

FCC PART 15.247

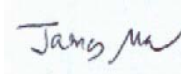
EMI MEASUREMENT AND TEST REPORT

For

ZEBRA TECHNOLOGIES CORPORATION

333 Corporate Woods Way
Vernon Hills, IL 60061

FCC ID: I28MD-BTC2TY6

This Report Concerns: ☒ Class II permissive change	Product Type: Bluetooth modular
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Report No.: R0608281PCII	
Report Date: 2006-09-25	
Reviewed By: Test Engineer: James Ma 	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The Zebra Technologies Corporation's product, FCC ID: I28MD-BTC2TY6 or the "EUT" as referred to in this report is a 2.4GHz Bluetooth modular. It is designed for mobile printing applications. Its compact size and rugged construction is ideally suited to print receipts and for many other situations where on-site printing is required.

Mechanical Description

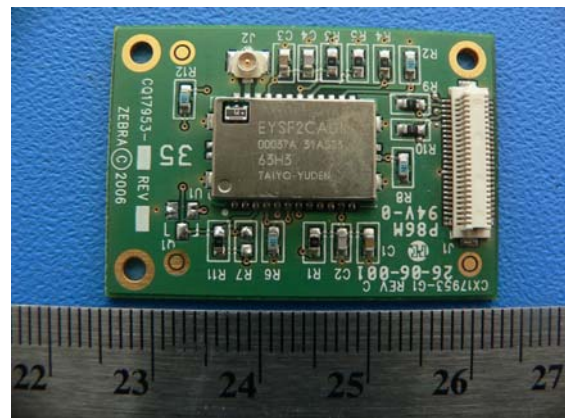
The EUT measures approximately 38mmL x 27mm W x 3mm H.

* The test data gathered are from a production sample, Serial Number: 001, provided by the manufacturer.

EUT Photo



Host (printer)



Bluetooth Modular

Additional photos in Exhibit C

Objective

This type approval report is prepared on behalf of Zebra Technologies Corporation in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

Related Submittal(s)/Grant(s)

This is a Permissive Change II application. The original application was granted on 2006-09-25. BACL's report number: R0608281.

Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003.

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 Corp. to collect radiated and conducted emissions measurement data is located at it's facility in Sunnyvale, California, USA.

Test site at BACL Corp. 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 test methods and procedures set forth in ANSI C63.4-2003& TIA/EIA-603.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464 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 is attached hereinafter and can also be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to ANSI C63.4-2003.

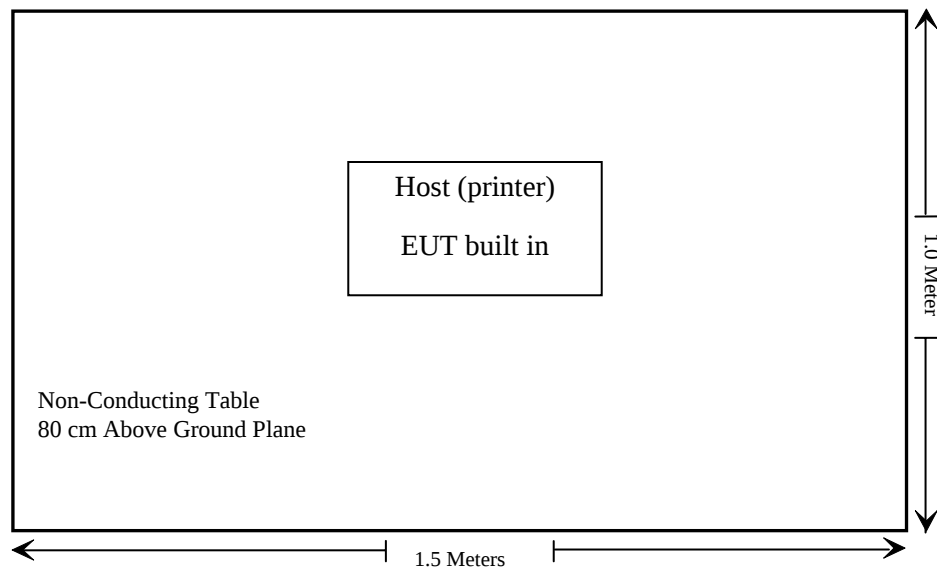
The EUT was built in the host (printer model name: MZ220) tested in the engineering test operating mode to represent *worst-case* results during the final qualification test.

Special Accessories

As shown in following test block diagram.

Equipment Modifications

No modifications were made to the EUT.

Test Setup Block Diagram**Radiated Emissions**

SUMMARY OF TEST RESULTS FOR FCC PART 15

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247(e)(i) §2.1091	RF Exposure	Pls. refer to original report
§15.203	Antenna Requirement	Pls. refer to original report
§ 15.207 (a)	Conducted Emissions	Pls. refer to original report
§2.1051 & §15.247(d)	Spurious Emissions at Antenna Port	Pls. refer to original report
§15.205, §15.209 & §15.247(c)	Radiated Emissions	Compliant
§15.247 (a) (1)	Hopping Channel Separation	Pls. refer to original report
§15.247 (a) (1)	Channel Bandwidth	Pls. refer to original report
§15.247 (a) (1) (iii)	Number of Hopping Frequencies Used	Pls. refer to original report
§15.247 (a) (1) (iii)	Dwell Time of Each Frequency	Pls. refer to original report
§15.247 (b)(3)	Maximum Peak Output Power	Pls. refer to original report
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Pls. refer to original report

§15.205, §15.209 & §15.247(c) - RADIATED EMISSIONS**Test Setup**

The radiated emissions tests were performed in the shield room, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Sonoma Instruments	Pre amplifier	317	260406	2006-02-03
Agilent	Pre amplifier	8449B	3008A01978	2006-08-21
Sunol Science	Combination Antenna	JB3 Antenna	A013105	2006-02-11
DRG	Horn Antenna	SAS-200/571	261	2006-04-20
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100044	2005-12-14
Sunol Science	System Controller	SC99V	122303-1	N/R
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2005-11-14
Agilent	Spectrum analyzer	8565EC	3946A00131	2006-01-11

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

Environmental Conditions

Temperature:	20-22° C
Relative Humidity:	40-50%
ATM Pressure:	1012-1014 mbar

**The testing was performed by Oscar Au and Choon Sian Ooi on 2006-09-01.*

Test Procedure

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

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "QP" in the data table.

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 emissions are 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

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

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, and had the worst margin of:

For 30-1000MHZ (Spurious Emissions)

-8.2 dB at 47.090000 MHz in the Vertical polarization

Radiated spurious emissions above 1GHz

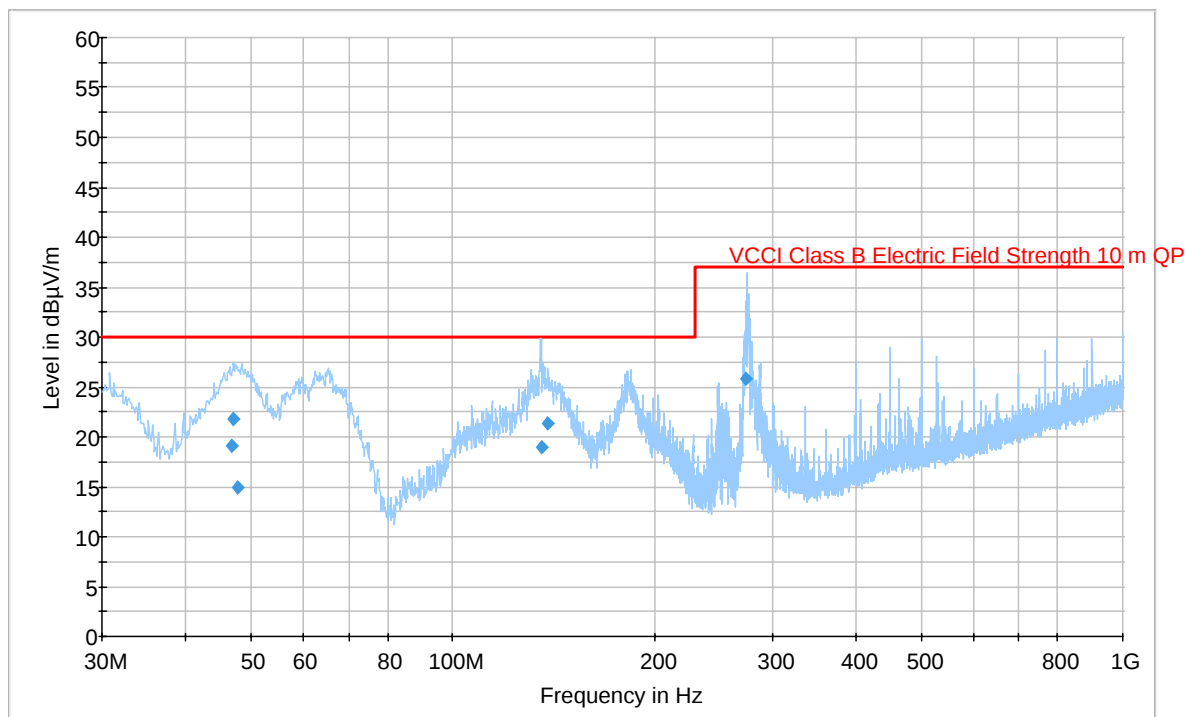
-8.4 dB at 4804.0000 MHz in the Horizontal polarization, 1GHz – 40GHz, Low Channel

-6.7 dB at 4882.0000 MHz in the Horizontal polarization, 1GHz – 40GHz, Middle Channel

-8.3 dB at 4960.0000 MHz in the Horizontal polarization, 1GHz – 40GHz, High Channel

Radiated Emissions Test Data @ 10 meter

30-1000MHz (Spurious Emissions)



Frequency (MHz)	Quasi-Peak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Limit (dBμV/m)	Margin (dB)
47.090000	21.8	305.0	V	262.0	30.0	-8.2
138.402500	21.4	99.0	V	97.0	30.0	-8.6
46.776250	19.1	134.0	V	212.0	30.0	-10.9
135.567500	18.9	121.0	V	82.0	30.0	-11.1
274.526250	25.8	118.0	V	128.0	37.0	-11.2
47.870000	14.9	237.0	V	162.0	30.0	-15.1

Radiated spurious emissions above 1GHZ (MZ220)

1GHz – 25GHz

Low Channel: 2402 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth Degrees	Height (m)	Polar H / V	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBuV/m)	FCC15.247 Limit (dBuV/m)	FCC15.247 Margin (dB)	Comments
2402.0000	91.0	252	2.3	v	28.7	1.5	35.8	85.4	-	-	Fund/Peak
2402.0000	99.1	353	2.2	h	28.7	1.5	35.8	93.5	-	-	Fund/Peak
2402.0000	88.4	267	1.3	v	28.7	1.5	35.8	82.8	-	-	Ave
2402.0000	98.2	350	1.2	h	28.7	1.5	35.8	92.6	-	-	Ave
4804.0000	46.0	352	1.3	h	32.5	1.9	34.8	45.6	54	-8.4	Ave
4804.0000	47.0	352	1.3	h	32.5	1.9	34.8	46.6	74	-27.4	Peak
4804.0000	24.8	104	1.4	v	32.5	1.9	34.8	24.4	54	-29.6	Ave
4804.0000	36.1	104	1.4	v	32.5	1.9	34.8	35.7	74	-38.3	Peak

Middle Channel: 2441 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth Degrees	Height (m)	Polar H / V	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBuV/m)	FCC15.247 Limit (dBuV/m)	FCC15.247 Margin (dB)	Comments
2441.0000	91.8	293	2.2	v	28.7	1.5	35.8	86.2	-	-	Fund/Peak
2441.0000	99.7	349	2.2	h	28.7	1.5	35.8	94.1	-	-	Fund/Peak
2441.0000	88.6	210	1.3	v	28.7	1.5	35.8	83.0	-	-	Ave
2441.0000	98.5	340	1.9	h	28.7	1.5	35.8	92.9	-	-	Ave
4882.0000	47.7	354	1.3	h	32.5	1.9	34.8	47.3	54	-6.7	Ave
4882.0000	30.5	300	1.4	v	32.5	1.9	34.8	30.1	54	-23.9	Ave
4882.0000	48.6	354	1.3	h	32.5	1.9	34.8	48.2	74	-25.8	Peak
4882.0000	36.9	300	1.4	v	32.5	1.9	34.8	36.5	74	-37.5	Peak

High Channel: 2480 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth Degrees	Height (m)	Polar H / V	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBuV/m)	FCC15.247 Limit (dBuV/m)	FCC15.247 Margin (dB)	Comments
2480.0000	91.9	284	1.7	v	28.7	1.5	35.8	86.2	-	-	Fund/Peak
2480.0000	99.1	351	1.9	h	28.7	1.5	35.8	93.4	-	-	Fund/Peak
2480.0000	89.0	180	1.3	v	28.7	1.5	35.8	83.3	-	-	Ave
2480.0000	98.0	280	1.8	h	28.7	1.5	35.8	92.3	-	-	Ave
4960.0000	46.1	347	1.3	h	32.5	1.9	34.8	45.7	54	-8.3	Ave
4960.0000	30.0	281	1.3	v	32.5	1.9	34.8	29.6	54	-24.4	Ave
4960.0000	47.0	347	1.3	h	32.5	1.9	34.8	46.6	74	-27.4	Peak
4960.0000	37.4	281	1.3	v	32.5	1.9	34.8	37.0	74	-37.0	Peak