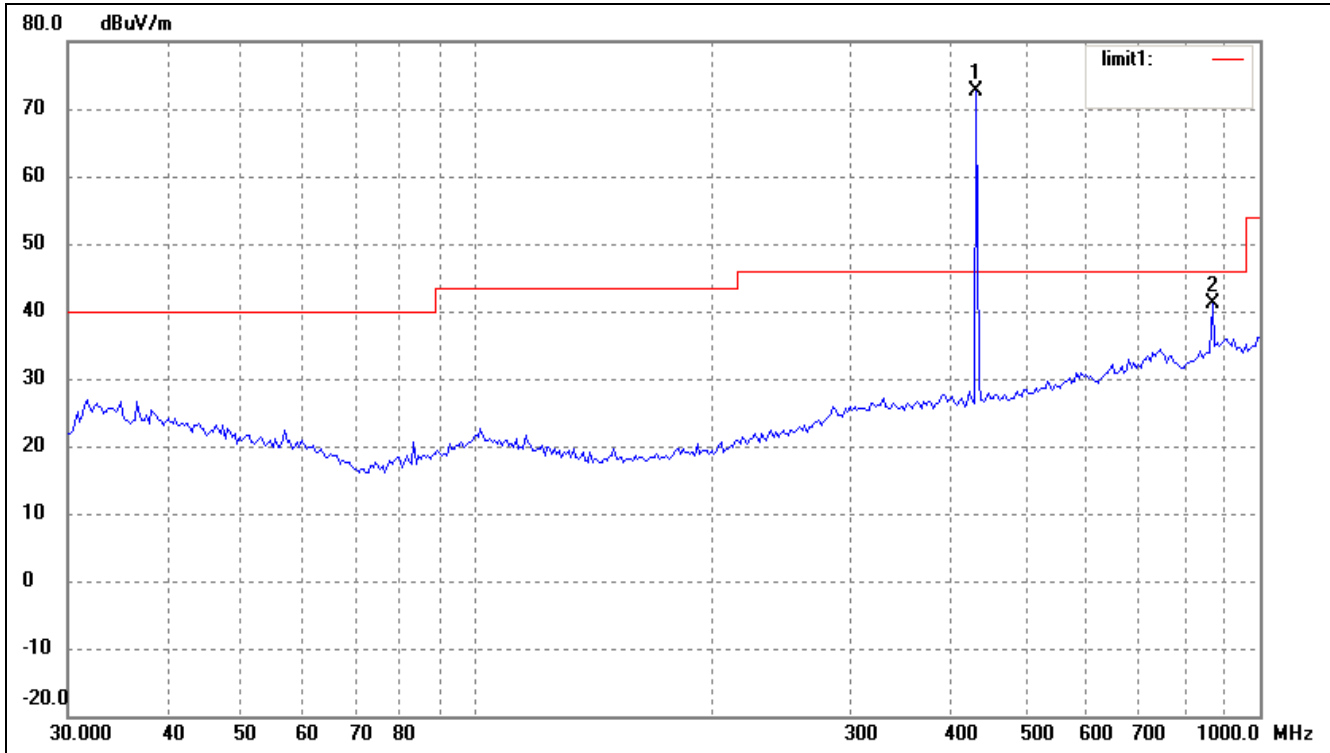


No.	Frequency MHz	Reading dBuV/m	Corr. Factor(dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin (dB)	Deg. (°)	Height (cm)	Remark
2	433.9236	71.31	11.10	N/A	82.41	100.82	-18.14	230	100	peak
	433.9236	/	/	-6.13	76.28	80.82	-4.54	230	100	Ave
3	599.3213	25.97	14.76	N/A	40.73	46.00	-5.27	360	100	peak
4	867.8401	33.66	18.54	N/A	52.20	80.82	-28.62	360	100	peak
	867.8401	/	/	-6.13	46.07	60.82	-14.75	360	100	Ave

Above 1GHz

No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin dB	Deg. (°)	Height (cm)	Remark
1	1301.7642	65.37	-15.05	N/A	50.32	74.00	-23.68	45	100	Peak
2	1735.6814	62.70	-13.13	N/A	49.57	74.00	-24.43	310	100	Peak
	1301.7642	/	/	-6.13	44.19	54.00	-9.81	360	100	Ave
	1735.6814	/	/	-6.13	43.44	54.00	-10.56	360	100	Ave

Test Specification: Vertical



No.	Frequency MHz	Reading dBuV/m	Corr. Factor(dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin (dB)	Deg. (°)	Height (cm)	Remark
1	433.9236	61.47	11.10	N/A	72.57	100.82	-28.25	360	100	peak
2	867.8401	22.62	18.54	N/A	41.16	80.82	-39.68	360	100	peak
	433.9236	/	/	-6.13	66.44	80.82	-14.38	360	100	Ave
	867.8401	/	/	-6.13	35.03	60.82	-25.79	360	100	Ave

Above 1GHz

No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin dB	Deg. (°)	Height (cm)	Remark
1	1301.7642	27.31	26.95	N/A	49.60	74.00	-24.40	45	100	Peak
2	1735.6814	27.64	27.77	N/A	48.74	74.00	-25.26	310	100	Peak
	1301.7642	/	/	-6.13	43.37	54.00	-10.53	360	100	Ave
	1735.6814	/	/	-6.13	42.61	54.00	-11.39	360	100	Ave

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 4th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz.

The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the the operating frequency 433.92MHz.

5. 20dB Bandwidth

5.1 Standard Applicable

According to FCC Part 15.231(c), 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2013-05-07	2014-05-06
Attenuator	ATTEN	ATS100-4-20	/	2013-05-07	2014-05-06

5.3 Test Procedure

With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna, which was connected to the spectrum analyzer with the START, and STOP frequencies set to the EUT's operation band.

5.4 Environmental Conditions

Temperature:	21° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

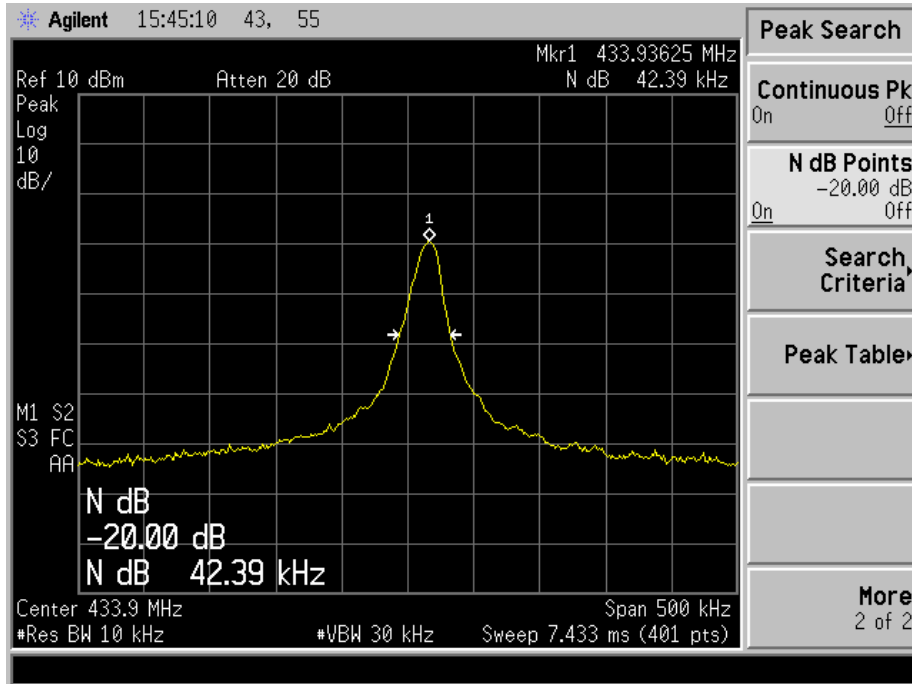
5.5 Summary of Test Results/Plots

Test Frequency MHz	20dB Bandwidth kHz	Limit kHz	Result
433.92	42.39	1085	Pass

Limit = Fundamental Frequency X 0.25% = 433.92 MHz X 0.25% = 1085 kHz

Please refer to the attached plots.

20dB Bandwidth Test Plot



6. Transmission Time

6.1 Standard Applicable

According to FCC Part 15.231 (a), the transmitter shall be complied the following requirements:

- 1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

6.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2013-05-07	2014-05-06
Attenuator	ATTEN	ATS100-4-20	/	2013-05-07	2014-05-06

6.3 Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

6.4 Environmental Conditions

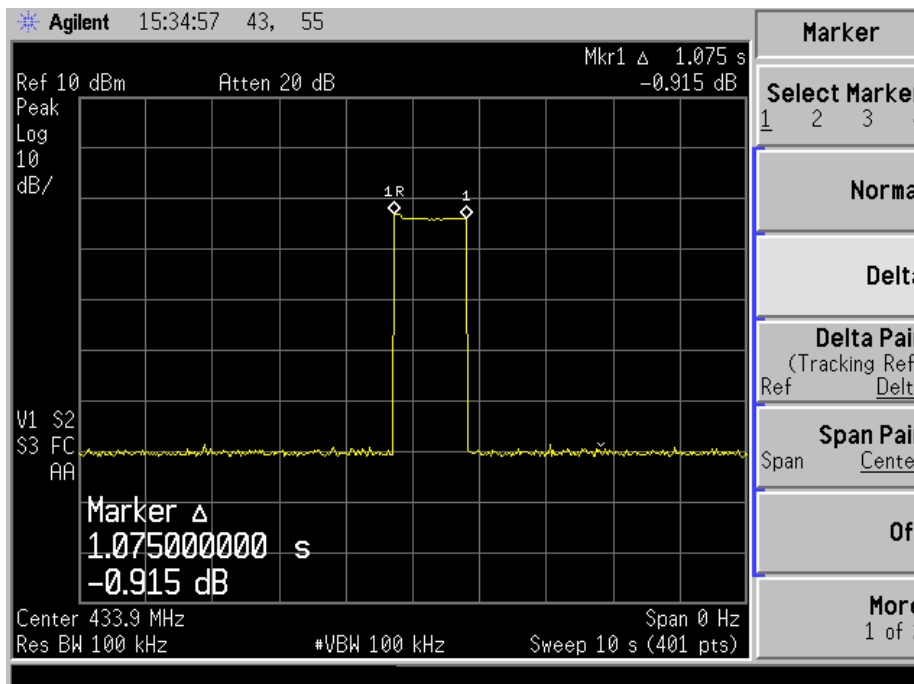
Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

6.5 Summary of Test Results/Plots

Transmission Type	Test Frequency MHz	Transmission Time seconds	Limit s	Result
Manually	433.92	1.075	5	Pass

Please refer to the attached plots.

Transmission Time



7. Duty Cycle

7.1 Standard Applicable

According to FCC Part 15.231 (b)(2) and 15.35 (c), For pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

7.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2013-05-07	2014-05-06
Attenuator	ATTEN	ATS100-4-20	/	2013-05-07	2014-05-06

7.3 Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

7.4 Environmental Conditions

Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

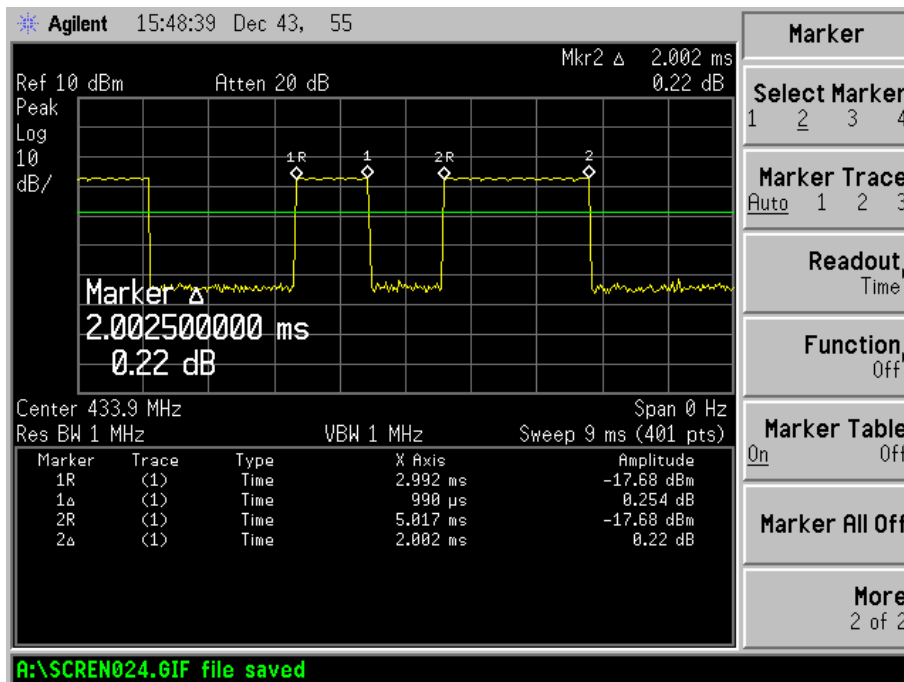
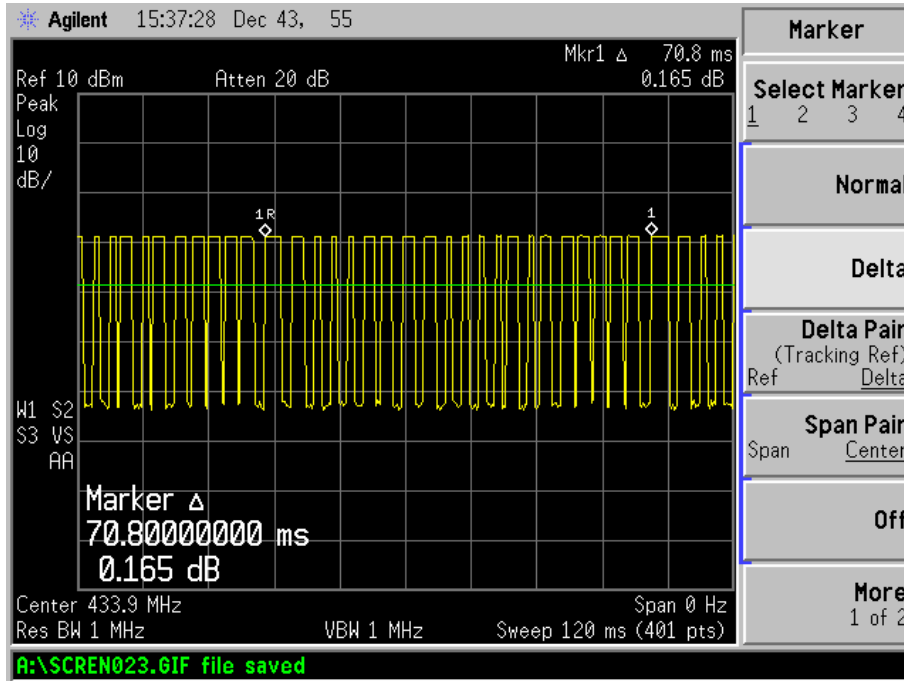
7.5 Summary of Test Results/Plots

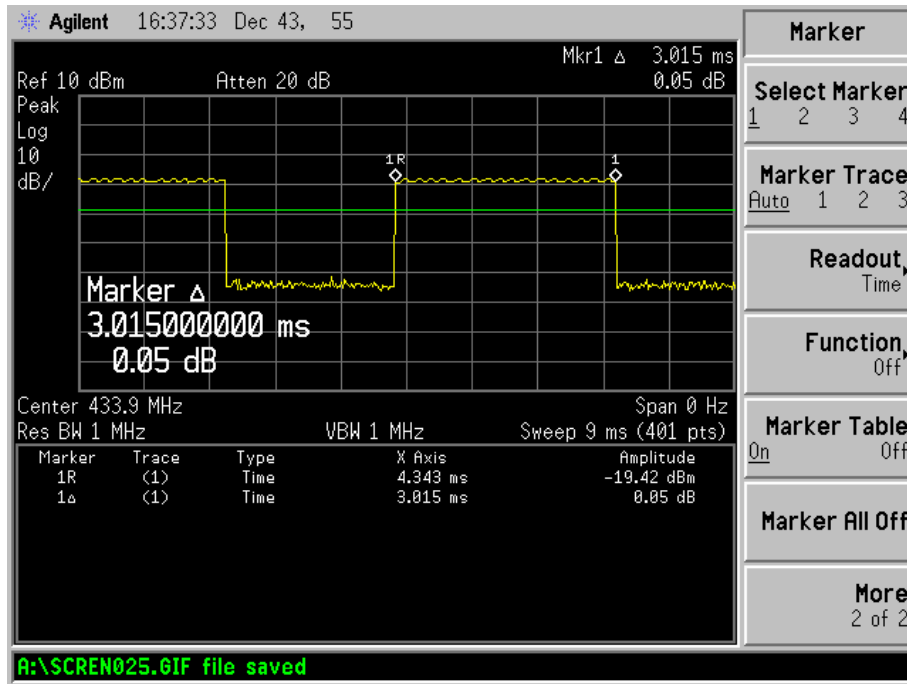
Type of Pulse	Width of Pulse ms	Quantity of Pulse	Transmission Time ms	Total Time (T _{on}) ms
Pulse 1 (Wide)	3.015	1	3.015	34.959
Pulse 2 (Middle)	2.002	12	24.024	
Pulse 3 (Narrow)	0.990	8	7.920	

Test Period (T _p) ms	Total Time (T _{on}) ms	Duty Cycle %	Duty Cycle Factor dB
70.8	34.959	49.38	-6.13

Please refer to the attached test plots

Width of Pulse





***** END OF REPORT *****