



**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT  
INTENTIONAL RADIATOR CERTIFICATION TO  
FCC PART 15 SUBPART C REQUIREMENT**

*OF*

**FCC ID: JWSB55R55**

**R/F BASE STATION/RELAY STATION TRANSCEIVER**

**MODEL NO: B55/R55**

**REPORT NO: 98E7708**

**SEPTEMBER 1, 1998**

*Prepared for*  
**WORTHINGTON DATA SOLUTIONS  
623 SWIFT STREET  
SANTA CRUZ, CA 95060 U.S.A.**

*Prepared by*  
**COMPLIANCE ENGINEERING SERVICES, INC.  
1366 BORDEAUX DRIVE  
SUNNYVALE, CA 94089, U.S.A.  
TEL: (408) 752-8166  
FAX: (408) 752-8168**



1366 BORDEAUX DRIVE, SUNNYVALE, CA 94089-1005

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### ATTACHMENTS:

1. EUT PHOTOGRAPHS.
2. USER'S MANUAL
3. SCHEMATICS
4. PROPOSED FCC ID LABEL

## 1. VERIFICATION OF COMPLIANCE

COMPANY NAME : Worthington Data Solutions  
623 Swift Street  
Santa Cruz, CA 95060 USA

CONTACT PERSON : STEVE LUZOVICH

TELEPHONE NO : (831) 458-6044

EUT DESCRIPTION : R/F BASE STATION/RELAY STATION  
TRANSCIVER

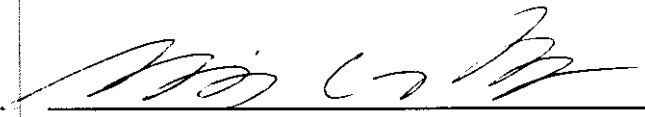
MODEM NAME : B55/R55

DATE TESTED : September 1, 1998

### LIMITS APPLY TO: FCC PART 15 SECTION 15.249

| TECHNICAL LIMITS                           | TEST RESULT |
|--------------------------------------------|-------------|
| Radiated Emission of fundamental Frequency | PASSED      |
| Radiated Emission of Harmonic Frequency    | PASSED      |
| Radiated Emission Outside the Band         | PASSED      |

The above equipment was tested by Compliance Engineering Services Inc. for compliance with the requirements set forth in CFR 47 PART 15 SUBPART C. This said equipment in the configuration described in this report shows the maximum emission levels emanating from equipment are within the compliance requirements.

MIKE C.I. KUO / VICE PRESIDENT  
COMPLIANCE ENGINEERING SERVICES, INC.

## 2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

|                       |                                                                                             |
|-----------------------|---------------------------------------------------------------------------------------------|
| CHASSIS TYPE          | PLASTIC                                                                                     |
| Frequency Range       | 902 – 928 MHz                                                                               |
| Tx and Rx Oscillator  | Worthington data solution                                                                   |
| Type of Transmitter   | Frequency Modulated                                                                         |
| Antenna Gain (dBi)    | 1.6 dBi                                                                                     |
| Antenna Requirement   | Unique connector which can not be replace by standard antenna jack of electrical connector. |
| DC voltage            | 5V DC                                                                                       |
| Number of Frequencies | 80                                                                                          |
| Channel Bandwidth     | 30kHz                                                                                       |

## 3. TEST LOCATION

All emissions tests were performed at:

Compliance Consulting Services  
561F Monterey Road  
Morgan Hill, CA 95087

CCS has site descriptions on file with the FCC for 10 and 3 meter site configurations.  
CCS is a NVLAP accredited facility.

## 4. TEST RESULT SUMMARY

### Radiated Emissions

Test Requirement: 15.249(A)(B)

#### Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)

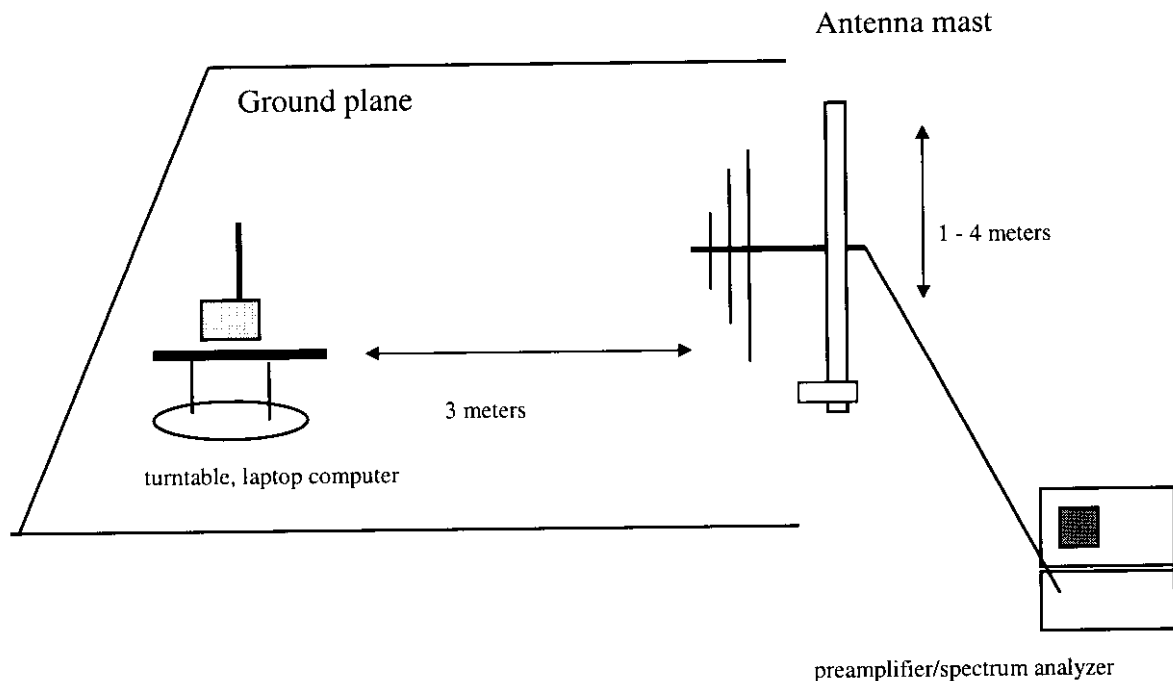
HP Spectrum Display/85662A (Cal Due: 09/99)

HP Quasi-Peak Detector/85650A (Cal Due: 09/99)

HP Pre-Amp(P5)/8447D (Cal Due: 09/99)

Emco Log-Periodic Antenna/3146 (Cal Due: 09/99)

### TEST SETUP FOR MEASUREMENT OF FUNDAMENTAL FREQUENCY



**Fig.1**

#### Test Procedures

- 1) Place the EUT on the turntable as shown. The EUT was placed as close as possible to the center of the turntable with the axis of rotation going through the EUT antenna when in vertical or horizontal polarization. Activated any auxiliary input or control equipment required to produce EUT's normal modulated output signal
- 2) The log periodic search antenna was place at a distance of 3 meters. The antenna was raised and lowered, the EUT rotated on the turntable, until the EUT azimuth,

antenna elevation, and antenna polarity were found which yielded maximum received emission levels on the spectrum analyzer.

- 3) The EUT is capable of operating at different frequencies, measurement of fundamental were performed for a channel near the bottom of the operating band, a channel near the middle of the operating band, and a channel near the top of the operating band. Steps (1) and (2) were repeated for low, middle and high channels of EUT.

**Test Results:** Please refer to attached data.

Compliance Engineering Services Inc.

Project No. : 98E7708

Report No. : 980901C1

Date : 09/01/1998

Time : 09:09

>> 3 M RADIATED EMISSION DATA <<

Test Engr : JUAN MARTINEZ

Company : WORTHINGTON DATA SOLUTIONS

Equipment Under Test : RF BASE STATION\RELAY STATION(B55/R55)

Test Configuration : EUT ONLY

Type of Test : FCC 15.249(A) (C)

Mode of Operation : TX

| Freq.             | dBuV  | PreAmp | Ant   | Cable | dBuV/m | Limit | Margin | Pol | Hgt (m) | Az  |
|-------------------|-------|--------|-------|-------|--------|-------|--------|-----|---------|-----|
| LOW CHANNEL:      |       |        |       |       |        |       |        |     |         |     |
| 902.35            | 87.80 | -27.76 | 23.05 | 3.94  | 87.03  | 94.00 | -6.97  | H   | 1.0     | 180 |
| 902.35            | 94.60 | -27.76 | 22.14 | 3.94  | 92.92  | 94.00 | -1.08  | V   | 1.2     | 270 |
| MIDDLE:           |       |        |       |       |        |       |        |     |         |     |
| 915.15            | 93.50 | -27.72 | 22.36 | 3.97  | 92.12  | 94.00 | -1.88  | V   | 1.2     | 270 |
| 915.15            | 85.10 | -27.72 | 23.22 | 3.97  | 84.58  | 94.00 | -9.42  | H   | 1.0     | 0   |
| HIGH CHANNEL:     |       |        |       |       |        |       |        |     |         |     |
| 927.55            | 90.80 | -27.67 | 22.58 | 4.00  | 89.70  | 94.00 | -4.30  | V   | 1.2     | 270 |
| 927.55            | 83.50 | -27.67 | 23.39 | 4.00  | 83.21  | 94.00 | -10.79 | H   | 1.2     | 180 |
| Total # of data 6 |       |        |       |       |        |       |        |     |         |     |
| V. c2.2           |       |        |       |       |        |       |        |     |         |     |

**Radiated Emissions**

**Test Requirement: 15.249(A)(B)**

**Measurement Equipment Used:**

Emco Horn Antenna/3146

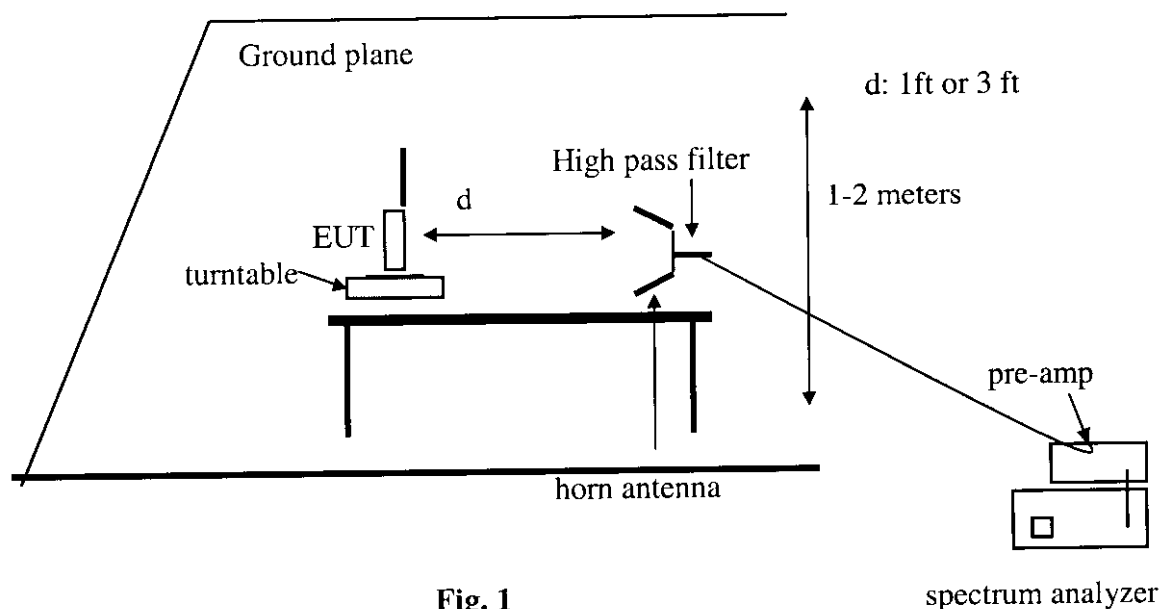
HP Pre-Amp (1 – 26.5 GHz)/8449B

HP Spectrum Analyzer/8593EM

FSY High Pass Filter(1.802GHz)/001

FLEXCO cable/20761; 19ft. coaxial cable (loss: .9dB/ft @ 26GHz)

**TEST SETUP FOR MEASUREMENT OF FUNDAMENTAL HARMONICS**  
**ABOVE 1GHz**



**Fig. 1**

spectrum analyzer

**Test Procedures**

1. The EUT was placed on a lazy Susan on the OATS wooden turntable. The search antenna was placed 3 ft. from the EUT.
2. The turntable was slowly rotated to locate the direction of maximum emission. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations.
3. The EUT is capable of operating at different frequencies, measurement of fundamental harmonics were performed for a channel near the bottom of the

operating band, a channel near the middle of the operating band, and a channel near the top of the operating band Steps (1) and (2) were repeated for low, middle and high channels of EUT.

**Test result:** Please refer to attached spreadsheets.

**Compliance Certification Services**  
**FCC 15.249(A)(B)**

8/31/1998  
 Juan Martinez  
 Site C(1 Meter)

WORTHINGTON DATA SOLUTIONS  
 R/F BASE STATION/RELAY STATION  
 MOD: B55/R55

f<sub>o</sub>=902.35MHz

| F(MHz)  | PK    | AV    | AF   | CL   | AMP  | DIST | OTHER | TOTAL          | LIMIT          | MARGIN           |
|---------|-------|-------|------|------|------|------|-------|----------------|----------------|------------------|
|         | dBuv  | dBuv  | (dB) | (dB) | (dB) | (dB) | (dB)  | (dBuV/m)       | (dBuV/m)       | (dBuV/m)         |
| 1804    | 49.54 | 42.33 | 26   | 1.23 | -35  | -9.5 | 1     | PK 33<br>AV 26 | PK 74<br>AV 54 | PK -41<br>AV -28 |
| 2707    | 45.01 | 35.63 | 30   | 3.5  | -35  | -9.5 | 1     | 35 26          | 74 54          | -39 -28          |
| 3609    | 48.34 | 42.97 | 32.9 | 4.38 | -35  | -9.5 | 1     | 42 37          | 74 54          | -32 -17          |
| 4511    | 54.82 | 51.14 | 32.4 | 5.18 | -35  | -9.5 | 1     | 49 45          | 74 54          | -25 -8.8         |
| 5415    | 44.04 | 36.42 | 34.9 | 5.74 | -35  | -9.5 | 1     | 41 34          | 74 54          | -33 -20          |
| 6316(N) | 43.71 | 36.51 | 35.3 | 6.08 | -35  | -9.5 | 1     | 42 34          | 74 54          | -32 -20          |
| 7218(N) | 45.32 | 31.82 | 36.5 | 6.65 | -35  | -9.5 | 1     | 45 31          | 74 54          | -29 -23          |
| 8119(N) | 46.49 | 33.83 | 37.1 | 7.6  | -35  | -9.5 | 1     | 48 35          | 74 54          | -26 -19          |
| 9023(N) | 46.05 | 33.51 | 38.3 | 7.98 | -35  | -9.5 | 1     | 49 36          | 74 54          | -25 -18          |

**NOTE: ALL MEASUREMENTS ARE HORIZONTAL MEASUREMENTS.**

N: Noise Floor      DIST: Distance Correction(9.5dB, 1M.)      RES      VBW      PK: 1MHz 1MHz      PK: Peak  
 AF: Antenna Factor      OTHER: High pass filter insertion loss      AV: 1MHz 10Hz      AV: Average  
 AMP: Pre-amp gain      FSY Microwave high pass filter (f<sub>o</sub>=1.802GHz)  
 CL: Cable loss

*J. m.*

**Compliance Certification Services**  
**FCC 15.249(A)(B)**

8/31/1998  
 Juan Martinez  
 Site C(1Meter)

WORTHINGTON DATA SOLUTIONS  
 R/F BASE STATION/RELAY STATION  
 MOD: B55/R55

f<sub>o</sub>=915.15MHz

| F(MHz)  | $\frac{PK}{dBuv}$ | $\frac{AV}{dBuv}$ | AF (dB) | CL (dB) | AMP (dB) | DIST (dB) | OTHER (dB) | $\frac{TOTAL}{(dBuV/m)}$                                                                          | LIMIT $\frac{PK}{(dBuV/m)}$ | MARGIN $\frac{AV}{(dBuV/m)}$ |
|---------|-------------------|-------------------|---------|---------|----------|-----------|------------|---------------------------------------------------------------------------------------------------|-----------------------------|------------------------------|
| 1830    | 49.08             | 42.3              | 26      | 2.66    | -35      | -9.5      | 1          | $\frac{PK}{34}$ $\frac{AV}{27}$ $\frac{PK}{74}$ $\frac{AV}{54}$ $\frac{PK}{-40}$ $\frac{AV}{-27}$ |                             |                              |
| 2745    | 42.26             | 32.76             | 30      | 3.8     | -35      | -9.5      | 1          | 33 23 74 54 -41 -31                                                                               |                             |                              |
| 3660    | 49.34             | 43.9              | 33      | 4.75    | -35      | -9.5      | 1          | 44 38 74 54 -30 -16                                                                               |                             |                              |
| 4575    | 55.83             | 53.36             | 32.4    | 5.32    | -35      | -9.5      | 1          | 50 48 74 54 -24 -6.4                                                                              |                             |                              |
| 5490    | 44.63             | 35.45             | 32.4    | 5.32    | -35      | -9.5      | 1          | 39 30 74 54 -35 -24                                                                               |                             |                              |
| 6406(N) | 42.52             | 35.47             | 35      | 5.89    | -35      | -9.5      | 1          | 40 33 74 54 -34 -21                                                                               |                             |                              |
| 7322(N) | 45.03             | 30.95             | 35.3    | 6.46    | -35      | -9.5      | 1          | 43 29 74 54 -31 -25                                                                               |                             |                              |
| 8236(N) | 46.21             | 35.12             | 36.5    | 6.65    | -35      | -9.5      | 1          | 46 35 74 54 -28 -19                                                                               |                             |                              |
| 9151(N) | 45.82             | 36.29             | 37.2    | 7.41    | -35      | -9.5      | 1          | 47 37 74 54 -27 -17                                                                               |                             |                              |

**NOTE: ALL MEASUREMENTS ARE HORIZONTAL MEASUREMENTS.**

N: Noise Floor      DIST: Distance Correction(9.5dB, 1M.)      RES      VBW  
 AF: Antenna Factor      OTHER: High pass filter insertion loss      PK: 1MHz 1MHz      PK: Peak  
 AMP: Pre-amp gain      FSY Microwave high pass filter (f<sub>o</sub>=1.802GHz)      AV: 1MHz 10Hz      AV: Average  
 CL: Cable loss

*S.m.*

Page 1

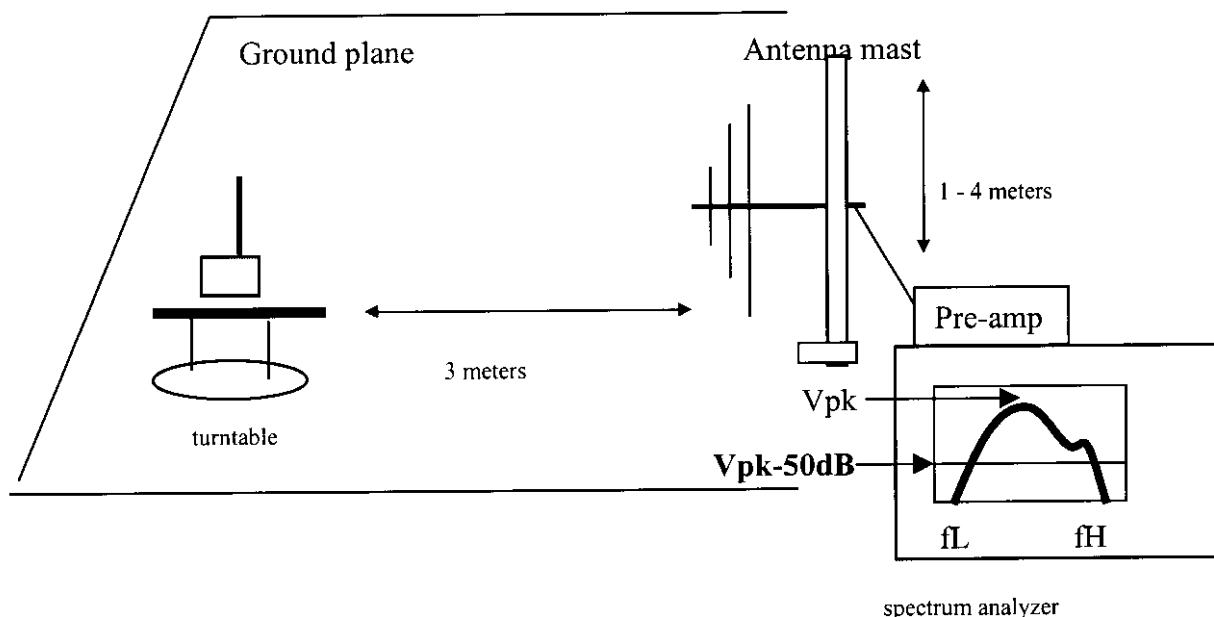
## Out of Band Emissions

Test Requirement: 15.249(C)

### Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)  
HP Spectrum Display/85662A (Cal Due: 09/99)  
HP Quasi-Peak Detector/85650A (Cal Due: 09/99)  
HP Pre-Amp(P5)/8447D (Cal Due: 09/99)  
Emco Log-Periodic Antenna/3146 (Cal Due: 09/99)

### Test Set-Up



### Test Procedures

1. The EUT was configured on wooden turntable as shown on figure 2. The log periodic search antenna was placed at a distance of 3 meters. The antenna was raised and lowered, the EUT rotated on the turntable, until the EUT azimuth, antenna elevation, and antenna polarity were found which yielded maximum received emission levels on the spectrum analyzer.
2. Spectrum analyzer START and STOP frequencies are set to the limits of the specified frequency band under which the EUT is operating, fL being the low end of the band, fH being the high end of the band. The DISPLAY LINE was set 50dB below the maximum peak of the signal. The EUT was set to operate on its lowest frequency.

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3. While the transmitter is operating, the analyzer MAX HOLD function was used to capture the envelope of the transmitters occupied bandwidth.
4. Steps (1) and (2) were repeated for the High channel.

**Test Results:**

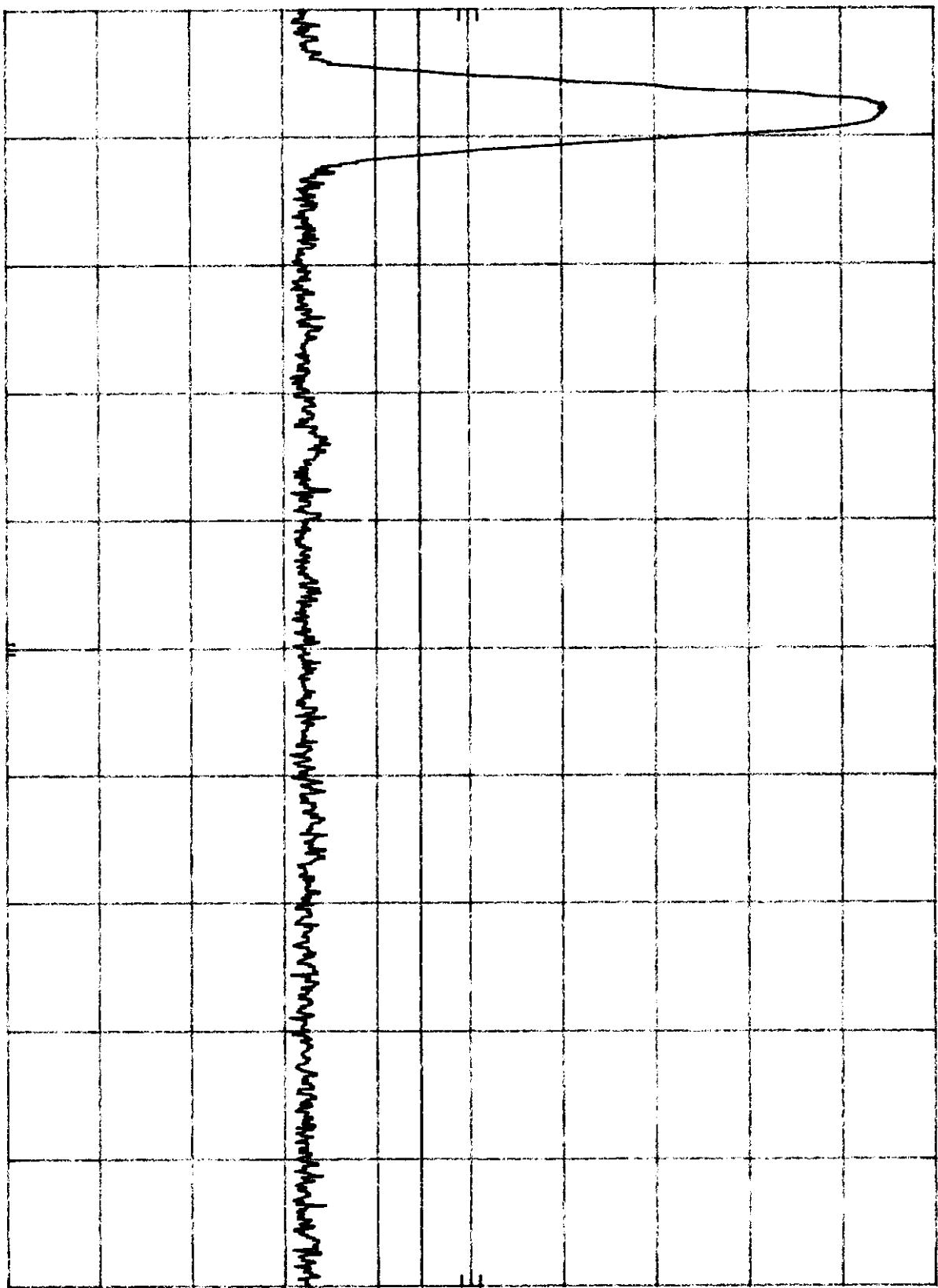
All signals outside 902MHz and 928MHz were at least 50 dB below the fundamental.  
Refer to attached spectrum analyzer charts.

S.M.

15.249 (C), WORTHINGTON (B55/R55) MKR 902.390 MHz  
7p REF 100.0 dBμV ATTN 10 dB 94.50 dBμV

10 dB/

DL  
44.5  
dBμV



START 902.000 MHz STOP 907.000 MHz  
RES BW 100 KHZ VBW 100 KHZ SWP 20 msec

J.M.

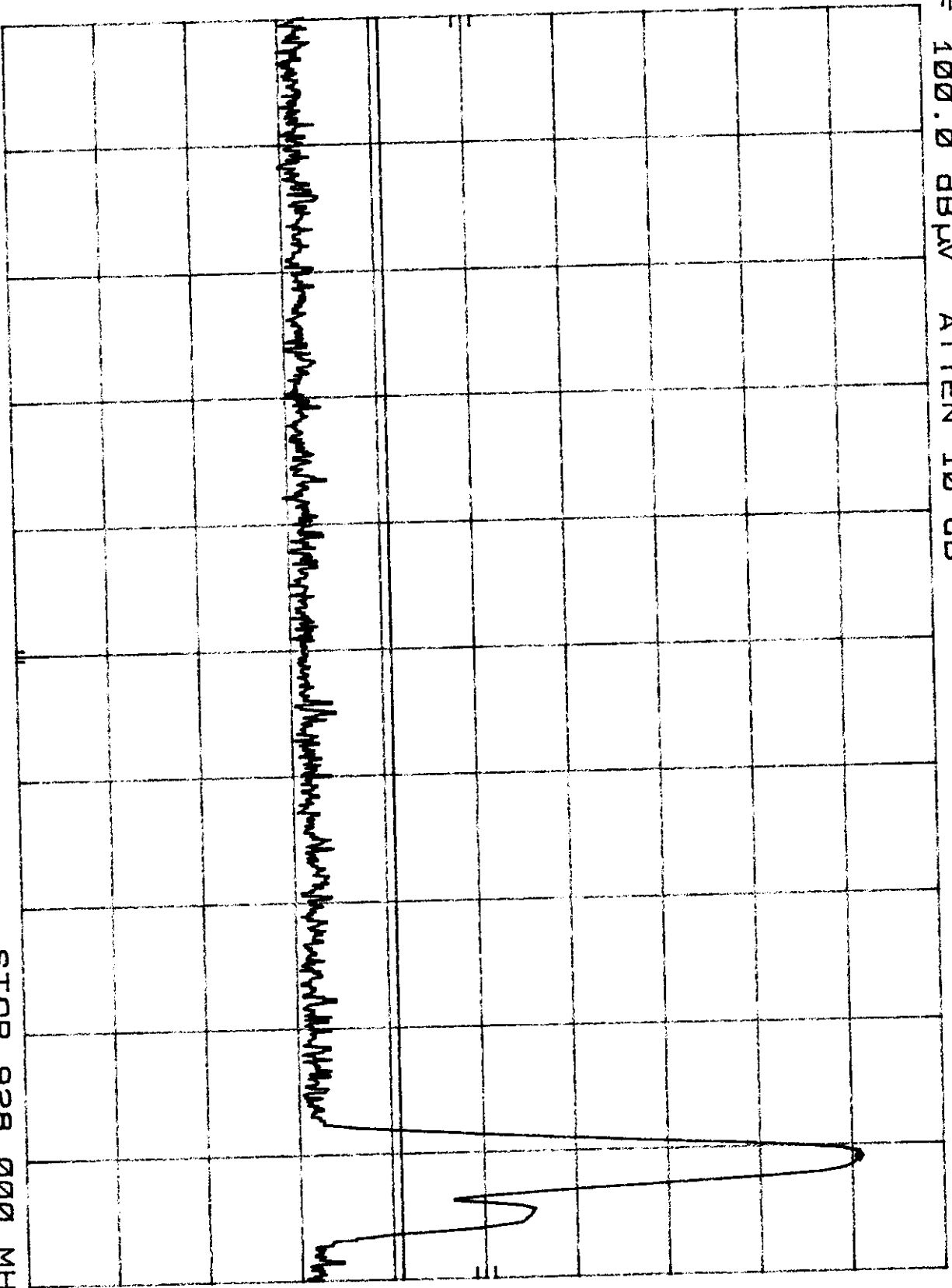
HP

15.249 (C). WORTHINGTON (B55/R55)  
REF 100.0 dBμV ATTEN 10 dB

MKR 927.499 MHz  
90.80 dBμV

10 dB/

DL  
40.8  
dBμV



START 922.550 MHz  
RES BW 100 KHz

VBW 100 KHz

STOP 928.000 MHz  
SWP 20 msec

100

2.m.

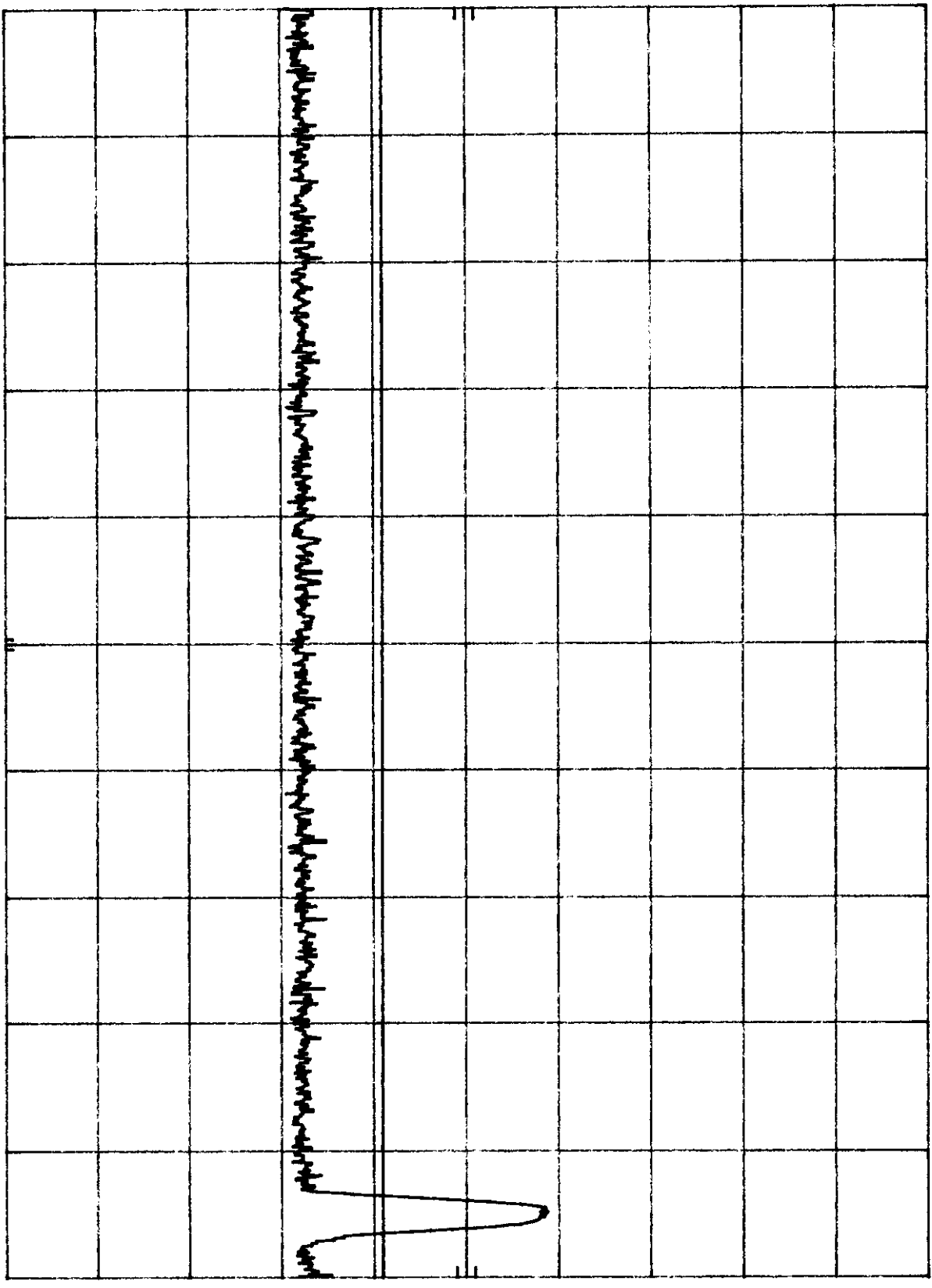
hp

EUT OFF. SIGNAL IS AMBIENT  
REF 100.0 dBμV ATTEN 10 dB

MKR 927.717 MHz  
58.40 dBμV

10 dB/

DL  
40.8  
dBμV



START 922.550 MHz  
RES BW 100 KHZ  
VBW 100 KHZ  
STOP 928.000 MHz  
SWP 20 msec

## **5. EUT SETUP PHOTO**