NVLAP LAB CODE 200707-0

FCC PART 15.231

MEASUREMENT AND TEST REPORT

For

Ningbo Yinzhou Dongqiao Dongfeng Power Tool Factory

SanLi Village, Dongqiao Town, Yinzhou District, Ningbo, China

FCC ID: VQADF2000-16800

This Report Concerns:	**Equipment Type:**
☒ Original Report	Wireless remote controller

Test Engineer:	Green Xu
Report No.:	RSZ07082901
Test Date:	2007-11-08
Report Date:	2007-11-09
Reviewed By:	EMC Manager: Boni Baniqued
Prepared By:	Bay Area Compliance Laboratory Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Ningbo Yinzhou Dongqiao Dongfeng Power Tool Factory* 's product, model: *DF2000-3500* or the "EUT" as referred to in this report is a *Wireless remote* controller which measures approximately 6.5 cm L x 3.9 cm W x 0.8 cm H, rated input voltage: DC 12V battery.

** The test data gathered are from production sample, serial number: 0708050, provided by the manufacturer, we receive the EUT on 2007-08-29.*

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 - 2003.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 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 - 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. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory 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 November 04, 2004. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

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).

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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).

EUT Exercise Software

N/A.

Special Accessories

The special accessories were supplied by manufacturer.

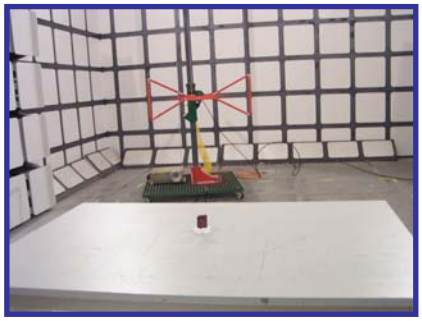
Equipment Modifications

Bay Area Compliance Laboratories Corp. (Shenzhen) has not done any modification on the EUT.

Configuration of Test Setup

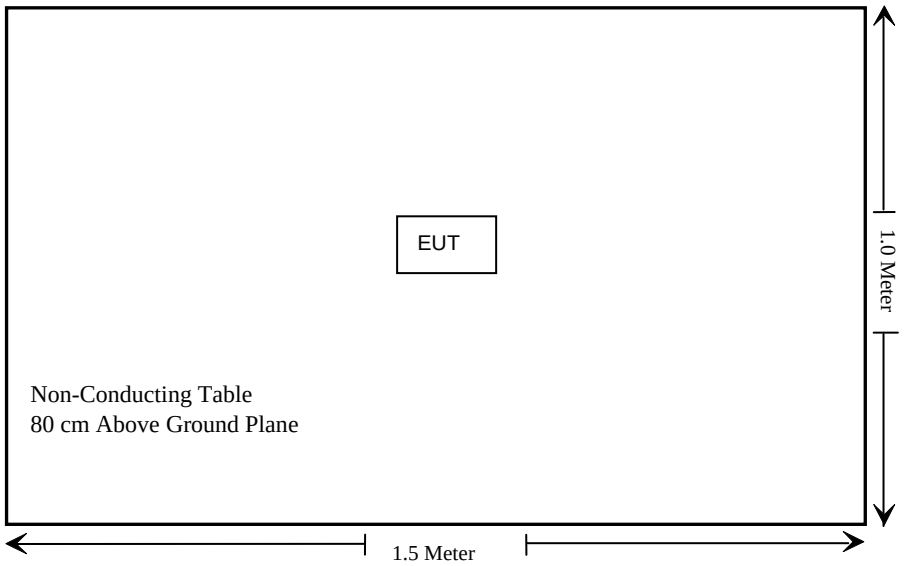
Lying View

Side View



Standing View

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Rules	Description of test	Result
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band	Compliant
§15.209	General Requirement	Compliant
§15.231 (b)	Radiated Emissions	Compliant
§15.231 (c)	20dB Bandwidth Testing	Compliant
§15.231 (a)(1)	Deactivation Testing	Compliant
§15.231	Duty Cycle	Compliant

§15.203 - ANTENNA REQUIREMENT

Standard Applicable

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.

The antenna of the EUT is an integral antenna.

Result: Compliant.

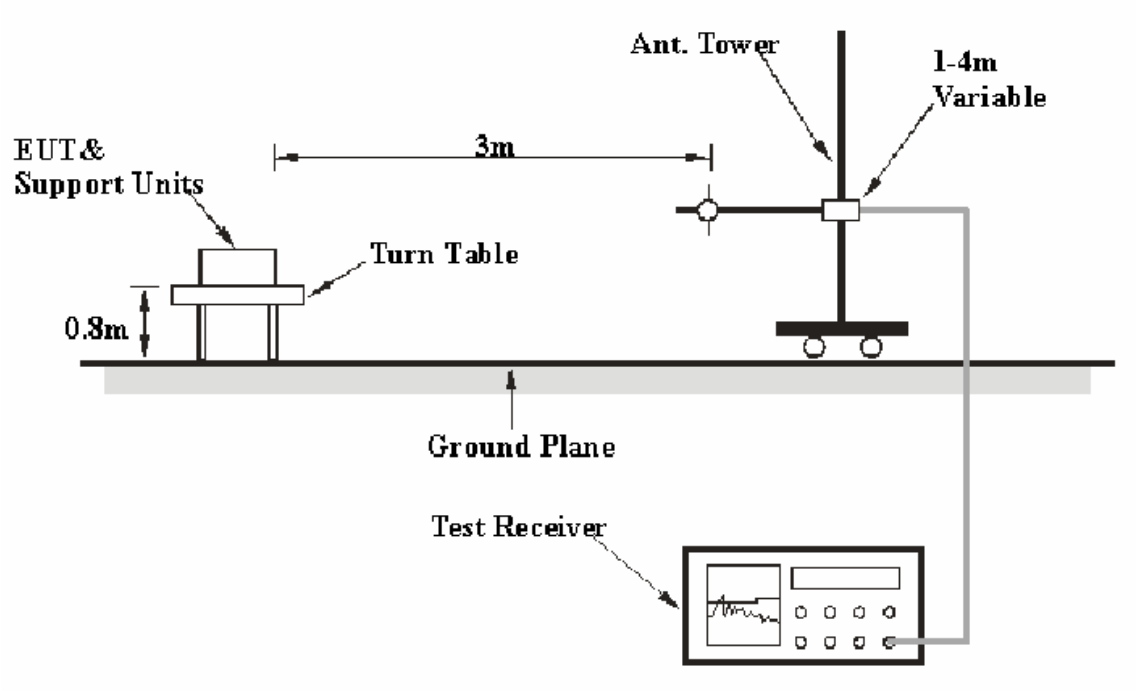
§15.205, §15.209, §15.231 (b) - RADIATED EMISSIONS

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 emissions measurement at Bay Area Compliance Laboratories Corp. (Shenzhen) is ±4.0 dB.

EUT Setup



The radiated emission tests were performed in the 3 meters chamber B test site, using the setup accordance with the ANSI C63.4 - 2003. The specification used was the FCC 15 § 15.209 and 15.231.

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:

Frequency Range	***RBW***	***VBW***
30 – 1000 MHz	100 kHz	300 kHz
1000 MHz –5 GHz	1 MHz	3 MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Spectrum Analyzer	8564E	3943A01781	2006-11-22	2007-11-22
HP	Amplifier	8449B	3008A00277	2007-09-29	2008-09-29
Sunol Sciences	Horn Antenna	DRH-118	A052604	2007-09-25	2008-09-25
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16
HP	Amplifier	8447E	1937A01046	2006-11-15	2007-11-15
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2007-08-14	2008-08-14

*** 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.

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 3,370..……..……	125 to375
174-260……..……	3,750	375
260-470……..……..……	3,750 to12, 500..……..……	375 to 1,250
Above 470	12,500……..……..……	1,250

Linear interpolations for frequency ranges 130 - 174 MHz and 260 - 470 MHz.

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:

Corrected Amplitude = Meter Reading + Antenna Loss + Cable Loss - Amplifier Gain

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

Margin = Limit –Corrected Amplitude

Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.231, with the worst margin reading of:

10.95 dB at **315 MHz** in the **Vertical** polarization.

Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56%
ATM Pressure:	100.2kPa

The testing was performed by Green Xu on 2007-11-08.

Test Mode: Transmitting

Frequency	Meter Reading	Detector	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Duty Cycle Factor	Corrected Amplitude	FCC Part 15.231	
(MHz)	(dBuV/m)	(PK/AV)	(Degree)	(m)	H / V	(dB)	(dB)	(dB)	(dB)	dB uV/m	Limit dBuV/m	Margin dB
315	85.71	*	0	1	V	12.2	2.5	25.8	-9.94	64.67	75.62	10.95
1575	57.04	*	120	1	V	26	2.8	35.5	-9.94	40.40	54.00	13.60
1260	57.86	*	90	1	V	25	2.5	35.8	-9.94	39.62	55.62	16.00
630	55.02	*	120	1	V	17.7	3	27.1	-9.94	38.68	55.62	16.94
315	85.71	PK	0	1	V	12.2	2.5	25.8	N/A	74.61	95.62	21.01
315	75.62	*	0	1	H	12.2	2.5	25.8	-9.94	54.58	75.62	21.04
1260	51.67	*	0	1.2	H	25.8	2.5	35.8	-9.94	34.23	55.62	21.39
1575	48.23	*	0	1	H	26.5	2.8	35.5	-9.94	32.09	54.00	21.91
945	44.25	*	90	1	V	20.8	3.8	26.2	-9.94	32.8	55.62	22.91
1575	57.04	PK	120	1	V	26	2.8	35.5	N/A	50.34	74.00	23.66
630	46.39	*	270	1.2	H	17.7	3	27.1	-9.94	30.05	55.62	25.57
1260	57.86	PK	90	1	V	25	2.5	35.8	N/A	49.56	75.62	26.06
630	55.02	PK	120	1	V	17.7	3	27.1	N/A	48.62	75.62	27.00
945	37.99	*	180	1.2	H	20.8	3.8	26.2	-9.94	26.45	55.62	29.17
315	75.62	PK	0	1	H	12.2	2.5	25.8	N/A	64.52	95.62	31.10
1260	51.67	PK	0	1.2	H	25.8	2.5	35.8	N/A	44.17	75.62	31.45
1575	48.23	PK	0	1	H	26.5	2.8	35.5	N/A	42.03	74.00	31.97
945	44.25	PK	90	1	V	20.8	3.8	26.2	N/A	42.65	75.62	32.97
630	46.39	PK	270	1.2	H	17.7	3	27.1	N/A	39.99	75.62	35.63
945	37.99	PK	180	1.2	H	20.8	3.8	26.2	N/A	36.39	75.62	39.23

Note:
*: Average value based on the duty cycle correction factor.
Average value =PK + Duty cycle Factor.

§15.231(c) - 20dB 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	2007-10-16	2008-10-16
HP	Amplifier	8447E	1937A01046	2006-11-15	2007-11-15
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2007-08-14	2008-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratory 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 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.

Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	50%
ATM Pressure:	100.9kPa

The testing was performed by Green Xu on 2007-11-08.

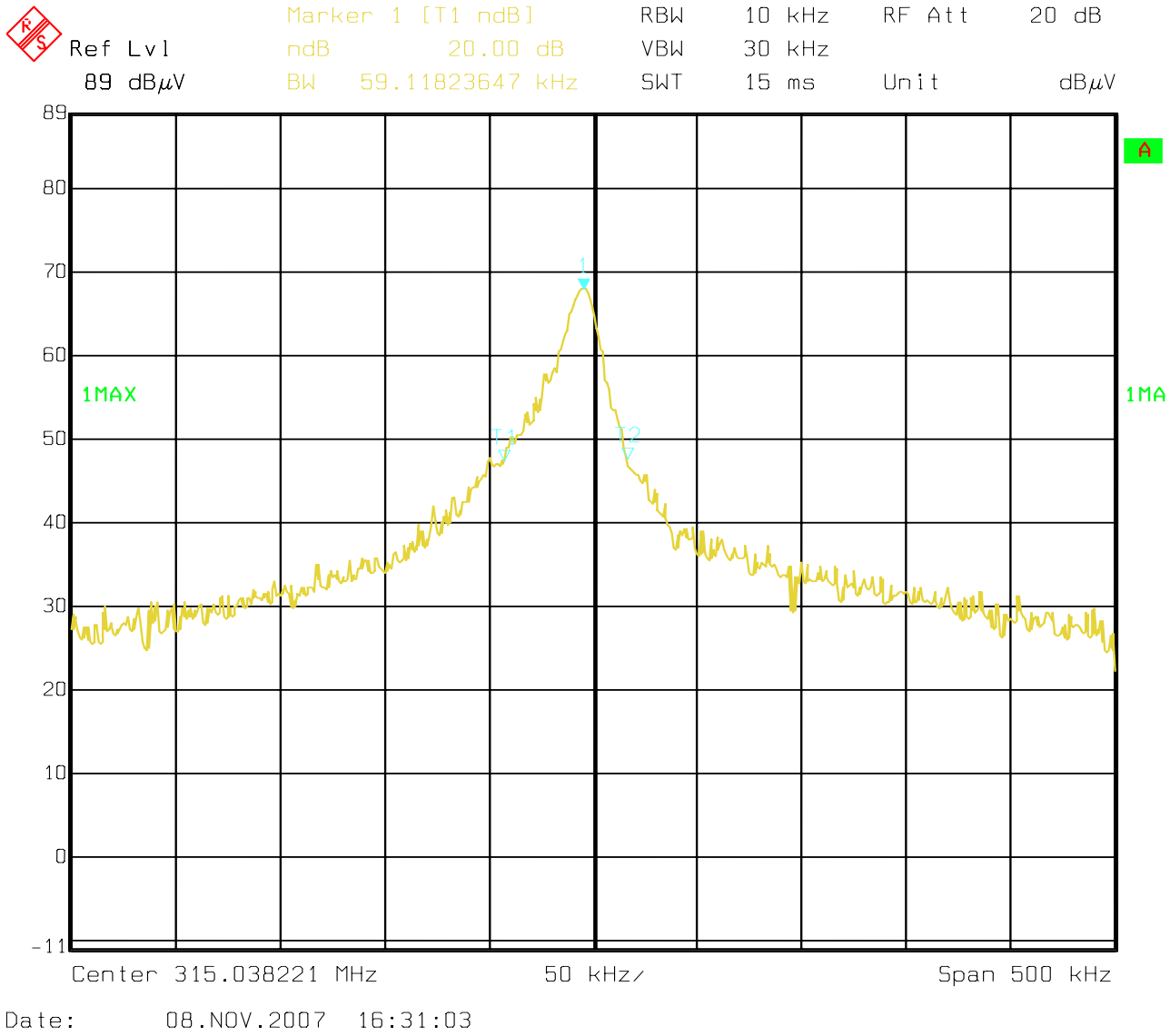
Test Mode: Transmitting

20 dB Bandwidth Limit = Fundamental * 0.25%
= 315 MHz *0.25%
= 787.5 KHz
20 dB Bandwidth = 59.1KHz〈787.5KHz

Test Result : Pass !

Channel Frequency (MHz)	20dB Bandwidth (kHz))	Limit(kHz))
315	59.1	787.5

Refer to the attached plots.

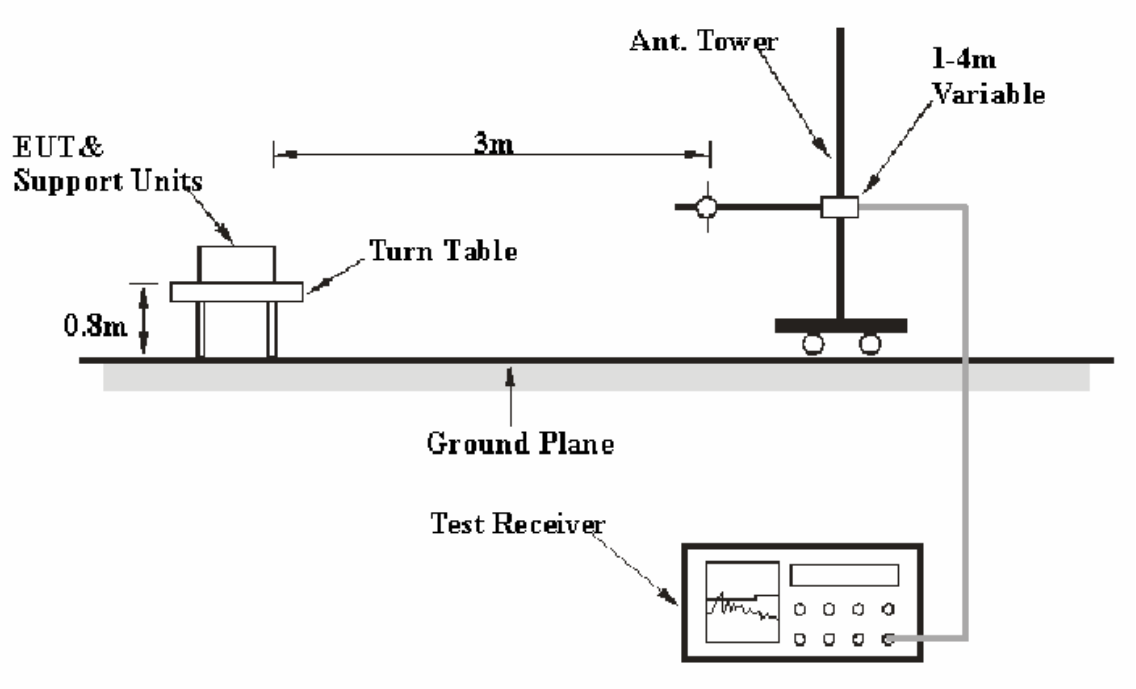

Marker 1 [T1 ndB]
RBW 10 kHz
RF Att 20 dB
Ref Lvl
ndB 20.00 dB
VBW 30 kHz
89 dBµV
BW 59.11823647 kHz
SWT 15 ms
Unit dBµV
89
80
70
60
50
40
30
20
10
0
-11
1MAX
1MA
A
T1
T2
Center 315.038221 MHz
50 kHz/
Span 500 kHz
Date: 08.NOV.2007 16:31:03

§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 chamber B test site, using the setup accordance with the ANSI C63.4 - 2003. The specification used was the FCC 15.231(a) limits.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16
HP	Amplifier	8447E	1937A01046	2006-11-15	2007-11-15
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2007-08-14	2008-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratory 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.

Test Data

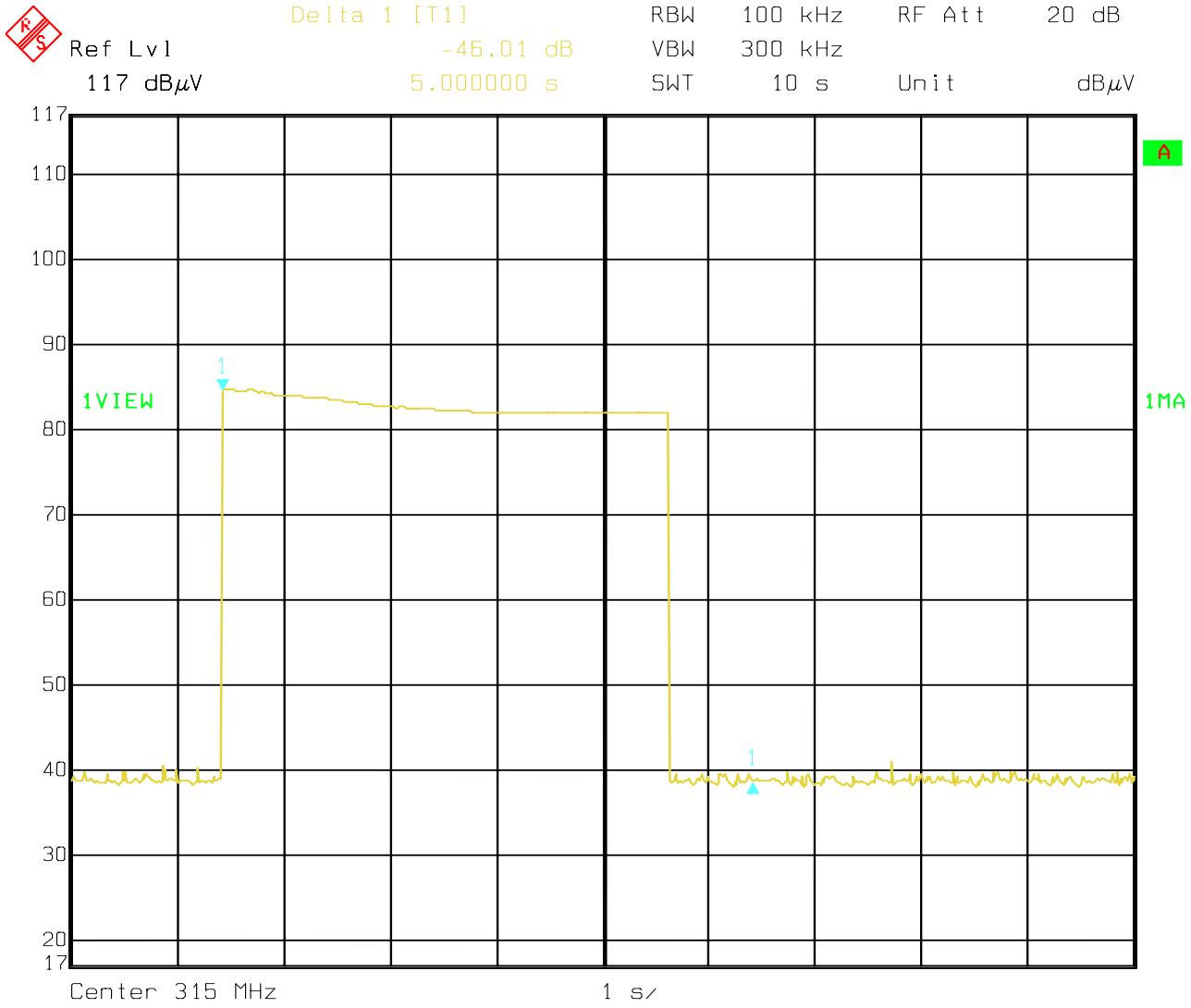
Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	50%
ATM Pressure:	103.2kPa

The testing was performed by Green Xu on 2007-11-08.

Test Mode: Transmitting

Refer to the attached plots.



§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	2007-10-16	2008-10-16

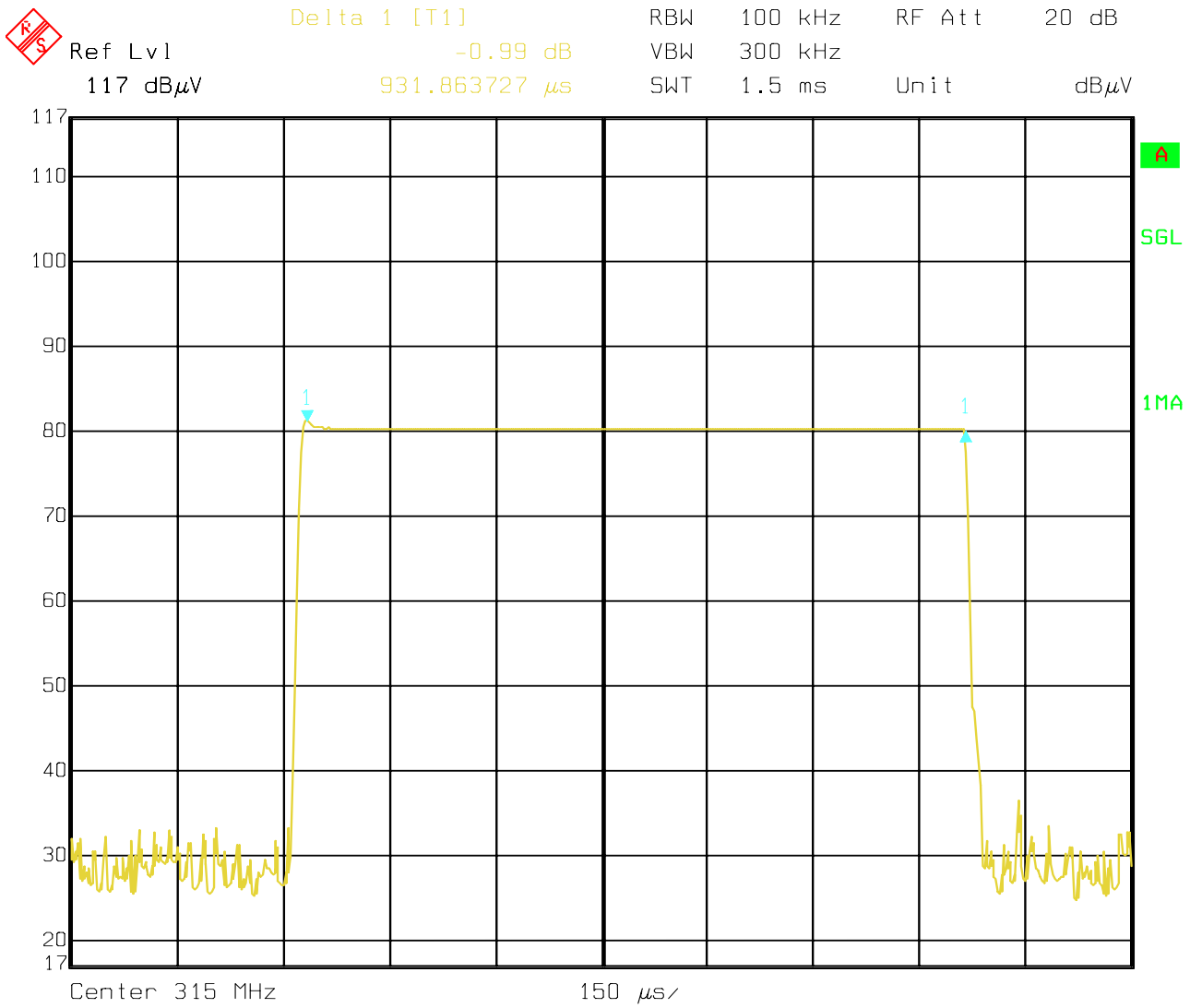
* **Statement of Traceability:** Bay Area Compliance Laboratory Corp. (ShenZhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

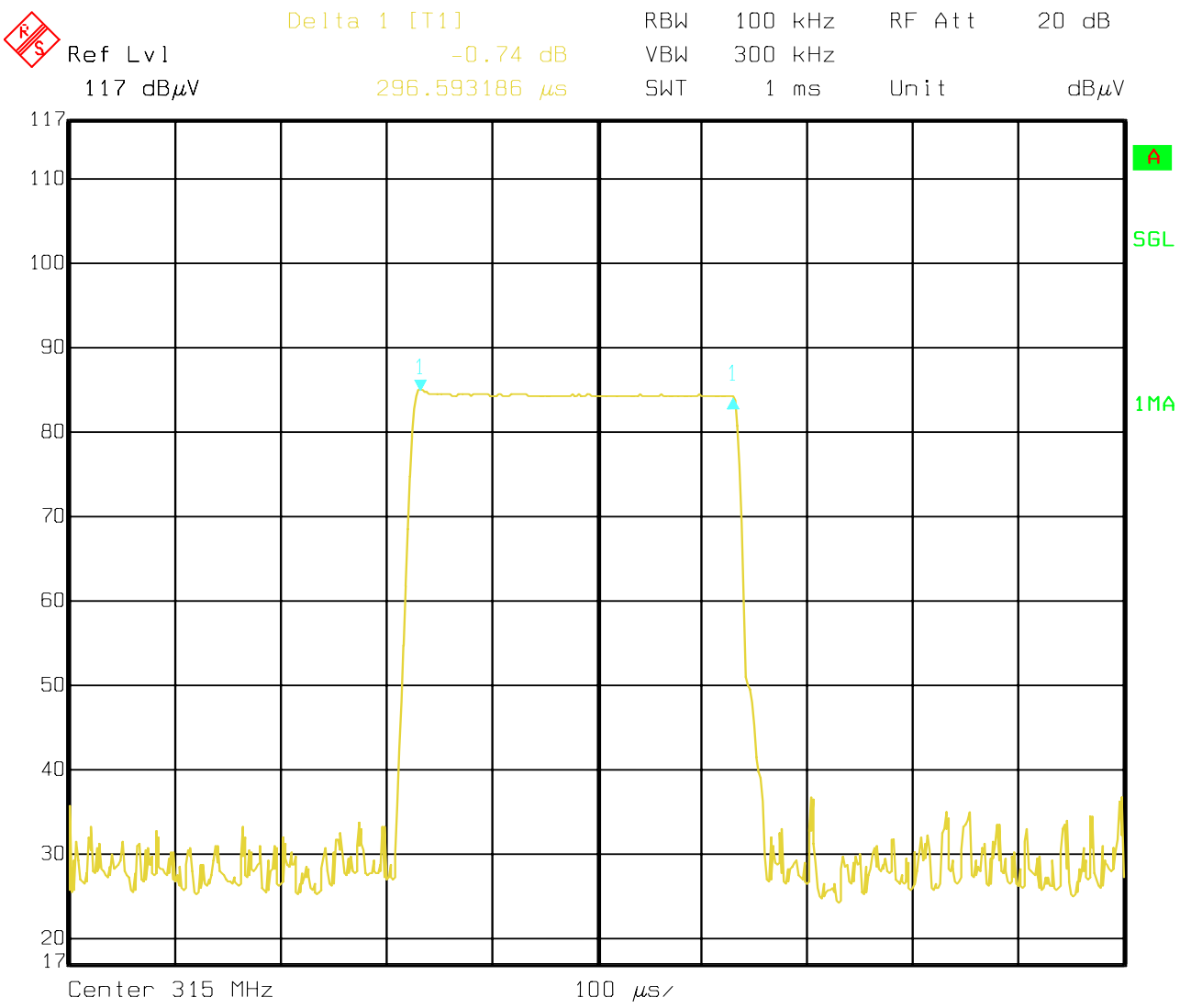
Test Procedure

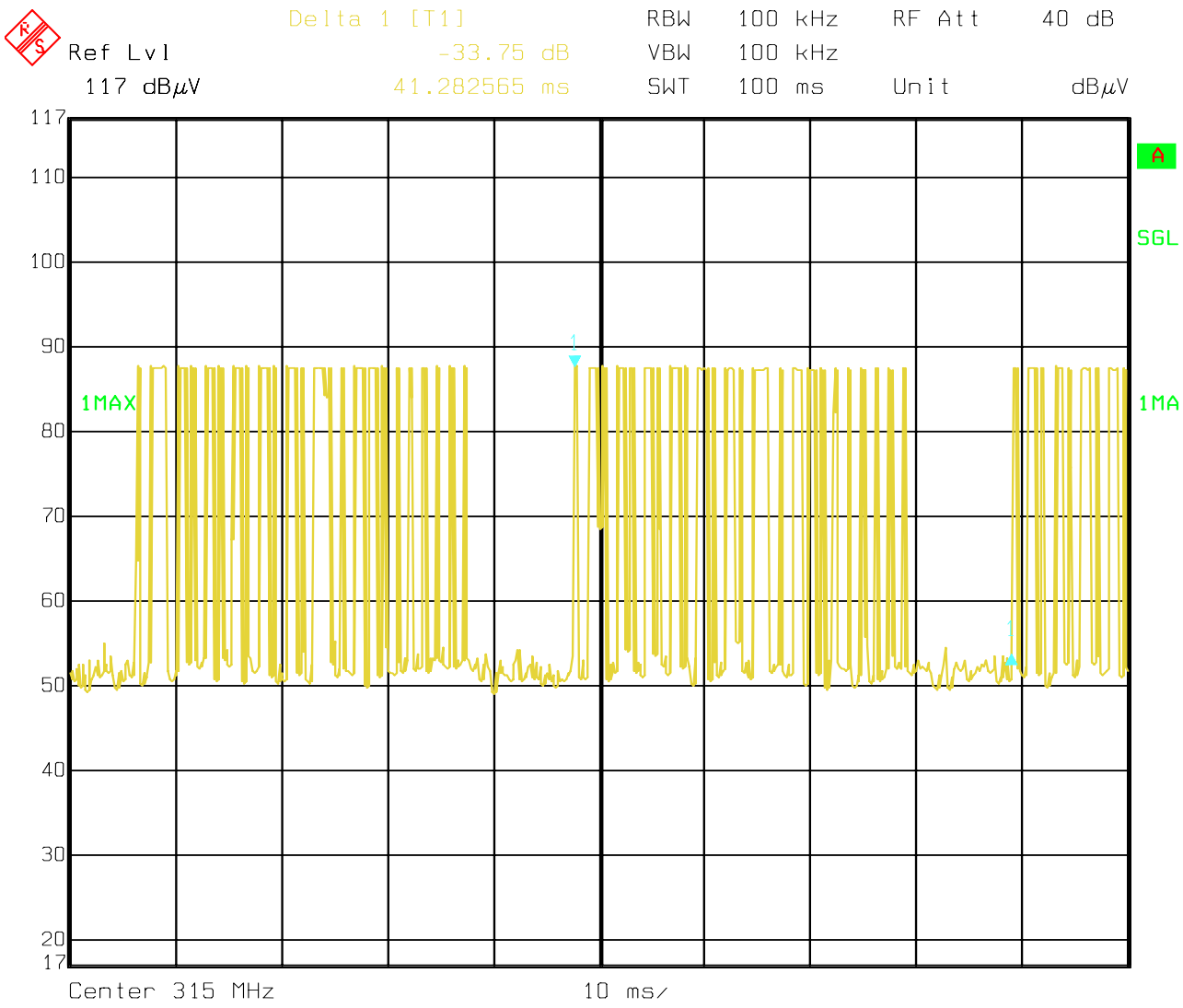
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer=operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=0Hz,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

Test Data

Tp = 41.28ms
Ton = 16*0.297+9*0.932=4.752+8.388=13.14ms
Factor =20log(Ton/Tp)=20log(13.14/41.28)=-9.94dB


Delta 1 [T1]
RBW 100 kHz
RF Att 20 dB
Ref Lvl
-0.99 dB
VBW 300 kHz
117 dBµV
931.863727 µs
SWT 1.5 ms
Unit dBµV
117
110
100
90
80
70
60
50
40
30
20
17
A
SGL
1MA
1
1
Center 315 MHz
150 µs/


Delta 1 [T1]
RBW 100 kHz
RF Att 20 dB
Ref Lvl
-0.74 dB
VBW 300 kHz
117 dBµV
296.593186 µs
SWT 1 ms
Unit dBµV
117
110
100
90
80
70
60
50
40
30
20
17
A
SGL
1MA
Center 315 MHz
100 µs/


Delta 1 [T1]
RBW 100 kHz
RF Att 40 dB
Ref Lvl
-33.75 dB
VBW 100 kHz
117 dBµV
41.282565 ms
SWT 100 ms
Unit dBµV
117
110
100
90
80
70
60
50
40
30
20
17
1MAX
1MA
A
SGL
Center 315 MHz
10 ms/