



**FCC CFR47 PART 90 PRIVATE LAND MOBIL RADIO SERVICES**

**TEST REPORT**

**FOR**

**BIDIRECTIONAL AMPLIFIER**

**MODEL: BDA800**

**FCC ID: OLDBDA800**

**REPORT NUMBER: 99U0269**

**ISSUE DATE: 06/02/1999**

,  
*Prepared for*  
**J RANDALL CO.**  
**1853 NORTH BISSELL 1<sup>ST</sup> FLOOR**  
**CHICAGO, IL 60614-5012**

*Prepared by*  
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**TABLE OF CONTENTS** **PAGE**

|  |    |
|--|----|
| 1. FCC PART 2, SUBPART J INFORMATION.....                  | 1  |
| 2. PRODUCT DESCRIPTION.....                                | 4  |
| 3. TEST FACILITY.....                                      | 4  |
| 4. ACCREDITATION AND LISTING.....                          | 4  |
| 5. MEASUREMENT INSTRUMENTATION.....                        | 4  |
| 6. MEASURING INSTRUMENT CALIBRATION.....                   | 5  |
| 7. UNITS OF MEASUREMENT.....                               | 5  |
| 8. CLASSIFICATION OF DIGITAL DEVICE.....                   | 5  |
| 9. RADIATED EMISSION LIMITS.....                           | 6  |
| 10. RADIATED EMISSION TEST PROCEDURE.....                  | 6  |
| 11. AMBIENT CONDITIONS.....                                | 7  |
| 12. TEST EQUIPMENT LIST.....                               | 7  |
| 13. EUT SETUP PHOTOS .....                                 | 8  |
| 14. TEST RESULT SUMMARY.....                               | 11 |
| SECTION 2.985 RF POWER OUTPUT .....                        | 13 |
| SECTION 2.987 MODULATION CHARACTERISTICS.....              | 13 |
| SECTION 2.989 OCCUPIED BANDWIDTH.....                      | 13 |
| SECTION 2.991 SPURIOUS EMISSION AT ANTENNA TERMINALS ..... | 13 |
| SECTION 2.993 FIELD STRENGTH OF SPURIOUS RADIATION.....    | 18 |
| SECTION 2.995 FREQUENCY STABILITY.....                     | 20 |
| 15. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION .....      | 20 |

**EXHIBITS**

1. AUTHORIZATION LETTER
2. PROPOSED FCC ID LABEL FORMAT
3. REQUEST FOR CONFIDENTIALITY LETTER
4. FUNCTIONAL DESCRIPTION
5. USER'S MANUAL
6. SCHEMATIC DIAGRAM
7. BLOCK DIAGRAM

**1. FCC PART 2, SUBPART J INFORMATION****FCC Rule 2.983**

2.983 (a) Name of Applicant: J RANDALL CO.  
1853 NORTH BISSELL 1<sup>ST</sup> FLOOR  
CHICAGO, IL 60614-5012

Contact Person: PETE SPEVACEK / OPERATIONS MANAGER  
Telephone No: (877) 572-8328

2.983 (b) Equipment Identification: Refer to Exhibit 2. FCC ID:OLDBDA800

2.983 (c) Planned for quantity production.

2.983 (d) Technical description:

The BDA800 enhances portable and radio performance inside buildings. It amplifies the signal from the basestation and the signal from the portable/radio. The outside antenna receives the signal from the basestation. The signal is amplified and filtered by the BDA800. The inside antenna retransmits this signal. The inside antenna receives the signal from the mobile/radio. The BDA800 filters and amplifies this signal. The outside antenna then retransmits the signal.

*Subsections*

(1) Types of Emissions:

EXPANDR

(2) Frequency Range:

Uplink: 806-824MHz

Downlink: 851-869MHz

(3) Range of Operating Power:

10 – 45dB gain (-30dBm/+15dBm)

Maximum Power Rating:

Uplink 14dBm (multi carrier)  
17dBm (single carrier)

Downlink 10dBm (multi carrier)  
13dBm (single carrier)

(4) Applied voltages and currents into the final transistor elements:

4.8 VDC at 0.065 A on U5 and U6

(5) Function of Each Active Device:

Refer to Exhibit 6, Schematic Diagram. Confidentiality is requested on this item.

(6) Complete Circuit Diagrams and Functional Diagram

Refer to Exhibit 6 , Schematic Diagram. Confidentiality is requested on this item.

(7) Instructions/Installation Manual

Refer to Exhibit 4, User;s Manual

(8) Tune-up/Optimizations Procedure

Not Applicable

(9) Means for Frequency Stabilization:

Not Applicable

(10) Means for Limiting Modulation:

Not applicable

(11) Means for Limiting Power:

The output amplifiers in both directions will reduce their gain in order to prevent the signal power from increasing beyond the rated power levels.

(12) Means for Attenuating Higher Audio Frequencies

Not Applicable

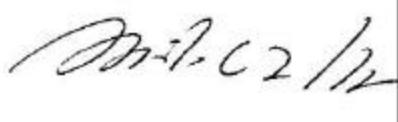
(13) Description of Digital Modulation Techniques

Not Applicable

|                                   |                              |  |
|-----------------------------------|------------------------------|--|
| TYPE OF EQUIPMENT:                | BIDIRECTIONAL AMPLIFIER      |  |
| MEASUREMENT DISTANCE:             | 3 METER                      |  |
| TECHNICAL LIMIT:                  | FCC 90.210                   |  |
| FCC RULES:                        | PART 15, PART 90             |  |
| EQUIPMENT AUTHORIZATION PROCEDURE | CERTIFICATION                |  |
| MODIFICATIONS MADE ON EUT         | <input type="checkbox"/> YES | <input checked="" type="checkbox"/> NO |

The above equipment was tested by Compliance Consulting Services for compliance with the requirements set forth in the FCC CFR 47, PART 15 AND 90. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved By



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MIKE KUO / VICE PRESIDENT  
COMPLIANCE CERTIFICATION SERVICES

## 2. PRODUCT DESCRIPTION

The BDA800 enhances portable and radio performance inside buildings. It amplifies the signal from the basestation and the signal from the portable/radio. The outside antenna receives the signal from the basestation. The signal is amplified and filtered by the BDA800. The inside antenna retransmits this signal. The inside antenna receives the signal from the mobile/radio. The BDA800 filters and amplifies this signal. The outside antenna then retransmits the signal.

## 3. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated and conducted data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

## 4. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code:200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT(1300F2))

## 5. MEASUREMENT INSTRUMENTATION

Radiated emissions were measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, ridged waveguide, liner horn. EMI receivers were used for line conducted readings, spectrum analyzers with pre-selectors and quasi-peak detectors were used to perform radiated measurements. Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specification for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

## 6. MEASURING INSTRUMENT CALIBRATION

The measuring equipment which was utilized in performing the tests documented herein has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment which is traceable to recognized national standards.

## 7. UNITS OF MEASUREMENT

Measurements of radiated interference are reported in terms of dB(uV/m) at a specified distance. The indicated readings on the spectrum analyzer were converted to dB(uV/m) by use of appropriate conversion factors. Measurements of conducted interference are reported in terms of dB(uV).

The field strength is calculated by adding the Antenna Factor and Cable Factors, then by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4dB/m and a Cable Factor of 1.1dB is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(32 \text{ dBuV/m})/20] = 39.8 \text{ uV/m}$$

## 8. CLASSIFICATION OF DIGITAL DEVICE

Class A includes digital devices that are marketed for use in commercial, industrial or business environments, excluding devices which are marketed for use by the general public or are intended to be used in the home.

Class B includes digital devices that are marketed for use in residential environments, notwithstanding use in commercial, business and industrial environments.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as Class B device, and in fact is encouraged

to do so provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

## 9. RADIATED EMISSION LIMITS

### FCC PART 15 CLASS A

| MEASURING DISTANCE OF 10 METER |                               |                         |
|--------------------------------|-------------------------------|-------------------------|
| FREQUENCY RANGE (MHz)          | FIELD STRENGTH (Microvolts/m) | FIELD STRENGTH (dBuV/m) |
| 30-88                          | 90                            | 39.1                    |
| 88-216                         | 150                           | 43.5                    |
| 216-960                        | 210                           | 46.4                    |
| Above 960                      | 300                           | 49.5                    |

### FCC PART 15 CLASS B

| MEASURING DISTANCE OF 3 METER |                               |                         |
|-------------------------------|-------------------------------|-------------------------|
| FREQUENCY RANGE (MHz)         | FIELD STRENGTH (Microvolts/m) | FIELD STRENGTH (dBuV/m) |
| 30-88                         | 100                           | 40                      |
| 88-216                        | 150                           | 43.5                    |
| 216-960                       | 200                           | 46                      |
| Above 960                     | 500                           | 54                      |

## 10. RADIATED EMISSION TEST PROCEDURE

The EUT and all other support equipment are placed on a wooden table 80 cm above the ground screen. Antenna to EUT distance is 3 meters . During the test, the table is rotated 360 degrees to maximize emissions and the antenna is positioned from 1 to 4 meters above the ground screen to further maximize emissions. The antenna is polarized in both vertical and horizontal positions.

EUT test configuration is according to Section 8 of ANSI C63.4/1992.

Monitor the frequency range of interest at a fixed antenna height and EUT azimuth. Frequency span should be small enough to easily differentiate between broadcast stations and intermittent ambients. Rotate EUT 360 degrees to maximize emissions received from EUT. If emission increases by more than 1 dB, or if another emission appears that is greater by 1 dB, return to azimuth where maximum occurred and perform additional cable manipulation to further maximize received emission.

Move antenna up and down to further maximize suspected highest amplitude signal. If emission increased by 1 dB or more, or if another emission appears that is greater by 1dB or more, return to antenna height where maximum signal was observed and manipulate cables to produce highest emissions, noting frequency and amplitude.

## 11. AMBIENT CONDITIONS

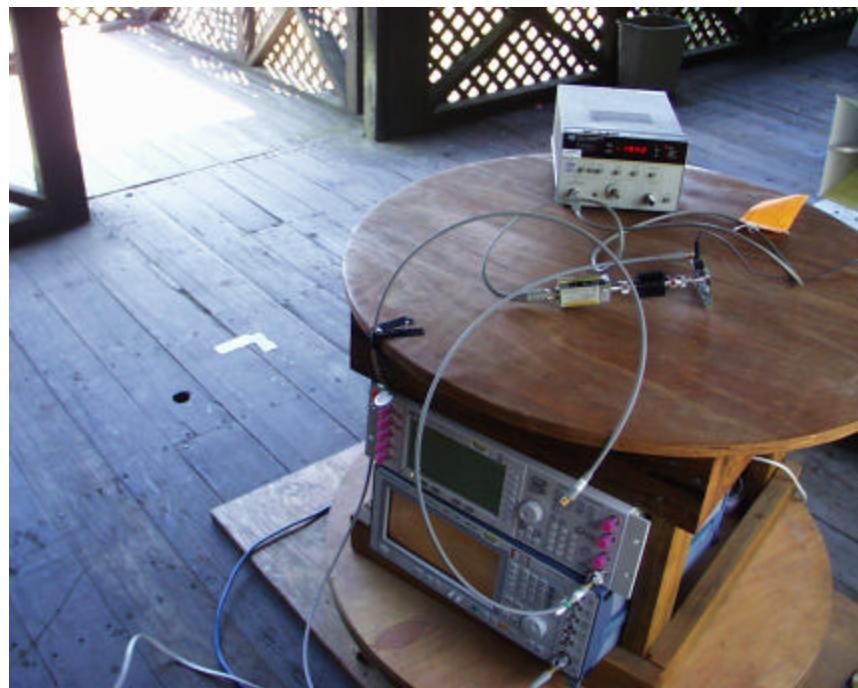
The ambient conditions at the time of final tests were as follows:

|             | Radiated Emission | Conducted Emission |
|-------------|-------------------|--------------------|
| Temperature | <b>18°C</b>       | <b>19°C</b>        |
| Humidity    | <b>60%</b>        | <b>62%</b>         |

## 12. TEST EQUIPMENT LIST

| Equipment         | Manufacturer | Model No. | Serial No. | Site | Cal Date | Due Date |
|-------------------|--------------|-----------|------------|------|----------|----------|
| Spectrum Analyzer | H.P.         | 8593EM    | 3710A00205 | A    | 05/98    | 05/99    |
| Antenna           | EMCO         | 3146      | NSN=X100   | A/F  | 03/99    | 03/00    |
| Antenna           | ARA          | DRG-118/A | 104        | A/F  | 06/98    | 06/99    |
| Pre-Amp           | H.P.(P2)     | 8447D     | 2944A06265 | A/F  | 09/98    | 09/99    |
| Pre-Amp           | H.P.         | 8449B     | 3008A00369 | A/F  | 04/98    | 04/99    |
| Antenna           | Emco         | 3110      | 8908-1079  | A/F  | 03/99    | 03/00    |

### 13. EUT SETUP PHOTOS







## 14. TEST RESULT SUMMARY

Final Conducted Emission Test was conducted by operating the worst mode as indicated above.

| Conducted Room                          | Plot No.<br>99U0269  |           | Date<br>5/14/99            |                 | Tested By:<br>PETE KREBILL |                      |              |  |  |  |  |  |
|---|----------------------|-----------|----------------------------|-----------------|----------------------------|----------------------|--------------|--|--|--|--|--|
| Six Highest Conducted Emission Readings |                      |           |                            |                 |                            |                      |              |  |  |  |  |  |
| Frequency Range Investigated            |                      |           | 450 kHz TO 30 MHz          |                 |                            |                      |              |  |  |  |  |  |
| Freq (MHz)                              | Meter Reading (dBuV) | C.F. (dB) | Corrected Reading (dBuV/m) | Limits (dBuV/m) | Margin (dB)                | Reading Type (P/Q/A) | Line (L1/L2) |  |  |  |  |  |
| 10.77                                   | 23.77                | 0         | 23.77                      | 48              | -24.23                     | P                    | 1            |  |  |  |  |  |
| 27.12                                   | 20.78                | 0         | 20.78                      | 48              | -27.22                     | P                    | 1            |  |  |  |  |  |
| 28.77                                   | 17.76                | 0         | 17.76                      | 48              | -30.24                     | P                    | 1            |  |  |  |  |  |
| 24.32                                   | 22.31                | 0         | 22.31                      | 48              | -25.69                     | P                    | 2            |  |  |  |  |  |
| 26.56                                   | 20.70                | 0         | 20.7                       | 48              | -27.30                     | P                    | 2            |  |  |  |  |  |
| 10.77                                   | 16.45                | 0         | 16.45                      | 48              | -31.55                     | P                    | 2            |  |  |  |  |  |

C.F.(Correction Factor)=Insertion Loss + Cable Loss

Corrected Reading = Metering Reading + C.F.

Margin=Corrected Reading - Limits

P=Peak Reading

L1=Hot

Q=Quasi-peak

L2=Neutral

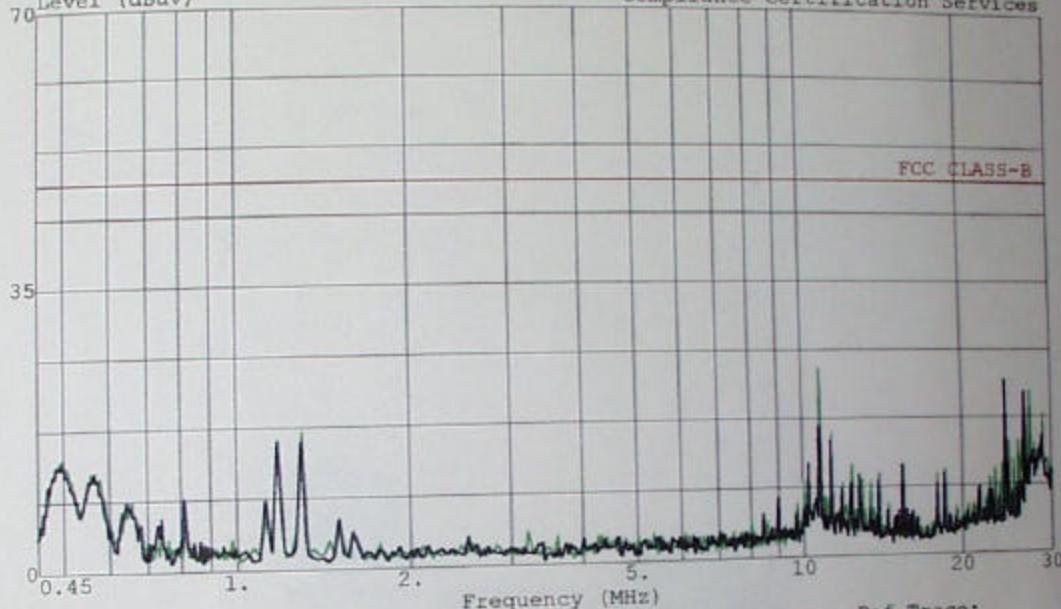
A=Average Reading



1366 Bordeaux Dr.  
Sunnyvale, CA 94089-1005 USA  
Tel: (408) 752-8166  
Fax: (408) 752-8168

Data#: 7 File#: 99U0269.EMI  
Level (dBuV)

Date: 05-14-1999 Time: 13:28:58  
Compliance Certification Services



Ref Trace:  
Trace: 3  
Project No. : 99u0269  
Report No. : 990514  
Test Engr : PETE KREBILL  
Company : J RANDAL CO  
EUT : M/N BDA800  
Test Config.: EUT/SIGNAL GENERATOR  
Type of Test: FCC 15  
Mode of Op. : TX FWD DOWNLINK 860MHZ MAX POWER  
: PEAK: L1(Green), L2(Black)  
: 120Vac, 60Hz

**FCC PART 2 TEST REQUIREMENT:****SECTION 2.985 RF POWER OUTPUT**

| MEASURED RF POWER OUTPUT |            |
|--------------------------|------------|
| REVERSE UPLINK 815MHz    | 35.5mWatts |
| FORWARD DOWNLINK 860MHz  | 11.2mWatts |

**SECTION 2.987 MODULATION CHARACTERISTICS**

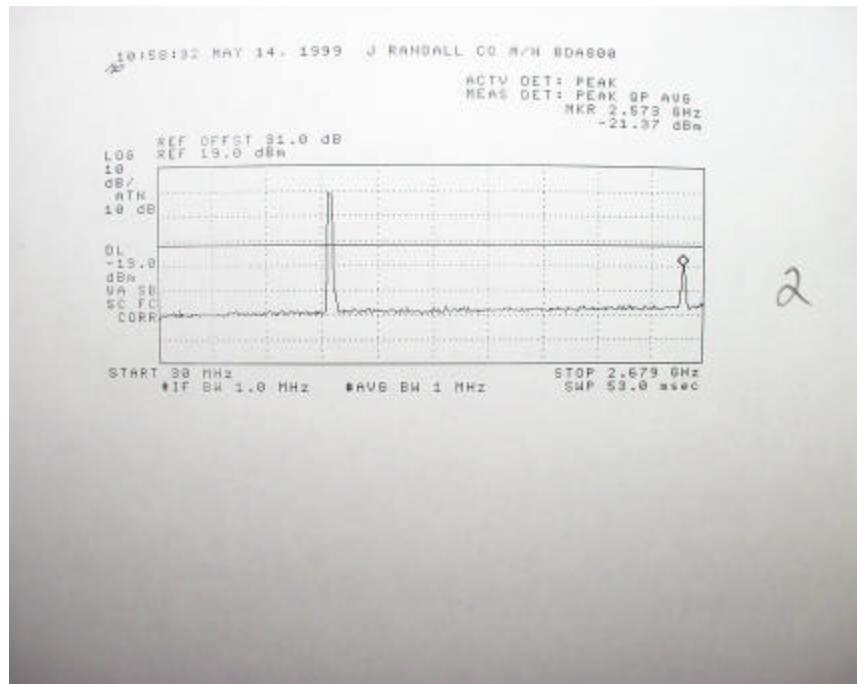
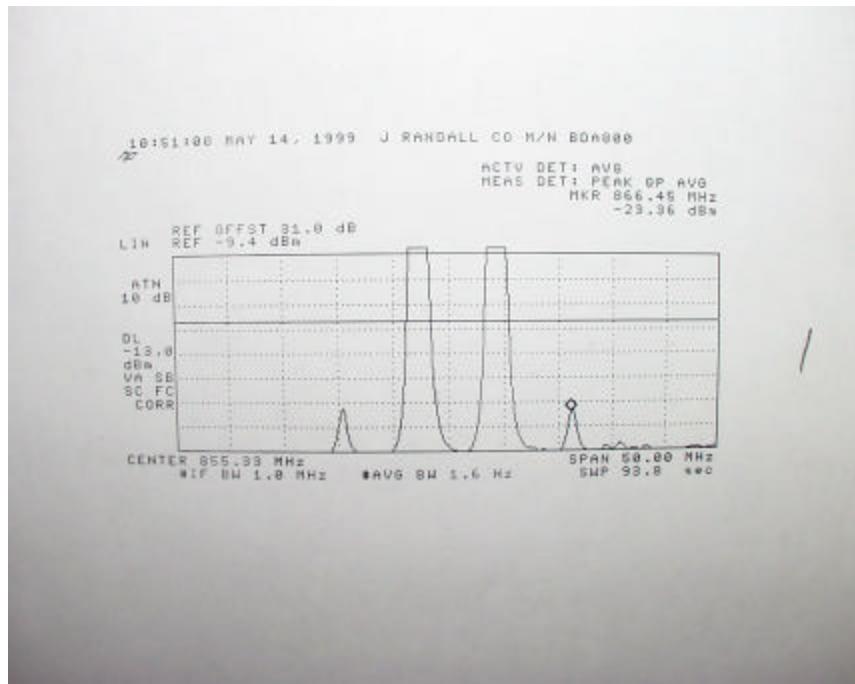
Not Applicable

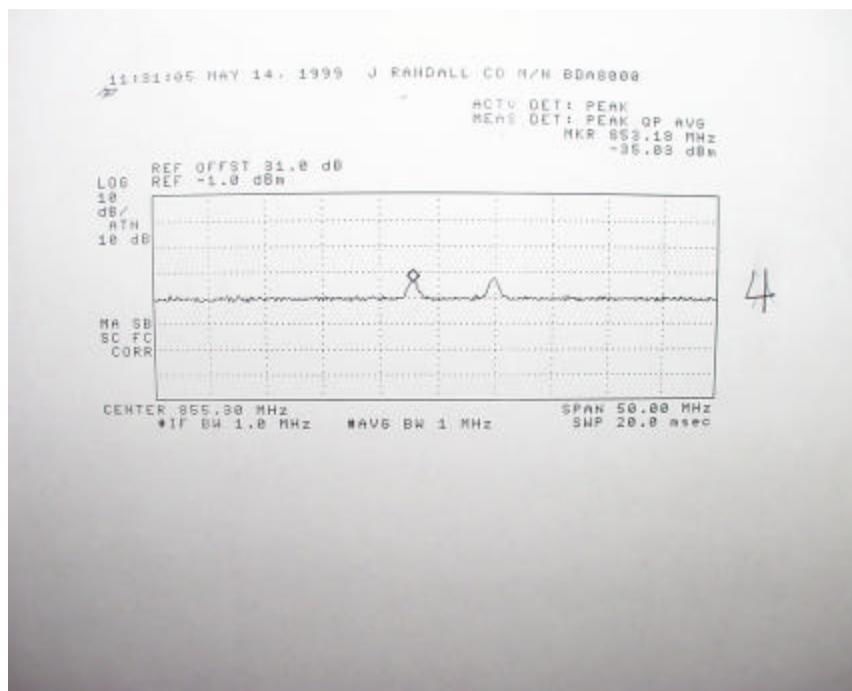
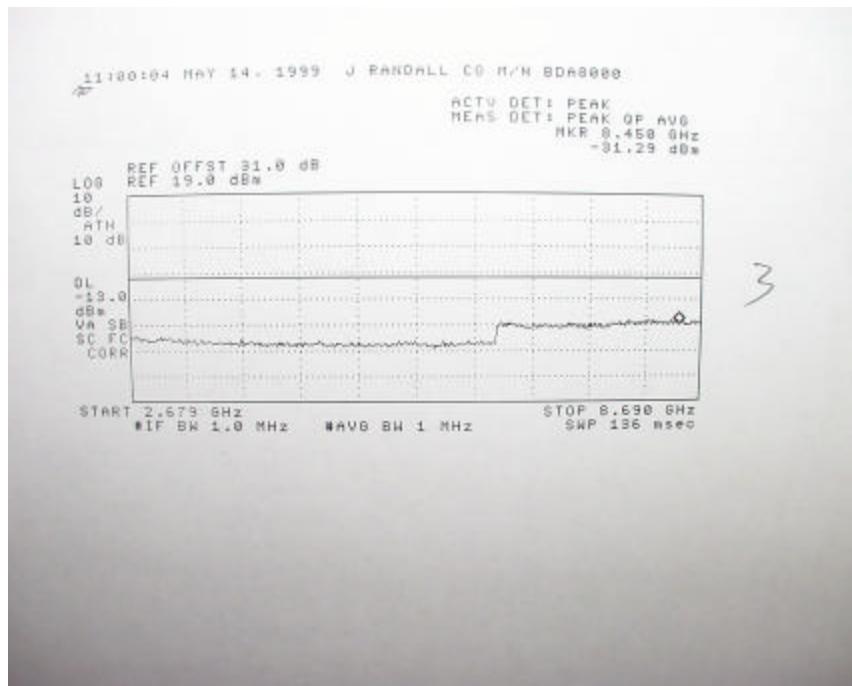
**SECTION 2.989 OCCUPIED BANDWIDTH**

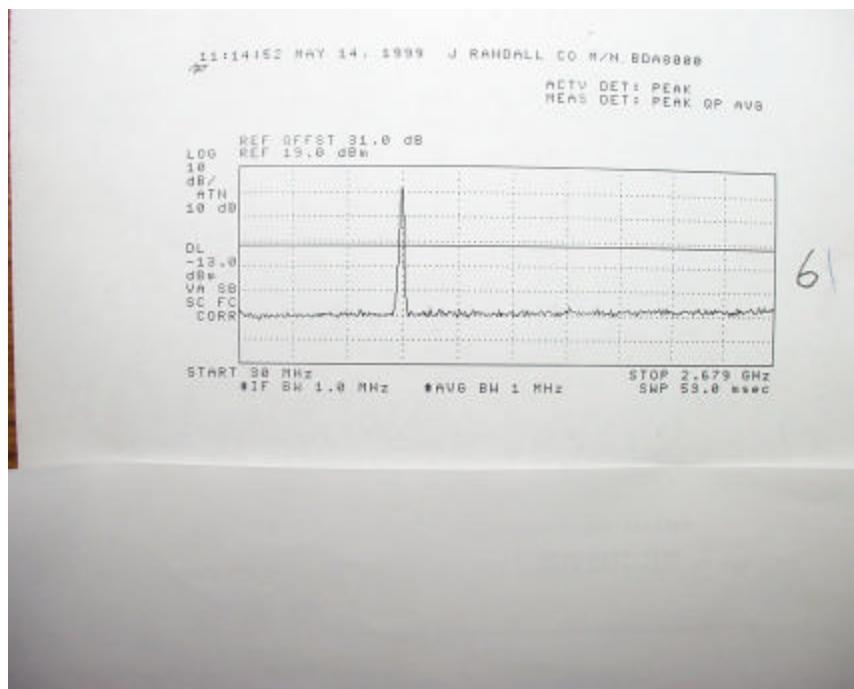
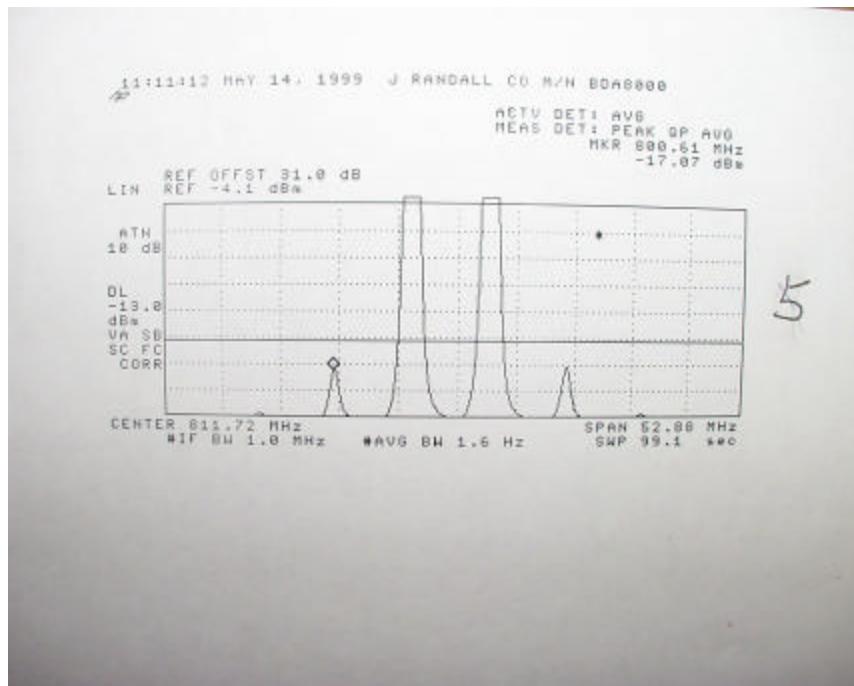
Not Applicable

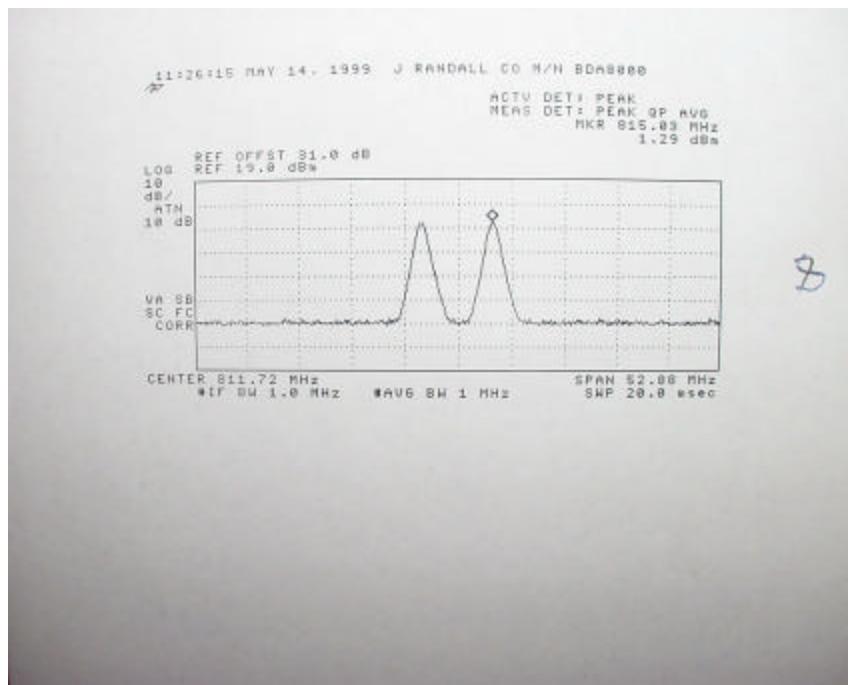
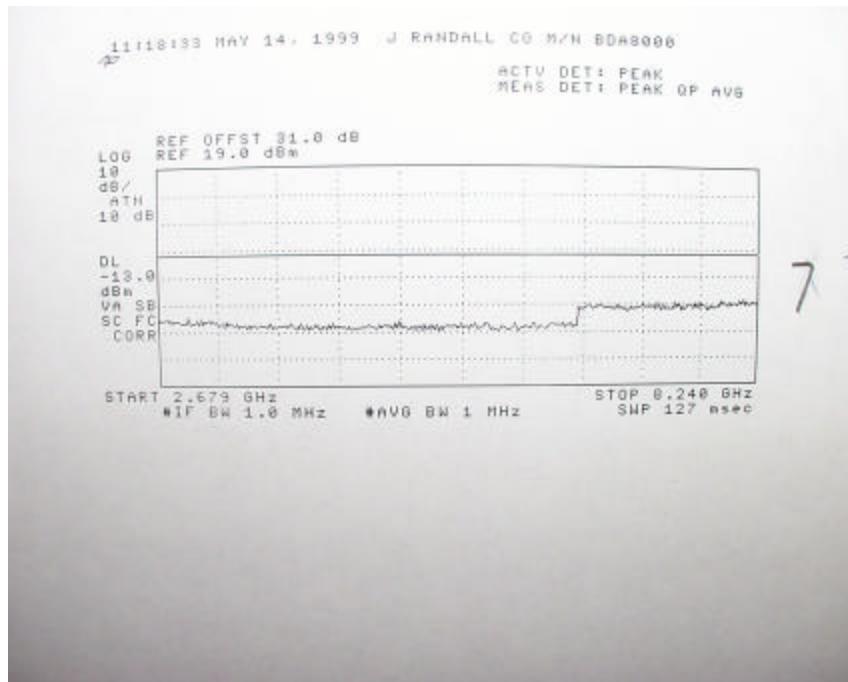
**SECTION 2.991 SPURIOUS EMISSION AT ANTENNA TERMINALS**

| INPUT FREQUENCIES | PLOT DESCRIPTION         | PLOT# |
|-------------------|--------------------------|-------|
| 853MHz/860MHz     | INTERMODULATION PRODUCTS | 1     |
| 853MHz/860MHz     | 30MHz-2679MHz            | 2     |
| 853MHz/860MHz     | 2679MHz-8690MHz          | 3     |
| 853MHz/860MHz     | INPUT TO ABOVE           | 4     |
|                   |                          |       |
| 808MHz/815MHz     | INTERMODULATION PRODUCTS | 5     |
| 808MHz/815MHz     | 30MHz-2679MHz            | 6     |
| 808MHz/815MHz     | 2679MHz-8690MHz          | 7     |
| 808MHz/815MHz     | INPUT TO ABOVE           | 8     |
|                   |                          |       |









**SECTION 2.993 FIELD STRENGTH OF SPURIOUS RADIATION**

Technical Limits applied :Section,90.210 emission masks

See attached chart

5/14/99

PETE KREBILL

J RANDAL CO  
BDA800

HORIZONTAL AND VERTICAL MEASURED ALL VERTICAL EMISSIONS HIGHER

| F(MHz)          | Level<br>(dBuV) | AF<br>(dB) | CL<br>(dB) | AMP<br>(dB) | FILTER<br>(dB) | DIST<br>(dB) | Total<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | TYPE |
|-----------------|-----------------|------------|------------|-------------|----------------|--------------|-------------------|-------------------|----------------|------|
| <b>Vertical</b> |                 |            |            |             |                |              |                   |                   |                |      |
| 1630            | 91.1            | 25.2       | 2.34       | -35.5       | 10             | -10.5        | 82.64             | 102               | -19.36         | PK   |
| 1630            | 78.9            | 25.2       | 2.34       | -35.5       | 10             | -10.5        | 70.44             | 82                | -11.56         | AV   |
| 2440            | 83.1            | 29.2       | 2.79       | -35.5       | 1              | -10.5        | 70.09             | 102               | -31.91         | PK   |
| 2440            | 73.2            | 29.2       | 2.79       | -35.5       | 1              | -10.5        | 60.19             | 82                | -21.81         | AV   |
| 3260            | 85.19           | 32.8       | 4.1        | -35.5       | 1              | -10.5        | 77.09             | 102               | -24.91         | PK   |
| 3260            | 76.1            | 32.8       | 4.1        | -35.5       | 1              | -10.5        | 68                | 82                | -14            | AV   |
| 4070            | 81              | 32.3       | 5          | -35.5       | 1              | -10.5        | 73.3              | 102               | -28.7          | PK   |
| 4070            | 70.7            | 32.3       | 5          | -35.5       | 1              | -10.5        | 63                | 82                | -19            | AV   |
| 4880            | 67.1            | 34.3       | 5.4        | -35.5       | 1              | -10.5        | 61.8              | 102               | -40.2          | PK   |
| 4880            | 49.9            | 34.3       | 5.4        | -35.5       | 1              | -10.5        | 44.6              | 82                | -37.4          | AV   |
| 5700            | 62.3            | 35.2       | 5.7        | -35.5       | 1              | -10.5        | 58.2              | 102               | -43.8          | PK   |
| 5700            | 46              | 35.2       | 5.7        | -35.5       | 1              | -10.5        | 41.9              | 82                | -40.1          | AV   |
| 6510            | 71.1            | 36         | 6          | -35.5       | 1              | -10.5        | 68.1              | 102               | -33.9          | PK   |
| 6510            | 59.4            | 36         | 6          | -35.5       | 1              | -10.5        | 56.4              | 82                | -25.6          | AV   |
| 7330            | 65.9            | 36.9       | 6.4        | -35.5       | 1              | -10.5        | 64.2              | 102               | -37.8          | PK   |
| 7330            | 54.9            | 36.9       | 6.4        | -35.5       | 1              | -10.5        | 53.2              | 82                | -28.8          | AV   |
| 8150            | 61.7            | 37.5       | 6.7        | -35.5       | 1              | -10.5        | 60.9              | 102               | -41.1          | PK   |
| 8150            | 49.8            | 37.5       | 6.7        | -35.5       | 1              | -10.5        | 49                | 82                | -33            | AV   |
| <b>Vertical</b> |                 |            |            |             |                |              |                   |                   |                |      |
| 1720            | 62              | 25.2       | 2.34       | -35.5       | 10             | -10.5        | 53.54             | 102               | -48.46         | PK   |
| 1720            | 53.7            | 25.2       | 2.34       | -35.5       | 10             | -10.5        | 45.24             | 82                | -36.76         | AV   |
| 2580            | 56.4            | 29.2       | 2.79       | -35.5       | 1              | -10.5        | 43.39             | 102               | -58.61         | PK   |
| 2580            | 43.8            | 29.2       | 2.79       | -35.5       | 1              | -10.5        | 30.79             | 82                | -51.21         | AV   |
| 3440            | 43.3            | 32.8       | 4.1        | -35.5       | 1              | -10.5        | 35.2              | 102               | -66.8          | PK   |
| 3440            | 31              | 32.8       | 4.1        | -35.5       | 1              | -10.5        | 22.9              | 82                | -59.1          | AV   |
| 4300            | 43              | 32.3       | 5          | -35.5       | 1              | -10.5        | 35.3              | 102               | -66.7          | PK   |
| 4300            | 30.1            | 32.3       | 5          | -35.5       | 1              | -10.5        | 22.4              | 82                | -59.6          | AV   |
| 5160            | 41.3            | 34.3       | 5.4        | -35.5       | 1              | -10.5        | 36                | 102               | -66            | PK   |
| 5160            | 29.4            | 34.3       | 5.4        | -35.5       | 1              | -10.5        | 24.1              | 82                | -57.9          | AV   |
| 6020            | 41.2            | 35.2       | 5.7        | -35.5       | 1              | -10.5        | 37.1              | 102               | -64.9          | PK   |
| 6020            | 28.7            | 35.2       | 5.7        | -35.5       | 1              | -10.5        | 24.6              | 82                | -57.4          | AV   |
| 6880            | 46.3            | 36         | 6          | -35.5       | 1              | -10.5        | 43.3              | 102               | -58.7          | PK   |
| 6880            | 33.8            | 36         | 6          | -35.5       | 1              | -10.5        | 30.8              | 82                | -51.2          | AV   |
| 7740            | 46.6            | 36.9       | 6.4        | -35.5       | 1              | -10.5        | 44.9              | 102               | -57.1          | PK   |
| 7740            | 34.2            | 36.9       | 6.4        | -35.5       | 1              | -10.5        | 32.5              | 82                | -49.5          | AV   |
| 8600            | 47.4            | 37.5       | 6.7        | -35.5       | 1              | -10.5        | 46.6              | 102               | -55.4          | PK   |
| 8600            | 33.9            | 37.5       | 6.7        | -35.5       | 1              | -10.5        | 33.1              | 82                | -48.9          | AV   |

AF= ANTENNA FACTOR

CL=CABLE LOSS

AMP= AMPLIFIER GAIN

FILTER=HP FILTER INSERTION LOSS

DIST=DISTANCE CORRECTION TO 3 METERS

RES &amp; VIDEO B/W=1MHZ

**SECTION 2.995 FREQUENCY STABILITY**

Not Applicable

**15. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION**

| CABLE NO: 1                 |                                    |
|-----------------------------|------------------------------------|
| I/O Port: RF                | Number of I/O ports of this type:2 |
| Number of Conductors:2      | Connector Type:SMA                 |
| Capture Type: SCREW-IN      | Type of Cable used: SHIELDED       |
| Cable Connector Type: METAL | Cable Length: 1.0M                 |
| Bundled During Tests: NO    | Data Traffic Generated: YES        |
| Remark: N/A                 |                                    |

| CABLE NO: 2                   |                                    |
|-------------------------------|------------------------------------|
| I/O Port: DC POWER            | Number of I/O ports of this type:1 |
| Number of Conductors: 2       | Connector Type: DC                 |
| Capture Type: SNAP IN         | Type of Cable used: UNSHIELDED     |
| Cable Connector Type: MOLDING | Cable Length:2M                    |
| Bundled During Tests: NO      | Data Traffic Generated: NO         |
| Remark: N/A                   |                                    |

