



FCC PART 15.231

MEASUREMENT AND TEST REPORT

For

Master Lock Company

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Milwaukee, WI 53154, USA

FCC ID: MZR8254DAT

Report Type: Original Report	Product Type: Master Lock Alert
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* This report contains data that are not covered by the NVLAP accreditation and are marked with an asterisk "★" (Rev.2)

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Master Lock Company's* product, model: 8254DAT (FCC ID: MZR8254DAT) or the "EUT" as referred to in this report is a *Master Lock Alert* which measures approximately: 5.1 cm (L) x 3.1 cm (W) x 1.1 cm (H), rated input voltage: DC 12V Battery. The operating frequency of EUT is 433.92 MHz±300 kHz

** All measurement and test data in this report was gathered from production sample serial number: 1101006 (Assigned by BACL, Shenzhen). The EUT was received on 2011-01-10.*

Objective

This document is a test report based on the Electromagnetic Interference (EMI) tests performed on the EUT. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4-2009.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 - 2009, 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. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located in the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0).



The current scope of accreditations can be found at <http://ts.nist.gov/Standards/scopes/2007070.htm>

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

Special Accessories

The special accessories were provided by Bay Area Compliance Laboratories Corp. (Shenzhen).

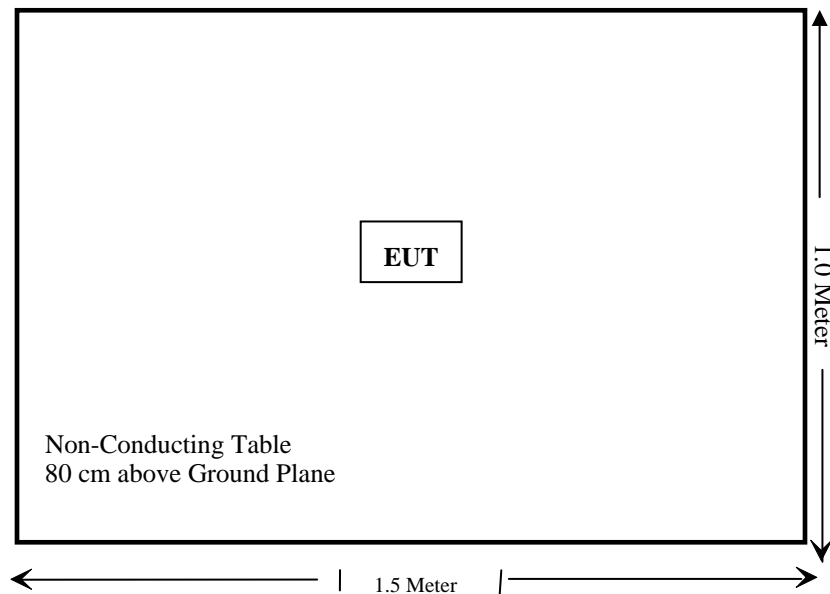
Equipment Modifications

No modifications were made to the unit tested.

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.205	Restricted Band	Compliance
§15.209	General Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	N/A
§15.231 (b)	Radiated Emissions	Compliance*
§15.231 (c)	20d B Bandwidth Testing	Compliance
§15.231 (a)(1)	Deactivation Testing	Compliance
§15.231	Duty Cycle	Compliance

Note: N/A * The EUT is battery operation.

FCC §15.203 - ANTENNA REQUIREMENT

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.

Result: Compliant.

The EUT has a printed antenna PCB; it is permanently attached to the PCB. Please refer to the EUT Internal photos.

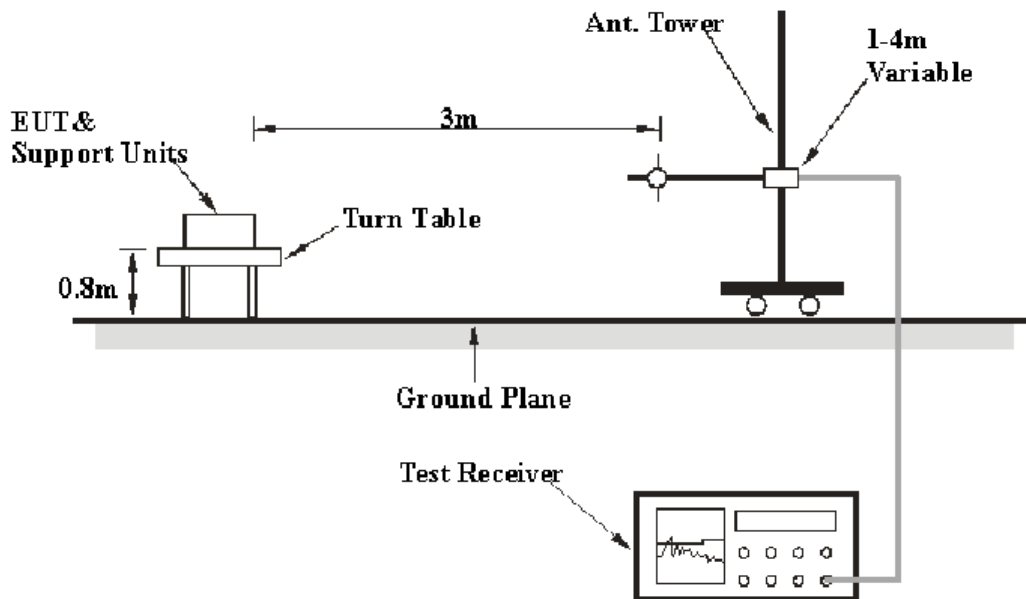
FCC §15.205, §15.209, §15.35(c) & §15.231(b) - RADIATED EMISSIONS

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emission measurement at Bay Area Compliance Laboratories Corp. (Shenzhen) is ± 4.0 dB.

EUT Setup



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4 - 2009. The specification used was the FCC 15 §15.209 and 15.231.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 5 GHz.

During the radiated emission test, the test receiver was set with the following configurations:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>	<i>Dectector</i>
30MHz – 1000 MHz	100 kHz	300 kHz	QP
1000 MHz – 5 GHz	1 MHz	3 MHz	PK

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2010-08-02	2011-08-02
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-24	2011-11-23
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2010-03-11	2011-03-11
HP	Amplifier	8449B	3008A00277	2010-09-12	2011-09-11
Sunol Sciences	Horn Antenna	DRH-118	A052604	2010-09-25	2011-09-25

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations. All data was recorded in the Peak and Average detection mode.

Applicable Standard

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	2250	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

*Linear interpolations.

The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

Corrected Amplitude & Margin Calculation

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

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 5.8 dB means the emission is 5.8 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the data in the following table, the EUT complied with the CFR47 §15.205, §15.209, §15.35(c), §15.231 (b), with the worst margin reading of:

Below 1 GHz:

13.01 dB at 867.26 MHz in the Horizontal polarization.

Above 1 GHz:

9.57 dB at 1302.39 MHz in the Vertical polarization.

Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Sula Huang on 2011-01-19.

Test Mode: Transmitting

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/Ave)	Direction (Degree)	Test Antenna			Cable Loss (dB)	Amp Gain (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.231(b)/15.209		
				Height (m)	Polar (H/V)	Factor (dB)				Limit (dBµV/m)	Margin (dB)	Remarks
30 MHz – 1000 MHz												
867.26	69.67	PK	0	2.00	H	19.9	3.86	25.64	67.79	80.80	13.01	Harmonic
867.26	62.73	PK	43	1.00	V	19.9	3.86	25.64	60.85	80.80	19.95	Harmonic
434.13	82.08	PK	68	1.50	H	14.5	1.73	25.96	72.35	100.80	28.45	Fund.
434.13	78.03	PK	94	1.00	V	14.5	1.73	25.96	68.30	100.80	32.50	Fund.
Above 1 GHz												
1302.39	62.83	PK	91	1.17	V	26.0	2.09	26.49	64.43	74.00	9.57	Harmonic
1736.52	65.77	PK	233	1.73	V	26.0	2.50	26.83	67.44	80.80	13.36	Harmonic
2170.65	60.75	PK	30	1.41	V	29.8	2.85	26.83	66.57	80.80	14.23	Harmonic
2604.78	59.31	PK	273	1.72	V	30.6	3.10	26.88	66.13	80.80	14.67	Harmonic
1302.39	56.67	PK	360	1.76	H	26.5	2.09	26.49	58.77	74.00	15.23	Harmonic
3038.91	56.84	PK	148	1.43	V	31.0	3.47	26.88	64.43	80.80	16.37	Harmonic
3038.91	50.58	PK	176	2.50	H	32.0	3.47	26.88	59.17	80.80	21.63	Harmonic
2604.78	51.67	PK	0	2.23	H	30.6	3.10	26.88	58.49	80.80	22.31	Harmonic
2170.65	51.98	PK	360	2.04	H	29.7	2.85	26.83	57.70	80.80	23.10	Harmonic
1736.52	53.27	PK	154	1.44	H	26.5	2.50	26.83	55.44	80.80	25.36	Harmonic

Field Strength of Average Emission:

Frequency (MHz)	Cord. Amp. (Peak) (dB μ V/m)	Test Antenna Polar (H/V)	Duty Cycle Factor (dB)	Cord. Amp. (Average) (dB μ V/m)	FCC Part 15.231(b)/15.209/15.205		
					Limit (dB μ V/m)	Margin (dB)	Note
30 MHz – 1000 MHz							
434.13	68.30	V	-11.52	56.78	80.80	24.02	Fund.
434.13	72.35	H	-11.52	60.83	80.80	19.97	Fund.
868.26	60.85	V	-11.52	49.33	60.80	11.47	Harmonic
868.26	67.79	H	-11.52	56.27	60.80	4.53	Harmonic
Above 1 GHz							
1302.39	64.43	V	-11.52	52.91	54.00	1.09*	Harmonic
1736.52	67.44	V	-11.52	55.92	60.80	4.88	Harmonic
2170.65	66.57	V	-11.52	55.05	60.80	5.75	Harmonic
2604.78	66.13	V	-11.52	54.61	60.80	6.19	Harmonic
1302.39	58.77	H	-11.52	47.25	54.00	6.75	Harmonic
3038.91	64.43	V	-11.52	52.91	60.80	7.89	Harmonic
3038.91	59.17	H	-11.52	47.65	60.80	13.15	Harmonic
2604.78	58.49	H	-11.52	46.97	60.80	13.83	Harmonic
2170.65	57.7	H	-11.52	46.18	60.80	14.62	Harmonic
1736.52	55.44	H	-11.52	43.92	60.80	16.88	Harmonic

Note: Calculate Average value based on Duty Cycle correction factor:

$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff}) = 6.90/26 = 0.265$$

$$\text{Duty Cycle Factor} = 20 \lg (\text{Duty Cycle}) = 20 \lg (0.265) = -11.52 \text{ dB}$$

$$\text{Average Reading} = \text{Peak Reading} + \text{Duty Factor}$$

*Within measurement uncertainty.

FCC §15.231(c) – 20 dB BANDWIDTH TESTING

Requirement

Per 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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-24	2011-11-23
HP	Amplifier	8447E	1937A01046	2010-11-15	2011-11-14
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2010-04-12	2011-04-12

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Sula Huang on 2011-01-20.

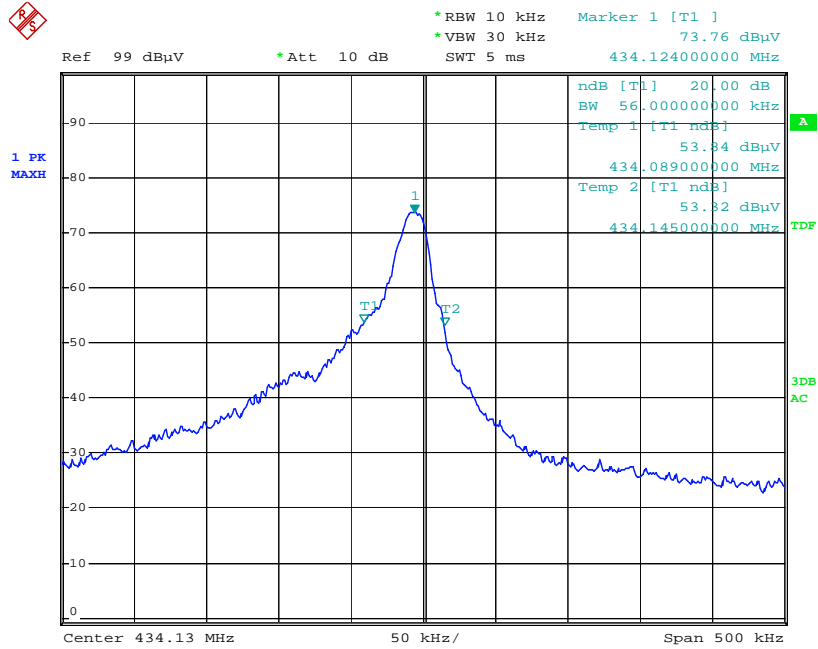
Test Mode: Transmitting

Please refer to following table and plot.

Channel Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (MHz)	Result
434.13	56	1.0848	Pass

Note: Limit = 0.25% * Center Frequency = 0.25% * 433.92 MHz = 1.0848 MHz

20 dB Occupied Bandwidth



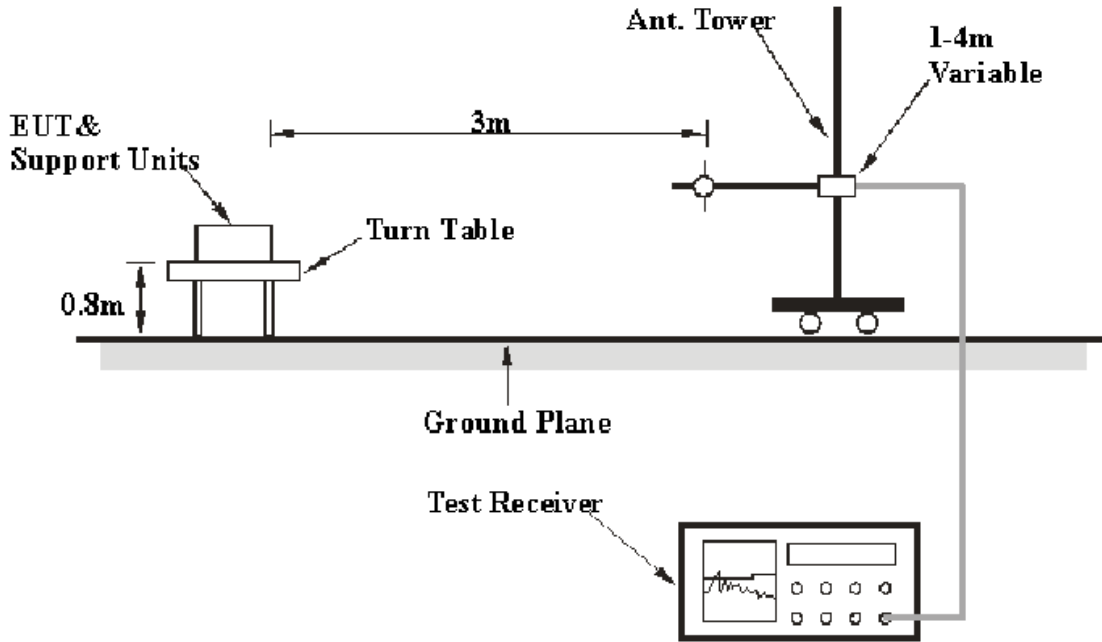
Date: 20.JAN.2011 19:05:40

FCC §15.231(a) - DEACTIVATION TESTING

Requirement

Per 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.

EUT Setup



The deactivation test was performed in the 3 meters test site, using the setup accordance with the ANSI C63.4 - 2009. The specification used was the FCC 15.231(a) limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-24	2011-11-23
HP	Amplifier	8447E	1937A01046	2010-11-15	2011-11-14
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2010-04-12	2011-04-12

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Data

Environmental Conditions

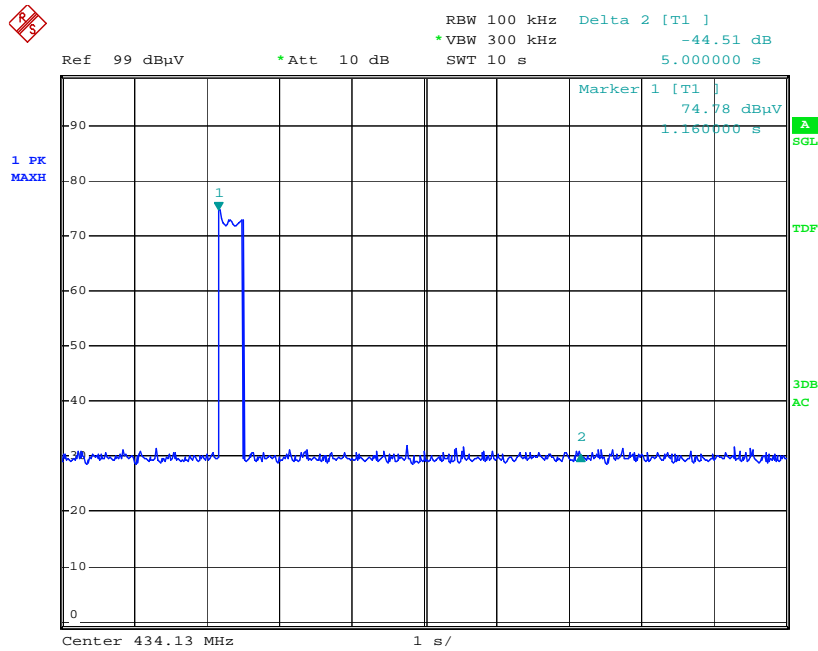
Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Sula Huang on 2011-01-20.

Test Mode: Transmitting

Test Result: Compliant.

Please refer to following plot



Date: 20.JAN.2011 19:00:36

FCC §15.231 - DUTY CYCLE

Limit

Nil (No dedicated limit specified in the Rules).

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100224	2010-11-24	2011-11-23

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer=operating frequency.
4. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Span=0Hz.
5. Repeat above procedures until all frequency measured was complete.

Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

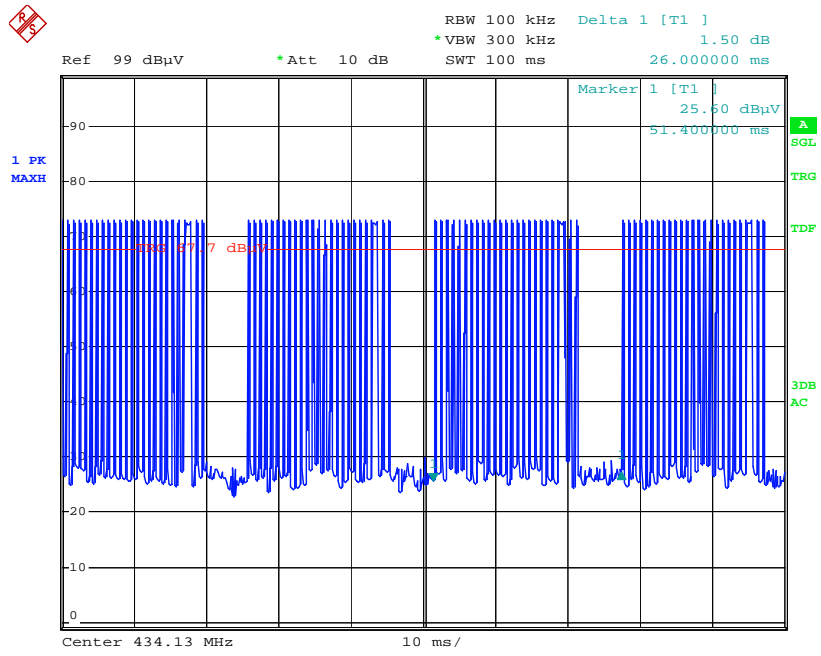
The testing was performed by Sula Huang on 2011-01-20.

Test Mode: Transmitting

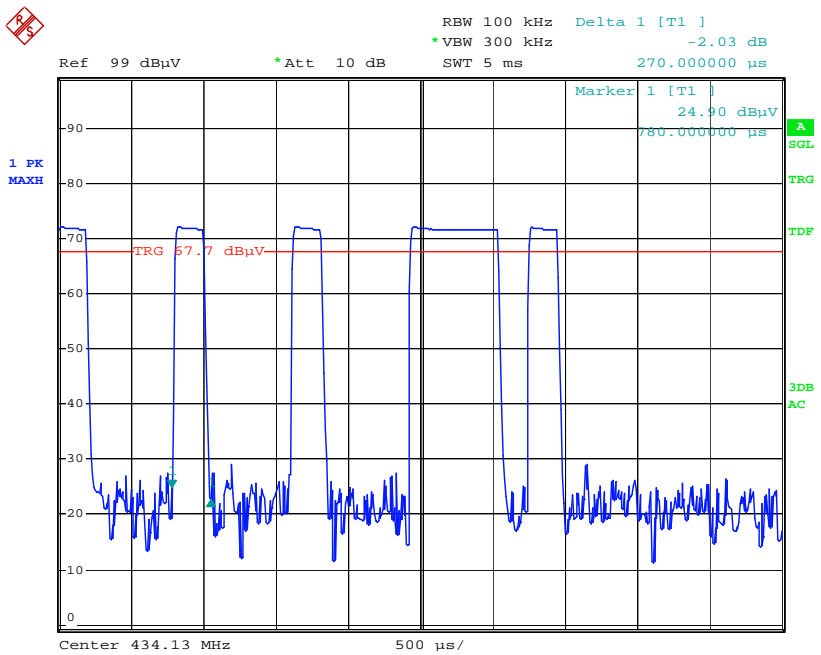
Test Result: Compliant.

Please refer to following plot

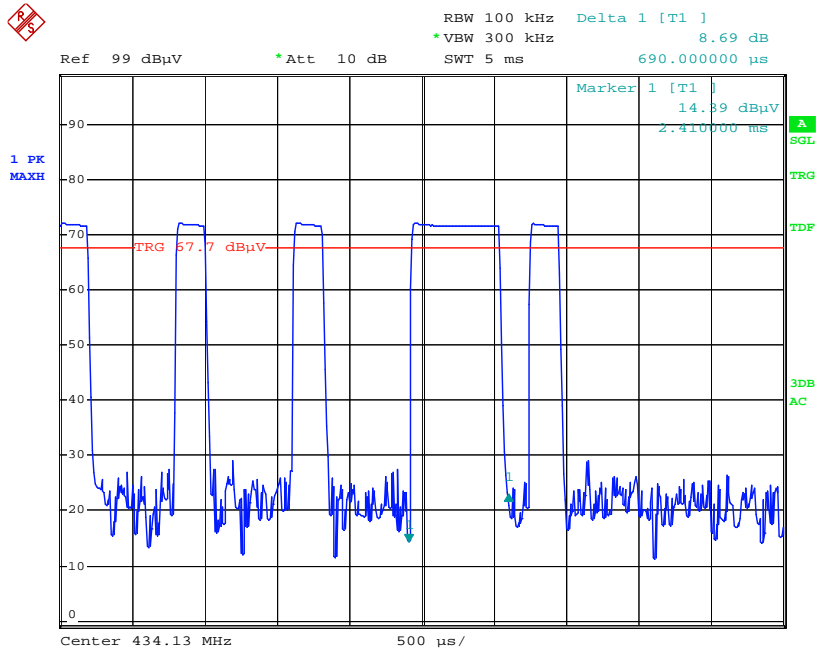
$Ton = Ton1N1 + Ton2N2 + \dots + TonnNn = 0.69ms * 1 + 0.27 * 23 = 0.69 + 6.21 \text{ ms} = 6.90 \text{ ms}$
 Duty cycle factor = $20 \text{ Log} (Ton/Tp) = 20 * \text{log}(6.90/26) = - 11.52 \text{ dB}$



Date: 20.JAN.2011 18:53:46



Date: 20.JAN.2011 18:56:58



Date: 20.JAN.2011 18:57:39

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