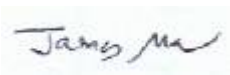


FCC PART 15.231
EMI MEASUREMENT AND TEST REPORT

For
DESA Specialty LLC

2901 Industrial Drive, Bowling Green, KY, 42102, USA

FCC ID: BJ4-64WDB44TX

This Report Concerns: ☒ Original Report		Product Type: Wireless Push Button
Test Engineer:	Choon Sian Ooi 	
Report No.:	R0611061-20	
Report Date:	2006-11-15	
Reviewed By:	Test Engineer: James Ma 	
Prepared By: (ct)	Bay Area Compliance Laboratories Corp. 1274 Anvilwood Ave. Sunnyvale, CA 94089, U.S.A. Tel: (408) 732-9162 Fax: (408) 732-9164	

Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP or any agency of the U.S. Government.

TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
MECHANICAL DESCRIPTION	4
EUT PHOTO	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	5
TEST METHODOLOGY	5
MEASUREMENT UNCERTAINTY	6
TEST FACILITY	6
SYSTEM TEST CONFIGURATION.....	7
JUSTIFICATION	7
EUT EXERCISE SOFTWARE	7
SPECIAL ACCESSORIES	7
EQUIPMENT MODIFICATIONS	7
TEST SETUP BLOCK DIAGRAM	7
SUMMARY OF TEST RESULTS	8
§15.203 - ANTENNA REQUIREMENT.....	9
APPLICABLE STANDARD	9
ANTENNA CONNECTED CONSTRUCTION	9
§15.207 – CONDUCTED EMISSIONS	10
APPLICABLE STANDARD	10
§15.205, §15.209, & §15.231(A1-A5) – RESTRICTED BAND AND RADIATED EMISSION DATA.....	11
APPLICABLE STANDARD: FCC §15.205 RESTRICTED BANDS OF OPERATION	11
APPLICABLE STANDARD: FCC §15.209 RADIATED EMISSION LIMITS, GENERAL REQUIREMENTS.....	11
APPLICABLE STANDARD: FCC §15.231 PERIODIC OPERATION IN THE BAND 40.66 - 40.70 MHZ AND ABOVE 70 MHZ.....	12
§15.231(A) – PERIODIC OPERATION IN THE BAND 40.66 – 40.70 MHZ AND ABOVE 70 MHZ	13
APPLICABLE STANDARD REQUIREMENT	13
TEST EQUIPMENT LIST AND DETAILS.....	13
TEST SETUP DIAGRAM	13
TEST RESULT	13
§15.231(B) – FIELD STRENGTH OF EMISSIONS	15
APPLICABLE STANDARD REQUIREMENT	15
RADIATED EMISSIONS EUT SETUP	15
SPECTRUM ANALYZER SETUP	15
TEST EQUIPMENT LIST AND DETAILS.....	16
TEST PROCEDURE	16
CORRECTED AMPLITUDE & MARGIN CALCULATION	16
CORRECTED FOR PULSE OPERATION	16
WHEN THE TRANSMITTER IS ACTIVATED (BY BUTTON PRESS), IT WILL, IN THE WORST CASE, TRANSMIT PULSE POSITION MODULATED (PPM) ASK DATA. WITHIN ANY GIVEN 100MS WINDOW, THE WORST CASE TOTAL ON TIME OCCURS IS 17.56MS.	16
SUMMARY OF TEST RESULTS	20
RADIATED EMISSIONS TEST DATA, 3 METERS.....	20
APPLICABLE STANDARD REQUIREMENT CONTINUED: 15.231 B(3) F/S LIMITS OF SPURIOUS EMISSIONS	20
§15.231(C) – EMISSIONS BANDWIDTH	22
APPLICABLE STANDARD REQUIREMENT	22
TEST EQUIPMENT LIST AND DETAILS.....	22
TEST SETUP DIAGRAM	22
TEST RESULT	22

§15.231(D), (E) – FREQUENCY AND VOLTAGE TOLERANCE, RELAXED RESRICTIONS WITH REDUCED F/S LIMITS	24
APPLICABLE STANDARDS	24

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *DESA Specialty* product, *FCCID: BJ4-64WDB44TX* or the "EUT" as referred to in this report is a wireless door bell push button transmitter in a metal housing that can transmit to one or more different receivers. Two 3-volt CR-2032 lithium batteries power the transmitter circuit. This input power is internally regulated in each encoder IC T-99. The miniature dip switches control the coding for the T-99 encoder, allowing up to 128 different code possibilities for each button. The output of each encoder chip goes through the oscillator/modulator stage. A SAW Resonator circuit sets the frequency, which is 315M Hz. The encoded signal from either button is then sent through the "helical" antenna mounted on the PCB and the RF output is transmitted into the air.

Mechanical Description

The *DESA Specialty, LLC* product, *FCCID: BJ4-64WDB44TX* in this report is a Wireless Push Button which measures approximately 109.60mm L x 25.20mm W x 26.00mm H and weighs 26.20g. The EUT is designed to operate at 315 MHz frequency.

** The test data gathered are from production sample, serial number: 001, provided by the manufacturer.*

EUT Photo



Additional Photos in Exhibit C

Objective

This report is prepared on behalf of *DESA Specialty, LLC* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine compliance with FCC rules, Part 15.231 for radiated emission, 20dB Bandwidth, and Deactivation.

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 measurements were performed at BACL.

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 values range from ± 2.0 for Conducted Emissions tests and ± 4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

Test Facility

The Test site used by BACL to collect radiated and conducted emission measurement data is located at 1274 Anvilwood Ave, Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. 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 and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

SYSTEM TEST CONFIGURATION

Justification

The EUT was tested in accordance with ANSI C63.4-2003.

EUT Exercise Software

None, the EUT was exercised in normal operating mode as detailed in the *DESA Specialty* provided instructions.

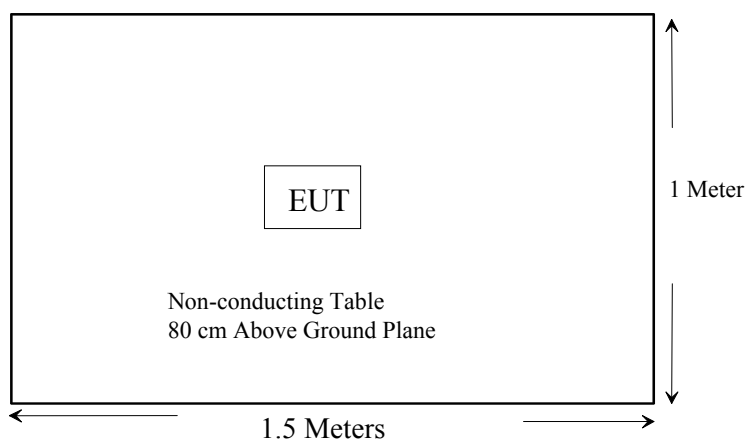
Special Accessories

None

Equipment Modifications

No modifications were made to the EUT.

Test Setup Block Diagram



SUMMARY OF TEST RESULTS

FCC Rules	REQUIREMENTS	RESULT
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Bands of Operation	Compliant
§15.207	Conducted Emissions	N/A
§15.209	Radiated Emissions, General Requirements	Compliant
§15.231 (a) (1)	5 second manual deactivation	Compliant
§15.231 (a) (2)	5 second automatic deactivation	N/A
§15.231 (a) (3)	Non predetermined transmission intervals. Aggregate Tx <2s/hr.	N/A
§15.231 (a) (4)	Transmissions during an emergency	N/A
§15.231 (a) (5)	15.211 (a)(1) & (a)(2) may be up to 10 seconds during professional installation	N/A
§15.231 (b)	Field strength of emissions	Compliant
§15.231 (b) (1)	Field strength limits at 3 meters	Compliant
§15.231 (b) (2)	Field strength; average or QP, 15.35 for averaging pulsed emissions and for limiting peak emissions) or QP detector	Compliant
§15.231 (b) (3)	F/S Limits of spurious emissions	Compliant
§15.231 (c)	Emission B/W	Compliant
§15.231 (d)	40.66–40.70 MHz; Frequency and Voltage Tolerance	N/A
§15.231 (e)	Relaxed restrictions with reduced F/S limits	N/A

§15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 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.

Refer to statement below for compliance.

“The antenna for this device is an integral antenna that the end user cannot access. Furthermore the device is for indoor/outdoor use as detailed in the Users Manual and Operational Description”.

Antenna Connected Construction

This product has a helix antenna which is soldered on the PCB board, fulfilling the requirement of this section.

☒ **Compliant**

☐ **N/A**

§15.207 – CONDUCTED EMISSIONS

Applicable Standard

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

This test is Not Applicable (N/A) to the EUT. The EUT is designed to be connected to direct current and is not designed to be connected to the public utility (AC) power line.

☐ **Compliant**

☒ **N/A**

§15.205, §15.209, & §15.231(a1-a5) – RESTRICTED BAND AND RADIATED EMISSION DATA

Applicable Standard: FCC §15.205 Restricted bands of operation

(a) Except as shown in 15.205 paragraphs (d), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.090 – 0.110	8.291 – 8.294	16.69475 – 16.69525	156.7 – 156.9	1435 – 1626.5	3.332 – 3.339	10.6 – 12.7
0.495 – 0.505	8.362 – 8.366	25.5 – 25.67	162.0125 – 167.17	1645.5 – 1646.5	3.3458 – 3.358	13.25 – 13.4
2.1735 – 2.1905	8.37625 – 8.38675	37.5 – 38.25	167.72 – 173.2	1660 – 1710	3.600 – 4.400	14.47 – 14.5
4.125 – 4.128	8.41425 – 8.41475	73 – 74.6	240 – 285	1718.8 – 1722.2	4.5 – 5.15	15.35 – 16.2
4.17725 – 4.17775	12.29 – 12.293	74.8 – 75.2	322 – 335.4	2200 – 2300	5.35 – 5.46	17.7 – 21.4
4.20725 – 4.20775	12.51975 – 12.52025	108 – 121.94	399.9 – 410	2310 – 2390	7.25 – 7.75	22.01 – 23.12
6.215 – 6.218	12.57675 – 12.57725	123 – 138	608 – 614	2483.5 – 2500	8.025 – 8.5	23.6 – 24.0
6.26775 – 6.26825	13.36 – 13.41	149.9 – 150.05	960 – 1240	2690 – 2900	9.0 – 9.2	31.2 – 31.8
6.31175 – 6.31225	16.42 – 16.423	156.52475 – 156.52525	1300 – 1427	3260 – 3267	9.3 – 9.5	36.43 – 36.5
						Above 38.6

(b) Except as provided in 15.205 paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

☒ Compliant

☐ N/A

Applicable Standard: FCC §15.209 Radiated emission limits, general requirements.

(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolt/meter)	(meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

☒ Compliant

☐ N/A

Applicable Standard: FCC §15.231 Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz.

(a): The provisions of this Section are restricted to periodic operation within the band 40.66 - 40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

☒ Compliant

☐ N/A

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.

☒ Compliant

☐ N/A

a(2): A transmitter activated automatically shall cease transmission within 5 seconds after activation.

☐ Compliant

☒ N/A

a(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.

☐ Compliant

☒ N/A

a(4): Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

☐ Compliant

☒ N/A

a(5): Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

☐ Compliant

☒ N/A

§15.231(a) – PERIODIC OPERATION IN THE BAND 40.66 – 40.70 MHz AND ABOVE 70 MHz

Applicable Standard Requirement

(a) The provisions of this Section are restricted to periodic operation within the band 40.66 - 40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

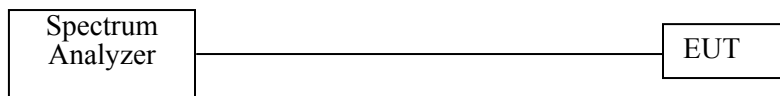
(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	20-174821	2006-02-24

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

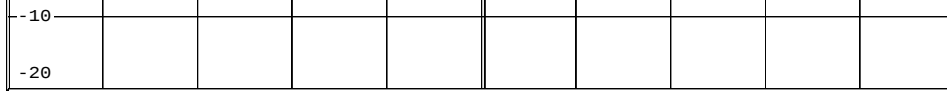
Temperature:	21 ° C
Relative Humidity:	56%
ATM Pressure:	1008mbar

The testing was performed by Choon Sian Ooi on 2006-11-15.

Test Result

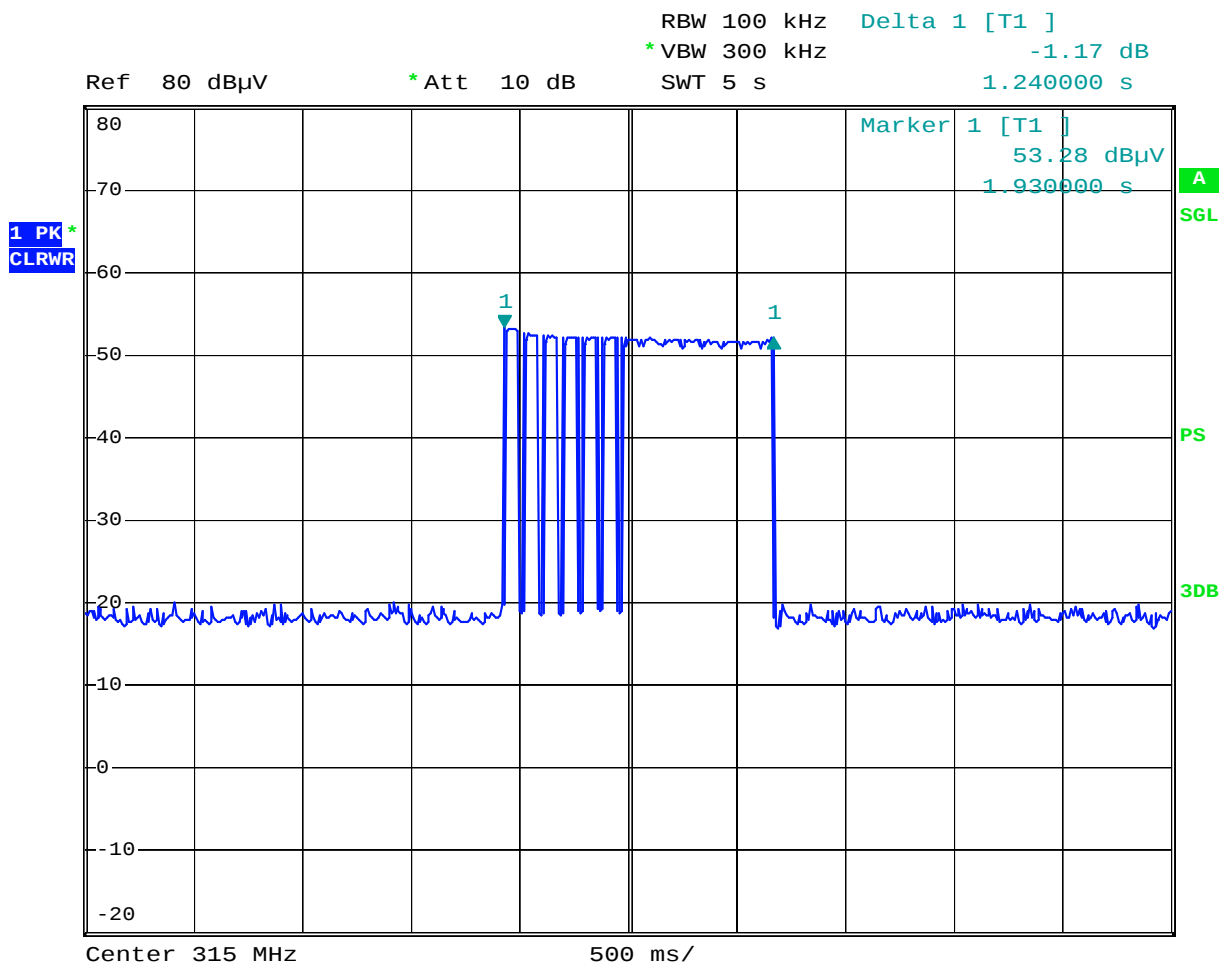
Frequency (MHz)	Transmission Time Measurement (Sec)	Time Limit Line (Sec)	Pass/Fail
315	1.24	5	PASS

Please see the following plot:



Center 315 MHz 500 ms/

IX



Date: 15.NOV.2006 13:17:47

§15.231(b) – FIELD STRENGTH OF EMISSIONS

Applicable Standard Requirement

(b): In addition to the provisions of §15.205, 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

☒ **Compliant**

☐ **N/A**

b(1): The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

☒ **Compliant**

☐ **N/A**

b(2): Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

☒ **Compliant**

☐ **N/A**

Radiated Emissions EUT Setup

The radiated emission tests were performed in the closed chamber 3-meter test site, using the setup in accordance with ANSI C63.4 - 2003. The specification used was the FCC Subpart C limits.

The spacing between the peripherals was 10 centimeters.

The EUT was placed on the center of the back edge on the test table.

Spectrum Analyzer Setup

According to FCC CFR 47, Section 15.33, the EUT was tested to 5GHz.

During the radiated emission test, the CISPR quasi-peak detection was employed:

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal Date
Sonoma Instruments	Pre amplifier	317	260408	2006-02-03
Agilent	Pre amplifier	8449B	3008A01978	2006-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2006-02-14
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	20-174821	2006-02-24
Sunol Science Corp	System Controller	SC99V	113005-1	N/R

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

According to §15.231, Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emission, based on the average value of the measured emissions. As an alternative, compliance with the limits may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

Corrected Amplitude & Margin Calculation

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

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

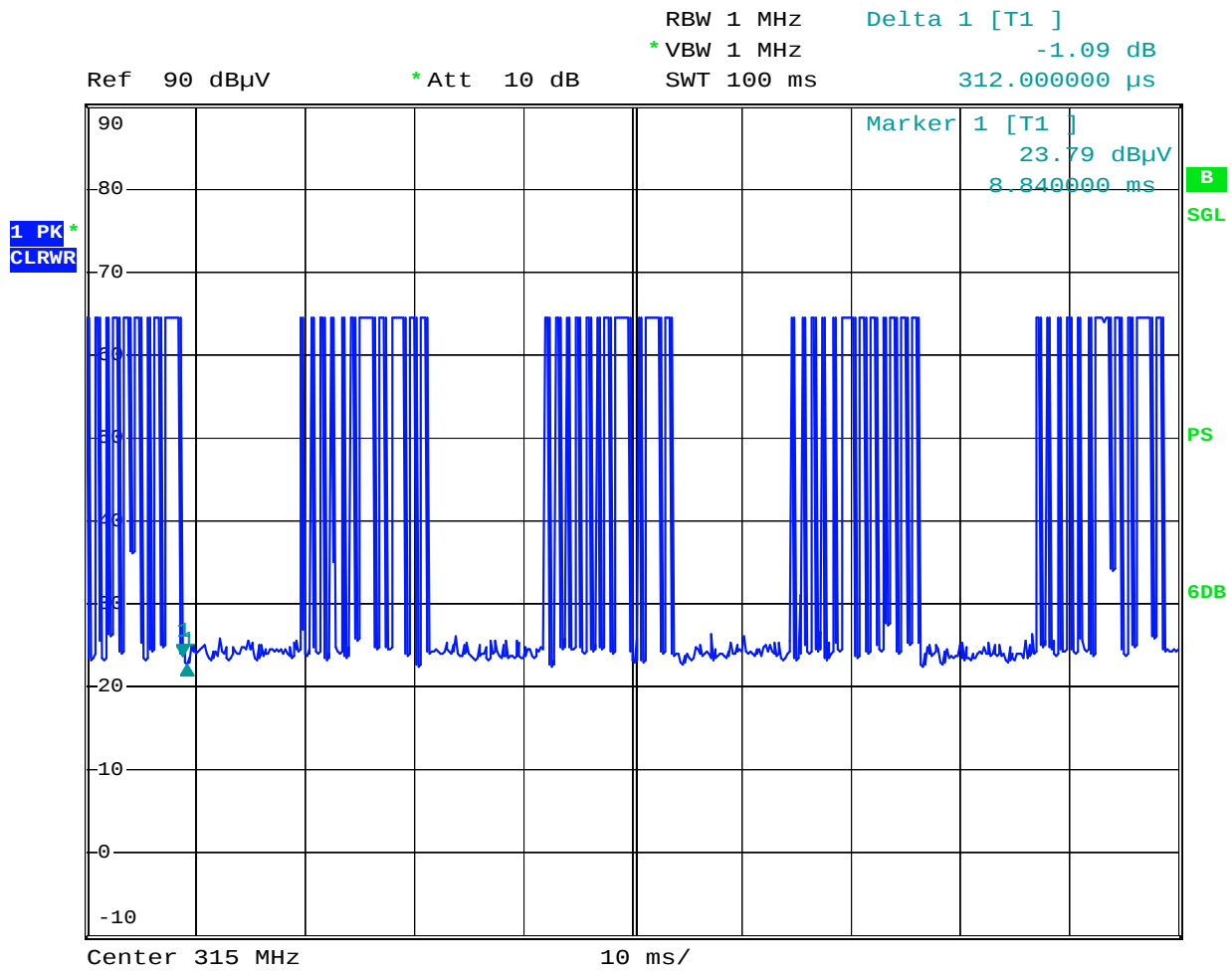
$$\text{Margin} = \text{Corrected Amplitude} - \text{FCC Limit}$$

Corrected For Pulse Operation

When the transmitter is activated (by button press), it will, in the worst case, transmit pulse position modulated (PPM) ASK data. Within any given 100ms window, the worst case total on time occurs is 17.56ms.

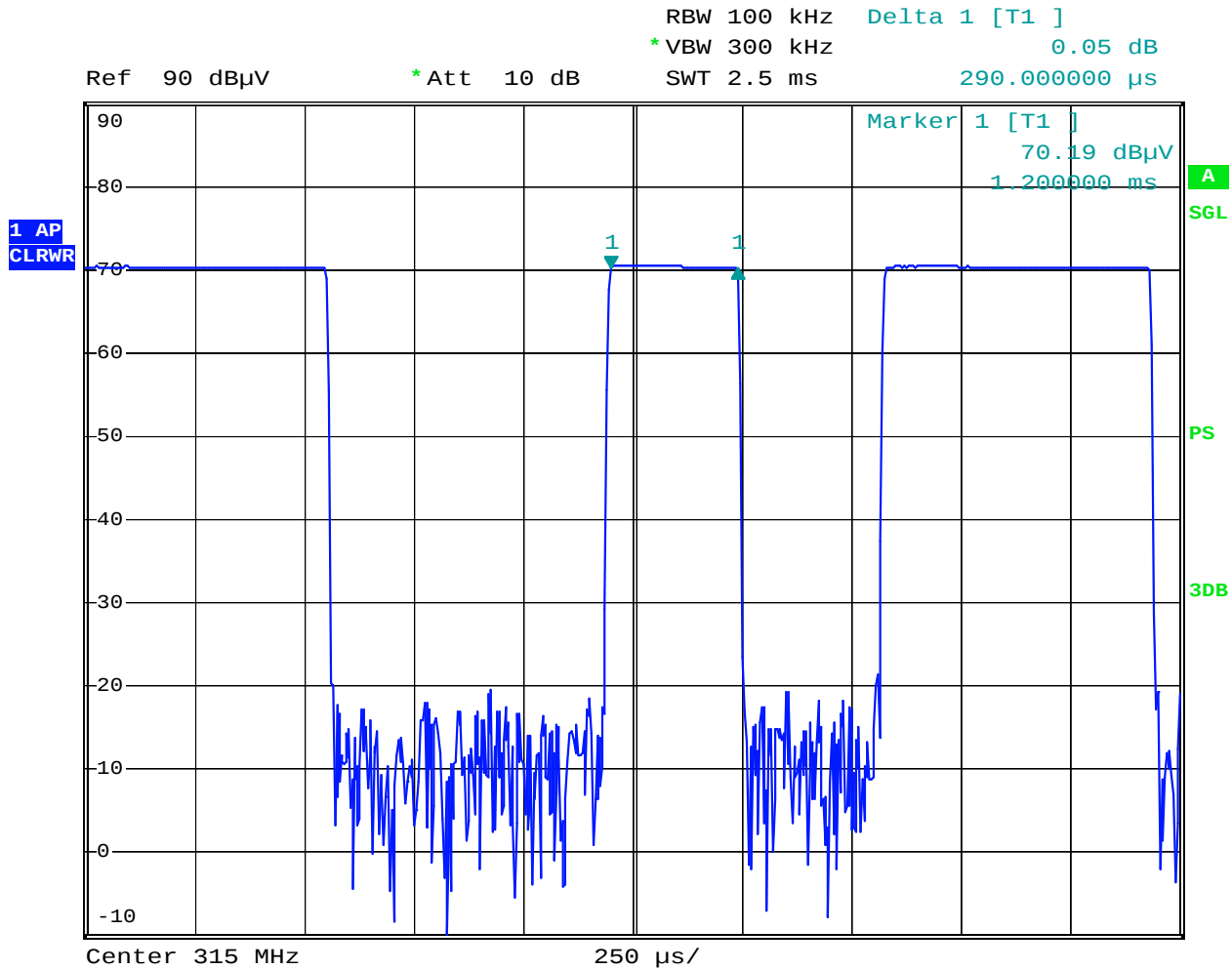
$$\begin{aligned} \text{Total transmission on time in 100ms sweep time} &= (8 \times 0.6) + (44 \times 0.29) \\ &= 17.56 \text{ ms} \end{aligned}$$

$$\text{Duty Cycle} = 20 \log [(17.56/100) \text{ ms}] = -15.12 \text{ dB}$$



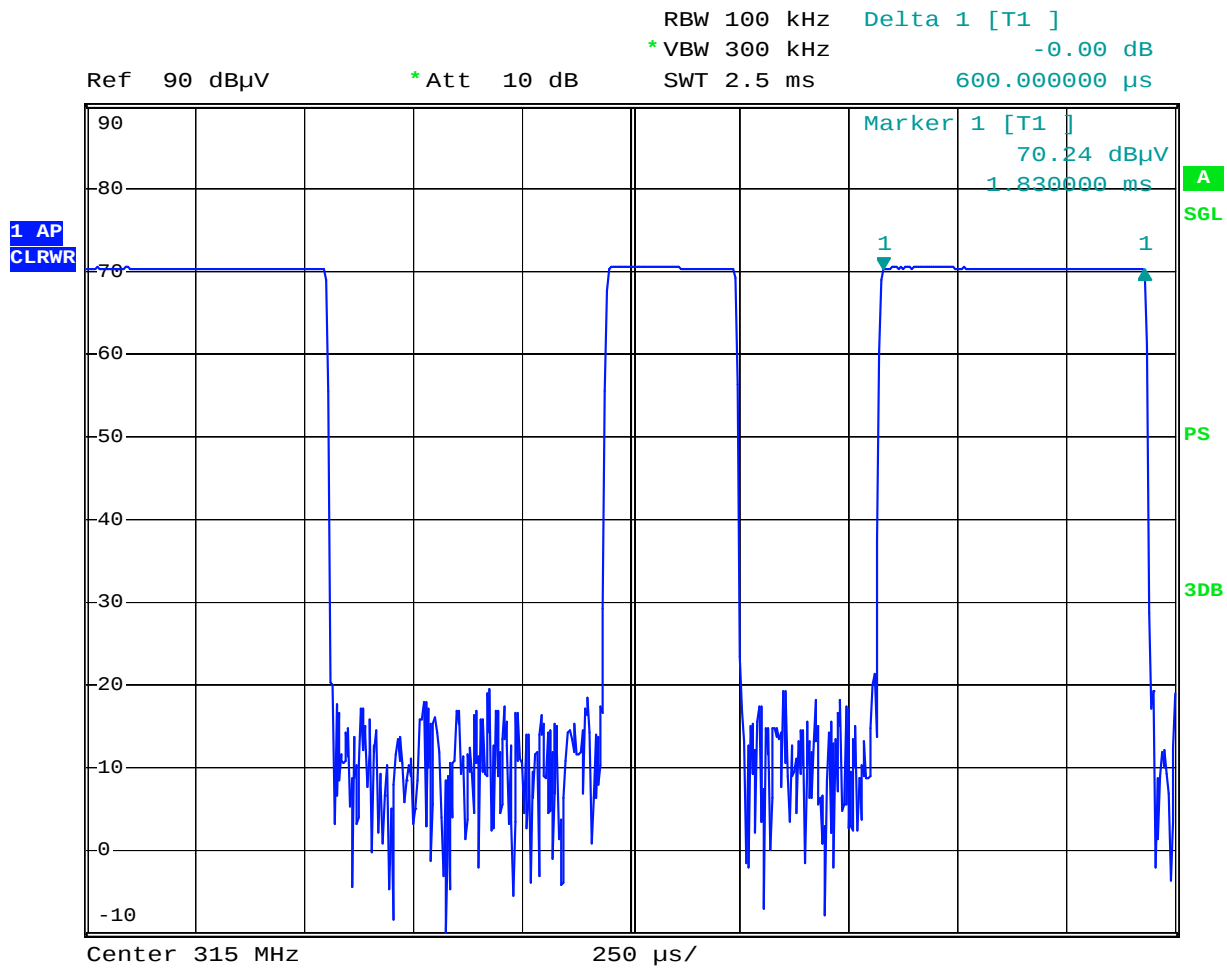
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Figure a: The Pulse transmission pattern in 100ms sweep time.
(Total of 8 wide pulses and 44 narrow pulses)



Date: 15.NOV.2006 10:33:29

Figure b: The Pulse width of narrow pulse.
Pulse width =0.29ms



Date: 15.NOV.2006 10:34:37

Figure b: The Pulse width of wide pulse.
Pulse width =0.6ms

Environmental Conditions

Temperature:	21 ° C
Relative Humidity:	55%
ATM Pressure:	1008mbar

The testing was performed by Choon Sian Ooi on 2006-11-09.

Summary of Test Results

According to the data in the following table, the EUT complied with the FCC 15.231(b) standards and had the worst margin reading of:

-18.22 dB at 315 MHz in the Horizontal polarization.

Radiated Emissions Test Data, 3 meters

Frequency MHz	Meter Reading dBuV/m	Detector PK/QP/AV	Direction Degree	Height Meter	Polar H / V	Correction factor dB	Corrected reading dBuV/m	FCC 15.231	
								Limit dBuV/m	Margin (dB)
315	72.5	AV	87	2	H	-15.12	57.38	75.6	-18.22
315	94.9	PK	87	2	H	22.4	72.5	95.6	-23.1
630	47.6	AV	284	1.1	H	-15.12	32.48	55.6	-23.12
1574	36.391	AV	298	1.1	H	7.8	28.591	55.6	-27.009
630	64.4	PK	284	1.1	H	16.8	47.6	75.6	-28.0
945	42.5	AV	309	1.1	H	-15.12	27.38	55.6	-28.22
1574	51.8	PK	298	1.1	H	7.8	43.7	75.6	-31.9
945	55.7	PK	309	1.1	H	13.2	42.5	75.6	-33.1
1260	28.1	AV	281	1.1	V	-15.12	12.98	55.6	-42.62
1260	38.5	PK	281	1.1	V	10.4	28.1	75.6	-47.5

Note: For Peak, Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain
For Average, Correction Factor = Duty Cycle (-15.12 dB).

Applicable Standard Requirement Continued: 15.231 b(3) F/S Limits of Spurious Emissions

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.

☒ **Compliant**

☐ **N/A**

§15.231(c) – EMISSIONS BANDWIDTH

Applicable Standard Requirement

(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. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

☒ **Compliant**

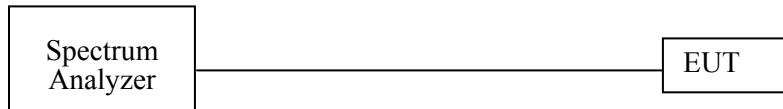
☐ **N/A**

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	20-174821	2006-02-24

* **Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

Temperature:	21 ° C
Relative Humidity:	55%
ATM Pressure:	1008mbar

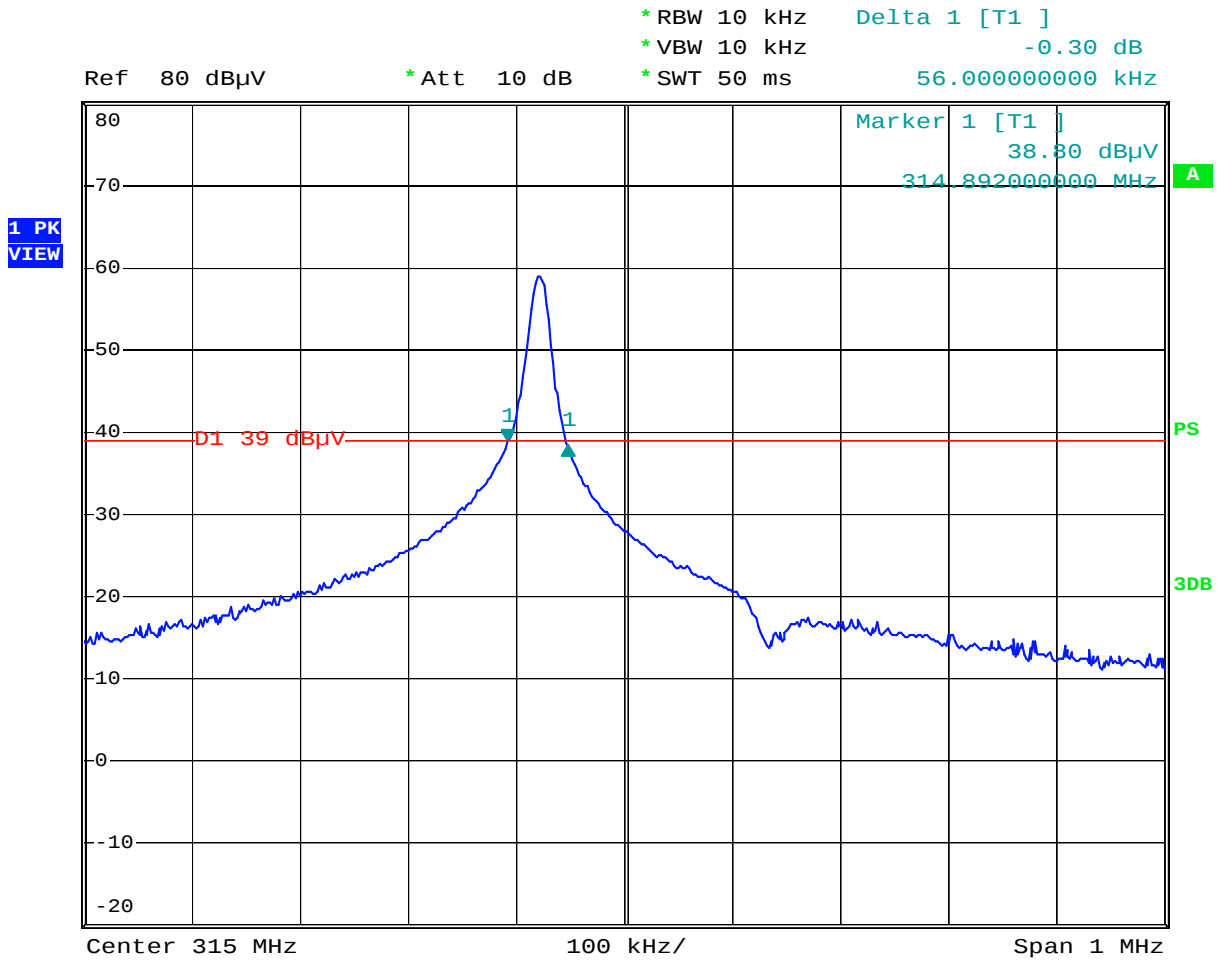
The testing was performed by Choon Sian Ooi on 2006-11-10.

Test Result

Limit = Frequency X 0.25% = 314.96×0.25%= 787.4 kHz

Fund. Frequency (MHz)	20dB Bandwidth Emission (KHz)	Limit (KHz)	Result
315	56	787.4	PASS

Please refer to the following plot.



Date: 10.NOV.2006 11:32:51

§15.231(d), (e) – FREQUENCY AND VOLTAGE TOLERANCE, RELAXED RESRICTIONS WITH REDUCED F/S LIMITS

Applicable Standards

(d) For devices operating within the frequency band 40.66–40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be $\pm 0.01\%$. This frequency tolerance shall be maintained for a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

☐ Compliant

☒ N/A

(e) Intentional radiators may operate at a periodic rate exceeding that specified in § (a) of this section and may be employed for any type of operation, including operation prohibited in § (a) of this section, provided the intentional radiator complies with the provisions of §§ (b) through (d) of this section, except the field strength table in § (b) of this section is replaced by the following:

Fundament al frequency	Field strength of fundamental	Field strength of spurious emissions
(MHz)	(microvolts/mete r)	(microvolts/mete r)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500**	50 to 150**
174-260	1,500	150
260-470	1,500 to 5,000**	150 to 500**
Above 470	5,000	500

**Linear interpolations.

In addition, devices operated under the provisions of this § shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

☐ Compliant

☒ N/A