



**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**



**FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TÜV, BCIQ, DHHS, NVLAP**

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
TRANSCIEVER

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

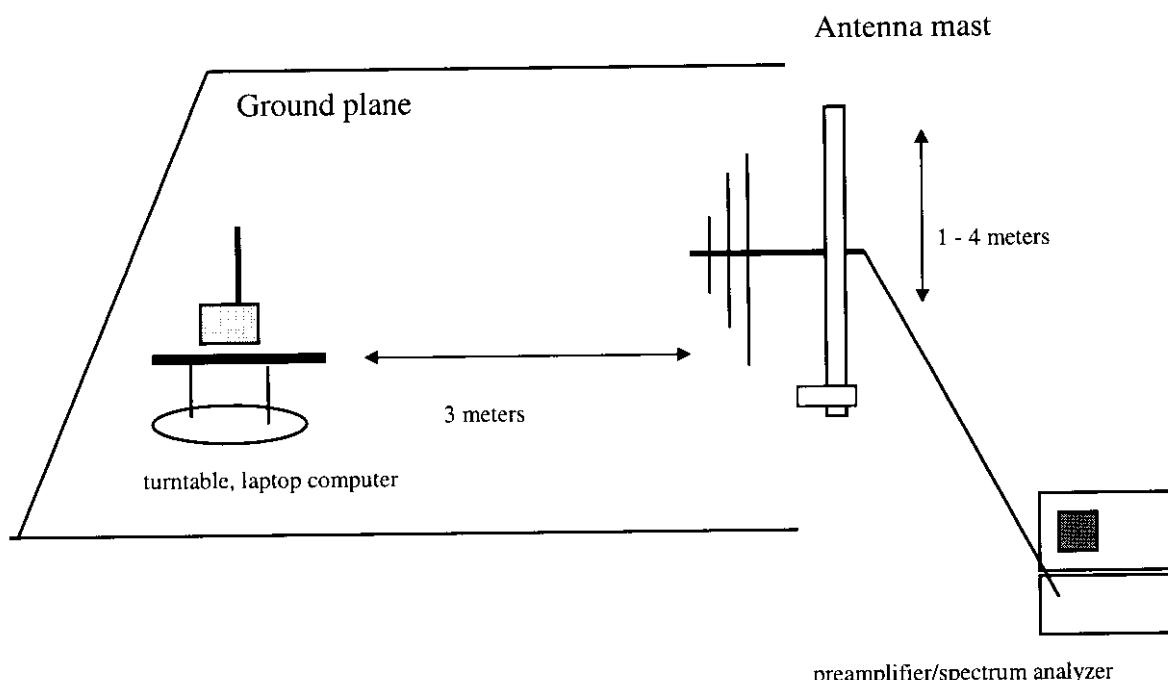


Fig.1

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,

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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.

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1366 BORDEAUX DRIVE, SUNNYVALE, CA 94089

DOCUMENT NO:CCSUP4031B
TEL:(408)752-8166 FAX:(408)752-8168

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Compliance Engineering Services Inc.

Project No. : 98E7708
Report No. : 980901C1
Date : 09/01/1998
Time : 09:09
Test Engr : JUAN MARTINEZ

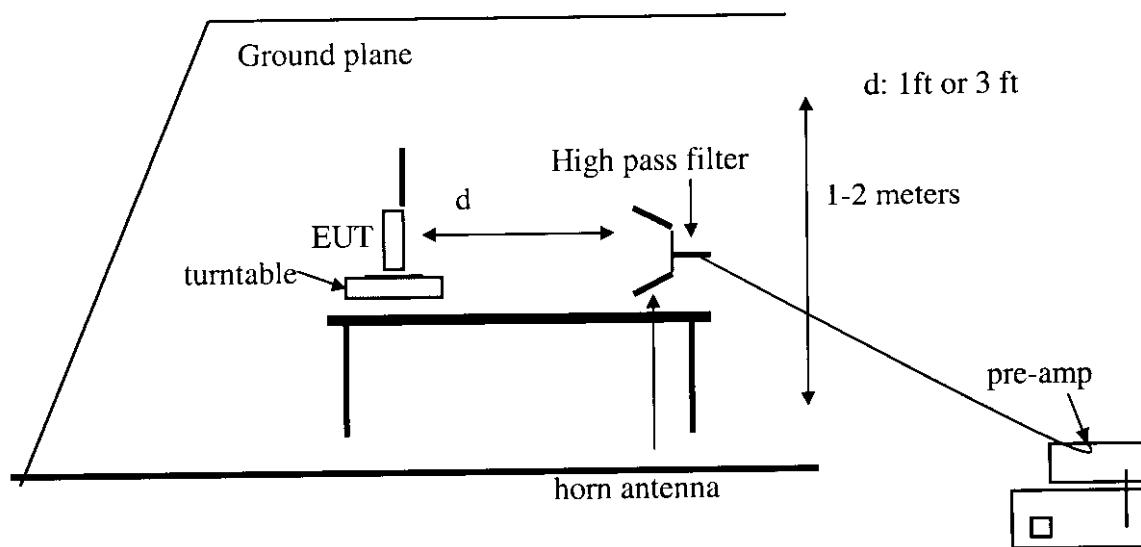
>> 3 M RADIATED EMISSION DATA <<

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

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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.

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1366 BORDEAUX DRIVE, SUNNYVALE, CA 94089

DOCUMENT NO:CCSUP4031B
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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

$f_0=902.35\text{MHz}$

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

PK AV PK AV
(dBuV/m) (dBuV/m)

NOTE: ALL MEASUREMENTS ARE HORIZONTAL MEASUREMENTS.

N: Noise Floor DIST: Distance Correction(9.5dB, 1M.)

AF: Antenna Factor OTHER: High pass filter insertion loss

AMP: Pre-amp gain FSY: Microwave high pass filter ($f_0=1.802\text{GHz}$)

RES VBW
PK: 1MHz 1MHz
AV: 1MHz 10Hz

PK: Peak
AV: Average

CL: Cable loss

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

$f_0=915.15\text{MHz}$

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

NOTE: ALL MEASUREMENTS ARE HORIZONTAL MEASUREMENTS.

N: Noise Floor

AF: Antenna Factor

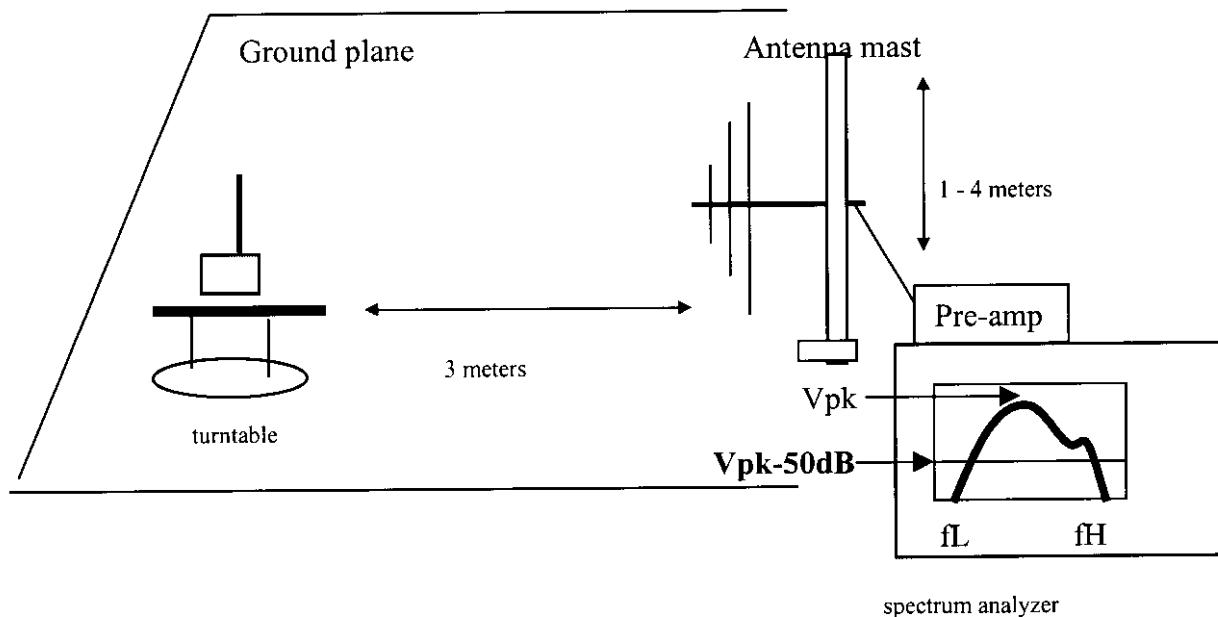
AMP: Pre-amp gain

CL: Cable loss

DIST: Distance Correction(9.5dB, 1M.)
OTHER: High pass filter insertion loss
FSY Microwave high pass filter ($f_0=1.802\text{GHz}$)

RES: $\frac{\text{PK}}{1\text{MHz}} \frac{\text{VBW}}{1\text{MHz}}$
PK: Peak
AV: 1MHz 10Hz
AV: Average

S.m.

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 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.
2. Spectrum analyzer START and STOP frequencies are set to the limits of the specified frequency band under which the EUT is operating, f_L being the low end of the band, f_H 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.

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.

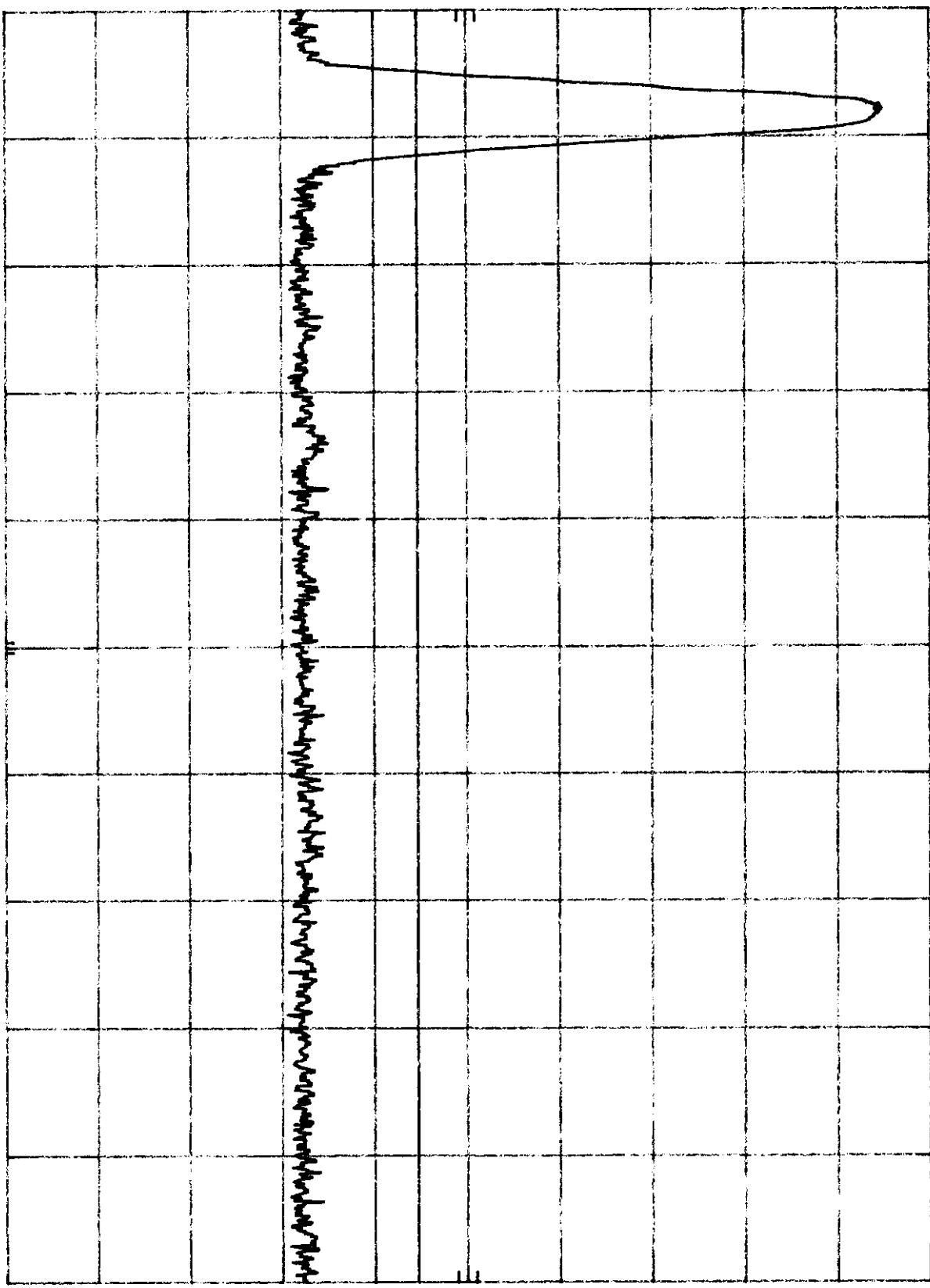
S. m.

15.249 (C). WORthington (B55/R55)

REF 100.0 dB μ V ATten 10 dB

MKA 902.390 MHz
94.50 dB μ V

hp
10 dB/
dB μ V



START 902.000 MHz
RES BW 100 kHz

VBW 100 kHz

STOP 907.000 MHz
SWP 20 msec

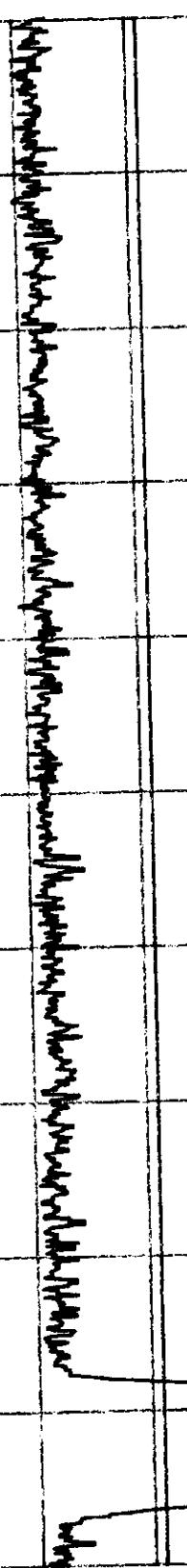
15.249 (C). WORthington (B55/R55)

REF 100.0 dB μ V ATten 10 dB

MKR 927.499 MHz
90.80 dB μ V

10 dB/
10 dB/

DL
40.8
dB μ V



START 922.550 MHz RES BW 100 kHz VBW 100 kHz

STOP 928.000 MHz SWP 20 msec

J.M.

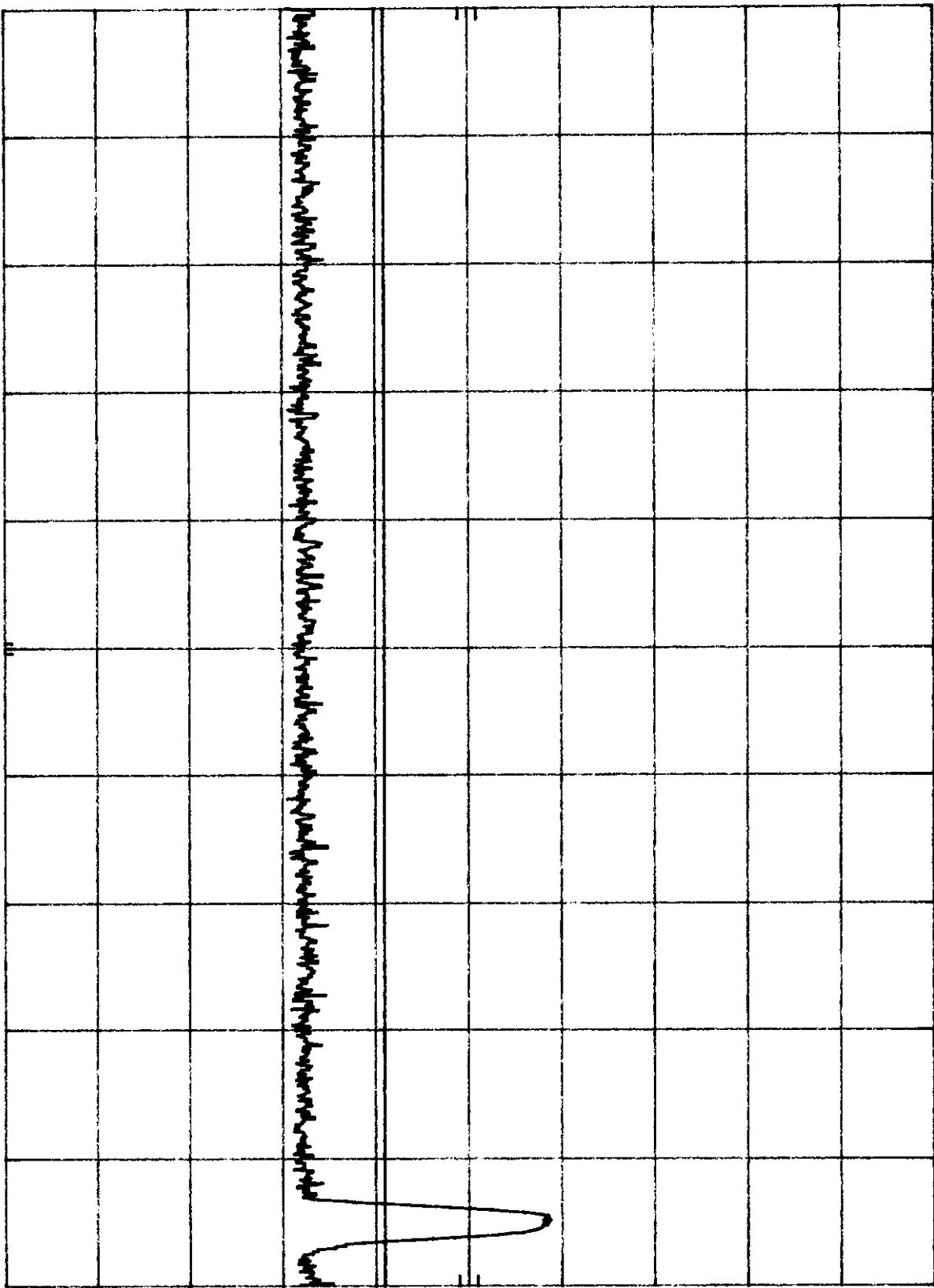
2. m.

EUT OFF. SIGNAL IS AMBIENT
REF 100.0 dB μ V ATTEN 10 dB

MKR 927.717 MHz
58.40 dB μ V

10 dB/

DL
40.8
dB μ V



START 922.550 MHz
RES BW 100 kHz

VBW 100 kHz

STOP 928.000 MHz
SWP 20 msec

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5. EUT SETUP PHOTO

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