

FCC PART 15.231
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: N9KSMARTST-1601

Report Concerns: Original Report	Equipment Type: Push Button
Model:	<u>ST-1601</u>
Report No.:	<u>STR10068197I</u>
Test Date:	<u>2010-06-23 to 2010-06-28</u>
Issue Date:	<u>2010-06-30</u>
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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 SEM.Test Compliance Service Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Smart Technologies & Investment Ltd.
Address of applicant: Units C & D, 18/F Spectrum Tower, No. 53 Hung To Road,
Kwun Tong, Kowloon, Hong Kong

Manufacturer: Smart Electronic Industrial (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 E.U.T

Items	Description
EUT Description:	Push Button
Trade Name:	/
Model No.:	ST-1601
Rated Voltage:	DC 12V
Output Power:	<1mW
Frequency Range:	433.92MHz
Antenna Type:	Integral Antenna
Size:	9.0X2.8X2.9 cm
Comment:	Manually Operated Device
For more information refer to the circuit diagram form and the user's manual.	

The test data is gathered from a production sample, provided by the manufacturer.

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 Related Submittal(s)/Grant(s)

No Related Submittal(s).

1.4 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.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions. The EUT was set to keep transmitting during the test.

1.5 Test Facility

- **FCC – Registration No.: 994117**

SEM.Test Compliance Services 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 994117.

- **Industry Canada (IC) Registration No.: 7673A**

The 3m Semi-anechoic chamber of SEM.Test Compliance Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 7673A.

1.6 EUT Exercise Software

The EUT exercise program used during the testing was designed to exercise the system components. The test software, provided by the customer, is started while the whole system is running.

1.7 Accessories Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

1.8 EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

2. SUMMARY OF TEST RESULTS

Description of Test	Result
§15.203 Antenna Requirement	Compliant
§15.205 Restricted Band	Compliant
§15.207 Conducted Emission	N/A
§15.209 General Requirement	Compliant
§15.231 (a) Deactivation Testing	Compliant
§15.231 (c) 20dB Band Width Testing	Compliant
§15.231 (b) Radiated Emission	Compliant

3. §15.203 ANTENNA REQUIREMENT

3.1 Standard Applicable

According to FCC 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 permanent antenna, fulfill the requirement of this section.

4. §15.205, §15.209, §15.231 (b) RADIATED EMISSION

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\ 1,250 to 3,750	\1\ 125 to 375
174-260.....	3,750.....	375
260-470.....	\1\ 3,750 to 12,500	\1\ 375 to 1,250
Above 470.....	12,500.....	1,250

\1\ 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.

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

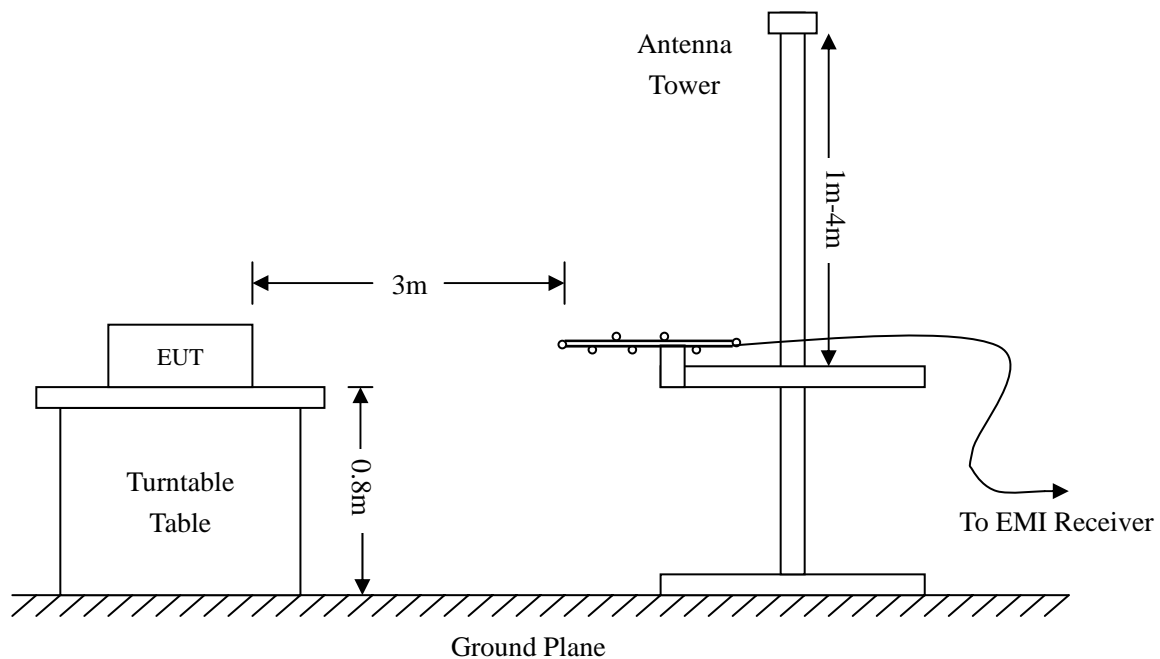
4.3 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Spectrum Analyzer	ROHDE&SCHWARZ	FSEA20	DE25181	2009-08-12	2010-08-11
Positioning Controller	C&C	CC-C-1F	N/A	2009-08-12	2010-08-11
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2009-07-21	2010-07-20
Horn Antenna	SCHWARZBECK	BBHX 9120	9120-426	2009-07-21	2010-07-20
RF Switch	EM	EMSW18	SW060023	2009-08-12	2010-08-11
Amplifier	Agilent	8447F	3113A06717	2009-08-12	2010-08-11
Coaxial Cable	SCHWARZBECK	AK9513	9513-10	2009-08-12	2010-08-11
Spectrum Analyzer	ROHDE&SCHWARZ	FSP	N/A	2010-04-16	2011-04-15

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

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 -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15.231 Limit}$$

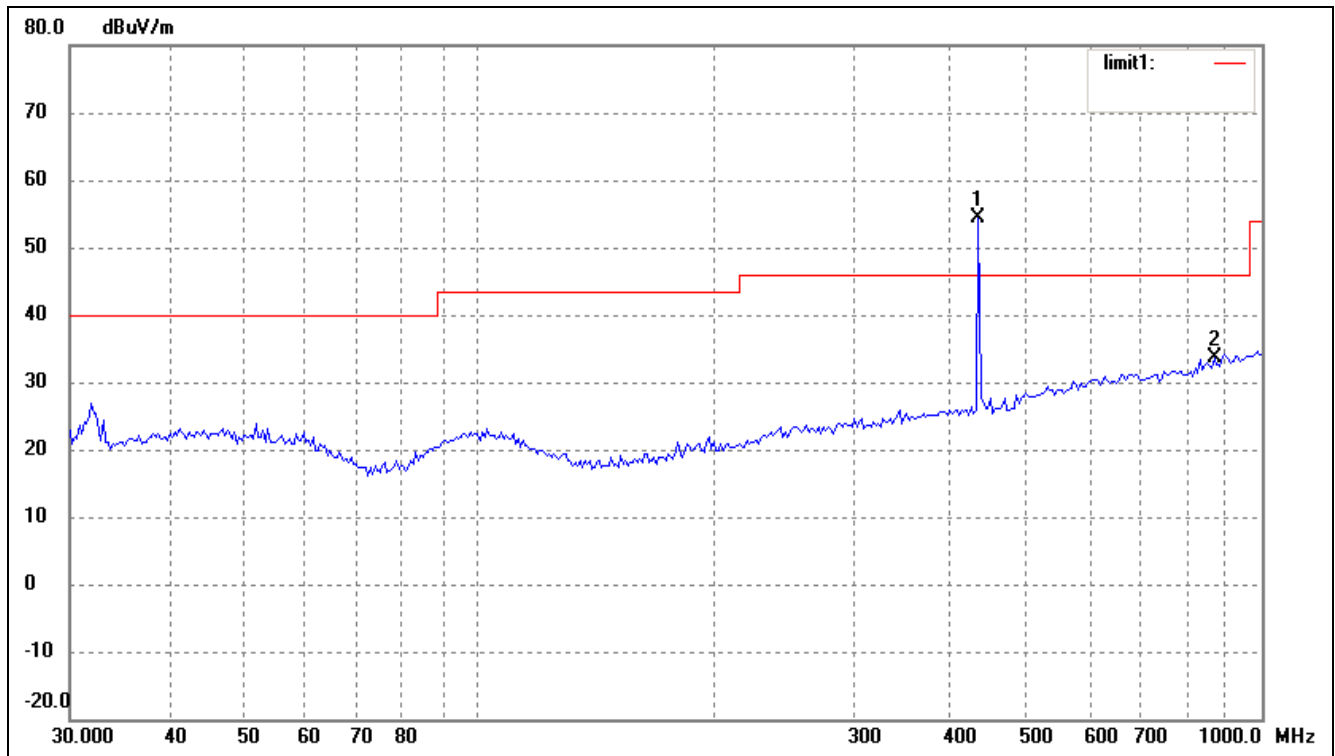
4.6 Environmental Conditions

Temperature:	26 °C
Relative Humidity:	61 %
ATM Pressure:	1012 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:

-1.16 dBμV at 2170.50 MHz in the Vertical, Ave Detector polarization, 30 MHz to 4 GHz, 3Meters

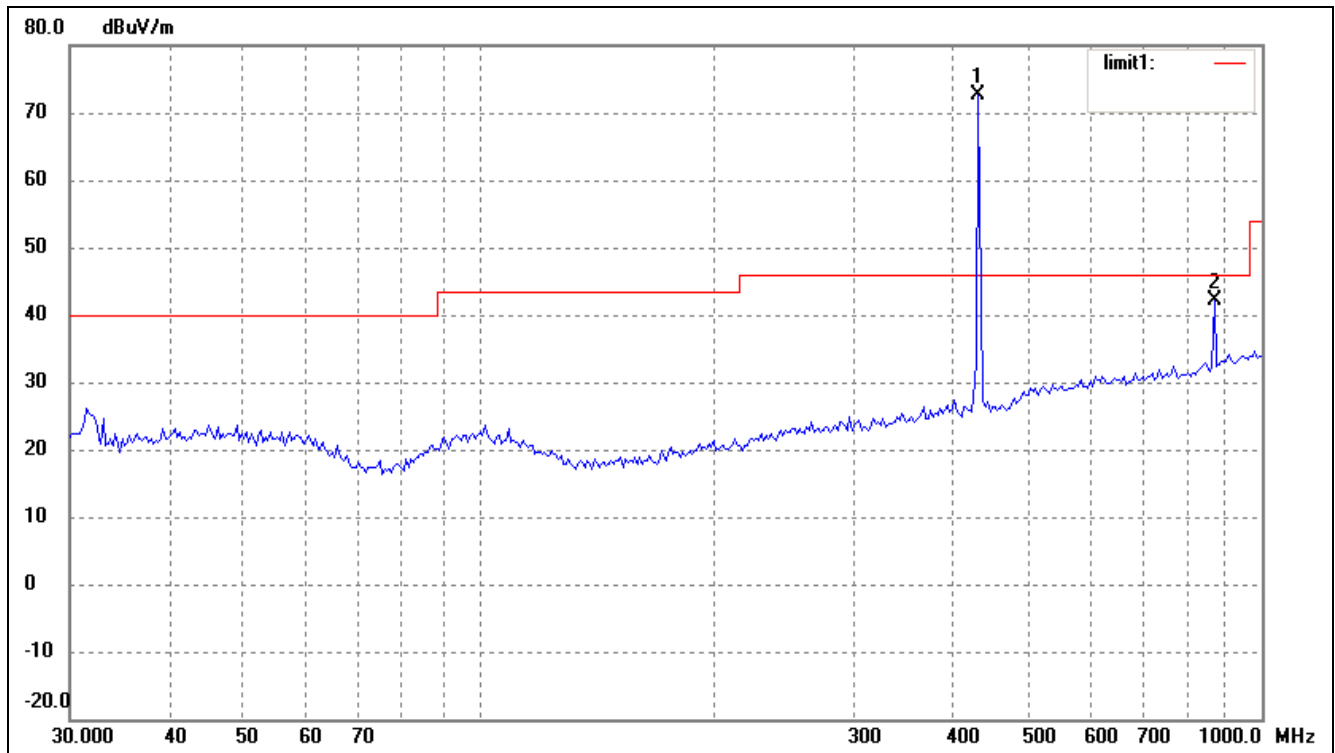
Plot of Radiation Emissions Test*Horizontal:*

No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin dB	Deg. (°)	Height (cm)	Remark
1	433.92	43.74	10.56	N/A	54.30	100.83	-46.53	114	100	peak
2	868.20	17.25	16.47	N/A	33.72	80.83	-47.11	225	100	peak
	433.92	/	/	-9.12	45.18	80.83	-35.65	357	100	Ave
	868.20	/	/	-9.12	24.60	60.83	-36.23	46	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	1302.30	29.45	21.61	N/A	51.06	74.00	-22.94	12	100	peak
2	1736.40	30.16	28.46	N/A	58.62	80.83	-22.21	31	100	peak
3	2170.50	32.77	32.69	N/A	65.46	80.83	-15.37	55	100	peak
4	2604.60	27.21	35.40	N/A	62.61	80.83	-18.22	97	100	peak
	1302.30	/	/	-9.12	41.94	54.00	-12.06	216	100	Ave
	1736.40	/	/	-9.12	49.50	60.83	-11.33	336	100	Ave
	2170.50	/	/	-9.12	56.34	60.83	-4.49	324	100	Ave
	2604.60	/	/	-9.12	53.49	60.83	-7.34	90	100	Ave

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	433.92	62.09	10.56	N/A	72.65	100.83	-28.18	56	200	peak
2	868.20	25.68	16.47	N/A	42.15	80.83	-38.68	46	100	peak
	433.92	/	/	-9.12	63.53	80.83	-17.30	219	200	Ave
	868.20	/	/	-9.12	33.03	60.83	-27.80	56	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	1302.30	29.36	21.61	N/A	50.97	74.00	-23.03	236	100	peak
2	1736.40	38.31	28.46	N/A	66.77	80.83	-14.06	49	100	peak
3	2170.50	36.10	32.69	N/A	68.79	80.83	-12.04	0	100	peak
4	2604.60	28.97	35.40	N/A	64.37	80.83	-16.46	0	100	peak
	1302.30	/	/	-9.12	41.85	54.00	-12.15	36	100	Ave
	1736.40	/	/	-9.12	57.65	60.83	-3.18	159	100	Ave
	2170.50	/	/	-9.12	59.67	60.83	-1.16	88	100	Ave
	2604.60	/	/	-9.12	55.25	60.83	-5.58	92	100	Ave

Note: The EUT was tested in all three orthogonal planes and frequency rang 30MHz to the tenth harmonics.

Emissions attenuated closely to the noise base are not reported.

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

5. §15.231(c) 20dB BANDWIDTH TESTING

5.1 Standard Applicable

According to FCC 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

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2009-08-12	2010-08-11
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2009-08-12	2010-08-11
ETS	Receiver Antenna	2175	57337	2009-08-12	2010-08-11
ETS	50 ohm Coaxial Cable	SUCOFLEX 104	25498514	2009-08-12	2010-08-11

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

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:	25 °C
Relative Humidity:	61 %
ATM Pressure:	1012 mbar

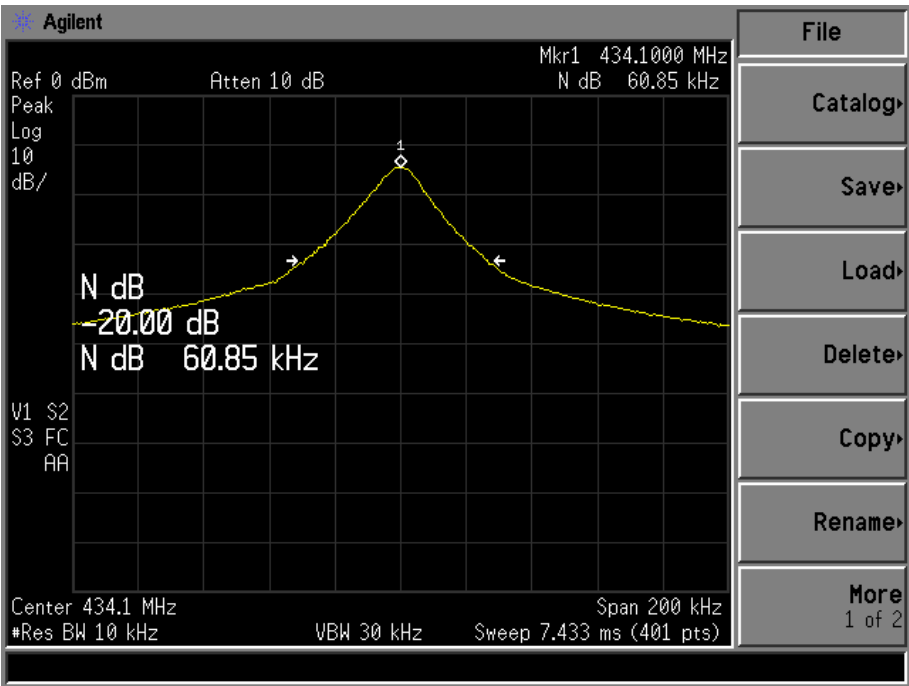
5.5 Summary of Test Results/Plots

Frequency MHz	20dB Bandwidth kHz	Limit kHz
433.92	60.85	1085.25

Limit=Fundamental Frequency \times 0.25%=434.10 \times 0.25%=1085.25kHz

Test Result Pass

Refer to the attached plots.



6. §15.231(a) DEACTIVATION TESTING

6.1 Standard Applicable

According to FCC 15.231 (a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

6.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2009-08-12	2010-08-11
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2009-08-12	2010-08-11
Receiver Antenna	ETS	2175	57337	2009-08-12	2010-08-11
50 ohm Coaxial Cable	ETS	SUCOFLEX 104	25498514	2009-08-12	2010-08-11

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

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.

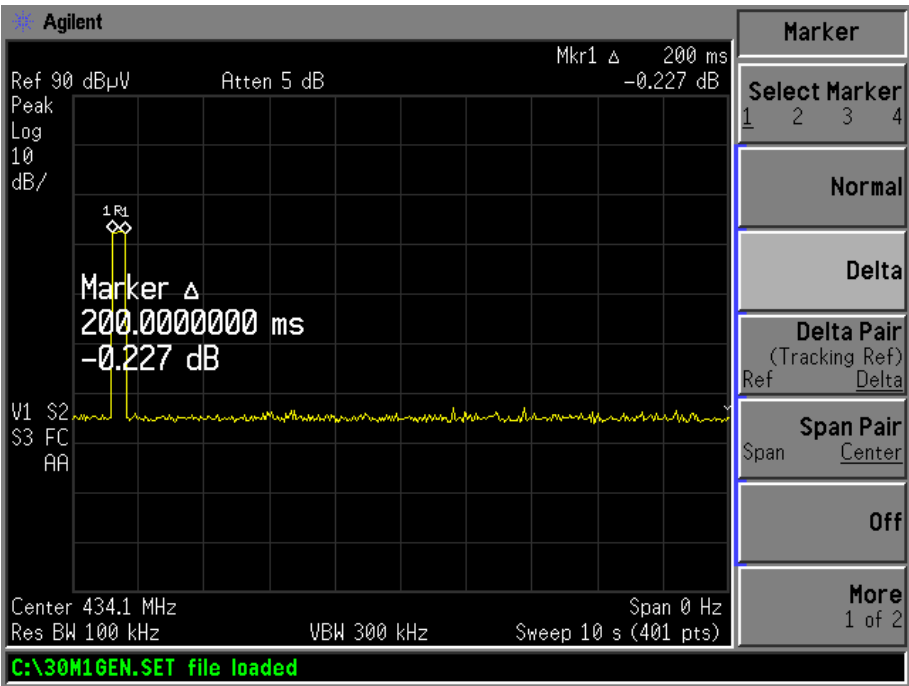
6.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	62 %
ATM Pressure:	1013 mbar

6.5 Summary of Test Results/Plots

Refer to the attached plots.

The transmission time <5s



Result: Pass

7. §15.231(b) Duty Cycle

7.1 Standard Applicable

According to FCC 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

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2009-08-12	2010-08-11
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2009-08-12	2010-08-11
Receiver Antenna	ETS	2175	57337	2009-08-12	2010-08-11
50 ohm Coaxial Cable	ETS	SUCOFLEX 104	25498514	2009-08-12	2010-08-11

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

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 434.10MHz, 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:	25 °C
Relative Humidity:	62 %
ATM Pressure:	1013 mbar

7.5 Summary of Test Results/Plots

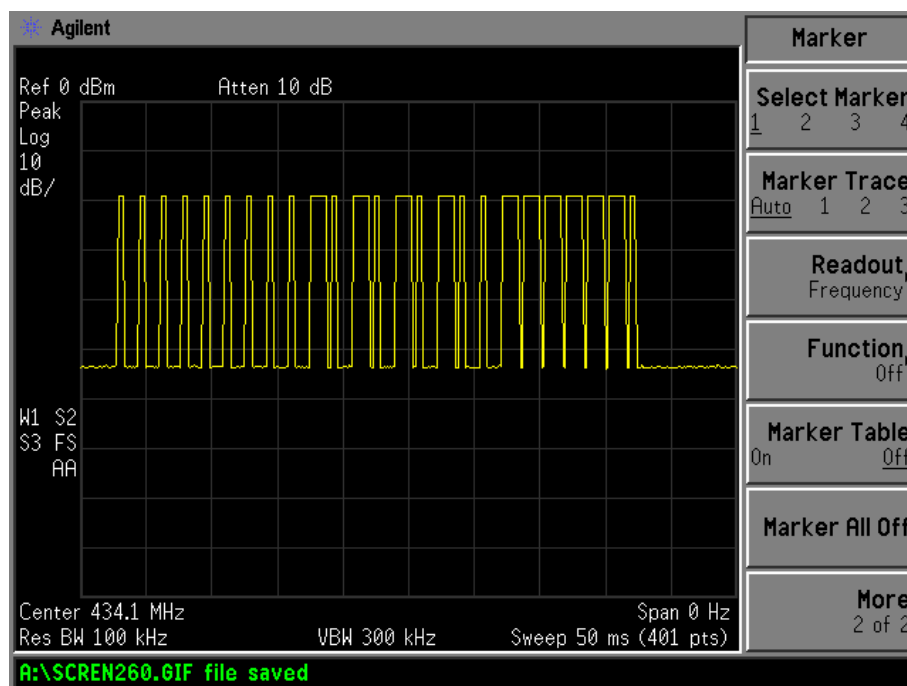
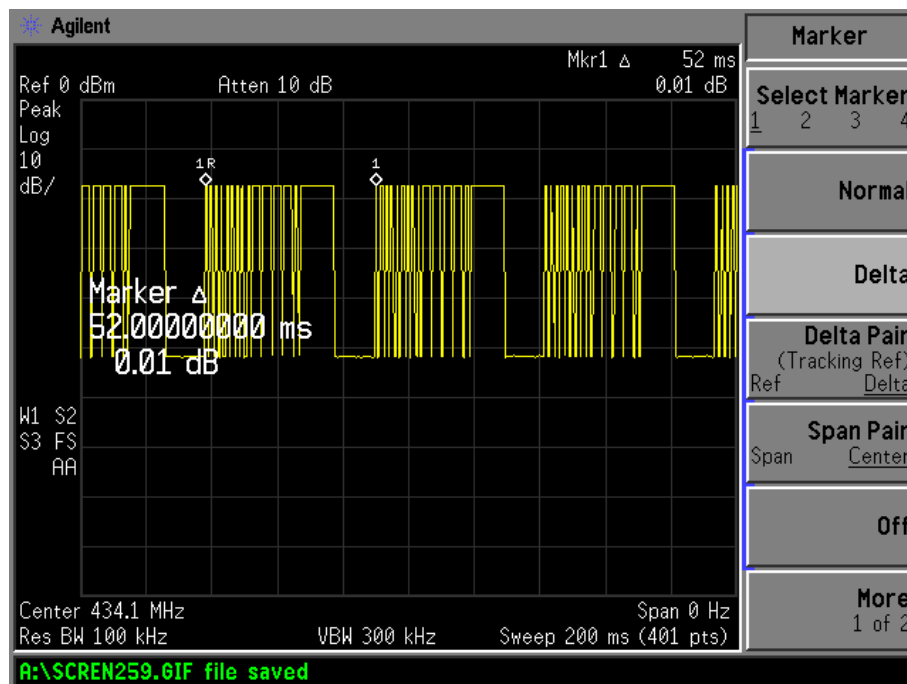
$$T_p = 44.5\text{ms}$$

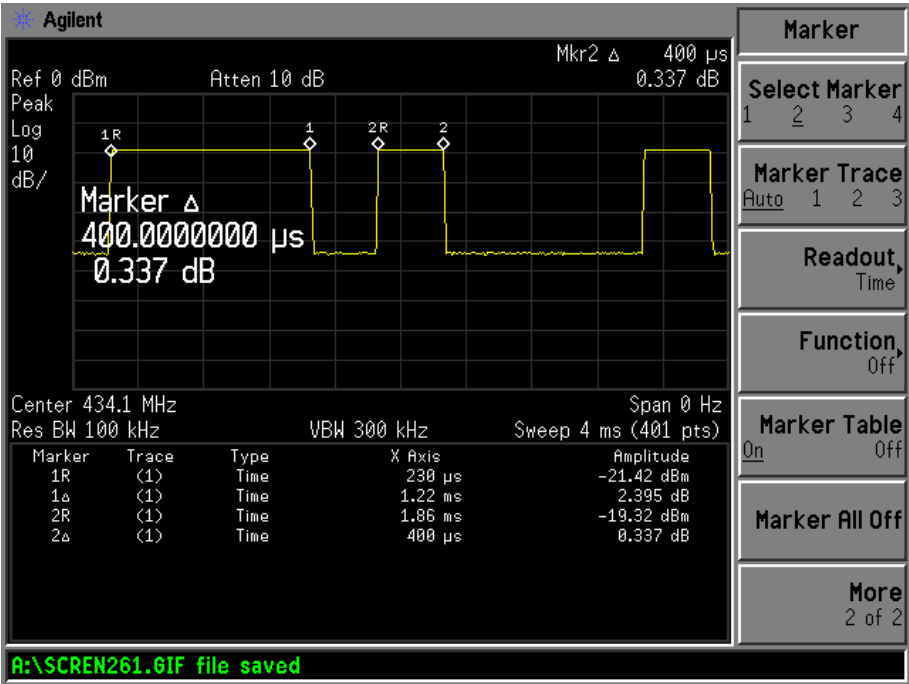
$$T_{on} = T_{on1} * \text{Number} + T_{on2} * \text{Number} = 1.22*10+0.4*15=18.2\text{ms}$$

$$\text{Duty Cycle} = T_{on} / T_p * 100\% = 35\%$$

$$\text{Factor} = 20*\text{Log} (T_{on}/T_p) = -9.12$$

Refer to the attached plots.





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