



STC Test Report

Date : 2009-12-09

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No. : MH183546

Applicant (C00055): GTO Inc.
3121 Hartsfield Road, Tallahassee, Florida 32303, USA

Description of Sample(s): Submitted sample(s) said to be
Product: FM231 Driveway Alarm
Brand Name: MIGHTY MULE
Model Number: FM131/FM231/R4450
FCC ID: I6HGTOFM231

Date Sample(s) Received: 2009-11-09

Date Tested: 2009-11-25

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2008 and ANSI C63.4:2003 for FCC Certification.

Conclusion(s): The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remark(s): For additional models details, see page 5.

Dr. LEE Kam Chuen
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
The Hong Kong Standards and Testing Centre Ltd.

The Hong Kong Standards and Testing Centre Ltd.

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1.0 General Details

1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.
EMC Laboratory
10 Dai Wang Street, Taipo Industrial Estate
New Territories, Hong Kong

Telephone: 852 2666 1888

Fax: 852 2664 4353

1.2 Applicant Details

Applicant

GTO Inc.
3121 Hartsfield Road, Tallahassee, Florida 32303, USA

Manufacturer

SMART TECHNOLOGIES & INVESTMENT LTD
Suites C&D, 18/F Spectrum Tower, 53 Hung To Road,
Kwun Tong, Kowloon, Hong Kong

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1.3 Equipment Under Test [EUT] Description of Sample(s)

Submitted sample(s) said to be

Product:	FM231 Driveway Alarm
Manufacturer:	SMART TECHNOLOGIES & INVESTMENT LTD
Brand Name:	MIGHTY MULE
Model Number:	FM131/FM231/R4450
Additional Brand Name:	SMARTEC
Additional Model Number:	SD2736
Rating:	3Vd.c. ("AA" size battery x 2)

1.3.1 Description of EUT Operation

The Equipment Under Test (EUT) is a GTO Inc., FM231 Driveway Alarm. The transmitter is automatic activated transmitter. The EUT will automatically cease transmission after one packet has been sent. It is pulse transmitter. Modulation by IC; and type is pulse modulation.

1.4 Date of Order

2009-11-09

1.5 Submitted Sample(s):

1 Sample

1.6 Test Duration

2009-11-25

1.7 Country of Origin

China

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2.0 Technical Details

2.1 Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15 2008 and ANSI C63.4:2003 for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary						
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Failed	N/A
Field Strength of Fundamental Emissions & Spurious Emissions	FCC 47CFR 15.231a	ANSI C63.4:2003	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Emissions	FCC 47CFR 15.209	ANSI C63.4:2003	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: N/A - Not Applicable

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3.0 Test Results

3.1 Emission

3.1.1 Radiated Emissions

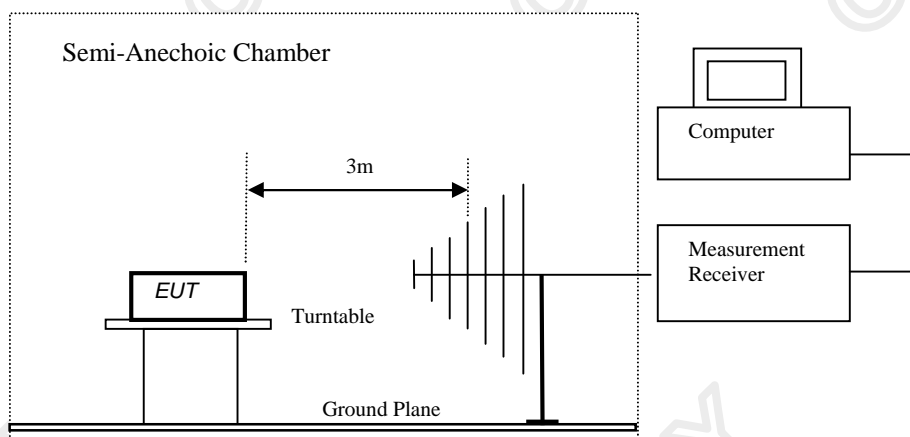
Test Requirement: FCC 47CFR 15.231a
Test Method: ANSI C63.4:2003
Test Date: 2009-11-25
Mode of Operation: Tx mode

Test Method:

The sample was placed 0.8m above the ground plane of semi-anechoic chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

*: Semi-anechoic chamber located on the STC (Dongguan) Company Ltd. 68 Fumin Nan Road, Dalang, Dongguan, Guangdong, PRC with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 629686.

Test Setup:



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Limits for Field Strength of Fundamental Emissions [FCC 47CFR 15.231a]:

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emission [Average] [$\mu\text{V/m}$]	Field Strength of Spurious Emission [Average] [$\mu\text{V/m}$]
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

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

Results:

Field Strength of Fundamental Emissions Peak Value						
Frequency MHz	Measured Level @3m dB μV	Correction Factor dB/m	Field Strength dB $\mu\text{V/m}$	Field Strength $\mu\text{V/m}$	Limit @3m $\mu\text{V/m}$	E-Field Polarity
434.00	71.6	18.6	90.2	32359.4	110,000.1	Horizontal

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dB μV	Correction Factor dB/m	Field Strength dB $\mu\text{V/m}$	Field Strength $\mu\text{V/m}$	Limit @3m $\mu\text{V/m}$	E-Field Polarity
868.00	< 1.0	29.1	< 30.1	< 32.0	11,000.0	Vertical
+ 1302.00	< 1.0	26.7	< 27.7	< 24.3	5,000.0	Vertical
1736.00	< 1.0	32.2	< 33.2	< 45.7	11,000.0	Vertical
2170.00	< 1.0	38.8	< 39.8	< 97.7	11,000.0	Vertical
2604.00	< 1.0	17.4	< 18.4	< 8.3	11,000.0	Vertical
3038.00	< 1.0	17.2	< 18.2	< 8.1	11,000.0	Vertical
3472.00	< 1.0	18.8	< 19.8	< 9.8	11,000.0	Vertical
+ 3906.00	< 1.0	19.7	< 20.7	< 10.8	5,000.0	Vertical
+ 4340.00	< 1.0	20.6	< 21.6	< 12.0	5,000.0	Vertical

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Results:

Field Strength of Fundamental Emissions						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
* 434.00	53.7	18.6	72.3	4121.0	11,000.0	Horizontal

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
868.00	< 1.0	29.1	< 30.1	< 32.0	1,100.0	Vertical
+ 1302.00	< 1.0	26.7	< 27.7	< 24.3	500.0	Vertical
1736.00	< 1.0	32.2	< 33.2	< 45.7	1,100.0	Vertical
2170.00	< 1.0	38.8	< 39.8	< 97.7	1,100.0	Vertical
2604.00	< 1.0	17.4	< 18.4	< 8.3	1,100.0	Vertical
3038.00	< 1.0	17.2	< 18.2	< 8.1	1,100.0	Vertical
3472.00	< 1.0	18.8	< 19.8	< 9.8	1,100.0	Vertical
+ 3906.00	< 1.0	19.7	< 20.7	< 10.8	500.0	Vertical
+ 4340.00	< 1.0	20.6	< 21.6	< 12.0	500.0	Vertical

Remarks:

*: Adjusted by Duty Cycle = -17.9dB

FCC Limit for Average Measurement = $41.6667(434.0\text{MHz}) - 7083.3333 = 11000.01 \mu\text{V/m}$

+: Denotes restricted band of operation.

Measurements were made using a peak detector. Any emission less than 1000 MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 were not adjusted for averaging and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor includes Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty : 30MHz to 1GHz 5.1dB

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Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range [MHz]	Quasi-Peak Limits [$\mu\text{V}/\text{m}$]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Result of on mode (9 kHz to 30MHz): PASS

Emissions detected are more than 20 dB below the limit line(s).

Result of on mode: PASS

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m $\text{dB}\mu\text{V}/\text{m}$	Limit @3m $\text{dB}\mu\text{V}/\text{m}$	Level @3m $\mu\text{V}/\text{m}$	Limit @3m $\mu\text{V}/\text{m}$
294.8	Horizontal	38.6	46.0	85.1	200
321.8	Vertical	37.3	46.0	73.3	200
405.8	Horizontal	35.1	46.0	56.9	200

Remark:

Correction Factor includes Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty: 30MHz to 1GHz 5.1dB

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3.2 20dB Bandwidth of Fundamental Emission

Test Requirement: FCC 47 CFR 15.231a
Test Method: ANSI C63.4:2003 (Section 13.1.7)
Test Date: 2009-11-25
Mode of Operation: On mode

Test Method:

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

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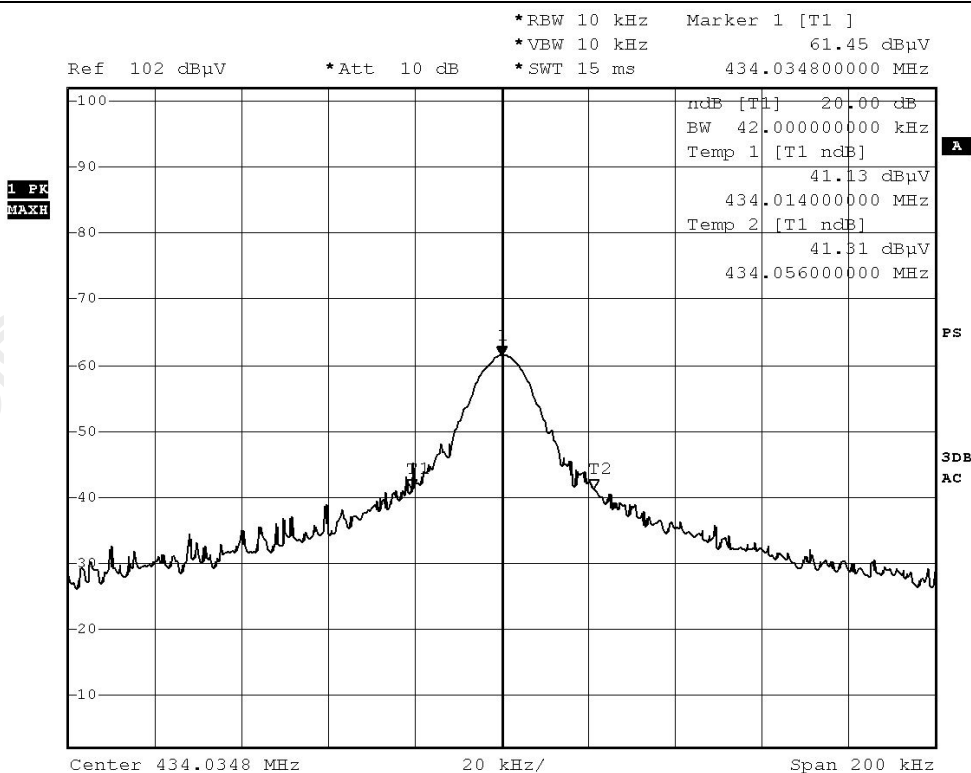
No. : MH183546

Limits for 20 dB Bandwidth of Fundamental Emission:

Frequency Range [MHz]	20dB Bandwidth [KHz]	FCC Limits * [KHz]
434.0	42.0	1085

*: FCC Limit for Bandwidth measurement = (0.25%)(Center Frequency)
 = (0.0025)(434.0)
 = 1085KHz

20dB Bandwidth of Fundamental Emission



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Appendix A

List of Measurement Equipment

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EMD062	HORN ANTENNA	EMCO	3117	0075933	2008/11/06	2010/11/06
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM216	MINI MAST SYSTEM	EMCO	2075	00026842	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-Linggren	FACT-3	--	2008/12/01	2011/12/01
EM083	STCOATS	--	--	--	2008/12/08	2011/12/08
EM174	BICONILOG ANTENNA	EMCO	3142B	1671	2008/01/24	2010/01/24
EM194	BICONILOG	EMCO	3142B	1795	2008/09/08	2010/09/08
EM229	EMI Test Receiver	R&S	ESIB40	100248	2009/09/27	2010/09/27
EM022	LOOP ANTENNA	EMCO	6502	1189-2424	2009/07/26	2011/07/26

Remarks:-

CM Corrective Maintenance
N/A Not Applicable
TBD To Be Determined

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Appendix B

Duty Cycle Correction During 100msec

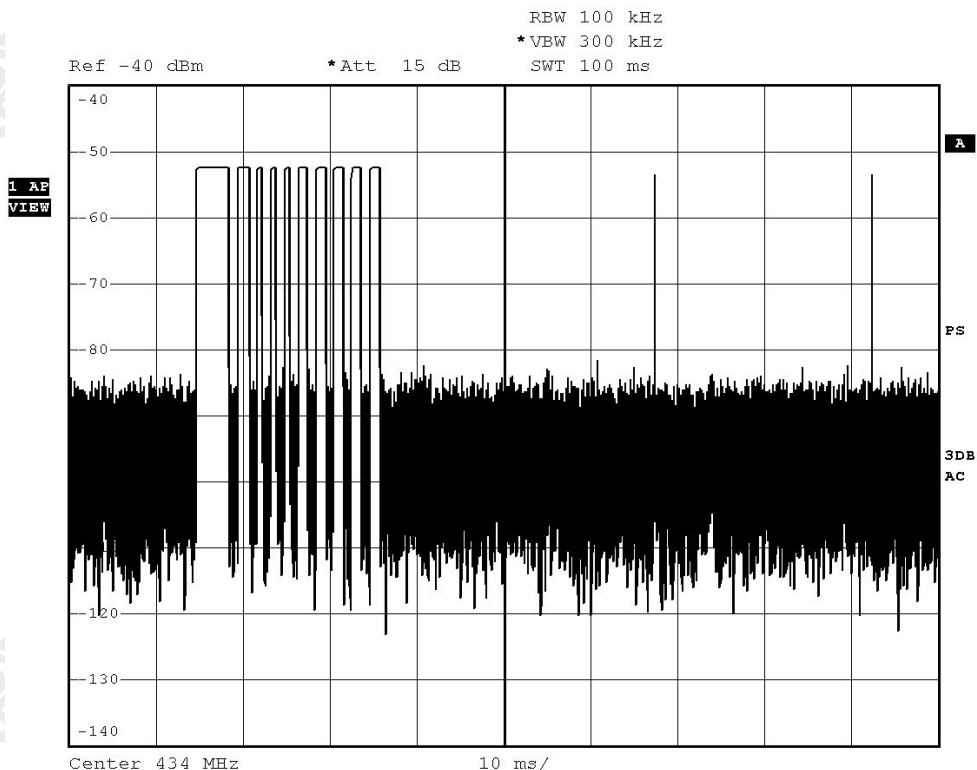
Each packet period (100msec) never exceeds a series of 1 long (3.8msec), 1 short (1) (1.4msec), 3 short (2) (0.7msec), 5 short (3) (1.1msec) and 2 short (4) pulses. Assuming any combination of short and long pulses may be obtained due to encoding the worst case transmit duty cycle would be considered $1 \times 3.8\text{msec} + 1 \times 1.4\text{msec} + 3 \times 0.7\text{msec} + 5 \times 1.1\text{msec} + 2 \times 0.008$ per 100msec = 12.8% duty cycle. Figure A through G show the characteristics of the pulses train for one of these functions.

Remarks:

Duty Cycle Correction = $20\text{Log}(0.128) = -17.9\text{dB}$

The following figures [Figure A to Figure E] showed the characteristics of the pulse train for one of these functions.

Figure A [Pulse Train]



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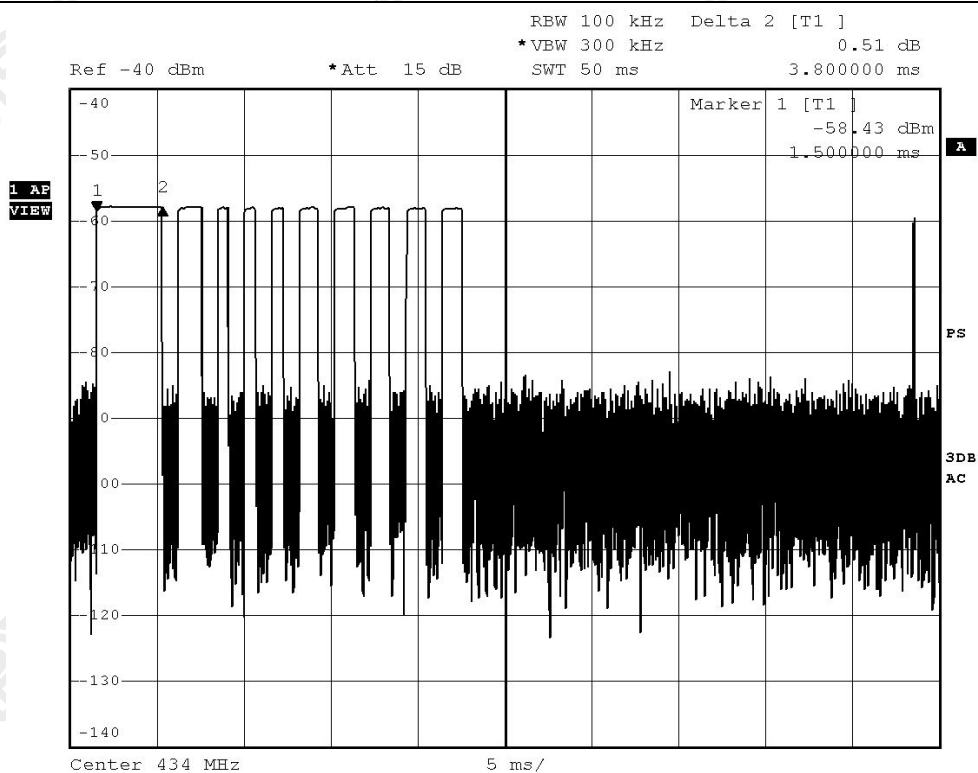
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Figure B [Long Pulse]



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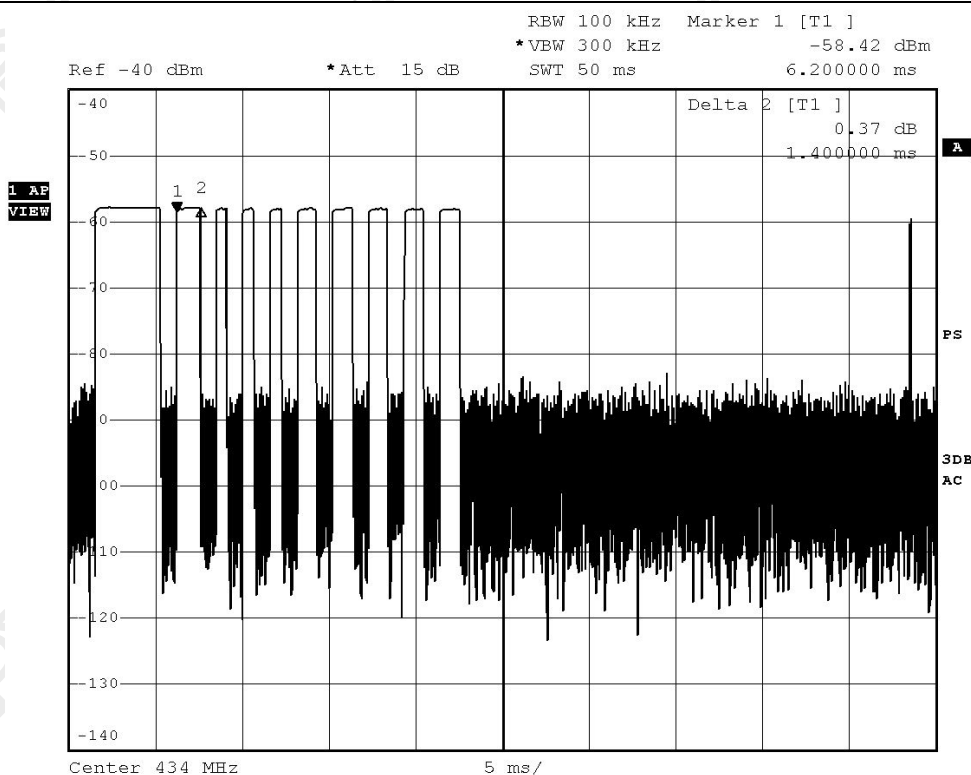
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Figure C [Short Pulse 1]



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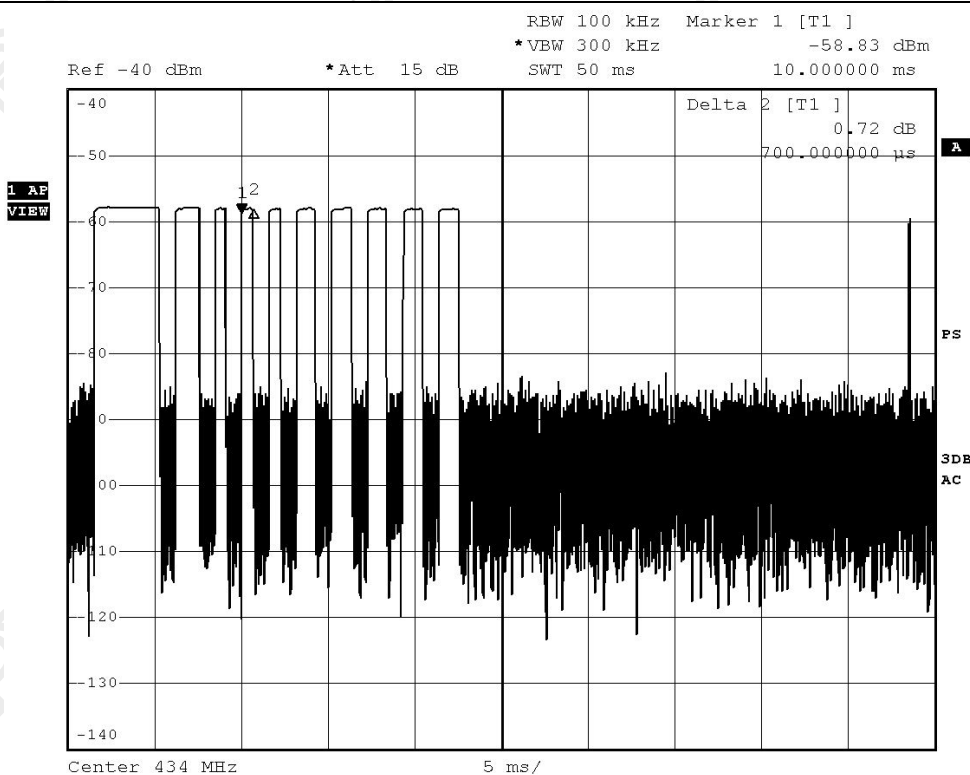
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Figure D [Short Pulse 2]



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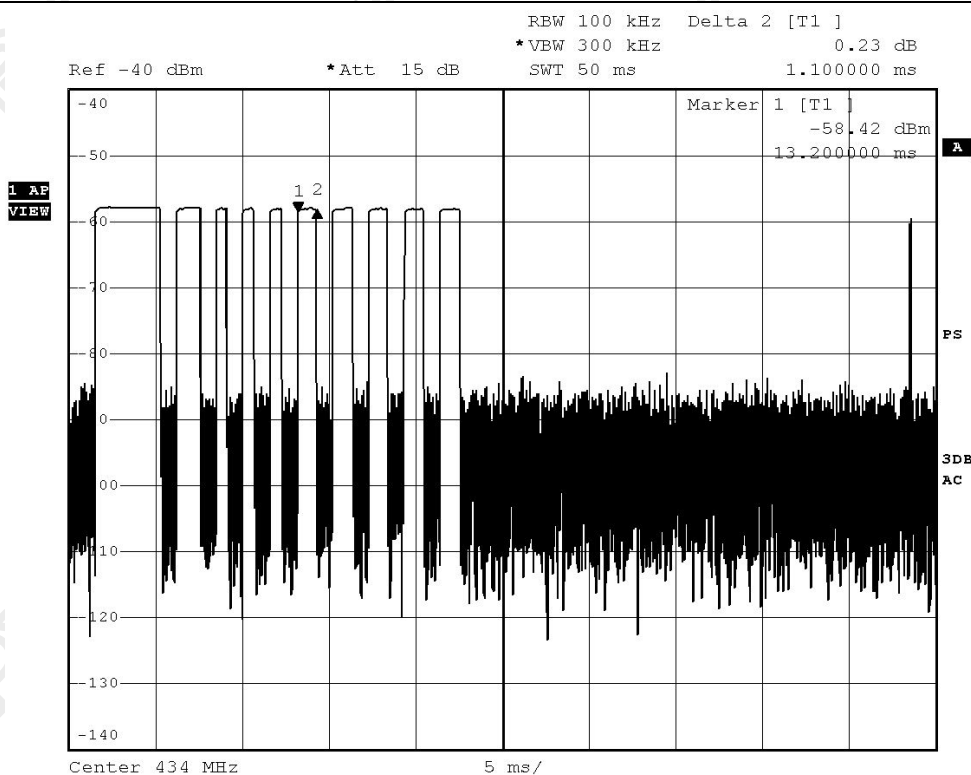
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Figure E [Short Pulse 3]



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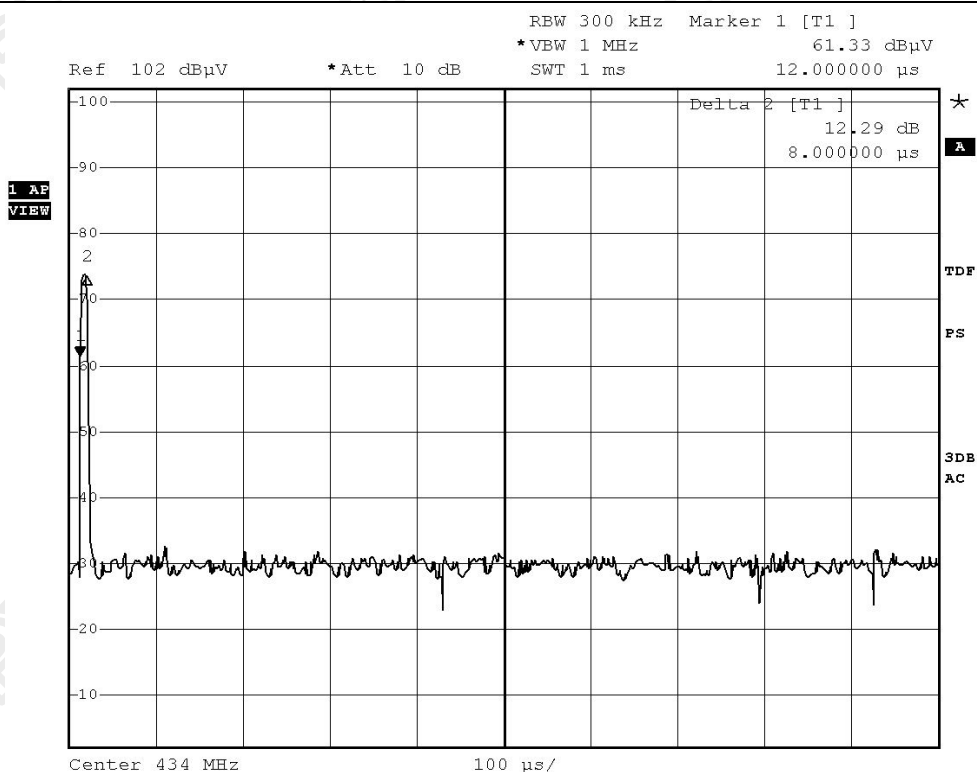
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Figure F [Short Pulse 4]



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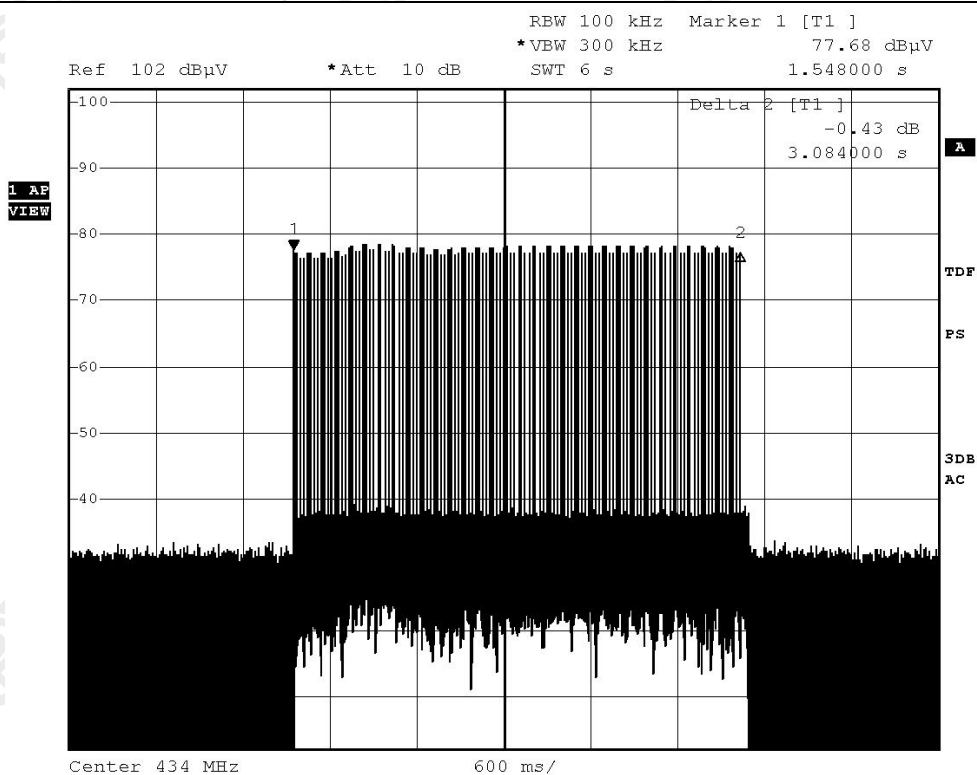
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Figure G [Total Transmission Time]



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Appendix C

Periodic Operation [FCC 47CFR 15.231(a2)]

According to FCC 47CFR15.231 (a2). A transmitter automatically activated must automatically deactivate within not more than 5 seconds of being released. The EUT ceases transmission almost immediately upon being released and appears to finish the current packet being transmitted. Therefore the longest period of time the transmitter should take to deactivate is a packet length.

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Appendix D

Photographs of EUT

Front View of the product



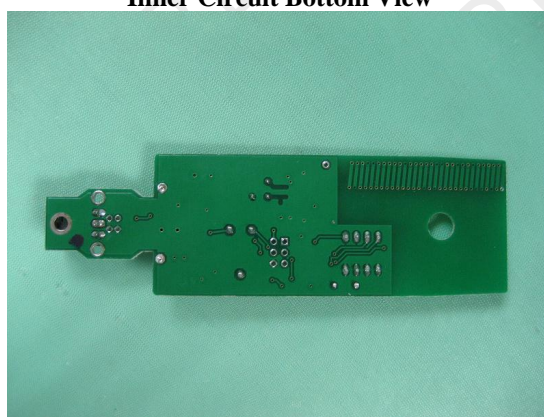
Rear View of the product



Inner Circuit Top View



Inner Circuit Bottom View



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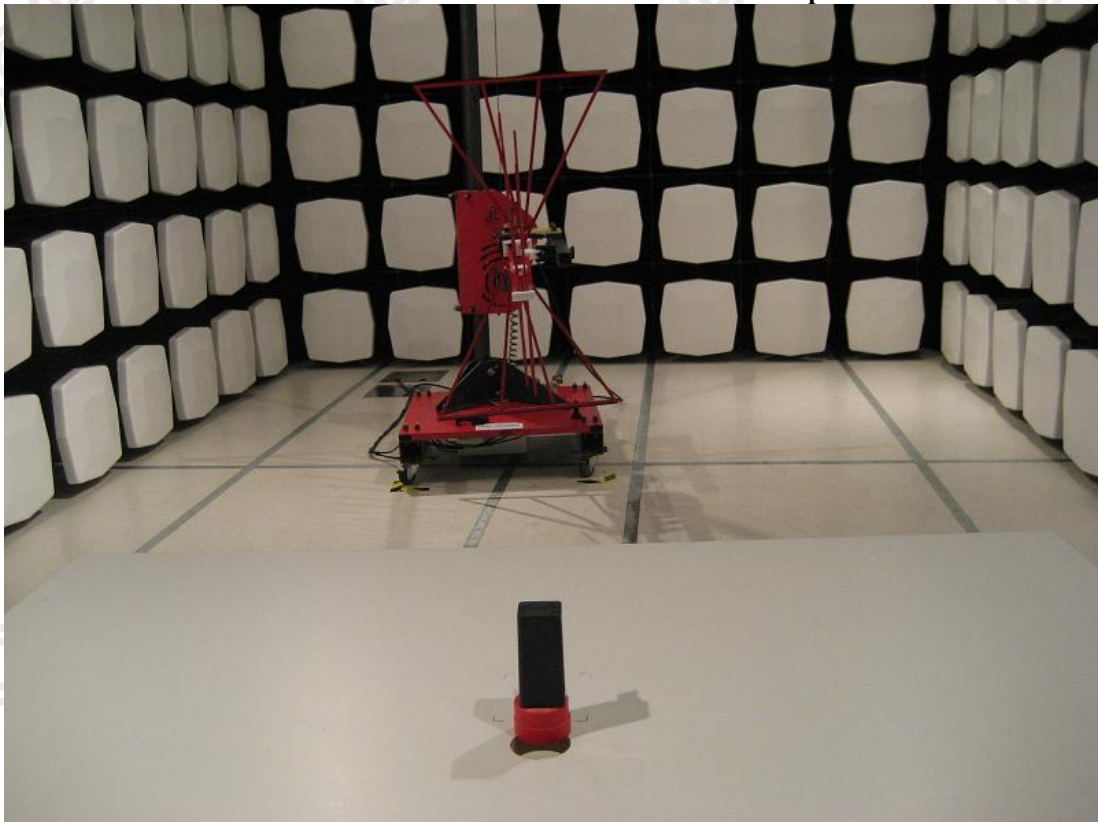
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Photographs of EUT

Measurement of Radiated Emission Test Set Up



***** End of Test Report *****

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