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

OF

FCC ID: JWST71

PORTABLE R/F TERMINAL TRANSCEIVER (BAR CODE READER)

MODEL NO: T71

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
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1366 BORDEAUX DRIVE, SUNNYVALE, CA 94089-1005

To: Mike Kuo, Compliance Consulting Services, Inc.
From: Joe Dichoso
jdichoso@fcc.gov
FCC Application Processing Branch

Re: FCC ID JWST71A

Applicant:	Worthington Data Solutions
Correspondence Reference Number:	5107
731 Confirmation Number:	EA92132
Date of Original E-Mail:	12/11/98

Subject: Transmitter

- 1) What kind of non-standard connector does the device use?
- 2) Verify that the lowest and highest frequency range is 902.35 MHz and 927.55.

The items indicated above must be submitted before processing can continue on the above referenced application. Failure to provide the requested information within 60 days of the original e-mail date may result in application dismissal pursuant to Section 2.917(c) and forfeiture of the filing fee pursuant to Section 1.1106

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Any questions about the content of this correspondence should be directed to the e-mail address listed below the name of the sender.

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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 : PORTABLE R/F TERMINAL TRANCEIVER
(BAR CODE READER)

MODEM NAME : T71

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 or 3xAA batteries
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: 10/99)
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

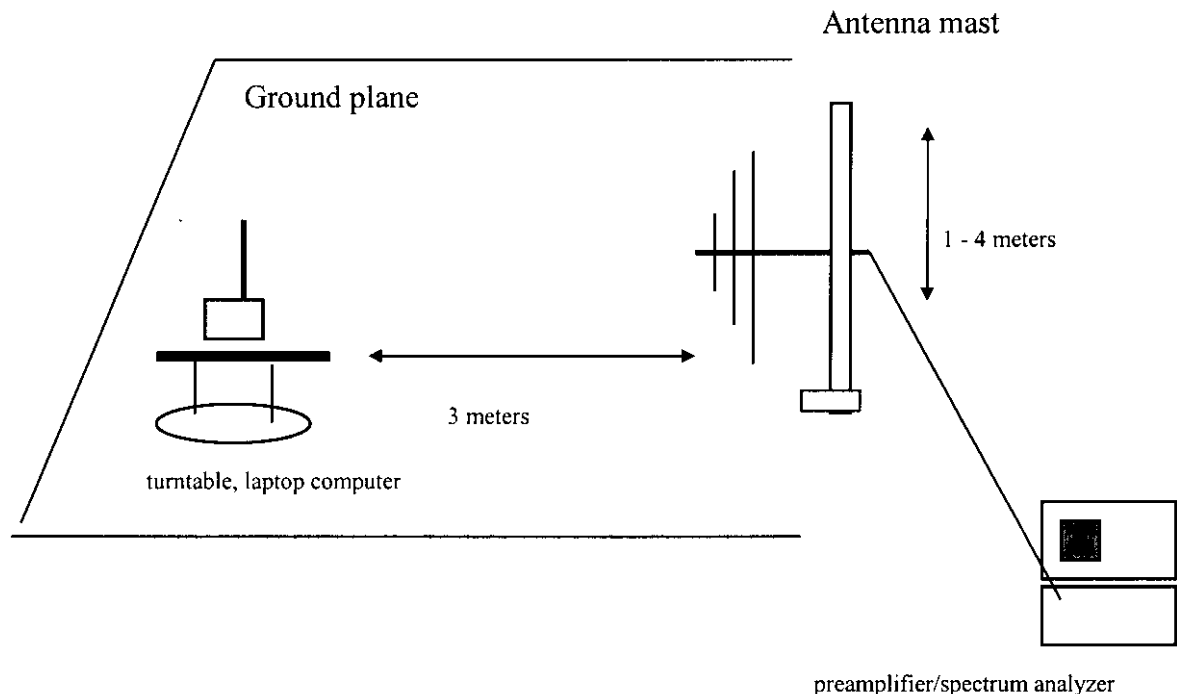


Fig.1

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. For handheld devices or EUT's that have no specified orientation during normal operation was placed standing-up(y-axis), on its side(x-axis), and laying down(z-axis). Steps 1 and 2 were repeated for each orientation and 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
Test Engr : JUAN MARTINEZ

>> 3 M RADIATED EMISSION DATA <<

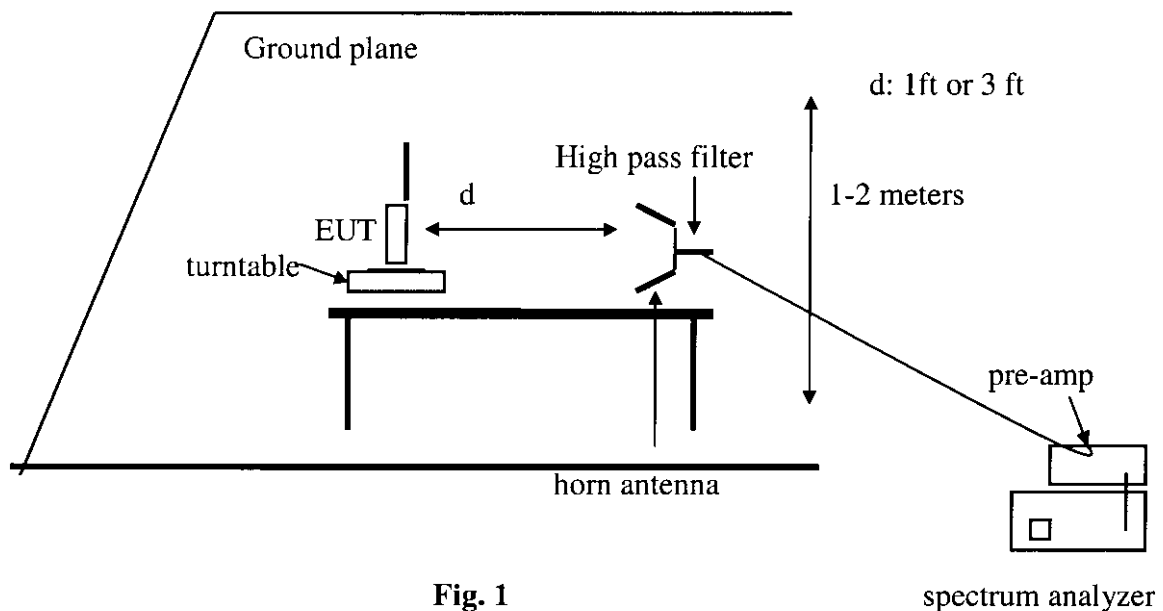
Company : WORTHINGTON DATA SOLUTIONS
Equipment Under Test : RF TERMINAL(T71)
Test Configuration : EUT ONLY
Type of Test : FCC 15.249(A) (C)
Mode of Operation : TX

J-3

Freq.	dBuV	PreAmp	Ant	Cable	dBuV/m	Limit	Margin	Pol	Hgt (m)	Az
T71 UNIT:										
LOW CHANNEL:										
Z-AXIS:										
902.35	85.20	-27.76	22.14	3.94	83.52	94.00	-10.48	V	1.0	270
Y-AXIS:										
902.35	90.00	-27.76	22.14	3.94	88.32	94.00	-5.68	V	1.0	260
X-AXIS:										
902.35	86.50	-27.76	22.14	3.94	84.82	94.00	-9.18	V	1.0	270
X-AXIS:										
902.35	92.20	-27.76	23.05	3.94	91.43	94.00	-2.57	H	1.0	225
Y-AXIS:										
902.35	84.00	-27.76	23.05	3.94	83.23	94.00	-10.77	H	1.1	270
Z-AXIS:										
902.35	93.40	-27.76	23.05	3.94	92.63	94.00	-1.37	H	1.0	45
MIDDLE CHANNEL:										
911.75	91.80	-27.73	23.18	3.96	91.21	94.00	-2.79	H	1.0	45
Y-AXIS:										
911.75	87.40	-27.73	23.18	3.96	86.81	94.00	-7.19	H	1.4	270
X-AXIS:										
911.75	85.40	-27.73	23.18	3.96	84.81	94.00	-9.19	H	1.5	315
X-AXIS:										
911.75	83.60	-27.73	22.30	3.96	82.14	94.00	-11.86	V	1.0	0
Y-AXIS:										
911.75	89.20	-27.73	22.30	3.96	87.74	94.00	-6.26	V	1.1	270
Z-AXIS:										
911.75	86.10	-27.73	22.30	3.96	84.64	94.00	-9.36	V	1.6	180
HIGH CHANNEL:										
Z-AXIS:										
927.55	89.20	-27.67	23.39	4.00	88.91	94.00	-5.09	H	1.0	90

J. m

Y-AXIS:											
927.55	80.10	-27.67	23.39	4.00	79.81	94.00	-14.19	H	1.0	225	
X-AXIS:											
927.55	85.80	-27.67	23.39	4.00	85.51	94.00	-8.49	H	1.0	225	
X-AXIS:											
927.55	82.30	-27.67	22.58	4.00	81.20	94.00	-12.80	V	1.8	0	
Y-AXIS:											
927.55	87.60	-27.67	22.58	4.00	86.50	94.00	-7.50	V	1.0	270	
Z-AXIS:											
927.55	81.40	-27.67	22.58	4.00	80.30	94.00	-13.70	V	1.0	90	
Total # of data 18											
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****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. For handheld devices or EUT's that have no specified orientation during normal operation was placed standing-up(y-axis), on its side(x-axis), and laying down(z-axis). Steps 1 and 2 were repeated for each orientation and for low, middle and high channels of EUT.

Test result: Please refer to attached spreadsheets.

PK

Compliance Certification Services
Fcc Part 15.249(A)(B)

9/2/1998
Pete Krebill
Site C(1Meter)

WORTHINGTON DATA SOLUTIONS
R/F TERMINAL
MOD: T71

f_o=902.39MHz

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)
Y-AXIS										
1804	47.6	40.2	26	1.23	-35	-9.5	1	PK AV	PK AV	PK AV
2707	52	47.4	30	3.5	-35	-9.5	1	42 37	74 54	-32 -17
3609	48.7	43.6	32.9	4.38	-35	-9.5	1	42 37	74 54	-32 -17
4511	47.9	41.7	32.4	5.18	-35	-9.5	1	42 36	74 54	-32 -18
5415	42.9	31.2	34.9	5.74	-35	-9.5	1	40 28	74 54	-34 -26
6316(N)	40.68	34.78	35.3	6.08	-35	-9.5	0	38 32	74 54	-36 -22
7218(N)	45.3	37.45	36.5	6.65	-35	-9.5	0	44 36	74 54	-30 -18
8119(N)	45.84	38.71	37.1	7.6	-35	-9.5	0	46 39	74 54	-28 -15
9021(N)	45.61	40.15	38.3	7.98	-35	-9.5	0	47 42	74 54	-27 -12
X-AXIS										
1804	45.9	38.9	26	1.23	-35	-9.5	1	30 23	74 54	-44 -31
2707	51.8	46.1	30	3.5	-35	-9.5	1	42 36	74 54	-32 -18
3609	46.9	39.4	32.9	4.38	-35	-9.5	1	41 33	74 54	-33 -21
4511	45.8	38.3	32.4	5.18	-35	-9.5	1	40 32	74 54	-34 -22
5415	42.8	35.8	34.9	5.74	-35	-9.5	0	39 32	74 54	-35 -22
6316(N)	41.9	36.81	35.3	6.08	-35	-9.5	0	39 34	74 54	-35 -20
7218(N)	46.2	38.9	36.5	6.65	-35	-9.5	0	45 38	74 54	-29 -16
8119(N)	47	37.12	37.1	7.6	-35	-9.5	0	47 37	74 54	-27 -17
9021(N)	46.8	38.58	38.3	7.98	-35	-9.5	0	49 40	74 54	-25 -14
Z-AXIS										
1804	47.7	40.1	26	1.23	-35	-9.5	1	31 24	74 54	-43 -30

2k.

2707	49.4	42.3	30	3.5	-35	-9.5	1	39	32	74	54	-35	-22
3609	51	44.1	32.9	4.38	-35	-9.5	1	45	38	74	54	-29	-16
4511	49.4	44.5	32.4	5.18	-35	-9.5	1	43	39	74	54	-31	-15
5415	45.8	38.5	34.9	5.74	-35	-9.5	1	43	36	74	54	-31	-18
6316(N)	40.5	36.54	35.3	6.08	-35	-9.5	0	37	33	74	54	-37	-21
7218(N)	44.5	39.78	36.5	6.65	-35	-9.5	0	43	38	74	54	-31	-16
8119(N)	46.6	36.89	37.1	7.6	-35	-9.5	0	47	37	74	54	-27	-17
9021(N)	46.2	37.02	38.3	7.98	-35	-9.5	0	48	39	74	54	-26	-15

NOTE: ALL MEASUREMENTS ARE HORIZONTAL MEASUREMENTS.

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

PK.

Compliance Certification Services
Fcc Part 15.249(A)(B)

9/2/1998
Pete Krebill
Site C(1Meter)

WORTHINGTON DATA SOLUTIONS
R/F TERMINAL
MOD: T71

f0=911.75MHz

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)
Y-AXIS										
1823	49.7	43.2	26	2.66	-35	-9.5	1	PK 35 28	PK 74 54	PK -39 -26
2735	48.8	42.3	30	3.8	-35	-9.5	1	39 33	74 54	-35 -21
3647	50.3	46.3	33	4.75	-35	-9.5	1	45 41	74 54	-29 -13
4558	44.9	36.3	32.4	5.32	-35	-9.5	1	39 31	74 54	-35 -23
5471	40.9	35.78	32.4	5.32	-35	-9.5	0	34 29	74 54	-40 -25
6382(N)	39.1	31.82	35	5.89	-35	-9.5	0	35 28	74 54	-39 -26
7294(N)	44.8	30.95	35.3	6.46	-35	-9.5	0	42 28	74 54	-32 -26
8266(N)	45.7	35.12	36.5	6.65	-35	-9.5	0	44 34	74 54	-30 -20
9118(N)	47.8	36.29	37.2	7.41	-35	-9.5	0	48 36	74 54	-26 -18
X-AXIS										
1823	47.7	40.5	26	2.66	-35	-9.5	1	33 26	74 54	-41 -28
2735	49.5	44.1	30	3.8	-35	-9.5	1	40 34	74 54	-34 -20
3647	49.7	44.8	33	4.75	-35	-9.5	1	44 39	74 54	-30 -15
4558	47.1	39	32.4	5.32	-35	-9.5	1	41 33	74 54	-33 -21
5471	42.78	36.45	32.4	5.32	-35	-9.5	0	36 30	74 54	-38 -24
6382(N)	44.89	33.54	35	5.89	-35	-9.5	0	41 30	74 54	-33 -24
7294(N)	43.87	31.75	35.3	6.46	-35	-9.5	0	41 29	74 54	-33 -25
8266(N)	47.58	36.47	36.5	6.65	-35	-9.5	0	46 35	74 54	-28 -19
9118(N)	48.24	36.78	37.2	7.41	-35	-9.5	0	48 37	74 54	-26 -17
Z-AXIS										
1823	48.2	43.2	26	2.66	-35	-9.5	1	33 28	74 54	-41 -26

PK.

2735	50.9	46.3	30	3.8	-35	-9.5	1	41	37	74	54	-33	-17
3647	50.4	46.2	33	4.75	-35	-9.5	1	45	40	74	54	-29	-14
4558	43.6	35.1	32.4	5.32	-35	-9.5	1	38	29	74	54	-36	-25
5471	40.66	36.78	32.4	5.32	-35	-9.5	0	34	30	74	54	-40	-24
6382(N)	39.6	33.45	35	5.89	-35	-9.5	0	36	30	74	54	-38	-24
7294(N)	44.9	38.74	35.3	6.46	-35	-9.5	0	42	36	74	54	-32	-18
8266(N)	45.7	36.48	36.5	6.65	-35	-9.5	0	44	35	74	54	-30	-19
9118(N)	46.7	35.18	37.2	7.41	-35	-9.5	0	47	35	74	54	-27	-19

NOTE: ALL MEASUREMENTS ARE HORIZONTAL MEASUREMENTS.

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

P.V.

1855	52.5	47.8	26	2.66	-35	-9.5	1	37.66	32.96	74	54	-36.3	-21
2783	52.9	46.7	30	3.8	-35	-9.5	1	43.2	37	74	54	-30.8	-17
3170	50.3	46.3	33	4.75	-35	-9.5	1	44.55	40.55	74	54	-29.5	-13.5
4637	44.4	32.6	32.4	5.32	-35	-9.5	1	38.62	26.82	74	54	-35.4	-27.2
5565	45.89	36.78	32.4	5.32	-35	-9.5	0	39.11	30	74	54	-34.9	-24
6495(N)	39.6	33.45	35	5.89	-35	-9.5	0	35.99	29.84	74	54	-38	-24.2
7420(N)	44.9	38.74	35.3	6.46	-35	-9.5	0	42.16	36	74	54	-31.8	-18
8348(N)	45.7	36.48	36.5	6.65	-35	-9.5	0	44.35	35.13	74	54	-29.7	-18.9
9277(N)	46.7	35.18	37.2	7.41	-35	-9.5	0	46.81	35.29	74	54	-27.2	-18.7
NOTE: ALL MEASUREMENTS ARE HORIZONTAL MEASUREMENTS.													
N: Noise Floor			DIST: Distance Correction(9.5dB, 1M.)					PK: 1MHz	1MHz			PK: Peak	
AF: Antenna Factor			HPF: High pass filter insertion loss					AV: 1MHz	10Hz			AV: Average	
AMP: Pre-amp gain			FSY Microwave high pass filter (fo=1.802GHz)										
CL: Cable loss													

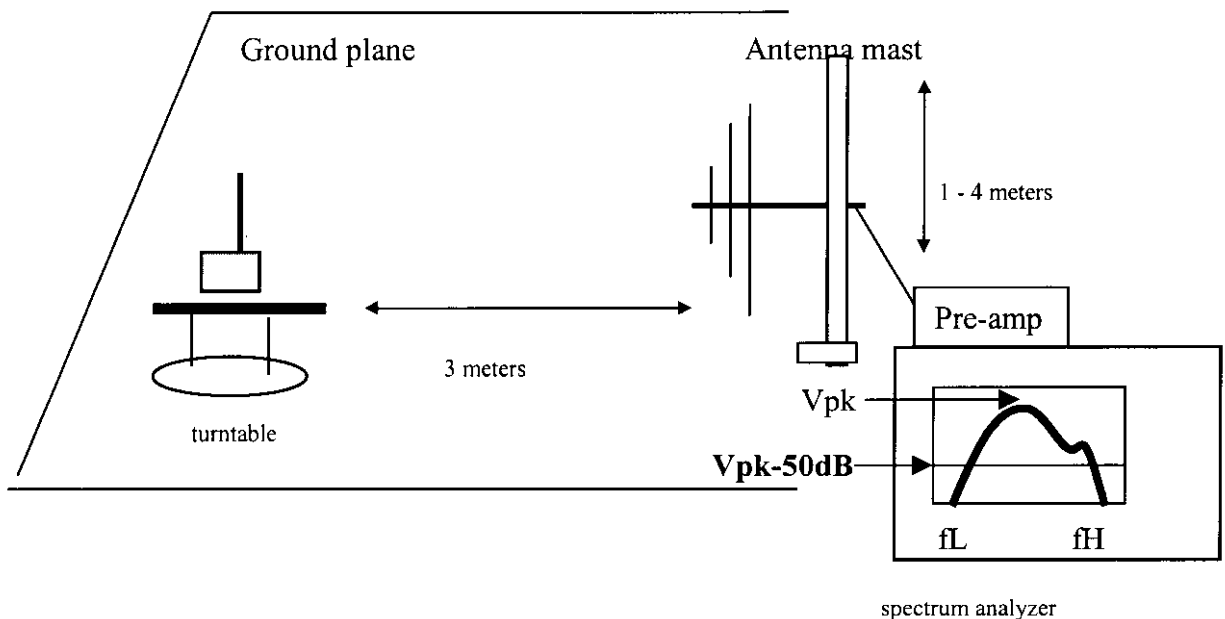
Out of Band Emissions

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.

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.

J.M.

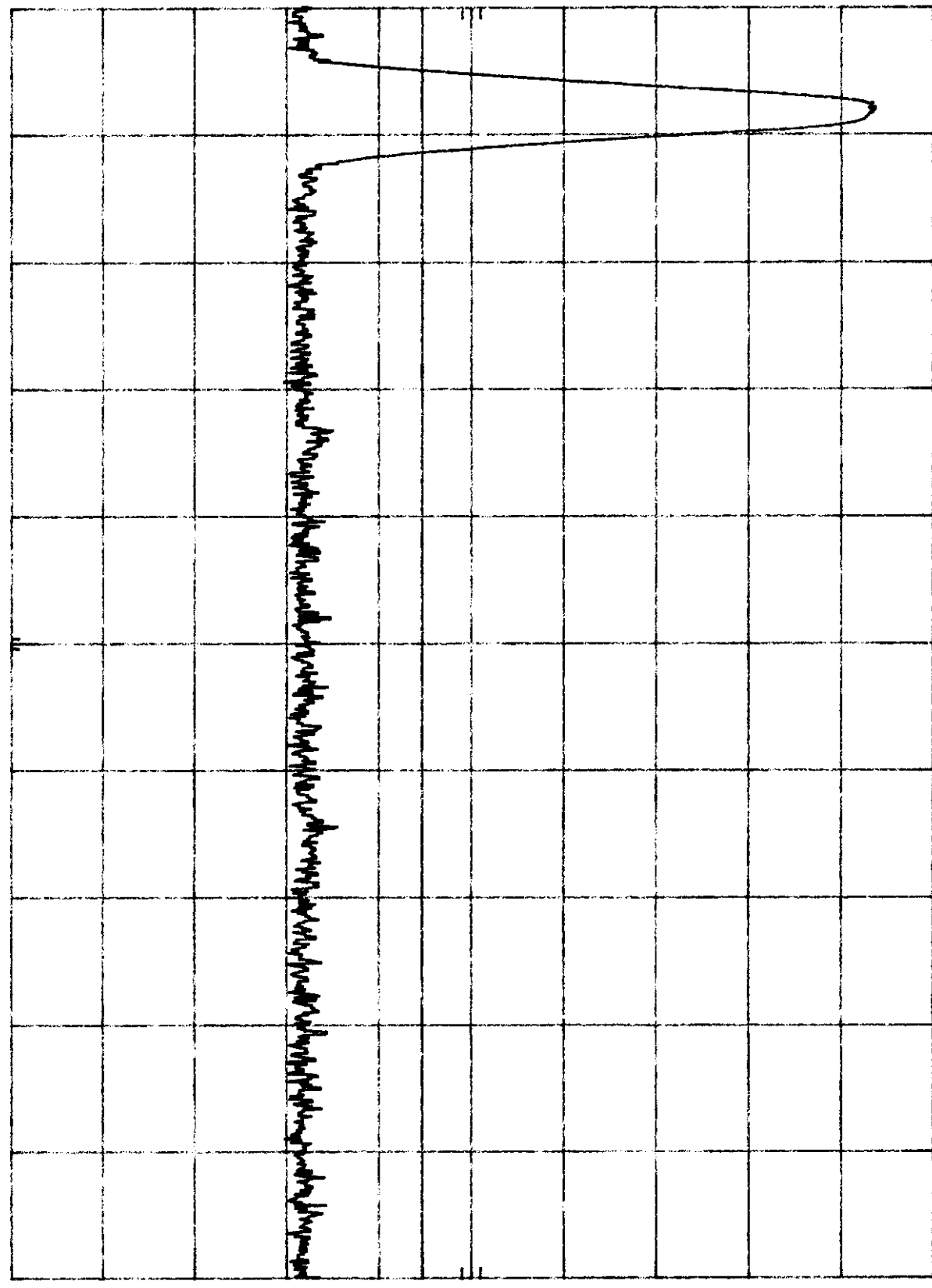
HP

15.249 (C). WORTHINGTON (T71)
REF 100.0 dBμV ATTEN 10 dB

MKR 902.390 MHz
93.40 dBμV

10 dB/

DL
44.5
dBμV

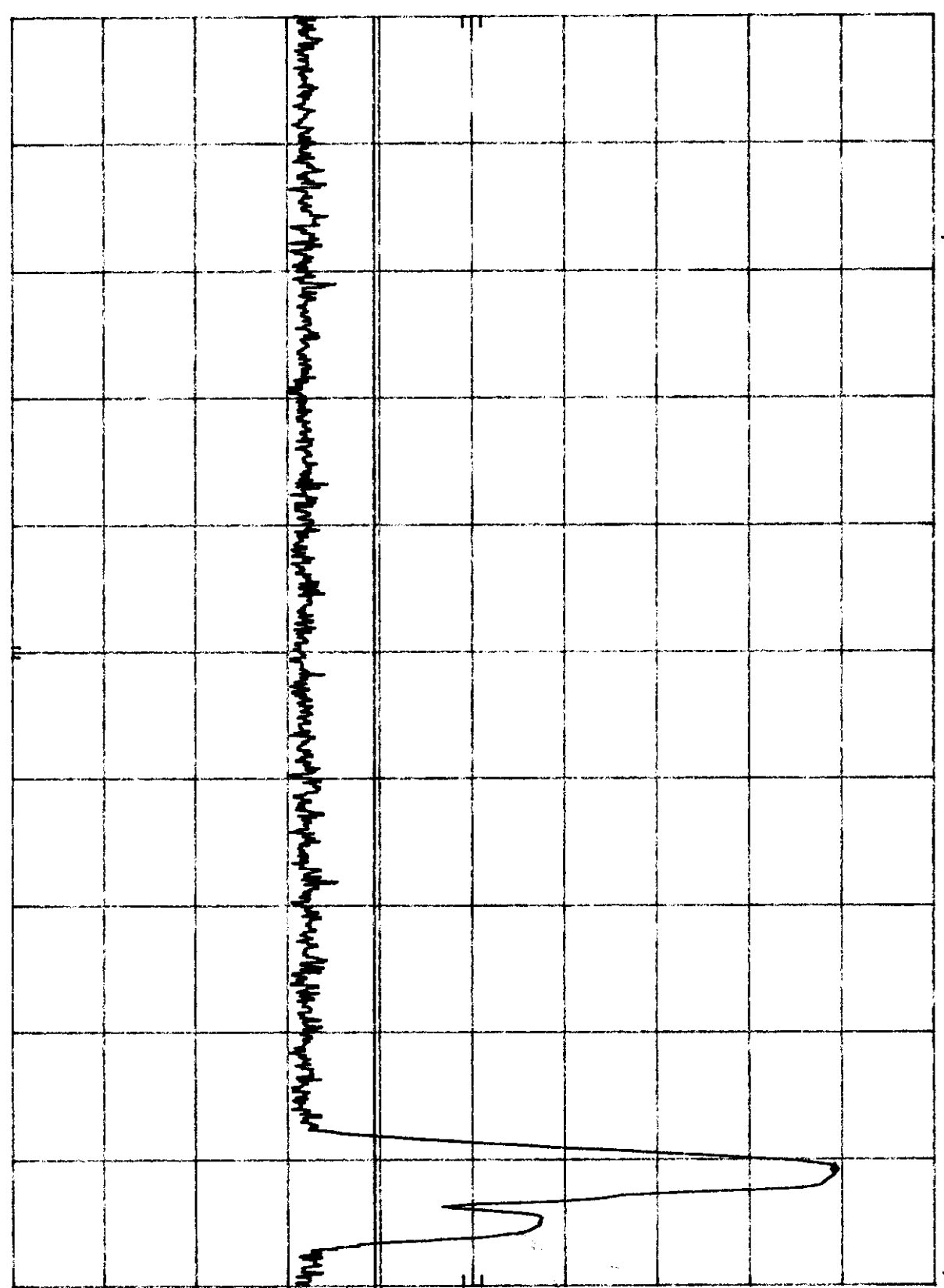


START 902.000 MHz
RES BW 100 KHZ
VBW 100 KHZ
STOP 907.000 MHz
SWP 20 msec

J.M.

15.249 (C). WORTHINGTON (T71) MKR 927.493 MHz
hp REF 100.0 dBμV ATTN 10 dB 89.20 dBμV
10 dB/

DL
39.2
dBμV



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

2.2

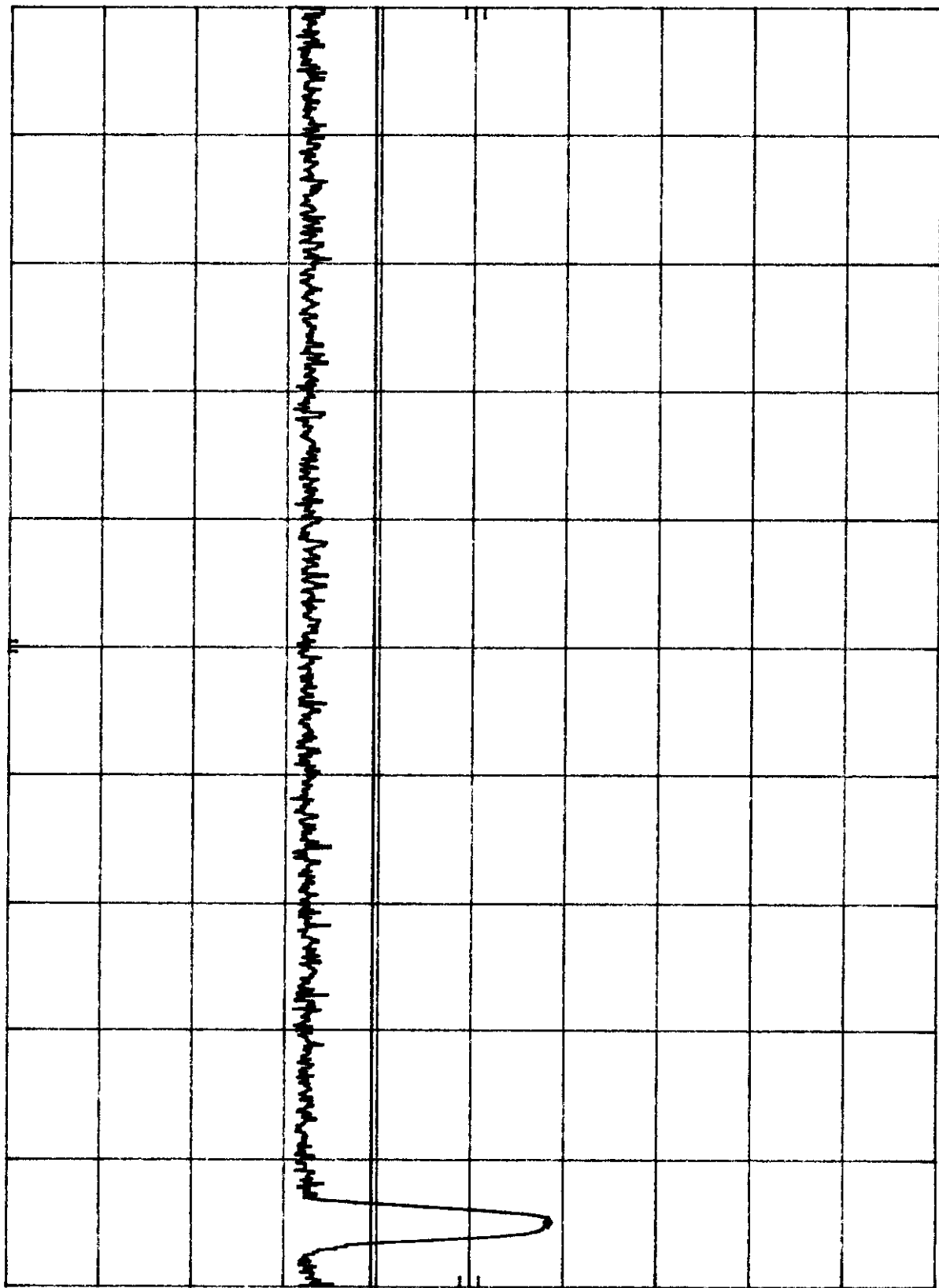
HP

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

MKR 927.717 MHz
58.40 dBμV

10 dB/

DL
39.2
dBμV



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

5. EUT SETUP PHOTO