

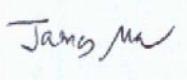


## FCC PART 15.247

### EMI MEASUREMENT AND TEST REPORT For ZEBRA TECHNOLOGIES CORPORATION

333 Corporate Woods Parkway  
Vernon Hills, IL 60061

**FCC ID: I28MD-ZLAN11G**  
**Printer Model: MZ320**

|  |   |
|--|---|
| <b>This Report Concerns:</b>                                   | <b>Product Type:</b>  |
| <input checked="" type="checkbox"/> Class II permissive change | 2.4GHz 802.11G modular  |
| <b>Test Engineer:</b>  | Oscar Au  Choon Sian Ooi  |
| <b>Report No.:</b>   | R0608282 MZ320  |
| <b>Report Date:</b>  | 2006-09-06  |
| <b>Reviewed By:</b>  | Test Engineer: James Ma   |
| <b>Prepared By:</b>  | Bay Area Compliance Laboratory Corporation<br>1274 Anvilwood Ave.<br>Sunnyvale, CA 94089<br>Tel: (408) 732-9162<br>Fax: (408) 732-9164  |

**Note:** This test report is for the customer shown above and their specific product only. It may not be duplicated 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**

|   |          |
|---|----------|
| <b>GENERAL INFORMATION.....</b>                                     | <b>3</b> |
| PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....            | 3        |
| MECHANICAL DESCRIPTION.....   | 3        |
| EUT PHOTO .....   | 3        |
| OBJECTIVE .....   | 3        |
| RELATED SUBMITTAL(s)/GRANT(s).....                                  | 3        |
| TEST METHODOLOGY .....  | 4        |
| MEASUREMENT UNCERTAINTY .....                                       | 4        |
| TEST FACILITY .....   | 4        |
| <b>SYSTEM TEST CONFIGURATION.....</b>                               | <b>5</b> |
| JUSTIFICATION .....   | 5        |
| SPECIAL ACCESSORIES .....   | 5        |
| EQUIPMENT MODIFICATIONS .....                                       | 5        |
| TEST SETUP BLOCK DIAGRAM.....                                       | 6        |
| <b>SUMMARY OF TEST RESULTS FOR FCC PART 15.....</b>                 | <b>7</b> |
| <b>§15.205, §15.209 &amp; §15.247(C) - RADIATED EMISSIONS .....</b> | <b>8</b> |
| TEST SETUP.....   | 8        |
| TEST EQUIPMENT LIST AND DETAILS.....                                | 8        |
| ENVIRONMENTAL CONDITIONS .....                                      | 9        |
| TEST PROCEDURE .....  | 9        |
| CORRECTED AMPLITUDE & MARGIN CALCULATION .....                      | 9        |
| SUMMARY OF TEST RESULTS .....                                       | 9        |
| RADIATED EMISSIONS TEST DATA @ 10 METER .....                       | 10       |

## GENERAL INFORMATION

### Product Description for Equipment Under Test (EUT)

The *Zebra Technologies Corporation*'s product, *FCC ID: I28MD-ZLAN11G* or the "EUT" as referred to in this report is a 2.4GHz 802.11b/g wireless modular which is built in the printer. It is designed for mobile printing applications.

### Mechanical Description

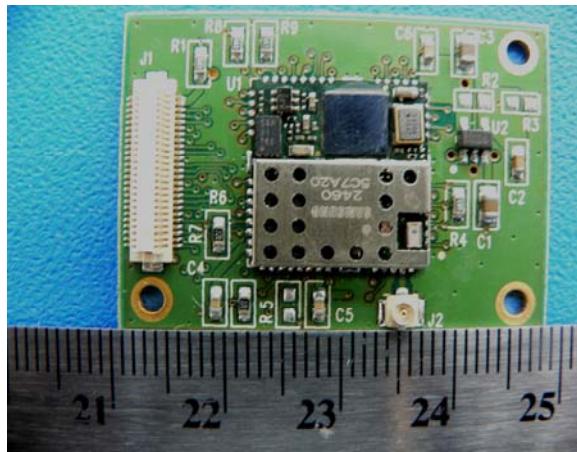
Model MZ320 measures approximately 140mmL x 105mm W x 55mm H.

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

### EUT Photo



Host (Printer)



802.11G 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 2006-05-08. Rhein Tech Laboratories, Inc.'s report number: 2006029.

## 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  $\pm 2.0$  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 tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

### **Special Accessories**

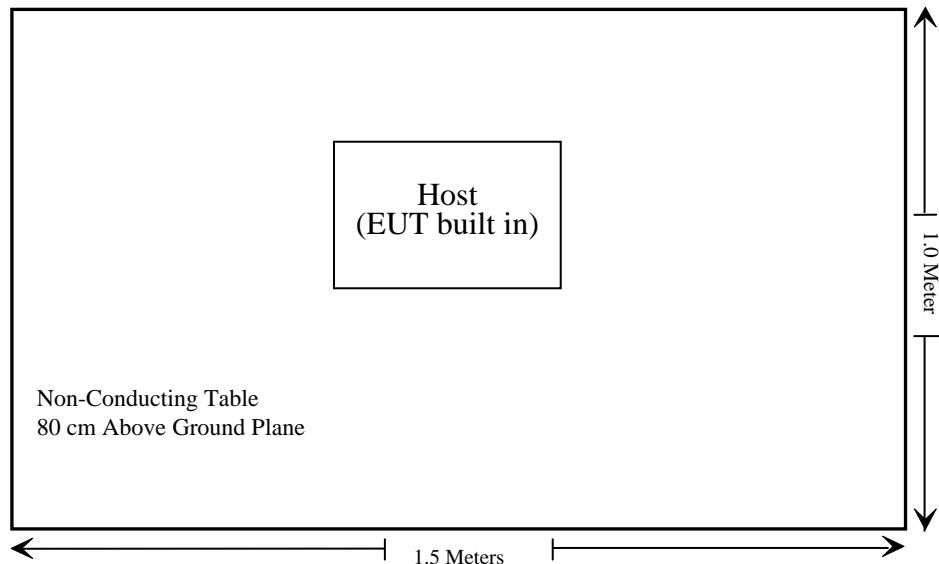
As shown in following test block diagram, all interface cables used for compliance testing are shielded.

### **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)<br>§2.1091         | RF Exposure                              | Pls. refer to SAR report      |
| §15.203                          | Antenna Requirement                      | Pls. refer to original report |
| § 15.207 (a)                     | Conducted Emissions                      | Pls. refer to original report |
| §2.1051 &<br>§15.247(d)          | Spurious Emissions at Antenna Port       | Pls. refer to original report |
| §15.205, §15.209 &<br>§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 emission 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)

**-8.3 dB at 47.257500 MHz in the Vertical polarization**

Radiated spurious emissions above 1GHz (MZ320)

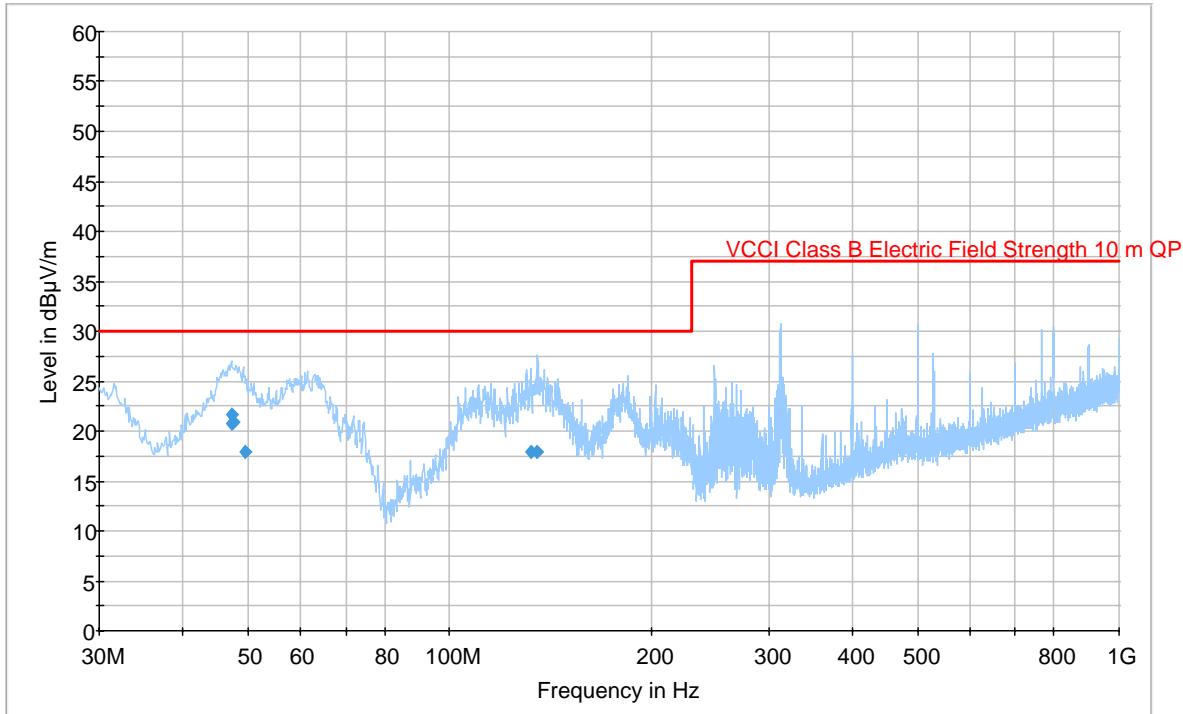
**-9.6 dB at 4824.0000 MHz in the Vertical polarization, 1GHz – 25GHz, Low Channel**

**-6.4 dB at 4874.0000 MHz in the Vertical polarization, 1GHz – 25GHz, Middle Channel**

**-11.9 dB at 4924.0000 MHz in the Vertical polarization, 1GHz – 25GHz, High Channel**

**Radiated Emissions Test Data @ 10 meter**

30-1000MHZ (Spurious Emissions for MZ320)



| Frequency (MHz) | Quasi-Peak (dB $\mu$ V/m) | Antenna height (cm) | Polarity | Turntable position (deg) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|---------------------------|---------------------|----------|--------------------------|----------------------|-------------|
| 47.257500       | 21.7                      | 284.0               | V        | 193.0                    | 30.0                 | -8.3        |
| 47.466250       | 21.0                      | 257.0               | V        | 289.0                    | 30.0                 | -9.0        |
| 47.212500       | 20.8                      | 370.0               | V        | 346.0                    | 30.0                 | -9.2        |
| 49.638750       | 17.9                      | 320.0               | V        | 223.0                    | 30.0                 | -12.1       |
| 135.406250      | 17.9                      | 118.0               | V        | 90.0                     | 30.0                 | -12.1       |
| 132.616250      | 17.8                      | 134.0               | V        | 81.0                     | 30.0                 | -12.2       |

Radiated spurious emissions above 1GHZ (MZ320)

1GHz – 25GHz

Low Channel: 2412 MHz

| Frequency<br>MHz | Reading<br>dBuV | Azimuth<br>Degrees | Height<br>m | Polar<br>H / V | Antenna<br>Loss<br>dB | Cable loss<br>dB | Amplifier<br>dB | Corrected<br>Reading<br>dBuV/m | FCC15.247<br>Limit<br>(dBuV/m) | FCC15.247<br>Margin | Comments  |
|------------------|-----------------|--------------------|-------------|----------------|-----------------------|------------------|-----------------|--------------------------------|--------------------------------|---------------------|-----------|
| 2412.0000        | 111.8           | 300                | 1.7         | v              | 28.7                  | 1.5              | 35.8            | 106.2                          | -                              | -                   | Fund/Peak |
| 2412.0000        | 117.0           | 350                | 1.8         | h              | 28.7                  | 1.5              | 35.8            | 111.4                          | -                              | -                   | Fund/Peak |
| 2412.0000        | 111.6           | 300                | 1.7         | v              | 28.7                  | 1.5              | 35.8            | 106.0                          | -                              | -                   | Ave       |
| 2412.0000        | 116.8           | 350                | 1.8         | h              | 28.7                  | 1.5              | 35.8            | 111.2                          | -                              | -                   | Ave       |
| 4824.0000        | 44.8            | 315                | 1.5         | v              | 32.5                  | 1.9              | 34.8            | 44.4                           | 54                             | -9.6                | Ave       |
| 4824.0000        | 42.3            | 300                | 2.0         | h              | 32.5                  | 1.9              | 34.8            | 41.9                           | 54                             | -12.1               | Ave       |
| 4824.0000        | 50.0            | 315                | 1.5         | v              | 32.5                  | 1.9              | 34.8            | 49.6                           | 74                             | -24.4               | Peak      |
| 4824.0000        | 48.4            | 300                | 2.0         | h              | 32.5                  | 1.9              | 34.8            | 48.0                           | 74                             | -26.0               | Peak      |

Middle Channel: 2437 MHz

| Frequency<br>MHz | Reading<br>dBuV | Azimuth<br>Degrees | Height<br>m | Polar<br>H / V | Antenna<br>Loss<br>dB | Cable loss<br>dB | Amplifier<br>dB | Corrected<br>Reading<br>dBuV/m | FCC15.247<br>Limit<br>(dBuV/m) | FCC15.247<br>Margin | Comments  |
|------------------|-----------------|--------------------|-------------|----------------|-----------------------|------------------|-----------------|--------------------------------|--------------------------------|---------------------|-----------|
| 2437.0000        | 111.9           | 310                | 1.4         | v              | 28.7                  | 1.5              | 35.8            | 106.3                          | -                              | -                   | Fund/Peak |
| 2437.0000        | 116.5           | 340                | 1.6         | h              | 28.7                  | 1.5              | 35.8            | 110.9                          | -                              | -                   | Fund/Peak |
| 2437.0000        | 111.8           | 310                | 1.4         | v              | 28.7                  | 1.5              | 35.8            | 106.2                          | -                              | -                   | Ave       |
| 2437.0000        | 116.2           | 340                | 1.6         | h              | 28.7                  | 1.5              | 35.8            | 110.6                          | -                              | -                   | Ave       |
| 4874.0000        | 48.0            | 190                | 1.6         | v              | 32.5                  | 1.9              | 34.8            | 47.6                           | 54                             | -6.4                | Ave       |
| 4874.0000        | 44.7            | 300                | 1.3         | h              | 32.5                  | 1.9              | 34.8            | 44.3                           | 54                             | -9.7                | Ave       |
| 4874.0000        | 51.3            | 190                | 1.6         | v              | 32.5                  | 1.9              | 34.8            | 50.9                           | 74                             | -23.1               | Peak      |
| 4874.0000        | 49.1            | 300                | 1.3         | h              | 32.5                  | 1.9              | 34.8            | 48.7                           | 74                             | -25.3               | Peak      |

High Channel: 2462 MHz

| Frequency<br>MHz | Reading<br>dBuV | Azimuth<br>Degrees | Height<br>m | Polar<br>H / V | Antenna<br>Loss<br>dB | Cable loss<br>dB | Amplifier<br>dB | Corrected<br>Reading<br>dBuV/m | FCC15.247<br>Limit<br>(dBuV/m) | FCC15.247<br>Margin | Comments  |
|------------------|-----------------|--------------------|-------------|----------------|-----------------------|------------------|-----------------|--------------------------------|--------------------------------|---------------------|-----------|
| 2462.0000        | 112.5           | 300                | 1.5         | v              | 28.7                  | 1.5              | 35.8            | 106.8                          | -                              | -                   | Fund/Peak |
| 2462.0000        | 117.4           | 340                | 1.4         | h              | 28.7                  | 1.5              | 35.8            | 111.7                          | -                              | -                   | Fund/Peak |
| 2462.0000        | 112.3           | 300                | 1.5         | v              | 28.7                  | 1.5              | 35.8            | 106.6                          | -                              | -                   | Ave       |
| 2462.0000        | 117.3           | 340                | 1.4         | h              | 28.7                  | 1.5              | 35.8            | 111.6                          | -                              | -                   | Ave       |
| 4924.0000        | 42.5            | 360                | 1.3         | v              | 32.5                  | 1.9              | 34.8            | 42.1                           | 54                             | -11.9               | Ave       |
| 4924.0000        | 42.4            | 120                | 2.0         | h              | 32.5                  | 1.9              | 34.8            | 42.0                           | 54                             | -12.0               | Ave       |
| 4924.0000        | 48.2            | 120                | 2.0         | h              | 32.5                  | 1.9              | 34.8            | 47.8                           | 74                             | -26.2               | Peak      |
| 4924.0000        | 48.1            | 360                | 1.3         | v              | 32.5                  | 1.9              | 34.8            | 47.7                           | 74                             | -26.3               | Peak      |