

***Electromagnetic Emissions Test Report  
and  
Application for Grant of Equipment Authorization  
pursuant to  
FCC Part 15, Subpart C Specifications for an  
Intentional Radiator on the  
Vocera Communications  
Model: Communications Badge***

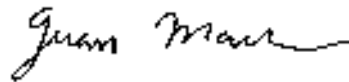
FCC ID: QGZ-B1000

GRANTEE: Vocera Communications  
20230 Steven Creek Blvd., Suite C  
Cupertino, CA 95014

TEST SITE: Elliott Laboratories, Inc.  
684 W. Maude Avenue  
Sunnyvale, CA 94086

REPORT DATE: June 27, 2002

FINAL TEST DATE: June 19, 2002



AUTHORIZED SIGNATORY: \_\_\_\_\_

Juan Martinez  
Sr. EMC Engineer

This report shall not be reproduced, except in its entirety, without the written approval of Elliott Laboratories, Inc.

---

**TABLE OF CONTENTS**

|                                                               |           |
|---------------------------------------------------------------|-----------|
| <b>COVER PAGE.....</b>                                        | <b>1</b>  |
| <b>TABLE OF CONTENTS .....</b>                                | <b>2</b>  |
| <b>SCOPE.....</b>                                             | <b>3</b>  |
| <b>OBJECTIVE.....</b>                                         | <b>3</b>  |
| <b>STATEMENT OF COMPLIANCE.....</b>                           | <b>3</b>  |
| <b>EMISSION TEST RESULTS .....</b>                            | <b>4</b>  |
| LIMITS OF CONDUCTED INTERFERENCE VOLTAGE.....                 | 4         |
| LIMITS OF ANTENNA CONDUCTED EMISSIONS.....                    | 4         |
| LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH.....           | 4         |
| LIMITS OF POWER, BANDWIDTH, AND POWER SPECTRAL DENSITY.....   | 5         |
| MEASUREMENT UNCERTAINTIES .....                               | 5         |
| <b>EQUIPMENT UNDER TEST (EUT) DETAILS .....</b>               | <b>6</b>  |
| GENERAL.....                                                  | 6         |
| INPUT POWER.....                                              | 6         |
| ENCLOSURE .....                                               | 6         |
| EMI SUPPRESSION DEVICES .....                                 | 6         |
| MODIFICATIONS.....                                            | 6         |
| SUPPORT EQUIPMENT.....                                        | 7         |
| EXTERNAL I/O CABLING.....                                     | 7         |
| TEST SOFTWARE .....                                           | 7         |
| <b>TEST SITE.....</b>                                         | <b>8</b>  |
| GENERAL INFORMATION.....                                      | 8         |
| CONDUCTED EMISSIONS CONSIDERATIONS.....                       | 8         |
| RADIATED EMISSIONS CONSIDERATIONS .....                       | 8         |
| <b>MEASUREMENT INSTRUMENTATION.....</b>                       | <b>9</b>  |
| INSTRUMENT CONTROL COMPUTER.....                              | 9         |
| LINE IMPEDANCE STABILIZATION NETWORK (LISN).....              | 9         |
| POWER METER .....                                             | 10        |
| FILTERS/ATTENUATORS.....                                      | 10        |
| ANTENNAS.....                                                 | 10        |
| ANTENNA MAST AND EQUIPMENT TURNTABLE .....                    | 10        |
| INSTRUMENT CALIBRATION.....                                   | 10        |
| <b>TEST PROCEDURES .....</b>                                  | <b>11</b> |
| EUT AND CABLE PLACEMENT .....                                 | 11        |
| CONDUCTED EMISSIONS.....                                      | 11        |
| RADIATED EMISSIONS .....                                      | 11        |
| RADIO RADIATED EMISSIONS FROM EUT.....                        | 12        |
| <b>SPECIFICATION LIMITS AND SAMPLE CALCULATIONS .....</b>     | <b>13</b> |
| CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207..... | 13        |
| RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209 ..... | 13        |
| SAMPLE CALCULATIONS - CONDUCTED EMISSIONS.....                | 14        |
| SAMPLE CALCULATIONS - RADIATED EMISSIONS .....                | 15        |
| EXHIBIT 1: Test Equipment Calibration Data .....              | 1         |
| EXHIBIT 2: Test Data Log Sheets.....                          | 2         |

---

**SCOPE**

An electromagnetic emissions test has been performed on the Vocera Communications Voice over 802.11b model Communications Badge pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Vocera Communications model Communications Badge and therefore apply only to the tested sample. The sample was selected and prepared by Karl Hannested of Vocera Communications.

**OBJECTIVE**

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

**STATEMENT OF COMPLIANCE**

The tested sample of Vocera Communications model Communications Badge complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product, which may result in increased emission, should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

**EMISSION TEST RESULTS**

The following emissions tests were performed on the Vocera Communications model Communications Badge. The actual test results are contained in an exhibit of this report.

**LIMITS OF CONDUCTED INTERFERENCE VOLTAGE**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.207.

The following measurement was extracted from the data recorded during the conducted emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

120V, 60Hz

| Frequency<br>MHz | Level<br>dBuV | Power<br>Lead | FCC 15.207 |        | Detector<br>QP/Ave | Comments |
|------------------|---------------|---------------|------------|--------|--------------------|----------|
|                  |               |               | Limit      | Margin |                    |          |
| 0.660            | 34.7          | N             | 48.0       | -13.3  | QP                 |          |

**LIMITS OF ANTENNA CONDUCTED EMISSIONS**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247.

The Radiated Emission replaced 15.247(a) (c) antenna conducted measurement. The EUT's antenna is permanently attached, so no antenna measurements were possible. The actual test data and any correction factors are contained an exhibit of this report.

**LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247 and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

| Frequency<br>MHz | Level<br>dBuV/m | Pol<br>v/h | FCC 15.247/15.209 |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------|------------|-------------------|--------|-----------------------|--------------------|------------------|----------|
|                  |                 |            | Limit             | Margin |                       |                    |                  |          |
| 17232.88         | 42.6            | H          | 54.0              | -11.4  | Avg                   | 0                  | 1.2              |          |

---

**LIMITS OF POWER, BANDWIDTH, AND POWER SPECTRAL DENSITY**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247.

The maximum power output was 16.1 dBm on channel 6. The minimum 6-dB bandwidth was 9.17 Megahertz on channel 1. The minimum PSD was 10.22 dBm. The actual test data and any correction factors are contained in an exhibit of this report.

**MEASUREMENT UNCERTAINTIES**

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

| Measurement Type    | Frequency Range<br>(MHz) | Calculated Uncertainty<br>(dB) |
|---------------------|--------------------------|--------------------------------|
| Conducted Emissions | 0.15 to 30               | $\pm 2.4$                      |
| Radiated Emissions  | 30 to 1000               | $\pm 3.2$                      |

**EQUIPMENT UNDER TEST (EUT) DETAILS****GENERAL**

The Vocera Communications model Communications Badge is a Voice over 802.11b used for In-building communication. The sample was received on May 29, 2002 and tested on June 19, 2002. The EUT consisted of the following component(s):

| Manufacturer/Model/Description                               | Serial Number |
|--------------------------------------------------------------|---------------|
| Vocera/Communications Badge/In-building communication device | N/A           |

**INPUT POWER**

The EUT input is rated at 3.4Vdc. The EUT contained the following input power components during emissions testing. The EUT is sold with a battery charger, but EUT is can operate while charging:

| Description     | Manufacturer | Model |
|-----------------|--------------|-------|
| Battery Charger | Vocera       | N/A   |

**ENCLOSURE**

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 0.5 cm wide by 0.15 cm deep by 11 cm high.

**EMI SUPPRESSION DEVICES**

EUT did not require any EMI suppression devices to comply with the emissions

**MODIFICATIONS**

The EUT did not require any modifications in order to comply with the emission specifications

**SUPPORT EQUIPMENT**

No local support equipment was used during emissions testing:

No remote support equipment was used during emissions testing:

**EXTERNAL I/O CABLING**

The I/O cabling configuration during emissions testing was as follows:

| Cable Description | Length (m) | From Unit/Port | To Unit/Port  |
|-------------------|------------|----------------|---------------|
| Power Cable       | 1          | DC             | AC/DC adaptor |

**TEST SOFTWARE**

Was programmed to continuously transmit at 11Mbps at maximum output power. The transmitter was set to the low, middle, and high channel.

## **TEST SITE**

### **GENERAL INFORMATION**

Final test measurements were taken on June 19, 2002 at the Elliott Laboratories Open Area Test Site #4 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

### **CONDUCTED EMISSIONS CONSIDERATIONS**

Conducted emissions testing are performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

### **RADIATED EMISSIONS CONSIDERATIONS**

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

---

**MEASUREMENT INSTRUMENTATION****RECEIVER SYSTEM**

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

**INSTRUMENT CONTROL COMPUTER**

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

**LINE IMPEDANCE STABILIZATION NETWORK (LISN)**

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

---

**POWER METER**

A power meter and thermister mount are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

**FILTERS/ATTENUATORS**

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

**ANTENNAS**

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers.

**ANTENNA MAST AND EQUIPMENT TURNTABLE**

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

**INSTRUMENT CALIBRATION**

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

---

**TEST PROCEDURES****EUT AND CABLE PLACEMENT**

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst-case orientation is used for final measurements.

**CONDUCTED EMISSIONS**

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

**RADIATED EMISSIONS**

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

---

**RADIO RADIATED EMISSIONS FROM EUT**

PSD, Power output, 6-dB Occupied Bandwidth were measured using the radiated method. All corrections factors were applied to the measurements. All radiated measurements for PSD and Power output were converted from a dBuV/m to a dBm values using the free-space conversion factor of 95.3 dB. All measurements were performed for the low, middle, and high channel of the EUT. For results please refer to data under the exhibit of this report.

**SPECIFICATION LIMITS AND SAMPLE CALCULATIONS**

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

**CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207**

| Frequency<br>Range<br>(MHz) | Limit<br>(uV) | Limit<br>(dBuV) |
|-----------------------------|---------------|-----------------|
| 0.450 to 30.000             | 250           | 48              |

**RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209**

| Frequency<br>Range<br>(MHz) | Limit<br>(uV/m @ 3m)                | Limit<br>(dBuV/m @ 3m)                            |
|-----------------------------|-------------------------------------|---------------------------------------------------|
| 0.009-0.490                 | $2400/F_{\text{KHz}} @ 300\text{m}$ | $67.6-20*\log_{10}(F_{\text{KHz}}) @ 300\text{m}$ |
| 0.490-1.705                 | $24000/F_{\text{KHz}} @ 30\text{m}$ | $87.6-20*\log_{10}(F_{\text{KHz}}) @ 30\text{m}$  |
| 1.705 to 30                 | 30 @ 30m                            | 29.5 @ 30m                                        |
| 30 to 88                    | 100                                 | 40                                                |
| 88 to 216                   | 150                                 | 43.5                                              |
| 216 to 960                  | 200                                 | 46.0                                              |
| Above 960                   | 500                                 | 54.0                                              |

---

**SAMPLE CALCULATIONS - CONDUCTED EMISSIONS**

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_T - B = C$$

and

$$C - S = M$$

where:

$R_T$  = Receiver Reading in dBuV

B = Broadband Correction Factor\*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

\* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

**SAMPLE CALCULATIONS - RADIATED EMISSIONS**

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$$F_d = \text{Distance Factor in dB}$$

$$D_m = \text{Measurement Distance in meters}$$

$$D_s = \text{Specification Distance in meters}$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_C = R_R + F_d$$

and

$$M = R_C - L_S$$

where:

$$R_R = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_C = \text{Corrected Reading in dBuV/m}$$

$$L_S = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

## ***EXHIBIT 1: Test Equipment Calibration Data***

**Radiated Emissions, 1 - 24000 GHz, 20-Jun-02****Engineer: jmartinez**

| <u>Manufacturer</u> | <u>Description</u>             | <u>Model #</u> | <u>Assett #</u> | <u>Cal interval</u> | <u>Last Calibrated</u> | <u>Cal Due</u> |
|---------------------|--------------------------------|----------------|-----------------|---------------------|------------------------|----------------|
| EMCO                | Horn Antenna, D. Ridge 1-18GHz | 3115           | 868             | 12                  | 3/11/2002              | #####          |
| Miteq               | Pre-amp, 1-18GHz               | AFS44          | 1346            | 12                  | 1/7/2002               | 1/7/2003       |

---

**Radiated Emissions, 1 - 24000 GHz, 20-Jun-02****Engineer: jmartinez**

| <u>Manufacturer</u> | <u>Description</u>              | <u>Model #</u>  | <u>Assett #</u> | <u>Cal interval</u> | <u>Last Calibrated</u> | <u>Cal Due</u> |
|---------------------|---------------------------------|-----------------|-----------------|---------------------|------------------------|----------------|
| Hewlett Packard     | High Pass filter, 3.5GHz        | P/N 84300-80038 | 1157            | 12                  | 3/1/2002               | 3/1/2003       |
| Hewlett Packard     | Spectrum Analyzer, 9KHz - 22GHz | 8593EM          | 1319            | 12                  | 4/5/2002               | 4/5/2003       |
| Hewlett Packard     | Spectrum Analyzer 9kHz - 40 GHz | 8564E (84125C)  | 1393            | 12                  | 2/21/2002              | #####          |

**Conducted and Radiated Emissions, 21-Jun-02****Engineer: Rafael**

| <u>Manufacturer</u>  | <u>Description</u>                              | <u>Model #</u> | <u>Assett #</u> | <u>Cal interval</u> | <u>Last Calibrated</u> | <u>Cal Due</u> |
|----------------------|-------------------------------------------------|----------------|-----------------|---------------------|------------------------|----------------|
| Elliott Laboratories | Biconical Antenna, 30-300 MHz                   | EL30.300       | 54              | 12                  | 1/4/2002               | 1/4/2003       |
| Elliott Laboratories | FCC / CISPR LISN                                | LISN-3, OATS   | 304             | 12                  | 6/5/2002               | 6/5/2003       |
| EMCO                 | Horn Antenna, D. Ridge 1-18GHz                  | 3115           | 1242            | 12                  | 10/9/2001              | 10/9/2002      |
| EMCO                 | Log Periodic Antenna, 0.2-2 GHz                 | 3148           | 1347            | 12                  | 10/16/2001             | 10/16/2002     |
| Filtek               | High Pass Filter, 1GHz                          | HP12/1000-5BA  | 955             | 12                  | 3/12/2002              | 3/12/2003      |
| Hewlett Packard      | EMC Spectrum Analyzer, Opt. 026 ,9 KHz -26.5GHz | 8593EM         | 1141            | 12                  | 3/11/2002              | 3/11/2003      |
| Hewlett Packard      | Microwave Preamplifier, 1-26.5GHz               | 8449B          | 870             | 12                  | 1/15/2002              | 1/15/2003      |
| Rohde & Schwarz      | Test Receiver, 9kHz-2750MHz                     | ESCS 30 EMI    | 1337            | 12                  | 12/26/2001             | 12/26/2002     |

## ***EXHIBIT 2: Test Data Log Sheets***

### **ELECTROMAGNETIC EMISSIONS**

#### **TEST LOG SHEETS**

#### **AND**

#### **MEASUREMENT DATA**

T 47390 16 Pages

T 47702 9 Pages



## EMC Test Data

|                 |                     |               |            |
|-----------------|---------------------|---------------|------------|
| Client:         | Vocera              | Job Number:   | J47369     |
| Model:          | Badge               | T-Log Number: | T47390     |
|                 |                     | Proj Eng:     | David Bare |
| Contact:        | Karl Hannestad      |               |            |
| Emissions Spec: | FCC 15.247; RSS-210 | Class:        | -          |
| Immunity Spec:  | -                   | Environment:  | -          |

## EMC Test Data

For The

**Vocera**

Model

**Badge**



## EMC Test Data

|                 |                     |               |            |
|-----------------|---------------------|---------------|------------|
| Client:         | Vocera              | Job Number:   | J47369     |
| Model:          | Badge               | T-Log Number: | T47390     |
|                 |                     | Proj Eng:     | David Bare |
| Contact:        | Karl Hannestad      |               |            |
| Emissions Spec: | FCC 15.247; RSS-210 | Class:        | -          |
| Immunity Spec:  | -                   | Environment:  | -          |

### EUT INFORMATION

#### General Description

The EUT is a Voice over 802.11b transmitter which is designed for In-building communications. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end user environment. The electrical rating of the EUT is 3.4Vdc.

#### Equipment Under Test

| Manufacturer | Model | Description        | Serial Number | FCC ID |
|--------------|-------|--------------------|---------------|--------|
| Vocera       | Badge | Voice over 802.11b | -             | -      |

#### Other EUT Details

#### Antenna Connector Requirement per 15.203 & RSS-210 (e2)

| Manufacturer | antenna          | Gain (dBi) | - | - |
|--------------|------------------|------------|---|---|
| Vocera       | Permanent attach | -          | - | - |

#### EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 0.5 cm wide by 0.15 cm deep by 11 cm high.

#### Modification History

| Mod. # | Test | Date | Modification |
|--------|------|------|--------------|
| 1      |      |      |              |
| 2      |      |      |              |
| 3      |      |      |              |



## EMC Test Data

|                 |                     |               |            |
|-----------------|---------------------|---------------|------------|
| Client:         | Vocera              | Job Number:   | J47369     |
| Model:          | Badge               | T-Log Number: | T47390     |
|                 |                     | Proj Eng:     | David Bare |
| Contact:        | Karl Hannestad      |               |            |
| Emissions Spec: | FCC 15.247; RSS-210 | Class:        | -          |
| Immunity Spec:  | -                   | Environment:  | -          |

### Test Configuration #1

#### Local Support Equipment

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|-------------|---------------|--------|
| None         |       |             |               |        |

#### Remote Support Equipment

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|-------------|---------------|--------|
| None         |       |             |               |        |

#### Interface Ports

| Port | Connected To | Cable(s)    |                        |           |
|------|--------------|-------------|------------------------|-----------|
|      |              | Description | Shielded or Unshielded | Length(m) |
| None |              |             |                        |           |

#### EUT Operation During Emissions

Was programmed to continuously transmit at 11Mbps at maximum output power. The transmitter was set to the low, middle, and high channel.



## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
|                           | Proj Eng: David Bare |
| Contact: Karl Hannestad   |                      |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Radiated Emissions

#### Test Specifics

Objective: The objective of this test session is to perform Final Qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/19/2002

Test Engineer: jmartinez

Test Location: SVOATS #4

Config. Used: 1

Config Change: None

EUT Voltage: 3.4 Vdc

#### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT. All measurements were by radiated method. The antenna of transmitter is permanently attach.

#### Ambient Conditions:

Temperature: 15°C

Rel. Humidity: 56%

#### Summary of Results

| Run # | Test Performed                             | Limit                                  | Result | Margin                    |
|-------|--------------------------------------------|----------------------------------------|--------|---------------------------|
| 1a    | RE, 30 - 24000 MHz -<br>Spurious Emissions | 15.209 / 15.247( c ) &<br>RSS-210 (e1) | Pass   | -12.7dB @<br>16884.01MHz  |
| 1b    | RE, 30 - 24000 MHz -<br>Spurious Emissions | 15.209 / 15.247( c ) &<br>RSS-210 (e1) | Pass   | -12.8dB @<br>17059.32MHz  |
| 1c    | RE, 30 - 24000 MHz -<br>Spurious Emissions | 15.209 / 15.247( c ) &<br>RSS-210 (e1) | Pass   | -11.4dB @<br>17232.881MHz |
| 2     | 6dB Bandwidth                              | 15.247(a)                              | Pass   | Refer to run              |
| 3     | Output Power                               | 15.247(b) & RSS-210<br>(b)             | Pass   | Refer to run              |
| 4     | Power Spectral Density (PSD)               | 15.247(d) & RSS-210<br>(b)             | Pass   | Refer to run              |
| 5     | Bandedge Measurements                      | 15.209 / 15.247( c ) &<br>RSS-210 (e1) | Pass   | -8 dB @ 2412 MHz          |

#### Modifications Made During Testing:

No modifications were made to the EUT during testing

#### Deviations From The Standard

No deviations were made from the requirements of the standard.



## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
|                           | Proj Eng: David Bare |
| Contact: Karl Hannestad   |                      |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Run #1a: Radiated Spurious Emissions, 30-2483.5 MHz. Low Channel @ 2412 MHz

| Frequency | Level        | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments |
|-----------|--------------|-----|-----------------|--------|-----------|---------|--------|----------|
| MHz       | dB $\mu$ V/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |          |
| 16884.01  | 41.3         | V   | 54.0            | -12.7  | Avg       | 0       | 1.1    | Note 2   |
| 16883.63  | 41.2         | H   | 54.0            | -12.8  | Avg       | 341     | 1.3    | Note 2   |
| 14471.11  | 40.2         | H   | 54.0            | -13.8  | Avg       | 2       | 1.3    | Note 2   |
| 14471.60  | 39.7         | V   | 54.0            | -14.3  | Avg       | 0       | 1.1    | Note 2   |
| 12059.46  | 38.5         | V   | 54.0            | -15.5  | Avg       | 0       | 1.1    | Note 2   |
| 12060.39  | 38.4         | H   | 54.0            | -15.6  | Avg       | 0       | 1.3    | Note 2   |
| 9647.082  | 36.6         | V   | 54.0            | -17.4  | Avg       | 348     | 1.1    | Note 2   |
| 9648.039  | 36.6         | H   | 54.0            | -17.4  | Avg       | 3       | 1.3    | Note 2   |
| 7235.528  | 35.9         | V   | 54.0            | -18.1  | Avg       | 345     | 1.1    |          |
| 7236.343  | 35.9         | H   | 54.0            | -18.1  | Avg       | 358     | 1.3    |          |
| 16884.23  | 53.5         | V   | 74.0            | -20.5  | Pk        | 0       | 1.1    | Note 2   |
| 16883.70  | 53.4         | H   | 74.0            | -20.6  | Pk        | 341     | 1.3    | Note 2   |
| 14472.73  | 52.2         | H   | 74.0            | -21.8  | Pk        | 2       | 1.3    | Note 2   |
| 14472.24  | 52.0         | V   | 74.0            | -22.0  | Pk        | 0       | 1.1    | Note 2   |
| 4823.045  | 31.4         | H   | 54.0            | -22.6  | Avg       | 0       | 1.3    |          |
| 12059.57  | 51.2         | V   | 74.0            | -22.8  | Pk        | 0       | 1.1    | Note 2   |
| 12060.65  | 51.1         | H   | 74.0            | -22.9  | Pk        | 0       | 1.3    | Note 2   |
| 4824.061  | 30.7         | V   | 54.0            | -23.3  | Avg       | 0       | 1.1    |          |
| 9647.321  | 49.0         | V   | 74.0            | -25.0  | Pk        | 348     | 1.1    | Note 2   |
| 9647.809  | 48.7         | H   | 74.0            | -25.3  | Pk        | 3       | 1.3    | Note 2   |
| 7235.721  | 48.1         | V   | 74.0            | -25.9  | Pk        | 345     | 1.1    |          |
| 7236.386  | 48.0         | H   | 74.0            | -26.0  | Pk        | 358     | 1.3    |          |
| 4823.664  | 43.8         | H   | 74.0            | -30.2  | Pk        | 0       | 1.3    |          |
| 4824.078  | 43.4         | V   | 74.0            | -30.6  | Pk        | 0       | 1.1    |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

Note 2: No harmonic emissions detected after the third harmonic. Readings are noise floor measurements.



## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
| Contact: Karl Hannestad   | Proj Eng: David Bare |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Run #1b: Radiated Spurious Emissions, 30-2483.5 MHz. Center Channel @ 2437 MHz

| Frequency | Level  | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments |
|-----------|--------|-----|-----------------|--------|-----------|---------|--------|----------|
| MHz       | dBµV/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |          |
| 17059.32  | 41.2   | V   | 54.0            | -12.8  | Avg       | 0       | 1.0    | Note 2   |
| 17058.97  | 41.1   | H   | 54.0            | -12.9  | Avg       | 0       | 1.3    | Note 2   |
| 14621.18  | 41.0   | H   | 54.0            | -13.0  | Avg       | 0       | 1.3    | Note 2   |
| 14621.04  | 40.9   | V   | 54.0            | -13.1  | Avg       | 0       | 1.0    | Note 2   |
| 9747.913  | 39.1   | H   | 54.0            | -14.9  | Avg       | 0       | 1.3    | Note 2   |
| 12184.36  | 38.2   | V   | 54.0            | -15.8  | Avg       | 0       | 1.0    | Note 2   |
| 12185.56  | 37.8   | H   | 54.0            | -16.2  | Avg       | 0       | 1.3    | Note 2   |
| 7310.275  | 36.6   | H   | 54.0            | -17.4  | Avg       | 325     | 1.3    |          |
| 9748.251  | 36.4   | V   | 54.0            | -17.6  | Avg       | 360     | 1.0    | Note 2   |
| 7310.854  | 36.1   | V   | 54.0            | -17.9  | Avg       | 0       | 1.0    |          |
| 17058.71  | 53.9   | V   | 74.0            | -20.1  | Pk        | 0       | 1.0    | Note 2   |
| 17058.94  | 53.5   | H   | 74.0            | -20.5  | Pk        | 0       | 1.3    | Note 2   |
| 14621.80  | 53.3   | H   | 74.0            | -20.7  | Pk        | 0       | 1.3    | Note 2   |
| 14621.96  | 53.0   | V   | 74.0            | -21.0  | Pk        | 0       | 1.0    | Note 2   |
| 4873.417  | 31.2   | H   | 54.0            | -22.8  | Avg       | 2       | 1.3    |          |
| 4874.053  | 30.9   | V   | 54.0            | -23.1  | Avg       | 352     | 1.0    |          |
| 12184.55  | 50.9   | V   | 74.0            | -23.1  | Pk        | 0       | 1.0    | Note 2   |
| 12185.72  | 50.9   | H   | 74.0            | -23.1  | Pk        | 0       | 1.3    | Note 2   |
| 9748.002  | 50.3   | H   | 74.0            | -23.7  | Pk        | 0       | 1.3    | Note 2   |
| 7310.930  | 49.3   | V   | 74.0            | -24.7  | Pk        | 0       | 1.0    |          |
| 9748.540  | 49.3   | V   | 74.0            | -24.7  | Pk        | 360     | 1.0    | Note 2   |
| 7311.537  | 48.7   | H   | 74.0            | -25.3  | Pk        | 325     | 1.3    |          |
| 4874.521  | 44.1   | H   | 74.0            | -29.9  | Pk        | 2       | 1.3    |          |
| 4875.002  | 43.9   | V   | 74.0            | -30.1  | Pk        | 352     | 1.0    |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

Note 2: No harmonic emissions detected after the third harmonic. Readings are noise floor measurements.



## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
| Contact: Karl Hannestad   | Proj Eng: David Bare |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Run #1c: Radiated Spurious Emissions, 30-2483.5 MHz. High Channel @ 2462 MHz

| Frequency | Level  | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments |
|-----------|--------|-----|-----------------|--------|-----------|---------|--------|----------|
| MHz       | dBμV/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |          |
| 17232.88  | 42.6   | H   | 54.0            | -11.4  | Avg       | 0       | 1.2    | Note 2   |
| 17232.92  | 42.5   | V   | 54.0            | -11.5  | Avg       | 0       | 1.1    | Note 2   |
| 14772.03  | 41.6   | H   | 54.0            | -12.4  | Avg       | 360     | 1.2    | Note 2   |
| 14770.74  | 41.4   | V   | 54.0            | -12.6  | Avg       | 0       | 1.1    | Note 2   |
| 12309.29  | 38.2   | V   | 54.0            | -15.8  | Avg       | 0       | 1.1    | Note 2   |
| 12309.44  | 38.2   | H   | 54.0            | -15.8  | Avg       | 0       | 1.2    | Note 2   |
| 9847.149  | 36.1   | V   | 54.0            | -17.9  | Avg       | 341     | 1.1    | Note 2   |
| 7384.579  | 35.7   | V   | 54.0            | -18.3  | Avg       | 5       | 1.1    |          |
| 7386.211  | 35.4   | H   | 54.0            | -18.6  | Avg       | 358     | 1.2    |          |
| 17233.62  | 55.2   | H   | 74.0            | -18.8  | Pk        | 0       | 1.2    | Note 2   |
| 17232.97  | 54.9   | V   | 74.0            | -19.1  | Pk        | 0       | 1.1    | Note 2   |
| 14771.10  | 54.5   | H   | 74.0            | -19.5  | Pk        | 360     | 1.2    | Note 2   |
| 14772.17  | 53.4   | V   | 74.0            | -20.6  | Pk        | 0       | 1.1    | Note 2   |
| 4923.211  | 31.2   | V   | 54.0            | -22.8  | Avg       | 352     | 1.1    |          |
| 4923.885  | 30.8   | H   | 54.0            | -23.2  | Avg       | 0       | 1.2    |          |
| 12309.64  | 50.3   | H   | 74.0            | -23.7  | Pk        | 0       | 1.2    | Note 2   |
| 12308.83  | 50.2   | V   | 74.0            | -23.8  | Pk        | 0       | 1.1    | Note 2   |
| 7386.142  | 48.8   | H   | 74.0            | -25.2  | Pk        | 358     | 1.2    |          |
| 9847.039  | 48.5   | V   | 74.0            | -25.5  | Pk        | 341     | 1.1    | Note 2   |
| 7386.097  | 47.5   | V   | 74.0            | -26.5  | Pk        | 5       | 1.1    |          |
| 4924.109  | 43.4   | V   | 74.0            | -30.6  | Pk        | 352     | 1.1    |          |
| 4923.247  | 43.0   | H   | 74.0            | -31.0  | Pk        | 0       | 1.2    |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

Note 2: No harmonic emissions detected after the third harmonic. Readings are noise floor measurements.

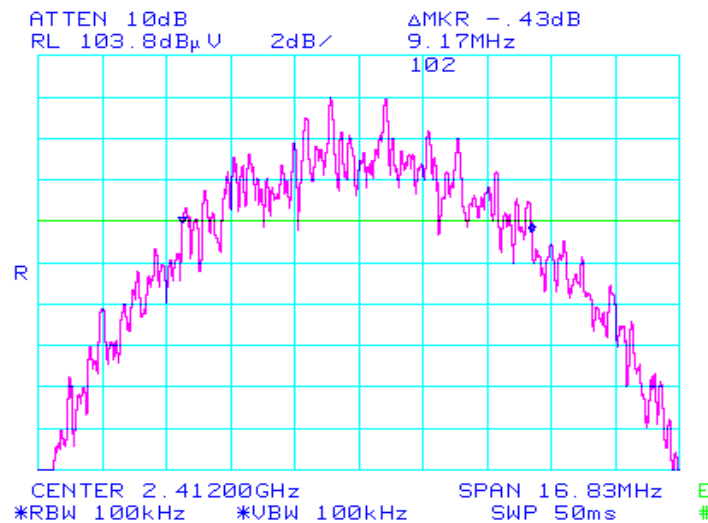


## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
|                           | Proj Eng: David Bare |
| Contact: Karl Hannestad   |                      |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Run #2: Signal Bandwidth

| Channel | Frequency (MHz) | Resolution Bandwidth | 6dB Signal Bandwidth | Graph reference # |
|---------|-----------------|----------------------|----------------------|-------------------|
| Low     | 2412            | 100 kHz              | 9.17 MHz             | 102               |
| Mid     | 2437            | 100 kHz              | 9.13 MHz             | 101               |
| High    | 2462            | 100 kHz              | 9.15 MHz             | 103               |





## EMC Test Data

Client: Vocera

Job Number: J47369

Model: Badge

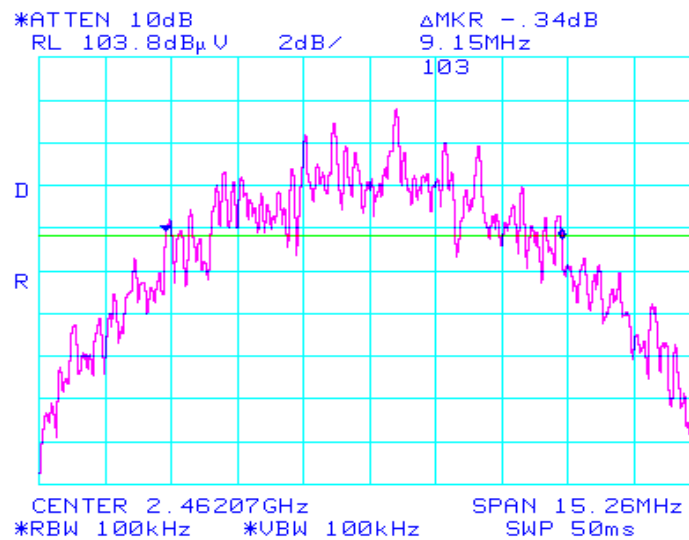
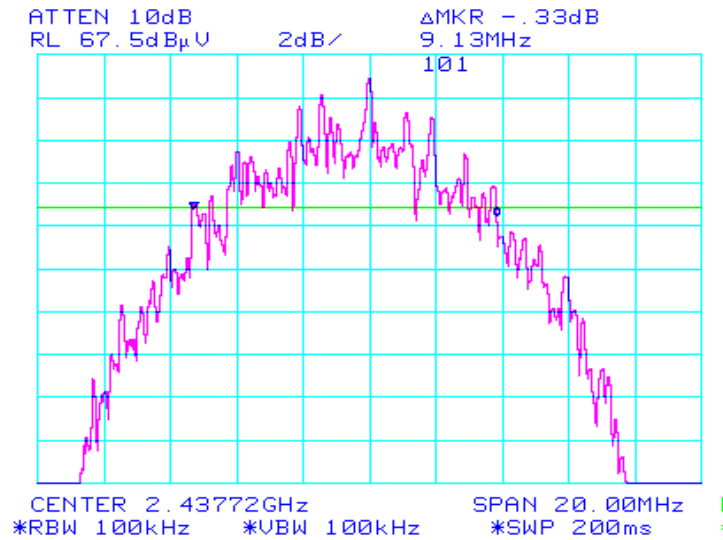
T-Log Number: T47390

Contact: Karl Hannestad

Proj Eng: David Bare

Spec: FCC 15.247; RSS-210

Class: N/A





## EMC Test Data

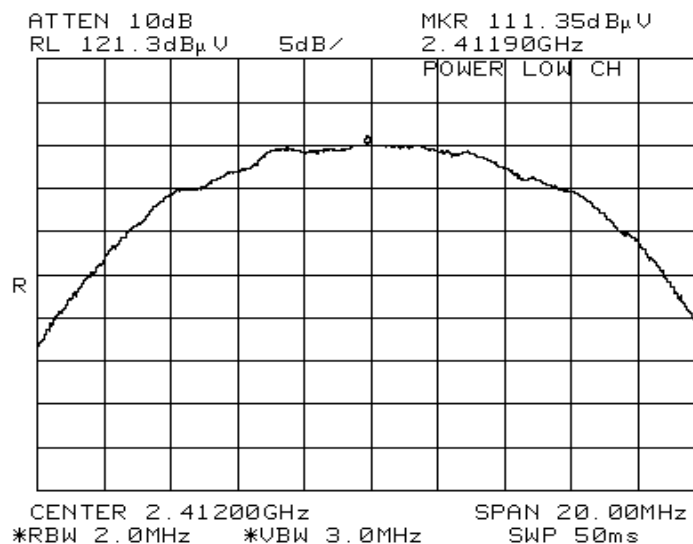
|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
|                           | Proj Eng: David Bare |
| Contact: Karl Hannestad   |                      |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Run #3: Output Power

| Channel | Frequency (MHz) | Field Strength at 3m | Antenna Pol. (H/V) | Res BW | Output Power |
|---------|-----------------|----------------------|--------------------|--------|--------------|
| Low     | 2412            | 102                  | H                  | 2 MHz  | 6.7          |
| Mid     | 2437            | 104                  | H                  | 2 MHz  | 8.7          |
| High    | 2462            | 106.2                | H                  | 2 MHz  | 10.9         |
| Low     | 2412            | 111.4                | V                  | 2 MHz  | 16.1         |
| Mid     | 2437            | 109.4                | V                  | 2 MHz  | 14.1         |
| High    | 2462            | 110.4                | V                  | 2 MHz  | 15.1         |

Note 1: 95.3 dB conversion factor sample formula included on a separate document label "free space conversion"

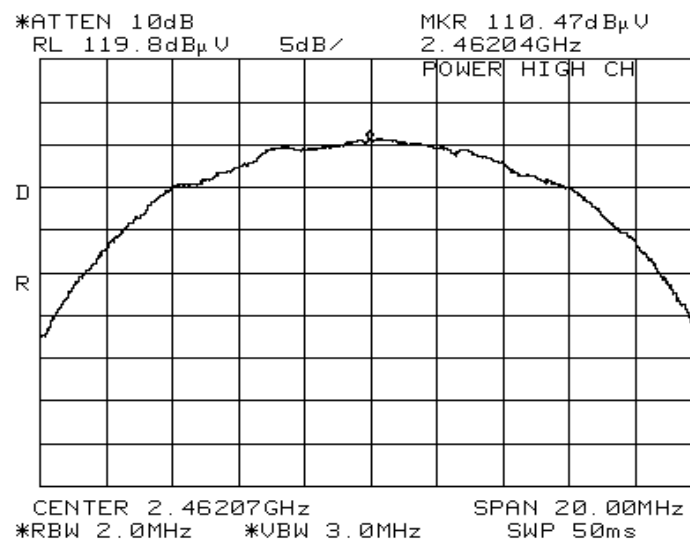
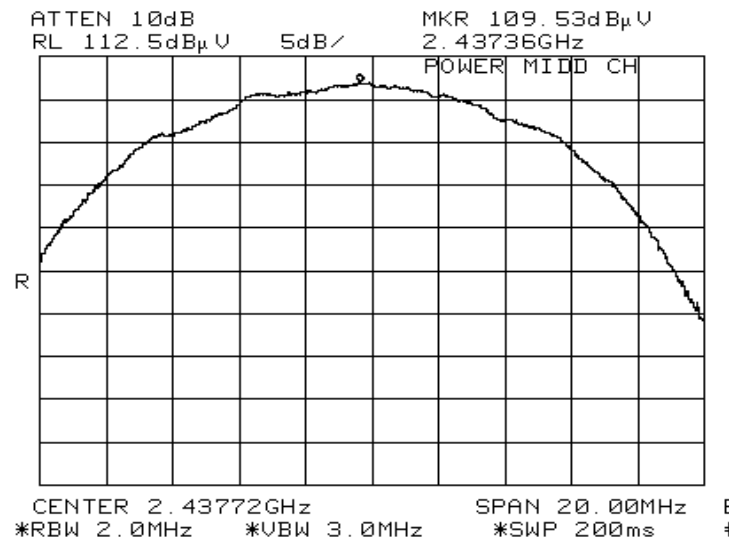
Note 2: Plots have the correction factor included. Readings in dBuV are actually in dBuV/m after correction factor applied.





## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
| Contact: Karl Hannestad   | Proj Eng: David Bare |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |





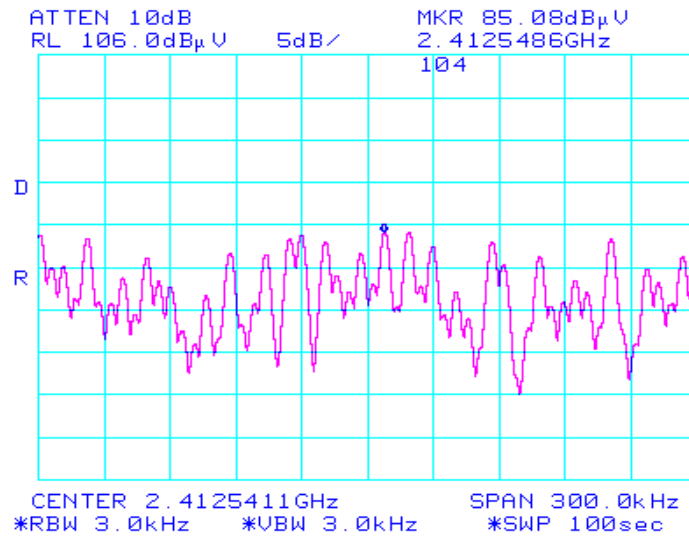
## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
| Contact: Karl Hannestad   | Proj Eng: David Bare |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Run #4: Power Spectral Density

| Channel | Frequency | Res BW | P.S.D. (averaged over 1 second in a 3kHz bandwidth) | Graph reference # |
|---------|-----------|--------|-----------------------------------------------------|-------------------|
|         | (MHz)     | (kHz)  | (dBm)                                               |                   |
| Low     | 2412      | 3      | -10.19                                              | 104               |
| Mid     | 2437      | 3      | -11.35                                              | 105               |
| High    | 2462      | 3      | -10.52                                              | 106               |

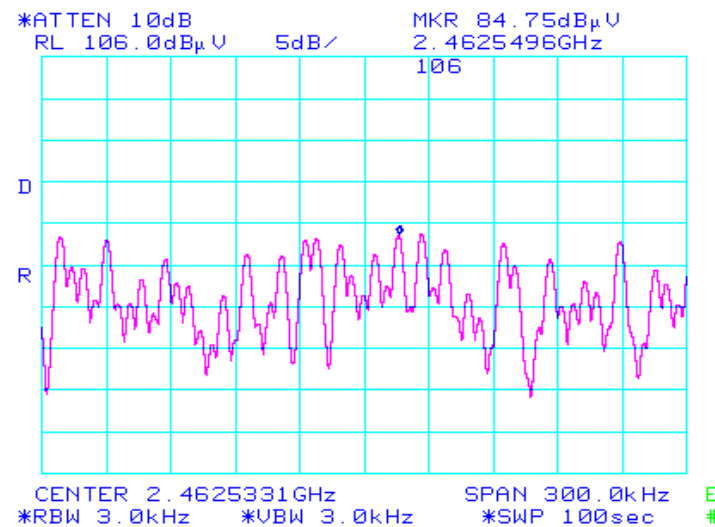
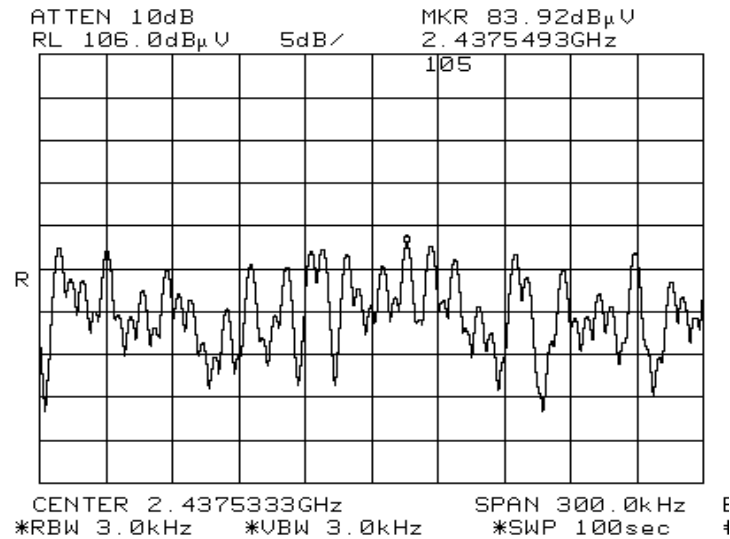
Note 1: Plots have the correction factor included. Field strength was converted to dBm by subtracting the measured value by 95.3 dB (measured value in dBuV/m - 95.3 dB). The Antenna and cable loss are the correction factor.





## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
| Contact: Karl Hannestad   | Proj Eng: David Bare |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |





## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
| Contact: Karl Hannestad   | Proj Eng: David Bare |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Run# 5: Bandedge measurements

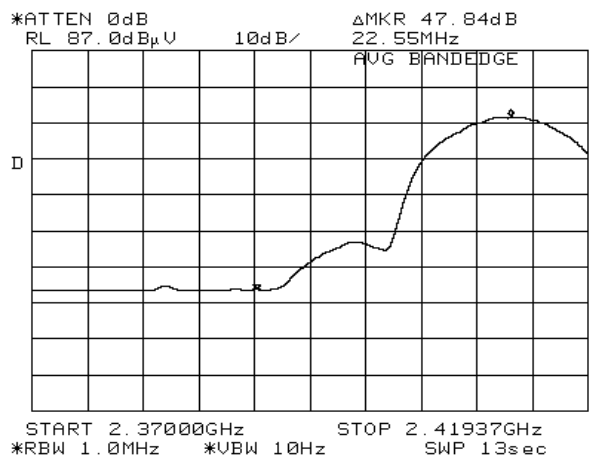
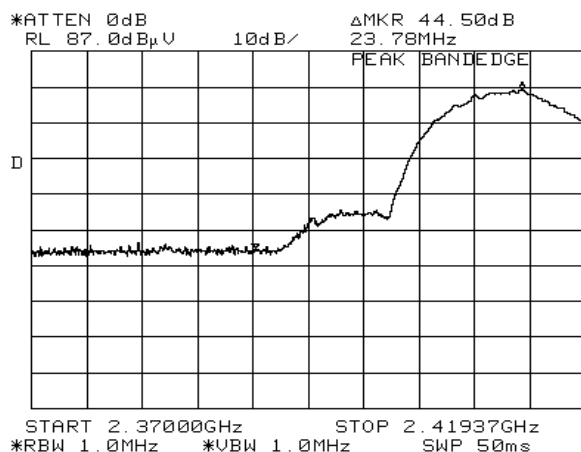
#### Band Edge Measurements:

For signals in the restricted bands immediately above and below the 2.39 to 2.4835 GHz allocated band a measurement was made of the amplitude of the spurious emissions with respect to the intentional signals. The relative amplitude, in dBc, was then applied to the average and peak field strength of the intentional signal made on the OATS to calculate the field strength of the unintentional signals.

#### Plots Showing Out-Of-Band Emissions (Peak RBW=VBW=1MHz; Average RBW = 1MHz, VBW = 10Hz)

##### 2.39 GHz band edge, EUT operating on the lowest channel 1

The highest signal in the 2.39 GHz band was -44.5 dBc (Peak) / -47.84 dBc (Average)





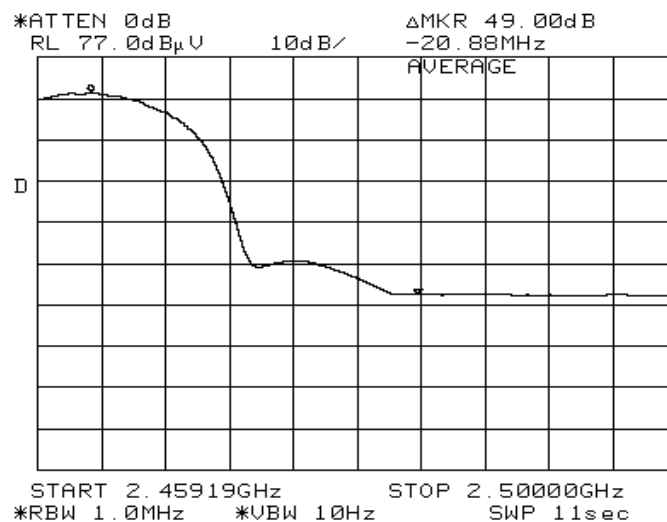
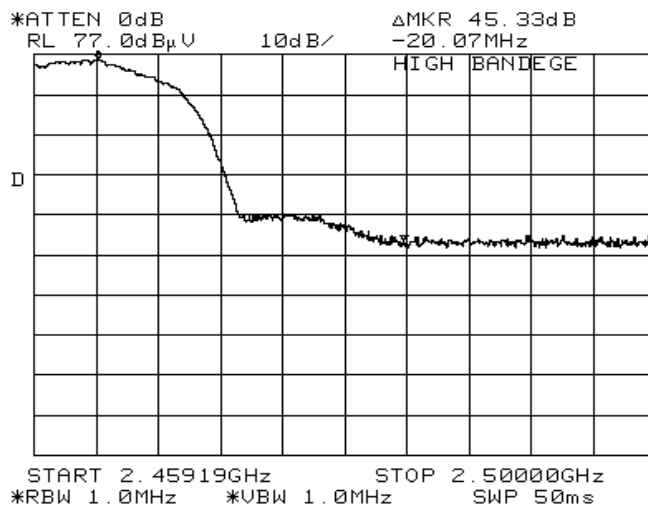
## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
| Contact: Karl Hannestad   | Proj Eng: David Bare |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### 2.4835 GHz band edge EUT operating on channel 11 (highest channel):

The highest signal in the 2.4835 GHz band was -45.33 dBc (Peak) / -49.0 dBc (Average)

Peak Bandedge Plot





## EMC Test Data

|                           |                      |
|---------------------------|----------------------|
| Client: Vocera            | Job Number: J47369   |
| Model: Badge              | T-Log Number: T47390 |
| Contact: Karl Hannestad   | Proj Eng: David Bare |
| Spec: FCC 15.247; RSS-210 | Class: N/A           |

### Fundamental signal measurements (to calculate the band edge field strengths):

| Frequency | Level        | Pol | 15.209 / 15.407 |        | Detector  | Azimuth | Height | Comments               |
|-----------|--------------|-----|-----------------|--------|-----------|---------|--------|------------------------|
| MHz       | dB $\mu$ V/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |                        |
| 2410.766  | 107.2        | V   | -               | -      | Pk        | 240     | 1.4    | RBW = VBW = 1 MHz      |
| 2411.017  | 101.0        | V   | -               | -      | Avg       | 240     | 1.4    | RBW = 1MHz, VBW = 10Hz |
| 2413.292  | 103.8        | H   | -               | -      | Pk        | 260     | 1.9    | RBW = VBW = 1 MHz      |
| 2412.766  | 96.9         | H   | -               | -      | Avg       | 260     | 1.9    | RBW = 1MHz, VBW = 10Hz |
| 2463.247  | 108.0        | V   | -               | -      | Pk        | 248     | 1.1    | RBW = VBW = 1 MHz      |
| 2462.786  | 101.2        | V   | -               | -      | Avg       | 248     | 1.1    | RBW = 1MHz, VBW = 10Hz |
| 2463.260  | 99.4         | H   | -               | -      | Pk        | 203     | 1.9    | RBW = VBW = 1 MHz      |
| 2462.802  | 92.4         | H   | -               | -      | Avg       | 203     | 1.9    | RBW = 1MHz, VBW = 10Hz |

### Band Edge Field Strength Calculations

| Frequency | Level        | Pol | 15.209 / 15.407 |        | Detector  | Azimuth | Height | Comments |
|-----------|--------------|-----|-----------------|--------|-----------|---------|--------|----------|
| MHz       | dB $\mu$ V/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |          |
| 2412.0    | 62.7         | v   | 74.0            | -11.3  | Pk        |         |        | Note 1   |
| 2412.0    | 53.2         | v   | 54.0            | -0.8   | Avg       |         |        | Note 1   |
| 2412.0    | 59.3         | h   | 74.0            | -14.7  | Pk        |         |        | Note 1   |
| 2412.0    | 49.1         | h   | 54.0            | -4.9   | Avg       |         |        | Note 1   |
| 2483.5    | 62.7         | v   | 74.0            | -11.3  | Pk        |         |        | Note 2   |
| 2483.5    | 52.2         | v   | 54.0            | -1.8   | Avg       |         |        | Note 2   |
| 2483.5    | 54.1         | v   | 74.0            | -19.9  | Pk        |         |        | Note 2   |
| 2483.5    | 43.4         | v   | 54.0            | -10.6  | Avg       |         |        | Note 2   |

Note 1: EUT operating on the lowest channel available. Signal level calculated using the relative measurements in run #5 (-44.5 dBc for peak and -47.84 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.

Note 2: EUT operating on highest channel available. Signal level calculated using the relative measurements in run #5 (-45.33 dBc for peak and -49.0 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.



## EMC Test Data

|                 |                |               |        |
|-----------------|----------------|---------------|--------|
| Client:         | Vocera         | Job Number:   | J47369 |
| Model:          | Badge          | T-Log Number: | T47702 |
|                 |                | Proj Eng:     |        |
| Contact:        | Karl Hannestad |               |        |
| Emissions Spec: | FCC part 15    | Class:        | B      |
| Immunity Spec:  | N/A            | Environment:  | N/A    |

## EMC Test Data

For The

**Vocera**

Model

**Badge**



## EMC Test Data

|                 |                |               |        |
|-----------------|----------------|---------------|--------|
| Client:         | Vocera         | Job Number:   | J47369 |
| Model:          | Badge          | T-Log Number: | T47702 |
|                 |                | Proj Eng:     |        |
| Contact:        | Karl Hannestad |               |        |
| Emissions Spec: | FCC part 15    | Class:        | B      |
| Immunity Spec:  | N/A            | Environment:  | N/A    |

### EUT INFORMATION

#### General Description

The EUT is a Voice over 802.11b transmitter which is designed for In-building communications. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end user environment. The electrical rating of the EUT is 3.4Vdc.

#### Equipment Under Test

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|-------------|---------------|--------|
| Vocera       | Badge | Transmitter | -             | -      |

#### EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 0.5 cm wide by 0.15 cm deep by 11 cm high.

#### Modification History

| Mod. # | Test | Date | Modificaion |
|--------|------|------|-------------|
| 1      | -    | -    | None        |



## EMC Test Data

|                 |                |               |        |
|-----------------|----------------|---------------|--------|
| Client:         | Vocera         | Job Number:   | J47369 |
| Model:          | Badge          | T-Log Number: | T47702 |
|                 |                | Proj Eng:     |        |
| Contact:        | Karl Hannestad |               |        |
| Emissions Spec: | FCC part 15    | Class:        | B      |
| Immunity Spec:  | N/A            | Environment:  | N/A    |

### Test Configuration #1

#### Local Support Equipment

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|-------------|---------------|--------|
| None         |       |             |               |        |

#### Remote Support Equipment

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|-------------|---------------|--------|
| None         |       |             |               |        |

#### Cradle Interface Port

| EUT Port | Connected To  | Cable(s)    |                        |           |
|----------|---------------|-------------|------------------------|-----------|
|          |               | Description | Shielded or Unshielded | Length(m) |
| DC       | AC/DC Adaptor | Power cable | Unshielded             | 1         |

#### EUT Operation During Emissions

The EUT was in the Transmit Mode during testing for 30-1000MHz and Stand-By Mode for 1-2.7GHz.



## EMC Test Data

|                         |                                |
|-------------------------|--------------------------------|
| Client: Vocera          | Job Number: J47369             |
| Model: Badge            | T-Log Number: T47702           |
|                         | Proj Eng: Enter on cover sheet |
| Contact: Karl Hannestad |                                |
| Spec: FCC part 15       | Class: B                       |

### Conducted Emissions - Power Ports

#### Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/21/2002  
Test Engineer: Rafael  
Test Location: SVOATS #1

Config. Used: 1  
Config Change: None  
EUT Voltage: Battery

#### General Test Configuration

For tabletop equipment, the EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment.

**Ambient Conditions:** Temperature: 14.4°C  
Rel. Humidity: 78%

#### Summary of Results

| Run # | Test Performed         | Limit      | Result | Margin           |
|-------|------------------------|------------|--------|------------------|
| 1     | CE, AC Power 120V/60Hz | FCC 15.207 | Pass   | -13.3dB @ .66MHz |

#### Modifications Made During Testing:

No modifications were made to the EUT during testing

#### Deviations From The Standard

No deviations were made from the requirements of the standard.



## EMC Test Data

|                         |                                |
|-------------------------|--------------------------------|
| Client: Vocera          | Job Number: J47369             |
| Model: Badge            | T-Log Number: T47702           |
|                         | Proj Eng: Enter on cover sheet |
| Contact: Karl Hannestad |                                |
| Spec: FCC part 15       | Class: B                       |

### Run #1: AC Power Port Conducted Emissions, 0.45 - 30MHz, 120V/60Hz

EUT placed on cradle

| Frequency | Level | AC   | FCC 15.207 |        | Detector | Comments |
|-----------|-------|------|------------|--------|----------|----------|
| MHz       | dBμV  | Line | Limit      | Margin | QP/Ave   |          |
| 0.660     | 34.7  | N    | 48.0       | -13.3  | QP       |          |
| 0.460     | 33.6  | N    | 48.0       | -14.4  | QP       |          |
| 0.610     | 31.5  | L    | 48.0       | -16.5  | QP       |          |
| 0.850     | 30.1  | N    | 48.0       | -17.9  | QP       |          |
| 0.470     | 28.2  | L    | 48.0       | -19.8  | QP       |          |
| 0.770     | 26.8  | L    | 48.0       | -21.2  | QP       |          |



## EMC Test Data

|                         |                                |
|-------------------------|--------------------------------|
| Client: Vocera          | Job Number: J47369             |
| Model: Badge            | T-Log Number: T47702           |
|                         | Proj Eng: Enter on cover sheet |
| Contact: Karl Hannestad |                                |
| Spec: FCC part 15       | Class: B                       |

### Radiated Emissions

#### Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/21/2002

Test Engineer: Rafael

Test Location: SVOATS #1

Config. Used: 1

Config Change: None

EUT Voltage: Battery

#### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 2.7 GHz.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

#### Ambient Conditions:

Temperature: 14.4°C

Rel. Humidity: 78%

#### Summary of Results

| Run # | Test Performed                          | Limit | Result | Margin                |
|-------|-----------------------------------------|-------|--------|-----------------------|
| 2     | RE, 30 - 1000MHz - Maximized Emissions  | FCC B | Pass   | -13.8dB @ 43.98MHz    |
| 3     | RE, 1000 - 2700 MHz Maximized Emissions | FCC B | Pass   | No emissions detected |

#### Modifications Made During Testing:

No modifications were made to the EUT during testing



## EMC Test Data

|                         |                                |
|-------------------------|--------------------------------|
| Client: Vocera          | Job Number: J47369             |
| Model: Badge            | T-Log Number: T47702           |
|                         | Proj Eng: Enter on cover sheet |
| Contact: Karl Hannestad |                                |
| Spec: FCC part 15       | Class: B                       |

### Deviations From The Standard

No deviations were made from the requirements of the standard.

### Run #1: Preliminary Radiated Emissions, 30-1000 MHz

Transmit Mode, EUT placed on cradle

| Frequency | Level        | Pol | FCC B |        | Detector  | Azimuth | Height | Comments |
|-----------|--------------|-----|-------|--------|-----------|---------|--------|----------|
| MHz       | dB $\mu$ V/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters |          |
| 43.980    | 26.2         | v   | 40.0  | -13.8  | QP        | 15      | 1.0    |          |
| 35.970    | 26.1         | v   | 40.0  | -13.9  | QP        | 300     | 1.0    |          |
| 47.980    | 25.6         | v   | 40.0  | -14.4  | QP        | 100     | 1.0    |          |
| 39.957    | 24.9         | v   | 40.0  | -15.1  | QP        | 315     | 1.0    |          |
| 43.970    | 24.8         | v   | 40.0  | -15.2  | QP        | 0       | 1.0    |          |
| 43.980    | 22.9         | h   | 40.0  | -17.1  | QP        | 185     | 1.8    |          |
| 39.957    | 22.4         | h   | 40.0  | -17.6  | QP        | 360     | 2.1    |          |
| 196.000   | 25.4         | v   | 43.5  | -18.1  | QP        | 325     | 1.0    |          |
| 31.960    | 21.4         | v   | 40.0  | -18.6  | QP        | 0       | 1.0    |          |
| 35.970    | 21.1         | h   | 40.0  | -18.9  | QP        | 0       | 1.5    |          |
| 245.000   | 25.9         | h   | 46.0  | -20.1  | QP        | 360     | 1.7    |          |
| 196.000   | 23.4         | h   | 43.5  | -20.1  | QP        | 300     | 1.6    |          |
| 245.000   | 23.6         | v   | 46.0  | -22.4  | QP        | 25      | 1.0    |          |

### Run #2: Maximized Readings From Run #1

Transmit Mode, EUT placed on cradle

| Frequency | Level        | Pol | FCC B |        | Detector  | Azimuth | Height | Comments |
|-----------|--------------|-----|-------|--------|-----------|---------|--------|----------|
| MHz       | dB $\mu$ V/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters |          |
| 43.980    | 26.2         | v   | 40.0  | -13.8  | QP        | 25      | 1.0    |          |
| 35.970    | 26.1         | v   | 40.0  | -13.9  | QP        | 300     | 1.0    |          |
| 47.980    | 25.6         | v   | 40.0  | -14.4  | QP        | 90      | 1.0    |          |
| 39.957    | 24.9         | v   | 40.0  | -15.1  | QP        | 300     | 1.0    |          |
| 43.970    | 24.8         | v   | 40.0  | -15.2  | QP        | 0       | 1.0    |          |
| 43.980    | 22.9         | h   | 40.0  | -17.1  | QP        | 185     | 1.8    |          |

### Run #3: Maximized readings, 1000 - 2700 MHz

Measurements made at 3m per FCC requirements.

Tested the EUT in the Stand-By Mode, no significant frequencies were observed.

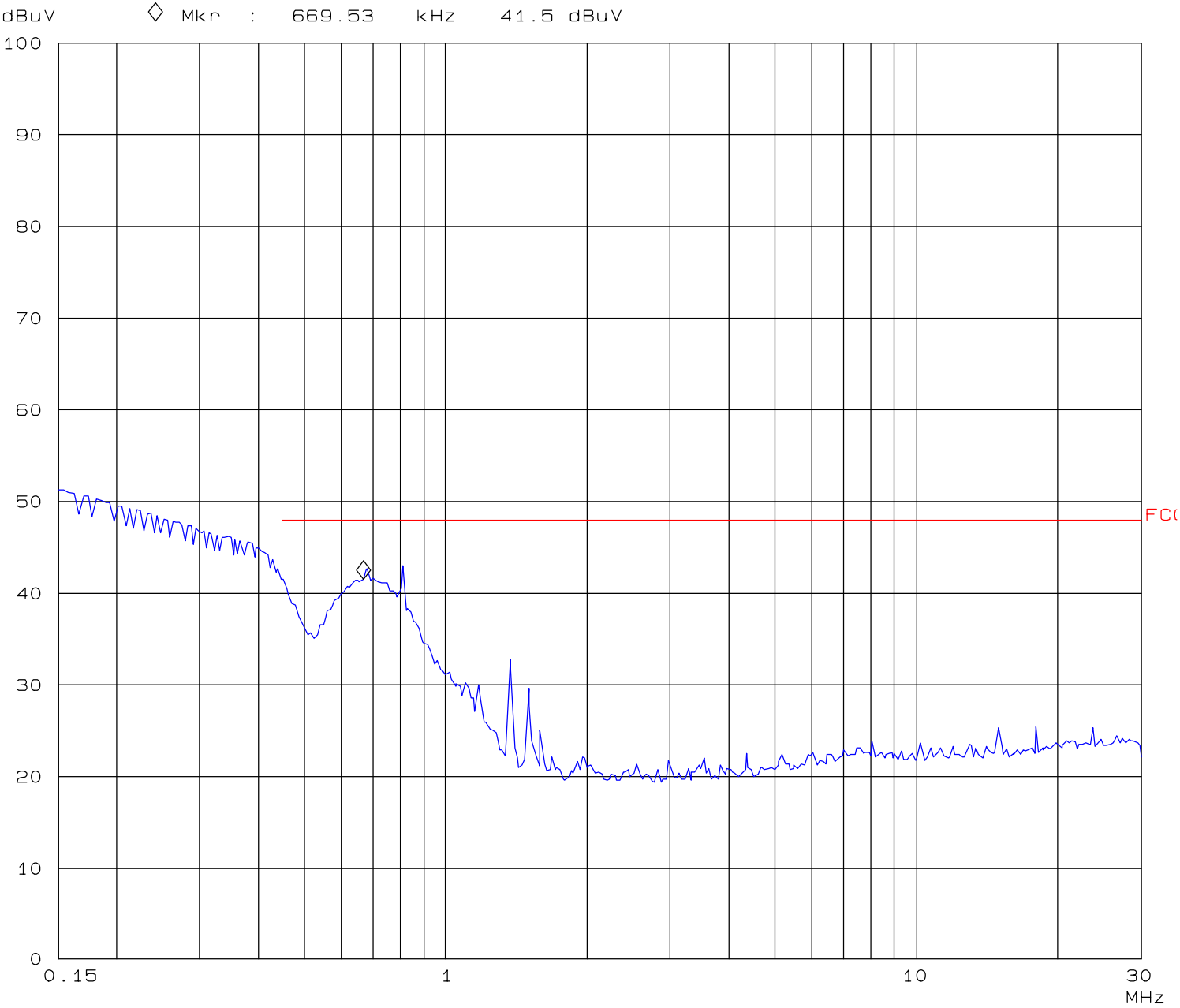
EUT placed on cradle

# Elliott Laboratories

## Conducted Emissions

21. Jun 02 23:51

EUT: Commbagde  
Manuf: Vocera  
Op Cond: 120V/60Hz  
Operator: Rafael Varelas  
Test Spec: FCC B  
Comment: J47369 / T47702  
Run 1 Neutral



# Elliott Laboratories

## Conducted Emissions

21. Jun 02 23:46

EUT: Commbagde  
Manuf: Vocera  
Op Cond: 120V/60Hz  
Operator: Rafael Varelas  
Test Spec: FCC B  
Comment: J47369 / T47702  
Run 1 Line

